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RHIZOCTONIA SPP. – DAMPING-OFF PATHOGENS OF SCOTS PINE (*PINUS SYLVESTRIS*) SEEDLINGS IN NOWY DWÓR FOREST NURSERY *VERSUS* SOIL FUNGI COMMUNITY IN 2006[1]

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Abstract

Nowy Dwór forest nursery (Forest District Lipka in north-western Poland) is one of the nurseries where damping-off of Scots pine occurs every year with high degree of seedling infestation.

In 2006 chosen binucleate and multinucleate *Rhizoctonia* isolates from the nursery were tested *versus* the soil fungi community, to compare the situation with that from the two previous years. The community supported the growth of all the isolates, yet the support to the multinucleate ones (*R. solani*) was greater. The situation reflected that of 2004 and 2005.

Key words: *Rhizoctonia solani, Rhizoctonia* spp., damping-off, soil fungi community, seedlings

Introduction

Damping-off of Scots pine seedlings (the most devastating disease of forest tree seedlings) occurs in many Polish forest nurseries every year, the more severe – the longer a forest nursery is being operated (Mańka 2005). This is associated with accumulation of the inoculum in soil (Mańka 2005).

In Nowy Dwór forest nursery (Regional Directorate of State Forests Piła, Forest District Lipka, north-western Poland) the disease has been monitored from 2004 on and each year *Rhizoctonia* spp. isolates have been isolated from the soil. According to Gierczak (1963, 1967), Mańka et al. (2001, 2005) and Bełka and Mańka

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(2008, 2010) *Rhizoctonia* spp. are considered the most severe pathogens of seedlings in many forest nurseries in Wielkopolska region.

The objective of this work was to investigate the impact of saprotrophic soil fungi community on *Rhizoctonia* spp. isolates in a forest nursery belonging to Forest District Lipka in 2006 and to compare it with the situation in 2004 and 2005.

Materials and methods

Nowy Dwór forest nursery is situated on fresh mixed coniferous forest site, according to Polish forest site typology.

In the first decade of June 2006 soil samples were collected from the top 15 cm of the soil profile from a bed on which the Scots pine seedlings were growing. From this soil isolates of *Rhizoctonia* spp. were obtained using the modified toothpick bait method (Paulitz and Schroeder 2005). Soil was mixed and dispensed into 0.5-l plastic pots. Ten wooden white birch toothpicks per pot were inserted into the soil. After 48 h the toothpicks were removed and placed on Petri plates with PDA medium, two toothpicks per plate. After 24 h plates were examined and colonies of *Rhizoctonia*-like fungi were transferred into plates with PDA. Further work was carried out on fungi identified as *Rhizoctonia* spp. All isolates belonging to the mentioned genus were examined for the number of nuclei in cell with the method by Bandoni (1979). Two *Rhizoctonia* spp. and two *R. solani* isolates were used for the biotic tests, to examine the effect of soil fungi community on the pathogens' growth.

From the same soil sample isolation of saprotrophic fungi was performed with Warcup (1950) soil plate method modified by K. Mańka (Johnson and Mańka 1961, Mańka 1964, Mańka and Salmanowicz 1987).

The biotic relations between the pathogens and the soil fungi communities were examined with the biotic series method by Mańka (Mańka 1974, Mańka and Mańka 1992, 1993). The biotic test results in individual biotic effect (IBE), which is the effect of one isolate of a saprotrophic soil fungus species on the pathogen growth. The IBE value is multiplied by the species frequency in the community, which results in general biotic effect (GBE = the effect of all the isolates of the species on the pathogen growth). All the GBE values are summarized to give summary biotic effect (SBE), i.e. the effect of the entire soil fungi community on the pathogen. The SBE describes the phytopathological function of the community. Any of the biotic effects mentioned, can be positive (suppressive effect on the pathogen's growth), negative (supporting effect on the pathogen's growth) or neutral ("0"). The supporting or suppressing effect intensity is described by the absolute value of the effect.

The similarity of the fungal communities obtained from the Nowy Dwór nursery soil in 2004, 2005 and 2006 was calculated with Marczewski-Steinhaus formula (Marczewski and Steinhaus 1959).

Results

In 2006 14 isolates of *Rhizoctonia* spp. were obtained from Nowy Dwór forest nursery, of which five were multinucleate and nine had two nuclei per cell. The multinucleate isolates represented *R. solani*. Two isolates of each group were used for further study.

The soil fungi community consisted of 344 isolates of which 11 most frequently occurring species (89% of all the isolates) were used for biotic tests (Table 1).

The only species displaying antagonistic activity against *Rhizoctonia* isolates proved to be *Trichoderma harzianum* (41 isolates) and *T. viride* (22 isolates; Table 1).

The effect of the soil fungi community on the growth of all pathogens considered (Table 1) was supporting to a great extent. The supporting effect was similar for both binucleate isolates: SBE –923 for isolate *R.*82 and SBE –940 for isolate *R.*74. The SBE on the multinucleate isolates was less supporting: –682 for *R.*89 isolate and –871 for *R.*64 isolate.

