Water as the source of *Phytophthora* spp. in ornamental nurseries

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Abstract

*Rhododendron* leaf baits were used for detection of *Phytophthora* spp. from water and as the measure of population density of that group of pathogens in rivers and nursery reservoirs. *Phytophthora* species, mainly *P. citricola*, were detected both from all sources of water. Significantly more necrotic spots were noticed on baits held in Skierniewka and Zwierzynka rivers than in Ner. Significantly more colonies were recovered from river water in July than in August and September. In nursery reservoirs more necrotic spots on leaves were observed in August in comparison to July and September. Using of pond water for sprinkling of *Thuja occidentalis* and *Buxus sempervirens* resulted in the development of *Phytophthora* tip blight of thuja and stem rot of boxwood. *P. citricola* was isolated from diseased parts of plants.

Key words: detection, nursery, pathogenicity, plants, *Phytophthora*, spread, water.
INTRODUCTION

 Phytophthora (= plant destroyer) is a cosmopolitan genus comprised already more than 100 species and varietes, many of which are important plant pathogens. In the end of XX century Phytophthora root and stem rot was mainly recorded on some coniferous and ericaceous plants [Orlikowski et al., 1995]. Actually 11 species of Phytophthora were recorded on ornamentals including coniferous, deciduous, ericaceous and perennial plants [Orlikowski and Szkuta, 2008]. Various symptoms including root and stem rot, shoot part rot and twig blight are caused by Phytophthora spp. Among identified pathogens P. citricola, P. cinnamomi, P. cryptogeae, P. citrophthora and P. cambivora were isolated the most often from affected plant organs [Orlikowski and Szkuta, 2002]. Losses of ornamental nursery plants because of wilting, necrosis of aerial parts or death varied from a few percent to even 100% [Orlikowski, 2006]. In opinion of Hong and Moorman (2005) contaminated, irrigation water is primary, if not the sole, source of inoculum of Phytophthora diseases of numerous nursery, fruit and vegetable crops. Occurrence and fast spread of Phytophthora root and trunk rot of alder caused by P. alni [Orlikowski et al., 2003] from Greece to Sweden since the end of XX century caused the wide discussion on the pathogen source [Jung and Blaschke, 2005]. Studies of Orlikowski et al. (2007) indicated on widespread of Phytophthora in Polish streams, rivers and standing water including nursery water ponds. In this study detection of Phytophthora spp. in some rivers and nursery water ponds and relationship between this source of sprinkling water and occurrence of twig blight and stem rot of some plants were evaluated.

MATERIALS AND METHODS

Detection of Phytophthora spp. in water. The chosen 3 rivers and 2 nursery water ponds were the objects of our studies. Rhododendron top leaves of cv. ‘Nova Zembla’, used as baits, were immersed in water about 2 m from the bank and held 5–6 days. After that
time they were washed and blotted dry. Number of necrotic spots was counted on each leaf blades and chosen parts of them were sterilized over a burner flame, cut into 3–5 mm diam pieces and placed on PDA (8 pieces/90 mm Petri dish). After 24 h incubation at 24°C in the dark small parts of colonies growing around inocula were transferred to PDA slants. Isolates obtained were grouped by growth pattern and morphology into species types and representative cultures were chosen for further identification [Wiejacha et al., 2006].

**Relationship between sprinkling of plants with contaminated water and development of twig blight on *Thuja occidentalis* and stem rot on *Buxus sempervirens.*** *Thuja occidentalis* ‘Fastigiata’ about 120 cm high and 3 years old *Buxus sempervirens* grown in containers were observed on the presence of *Phytophthora* spp. on shoot tips and stems. All plants were watered using sprinkling system. During hot days plants were sprinkled even 4 times. First twig blight symptoms on thuja were observed on the beginning of July, but numbers of plants with browning of tips were noticed during 10 days (Fig. 2). On *Buxus sempervirens* the spread of the disease were observed from middle of June till October (Fig. 3). Experimental design was completely randomized with 4 replications and 200 plants in each rep.

