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The Efficacy of Cypermethrin (Vapco Cypermethrin® 10 EC) Against Cattle Ticks in Tanzania

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Abstract

A study was carried out for six weeks to determine the efficacy of cypermethrin against cattle ticks. The laboratory evaluation was conducted at TPRI Arusha using laboratory reared tick species of *Rhipicephalus appendiculatus* (Lushoto strains) by larval packet test as recommended by FAO. The results showed that the three weeks old larvae of *Rhipicephalus appendiculatus* were susceptible to the technical grade of cypermethrin (purity 92.1% w/v) with the LC_{50} and LC_{99} being 0.0027 and 0.0084 respectively.

On other hand, the field work was conducted at Olarash village in Monduli district, 51 kms west of Arusha Municipality. Two herds which were 3 kms apart whereby one herd which had 36 cattle were treated with Vapco cypermethrin 10 EC at recommended dose rate (0.01%) once fortnightly while the other herd was untreated. The results showed that the Vapco cypermethrin reduced tremendously the number of ticks in the treatment group (P=0.000) while the number of ticks in the control group remained more less the same throughout the study period (P=1.00). The maximum efficacy was over 99% while the minimum efficacy of 97.7% was only noted on 29th day which was a fourteenth day post dipping.

Keywords: Tick control, Tick borne diseases, Acaricide

1. Introduction

Diseases and parasites are a serious constraints affecting cattle production in East Africa (Chenyambuga *et al*., 2010). Tick and tick borne diseases in particular exert a major economic impact in the region (Rubaire-Akiiki *et al.,* 2004; Okuthe and Buyu 2006; Swai *et al.,* 2007). The economic significance of ticks is due to being both parasitic and vectors of serious diseases of livestock. The parasitic consequences of ticks' parasitism results in retarded weight gain due to haemorrhages and toxins that impairs cattle's appetite while the most economic important diseases they transmit includes; Theileriosis, Anaplasmosis, Babesiosis and Heart water. These diseases affect cattle in a diverse ways such as reduced growth rate, fertility, milk production and value of hides and death, hence leading to considerable economic losses to livestock keepers. For instance, theileriosis (East Coast Fever) is the number one killer disease, can kill up to 100% of susceptible breed calves (ILRAD, 1990; Norval *et al.*, 1992). Mukhebi *et al.*, (1992) estimated theileriosis to cause losses of up to US$ 168 million in Eastern Africa alone, and recent observations indicate direct losses due to ticks and tick borne diseases (TBD) in Tanzania to reach US$ 364 million annually, mainly due to death of > 1.31 million cattle; 68% caused by theileriosis, 13% by anaplasmosis, 13% by babesiosis and 6% by cowdriosis (Kivaria 2006 & Kivaria *et al.,* 2007).

Although control of TBD against cattle through immunization is recommended (Musisi and Lawrence, 1995), the only immunization currently practiced in the country is against theileriosis since is the most dreadful of all TBD. Immunization is done by injecting *T. parva* sporozoites of infected *Rhipicephallus appendiculatus* and simultaneously treating the animal with 30% oxytetracycline (Ruheta *et al*., 1996; Mbassa *et al.*, 1998). However, there are several obstacles which have been observed which includes; the tick stabilate may cause fatal disease, requires continuous cold chain of liquid nitrogen for storage and therefore is expensive, is not protective against all

types of *T. parva* genotypes and has unpredictable duration of immunity (Mbassa *et al*., 2009). On other hand, vaccines against other TBD are currently not available in the Eastern Africa market (Ibid) and thus acaricides use become the only fast, reliable and most effective tick control method and hence TBD (Kagaruki, 1996). Therefore, in regard to this study it was desirable to test whether Vapco cypermethrin® 10 EC is effective against ticks for registration purpose.

