RESEARCHES ON BARK BEETLE PREDATOR AND PARASITOID SPECIES OF SPRUCE BARK BEETLES

CERCETĂRI PRIVIND SPECIILE DE PRĂDĂTORI ŞI PARAZITOIZI AI GÂNDACILOR DE SCOARŢĂ AI MOLIDULUI

LUPAŞTEAN Daniela
„Ştefan cel Mare" University of Suceava, Romania

Abstract. *There is a long tradition in forest entomology regarding the study of different aspects on bark beetle ecology, including the natural enemies, in order to evolve control methods. During the last period of time, the interest in natural mortality agents of bark beetles increased because of the necessity to create efficient control methods, considering the entire ecosystem. Researches on entomophagous species were developed in bark beetle outbreak spots in spruce forests. The entomophagous bark beetle entomofauna in the studied area was represented by coleopteran (Cleridae) and dipteran (Medetera) predators, as well as hymenopteran parasitoids (Pteromalidae, Braconidae). The population density of Thanasimus formicarius clerid decreased during the third season of vegetation after the windfalls, due to larval stages destroying, during the debarking and/or removal from the forests of the bark beetle infested trees.*

Key words: entomophagous entomofauna, bark beetles, windfalls, debarking.

Rezumat. *Există o lungă tradiţie în entomologia forestieră pentru studierea diferitelor aspecte de ecologie a gândacilor de scoarţă, inclusiv a complexelor de duşmani naturali, în scopul elaborării metodelor de combatere. În ultima perioadă, din necesitatea de a elabora metode durabile de combatere a dăunătorilor forestieri, luând în considerare întregul ecosistem forestier, a crescut interesul pentru cunoaşterea factorilor naturali de producere a mortalităţii la gândacii de scoarţă. Au fost desfăşurate cercetări privind complexul de prădători şi parazitoizi în focarele de înmulţire în masă a populaţiilor de gândaci de scoarţă ai molidului. Cel mai frecvent prezente în entomofauna scolitofilă sunt insectele prădătoare, coleoptere (Cleridae) şi diptere (Medetera), precum şi himenopterele parazitoide (Pteromalidae, Braconidae). Densitatea mai redusă a cleridului Thanasimus formicarius în al treilea sezon de vegetaţie după doborâturi se explică şi prin distrugerea stadiului larvar prin acţiunea de cojire a materialului lemnos infestat şi de transport în afara pădurii a acestuia.*

Cuvinte cheie: entomofauna entomofagă, gândaci de scoarţă, doborâturi produse de vânt, cojire.

INTRODUCTION

There is a long tradition in forest entomology regarding the study of different aspects on bark beetle ecology, including the natural enemies, in order to evolve control methods. During the last period of time, the interest in natural mortality agents of bark beetles increased because of the necessity to create efficient control methods, considering the entire ecosystem.

The parasitoid complex of a certain species of bark beetles is hard to determine because of the hidden living place of larvae and because bark beetles usually share food resources with other insect species. Most of the studies worked on parasitoids reared on infested logs and attributed to the most abundant species or the most common host, resulting in inaccurate conclusions. The errors are hard to detect when samples containing two or more associated scolytid species are analyzed (Kenis *et al*., 2004). Same as parasitoids, many predators localize the pray using the pheromones released by bark beetles or the volatiles released by host trees. Usually predators find the trees even before these have been infested, and often in the same time with the host insect, as the majority of parasitoids reach later the infested trees. Predator species seem not to prefer particular parts of the trees, but they localize only occasionally on the basal part of the trunk, comparing with parasitoids, which prefer parts from the top of the trees with thin bark (Wermelinger, 2004).

MATERIAL AND METHODS

The studies of parasitoid and predator species developed during the growing season and after cease of the flight. During the growing season, parasitoids and predators were collected from infested trees partially debarked, as well as from pheromonal traps and the biological material was analyzed in lab conditions for species determination. For a clear image on the parasitoid and predator complex, rearing boxes in lab conditions were executed. Two directions were adopted:

- Bark samples with hibernating adults were collected from infested trees, and were monitored the parasitoid and predator emerging adults. The emerged individuals were analyzed, selected and identified with the help of experts.
- In order to avoid the errors in associating some parasitoid species with bark beetle species, because they were obtained from the same piece of log, parasitoid cocoons were collected from galleries and separately reared (fig. 1).

Fig. 1. Parasitoid cocoons (original)

REZULTS AND DISCUSSIONS

Bark beetle population outbreaks are followed by the increase of the density level of entomophagous insect populations.

Field trials consisted in observations on parasitoid and predator species, during the growing season and after flight ceasing as well. The partial debarking

of infested trees revealed the occurrence of *Thanasimus formicarius* L. (Coleoptera: Cleridae)(fig. 2) and *Medetera* sp. Fischer (Diptera: Dolichopodidae) larvae, as well as *Nemosoma elongatum* L. (Coleoptera: Trogossitidae) adults.

