

## Analysis of the use of fenthion via epicutaneous in dogs for *Rhipicephalus sanguineus* control

Análise do uso de *fenthion* via epicutânea em cães para o controle de *Rhipicephalus sanguineus*

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**Abstract** The action of fenthion was studied in a 15% epicutaneous formulation upon *Rhipicephalus sanguineus*, which may transmit pathogens to men and other animals, such as Ehrlichia, Babesia and Rickettsia. Dogs were artificially infected for the trial. The fenthion bioassays were begun four months after artificial infestation. The test group, having a mean of 186 ticks per dog, received the formulation dosage according to body weight on the neck region. Tick counts were performed, considering diameters  $\geq 2$ mm, during 11 days of treatment, in the most affected body areas: back, ears and paws. Before the application of fenthion in the dogs, it were observed an average 43.3% ticks in the ears, 38.1% in the back area and 17.6% in the paws. The number of ticks in dogs decreased by 36.2%, 63.8%, 82.7%, 67%, 40% and 4.9%, respectively on days 1, 2, 3, 5, 7, 9 and 11 after treatment. *R. sanguineus* anti-tick activity, lower than that officially recommended, was verified. The number of ticks increased progressively after the 5<sup>th</sup> day, demonstrating residual insecticide inefficacy. The results obtained did not indicate the use of this formulation, at the tested dosage, as an elective measure for *R. sanguineus* control.

**Key-words:** Ixodidae. Tick. *Rhipicephalus sanguineus*. Control. Fenthion.

**Resumo** Investigou-se a atividade de fenthion em formulação epicutânea a 15% sobre *Rhipicephalus sanguineus*, transmissor de patógenos ao homem e animais, tais como Ehrlichia, Babesia e Rickettsia. Infestou-se artificialmente cães com larvas deste carrapato. Os bioensaios com o fenthion iniciaram-se 4 meses após a infestação artificial. Constatada a média de 186 ixodídeos/cão, cães do grupo teste receberam na região da nuca a dosagem correspondente ao seu peso. Avaliaram-se a eficiência e a atividade residual através de contagens dos carrapatos com diâmetro  $\geq 2$ mm, durante 11 dias, nas áreas corpóreas mais parasitadas: dorso, orelhas e patas. Anteriormente, à aplicação do fenthion, 44,3% dos carrapatos foram observados nas orelhas, 38,1% na área estudada do dorso e 17,6% nas patas. Revelou-se uma redução do número de carrapatos nos cães de 36,2%, 63,8%, 82,7%, 67%, 40% e 4,9%, respectivamente, nos dias 1, 2, 3, 5, 7, 9 e 11. Atividade carrapaticida menor do que a recomendada oficialmente foi constatada. O número de carrapatos aumentou progressivamente após o 5º dia, denotando ineficácia carrapaticida residual. Os resultados obtidos impedem a indicação da formulação na dosagem testada como medida eletiva para controle de *R. sanguineus*.

**Palavras-chaves:** Ixodidae. Carrapato. *Rhipicephalus*. Controle. Fenthion.

*Rhipicephalus sanguineus* (Latreille, 1806) is an African tick, which became widespread throughout the world, following Man's activities, affecting especially domestic dogs, its principal host. Due to either its high biotic potential or the existence of environmental conditions which were favorable to its development, it established with high density or prevalence in several cities of the world<sup>1 17</sup>. This tick is involved in the transmission of protozoa, rickettsia, virus and filariae which cause illnesses to the animals and emergent diseases to man, although these are rarely lethal<sup>5 6 20 21 23 24 25 26 29 32</sup>. Recently in the USA, studies have demonstrated that immature stages feeding on humans is more common than one would suppose<sup>19</sup>.

Tick control is usually carried out by applying acaricide onto the hosts, with the aim of impairing engorged females from laying eggs. In Brazil, few studies have been realized on *Rhipicephalus sanguineus*<sup>8 9 10 11 12 13 14 31</sup>. Because it is a 3-host tick, with a wide variety of hosts and having a great diversity of colonized environments, *Rhipicephalus sanguineus* control becomes difficult and expensive, requiring a great substructure including people and materials. Epicutaneous acaricides are a good tool for control, since they are easy to apply and reach larger areas within a lower time. Furthermore, it requires a smaller working team<sup>1</sup>.

