PARASITOIDS OF XYLOPHAGUS AND PHLOEOPHAGOUS INSECTS OF THE HUNGARIAN CONIFEROUS TREE SPECIES

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Abstract – In Hungary, besides the most important broad-leaved tree species (*Quercus* spp., *Robinia*, *Populus*, *Fagus* and *Carpinus*) some 15.1% of the forested land is covered by coniferous tree species. The three most important ones are *Pinus sylvestris* (9.1%), *Pinus nigra* (4.2%) and *Picea abies* (1.5%). All the three genera are either economically or ecologically important. In recent years the mass outbreaks of different bark and wood boring insects have caused enormous economic losses in these stands. In our research, completed in 1998-99, through field investigations and laboratory experiments, we assessed phloeophagous and xylophagous insect species, moreover the parasitoid complex of them. There were 24 research plots: 14 plots for *P. sylvestris*; 4 for *P. nigra*; and 6 for *P. abies*. The use of felled trap trees allowed us to determine the species abundance: on *P. sylvestris* 14 Scolitidae, 2 Curculionidae and 3 Cerambycidae species; on *P. nigra* 9 Scolytidae, 2 Curculionidae and 2 Cerambycidae species; and on *P. abies* 13 Scolytidae, 1 Curculionidae and 3 Cerambycidae species were found. A great number of various parasitoid species have been found. Family Pteromalidae (Chalcidoidea) has been represented by 15 species, and 5 of them has recorded first. Further species of families Eurytomidae, Encyrtidae, Eulophidae, Mymaridae (Chalcidoidea), Platygastridae (Proctotrupoidea), Braconidae, Ichneumonidae (Ichneumonoidea) and Bethylidae (Chrysidoidea) have also emerged.

Key words: Bark and wood boring insects, Curculionidae, Cerambycidae, Chalcidoidea, Ichneumonoidea, Pteromalidae, Mymaridae, Scolytidae

Introduction

The forest cover of Hungary is 18.6% (Hungarian Forest Service 2001). Besides the most important broad-leaved tree species (*Quercus* spp., *Robinia*, *Populus*, *Fagus* and *Carpinus*), 15.1% of the forested land is dominated by coniferous tree species. The three most important ones are *Pinus sylvestris* (9.1%), *Pinus nigra* (4.2%) and *Picea abies* (1.5%). All the three genera are either economically or ecologically important. Coniferous forests are often situated where the climate and soil conditions are unfavourable for them (marginal stands), and therefore the frequency of xylophagous insect outbreaks is higher than in other stands. In recent years the mass outbreak of different bark and wood boring insects have caused enormous economic losses in these stands.

An extraordinarily great diversity has been observed among the species, either in composition or frequency of pests present in different areas. In addition to abiotic factors of the environment (e.g. temperature), their natural enemies might play a highlighted limiting role up to how many species of them and in what abundance are present. In Hungary, similar investigations were only carried out in the 50's (Győrfi 1941), in which the identification of parasitoids reared from different bark beetle species was completed.

Materials and Methods

In our study, made in 1998-99 on typical Hungarian coniferous stands, through field investigations and laboratory experiments, we assessed the phloeophagous and xylophagous insect species and further the parasitoid complex of them.

The observation has had 24 research plots. The *P. sylvestris* plots (14) in: Bak (BA), Bugac (BU), Fenyőfő (FE), Haláp (HA), Iván (IV), Kemenes (KM), Kerekegyháza (KE), Lábod (LA), Nagybajom (NB), Nagydorg (ND), Őrség (ÖR), Pornóapáti (PO), Salgótarján (NO) and Sopron (SO). The *P. nigra* plots (4) in: Budapest (BP), Bugac (BU), Herend (HE) and Kerekegyháza (KE). The *P. abies* plots (6) in: Bak (BA), Fenyőfő (FE), Kőszeg (KÖ), Őrség (ÖR), Sopron (SO) and Telkibánya (TB). On every research plot 50-60 trees have been marked and the health conditions have been investigated using the international method (II. level: TC1 & TC2). Trap trees were felled in early spring to induce beetle attack. Attacked trees were taken for laboratory studies into light eclectors. Species composition and abundance were determinated for xylophagous and phloeophagous as well as for the parasitoid complex.

Once the different insects hatching in the bark and in the wood respectively had settled, samples were taken from the basal, stem, and the crown sections, and were subsequently placed into light eclector. The pests and their parasites trapped when emerging from the sample and stored frozen until identification. The parasitoids identified do not represent only a typical array of species living on some certain xylophagous or phloeophagous insect species, but show the parasitoid complex of all the insect species occurring in bark and wood in the investigation area.

Results and Discussion

Xylophagous and phloeophagous species abundance are shown in Table 1.

