

Efficacy of acaricides used to control the cattle tick in dairy herds raised in Rondônia - Brito L.G.^{1*}, Barbieri F.S.¹, Rocha R.B.¹, Oliveira M.C.S.²

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Most dairy herds in the Rondônia are crossbreeds with varying bloodline degrees. However, the incorporation of cattle with greater percentages of taurine breeds specialized for milk production has made dairy herds more susceptible to infestation by ticks. The climate conditions in Rondônia are propitious for the establishment of cattle ticks due to the predominantly equatorial climate. Besides transmitting diseases, *Rhipicephalus microplus* impairs milk production costs. The intensive use of chemical formulations leads to loss of efficacy of the base molecules because of the development of resistant tick populations. The spread of this resistance reveals the limits on chemical control of this parasite, making it essential to administer these chemicals wisely. The adult immersion test (AIT) was used to evaluate the efficacy of pesticides used for control of *R. microplus* on 106 populations collected in Rondônia. The analysis of the data showed that the pesticides had different efficacies on the tick populations surveyed. The synthetic pyrethroids (SPs) acaricides were the least effective ($61.23 \pm 6.83\%$), followed by SP + organophosphate (OP) associations ($74.08 \pm 4.10\%$) and amidine ($77.20 \pm 15.53\%$). For the macrocyclic lactones (MLs), the milbemycin ($99.94 \pm 0.51\%$) was the most effective, followed by spinosad ($99.96 \pm 0.23\%$) and the avermectins ($97.61 \pm 4.29\%$). The phenylpyrazole (PZ) group had similar efficacy ($99.90 \pm 0.74\%$) to the MLs. Therefore, SP acaricides, including associations with OP, and formulations based on amidine presented low in vitro efficacy to control the *R. microplus* populations surveyed. Such measures are important to delay the development of resistant *R. microplus* populations.

Key-words: acaricide resistance, *Rhipicephalus microplus*, adult immersion test

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Efficacy of acaricides used to control the cattle tick in dairy herds raised in Rondônia

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Introduction

Most dairy herds in the Brazilian Southwestern Amazon are crossbreeds (*Bos Taurus* × *Bos indicus*) with varying bloodline degrees. However, the incorporation of crossbreeds with greater percentages of taurine breeds specialized for milk production, such as Holsteins, has made dairy herds more susceptible to infestation by ticks (Jonsson et al., 2006). The climate conditions in the region are propitious for the establishment of cattle ticks due to the predominantly equatorial climate. Besides transmitting diseases, *R. microplus* impairs milk production because each female tick is able to ingest 1.0mL of blood from the host cow during its parasite phase, causing a weight loss of approximately 1 g and reducing milk production by 8.9mL. In economic terms, these ticks cost farmers around US\$ 7.30/head/year when considering the production losses and treatment costs (Jonsson et al., 1998; Jonsson, 2006). Despite the disadvantages of using acaricides, such as environmental contamination, potentially harmful residues in meat and milk, and toxicity to workers who apply them, these drugs are still essential to control tick infestations in the world (de Castro, 1997). However, the intensive use of chemical formulations leads to loss of efficacy of the base molecules because of the development of resistant tick populations. The spread of this resistance reveals the limits on chemical control of this parasite, making it essential to administer these chemicals wisely (FAO, 2004). There are reports in the literature of growing resistance of cattle ticks to chemical molecules in many countries including Brazil, but the status is unknown of pesticide resistance in cattle ticks collected in the Southwestern Amazon (FAO, 2004; Furlong et al., 2007).

