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# The efficiency of avermectins (abamectin, doramectin and ivermectin) in the control of *Boophilus microplus*, in artificially infested bovines kept in field conditions

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ABSTRACT

Tests were performed on artificially infested bovines, kept in field conditions, to assess the efficiency of avermectins (abamectin, doramectin and ivermectin) on *Boophilus microplus* (Canestrini, 1887). This assessment was carried out on 40 bovines, in the Paraíba Valley, in the State of São Paulo, Brazil. These bovines were distributed into four groups (abamectin, doramectin, ivermectin and a control group), after artificial infestation with some 4000 larvae per animal on days −21, −14, −7, −1, 7 and 14. The animals from the treated groups were subcutaneously injected with the commercial avermectins, at a dose of 200 μg/kg of live weight (1 mL/50 kg). The best results were shown by the group treated with doramectin, both in relation to the reduction of female count (an average of 85.92% between 3rd and 28th day after treatment) and also in the reduction of oviposition among the females collected from the bovines after treatment and then kept in the laboratory (an average of 83.51%). None of the avermectins proved to be efficient in inhibiting the hatching of the larvae.



## 1. Introduction

The bovine tick, *Boophilus microplus*, causes significant economic harm to livestock raising, due to factors such as lower milk production, reduction in weight gain, injury to the leather, and general retardation of growth. Such damage is largely due to its skin-peeling action and also the transmission of diseases such as redwater fever and anaplasmosis to the hosts. According to data supplied by Grisi et al. (2002), the total economic losses for the Brazilian livestock business, arising from this skin-peeling action, disease and the costs incurred in controlling bovine ticks, totals about 2 billion dollars per year.

The methods currently used for controlling ticks are almost exclusively based on the use of chemicals (anti-tick compounds), including avermectins. Avermectins are products obtained from the fermentation of the fungus *Streptomyces avermitilis*; they were discovered in 1975, with ivermectin being the first to be put on the market. Abamectin and doramectin, other representatives of the group, were launched at a later date. The systematic action of the avermectins (the name coming from a combination of *a* = without + *verm* = worm + *ect* = ectoparasites + *in* = -pharmaceutical product) led to the coining of the new term, endectocide (Shoop et al., 1995).

Their endectocidal activities and the practicality of treatment (normally either injectable or pour-on) have made avermectins one of the assets most used by livestock farmers for the control of bovine ticks in the country. This fact is indeed reflected in the number of products with these ingredients that are currently available on the

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Brazilian market. According to the Compendium of Veterinary Products, Sindan (2008), there are 113 such brands, of which 66 are ivermectins, 46 abamectins and 1 doramectin.

Several studies on this issue have confirmed the efficiency of avermectins in the control of *B. microplus*. However, there is no study comparing the performance of the different avermectins (abamectin, doramectin and ivermectin) in controlling the tick *B. microplus* in animals that have been artificially infested and kept in field conditions.

## 2. Materials and methods

These experiments were performed in the Regional Agribusiness Technology Development Pole of the Paraíba Valley, in the municipality of Pindamonhangaba, in the Paraíba Valley, State of São Paulo, Brazil.

Forty calves of the Mantiqueira and Dutch ecotypes, regularly treated with ivermectin 1% (Ivermecthal® Minerthal Saúde Animal, Brazil) for the control of ecto- and endoparasites, with ages ranging between 1.5 and 2.0 years, were selected from a batch of 60 animals, after having been artificially infested in the three previous weeks (−21, −14 and −7 days) and also on the day immediately preceding treatment (−1) with about 4000 larvae of *B. microplus* per animal. On day zero, according to the geometric mean of three separate counts of females with sizes between 4.5 mm and 8.0 mm, on the left side of the animal, taken on days −2, −1 and zero, the calves were then put in decreasing order of infestation and then randomised, with distribution into four groups of 10 animals each, three groups being treated with abamectin 1% (Animax® - Agener União Saúde Animal, Brazil), doramectin 1% (Dectomax® - Pfizer Saúde Animal, Brazil) and ivermectin 1% (IVOMEC® - Merial Saúde Animal, Brazil), respectively and one, a control group, not being treated. The animals of the treated groups received subcutaneous injections of avermectins at a dose of 200 μg/kg of live weight (1 mL/50 kg). On days 7 and 14 after treatment, each calf was infested with an additional 4000 larvae.

