# STRATEGIC CONTROL OF *BOOPHILUS MICROPLUS* WITH DORAMECTIN AND THE EFFECT ON THE POPULATION DYNAMICS OF *DERMATOBIA HOMINIS* AND GASTROINTESTINAL HELMINTHS

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SUMMARY: With the aim of evaluating two strategic treatment schemes for the control of *Boophilus microplus* using endectocides, as well as their effects on the *Dermatobia hominis* population and on the gastrointestinal helminth infections, 30 cross-bred beef steers, approximately one year old were equally distributed to three paddocks, and were replaced once a year. Animals in paddock "A" were treated with acaricide/boticide when the mean infestation on one side of the body was equal or higher than 20 *B. microplus* females over 4mm long and around 10 *D. hominis* nodules. They were treated with anthelmintic when the mean count of eggs per gram feces (EPG) was equal to or higher than 250. The animals of paddock "B" were treated twice with doramectin at 0.2mg/kg bodyweight subcutaneously, in Mid-January and 35 days later.

Animals in paddock "C" were treated twice a year with doramectin at 0.2mg/kg bodyweight subcutaneously, in mid-August and 35 days later. The cattle in paddock "A" needed about 4 acaricide/ boticide treatments per year to control *B. microplus* and *D. hominis*, and three anthelmintic treatments to control helminth infections in the technical levels established. In cattle of paddock "B" treatments partially controlled the *B. microplus* population mainly during the second and third years of the experiment, and only four peak infestations were above the technical criteria. The number of *D. hominis* nodules remained during the three years below the technical criteria for approximately 10 months each year. The EPG continuously declined from the beginning until the last year, with a single peak above 250, in the beginning of the third year of the experiment. In the cattle of paddock "C" the results of the control of *B. microplus* were similar to those of paddock "B". The number of *D. hominis* nodules remained below 10, except for a single occasion in the third year of the experiment. The EPG usually remained below 250 during the spring and summer in the three years of the experiment.

KEY WORDS: *Boophilus microplus*, *Dermatobia hominis*, gastrointestinal helminths, strategic control, population dynamics, treatments.

## *INTRODUCTION*

According to data of the Integrated Company for Agricultural Development of the State of Santa Catarina – CIDASC (1991), the cattle herd of that State was of 3,004,580 head and GRUMANN *et alii* (1977) stated that 68.7% of the beef herd was located in the Planalto Catarinense (Tablelands).

The most important factors for the reduction of productivity of the herd of that State are the seasonal fluctuation of pasture availability and parasitic diseases. These two factors have a synergistic effect, reducing feed conversion, retarding growth and decreasing weight gain. During winter losses may reach 15 to 20% of the bodyweight, with frequent mortality of young animals and female fertility indexes around 50% (ACARESC, 1977).

Parasitic disease control schemes, based on epidemiological studies, aiming primarily at reducing pasture contamination and secondly at a therapeutic treatment, have been widely studied around the world. With the same intent, in 1979, studies were initiated in the Tablelands of the State of Santa Catarina, providing significant data on the biology of *B. microplus*. The studies of the free-living phase demonstrated that eggs from engorged females exposed to the environment from April to August were always infertile. Another epidemiologically important factor was the observation of a concentration in egg hatching in January and February, increasing the possibility of cattle infestation. (SOUZA *et alii*, 1988a). This fact was proven when SOUZA *et alii* (1988b) studied seasonal variation.

From these studies, it may be concluded that some larvae may survive and infest cattle during autumn, winter and beginning of spring and the most severe infestations in cattle occur in summer and autumn.

In Brazil, research on the strategic control of *B. microplus* were carried out by ALVES-BRANCO *et alii* (1989) and QUEIROLO & PONTES (1995) in the State of Rio Grande do Sul and by VERÍSSIMO *et alii* (1997) in the State of São Paulo, and on strategic control of helminths by PINHEIRO (1970) in Rio Grande do Sul, by BIANCHIN & MELO (1985) in the State of Mato Grosso do Sul and by GUIMARÃES *et alii* (1997) in the State of Minas Gerais.

In the Tablelands of Santa Catarina, RAMOS *et alii* (1984), tested anthelmintic treatment systems and observed that animals treated every 45 days reached 380kg bodyweight one and a half year before non-treated animals.

In spite of the studies on the epidemiology of *D. hominis* carried out by BELLATO *et alii* (1986) and PALOSCHI (1989) in Santa Catarina, OLIVEIRA (1989) in São Paulo and GOMES *et alii* (1989) in Mato Grosso do Sul, there are not enough data regarding strategic control.

With the advent of the endectocides, it is possible to evaluate strategic control schemes for *B. microplus* and the effect on the populations of gastrointestinal helminths and *D. hominis*, which was the objective of this work.

## MATERIALS AND METHODS

The experiment was carried out in a 230ha farm, located at Lages, Santa Catarina, in native pasture which bore a maximum of 0.4 animal unit/ha of crossbred beef cattle, allocated by the Empresa de Pesquisa Agropecuária e Difusão de Tecnologia de Santa Catarina.

In order to assess two strategic *B. microplus* control schemes with the use of endectocides, as well as the effect on the population of *D. hominis* and on gastrointestinal helminth infections, 30 crossbred beef steers approximately one year old were used. They were evenly distributed in three paddocks, with the same husbandry practices, except for parasite control, and were replaced annually. For each paddock (A, B and C) ten animals were identified after prior random grouping according to *B. microplus* infestation levels, breed and weight.

