

FULL PAPER

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***Myrothecium dimorphum*, sp. nov., a soil fungus from beach sand in the Bonin (Ogasawara) Islands, Japan**

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Abstract A new *Myrothecium* species isolated from beach sand in the Bonin Islands, Japan, is characterized by dark green sporodochia composed of conidiophores with verticillate phialides and ovate and ellipsoidal, often curved conidia on their apexes mixed with erect, straight setae, and seta-like conidiophores with terminal polytomous structures composed of 2–8 digitate polyphialides bearing single globose conidia at each apex.

Key words Hyphomycetes · Soil fungus · Systematics

Introduction

Among a total of 370 soil fungus strains obtained from the Bonin Islands during studies on dioxin and lignocellulose decomposing fungi (Sato et al. 2002; Watanabe et al. 2003), some new and noteworthy fungi were found, including *Acremonium macroclavatum* Ts. Watan., *Cylindrocarpon boninense* Ts. Watan., *Dactylella chichisimensis* Ts. Watan., *Verticillium hahajimaense* Ts. Watan., *Monacrosporium sclerohypha* (Drechsler) Xing Z. Liu & K.Q. Zhang, *Neta quadriguttata* (Matsush.) de Hoog, *Sporoschisma saccardoi* E.W. Mason & S. Hughes, and *Wiesneriomyces javanicus* Koord. (Watanabe et al. 2001a–c). In addition, several new species among *Mortierella*, *Pestalotia* (*Pestalotiopsis*), and *Myrothecium* species were found and isolated.

An undescribed *Myrothecium* species is characterized by dark green sporodochia composed of conidiophores with verticillate phialides, and ovate and ellipsoidal, often curved conidia on their apexes mixed with straight setae, and seta-like conidiophores with apical polytomous structures composed of 2–8 digitate polyphialides bearing single globose conidia at each apex.

The genus *Myrothecium* Tode : Fr. is characterized by formation of discoid, cupulate, or synnematus sessile or short-stalked sporodochial conidiomata composed of branched conidiophores with verticillate phialides and a mass of single-celled phialoconidia mixed or surrounded with setae or sterile hyphae (Preston 1961; Tulloch 1972; Udagawa and Awao 1984). This fungus resembles *M. setiramosum* R.F. Castañeda (1986), as its seta-like conidiophores and the setae of *M. setiramosum* are morphologically very similar because of formation with apical polytomous structures; however, those of the former are fertile, forming globose phialoconidia at each apical phialide, but those of latter are sterile. In addition, sporodochial conidia of this fungus are ovate, ellipsoidal, curved, $5\text{--}8 \times (1.8\text{--}) 2\text{--}2.6\text{--}(3) \mu\text{m}$, but those of *M. setiramosum* are narrowly ellipsoidal, $5.5\text{--}10 \times 1.5 \mu\text{m}$. The morphological characteristics of this fungus are not found in the described species in *Myrothecium*. Thus, it is described as new in this study.

Materials and methods

This fungus was isolated from beach sand in Chichijima in the Bonin Islands by a modification of Waksman's direct inoculation method (Watanabe 1989). A living culture was deposited at Research Institute of Biological Resources and Functions, National Institute of Advanced Industrial Science and Technology (AIST) in Tsukuba, Ministry of Economy, Trade and Industry, and the Genebank, Ministry of Agriculture, Forestry and Fisheries (MAFF), National Institute of Agrobiological Sciences in Tsukuba, Ibaraki, Japan.

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Taxonomy

Myrothecium dimorphum Ts. Watanabe, sp. nov.

Figs. 1–10

Coloniae in agar decocto tuberosum albae vel pallide luteo-brunneae, pallide pulvereae, radiatae, mycelio aereo absente. Sporodochia cupliformia, irregularia, discreta, aggregata vel confluentia, 10–220 µm in diam. Conidiophora sporodochialia macronematosa, erecta, simplicia, hyalina vel subhyalina, sparsim aggregata, apice verticillate ramosa, septata, 30–70 µm longa, e 2.8–4 µm ad 1.2–2 µm sursum attenuata; metulae 2–4 per verticillum, 11–18 × 2.2–3 µm; phialides 3–5 per verticillum, cylindricae, apice angustatae, 6–20 × 1.6–3 µm. Phialoconidia in sporodochiis, hyalina, ovata vel ellipsoidea, saepe curvata, unicellularia, (5–) 6–6.4 (–8) × (1.8–) 2–2.6 (–3) µm. Conidiophora ad instar setae erecta, plerumque 5–8 septata, protrudentia, apice polyramificantia ex 2–8 phialidibus digitatis composita, 110–300 µm longa, e 3–4 µm ad 1.8–2 µm sursum attenuata; phialides 5–8 × 2 µm. Conidia ad setas hyalina, globosa, unicellularia, 1–2 µm diam. Setae steriles hyalina, electae, simplices, subulatae, rectae, 8–12-septatae, 185–220 (–400) µm longa, e 2–4 µm ad 1.6 µm sursum attenuata.

