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CONTRIBUTION TO THE KNOWLEDGE OF INSECTS HUMIFICATORS OF FUNGI IN LITHUANIA

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Abstract. According to the data obtained in 1997-1998 36 species belonging to 11 families of Diptera, 10 species of Hymenoptera, 7 species of Coleoptera and 2 species of Lepidoptera have been reared from 34 genera of fungi in Lithuania. The most numerous were the following: Mycetophilinae on *Russula* sp. (390 specimens), Bolitophilidae on *Paxillus involutus* (220), Mycetophilinae on *Agrocybe* sp. (140), *Mycetophila strigatoides* on *Lyophyllum decastes* (127) and *Mycetophila fungorum* on *Boletus luridus* (105). The most frequently encountered species of parasites were: *Dialipsis exilis* from *Cordyla* sp. on *Russula* sp. (14 specimens), *Proclitus comes* on *Lactarius piperatus* (13) and *Plectiscidea nava* from *Mycetophila fungorum* on *Russula* sp.
Key words: Fungi, Insects: Coleoptera, Lepidoptera, Hymenoptera and Diptera, Lithuania

INTRODUCTION

Fungi are an important component of biogeocenosis. They take an active part in the process of soil formation and humification of ground litter. Mycorrhizal fungi are very important for the forest, since 80% of flora form mycorrhiza (Urbonas, 1997). Most polypores fungi are active destructors of live wood and do much damage to forests. Fungal fruit-bodies account for a large part of biomass in forests. In Lithuania, only the biomass of edible fungi fruit-bodies makes up approximately 50-70 thousand tons per year (Urbonas, 1997). During the process of putrefaction, old fungal fruit-bodies destruct the underground mycelium. Humificators of fungi naturally prevent this process by gnawing through a fungal fruit-body and thus, forming favourable conditions for other biodestructors. In this way, fungus is destroyed and vegetative mycelium is less harmed.

Fungi are a medium for various invertebrates – molluscs, ticks, spiders, insects, nematodes and crustaceans to dwell on. According to some authors, most of the fungal fruit-bodies are destructed up to 100% (including the laid eggs) (Krivosheina et al., 1986). Invertebrates, which are found in fungi, take an active part in the initial stages of destruction of the organic substance of fungal fruit-bodies, distribution of spores and they also assist in the formation of mycorrhiza. Thus, they accelerate the process of metabolism in nature (Krivosheina et al., 1986).

Although the fauna of mycetobionts in Lithuania is at the initial stage of investigation, there are some fragmentary data about some representatives of Lepidoptera and Coleoptera orders related to fungi (Ivinskis, 1993; Pileckis, Monsevičius, 1995, 1997). However, there are almost no data concerning the biology of the most abundant mycetophagous group – fungus gnats and about its specific composition. S. Pakalniškis and S. Podėnas (1992) have published a checklist of Lithuanian Diptera, where 3 species of fungus gnats have been mentioned. J. Rimšaitė (1998) reported 23 fungus gnats species.

The purpose of this work is to examine the diversity of trophic relations of insects and fungi, which accelerate the process of decay of fungi and to reveal the species of insects taking part in the process of humification.

MATERIAL AND METHODS

In 1997-1998, fungal fruit-bodies damaged by larvae were collected in various districts of Lithuania. They were placed into jars covered with a layer of peat-moss in order to breed imagos.

There were taken 562 samples of fungi (Ascomycetes, Pezizales; Basidiomycetes, Agaricales, Aphyllophorales). 2 Lepidoptera species, 7 Coleoptera species, and 36 Diptera species were reared from them. Besides, various Staphylinidae species were taken directly from mushrooms while gathering them.

Results

From the fungi, we have reared insects of 4 orders: Diptera, Hymenoptera, Coleoptera, Lepidoptera. Diptera is the most abundant and diverse group of mycetophagous insects. We have reared dipterous insect imagos from the families of Mycetophilidae, Keroplatidae, Bolitophilidae, Limoniidae, Sciaridae, Psychodidae, Cecidomyiidae, Anisopodidae, Drosophilidae, Phoridae, and Sphaeroceridae.