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Fenthion is an organophosphorad available on the market as an epicutaneous formulation, at a 15% concentration (spot-on), commercialized as an anti-flea product for dogs. This formulation allows rapid absorbency after application, in a few millimeters as a simple spot, on the animals' back skin, playing a systemic role<sup>13</sup>. Dog breeders from Goiânia - capital of

the Brazilian State of Goiás – have observed that treating animals infected by fleas and ticks with the formulation reduced the number of both these ectoparasites. The aim of this study was to investigate the efficiency and residual activity of that product on *Rhipicephalus sanguineus*, administrated via epicutaneous in dogs in order to contribute to those strategies for its control.

### MATERIAL AND METHODS

Female *Rhipicephalus sanguineus*, which were full of blood and naturally detached were collected in infested kennels from ten residences distributed in five districts of Goiânia. From each kennel, twelve engorged females were collected, these were found climbing walls, on the wooden roof and on the ground, hiding themselves in slits for laying eggs. They were placed inside polyethylene tubes (3 x 9cm, spiral cap) and transported to the laboratory for obtaining larvae, after incubation in a B.O.D. chamber at 27 ± 1 °C under relative humidity higher than 80%. From the egg-layings with the best indexes of hatching, verified according to the method described by Amaral<sup>2</sup>, a pool of larvae was prepared, which was used for artificial infection, in an experimental kennel<sup>12</sup>. Dogs were chosen from both genders of no specific breed and varying ages, with a good nutritional status and free from acaricide residues.

The fenthion bioassays were begun four months after the artificial infestation and after verification of nymphs and adults on the dogs and in the environment. In fenthion bioassays, six dogs represented the test group and one dog that did not receive the drug was considered

as the control. Test group dogs were weighed and divided into two groups, according to the dosage determined (2.0ml / 23 - 30kgb.w. and 1.5ml / 16 - 22kgb.w.). A 15% epicutaneous fenthion solution was injected on the skin in the region of the neck.

In order to evaluate treatment efficacy and the product's residual activity, counts were made of the total number of ticks in each phase, considering diameters equal to or larger than 2.0mm, which were found on the animals on the day of treatment (day 0), and on days 1, 2, 3, 5, 7, 9 and 11, following the product's use. The most affected corporal areas were chosen, including the back (a 100cm<sup>2</sup> area), the ears (inner surface), and the paws (spaces between fingers and cushions).

The Chi-square test ( $\chi^2$ ), at 5% significance level, was used in order to verify the influence of fenthion treatment on reducing the number of ticks in dogs<sup>7</sup>. The efficiency of the treatment was evaluated according to the Brazilian Ministry of Agriculture norms<sup>28</sup>, which establish 95% as the minimum mortality obtained for an ascaricide dosage to be recommended for use in the ixodids control.

### RESULTS

The results are shown in (Figure 1). Artificial infestation was successfully achieved, causing either a

notable development or proliferation of ticks in the experimental kennel. The dogs were evaluated prior to

