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FIRST NOTICE OF *PHYTOPHTHORA* TIP BLIGHT OF *CALLUNA VULGARIS*

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Incidence of heather dieback has increased dramatically on some Polish container-grown nurseries during the past 10 years. Several species including *Phytophthora cinnamomi* Rands, *Cylindrocladium scoparium* Morgan and *Rhizoctonia solani* Kühn (Vegh 1989) could be the causal agents of the disease (Orlikowski and Szkuta 2002). Studies of Orlikowski and Szkuta (2002) showed that *P. cinnamomi* was the most dangerous threat of ericaceous plants, including heather. Additionally, *P. citricola* Sawada, *P. cactorum* (Leb. et Cohn) Schroet., *P. cambivora* (Petri) Buisman, *P. citrophthora* (Smith and Smith) Leonian and *P. nicotianae* var. *nicotianae* Breda de Haan were reported on some ericaceous plants (Benson and Jones 1980, Kuske and Benson 1983). Our own observation showed that *P. citricola* is the causal agent of rhododendron shoot blight. The disease occurs not only on the top leaves and stem parts but also in branches as browning and dying a part of them. However, information connected with *Phytophthora* tip dying of heather (*Calluna vulgaris* L. Salisb.) is lacking.

In the beginning of July 2003, in two heather container-grown nurseries yellowing and browning of shoot tips on a length of 2–10 cm were observed. Within few days stem parts changed colour on dark brown and were sabre shaped (Phot. 1). The disease symptoms were observed on single shoots or on the most of them on individual plants. The disease development was accompanied by high air humidity and temperature at least 20°C. Sprinkling of plants three–five times per day caused that shoots were wet especially during nights. Growers protected plants against grey mould but spraying of heathers with chemicals inhibiting the development of *Botrytis cinerea* Pers. was not effective. The purpose of this study was (1) to isolate and identify fungi or fungi like organisms inhabiting heather shoot tips and (2) to determine pathogenicity of isolates of *P. citricola* toward cultivars of host plant and some other ericaceous plants.

Isolation and identification of fungi and fungi like organisms. Affected shoot samples were collected from diseased plants 7–10 days after occurrence of

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Phot. 1. Tip blight of heather
(photo by Cz. Skrzypczak)

the first symptoms and additionally one month later. Top parts of diseased stem parts were cut 2–3 cm below the necrotic tissues, put to plastic bags and transferred into laboratory. Samples were stored 14 h at 4°C. After washing under tap water and next in sterilised water shoot parts were dried between sterile blotting paper. Individual shoot tips were disinfected over a burner flame and about 5 mm long fragments were put on the surface of Difco potato dextrose agar (PDA) in 90 mm Petri dishes (six–eight pieces per dish). During two–five-day-incubation of plates at 24°C colonies grown around tissue parts were transferred into PDA slants. After segregation, chosen isolates were identified using the available monographs. *Phytophthora* sp. was identified to species with methods described by Orlikowski et al. (2002).

Botrytis cinerea, Pestalotia sydowiana Bres. and *Phytophthora citricola* dominated among seven genera and species isolated from 168 heather diseased shoots (Table 1). The first two species were found in both nurseries on all tested samples. *Phytophthora citricola* was isolated from plants collected from both nurseries but in the first one was found only on cv. 'Peter

Table 1

Fungi and fungi like organisms isolated from diseased heather tips taken from two nurseries and three cultivars (isolation: 03–07.07.2003)

Genera, species	Nursery I				Nursery II					
	'Annemarie' (28 shoots)		'Peter Sparkes' (37 shoots)		'Annemarie' (42 shoots)		'Elsie Purnell' (42 shoots)		'Peter Sparkes' (29 shoots)	
	a	b	a	b	a	b	a	b	a	b
Alternaria alternata Nees	3	9	1	2	–	–	–	–	–	–
Botrytis cinerea Pers.	7	19	12	21	7	18	13	19	9	21
Fusarium avenaceum (Fr.) Sacc.	1	3	–	–	9	20	5	9	6	14
Mucor spp.	2	3	1	4	1	2	1	3	1	2
Penicillium spp.	4	4	3	7	2	4	3	5	2	6
Pestalotia sydowiana Bres.	8	14	7	9	3	8	2	5	4	6
Phytophthora citricola Sawada	–	–	14	26	15	39	7	31	14	46

a – number of settled shoots, b – number of isolates obtained.

Sparkes'. The species colonised almost half of analysed stem parts. In the second nursery the species was isolated from three cultivars but on 'Peter Sparkes' it settled about half of analysed shoots (Table 1). *Botrytis cinerea, P. sydowiana* and *Mucor* spp., which grown on PDA faster than *P. citricola* often overgrown Phytophthoras' colonies. *Phytophthora citricola* was not detected from diseased shoots taken for mycological analyse one month later.

Colonisation of shoot parts of heather and other ericaceous plants by isolates of *Phytophthora citricola.* Six isolates of *P. citricola* from *Abies alba* Mill., *Calluna vulgaris* L. Salisb., *Fagus sylvatica* L., *Rhododendron* sp. and *R. edgarianum* Rehd. & Wils. (Tables 2, 3) were used for shoots inoculation. Stock cultures were maintained on PDA at 24°C in the dark. The top parts of stems for inoculation by *P. citricola* were taken from five heather (*C. vulgaris*) cultivars, one from heath (*Erica vagans* L.), pieris (*Pieris japonica* Thunb. D. Don.) and *R. impeditum* Balf. F. & W. Sm. cv. 'Buchlovice' (Tables 2, 3). 3 mm diameter disks, taken from the edge of seven-day-old colonies, were put on shoot bases. Inoculated shoots were incubated on moist, sterilised, blotting paper covered with plastic net in polystyrene boxes, covered with foil. Length of necrosis was measured after three-day-incubation at 24°C. Experimental design was completely randomised with four replica-