Mycetophilinae were reared from 26 species and 12 genera of fungi (species were not characterized) (Table 1). The larvae of fungus gnats from Sciophilinae, Gnoristinae, and Leiinae subfamilies are found on the

Table 1. Trophic relations between insects and fungi

Group of insects	Insect genus, species	Fungus genus, species	Number of reared imagos
Diptera Mycetophilidae			
Sciophilinae	*Sciophila lutea* Macq.	*Ptychoverpa bohemica*	3
		Gyrodon lividus	1
		Suillus granulatus	2
		Lactarius deliciosus	2
		L. necator	1
		Russula sp.	4
	S. pseudoflexuosa Kurina	*Gyrodon lividus*	1
		Lactarius necator	1
		Russula sp.	1
Gnoristinae	*Coelosia tenella* (Ztt.)	*Tricholoma flavovirens*	1
Leiinae	*Leia bilineata* (Winn.)	*Phellinus* sp.	1
Mycetophilinae	*Allodiopsis domestica* (Mg.)	*Lepiota clypeolaria*	2
	A. rustica (Edw.)	*Phaeolepiota aurea*	2
	Allodia anglofennica Edw.	*Ptychoverpa bohemica*	14
	A. grata (Mg.)	*Polyporus squamosus*	6
	A. ornaticollis (Mg.)	*Lepiota* sp.	10
	Cordyla fusca Mg.	*Russula* sp.	20
	C. sixi (Bar.)	*Amanita citrina*	3
		Boletus pinicola	15
	Exechia dorsalis (Staeg.)	*Collybia* sp.	2
		Hygrophorus sp.	2
	E. fusca (Mg.)	*Russula* sp.	4
	E. nigroscutellata Landr.	*Lactarius torminosus*	6
	E. seriata (Mg.)	*Lactarius vellereus*	4
		Russula sp.	3
	Tarnania fenestralis (Mg.)	*Cortinarius armillatus*	7
		Hygrophorus sp.	1
	T. tarnanii (Dz.)	*Tricholoma flavovirens*	8
	Mycetophila blanda Winn.	*Lactarius deliciosus*	5
	M. flava Winn.	*Pleurotus* sp.	5
	M. fungorum (De Geer)	*Boletus luridus*	105
		Suillus granulatus	64
		Lyophyllum decastes	12
		Agrocybe sp.	140
		Rozites caperata	11
		Russula sp.	390
		R. emetica	17

		Amanita muscaria	56
		Macrolepiota procera	3
		Macrolepiota sp.	21
	M. ichneumonea Say	*Lactarius torminosus*	4
	M. laeta Walk.	*Fomitopsis* sp.	18
		Phellinus tremulae	3
	M. signatoides Dz.	*Gyrodon lividus*	25
		Xerocomus sp.	12
	M. strigatoides (Landr.)	*Lyophyllum decastes*	127
Bolitophilidae	*Bolitophila hybrida* (Mg.)	*Paxillus involutus*	76
	B. tenella Winn.	*Armillaria* sp.	68
	B. sp.	*Lepista nuda*	10
		Paxillus involutus	220
Keroplatidae	*Keroplatus testaceus* Dalm.	*Fomitopsis pinicola*	2
		Fomes fomentarius	2
	Keroplatus sp.	*Gloeophyllum abietinum*	1
		Stereum sp.	1
Anisopodidae	*Sylvicola cinctus* F.	*Lactarius* sp.	10
Phoridae	*Megaselia* sp.	*Leccinum* sp.	12
		Ptychoverpa bohemica	10
		Russula sp.	41
Sphaeroceridae	*Leptocera parapusia* Duda	*Ptychoverpa bohemica*	1
Drosophilidae	*Drosophila buscki* Cog.	*Leccinum* sp.	15
	D. limbata Roser	*Ptychoverpa bohemica*	34
		Russula sp.	45
	D. testacea Roser	*Gyrodon lividus*	5
	D. phalerata Mg.	*Russula* sp.	30
Coleoptera			
Ciidae	*Ennearthron affine* Gypp.	indeterm. sp. Aphyllophorales	2
Colydiidae	*Bitoma crenata* Fabr.	indeterm. sp. Aphyllophorales	2
Erotylidae	*Triplax russica* L.	*Pleurotus ostreatus*	10
	Tritoma subbasalis Reitt.	indeterm. sp. Aphyllophorales	6
Nitidulidae	*Cychramus variegatus* Hbst.	*Armillaria* sp.	2
	C. luteus Fabr.	*Armillaria* sp.	2
Tenebrionidae	*Diaperis boleti* L.	*Laetiporus sulphureus*	27
		Piptoporus betulinus	15
Lepidoptera			
Tineidae	*Scardia polypori* Esp.	indeterm. sp. Aphyllophorales	2
	Morophaga choragella (Den. & Schiff.)	indeterm. sp. Aphyllophorales	4

surface of a fungal fruit-body. These larvae are not only mycetophagous, but sometimes zoosapromycetophagous too (Krivosheina et al., 1986). The larvae of Mycetophilinae subfamily are more specialized, they feed on the inner fungal fruit-body tissues. Most of fungus gnat species have trophic relations with the relevant groups of fungi. From the fungus gnats that we found, only *Mycetophila fungorum* (De Geer) and *Sciophila lutea* Macq. larvae were polyphagous.

