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FIRST NOTICE OF PHYTOPHTHORA ROOT AND STEM BASE ROT OF *SCIADOPITYS VERTICILLATA* IN POLISH ORNAMENTAL NURSERIES

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Abstract: Severe root and stem base rot was noticed for the first time on *Sciadopitys verticillata* in 3 hardy ornamental nursery stocks. *Phytophthora citrophthora* was isolated from about 4/5 of the analysed plants. In the laboratory trials this species caused stem and root rot. On stem parts and needles inoculated by isolates from the host plant and *Pinus sylvestris*, necrosis was observed to have spread at a similar rate. The needles, however, were colonized significantly quicker than the stem parts.

Key words: *Sciadopitys verticillata*, nurseries, occurrence, *Phytophthora*, pathogenicity

Sciadopitys verticillata (Thunb.) Siebold. & Zucc., known as Japanese umbrella pine, is a slow-growing ornamental tree found in Polish nurseries over the last 10 years. Small plants grow to about 30 cm under cover, and later they are put in outside container nurseries. Lambe and Wills (1983) did not notice disease symptoms on plants in the landscape whereas in containers having excessive moisture, the trees are highly susceptible to root rot incited by *Phytophhtora cinnamomi* Rands. Affected plants showed wilting and an off-green color, with needles turning yellow. The reason for such changes were the rotting of the fibrous roots and the discoloration in the wood at the stem base.

The first time yellowing of the needles was noticed on small *S. verticillata* growing in plastic tunnels and older plants as tall as 50–70 cm was in 2008–2010. This observation took place in two hardy ornamental nursery stocks in the south-east part of Poland and in one nursery in the north of Poland.

The purpose of this study was to evaluate a causal agent of dieback of *S. verticillata*, and its pathogenicity to a host plant.

Nurseries were surveyed from July to September at one month intervals. On plants as tall as 10–25 cm needles changed color from green to light green and finally to brown (Fig. 1). On the base of the plants, up to 5–10 cm of brown or dark brown discoloration of wood was observed. Most of the roots were dark brown and dead. On older trees growing at outside container nurseries, yellowing and browning of needles was noticed, usually on one part of the plants (Fig. 2). Base rot even extended 15 cm up the stem. Plants showing disease symptoms were placed in plastic bags together with substratum, and transported to the laboratory. The procedure of Orlikowski and Szkuta (2001) was used for isolating microorganisms from diseased plant tissues. Over the span of 3 years, 50 diseased plants were analysed. Rhododendron leaf baits and the procedure described by Themann and Werres (1998) was used for the detection of *Phytophthora* spp. from the substratum. Obtained isolates were grouped by growth pattern and their morphology. Representative cultures were identified to species on the base of morphology features and confirmed by molecular methods (Èrsek *et al*. 1994; Trzewik *et al*. 2006, 2010).

Fig. 1. Needle yellowing of *S. verticillata* incited by *P. citrophthora*

Pathogenicity of *P. citrophthora* isolates from *Pinus sylvestris* Michx. seedling and *S. verticillata* stem base, were evaluated on stem parts, roots, and needles using the procedure of Orlikowski and Szkuta (2001). Additionally, isolates of the species from the host plant and rhododen-

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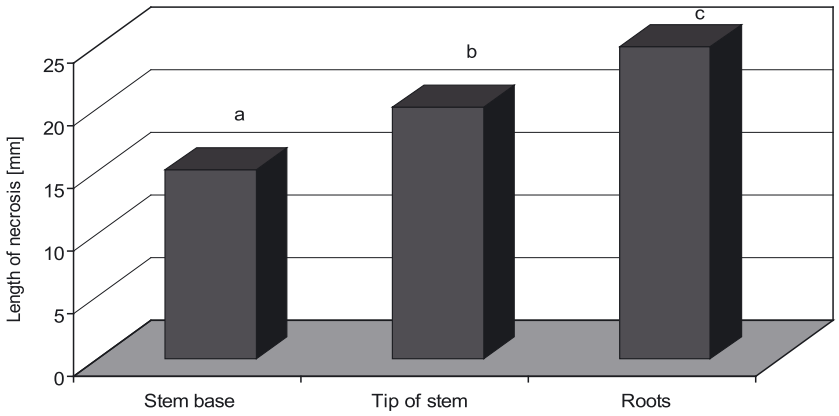
dron were used for inoculation of stem parts and leaves of rhododendron. Cultures were maintained on Potato Dextrose Agar (PDA) at 25°C for 7 days. Three mm diam mycelium discs overgrown by *P. citrophthora* were transferred to the base of the tested organs in photographic trays. The length of necrosis was measured within the 6 day-incubation period. Experimental design was completely randomized with 4 replications and 5 plant organs in each rep. Trials were repeated twice.

