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The effect of collecting fluid on the catch results of *Hylobius abietis* in pitfall traps

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Abstract. Two different collecting and killing agents – ethylene glycol and water – were tested in pitfall traps used for trapping adults of the large pine weevil, *Hylobius abietis* (L.) in clear-felled areas of a massive pine-dominated forest in southern Estonia. The traps were baited with a blend of turpentine and ethanol and filled with a 50%-water-solution of ethylene glycol or clean water without any ingredients and were established in fresh or one-year-old clear-cuttings. During the two-year experiment, 5952 individuals of the pine weevil were caught, of which 50.5% were female and 49.5% male. No significant differences were observed either in the total catch results or in the sex ratios of the pine weevil between the traps filled with ethylene glycol or water.

Key words: Coleoptera, Curculionidae, ethylene glycol, sex ratio, trapping, water

INTRODUCTION

Pitfall trapping is a simple, widely used method for sampling different beetles and other surface-active insects. This method is also extensively used in investigations and experiments with the large pine weevil, *Hylobius abietis* (L.), (Coleoptera, Curculionidae), which is an insect species of great economic importance affecting reforestation (Nordlander, 1987; Zumr & Stary, 1993, etc.). For monitoring pine weevil populations as well as for other research purposes, pitfall traps of different design, attracting bait or collecting fluids have been used. However, the results obtained from experiments with different types of traps need not be comparable. Before such data can be pooled for further analysis, it is necessary to assess whether or not they are significantly different. In the case of the traps used in our studies, comparison was made regarding the design and bait of the traps filled with water (Voolma, 2000). Plain water or with detergent is a suitable collecting fluid in pitfall traps in cases where traps are checked and emptied quite frequently, at least once a week. Traps established for a longer period require a more effective killing and preservative agent to prevent decaying and fouling of specimens. A wide variety of solutions have been used in pitfall traps, ethylene glycol (antifreeze) being one of the most common preservatives in ecological experiments (Leather, 2005). Pitfall trapping techniques with the use of various lethal agents have been applied to different insect groups, especially for capturing epigaeic invertebrates (Weeks & McIntyre, 1997; Kotze et al., 2000). The effect of ethylene glycol on catches of ground beetles (Carabidae) was studied by several authors (Holopainen, 1992; Lemieux & Lindgren, 1999; Koivula et al., 2003).

In this study, we compared the catch results and sex ratios of adult pine weevils (*H. abietis*) in pitfall traps filled with ethylene glycol or water.

MATERIALS AND METHODS

The study was conducted in 2000–2001 in an intensively managed area of 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. In 2000, ten traps were set on a one-year-old clear-cutting, while in 2001 the study was conducted in a fresh clear-cut area.

The pitfall traps used in this study have been described in detail in our previous publications (Voolma, 1994, 2001; Voolma et al., 2001). The trap was a completed modification of one originally constructed for trapping click-beetles (Elateridae) (Kudryavtsev et al., 1993) and consisted of plastic jars (height 120 mm, upper width 120 mm, bottom width 90 mm, content 1000 ml) capped with a bottomless click-beetle trap. The aboveground part of the trap holds a glass vial (6.5 ml) containing the bait fluid, a blend of commercial turpentine (AS Flora, Estonia) and ethanol (1:5). The plastic jar was inserted in the ground and filled with a 50% solution of ethylene glycol or water to half of its volume. The aboveground parts of the traps (click-beetle traps) were white in colour. To enter a trap, insects climb along the inclined plane to the top of the trap and fall into the jar. The distance between the set traps was 15–20 m. The traps were usually checked once each week. At each inspection insects were collected and the bait and the preservative solution or water were renewed. All collected insects were identified, separated by sex and counted in the laboratory.

For statistical analysis, raw trapping data were subjected to square root transformation and analysis of variance was followed by comparison of the means using simple *t*-test, at significance level $P < 0.05$.

RESULTS AND DISCUSSION

During the survey of 2000–2001, a total of 5952 adult specimens of *H. abietis* were caught at two study sites (Table 1).

Table 1. The total catch and the sex ratio of *Hylobius abietis* beetles (F – female; M – male) in pitfall traps filled with ethylene glycol (EG) or water (W) in 2000 and 2001.

