

INTERESTING INSTANCES OF ASCOMYCOTA ON ACORUS, PHRAGMITES AND TYPHA

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Abstract

Studies on the occurrence of parasitic fungi colonising plants of the genera *Acorus*, *Phragmites* and *Typha* were conducted in Western Pomerania between 2005 and 2008. In total, 25 fungal species were recorded, of which anamorphic fungi dominated. One ascomycete recorded in the study was a taxon new to Poland (*Metasphaeria acorella*), while five were classified as rare in Poland (*Didymella proximella*, *Lentithecium arundinaceum*, *Phaeosphaeria eustoma*, *P. nigrans* and *Pyrenophora typhicola*).

Key words: fungi, *Didymella*, *Lentithecium*, *Metasphaeria*, *Phaeosphaeria*, *Pyrenophora*, *Acorus*, *Phragmites*, *Typha*

Introduction

Plants of the genera *Acorus*, *Phragmites* and *Typha* are common in Poland. They colonise banks of both stagnant and slow-flowing water basins. *Typha angustifolia* and *T. latifolia* have been recorded in the northern temperate zone and the tropics, and *Phragmites australis* is a cosmopolitan species. *Acorus calamus* has been recorded in Asia, North America and Eastern and Central Europe. Young plants of the genera *Phragmites* and *Typha* are mown for fodder while older plants are used for the production of construction and insulation boards. Oil extracted from the roots of *A. calamus* is used in medicine, cosmetology (as an ingredient in perfume) and food industry, and its leaves used to serve as mats in bread baking (Podbielkowski and Sudnik-Wójcikowska 2003).

Studies on the occurrence of microscopic fungi on natural rush vegetation in Poland were conducted only in Mazurskie Lakeland (Durska 1969, 1974), Pomerania (Mazurkiewicz-Zapałowicz et al. 2005, 2006, 2007, 2011, Adamska and Czerniawska 2009, 2010, Czerniawska and Adamska 2009, 2010, Mazurkiewicz-Za-

pałowicz 2009, 2010, Adamska et al. 2010 a, 2010 b, Czerniawska et al. 2010, Mazurkiewicz-Zapałowicz and Grajewski 2010) and Słowiński National Park (Adamska and Błaszczkowski 2000, Adamska 2001).

Parasitic fungi have often been recorded on plants belonging to the genera *Acorus*, *Phragmites* and *Typha* during studies on the occurrence of microscopic fungi in Pomerania. Although the fungi became visible mostly towards the end of the summer, mature fruit bodies of some were found only at the end of the winter. Several species were rare in Poland. The aim of this study was to describe them.

Materials and methods

The banks of lakes, isolated stagnant water bodies and intrafield ponds in Western Pomerania were investigated. The plant material was collected in the vicinity of Kołobrzeg and Bobolice between December 2005 and October 2008. Plant fragments were evaluated using a stereoscopic microscope. Sections of pathological tissues were cut out with a safety razor and cut into small strips. They were placed in a drop of lactic acid on a microscopic slide and covered with a cover slip. Preparations were examined using an Axiolab Zeiss light microscope and measurements were taken using an optical micrometric glass.

Fungi were isolated, incubated and determined directly after harvesting and after three–four months. Leaf fragments without sporulation were incubated in sterile humid chambers for 24–48 h. The resulting species of fungi were determined directly and after isolation on PDA medium.

Plant species were determined using a key (Rutkowski 2004) and their nomenclature was determined according to Mirek et al. (1997). The fungi were identified using studies by Brandenburger (1985), Ellis and Ellis (1987) and Shoemaker and Babcock (1989, 1992). The nomenclature of fungi taxa is given after “Index Fungorum” (2012). The plant material with fungal specimens was deposited in the Department of Plant Protection at the West Pomeranian University of Technology in Szczecin.

Results and discussion

In total, 25 fungal species colonising representatives of the genera *Acorus*, *Phragmites* and *Typha* were identified during the analysis of the plant material collected in Western Pomerania. Amongst them, anamorphic fungi dominated (13 species), and eight species belonged to the Ascomycota. Some of the species are taxa new to or rarely observed in Poland. The more interesting fungi of the phylum Ascomycota are described in this study.

