Efficacy of a Topical Spot-on Containing 65% Permethrin Against the Dog Louse, *Trichodectes canis* (Mallophaga: Trichodectidae)*

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**ABSTRACT**

The efficacy of a 65% permethrin spot-on formulation (Defend® EXspot®, Schering-Plough Animal Health Corp., Union, NJ) against the dog louse, *Trichodectes canis* de Greer 1778, was studied. Fourteen dogs naturally infested with *T. canis* were evenly and randomly allocated to treatment with 65% permethrin administered at the label dose rate of 1 or 2 ml per dog or to an untreated control group. Louse counts were performed for each dog by gently back-combing the hair at six designated anatomic sites (head, tail, belly, each side, and an 8-cm strip the length of the body on the back), and lice were counted without removal on Days 0 (pretreatment), 7, 14, 21, and 28. Lice were eliminated from all dogs treated with the 65% permethrin spot-on within 7 days after treatment, and no subsequent reinfestations due to hatching of eggs were observed during the 28-day evaluation period. Untreated control dogs were subsequently treated with the 65% permethrin spot-on after the initial phase was completed and lice populations were evaluated as previously described. All lice were cleared from these dogs by Day 7, and there were no signs of reinfestation. No adverse reactions to treatment were noted during the study.

**INTRODUCTION**

Dog lice, *Trichodectes canis* de Greer 1778, are cosmopolitan in distribution and have been reported as infesting wild and domestic canids.
in Norway, Sweden, the United Kingdom, Germany, the United States, Canada, India, Chile, Brazil, Panama, France, Poland, China, the Marquesas islands, and Australia. In a US survey, approximately 25% of wild canids were infested with up to 18 lice per animal, and similar infestation rates were observed in domestic dogs in India.

The life history of *T. canis* has been described by Dement. Briefly, the life cycle (egg, three nymphal instars, adults) requires about 4 weeks for completion. The lice are obligate parasites of dogs and an entire life cycle can be completed on a single host. Eggs are cemented to hairs within a few millimeters of the skin and hatch in 1 to 2 weeks. Nymphs feed on dermal detritus and undergo three molts prior to becoming adults within about 2 weeks after eclosion. Adults have a life expectancy of approximately 3 to 4 weeks during which females produce several eggs per day.

Little detailed bionomic data are available for *T. canis* and the life history descriptions cited are remarkably similar to those described for lice species that parasitize humans and cattle. Signs of infestation typically include irritation, dermatitis, pruritus, and alopecia.

In 1869, Melnikow discovered cysticercoid larvae of the dog tapeworm, *Dipylidium caninum*, infecting *T. canis*. In subsequent experiments, he demonstrated that lice on dogs were capable of ingesting tapeworm ova and becoming infected with immature tapeworms. This was one of the earliest demonstrations that an insect could serve as an intermediate host for a mammalian parasite. Zimmerman conclusively confirmed the earlier observations of Melnikow in a series of detailed experiments.

Permethrin, the active ingredient in Defend® EXspot® (Schering-Plough Animal Health Corp., Union, NJ) kills and repels adult fleas, ticks, mites, and mosquitoes on dogs for 1 month. The present study was designed to investigate the efficacy of this spot-on formulation containing 65% permethrin against naturally occurring *T. canis* infestations on dogs. No reports of in vitro rearing of any members of the Trichodectidae family have been found; therefore, evaluations of insecticides for their control must be conducted with naturally occurring or induced infestations on dogs.

**MATERIALS AND METHODS**

### Test Subjects

Six springer spaniels (four females, two males) and eight cocker spaniels (six females, two males), individually identified by ear tattoo, were selected from dogs in a laboratory colony for the study. Dogs ranged in age from 1 to 9 years and in weight from 9.1 to 24.5 kg (Table 1). Inclusion in the study was based on the presence of at least 10 lice (*T. canis*) per dog; however, one dog did not meet the selection criterion and had only eggs of *T. canis* present at the initial examination. Nevertheless, the dog was accepted into the study as a control because it was deemed a functional subject for the evaluation. Dogs were housed individually in indoor/outdoor runs and were fed a commercial dog food; water was provided ad libitum. All dogs were shown to be in good health at the start of the study, and none had been treated with any parasiticide for at least 28 days prior to receiving the test formulation.

### Allocation and Treatment

The number of *T. canis* lice on each dog was determined on Day 0 prior to treatment. Dogs were ranked in descending order according to the number of lice observed at this evaluation. The first two dogs formed the first replicate pair, the next two dogs formed the second replicate pair, and so on until seven replicates had been formed. Each dog within a replicate was randomly assigned by coin toss to a treatment group: untreated control or 65% permethrin. The present study was designed to investigate the efficacy of this spot-on formulation containing 65% permethrin against naturally occurring *T. canis* infestations on dogs. No reports of in vitro rearing of any members of the Trichodectidae family have been found; therefore, evaluations of insecticides for their control must be conducted with naturally occurring or induced infestations on dogs.

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thrin spot-on (Defend® EXspot®). The 65% permethrin spot-on was applied in accordance with the product label: For dogs weighing less than 15 kg (33 lb), the hair was parted and 1 mL was applied to the skin at the dorsum of the shoulder insertion. Dogs weighing 15 kg or more also were treated with 1 mL applied to the skin at the dorsum of shoulder insertion; in addition, 1 mL was applied to the skin at the dorsum of the tailhead. Treatments were administered once on Day 0. At the completion of the evaluation, dogs in the untreated control group were treated with the 65% permethrin spot-on, and lice populations were evaluated as previously described.

