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SHORT COMMUNICATION

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Transfer of *Asterosporium orientale* to the genus *Prosthemium* (Pleosporales, Ascomycota): a common coelomycetous fungus with stellate conidia occurring on twigs of *Betula* spp.

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Abstract *Asterosporium orientale*, described on *Betula ermanii*, is transferred to the genus *Prosthemium*, and a new combination, *P. orientale*, is proposed. Because of the morphological similarities, *P. asterosporum* originally described from twigs of *B. pendula* is considered as a synonym of *P. orientale*.

Key words Anamorphic fungi · Coelomycetes · Dothideomycetes · Pleomassariaceae · Taxonomy

In our ongoing study of coelomycetous fungi in Japan and Russia (Endo et al. 2008; Hatakeyama et al. 2008; Sato et al. 2008; Shabunin et al. 2008; Yonezawa and Tanaka 2008), an interesting fungus with stellate conidia was found on twigs of *Betula* spp. There are several anamorphic genera with stellate conidia in the coelomycetes, such as *Asterosporium* Kunze, *Prosthemium* Kunze, *Psammina* Sacc. & M. Rousseau ex E. Bommer & M. Rousseau, *Suttoniella* S. Ahmad, *Tetranacrium* H.J. Huds. & B. Sutton, and *Tribolospora* D.A. Reid (Michaelides et al. 1979; Sutton 1980). Among them, *Prosthemium* and *Asterosporium* both share several morphological and ecological features.

Prosthemium was established with *P. betulinum* Kunze as the type species in 1817. Species in this genus have been mainly reported from twigs of *Betula* and *Alnus* in Betulaceae as endophytes or phellophytes (Kowalski and Kehr 1992, 1996) and have ascomatal stages belonging to the genus *Pleomassaria* Speg. in Pleosporales, Dothideomycetes (Sivanesan 1984; Hantula et al. 1998; Paavolainen et al. 2000). This genus is characterized by pycnidial conidiomata and stellate conidia that consist of a central cell and several euseptate arms (Morgan-Jones and Kendrick 1972).

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Asterosporium, typified by *A. asterospermum* (Pers.) S. Hughes, is also a lignicolous genus occurring on *Fagus* and *Betula* as endophytes (Sutton 1980; Danti et al. 2002). No teleomorph was found for this genus. The important criterion to distinguish *Asterosporium* from *Prosthemium* is the acervular conidiomata rather than pycnidia (Morgan-Jones and Kendrick 1972). Sutton (1980), however, regarded the conidiomata of *Prosthemium* also as acervular to eustromatic and weighted to the difference of conidial septation, namely, distoseptate in *Asterosporium* instead of euseptate conidia.

In this study, we compared the morphological features of two similar species in these two genera, namely, *P. asterosporum* T. Kowalski & Holdenr. and *A. orientale* Melnik. *Asterosporium orientale* was originally described from twigs of *B. ermanii* in Russia by Mel'nik (1988). However, except for the presence of stellate conidia, the general characteristics of *A. orientale* do not fit within the generic concept of *Asterosporium* typified by *A. asterospermum* (Hughes 1958; Morgan-Jones and Kendrick 1972). In terms of the presence of pycnidial conidiomata and euseptate conidia, *A. orientale* has close affinities with *P. betulinum*, the type of *Prosthemium*. In *Prosthemium*, seven taxa have been previously recognized as species of the genus (Saccardo 1884, 1895, 1899, 1906; Kowalski and Holdenrieder 1996; Tanaka et al. 2005). Among these, *P. asterosporum* originally found on *B. pendula* from Poland (Kowalski and Holdenrieder 1996) closely resembles *A. orientale*. Comparisons between these taxa based on each type specimen clearly revealed that these fungi are identical (Figs. 1, 2; Table 1). Therefore, we concluded that these taxa are conspecific. *Prosthemium asterosporum* is synonymized under the older epithet, *A. orientale*, and the following new combination *P. orientale* is proposed for this species.

Prosthemium orientale (Melnik) Kamiy., Kaz. Tanaka & Melnik, comb. nov. Figs. 1, 2

MycoBank no.: MB 514191
Asterosporium orientale Melnik, Mikol. Fitopatol. 22: 493, 1988 (Basionym).

