**BARK AND WOOD BORING BEETLES IN THE PINE STANDS**

Knížek Miloš, Zahradnik Petr - Forestry and Game Management Research Institute Jiloviště - Strnady, CZ-156 04 Praha 5 - Zbraslav, Czech Republic

**Introduction**

The pine stands in the Czech Republic represent about 18% of forests. However, harmful agents in these stands were not studied sufficiently during the last decades. Since 1992, in connection with a pine decline caused by dryness, activation of bark boring insects could be observed in the whole area of our republic (ZAHRADNIK, 1998). In the same time has increased also the attention paid to pine stands and connected problems in general. Insect gradation in the pine stands has been observed in 1993 - 1996 (graph 1), with the damages culminating in 1994 - 1995. Decay of pine hardly affected by dryness was caused by a complex of different bark borers. *Ips acuminatus* and *Melanophila cyanea* were probably the most important among them. The role of *Ips sexdentatus*, *Tomicus piniperda*, *Tomicus minor* and *Pityogenes chalcographus* was probably less important. The role of individual species is shown in the graph 2 and the volume of sanitary fellings in different years is shown in the table 1.

In 1998 the highest was the proportion of *Tomicus piniperda* and *T. minor*, however it was not caused by its significant increase, but by dramatic decrease of damages caused by the other insect species (the volume of *T. piniperda* and *T. minor* in 1997 and 1998 was nearly the same). As mainly the dominant *T. piniperda* attacks freshly dead trees, it can be find in the stands any time. During the period of increased damages caused by the other species (1994 - 1995), in connection with higher food supply in general, also the volume of wood attacked by this species has increased. The proportion of *Ips acuminatus* was 22 % and of *Melanophila cyanea* 10 % resp. The rest of 5 % was damaged by *Ips sexdentatus*. Such proportion is, in our opinion, close to normal state, slight decrease is still supposed with *Melanophila cyanea* and *Ips sexdentatus*, and possibly also with *Ips acuminatus*. In contrary in 1997, the role of *Melanophila cyanea* in sanitary felling was surprisingly the highest (38 %), followed by

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Ips acuminatus</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Tomicus spp.</em></td>
<td>6769</td>
<td>7157</td>
<td>12070</td>
<td>23612</td>
<td>30391</td>
<td>10655</td>
<td>4785</td>
<td>1093</td>
<td>1998</td>
</tr>
<tr>
<td><em>Ips sexdentatus</em></td>
<td>30185</td>
<td>697</td>
<td>379</td>
<td>34</td>
<td>154</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Volume of sanitary fellings in the pine stands caused by biotic agents (in m³)

In 1996 and 1995, in the mean time the representation of *Melanophila cyanea* was 14 % and 8 % respectively. The data of 1997 were sharply inconsistent with the results of our investigation - in many localities where *Melanophila cyanea* was quite common in previous years we did not find it at all. More probably it can be stated that it was a mistake in the reports, considering our investigation and current situation, the damages had been caused more probably by *Ips sexdentatus* or *Tomicus piniperda*. It is than obvious (graph 1) that the gradation of *Ips acuminatus* and *Melanophila cyanea* was supported by the warm period at the
beginning of nineties of very low precipitation. After an improvement of this situation also the gradation of the pest decreased. This situation corresponds also with the data presented in literature (KRUEL, 1954, EGBERT AT AL., 1978). Melanophila cyanea is supposed to be abundant only during warm and dry periods. This situation was prevailing in 1990 - 1994 in our case.

Graph 1: Comparing of the volume of wood infested by bark borers as registered in spruce and pine stands, and the Lang’s rain factor

To keep the principals of the stand hygiene is a base of an effective protection against the complex of bark borers. First it is necessary to remove all the material suitable for development of individual pest species. With the bark borers it means mainly to remove the felled wood and blown down and broken trees in the period of swarming (the wood is also damaged by fungi of Ceratocystis spp. causing the bluestain); with Tomicus minor and Ips acuminatus also cleaning of brush-wood and tree tops is of importance (with Ips acuminatus even very thin wood of the diameter of 2 - 3 cm). Having in mind the swarming period, for Tomicus piniperda March is critical (when the weather is suitable, even end of February; in cold years even April), for the other species it is the period from end of April to September. Another important step is to find and remove in time the trees affected. With Melanophila cyanea it is important to find the trees affected during the winter period, when they can be identified thanks to bark dropping down. Such trees should be felled down, the bark removed and burned. Also the dropped bark around the stumps should be burned, as there can be pupas and larvae, often not visible as hidden inside the bark (LIŠKA, ŠRÚTKA, 1996).

