

NOVEL APPROACH TO CONTROLLING THE POULTRY RED MITE (ACARINA: MESOSTIGMATA)

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Abstract The potential of combination using of chitin-synthesis inhibitor, triflumuron, synthetic pyrethroid, lambdacyhalothrin and carbamate, bendiocarb was assessed to control and evaluated for effectiveness against the poultry red mite *Dermanyssus gallinae* (De Geer) under practical conditions. More than 70 % of reduction of mites was noticed during 5 months after hall treatment with Triflumuron. Treatment breeding hen houses with triflumuron, lambdacyhalothrin and bendiocarb in their combination, showed noticeable differences in mite density in comparison of control and experimental halls, with mean efficacy 98.9 and 77.6 %, respectively. Complete extinction of the population of red mites did not occur.

Key Words *Dermanyssus gallinae*, chitin-synthesis inhibitor, triflumuron, lambdacyhalothrin, bendiocarb

INTRODUCTION

The poultry red mite (*Dermanyssus gallinae*), is an important emerging parasite problem in production premises for layers which is responsible for large financial losses. *D. gallinae* has been known for a long time and its role as a vector of several significant diseases has been emphasized many times (Petrov, 1975; Zeman et al., 1982; Chirico et al., 2003; Moro et al., 2005). Occasionally, *D. gallinae* causes dermatitis and a nuisance of people working at heavily infested poultry houses (Pampiglione et al., 2001; Rosen et al., 2002). From the economical point of view, this blood-sucking pest causes production losses decrease meat (15%) and egg production (15-20 %), and may even cause death of its host (6-7%) (Cencek, 2003; Pilarczyk et al., 2004; Kilpinen et al., 2005; Kočíšová, 2007). Conventional control of red mite population is primarily depends on continued applications of various contact acaricides such as organophosphates, pyrethroids and carbamates. Their repeated use has sometimes resulted in the development of resistance (Genchi et al., 1984; Zeman and Železný, 1985; Beugnet et al., 1997). Now in literature more than 35 compounds have been mentioned for red mite control and although many of them are efficient, some are unsuitable from a food safety point of view and for environmental reasons (Koréneková et al., 2003; Kovalkovičová et al., 2004). Some of them are efficient in theory but inadequate in practice.

With respect to possibility of long-term survival of mites in shelters, prevention tends to be rather difficult. Due to the lack of new acaricides, the strategy of red poultry mite control should be based on a rotation of various acaricides and tried to use other possible alternative chemicals as insect growth regulators. This paper describes a practical condition study to assess the potential of chitin-synthesis inhibitor, triflumuron for use as commercial acaricides and in its combination using with synthetic pyrethroids, lambdacyhalothrin and carbamate bendiocarb.

MATERIALS AND METHODS

Poultry Breeding

The study was performed between May 2005 and December 2007 on large-scale laying hen breeding farm. The farm was already naturally infested with *D. gallinae* and consists of 9 halls (50 x 10 x 3 m) with 4600 hens and 500 cocks per one hall. The poultry were kept on deep litter. Drinking and feeding bowls were placed vertically on the tiers in the periphery of hall. Nest boxes and belt conveyor of eggs were in the middle of hall. The light regimes used were normal for the hybrids, starting with 8 h of light per day at 16

weeks, and increasing with age up to a maximum of 14 h light per day. The birds were kept indoors and no natural entered the houses.

Mite Sampling and Laboratory Examination

The presence of the parasites on the farm was determined by inspection of their likely hiding and breeding place. Using a small surgical spoon, mites were collected by scrapings from the poles, feeding and drinking bowls, doors, hinges, crevices of hall walls, belt conveyor of eggs etc., and put into plastic containers. Samples (10 g) of litter and nest box lining were also collected. Mites were driven away from the litter using modified Tullgren's apparatus (the funnel was connected with test tube by elastic hose, the tube contained a little amount of water and the stand of apparatus was placed into the dish with clove oil to avoid the escape of the mite) or the scrapings (1 g) were also mixed with 10% KOH (20 ml) and after 2 h were investigated. Thereby we ensured releasing red mites from clusters of organic origin and facilitated their counting and numbered under light microscope. The numbers of found red mites were recalculated to one gram of scraped organic material to facilitate the comparison of effect of the tested preparation in the experimental and control objects.