Pinus sylvestris

Three Cerambycid species have been found, and the dominant ones are *Rhagium inquisitor* and *Acanthocinus aedilis*. The Curculionid *Pissodes pini* has emerged also frequently. The most various taxon occurred that of the family Scolytidae, with 14 species in it. The primary species, which is able to kill older Scoth pine stands, *Ips sexdentatus* has presented rare (2 spots). Young trees (till the age of 3-5 years) can be killed by *Hylurgus ligniperda*, *Hylastes opacus* and *Hylastes ater*, but their abundance has seemed also low. The secondary species *Tomicus piniperda* and *Hylurgops palliatus* have occurred in common. From them, *T. piniperda* is able to attack healthy trees and we could observe its damages on many research plots.

Pinus nigra

Besides of Cerambycids and Curculionids we have caught Anobiids from young drying branches too. On black pine the secondary and tertiary bark beetles seemed to be dominant, only *Pityogenes bistridentatus* can be considered as a potentially dangerous species.

Picea abies

The lower number of Cerambycids and Curculionids is typical for Norway spruce. The dominant taxon was family Scolytidae, with high number of primary (*Ips typographus*, *Pityogenes chalcographus*), secondary (*Pityophthorus pityographus*, *Dryocoetes autographus*), and tertiary (*Crypturgus cinereus*) species.

Table 1 Relative dominance of xylo- and phloeophagous species on different conifers

SPECIES	*Pinus sylvestris*		*Pinus nigra*		*Picea abies*	
	Rel. value	**Dom. value**	**Rel. value**	**Dom. value**	**Rel. value**	**Dom. value**
Anobiidae						
Anobium sp.	-		0.70%	*	-	
Cerambycidae						
Acanthocinus aedilis (Linné, 1758)	5.73%	***	0.35%	*	-	
Callidium violaceum (Linné, 1758)	-		-		0.01%	*
Monochamus galloprovincialis	0.27%	*	-		-	
Rhagium inquisitor (Linné, 1758)	2.39%	**	0.44%	*	0.30%	*
Tetropium castaneum (Linné, 1758)	-		-		0.02%	*
Curculionidae						
Hylobius abietis (Linné, 1758)	0.03%	*	0.52%	*	0.02%	*
Pissodes pini (Linné, 1758)	5.53%	***	0.96%	*	-	
Scolytidae						
Crypturgus cinereus (Herbst, 1793)	9.71%	***	52.49%	*****	36.53%	*****
Dryocoetes autographus (Ratzeburg, 1837)	-		-		3.31%	**
Hylastes ater (Paykull, 1800)	1.85%	**	-		0.01%	*
Hylastes opacus (Erichson, 1836)	0.07%	*	0.26%	*	0.04%	*
Hylurgops palliatus (Gyllenhal, 1813)	18.91%	****	0.26%	*	0.20%	*
Hylurgops glabratus (Zetterstedt, 1828)	-		0.35%	*	-	
Hylurgus ligniperda (Fabricius, 1787)	0.07%	*	1.48%	**	-	
Ips acuminatus (Gyllenhall, 1827)	1.31%	**	-		-	
Ips amitinus (Eichhoff, 1871)	-		-		0.05%	*
Ips sexdentatus (Börner, 1776)	8.60%	***	-		46.97%	*****
Ips typographus (Linné, 1758)	-		-		-	

SPECIES	*Pinus sylvestris*		*Pinus nigra*		*Picea abies*	
	Rel. value	**Dom. value**	**Rel. value**	**Dom. value**	**Rel. value**	**Dom. value**
Orthotomicus laricis (Fabricius, 1792)	2.39%	**	5.50%	***	-	
Orthotomicus robustus (Knotek, 1899)	-		7.60%	***	-	
Orthotomicus proximus (Eichhoff, 1867)	2.90%	**	-		-	
Pityogenes chalcographus (Linné, 1761)	1.48%	**	-		6.43%	***
Pityogenes bistridentatus (Eichhoff, 1878)	0.17%	*	29.08%	****	-	
Pityokteines sp.	1.92%	**	-		-	
Pityophthorus pityographus (Ratzeburg, 1837)	1.35%	**	-		5.47%	***
Polygraphus poligraphus (Linné, 1758)	-		-		0.52%	*
Tomicus piniperda (Linné, 1758)	35.30%	*****	0.01%	*	0.01%	*
Xyloterus lineatus (Oliver, 1795)	-		-		0.09%	*
Xyleborus saxesenii (Ratzeburg, 1837)	-		-		0.02%	*

Parasitoids

Former studies on bark beetle parasitoids and natural enemies (Györfi 1941) indicated a various number of insect species living in or from bark beetles.

According to our investigations Braconids and Pteromalids are the dominant parasitoids, but in general a high number of various parasitoid species haven't been determined yet.

