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MONITORING OF THE SPRUCE BARK BEETLE (*Ips typographus* L.) IN SWEDEN

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Background

Certain regions in Sweden have suffered substantial damage caused by *Ips typographus*. For instance, during 1971-1982, spruce forest comprising millions of m^3 was killed in southern Sweden as a consequence of mass reproduction in fallen trees after a storm in 1969 and heat/drought favouring flight and attack on standing trees in 1975/1976. Actions taken during and after this period has involved sanitation cutting of attacked trees as well as reducing the amount of course spruce wood available for barkbeetle reproduction as windfallen trees and logging residues after clearcutting and thinning.

Since 1994, the policy in Swedish forestry, governed by the Forestry act, aim to secure both forest productivity as well as to maintain the biodiversity in the forests. One important feature is to raise the amount of dead wood, due to awareness of the multitude of species dependent on this kind of substrate e.g. bark- and wood living insects, but also fungi, lichens and mosses.

The forest ecosystem is supplied with large amount of dead wood as a result of disturbances such as stormfellings and snow brakes. Until recently all damaged trees were presupposed utilised by man as timber, pulpwood or fuel and therefor being cut and transported out of the forests. This management was also in accordance with the policy of forest protection to maintain low populations of bark beetles to avoid damages on living trees caused by *Tomicus* spp., *Pityogenes chalcographus* and *I. typographus*.

However, at present forest owners, according to the forestry act are allowed to leave not more than 5 m^3 damaged conifer trees per hectare. Also in the process of certification (Forest Stewardship Council) a recommended amount of not less than 3 m^3 damaged trees should be left in the forest. These regulations aim to increase the amount of dead wood in the forests. This implies general higher populations of barkbeetles produced in e.g. windthrown spruce trees. Raised populations of *I. typographus* may lead to substantial mass production in downed trees after a storm or intense flight and attack of living trees in dry/hot summers. Thus, an increased risk for attack on and killing of growing spruce trees by the spruce bark beetle may be expected from now on. In these circumstances there is a demand for a system to monitor the spruce bark beetle populations and assess the risk for attack on growing trees. In 1995, a project was started aiming to evaluate the use of pheromone traps and pheromone baited trees for this purpose.

Monitoring system

Spruce bark beetle population density and activity is assessed by using pheromone traps on fresh clear-cut areas. The same system of monitoring used by Weslien et al. 1989 was selected to get comparable data. In four regions, areas about 20 000 hectares were selected for a 5 year study period. In each area 5 clear cuts are selected every year and on each clear-cut three traps (Norwegian pipe trap, model 1979 without funnel) are operating during May-August. The traps are baited with Pheroprax and re-baited once. Traps are emptied four times during the trapping period. Catches are counted by means of volume/number. In the same area one living spruce tree is selected at five sites at a northern faced stand edge and baited. The colonisation success of the baited tree and adjacent trees are registered. In the area a number of old spruce stand edges facing against one or two year old clearcuts are surveyed during autumn and all attacked and dead spruce trees within 10 meters are counted and these figures are used as a general level of beetle damage in the area. Data are now available from 1985-86 (Weslien et al. 1989) and 1995-98.
In this paper we present the project and some preliminary results.

Results and discussion

During 1995-1998, the trap catches were higher compared to 1985-86. (Fig. 1) This is also in accordance with data from the ongoing long term monitoring programme in Norway since 1980 (Christiansen in litt.), showing low catches during the mid 1980:s.
There is a correlation between the number of beetles caught in the traps and the number of dead trees per km stand edge within an area. (Fig. 1) This is also true for the number of dead trees including the baited one at the baiting sites. (Fig. 2) Thus the population level measured in these two ways reflects the damage level within an area.

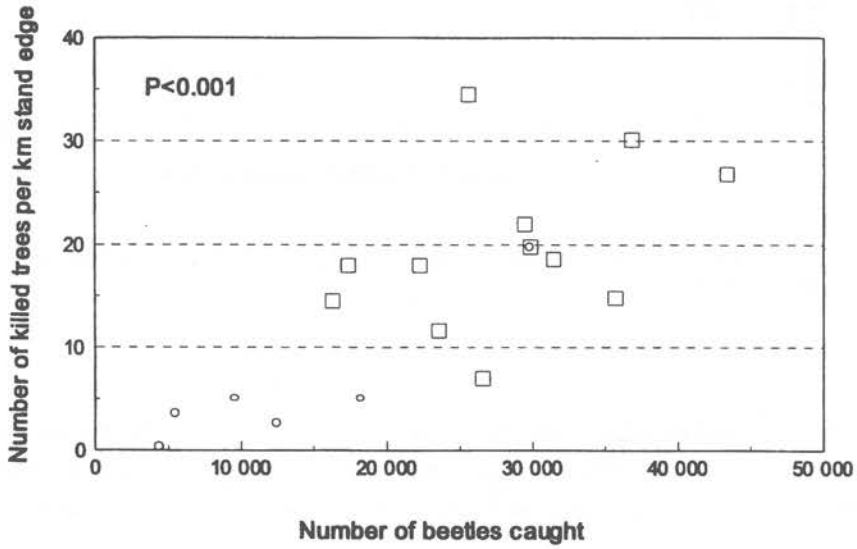

Figure 1. Relationship between the number of trapped *I. typographus* (mean catch of five clear-cuts) and number of dead spruce trees, killed by *I. typographus* the same year per km stand edge. Open circles refer to data from Sweden 1985-86. (Weslien et al. 1989)