**Louse Counting**

Lice were counted on each dog before treatment on Day 0 and after treatment on Days 7, 14, 21, and 28. Counting was done by observing lice exposed as a medium-toothed (4.3 teeth/cm) comb was gently moved through the hair from posterior to anterior at six designated sites: head, tail, belly, each side, and an 8-cm strip the length of the body along the back. Lice were not removed during counting, and the total number of lice observed from all six sites was used as the index of infestation.

Louse counting was conducted on a table covered with disposable paper that was changed after lice were counted on each dog. Individuals handling dogs wore disposable gloves and aprons, which were changed after handling dogs in each group. Louse populations on untreated dogs were evaluated prior to assessment of treated dogs, and combs were rinsed in alcohol and dried between dogs. Identification of *T. canis* was according to Emerson and coworkers. Counts of lice at each evaluation time were transformed to the natural logarithm of (count + 1) for calculation of geometric means.

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**TABLE 1. Dog Identification and Lice (*Trichodectes canis*) Counted on Dogs Prior to Treatment with a 65% Permethrin Spot-on Formulation**

<table>
<thead>
<tr>
<th>Dog Identity</th>
<th>Breed</th>
<th>Sex</th>
<th>Age (yr)</th>
<th>Weight (kg)</th>
<th>Total Lice/Dog</th>
</tr>
</thead>
</table>
| Untreated control
| Lea           | Cocker spaniel      | Female  | 2        | 12.3        | 45             |
| Sasha        | Cocker spaniel      | Female  | 6        | 10.9        | 26             |
| Bubba        | Cocker spaniel      | Male    | 1        | 10.0        | 31             |
| Monta Lou    | Springer spaniel    | Female  | 9        | 16.8        | 19             |
| Trixie       | Springer spaniel    | Female  | 7        | 20.9        | 20             |
| Lixie        | Springer spaniel    | Female  | 1        | 17.3        | 35             |
| Alex         | Springer spaniel    | Male    | 6        | 24.5        | 0*             |
| Permethrin
| Clarissa     | Cocker spaniel      | Female  | 4        | 9.1         | 22             |
| Paul         | Cocker spaniel      | Male    | 2        | 15.0        | 37             |
| Bethi        | Cocker spaniel      | Female  | 4        | 10.0        | 85             |
| Lora         | Cocker spaniel      | Female  | 2        | 12.3        | 25             |
| Luca         | Cocker spaniel      | Female  | 5        | 9.6         | 55             |
| Sue Gal      | Springer spaniel    | Female  | 6        | 18.6        | 38             |
| Checkers     | Springer spaniel    | Male    | 3        | 22.3        | 12             |

*Only eggs were observed.

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Dr. J. Keithley, Field Museum of Natural History, Chicago.
Other Observations

Dogs were observed once per hour for 4 hours immediately following application of the 65% permethrin formulation and once daily thereafter for any signs of reaction to the treatment. Each dog was observed for clinical signs of infestation when lice were counted.

RESULTS

Geometric mean lice per dog (nymphs and adults) for control dogs ranged from 17.0 on Day 0 to 25.1 on Day 7 (Table 2). The mean number of lice per dog in the treated group at the start of the study was 33.3, and all lice were eliminated within 7 days after treatment with the 65% permethrin spot-on. No adverse reactions were noted for the dogs during the course of the study.

Clinical signs of infestation with *T. canis* included skin irritation, scratching with resultant scabs, dermatitis, and pruritus. Signs of infestation abated within 7 days after treatment when all lice had been killed with the 65% permethrin spot-on formulation.

Live lice were not observed on the seven controls dogs following treatment with 65% permethrin spot-on dogs immediately after the initial phase of the study was completed.

DISCUSSION

Dement described classes of compounds such as organochlorines (e.g., BHC, DDT, chlordane, methoxychlor), pyrethrins, rotenone, and organophosphates (malathion)—which were available as dips, washes, sprays, or dusts—for control of dog lice. More recently the synthetic pyrethroid, deltamethrin, administered as a whole-body spray in an aqueous formulation diluted at 1:250, 1:500, or 1:750, and fipronil, a phenylpyrazole administered as a spray, have demonstrated effective control of *T. canis* infestations. Recently, two of the new low-volume, spot-on formulations for controlling fleas have been evaluated for efficacy against dog lice. One such spot-on product containing imidacloprid, a nitroquaiidine compound, was effective against dog lice following a single treatment. In the study described here, the synthetic pyrethroid, permethrin spot-on, was highly effective against dog lice.

All stages of lice (eggs, nymphs, and adult) were present on all dogs, except one control, at the time of treatment. The 65% permethrin formulation was effective in killing both nymphs and adult lice, but ovicidal activity of the formulation was not a focus of this study.

It was noted, however, that eggs present at the
time of treatment had sufficient time to hatch and reestablish the infestation. Subsequent infestations were not observed on treated dogs during the 28-day evaluation period, suggesting the 65% permethrin formulation either killed louse embryos in the eggs or killed first-instar nymphs immediately after eclosion.

## CONCLUSION

The data presented herein show that complete control of *T. canis* on dogs was achieved within 7 days with a single application of a 65% permethrin spot-on formulation.

## REFERENCES