

RESEARCH ARTICLE

A Comparison of the Efficacy of Selamectin and Fluralaner in the Treatment of the Canaries Infected with *Dermanyssus gallinae*

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Abstract: *Dermanyssus gallinae* is a hematophagous ectoparasite responsible for anaemia, weight loss, itching, dermatitis, and also decreased egg production in many domestic and wild bird species. The use of various synthetic acaricides such as avermectin and isoxazoline group is common in its treatment. This study aimed to compare the efficacy of Selamectin and Fluralaner on canaries during *D. gallinae* infestations. In the study, all canaries before treatment constituted the control group. Two groups of canaries were included in the study (n:40): Selamectin was applied to the first group (n:20) and Fluralaner to the second group (n:20). Selamectin was applied topically and infracapularly at a 20 mg/kg dose, while Fluralaner was administered orally by a dose of 0.5 mg/kg. Parasite load was evaluated before and after treatment. With regard to the reduction in the mean number of red mites, the treatment successes of Selamectin and Fluralaner were evaluated as percentages of the efficacy. The percentage of efficacy of Selamectin and Fluralaner treatments were 80.0%, and 90.90%, respectively. We conclude that both drugs provide effective treatment in the treatment of *D. gallinae* infestation in canaries, nevertheless short-term clinical efficacy of Fluralaner was superior to Selamectin.

Keywords: *Dermanyssus gallinae*, Canaries, Selamectin, Fluralaner

Dermanyssus gallinae İle Enfekte Kanaryaların Tedavisinde Selamectin ve Fluralaner Etkinliğinin Karşılaştırılması

Öz: *Dermanyssus gallinae* evcil kuş türlerinde ve yabani kuş türlerinde görülen anemi, kilo kaybı, kaşıntı ve dermatite yol açan ayrıca yumurta üretiminin azalmasına neden olan hematofagöz bir ektoparazit türüdür. *D. gallinae* tedavisinde avermektin ve izoksazolin grubu gibi çeşitli sentetik akarisitlerin kullanımı oldukça yaygındır. Bu çalışma, kanaryalarda *D. gallinae* enfestasyonlarının tedavisi amacıyla kullanılan Selamectin ve Fluralaner'in etkinliğini karşılaştırmayı amaçladı. Çalışmada tedavi öncesi tüm kanaryalar kontrol grubunu oluşturdu. Çalışmada yer alan kanaryalar (n:40) iki farklı gruba ayrıldı: birinci gruptaki kanaryalara (n:20) Selamectin tedavisi ve ikinci gruptaki kanaryalara (n:20) ise Fluralaner tedavisi uygulandı. Selamectin tedavisi lokal olarak, infraskapular bölgeye 20 mg/kg dozda uygulanırken, Fluralaner tedavisi ise 0.5 mg/kg dozda oral olarak uygulandı. Parazit yükü tedavi öncesinde ve tedavi sonrasında değerlendirildi. Ortalama kırmızı akar sayısındaki azalmaya bağlı olarak Selamectin ve Fluralaner'in tedavi başarıları etkinlik yüzdesi hesaplanarak değerlendirildi. Selamectin tedavisindeki etkinlik yüzdesi %80.0 iken Fluralaner tedavisindeki etkinlik yüzdesi ise %90.90 olarak tespit edildi. Çalışma sonucunda kanaryalarda *D. gallinae* enfestasyonlarının tedavisinde uygulanan hem Selamectin hem de Fluralaner'in etkili tedavi sağladığı tespit edildi. Bu çalışmada tedavi edilen kanaryaların kısa süreli klinik etkinliği değerlendirildiğinde ise Fluralaner ile tedavinin etkinlik yüzdesinin Selamectin ile tedavinin etkinlik yüzdesine göre daha yüksek olduğu gözlemlendi.