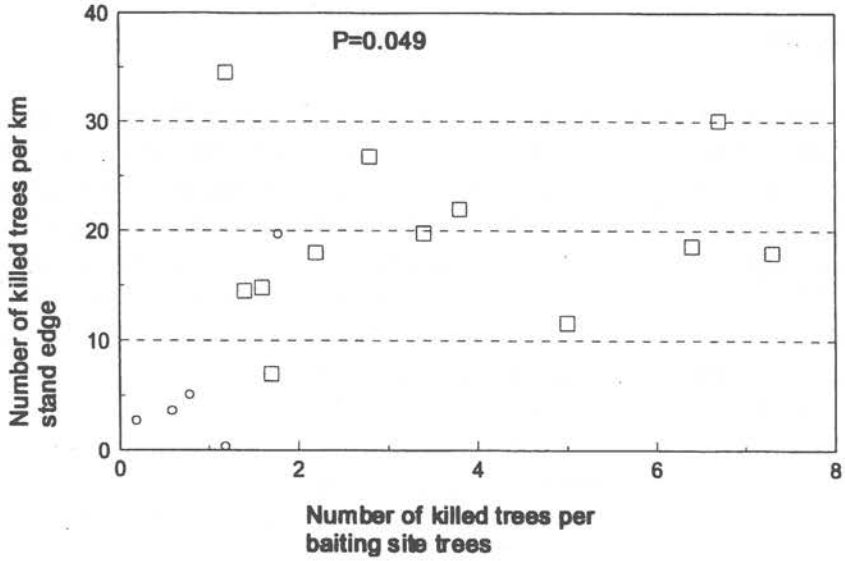

Figure 2. Relationship between the number of dead trees on baiting sites and the number of killed trees per km stand edge.

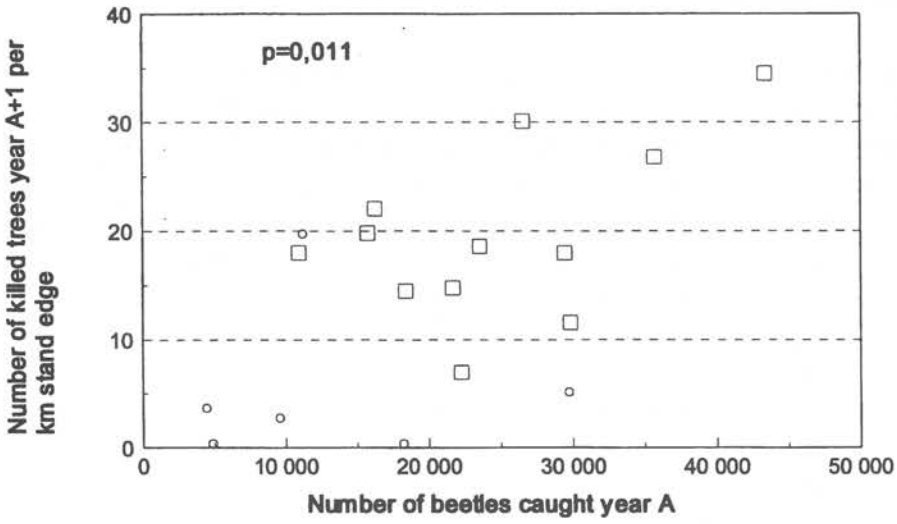

Figure 3. Relationship between the number of trapped *I. typographus* and the number of dead trees per km the year after.

Both the number of beetles caught in pheromone traps as well as the number of trees killed on baiting sites can be used to predict the general level of damage (number of killed trees in stand edges) in a region. So far, data also indicate that a prediction one year ahead seems possible. (Fig. 3)

The predictive value of trap catches seem to have some utility in the future. The future damage level may be predicted in a region by just measuring the flying population in pheromone traps. This is an important information for decision whether or not, actions to prevent further damage are to be taken. Complementary information about area and proportions of old spruce forest in a region should be incorporated in a general risk model for *I. typographus* where the relative

expensive pheromone traps could be used regularly to assess the present population. The possibilities to use e.g. GIS technique to obtain information about distribution and age of spruce stands and thereby define regions where risk assessment using pheromone traps may be profitable should be evaluated.

At present, moderate damages caused by *I. typographus* occur in southern Sweden, approximately the same area suffering from damages in the 1970s. In three of the four regions studied the level of damage is considered unacceptable high and there are legal procedures charged by the Regional Board of Forestry to counteract further damages. In one region these procedures, involving e.g. sanitation logging and clearing of windthrown spruce trees have been carried out since 1994 and still trap catches have increased since then.

Acknowledgement

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References

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