Species new to Poland

Metasphaeria acorella (Cooke) Berl. & Vog. 1886

Pseudothecia brown to dark brown, immersed in tissue, globose, diam. 130–160 μm , ostiole 22 μm in diam. Asci cylindrical, 70–80 \times 16–18 μm , 8-spored. Ascospores hyaline to light yellow, straight or slightly curved, 26–32 \times 4–5 μm , 3-septate.

Specimen examined. On: *A. calamus*, Chlewo Lake, Porost near Bobolice, October 2007, leg. I. Adamska.

Notes. The species was observed in Europe (Brandenburger 1985) and reported in Denmark and Great Britain (Farr and Rossman 2012).

The fungus in the present material collected in the village of Porost, produced pseudothecia with a slightly larger diameter than those described by Munk (1957) and Brandenburger (1985; diam. up to 150 μm in both descriptions), and asci slightly longer than those described by Brandenburger (1985; 55–75 \times 15–19 μm). Ascospores of the fungus recorded in the present material were slightly longer than those reported by Munk (1957; 26–30 \times 4–5 μm) and Brandenburger (1985; 26–30 \times 4–5 μm), and shorter and narrower than those described by Berlese and Vogliano (1886; 30–35 \times 6 μm).

Rare species in Poland

Didymella proximella (P. Karst.) Sacc.

Pseudothecia brown, immersed in tissue, slightly flattened, diam. 180–190 μm . Asci 75–90 \times 18–20 μm . Ascospores hyaline to light straw-coloured, slightly curved, 20–26 \times 7–10 μm , 1-septate; slight constricted at septum, both free ends rounded, 2 guttules in each ascospore cell.

Specimen examined. On: *A. calamus*, Długie Lake, Porost near Bobolice, August 2008, leg. I. Adamska.

Literature records. The fungus was only recorded in the Drawa National Park (Mazurkiewicz-Zapałowicz et al. 2007, 2011, Mazurkiewicz-Zapałowicz 2009), however, it colonised leaves of *T. angustifolia*, *Carex acuta*, *C. paniculata* and *C. vesicaria*. **Other regions.** The fungus has been observed in Europe (Sivanesan 1984), for instance in Denmark (Munk 1957), Austria (Scheuer 1988, Farr and Rossman 2012), Bulgaria, Great Britain, Germany and Sweden (Farr and Rossman 2012), as well as in the USA (Corlett and Smith 1978, Sivanesan 1984, Farr and Rossman 2012).

Notes. According to Ellis and Ellis (1987), the species occurs on dead culms and the leaves of monocotyledons (Munk 1957), especially on representatives of the genera *Carex*, *Schoenoplectus*, *Trichophorum* and the family Typhaceae (Ellis and Ellis 1987). Sivanesan (1984) recorded it on wintering fragments of *Carex californica* and the leaves of *C. acuta*. The taxon has quite often been observed in Denmark according to Munk (1957).

The diameter of pseudothecia in the present material was smaller than that described by Sivanesan (1984; up to 200 μm) and Munk (1957; 200 μm), and the asci were narrower than those described by Sivanesan (1984; 67–95 \times 19–23 μm) and, at the same time, shorter than those described by Munk (1957; 75–100 \times 16–20 μm) and Scheuer (1988; 75–105 \times (16–)19–21.5(–25) μm). Ascospores in the material collected in the vicinity of Porost were slightly broader than those described by Sivanesan (1984; 20–26 \times 7.5–9 μm) and Scheuer (1988; 18.5–24.5(–27.5) \times 6.5–9 μm) and slightly narrower than those described by Munk (1957; 20–27 \times 9–11 μm).

