ACTIVITY OF INJECTABLE DORAMECTIN AGAINST *HAEMATOBIA IRRITANS* IN CATTLE

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SUMMARY: A study was conducted in central Argentina to evaluate the activity of a single administration of doramectin against field population of *Haematobia irritans*. On day 0 (treatment day), 50 steers naturally infested with *H. irritans* were selected from a same herd and allocated on the basis of fly counts to two treatment groups of 25 animals each. Steers of one group were injected subcutaneoulsly with 200 ug/kg of doramectin in the midline of the neck while animals of the other group were treated with saline solution at a dose rate of 1 ml/50 kg. After treatments, horn fly counts were made on days 7, 14, 21, 35, 42 and 49. Fecal samples of five animals from each treated group were taken and bioassayed in the laboratory with *H. irritans* eggs on days 0, 2 and then weekly until the end of the study or day 49. In the doramectin treated steers, horn fly reduction was observed during all the period of study ranging 80.9% to 40.1% for the days 14 and day 49 post treatment respectively. In the bioassays no adult emergence was observed during 35 days post treatment in the feces of doramectin treated animals.

KEYWORDS: *Haematobia irritans*, doramectin, control.

INTRODUCTION

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

In the Americas, pyrethroids insecticides were readily accepted and extensively used by farmers to control *H. irritans* in countries of North America (DRUMMOND *et alii*, 1988) and South America (GRISI and SCOTT, 1992; ANZIANI *et alii*, 1993). However the widespread nature of horn fly resistance to pyrethroids (KUNZ and SCHMIDT, 1985; MWANGALA and GALLOWAY, 1993; TORRES *et alii*, 1996) and the likelihood of resistance developing with organophosphorus insecticides (KUNZ *et alii*, 1995) have increased the interest to look for alternative chemicals.

Doramectin, a fermentation-derived avermectin, has been reported as higly effective against several Dipteran cattle ectoparasites as for example, *Dermatobia hominis* (MOYA BORJA *et alii*, 1993), *Cochliomyia hominivorax* (ANZIANI *et alii*, 1995) and *Hypoderma bovis* (HENDRICKX *et alii*, 1993). This paper reports the activity of injectable doramectin against adult and inmature stages of horn fly, *H. irritans*, in naturally infested cattle.

MATERIALS AND METHODS

Site study and experimental animals:

the study was conducted at the Experimental Station of the Instituto Nacional de Tecnología Agropecuaria located at Rafaela, Santa Fe province (31º11´S, 61º29´W), Argentina. Fifty pure breed Holstein steers of 16 to 26 months old and with a average weight of 259,9 kg (230 kg-378 kg) from the same herd and harboring natural field *H. irritans* infestations were used in the experience.

Experimental design, field procedures and treatments:

on day of treatment (day 0), adult flies were counted on one side of the body of each steer using a pair of binoculars. Each resulting number was doubled to provide an estimate of the total fly population on an individual steer. Animals were weighed individually and allocated to two treatment groups according to fly number. Animals of the first group were treated with injectable doramectin at a dosage rate of 200 mcg/kg while steers of the second group were injected with saline solution (1 ml/ 50 kg), and used as controls. Injections were given subcutaneously in the lateral midline of the neck. On the same day, five animals of each group were randomly selected and used to take fecal samples for bioassays.

After treatments and during all the experience, animals were placed in similar grazing units of lucerne pastures. The grazing unit of the control animals was separated from the treated units

for at least 1.000 meters away. In both groups, horn fly counts were made on days 7, 14,21,28,35,42 and 49 at 08:00-10:00 hours.

Bioassays:

fecal samples were taken on days 0, 2, 7, 14, 21, 28, 35, 42 and 49 of the experience from five steers of each group to determine the activity of doramectin against horn fly development in the manure. A 150 g manure sample was collected from each animal and each sample was divided into 3 subsamples of 50 g each and placed in plastic cups. Each manure subsample was inoculated with 50 horn fly eggs. The manure samples were covered with cheese cloth and allowed to incubate at 27ºC and 50-70 RH for 7 days. On the 8th day, the pupae were extracted from the samples by washing over a sieve of screen. The collected pupae were then placed in other plastic cups and held at 27ºC and 60%-70% RH until all adults were dead. The number of pupae and number of emerging adults were recorded for each subsample from each animal.

Data analysis:

statistical differences in the distribution of *H. irritans* numbers between both groups of steers were measured using the Wilcoxon test. The percentage of reduction of adult fly populations was estimated by day on test according to HENDERSON and TILTON (1955). The percent inhibition of adult emergence obtained from the manure of doramectin treated animals was corrected for control inhibition by Abbott´s formula (ABBOT 1925). The mean number of pupae obtained and adult emerged between both groups were analized by using the Student's t-test.

RESULTS

The average of horn fly counts and the reduction percentage observed in doramectin group in relation to control group are presented in Table 1. For the 49 days of the observation period the weekly fly counts fly were significantly lower in the doramectin treated steers than the observed in the control animals *(P<0.05)*. During the first 2 weeks was observed the higher declination of adult fly population in the doramectin treated group relative to saline treated steers with reduction greater than 80%. After that, horn fly count reduction declined throughout the rest of the study and it was of 40.1% on day 49 post treatment or the end of the study.

Table 1 – Evolution of weekly average counts and percentage of reduction of *Haematobia irritans* in Holstein steers treated with injectable doramectin in relation to control steers.