Treatments

Experimental objects were treated with Baycidal 25 WP (a.i. triflumuron 25%), Ficam W (a.i. bendiocarb 80%) manufactured by Bayer Ag, D — 413 68 Leverkusen, Germany and Oxyfly 10 Cs (a.i. lambda-cyhalothrin 10%) manufactured by Novartis Basel, Switzerland. On experimental farms usually organic mass — litter and housing facilities were sprayed with 0.2% Baycidal 25 WP. The application was made with the use of knapsack sprayer in dose of 1 litter solution per 10 m² as a barrier spraying on the places of the most frequent occurrence of red mite (Kočíšová, 2007). Oxyfly and Ficam were applied to crack and crevices in concentration 25 and 24 mg a.i. / m², respectively.

Statistical analysis

All graphs were made in Microsoft Excel 5.0 and statistical analysis was performed using Prism3. The significance level was set to $P < 0.05$. Efficiency of treatment (% of reduction) data is given as a percentage to compare with control objects.

RESULTS AND DISCUSSION

Effects of two-times treatment with triflumuron on absolute densities of the *D. gallinae* showed a graduated response. In experimental hall the density of mites was significantly decreased for 120 days in comparison with control hall (Fig. 1). Mean efficacy of treatment was 71.3% and during the six months varied from 56.6 to 83.1% (Fig. 5). Three months after second triflumuron application increased the number of mites to more than 500 in 1 gram per sample. Eradication of massive infestation in henhouses is very problematic, because after each control a several mites survive at various cracks and crevices and by presence of hosts large populations can be rapidly established. A variety of chemical products are now used to reduce populations of *D. gallinae*, their choice depends on many factors and has to be made according to local regulations and directions of National Veterinary and Food Administration. The ideal acaricide should be able to penetrate into refuges where the mites are hidden and should remain active on exposed surfaces for a long time to destroy all the hidden mites. This acaricide should be very selective for the parasite and should not induce mite resistance. Results obtained by treating with triflumuron confirm a significant reduction of mites during 4-6 months. Two months after the last application of triflumuron, the density of mites increased gradually. Interestingly, however at day 95 after treatment the mite density in experimental hall was 3.7 times higher in comparison with control hall. Triflumuron has effects on decreased hatching of eggs (Kočíšová et al., 2006), but till now only rare data about the chitin-synthesis inhibitors potential on mites were published.

