

New species and new records of *Hyphoderma* (Basidiomycotina) from Taiwan

Sheng-Hua Wu¹

Division of Collection and Research, National Museum of Natural Science, Taichung, Taiwan, Republic of China

(Received September 9, 1996; Accepted November 27, 1996)

Abstract. Four new species of *Hyphoderma* collected from Taiwan are presented, viz. *H. clavatum*, *H. rimulosum*, *H. subclavatum*, and *H. subpraetermissum*. Two species are additionally reported from Taiwan for the first time, viz. *H. definitum* and *H. variolosum*. A key to known species of Taiwanese *Hyphoderma* is given. Description, microscopic line drawings, sexuality, cultural characters, and nuclear behavior are presented for the four new species.

Keywords: Basidiomycotina; Cultural studies; *Hyphoderma*; Taiwan; Taxonomy.

Introduction

Hyphoderma Wallr. is usually treated by mycologists under the heterogeneous Corticiaceae Herter (Donk, 1964; Eriksson and Ryvarden, 1975; Telleria, 1990; Wu, 1990). More than ninety species of *Hyphoderma* are known (e.g., Hjortstam, 1987; Hjortstam and Larsson, 1994; Wu, 1997), representing the largest genus among the Corticiaceae s.l.

Basidiomata of *Hyphoderma* are resupinate and effuse. Most species have smooth hymenial surfaces, but tuberculate, grandinioid, or odontoid cases are present in some species. *Hyphoderma* is microscopically characterized by the subclavate basidia with a median constriction, and typically monomitric hyphal system and nodose-septate generative hyphae, as well as nonamyloid and acyanophilic basidiospores, which are basically thin-walled. Leptocystidia, encrusted cystidia, or both are present in most species. Sexually, most species of *Hyphoderma* have been reported as heterothallic bipolar. *Hyphoderma* is lignicolous, saprobic, and causes a uniform white rot in wood. Tzean and Liou (1993) have shown that *Hyphoderma* is the only one among several tested genera of resupinate basidiomycetes that can capture or poison and consume nematodes.

Lin and Chen (1990) first reported *Hyphoderma* species from Taiwan, viz. *H. praetermissum* (P. Karst.) J. Erikss. & Strid, *H. rude* (Bres.) Hjortstam & Ryvarden (as *Hyphodontia mucronata* (Furukawa) S.H. Lin & Z.C. Chen), and *H. setigerum* (Fr.) Donk. Nine *Hyphoderma* species were further presented by Wu (1990) as new to Taiwan: *H. allantosporum* Sheng H. Wu, *H. argillaceum* (Bres.) Donk, *H. ayresii* (Berk. ex Cooke) Hjortstam (as *H. macrosporum* Sheng H. Wu), *H. hjortstamii* Sheng H. Wu, *H. litschaueri* (Burt) J. Erikss. & Strid, *H. malenconii* (Manjón & Moreno) Manjón et al., *H. microcystidium*

Sheng H. Wu, *H. neopuberum* Sheng H. Wu and, *H. puberum* (Fr.:Fr.) Wallr. Recently, Wu (1997) reported four additional new species of *Hyphoderma* from Taiwan: *H. acystidiatum* Sheng H. Wu, *H. cremeum* Sheng H. Wu, *H. densum* Sheng H. Wu, and *H. subsetigerum* Sheng H. Wu. However, the survey of *Hyphoderma* in Taiwan is still incomplete. In this study, four new species and two new records of *Hyphoderma* are proposed from Taiwan. Cultural studies including sexuality and nuclear behavior are also provided for the four new species.

Materials and Methods

Materials for this study were collected from Taiwan by the author in recent years. All studied specimens and cultures are deposited at the herbarium of National Museum of Natural Science of ROC (TNM).

Free-hand thin sections of basidiomata were prepared for microscopic studies. For observations and measurements of microscopic characters, 5% KOH was used as mounting medium to ensure rehydration. Melzer's reagent (IKI) was employed to detect amyloidity and dextrinoidity. Cotton blue (CB) was used as a mounting medium to determine cyanophily. Cultural description and species code system are basically from Nobles (1965) with amendments by Boidin and Lanquetin (1983). Minor modifications to Nobles' code system have been presented by many mycologists. The Nobles' code detailed by Nakasone (1990) is comprehensive and adopted in this study. Following Nakasone (1990) the mycelia were grown on 1.5% MEA instead of 1.25% MEA. In this study, plates were inverted to avoid accumulation of water produced by the mycelia. Inverted plates permit formation of a hymenium oriented as in nature. Nuclear staining of mycelia were made with Giemsa according to Boidin (1958). DAPI (4'-6'-diamidino-2-phenylindole) was used at a concentration of 0.25 µm/ml as fluorescent stain for nuclei of basidiospores.

¹Fax: +886-4-323-5367; Email: shwu@nmns1.nmns.edu.tw

Terminology for nuclear behavior is based on Boidin and Lanquetin (1984). The methods of cultural studies and determination of sexuality have been detailed by Wu (1996).

Taxonomy

Key to Known Species of *Hyphoderma* from Taiwan

1. Cystidia present 3
1. Cystidia lacking 2
2. Hymenial surface grandinioid. Subicular texture fairly loose *H. acystidiatum*
2. Hymenial surface smooth. Subicular texture dense *H. densum*
3. Septocystidia present 21
3. Septocystidia absent 4
4. Encrusted cystidia present 15
4. Encrusted cystidia absent 5
5. Hymenial surface grandinioid *H. rude*
5. Hymenial surface smooth 6
6. Cystidia moniliform 14
6. Cystidia not moniliform 7
7. Cystidia basally swollen, distinctly emergent *H. argillaceum*
7. Cystidia if basally swollen, not distinctly emergent .. 8
8. Cystidia distinctly clavate 13
8. Cystidia not, or only slightly clavate 9
9. Basidiospores ellipsoid 12
9. Basidiospores allantoid or suballantoid 10
10. Cystidia distinctly narrow towards apices *H. allantosporum*
10. Cystidia not distinctly narrow towards apices 11
11. Cystidia > 7 µm wide. Basidiospores > 3.5 µm wide *H. hjortstamii*
11. Cystidia < 7 µm wide. Basidiospores usually < 3.5 µm wide *H. definitum*
12. Basidiospores > 8 µm long *H. praetermissum*
12. Basidiospores < 8 µm long *H. subpraetermissum*
13. Heterothallic. Basidia < 40 µm long. Basidiospores colorless *H. clavatum*
13. Homothallic. Basidia > 40 µm long. Basidiospores brownish *H. subclavatum*
14. Basidiospores > 10 µm long *H. malenconii*
14. Basidiospores < 10 µm long *H. litschaueri*
15. Basidiospores > 6 µm wide *H. ayresii*
15. Basidiospores < 6 µm wide 16
16. Leptocystidia present 18
16. Leptocystidia absent 17
17. Basidiospores > 10 µm long *H. cremeum*
17. Basidiospores < 10 µm long *H. rimulosum*

