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Occurrence of *Phytophthora citrophthora* on *Syringa vulgaris* in Poland

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Phytophthora citrophthora was isolated from dieback shoots, base of diseased stems and top parts of lilac plants during 3 vegetation periods. The species was detected from about 75% of analysed plant parts. On V8 juice agar and potato-dextrose agar the quickest growth of the species was observed at 25-30°C but development did not occur at 5° and 35°C. Zoosporangia were mostly papillate from spherical to ellipsoidal with average dimensions 45.6 x 31.5 μm. *P. citrophthora* from 5 host plants caused necrosis development of leaves and stem parts of lilac but the quickest spread of disease occurred when plants or their parts were inoculated with isolates from *Syringa vulgaris* and *Pieris japonica*. It indicates that the pathogen may be transmissed in nurseries from diseased pieris grown near lilac.

Key words: lilac, dieback, blight, *Phytophthora*, colonisation, host plants

INTRODUCTION

Lilac (*Syringa vulgaris* L.) is very susceptible plant to various fungi including *Oomycetes*. In France Vegh (1987) mentioned 22 lilac pathogens, including *Phytophthora cactorum* (Leb. et Cohn) Schroet. and *P. syringae* (Kleb.) Kleb. as causal agents of shoot base and leaf spot. Novotielnova (1974) in her *Phytophthora* monograph mentioned *S. vulgaris* as a host plant for *P. palmivora* (Butl.) Butl. and *P. citricola* Sawada. In 2003 *P. ramorum* Werres de Cock et Man in't Veld as the causal agent of bud and leaf blight of lilac was found in the UK (Beales et al. 2004). Vegh and Le Berre (1985) found container-grown nurseries as favourable places for development of *Phytophthora* species. In Hall et al. (1992) studies, *P. inflata* Caroselli and Tucker caused root and stem rot on very young plants. After transferring of *in vitro* propagated lilacs from glass into cell trays they detected the pathogen from diseased root pieces.

In June 2002 and in the next 2 years new disease symptoms were observed on 1-year-old lilacs. In April plants were transferred into 3 dm^3 container filled with fresh, white peat and grown in container nursery with fertilisation and watering as plant splash. Lilacs were grown close to other plant species, including *Pieris japonica* (Thunb.) D. Don, *Cotoneaster* spp., *Cytisus* spp., *Elaeagnus* spp., *Evonymus* spp., *Fagus sylvatica* L. and others. Different types of symptoms were distinguishable on affected plants: individual crown rot associated with shoot dieback, browning of stem tissues 10-15 cm above the substratum level, darkbrown spots on leaf blades enlarging on petioles and stems. On some plants blight of the youngest foliage and shoot tips were observed.

In this paper we report the occurrence of *Phytophthora citrophthora* (Sm. et Sm.) Leonian on lilac in a container nursery, its characteristics and colonisation of plants by the species.

MATERIALS AND METHODS

Survey of plants, isolation and identification of fungi. Diseased plant parts were collected from the nursery at east-south part of Poland at least 3 times a year during vegetation periods. Samples were transferred in plastic bags to laboratory and usually next day plants were washed for at least 2 hrs under tap water, rinsed 3 times in sterilised, distilled water and dried in sterile blotting paper. About five mm pieces, after disinfection over a burner flame, were put on Difco potato-dextrose agar in 90 mm Petri dishes (6-8 inocula /dish). Within 4-day-long incubation at 24°C in the dark colonies growing around tissue pieces were transferred into PDA slants. After segregation and cleaning, representative cultures were identified to genera and species using available monographs. Procedure described by Szkuta (2004) was used for identification of *Phytophthora* sp.

Characteristic of *Phytophthora citrophthora*. Isolate P0098 from the base of rotted shoot was used. Stock culture was grown on V8 juice agar at 24 °C in the dark. Radial growth rate was evaluated at 5° to 35°C on V8 juice agar and PDA. Formation of zoosporangia was studied on V8 juice agar and 1% sterilised soil extract.