Fig. 2. Needle and stem parts browning of *S. verticillata* incited by *P. citrophthora*

From about 4/5 of the analysed plants *Phytophthora citrophthora* (R.E. Sm. & E.H. Sm.) Leonian was recovered, mainly from diseased stem bases. Additionally, *Alternaria alternata* Nees, *Botrytis cinerea* Pers., *Fusarium avenaceum* (Cda) Sacc., *Mucor* spp., *Penicillium* spp. and *Trichoderma* spp. were often noticed as naturally occurring fungi on plant parts or as colonizers of already affected tissues.

Isolate of *P. citrophhtora* from the host plant, colonized stem bases, tips, and root parts of *S. verticillata* (Fig. 3). The largest lesions (about 4 mm/24 hrs) were observed on root parts whereas the slowest (2.5 mm/24 hrs) on stem bases (Fig. 3). Inoculation of stem parts and needles by isolates from the host plant and *Pinus sylvestris* resulted in the colonization of both organs (Table 1). After a 3 and 6 day-incubation period, necrosis developed quicker on needles than on stem parts. There were no significant differences in necrosis development on plant parts inoculated with isolates from 2 host plants (Table 1). Both isolates, colonized needles about 9 mm/24 hrs whereas stem parts about 6.5 mm/24 hrs (Table 1). Isolate from *S. verticillata* colonized stem parts and leaf blades of rhododendron significantly quicker than isolate from inoculated plants (Fig. 4).

P. citrophhtora was found for the first time in Polish hardy ornamental nursery stocks by Szkuta (2004) on diseased *Podocarpus alpinus*. During the next 4 years, the species was noticed on trees, shrubs and perennials, including coniferous plants (Orlikowski and Szkuta 2001; Orlikowski and Ptaszek 2010; Orlikowski and Valiuskaite 2007; Orlikowski *et al*. 2010; Oszako and Orlikowski 2004). This study indicates on the increase of host range of *P. citrophthora* as the very active colonizer not only of the host plant but also of rhododendron. These data con-



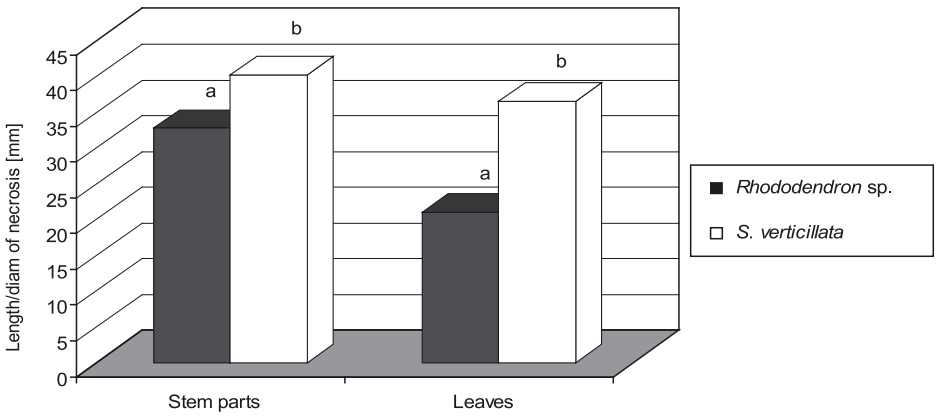
Note: means in columns, followed by the same letter, do not differ significantly at the 5% level (Duncan's multiple range test)

Fig. 3. Spread of necrosis on stem parts and roots of *S. verticillata* 6 days after inoculation by *P. citrophthora*

Table 1. Colonisation of needles (a) and stem parts (b) of *S. verticillata* in relation to isolates of *P. citrophthora* and incubation time; length of necroses in mm

Source of isolates	Days after inoculation			
	2		4	
	a	b	a	b
Pinus sylvestris	13.8 a	12.0 a	35.6 a	27.9 a
Sciadopitys verticillata	14.2 a	11.6 a	35.7 a	25.5 a

Note: means in columns, followed by the same letter, do not differ significantly at the 5% level (Duncan's multiple range test)



Note: means in columns, followed by the same letter, do not differ significantly at the 5% level (Duncan's multiple range test)

Fig. 4. Relationship between source of isolates, rhododendron organs, and their colonization by *P. citrophthora* 4 days after inoculation

firmed the results of Lambe and Wills (1983) which indicated that *S. verticillata* was not only highly susceptible to *P. cinnamomi* but also to *P. citrophthora*. Different disease symptoms caused by that pathogen were observed. On *Forsythia intermedia*, *Syringa vulgaris* and *Sorbus aucuparia*, the species was the causal agent of stem base rot or tip blight whereas on *Picea abies* and *Pinus sylvestris* the pathogen caused root rot (Orlikowski unpubl., Oszako and Orlikowski 2004). It is possible that besides host plants for *P. citrophthora*, the species may be transferred to nurseries with sprinkling water taken from water ponds or rivers (Trzewik *et al.* 2011). To our knowledge, this is the first report describing the disease caused by that pathogen on *S. verticillata* in Poland.

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