

Fungi causing dying out of heather in permanent plantings

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The purpose of the paper was to define fungi causing dying out of heather (*Calluna vulgaris*) in permanent plantings of Kraków. Mycological analyses of 40 dying undershrubs were made. Identified fungi belonged to 38 species within 25 genera.

Key words: *Calluna vulgaris*, pathogenic fungi, necrosis, dying out

INTRODUCTION

Heathers, as ornamental plants, were brought to gardens not earlier than two hundred years ago. Due to the variety of the colours of their leaves and flowers they make an attractive material for planting both in large green areas and in house gardens of different size as well as in small allotments (Chojnowscy 2003).

These small undershrubs, regardless the place of planting, often loose their decorative value and die of infectious diseases caused by fungi attacking the parts above the ground and the root system. Fungi cause specific symptoms on infected plants, visible in the form of undesirable colour changes and necroses.

The purpose of the paper was the identification of the fungi causing dying out of heather in permanent plantings.

MATERIAL AND METHODS

The infected plant material was collected from the Botanical Garden of the Jagiellonian University (UJ), the area of the AGH-UST Campus, city lawns and recreational allotments and house gardens. Five shoots with the symptoms of necrosis and five dead roots were collected for mycological analyses from each of the 40 plants. From each part 25 (0.5-cm long) fragments were cut. Shoots and roots were disinfected in 70% ethyl alcohol and put on Petri dishes with 2% PDA medium. Isolated colonies of fungi were determined according to the mycological keys by Guba (1961), Booth (1971, 1996), Domsch, Gams and Anderson (1980).

RESULTS

From the collected plant material 1110 colonies of fungi were obtained, including 703 from the shoots and 407 from the roots of heather (Tab. 1). Isolated fungi be-

Table 1
Fungi isolated from shoots and roots of heather

Species	Frequency of occurrence		Percentage of occurrence
	shoots	roots	
<i>Acremonium sarcinellae</i> (Pat. et Har.) Armand ex Deighton	2	-	0.18
<i>Alternaria alternata</i> (Fr.) Keissler	208	-	18.74
<i>Aspergillus niger</i> v. Tiegh.	1	-	0.09
<i>Botrytis cinerea</i> Pers. ex Nocca et Balb.	23	-	2.07
<i>Cochliobolus sativus</i> (Ito et Kuribayashi) Drechsler ex Dastur	2	-	0.18
<i>Coniothyrium fuckelii</i> Sacc.	10	-	0.90
<i>Coniothyrium minutans</i> W. A. Campbell	5	-	0.45
<i>Cylindrocarpon destructans</i> (Zinssm.) Scholten	27	72	8.92
<i>Cylindrocarpon orthosporum</i> (Sacc.) Wollenw.	2	33	3.15
<i>Cylindrocladium parvum</i> P. J. Anderson	20	21	3.69
<i>Epicoccum purpurascens</i> Ehrenb. ex Schlecht.	193	4	17.75
<i>Fusarium avenaceum</i> (Corda ex Fr.) Sacc.	3	35	3.42
<i>Fusarium culmorum</i> (W. G. Smith) Sacc.	24	28	4.68
<i>Fusarium flocciferum</i> Corda	1	-	0.09
<i>Fusarium lateritium</i> Nees	19	16	3.15
<i>Fusarium poae</i> (Peck.) Wollenw.	15	6	1.89
<i>Fusarium sambucinum</i> Fuckel	8	-	0.72
<i>Hemicola grisea</i> Traaen v. <i>grisea</i>	3	-	0.27
<i>Hemicola fuscoatra</i> Traaen v. <i>fuscoatra</i>	5	-	0.45
<i>Leptosphaeria coniothyrium</i> (Fuckel) Sacc.	24	-	2.16
<i>Mucor hiemalis</i> Wehmar f. <i>hiemalis</i>	-	8	0.72
<i>Ooiodendron tenuissimum</i> (Peck) Hughes	-	17	1.53
<i>Penicillium expansum</i> (Link ex Gray) Thom	1	2	0.27
<i>Penicillium waksmanii</i> Zaleski	1	-	0.09
<i>Pestalotia sydowiana</i> Bres.	54	-	4.86
<i>Phoma chrysanthemicola</i> Hollós	3	-	0.27
<i>Phoma eupyrena</i> Sacc.	3	-	0.27
<i>Phoma leveillei</i> Boerema et Bollen	3	-	0.27
<i>Phoma medicaginis</i> Malbr. et Roum	2	-	0.18
<i>Phoma pomorum</i> Thüm	1	-	0.09
<i>Phytophthora cinnamomi</i> Rands	3	9	1.08
<i>Rhizoctonia solani</i> Kühn	11	44	4.95
<i>Sordaria fimicola</i> (Rob.) Ces. et de Not.	26	-	2.34
<i>Talaromyces wortmannii</i> (Klöcker) C. R. Benjamin	-	22	1.98
<i>Thysanophora penicillioidea</i> (Roum) Kendrick	1	-	0.09
<i>Trichoderma viride</i> Pers ex S. F. Gray	-	78	7.03
<i>Ulocladium consortiale</i> (Thüm) Simmons	2	-	0.18
<i>Verticillium albo-atrum</i> Reinke et Berthold	-	12	1.08
Total	703	407	100.00