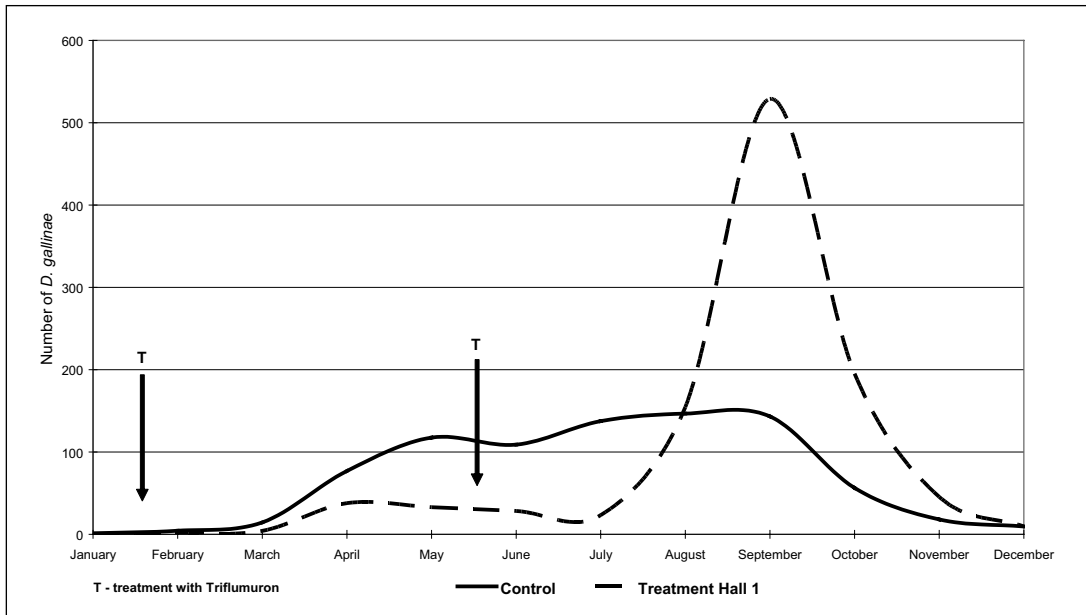


Figure 1. Numbers of *D. gallinae* caught on the refuges in control and experimental halls after two times treatment with triflumuron.

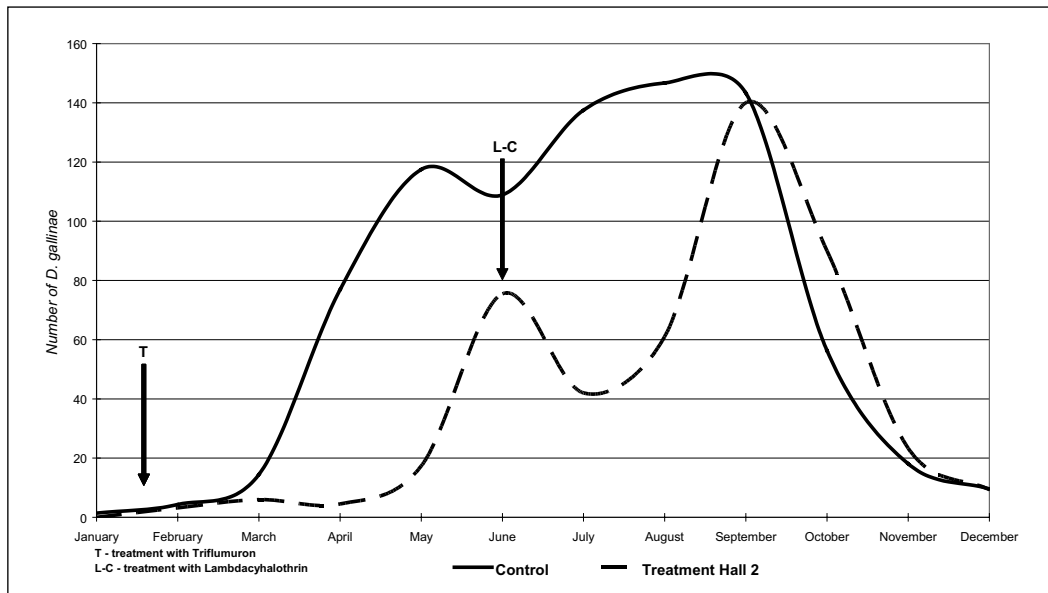


Figure 2. Numbers of *D. gallinae* caught on the refuges in control and experimental halls after treatment with triflumuron and lambdacyhalothrin

In second experimental hall (Fig. 2) the graduated increased density of mites were observed and in June it was in mean 75.5 mites in 1 gram of sample. Once application of lambda-cyhalothrin in June decreased the number of mites in July more than three times, but in September the density of *D. gallinae* was practically as in control hall. During the experiment the mean efficacy of treatment in this hall was 60.6% (Fig. 5). From September to December we did not show any marked difference between the experimental and control hall.

