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Phyllactinia mali and *Podosphaera tridactyla* var. *tridactyla* – new hosts of *Ampelomyces quisqualis*

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In 2002, the occurrence of fungi of the order Erysiphales on plants of the Słowiański Park located in Gorzów Wielkopolski was investigated. Plant samples were collected once a month, from August to November. The samples examined were above ground plant parts colonized by powdery mildew fungi. A total of 78 samples were collected. Apart from 14 species of the order Erysiphales, *Ampelomyces quisqualis* parasitizing on *Erysiphe cichoracearum* var. *cichoracearum*, *Phyllactinia mali* and *Podosphaera tridactyla* var. *tridactyla* was found. *Ampelomyces quisqualis* affected hyphae, oidia, and young cleistothecia of *P. mali*. In contrast, in *E. cichoracearum* var. *cichoracearum*, *Po. tridactyla* var. *tridactyla*, this hyperparasite colonized only hyphae and oidia. This paper for the first time informs of *A. quisqualis* parasitizing on *P. mali* and *Po. tridactyla* var. *tridactyla*.

Key words: hyperparasite, *Ampelomyces quisqualis*, *Phyllactinia mali*, *Podosphaera tridactyla*

INTRODUCTION

Ampelomyces quisqualis Ces. has originally been described as *Cicinnobolus cesatii* de Bary in 1852 (Hino and Kato 1929). In the literature, about 40 synonyms of this fungus exist (Kiss and Nakasone 1998).

Ampelomyces quisqualis is a hyperparasite of fungi of the order Erysiphales, the causal agents of powdery mildews (Sutton 1980). This fungus forms pycnidia in hyphae, conidia, and young cleistothecia of the powdery mildew fungi (Barnett 1960; Cook and Backer 1989; Madej and Antoszczyszyn 1965; Sutton 1980). Only the conidial stage of this fungus is know do date (Sutton 1980). However, Kiss and Nakasone's (1998) molecular investigations indicated that *A. quisqualis* is a member of the order Dothideales in the phylum Ascomycota.

In the world, *A quisqualis* has been reported from 66 species in 9 genera of the order Erysiphales (Kiss and Nakasone 1998; Szentiványi and Kiss 2003). In Poland, this fungus has so far been found on 30 species in 6 genera of this group of fungi, i. e.: *Erysiphe*, *Microsphaera*, *Oidium*, *Podosphaera*, *Sphaerotheca*, and *Uncinu-*

la (Adamska 2001, 2002; Adamska et al. 1999; Czerniawska 2001a, b; Czerniawska et al. 2000; Domański et al. 1970; Kućmierz 1968, 1971, 1973, 1976; Madej 1963, 1974, 1993, 1996; Madej and Antoszczyszyn 1965; Majewski 1970, 1972; Michalski 1959; Mułenko 1988; Mułenko et al. 1995; Romaszewska-Sałata 1981, 1982; Sałata et al. 1984).

During studies of the occurrence of fungi of the order Erysiphales on plants of the Słowiański Park located in Gorzów Wielkopolski (north-western Poland), *A. quisqualis* was found on three species of powdery mildew fungi, including *P. mali* (Duby) U. Braun and *Po. tridactyla* (Wallr.) de Bary var. *tridactyla*, taxa earlier unknown to be its hosts.

The aims of this paper were to describe and illustrate the characters of *A. quisqualis* coming from *E. cichoracearum* DC. var. *cichoracearum P. mali,* and *Po. tridactyla* var. *tridactyla*, as well as the mode of colonization of these powdery mildew fungi and formation of pycnidia by this hyperparasite.

MATERIALS AND METHODS

The study materials were above ground plant parts affected by powdery mildew fungi in the Słowiański Park of Gorzów Wielkopolski in 2002. The plant parts were collected once a month, from August to November. A total of 78 samples of diseased plants were collected.