***Lentithecium arundinaceum* (Sowerby) Hyde, Fourn. & Ying Zhang**

Pseudothecia dark brown, immersed in tissue, slightly flattened, diam. 180–200 μm , ostiole 22–25 μm in diam. Asci numerous, 70–90 \times 10–12 μm , 8-spored. Ascospores hyaline to light straw-coloured, narrow, fusiform, straight or slightly curved, 22–32 \times 3.5–5 μm , 2- or 4-septate. Prominently constricted at septum in 2-celled ascospores; constricted at medial septum in 4-celled ascospores. Fine guttules visible in 2-celled ascospores.

Specimen examined. On: *P. australis*, Kamienica Lake, Kamica near Kołobrzeg, May 2006, leg. I. Adamska (Adamska et al. 2010 b).

Literature records. Recorded on *P. australis* in Silesia (Schroeter 1972) and in the forests of north-eastern Poland (Chlebicki 2005). **Other regions.** The fungus was reported in France and Great Britain (Shoemaker and Babcock 1989), the Netherlands (Van Ryckegem and Verbeken 2005) and Japan (Tanaka and Harada 2003). It has also occurred in Denmark, Belgium, Switzerland, the Czech Republic and Italy (Farr and Rossman 2012). It usually colonises *P. australis* (Munk 1957, Dennis 1968, Schroeter 1972, Shoemaker and Babcock 1989, Tanaka and Harada 2003), although it has also been recorded on other grasses according to Ellis and Ellis (1987).

Notes. The fungus was recorded on the dead sheaths and stems of the host (Ellis and Ellis 1987). Pseudothecia rarely occurred singly, more often in groups or arranged in elongated rows (Munk 1957, Ellis and Ellis 1987).

The diameter of pseudothecia was smaller than that reported by Munk (1957) and Ellis and Ellis (1987; 200–250 μm in both studies), and similar to that reported by Shoemaker and Babcock (1989; 180–220 μm). The size of the asci was similar to that reported by Dennis (1968; 75–90 \times 10–13 μm) and Schroeter (1972; 75–90 \times 10–12 μm), but the asci were narrower and shorter than those described in Japan (Tanaka and Harada 2003; 70–131.5 \times 9.5–15.5 μm). Ascospores in the present material were similar to those reported by Ellis and Ellis (1987; 21–30 \times 3–5 μm), Dennis (1968; 21–30 \times 3–4 μm), Munk (1957; 20–30 \times 4–5 μm) and Schroeter (1972; 21–30 \times 6 μm), but were shorter than those observed by Shoemaker and Babcock (1989; 32–36 \times 4.5–5 μm) and Tanaka and Harada (2003; 23–40.5 \times 3.5–6 μm).

***Phaeosphaeria eustoma* (Fuckel) Holm**

Pseudothecia brown to dark brown, immersed in tissue, globose, diam. 75–100 μm , ostiole 25 μm in diam. Asci numerous, cylindrical, 57.5–60.0 \times 10–12.5 μm , 8-spored arranged at oblique angles in two rows, sometimes overlapping. Ascospores pale yellow to yellow, narrowly fusiform, straight or slightly curved, (17.5–)22.5–25(–25.5) \times 4–5(–6) μm , 3-septate, the second ascospore cell is the broadest.

Specimen examined. On: *T. latifolia*, Kamienica Lake, Kamica near Kołobrzeg, December 2005, leg. I. Adamska.

Literature records. The fungus has been recorded in Poland (Schroeter 1908, Chlebicki and Lembicz 2001, Kowalik 2011). Schroeter (1972) reported *P. eustoma* in Legnica, Kluczbork and Wrocław, Faliński and Mułenko (Cryptogamous plants... 1997) found this taxon in Białowieża National Park, Mułenko (1988) in the Łęczyńsko-Włodawskie Lake District and Czerniawska et al. (2010) and Mazurkiewicz-Zapałowicz (2010) in Western Pomerania. **Other regions.** The fungus has been recorded in Denmark (Munk 1957), Germany (Shoemaker and Babcock 1989) and India (Ponnappa 1968). It also occurred in Austria, Canada, France, Italy, Libya, Netherlands, New Zealand, Sweden, Switzerland, Pakistan and USA according to Farr and Rossman (2012).

