

ATTRACTION OF SOME SCOLYTIDS AND ASSOCIATED BEETLES TO THE HOST VOLATILES α -PINENE AND ETHANOL

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INTRODUCTION

Several scolytid species are known to use host volatiles such as monoterpenes and the degradation product, ethanol, when searching for suitable host material. The release rates of terpenes and ethanol and the proportions in which they are released can be expected to differ depending on the breeding substrate preferences of the various scolytid species.

The aim of this study was to compare the attraction of various scolytid species and associated beetles to combinations of α -pinene and ethanol in proportions of approximately 1:1 and 1:10 when released at three different rates. α -Pinene was chosen because it is one of the major monoterpenes in both Scots pine, *Pinus sylvestris* L., and Norway spruce, *Picea abies* (L.) Karst., the two dominant conifers in Scandinavia. Ethanol was chosen because it is one of the major degradation volatiles which are produced as a result of deterioration processes in dead or dying trees. Both substances have previously been demonstrated to attract several wood- and bark-living beetle species.

EXPERIMENTAL METHODS

The attraction of beetles to the different compounds or combinations of compounds was estimated using baited flight-barrier traps (40 x 40 cm transparent plastic sheets). The chemicals used were (-)- α -pinene (Fluka 97 percent) and 95 percent ethanol (5 percent water). The substances were released at different rates from polyethylene vials with different-sized openings. After combinations of α -pinene and ethanol had been tested, the two substances were released from separate vials. To minimize release of oxidized substances during the experiment, new vials containing fresh compounds were exchanged for old ones on each day of the experiment. A randomized block experimental design was used in the arrangement of the experiment. There were 10 blocks, and each block consisted of 14 treatments (traps). The following types of treatments were used: unbaited control, three release rates of α -pinene (0.1, 1, 10 mg/hr), four release rates of ethanol (0.1, 1, 10, 130 mg/hr), and the 1:1 and 1:10 combinations of α -pinene and ethanol at the three α -pinene release rates.

RESULTS

With the exception of *Anisandrus dispar* (F.), all scolytid species involved in the study breed in conifers. *A. dispar*, which breeds in dead or dying trees of several hardwood species, was the only species that was repelled by the conifer monoterpene, α -pinene. *A. dispar* was strongly attracted to ethanol alone.

BARANCHIKOV, Y.N., MATTSON, W.J., HAIN, F.P., and PAYNE, T.L., eds. 1991. Forest Insect Guilds: Patterns of Interaction with Host Trees. U.S. Dep. Agric. For. Serv. Gen. Tech. Rep. NE-153.

In contrast to the other scolytids in this study, *Tomicus piniperda* (L.) generally breeds in relatively fresh material, e.g. newly windbroken or windthrown trees and winter- or spring-cut logs. Since such material has only just begun to deteriorate, the release of ethanol should be rather low, while high amounts of terpenes may be released from resin exuding from damaged parts. Accordingly, *T. piniperda* was the species most strongly attracted by α -pinene alone. Ethanol also attracted this species, but to a much lesser degree than α -pinene. *T. piniperda* was synergistically attracted to combinations of α -pinene and ethanol at the two lowest release rates of α -pinene. At the highest release rate of α -pinene, the combinations caught lower numbers of *T. piniperda* than did α -pinene. Evidently, attraction cannot be increased further by adding ethanol to α -pinene at this high release rate.

The scolytids *Hylurgops palliatus* (Gyll.) and *Trypodendron lineatum* (Oliv.) generally reproduce in dead or dying trees. They prefer logs cut during autumn of the previous year over newly cut logs. This type of stored breeding material may release relatively high amounts of ethanol produced in deteriorating tree tissue, while monoterpenes are probably released in lower amounts compared with the amounts released from newly felled or broken trees. As expected, neither *H. palliatus* nor *T. lineatum* was attracted as strongly to α -pinene alone as was *T. piniperda*. The ambrosia beetle *T. lineatum* was not attracted at all by α -pinene, but was strongly attracted by ethanol which exerted a weaker attraction on *H. palliatus*. Both species were synergistically attracted to combinations of α -pinene and ethanol. The synergism was strongest when the release rate of ethanol was 10 times higher than that of α -pinene.

Adults of the clerid *Thanasimus formicarius* (L.) prey on adults of several species of bark beetles, and their larvae feed on bark beetle progeny. The wide range of prey species, which in their turn are attracted to different kinds of breeding material, may explain the fact that *T. formicarius* was as strongly attracted to α -pinene alone as to combinations of α -pinene and ethanol.

The nitidulid beetles *Glischrochilus quadripunctatus* (L.) and *Epuraea* spp. were significantly attracted to α -pinene and ethanol alone, but much higher numbers of beetles of these species were attracted to the combinations, especially when the ethanol was released at a higher rate than the α -pinene. *G. quadripunctatus* and *Epuraea* spp. are species associated with bark- and wood-living beetles. Adults and the progeny of these species inhabit scolytid galleries. In this kind of substrate, deterioration processes should result in a gradual increase in the production of ethanol, released together with host terpenes. This may explain the strong synergistic effect of combinations of α -pinene and ethanol on attraction in these species.

CONCLUSIONS

The present study demonstrates great differences between beetle species in their response to α -pinene, ethanol, and combinations of the two. These probably reflect the dissimilarities in the release of volatiles among the various types of breeding material to which the different species are adapted. Both the absolute release rates and the ratios at which the two substances were released influenced the response of the beetles to the combinations.

A more detailed presentation of the experiments and the results is given in Schroeder (1988) and Schroeder and Lindelöw (1989).

LITERATURE CITED

- SCHROEDER, L.M. 1988. Attraction of the bark beetle *Tomicus piniperda* and some other bark- and wood-living beetles to the host volatiles α -pinene and ethanol. Entomol. Exp. Appl. 46: 203-210.
- SCHROEDER, L.M. and LINDELÖW, Å. 1989. Attraction of scolytids and associated beetles by different absolute amounts and proportions of α -pinene and ethanol. J. Chem. Ecol. 15: 807-817.