All animals in the paddock with treatment "A" received acaride/boticide dosings of flumethrin and trichlorfon, when on one half of the body surface the mean *B. microplus* infestation was equal to or higher than 20 females more than 4mm long or when the number of *D. hominis* nodules was equal to or higher than 10. They were treated with anthelmintics when the mean count of eggs per gram (EPG) feces was equal to or higher than 250 (technical indexes).

All animals in paddock "B" were treated twice with 0.2mg/kg bodyweight doramectin subcutaneously, in mid-August and 35 days later.

Every 14 days, *B. microplus* females more than 4mm long were counted on the right half of the body of each animal of the three groups, as well as the *D. hominis* nodules, and feces were collected to quantify the EPG of gastrointestinal nematodes with the technique of GORDON & WHITLOCK (1939).

Every 28 days the animals were weighed to evaluate the cost/benefit ratio.

## RESULTS AND DISCUSSION

The results of the present experiment are presented in Figures 1 to 12, and the climatic data are shown in Figure 13. Strategic treatment with doramectin in mid-January, 1994 and 35 days later, in the first year of the experiment, considerably reduced the population of *B. microplus*, although this was not enough to keep that population below the technically recommended levels for autumn and early winter. This was possibly due to the occurrence of above-normal temperatures in May reaching a mean of 15.5°C, with the absence of frost, which are common in this part of the year, as well as the high pasture infestation. In the second and third years, 14 days after the second treatment, some animals were infested with *B. microplus*, then a third dose was administered to prevent pasture recontamination, and this resulted in a considerable reduction in the population of *B. microplus* in these two years (Figure 2).

GONZALES *et alii* (1998) observed that a single doramectin injection at a dose of 200 µg/kg bodyweight was effective to eliminate the adult parasite population and to prevent development of immature stages. Besides, the effect of the treatment persisted for at least 20 days, and no engorged females were detected until 42 days after treatment. These results differ partially from those found in the present experiment, maybe due to different experimental conditions.

The strategic control recommended in Figure 2 for the Tablelands of Lages, SC, is related to the period needed for a significant reduction in the numbers of *B. microplus* larvae in the pastures, observed by SOUZA *et alii* (1993), which ranges, depending on the temperature, from 63 to 126 days, and to the fact that in that region from April to August the oviopositions are generally infertile (SOUZA *et alii*, 1988a).

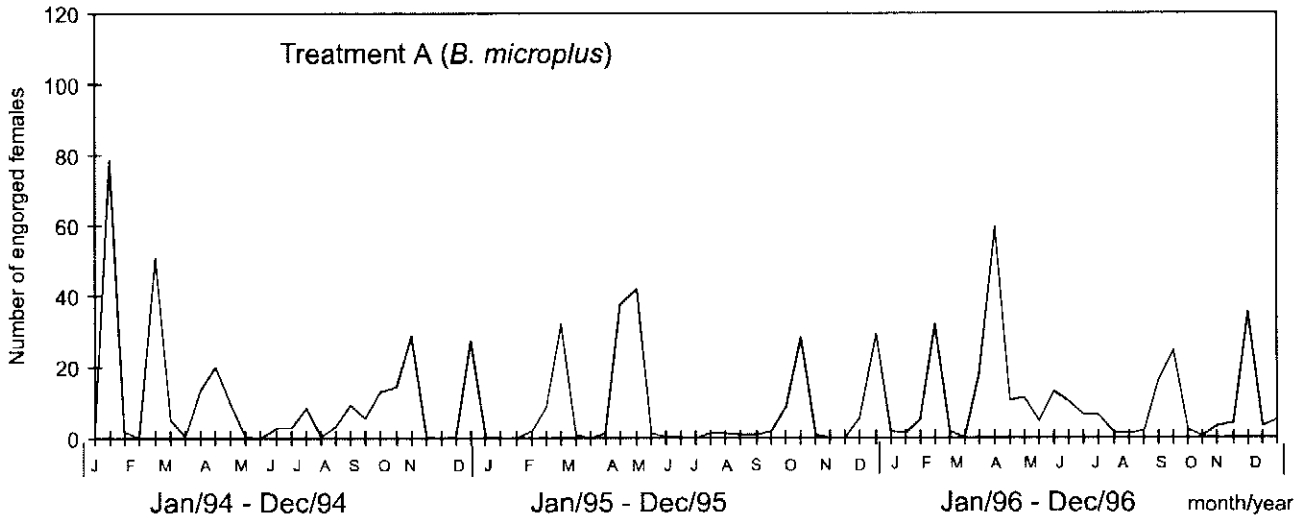


Figure 1 - Effect of the acaricide/boticide treatments on *B. microplus*, administered when the mean number of engorged females on one half of the cattle's body was equal to or higher than 20, in the Tablelands of Lages.