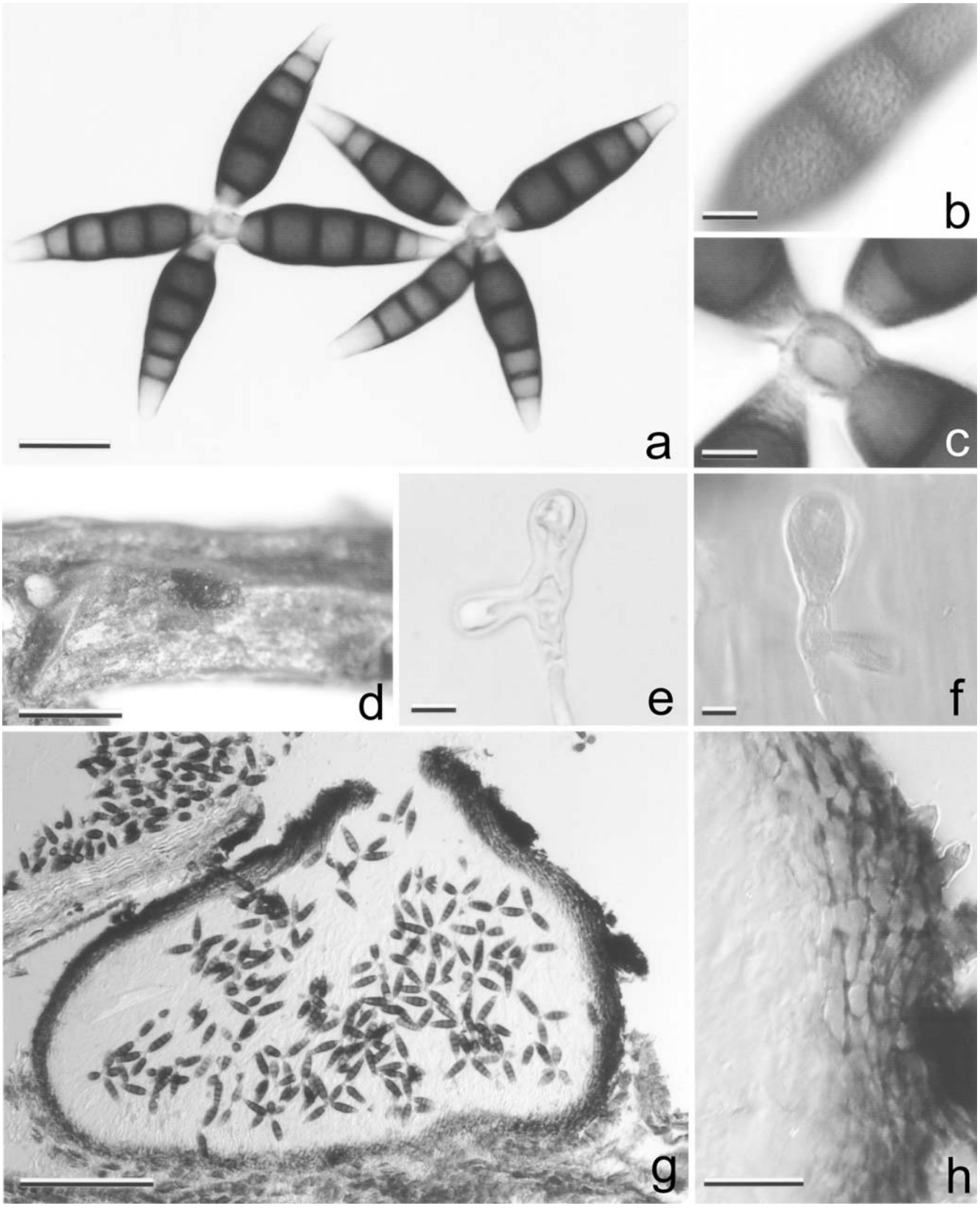

Fig. 1. *Prosthemium orientale* (from LE 73863). **a** Conidia. **b** Minutely verrucose ornamentation of conidial surface. **c** Central cell of conidium. **d** Conidioma on host surface. **e, f** Developing conidia. **g** Longitudinal section of conidioma. **h** Wall of conidioma composed of "textura angularis." *Bars* **a** 20 µm; **b, c, e, f** 5 µm; **d** 1000 µm; **g** 200 µm; **h** 30 µm