Colonisation of stem and leaves of lilac and other plants by isolates of *Phytophthora citrophthora*. Five isolates of the species, obtained from plants, were used for inoculation of lilac in laboratory and greenhouse trials (Tabs 2 and 3). In the first trial base and top parts of stems 80 mm long were inoculated with 3 mm diameter disks, taken from the edge of 7-day-old isolate P0098 grown on V8 juice agar at 25°C. Inoculated plant parts were incubated on moist, sterilised blotting paper covered with plastic net in polystyrene boxes, covered with foil. Length of necrosis was measured after 5 and 9 days of incubation. In greenhouse trial 3 mm diameter disks taken from cultures of 5 isolates were put on the wounded bases of one-year-old plants (growing in 1 dm^3 pots) and covered with pieces of foil. After 8 and 16 days of incubation at temperature 18 to 25°C length of necrosis was measured. Colonisation of *Syringa* spp. and *Ligustrum vulgare* L. leaves and stem parts (Tab. 4) were observed in laboratory trials using the same procedure like in previous experiment. Experimental designs were completely randomised with four replications with 5 plants or their parts in each of them. Trials were repeated at least twice.

RESULTS AND DISCUSSION

Isolation and identification of fungi. Diseased parts of tissues taken from 116 plants (Tab. 1) were analysed during 3 vegetation periods (Tab. 1). Every year *Phytophthora citrophthora* was isolated from diseased plants. The species was detected from at least 3/4 of diseased plants (Tab. 1). *Botrytis cinerea* Pers. was isolated from

Table 1

Fungi isolated from diseased shoot base, tip parts and leaves of *Syringa vulgaris*; number of affected plants (a) and number of isolates obtained (b) isolation: 2002-2004

Genera / species	Years					
	2002 – 27 plants		2003 – 49 plants		2004 – 40 plants	
	a	b	a	b	a	b
Botrytis cinerea Pers.	11	18	10	21	15	39
Cladosporium herbarum Link	-	-	5	9	2	4
Chaetomium globosum Kunze	2	4	10	18	6	11
Fusarium avenaceum (Fr.) Sacc.	7	13	4	8	5	9
Fusarium culmorum (W.G.Sm.) Sacc.	4	7	8	19	2	3
Fusarium solani (Mart.) Sny. et Hans.	5	8	12	21	11	23
Mucor spp.	5	12	25	38	18	31
Penicillium spp.	8	15	9	14	9	12
Phytophthora citrophthora (Smith et Smith) Leonian	22	80	32	117	29	64
Trichoderma spp.	7	16	17	39	11	18
Brown, nonsporulating fungi	2	3	4	5	-	-