As a result, family Pteromalidae (Chalcidoidea) is represented by 15 species (Table 2). Most of them have already recorded from Hungary (Pteromalidae sp., *Catolaccus ater*, *Dinotiscus colon*, *Heydenia pretiosa*, *Metacolus azureus*, *Rhopalicus guttatus*, *Rh. tutela*, *Rhoptrocerus mitus*, *R. xylophagorum* and *Tomicobia seitneri*). The reared parasitoids, at least those of Pteromalidae, are generalists and well known for other xylophagous and phloeophagous insects. It is the first time that the further 5 species have recorded from Hungary (*Metacolus unifasciatus*, *Karpinskiella pityophthori*, *Dinosticus eupterus*, *Rhoptrocerus brevicornis*, *Rhopalicus brevicornis*). The species, have emerged in low number, are species of families Encyrtidae, Eulophidae, Eurytomidae, Mymaridae (Chalcidoidea), Braconidae, Ichneumonidae (Ichneumonoidea), Platygastridae, Diapriidae (Proctotrupoidea) and Bethylidae (Chrysidoidea), of which host relations are still not clarified.

In most braconid parasitoid cases the exact species have not been identified. Because of their importance in bark and wood boring insect complex we should carry out further braconid research.

Table 2 Relative and dominance values of parasitoids on different conifers

Parasitoid species	*Pinus sylvestris*		*Pinus nigra*		*Picea abies*	
	Rel. value	**Dom. value**	**Rel. value**	**Dom. value**	**Rel. value**	**Dom. value**
Ichneumonoidea						
Braconidae						
Braconidae sp.	0.74	*	-		-	
Doryctinae sp.	4.43	**	-		-	
Euphorinae sp.	0.74	*	-		1.21	**
Bracon sp.	18.08	****	25.00	****	47.58	*****
Coleoides sp.	5.17	***	-		13.31	****
Eubazus sp.	42.07	*****	5.00	**	-	
Dendrosoter sp.	-		-		1.61	**
Rhopalophorus clavicornis (Wesm.)	-		-		4.84	**
Ichneumonidae						
Ichneumonidae sp.	0.37	*	-		-	
Trathala sp.	0.74	*	-		-	
Neutrales sp.	-		2.50	**	-	
C h a l c i d o i d e a						
Pteromalidae						
Pteromalidae sp.	-		-		0.40	*
Catolaccus ater (Ratzeburg, 1852)	-		-		0.40	*
Dinotiscus colon (Linné, 1758)	0.74	*	-		-	
Dinotiscus eupterus (Walker, 1836)	0.37	*	-		2.42	**
Heydenia pretiosa (Förster, 1856)	1.11	**	7.50	***	0.81	*
Karpinskiella pityophthori (Bouček, 1954)	2.21	**	-		-	
Metacolus azureus (Ratzeburg, 1844)	0.37	*	-		-	
Metacolus unifasciatus (Förster, 1856)	2.95	**	25.00	****	0.40	*
Rhopalicus brevicornis (Thomson, 1878)	6.64	***	-		4.44	**
Rhopalicus guttatus (Ratzeburg, 1844)	3.32	**	-		0.40	*
Rhopalicus tutela (Walker, 1836)	4.06	**	-		5.65	***
Rhoptrocerus mitus (Walker, 1834)	-		-		6.05	***
Rhoptrocerus brevicornis (Thomson, 1878)	-		17.50	****	-	
Rhoptrocerus xylophagorum (Ratzeburg, 1844)	0.37	*	-		2.82	**

Parasitoid species	*Pinus sylvestris*		*Pinus nigra*		*Picea abies*	
	Rel. value	Dom. value	Rel. value	Dom. value	Rel. value	Dom. value
Tomicobia seitneri (Ruschka, 1924)	-		-		2.42	**
Encyrtidae						
Encyrtidae sp.	-		-		0.40	*
Eulophidae						
Aprostocetus sp.	1.11	**	-		-	
Eurytomidae						
Eurytoma spp.	3.69	**	5.00	**	1.61	**
Mymaridae						
Anaphes sp.	-		-		2.02	**
P r o c t o t r u p o i d e a						
Platygastridae						
Platygaster sp.	0.37	*	-		-	
Diapriidae						
Diapriidae sp.	0.37	*	-		-	
C h r y s i d o i d e a						
Bethylidae						
Bethylidae sp.	-		2.50	**	1.21	**

Conclusion

Considering that rearings have not been carried out individually, namely the eclectors have contained several xylophagous species, host-relations cannot be determinated unambiguously. As a result of a long-term project, we supposed to introduce only the list of the already reared xylophagous, phloeoephagous and parasitoid insects both in species and in their abundance. As the project progresses, the xylophagous – parasitoid species complex reared from newer and newer samples and producing systematically similar results, their statistic probability can be evidences of real host-parasitoid relations. The last main step in this project is the individual rearing of the dominant xylophagous insects.

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