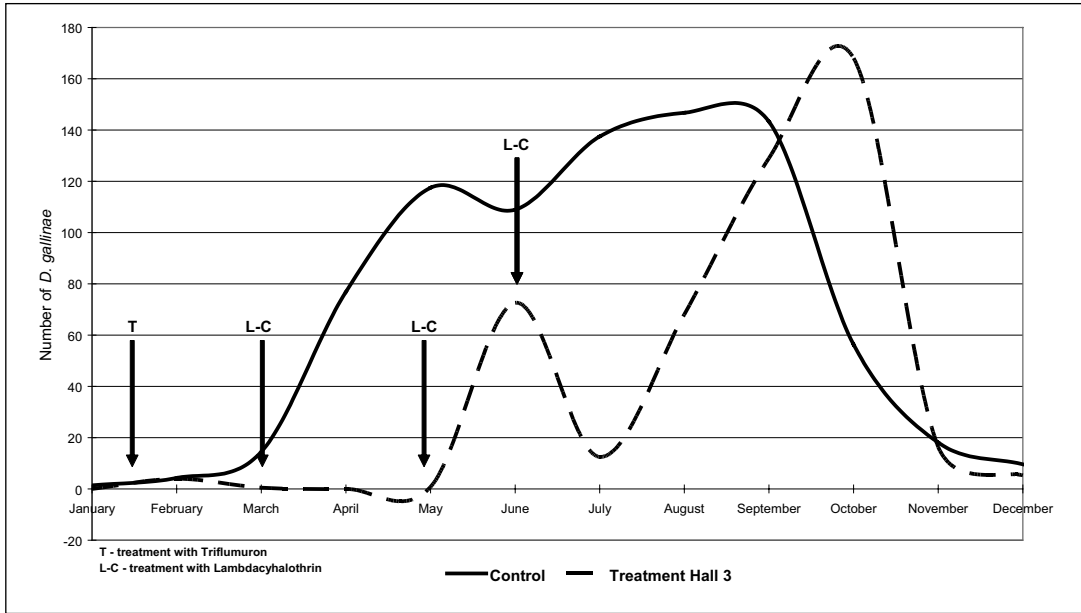


Figure 3. Numbers of *D. gallinae* caught on the refuges in control and experimental halls after treatment with triflumuron and three-times lambdacyhalothrin

Three times more application of lambdacyhalothrin showed noticeable differences in mite density during February to May (Fig. 3) with mean efficacy 98.6% (Fig. 5). But from July the number of mites started gradually increase and in October the mite density was three multiple more in comparing with control hall. Hall treated with triflumuron and bendiocarb showed the most effect (77.6%) to reducing of mites during 6 months experiment (Fig. 4 and 5). From July the density of mites gradually increased but showed significantly lower mite density to the ending of September. With respect to the eradication of red mites, the presented results are promising but, in the monitored period, complete extinction of the population of red mites did not occur.

