

Assessment of the efficacy of Deltamethrin 1% pour-on (Smash) and Deltamethrin 1% SC (Pali) and comparison of their mode of applications against ticks in Ethiopia

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Abstract

The efficacy of Deltamethrin 1% pour-on (Smash) and Deltamethrin 1% SC (Pali) against ticks was evaluated on cattle at private cattle farm (04°53'03" N; 38°08'31" E, altitude of 1620 masl), in Yabello district of Borena zone, Ethiopia. Experimental cattle were divided into three groups. Cattle in Group 1 were each treated with Deltamethrin 1% pour-on (Smash) and cattle in Group 2 were treated with Deltamethrin 1% SC (Pali) while the third group received no treatment and served as a control. During the experimental period (10 to 29 January 2011), the three groups of cattle were attended separately to avoid contacts. A high degree of efficacy of Deltamethrin 1% pour-on (Smash) and Deltamethrin 1% SC (Pali) against single- and multi-host ticks was achieved by a single application of each product. Deltamethrin 1% pour-on (Smash) controlled ticks for 15 days while Deltamethrin 1% SC (Pali) did for 13 days. Deltamethrin 1% pour-on (Smash) shown to be 97.3- 100% effective in the control of ticks from Day 2 to Day 14 post treatment. The percentage tick control achieved by Deltamethrin 1% SC (Pali) ranged from 96.5-100% from Day 2 to Day 10 post treatment. The result demonstrated that Deltamethrin 1% when applied as pour-on effectively controlled ticks on cattle than when applied as spray form. Comparative advantage of pour-on application over spraying is that the pour-on application is relatively easier than the spraying when spraying facilities are not available. Pour-on application does not require specialized manpower to perform the operation and pastoralists can easily carry Deltamethrin 1% pour-on (Smash) and can apply while moving with their livestock.

Key words: Deltamethrin, efficacy trial, Ixodid ticks, pour-on, synthetic pyrethroids

Introduction

Ticks and the diseases they transmit are widely distributed throughout the world, particularly in tropical and subtropical regions (Bram, 1983). In Ethiopia, Ixodid ticks are common in all agroecological zones where more than 30

tick species were recorded belonging to the genera *Amblyomma* (8 spp), *Boophilus* (2 spp), *Haemaphysalis* (4 spp), *Hyalomma* (9 spp) and *Rhipicephalus* (15 spp) (Sileshi Mekonnen, *et al.*, 2007).

Losses attributed to ticks are caused either directly, through tick worry, blood loss, damage to hides and udders and the injection of toxins or indirectly through mortality or debility caused by the diseases transmitted (Anaplasmosis, Babesiosis, Cowdriosis and Theileriosis). Exports of hides and skins yield foreign earnings, but these products are consistently downgraded because of damages from ectoparasites. There is great concern that ticks and tick-borne diseases will, in future, pose a potential threat to the country's dairy industry parallel with the present trend of dairy cattle productivity improvement programme, in which the indigenous *B. indicus* breeds are crossbred with the more productive European (*Bos taurus*) breeds, an operation known to produce tick-borne disease susceptible stock.

The control of ticks is mainly based on the use of acaricides and the chemicals currently used are grouped into organophosphates, carbamates, amidines and synthetic pyrethroids (Sileshi Mekonnen, *et al.*, 2001). In Ethiopia, Synthetic pyrethroids group of acaricide are mostly used to control ticks in dairy farms and big ranches where regular tick control programme is practiced.

The objective of this trial is to assess the efficacy of Deltamethrin 1% pour-on (Smash) and Deltamethrin 1% SC (Pali) against single and multi-host ticks and to evaluate the persistence of activity against re-infestation under local field conditions in Ethiopia.

Materials and methods

Tolerability Test

Tolerance of cattle to Deltamethrin 1% pour-on (Smash) and Deltamethrin 1% (Pali) applied at a manufacturer's recommended dose was evaluated with the objective to ascertain that the chemical does not harm the treated cattle. Accordingly, two calves were treated with Deltamethrin 1% pour-on (Smash) at 1ml/10kg body weight and two with Deltamethrin 1% SC (Pali) diluted at 25 ml in 10 litres of water.