As a control measure, as well as a direct protection, also the pine trap tree can be used. For Ips sexdentatus they are prepared as usual in February, for the other species during March or in April. To attract Ips acuminatus and Tomicus minor the trap trees are left with the branches, or the upper part of the trunk with a crown is used. Trap trees mainly for Ips acuminatus are placed in sunny spots, as there they can attract more beetles. However, even
then they are less visited by *Ips acuminatus*, and in shadowed places they are usually not visited at all. As in many localities this condition can be hardly completed, we tried to increase the attractivity of the trap trees by baiting them with pheromone dispensers, also the use of pheromone traps had been discussed.

**Graph 2:** The proportion of individual bark boring species in sanitary fellings in the pine stands during the period of 1995 - 1998 (according to the data by forest management)

![](image)

**Testing of pheromone dispensers**

The presence of pheromones at *Ips acuminatus* was first find by Bakke (1967), who had latter also revealed the first components of it. Today many compounds has been identified (Mayer, McLoughlin, 1991). Both in laboratory and field tests ipsdienol, ipsenol, S-cis-verbenol have been confirmed as the basic components of pheromone (Bakke, 1978, Francke et al., 1986, Kohnle et al., 1986).

In the tests carried out in 1996 and 1997 following substances or their combinations have been tested:

- ipsdienol racemat
- +ipsdienol (+97%, -3%)
- -ipsdienol (-97%, +3%)
- ipsdienol racemat + ipsenol + S-cis-verbenol
- +ipsdienol + ipsenol + S-cis-verbenol
- -ipsdienol + ipsenol + S-cis-verbenol
- ipsenol + S-cis-verbenol

In 1997, where the final assessment was carried out (in 1996 only orientation tests), the substances have been used in two different forest districts (FD):
• Southern Moravia near Jaroměřice (FD Jaroměřice - higher population density of *Ips acuminatus*)
• Central Bohemia, to the north from Prague (FD Mělník - lower population density of *Ips acuminatus*)

At the FD Jaroměřice the total number of 11 346 specimens of *Ips acuminatus* has been trapped in 38 pheromone traps type Theysohn in the period between May 15 and October 15, 1997. The proportion of those from the second swarming was much higher - 10 650 specimens. The number of beetles trapped have oscillated between 0 - 3 086 specimens per trap and the substance tested or mixture resp., or between 0 - 2 163 specimens in the time period given (check) - about one week. The most effective were the pheromone mixtures +ipsdienol + ipsenol + S-cis-verbenol, and ipsdienol racemat + ipsenol + S-cis-verbenol respective. These two substances have attracted the total of 11 334 specimens, the rest have attracted only 12 specimens, in the unbaited traps nothing was attracted. The average number of specimens attracted by +ipsdienol was 1 244 per trap, with ipsdienol racemat it was 744 specimens.

Graph 3: Captures of *Ips acuminatus* in different types of pheromone dispensers

At the FD Mělník the total of 4 836 specimens of *Ips acuminatus* has been trapped in the 26 pheromone traps Theysohn, in the period of May 9 to August 19, 1997. About 1/3 of it was from the first swarming, the rest of second swarming. The number of specimens trapped have oscillated between 0 - 1 481 per trap and the substance tested (mixture), or between 0 - 971 specimens per trap in the time period given - about 1 week. The pheromone mixtures +ipsdienol + ipsenol + S-cis-verbenol, and ipsdienol racemat + ipsenol + S-cis-verbenol were the most effective also here. These two substances have attracted the total number of
4,756 specimens of *Ips acuminatus*. The average catch per trap was in this case 972 specimens for +ipsdienol, or 217 specimens for ipsdienol racemat respective. The number of beetles attracted by the other substances was negligible, the total number of 80 *Ips acuminatus* specimens has been trapped. In the unbaited traps none was trapped.

The results have confirmed significant attracting capability of the mixture +ipsdienol + ipsenol + S-cis-verbenol, and ipsdienol racemat + ipsenol + S-cis-verbenol, when the first substance was significantly better at both localities tested. The first substance mentioned is more effective, it could be used also in pheromone traps, however, considering the high production price of +ipsdienol the use in forest practice is not realistic. The second, less effective mixture - the effect was approximately half of the previous one - can be used also in forest practice, mainly to increase the attractiveness of the pine trap trees for this pest. In 1997 all the 50 trap trees baited with this mixture have attracted *Ips acuminatus* (mostly high number of it), even when the trap tree was in a shadow place. The very first attack was always close to the dispenser. The unbaited trap trees were only rarely visited, and only when they were situated in extremely sunny spots.