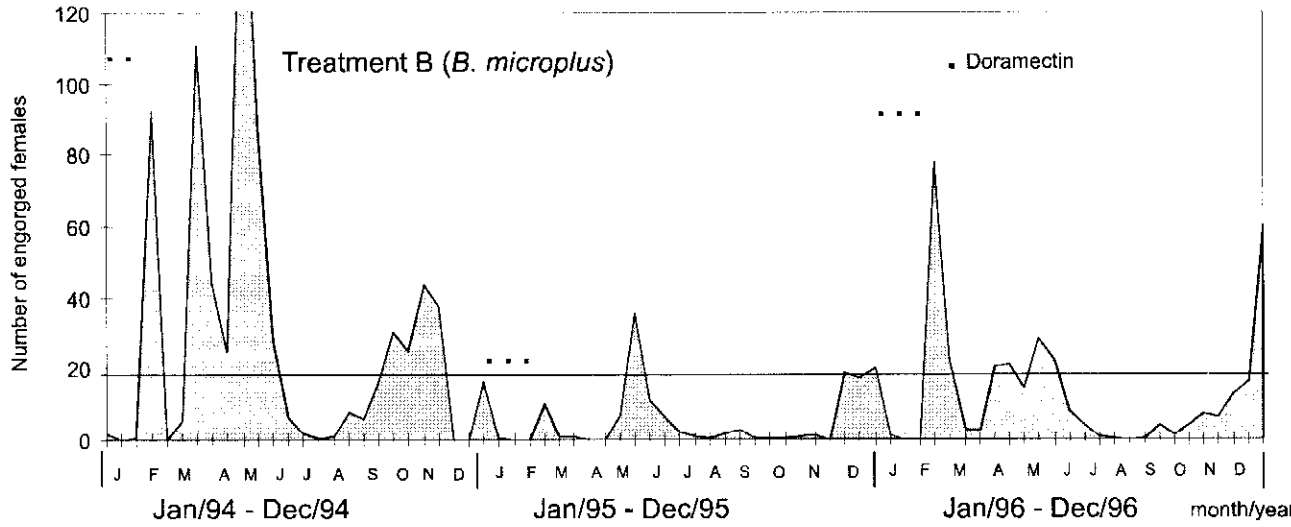


Figure 2 - Effect of strategic control with doramectin in mid-January and February, on the number of *B. microplus* engorged females on cattle, in the Tablelands of Lages.

For the control of *B. microplus*, with treatment "A" 13 dosings were necessary during the three experimental years (Figure 1).

The number of *D. hominis* nodules remained below the technical indexes recommended for the treatment for 8 months after the last administration of doramectin, in the first year of the experiment and for 10 months in the remaining two (Figure 4). Group "A", in spite of having received 12 acaricide/boticide treatments during the three years, presented *D. hominis* nodules in higher numbers than recommended for treatment in five occasions (Figure 3).

The most important peaks of *D. hominis* found in the present work coincide with those observed by BELLATO *et alii* (1986). The efficacy and protective effect observed are in agreement with those demonstrated by MOYA-BORJA (1993) when, in experimental conditions, animals challenged 35 days after treatment with 25 *D. hominis* larvae, did not acquire infestation.

The population of gastrointestinal helminths gradually decreased, reaching the recommended level for treatment only in December during the second year of the experiment, and in the third year no treatment was necessary apart from the

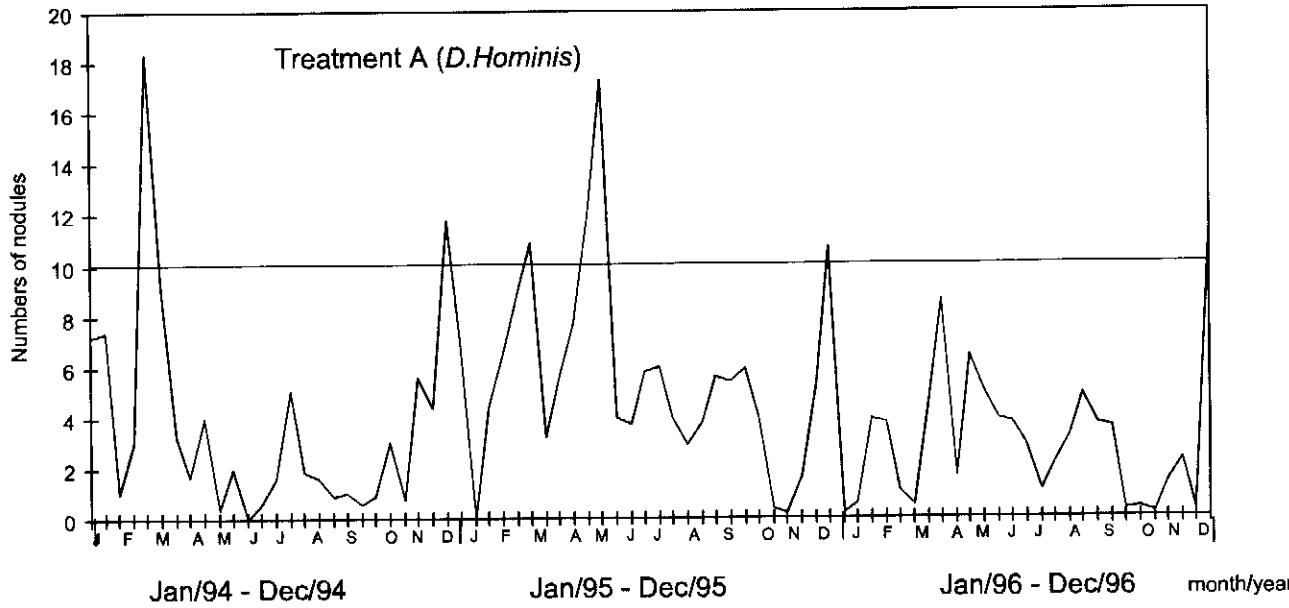


Figure 3 - Effect of the acaricide/boticide treatments on the number of *Dermatobia hominis* nodules in cattle, in the Tablelands of Lages.