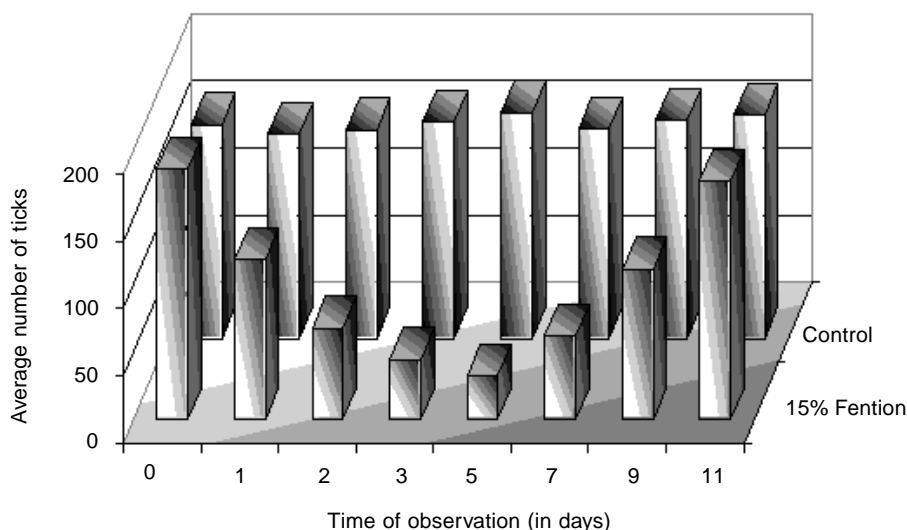


Figure 1 - Activity of fenthion 15% on *Rhipicephalus sanguineus*, applied in epicutaneous formulation on the dogs.

application of fenthion, finding on average 44.3% of ticks in the ears (inner surface), 38.1% in the back area and 17.6% in the dog's paws (spaces between claws and pads). The counts on days 0, 1, 2, 3, 5, 7, 9 and 11 showed a mean number of ticks of 186, 118.64, 67.37, 44.25, 32.18, 61.34, 111.60 and 176.96 in the test group and 159, 152, 155, 161, 168, 156, 162 and 166 in the control group, respectively. Statistical analysis demonstrated that elimination of ticks in the test group was significantly higher than that observed in control group ( $\chi^2 = 50.09 > \chi^2_{.05 (1)} = 3.84$ ).

Better results for *R. sanguineus* control, using epicutaneous pyrethroids, have been reported. Alcaíno *et al*<sup>1</sup>, employing epicutaneous cipermetrin, achieved an 87% tick reduction in dogs and a residual effect of 20 days. Ulloa *et al*<sup>4</sup>, using epicutaneous Flumethrin, demonstrated tick reduction in dogs which was always higher than 85%.

In New Caledonia, *Boophilus microplus* tick resistance against fenthion was reported by Beugnet & Chardonnet<sup>4</sup>. Since in Brazil, the use of bovine anti-tick formulas on dogs is common<sup>11 12 13 14</sup>, it may be possible that *R. sanguineus* fenthion resistance has already occurred, which could be detected by fastened larvae *in vitro* susceptibility tests<sup>11 12 16</sup>.

However, there are reports of fenthion efficacy against *Ctenocephalides felis* fleas in cats, describing a reduction of 91.3% in animals treated every 28 days with this insecticide, 50 days following initial treatment<sup>15 16</sup>. This index was higher than 80%, which is recommended for insecticides by WHO<sup>35</sup>.

After the 5<sup>th</sup> day, the number of ticks on the dogs progressively increased, demonstrating residual anti-tick

The percentage reduction in the number of ticks on the treated dogs was 36.2%, 63.8%, 76.2%, 82.7%, 67%, 40% and 4.9%, on days 1, 2, 3, 5, 7, 9 and 11 respectively, following treatment. It was demonstrated that the anti-tick activity of epicutaneous 15% fenthion against *R. sanguineus*, achieved a progressive reduction in the number of ticks on dogs from the 1<sup>st</sup> to 5<sup>th</sup> day after application, however the results were lower than the 95% minimum level recommended for insecticides<sup>28</sup>.

## DISCUSSION

inefficacy for *R. sanguineus*. The results obtained in the present trial did not support the choice of epicutaneous 15% fenthion in control campaigns against *R. sanguineus*, however, its use could be justified as an auxiliary procedure in a simultaneous control of fleas in the affected dogs, since it would then be associated to suitable methods for tick control. This hypothesis suggests that such procedures should not only consider tick control in dogs, but especially an eradication program against the tick's free life forms. Consequently, the authors suggest that some physical, semiochemical, biological or immunological alternative control measures, should be studied and adopted taking into consideration also the lowest environmental impact. Such methods may include the use of fire-broom on the infested surfaces (domestic flame-launching), to the use of semiochemical attracting traps<sup>18</sup>, associated with phyto-sanitary insecticides or acaricides<sup>33</sup> or entomopathogenic microorganisms<sup>22</sup>, or the use of anti-tick vaccine<sup>27 30</sup>, obviously with an accompanying cost-benefit analysis.

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