THE USE OF FLUMETHRIN POUR-ON FOR DE-TICKING BLACK RHINOCEROS *(Diceros bicornis)* PRIOR TO TRANSLOCATION IN ZIMBABWE

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ABSTRACT

The use of flumethrin pour-on in 1.0% and 0,5% concentrations for the purpose of de-ticking black rhinoceros (*Diceros bicornis*) prior to translocation is reported. Both formulations achieved a high level of efficacy within 8 to 12 h following treatment. The 0,5% formulation was found to be more suitable than the 1.0% for use on the dry, hairless skin of the rhinoceros because the increased dose volume resulted in more rapid spreading.

Key words: Rhinoceros, *Diceros bicornis,* tick control, translocation

Duncan I.M. The use of flumethrin pour-on for de-ticking black rhinoceros (*Diceros bicornis*) prior to translocation in Zimbabwe. *Journal of the South African Veterinary Association* **(1989) 60 No. 4, 195-196 (En.) Agricura (Pvt) Ltd, P.O. Box 2742, Harare, Zimbabwe.**

INTRODUCTION

The relocation of black rhinoceros (*Diceros bicornis)* from the Mana Pools National Park, and the Sapi and Chiwore Hunting Areas of the Zambezi Valley of nort Zimbabwe, (29° 15'E to 30° 0'E and 16° 15'S), to more centrally situated, safer habitats is part of the Department of National Parks and Wildlife Management's effort to preserve this threatened species from the onslaughts of poachers. In 1988 the rhino capture and translocation took place between mid-June and the end of July. The 20 animals mentioned in this report were relocated in the Zimbabwe Midlands, near Kwe Kwe (18° 59' S, 29° 46' E) and in southern Matabeleland near Gwanda (21° O' S, 29° O' E).

Black rhinoceros are the natural hosts of a number of ixodid tick species, some of which are the vectors of diseases affecting domestic livestock and some wild animals. The species *Amblyomma rhinocerotis* apparently occurs only in the Zambezi Valley and adjacent areas[1]. However, *Amblyomma sparsum* has been reported from other areas of Zimbabwe besides the Zambezi Valley, particularly areas to which black rhinoceros have been relocated[2]. This applies also to *Dermacentor rhinocerinus*[3]. While black rhinoceros appear to be refractory to tick-borne diseases, the role of the tick species they host in the possible transmission of disease to other classes of livestock in relocation areas is largely ignored. The introduction of ticks into these areas by means of translocated black rhinoceros therefore may have important implications. For example the nymphs of *Amblyomma sparsum,* a species hosted by black rhinoceros, are capable of transmitting heartwater (*Cowdria ruminantium)* to sheep[3].

The objectives of the present experiment were to test both the effectiveness and feasibility of using flumethrin pour-on to de-tick black rhinoceros destined for translocation and to prevent the introduction of tick species into relocation areas in which they do not occur naturally.

MATERIALS AND METHODS

Black rhinoceros (n=20) were carefully examined for tick infestation at the time of capture shortly after immobilisation. Estimates of the tick burdens were made, noting species and attachment sites. Where possible, semi-and fully engorged female ticks were counted and recorded. No sex identification of flat adult ticks was attempted and the numbers of flat ticks were recorded collectively.

Each animal was identified by an ear tag numbered from 01/88 to 20/88. Ticks were collected from each animal. Half of these were placed in 70% alcohol in specimen bottles for identification, while the other half were retained alive for in vitro exposure to flumethrin pour-on.

After capture all animals were transported to holding stockades where they were held for 3 to 7 d prior to crating for transportation by road to their relocation sites. Treatment with flumethrin pour-on took place after crating but before translocation.

The animals numbered 01/88 — 06/88 were treated with a 1,0% pour-on formulation of flumethrin (Drastic Deadline, Bayer) at the rate of 1 mg kg^{-1} live mass (10 mℓ 100 kg^{-1} live mass). The acaricide was applied with an automatic dosing gun, one third of the dose being placed on the dorsal mid-line over the fore quarters, and the remaining two thirds over the hind quarters.

This method of dosage placement was designed to facilitate the rapid spreading of the acaricide to the preferred tick attachment sites of the axilla, groin, udder/scrotum and perineum.

The animals numbered 07/88 — 20/88 were treated in similar fashion with a 0,5% pour-on formulation of flumethrin and the dose volume was doubled to 20 mℓ 100 kg^{-1} live mass to attain the same dosage of active ingredient as for the 1% formulation. This formulation and dose volume were used to achieve faster and more satisfactory spreading of the acaricide.

All 20 animals were checked 30 min and 1 h after treatment and again on arrival at their relocation sites 8-12 h later for tolerance to the treatment. All the animals were inspected for ticks through the sides of the crates before their release into holding stockades, where they were all inspected a second time, to determine the effect of the flumethrin on the ticks, and to note the spreading of the formulations.

