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Short communication

Sordaria fimicola (Ascomycota, Sordariales) on *Acer palmatum*

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Abstract

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During an investigation of the mycoflora of Japanese red maple trees growing in an urbanized area of Nitra, Slovakia, *Sordaria fimicola* (Roberge ex Desm.) Ces. & De Not) was isolated from affected leaves and branches of *Acer palmatum* ´Atropurpureum´ L. This fungus was associated with symptoms of brown wood discoloration and leaf spottiness of these trees. *Sordaria fimicola* was recorded for the first time on *Acer palmatum* ´Atropurpureum´ in Slovakia. The fungus is characterized by dark brown ascomata clothed with setae, fasciculate, unitunicate, cylindrical asci, and olivaceous to olivaceous-brown, one-celled, ellipsoidal, smooth-walled ascospores with a colourless basal germ pore and surrounded by a gelatinous sheath**.**

Keywords

ascomycetes, Japanese red maple, pathogenic fungus

Introduction

In recent years stems and branches of woody hosts such as fruit and ornamental trees have been shown to share the same range of fungi, which are able to migrate between these different hosts (Mostert et al., 2005, 2006; Essakhi et al*.,* 2008). However, most of these genera are typical inhabitants of wood and bark, occurring on a broad spectrum of trees and shrubs worldwide (Schoch et al., 2009; Zhang et al., 2009).

These fungi associated with symptoms of brown wood discoloration and leaf spottiness include several ascomycetes such as *Sordaria*. Several members of this order have been isolated from remains of plant biomass, live plants, from seeds and from soil (Lundqvist, 1972; Doveri, 2004; Richardson, 2008) and they are important candidates for studies in genetics and biochemistry (Kendrick, 2000). Natural habitat of this species is dung of herbivorous animals (Fields, 1970).

The aim of this work was to isolate and identify the organism occurring on infected Japanese red maple leaves and branches in green areas of Nitra.

Material and methods

The samples of leaves and twigs of *Acer palmatum* ´Atropurpureum´ showing blight symptoms were gathered from plants growing in private gardens of the town Nitra, during summer–autumn 2013 and summer 2014. Altogether 15 trees were studied. The age of evaluated trees was between 5–10 years. The collected material was deposed in herbarium at the Institute of Forest Ecology of the Slovak Academy of Sciences, Branch for Woody Plant Biology in Nitra. [*Sordaria fimicola*, *Acer palmatum* ´Atropurpureum´, Slovakia, Nitra, Zobor-hill, 2. July 2013, leg. H. Ivanová (IFE SAS, Nitra, Slovakia, NR 5190)]. Pure cultures were obtained through cultivation on nutritive 3% PDA medium in a test chamber with constant temperature and humidity (24 ± 1 °C and 45% humidity in dark conditions in a versatile environmental test chamber MLR-351H – Sanyo). Leaves and twigs cut from the diseased plants were surface-sterilized for 20 minutes. Study of fungal structures was performed with a light clinical microscope BX41 (Olympus) under 400× and 1,000×

magnification. Measurements were made using QuickPhotomicro 2.2 programme and the morphometric values were compared with previously published data for the taxa (Lundquist, 1972; Alexopoulos et al., 1996; Crous et al., 2009).

Results and discussion

Many fungal diseases cause damage to ornamental tree species in the genus *Acer*, including *Acer palmatum* ´Atropurpureum´. Among pathogenic fungi, microscopic pathogens isolated and identified from the affected leaf and branch tissues include ascomycetous fungi in the genus *Sordaria*. The causal organism – *Sordaria fimicola* (Roberge) Ces. & De Not., (syn. *Sphaeria fimicola* Roberge in Desm.) (Sordariomycetes, Ascomycota) was systematically isolated from the leaf and twig tissues showing rusty to brown coloured blight symptoms. Microscopic examination of fresh material indicated that the ascomycete fungus from Slovakia fits well within the genus *Sordaria*. Thick-walled, obpyriform, densely aggregated ascomata, as well as olivaceous, dark brown ascospores at maturity with a basal germ pore suggest this fungus is *Sordaria fimicola* on *Acer palmatum* ´Atropurpureum´.

White at the beginning homothallic colonies fast growing on PDA (Fig. 1a) formed sparse aerial mycelium pale white colour. Dark, mostly densely aggregated superficial, obpyriform pycnidia were formed after 1 week of inoculation in dark conditions (Fig. 1b). Vegetative hyphae were thin-walled, septate, branched (Fig. 1c), lacking chlamydospores. Macroconidia did not discover. The ascomata were superficial, glabrus or sparsely covered with flexuous, colourless hairs (Fig. 1d), pear-shaped or obpyriform, with central ostiole (Fig. 1e). The ascocarps walls were thick, composed of several layers, on the outer surface with hyaline, straight or bent short setae 80–100 × 6 µm in size, sometimes shorter. Paraphyses absent, periphyses lining the ostiole. Asci (Figs 1f, g) with eight uniseriate ascospores on ascus arranged obliquely and formed rosettes (Figs 1h, i), growing from the bottom of the perithecium. Ascospores were olivaceous to olivaceous-brown, aseptate with a colourless basal germ pore (Fig. 1j), immature were granular (Fig. 1k), mature ascospores (Fig. 1m) were brown and ellipsoidal to obovoid.

