



Efficacy of dinotefuran–pyriproxyfen, dinotefuran–pyriproxyfen–permethrin and fipronil–(S)-methoprene topical spot-on formulations to control flea populations in naturally infested pets and private residences in Tampa, FL

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ABSTRACT

Thirteen cats and 7 dogs living in 14 homes were treated topically with either a dinotefuran (22%, w/w)/pyriproxyfen (3.00%, w/w) (DP) or dinotefuran (4.95%, w/w)/pyriproxyfen (0.44%, w/w)/permethrin (36.08%, w/w) (DPP) topical spot-on, respectively. Twenty cats and 7 dogs living in 16 homes were treated topically with either a fipronil (9.8%, w/w)/(S)-methoprene (11.8%, w/w) or fipronil (9.8%, w/w)/(S)-methoprene (8.8%, w/w) topical spot-on (FM), respectively. All products were applied according to label directions by study investigators on day 0 and again between days 28 and 30. Flea populations on pets were assessed using visual area counts and premise flea infestations were assessed using intermittent-light flea traps on days 0, 7, 14, 21, 28–30, 40–45, and 54–60. A single application of the DP–DPP and FM formulations reduced flea populations by 87.35% and 88.44%, respectively within 7 days. Following two monthly applications of either the DP–DPP or FM formulations, pet flea burdens were reduced by 95.24% and 95.47%, respectively. Flea numbers in the indoor-premises were also markedly reduced by days 54–60, with 98.05% and 96.15% reductions in intermittent-light flea trap counts in the DP–DPP or FM treatment groups, respectively.

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1. Introduction

Field studies conducted previously in Tampa, FL (USA) have demonstrated that fipronil, imidacloprid, lufenuron (+pyrethrin spray or +nitenpyram tablets) and selamectin were 95–100% effective in eliminating established flea populations in private residences within 60–90 days, without the need for premise treatments (Dryden et al., 1999, 2000, 2001a,b).

Control of fleas on pets and in the premises was achieved in these studies though effective suppression of flea reproduction. These formulations either killed most newly acquired fleas prior to initiation of reproduction and/or had ovidical activity that rendered most deposited eggs non-viable.

The objective of this current study was to evaluate the performance of two new topical spot-on formulations containing dinotefuran–pyriproxyfen and dinotefuran–pyriproxyfen–permethrin and compare their performance with a fipronil–(S)-methoprene topical spot-on formulation to manage natural flea infestations on dogs and cats in Tampa, FL, USA. Dinotefuran is a third-generation, rapid-acting nitroguanidine neonicotinoid

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insecticide that exerts its action on nicotinic acetylcholine receptors in the insect nervous system (Wakita et al., 2005). The phenyl pyrazol insecticide fipronil was used as a positive reference control since a fipronil-only spot-on had been used previously in our studies in Tampa. The dog and cat flea products used in this study also contained the insect growth regulators pyriproxyfen or methoprene that should provide potent ovicidal activity (Blagburn and Dryden, 2009).

The study design used in this investigation eliminates client and veterinary perceptions of performance and reduces client compliance as an issue because investigators administered products to all animals in each home and objective data was collected.

2. Materials and methods

2.1. Home and pet study inclusion criteria

Through referrals from Sunshine Animal Hospital, Tampa, FL, and advertisements on CRAIGSLIST®, 32 private residences were selected for inclusion in the study between May 19 and June 5, 2010.

Homes were selected based on the following criteria: (1) a minimum of 5 fleas collected in a 16–24 h period in two intermittent light flea traps; (2) a minimum of 5 fleas observed in area flea counts on at least one dog or cat at the residence; (3) one to four healthy, non-fractious dogs or cats at the residence; (4) qualifying pets must spend the majority of their time in the indoor premises; (5) home owners' willingness to participate in the study at least 2 months and (6) completion of a questionnaire concerning pet habits, flea treatment and personal observations on wildlife and feral cats.

