Efficacy of Phoxim 50 % E.C. (ByeMite) for treatment of Dermanyssus gallinae in laying hens under field conditions

A. KEÏTA*, E. PAGOT1, P. POMMIER1, L. BADUEL2 AND J. HEINE3

1 CTPA. ZOOPOLE développement, 2 rue Jean Bostand, Ploufragan, F-22440
2 BAYER Pharma, Division santé animale, 13 rue Jean Juarès, Puteaux, F-92807
3 BAYER HealthCare AG, Animal Health, Leverkusen, D-51368

* Corresponding author : Email : alassane.keita@zoopole.asso.fr

SUMMARY

A GCP-controlled, randomised and blind trial used 2 layer houses naturally infested with D. gallinae. One house with space for 23,000 hens was treated with an aqueous solution (2,000 ppm Phoxim, 25 ml/hen place) twice 7 days apart. The second house with space for 21,000 hens was not treated. For quantitative assessment of mite population, 20 cardboard traps per house were deployed onto the cages for 24 hours on Days –1, 2, 6, 9, 13, 20, 34 and 48 in both houses. The mite population had decreased by 91 % on D3. Efficacy on D7 was 88.5 % and remained > 97 % from D10 until D49. There was a drop in egg production the day following the first and the second treatment in both buildings, but it was not treatment-related. Finally, the egg-laying rate was similar in both groups. The mean number of dead hen was significantly higher in the control group (0.6 %) than in the treatment group (0.4 %). A maximum residue level for chicken meat and eggs has been granted by EMEA [3] in January 2005 and data have been submitted to the authorities to approve a 0-day withdrawal period for eggs.

Keywords : Dermanyssus gallinae, hen, control methods, acaricide, withdrawal period.

Introduction

In France [1] as well as in Europe [4, 7, 10] and worldwide [6, 14], poultry houses for egg layers are often affected by ectoparasites and especially by Dermanyssus gallinae (DG), also called the poultry red mite. The frequency of infestation with this parasite is currently increasing and farmers worry about the potential economic losses [1, 7]. DG is an haematophagous mite (photo 1). It is a cosmopolitan blood-feeding parasite of birds that sucks blood mainly at night. During the day, mites hide in cracks and crevices where they lay their eggs [13]. Under favourable conditions (the most favourable temperatures for juvenile development of D. gallinae ranges between 25 °C and 37 °C) [8], the life cycle (larval stage – nymph – adult) can be completed in less than 7 days, and a high reproduction rate may occur as the feeding-oviposition cycle repeats about every third day [9]. Large population can therefore be established rapidly. Without any blood feeding, these mites can survive 4 or 5 months. High densities of parasites may cause blood staining on eggs (eggs crush the mites during the transfer to the collect point) and it may result in poorer hen performance (lowering production and increasing feed consumption). Furthermore, the mites may attack humans causing painful skin irritation.

Currently chemical acaricide treatments are restricted to application in the empty chicken house in most countries. But farmers require an effective treatment for mite control in stocked layer houses which will not cause prohibitive residues in eggs and meat. In France, there is currently no registered compound to control mite infestation in poultry houses stocked with replacement and egg-laying chickens. BAYER Animal Health has developed an emulsion concentrate containing Phoxim 50 % to control infestation by the red mite in poultry houses. A maximum residue level for chicken meat and eggs has been granted by EMEA [3] in January 2005 and data have been submitted to the authorities to approve a 0-day withdrawal period for eggs. The objective of this study was to evaluate, under field conditions, the safety and efficacy of this product.

RéSUMÉ

Essai terrain d’efficacité du Phoxim 50 % E.C. (ByeMite) dans le traitement de Dermanyssus gallinae chez la poule pondeuse.

Dans un essai BPC, contrôlé, randomisé et conduit en aveugle, 2 bâtiments de poules pondeuses infestés par D. gallinae ont été utilisés : l’un (23000 places) a été traité avec une solution aqueuse (2000 ppm de Phoxim, 25 ml/place), 2 fois à 7 jours d’intervalle et l’autre (21000 places), non traité, a servi de témoin. La population de poux a été suivie en disposant 20 pièges dans chaque bâtiment pendant 24 heures, aux jours –1, 2, 6, 9, 13, 20, 30 et 48. A J3, la population de poux a diminué de 91 %. L’efficacité à J7 est de 88,5 % et demeure > 97 % de J10 à J49. Une baisse de la production d’œufs a été notée, dans les deux bâtiments, le jour suivant chaque traitement mais elle n’est pas liée à celui-ci. Au final, le taux de ponte a été similaire dans les deux groupes. Le nombre moyen de poules mortes est significativement plus élevé dans le groupe témoin (0,6 %) que dans le groupe traité (0,4 %). Un niveau maximum de résidu pour la viande de poulet et les œufs a été accordé en janvier 2005 par EMEA et les données ont été soumises aux autorités en vue de l’obtention d’un temps d’attente nul pour les œufs.

