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THE USE OF FLUMETHRIN* 1 % POUR-ON FOR THE CONTROL OF *AMBLYOMMA* SPP. IN VARIOUS SOUTHERN AFRICAN COUNTRIES

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ABSTRACT

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Efficacy trials with flumethrin 1 % pour-on were conducted in 9 different areas in 3 southern and central African countries against *Amblyomma hebraeum* and *A. variegatum* on cattle. A dose volume of 10 mℓ/100 kg body mass applied at bi-weekly intervals provided excellent control of both tick species on their predilection sites, irrespective of locally and seasonally high tick pressure. The trial results demonstrate clearly that this new concept of tick control can be effectively applied in commercial and traditional cattle husbandry situations.

INTRODUCTION

Two economically important *Amblyomma* species (bont ticks) occur in the southern and central Africa region. *A. hebraeum* is present in suitable habitats in the Republic of South Africa (Howell, Walker & Nevill, 1978), eastern Botswana (Walker, Mehlitz & Jones, 1978), Swaziland, Moçambique (Arnold & Travassos Santos Dias, 1983) and Zimbabwe (Norval, 1983). It is replaced by *A. variegatum* in north-western Zimbabwe (Norval, 1983) and Zambia (Pegram, Perry, Musisi & Mwanaumo, 1986). Both species are efficient vectors of heartwater *(Cowdria ruminantium)* in cattle, sheep and goats. They have a predilection for the lower parts of the body such as the belly, groin, axillae, perineum, and feet (Baker & Ducasse, 1967; Londt, Horak & De Villiers, 1979). Their long mouth parts cause discomfort; irritation; tissue damage, particularly on udders, and foot abscesses, with resulting lameness in sheep and goats.

They have no particular host-specificity: a wide spectrum of hosts is utilized by the immature stages (birds, rodents, hares and antelopes) and adults (cattle, sheep, goats, the African buffalo and antelopes) of these 2 *Amblyomma* species (Knight & Rechav, 1978; Horak, 1982; Horak, Potgieter, Walker, De Vos & Boomker, 1983; Horak, De Vos & Brown, 1983; Horak, De Vos & De Klerk, 1984; Hamel & Van Amelsfoort, 1985b; Mulilo, 1985).

The often high numbers of immature ticks on host animals other than cattle, and their distinct seasonal incidence during the dry winter months in most regions of southern Africa, frequently allows a build-up of tick populations on reservoir hosts which are not amenable to tick control (Mulilo, 1985).

On the other hand, the high prevalence of adult bont ticks on domestic animals during the wet summer months (October–March) requires appropriate control measures.

MATERIALS AND METHODS

It was decided to test the new concept of tick control with flumethrin 1 % pour-on in various situations in which *A. hebraeum* and *A. variegatum* were prevalent on cattle:

Republic of South Africa (commercial)—3 farms (Tables 1–3).

Zimbabwe (commercial)—1 farm (Table 4).

Moçambique (traditional)—2 sites (Table 5).

Zambia (traditional)—3 sites (Table 6).

Even in situations with initially high tick pressure it was decided to apply the tickicide, as far as was practically possible, at bi-weekly intervals. The aim was to confirm the prolonged residual action of the formulation and its high efficacy on commercial farms, as well as to demonstrate its action in traditional farming situations in Moçambique and Zambia.

In all but 1 of the field trials a uniform dose volume of 10 mℓ/100 kg body mass was applied along the backline. In 1 of the Moçambiquan trials, though, 1 group received only 20 mℓ per beast (Table 5).

Only adult ticks were counted. The various stages of engorgement (flat, semi-engorged, and fully engorged) were recorded in the R.S.A. and Zimbabwe trials. In trials with traditionally kept cattle these stages were not differentiated, due to rather difficult management conditions.

RESULTS

Pre-treatment adult bont tick counts (mean per group) were generally medium-high:

A. hebraeum

R.S.A.	Farm 1—360
	Farm 2—60
	Farm 3—60
Zimbabwe	Farm 1—10
Moçambique	Site 1—40
	Site 2—40

A. variegatum

Zambia	Site 1—15
	Site 2—30
	Site 3—70

The results of the field trials against these 2 *Amblyomma* species are summarized in Tables 1–6. The concept of flumethrin pour-on treatment at bi-weekly intervals provided excellent control of both *Amblyomma* species under various management and tick pressure situations in the different countries. The pour-on formulation was fully efficacious at all predilection sites of the ticks.

Re-infestation was effectively prevented for 2 weeks. Where ticks were recorded, practically no fully and very few semi-engorged females were counted. The regular treatments kept the tick pressure at a very low level on all trial sites.