**RESULTS AND DISCUSSION**

**Detection of *Phytophthora* spp. in water.** Brown or dark-brown necrotic spots with different sizes were observed on rhododendron leaf baits hold in each river from June to October. The highest numbers of spots were observed on leaves held in Skierniewka River (Table 1). In July more than 100 spots were observed on leaves but in the next month their number decreased 3 times whereas in October population of *Phytophthora* decreased about 13 times. Similar tendency, connected with the decrease of *Phytophthora* number, were observed in 2 other rivers (Table 1).
Table 1. Occurrence of *Phytophthora* spp., mainly *P. citricola*, in rivers water in relation to surveying time

1 lentelė. *Phytophthora* spp. (ypač *P. citricola*) aptinkamumas upių vandenyje, priklausomai nuo laiko

<table>
<thead>
<tr>
<th>Rivers / upės</th>
<th>Mean number of necrotic spots / Rhododendron leaf in surveying time</th>
<th>Nekrotinių dėmių vidurkis / Rhododendron lapai tyrimo metu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ner</td>
<td>2005 07 12 32 a 2005 07 29 37 a 2005 08 11 23 b 2005 10 20 4 a</td>
<td>130 c 123 c 38 b 11 a</td>
</tr>
<tr>
<td>Skierniewka</td>
<td></td>
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<tr>
<td>Zwierzynka</td>
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</tbody>
</table>

Note: Means in columns followed by the same letter do not differ at 5 % significance according to Duncan’s multiple range tests.

Skirtumai tarp skaičių, pažymėtų ta pačia raide stulpelyje, yra statistiškai patikimi, esant 5 % tikimybės lygmeniui (daugialypis Dunkano kriterijus).

From necrotic spots mainly *P. citricola* was detected, but *P. cinnamomi, P. cambivora* and *P. cryptogea* were also found on baiting leaves. *Phytophthora* spp. were also detected from 2 nursery water reservoirs (Fig. 1).

![Fig. 1](image-url)  
**Fig. 1.** Influence of nursery reservoirs location, time of water surveying and number of *Phytophthora* spots / rhododendron leaf baits

1 pav. Medelynų rezervuarų vietos ir tyrimo laiko įtaka *Phytophthora* dėmių skaičiui ant rododendirų lapų
In both ponds more *Phytophthora* spp. were detected in August than in July and September. This may be connected with water temperature higher in August than in other 2 months. Among isolates obtained *P. citricola* was identified the most often.

**Development of *Phytophthora* twigs and stem blight of *Thuja occidentalis* and *Buxus sempervirens***. Three days after the first notice of individual tip browning of thuja, the disease symptoms were already observed on 5 % of plants. After the next 4 days number of affected plants increased 4 times and disease was noticed on 2–5 tips/plant (Fig. 2). After the next 5 days about 1/3 of analysed thuja was infected by *Phytophthora citricola*. This species was only isolated from the diseased parts of twigs.

![Graph](image)

**Fig. 2.** Spread of *Phytophthora* tip blight on *Thuja occidentalis* ‘Fastigiata’ in July, 2005

2 pav. *Phytophthora* paplitimas ant *Thuja occidentalis* ‘Fastigiata’ 2005 m. liepos mėn.

On *Buxus sempervirens* the disease symptoms developed slower than on thuja. First, sporadic yellowing of shoots were observed in the middle of June (Fig. 3), but during 4 months symptoms were already seen on about 10 % of plants and 5 % of them showed browning, yellowing and strow-coloured shoots. *Phytophthora citricola* was isolated from diseased parts of shoots.
Fig. 3. Development of *Phytophthora* shoot rot of *Buxus sempervirens* in hardy ornamental nursery stock during the vegetation period of 2005

**Phytophthora** spp. with domination of *P. citricola* was detected from each source of water. Population density of *P. citricola* varied in relation to water source and baiting time. Using of nursery pond water for plant sprinkling resulted in the development of thuja tip blight and stem rot of boxwood.

**REFERENCES**


Santrauka


Reikšminiai žodžiai: aptinkamumas, medelynas, patogeniškumas, augalai, Phytophthora, paplitimas, vanduo.