

ENDANGERMENT OF FIR STANDS BY ROOT INFECTION DISEASES BEYOND FIR NATURAL OCCURRENCE REACH

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Abstract. From the area of West Pomerania, there are no reports referring to mycological studies connected with tree stands dominated by fir or spruce infested by dangerous root pathogens. The purpose of this introduction was to verify whether fir stands beyond the borders of their natural reach are threatened by *Heterobasidion* sp. and *Armillaria* sp. Studies were carried out on three research areas in the survey units: 244 b and 225 kx of the Forest District Osusznicza. From the sampled wood, 10 isolates of *Armillaria* sp. and 21 isolates of *Heterobasidion* sp. were obtained. The analysis of results obtained during the presented studies permits to state definitely that the tree stands in 244 b and 244 kx subcompartments show a good state of health). An interesting scientific report is the statement of occurrence, on the area covered by the presented studies, of the species *Heterobasidion annosum* of S type which has not been reported so far from West Pomerania.

Key words: fir, *Armillaria*, *Heterobasidion*, root rot

INTRODUCTION

Pathogenic fungi have an immense importance for a forester and, therefore, the majority of mycological studies are devoted to that problem. There is a great number of elaborations, publications and papers dealing with *Heterobasidion* sp. and *Armillaria* sp. which constitute the basic source of forest threat in Poland and worldwide [Woodward et al. 1998, Roland 2000, Shaw 1978, Rykowski 1990, Mańka 1953]. From the area of West Pomerania, there are no reports referring to mycological studies connected with tree stands dominated by fir or spruce infested by dangerous root pathogens. An example of a tree stands of this type is the fir forest in the Szczecinek State Forest occupying an area of 106.03 ha including 40.84 ha in the Forest District Osusznicza. Fir was introduced there by German foresters about one hundred years ago. The purpose of this introduction was to verify whether fir stands beyond the borders of their natural reach are threatened by *Heterobasidion* sp. and *Armillaria* sp. Additionally, the aim was to

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determine the species composition of fungi settling the wood of trunks and stumps in the mentioned stands.

MATERIALS AND METHODS

Studies were carried out on three research areas in the survey units: 244 b (according to Polish site typology: fresh broadleaved forest) and 225 kx (Fresh mixed broadleaved forest) of Forest District Oszusznica. These stands were selected because of the participation of fir, spruce and beech in the age of 107 years. On each plot, 10 trees and stumps were selected and samples were taken. Samples were taken by Pressler's borer and they were wrapped with disinfected and sterile paper at the height of one meter in two places lying perpendicularly to their axes. In laboratory, the wood samples were disinfected in ethyl alcohol (about 1 min), and subsequently they were dried in sterile paper. After drying, the wood was divided into smaller pieces (2×10 mm) and placed on Petri dishes with 1% maltose nutrient and an addition of streptomycin. Grow cultures of fungi were transferred to test-tubes with nutrient and then, species were determined basing on mycological keys [Domsch et al. 1980, Ellis and Ellis 1987]. In case of species determination of *Heterobasidion* and *Armillaria* genera, separate methods were used basing on the genetical agreement of mycelium [Korhonen 1978].

RESULTS

From the sampled wood, 10 isolates of *Armillaria* sp. and 21 isolates of *Heterobasidion* sp. were obtained. Other fungi species were represented by 131 isolates belonging to 16 species and 3 undetermined species because of the absence of sporulation. The obtained fungi species are shown in Table 1. During analyses, from 21 isolates of *Heterobasidion* genus, 2 were identified as *Heterobasidion parviporum* Niemielä et Korhonen, the rest of isolates was represented by *Heterobasidion annosum* s.s. All isolates of *Armillaria* sp. obtained from wood of fir and stumps were determined as *Armillaria ostoyae* (Romagn.) Herink.

The studied wood of trunks, in the majority showed an absence of dangerous pathogens such as *Armillaria ostoyae* *Heterobasidion annosum*. Only fir no. 3 on plot no. 2 in subcompartment 244 b was infested by *Armillaria ostoyae*. The remaining trees from this subcompartment were settled by cosmopolitan soil fungi species which sometimes can favour the growth of pathogenic fungi (*Penicillium* and *Fusarium*). Among all cultures of fungi, the highest percentage participation was shown by *Penicillium* spp. From the wood sampled from trunks, in the subcompartment 225 kx, no fungi culture was developed. The studied stumps were poorly settled by *Heterobasidion* root rot and *Armillaria* root rot. A huge majority of fungi isolated from the wood of stumps belonged to the *Trichoderma* genus (62 isolates). The remaining species belonged to cosmopolitan microscopic mitosporiferous fungi and to fungi from *Ascomycetes* class. They are characterized by an ability of mouldy superficial wood decomposition. All their isolated cultures showed a low percentage of precipitation (they rarely exceeded 5%).