Colonies on potato dextrose agar (PDA) nonaerial, resupinate, white, pale yellow, or olive buff (Ridgway 1912), slightly radiate, dotted with sporodochial conidiomata, cup-shaped, irregular, erect, scattered, aggregated or confluent, with dark green spore masses, 10–220 µm in diameter (Figs. 1, 3, 10A). Sporodochial conidiophores (Figs. 1, 4, 5, 9, 10E) composed of apical verticillate phialides bearing spore masses, macronematous, loosely packed, often *Gliocladium*-like state (Figs. 1, 3, 10B,C) when solitary or sparsely formed, 30–70 µm tall, 2.8–4 µm wide basally, 1.2–2 µm wide apically, metulae 2–4 per verticil, 11–18 × 2.2–3 µm, phialides 3–5 per verticil, cylindrical, apically pointed, 6–20 × 1.6–3 µm. Sporodochial conidia phialosporous, one-celled, hyaline to pale green, dark green in mass, ellipsoidal or ovate, asymmetrical, often curved, 5–8 × (1.8–) 2–2.6 (–3) µm (Figs. 4–9, 10G). Seta-like conidiophores (Figs. 1–3, 6–8, 10A,C,F), erect, usually 5–8 septate, protruded with terminal polytomous structures composed of 2–8 digitate polyphialides (Figs. 6–8, 10A,C,F) bearing single conidia at each apex, 110–300 µm long, 3–4 µm wide basally, 1.8–2 µm wide apically; phialides gradually tapered toward apexes, 5–8 × 2 µm. The globose conidia (Figs. 6, 10A,C,F,H) borne on seta-like conidiophores, hyaline, globose, one-celled, 1–2 µm in diameter. Setae (Figs. 1, 8, 9, 10A,D) hyaline, erect, subulate, straight, 8–12-septate, 185–400 µm long, occasionally slightly narrowed basally, 2–4 µm wide basally, gradually tapered toward apexes, 1.6–2 µm wide apically.

This fungus grew well on the conventional agar media tested including both homemade and commercial PDA (Nissui; Nissui Pharmaceutical, Tokyo, Japan), Difco corn meal agar (CMA) (Difco Laboratories Detroit, MI, USA), Difco malt agar (MA), and Difco YM agar (YM). Best sporulation occurred on MA. Colonies on CMA are nonaerial and semitransparent with thin mycelium; colonies

on MA are nonaerial, pale yellow, and slightly radiate, dotted with dark green spots of sporodochia particularly at the margin; and colonies on YM are nonaerial, pale yellow, and slightly radiate. Colony diameters are 31–34 mm on CMA, 27–30.5 mm on MA, 36–38 mm on PDA, and 29–32 mm on YM after incubation for 6 days at 25°C.

Holotypus: AIST 01250, Living culture ex type: TW 01-250 (= MAFF 238296)

Etymology: In Latin, *dimorphum* refers to dimorphic sporulation forming both ovate, ellipsoidal, often curved, asymmetrical conidia from sporodochial conidiophores and small globose conidia on the seta-like conidiophores with the terminal polytomous structures composed of digitate polyphialides.

Habitat: A soil fungus from beach sand.

Specimens examined: Japan. Tokyo, the Bonin Islands, Chichijima, Ougiura, from beach sand, Jan. 14, 2001, *T. Watanabe* (TW 01-250) (holotype) (MAFF 238296).

Remarks: Pure culture of this fungus was obtained from single hyphal tipplings elongated from sand particles distributed on water agar, and purity was confirmed by repeated single hyphal tipplings for further transfers and single spor-ing with ellipsoidal or ovate conidia, although pure cultures due to single spor-ing from small globose conidia were not successful. However, formation of these two kinds of conidia is clearly shown in Fig. 10C.

