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NOTE

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Marasmiellus mesosporus, a *Marasmius*-blight fungus newly recorded from sand dunes of the Japanese coast

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Abstract A *Marasmius*-blight fungus, *Marasmiellus mesosporus*, is newly recorded from sand dunes of the Japanese coast. Macro- and microscopic features and ecological characteristics of the species are described and illustrated based on Japanese and European specimens.

Key words Agaricales · Marasmiaceae · New record · Plant pathogenic fungus

The genus *Marasmiellus* Murrill (Singer 1973; Pegler 1977, 1983, 1986; Antonín and Noordeloos 1993; Corner 1996), including about 250 species hitherto known worldwide (Takahashi and Degawa 2006), are ecologically known as saprotrophs of herbaceous and woody plants. On the one hand, several species of *Marasmiellus* are plant pathogenic fungi with an extensive host range that cause damage to a wide range of plants, including economically important crops, such as palm or orchid (Dingley et al. 1981; Fong et al. 1996; Kohler et al. 1997). Recently, while examining the agaric collections from sand dunes of the Japanese coast, a noteworthy fungus, characterized by pale brown to pale pinkish brown collybioid basidiomata, poorly developed pileipellis, and habitat growing on stems or roots of beach grasses, was found. According to these characteristics, this fungus was considered as *Marasmiellus mesosporus* Singer. This species, known as *Marasmius*-blight fungus, infects several species of Poacaeae in the coastal sand dunes of northeastern North America (Lucas et al. 1971; Warren and Lucas 1973, 1975), and is a new record for Japan.

In this article, we describe and illustrate morphological characters of *M. mesosporus* based on the Japanese specimens and compare the present species with some related taxa. European material of *M. mesosporus* is also examined and morphologically compared with Japanese collections. Moreover, brief notes on ecological characteristics of the present fungus in Japan are also given.

The specimens examined in this study are deposited in the herbaria of National Museum of Nature and Science (TNS), Toyama Botanic Garden (TYM), and Universidad de Alcalá de Henares, Madrid (AH). Macroscopic characters were described by observations on dried or fresh materials. For light microscopic observations, sections of dried specimens were mounted in water, 3% or 5% (w/v) KOH, cresyl blue, and phloxine B solution on glass slides. Forty randomly selected basidiospores were measured under a light microscope at 1000× magnification. Length measurements excluded the apiculus for basidiospores. The abbreviations *Q* and *Q ave.* signify the ratio of length to width of basidiospores and average *Q*, respectively. The surface features of basidiospores were also observed by scanning electron microscopy (SEM). For SEM, pileus were cut onto specimen holders attached with double-sided adhesive tape and then coated with platinum-palladium with an E-1030 Ion Sputter Coater (Hitachi, Tokyo, Japan). They were examined with a S-4200 SEM (Hitachi, Tokyo, Japan) operating at 20 kV.

Marasmiellus mesosporus Singer, Mycologia 65:469, 1973.
= *Marasmiellus dunensis* Robich, Moreno & Pöder, Mycotaxon 42:181, 1991. Figs. 1–7

Pileus 11.8–17.3 mm, at first campanulate to convex, then applanate, sometimes shallowly depressed at the center with incurved margin, not hygrophanous, smooth, distinctly rugulose toward the margin, especially in the dried condition, pale brown to pale pinkish brown. Flesh white, unchanging in color when cut, thickened; odor and taste indistinct. Lamellae subdistant, sinuate to subdecurrent,