In the laboratory, the plant parts collected were first dried between sheets of filter paper, and then their species affiliation was determined according Szafer, Kulczyński and Pawłowski (1969). The nomenclature of plants used is after Mirek et al. (1995). Fungi of the order Erysiphales were recognized according to Braun (1987).

The structures examined were oidia, intact and crushed cleistothecia, as well as their asci and ascospores.

To examine the morphological characters of *A. quisqualis* and the mode of colonization of its fungal hosts, microscope slides were prepared with mycelium and pycnidia of this fungus and structures of the powdery mildew fungi attacked by it. The mounting medium used in both identification of powdery mildew fungi and observations of *A. quisqualis* was a drop of lactic acid placed on a microscope slide and covered with a cover glass.

Microscope observations were performed using the Olympus SZ 40 dissecting microscope and the Olympus CX 21 compound microscope. Microphotographs were recorded on a Sony 3CDD DXC-390 colour video camera coupled to the Olympus BX 50 compound microscope equipped with Nomarski differential interference contrast optics.

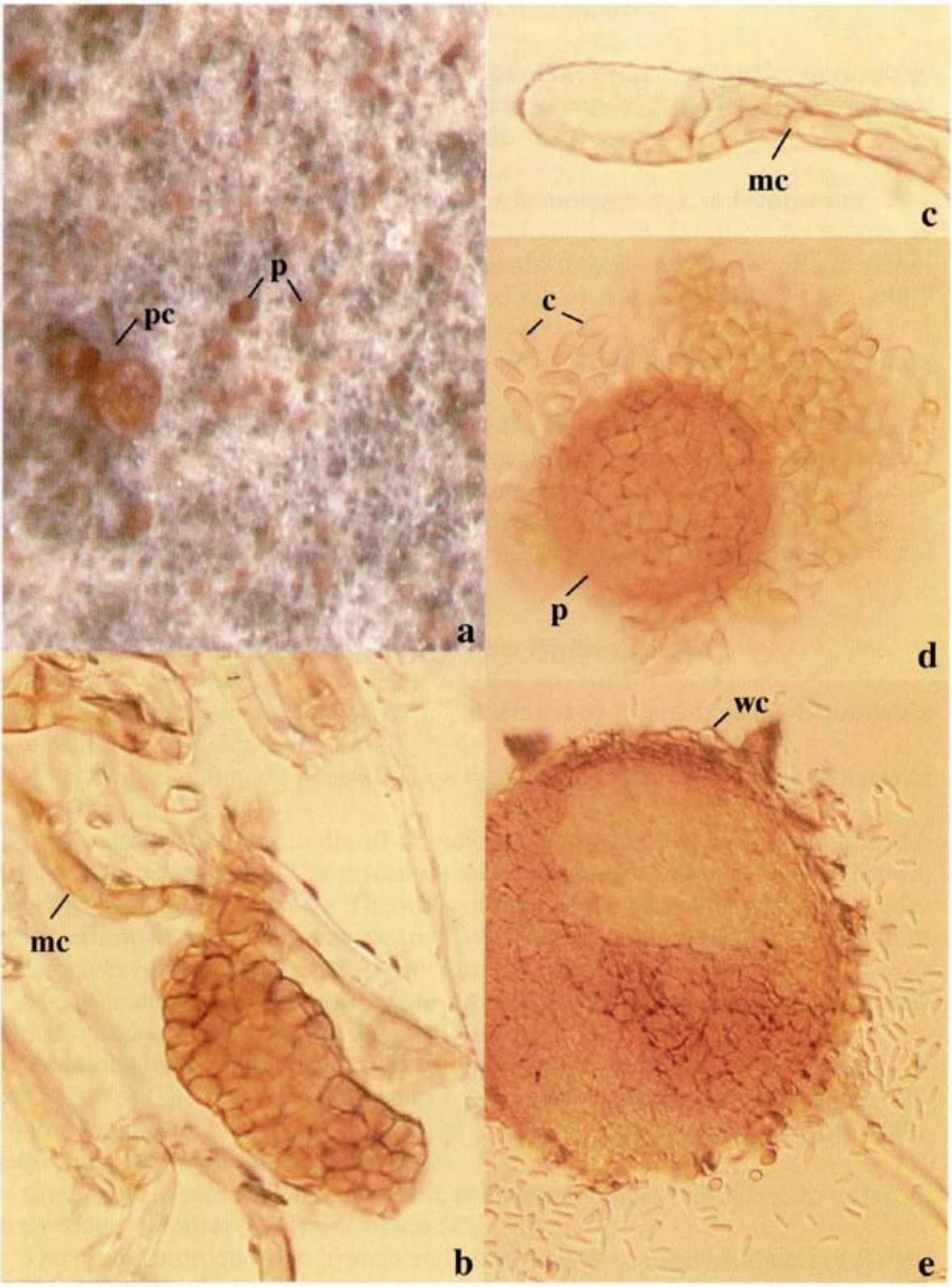

Fig. 1. *Ampelomyces quisqualis* on *Phyllactinia mali*: (**a**) pycnidia formed in hyphae (p) and a young cleistothecium (pc), (**b**) multicellular hyphae (mc) of *A. quisqualis* inside hypha of *P. mali* and a young pycnidium (p) of *A. quisqualis*, (**c**) multicellular hyphae (mc) of *A. quisqualis* inside oidium of *P. mali*, (**d**) globose pycnidium (p) and conidia (c) of *A. quisqualis*, (**e**) pycnidium of *A. quisqualis* formed from a young cleistothecium; the wall of the cleistothecium is idicated (wc).

RESULTS AND DISCUSSION

In the 78 plant samples collected, 14 species of the order Erysiphales were recognized. Of them, *E. cichoracearum* DC. var. *cichoracearum*, *P. mali*, and *Po. tridactyla* var. *tridactyla* were parasitized by *A. quisqualis.*