Notes. According to Ellis and Ellis (1987), the fungus is usually observed in material collected in May and June. The material from the vicinity of Kołobrzeg was collected in December.

The diameter of the pseudothecia recorded in the present study was consistent with that reported by Ellis and Ellis (1987; up to 0.2 mm); the ascospores, however, were slightly broader than those described by Ellis and Ellis (1987; 13–25 \times 3–5 μm , usually 15–20 \times 3–4 μm) and by Munk (1957; 13–21 \times 3–4 μm), but similar to the size reported by de Bary et al. (1887; 16–21 \times 4–5.5 μm), Dennis (1968; 16–23 \times 4–5.5 μm), Schroeter (1972; 16–21 \times 4–5.5 μm) and Shoemaker and Babcock (1989; 18–22 \times 4.5–5.5 μm). The number of septa in *P. eustoma* ascospores in the present material agrees with that reported by Ellis and Ellis (1987; 3 septa), Schroeter (1972), Dennis (1968) and Shoemaker and Babcock (1989). Only Munk (1957) recorded 2–3 septa in ascospores, and de Bary et al. (1887) recorded 3–4 septa.

Phaeosphaeria typharum (Desm.) L. Holm is another species of the genus *Phaeosphaeria* occupying the leaves and stems of plants belonging to *Typha*. According to Ellis and Ellis (1987) as well as Shoemaker and Babcock (1989), the species produces pseudothecia smaller than those in *P. eustoma* (up to 0.15 mm and 90–110 μm in diam., respectively), and its ascospores are broader than those in *P. eustoma* (21–24 \times 7–9 μm , de Bary et al. 1887; 25–37 \times 10–12 μm , Munk 1957; 20–33 \times 9–13 μm , Dennis 1968, Sivanesan 1984; 21–28 \times 8–10 μm , Schroeter 1972; 25–35 \times 9–13 μm (usually 25–30 \times 10–12 μm), Ellis and Ellis 1987; (21–)24–30(–35) \times (8–)9–11(–12) μm , Shoemaker and Babcock 1989).

***Phaeosphaeria nigrans* (Rob. & Desmaz.) Holm**

Pseudothecia brown to black, immersed in plant tissue, slightly flattened, diam. 180–240 μm , ostiole 20 μm in diam. Asci numerous, cylindrical, 75–90 \times 8–10 μm , 8-spored. Ascospores hyaline to pale yellow, narrow, straight, less frequently slightly curved, 18–22 \times 4–5 μm , 5-septate. The first ascospore cell slightly elongated and rounded at end, the second distinctly broader than others.

Specimen examined. On: *P. australis*, Kamienica Lake, Kamica near Kołobrzeg, May 2006, *leg. I. Adamska* (Adamska et al. 2010 b).

Literature records. The fungus occurred only on *Nardus stricta* and was recorded in the Łęczyńsko-Włodawskie Lakeland (Mułenko 1988). **Other regions.** The taxon often occurs in Europe (Sivanesan 1984, Farr and Rossman 2012). It has been reported in Austria, France, Switzerland, Germany and Sweden, as well as in India, Canada and the USA (Shoemaker and Babcock 1989, Farr and Rossman 2012) and Japan (Fukuhara 2002).

Notes. According to Sivanesan (1984) and Dennis (1968), the fungus often colonises the dead culms and leaves of many grass species. Taxa of the genera *Dactylis*, *Deschampsia*, *Elymus*, *Festuca*, *Glyceria* etc., have been reported by Ellis and Ellis (1987) as hosts, and Shoemaker and Babcock (1989) also reported representatives of the genera *Anthoxanthum*, *Bromus*, *Carex*, *Phragmites* and *Poa*.