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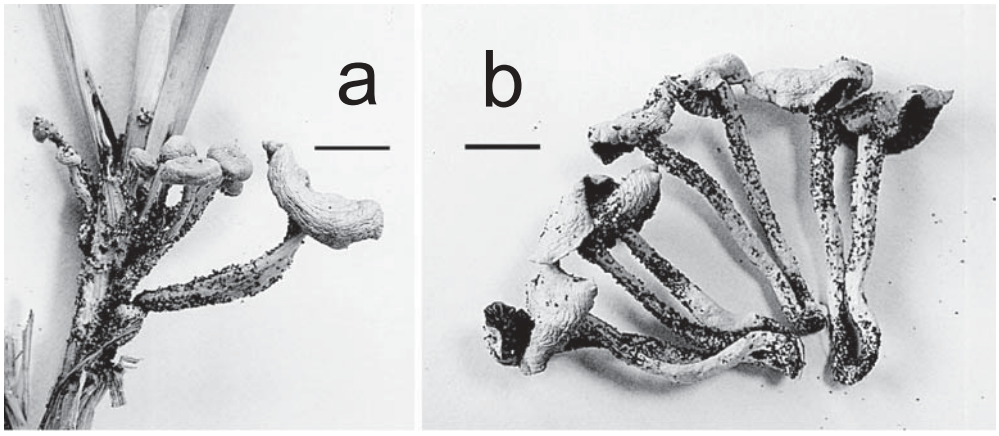
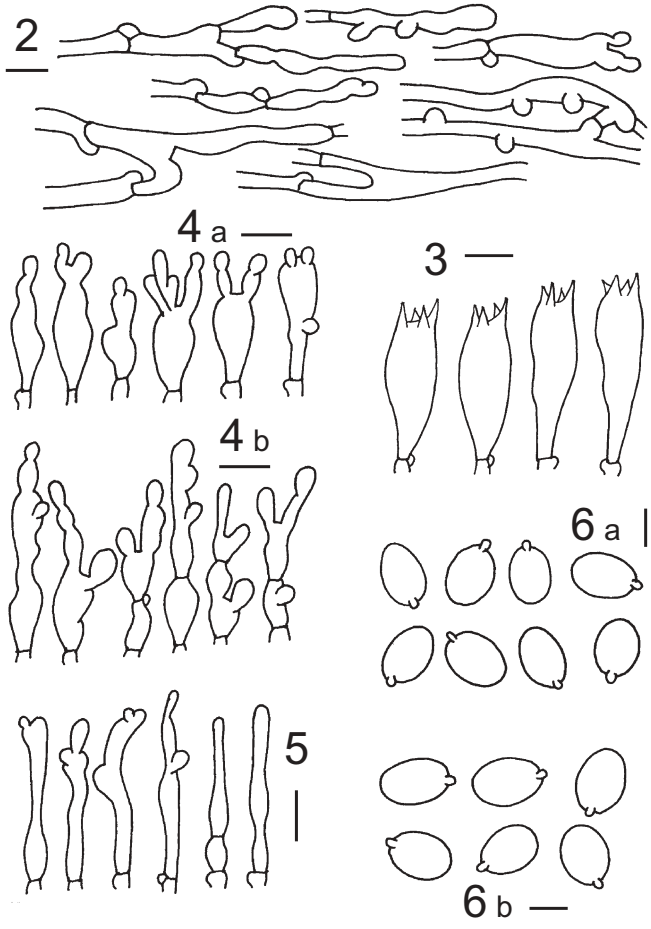


Fig. 1. *Marasmiellus mesosporus*. **a** Basidiomata (TNS-F-15213). **b** Basidiomata (TNS-F-15214). *Bars* 10 mm



Figs. 2–6. Microscopic features of *M. mesosporus*. **2** Hyphae of the epicutis of pileus (TNS-F-15213). **3** Basidia (TNS-F-15213). **4** Cheilocystidia: **a** Japanese specimen (TNS-F-15213); **b** Spanish specimen (AH-16182). **5** Caulocystidia (TNS-F-15213). **6** Basidiospores: **a** Japanese specimen (TNS-F-15213); **b** Spanish specimen (AH-16182). *Bars* 10 μm

pale brown, often pale pink to pale pinkish brown, slightly thickened. Stipe 31.3–39.7 × 1.8–3.4 mm, almost equal or somewhat enlarged at the base, at times slightly tapering toward the base, subcylindrical, somewhat flexuous, central, slender, tough, solid, sometimes compressed, pale brown to brown, often pale pink or violet tone when fresh, pulverous to tomentose at the apex. Spore print white.

Basidiospores (8–)10–13(–14) × (5–)7–8(–9) μm, Q = 1.4–2.0(–2.3), *Q ave.* = 1.70 (*n* = 40 spores of three specimens), broadly ellipsoid to oblong, smooth, hyaline, thin-walled, with one or several oil drops, inamyloid, with a prominent obtuse apicule. Basidia (28–)33–43 × (7–)9–12 μm, clavate, four-spored, rarely two-spored. Basidioles 28–30 × 7–9 μm, clavate to subclavate. Cheilocystidia 20–40 × 4–10 μm, numerous, subclavate to subcylindrical, often irregularly shaped, with two-forked, one to several finger-like projections at the apex, hyaline, thin-walled. Pleurocystidia absent. Pileipellis a cutis with poorly developed *Rameales* structure, composed of interwoven, repent hyphae, pale brown, smooth or infrequently with a few digitate excrescences, sometimes with granular, refractive contents in 3% KOH, thin-walled; terminal cells 3–10 μm broad, subclavate to subcylindrical, smooth or infrequently with scattered, small, finger-like projections. Caulocystidia 15–32 × 3–10 μm, abundant, clavate to subcylindrical, smooth or with scattered, small, finger-like projections, flexuous, hyaline, thin-walled. Clamp connections abundant in all tissues.

