PERSISTENT EFFICACY OF DORAMECTIN AND IVERMECTIN IN THE PREVENTION OF NATURAL *COCHLIOMYIA HOMINIVORAX* INFESTATIONS IN CATTLE CASTRATED 10 DAYS AFTER TREATMENT.

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SUMMARY: A study was conducted in Brazil to compare the persistent efficacy of a single subcutaneous injection of doramectin and ivermectin at a dose rate of 200 mcg/kg in the prevention of myiasis caused by *Cochliomyia hominivorax* larvae in cattle castrated 10 days after treatment and exposed to natural field challenge. The study consisted of 91 comparative replicate tests conducted in all regions of Brazil under different epidemiological and management conditions and involved 2,718 cattle of different breeds. For each replicate test, approximately 30 male cattle were selected and randomly allocated to two groups (T1 and T2) of equal numbers. On day 0, animals in T1 were treated with doramectin and animals in T2 were treated with ivermectin. Twenty-nine animals were not found after treatment and thus the total number of animals used in the calculation of efficacy was 2,689. On day 10 post-treatment (p.t.) all animals were castrated surgically and were maintained together in the same pasture, exposed to natural field challenge of *C. hominivorax*. On days 13 and 17 p.t. (i.e., 3 and 7 days after castration), animals were examined and the presence or absence of oviposition and active myiasis with live larvae of *C. hominivorax* and open wound with sero-hemorrhagic exudate were recorded. Doramectin was more efficacious than ivermectin in the protection of animals castrated 10 days p.t. and exposed to above described natural *C. hominivorax* challenge. The overall mean efficacy of doramectin was 94.6% (varying from 53.3% to 100%) compared to 43.7% (ranging from 0% to 100%) for ivermectin. This difference was statistically significant ($p<0.0001$). Doramectin had an efficacy higher than 90% in 73 of 91 replicates whereas ivermectin had an efficacy higher than 90% in only 3 tests. On the other side, ivermectin had an efficacy of less than 50% in 56 tests, while the lowest efficacy for doramectin was 53.3% in only one test. The efficacy of doramectin was higher than that of ivermectin in 90 of the 91 replicate tests and in only one test ivermectin was equal to doramectin with 100% efficacy.

KEY WORDS: Doramectin, ivermectin, persistent efficacy, prevention, *Cochliomyia hominivorax*, cattle.

INTRODUCTION

Cochliomyia hominivorax, a myiasis causing fly, is an obligatory parasite of mammals including man (BAUMHOVER, 1966). *C. hominivorax* is endemic in all 26 States of Brazil where 93% of counties reported its occurrence affecting cattle, with higher incidence in Southern, Central-Western and Northeastern regions (HORN & ARTECHE, 1985). The adult flies are attracted by blood and sero-hemorrhagic exudates of open wounds or other injuries where they lay eggs. The eggs hatch, generating first instar larvae that penetrate actively the wounds, and feed on live tissue, causing great destruction. Infested wounds attract new gravid female flies causing reinfestations and self-perpetuation of the wounds if not treated properly (MOYA BORJA *et alii*., 1993). Losses caused by *C. hominivorax* are difficult to evaluate as many times infested animals die. However direct losses and costs for screwworm treatment and control in Brazil are estimated to be greater than US$ 181 millions annually (HORN, 1987).

Many topical insecticides of short duration are used for the treatment of screwworm infestations. These organophosphorous -based chemicals (DRUMMOND *et alii*., 1967) although effective as larvicid, require repeated treatment until the wounds are completely healed and become unattractive to the fly. This is not practical approach to the control of screwworms.