Trial site

The trial was carried out in Tekle Private Cattle Farm found in Yabello town (04°53'03" N; 38°08'31" E, altitude of 1620 masl), Yabello district, Borena Zone, Oromiya Regional State, Ethiopia. The site is located at 565 kms south of Addis Ababa.

Trial period

The assessment of the efficacy of Deltamethrin 1% pour-on (Smash) and Deltamethrin 1% SC (Pali) against ticks in Yabello town was conducted from 10 to 29 January 2011.

Tick identification

Prior to commencement of the trial, sample ticks were collected from cattle with the aim to get enough knowledge on the tick species present in the trial site. Ticks in the trial site were collected with forceps and placed in screw cap bottles filled with 68% methanol. The identification was performed in Yabello Regional Veterinary Laboratory using the taxonomic criteria described by Hoogstraal (1956), Kaiser, (1987), Matthyse and Colbo (1987) and Horak *et al.* (2001).

Experimental cattle

Twenty four Zebu cattle aged between 6 months and 8 years and naturally infested with different tick species were randomly selected and allocated into 3 groups, each consisting of eight cattle (Table 1). Group 1 and 2 were the treatment cattle and Group 3 was the untreated (control) cattle. Prior to initiating the trial, the three groups of cattle grazed together in the open field to pick up enough ticks. The cattle were not treated with acaricides for one month prior to commencement of the trial. However, to avoid other health complications, the animals were dewormed with Albendazole 2500 mg and treated against infectious diseases using Oxytetracycline 20%.

Table 1. Experimental design of the efficacy trial of Deltamethrin 1% pour-on (Smash) and Deltamethrin 1% SC (Pali) against ticks on cattle

	No of cattle	Treatment	Application method	Dose rate
G1	8	Deltamethrin 1% pour-on (Smash)	Pour-on	1ml/10kg body weight
G2	8	Deltamethrin 1% SC (Pali)	Spray	Dilute 25 ml of Deltamethrin 1% SC (Pali) with 10 liters of water and spray 3 liters of diluted product per cattle
G3	8	Untreated control	Not applicable	Not applicable

Acaricides used in the trial

Acaricides used for this trial were Deltamethrin 1% pour-on (Smash) and Deltamethrin 1% SC (Pali) and both products are classified under Synthetic pyrethroids group (Fig 1). Each product contains 10 mg of Deltamethrin BP (vet) in one ml. Deltamethrin is a light-stable synthetic pyrethroid with potent insecticidal activities. It controls ticks, tsetse flies, biting and sucking flies and nuisance flies on animals. It is safe for all age groups and at all stages of pregnancy. These products were manufactured by Tagros Chemicals India Ltd and are registered in Ethiopia for ectoparasite control.



Fig 1. Delthamethrin 1% pour-on (Smash) & Deltamethrin 1% SC (Pali)

Acaricide application

On 11 January 2011 Deltamethrin 1% pour-on (Smash) was applied on eight cattle (Group 1) with disposable syringe along the dorsal midline from the head to the base of the tail as per the manufacturer recommendation, ie. 10ml for 100 kg body mass. On the same day, eight cattle (Group 2) were thoroughly wetted with Deltamethrin 1% SC (Pali) using knapsack sprayer where each cattle received approximately three liters of the diluted product. The dilution rate was 25 ml of Deltamethrin 1% SC (Pali) in 10 liter of tap water as per the manufacturers' recommendation. The rest eight cattle (Group 3) were left untreated and served as control animal.

Tick counts

Adult ticks were counted on each of the 24 cattle (treatment and control groups) on the day prior to the onset of the trial. Cattle were restrained on the ground to get an accurate estimate of tick number. All visible ticks were counted *in situ* on ears, head, dewlap, back, abdomen, anus-vulva, tail and hooves of the animals. After acaricide application, tick counting was performed every two days until the percentage control reaches less than 80%. Tick counts on individual cattle were recorded on excel sheet format prepared for each cattle in the treatment & control groups. Tick count on the control (untreated) cattle was used as an index in the calculation of the percentage tick control achieved (Rinkanya, 1984) using the formula described by Drummond *et al.* (1981).

$$\% \text{ Control} = \frac{\text{Number of ticks on control cattle} - \text{Number of ticks on treatment cattle}}{\text{Number of ticks on control cattle}} \times 100$$

Results

Tolerability Test

Two calves were treated with Deltamethrin 1% pour-on (Smash) and the other two thoroughly sprayed with freshly prepared Deltamethrin 1% SC (Pali) at manufacturers' recommended rate. The calves were checked daily for four days and did not show any clinical abnormalities and there was no adverse reaction on the skin after acaricide application. It was observed that the treated calves were in good body conditions with good appetite and normal body temperature.