1.1 ***Materials and Method***

1.1.1 Sample Chemicals

Both technical and formulated chemicals were brought to TPRI by Veterinary and Agricultural Products Co. Ltd, Jordan through Corticomp International (T) Ltd. The technical and formulated chemicals were used for laboratory and field trials respectively. Vapco cypermethrin is a synthetic pyrethroid with the technical chemical containing cypermethrin with purity of 92.1% w/v while the formulated preparation is an emulsifiable concentrate (EC) containing cypermethrin at 10% ((IRS) Cis, trans – 3 – (2, 2 – Dichlorovinyl) -2, 2 – Dimethyl – Cyclopropane – Carboxylate). It is a non-systemic insecticide but works through contact and stomach action.

1.1.2 Ticks

Ticks used for laboratory test were strain of *Rhipicephalus appendiculatus* collected at Lushoto Tanga which are reared at TPRI laboratory.

1.1.3 Laboratory Trial

The laboratory test (tick susceptibility test) was carried out at TPRI Arusha using unfed tick larvae of three weeks old. The test was done in accordance with the packet test method described by Stone and Haydock (1962) and modified by FAO (1984). The larvae were tested against different concentrations of Vapco cypermethrin whereby two batches of about 70 larvae were tested at each concentration level. The packets were incubated for 24 hours at 28 ± 1^0C and 80 ± 5% relative humidity after which susceptibility was assessed and results corrected by Abbott's formula (Abbott, 1995) as cited in Amaral (1993);

$$\% \text{ Mortality} = \frac{\% \text{ Mortality of treated} - \% \text{ Mortality of controls} \times 100}{100 - \% \text{ Mortality of controls}}$$

1.1.4 Field Trial

1.1.4.1 Location

The field trial was conducted at Olarash village in Monduli district, 51 kms west of Arusha Municipality. This location was selected on account of its accessibility, presence of un-dipped cattle over the period of five weeks and many reported deaths of animals due to tick borne diseases especially by East Coast Fever (ECF) (Personal communication, February 2012). Two bomas (blocks) were used for the trial Mr. Siara Ngiriki herd (36 cattle) and Mr. Albert Laanyisho herd (12 Cattle). These bomas were about 8 kms north east of Monduli district council headquarters; the distance between the experimental blocks was about 3 kms. Both blocks were infested with ticks mainly with *Rhipicephalus appendiculatus, R. pulchellus, R. evertsi* and *Amblyomma gema*.

1.1.4.2 Experimental Design

The field work started in 29th March and ended 13th May 2012. The experimental cattle were of 1 to 10 years old, males and females varying in weight between 80 – 300kgs. In each block 10 cattle were ear tagged with metallic ear tags using ear tag applicator respectively for easy identification. Cattle belongs to Mr Siara Ngiriki were used as treatment group while those belong to Mr. Albert Laanyisho were used as control group.

The dip wash was done by spraying using bucket pump once fortnightly at the rate of 20 millilitres of Vapco Cypermethrin 10% EC in 20 litres of water (0.01%) to all cattle in the treatment group. Tick borne diseases were monitored throughout the experimental period and each group grazed separately to avoid contamination by rubbing

on.

1.1.4.3 Tick Population

Tick populations were established in all experimental blocks one day before treatment; post treatment ticks monitoring was done in the first, second, sixth, ninth, twelfth, fifteenth, eighteenth, twenty first, twenty fourth, twenty ninth, thirty second, thirty fifth and forty second day respectively. However, data on tick were also recorded after every other day following spraying of the treatment group. Old adult ticks were identified and counted on the right side of the cattle early in the morning before grazing and the number of tick counts multiplied by two to get the approximate number of ticks on the respective animal while post treatment tick count on treatment group was done in both sides of the cattle.

1.1.4.4 Statistical Analysis

This was done by subjecting the number of tick counts of both groups in x^2- test to see if there is significant difference as compared to the number of tick counts before treatment using SPSS program while excel program was used to gauge the tick re-infestation trend post. For the laboratory findings, the mean mortalities of larvae in various concentrations were subjected to Probit Analysis using SPSS programme where the LC_{50} and $LC_{99.9}$ were obtained.

1.2 Results

1.2.1 Tick Susceptibility Test

The tick showed high susceptibility to Cypermethrin, the LC_{50} (the lowest concentration of the chemical that will kill 50% of the population) was 0.0027% while the LC_{99} (the lowest concentration that will kill 99% of the population) was 0.0084%.