Mots-clés : Dermanyssus gallinae, poule pondeuse, moyens de contrôle, acaricide, temps d’attente.
Material and methods

STUDY SITES

Two commercial layer houses on the same farm naturally infested with DG with a cage system (61 cm of length, 55 cm of width, 550 cm of height) were included in the study. Before treatment, traps were placed in the houses to confirm a medium to high infestation rate (arithmetic mean of at least 75 mites per trap) and the susceptibility of mites against the test product was confirmed by the mite-package-test conducted by Zecklab (Burgwedel, Germany). This test determined the percentage of surviving mites after exposition to a given concentration of pyrethroids, organophosphates and carbamates.

One house, stocked with 23,000 hens, was treated with Phoxim 50 % (test group). The second house, stocked with 21,000 hens, remained untreated (control group). Birds in both groups were housed in battery cages with 6 animals per cage. In both buildings temperatures were kept at around 22 °C. The lighting regime comprised a 2-hour dark phase followed by 4 hours of light.

TREATMENT REGIMEN

A spray solution of 2,000 ppm Phoxim was prepared with 100 ml of the test article into 25 litres water and stirred thoroughly. This spray solution was applied at a rate of 25 litres per thousand hen places onto the surfaces directly surrounding the birds, i.e. cage wires, ancillary equipment, metal posts, feed troughs, conveyer belts, laying nests. A spray device that delivers coarse spray droplets was used. Feed and eggs were removed before spray treatment. Eggs laid during treatment were removed. A second treatment was applied 7 days later. The aqueous emulsion was prepared freshly before application. The control house remained untreated.

DERMANYSSUS INFESTATION ASSESSMENT

Cardboard traps (140 mm by 100 mm) [11] were used to collect the mites and to assess the intensity of mite infestation. At each sampling, 20 traps were used in each layer house. Before the study (Day-10 to Day-9), 20 traps were deployed onto hen cages to determine mite density and mite...
resistance (by collecting alive mites which were submitted to the mite-package-test).

Twenty trap places were designated in each layer house before the study started. The same places, evenly distributed throughout the cages rows and floors, were used for the whole duration of the trial. Traps were placed on Days –1, 2, 6, 9, 13, 20, 34 and 48. Traps were deployed using a rubber band near the feeder in front of the cage. Each trap was allowed to collect mites for 24 hours.

After collection, traps were placed into individual plastic bags that were frozen at -18 °C to kill the mites and then sent to the laboratory in blind conditions. For easier counting, a standard 9 cm diameter petri dish, with calibrated paper under the dish was used. The plastic bag was opened and all the mites which escaped from the trap were poured into the petri dish. The trap was opened and the mites were also poured into the same petri dish. Mites attached to the paper of the tubes were gently detached using a needle. Before counting, the mites were spread evenly in the petri dish. Using a (reflecting) stereomicroscope with a magnification 10 X to 40 X, i.e. 10X ocular and 1X to 4X objectives, mites were distinguished (larval stages, nymphal stages and adult were counted). The total number of mites was recorded. Eggs were not counted. At low densities (below approximately 500 mites/trap) mites were exactly counted. If the total number of mites exceeded 500 mites, a representative part of the petri dish (10 %) was counted and the number of mites was then calculated.

NUMBER OF LAID EGGS

From Day-1 to the end of the study the farmer recorded the number of laid eggs in each house on daily basis (figure 3).

NUMBER OF DEAD HENS

The number of dead hens per group was recorded twice a week.

STATISTICS

The statistical unit was the individual cardboard. The course of the number of mites (median values) according to study days was analysed between groups using the Friedman two-way ANOVA test. If a significant difference was observed, both study groups were then compared at each study day using the Kruskal-Wallis test. The mean number of eggs laid per hen and per day was compared between groups using the Student’s t test. The percentage of dead hens was compared between groups using the Pearson chi square test. All statistical calculations were performed using SYSTAT statistical software version 9.0.