In some cases it was possible to pluck ticks off animals by hand, or with specially adapted forceps. The empty translocation crates were searched after the animals were released into the stockades and the dead and live ticks collected. Those already dead were placed in specimen bottles containing 70% alcohol for identification while those still alive were placed in ventilated plastic containers. A small wad of slightly moistened cotton wool was placed to one side on the floor of each container. These containers were placed in an insulated, ventilated box and kept in the shade.

Live ticks collected at the time of immobilisation (before treatment with flumethrin pour-on) were divided into 3 treatment groups as follows: untreated controls, 1,0% flumethrin, and 0,5% flumethrin. Each group consisted of the following ticks:

Amblyomma rhinocerotis x 20 (10 male and 10 female)
Amblyomma sparsum x 10 (males only)
Dermacentor rhinocerinus x 5 (males only)

There were a total of 9 containers, 1 for each species within each treatment group.

In the treated groups, exposure of the ticks to flumethrin took place by means of a 30 mm diameter filter paper placed on the base of a 90 mm diameter Petri dish. One mℓ of the 1,0% and 0,5% formulations of flumethrin was run onto the filter papers prior to the ticks being placed in the containers. Gauze caps were placed over the tops of all containers to prevent the escape of ticks. Each container was checked at two hourly intervals up to 8 h after tick placement and finally at 24 h.

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Received: February 1989 Accepted: July 1989

Table 1: **Tick infestations on 20 black rhinoceros captured in Zimbabwe during 1988**

	Estimated numbers of ticks								
	A. rhino		A. sparsum		D. rhino		Hyalomma spp.		
Animal No.	FL	S/F	FL	S/F	FL	S/F	FL	S/F	TOTALS
01/88	300	20	25	2	0	0	5	1	353
02/88	100	10	40	3	2	0	1	0	156
03/88	200	15	12	1	0	0	10	0	238
04/88	200	20	10	2	0	0	4	1	237
05/88	500	60	20	4	4	0	15	2	605
06/88	400	20	20	8	7	0	25	8	488
07/88	300	20	15	5	4	0	20	5	369
08/88	150	4	10	2	2	0	20	5	193
09/88	150	4	20	2	0	0	4	1	181
10/88	200	20	15	5	2	0	4	0	246
11/88	250	12	25	4	6	0	20	4	321
12/88	200	5	12	2	2	0	15	2	238
13/88	250	30	20	4	5	0	50	8	367
14/88	not counted								
15/88	400	20	10	2	4	0	50	10	496
16/88	300	30	50	7	0	0	20	4	411
17/88	300	30	0	0	1	0	20	8	359
18/88	not counted								
19/88	150	20	50	10	0	0	50	10	290
20/88	200	20	10	0	1	0	15	5	251
Totals	4 550	360	364	63	40	0	348	74	5 799
Combined totals	4 910		427		40		422		
Percentage of total infestation	84,7%		7,3%		0,7%		7,3%		

Key

A.rhino = *Amblyomma rhinocerotis*
A.sparsum = *Amblyomma sparsum*
D.rhino = *Dermacentor rhinocerinus*
FL = Flat ticks
S/F = Semi- and fully engorged female ticks

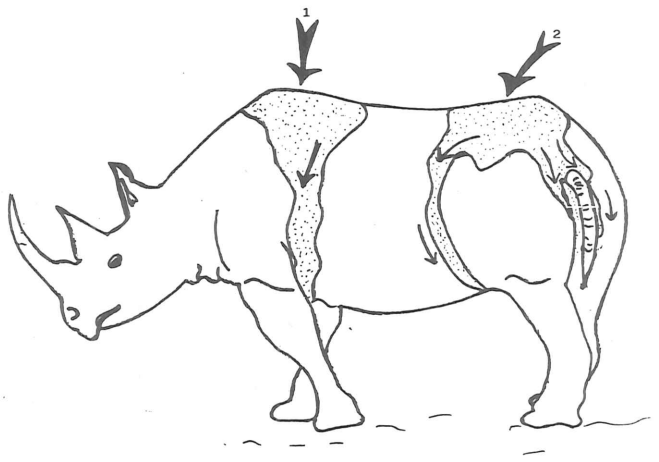

Fig. 1: **Illustration of dosage placement and spread of flumethrin pour-on on black rhinoceros (1 = one third of dose deposited 2 = two thirds of dose deposited)**

RESULTS

Estimates made at the time of capture revealed that the black rhinoceros were, at that time, hosting considerable numbers of ticks, mainly of 4 species. These were *A rhinocerotis,* which accounted for roughly 84,7% of the infestations; *A sparsum:* 7,3%; *Hyalomma* spp: 7,3% and *D rhinocerinus:* 0,7%.

No *Rhipicephalus* species were present and members of the genus *Boophilus* are known not to occur in this area. *Amblyomma hebraeum* and *Amblyomma variegatum* could not be found on any of the animals examined. Table 1 summarises the estimated tick burdens of each of 18 animals at the time of capture. It was not possible to estimate the tick numbers on animals 14/88 and 18/88. Tick numbers varied from approximately 156 to 605 adult ticks. Roughly 8,6% of these were semi-and fully engorged female ticks, mainly of the species *A rhinocerotis.* The average tick burden was 322. There was no evidence of tick stress or physical damage on any of these animals.

