Survey of *Hylobius abietis* (L.) and Associated Species in Reforestation Areas Using Baited Pitfall Traps

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Abstract

Intensive logging of pine and spruce forests in Estonia has led to a rapid increase in the populations of some insect species. A survey using ground traps baited with a blend of turpentine and ethanol resulted in the recovery of large numbers of the large pine weevil, *Hylobius abietis*, as well as bark beetles of the genus *Hylastes*. During an 11-year study (1990-2000) carried out in reforestation areas of Estonia, a total of 61,721 insect specimens were captured. The percentages of trapped insects were as follows: *Hylobius abietis* 65.6%, *Hylobius pinastri* 0.5%, *Hylastes brunneus* 17.8%, *Hylastes opacus* 5.3%, *Hylastes cunicularius* 0.5%, and all other insect species 10.3%. In newly created clear cuttings, an average of 1124 individuals of *Hylobius abietis* were caught per trap in 1999. The associated bark beetle species *Hylastes brunneus* and *Hylastes opacus* were more abundant in the second year after felling; the mean numbers of individuals caught per trap were 309 and 94, respectively.

Key Words: *Hylobius abietis*, *Hylastes*, logging, pitfall traps, clear-cutting, Estonia

The large pine weevil, *Hylobius abietis* (L.) (Coleoptera: Curculionidae), is the major insect pest affecting reforestation (Leather et al. 1999). Its abundance is strongly dependent on the intensity of forest cutting because this species utilizes stumps and roots of recently felled conifer trees as suitable breeding sites.

In Estonia, the extent of forest exploitation increased considerably during recent years. In 2000, the gross felling volume was 12.7 million solid cubic metres, i.e. about four times as much as in the early 1990s. The total area of felling activity was 28,800 hectares, of which 26,900 ha was attributed to clear cuttings (Adermann 2002). Of the volume felled, the prevailing tree species was Norway spruce, which accounted for 46%, followed by Scots pine (21%) and birch (17%). Intensive logging of pine and spruce forests has led to a rapid increase in populations of the pine weevil.

Several methods for using baited pitfall traps have been developed for monitoring *H. abietis* populations. A standardized method for trapping pine weevils, using pitfall traps baited with alpha-pinene and ethanol, was developed in Sweden (Nordlander 1987). Different modifications of this trap have been applied in Europe (Zumr and Stary 1993, Örlander et al. 1997) and have been used in North America to investigate related native species (Raffa and Hunt 1988, Rieske and Raffa 1999). Some investigations using baited ground traps have been conducted in Estonia (Voolma 2000, 2001, Voolma et al. 2001). In this study, trapping was used for estimating the relative size of the populations of *H. abietis* and associated bark beetle species of the genus *Hylastes*. Since some species of bark beetles, particularly *Hylastes brunneus* and *Hylastes opacus* respond to the same host volatiles as *H. abietis*, the same trap can be also used for monitoring these species.

Materials and Methods

Study sites

The study was conducted in 1990–2000 in an intensively managed forest area in the forest district of Räpina, Estonia (58°09' N, 27°08' E). Clear-cuttings of former pine-dominated stands (90% of *Pinus sylvestris* and 10% of *Picea abies*) on dry sandy soil were selected as the study sites. The clear-cuttings were reforested by sowing Scots pine in the first season following felling.

The traps

The traps used in this study have been described in detail in our previous publications (Voolma 2001, Voolma et al. 2001). The ground trap consisted of a plastic jar inserted in the ground and filled with water to 1/3-1/2 of its volume.

The above-ground part of the trap holds a glass vial containing the bait fluid, a blend of commercial turpentine (AS Flora, Estonia) and ethanol (1:5). To enter the trap, insects climb along the inclined plane to the top of the trap and fall into the jar. The traps were checked usually once each week. At each inspection, insects were collected and the baits were renewed. Most captures occurred from late April (early May) to September. As a comparison, Swedish pitfall traps described in Nordlander (1997) were also used in 1993-1995.

Results and Discussion

During the survey of 1990-2000, a total of 61,721 specimens were caught at the study sites. The percentages of trapped insects were as follows: *H. abietis* 65.6%, *Hylobius pinastri* 0.5%, *Hylastes brunneus* 17.8%, *Hylastes opacus* 5.3%, *Hylastes cunicularius* 0.5%, and all other insect species 10.3%. There was no difference in captures of *H. abietis* in 1993-1995 between the Swedish pitfall traps and the trap used in this study (Voolma 2000).

This trapping method enabled us to estimate the relative size of populations of *H. abietis* and associated species, particularly *H. brunneus* and *H. opacus*, in felled areas and at reforestation sites. In the study area, several clear-cut plots had been established in recent years within a range of 2-3 km; this resulted in a rapid increase in populations of *H. abietis,* a species which is abundant in fresh clear-cuts. Consequently, populations increased considerably in these clear-cuts and the average captures per trap reached 1,124 in 1999.

Bark beetle species such as *H. brunneus* and *H. opacus* were more abundant in the second year after felling; the mean numbers of individuals caught per trap were 309 and 94, respectively. The abundance of *H. abietis* at any particular site depends largely on the temporal and spatial arrangement of clear-cuts. Newly established clear-cuts attract dispersing pine weevils which influences trapping results at neighbouring sites. Therefore, the abundance of *H. abietis* was high not only in the first year after felling but also in subsequent years after new clearings were established in adjacent areas. In some clear-cuts *H. abietis* was abundant even 6–7 years after felling (Voolma 2001).

Hylobius pinastri and *Hylastes cunicularius* occurred in low numbers in the study sites. In general, these species are common in Estonia but they occur more numerously in felled areas of former spruce forests.

Acknowledgments

The study was supported by Grant No. 4728 from the Estonian Science Foundation.

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