Chemical reaction: Inamyloid in Melzer's reagent, violet in cresyl-blue.

Habitat and phenology: Solitary to caespitose on roots and stem of dead or living beach grasses, especially of *Elymus mollis* Trin., *Ischaemum anthephoroides* Makino, *Imperata cylindrica* (L.) P. Beauv. var. *koeningii* Durand et Schnz, *Carex kobomugi* Ohwi and *C. pumila* Thunb. on sandy soil of coastal dunes. Summer to fall, especially June to October.

Distribution: Japan (Hokkaido, Miyagi, Fukushima, Chiba, Shizuoka, Toyama, Ishikawa, Hyogo, Tokushima, Oita, Miyazaki), United States (Singer et al. 1973), Hawaiian Islands (Desjardin et al. 1992), China (Redhead and Liu

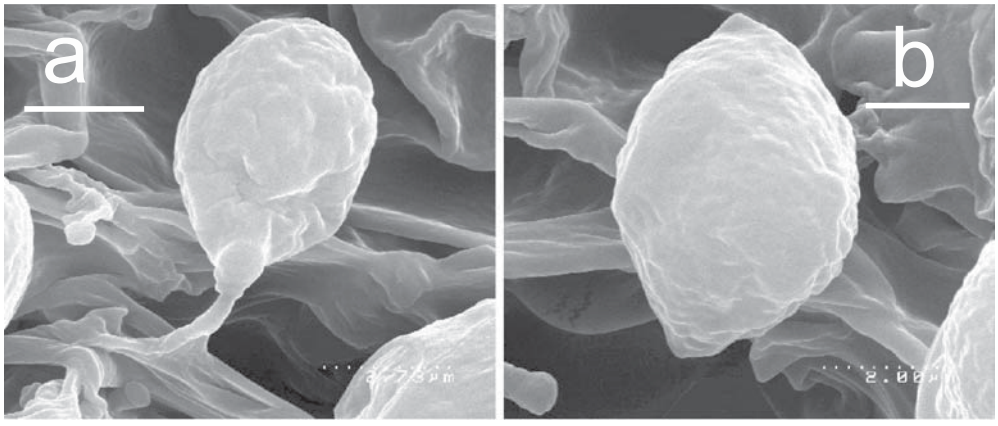


Fig. 7. Basidiospore by scanning electron microscopy (SEM). **a** Japanese specimen (TYM-4847). **b** Spanish specimen (AH-16182). *Bars* 5 µm

1982), Pakistan (Singer 1973), and Spain and Italy (Robich et al. 1991).

Specimens examined: Japan. Hokkaido Pref., Ishikari Prov., Ishikari-shi, Atsuta-ku, Muen-hama, July 2, 2006, coll. S. Takehashi & C. Takehashi, TNS-F-15213; same place, July 2, 2006, coll. S. Takehashi & C. Takehashi, TNS-F-15214; Hokkaido Pref., Ishikari-shi, Ishikari-hama, August 13, 2006, coll. S. Takehashi & C. Takehashi, TNS-F-15215; Miyagi Pref., Sendai-shi, Miyagino-ku, Gamo, July 27, 2006, coll. K. Maruyama, TNS-F-12190; Fukushima Pref., Minami-souma-shi, Haramachi-ku, Kitaizumi, July 28, 2006, coll. T. Kasuya, TNS-F-13360; Fukushima Pref., Iwaki-shi, Yotsukura-cho, June 18, 2006, coll. H. Sato, TNS-F-12141; Chiba Pref., Sambu-shi, Hasunuma, Minamihama, July 12, 2006, coll. T. Kasuya, TNS-F-13358; Shizuoka Pref., Omaezaki-shi, Hamaokasakyu, July 18, 2006, coll. T. Kasuya, TNS-F-13359; Toyama Pref., Toyama-shi, July 27, 2004, coll. M. Hashiya, TYM-4162; Toyama Pref., Takaoka-shi, June 10, 2005, coll. M. Hashiya, TYM-4847; Ishikawa Pref., Matsuto-shi, June 27, 2004, coll. M. Hashiya, TYM-4150; Hyogo Pref., Kobe-shi, Suma-ku, Ichinotani-cho, July 6, 2006, coll. T. Kasuya, TNS-F-12091; Hyogo Pref., Minami-awaji-shi, Keinomatsubara, June 27, 2006, coll. T. Kasuya, TNS-F-12095; Hyogo Pref., Takasago-shi, Mukoujima-cho, June 28, 2006, coll. T. Kasuya, TNS-F-12097; Hyogo Pref., Sumoto-shi, Yura, Narugashima, June 27, 2006, coll. T. Kasuya, TNS-F-12098; Tokushima Pref., Tokushima-shi, Komatsu, June 24, 2006, coll. T. Kasuya, TNS-F-12100; Tokushima Pref., Itano-gun, Matsushige-cho, Toyohisa, June 24, 2006, coll. D. Matsuka, TNS-F-12102; same place, June 24, 2006, coll. D. Matsuka, TNS-F-12103; Oita Pref., Saiki-shi, Hatouzu, June 2, 2007, coll. Y. Sunada, TNS-F-16122; Miyazaki Pref., Hyuga-shi, Ogura, July 25, 2005, coll. Y. Murakami TNS-F-16121. Spain. Prat de Llobragat (B, Espa'na), October 19, 1990, coll. A. Mayoral, G. Moreno, R. Pöder, & C. Iiiana, AH-16182 ("Isoparatypus" of *M. dunensis*).

