

Efficacy of Collars Containing Dichlorvos, Naled, or Stirofos Against Fleas on Persian Cats in Puerto Rico¹

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ABSTRACT

Collars impregnated with dichlorvos, naled, or stirofos on Persian cats for 10 weeks were tested against the cat flea, *Ctenocephalides felis* (Bouché). Both the stirofos collar and the naled collar were ineffective, whereas the dichlorvos collar gave good to excellent control. There were no adverse reactions to the stirofos collar, but the dichlorvos collar caused excessive salivation, from which the cat recovered after the collar was removed. After 9 weeks, the cat wearing the naled collar died with signs of organic phosphate toxicosis. This paper reviews the literature on flea collars.

INTRODUCTION

The cat flea, *Ctenocephalides felis* (Bouché), is a frequent pest of cats, dogs, and sometimes humans in warm climates. Veterinarians estimate that millions of dollars are spent annually to control them (34). In the United States, the plastic collar impregnated with insecticides is the most popular method of controlling fleas on pet cats and dogs (4). Flea collars represent a practical industrial application of the concept of controlled release pesticides, and financially they have been a success. These collars are manufactured by various companies and contain different insecticides. The effect of the collar on fleas is due to the insecticide in the collar (15); therefore collars with different insecticides, or different concentrations, must be identified as such and tested separately.

Heretofore, data on the efficacy of collars in controlling fleas on cats have been published only for collars impregnated with dichlorvos (17, 19) carbaryl (28), and temephos (5), excluding data in technical bulletins issued by the manufacturers. The purpose of this study was to find out whether the naled or stirofos collar is as effective against fleas on Persian cats as is the dichlorvos collar.

REVIEW OF LITERATURE

The concept of the slow release of toxic vapors by impregnating dichlorvos into plastic strips originated at the Shell Chemical Company. In 1965 dichlorvos flea collars were available commercially in the United

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States (29), and by 1969 millions had been sold (3). Credit has been given to Dr. Grover Cloyd for developing the collars, and to the A. H. Robins Company as the first to produce them (21). Early laboratory experiments showed that the dichlorvos collar was effective against adult fleas on dogs (24, 25, 32), and cats (17, 19), and a free-hanging disc containing dichlorvos was also effective against fleas on dogs (33).

During the last decade a number of different insecticides have been used in plastic collars against various ectoparasites on cats and dogs. Table 1 lists these: carbaryl, chloropyrifos, diazinon, dichlorvos, fospirate, naled, phosmet, propoxur, stirofos, and temephos, as shown in table 1. Table 2 lists the various species of fleas, lice, ticks, and mites for which

TABLE 1.—*Insecticides which have been used in plastic collars against ectoparasites on cats or dogs*

Common name (other name)	Chemical name
Carbaryl (Sevin)	1-naphthyl N-methylcarbamate
Chloropyrifos (Dursban)	0,0-diethyl 0-(3,5,6-trichloro-2-pyridyl) phosphorothioate
Diazinon (Spectracide)	0,0-diethyl 0-(2-isopropyl-6-methyl-4-pyrimidinyl) phosphorothioate
Dichlorvos (Vapona)	2,2-dichlorovinyl dimethyl phosphate
Fospirate (Dowco 217)	dimethyl 3,5,6-trichloro-2-pyridyl phosphate
Naled (Sengard)	1,2-dibromo-2,2-dichloroethyl dimethyl phosphate
Phosmet (Paramite)	N-(mercaptomethyl) phthalimide s-(0,0-dimethyl phosphorodithioate)
Propoxur (Sendran)	0-isopropoxyphenyl methylcarbamate
Stirofos (Rabon)	2-chloro-1-(2,4,5-trichlorophenyl) vinyl dimethyl phosphate
Temephos (Abate)	0,0'-(thiodi-4,1-phenylene) bis (0,0-dimethyl phosphorothioate)

reports have been published on the effectiveness of these insecticidal collars.

Adverse reactions to flea collars have been discussed by a number of authors, but much of the information is anecdotal with little or no supporting data. Some of the publications for or against flea collars lose part of their value because the authors failed to specify the insecticide in the collar (15). Mild local irritation of the skin of the neck, loss of hair under the collar, or even severe contact dermatitis could occur in some individual cats or dogs from plastic collars impregnated with any insecticide. The labels on the packages of all the commercial collars we have seen bear a caution to that effect. Polyvinyl chloride plastic may contain certain potential sensitizers (30), and even placebo collars have produced mild irritation (2). Dichlorvos collars in particular were cited for der-

TABLE 2.—*Ectoparasites which have been tested against insecticides in plastic collars on cats (C) and dogs (D)*

Species	Insecticide	Reference ¹
<i>Ctenocephalides felis</i> (Bouché) ² , cat flea	Carbaryl	28 (C, D)
	Dichlorvos	24 (D), 25 (D), 32 (D), 33 (D), 17 (C), 19 (C), this report (C)
	Naled	23 (D), 34 (D), this re- port (C)
	Naled & Propoxur	29 (C, D)
	Phosmet	45 (D)
	Propoxur	22 (D), 28 (D), 34 (D),
	Stirofos	This report (C)
	Temephos	5 (C, D), 34 (D)
<i>Echidnophaga gallinacea</i> (Westwood), sticktight flea	Naled	23 (D)
<i>Felistrphorus radofskyi</i> (Tenorio), cat fur mite	Dichlorvos	16 (C)
	Naled	16 (C)
	Stirofos	16 (C)
<i>Heterodoxus</i> species, biting louse	Propoxur	22 (D)
<i>Ixodes holocyclus</i> Neumann, Ixodes tick	Propoxur	26 (D)
<i>Otodectes cynotis</i> (Hering), ear mite	Dichlorvos	18 (C), 42 (C)
<i>Pulex irritans</i> Linnaeus, human flea	Naled	23 (D)
<i>Rhipicephalus sanguineus</i> (Latreille) ³ , brown dog tick	Fospirate	9 (D)
	Naled & Propoxur	29 (D)
	Phosmet	22 (D) 45 (D)
<i>Sarcoptes scabiei</i> (DeGeere), itch mite	Phosmet	45 (D)