longed to 38 species within 25 genera, and vast majority of fungal colonies (63.33%) were isolated from dying shoots of heather.

Among fungi isolated from shoots the following dominated: *Alternaria alternata*, *Cylindrocarpon destructans*, *Epicoccum purpurascens* and *Pestalotia sydowiana*. The following were less frequent: *Botrytis cinerea*, *Cylindrocladium parvum*, *Fusarium culmorum*, *F. lateritium*, *F. poae*, *Leptosphaeria coniothyrium* and *Sordaria fimicola*. From the roots the most frequently isolated were: *C. destructans*, *C. orthosporum*, *Cylindrocladium parvum*, *Fusarium avenaceum*, *F. culmorum*, *Rhizoctonia solani*, *Talaromyces wortmanni* and *Trichoderma viride*. Fungi common in shoots and roots (occurring very frequently) were: *C. destructans*, *C. orthosporum*, *C. parvum*, *F. culmorum*, *F. lateritium*, *F. poae* and *R. solani*.

DISCUSSION

Fungi such as *Alternaria alternata*, *Epicoccum purpurascens* and *Pestalotia sydowiana*, occurring with a high frequency on infected shoots and roots of heathers in permanent plantings, are not mentioned in literature as the pathogens of ericaceous plants, however their role in causing necroses on shoots and leaves was taken into account by Orlikowski, Stroczyński and Szkuta (2004). One should assume that such a numerous occurrence of the complex of saprotrophic fungi the genera: *Alternaria*, *Epicoccum*, *Sordaria*, *Pestalotia* and pathogenic ones of the genera: *Botrytis*, *Cylindrocarpon*, *Fusarium*, *Phytophthora* and *Rhizoctonia* on shoots and roots caused necroses, and then dieback of plants.

Among the fungi given in literature as the causes of diseases on heather, fungi of genus *Fusarium* also occurred, particularly *F. avenaceum* and *F. culmorum* as well as *Cylindrocladium parvum*, *Cylindrocarpon destructans*, *Botrytis cinerea*, *Phytophthora cinnamomi* and *Rhizoctonia solani*. The results of their pathogenic pressure and the possibility of causing the putridity of the bases of shoots, tip blight, grey mould and rhizoctoniosis are documented in papers by Łabanowski et al. (2001) and Orlikowski et al. (2004).

Orlikowski et al. (1995, 2004) showed that *P. cinnamomi* is one of the most dangerous pathogens of heather, causing necroses of roots and leaves and dieback of shoots. The analysis of dying undershrubs of heather show that this pathogen contributed in a small percentage to the phytocenosis, but it was isolated from roots and shoots, which proves that mycelium grows from roots to stems and causes necroses of shoots. Frequently isolated fungus *C. destructans* causing symptoms of putridity of the base of a shoot, similar to these caused by *Cylindrocladium scoparium*, dominated among the fungi living in dying roots. The role of this pathogen, as well as *R. solani*, in causing rhizoctoniosis is reported by Łabanowski et al. (2001) and Orlikowski and Szkuta (2002). Isolation of these fungi, in great number from roots and slightly smaller number from shoots, proves that initial place of the infection is a root system, from which pathogens grow to the above-ground parts.