Ampelomyces quisqualis from *Erysiphe cichoracearum* var. *cichoracearum*

The leaves of *Helianthus tuberosus* L. parasitized by *E. cichoracearum* var. *cichoracearum* hosting *A. quisqualis* were collected on 26 Aug., 24 Sept., 7 Oct., and 7 Nov. 2002.

In the specimens of *E. cichoracearum* var. *cichoracearum* examined, *A. quisqualis* colonized only hyphae and oidia.

The specimens of *A. quisqualis* found in the Słowiański Park did not differ in morphology of their pycnidia and conidia from those described by Sutton (1980).

In Poland, *A. quisqualis* hosted by *E. cichoracearum* var. *cichoracearum* has earlier been found on the Łęczyńsko-Włodawskie Lake District (Mułenko 1988), in the Drawski Landscape Park (Czerniawska 2001a, b), and the Słowiński National Park (Adamska 2001).

Ampelomyces quisqualis from *Phyllactinia mali*

The leaves of *Crataegus monogyna* L. parasitized by *P. mali* hosting *A. quisqualis* were collected on 7 Oct. 2002.

Ampelomyces quisqualis parasitized on hyphae, oidia, and young cleistothecia of *P. mali* (Fig. 1 a, b, c, e).

Inside the hyphae and oidia of *P. mali, A. quisqualis* first formed multicellular mycelium (Figs. b, c). The mycelium was composed of hyaline to pale brown, branched hyphae, 2-3 μm wide. The walls of the hyphae and oidia of *P. mali* gradually deteriorated and finally disappeared. With time, the multicellular mycelium of *A. quisqualis* formed a wall of the pycnidium (Fig. 1b).

The pycnidia were brown, globose to subglobose, 27-30 μm diam (Fig. d), rarely elliptic-cylindrical, 18(-22) x 36(-40) μm (Fig. 1b).

Additionally, *A. quisqualis* produced pycnidia inside young cleistothecia of *P. mali* (Fig. 1e). They were pale brown to brown, glistening, subglobose, 45(-50)-57(-60) μm diam, rarely larger, up to 115-120 μm diam. Inside them, remnants of the cleistothecial wall were frequently visible.

