

Braconid (Hymenoptera, Braconidae) Parasitoids of Bark Beetles in Upland Spruce Stands of the Czech Republic

Aurel Lozan and Jiří Zelený

The Institute of Entomology, Czech Academy of Sciences, Branišovská 31, 370 05
České Budějovice, Czech Republic. E-mail: lozan@entu.cas.cz

Introduction

Several species of bark beetles occur frequently in the upland spruce forests of the Czech Republic; some of them are serious pests that may cause vast destruction of forest stands. In the last decade, a complex of several species from the genera *Ips*, *Pityogenes* and *Polygraphus* contributed to large-scale devastation of thousand hectares of spruce forest in the Šumava Mountains and in Northern Moravia. To understand the course of such outbreaks and to appreciate the role of natural enemies in bark beetle population dynamics, we investigated the importance of braconid parasitoids that attack several species of bark beetles.

Braconids represent the second most numerous family of parasitic Hymenoptera and include more than 20,000 species worldwide. Thirty-eight percent of braconid genera are associated with different stages of Coleoptera, most often from families (Scolytidae, Bostrychidae, and Cerambycidae) that are rarely attacked by other hymenopterans (Belokobylsky 1996).

The present work extends these observations by demonstrating the occurrence of two additional braconid species and providing counts of bark beetles and braconids that emerged from sample logs collected in several upland (550-1200 m) spruce stands in the Czech Republic.

Methods and Materials

The communities of spruce bark beetles and their insect enemies, especially braconid wasps, were examined in sample logs that were cut twice per year during 2000-2002 from spruce trees felled in the listed forest localities. Logs were placed in photoelectors, which are light-tightly closed tin cylinder about 1 m long and 25 cm in diameter, with a small hole near the top and another one close to the bottom where the emerging insects escape into collecting vials. Emerged insects were collected every 4 days, during the season, and at longer intervals in early spring and late autumn. Almost 10,000 specimens of bark beetles and 700 specimens of braconids were obtained.

Areas Investigated

The samples (tree logs) were collected from eight localities within four upland forest areas throughout the Czech Republic: Šumava Mountains/National Park (Březník (near Modrava, 1000-1200m; Černá hora, 1100-1200m; Strážný, 1000m; České Žleby, 800m; Stožec, 900m), Krkonoše Mountains (Špindlerův Mlýn, 750m), Bílé Karpaty Mountains (Velké Karlovice, 550m) and Českomoravská vrchovina hills (Čiměř, 550m).

Braconids Associated With Bark Beetles

Eight braconid species - *Coeloides bostrichorum* Giraud, *Cosmophorus regius* Niez., *Dendrosoter middendorffi* Ratz., *Cosmophorus klugii* Ratz., *Rhopalophorus clavicornis* Wesm., *Ecphyllus sylesiacus* Ratz., *Spathius rubidus* Rossi, and *Meteorus varinervis* Tobias - were found in the logs attacked by the bark beetles of the genera *Ips*, *Pityogenes* and *Polygraphus*.

Rate of Control

The rates of bark beetle control by the braconids were assessed from the ratio between the numbers of emerged bark beetles and parasitoids. Assessments were done separately for each locality and year.

The rate of parasitism varied in space and time between 1.6% and 40.5% and was often high in comparison with the abundance of other natural enemies, suggesting that braconids may play a significant role in the regulation of bark beetles. In exceptional cases registered in the Šumava Mountains, *Coeloides bostrichorum* destroyed 40% of the host complex *Ips typographus* + *Ips amitinus*, and *Ropalophorus clavicornis* 30% of *Polygraphus poligraphus*. *Cosmophorus klugii* eliminated 1.6% *Polygraphus poligraphus* + *Ips typographus* in Černá hora and as much as 19% of *Polygraphus poligraphus* in Březník. *Dendrosoter middendorffi* was present in five photoelectors showing a low parasitism rate, from 0.3% of *Ips typographus* + *Pityogenes chalcographus* (Velké Karlovice) to 4.6% of *Ips typographus* (Čiměř). *Ecphyllus silesiacus* killed from 0.5% hosts in the complex *Ips amitinus* + *Ips typographus* + *Pityogenes chalcographus* in České Žleby to 5.2% of *Ips typographus* + *Ips amitinus* in Březník. The three remaining braconid species had negligible impact on the host populations.

Conclusion

Our results demonstrate that considerable numbers of spruce bark beetles can be killed by braconids in the upland forests of the Czech Republic. From the eight braconid species we collected, *Coeloides bostrichorum* destroyed as much as 40% of the complex *Ips amitinus* + *I. typographus*, and *Ropalophorus clavicornis* 30% of *Ips typographus*. We conclude that braconid wasps may regulate the population dynamics of bark beetles.

Forest management should take advantage of such natural processes, as is the biological control of xylophagous species. Minimally managed “microreserves” should be set aside for the maintenance and regeneration of insect predators and parasitoids.

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