Table 2

Colonisation of heather shoots by *Phytophthora citricola* from different plants; length of necrosis three days after inoculation (inoculation: 13.09.2003) (mm)

Source of isolates	'Amethyst'	'Annemarie'	'Elsie Purnell'	'Peter Sparkes'
Rhododendron sp. 'Cunningham's White'	14.0 bc	13.5 ab	13.5 ab	16.3 d
Rhododendron edgarianum	13.3 ab	13.0 a	13.3 ab	14.5 c
Calluna vulgaris 'Elsie Purnell'	13.3 ab	13.3 ab	14.0 bc	13.5 ab

Means in columns followed by the same letter do not differ with 5% of significance (Duncan's multiple range test).

Table 3

Colonisation of shoots of ericaceous plants by *Phytophthora citricola* from different hosts; length of necrosis three days after inoculation (inoculation: 05.09.2003) (mm)

Source of isolates	*Calluna vulgaris* 'Allegro'	*Erica vagans* 'Alba'	*Pieris japonica* 'Prelude'	*Rhododendron impeditum* 'Buchlovice'
Abies alba	4.0 a	3.4 b	11.6 a	0 a
Calluna vulgaris 'Peter Sparkes'	7.3 bc	4.8 d	16.3 c	6.8 b
Fagus sylvatica	6.5 b	0 a	13.5 b	9.6 d
Rhododendron sp. 'Cunningham's White'	8.4 c	4.2 c	12.7 ab	7.6 bc

Means in columns followed by the same letter do not differ with 5% of significance (Duncan's multiple range test).

tion and five shoot parts in each rep. Trials were repeated three times at two–three--week-intervals.

Isolates of *P. citricola* from two rhododendron species and heather, used for inoculation of four heather cultivars, caused the development of necrosis on the length at least 13 mm after three-day-incubation. Necrosis spread, in general, faster on cv. 'Peter Sparkes' than on the other cultivars, especially when shoot parts were inoculated with isolate from rhododendron cv. 'Cunningham's White' (Table 2). In the study of relationship between source of *P. citricola* isolates and colonisation of stem parts of different ericaceous plants (Table 3) significant differences were observed in reaction of individual species on the pathogen. The slowest spread of necrosis was observed on heath shoots whereas the quickest on pieris. The source of isolates had also significant influence on necrosis development. Isolate from silver fir did not cause any disease symptoms on *R. impeditum* whereas from European beech on the heath (Table 3).

This is the first report of *Phytophthora* tip blight of heather in Poland. Similar symptoms were previously observed by Orlikowski and Szkuta (2003) on arbovitae and Serbian spruce. Results obtained indicated that even in very hot and dry conditions during the summer 2003, *Phytophthora* tip blight has developed on three heather cultivars. All of them were grown in the semi-darkness part of nurseries. Additionally, plants were sprinkled at least three–four times a day. Temperature above 20°C even at night, high air moisture and wet shoots favoured infection and development of disease symptoms. The question arises about source of *P. citricola*. Probably the pathogen zoospores were spread during sprinkler irrigation from rhododendron growing in the same nurseries with some plant shoots invaded by *P. citricola*. During watering zoospores may be splushed up with droplets and reach even the top parts of container-grown heathers. Kuske and Benson (1983) found that *P. parasitica* Dast. propagules were splushed up to 60 cm from invaded plant bases (also from container mat), easily reaching susceptible rhododendron foliage. Overabundance of water, floating to nursery reservoirs could also contain zoospores of *P. citricola*, which may be disseminated over plants in splash droplets. The data obtained showed similar reaction of four species of heather on the pathogen's isolates from two ericaceous plants. It indicates why *P. citricola* from rhododendron caused tip blight of heather. Probably in both nurseries the pathogen was spread from infected rhododendron cultivars on heathers. Inoculation trials showed that isolates of tested pathogen from silver fir and European beech colonised also heather and heath shoot parts. Growing of those plants or other potential hosts of *P. citricola* in nurseries, increase probability of heather threat by the pathogen. Production of heathers in nurseries for one–two years, possibility of removing of affected plants with containers immediately after seeing the first tip blight symptoms or cutting of invaded shoots decrease the pathogen spread and losses. In integrated heather management program *Phytophthora* tip blight should be consider as one of dangerous diseases.

Literature

Benson D.M., Jones R.K., 1980: Etiology of rhododendron dieback caused by four species of *Phytophthora*. Plant Dis. 64: 687–691.
Kuske C.R., Benson D.M., 1983: Survival and splash dispersal of *Phytophthora parasitica*, causing dieback of rhododendron. Phytopathology 73: 1188–1191.
Orlikowski L.B., Jaworska-Marosz A., Szkuta G., 2002: Maple stem rot induced by *Phytophthora cambivora*. Phytopathol. Pol. 24: 17–26.
Orlikowski L.B., Oszako T., Szkuta G., 2003 a: First record of alder *Phytophthora* in Poland. J. Plant Pathol. Res. 43: 33–39.
Orlikowski L.B., Szkuta G., 2002: Occurrence of *Phytophthora cinnamomi* on ericaceous plants in container grown ornamental nurseries. J. Plant Prot. Res. 42: 157–163.
Orlikowski L.B., Szkuta G., 2003: First notice of *Phytophthora* tip blight on *Picea omorika* and *Thuja occidentalis* in Poland. Phytopathol. Pol. 28: 63–67.
Vegh I., 1989: Maladies fongiques des bruyeres en France. Rev. Hortic. (Paris) 300: 63–66.

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