Anahtar sözcükler: *Dermanyssus gallinae*, Kanarya, Selamectin, Fluralaner

INTRODUCTION

Dermanyssus gallinae is a nocturnal, hematophagous mite that is very common in poultry farms around the world. It causes weight loss, anemia, and dermatological lesions, and adversely affects reproductive functions^[1]. There are some reports regarding human transmission^[2]. These mites

live in clusters in cracked and recessed environments^[3]. They seem white, but turn red while sucking. Females are 0.7-1 mm and males are smaller, 0.3-0.6 mm in size. The optimum living ambient temperature is 20-25°C, however they cannot survive below -20°C and above 45°C^[4]. The major struggle with these mites is that they can survive 5-9 months without sucking blood and they proliferate

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rapidly [5]. They are not species-specific as they can also hold on other domestic animals apart from humans and poultry [6]. They are vectors of many zoonotic diseases such as *Chlamydia psittaci*, *Coxiella burnetti*, *Salmonella* spp., *Listeria monocytogenes*, *E. coli* [1,7]. Clinical symptoms associated with this infestation include itching, insomnia, self-pecking, cannibalism, dermatitis, weakening and anemia, reduced laying rate, increased percentage of downgraded eggs, and death [8,9].

Several acaricides are widely used against *D. gallinae*. Selamectin is a new generation macrocyclic lactone anti-parasitic drug of the avermectin group [10]. Like other avermectins, it binds to gamma-amino-butyric acid (GABA) receptors in the nervous system and activates glutamate chloride ion channels in muscle synapses, thus disrupting the neuromuscular transmission of nematodes and arthropods [11]. Selamectin is widely used in small animals and exotic companion practices due to its broad spectrum of coverage, high margin of safety, and straightforward administration and packaging [10]. Fluralaner is a strong ligand-gated chloride channel inhibitor targeting insect nervous systems [12]. It works by blocking GABARs specifically and is a good acaricide for ticks and mites. Fluralaner has significant antagonistic actions for these GABARs and its high pest control activities against parasitic agents [13]. In comparison to other classic GABAergic chemicals, fluralaner demonstrates no cross-resistance against numerous insect species in both *in vivo* and *in vitro* investigations [14].

The aim of this study was to compare the clinical efficacy of Selamectin and Fluralaner against red mites, including the rate of killing, and their possible effects on mite reproduction after administration to canaries.

MATERIAL AND METHODS

Ethical Statement

This study was conducted in clinical cases naturally infested with *Dermanyssus gallinae* in Amasya and Samsun regions. For this reason, Ethics Committee approval was not required in our study, and the animal ethical rules in force during the study were followed. In addition, an Informed Consent Form (for each patient) was obtained from the owners.

Animal and Groups

A total of 40 owned gloster canaries (25 females and 15 males) (*Serinus canaria*) were enrolled in the study, in Amasya and Samsun, Türkiye. The age range of the canaries was 8-36 months, and body weights were 18-20 g.

Clinical Application Procedure

In the anamnesis, the canaries had itching, insomnia, moult, skin lesions, and decreased spawning rate and reproductive

performance reported. In the clinical examination, the mites in the cage and on the canaries were observed with the naked eye. Traps constructed of folded cardboard papers were made and used before treatment and after treatment to measure the infestation rate. The mites were collected by punching holes in the surfaces of cardboard papers to create a gap. All traps were placed at a safe distance from each other on the floor. For 72 h, traps were placed inside perches. The parasitic population was counted as an estimated before the treatment and then 7 and 15 days after the initial treatment. Samples collected for ectoparasitic examination were examined under a light microscope (x10) and *D. gallinae* mites were detected. The canaries were housed in 4 cages with 10 canaries in each. They were randomly assigned to 2 study groups of 20 canaries (Group 1 was the Selamectin treatment group and group 2 was the Fluralaner treatment group) in 2 cages each, based on their health status, age (8-18 months), and body weight (18-21 g). The canaries were not exposed to any ectoparasite control product prior to initiation of treatment.

