

8. Arthropod pests in poultry production

8.1 Field evaluation of micro-encapsulated chlorpyrifos for control of poultry litter beetles

Under field conditions in chicken broiler houses, the effectiveness of micro-encapsulated chlorpyrifos (a.i. 20% w/w) was evaluated for the control of litter beetles, in particular the lesser mealworm, *Alphitobius diaperinus*.

The study was carried out on four separate broiler farms. On each farm, three houses were included. Two of these were treated and the third left untreated to act as a control. Beetles were sampled from each house in two successive broiler flocks with treatment taking place during the cleaning phase between these two flocks.

The treatment with micro-encapsulated chlorpyrifos took place in the empty period after all cleaning and disinfecting procedures in the houses had been performed, a few hours before new litter was distributed on the floor, and the chickens were installed.

The treatment covered the walls evenly from floor level to one meter above the floor, and it covered the floor one meter inwards from the walls. In addition, all wall cracks up to two meters above floor level and all floor cracks were treated as were other observed refuge sites in the houses. The product was used in the broiler houses at a dosage of 100 ml micro-encapsulated chlorpyrifos per 5.0 l spray solution.

The utilized amount of product was dependent on the state of the individual house. The quantity of product applied directly on the treated wall and floor surfaces was 1.0 l spray solution per 20 m² treated area, but due to the treatment of refuge sites, more product was applied in the houses. The actually amounts of product used in the broiler houses was on the average 1.0 l spray solution per 33.4 m² total ground area (range 20-45 m²). The total ground area includes both the treated and the untreated floor area of a broiler house.

Four species of beetles were identified from samples during this trial: *Alphitobius diaperinus* (the lesser mealworm), *Typhaea stercorea* (hairy fungus beetle), *Ahasverus advena* (foreign grain beetle) and *Carcinops pumilio* (a histerid beetle).

The infestation level in the houses in the rotations of production before and after treatment was compared statistically. It was concluded that the treatment carried out with micro-encapsulated chlorpyrifos, after all cleaning and disinfecting procedures in the houses had been performed, caused a significant reduction in the litter beetle infestation in the broiler houses.

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8.2 Behavioural reactions of chicken mite to temperature gradients after variable periods of starvation

In collaboration with Bradley A. Mullens from the Department of Entomology at the University of California at Riverside, a study was conducted with the aim of showing how the motivation of chicken mites for reacting to a host-related stimulus changes after variable periods of starvation.

Groups of adult female chicken mites were isolated on small platforms. The mites were kept in a temperature- and humidity-controlled room without access to food. After variable periods of starvation the behavioural response of the mites to a temperature gradient was studied. The temperature gradient was obtained by heating of the platform from below by a light bulb. A computer was used to control the stimulus

and simultaneously collect data on the temperature changes occurring. The behavioural response of the mites was analysed by means of video recordings.

The analysis showed that after just one day of starvation the majority of the chicken mites were not activated by the temperature gradient which was approximately 0.0125 °C/sec. The following week the fraction of mites being activated increased to approximately 75% and after additionally one to two weeks the fraction dropped to around 30%.

This indicates that immediately after a blood meal has been digested, the mites are highly motivated for locating a new host to feed on. They are easily activated by a temperature gradient mimicking the presence of a host. However, after two or more weeks of starvation their energy reserves are so low, and/or they have reached a degree of dehydration which means that their chances of survival are lowered if they react to stimuli which do not lead to a blood meal. The stimulus must therefore be stronger or otherwise represent a clear indication that a new host is within reach of the mite.

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8.3 Alternative control methods against chicken mite

Based on preliminary studies of the potential of fungal isolates to control chicken mites and studies of the behavioural response of chicken mites to various extracts containing pheromones a project was developed in collaboration with three European partners and a proposal was sent to the EU Fifth Framework Programme. The project involves a combination of mite pathogenic fungi and pheromones. The proposal received a positive evaluation and contract negotiations are going on.

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