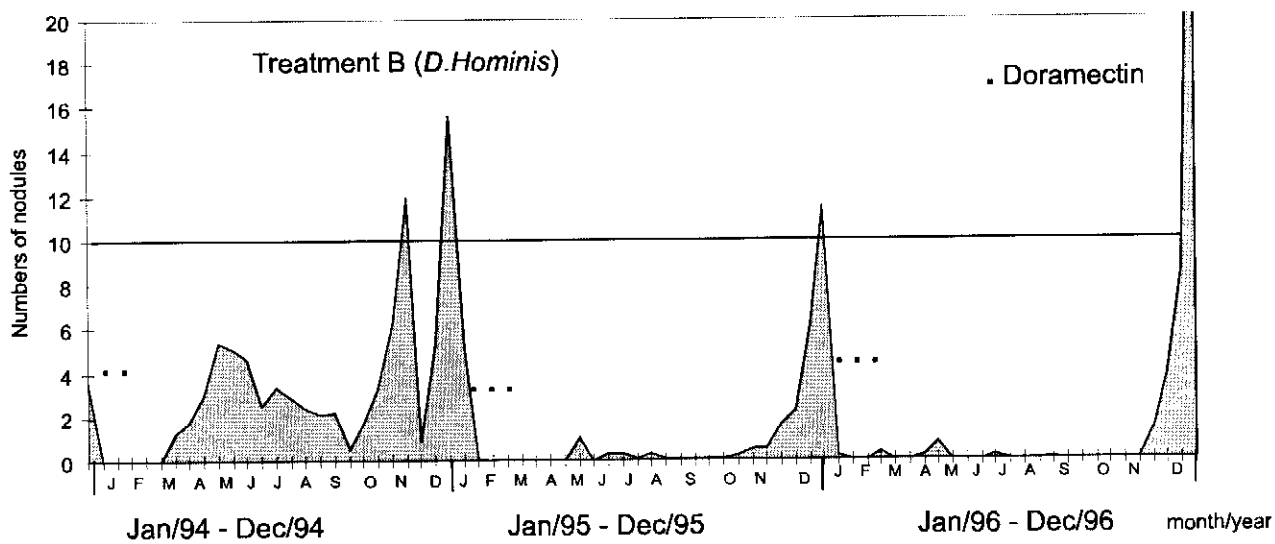


Figure 4 - Effect of strategic control of *Boophilus microplus* with doramectin, on the number of *Dermatobia hominis* nodules in cattle, in the Tablelands of Lages.

strategic scheme (Figure 6). These results may be explained by the time period when the pasture remained uncontaminated and by the efficacy and residual effect of doramectin, like those demonstrated by YAZWINSKI *et alii* (1994), who observed efficacy rates equal or higher than 99' for all nematodes except for *Trichuris ovis* and *Nematodirus helvetianus*. SOUZA *et alii* (1995) demonstrated that in the city of Lages, SC, in summer, the withdrawal from pasture promotes a significant decontamination in terms of nematode larvae in 70 days.

In treatment "A", eight anthelminthic treatments where necessary during the three experimental years (Figure 5) and the mean EPG counts where always higher during the experiment.

After coproculture and identification of larvae, the predominant genera observed where: *Haemonchus* spp, *Ostertagia* spp, *Trichostrongylus* spp, *Cooperia* spp and *Oesophagostomum* spp.

The mean weight gains per animal/year were 63.6; 59.7; and 116kg in treatment "B", dosed strategically, and 70.6; 69.7 and 104.3kg in treatment "A".

The statistical analysis did not evidence any difference at

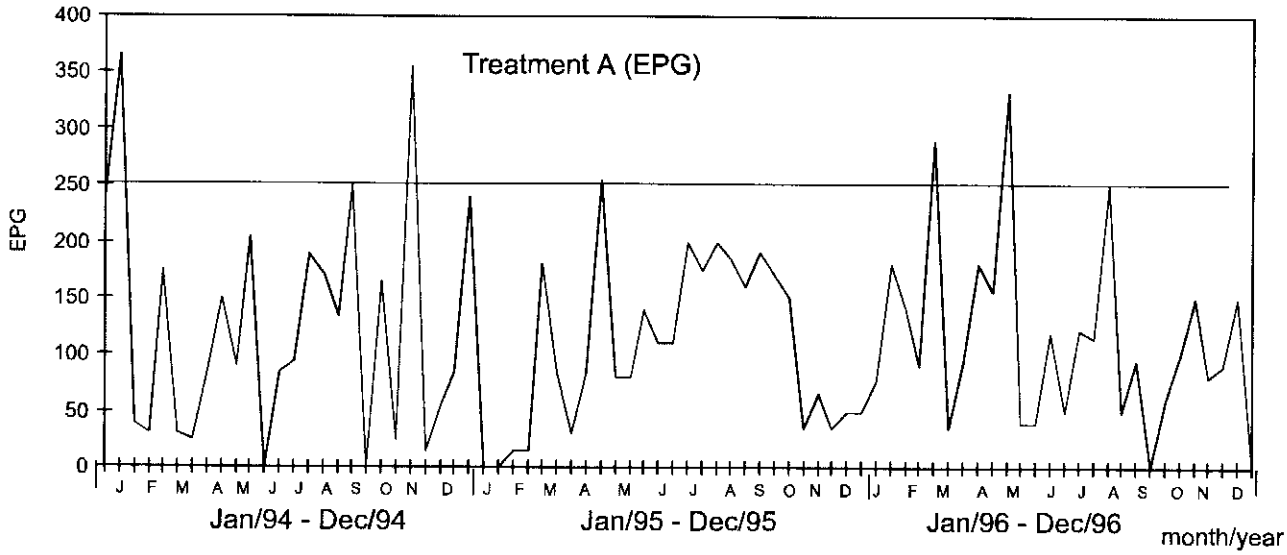


Figure 5 - Effect of anthelmintic treatments, administered when the mean eggs per gram feces, was equal to or higher than 250, in the Tablelands of Lages.