Japanese name: Sunaji-houraitake (newly named).

Remarks: *Marasmiellus mesosporus* was originally described from coastal sand dunes of North Carolina, United States (Lucas et al. 1971; Singer et al. 1973). In the northeastern North America, this species is known as the causal agent of *Marasmius*-blight of beach grasses, especially of *Ammophila breviligulata* Fern. and another members of Poaceae (Lucas et al. 1971; Singer et al. 1973; Warren and Lucas 1973, 1975).

Japanese specimens are well characterized by the pileipellis composed of a cutis with poorly developed *Rameales* structure, the rather long basidiospores (8–14 µm in length), and the subcylindrical-coralloid cheilocystidia and caulocystidia. In addition, they are also characterized by their habitat, which is growing on roots and stem of beach grasses in sandy soil of coastal dunes. The foregoing morphological characteristics suggest that the Japanese fungus belongs to the subsection *Quercini* Singer of the section *Dealbati* (Bat.) Singer (Singer 1973, 1986; Noordeloos 1995), and that it is undoubtedly identified to *M. mesosporus* (Singer et al. 1973; Redhead and Liu 1982; Desjardin et al. 1992; Antonín and Noordeloos 1993). This species is newly recorded from Japan.

We observed a Spanish specimen of the present fungus ("Isoparatypus" of *M. dunensis*). It is macro- and microscopically nearly identical with the Japanese specimens, with the slight exception of measurements of its basidiospores [9.5–14 (–17) × (5.5) 6–9 (–10) µm, Q = 1.4–2.1, *Q ave.* = 1.69, *n* = 40 spores].

This species is morphologically very similar to *M. carneopallidus* Pouzer by its colored stipe, the structure of the pileipellis, and its habitat, growing on old decaying stems and roots of herbaceous plants (e.g., *Thymus* spp., *Artemisia* spp., *Festuca* spp.) in xerophytic grassland (Antonín and Noordeloos 1993). However, the latter species differs mainly in a duller colored stipe, broadly clavate cheilocystidia, and structure of pileipellis (Antonín and Noordeloos 1993). The present fungus also resembles *M. vaillantii* (Pers.) Singer and *M. pachycraspedum* Noordel. in the poorly developed *Rameales* structure in the pileipellis and the coralloid cheilocystidia and caulocystidia. However, *M. vaillantii* clearly differs from *M. mesosporus* by the radial grooved, furrowed, or wrinkled pileus, somewhat smaller basidiospores, and its habitat (Breitenbach and Kränzlin 1991; Antonín and Noordeloos 1993; Noordeloos 1995; Desjardin 1997). *Marasmiellus pachycraspedum* is distinct from *M. mesosporus* by having clavate to subfusiform,

brown-encrusted cheilocystidia (Noordeloos 1977; Antonín and Noordeloos 1993). In the subsection *Quercini*, *Marasmiellus vernalis* Har. Takah., recently described from Japan, is microscopically similar to the present species in the structure of the pileipellis, measurements of the basidiospores, and the shape of the cheilocystidia. However, the former species is clearly distinct in having much smaller basidiomata and its habitat on the bark of living *Pinus thunbergii* Parl. (Takahashi and Degawa 2006).

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