The elimination of *B. microplus* and the effect of each product were assessed by counting all the female ticks between 4.5 mm and 8.0 mm in length, present on the left side of each bovine (Wharton et al., 1970), on days 1, 3, 7, 14, 21, 28 and 35. The counts were always made at the same time, and by the same person (between 7 and 9 a.m.). The efficacy of each product was assessed using the method proposed by Roulston and Wharton (1968).

On the days on which counts were made after treatment, 10 engorged females of *B. microplus* were collected by group for in vitro assessment of the reproductive performance and for calculating the percentage of reduction in laying and hatching of larvae, according to Abbott (1925).

Logarithmic transformations of the $\log(x + 1)$ type were then made, for statistical analysis. The variances between the average female count between treatments, and between the days of treatment and after treatment (0, 1, 3, 7, 14, 21, 28 and 35) were analysed making use of the Tukey test, assuming a probabilistic error between 1% and 5%, for comparison of means.

## 3. Results

According to the analysis of the average counts and efficiency of treatment, as shown in Table 1, there was no significant difference between the four groups, regarding counts on day 1. As from day 3, the products started to show an influence on the counts, when compared to the control (untreated) group. This effect persisted until day 28, with the treated groups showing statistically significant differences compared with the control group, with the sole exception of abamectin on day 14.

All groups treated showed efficiency throughout the duration of the experiment, with an advantage for the doramectin group which had the lowest average count (6.15 ticks per animal), being statistically different from the others ($p < 0.01$), and also having the greatest average efficiency (85.92%), considering the period between day 3 and day 28 after treatment. In this case the action of the active ingredients in fighting ticks became evident. All these products showed a residual effect lasting 7 days, against reinfestation with larvae.

The analysis of the oviposition of *B. microplus* collected after the treatment (Table 2) shows the action of all these

**Table 1**
Average count of females of *Boophilus microplus* on day zero and after treatment with avermectins and respective efficiency. Tukey Test. Paraíba Valley, São Paulo, Brazil.

| Days post-treatment | Tick numbers | | | | Efficacy (%) | | |
|---|---|---|---|---|---|---|---|
| | Control group | Treated group | | | Treated group | | |
| | | Abamectin | Doramectin | Ivermectin | Abamectin | Doramectin | Ivermectin |
| Zero | 28.81$^{a*A**}$ | 29.62$^{a\ A}$ | 29.51$^{a\ A}$ | 29.28$^{a\ A}$ | | Not applicable | |
| 1 | 31.08$^{a\ A}$ | 28.52$^{a\ A}$ | 30.15$^{a\ A}$ | 23.98$^{a\ A}$ | **11.37** | **5.96** | **24.61** |
| 3 | 37.50$^{a\ A}$ | 17.62$^{b\ AB}$ | 13.43$^{b\ B}$ | 17.98$^{b\ AB}$ | **54.63** | **65.29** | **53.16** |
| 7 | 55.15$^{a\ A}$ | 14.08$^{b\ AB}$ | 5.20$^{c\ B}$ | 9.88$^{bc\ B}$ | **75.34** | **90.87** | **82.50** |
| 14 | 61.70$^{a\ A}$ | 26.94$^{ab\ AB}$ | 6.61$^{c\ C}$ | 17.99$^{b\ BC}$ | **57.82** | **89.62** | **71.51** |
| 21 | 82.90$^{a\ A}$ | 16.99$^{b\ B}$ | 3.44$^{c\ C}$ | 15.08$^{b\ B}$ | **80.20** | **95.98** | **82.22** |
| 28 | 54.82$^{a\ A}$ | 18.52$^{b\ AB}$ | 4.66$^{c\ B}$ | 11.93$^{b\ BC}$ | **67.37** | **91.76** | **78.74** |
| 35 | 60.51$^{a\ A}$ | 45.29$^{a\ A}$ | 40.74$^{a\ A}$ | 47.36$^{a\ A}$ | **27.70** | **34.73** | **23.53** |
| 3–28 | 56.51$^{a\ A}$ | 18.41$^{b\ B}$ | 6.15$^{c\ C}$ | 13.73$^{b\ B}$ | **66.35** | **85.92** | **72,70** |

Means within lines with different letters (a–c) are significantly different $^{*}p < 0.05$ and means within lines with different letters (A–C) are significantly different $^{**}p < 0.01$.