According to Alexopoulos et al. (1996) and García et al. (2004) species are characterized by black globose or flask-shaped solitary perithecia, which are ostiolate, usually with stiff setae, forming cylindrical asci with an apical ring. The ascus apex usually has one or several germ pores and a refractive ring through which the ascospores are discharged. *Sordaria* species have smooth-walled, dark brown ascospores, generally aseptate, with the surface smooth, pitted, reticulate or striate, sheathed or unsheathed. Spores surrounded gelatinous sheath which is sometimes thick and conspicuous, or it is difficult to detect. Darkly pigmented ascospores show wide variation in the kinds of appendages or sheaths. (Important aspect of the life cycle of this species is that no macroconidia are formed). Microconidia are produced, functioning as male gametes in sexual reproduction. Germination of microconidia may occur, but it is very poor.

When compared morphologically with the species occurring on different trees reported in the literature (Lundquist, 1972; Doveri, 2004), *Sordaria fimicola* differs from *S. macrospora* in having smaller spores, ellipsoidal rather than broadly ellipsoidal and smaller perithecia and asci (Crous et al., 2009). Comparison of the main morphological characteristics of *S. fimicola* identified on different hosts and examined material is described in Table 1.

Up to now, fungus *Fusarium* sp. has been known as an opportunistic and quite common pathogen associated with affected Japanese red maple leaves and branches. This fungus, which caused *Fusarium* wilt disease, remains in infested soils for up to ten year. Wilts may be contracted through infected seed, plant debris or soil. The fungus begins and multiplies during the cool, moist season, becoming obvious when weather turns warm and dry. Plants wilt because the fungus damages their water conducting mechanisms (Ivanová, 2013). Important finding is that *S. fimicola* was identified for the first time as a new pathogenic fungus associated with infected *Acer palmatum* ´Atropurpureum´ in Slovakia. Further studies are required for determination of pathogenicity and relevance of *Sordaria* infection in connection with Japanese red maple tree damage.

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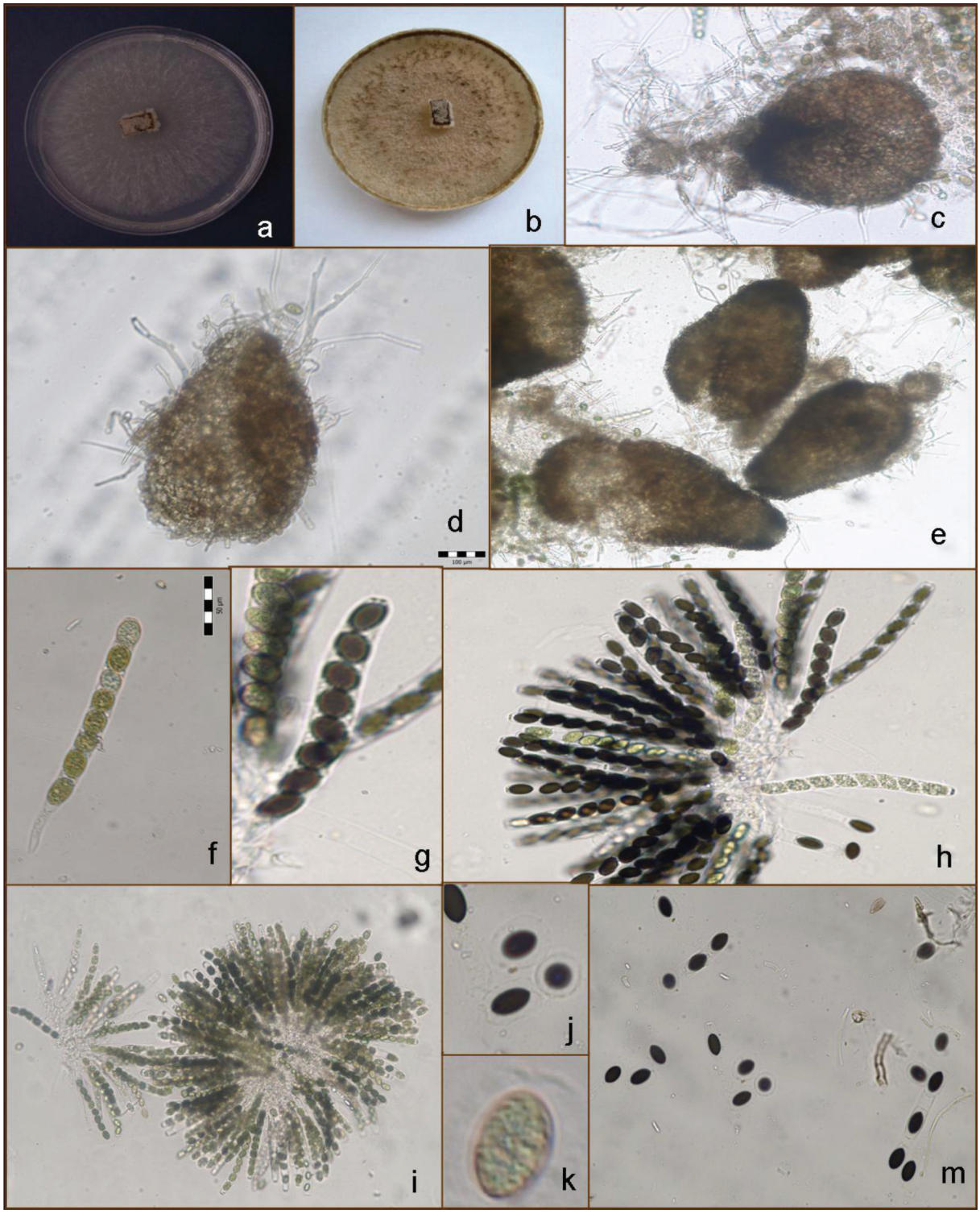