18. Subicular hyphae brown *H. variolosum*
18. Subicular hyphae colorless 19
19. Lamprocystidia < 40 µm long *H. microcystidium*
19. Lamprocystidia > 40 µm long 20
20. Basidiospores > 11 µm long *H. neopuberum*
20. Basidiospores < 11 µm long *H. puberum*
21. Basidiospores > 3.5 µm wide *H. setigerum*
21. Basidiospores < 3.5 µm wide *H. subsetigerum*

Hyphoderma clavatum Sheng H. Wu, sp. nov.

Figures 1, 5A

Holotypus. TAIWAN. MIAOLI HSIEN: Takeshan, alt. 550 m, on branch of *Euphorbia pulcherrima*, 25-III-1994, Wu 9403-4 (TNM).

Etymology: From clavatus (= clavate), referring to the shape of the cystidia.

Basidiocarpum effusum, membranaceum, 70–150 µm crassum; superficies hymenialis plana vel exigue tuberculata. Systema hypharum monomiticum; hyphae fibulatae. Cystidia clavata. Basidia subclavata, 30–40 × 6.5–8 µm, 4 sterigmatibus. Basidiosporae cylindricae, laeves, tenuitunicatae, 10–13 × 4.2–5.2 µm, IKI-, CB-.

Basidioma resupinate, effuse, adnate, 70–150 µm thick in section, membranaceous. Hymenial surface grayish clay in color, with numerous tiny brownish dots under the lens, smooth or slightly tuberculate, occasionally cracked; margin thinning, concolorous, slightly byssoid. Hyphal system monomitic; hyphae nodose-septate. Subiculum composed of basal layer and medullary layer. Basal layer fairly thin, with dense texture, with horizontal hyphae. Medullary layer with fairly loose texture, with variously oriented hyphae. Subicular hyphae colorless, 2–3.5 µm diam, thin-walled. Subhymenium ± thickening, with fairly dense texture; hyphae mainly vertical, colorless. Cystidia usually immersed, clavate or apically globose, colorless, 30–60 µm long, 10–15 µm diam for the globose parts, thin-walled or apically slightly thick-walled, sometimes apically covered with brownish yellow resinous material. Basidia subclavate with a median constriction, 30–40 × 6.5–8 µm, 4-sterigmate. Basidiospores cylindrical, adaxially slightly concave, smooth, thin-walled, usually guttulate, 10–13 × 4.2–5.2 µm (holotype spore-print: $\bar{X} = 11.11 \pm 0.83 \times 4.86 \pm 0.25$ µm, n = 30), IKI-, CB-.

Specimen examined. TAIWAN (see type).

Distribution. Known only from Taiwan.

Cultural description (polysporous mycelium of Wu 9403-4). 1 wk growth: Colony radius 15–20 mm. Advancing zone fairly even. Mats white. Aerial mycelium pellicular. 2 wk growth: Colony radius 50–60 mm. Advancing zone fairly even. Mats white. Aerial mycelium almost absent. Advancing hyphae colorless, nodose-septate, 3–6 µm diam, thin-walled. 3 wk growth: Plates covered. 6 wk growth: Mats white. Aerial mycelium absent. Hyphal system monomitic. Hyphae colorless, moderately