Table 1. Species of fungi obtained from wood
Tabela 1. Gatunki grzybów uzyskane z drewna

Species Gatunek grzyba	Division – Wydzielenie 244 b		Division – Wydzielenie 225 kx	
	trunk strzała	stump pniak	trunk strzała	stump pniak
<i>Acremonium luzulae</i> (Fuckel) W. Gens		3		
<i>Armillaria ostoyae</i> (Romagn.) Herink	4 (Fir)			6
<i>Aspergillus clavatus</i> Desm.		4		
<i>Chaetomium funicola</i> Cooke		4		3
<i>Fusarium culmorum</i> (W.G. Smith) Saac.				3
<i>Fusarium oxysporum</i> Schlecht.		4		2
<i>Fusarium trinctum</i> (Corda) Saac.	2			
<i>Gliocladium viride</i> Matr.		1		1
<i>Heterobasidion annosum</i> (Fr.) Bref.		3	2	14
<i>Heterobasidion parviporum</i> Niemielä et Korhonen				2
<i>Penicillium chrysogenum</i> Thom	4			
<i>Penicillium decumbes</i> Thom		2		
<i>Penicillium steckii</i> K.M. Zalessky	7 (Fir)	7		
<i>Penicillium</i> sp.	1 (Fir)	1		2
<i>Sclerotinia scleroturum</i> (Lib) De Bary		4		
<i>Trichoderma auroviridae</i> Rifai		4		4
<i>Trichoderma harzianum</i> Rafał.				12
<i>Trichoderma koningii</i> Oudem.				5
<i>Trichoderma viridae</i> Pers. ex Gray		27		12
Total – Razem	18	64	2	60

DISCUSSION

The analysis of results obtained during the presented studies permits to state definitely that the tree stands in 244 b and 244 kx subcompartments show a good state of health. This is supported by several observed features. Primarily, the appearance of tree crowns observed during field studies in May 2004 revealed that only one tree showed a reduction of foliage. While the others were in good condition. According to Sierota [1998], thinning of crowns and decreased increments of compact wood are valuable indicators of a deteriorated tree condition confirmed because sometimes, a healthy plant does not show an optimal increment [Mańka 2005]. In case when a fir is infested by *H. annosum*, there follows a thinning of the crown, essential measurable indicator in the

estimation of health condition includes also the compositions and structure of rhizospheric fungi and fungi settling in wood [Sierota 1998] This fact is confirmed by the example of a fir from plot no. 2, where its crown was reduced in 60%. From a performed bore-hole, *Armillaria ostoyae* was isolated. The remaining trees from both sub-compartments were not settled by any of the above mentioned pathogens.

Also the species composition of fungi obtained after the examination of stumps testified a good health of those stands. Among the examined stumps, only 5 were settled by *Heterobasidion* root rot and only one stump was infested by *Armillaria ostoyae*. It must be stressed that the analysed stumps were in the vicinity of the selected research areas where the occurrence or the possibility of occurrence or the possibility of occurrence of the above mentioned pathogens was found.

Trichoderma spp. was the species which dominated in the wood of stumps from both studied subcompartments. There are known numerous examples of studies of the antagonistic action of this type species in relation to *Rhizoctonia solani* and *Fusarium oxysporum* [Kwaśna 1987]. Also the inhibiting effect of *Trichoderma* spp. On the growth of rhizomorphs of *Armillaria* sp. was confirmed [Shaw and Kile 1991].

The same problem in the determination of the role played by microscopic fungi species which as cosmopolitan soil organisms may cause mouldy wood decomposition and its discoloration refers also to other microscopic fungi species. An interesting scientific report is the statement of occurrence, on the area covered by the presented studies, of the species *Heterobasidion annosum* of S type which has not been reported so far from West Pomerania. Studies carried out on the intersterile types of brown root rot [Łakomy et al. 2000] showed the presence of the S type in the north-eastern and southern parts of Poland.

The occurrence in the studied stands of only one species of *Armillaria ostoyae* confirms its high adaptational abilities to endure changed climatic conditions and a differentiated composition of tree stands. It proves the Euro typical character of this species, showing, however, its preferences in relation to pine, spruce and fir [Zółciak 2003].

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ZAGROŻENIE DRZEWOSTANÓW JODŁOWYCH CHOROBAMI INFEKCYJNYMI KORZENI POZA ICH NATURALNYM ZASIĘGIEM WYSTĘPOWANIA

Streszczenie. Z obszaru Pomorza Zachodniego brak jest doniesień na temat badań mikologicznych związanych z drzewostanami, w których dominowałyby jodła lub świerk, dotyczących występowania groźnych patogenów korzeni. Celem pracy było stwierdzenie czy drzewostany z udziałem jodły poza granicą jej naturalnego występowania są zagrożone infekcją ze strony *Heterobasidion* sp. oraz *Armillaria* sp. Badania przeprowadzono na trzech powierzchniach badawczych w wydzieleniach 244 b (Lśw) oraz 225 kx (LMśw) Nadleśnictwa Osusznica. Z pobranych prób drewna uzyskano 10 izolatów opieńki oraz 21 izolatów korzeniowca wieloletniego. Analizując wyniki otrzymane podczas badań, można z całą pewnością stwierdzić, że drzewostany w pododdziałach 244 b i 225 kx cechują się dobrym stanem zdrowotnym. Interesującym doniesieniem naukowym jest występowanie na terenie objętym badaniami gatunku *Heterobasidion annosum* typu S, który dotychczas nie został stwierdzony na Pomorzu Zachodnim.

Słowa kluczowe: jodła, *Armillaria*, *Heterobasidion*, zgnilizna korzeni

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