Fig. 1. *Sordaria fimicola* on *Acer palmatum* ´Atropurpureum´ – a, colony of *S. fimicola* on PDA; b, dark pycnidia after 1 week of inoculation; c, hyaline vegetative hyphae and dark pycnidium; d, ascomata of *S. fimicola* with colourless hairs; e, mature pear-shaped ascomata of *S. fimicola;* f, immature ascus; g, mature ascus with small inamyloid apical ring; h, rosettes of unitunicate asci of *S. fimicola;* i, rosettes of asci of *S. fimicola*; j, mature ascospores surrounded by a gelatinous sheath (detail); k, immature ascospore with granular content (detail); m, masses of mature ascospores of *S. fimicola*. Scale bars: i, k = 10 µm, g, j = 20 µm, f, h, m = 50 µm, c, d, e = 100 µm.

Table 1. Comparison of morphological characteristics of *Sordaria fimicola* identified on different hosts and on examined material

Authors	**Sampled plant material under examination**	**Lundquist, 1972**	**Mungai et al., 2012**
Host plant	*Acer palmatum*		
Causal agent	*Sordaria fimicola*	*Sordaria fimicola*	*Sordaria fimicola*
Ascomata	Perithecial, subglobose to pyriform, solitary, 370 × 320 µm, neck 100–160 µm	Mostly densely aggregated, superficial, obpyriform, glabrus 360–420 × 240–325 µm, papilose, neck cylindrical, 120–240 × 100 µm	Perithecium, semi-immersed to superficial, 550–620 µm high., dark brown, ovoid to pyriform, neck conical or subcylindrical 111–120 × 120–150 µm
Setae	Brown or hyaline, straight setae 80–100 × 6 µm	Flexous colourless hairs	Hyphoid hairs sparsely covered ascomata
Paraph.	Absent	Not observed	Moniliform, septate with segments 4.5–12.5 µm broad, abundant, containing hyaline vacuoles
Asci	150 (165) × 15 µm, fasciculate, unitunicate, cylindric, with a truncate apex and small apical rings, 8 ascospores/ascus	Cylindrical, short-stipitate, 8-spored, in a single row, apical ring, (155–) 170–215 × 14–17 µm, with a truncate 9 µm apex	8-spored, 111–163 × 10.5–14 µm, cylindrical, flattened at apex, short stipitate, with a lobate stipe and prominent apical apparatus
Ascospores	Green to brown, one-celled, ellipsoidal, smooth-walled, without guttules, 17–22 × 10–11 µm, with granular contents, surrounded by a gelatinous sheath, germ pore	Aseptate, binucleate, at maturity dark brown, ellipsoidal to obovoid (17–) 18–24 × (9.5–)10–13 µm, often slightly inequilateral, rounded above, somewhat apiculate below with a basal germ pore, gelatinous sheath surrounding the spore except for a basal invagination	15.5–18.5 × 9.5–11.5 µm, obliquely to vertically uniseriate, dark brown, ellipsoidal, occasionally ovoid, smooth, slighty pointed and apiculate base, surrounded by a gelatinous sheath. Germ pore single and basal
Hyphae	Hyaline, 2 µm wide	–	

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