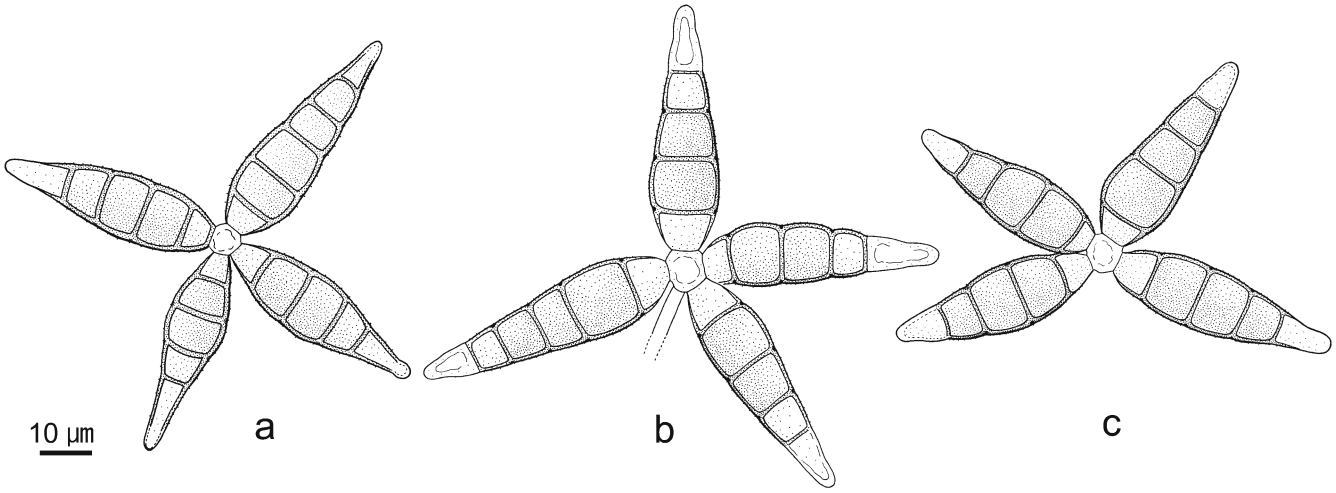

Fig. 2. Conidia of *Prosthemium orientale*. **a** *Asterosporium orientale* (LE 73863, holotype). **b** *Prosthemium asterosporum* (ZT, holotype; dried culture specimen made from CBS 431.96). **c** *Prosthemium asterosporum* (ZT, paratype; natural specimen on twigs of *Betula pendula*)

Table 1. Comparison of conidia between *Asterosporium* orientale and *Prosthemium asterosporum*

Taxon	Widest point (µm)	Size of arms (µm)	Central cells (µm)
Asterosporium orientale[a]	70–92 (mean = 82.0)	36–45 × 10–14 (mean = 40.0 × 11.9)	5–8
Prosthemium asterosporum[b]	69–89 (mean = 83.3)	32–48 × 11–15 (mean = 39.4 × 13.2)	6–9
Prosthemium asterosporum[c]	85–104 (mean = 94.9)	39–51 × 11–16 (mean = 44.9 × 13.3)	7–9

[a] From LE 73863 holotype of *A. orientale*
[b] From ZT paratype of *P. asterosporum* (natural specimen on twigs of *Betula pendula*)
[c] From ZT holotype of *P. asterosporum* (dried culture specimen made from CBS 431.96)

Prothemium asterosporum T. Kowalski & Holdenr., Mycol. Res. 100: 1243, 1996 (Synonym).

Conidiomata pycnidial, 375–530 µm high, 630–750 µm in diameter, unilocular, immersed, scattered to crowded, depressed globose to globose, ostiolate. Wall at sides brown, 35–45 µm thick, composed of "textura angularis" cells of 13.5–22 × 4–12 µm; at the base pale brown, 20–37 µm thick, composed of polygonal cells of 3–6 × 5–10 µm. Conidiophores up to 110 µm long, 3–4 µm thick, unbranched, septate, hyaline, smooth. Conidiogenous cells holoblastic, integrated, determinated, hyaline, smooth, terminal. Conidia stellate, brown, minutely verrucose, mostly composed of 4 arms equally developed (Table 2), 70–92 µm (mean = 82.0 µm, n = 30) between the widest points; arms 36–45 × 10–14 µm (mean = 40.0 × 11.9 µm, n = 50), L/W 2.8–4.0 (mean = 3.4, n = 50), 4–5 transversely euseptate, hyaline to pale brown at the terminal cell, constricted and connected at the central cell; central cells hyaline to pale brown, 5–8 µm in diameter.