Tick spp recorded in the trial site

Ticks identified in the trial site in order of abundance were *Rhipicephalus pulchellus*, *R. evertsi evertsi*, *Amblyomma variegatum*, *A. gemma*, *A. lepidum*, and *Hyalomma marginatum rufipes*.

Efficacy trial results

Tables 2 and 3 summarize the total tick counts on treatment and control groups and percentage control achieved by Deltamethrin 1% pour-on (Smash) and Deltamethrin 1% SC (Pali). The eight cattle in the treatment group (G-1) had total tick infestation of 1448 adult ticks before treatment with Deltamethrin pour-on (Smash), after which their tick count decreased to 42 by Day-2 post treatment. Similarly, the eight cattle in the treatment group (G-2) had a total tick infestation of 1806 adult ticks before spraying with Deltamethrin SC (Pali), after which their total tick counts fell to 55 by Day-2 post treatment.

Significant reduction of tick burden was achieved after treating cattle with Deltamethrin 1% pour-on (Smash) and Deltamethrin 1% SC (Pali). With the treatment of Deltamethrin 1% pour-on (Smash), 97.3% control was achieved after two days and 100% control was achieved from Day-4 to Day-14 post treatment (Table 2). 96.5% control was achieved after two days of treatment with Deltamethrin 1% SC (Pali) and 100 % control from Day-4 to Day-10 post treatment (Table 3). Starting from Day-18, all the treated cattle showed increase in tick infestation and therefore it was decided to discontinue the trial on Day-18 post treatment.

Table 2. Summary of tick counts and percentage control of Deltamethrin 1% pour-on (Smash) against ticks on cattle

D	-1 (10/1/11)	0* (11/1/11)	2 (13/1/11)	4 (15/1/11)	6 (17/1/11)	8 (19/1/11)	10 (21/1/11)	12 (23/1/11)	14 (25/1/11)	16 (27/1/11)	18 (29/1/2011)
T	1520	1448	42	0	0	0	0	0	0	125	407
C	1716	1658	1558	1456	1468	1444	1368	1273	1082	915	825
%	-	-	97.3	100	100	100	100	100	100	86.3	50.7

D = Tick counting days, T = Treatment group, C = Control group, % = Percentage control achieved, * = Acaricide application day

Table 3. Total tick counts and percentage control achieved by the application of Deltamethrin 1% SC (Pali 1% SC)

D	-1 (10/1/11)	0* (11/1/11)	2 (13/1/11)	4 (15/1/11)	6 (17/1/11)	8 (19/1/11)	10 (21/1/11)	12 (23/1/11)	14 (25/1/11)	16 (27/1/11)	18 (29/1/2011)
T	1841	1806	55	0	0	0	0	30	91	207	395
C	1716	1658	1558	1456	1468	1444	1368	1273	1082	915	825
%	-	-	96.5	100	100	100	100	97.6	91.6	77.4	52.1

D = Tick counting days, T = Treatment group, C = Control group, % = Percentage control achieved, * = Acaricide application day

Table 4. Total tick counts on each treatment and control groups of cattle Deltamethrin 1% pour-on (Smash)

Date	Animal name								Total
	Dika (M)	Dalu (F)	Bule (F)	Adio (F)	Adio Bude (M)	Adio Sala (F)	Dima (M)	Bora (M)	
10/01/2011	209	124	132	139	102	284	288	242	1520
11/01/2011*	207	121	129	137	98	279	279	234	1484
13/01/2011	10	3	4	6	4	5	5	5	42
15/01/2011	0	0	0	0	0	0	0	0	0
17/01/2011	0	0	0	0	0	0	0	0	0
19/01/2011	0	0	0	0	0	0	0	0	0
21/01/2011	0	0	0	0	0	0	0	0	0
23/01/2011	0	0	0	0	0	0	0	0	0
25/01/2011	0	0	0	0	0	0	0	0	0
27/01/2011	17	9	13	7	12	21	23	23	125
29/01/2011	59	53	40	32	33	54	76	60	407

