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

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

Fernando de Freitas Fernandes¹ and Edméia de Paula e Souza Freitas²

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 Ricketsia. 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 ≥ 2mm, during 11 days of treatment, in the most affected body areas: back, ears and paws. Before the application of fenthion in the dogs, it was 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 5th 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.


Resumo A atividade de fenthion em uma formulação epicutânea com 15% sobre Rhipicephalus sanguineus, transmissor de patógenos ao homem e animais, tais como Ehrlichia, Babesia e Ricketsia. Os bioensaios com o fenthion iniciaram-se quatro 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 ≥ 2mm, durante 11 dias, nas áreas corpóreas mais parasitadas: dorso, orelhas e patas. Anteriormente, à aplicação do fenthion, foram observados 44,3% dos carrapatos format 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.

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. 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 egglayings with the best indexes of hatching, verified according to the method described by Amaral, a pool of larvae was prepared, which was used for artificial infection, in an experimental kennel. 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 100cm² area), the ears (inner surface), and the paws (spaces between fingers and cushions).

The Chi-square test (χ²), at 5% significance level, was used in order to verify the influence of fenthion treatment on reducing the number of ticks in dogs. The efficiency of the treatment was evaluated according to the Brazilian Ministry of Agriculture norms, 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...
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 ($\chi^2 = 50.09 > \chi^2_{0.05} (1) = 3.84$).

**DISCUSSION**

Better results for *R. sanguineus* control, using epicutaneous pyrethroids, have been reported. Alcaíno et al., employing epicutaneous cipermethrin, achieved an 87% tick reduction in dogs and a residual effect of 20 days. Ulloa et al., 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. Since in Brazil, the use of bovine anti-tick formulas on dogs is common, it may be possible that *R. sanguineus* fenthion resistance has already occurred, which could be detected by fastened larvae in vitro susceptibility tests. 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. This index was higher than 80%, which is recommended for insecticides by WHO.

After the 5th day, the number of ticks on the dogs progressively increased, demonstrating residual anti-tick 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, associated with phyto-sanitary insecticides or acaricides or entomopathogenic microorganisms, or the use of anti-tick vaccine, obviously with an accompanying cost-benefit analysis.

**ACKNOWLEDGEMENT**

We are grateful to Prof. Tânia F.F. Gallé for critical review and suggestions on the translation of this manuscript.

**REFERENCES**

11. Fernandes FF. *In vitro* activity of permethrin, cipermetrin and deltamethrin on larvae of *Rhipicephalus sanguineus* (Latreille,


