ORIENTATION OF *PTEROSTICHUS MELANARIUS* (COLEOPTERA: CARABIDAE) IN DIVERSIFIED AGRICULTURAL SYSTEMS

Summary

Hajnalka Tréfás
Szent István University Gödöllő
Department of Crop Protection

2003.

The studies described in this thesis analyse the effects of plant derived chemicals, plant structure and microclimate on the habitat selection and activity of *Pterostichus melanarius* (Col.: Carabidae), a polyphagous predatory ground beetle, in intrecropped systems. Experiments included laboratory tests (4-arm olfactometer and a locomotion compensator to test the effect of chemical cues, tests on egg laying site preferences) as well as field experiments (adult and larva trapping, mark-release-recapture). Laboratory investigations made use of cabbage, Brussels sprouts and white clover plants, whereas field experiments applied the monocultures and intercrops of Brussels sprouts, barley and black mustard.

P. melanarius showed reactions to the odours of intact plants. Females are more likely to use plant derived chemical cues in habitat location, the results of the olfactometer tests indicate a preference for the mixed odours of different plant species (cabbage and white clover) grown together. The habitat selection of females might influence the males' choice, too, as males showed measurable reactions to the odours of females in the olfactometer. Damaged plants elicited no reactions in the beetles.

Movement characteristics of *P. melanarius*, e.g. length of movement track or the period of activity can be influenced by plant odours. Movement characteristics of males and females are proved to be different, regardless of the plant odours present.

P. melanarius could be trapped in different numbers in the intercropped plots of sprouts, depending on the nature of the second plant. The low relative humidity and dry soil, combined with sparse vegetation in the sprouts monocrop, resulted in increased short term activity measured in mark-release-recapture but low trapped numbers during the season. These features were not influenced by adding barley to the system, but the combination of black mustard and sprouts significantly increased trapped numbers. Dense vegetation, as a result of intercropping, seemed to increase daytime activity.

Females laid more eggs under conditions otherwise characteristic of dense vegetation such as shadowed ground, moist soil and structured environment. More larvae could be trapped in the intercrop of barley and sprouts compared to sprouts alone.

According to my results, early colonisation of *P. melanarius* is most probably influenced by soil cover and microclimate, the effect of these factors being possibly modified by the influence of plant odours on the movement characteristics. As beetles do not show reactions to the odours of damaged plants, it is not probable, at least in cabbage crops, that *P. melanarius* actively seeks out pests damaging the plant canopy. Soil cover and microclimate in an increased-biodiversity system might be favourable compared to sparse horticultural crops and certain plant odours may influence the movement of beetles, but these facts by themselves do not mean that the *P. melanarius* population of a given area will accumulate in the intercrop, as it depends on the crops of other plots in the region

as well as the vegetation surrounding the plots. Beetles colonizing a certain vegetation type or emerging within it are reluctant to leave their habitat, as it is shown by the relatively slow distribution of individuals, this phenomenon can be further increased by the radically different vegetation surrounding a plot. The slow and, in comparison with the males, rather passive females are particularly improbable to switch habitat within the season, so the new generation of larvae will be most probably produced in the habitat chosen by the females at the beginning of the season. The results also suggest that the plant combination has to be chosen with care. Growing barley and sprouts together did not seem to be favourable for *P. melanarius*, as it reduced trapped numbers compared to barley grown alone and did not increase them compared to sprouts grown alone. The intercrop of mustard and sprouts, on the other hand, increased trapped numbers significantly, compared to sprouts alone. Nevertheless, none of the mentioned plant combinations can be recommended for practical use, as yields of sprouts were drastically reduced in both intercropped systems.

Within field activity, similarly to colonisation processes, is determined by plant density and microclimate and may be modified by plant odours. The increased daytime activity, caused by the dense vegetation of the intercrops compared to the sprouts monocrop, may be a positive feature regarding pest management, as the time for foraging may also increase.

The reproductive season brings along new motivations, mate finding and egg laying site location. According to the results of the experiments on egg laying site preferences and larva trapping, dense vegetation and wet conditions favour egg laying and the surface activity of larvae. These results also call the attention to the danger tilling and other agricultural works may represent to the high numbers of surface active larvae in favourable vegetation types.

Results of this thesis support the use of a second plant that gives high soil cover early but does not prevent the growing of the main crop. Probably these goals cannot be achieved using only one plant species as second plant.