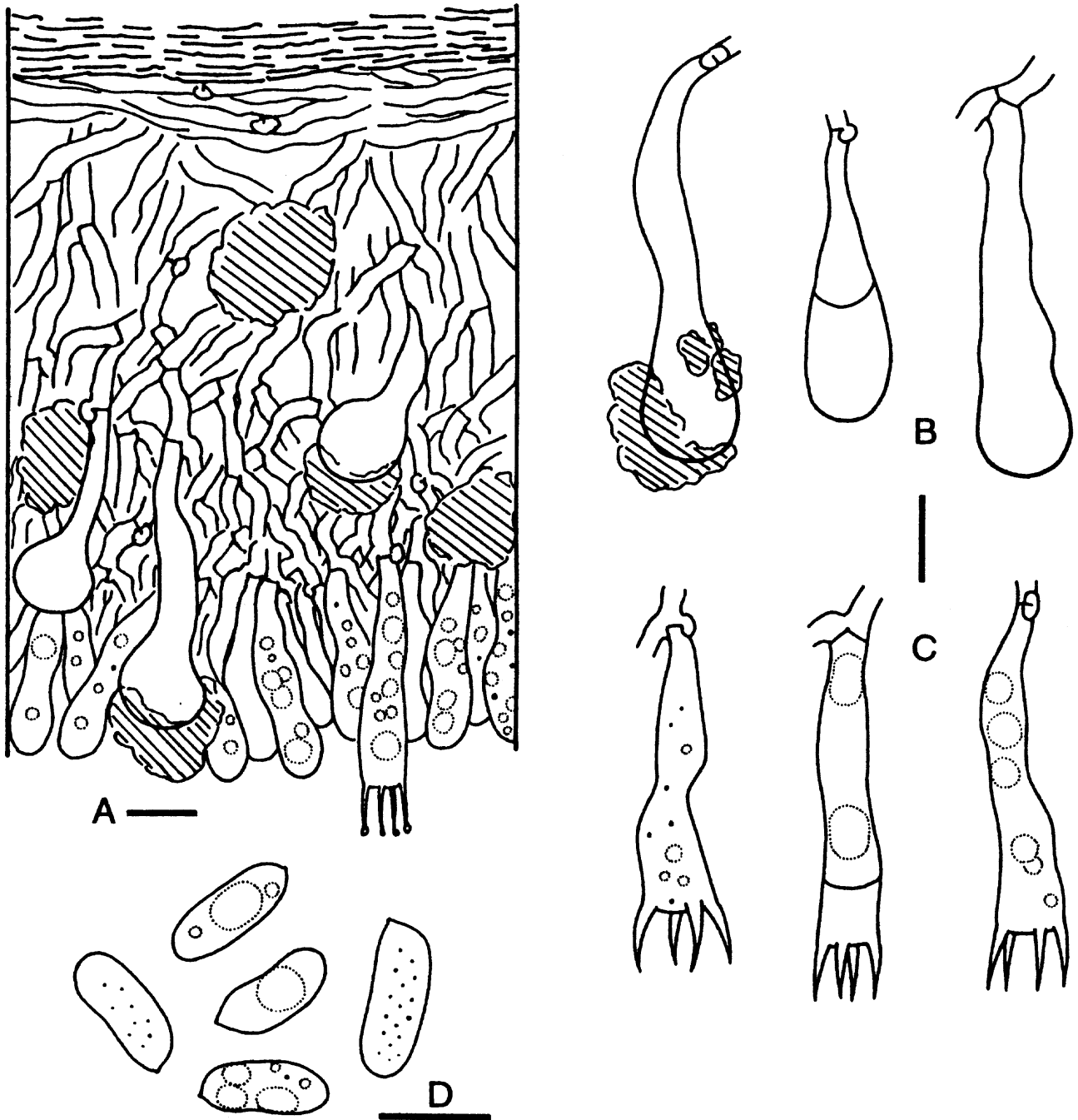


Figure 1. *Hyphoderma clavatum* (holotype). A, Basidioma section; B, Cystidia; C, Basidia; D, Basidiospores. Scale bars = 10 µm.

ramified, nodose-sepate, occasionally irregularly swollen, 2–8 µm diam, thin-walled, usually guttulate, occasionally with secondary septa. Crystals present. No distinct odor. Not fruiting.

Oxidase reactions. TAA: -, 0; 0. GAA: +, 0; 0. TYA: -, 12; 25.

Species code. 2a, 3c, 26, 32, 36, 38, 43, 54, 58, 61.

Sexuality. Heterothallic, but type of incompatibility unknown. Two among eight monosporous mycelia of the holotype were paired in all combination, but all crossings were incompatible.

Nuclear behavior. Normal. Spores uninucleate, monosporous mycelium uninucleate, polysporous mycelium dikaryotic.

Remarks. *Hyphoderma clavatum* is allied to *H. clavigerum* (Bres.) Donk by the clavate cystidia and the brownish resinous material on apical parts of cystidia, but differs from it in having longer basidiospores. This new species also resembles *H. subclavigerum* K.H. Larss. & Hjortstam in having clavate cystidia and similar-sized basidiospores, but is distinct from the latter by the lack of projecting cylindrical cystidia.

Hyphoderma definitum (Jacks.) Donk, Fungus 27: 15. 1957.

A good description and illustration of this species have been given by Eriksson and Ryvar den (1975).

Specimen examined. TAIWAN. NANTOU HSIEN: Yushan National Park, Shenmu Forest Road, alt. 1,800 m, on branch of angiosperm, 7-X-1992, Wu 9210-78 (TNM).

Distribution. North America (Ginns and Lefebvre, 1993), North Europe (Eriksson and Ryvar den, 1975), Romania (Hallenberg and Toma, 1987), Taiwan.

Hyphoderma rimulosum Sheng H. Wu, sp. nov.

Figures 2, 5B

Holotypus. TAIWAN. NANTOU HSIEN: Entrance of Shalihshienhsi Forest Road near Tungpu, alt. 1,350 m, on culm of *Miscanthus floridulus*, 24-XI-1993, Wu 9311-62 (TNM).

Etymology: From rimulosus (= minutely cracked), referring to the appearance of the hymenial surface.

Basidiocarpium effusum, membranaceum, 70–130 μm crassum; superficies hymenialis plana. Systema hypharum monomiticum; hyphae fibulatae. Cystidia incrustedata, cylindrica. Basidia subclavata, 22–32 \times 4.5–6 μm , 4 sterigmatibus. Basidiosporae ellipsoideae, laeves, tenuitunicatae, 6–7 \times 3.9–4.1 μm , IKI-, CB-.

Basidioma resupinate, effuse, adnate, 70–130 μm thick in section, membranaceous. Hymenial surface white to