1.2.2 Field Trial

The composition and proportion of tick species found were *Rhipicephalus appendiculatus* (49%), followed by *Rhipicephalus pulchellus* (32%), *Rhipicephalus evertsi* (12%) and *Amblyomma gemma* (7%) (Figure 1). There was tremendous reduction in number of ticks (P=0.000) in the cattle treated with Vapco cypermethrin while the number of ticks in the control group remain more less the same throughout the study period (P=1.00) (Table 1). Similarly, the trend showed a decrease in tick burden post spraying on cattle when compared with the control group (Figure 2). The efficacy of Vapco cypermethrin is given in (Table 2) whereby it was found to be 100% after 24 hrs and sustained at the maximum of over 99% throughout the study period except on 29^{th} day where a minimum efficacy of 97.7% was noted.

1.2.3 Tick Borne Diseases

The parasitological data obtained from blood diagnosis prior to the experiment showed positive cases of East Coast Fever (ECF) and Anaplasmosis. Out of 20 cattle examined 4 were positive (3 cattle had ECF and one had Anaplasmosis). The ECF cases were found in the treatment group and these were treated with Buparvaquone and Oxytetracycline while the anaplasmosis case was from the control group and it was just treated with Oxytetracycline only. Near the end of the experiment we had 2 cases of ECF in the control group and were treated accordingly while in the treatment group we didn't experience any tick borne disease.

1.3 Discussion

The fact that the obtained concentrations for the susceptibility test being lower than the manufacturers' recommended dose shows that Vapco Cypermethrin 10% EC can be a useful tool for control of ticks in Tanzania, though it was not the scope of this study to determine its efficacy on the other insects of veterinary importance, studies done in Morogoro by Msolla (2000) showed that Cypermethrin was able to protect cattle against ticks, tsetse flies and other common biting flies.

In this trial, the concentration of 0.01% of (Vapco cypermethrin 10% EC) dip wash preparation has been shown to be over 99% effective for control of ticks and tick borne diseases with 100% drop down effect of ticks within the first 24 hours post treatment. The Vapco cypermethrin, an emulsifiable concentrate containing the synthetic pyrethroid, 10% w/v cypermethrin has shown to have long residual effect on tick species that's why the ticks observed to re-occur frequently in all treated group (*R. appendiculatus)* were found unattached or attached but not feeding. The absence of new cases in the treated group could be explained that Vapco Cypermethrin is able to control both ticks and tick borne diseases and hence recommended for veterinary use.

1.4 **Conclusion**

Sustainable tick and tick borne disease control remain a major concern of animal health programmes to protect livestock especially cattle in developing countries whereby a good number of people obtain their livelihood through livestock production. Taking an example of study area where tick species of *Rhipicephalus appendiculatus* were found in high proportion of 49% of all ticks encountered, this shows that ECF remain a major threat of all TBDs. The current results have shown that Vapco Cypermethrin 10 EC is effective against ticks at the rate of 0.01% and hence can be used for controlling tick borne diseases. It has also been shown to be cost effective as it protect the animals for the period of two weeks and hence can be reliable for future control of ticks in Tanzania.

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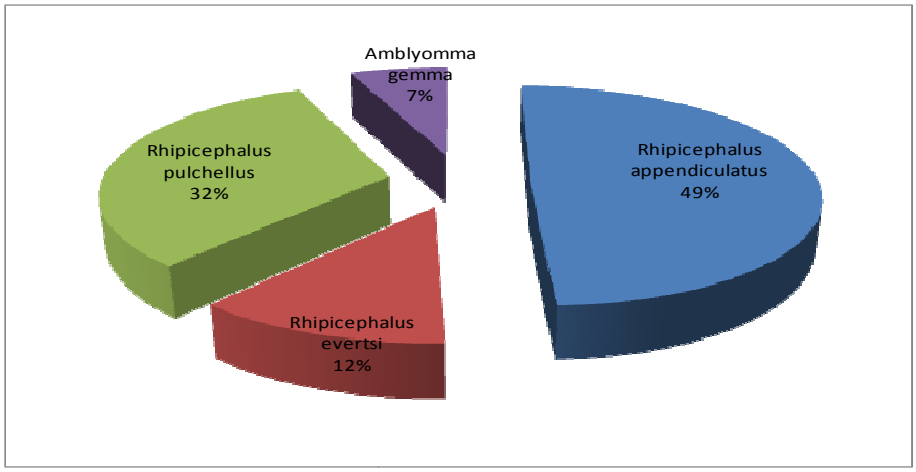