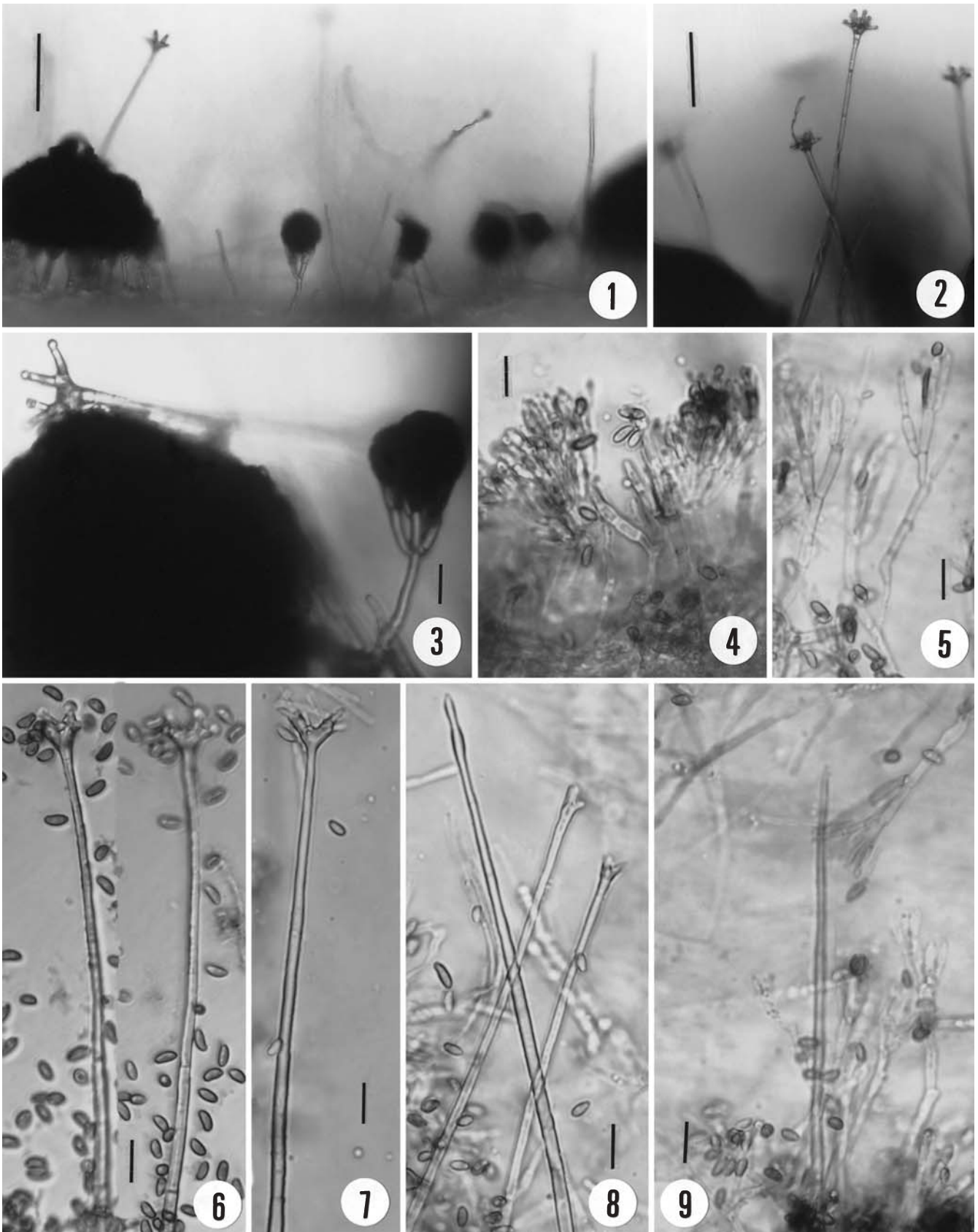
Discussion

This fungus resembles *M. australiense* Matsush. (1989), *M. gramineum* Lib., *M. inundatum* Tode: Fr., *M. leucotrichum* (Peck) M.C. Tulloch and *M. prestonii* M.C. Tulloch (Tulloch 1972), *M. nipponicum* Matsush. (1995), *M. penicilloides* Udagawa & Awao (1984), or *M. setiramosum* that form sporodochia with setae or sterile hyphae. However, this fungus is unique, forming two kinds of conidia, i.e., ovate, ellipsoidal, often curved, asymmetrical conidia on sporodochial conidiophores and small globose conidia on seta-like conidiophores. It also forms simple straight setae.

Nine *Myrothecium* species with setose or hyphal sporodochia are differentiated from one another by the following key.