Specimens examined: Russia, Kamczatka, distr. Ustj-Kamczatskij, settlement Kljuczi, on dead twigs of *Betula ermanii*, July 22, 1983, Lar. N. Vassiljeva (LE 73863, holotype of *Asterosporium orientale*). Poland, Ojców National Park, on living twigs of *Betula pendula*, Aug. 22, 1988, T. Kowalski (ZT, paratype of *P. asterosporum*, original specimen used for isolating of CBS 431.96). Dried culture specimen made from CBS 431.96 (ZT, holotype of *P. asterosporum*). USA, Selkirk, Yukon territory, on twigs of *Betula* sp., Aug. 18, 1935, D.V. Baxter (BPI US0375708 as *P. betulinum*). Japan, Campus of Hirosaki Univ., Aomori, on living twigs of *Betula platyphylla* var. *japonica*, May 2, 2006, K. Tanaka 2088 (HHUF 29946).

Table 2. Proportion of *Prosthemium orientale* conidia with different number of arms

Number of conidial arms	*Asterosporium orientale*[a]	*Prosthemium asterosporum*[b]	*Prosthemium asterosporum*[c]
3	11 (4.5)[d]	21 (5.3)	21 (3.9)
4	205 (83.7)	318 (80.1)	486 (90.7)
5	11 (4.5)	25 (6.3)	7 (1.3)
6	1 (0.4)	0 (0)	0 (0)
7	2 (0.8)	8 (2.0)	3 (0.6)
8	12 (4.9)	24 (6.1)	19 (3.5)
9	2 (0.8)	1 (0.3)	0 (0)
10	1 (0.4)	0 (0)	0 (0)
Sum[e]	245	397	536

[a] From LE 73863 holotype of *A. orientale*
[b] From ZT paratype of *P. asterosporum* (natural specimen on twigs of *Betula pendula*)
[c] From ZT holotype of *P. asterosporum* (dried culture specimen made from CBS)
[d] Numbers in parentheses indicate percent (%)
[e] Total number of conidia observed

Cultures examined: CBS 431.96 isolated from living twigs of *Betula pendula*, Poland, Ojców National Park, T. Kowalski (ex-type culture of *P. asterosporum*). CBS 114278 isolated from leaves of *Salix caprea*, Sweden, Uppland,

Dalby, Jerusalem, April 20, 1989, O. Constantinescu (as *A. orientale*).

Notes. *Prosthemium orientale* occurs primarily on twigs of *Betula* spp., e.g., *B. ermanii*, *B. pendula*, *B. pubescens*, and *B. platyphylla* var. *japonica*, and appears to be widely distributed throughout the various regions of the Northern Hemisphere, including Austria, Finland, Japan, Poland, Russia, and Switzerland (Mel'nik 1988; Kowalski and Holdenrieder 1996; Barengo et al. 2000; Paavolainen et al. 2000, 2001; Mel'nik et al. 2001; Tanaka et al. 2005). It is generally considered that *P. orientale* is an endophytic (or phellophytic) species that acts as a natural pruning fungus of *Betula* twigs (Kowalski and Kehr 1992; Barengo et al. 2000), but Paavolainen et al. (2000, 2001) suggest that it could be the causative agent in killing the twigs. Apparently, this species has host specificity to *Betula* spp., but it has been found on other plants, such as *Acer pseudoplatanus* twigs (Kowalski and Holdenrieder 1996), *Carex acutiformis* leaves (Mel'nik et al. 2001), and *Salix caprea* leaves (CBS 114278). Of these records, the latter two cases are considered to result from sedimentation of conidia washed off their natural substrata (presumably *Betula* spp.) by rainwater, because there were none of the highly characteristic pycnidial conidiomata of this fungus on the leaves of *Carex* (Mel'nik et al. 2001) and *Salix* (Constantinescu, personal communication).

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