

Joanna JARMUŁ-PIETRASZCZYK¹, Marta KAMIONEK¹
and Ewelina MALINOWSKA²

OCCURRENCE OF ENTOMOPATHOGENIC FUNGI AND NEMATODES ON PASTURES IN CENTRAL AND NORTHERN POLAND

WYSTĘPOWANIE GRZYBÓW I NICIENI ENTOMOPATOGENNYCH NA PASTWISKACH W CENTRALNEJ I PÓŁNOCNEJ POLSCE

Abstract: Entomopathogenic fungi and nematodes as important elements of the natural environment focussed the attention of researchers. Both groups of organisms possess an ability to infect and reduce the number of insects at various stages of their growth. This ability was used in the production of biopreparations. For this reason, the studies were aimed at estimating species composition and population density of entomopathogenic fungi and nematodes living in a given ecosystem. Experiments were performed in soils obtained from pastures. Fungi: *Metharidium anisopliae*, *Bauveria basianna*, *Pecylomyces fumosoroseus* as well as and nematodes of the family *Steinernematidae* were isolated from soil samples.

Keywords: entomopathogenic fungi and nematode, soil

Entomopathogens comprise a very numerous group of microorganisms including fungi and nematodes. Under natural conditions these organisms were found in various ecosystems. They are an important factor decreasing population density of eg plant pests. Arthropods are their main food base though they do not show distinct food preferences [1–4]. The most frequent entomopathogenic fungi in Poland are the species of the genera: *Peacilomyces*, *Bauveria*, and *Metarhizium*. Apart from entomopathogenic nematodes, these organisms are a very efficient factor controlling arthropod populations and the first discovered pathogens of insects [2, 5, 6]. They were used to control pests already at the end of the 19th century. Intensification of agricultural production and common use of plant protection chemicals inclined researchers to search for alternative methods of plant protection. The last decade has brought many studies on these groups

¹ Division of Zoology, Warsaw University of Life Sciences – SGGW, ul. Ciszewskiego 8, 02–786 Warszawa, Poland, phone: +48 22 593 66 28, fax: +48 22 593 66 23, email: Joanna_jarmul@sggw.pl

² Student of the Division of Zoology, Warsaw University of Life Sciences – SGGW, ul. Ciszewskiego 8, 02–786 Warszawa, Poland.

of organisms which contributed to the commercial use and production of biopreparations based on local isolates. Species composition and density of entomopathogenic fungi and nematodes depends on factors like: soil type and moisture, human impact and land use in a given area [7–11].

Material and methods

Soil samples collected in 2007 and 2008 from variously managed pastures were used in the experiment. Mixed samples were taken with the soil core to the depth of 20 cm. The first sample originated from barren pasture in Niekursk which was extensively grazed by sheep. The second study area was a pasture in Konradów grazed by slaughter cattle of the Hereford race and the third pasture was situated in Spala. Since 1985 this pasture has been unmanaged.

Entomopathogenic fungi and nematodes were isolated from soil samples with the method of Zimmermann (1986) [12] using trap insects. The trap organisms were the *G. mellonella* caterpillars from the culture bred in the Department of Zoology, WULS. The experiment was carried out at 25 °C for 25 days for each soil sample. The first control was performed 5 days after the set up of the experiment and later the samples were controlled every 2–3 days. Dead insects were removed from soil samples and replaced by live ones. Dead insects were transferred to Petri dishes to estimate the reason of their death, to obtain complete growth of mycelium on the skin surface or to multiply entomopathogenic nematodes for estimation of their species composition. The obtained results were statistically processed with the SPSS 11 statistical software.

Results and discussion

The use of pastures affected species composition of isolated pathogens and intensity of their occurrence. Three most frequent species of entomopathogenic fungi were isolated from the studied samples were: *P. fumosoroseus*, *B. bassiana*, and *M. anisopliae* (Table 1). Apart from fungi, entomopathogenic nematodes of the family *Steinernematidae* were also found in studied area. *M. anisopliae* was the most frequent in pastures in Spala and Niekursk. The second frequent fungal species in these pastures was *P. fumosoroseus*. The least frequent species was *B. bassiana* (Table 1).

Table 1

The occurrence of entomopathogenic fungi and nematode in the soil [%]

		Niekursk	Konradów	Spala
Entomopathogenic fungi	<i>B. bassiana</i>	2.0	0.7	10.0
	<i>P. fumosoroseus</i>	6.2	24	36.7*
	<i>M. anisopliae</i>	17.4*	0	31.1
Saprotic fungi		10.0	43.3	6.7
Entomopathogenic nematode (<i>Steinernematidae</i>)		48.6	27.3*	7.8
Other biotic factor		16.1	4.7	7.8

p < 0.05 for the test ANOVA.

The rate of insect infection by nematodes is largely determined by the size of the nematode population in soil and by their ability to infect the host. Studies of three soils from different pastures showed high variability of trap insect infection by nematodes (Table 1). Most entomopathogenic nematodes were isolated from the soil from Niekursk in the first week of the experiment.

Isolating entomopathogenes from soil presents problems with rich soil microflora (saprophagous fungi, plant pathogens, various bacteria and saprophytes). The use of trap insects enables isolation of most frequent species and their further culture under laboratory conditions [1–4, 12, 13] to estimate their species composition. Many authors underline that the occurrence of entomopathogens varies seasonally and their composition depends on sampling date. Entomopathogenic nematodes attack their prey most often in summer and late autumn. This was confirmed in the present experiment. Autumn samples from Niekursk contained more nematodes which infected insects before fungal infection.

According to Ropek (2005) [14] the occurrence of spores of entomopathogenic fungi in soil may significantly decrease nematode infections. Fungal spores infecting an insect produced enzymes that inhibit the growth of mutualistic bacteria living in symbiosis with nematodes. Another factor affecting differentiation of pathogens was the type of pasture used. Pastures in Niekursk and Konradów are used permanently in contrast with that in Spala. Organic fertilisation affects mainly the occurrence of entomopathogenic nematodes [3, 9–11] and less intensively the abundance of fungi [2, 5, 15, 16].

Conclusions

Entomopathogenic fungi were mainly isolated from the soil from pastures in Spala and Niekursk. The dominating species was *M. anisopliae*. Nematodes of the family *Steinernematidae* were less frequent. No representatives of *Heterorhabditis species* were isolated.

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¹ Katedra Biologii Środowiska Zwierząt, Zakład Zoologii

² Student – Katedra Biologii Środowiska Zwierząt, Zakład Zoologii
Szkoła Główna Gospodarstwa Wiejskiego w Warszawie

Abstrakt: Polska jako kraj o zróżnicowanej topografii stwarza dogodne warunki do rozwoju oraz zróżnicowania fauny. Do niej zaliczamy m.in. grzyby i nicienie entomopatogenne, które są ważnym elementem środowiska. Ważną rolą jest ich zdolność do infekowania różnych stadiów rozwojowych owadów i ich redukcja. Te umiejętności są wykorzystywane w produkcji biopreparatów. Z tego powodu prowadzone badania miały na celu określenie składu gatunkowego oraz wielkość populacji grzybów i nicieni entomopatogennych występujących w określonym ekosystemie. Doświadczenie przeprowadzono na glebach pozyskanych z pastwisk. Z badanych próbek glebowych wyizolowano takie grzyby, jak: *M. anisopliae*, *B. basianna*, *P. fumosoroseus* oraz nicienie z rodziny *Steinernematidae*.

Słowa kluczowe: nicienie entomopatogenne, grzyby entomopatogenne, gleba