Notice:
To assess intensity of the trap tree infestation following scale has been used:
- **low infestation** - sporadic holes, the number is less than 5 per m of the length, when this number is exceeded than only in one meter section of the trap
- **medium infestation** - more than 5 holes at one meter section, repeatedly in more sections of the crown, the number of holes per section is not higher than 20, when this number is exceeded than only in one of the sections
- **heavy infestation** - more than 20 holes at more than one meter sections

*(only the crown is assessed - the part of the stem starting with the first green branch, branches included)*

**Assessment of the non-target species**

More or less the same number of species of the non-target bark borers has been trapped in pheromone traps at all the localities of the two forest districts mentioned. *Lymantor coryli* and *L. aceris* find in the localities of the FD Jaromerice were the only exclusion. The differences were only in the frequency of individual species attracted.

*Ips sexdentatus* was comparatively frequent at all the localities, the number was oscillating from several dozens to few hundreds specimens. The occurrence of *Hylurgus ligniperda*, more frequent in Moravia, was also of importance. The number of specimens attracted was from 0 to 35 beetles per trap and catch. In Moravia also the number of *Hylastes attenuatus* was higher, find in dozens. All the above mentioned species are common representatives of the typical fauna of pine stands, and more significant impact of the substances tested on the number of specimens attracted can be hardly supposed. This was proved also by the number of such specimens find in unbaited traps. *Dryocoetes autographus*, *Pityogenes chalcographus*, *P. bidentatus*, *Orthotomicus suturalis*, *O. laricis*, *Xyloterus lineatus*, *Hylastes opacus*, and *H. ater*, which can be also find at pine, were among the other non-target species. From the other species living at different tree species (spruce, oak), also find at the locality investigated, following can be mentioned - *Ips typographus*, *I. cembrae*, *Scolytus intricatus*, *Dryocoetes villosus*, *Platypus cylindrus*, *Xyleborus dryographus* and *X. alni*. Above mentioned *Lymantor aceris* is of interest: the total number of 350 specimens was trapped, in spite of the fact that this species is one of the most rare species in our country in general. This rare occurrence is given by insufficient knowledge on its bionomy; it develops in dead branches of *Acer* spp., *Rhamnus frangula*, *Prunus padus*, and *Cornus mas*, in connection with an occurrence of some *Ascomycetes*. 
Among the beetle trapped also some predators of *Ips acuminatus* (and other bark borers, thus these species are not monophagous) were found, together with other species bind to pine or other tree species growing at the locality as an admixture or in shrub layer. The proportion of species of the genus *Rhizophagus* was the highest among the predators (mainly *R. depressus*, and *R. ferrugineus*) of Rhizophagidae, and also of the representatives of the *Corticeus* (*C. pini*, *C. linearis*) from the Tenebrionidae. All the above mentioned species occured in dozen of specimens, with the exclusion of *C. linearis*, where only several specimens were found. From the others, mainly in July and August, *Spondylis buprestoides* and *Ampedus balteatus* were found - both of them are developing in pine stumps (*A. balteatus* also in spruce stumps). Nevertheless, their higher occurrence in the traps can be explained by their abundance at the plots investigated.

**Conclusion**

It can be stated, also with respect to development of weather conditions and more intensive and consistent approach to protective measures, that the calamity in the pine stands is over. However, when the protection of those stands will be neglected, possible increase of sanitary felling of trees affected by the complex of bark borers can be expected also in future, mainly under suitable climatic conditions.

To decrease the population density of *Ips acuminatus*, in our conditions dominant species of the pine stands during the gradation period, the pheromone dispensers with a mixture of racemic ipsdienol, ipsenol and S-cis-verbenol can be successfully used to increase the attractivity of trap trees. For possible use in pheromone traps to replace the racemic ipsdienol by the optic isomere +ipsdienol seems to be more adequate.

**References**


KOHNLE U., KOPP S., FRANCKE W., 1986: Inhibition of the attractant pheromone response in *Ips acuminatus* (Gyll.) by *I. sexdentatus* (Boerner) (Coleoptera, Scolytidae) - *J.Appl.Ent.* 101: 316-319


LIŠKA J., ŠRÚTKA P., 1975: Krasec borový a současné odumírání borovic - *Lesnická práce* 75:171-172