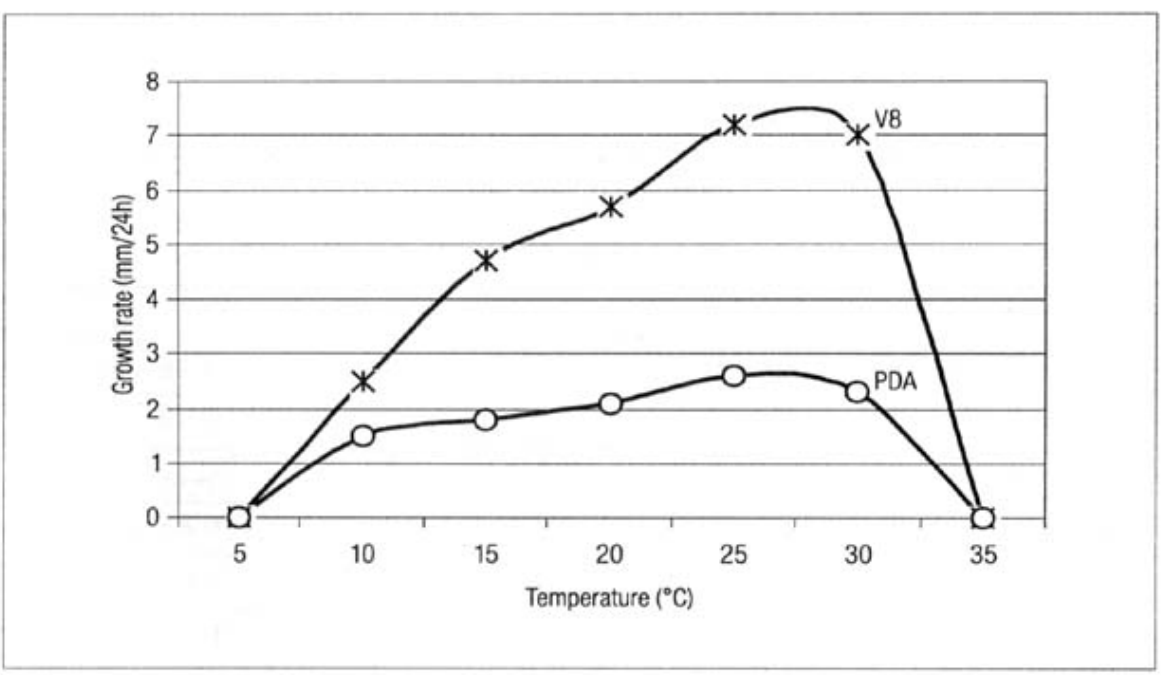

Fig. 1. Growth of *Phytophthora citrophthora*, isolate P0098 in relation to temperature and medium.

Table 2
Development of rot on *Syringa vulgaris* inoculated with *Phytophthora citrophthora* isolate PO098; length of necrosis in mm; Inoculation: 2002.08.23

Place of inoculation	Days after inoculation	
	5	9
Base of stem	13.5 a	25.5 a
Top of stem	18.0 b	31.0 a

Note: Means in columns, followed by the same letter, do not differ with 5% of significance (Duncans multiple range test)

Table 3
Necrosis spread (in mm) on *Syringa vulgaris* stem inoculated with different isolates of *Phytophthora citrophthora*; greenhouse trial Inoculation: 2004.04.19

Source of isolates	Isolate numbers	Length of necrosis (mm) after days of inoculation	
		8	16
Picea abies	PO323	10.3 a	24.8 a
Pieris japonica	PO001	12.8 a	31.5 b
Podocarpus alpinus	PO118	16.2 b	29.0 ab
Rhododendron sp.	PO125	12.0.a	27.5 a
Syringa vulgaris	PO098	18.7 bc	38.9 c

Note: see Table 2

Table 4
Length of necrosis (mm) on leaf blades and stem parts of *Syringa* spp. and *Ligustrum vulgare* inoculated with *Phytophthora citrophthora,* isolate PO098; after 6 days of incubation Inoculation: 2003.06.02

Species	Leaf blades	Stem parts
Syringa chinensis Willd. 'Saügeana'	28.1 ab	43.1 bc
Syringa meyeri Willd. Palibin	34.3 bc	67.1 d
Syringa julianae Schneid.	27.5 ab	52.8 c
Syringa microphyla Diels.	28.2 ab	52.3 c
Syringa preastoniae Mc Kelvy	47.0 d	51.8 c
Syringa prestoniae Kim	22.2 a	21.9 a
Syringa vulgaris L.	39.0 c	41.3 b
Ligustrum vulgare L.	39.0 c	74.6 d

Note: see Table 2

diseased tissues each year but especially from invaded tips of shoots. It is possible that this was the secondary invader of lilac plants. Three species of *Fusarium* were isolated, both, from shoot bases but also from the top parts of lilacs. *Trichoderma* spp. were often found in diseased plant bases (Tab. 1).