DISCUSSION

The excellent field efficacy of flumethrin 1 % pour-on against *Amblyomma* spp. has already been proven under South African and Zimbabwean farming conditions (Hamel & Van Amelsfoort, 1985a; Hamel & Duncan, 1986). It is directly related to the high tickicidal potency of the active substance.

In vitro studies by Stendel (1985) showed oviposition inhibition of 60–100 % in engorged *A. hebraeum* females topically treated with 1,5–5 μg active flumethrin per tick.

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TABLE 1 Mean *Amblyomma hebraeum* counts on untreated and treated cattle on a farm in the Eastern Cape Province, Republic of South Africa, from January–March 1984

Day	Controls (5)			Treated group (10)		
	Males	U + S	F	Males	U + S	F
Day −3	234	135	1,0	248	125	0,8
Day 0*	—	—	—	—	—	—
Day + 1	251	129	3,6	27	11,7	1,2
Day + 3	273	122	1,0	1,0	0,4	0
Day + 5	271	128	10,4	1,1	0,6	0
Day + 7	106	45	0,6	5,1	1,5	0
Day + 14	71	21	0,1	48,7	20,5	0
Day + 16**	Controls also	—	—	—	—	—
Day + 21	treated	—	—	3,0	1,7	0,1
Day + 28	—	—	—	69,4	7,6	0
Day + 31*	—	—	—	30,5	10,8	0,3
Day + 35	—	—	—	2,2	1,7	0
Day + 42	—	—	—	7,6	2,3	0
Day + 49*	—	—	—	24,1	13,1	0
Day + 56	—	—	—	1,6	0,3	0

F = fully engorged female ticks
S = semi-engorged female ticks
U = unengorged female ticks
* = day of treatment for treated group
** = day of treatment for controls (at farmer's request) as well as treated group. No tick counts done on controls after this day
— = no tick counts made

TABLE 2 Mean *Amblyomma hebraeum* counts on untreated and treated cattle on a farm in the Eastern Cape Province, Republic of South Africa, from February–March 1984

Day	Untreated controls (5)			Treated group (10)		
	Males	U + S	F	Males	U + S	F
Day 0*	27	24,1	0,3	29,8	31,1	0,1
Day + 1	25	21,5	0	22,6	20,6	0
Day + 2	24	18,4	0,2	4,6	2,0	0
Day + 5	8,8	10,0	0	0	0	0
Day + 7	10,1	13,8	0	2,3	0,8	0
Day + 16*	25,3	16,3	0,3	7,1	5,2	0
Day + 21	25,1	16,5	0,2	0,4	0,9	0
Day + 28	25,5	9,5	0	1,7	0,4	0
Day + 35*	43,5	20,1	0	10,6	2,9	0
Day + 42	29,3	12,8	0,3	0,6	0,3	0

F = fully engorged female ticks
S = semi-engorged female ticks
U = unengorged female ticks
* = day of treatment

TABLE 3 Mean *Amblyomma hebraeum* counts on untreated and treated cattle on a farm in Zululand, Republic of South Africa, from October 1984–January 1985

Day of treatement	Untreated controls (5)			Treated group (10)		
	U	S	F	U	S	F
Day 0	40	5	0,8	54	8	2
Day 15	26	3	0,1	1,7	0,1	0
Day 27	11	2	0	2	0,2	0
Day 41	32	2,4	0	1,8	0,1	0
Day 55	20,4	10	0,4	0,9	0	0
Day 76	64,4	11,8	0	7,0	0,8	0

F = fully engorged female ticks
S = semi-engorged female ticks
U = unengorged female ticks

Translated into practice, a beast of 400 kg body mass receives a total of 400 mg active flumethrin (1 mg/kg b.m.). This amount theoretically becomes distributed over a calculated body surface of 5 m^2, thus providing a maximum of 8 μg active flumethrin per cm^2 (Stendel, 1986). Such a uniform distribution cannot be expected *in vivo*. However, it can be concluded from the field efficacy data that the active substance exerts its full tickicidal effects on all predilection sites, i.e. in concentrations shown to be efficacious in laboratory tests.

The field trials have shown that applications of this tickicide at bi-weekly intervals basically prevented the development of semi- and fully engorged bont ticks. This demonstrated the potential of the product to reduce tick populations on a farm to an acceptable and manageable level, particularly by interfering with the high reproductive potential of bont tick females (Norval, 1974). In general, the very low incidence of adult ticks on treated cattle will also to a great extent prevent tick-associated tissue damage and disease transmission.