* Acaricide application day

Deltamethrin 1% SC (Pali)

Date	Animal name								Total
	Bule Birte (F)	Suki (M)	Bora (M)	Dalu Wario (F)	Bora Tiko (F)	Adio Bude (F)	Birte-ox (M)	Adio Tiko (M)	
10/01/2011	124	170	127	230	134	364	348	344	1841
11/01/2011*	134	165	120	225	131	350	342	339	1806
13/01/2011	7	4	2	4	3	5	11	19	55
15/01/2011	0	0	0	0	0	0	0	0	0
17/01/2011	0	0	0	0	0	0	0	0	0
19/01/2011	0	0	0	0	0	0	0	0	0
21/01/2011	0	0	0	0	0	0	0	0	0
23/01/2011	7	7	1	0	0	4	4	7	30
25/01/2011	12	7	5	2	0	9	29	27	91
27/01/2011	20	15	13	12	7	39	52	49	207
29/01/2011	46	36	35	43	26	79	61	69	395

* Acaricide application day

Control cattle

Date	Animal name								Total
	Dalu Girma (F)	Suki Wario (F)	Bore Magala (M)	Magala Gababa (F)	Ole Baji (F)	Bora Gababa (M)	Ore Tick (F)	Dima (F)	
10/01/2011	292	188	184	214	340	92	178	42041	1716
11/01/2011	223	281	182	182	209	328	83	170	1658
13/01/2011	225	282	165	179	206	255	107	139	1558
15/01/2011	224	261	164	176	160	235	100	136	1456
17/01/2011	216	262	159	172	171	229	112	147	1468
19/01/2011	220	262	167	163	167	214	110	141	1444
21/01/2011	214	250	156	148	160	201	100	139	1368
23/01/2011	188	236	147	136	151	189	90	136	1273
25/01/2011	174	217	136	115	125	159	65	91	1082
27/01/2011	143	199	101	96	105	149	52	70	915
29/01/2011	131	182	99	88	87	131	48	59	825

Discussion and conclusion

Acaricide application is still the main tick control method in Ethiopia and group of acaricides currently in use are Organophosphates, Amidines and Synthetic pyrethroids (Sileshi Mekonnen, 2001). *Rhipicephalus pulchellus* and *Amblyomma* spp predominate in the study area which coincided with the reports of Solomon Gebre, *et al.* (2004) and Assefa Regassa, (2001). During this trial, over 180 *R. pulchellus* ticks were counted in the ears of one cattle and more than 90 *Amblyomma* spp were recovered from the ventral part of a cow. Tick infestations on local cattle can be solved by spraying a localized part of the cattle such as ears to control *R. pulchellus* and axilla, ventrum, abdomen or udder for the control of *Amblyomma* ticks. Reduction in *Amblyomma* tick numbers would be beneficial in controlling heartwater and dermatophilosis, thus preventing udder damage which can lead to loss of udder quarters or, in bulls, sterility from testicular abscess (Tatchell, 1992).

Findings of this trial indicated that Deltamethrin 1% pour-on (Smash) effectively controlled ticks on cattle for 15 days while Deltamethrin 1% SC (Pali) controlled for 13 days. Results obtained on the effectiveness of Deltamethrin against ticks concord with other findings of related synthetic pyrethroid acari-

cides such as Flumethrin 1% (Rinkanya & Tatchell, 1988; Sileshi Mekonnen, 2000), Ectopor (Rinkanya, *et. al*, 1992) and Cypermethrin (Sileshi Mekonnen, *et. al*. 2004).

There was a significant difference between the mean tick counts for the control group compared to treatment group ($P<0.05$). It was also noted that there was no significant influence of sex on tick count between and within groups both before and after acaricide application. From this trial it can be concluded that Deltamethrin 1% pour-on (Smash) applied as a pour-on application showed better protection period than Deltamethrin 1% SC (Pali) spray form and proved to be highly effective against ticks.

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