Key to *Myrothecium* species with setose or hyphal sporodochia

1. Sporodochia with sterile hyphae *M. penicilloides*
1. Sporodochia with setae and/or setae-like conidiophores 2
2. Setae or setae-like conidiophores complicated, forming apical polytomous structures composed of digitate sterile or fertile portions 3
2. Setae simple 4
3. Seta-like conidiophores complicated, seta simple, and conidia of two kinds: ovate ellipsoidal and globose *M. dimorphum*



Figs. 1–9. *Myrothecium dimorphum*. **1,2** Habit showing sporodochia with extruded several seta-like conidiophores and a seta (**1**, right). *Bars* **1** 100 μ m; **2** 50 μ m **3** Part of sporodochium and *Gliocladium*-like state together with an apical part of seta-like conidiophore lying over the sporodochium. **4,5** Sporodochial conidiophores, phialides, and conidia. **6** Two seta-like conidiophores, sporodochial conidia, and two

undetached globose conidia at the phialides from terminal polytomous structures with 4–8 digitate polyphialides under different focus. **7,8** One simple seta (**8**), immature (**7**), and mature seta-like conidiophores (**7**), and sporodochial conidia. **9** One simple seta, part of sporodochial conidiophores, and conidia. *Bars* **3–9** 10 μ m

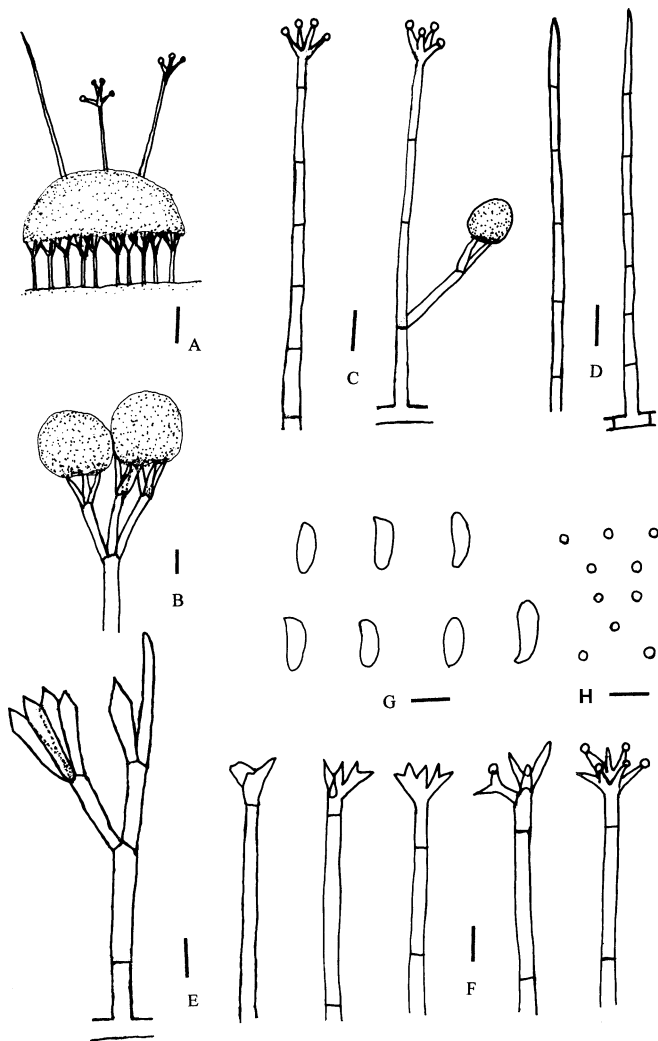


Fig. 10. *Myrothecium dimorphum*. **A** Sporodochium with one simple seta, and two seta-like conidiophores with terminal polytomous structures with digitate polyphialides and globose conidia at each apex. Bar 50 μm **B** *Gliocladium*-like state. Bar 10 μm **C** Seta-like conidiophores. Note the right conidiophore with *Gliocladium*-like state. Bar 20 μm **D** Setae. Bar 20 μm **E** Sporodochial conidiophores and phialides. Bar 10 μm **F** Terminal polytomous structures with fertile digitate polyphialides bearing conidia at each apex on seta-like conidiophores. Bar 20 μm **G** Sporodochial conidia. **H** Conidia from seta-like conidiophores. Bar 5 μm

3. Setae complicated, conidia narrowly cylindrical *M. setiramosum*
4. Spores less than 6 μm long 5
4. Spores more than 6 μm long 7
5. Spores less than 1.5 μm wide *M. inundatum*
5. Spores more than 2 μm wide 6
6. Spores ellipsoidal or allantoid *M. prestonii*
6. Spores navicular *M. nipponicum*
7. Setae many septate, thin walled *M. leucotrichum*
7. Setae up to 4-septate, thick walled 8
8. Setae nonseptate or rarely up to 2-septate, spores 2–3 μm wide *M. gramineum*
8. Setae 2–4 septate, spores 1.5–2 μm wide *M. australiense*

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