5. Summary

Introduction

Termites feeding on woody materials inflict considerable damage to crops, forests and buildings. Current control of termites focuses on integrated pest management. This involves knowledge on ecology and behaviour of the termites using safer biological, cultural as well as chemical methods to mange the pest potential of the total colony. Chemical control of termites relies on baits treated with biocides that have to be accepted by the foraging termites and transported by workers from the site of application inside the nest. Later these substances have to be distributed among nest-mates by trophallaxis or grooming.

Potential biocides for the impregnation of baits are IGRs and especially juvenile hormone analogues (JHAs) and chitin synthesis inhibitors (CSIs). They have no impact on the environment, because they only affect termites that feed on baits but not non target organisms. Therefore, using IGR treated baits seems to be a promising and environmentally safe method for the control of termites. In the present study, the impact of fenoxycarb (a JHA) and flufenoxuron (a chitin synthesis inhibitor) was studied for three termite species, namely *Reticulitermes santonensis*, *Neotermes casteus*, and *Microtermes lepidus* at the laboratory level and for *Microtermes* spp at the field level.

The general effect of fenoxycarb on termites

R. santonensis feeding on filter papers treated with fenoxycarb was fed to between 0.32 and 32 ppm, consumed the same amount of treated and untreated materials. No significant increase in mortality was found as compared with the control group that has been fed untreated filter paper only. This demonstrates that fenoxycarb at these concentrations has no feeding deterrent properties and is not toxic to *R. santonensis*. At concentrations above 16 ppm fenoxycarb induced the production of presoldiers one week after treatment. Gaschromatographic analyses of whole termite body extracts

revealed that the amount of fenoxycarb taken up into the body is not significantly different between oral and contact treatment.

The transferability of fenoxycarb between termites

When termite workers of *R. santonensis* that have been fed with filter papers treated with 320 ppm fenoxycarb were kept in groups together with unfed workers, presoldiers were not only produced from the treated workers but also from untreated workers. This demonstrates that fenoxycarb was transferred from fed to unfed termites via trophallaxis or grooming behavior.

Feeding of foragers from laboratory colonies of *Microtermes sp. nr. albopartitus* with filter papers treated with 32 ppm fenoxycarb caused a significant decrease in egg laying and presence of larvae in treated colonies as compared to control colonies. Foragers from laboratory colonies of *Macrotermes bellicosus* were fed with grass treated with 320 ppm fenoxycarb dyed with neutral red. Opening of the nest after 6 month revealed the presence of neutral red in the fungus comb. These results and observations demonstrate, that fenoxycarb is transported by foragers to the inside of nests and fed to nest mates including the reproductives or deposited into the fungus garden in higher termites. Furthermore, fenoxycarb has a negative influence on fecundity of termites and on survival of termite larvae. The former has been demonstrated already for other insect species.

The general effect of flufenoxuron on termites

Feeding of termites on filter paper treated with flufenoxuron in concentrations above 2 ppm resulted in a significant increase in mortality rate in *R. santonensis* as compared with the control. The accumulative mortality rate increased with increasing concentrations. The consumed weight of filter papers treated with concentrations up to 20 ppm flufenoxuron was not statistically significant from untreated filter papers. This indicates that flufenoxuron is toxic to *R. santonensis* but has no feeding deterrent effect.

Synergistic effect of fenoxycarb and flufenoxuron

The synergistic effect of fenoxycarb and flufenoxuron on *R. santonensis* was tested by feeding termites with filter papers treated with 16 ppm fenoxycarb combined with either 0.2 ppm or 2.0 ppm flufenoxuron. The addition of fenoxycarb to flufenoxuron caused an increase in mortality of the workers as compared to the use of flufenoxuron only. This synergism between fenoxycarb and flufenoxuron is probably due to induction of moulting from worker to presoldier by fenoxycarb and the prevention to successfully complete this moulting by flufenoxuron.

Acceptance of fenoxycarb and flufenoxuron on *Microtermes on the field*

Baits treated with fenoxycarb and flufenoxuron have been accepted by foraging termites in the field for a minimum of 3 weeks. From laboratory work it can be assumed that this might be time enough to control termites by influencing the colony structure.

Conclusion

In conclusion, the JHA fenoxycarb and the CSI flufenoxuron, alone or in combination, are promising candidates for the control of termites and may provide alternatives to conventional termite control strategies in the future.