Fig. 2. *Thanasimus formicarius* larva (original)

In pheromonal trap catches, it was frequently recorded the occurrence of *T. formicarius* adults, at traps baited for *I. typographus* and *N. elongatum* adults, at traps baited for *P. chalcographus.* The lower density of *T. formicarius* populations in the third season after windfalls may be the consequence of larvae extinguish during the debarking operation and transportation of the infested timber far from forests.

In lab trials, besides bark beetles, from infested logs emerged predator, parasitoid and saproxylophagous insects (insects living in bark beetles galleries and feeding on bark and wood altered by fungi and insects). The infested logs were collected in Tomnatic, Pojorîta, and Moldoviţa Forest Districts, from stands placed between 900 and 1000 m a.s.l. elevation. At sampling, the beetles were found inside the bark, ready to hibernate. About 30% of the adults have been already left the initial place. Bark samples of 30 x 30 cm were introduced in rearing boxes and were kept at room temperature and proper humidity conditions. The emerging insects were daily collected during one month.

Table 1

Reared associated scolytid fauna

Scolytids' associated entomophauna	Insects/m^2 bark			
	F.D. Pojorâta	F.D. Moldoviţa	F.D. Tomnatic	Food regime
Thanasimus formicarius L.- larvae	9,1	7,2	8,1	predator
Medetera sp. - larvae	3,1	4,5	2	predator
Rhopalicus tutella (Walk.)	3,2	1,7	4,7	parasitoid
Coeloides bostrichorum Giraud.	1	-	1	parasitoid
Sciaridae	38,1	31,2	15,9	sapromycetophagous
Staphilinidae	5,3	2,7	-	necrophagous
Acarina	6,3	-	3,3	Saprophagous?

The samples from Pojorâta, Moldoviţa and Tomnatic Forest Districts belonged from trees infested merely with *I. typographus.* In table 1 are integrated data on entomophagous and necrosaprophagous species resulted from infested trees.

Among the main mortality agents, were recorded subcortical predators (*Medetera* sp., *Thanasimus* sp.) and larval ectoparasitoids (*Coeloides bostrichorum* and *Rhopalicus tutela*). Staphylinids (Coleoptera) and sciarids (Diptera) are acting as saprophagous or their status is not clear.

In order to avoid the erroneous association of some parasitoid species with bark beetle species merely because they emerge from the same logs, in the field were collected parasitoid cocoons from the galleries, were reared and *Rhopalicus tutella* adults emerged. Among the entomophagous insects, the most frequent are predator beetle species (Cleridae) and flies (Medetera), as well as hymenopteran parasitoids (Pteromalidae, Braconidae).

The amount of parasitoids in the analyzed samples confirms that the density of entomophagous population is high in the infested logs even after it was left by bark beetles. So that, it's authorized the recommendation not to debark the trees left by bark beetles before May next year (Ceianu, 1971, Ceianu *et al.,* 1990), providing this way the possibility for associated fauna to leave the host tree. The entomophagous population efficiency in controlling bark beetle populations' density depends on the existence in forests of trees infested and left by bark beetles.

CONCLUSIONS

Among entomophagous species of *Ips typographus*, predators have the higher frequency: coleopterans (Cleridae) and (*Medetera*) dipterans, as well as parasitoid hymenopterans (Pteromalidae, Braconidae).

The lower density of clerid *Thanasimus formicarius* in the third season after the windfalls can be explained by the extinction of larval stage during debarking or transportation of the infested timber out of forests.

The efficiency of entomophagous species in controlling bark beetle populations strongly depends on the existence in forests of infested trees, left by bark beetles.

REFERENCES

1. **Ceianu I., 1971** – *Limitarea înmulţirii în masă a gândacilor de scoarţă prin insecte entomofage*, manuscris ICAS, 137 p.
2. **Ceianu I., Ghizdavu Luminiţa, Mihalciuc V., Ichim I., 1990** – *Contribuţii la cunoaşterea ecologiei unor coleoptere scolitofage din pădurile de molid*. Lucrările Simpozionului „Entomofagii şi rolul lor în păstrarea echilibrului natural", Iaşi, pp. 123 – 136.
3. **Kenis M., Wermelinger B., Gregoire J.-C., 2004** – *Research on parasitoids and predators of Scolytidae, a review.* In: F. Lieutier et al. (eds.), Bark and Wood Boring Insects in Living Trees in Europe, A Synthesis, 237 – 290, Kluwer Academic Publisher.
4. **Wermelinger B., 2004** – *Ecology and management of the spruce bark beetle Ips typographus - a review of recent research*. Forest Ecology and Management 202, pp. 67 – 82.