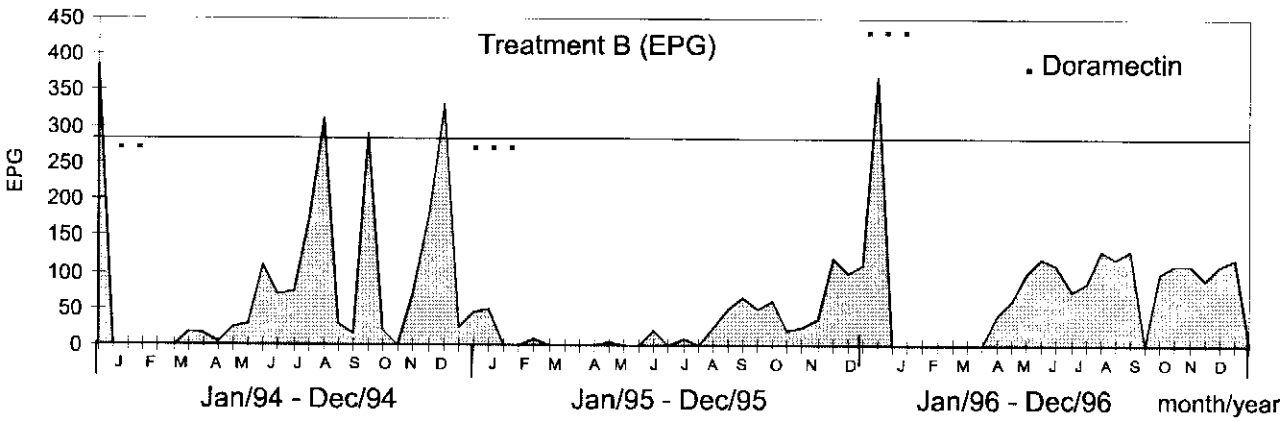


Figure 6 - Effect of strategic control of *Boophilus microplus* with doramectin, in Mid-January and February, on the number of helminth eggs per gram of cattle feces, in the Tablelands of Lages.

the 5% confidence level between treatments "A" and "B" in each experimental year. Thg mean annual cost for parasiticides and labor to carry them out, projected for 100 animals was R$568.00 and R$576.00, respectively.

For the strategic treatment which had begun in mid-August (treatment C), it was observed that although doramectin had been effective against *B. microplus*, two treatments with a 35-day interval were not enough to prevent infestations from reaching the recommended levels for treatment, around November, in the three experimental years (Figure 8), a time when there usually is a rise in the infestation levels with this parasite, according to SOUZA *et alii* (1988b). Probably, in early August, the engorged females that detached found weather conditions that allowed the occurrence of fertile ovipositions with larval hatching in November. Due to the high parasitic burden, treatments with flumethrin and trichlorfon-based products were administered. However, the strategic treatment gradually reduced the number of treatments for *B. microplus* control from one year to the next. This demonstrates that there was a reduction in pasture contamination.

In treatment "A", during the three experimental years, 13 acaricide treatments were necessary, and the number of treatments per year was similar (Figure 7).

The population of *D. hominis* remained below the recommended technical levels for treatment, with only one peak above this level, in the last year of the experiment (Figure 10). The strategic treatment for the control of *B. microplus*, beginning in mid-August, coincides with the recommended

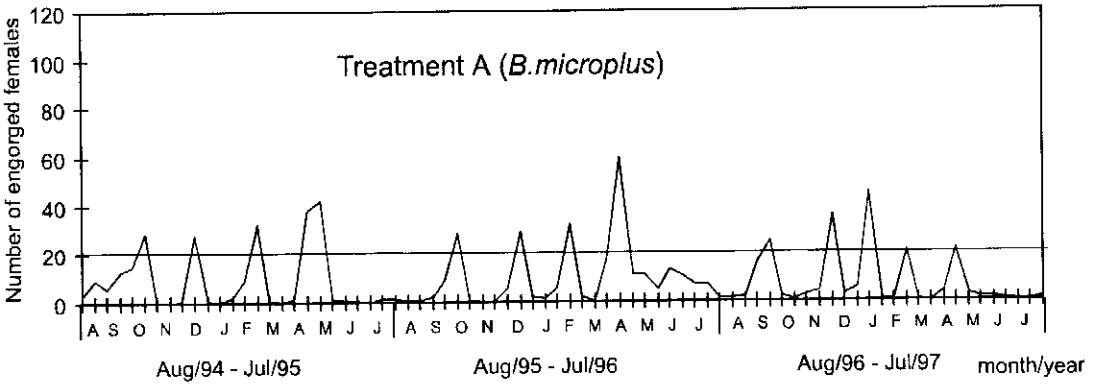


Figure 7 - Effect of the acaricide/boticide treatments on *B. microplus*, administered when the mean number of engorged females on one half of the cattle's body was equal to or higher than 20, in the Tablelands of Lages.

