

Forest Litter Insect Community Succession in Clearcuts of Norway Spruce

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Abstract

Insects are subjected to stress in fresh clearcuts due to changes in microclimate, vegetation, and trophic links. The objective of this study was to investigate succession in litter insect communities (most abundant by number of species and individuals of all clearcut insects).

Representatives of the order *Coleoptera* order were dominant and represented 78% of all trapped arthropods; 9% were *Aranei* and 4% were *Hymenoptera*. The most abundant beetles were in the families *Carabidae* (65%), *Curculionidae* (16%) and *Staphylinidae* (7%). Entomophagous arthropods (carabids, spiders, ants) consisted of 69% of all insects found in the litter; 17% of insects recovered were phytophagous insects, *Hylobius* weevils, which represented 78% of this number.

Insects in fresh clearcuts aggregate in the periphery or near piles of forest residues. Diversity is lower within the forest because vegetation in the understory of spruce forests is rather scarce. Special attention should be directed to the margins of clearcut where most *Hylobius* weevils were found.

Keywords: clearcut, litter arthropod, pitfall traps, trophic specialization.

Introduction

There have been few investigations of the composition of insects in the litter of forest clearcuts; most research studies have been limited to insects pests of planted trees (*Hylobius*, *Melolontha*, *Evetria*, *Aradus*).

The objective of this research was to investigate the complex of insect communities and their changes in clearcuts under different management practices. Only the results from investigations conducted in spruce clearcuts are presented in this report.

Material and Methods

Research was carried out in 2001 at the Vaišvydava forest of Dubrava experimental-training enterprise.

Forest litter insects were trapped using pitfall (Barber) traps – plastic 7 cm diameter 150 ml cup, burrowed in the soil with its top at the level of the litter. Each cup was filled with 50 ml of 10% formalin which was changed each month to prevent trapped specimens from decaying and to prevent removal by birds. Pitfall traps were installed on April 24 and inspected (emptied, cleaned, replaced, if needed) every 2-3 weeks (Fig. 1).

Seasonal Dynamics in the Abundance of Clearcut Insects

There were two declines in insect abundance during the summer seasons that were recorded in all trapping zones. Possibly, decrease in insect numbers in June was conditioned by the life history properties of carabid beetles (egg and larval stages are seldom recovered in pitfall traps). The dynamic curve of the abundance of insects was similar in both open areas and inside the forest. The least number of arthropods was trapped in 'b' and 'c' zones, which were exposed to direct sunlight. Highest catches were recovered in forest zones 'd' and 'e.' This suggests that arthropods concentrate at the periphery of clearcuts and near piles of residues.

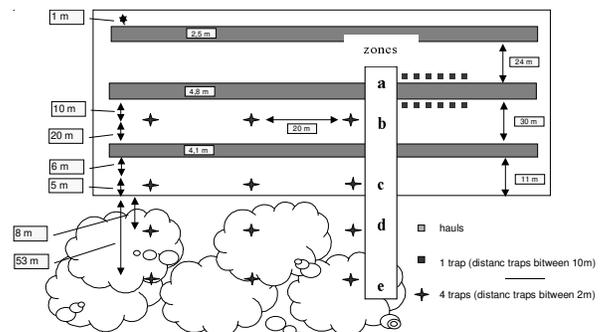


Figure 1.—Scheme of the distribution of the pitfall traps on the clearcut.

This evidence is true for the dominant species of *Carabidae* and *Aranei*, while weevils, most of which are pests of planted trees, were concentrated in the 'c' zone (clearcut 10 m from the forest edge). This suggests that species of *Hylobius* prefer light and accumulate closer to breeding sites (stumps) and feeding sites (seedlings).

Ants can also be considered heliophilous species, since most of them were trapped in 'b', 'c' and 'd' zones. Forest litter habitats were preferred also by rove (*Staphylinidae*) and scarab beetles (*Scarabeidae*). Species richness was lower inside forests zones 'd' and 'e' (Fig. 2). This is expected because there is little plant diversity within a closed canopy spruce stand. The decrease in the number of species collected in the middle of July corresponds to a general decline in insect abundance that occurs during this period. High species numbers recorded in spring catches can be explained in part by the migration of species to new ecological niches created in the modified environment.

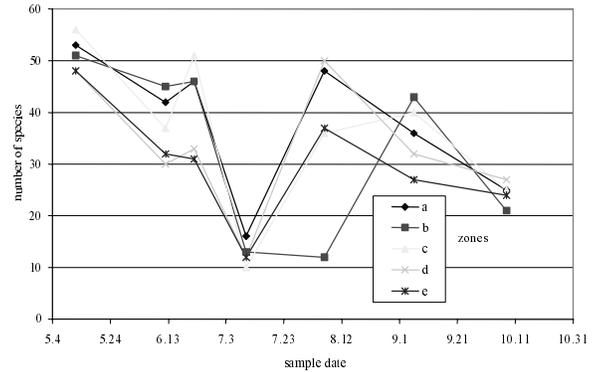


Figure. 2.—Litter arthropod species richness dynamics by zones

Trophic Associations of Litter Insects

Entomophagous insects were most abundant in the litter as determined by the abundance (69%) of predacious ground beetles, spiders and ants in trap catches. Entomophagous arthropods prey upon phytophagous species and are numerous in traps placed within forests; phytophagous insects are also scarce due to the lack of host plants. The seasonal dynamics curve of phytophagous species corresponds to the general pattern for all species.

Phytophagous arthropods are more numerous in the clearcuts where forest succession is in the initial stage with establishing microclimate, vegetation and trophic relations. The number of phytophagous insects in the clearcut area was dominated by *Hylobius* weevils. These pests migrate to fresh clearcuts from nearby stands, attracted by the odor of freshly cut stumps. In addition they find spare food – planted trees. Concentrations of weevils were noticed in the zone near the forest edge. Therefore special emphasis on pest management activities should be directed to the peripheral 10 m strip adjacent to clearcuts.

Conclusions

1. Species of *Coleoptera* order were dominant and represented 78% of all trapped arthropods; nine percent of trapped arthropods were *Aranei*, 4% *Hymenoptera*, and the remaining 9% consisted of 10 different insect orders.
2. Representatives of the families *Carabidae* (65%), *Curculionidae* (16%), and *Staphylinidae* (7%) were the most abundant.
3. Decrease of arthropod abundance in June was influenced by the life history of carabid beetles (most are in the egg and larval states at that time).
4. Arthropods concentrate in the periphery of fresh clearcuts near piles of slash and logs.
5. Forest litter arthropod species diversity was lower inside spruce stands due to reduced abundance and diversity of vegetation.
6. Entomophagous arthropods make up 69% of the species recovered in the litter complex, and consisted mainly of predaceous ground beetles, spiders and ants. Phytophagous arthropods account for 17% and are dominated by *Hylobius* weevils (78%).
7. Pest management activities in clearcuts should be directed at the peripheral 10 m strip adjacent to the residual forest.