The ideal product for treatment and control of *C. hominivorax* would have the following characteristics: a) easy of administration; b) effective as single dose, c) no repellent activity; d) safe for animals and operators and e) prolonged period of protection until complete healing of wounds. Doramectin (Dectomax, trademark of Pfizer Inc.), a new broad spectrum endectocide of the avermectin group (GOUDIE *et alii.*, 1993) is safe, easy to administer and highly effective and persistent against induced (MOYA BORJA *et alii.*, 1993) or natural *C. hominivorax* infestations (MUNIZ *et alii.*, 1995a; b). Even though doramectin did not demontrate repellent activity since many *C. hominivorax* egg masses were observed in animals exposed to field challenge after treatment and castration or in treated cows after parturition and in treated neonatal calves, all animals were protected against the development of active myiasis (MUNIZ *et alii.*, 1995a; b). The activity of other members of the avermectin family against *C. hominivorax* is controversial. For example, ANZIANI & LOREFICE (1991) reported high efficacy of ivermectin (Ivomec, trademark of Merck Sharp & Dohme, Hahway, NJ, USA) in the protection of cattle after castration, whereas TREGONING (1983), reported efficacy of less than 10%. Also, an oral formulation of ivermectin protected 100% against navel strike in neonatal calves (SANTOS & LESSA, 1994) but, BIANCHIN *et alii.*, (1992) using injectable formulation of ivermectin in neonatal calves reported protection of only 61% compared to control.

The objective of the present study was to investigate comparatively the prolonged prophylactic efficacy of a single injection of 200 mcg/kg of doramectin and ivermectin in cattle castrated 10 days after treatment and exposed to natural field challenge of *C. hominivorax*. The study was conducted during the season of high *C. hominivorax* incidence and consisted of 91 comparative replicate tests carried out by 91 Veterinary Practitioners following the same experimental protocol and using cattle of several breeds raised under different management conditions in all regions of Brazil.

MATERIALS AND METHODS

The study consisted of 91 replicate tests and was conducted in all regions of Brazil during the period of September through December 1995 using the same protocol.

Animals: A total of 2,718 animals was used in this study. For each replicate test, approximately 30 male cattle were selected and randomly allocated to two groups (T1 and T2) of equal numbers. All animals were identified by a numbered ear tag and weighed on Day 0 for calculation of doramectin or ivermectin doses.

Treatment: On Day 0, animals of group T1 received a subcutaneous (SC) injection of doramectin at a dose rate of 200 mcg/kg and animals of group T2 received a SC injection of ivermectin at a dose rate of 200 mcg/kg. Injections were given in the lateral midline of the neck. After treatment, all animals returned to their original pasture where they were maintained together until the end of the experiment.

Castration: Ten (10) days after treatment, all animals were surgically castrated according to the normal practice of each farm. After castration animals returned to their original paddock where they were maintained together exposed to the same conditions of natural field challenge of *Cochliomyia hominivorax*.

Clinical examination: All animals were examined on Days 13 and 17 post-treatment (p.t.) (3 and 7 days after castration) and the presence or absence of *C. hominivorax* oviposition and *C. hominivorax* larvae (active myiasis) were recorded. Animals having open wounds with sero-hemorrhagic exudate and presence of active larvae of *C. hominivorax* were considered not protected.

RESULTS AND DISCUSSION

After treatment, some animals were not found and thus the total number of animals used in the calculation of efficacy consisted of 2,689 cattle. Results of the 91 comparative replicate tests are presented in Table 1. Doramectin was significantly ($p<0.0001$) more effective than ivermectin in the protection of animals castrated 10 days after treatment and exposed to natural field challenge of *C. hominivorax*.

The overall mean percent efficacy of doramectin was 94.6% (varying from 53.3% to 100%) compared to 43.7% (0% to 100%) efficacy for ivermectin. This difference was statistically significant ($p<0.0001$). From a total of 1,343 animals in the ivermectin-treated group, 756 (56.3%) had active myiasis whereas from the 1,346 animals in the doramectin-treated group, only 73 (5.4%) had screwworm strike and were not protected.