The quality similarity of the fungal communities from the nursery investigated in 2004 and 2005 was 55%, in 2004 and 2006 was 36% and in 2005 and 2006 was 31%.

Table 1

Biotic effect of soil fungi community from Nowy Dwór forest nursery in 2006 on the growth of *Rhizoctonia* spp. isolates

Fungus	Frequency	Isolates							
		multinucleate				binucleate			
		*R.*89		*R.*64		*R.*74		*R.*82	
		IBE	GBE	IBE	GBE	IBE	GBE	IBE	GBE
Chaetomium globosum	54	–4	–216	–8	–432	–7	–378	–7	–378
Penicillium simplicissimum	49	–6	–294	–4	–196	–4	–196	–5	–245
Trichoderma viride	41	+6	+246	+5	+205	+4	+164	+4	+164
Penicillium daleae	40	–3	–120	–4	–160	–2	–80	–2	–80
Gliocladium viride	27	–5	–135	–5	–135	–7	–189	–6	–162
Umbelopsis vinacea	24	–5	–120	–3	–72	–6	–144	–5	–120
Trichoderma harzianum	22	+9	+198	+8	+176	+7	+154	+8	+176
Fusarium oxysporum	18	–7	–126	–5	–90	–8	–144	–6	–108
Penicillium janczewskii	12	–4	–48	–5	–60	–3	–36	–2	–21
Aspergillus clavatus	11	–2	–22	–4	–44	–5	–55	–7	–77
Alternaria alternata	9	–5	–45	–7	–63	–4	–36	–8	–72
Summary biotic effect			–682		–871		–940		–923

IBE – individual biotic effect, GBE – general biotic effect.

Discussion

Research on detection of *Rhizoctonia* spp. have been conducted in Nowy Dwór forest nursery from 2004 to 2006.

In the forest nursery during three consecutive years the supporting effect of soil fungi communities on *Rhizoctonia* spp. isolates' growth was a supportive one. The effect of the soil fungi communities supported the growth of *Rhizoctonia* spp. isolates to a greater extent than the growth of binucleate isolates, this pattern was repeated for three consecutive years. It seems that *R. solani* – considered a more severe pathogen, has bigger support of soil fungi communities than the binucleate *Rhizoctonia* spp. isolates. In comparison to two previous years, when in the soil fungi communities there were 10 isolates of *T. harzianum* (in 2004) and 19 isolates of *T. viride* (in 2005), the activity of *Trichoderma* spp. against *Rhizoctonia* isolates was stronger in 2006, although the summary biotic effect was still showing a considerable supportive effect of the soil fungal community on the pathogens' isolates growth (Bełka and Mańka 2010).

The supporting effect in 2006, similar for both binucleate isolates investigated (SBE –923 and SBE –940) was stronger than in 2004 (SBE –779 and –774). In 2005 no binucleate isolates were found in the tested soil.

The effect of the soil fungal community on the multinucleate isolates was more supporting in 2006 comparing to two previous years (SBE –682 and –871). The summary biotic effects was –813 in 2004 and –539 in 2005 (Bełka and Mańka 2008).

In 2004 and 2005 the results obtained there were not as similar to the ones reported here, as expected. The quality similarity of the fungal communities was on relatively low level comparing 2006 with two previous years.

In 2006 the precipitation was lower, as compared to 2004 and 2005, and air temperature was higher. This weather could have had an impact on the relationship occurring between soil fungi and *Rhizoctonia* spp., as *R. solani* is a species favoured by high temperature (Kacprzak and Mańka 2001) and the supporting effect of soil fungal community on its growth is also favoured by temperatures over 15°C (Kacprzak and Mańka 2000).

Streszczenie

RHIZOCTONIA SPP. – PATOGENY WYWOŁUJĄCE ZGORZEL SIEWEK SOSNY ZWYCZAJNEJ (*PINUS SYLVESTRIS*) A ZBIOROWISKO GRZYBÓW GLEBOWYCH W SZKÓŁCE LEŚNEJ NOWY DWÓR W 2006 ROKU

W szkółce leśnej Nowy Dwór należącej do Nadleśnictwa Lipka (RDLP Piła) co roku straty powoduje zgorzel siewek sosny zwyczajnej, wywoływana przez *Rhizoctonia* spp. W 2006 roku wpływ zbiorowiska saprotroficznych grzybów glebowych na wzrost izolatów *R. solani* i izolatów dwujądrowych *Rhizoctonia* był

sprzyjający. Wyniki uzyskane w 2006 roku porównano z wynikami badań z dwóch poprzednich lat. Okazało się, że przy niewielkim podobieństwie zbiorowisk grzybów glebowych z badanych grzęd sytuacja w glebie badanej szkółki jest niekorzystna. Co roku zbiorowisko grzybów glebowych mocno sprzyjało wzrostowi badanych patogenów. Sprzyjający wpływ jest silniejszy w odniesieniu do dwujądrowych gatunków rodzaju *Rhizoctonia* niż do *R. solani*.

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