Characteristics of *Phytophthora citrophthora*. The quickest radial growth was observed at 25 - 30°C on both media but species developed at least twice quicker on V8 than on PDA (Fig. 1). No growth was observed at 5° and 35°C. In opinion of Gerlach et al. (1974) *P. citrophthora* is mainly the pathogen of tropical and subtropical regions whereas in Poland its development was limited to container-grown plants during summer time. The pathogen was detected, however, from *Picea abies* (L.) Karst. trees (Oszako and Orlikowski 2004). It indicates that among species population there are some isolates tolerant to lower temperature. Sporangia were variable in shape, mostly papillate and persistent, from spherical to ellipsoidal with dimensions from 25-57.5 x 27.5-37.5 μm (average: 45.6 x 31.5 μm). Length-breadth ratio was 1.45:1. In Erwin and Ribeiro (1996) studies optimal growth temperature for the species on V8 juice agar was 18 - 27°C and lethal - 5° and 35°C, whereas zoosporanagia dimensions were almost the same as in our trials.

Colonisation of stem and leaves of lilac and other plants by *Phytophthora citrophthora* isolates. Inoculation of stem parts of lilac resulted in the development of necrosis. The spread of necrosis was significantly quicker on top parts of stems (Tab. 2). In greenhouse experiment isolates from *Picea abies* L., *Pieris japonica, Podocarpus alpinus, Rhododendron* sp. and *Syringa vulgaris* caused development of stem discoloration and browning of invaded tissues. Both 8 and 16 days after inoculation the quickest spread of necrosis was observed on stems inoculated with the isolate from lilac and pieris (Tab. 3). It indicates that the pathogen may be transmissed from pieris, grown nearby lilac plants. The occurrence of *P. citrophthora* on pieris was reported by Gerlach et al. (1974) and Orlikowski and Szkuta (2002). Additionally *Evonymus* spp. known as host plants of the pathogen (Erwin and Ribeiro 1996) may serve as a potential source of pathogen in the surveyed nursery. Further study showed that six lilac species and *L. vulgare* were very sensitive to *P. citrophthora*, isolate P0098 (Tab. 4). Necrosis developed on leaves and stem parts. Stems, however, were more sensitive to pathogen inoculation. The quickest spread of necrosis was observed on *L. vulgare* and *S. meyeri* stem parts (Tab. 4). Studies of Gerlach et al. (1974, 1976) give some details on disease cycle of *P. citrophthora* on *P. japonica*. Penetration of tissues occurred within 2 hrs at 24-30°C but 12 hrs were required at 12°C. Zoosporangia of the species are produced on abscised leaf blades on wet soil and zoospores are released. They were probably splashed up to foliage and higher parts of stems and accumulated around open stomata in the dark but not if they are closed. According to the authors study, lesions were found even higher than 50 cm above the ground. This explains why disease symptoms were observed on surveyed lilacs on top foliage and stem parts.

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Występowanie *Phytophthora citrophhthora* na *Syringa vulgaris* w Polsce

Streszczenie

W latach 2002-2004 izolowano *Phytophthora citrophthora* z zamierających łodyg, ich porażonej podstawy oraz wierzchołków pędów lilaka rosnącego w pojemnikowej szkółce roślin ozdobnych w południowo-wschodniej części Polski. Obok lilaka w szkółce uprawiano również pieris, irgę, trzmielinę, buk i inne rośliny. Występowanie tego gatunku stwierdzono na około 75% analizowanych pędów. Na pożywce wielowarzywnej V8 oraz agarze ziemniaczano-glukozowym wyosobniony gatunek rozwijał się najszybciej w temperaturze 25 - 30°C natomiast wzrostu nie obserwowano w 5° i 35°C. Zoosporangia z charakterystycznymi papilami były kuliste lub elipsoidalne o średnich wymiarach 45,6 x 31,5 μm. Izolaty tego gatunku uzyskane z 5 roślin żywicielskich powodowały nekrozę liści i pędów lub ich części. Choroba rozwijała się najszybciej, gdy do inokulacji użyto izolaty z *Syringa vulgaris* i *Pieris japonica*. Wskazuje to na możliwość przenoszenia się tego patogena w szkółce z pierisa na lilak.