All canaries in both groups represented the control group before treatment. As group 1 Selamectin treatment; A drop solution containing 0.25 mL/15 mg Selamectin was used. With the help of a 0 size fine brush, 1 drop of solution (20 mg/kg) was applied topically and infrascapularly from the gap between the wing and neck. During the application, the hairs in the area were separated and the skin was exposed. The efficiency of the solution was augmented by applying to the hairless area at the neck-wing junction, where subcutaneous vascularization is intense. The Selamectin treatment was performed as a single dose. As for group 2 Fluralaner treatment; A stock solution was diluted with tap water to achieve the intended dosing concentration of 0.03 mg fluralaner/0.1 mL and administered orally to the canaries. The Fluralaner treatment was performed 2 times with an interval of 7 days.

Statistical Analysis

Changes in parasite load were assessed by examining mites in cage perches and canaries before and after treatments to confirm the presence of natural infestations. For each post-treatment, the antiparasitic efficacy (E) was calculated using the formula [15]:

$$E \% = \frac{A-B}{A} \times 100$$

where A is the number of mites before treatment and B is the number of mites after treatment.

RESULTS

No adverse effects were reported in a total of 40 canaries in four cages following treatment. The mite population before treatment was approximately 450 in group 1 and

400 in group 2. At day 7, in Selamectin group (S1), the mite population declined significantly to 61.11% and in Fluralaner group (F1), the mite population declined significantly to 72.50% (Table 1).

After 15 days of both treatments, in Selamectin group (S2), the mite population dropped significantly to 80.0% and in Fluralaner group (F2), the mite population dropped significantly to 90.90% (Table 2). After the both treatments, the number of mites was significantly reduced.

When the short-term clinical efficacy of the two treatments was compared, Fluralaner showed a higher percentage of efficacy than Selamectin (Fig. 1).

DISCUSSION

Dermanyssus gallinae infestation is observed in many bird species, but also studies reports that many other species are affected, nearby being a zoonotic infection [16]. *D. gallinae* infestations result in death in progressive cases [17]. Studies show that skin lesions similar to those in birds are also seen in humans [18]. More than 35 compounds have been mentioned for the control of *D. gallinae* in birds (organophosphates, organochlorines, pyrethroids, carbamates amitraz, and endectocytcs). Although some of these are theoretically efficient, they are insufficient in practice [19]. Selamectin is an efficient antiparasitic drug in veterinary medicine. Its long duration of action and

broad therapeutic activity facilitate its use against a wide variety of internal and external parasites. In addition, it is preferred in domestic and wild bird species as it is suitable for widespread and safe use [10]. Selamectin can also be used successfully in canary species, and it has been reported in various publications that the appropriate dose should be investigated [10,19].

Selamectin was used in the treatment of *D. gallinae* in canaries and was found to be quite successful in a study comparing different preparations. However, the dose rate was not mentioned in the study [20]. In another study, Selamectin applied topically at a dose of 20 mg/kg reached its maximum level in 3 days, and it was reported that effective plasma concentrations were reached for 19 days [21]. Nevertheless, Selamectin can be used as an efficient antiparasitic drug in bird species [19,21].

Oral administration of Fluralaner is routinely used in dogs to provide a safe and fast acting antiparasitic treatment that also disrupts flea reproduction [22,23]. Fluralaner's proven acaricidal effects after oral treatment suggested that a similar approach would be effective for the treatment of *D. gallinae*. Fluralaner has no cross-resistance against a variety of insect species in both *in vivo* and *in vitro* studies, unlike other conventional GABAergic compounds [24]. There has been no research on the use of oral Fluralaner to control *D. gallinae* in canaries. It has been reported that

Table 1. First application efficiency of Selamectin treatment (ES1) and Fluralaner treatment (EF1)

| Groups | Number of Mites Before Treatment | Number of Mites After Treatment | Antiparasitic Efficacy |
|--------|----------------------------------|---------------------------------|------------------------|
| ES1 | 450 | 175 | 61.11% |
| EF1 | 400 | 110 | 72.50% |