All dogs and cats were client-owned, resided in a private residence and were handled and treated in compliance with Kansas State Institutional Animal Care and Use Committee (IACUC #2858) approval.

2.2. Treatment groups

Homes and pets meeting these criteria were randomly placed into 1 of 2 treatment groups. Cats in Group DP–DPP were treated topically with dinotefuran (22%, w/w)/pyriproxyfen (3.00%, w/w) (Vectra for Cats® or Vectra for Cats & Kittens® Summit VetPharm) DP and dogs were treated with dinotefuran (4.95%, w/w)/pyriproxyfen (0.44%, w/w)/permethrin (36.08%, w/w) (Vectra 3D® Summit VetPharm) DPP.

Cats in Group FM were treated topically with fipronil (9.8%, w/w)–(S)–methoprene (11.8%, w/w) (Frontline® Plus; Merial) and dogs were treated topically with fipronil (9.8%, w/w)–(S)–methoprene (8.8%, w/w) spot-on (Frontline® Plus, Merial).

All pets were weighed prior to each treatment and products were administered according to label directions. While only pets meeting the inclusion criteria were included in the study for data collection, all dogs and cats living at a residence were administered appropriate treatments. Dogs and cats were treated on days 0 and between days 28 and 30. All treatments were administered by members of the

Kansas State University (KSU) Flea Team. No other topical or in-door premise flea treatments were used during the 60 days of the study. There were no restrictions on the animals regarding exposure to rain, swimming, bathing or movement outdoors.

2.3. Flea population assessment

The numbers of adult fleas present in the indoor premises were assessed using intermittent light traps (Dryden and Broce, 1993). One trap was placed in each of two rooms for 16–24-h. Rooms were selected based on where the pet(s) spent most of the time or where owners had observed fleas. Once rooms are selected, the traps were returned to the same rooms in the same location at every counting period. Fleas collected on the adhesive pads of the traps were enumerated and identified to species.

The flea population on each pet was assessed using a visual area count methodology (Dryden et al., 1994). Area counts were performed at five locations on each animal; dorsal midline, tail head, left lateral, right lateral, and inguinal region. Area counts were limited to 1 min per location and conducted by parting the hair against the lay using both hands until the area was covered. Pet and premise flea counts were conducted on days 0, 7, 14, 21, 28–30, 40–45, and 54–60.

Percent control achieved by the flea products was calculated by the following formula: $\{(\text{day 0 geometric mean flea counts (area or trap)} - \text{day } x \text{ geometric mean flea counts (area or trap)}) / \text{day 0 geometric mean flea counts (area or trap)}\} \times 100$. The pet and trap counts were analyzed separately at each time point, using the two-sample *t* test to test for differences in the two groups. Statistical tests were performed with freeware available on the Internet through Kirkman, T.W. (1996) "Statistics to Use". <http://www.physics.csbsju.edu/stats/> (accessed January 10, 2011).

3. Results

Two households in the DP–DPP study group did not complete the study and therefore data from those households was not included. At one of those households the single enrolled pet "ran away" and in the other household the owner gave the pet away. In the DP–DPP treatment group there were 13 dogs (av. 14.9 kg; range 2.3–35.9 kg) and 7 cats (av. 4.9 kg; range 2.3–7.7 kg) officially enrolled in the study. These cats received a mean topical dose of 51.91 mg/kg (range 34.16–70.40 mg/kg) dinotefuran and 7.08 mg/kg (range 4.66–9.60 mg/kg) pyriproxyfen. The dogs received a mean of 14.15 mg/kg (range 6.54–35.2 mg/kg) dinotefuran, 1.25 mg/kg (range 0.58–3.1 mg/kg) pyriproxyfen and 101.91 mg/kg (range 47.12–253.44 mg/kg) permethrin. There were an additional 8 dogs and 13 cats in these homes that did not qualify for the study due to either insufficient numbers of fleas (<5) on day 0, resided permanently outdoors or inability to safely handle to conduct flea counts. Therefore there were a total of 21 dogs and 20 cats resident in the 14 homes that were treated.

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