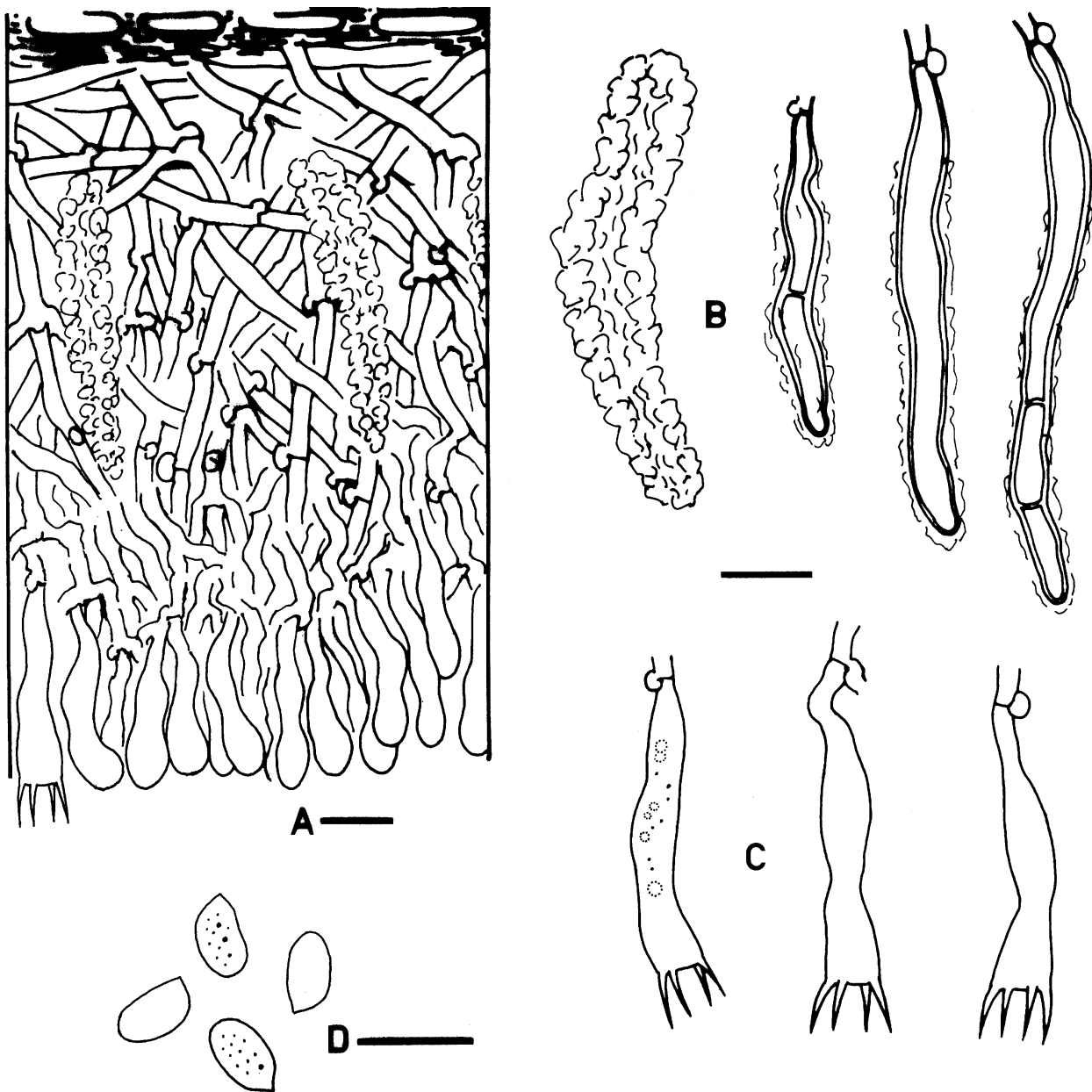


Figure 2. *Hyphoderma rimulosum* (holotype). A, Basidioma section; B, Cystidia (left: with encrustation, right: almost without encrustation); C, Basidia; D, Basidiospores. Scale bars = 10 μm .

ivory yellow in color, smooth, minutely cracked throughout; margin rather determinate, concolorous, slightly pruinose-filamentose. Hyphal system monomitic; hyphae nodose-septate. Subiculum composed of medullary layer, with loose to dense texture; hyphae variously oriented, colorless, 2–4 μm diam, thin-walled. Basal hyphae sometimes present. Subhymenium thickening, with dense texture; hyphae mainly vertical, colorless, 2–3 μm diam, thin-walled. Cystidia usually immersed, cylindrical, colorless, usually encrusted throughout, 30–55 μm long, 4–6 μm diam (without encrustation), slightly thick-walled. Basidia subclavate with a median constriction, 22–32 \times 4.5–6 μm , 4-sterigmate. Basidiospores ellipsoid, adaxially slightly concave, smooth, thin-walled, 6–7 \times 3.9–4.1 μm (holotype spore-print: $\bar{X} = 6.47 \pm 0.38 \times 4.03 \pm 0.06 \mu\text{m}$, $n = 30$), IKI-, CB-.

Specimen examined. TAIWAN (see type).

Distribution. Known only from Taiwan.

Cultural description (secondary mycelium of *Wu 9311-62*). 1 wk growth: Colony radius 53–56 mm. Advancing zone even. Mats white. Aerial mycelium slightly pellicular or almost absent. Advancing hyphae nodose-septate, colorless, 2.5–5 μm diam, thin-walled. 2 wk growth: Plates covered. Mats whitish. Aerial mycelium slightly pellicular or almost absent. 6 wk growth: Mats whitish-sulfur yellow. Aerial mycelium almost absent. Hyphal system monomitic. Hyphae colorless, sparsely ramified, nodose-septate, sometimes covered with minute yellowish granules, 2–5 μm diam, with thin walls to almost solid thick walls, the thick-walled hyphae usually distantly septate; vesicles occasionally present on thin-walled hyphae, 8–15 μm diam, thin-walled. Cubical crystals present. No distinct odor. Not fruiting.

Oxidase reactions. TAA: -, 0; 0. GAA: ++, 17–20; 32–36. TYA: - (brownish yellow), (+90).

Species code. 2a, 3c, 13, 21, 25, 27, 32, 36, (37), 38, 42, 54, 59, 61.

Sexuality. Bipolar (A_1 : 1, 3, 5, 6, 7, 8; A_2 : 2, 4).

Nuclear behavior. Normal. Spores uninucleate, monosporous mycelium uninucleate, secondary mycelium dikaryotic.

Remarks. This new species is closely related to *Hyphoderma fouquieriae* Nakasone & Gilb. by the similarity of encrusted cystidia, and similar-sized basidiospores. Holotype of *H. fouquieriae* (*K.K. Nakasone 207*, deposited in BPI) has been borrowed for this study, and its basidiospores were measured as 5.5–6.7 \times 3.5–4.2 μm . The main feature that can be used to separate the two species is the difference of subicular hyphae. *Hyphoderma rimulosum* has subicular hyphae with 2–4 μm diam and thin walls, while those in *H. fouquieriae* are 3–7 μm diam, with 0.7–1.7 μm thick walls (measured from the holotype). Moreover, hymenium of *H. fouquieriae* turns purple in KOH, but this reaction does not occur in *H. rimulosum*. Incompatibility between the two species was obtained in

this study. Two monosporous mycelia sourced from holotype of *H. rimulosum* were respectively paired with polysporous mycelium of a *H. fouquieriae* specimen (*K.K. Nakasone 121*). Incompatibility between them was shown by the failure of dikaryotization of the monosporous mycelia after contact for four weeks. It is noted that recently Nakasone et al. (1994) transferred *H. fouquieriae* to the genus *Ceraceomyces* Jülich, i.e. *C. fouquieriae* (Nakasone & Gilb.) Nakasone et al.

Hyphoderma subclavatum Sheng H. Wu

Figures 3, 5C

Holotypus. TAIWAN. PINTUNG HSIEN: Kenting National Park, Lanjenshan, alt. 300 m, on branch of angiosperm, leg. S.H. Wu, 1-IX-1994, *Wu 9409-4* (TNM).

Etymology. From sub- (= somewhat, not completely) + clavatum, referring to the resemblance of this new species to *Hyphoderma clavatum*.

Basidiocarpum effusum, membranaceum, 60–130 μm crassum; superficies hymenialis plana. Systema hypharum monomiticum; hyphae fibulatae. Cystidia clavata. Basidia subclavata, 40–55 \times 7–8 μm , 4 sterigmatibus. Basidiosporae cylindricae, laeves, tenuitunicatae, brunneolae, 10–12 \times 4.2–5.3 μm , IKI-, CB-.