The role of fungi of genera *Pythium* and *Fusarium* causing putridity of heathers is described by Łabanowski et al. (2001). The authors state that these fungi cause a mass dieback of young plants and the shoots over the place of infection in older plants several years old heather plantings.

A pathogen *B. cinerea* was isolated in spring, usually from damaged shoots after long rains, which is compliant with Łabanowski et al. (2001).

Among the fungi isolated from the roots of heather, the presence of *Talaromyces wortmanni* and *Trichoderma viride* was significant. The role of *T. viride* in the rooting of cuttings of ericaceous plants was described by Rudawska, Bojarczuk and Przybył (1993). The fungus introduced into the substrates diminished the population of pathogens and contributed to the improvement of health status of plants and their better rooting. Its predominance on the root system of heathers could possibly contribute to the diminishing of the number of the propagulae of *Ph. cinnamomi* and *R. solani*.

The presence of the fungus *Oidiodendron tenuissimum* on a root system proves the mycorrhization of the cuttings (Werner 2001).

The comparison of fungi living in necrotized shoots of one-year-old heather seedlings (Kowalik and Wandzel 2005) and heathers in permanent plantings reveals that several fungi species including: *A. alternata*, *B. cinerea*, *C. destructans*, *E. purpurascens*, *Humicola grisea* v. *grisea*, *P. sydowiana*, *Ph. cinnamomi* and *S. fimicola* can be transferred by transplants to permanent plantings and cause the intensification of diseases leading to necroses and dieback of undershrubs.

CONCLUSIONS

1. The perpetrators of dying out of heathers in permanent plantings of green areas in Cracow were fungi of the genera: *Alternaria*, *Botrytis*, *Cylindrocarpon*, *Cylindrocladium*, *Fusarium*, *Pestalotia*, *Phytophthora* and *Rhizoctonia*.

2. The occurrence of the following fungi pathogenic for heather was confirmed on the infected shoots: *Botrytis cinerea*, *Cylindrocarpon destructans*, *Fusarium culmorum*, *Phytophthora cinnamomi* and *Rhizoctonia solani*.

3. Shoots were massively occupied by fungi: *Alternaria alternata*, *Cylindrocladium parvum*, *Epicoccum purpurascens*, *Fusarium lateritium*, *Fusarium poae*, *Leptosphaeria coniothyrium*, *Pestalotia sydowiana* and *Sordaria fimicola*, which intensified the necroses of shoots.

4. Dieback of the roots of heathers was caused by the following fungi species: *Cylindrocarpon destructans*, *C. orthosporum*, *Fusarium avenaceum*, *F. culmorum*, *Phytophthora cinnamomi* and *Rhizoctonia solani*.

5. Most pathogens grew from roots to the above-ground parts of plants and caused necroses of shoots.

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Grzyby powodujące zamieranie wrzosów w nasadzeniach trwałych

Streszczenie

Celem pracy było określenie grzybów powodujących zamieranie wrzosu (*Calluna vulgaris*) w nasadzeniach trwałych na terenie Krakowa. Analizy mikologiczne wykonano na 40 zamierających krzewinkach. Wśród grzybów wyizolowanych z pędów dominowały: *Alternaria alternata*, *Cylindrocarpon destructans*, *Epicoccum purpurascens* i *Pestalotia sydowiana*. Z mniejszą częstością występowały: *Botrytis cinerea*, *Cylindrocladium parvum*, *Fusarium culmorum*, *F. lateritium*, *F. poae*, *Leptosphaeria coniothyrium* i *Sordaria fimicola*. Z korzeni wyodrębniano najliczniej grzyby: *C. destructans*, *Fusarium avenaceum*, *F. culmorum*, *Rhizoctonia solani* i *Trichoderma viride*. Izolowano również grzyby z rodzajów: *Coniothyrium*, *Oidiodendron*, *Phoma*, *Phytophthora*, *Talaromyces* i *Verticillium*.