The diameter of the pseudothecia produced by the fungus recorded near Kołobrzeg is smaller than that reported by Sivanesan (1984; up to 300 μm) and Dennis (1968; 250 μm), but is similar to that reported by Shoemaker and Babcock (1989; 160–250 μm). The size of the asci is similar to that reported by Sivanesan (1984; 60–110 \times 8–12 μm), Dennis (1968; 75–90 \times 6–8 μm) and Shoemaker and Babcock (1989; 60–90 \times 7–12 μm). Ascospores in the present material were broader and at the same time shorter than those described by Dennis (1968; 18–23 \times 3–4 μm) as well as by Ellis and Ellis (1987; 17–24 \times 3–4 μm), and narrower and shorter than the ascospores described by Sivanesan (1984; 17–24 \times 3–6 μm) and shorter than those described by Shoemaker and Babcock (1989; 17–26 \times 3.5–5 μm).

***Pyrenophora typhicola* (Cooke) E. Müller**

Spots on leaves and leaf sheaths, cinereous grey with tiny black or dark brown spots. Pseudothecia globose, brown to dark brown, immersed in plant tissue, 350–400 μm in diam. Ostiole 100–125 μm in diam. Asci numerous, clavate, hyaline, 100–125 \times 25–30 μm . Ascospores muriform, oval to cylindrical, straight, rounded at one end, slightly tapered at the other, hyaline when immature, light yellow to yellow (less frequently yellow-brown) when senescent, 45–50 \times 10–12.5 μm , with three transverse septa and one longitudinal septum across the entire ascospore. 2–5 light olive to olive guttules, 2 μm , 5 μm or 7 μm in diam., in cells of senescent ascospores. Many tiny hyaline guttules, up to 2.5 μm in diam., in immature ascospores.

Specimen examined. On: *T. latifolia*, Kamienica Lake, Kamica near Kołobrzeg, December 2005, *leg. I. Adamska*.

Literature records. The fungus was recorded in the Drawa National Park on *T. angustifolia* (Mazurkiewicz-Zapałowicz et al. 2007, 2011). **Other regions.** The fungus often occurs in Denmark according to Munk (1957). Shoemaker and Babcock (1992) reported it in Austria, Great Britain, Germany and Switzerland, and Fallah and Shearer (1998) also reported it in the USA. The species has also occurred in France and Portugal according to Farr and Rossman (2012).

Notes. According to Ellis and Ellis (1987), *P. typhicola* produces pseudothecia on leaf sheaths, sometimes on stems. Pseudothecia were also produced on the leaves in the material collected near Gościno.

The diameter of the pseudothecia is consistent with that reported by Ellis and Ellis (1987; diam. up to 0.5 μm) and Shoemaker and Babcock (1992; 400–500 μm in diam.). The asci produced by the fungus recorded near Kołobrzeg are shorter and narrower than those in *P. typhicola* described by Munk (1957; 200–210 \times 34–36 μm), but their size is within the range reported by Shoemaker and Babcock (1992; 90–150 \times 20–50 μm). The ascospores of the fungus recorded in the vicinity of Kołobrzeg are shorter and narrower than those described by de Bary et al. (1887; 60 \times 25 μm), Ellis and Ellis (1987; 50–70 \times 18–24 \times 12–14 μm) and by Munk (1957; 50–70 \times 12–14 μm), but are similar to the size reported by Shoemaker and Babcock (1992; 28–50 \times 11–18 \times 8–14 μm).

Streszczenie

INTERESUJĄCE ASCOMYCOTA NA ROŚLINACH RODZAJÓW *ACORUS*, *PHRAGMITES* I *TYPHA*

W latach 2005–2008 na terenie Pomorza Zachodniego przeprowadzono badania nad występowaniem grzybów mikroskopijnych zasiedlających rośliny rodzajów *Acorus*, *Phragmites* i *Typha*. Łącznie wyizolowano z nich 25 gatunków grzybów. Dominowały wśród nich grzyby anamorficzne. Jeden gatunek workowca znaleziony w trakcie badań był nowy dla Polski (*Metasphaeria acorella*), a pięć notowano wcześniej rzadko (*Didymella proximella*, *Lentithecium arundinaceum*, *Phaeosphaeria eustoma*, *P. nigrans* i *Pyrenophora typhicola*).

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