Basidioma resupinate, effuse, adnate, 60–130 μm thick in section, membranaceous. Hymenial surface clay yellow, usually with numerous tiny brownish dots under the lens, smooth, occasionally cracked; margin thinning, concolorous, pruinose. Hyphal system monomitic; hyphae nodose-septate. Subiculum composed of basal layer and medullary layer. Basal layer fairly thin, with dense texture, with horizontal hyphae. Medullary layer with fairly loose texture, with variously oriented hyphae. Crystals scattered or crowded in deep subiculum. Subicular hyphae colorless, 2.5–5 μm diam, thin- or slightly thick-walled. Subhymenium slightly thickening. Brownish resinous material scattered in subiculum and subhymenium. Cystidia clavate, colorless or with brownish contents, 40–70 μm long, 8–11 μm diam for apical parts, usually with one or more secondary septa, thin-walled, slightly thick-walled towards apices, usually covered with brownish resinous material. Basidia subclavate with a median constriction, colorless or occasionally with brownish contents, 40–55 \times 7–8 μm , 4-sterigmate. Basidiospores usually with brownish contents, cylindrical, adaxially slightly concave, smooth, thin-walled, 10–12 \times 4.2–5.3 μm , IKI-, CB-.

Additional specimen examined. TAIWAN. PINTUNG HSIEN: Kenting National Park, Lanjenshan, alt. 300 m, on branch of angiosperm, leg. S.H. Wu, 1-IX-1994, *Wu 9409-11* (TNM).

Distribution. Known only from Taiwan.

Cultural description (polysporous mycelium of *Wu 9409-4*). 1 wk growth: Colony radius 12–15 mm. Advancing zone fairly even. Mats white. Aerial mycelium downy. Advancing hyphae nodose-septate, colorless, 2–5

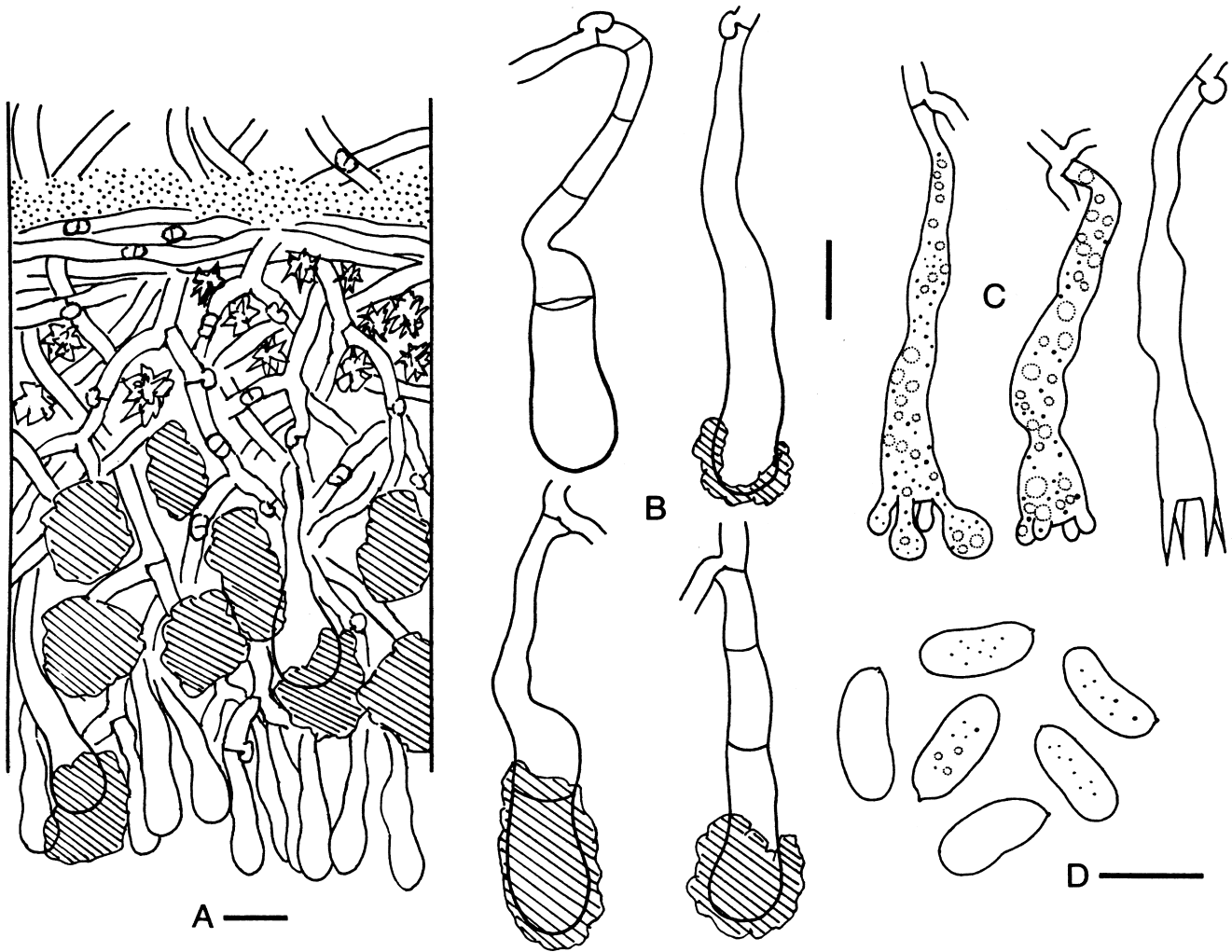


Figure 3. *Hyphoderma subclavatum* (holotype). A, Basidioma section; B, Cystidia; C, Basidia; D, Basidiospores. Scale bars = 10 μm .

μm diam, thin-walled. 2 wk growth: Colony radius 30–35 mm diam. 3 wk growth: Colony radius 55–60 mm diam. Advancing zone fairly even, slightly fimbriate. Mats white. Aerial mycelium pellicular near inoculum, downy elsewhere. 4 wk growth: Plates partly covered. 6 wk growth: Mats white or whitish. Aerial mycelium almost absent, slightly zonate. Hyphal system monomitic. Generative hyphae nodose-septate, moderately or sparsely ramified, colorless, sometimes guttulate, 2–6 μm diam, thin-walled, secondary septa occasionally present. Cubical crystals present. No distinct odor. Not fruiting.