The protective efficacy offered by doramectin was higher than that of ivermectin in 90 of the 91 replicate tests and in only one test ivermectin was equal to doramectin with 100% efficacy. The frequency of distribution of percent efficacy of the 91 replicate tests is shown in Table 2. Doramectin had an efficacy higher than 90% in 73 of the 91 tests compared to 3 tests for the ivermectin treated group. Doramectin was 100% effective in 53 tests whereas ivermectin had only one result of 100%. Furthermore, the efficacy of ivermectin was less than 50% in 56 replicates (61.5%), while the lowest efficacy for doramectin was 53.3% in only one test in which the paired ivermectin group had an efficacy of 33.3%.

Table 1 - Number of animals used (Nº A.), animals infested (A.I.) and % efficacy (% E.) of doramectin and ivermectin against *Cochliomyia hominivorax* in cattle castrated 10 days after treatment. R.T.=Replicate tests.

		Doramectin-treated Cattle			Ivermectin-treated Cattle		
R.T.	Location	Nº A.	A.I.	% E.	Nº A.	A.I.	% E.
1	Sta. Rita-MA	14	1	92.9	14	7	50.0
2	S. F.Brejão-MA	15	0	100.0	14	10	28.6
3	Teresina-PI	14	0	100.0	15	9	40.0
4	Araguaína-TO	15	0	100.0	15	15	0.0
5	Altamira-PA	15	0	100.0	15	11	26.7
6	R. Dantas-SE	15	0	100.0	15	10	33.3
7	Catalão-GO	14	0	100.0	15	1	93.3
8	Goianésia-GO	15	0	100.0	15	7	53.3
9	Goiânia-GO	14	0	100.0	14	6	57.1
10	Jussara-GO	15	0	100.0	15	10	33.3
11	Rio Verde-GO	15	0	100.0	15	3	80.0
12	Quirinópolis-GO	15	1	93.3	15	12	20.0
13	Jataí-GO	15	0	100.0	15	7	53.3
14	Porangatu-GO	15	1	93.3	15	12	20.0
15	B. Garças-MT	15	0	100.0	15	12	20.0
16	Sinop-MT	15	0	100.0	15	1	93.3
17	Juara-MT	15	0	100.0	15	8	46.7
18	Juscimeira-MT	15	2	86.7	15	10	33.3
19	Rondonópolis-MT	15	4	73.3	15	7	53.3
20	Cuiabá-MT	15	0	100.0	15	9	40.0
21	T. da Serra-MT	15	1	93.3	15	14	6.7
22	Cacoal-RO	15	0	100.0	15	9	40.0
23	P. Bueno-RO	15	0	100.0	15	7	53.3
24	Ariquemes-RO	15	0	100.0	15	6	60.0
25	Porto Velho-RO	14	1	92.9	13	8	38.5
26	Prim. Leste-MT	15	1	93.3	15	5	66.7
27	C.GuimarãesMT	15	0	100.0	15	12	20.0
28	Pres. Medici-RO	14	0	100.0	15	13	13.3
29	SJQMarcos-MT	15	1	93.3	15	12	20.0
30	Itambé-BA	14	1	92.9	15	8	46.7
31	B. Choça-BA	15	0	100.0	15	5	66.7
32	Jaguaripe-BA	15	0	100.0	15	4	73.3
33	B. do Piraí-RJ	15	0	100.0	15	9	40.0
34	Rio Flores-RJ	15	0	100.0	15	7	53.3
35	Uberaba-MG	15	1	93.3	15	7	53.3
36	M.Carmelo-MG	15	1	93.3	15	10	33.3
37	Leopoldina-MG	15	3	80.0	15	11	26.7
38	C. Branco-MG	15	0	100.0	15	6	60.0