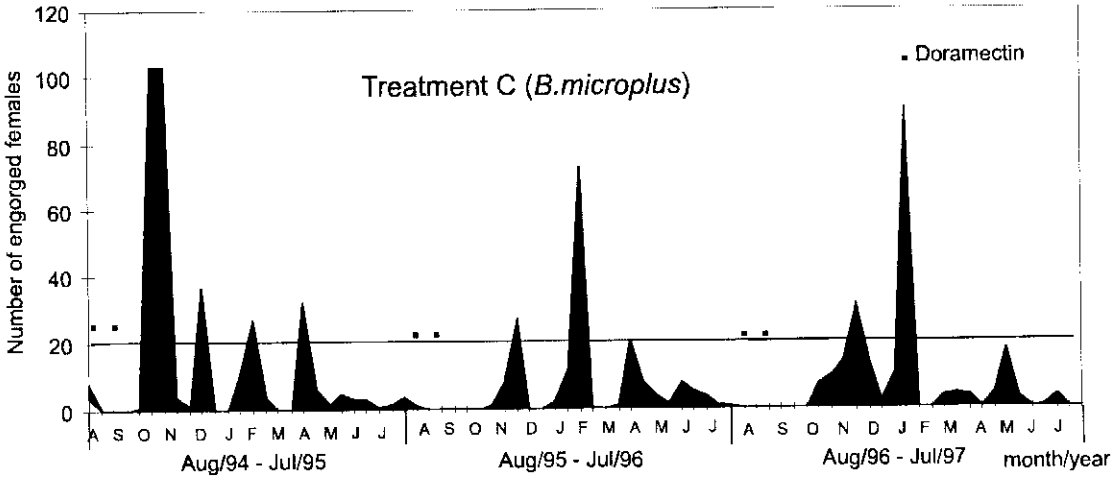


Figure 8 - Effect of strategic control with doramectin in mid-August and September, on the number of *B. microplus* engorged females on cattle, in the Tablelands of Lages.

period for the control of *D. hominis*, based on the epidemiological study carried out by BELLATO *et alii* (1986).

The effect of strategic control of *B. microplus*, using doramectin and beginning in mid-August, was effective in the reduction of the population of gastrointestinal helminths only in the first year of the experiment (Figure 12). In the other two years the animals acquired infections equal to or higher than 250 epg for five times. During this period the temperatures are milder than in summer, what probably explains the difference in the results obtained for the two periods of strategic treatments.

In treatment "A" nine anthelmintic treatments were necessary during the three years (Figure 11).

The mean weight gains per animal/year were 108.5; 105.5 and 112.8kg in treatment "C" and 83.7; 88.0 and 91.4 kg in "A". Statistically significant difference at the 5% confidence level was achieved in the first year of the experiment only. This fact may be related to the reduced infection by gastrointestinal helminths, in this year, in the strategically treated group. The mean annual cost with parasiticides and labor to carry the treatments out, projected for 100 animals, were R$593.00 and R$553.00 respectively.

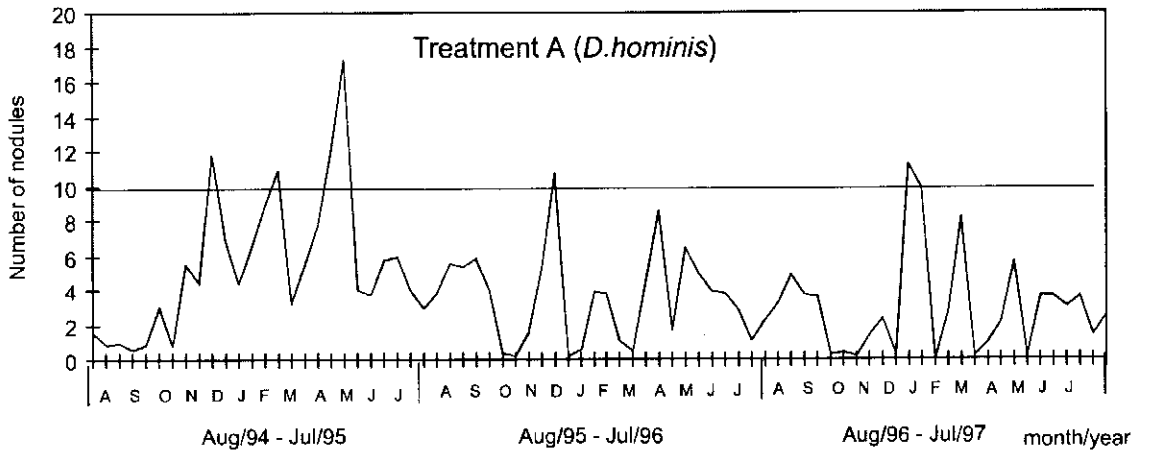


Figure 9 - Effect of the acaricide/boticide treatments on the number of *Dermatobia hominis* nodules in cattle, in the Tablelands of Lages.