Materials and Methods

Collection and Preparation of Ticks: Engorged female ticks were collected from 106 dairy herds were formed of crossbreed animals of Holstein and dairy Gir raised in Rondônia. In each farm, up to 250 engorged female *R. microplus* ticks were collected from cows naturally infected, none of which had received tick treatments for at least 30 days and the samples were shipped to the Embrapa Rondônia Animal Health Laboratory for the evaluation of the *in vitro* efficacy of acaricides. Engorged females weighing between 160 and 300 mg, with no signs of injury, were used in the tests. **Acaricides:** The following acaricides were tested: amitraz in a final concentration of 0.00006%; cypermethrin at a final concentration of 0.00015%; cypermethrin + dichlorvos at final concentrations of 0.00005% and 0.00045%, respectively, cypermethrin + deltamethrin + citronellal at final concentrations of 0.00015%, 0.00025%, and 0.00001%, respectively, deltamethrin at a final concentration of 0.0005%; doramectin, ivermectin; abamectin; spinosad and moxidectin, all at a final concentration of 0.0001%. Technical fipronil was used at a final concentration of 0.0001%. **Adult Immersion Tests:** The AIT conducted followed the method described by Drummond et al. (1973). For the evaluation of the avermectins (ivermectin, doramectin, and abamectin) and moxidectin, the females were immersed for 30 minutes in 30 mL of the solutions (Sabatini et al., 2001). The females of the control groups were immersed in distilled water for 30 minutes. After immersion time, all the engorged females were fixed with two-sided adhesive tape in Petri dishes, which were identified by group, weight, pesticide, and testing date. The Petri dishes were incubated in a B.O.D chamber at 27 ± 1°C and relative humidity of 85 ± 5%. After the oviposition period (14–18 days), the eggs were weighed and transferred to test tubes closed with cotton balls, which were replaced in the B.O.D chamber under the same temperature and relative humidity conditions described previously, where they remained until the larvae hatched.

Results and Discussion

The mean efficacy of the acaricides and their respective standard deviations against *R. microplus* collected from dairy herds in Rondônia are presented in Table 1. The products based on amide were more effective than the SP, but with a higher confidence interval. The data obtained suggest that citronellal enhanced the efficacy of the SP + OP association. The macrocyclic lactones (MLs) group, the spinosins, and milbemoyin showed high efficacy according to the AIT, as well as the PZ, all with a small confidence interval (Figure 1). Ivermectin, abamectin, and doramectin had lost efficacy on some farms, as shown by minimum efficacy values between 81 and 86%. Presently, the Working Group on Parasite Resistance (WGPR-FAO) recommends the AIT proposed by Drummond et al. (1973) for the evaluation of the susceptibility to acaricides in cattle tick populations, since it is fast, simple and a relatively cheap method for the detection of acaricide resistance in the field (FAO, 2004). Despite the high variation of AIT results obtained for SP, OP, abamectin and moxidectin as observed by Jonsson et al. (2007), the AIT is a valuable tool for the rapid and cheap detection of loss of susceptibility to a certain acaricide and should be used with this specific objective in resistance management programs.

Table 1. Efficacy of acaricides based on populations of *Rhipicephalus microplus* collected from dairy herds in the state of Rondônia, Brazil.

Chemical group of function	Min. Efficacy (%)	Max. Efficacy (%)	Mean Efficacy (n = 50)
Amide	51.35	100	77.20 ± 15.53
Cypermethrin	48.35	70.5	61.23 ± 6.81
Deltamethrin	61.22	76.84	67.10 ± 4.70
Cypermethrin + dichlorvos	68.91	81.47	71.08 ± 4.10
Cypermethrin + chlorpyrifos + citronellal	72.41	86.37	78.08 ± 4.10
Doramectin	86.21	100	92.74 ± 1.43
Ivermectin	86.84	100	97.61 ± 4.29
Abamectin	81.34	100	99.65 ± 2.22
Milbemoyin	94.84	100	99.94 ± 0.51
Spinosin	93.21	100	99.96 ± 0.23
Phenylpyrazole	92.78	100	99.90 ± 0.74

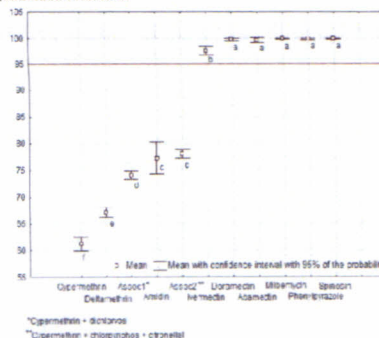


Figure 2: Effectiveness of acaricide bases observed in adult immersion test (AIT) in *Rhipicephalus microplus* populations surveyed in Rondônia state, Brazil.

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