39	A. Paraíba-MG	15	5	66.7	15	10	33.3
40	G.ValadaresMG	15	0	100.0	15	10	33.3
41	Sta.Vitória-MG	15	2	86.7	15	11	26.7
42	P.Branco-PR	15	3	80.0	15	12	20.0
43	Loanda-PR	15	0	100.0	15	2	86.7
44	P. do Norte-PR	15	2	86.7	15	10	33.3
45	Tuneiras Oeste-PR	15	0	100.0	15	4	73.3
46	Jataizinho-PR	15	0	100.0	15	5	66.7
47	MariaHelena-PR	15	0	100.0	15	6	60.0
48	JundiaíSul-PR	15	1	93.3	15	10	33.3
49	Guarapuava-PR	15	1	93.3	14	9	35.7
50	NS Graças-PR	15	0	100.0	15	6	60.0
51	Ivinhema-MS	15	0	100.0	15	11	26.7
52	Camapuã-MS	15	0	100.0	14	9	35.7
53	Amambaí-MS	15	0	100.0	15	3	80.0
54	Jardim-MS	15	1	93.3	15	8	46.7
55	Bandeirante-MS	15	2	86.7	15	11	26.7
56	R. Brilhante-MS	15	0	100.0	15	14	6.7
57	Itaquiraí-MS	15	0	100.0	15	5	66.7
58	Rochedo-MS	15	2	86.7	15	13	13.3
59	Bonito-MS	15	1	93.3	15	9	40.0
60	Nioaque-MS	15	0	100.0	15	7	53.3
61	Batatais-SP	15	3	80.0	15	8	46.7
62	Veríssimo-MG	15	1	93.3	15	11	26.7
63	MorroAgudo-SP	15	1	93.3	13	2	84.6
64	Itapetininga-SP	15	0	100.0	15	12	20.0
65	Itapetininga-SP	15	0	100.0	15	2	86.7
66	Uberaba-MG	15	1	93.3	15	10	33.3
67	P. Caldas-MG	15	7	53.3	15	10	33.3
68	SAAraçanguáSP	15	3	80.0	15	9	40.0
69	J.Bonifácio-SP	15	2	86.7	15	8	46.7
70	Três Lagoas-MS	15	2	86.7	15	8	46.7
71	Martinópolis-SP	15	0	100.0	15	6	60.0
72	Ipiguá-SP	14	0	100.0	14	6	57.1
73	O.Bressane-SP	15	0	100.0	15	9	40.0
74	SC RioPardo-SP	15	4	73.3	14	13	7.1
75	Herculândia-SP	15	0	100.0	14	0	100.0
76	Itatinga-SP	15	0	100.0	15	7	53.3
77	Uruguaiana-RS	15	0	100.0	14	8	42.9
78	S.LourençoSul-RS	14	0	100.0	14	11	21.4
79	S.LivramentoRS	15	3	80.0	15	10	33.3
80	S. Gabriel-RS	15	0	100.0	15	5	66.7
81	Rio Pardo-RS	14	0	100.0	14	10	28.6
82	Camaquã-RS	14	0	100.0	14	11	21.4
83	Bossoroca-RS	11	2	81.8	12	8	33.3
84	Guaíba-RS	13	1	92.3	13	10	23.1
85	S.Valentin-RS	15	2	86.7	15	5	66.7
86	CelsoRamos-SC	13	1	92.3	14	6	57.1
87	S.Maria-RS	15	0	100.0	15	7	53.3
88	MangueirinhaPR	15	0	100.0	15	11	26.7
89	Curitibanos-SC	15	0	100.0	15	5	66.7
90	Chapecó-SC	15	0	100.0	15	11	26.7
91	Bossoroca-RS	15	1	93.3	15	12	20.0
Total	91 Replicate tests	1,346	73	94.6[a] (53.3 to 100)	1,343	756	43.7[b] (0 to100)

a,b Between treatments, means with different letters are significantly different ($p<0.0001$).

C. hominivorax egg masses in the castration wound were observed in a high proportion of animals of both groups (62.3% in doramectin group and 50.4% in ivermectin group) in all 91 replicate tests demonstrating the high level of challenge to which the animals were exposed.