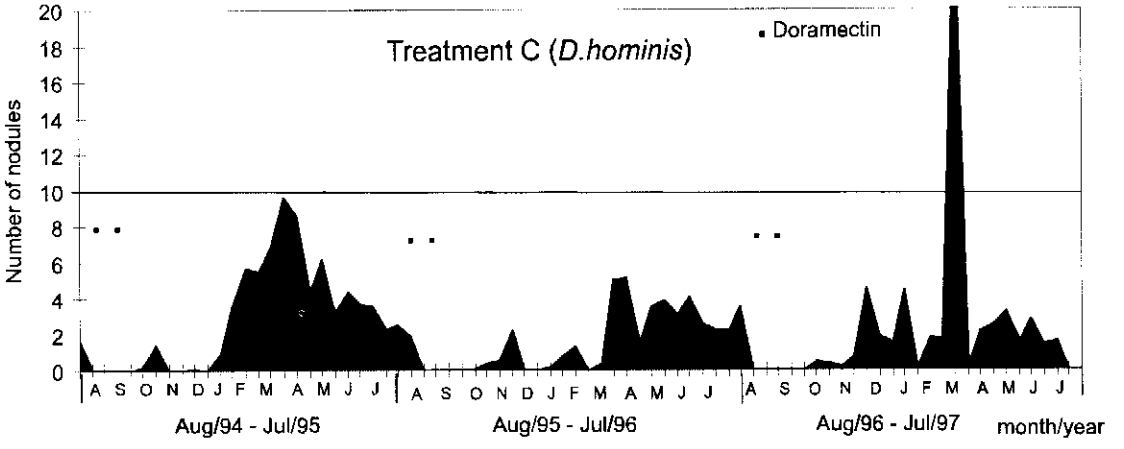


Figure 10 - Effect of strategic control of *Boophilus microplus* with doramectin, on the number of *Dermatobia hominis* nodules in cattle, in the Tablelands of Lages.

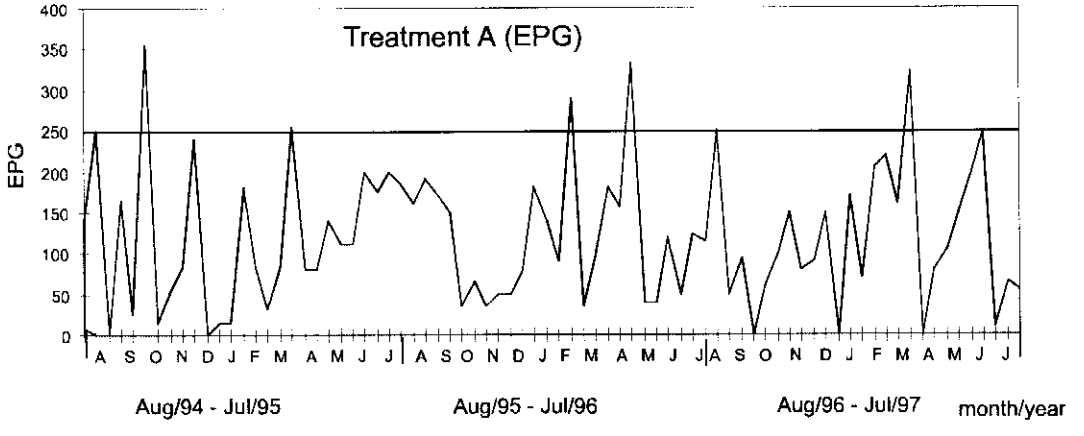


Figure 11 - Effect of anthelmintic treatments, administered when the mean eggs per gram of feces, was equal to or higher than 250, in the Tablelands of Lages.

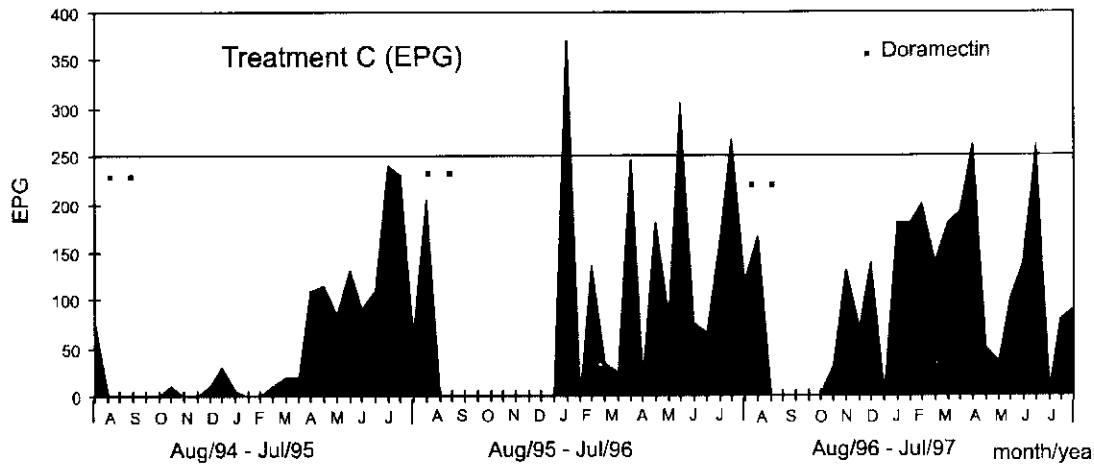


Figure 12 - Effect of strategic control of *Boophilus microplus* with doramectin, in Mid-January and February, on the number of helminth eggs per gram of cattle feces, in the Tablelands of Lages.