Results

COURSE OF MITE COUNTS ACCORDING TO STUDY DAYS

The course of the median values of mite counts is shown in Table I, with the calculated efficacy defined as [(median value in the control group – median value in the treated group) / median value in the control group] X 100. The efficacy of the treatment over time is presented on the Figure 1.

On Day 0 before treatment, the median value of the mite count was significantly higher in the treatment group compared to the control group. From Day 3 to the end of the study, a significantly lower median value was observed in the treatment group at each counting date than in the control group.

The factor “study day within the treatment group” was significant (p < 0.001) : the median value decreased in the treatment group until the end of the study although it increased in the control group (see Figure 2).

On Day 3 after the first application, mite population had decreased by 91 %. Efficacy on Day 7 was 88.5 % and remained > 97 % from Day 10 to the end of the trial (see Figure 1).

DAILY NUMBER OF LAID EGGS

The daily number of eggs laid per hen is shown in the figure 3. At Day 0 (day of first treatment) the number of egg/hen/day was respectively 0.97 and 1.02 in the treatment group and in the control group. At Day 1 there was a drop in egg production since the number of egg/hen/day was respectively 0.91 and 0.90. A similar drop was observed on Day 8 compared to Day 7 (day of second treatment). Such drop was probably due to a delayed feeding time on Day 0 and on Day 7 in both buildings. So it doesn’t provide any evidence the drop might be treatment related. No significant difference was observed between the mean number of eggs laid per hen and per day from the beginning to the end of the study (0.92 in both groups).

NUMBER OF DEAD HENS

From Day 0 to Day 49, the percentage of dead hens was : 89/23,000 (0.4 %) in the treated house versus 135/21,000 (0.6 %) in the control group. This difference between groups is significant (p < 0.001).

Discussion

During the study period, a significantly higher mortality was demonstrated in the control house compared to the treated house, even if no difference in egg production was observed. The red mite is sometimes described to be a possible cause of death. Kilpinen [5] artificially infected 2 groups of 15 pullets and 2 groups of 15 pullets were kept as
uninfected controls. Infections with *D. gallinae* resulted in reduced weight gain, anaemia and even death of some of the hens. Behavioural changes were also observed, as the mite-infected hens showed higher self-grooming and head scratching both during the day and night.

In the study reported here, the population of mites was substantially and consistently reduced in the treated group compared to the control group: on Day 3 after the first application, mite population had decreased by 91%. Efficacy on Day 7 was 88.5% and remained > 97% from Day 10 to the end of the trial on Day 49.

Several methods have been proposed to control the poultry mite. Chauve [1] divided the control methods either in chemical control method or alternative methods, the latter category including insect growth regulators, feeding deterrence or predatory mites. The author predicted that for reasons related to animal welfare and in order to produce foodstuff without residues, priority would be shifted to control mites in empty houses.

A means of chemical control using treated cardboard (allowing a restricted exposure of the active ingredient) was developed some years ago [2, 7, 12]. Chirico [2] placed cardboard traps (containing 2% metriphonate) where mites gathered on farms stocking 2,000 to 3,000 hens. In two separate trials, treated traps were replaced every second day for 2 weeks and every week for 8 weeks. Untreated compartments were used as controls. The parasite populations were monitored by collecting mites in untreated cardboard traps. A 95% reduction in the mite population was recorded in the 8-week trial, and a 99% reduction was recorded in the 2-week trial. It was essential to place treated traps near mite aggregation sites to achieve satisfactory control.

Lundh [7] used the same control concept with cardboard traps containing 20% neem oil in a floor system stocking
2,400 birds. Treated traps were replaced every week for 4 weeks. A 92% reduction in the mite population was recorded.

In these studies, impregnated cardboards must be placed at the mites’ aggregation sites. It is easier to find these sites in buildings stocking 2,000 to 3,000 birds than on farms with 21,000 or 23,000 hens, as in our study. In France, buildings with more than 20,000 birds are common.

Currently, in most countries, acaricide treatments are restricted to application in empty chicken houses in order to fulfill the requirement to produce foodstuffs free of biological or chemical residues. But farmers require an effective treatment for mite control in stocked layer houses which will not cause prohibitive residues in eggs and meat. In addition, the egg laying rate and average daily number of dead chickens were not negatively affected by the treatment. This is a field trial report on a product for which a maximum residue level for chicken meat and eggs has been granted by EMEA [3] and data have been submitted to the authorities to approve a 0-day withdrawal period for eggs.

References