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Short communication

## Evaluation of insecticide ear tags containing ethion for control of pyrethroid resistant *Haematobia irritans* (L.) on dairy cattle

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### Abstract

A field study was conducted in central Argentina to evaluate the efficacy of ear tags containing 36% ethion against pyrethroid resistant populations of *Haematobia irritans* on grazing dairy cattle. The treated group consisted of 45 milking Holstein cows which received two tags per head and the control consisted of 22 dry cows from the same cohort. Treated and control groups were grazed on similar lucerne pastures separated for a minimum distance of 800 m but they were not isolated from other cattle herds on the same or contiguous properties. In both groups, horn fly estimation were made weekly by examining cattle in the pastures with the aid of binoculars. The percentage reduction of fly numbers on treated cows was considered as efficacy of control provided by the tags. The ethion ear tags provided a range of 85–99% reduction in horn fly numbers for 16 weeks. During this period, the weekly mean number of *H. irritans* on the tagged cows ranged between 0.44 and 28.26 compared with 143.5 and 239.1 in control animals. The ethion ear tags could be a useful tool for the control of *H. irritans* mainly in areas where populations of this insect have developed resistance to pyrethroid insecticides. © 2000 Elsevier Science B.V. All rights reserved.

**Keywords:** *Haematobia irritans*; Dairy cattle; Ethion; Ear tags

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## 1. Introduction

The horn fly, *Haematobia irritans*, is a severe pest of cattle in virtually all extensive cattle producing areas of the world. Control of this insect is carried out mostly with chemical insecticides with diverse treatment technology and application methods such as sustained release bolus, dips, sprays, dusts, impregnated ear tags and pour-on.

In the American countries, pyrethroid insecticides were readily accepted and extensively used by farmers to control *H. irritans* in countries of North America (Drummond et al., 1988) and South America (Grisi and Scott, 1992; Anziani et al., 1993). However, the widespread nature of horn fly resistance to pyrethroids (Kunz and Schmidt, 1985; Mwangala and Galloway, 1993; Torres et al., 1996; Guglielmone et al., 1998) has increased the interest to look for alternative chemicals. In this context, organophosphate ear tags containing diazinon have been used in American countries such as the USA (Sheppard and Marchiondo, 1987; Byford et al., 1988), Canada (Lysyk and Colwell, 1996), Argentina (Anziani et al., 1998) and Brazil (Sartor et al., 1999) to control horn flies, especially in areas where this pest has developed resistance to pyrethroid insecticides.

Recently a new organophosphate ear tag containing ethion (36%) has been registered in the USA and Argentina. The objective of the present study was to evaluate the effectiveness of this new ethion ear tag to control pyrethroid resistant horn fly populations on dairy cattle.

## 2. Materials and methods

### 2.1. Study site, experimental animals and insect populations

The field trial was conducted at the Experimental Station of the Instituto Nacional de Tecnología Agropecuaria located at Rafaela, Santa Fe Province (31°11'S, 61°29'W), Argentina, using a Holstein dairy herd naturally infested with *H. irritans*. Susceptibility of fly populations to pyrethroids was determined by insecticide bioassays using impregnated cypermethrin filter paper (Sheppard and Hinkle, 1987) on flies collected with hand nets. The bioassays were carried out 1 week before treatment and 10 days after tags were removed. The 50% lethal concentration (LC50) was derived from the dose–mortality responses obtained by probit analysis using POLO PC (Russell et al., 1977).

### 2.2. Procedures and treatments

The treated group consisted of 45 milking cows that received two tags per head (Commando®, Boehringer Ingelheim Animal Health) while 22 untreated dry cows remained as a control group. Both groups were grazed on similar lucerne pastures, but separated for a minimum distance of 800 m; they were not isolated from other cattle herds on neighboring farms.

On day of treatment (Day 0), adult flies were counted on one side of the body of each cow with the aid of binoculars. Each resulting total was doubled to provide an estimate of the total fly population on an individual cow (Bean et al., 1987). After treatment, horn fly

estimates were made on Days 0, 1, 4, 7 and thereafter on a weekly basis for 19 weeks on 20 randomly selected cows of each group. Counts were made in the pastures between 8:00 and 10:00 hours.