Table 2. Efficiency of Selamectin treatment (ES2) and Fluralaner treatment (EF2).

| Groups | Number of mites Before Treatment | Number of Mites After Treatment | Antiparasitic Efficacy |
|--------|----------------------------------|---------------------------------|------------------------|
| ES2 | 175 | 35 | 80.0% |
| EF2 | 110 | 10 | 90.90% |

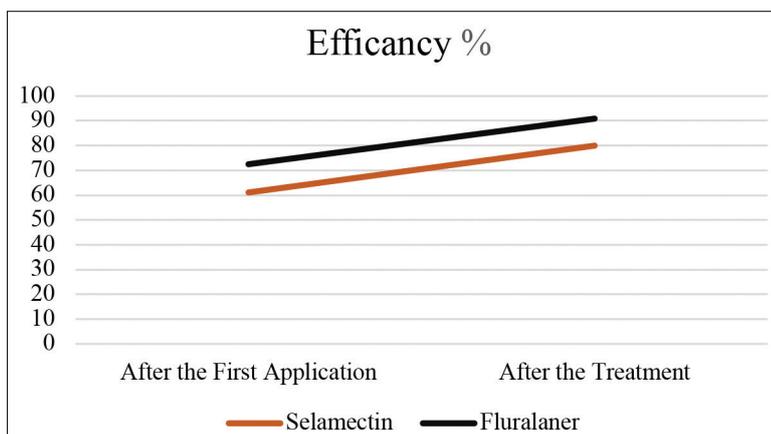


Fig 1. Efficacy of Selamectin and Fluralaner treatment

the application of 0.5 mg Fluralaner/kg body weight twice to hens with 7-day intervals is effective in controlling mites [25].

Brauneis et al. [26], added Fluralaner to the drinking water of laying hens twice with 7-day interval and, reported a reduction of up to 99% of *D. gallinae* mites within 3 days from the first application. It has been reported that up to 100% success was achieved within 2 days after the second application. Two oral applications of Fluralaner, 7 days apart, to canaries provide a maximum efficacy from the end of the second week, against bird red mite. The rapid mite killing effect is achieved within 4-8 h after application, it prevents the mite spawning and disrupts the life cycle of the mite. Therefore, oral administration of Fluralaner can effectively treat existing poultry red mite infestation leading to eradication of mites in canaries as well as poultry [26]. In another study, it is suggested that Fluralaner should be tried on eagles in the treatment of bird mites such as *D. gallinae* [27].

Antiparasitic treatment protocols should be held with caution especially in birds as they are very frail. Many agents are found to be toxic and most have many potential side effects. For example, Gozalo et al. [28] reported mortality associated with Fenbendazole, a very widespread used antiparasitic agent, with hemorrhagic enteritis, diffuse lymphoplasmacytic enteritis, small intestinal crypt necrosis, bile duct hyperplasia etc. In the present study, the absence of any side effects related with medications, contributes to the promising potential of Selamectin and Fluralaner in canary *D. gallinae* infestations.

This study concluded that subcutaneous administration of a macrocyclic lactone antiparasitic drug, Selamectin, and oral administration of Fluralaner, a systemic acaricide, would offer an alternative treatment option for the control and treatment of *D. gallinae* in canaries. Under the light of the present data, both of the antiparasitic medications may be considered in *D. gallinae* infestations of canaries.

ETHICAL STATEMENT

There is no connection between the authors of this study and the commercial companies of the products used in the study.

AVAILABILITY OF DATA AND MATERIALS

The datasets and analysed during the current study available from the corresponding author (Ç. Esin) on reasonable request.

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CONFLICT OF INTEREST

The authors report no conflicts of interest. The authors

alone are responsible for the content and writing of the paper.

CONTRIBUTIONS OF AUTHORS

ÇE, UA and SR are listed according to the determination of the subject, experimental design and writing stages, their contribution rates to laboratory studies and literature review, and corrections.

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