The results reported here confirm the high efficacy and persistent activity of doramectin against *C. hominivorax* obtained by other authors (MOYA BORJA *et alii.*, 1993; MUNIZ *et alii.*, 1995a; b) and demonstrate that the persistent efficacy of doramectin was independent of the epidemiological conditions, the different cattle breeds and different

Table 2. Frequency of distribution of percent efficacy of doramectin and ivermectin against *Cochliomyia hominivorax* in cattle castrated 10 days after treatment.

Percent Efficacy	Doramectin-treated Cattle	Ivermectin-treated Cattle
100	53	1
90 ⊢ 100	20	2
80 ⊢ 90	14	5
70 ⊢ 80	2	2
60 ⊢ 70	1	12
50 ⊢ 60	1	13
40 ⊢ 50	0	14
30 ⊢ 40	0	15
20 ⊢ 30	0	21
10 ⊢ 20	0	2
0 ⊢ 10	0	4
Total Replicate Tests	91	91

management practices found in the various regions of Brazil where the study was conducted. The results for ivermectin observed in this study show that this product is highly variable in the prevention of *C. hominivorax* infestations and confirm the controversial data from other authors (ANZIANI & LOREFICE, 1991; TREGONING, 1983; BIANCHIN *et alii.*, 1992; SANTOS & LESSA, 1994). Because of its prolonged prophylactic efficacy against screwworm, doramectin is an important tool for the control and eradication program of *C. hominivorax*.

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SUMÁRIO

Um estudo foi conduzido no Brasil para comparar a eficácia persistente de uma injeção subcutânea de doramectin e ivermectin na dosagem de 200 mcg/kg na prevenção de miíases causadas por *Cochliomyia hominivorax* em bovinos castrados 10 dias após os tratamentos e expostos ao desafio natural. O estudo consistiu de 91 testes comparativos em diversas regiões do Brasil sob diversas condições epidemiológicas e de manejo, envolvendo 2.718 animais de diferentes raças. Para cada teste, aproximadamente 30 bovinos machos, foram distribuídos aleatoriamente em dois grupos iguais (T1 e T2). No dia 0, os animais do grupo T1 foram tratados com doramectin e os animais do grupo T2 foram tratados com ivermectin. Do total de animais, vinte e nove (29) não foram encontrados após os tratamentos, assim o número total de animais foi de 2.689. No dia 10 pós-tratamento, (p.t.) todos os animais foram castrados cirurgicamente e mantidos juntos no mesmo pasto, expostos ao desafio natural por *C. hominivorax*. Nos dias 13 e 17 p.t. (isto é, 3 e 7 dias após castração), os animais foram examinados e o estado das lesões de castração foram avaliados quanto a presença de oviposição e miíase ativa com presença de larvas vivas de *C. hominivorax* e exudato sero-hemorrágico. Doramectin foi mais efetivo do que ivermectin na proteção dos animais castratados 10 dias após os tratamentos e expostos ao desafio natural. A média geral de eficácia do doramectin foi de 94,6% (variação entre 53,3% e 100%) comparado com 43,7% (variação entre 0% a 100%) para o ivermectin. Esta diferença foi estatisticamente significante ($p<0,0001$). Doramectin teve 73 testes de 91 repetições com eficácias maiores do que 90% enquanto ivermectin teve somente 3 testes. Por outro lado, ivermectin teve 56 testes com resultados de eficácia menores do que 50% enquanto a menor eficácia de doramectin foi de 53,3% em um único teste. A eficácia de doramectin foi maior do que ivermectin em 90 das 91 repetições e em somente 1 teste, ivermectin foi igual a doramectin com eficácia de 100%.

PALVARAS-CHAVE: Doramectin, ivermectin, eficácia persistente, prevenção, *Cochliomyia hominivorax*, bovinos.

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