Figure 1: proportion of tick species at Olarash village, Monduli district, Arusha

Table 1: X^2 – Test of the Mean Tick Count for Control and Treatment Group

	Mean Tick Counts for Control Group in Six Week	Mean Tick Count for the Treatment Group in Six Week	Species found in the Study Area
Chi-Square	4.571[a]	92.000[b]	.000[c]
df	23	9	3
Asymp. Sig.	1.000	.000	1.000

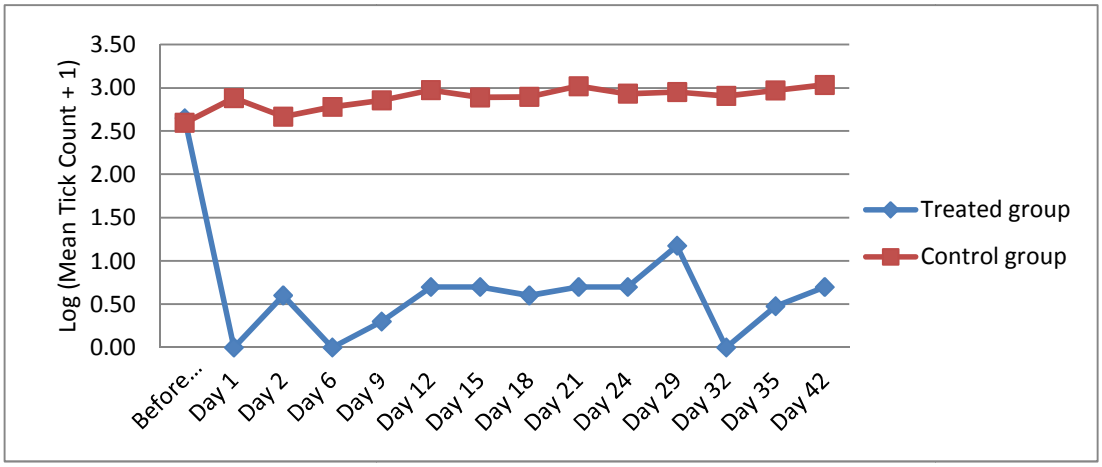

Figure 2: Tick Burden trend post Vapco Cypermethrin treatment at Olarash village, Monduli district, Arusha

Table 2: Numbers of Ticks counted in the Field Trial of vapco Cypermerthrin 10 EC – Treatment group

S/N	Animal ID	Counts Before Treatment	Tick Counts Post Treatment														
			Day 1	Day 2	Day 6	Day 9	Day 12	Day 15	Day 16	Day 18	Day 21	Day 24	Day 29	Day 30	Day 32	Day 35	Day 42
1	2051	96	0	1	0	0	0	1	0	1	1	0	1	0	0	0	1
2	2057	48	0	2	0	0	1	1	0	0	1	1	2	0	0	0	0
3	2054	10	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0
4	2060	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	2053	6	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0
6	2052	68	0	0	0	0	2	0	0	0	0	0	2	0	0	1	1
7	2059	34	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
8	2058	48	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0
9	2055	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	2056	60	0	0	0	1	0	1	0	0	2	3	1	0	0	0	0
	Total	**444**	**0**	**3**	**0**	**1**	**4**	**4**	**0**	**3**	**4**	**4**	**9**	**0**	**0**	**2**	**4**
	Log. Base 10	2.64	0	0.6	0	0.3	0.69	0.69	0	0.6	0.69	0.69	1.17	0	0	0.47	0.69
Efficacy			100	99.3	100	99.8	99.1	99.1	100	99.3	99.1	99.1	98.0	100	100	99.5	99.1