Bolitophilidae (Diptera) imagos were reared from 3 fungi species (Table 1). Their larvae are typical mycetophages (Krivosheina et al., 1986). It is noteworthy that Bolitophilidae were reared from the fungi species, where no Mycetophilidae are found or it is found very rarely.

Keroplatidae (Diptera) were reared from 4 species of Aphyllophorales (Table 1). Their larvae were found on the surface of fruit-bodies where their chrysalides are developing too. Zoophagy and a partial mycetophagy are typical of the larvae of Keroplatidae (Krivosheina et al., 1986).

Imagos of some Diptera families have been reared from

fungal fruit-bodies in the late stages of the decay process. Those were Anisopodidae, Phoridae, Sphaeroceridae, and Drosophilidae (Table 1). Also, imagos of Sciaridae, Cecidomyiidae, Psychodidae, and Limoniidae families were reared from decayed fungi. The most abundant (in 95% of samples have been registered) were the insects of Sciaridae family.

Representatives of Hymenoptera order parasitize the larvae of fungus gnats. We have reared Ichneumonidae (subfamilies Orthocentrinae, Oxytorinae), Braconidae (subfamily Alysiinae), and some others. Besides, the hosts for 10 species of Oxytorinae have been established (Table 2).

The larvae of Coleoptera are commonly found in polypores (Basidiomycetes, Aphyllophorales). The larvae of Elateridae (Coleoptera) are sometimes also found

Table 2. Trophic relations of Oxytorinae (Hymenoptera, Ichneumonidae)

Oxytorinae species	Mycetophilidae genus, species	Fungus genus, species	Number of reared Oxytorinae
Aperileptus albipalpus (Grav.)	*Mycetophila fungorum* (De Geer)	*Amanita muscaria*	1
Dialipsis exilis Först.	*Cordyla* sp. *C.* sp. *?* *Exechia seriata* (Mg.)	*Russula* sp. *Lactarius piperatus* *Russula* sp. *?*	14 1 14 1
Plectiscidea collaris (Grav.)	*Allodiopsis rustica* (Edw.) *Exechia dorsalis* (Staeg.) *Mycetophila fungorum* (De Geer)	*Lepista* sp. *Collybia* sp. *Russula* sp.	2 4 2
P. monticola (Först.)	*Mycetophila fungorum* (De Geer)	*Rozites caperata*	3
P. nava (Först.)	*Mycetophila fungorum* (De Geer)	*Russula* sp.	6
Proclitus ardentis Van Rossem	*Mycetophila laeta* Walk.	Polyporaceae	4
P. attentus (Först.)	*Allodia czernyi* (Landr.)	*?*	2
P. comes (Hal. in Curtis)	*Cordyla* sp. *?*	*Russula* sp. *Lactarius piperatus*	2 13
P. fulvicornis (Först)	*?*	*Fomitopsis pinicola*	5
P. praetor (Hal. in Curtis)	*Allodiopsis rustica* (Edw.) *Tarnania tarnanii* (Dz.)	*?*	1 1

in Agaricales fungi. The predatory Staphylinidae (Coleoptera) insects are usually found in the fungi damaged by mycetophages. From fungi we have reared imagos of 6 Coleoptera families (Table 1).

The larvae of some Lepidoptera also develop in fungi, especially in polypores (Basidiomycetes, Aphyllophorales) (Table 1).

Discussion

Although the investigations of mycetobiont insects are at the initial stage, the results show what a large and diverse is the complex of insects, which are related to fungi. The tissues of the fungal fruit-body damaged by the larvae of mycetophages undergo the process of decay more rapidly. The utilizers of live tissues give way to sapromycetophages, saprophages, predators and parasites (Krivosheina et al., 1986).

Separate groups of insects play different roles in the process of humification. Further investigations will help to evaluate the role of individual species and higher taxa in these processes.

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Įnašas į vabzdžių grybų humifikatorių pažinimą Lietuvoje

J. Rimšaitė

Santrauka

Įvairūs vabzdžių kompleksai sudėtingais mitybiniais ryšiais susiję su grybų vaisiakūniais. Tiriant micetobiontų fauną 1997-1998 m. iš grybų išauginta 4 vabzdžių būrių imago: 11 šeimų Diptera, 7 šeimų Coleoptera, 1 šeimos Lepidoptera atstovai, taip pat parazitiniai plėviasparniai Hymenoptera (Ichneumonidae, Orthocentrinae, Oxytorinae; Braconidae, Alysiinae ir kiti). Atskirų išaugintų vabzdžių grupių vaidmuo grybų vaisiakūnių humifikacijos procesuose nevienodas. Ardydami vaisiakūnius aktyviausiai dalyvauja gyvų audinių vartotojai, vėliau juos pakeičia sapromiceto-, saprofagai, plėšrūnai ir parazitai.