Trap	2000			2001			Total			F %
	F	M	Σ	F	M	Σ	F	M	Σ	
EG	796	634	1430	602	677	1279	1398	1311	2709	
%	55.7	44.3	100	47.1	52.9	100	51.6	48.4	100	51.6
W	795	642	1437	810	996	1806	1605	1638	3243	
%	55.3	44.7	100	44.9	55.1	100	49.5	50.5	100	49.5
Total	1591	1276	2867	1412	1673	3085	3003	2949	**5952**	
%	55.5	44.5	100	45.8	54.2	100	50.5	49.5	100	50.5

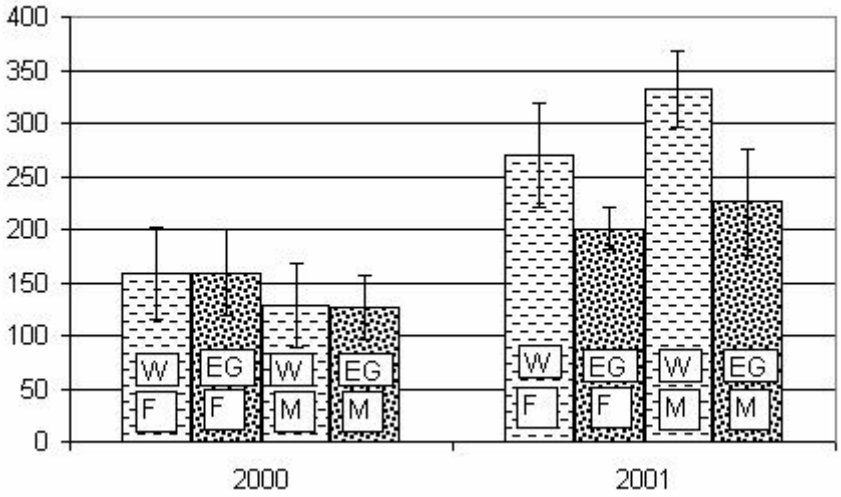

Fig. 1. Mean (± SE) number of *Hylobius abietis* female (F) and male (M) beetles in pitfall traps filled with ethylene glycol (EG) or water (W) in 2000 and 2001.

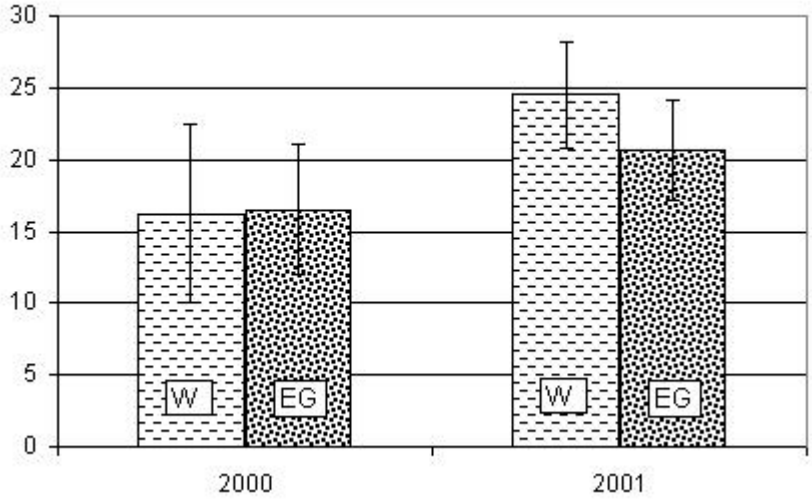

Fig. 2. Mean (± 95% confidence level) square root transformed number of *Hylobius abietis* beetles in pitfall traps filled with ethylene glycol (EG) or water (W) in 2000 and 2001.

The average sex ratio of the weevils caught in the traps was female 50.5% to male 49.5%. In 2000 in the one-year-old clear-cutting, female beetles prevailed (55.5%), while in 2001 in the fresh clear-cutting, male beetles were more abundant (54.2%). The traps filled with ethylene glycol or water showed analogous catch results (Fig. 1). In 2001, the traps filled with water showed slightly higher catch results than the traps with ethylene glycol but the differences were statistically not significant (Fig. 2).

Our studies with the pine weevil, *H. abietis*, allowed us to conclude that the trapping efficiency of pitfall traps was not statistically different with the use of

ethylene glycol or water. A similar result was reported by J.P. Lemieux and B.S. Lindgren (1999) for ground beetles (Carabidae). On the contrary, J.K. Holopainen (1992), found earlier that the use of ethylene glycol as a preservative increases the trapping efficiency of pitfall traps for carabid beetles. Our trials with the pine weevil did not confirm this statement.

CONCLUSIONS

The mean numbers of pine weevils caught per trap with two different collecting fluids or with a preservative solution (ethylene glycol and water) were not significantly different either in the fresh clear-cutting or in the one-year-old clear-cutting. Consequently, the results of the studies carried out using pitfall traps filled with the solution of ethylene glycol are comparable to the estimates obtained with water-filled traps.

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