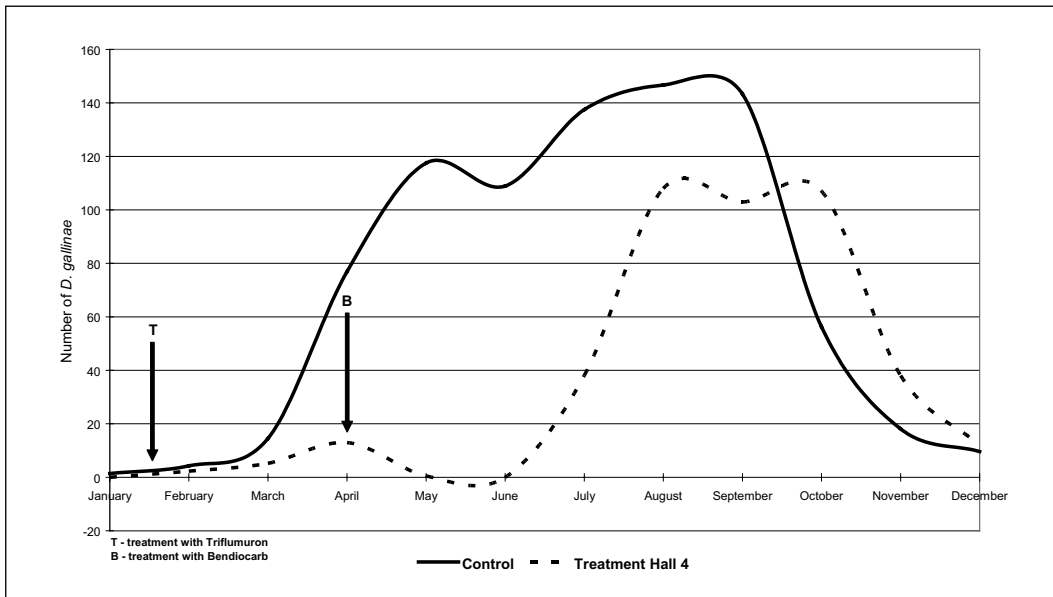


Figure 4. Numbers of *D. gallinae* caught on the refuges in control and experimental halls after treatment with triflumuron and bendiocarb

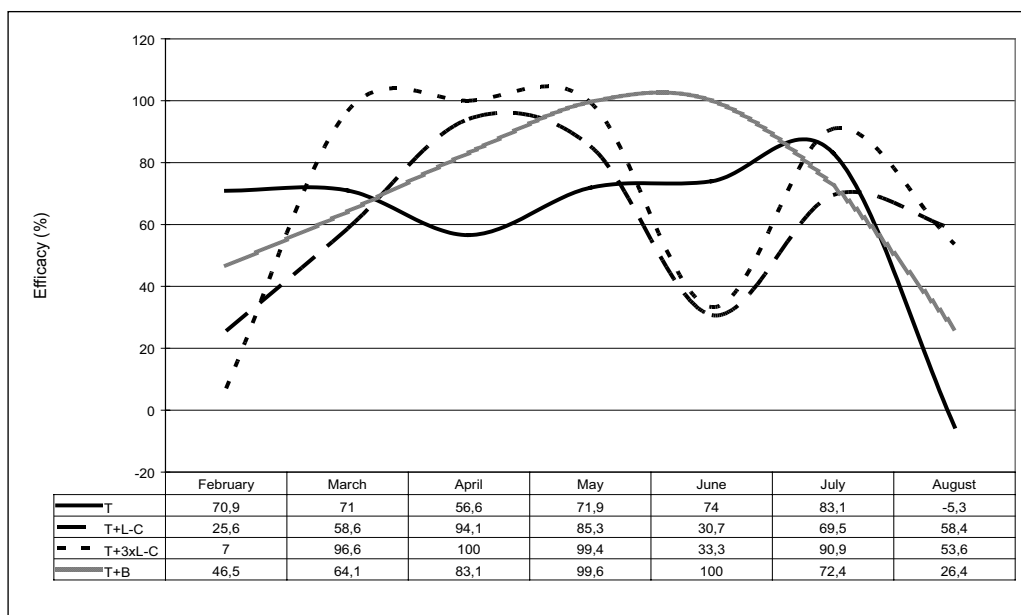


Figure 5. Efficacy (%) of individual treatments against *D. gallinae* in practical breeding conditions

CONCLUSIONS

We should advise following effective control program of the poultry red mite with combination treatment:

1. Treat the litter with Baycidal 25 WP before the next flock is housed. The best application is in the form of granules in order to allow slowly release of the effective agent into the surroundings and not to be damaged by poultry.
2. Start with “knock-down” by adulticide (lambdacyhalothrin, bendiocarb, etc. in rotational control programme) three months after the breed starting and continue with local application every 2.5-3 months. Therefore the continuous monitoring of the mite infestation with follow-up immediate local treatment has of great importance on occurrence new source of the mites spread.
3. We recommend the final treatment of the houses immediately after removal of birds before the hall temperature decrease and mites hide into refuges.

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