Oxidase reactions. TAA: -, 0; 0. GAA: +++, 0; 0. TYA: -, 14–17; 27–30.

Species code. 2a, 3c, 7, 32, 36, 38, (44), 54, 57, 68.

Sexuality. Homothallic (indicated by the presence of clamped hyphae of all monosporous mycelium).

Nuclear behavior. Holodikaryotic. Spores binucleate, monosporous mycelium dikaryotic, polysporous mycelium dikaryotic.

Remarks. This species is very close to *H. clavatum* in characters, such as the clavate cystidia and the almost

same-sized basidiospores. However, it differs from the latter in having homothallic sexuality and brownish basidiospores.

Hyphoderma subpraetermissum Sheng H. Wu, sp. nov.
Figures 4, 5D

Holotypus. TAIWAN. TAICHUNG HSIEN: Anmashan, alt. 2250, on branch of angiosperm, 7-VI-1995, leg. S.H. Wu & J.Y. Tseng, *Wu 9506-27* (TNM).

Etymology. From sub- (= somewhat, not completely) + praetermissum, referring to the resemblance of this new species to *Hyphoderma praetermissum*.

Basidiocarpum effusum, membranaceo-subceraceum, 50–120 μm crassum; superficies hymenialis plana. Systema hypharum monomiticum; hyphae fibulatae. Stephanocystae praesentes. Cystidia cylindrica vel ventricosa, 30–100 \times 7–15 μm . Basidia subclavata, 20–35 \times 6–8 μm , 4 sterigmatibus. Basidiosporae ellipsoideae vel late ellipsoideae, laeves, tenuitunicatae, 6.2–7.5 \times 4–5 μm , IKI-, CB-.

Basidioma resupinate, effuse, \pm adnate, 50–120 μm thick in section, membranaceous-subceraceous. Hymenial

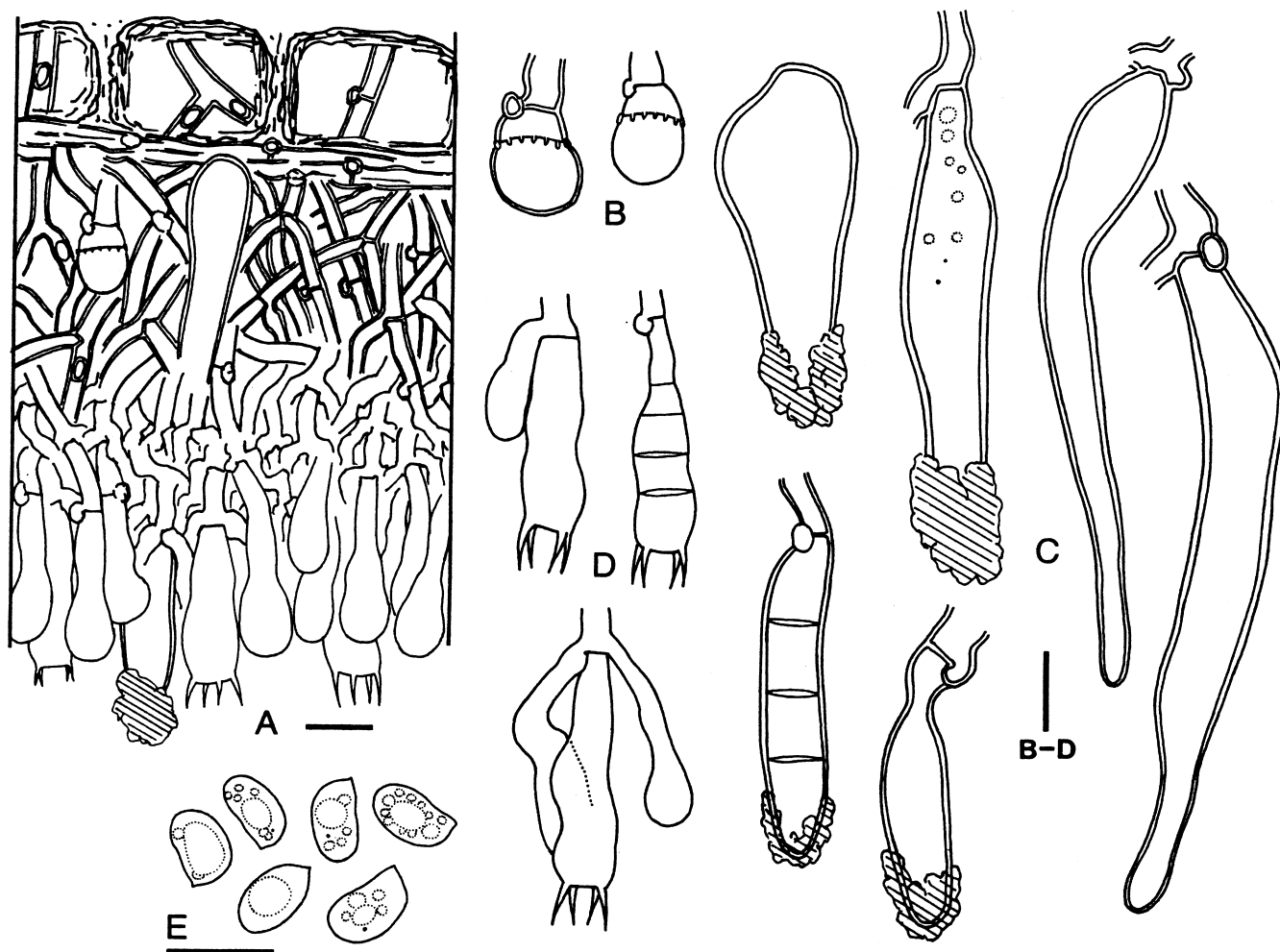


Figure 4. *Hyphoderma subpraetermissum* (holotype). A, Basidioma section; B, Stephanocysts; C, Cystidia; D, Basidia; E, Basidiospores. Scale bars = 10 μ m.

surface whitish, cream-colored when old, slightly purplish tinted due to the small excreted dots, smooth, not cracked; margin thinning, concolorous or paler, pruinose-filamentose. Hyphal system monomitic; hyphae nodose-septate. Subiculum composed of a thin basal layer and a medullary layer, the former sometimes indistinct, medullary layer with fairly loose texture; hyphae colorless, 3–6 μ m diam, with 0.5–1 μ m thick walls. Subhymenium \pm thickening. Stephanocysts located in deep subiculum, 8–11 μ m diam for global apices, Cystidia abundant, emergent, or immersed, colorless, usually apically covered with brownish resinous material, cylindrical or ventricose, sometimes tapering towards apices, 30–100 \times 7–15 μ m, with 0.5–1.2 μ m thick walls, occasionally with secondary septa. Basidia subclavate with a median constriction, 20–35 \times 6–8 μ m, 4-sterigmate, occasionally with secondary septa. Basidiospores ellipsoid or broadly ellipsoid, adaxially slightly concave, smooth, thin-walled, 6.2–7.5 \times 4–5 μ m (holotype spore-print: \bar{X} = 6.94 \pm 0.31 \times 4.44 \pm 0.37 μ m, n = 30), IKI-, CB-.