¹ See Literature Cited.² Includes "*Ctenocephalides* species", "*Ctenocephalides canis*", and "fleas".³ Includes "ticks".

matitis in some cats (2, 4, 6, 7, 8, 17, 19, 30, 31, 37), dogs (11, 20, 30, 31, 32, 41), and even humans (12). Irritation of the skin of some dogs was produced by the propoxur collar (14), and the diazinon collar occasionally caused local skin reactions in both dogs and cats (38). Cats showed low cholinesterase levels from dichlorvos collars (1, 37), and from stirofos collars (10), as did dogs wearing propoxur collars (14).

Death of a Persian cat showing signs of organic phosphate toxicosis was attributed to wearing a naled collar (16). Some authors believe that it is hazardous to administer anesthetics, antihelminths, tranquilizers, or other drugs to cats or dogs wearing dichlorvos or other organophosphate collars (39, 40). Other authors, however, indicate little risk, although cholinesterase levels may be reduced (1, 10, 35, 36, 44). Cats may be

physically hurt by collars because of incorrect fittings, and incidents of strangulation have been reported (6, 43).

MATERIALS AND METHODS

For the tests we used three large Persian cats which had never been let outdoors. Cat 1, a cameo male, 8 years old, weighed 3.62 kg; cat 2, a pregnant silver female 9 years old weighed 3.18 kg; and cat 3, a silver female 2 years old, weighed 4.08 kg. We obtained collars from commercial sources. The active ingredients shown on the labels were: dichlorvos, 4.37% 2,2-dichlorovinyl dimethyl phosphate, and 0.33% related compounds; naled, 10% 1,2-dibromo-2,2-dichloroethyl dimethyl phosphate; and stirofos, 9.50% 2-chloro-(2,4,5-trichlorophenyl) vinyl dimethyl phos-

TABLE 3.—*Efficacy of experimental and commercial collars containing dichlorvos, naled, or stirofos against cat fleas as shown by the number of fleas counted on Persian cats once per week*

Week	Commercial collars			Experimental collars	
	Dichlorvos (Cat 1)	Naled (Cat 2)	Stirofos (Cat 3)	Dichlorvos (Cat 1)	Dichlorvos (Cat 2)
0 ¹	6	10	5	12	5
1	0	8	3	0	1
2	0	2	1	0	0
3	0	1	1	0	0
4	1	8	2	0	0
5	0	5	5	0	0
6	0	5	4	0	0
7	0	5	7	0	0
8	0	2	2	0	2
9	2	6	5	0	1
10	1	D ²	6	0	3
Average	0.4	4.7	3.6	0	0.7

¹ Pretest count (before applying collar).

² D = died.

phate. We applied the dichlorvos collar to Cat 1, the naled collar to Cat 2, and the stirofos collar to Cat 3, and left them in place for 10 weeks. The labels of the collars did not caution against use on Persian or pregnant cats. We also tested experimental collars impregnated with 5% dichlorvos, which had been received from the manufacturer about 7 years before the tests. The experimental collars were tested on Cats 1 and 2 before the tests with commercial collars.

All the cats were naturally infested with fleas for some time before the experiments began. The infestations were moderate; that is, at one sitting 5 to 12 fleas could be found. Passing the fingers through the fur to count the fleas we searched the head, back, sides, belly, legs and tail. We

counted the fleas once per week for 10 weeks. If living fleas were continuously present, we deemed the collar ineffective.

RESULTS AND DISCUSSION

Table 3 shows the results. Only the collars containing dichlorvos gave good to excellent control with 86% to 100% reduction of the pretest flea count for the entire period of 10 weeks, and 98 to 100% reduction for the first 7 weeks. Fleas were completely absent, or only one flea was present, on each of the cats wearing dichlorvos collar for at least 8 of the 10 weeks of the test period. Fleas were continuously present on the cat wearing the naled collar; therefore, we concluded the collar was ineffective, a conclusion also reached by Randell et al. (34), who tested naled collars against cat fleas on dogs. The stirofos collar was also ineffective, for fleas were always present on the cat, sometimes in numbers equal to or greater than the pretest count. Toxic reactions were as follows: Cat 3, wearing the stirofos collar indicated no adverse reactions; Cat 1, wearing the commercial dichlorvos collar salivated excessively during the tenth week but recovered after the collar was removed; and Cat 2, wearing the naled collar, after the ninth week died, showing signs of organic phosphate toxicosis, which have been described in detail elsewhere (16).

RESUMEN

Tres gatos persas usaron por 10 semanas collares impregnados con dichlorvos, naled, o stirofos para probarlos contra la pulga *Ctenocephalides felis* (Bouché). Los collares con stirofos y con naled fueron ineficaces, mientras que el control del collar con dichlorvos fue de bueno a excelente. No hubo reacciones adversas en el gato con el collar con stirofos, pero el collar con dichlorvos causó salivación, la cual desapareció después que el collar se le quitó. El gato con el collar impregnado con naled murió a las 9 semanas con síntomas de toxicosis causada por fosfato orgánico.

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