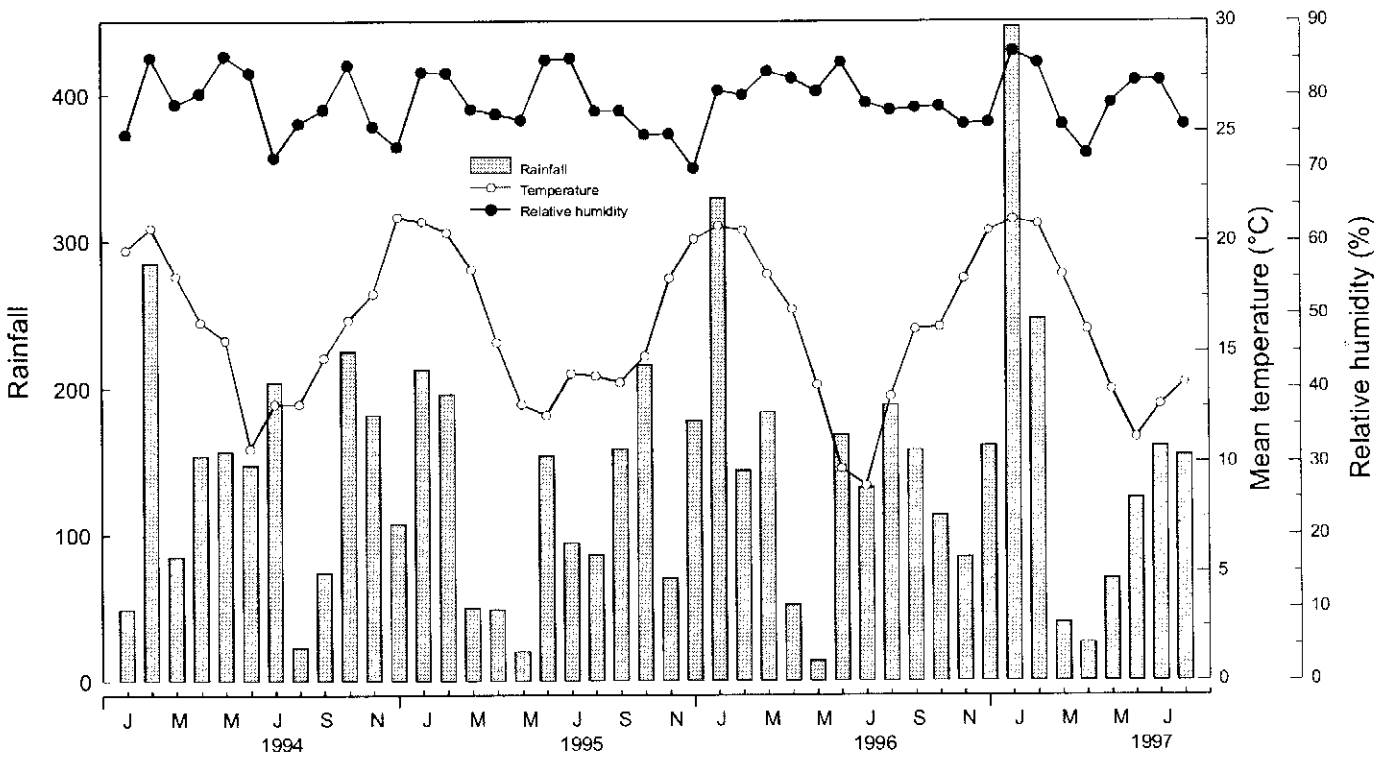


Figure 13 - Mean monthly temperature, relative humidity and rainfall in the period of January 1994, through July 1997.

## *SUMÁRIO*

Com o objetivo de avaliar dois esquemas estratégicos de controle do *B. microplus* com uso de endectocida, bem como o efeito na população de *D. hominis* e nas infecções por helmintos gastrintestinais, utilizaram-se 30 novilhos mestiços para corte, com aproximadamente um ano de idade e distribuídos eqüitativamente em três invernadas, sendo substituídos anualmente. Os animais da invernada "A" receberam tratamento carrapaticida/bernicida quando em um lado do corpo, a infestação média por *B. microplus*, encontrava-se igual ou acima de 20 fêmeas com tamanho superior a quatro milímetros e em torno de 10 nódulos de *D. hominis*. Foram tratados com anti-helmínticos quando a contagem média de ovos por grama de fezes (OPG) estava igual ou acima de 250. Os animais da invernada "B" foram tratados duas vezes com doramectin a 0,2 mg/Kg de peso vivo

por via subcutânea, em meados de janeiro e 35 dias após. Os animais da invernada "C" foram medicados duas vezes por ano com doramectin a 0,2 mg/kg de peso vivo por via subcutânea em meados de agosto e 35 dias após. Os bovinos da invernada "A" necessitaram em torno quatro tratamentos carrapaticidas/ bernicidas por ano para controlar o *B. microplus* e *D. hominis* e de três aplicações de anti-helmínticos para controlar as helmintoses nos níveis técnicos estabelecidos. Nos bovinos da invernada "B" as medicações controlaram parcialmente a população de *B. microplus* principalmente durante o segundo e terceiro ano do experimento, ocorrendo apenas quatro picos de infestação acima dos índices técnicos. O número de nódulos de *D. hominis* manteve-se durante os três anos abaixo dos índices técnicos por aproximadamente 10 meses em cada ano. O OPG apresentou um contínuo declínio do início até o último ano, apresentando apenas um pico acima de 250, no início do terceiro ano do experimento. Nos bovinos da invernada "C" os resultados do controle do *B. microplus* foram semelhantes aos da invernada "B". O número de nódulos de *D. hominis* manteve-se abaixo de 10, exceto uma vez no terceiro ano do experimento. O OPG apresentou-se abaixo de 250 durante a primavera e verão nos três anos do experimento.

PALAVRAS-CHAVE: *Boophilus microplus*, *Dermatobia hominis*, helmintos gastrointestinais, controle estratégico, dinâmica populacional, tratamentos.

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