Day post treatment	Horn fly means		% of Reduction
	Control	Treated	
0	235.5	232.8	Not applicable
7	219.6	42.8 *	80.9
14	167.6	32.7 *	80.6
21	138.4	48.3 *	65.5
28	211.2	65.9 *	69.1
35	138.8	46.2 *	67.1
42	134.8	59.3 *	56.5
49	153.3	92.8 *	40.1

* Significant different from control (*P<0.05*)

In Table 2 are presented the results of bioassays with the averages of pupal yield and adult emergence. Before treatment, the pupae production and adult emergence were not significant different (*P>0.05*) between the fecal samples obtained from animals of both groups. On the contrary, from day 2 to day 35 reduction of adult emergence was 100% in the feces of doramectin treated steers relative to saline treated animals (*P<0.001*). Inhibition of 100% in pupa production was observed from days 2 to 21 post treatment. From day 21 to 35 post treatment, a gradual increasement of pupae yield was observed, but more than 90% of the pupae obtained in these days had malformations characterized by larviform or elongated puparium. No adult emergence was observed from these puparium. On days 42 and 49 differences on pupae yield and adult emergence were not signicant different between the feces of saline and doramectin treated steers (*P>0.05*).

DISCUSSION

There are extensive evidence of activity of avermectins when they are used as systemic insecticides. In the present study, a single administration of doramectin resulted in a significative reduction of horn fly adult population for at least

Table 2 – Percentage of pupae and adults obtained in fecal samples of treated and control animals inoculated with *H. irritans* eggs.

Days post-treatment	Pupae (%)		Adults (%)		Emergence reduction (%)
	Control	Treated	Control	Treated	
0	70.7	72.0	61.2	69.6	
2	55.3	0 **	48.0	0 **	100
7	72.4	0 **	69.8	0 **	100
14	56.0	0.3 ** [a]	54.6	0 **	100
21	40.0	8.1 ** [a]	33.1	0 **	100
28	52.0	16.6 * [a]	50.1	0 **	100
35	55.1	32.8 * [a]	50.1	0 **	100
42	56.5	45.1	49.3	39.9	19
49	65.3	45.2	62.0	42.0	32

** Significant different from control (*P<0.001)*
* Significant different from control (*P<0.05*)
[a] > 90% of pupae with malformations

49 days after treatment and inhibition of the preparasitic cycle of this fly for a 35 day period.

Letal concentrations of doramectin in the blood could explain the decreasement in adult fly population for the first two weeks after treatment. Activity of other menbers of the avermectin family has been documented against *H. irritans*. For example, MILLER *et alii* (1986) reported that a 200 ug /kg dose of ivermectin resulted in a adult horn fly mortality higher than 90% during the days 2 to 12 post treatment. KERLIN and EAST (1992) also informed that the blood from cattle injected with the same dose of ivermectin killed 95% of the horn flies 8 days after treatment. In grazing management systems, topical formulations of ivermectin reduced adult populations by 90% during 16 days and by 50% at day 26 post treatment (LYSYK and COLWELL, 1996). In other studies, pour on ivermectin treatments resulted in longer duration effects on adult populations with more than 50% reductions for 42 and 45 days post treatment (LANCASTER *et alii*, 1991; WILLIAMS and TOWELL, 1992). Recently, efficacy of a long acting injectable ivermectin has also been informed with reductions on horn fly counts higher than 80% relative to non medicated animals during the first two weeks after treatment (GUGLIELMONE *et alii*, 1998). Degree isolation differences between treated and control herds could be an important variation factor in duration of efficacy on adult populations of these experiences.

In the bioassays of our study, doramectin prevented the adult emergence for a 35 days period in the manure of treated steers. MILLER *et alii* (1981) and SCHMIDT (1983) reported that no flies emerged for aperiod of 28 days from the feces of cattle treated subcutaneously with ivermectin at a dose rate of 200 ug/kg. On the other hand, FINCHER (1992) informed on reductions of adult emergence higher than 99% for a period of 42 days after treatment with ivermectin at a same way and dose rate. Malformation of the pupae observed in the treated group on days 21, 28 and 35 could be the effect of doramectin on the nervous system of the larvae. ZDAREK and FRAENKEL (1987) reported that neurotoxic sustances which act to paralyze the peripheral nervous system result in dysfunction of pupariation process in flies. Some paralitic neurotoxins affect the muscular contraction of the body into a barrel-shape and stabilization of the larval cuticle resultanting in larviform malformations of the pupae. HOPKINS and CHAMBERLAIN (1976) have also informed on these larviform or elongated puparia of horn fly after treatment with diflubenzuron.

Under field conditions, the use of avermectins for the control of *H. irritans s*hould consider the inwards migration of flies from neighboring areas which may greatly diminished and diluted the effects of the treatments. Considering the above limitation, the 200 ug per kg dose rate of doramectin used in cattle to control gastrointestinal nematodes, myiasis producing flies, ticks, and mites, could also aid to the simultaneous control of *H. irritans*. In addition, doramectin could be useful as part of an integrated pest management program to control pyrethroids resistant horn fly populations. Administration of doramectin in spring time may delay and diminish the use of organophosphates insecticides whose use grew year by year to control pyrethroid resistent horn flies. Use of late-season diapause control with alternative chemistry from that used in peak season has been one of the strategies recommended for prevention and management of horn fly resistance (KUNZ, 1994). In areas where pyrethroid resistant horn flies are a problem, autum treatments with doramectin could help reducing the number of resistant flies going into diapause in the manure and could delay onset of treatment next spring.

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