Conidia were pale brown, one-celled, cylindric-elliptical, 7.5-10.0 x 2.5-3.0) μm, rarely widely elliptical , 2(-3) x 4(-6) μm (Fig. 1d).

The pycnidia produced in hyphae and oidia, as well as in cleistothecia of *P. mali* lacked an ostiolum.

The pycnidia of *A. quisqualis* found on *P. mali* by the author of this paper were similar in size to those characterized by Sutton (1980). However, conidia of this hyperparasite coming from this powdery mildew fungal host were slightly larger (7,5-10 x 2,5-3 μm vs. 4-6,5 x 2-2,5 μm).

Only two literature reports exist of the occurrence of *A. quisqualis* on fungi of the genera *Phyllactinia*. Kiss (1998) found *A. quisqualis* on *Ph. guttata* (Wallr.: Fr.)

Lév., Kiss (1998) and Szentiványi and Kiss (2003) on *Ph. fraxini* (DC.) Fuss. Thus, this paper is the first report of *A. quisqualis* parasitizing on *P. mali*.

Ampelomyces quisqualis from *Podosphaera tridactyla* var. *tridactyla*

The leaves of *Padus serotina* (Ehrh.) Brokh. affected by *Po. tridactyla* var. *tridactyla* and hosting *A. quisqualis* were collected on 7 Oct. 2002.

Ampelomyces quisqualis produced pycnidia in hyphae and oidia of *Po. tridactyla* var. *tridactyla*. The ontogenesis of the pycnida was identical to that found in *P. mali*. None of the cleistothecia examined was affected by this hyperparasite.

The morphological characters of the mycelium, pycnidia, and conidia of *A. quisqualis* revealed on *Po. tridactyla* var. *tridactyla* by the author of this paper correspond with those given by Sutton (1980).

In Poland, of fungi of the genus *Podosphaera, A. quisqualis* has been found only on *Po. leucotricha* (Ell. & Ev.) Salmon (Czerniawska 2001a, b; Kućmierz 1976; Madej 1974, 1996; Madej and Antoszczyszyn 1965).

The only other literature reports of the occurrence of *A. quisqualis* on *Podosphaera* spp. are those from Romania and Hungary regarding *Po. clandestina* (Wallr. ex Fr.) Lév. and *Po. leucotricha* (Kiss 1998). So, *Po. tridactyla* var. *tridactyla* is a new host of *A. quisqualis*.

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Phyllactinia mali i *Podosphaera tridactyla* var. *tridactyla* – nowi żywiciele *Ampelomyces quisqualis*

Streszczenie

W roku 2002 zbadano występowanie grzybów z rzędu Erysiphales na roślinach Parku Słowiańskiego położonego w Gorzowie Wielkopolskim. Próby roślinne pobierano raz w miesiącu, od sierpnia do listopada. Materiałem badawczym były części nadziemne roślin z objawami zasiedlenia przez sprawców mączniaków prawdziwych. Z terenu badań pobrano losowo 78 prób chorujących roślin. Poza 14 gatunkami z rzędu *Erysiphales*, stwierdzono występowanie nadpasożyta sprawców mączniaków prawdziwych - *Ampelomyces quisqualis*, które występowało na *Erysiphe cichoracearum* var. *cichoracearum*, *Phyllactinia mali* i *Podosphaera tridactyla* var. *tridactyla*. *Ampelomyces quisqualis* zasiedlało zarówno strzępki grzybni, oidia, jak i młode kleistotecja *P. mali*. Natomiast u *E. cichoracearum* var. *cichoracearum* i *Po. tridactyla* var. *tridactyla* nadpasożyt ten zasiedlał tylko strzępki grzybni i oidia. Niniejszy artykuł po raz pierwszy informuje o pasożytowaniu *A. quisqualis* na *P. mali* i *Po. tridactyla* var. *tridactyla*.