Specimen examined. TAIWAN (see holotype).

Distribution. Known only from Taiwan.

Cultural description (secondary mycelium of Wu 9506-27). 1 wk growth: Colony radius 3–6 mm. Mats white. 2 wk growth: Colony radius 16–18 mm. Mats white. Aerial mycelium almost absent. Advancing zone fairly even. Advancing hyphae colorless, nodose-septate, 2.5–5 μ m diam, thin-walled. 3 wk growth: Colony radius 27–30 mm. 4 wk growth: Colony radius 38–42 mm. 5 wk growth: Colony radius 48–53 mm. 6 wk growth: Colony radius 58–63 mm. Mats white. Aerial mycelium absent. Advancing zone fairly even. Hyphal system monomitic. Hyphae colorless, moderately ramified, nodose-septate, occasionally irregularly swollen, 2–6 (-9) μ m diam, thin-walled, usually guttulate, occasionally with secondary septa. Cystidia present, colorless, irregularly cylindrical, guttulate, 15–40 \times 4–8 μ m, thin-walled. Stephanocysts present. Cubical crystals present. No distinct odor. Not fruiting.

Oxidase reactions. TAA: -, 0; -, 0. GAA: +++, 0; +++, 0. TYA: +, 7–10; ++, 25–30.

Species code. 2a, 3c, 15b, 30, 32, 36, 38, 47, 54, 60, 61.

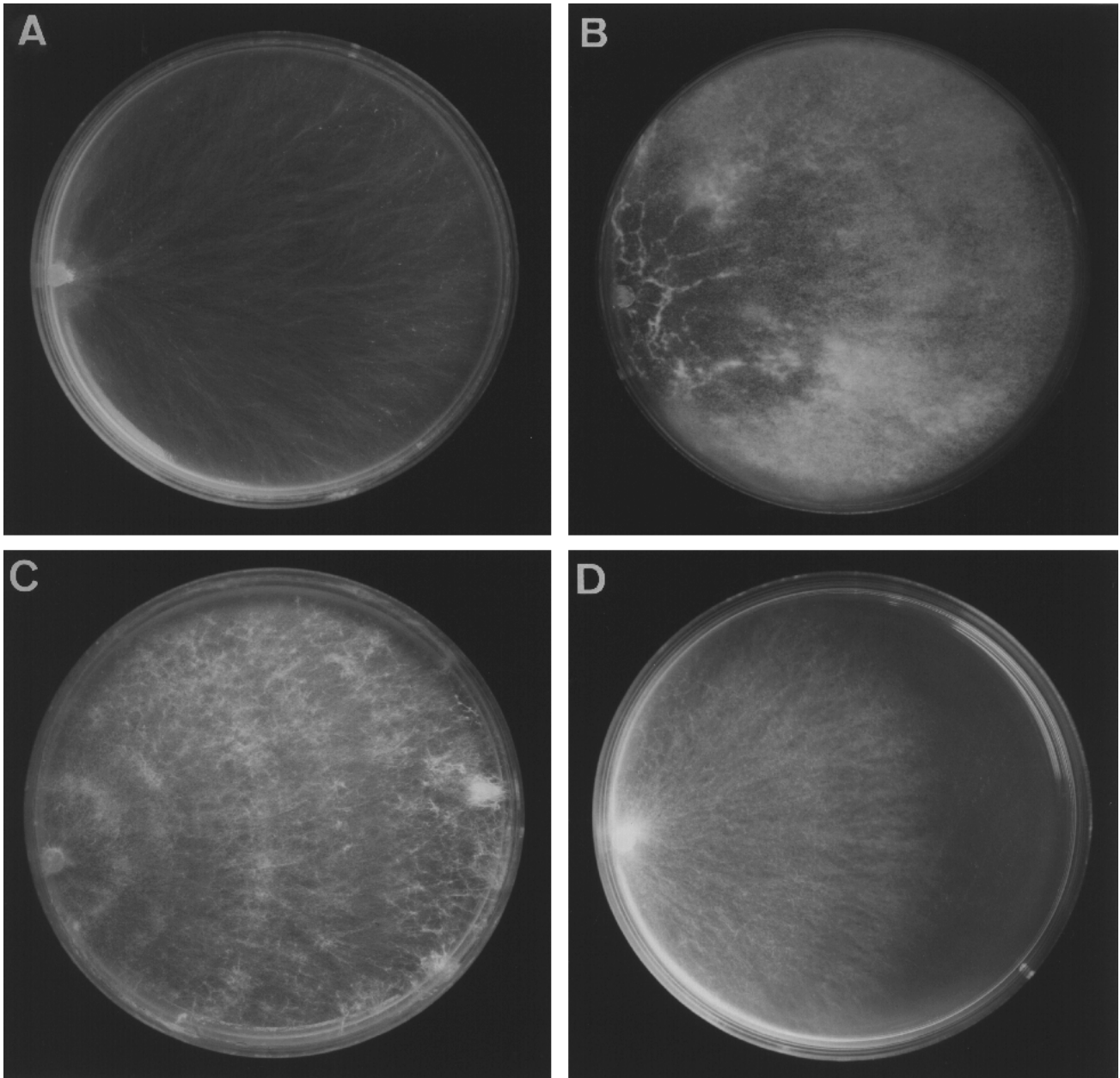


Figure 5. Cultures after 6 wk of growth on 1.5% MEA at 25°C. A, *Hyphoderma clavatum* (polysporous mycelium of holotype); B, *Hyphoderma rimulosum* (secondary mycelium of holotype); C, *Hyphoderma subclavatum* (polysporous mycelium of holotype); D, *Hyphoderma subpraetermissum* (secondary mycelium of holotype).