Significant differences in the distribution of *H. irritans* numbers among treated and control cows were assessed with the Wilcoxon test. Efficacy of the tags was considered as the percent reduction of *H. irritans* populations in treated versus control cows and calculated according to Abbot's formula (Abbott, 1925). The parameter used to end the trial was efficacy lower than 80% control.

### 3. Results and discussion

Previous works at the same location reported a LC50 to cypermethrin of  $0.04 \mu\text{g}/\text{cm}^2$  during spring/summer 1994–1995 (Aguirre et al., 1995) which increased to  $9.7 \mu\text{g}/\text{cm}^2$  in February 1997 (Guglielmone et al., 1998). The pretreatment bioassay carried out in December 1998 showed an LC50 to cypermethrin of  $28.5 \mu\text{g}/\text{cm}^2$  (fiducial limits: 19.21–35.08) while this value was  $24.6 \mu\text{g}/\text{cm}^2$  (fiducial limits: 17.4–34.3) after tags were removed in March 1999 indicating a horn fly population with a relatively high level of resistance to this pyrethroid.

The mean number of horn flies per animal on treated and untreated cattle and the efficacy of the tags on a weekly basis are summarized in Table 1. Two ethion ear tags provided >90% efficacy for 14 weeks against pyrethroid resistant flies. Reduction in horn fly number

Table 1

Average of horn fly numbers per animal and percentage of efficacy on dairy cows treated with two ethion 36% ear tags

Weeks after tagging	Horn flies on treated cows		Horn flies on control cows		<i>p</i> -value	Efficacy (%)
	Mean	S.D.	Mean	S.D.		
0	193.88	17.3	188.94	48.1	0.918	Not applicable
1	0.44	1.1	215.5	96.8	<0.001	99.7
2	0.66	1.5	229.0	82.4	<0.001	99.7
3	0.76	1.2	239.1	75.1	<0.001	99.6
4	0.66	0.9	182.5	60.3	<0.001	99.6
5	1.66	2.3	165.7	56.4	<0.001	98.9
6	1.22	2.1	166.5	60.6	<0.001	99.2
7	3.78	4.1	164.0	54.8	<0.001	97.6
8	7.58	6.3	185.0	68.4	<0.001	95.9
9	9.42	4.2	143.5	44.8	<0.001	93.4
10	6.10	5.2	179.5	56.1	<0.001	96.6
11	8.90	4.72	164.8	44.2	<0.001	94.5
12	11.1	8.22	196.1	60.4	<0.001	94.3
13	9.72	12.4	194.0	48.0	<0.001	94.9
14	11.88	9.6	190.0	50.9	<0.001	93.4
15	28.26	11.1	193.2	49.8	<0.001	85.3
16	25.1	13.9	178.4	56.4	<0.001	85.9
17	27.46	26.1	125.4	48.2	<0.001	78.4

was above 90 and 99% at 24 h and 4 days post treatment, respectively. On these days, fly count averages on treated cows were 20 and 1.3 compared with 216.6 and 209.4 on control animals. The efficacy was >95% during weeks 1–8 post treatment and remained >93% from weeks 9–14. During the entire study period, the maximum fly burden on individual treated milking cows was 50 flies, observed in week 16 post treatment, compared with more than 400 in some dry control cows.

Duration of the control provided by ear tags containing other organophosphate insecticides, for example diazinon, has been variable. Fly reduction of  $\approx 90\%$  for 15 and 20 weeks was reported by Crosby et al. (1991) and Cocke et al. (1990), while in other studies, similar efficacy was only observed for 6–7 weeks (Lancaster et al., 1991; Lysyk and Colwell, 1996). In previous work carried out at the same location of the present study, the application of one 40% diazinon tag per head to Holstein heifers provided >80% reduction in horn fly number for 15 weeks (Anziani et al., 1998).

Our results with two tags containing 36% ethion per cow are similar to this last study. The efficacy percentages observed were higher than 85% during 16 weeks indicating that this new ethion tag would be a useful tool for effective horn fly control on herds where resistance to pyrethroid insecticides has developed. Under the conditions of central Argentina where horn fly populations have developed a high degree of resistance to pyrethroids, these ethion tags could provide control during most of the horn fly season (Guglielmone et al., 1997). However, control of horn fly based only on use of a new ear tag containing organophosphate or any other insecticide, might result in resistance, and therefore, other alternative approaches should also be explored for long-term control.

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