The main sites of tick attachment for all species were the groin, udder/scrotum, perineum and axilla. A few *A sparsum* were also attached to the dorsal regions of the animals.

Acaricidal efficacy of flumethrin pour-on

It was not possible to immobilise the animals at their relocation sites prior to release and detailed tick estimates could therefore not be made. However, it was possible to conduct close-quarter observation of the animals through the sides and tops of their translocation crates.

Further observations were carried out through the sides of the stockades after the animals were released from the crates. Those ticks which could be reached by hand or be plucked off with a specially adapted pair of forceps were all found to be dead.

The empty translocation crates were searched for detached ticks and large numbers collected. A total of 110 live ticks were collected from the crates but none survived for longer than 24 hours after collection.

All the ticks exposed in vitro to either of the formulations of flumethrin died. The untreated controls were still alive 3 d later at which time they were discarded.

The 1,0% formulation when used at the recommended dosage of 1 mg kg^{-1} spread slowly but in most cases did eventually reach the target areas. The 0,5% formulation used at the dosage volume of 20 mℓ 100 kg^{-1} live mass (1 mg flumethrin per kg) however, spread rapidly and visibly reached the target areas in a much shorter time.

Placement of the dosage for both 1,0% and 0,5% formulations was identical. Solution placed on the hindquarters spread down either side of the tail attachment to the perineum and beyond to the area between the thighs. Spreading also took place forward down the groove formed by the anterior aspect of the hind legs and the posterior aspect of the abdomen. Placement over the forequarters on the shoulders resulted in spreading down behind the front legs, down the girth to the axilla. (Fig. 1).

There was no evidence of sensitivity to flumethrin pour-on in any of the 20 animals with either of the pour-on formulations.

DISCUSSION

Black rhinoceros appear to suffer no ill effects due to physical damage or tick-borne diseases following tick infestation under the normal extensive wildlife conditions found in the Zambesi Valley. Problems which may result through confining the black rhinoceros to fenced-off areas are to be expected since the confinement of other species of wild animals has, on may occasions, resulted in high tick challenge with its consequent problems[4].

The provisions of the Animal Health Act in Zimbabwe may, at any time, be invoked and applied to translocated wild animals to ensure they are tick free prior to translocation. The rule does apply to domestic livestock (Cattle Cleansing regulations, 1976) and is designed to circumvent the outbreak of serious tick-borne diseases in all classes of domestic livestock and game.

It would appear that before the present exercise, effective de-ticking of black rhinoceros prior to translocation was not carried out. Treatment of rhino after re-location has taken place (P Trembath, 1988 - personal communication). This has been largely due to the unsuitability of conventional means of de-ticking, eg. acaricidal sprays.

Such methods may prove ineffective since the acaricide might not reach some of the inaccessible target areas on black rhinoceros where ticks are likely to be attached. Ticks attached in the deep skin folds of the groin, for example, might not be reached by the acaricide. One of the most important advantages of the "pour-on" method of acaricide application is the fact that it is stress-free. This is an important consideration at a time when the animal is subjected to a considerable amount of stress-producing activity.

The large numbers of dead ticks collected from the empty translocation crates, the relatively tick-free state of the animals when checked at their re-location sites, and the high in vitro efficacy of the acaricide suggest that flumethrin pour-on when applied to tick infested black rhinoceros, will achieve a high degree of efficacy within 24 h.

Regrettably, because immobilisation of the rhinoceros after transportation was not possible, a more critical comparison of the efficacy of the two formulations was not carried out. It is reasonable to assume, however, that the 0,5% formulation was more effective due to its more satisfactory spreading.

The dry, hairless hide of the black rhinoceros implies that it has a low sebaceous gland density, resulting in a much lower level of sebum secretion. Since flumethrin pour-on depends to some extent on naturally secreted sebum to spread across the animal's skin surface, its absence obviously results in slower and less efficient spreading. The spread of the 1,0% flumethrin formulation on the skins of the rhinoceros was slow and in some cases the acaricide may not have reached the target areas in the groin and axilla of treated animals.

A similar situation has been observed in experiments carried out on African Buffalo at Mushandike National Park, west of Masvingo in Zimbabwe (Duncan and Monks, 1986 - unpublished observations).

In addition to the presumed low sebum secretion, the hide of the rhinoceros is characterised by a rich network of wrinkles forming both large and minute channels. When applied to such a surface, instead of spreading rapidly, as it would on the sebum saturated skin surface of most other animals, much of the pour-on formulation is soaked up in the wrinkles. Further spreading only takes place if there is a sufficient volume of pour-on to fill the wrinkles and overflow to unsaturated areas. Since the attachment sites of ticks on black rhinoceros are well defined, the split-dose placement of flumethrin pour-on over the forequarters and hindquarters is advisable.

ACKNOWLEDGEMENTS

I wish to thank the Director, Department of National Parks and Wildlife Management, Zimbabwe, Mr Justin Muchuwe, as well as Dr Jane B Walker, Dr Mike Kock, and Dr Johann Schröder for their assistance during this project.

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