TABLE 4 Means of *Amblyomma hebraeum* counts per animal in groups of 20 cattle, Hippo Valley Estates, Chiredzi, Zimbabwe, from November 1985–February 1986

Interval (days)	Controls			Conventional dip*			Flumethrin p-o		
	U	S/F	Total	U	S/F	Total	U	S/F	Total
Day 0*	0	0	0	4	1,8	5,8	1,5	0,1	1,6
Day 14	0	0	0	3,9	2,1	6	0	0	0
Day 14	6,4	1,3	7,7	1,2	0,05	1,25	0,1	0	0,1
Day 14	1,9	0,4	2,3	1	0	1	0,2	0	0,2
Day 14	4,0	0,53	4,53	1,7	0,4	2,1	0,17	0	0,17
Day 21	1,6	0,5	2,1	0	0	0	0	0	0
Day 14	0,6	0,2	0,8	0,9	0,05	0,95	0	0	0
Day 21	0,6	0,1	0,7	0	0	0	0	0	0

U = unengorged female ticks
S/F = semi- and fully engorged ticks
* = conventional dip: Chlorfenvinphos + Dioxathion (both 0,025 %)

TABLE 5 *A. hebraeum* counts on untreated and treated cattle, Gaza Province, Moçambique

Dates	Inhamavila			Chau		
	Group 1	Group 2	Group 3	Group 1	Group 2	Group 3
14 Oct. 1985*	42	43	46	40	54	47
21 Oct. 1985	48	0	0	16	2	0
28 Oct. 1985*	41	9	8	23	7	3
4 Nov. 1985	57	3	2	52	3	2
20 Mar. 1986	18,6	18	11,8	18,8	13,4	13,0
3 Apr. 1986	11,6	0	0,5	19,5	4,0	0,4
17 Apr. 1986	—	1,0	0	17,2	3,0	1,1
9 May 1986	3,1	1,0	2,3	8,0	2,0	2,3
5 Jun. 1986	17,6	7,6	7,2	12,3	10,6	4,1
3 Jul. 1986	17,1	0,2	2,5	6,6	0,8	2,4

Trial design
— Ten cattle per group (Landin Zebu)
— Tick counts = mean for 10 cattle (all stages)
— Group 1 = untreated controls
— Group 2 = 20 mℓ flumethrin p.-o. on pelvic area
— Group 3 = 30 mℓ flumethrin p.-o. along backline
Treatment at monthly intervals
*Bi-weekly treatments

TABLE 6 *Amblyomma variegatum* counts following bi-weekly flumethrin pour-on treatments, Choma District, Zambia

Dates	Simata I		Simata II		Muzoka	
	Mean ticks		Mean ticks		Mean ticks	
7 Jan. 1986	34,5	(18)*	15,5	(30)		
14 Jan. 1986	0,15	(14)*	—			
21 Jan. 1986	0,5	(13)	0	(10)	72,1	(20)**
4 Feb. 1986	0,1	(3)	0	(5)	0,1	(13)**
18 Feb. 1986	1,9	(11)	2,1	(8)	3,6	(13)
4 May 1986	0,8	(12)	1,0	(9)	0,1	(14)
18 May 1986	0,2	(13)	0,1	(11)	0	(6)
1 Apr. 1986	0	(12)	0,3	(11)	0	(5)

* Simata I: Initially 2 treatments at weekly intervals; at the other sites fortnightly treatments from the beginning
**Checks at Muzoka made on 22 Jan. and 5 Feb. respectively
( ) Number of cattle available for tick counts at respective check days

In areas with traditional animal husbandry practices, cattle losses due to tick infestation and tick-borne diseases are still inevitable, even taking into consideration the fact that endemic cattle breeds are rather resistant to the effects of tick-borne diseases.

Malnutrition and other concurrent diseases, however, are known to lower overall resistance, rendering cattle more susceptible to other noxious influences, particularly excessive tick infestation. The general economic constraints in many African countries allow only tight budgets for animal health programmes, in which tick control ranks prominently.

The establishment, maintenance and running of regular dipping operations is costly and troublesome. In this respect strategic treatments with flumethrin 1 % pour-on during the peak of the tick season at 2–3-weekly intervals offer new prospects in areas with no, or limited, tick control facilities.

The requirements of tick control in commercial farming are quite different, calling principally for tick-free cattle, even at the risk of lowering enzootic stability for tick-borne diseases. In many parts of southern and central Africa the co-existence of cattle with game and any other small wildlife species—potential hosts of bont tick

immatures—creates a permanent risk situation for livestock which can only be kept under control by strict and regular tickicidal treatments.

Based on the overall results of the various field trials, it can be concluded that this concept of tick control provides a high degree of efficacy against these 2 bont tick species. Under the existing tick pressure situations reinfestation with bont ticks was effectively prevented for 2–3 weeks, demonstrating the prolonged protective action of the pour-on formulation of flumethrin.

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