Sexuality. Tetrapolar (A_1B_1 : 1, 3, 5; A_1B_2 : 2; A_2B_1 : 6, 8; A_2B_2 : 4, 7).

Nuclear behavior. Normal. Spores uninucleate, monosporous mycelium uninucleate, secondary mycelium dikaryotic.

Remarks. This new species can be regarded as belonging to *Hyphoderma praetermissum* (P. Karst.) J. Erikss. & Strid group due to the presence of similar cystidia and stephanocysts. Hallenberg et al. (1994) have detected five incompatible sibling species of *H. praetermissum* complex, based on collections from various countries of Europe, Turkey, and Canada. Nevertheless, basidiospore lengths

measured from all of their studied specimens are longer than this new species. Wu (1990) measured basidiospores of Taiwanese *H. praetermissum* as $8.8\text{--}12 \times 4.2\text{--}5$, which is also distinctly longer than this proposed new taxon. Both bipolar heterothallism and homothallism within *H. praetermissum* complex have been detected by Boidin (1958). Tetrapolar sexuality of *H. subpraetermissum* as detected in this study is the only case known for a species of *Hyphoderma*.

Hyphoderma variolosum Boidin, Lanquetin & Gilles, Bull. Soc. Mycol. France 107: 143. 1991.

Description, drawn figure, and cultural studies of this species have been adequately provided in the protologue (Boidin et al., 1991).

Specimen examined. TAIWAN. KAOHSIUNG HSIEN: Liukuei, Shanping, on branch of angiosperm, 14-VII-1989, Wu 890714-14 (TNM).

Distribution. Central African Republic, Gabon (Boidin et al., 1991), Taiwan.

Remarks. Boidin et al. (1991) have noted that the brown subicular hyphae in this species are reminiscent of the genus *Peniophora* Cooke. According to their study, this species is homothallic. Sexually, *Hyphoderma* is typically bipolar and *Peniophora* is typically tetrapolar. However, the subclavate basidia with a median constriction clearly indicates the placement of this species in the genus *Hyphoderma*. Species of *Peniophora* have clavate basidia.

Acknowledgments. The author is indebted to curators of BPI and CFMR for arranging the loan of specimens and providing cultures. Dr. K.K. Nakasone has provided valuable suggestions on the manuscript. This study was supported by the National Science Council of the ROC (No. NSC 84-2311-B-178-002) in surveying *Hyphoderma* of Taiwan.

Literature Cited

- Boidin, J. 1958. Essai biotaxonomique sur les Hydnés résupinés et les Corticiés. *Rev. Mycol. Mém. Hors-Sér.* **6**: 1–388.
- Boidin, J. and P. Lanquetin. 1965. Hétérobasidiomycètes saprophytes et Homobasidiomycètes résupinés X. Nouvelles données sur la polarité dite sexuelle. *Rev. Mycol.* **30**: 3–16.
- Boidin, J. and P. Lanquetin. 1983. Basidiomycètes Aphyllophoralés épithéloïdes étalés. *Mycotaxon* **16**: 461–499.
- Boidin, J. and P. Lanquetin. 1984. Répertoire des données utiles pour effectuer les tests d'intercompatibilité chez les Basidiomycètes. I. Introduction. *Crypt. Mycol.* **5**: 33–45.
- Boidin, J., P. Lanquetin, and G. Gilles. 1991. Les Peniophoraceae de la zone intertropicale (Basidiomycetes, Aphyllophorales). A. Especies Paleotropicales. *Bull. Soc. Mycol. France* **107**: 91–147.
- Donk, M.A. 1964. A conspectus of the families of Aphyllophorales. *Persoonia* **3**: 199–324.
- Eriksson, J. and L. Ryvarden. 1975. The Corticiaceae of North Europe volume 3. *Coronicium-Hyphoderma*. *Fungiflora*, Oslo, pp. 285–546.
- Ginns, J. and M.N.L. Lefebvre. 1993. Lignicolous corticioid fungi (Basidiomycota) of North America. *Mycol. Mem.* **19**: 1–247.
- Hallenberg, N., K.-H. Larsson, and E. Larsson. 1994. On the *Hyphoderma praetermissum* complex. *Mycol. Res.* **98**: 1012–1018.
- Hallenberg, N. and M. Toma. 1987. Species of Corticiaceae (Basidiomycetes) new to the mycoflora of Romania. *Rev. Roumaine Bio.* **32**: 1–8.
- Hjortstam, K. 1987. A check-list to genera and species of corticioid fungi (Hymenomycetes). *Windahlia* **17**: 55–85.
- Hjortstam, K. and K.-H. Larsson. 1994. Annotated check-list to genera and species of corticioid fungi (Aphyllophorales, Basidiomycotina) with special regards to tropical and subtropical areas. *Windahlia* **21**: 1–75.
- Lin, S.H. and Z.C. Chen. 1990. The Corticiaceae and the resupinate Hydnaceae of Taiwan. *Taiwania* **35**: 69–111.
- Nakasone, K.K. 1990. Cultural studies and identification of wood-inhabiting Corticiaceae and selected Hymenomycetes from North America. *Mycol. Mem.* **15**: 1–412.
- Nakasone, K.K., C.R. Bergman, and H.H. Burdsall, Jr. 1994. *Phanerochaete filamentosa-Corticium radicum* species complex in North America. *Sydowia* **46**: 44–62.
- Nobles, M.K. 1965. Identification of cultures of wood-inhabiting Hymenomycetes. *Canad. J. Bot.* **43**: 1097–1139.
- Tellería, M.T. 1990. Annotated list of the Corticiaceae, sensu lato (Aphyllophorales, Basidiomycotina), for Peninsular Spain and Balearic Islands. *Biblioth. Mycol.* **135**: 1–152.
- Tzean, S.S. and J.Y. Liou. 1993. Nematophagous resupinate basidiomycetous fungi. *Phytopathology* **83**: 1015–1020.
- Wu, S.H. 1990. The Corticiaceae (Basidiomycetes) subfamilies Phlebioideae, Phanerochaetoideae and Hyphodermoideae in Taiwan. *Acta Bot. Fennica* **142**: 1–123.
- Wu, S.H. 1996. Studies on *Gloeocystidiellum* sensu lato (Basidiomycotina) in Taiwan. *Mycotaxon* **58**: 1–68.
- Wu, S.H. 1997. New species of *Hyphoderma* from Taiwan. *Mycologia* **89**: 132–140.