

EVALUATION OF DELTAMETHRIN 7.5 % POUR ON FOR THE CONTROL OF SOME ECTOPARASITES OF CATTLE AND BUFFALOES

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Abstract

The results of *in vivo* evaluation of deltamethrin 7.5 % pour on revealed that single application caused 100% elimination of *Boophilus annulatus* hard ticks from naturally infested cows under treatment within 2-3 weeks. There was neither any reinfestation nor undesirable side effect up to 45 days post treatment. Deltamethrin 7.5% pour on seems to be very effective against tick infested cows, safe for use and easy for application. *In vitro* evaluation, *B. annulatus* tick species exposed to hair (10 minutes) collected from cows previously treated with deltamethrin 7.5% pour on show some degree of paralysis and mortality varies according to time of collected hair post treatment. The most effective result was observed on hair collected 14 days post treatment, while hair collected 35 days post treatment was the least, since the speed of killing activity slows down gradually with time pass. The predilection site of lice, *Haematopinus tuberculatus* among buffaloes were the wither region (47.6%) followed by the neck and dewlap (45%), while the cheek was (0.16%) the lowest predilection site for buffalo lice. *In vivo* evaluation, of deltamethrin 7.5% pour on against buffalo's lice was 100% on day 7 post treatment compared to control group. Animal showed relief from symptoms of itching which continued for 35 days post treatment. *In vitro* evaluation, the mortality of lice was started 15 minutes after exposure and completed after 30 minutes from exposure to insecticide.

INTRODUCTION

The world tick fauna (acarina) is composed of 850 species in three families and 19 genera. All known ticks are obligate hematophagous ectoparasites of either warm or cold blooded animals during one or more stages of their life cycle. It is characterized by longevity and high reproductive potential, relative freedom from natural enemies, highly sclerotized bodies that protect them from environmental stresses, slow feeding behavior of it permits wide dispersal and increases the likelihood of acquiring pathogens during attachment to a host, transovarian transmission of microbial disease agents contributes to the maintenance and spread of some tick-borne agents, pharmacologically active substance present in the saliva of ticks may promote feeding success and aid transmission of microbial agents

(antiedema , antihemostatic and immunosuppressive properties) (Balashov, 1972). Ticks imbibe large quantities of blood during each feeding period, each female is able to ingest 1.0 ml of blood from the host during its parasitic phase causing a weight loss of approximately 1gm and reducing milk production by 8.9 ml (Luciana *et al.*, 2011). Some species of ticks take multiple blood meals during their life time (Three times). Following acquisition of an infective blood meal, many larval or nymphal vector ticks pass microorganisms transstadially.

The water buffalo (*Bubalus bubalis*) population in the world is about 190 million head (FAO, 2010) and increasing nearly 1.3 % annually. The buffaloes play an important economic role in the livestock economy of several countries including Brazil, India, China, Pakistan, Turkey and Italy.

The suckling louse *Haematopinus tuberculatus* is a louse of *B.bubalis*, being the principle ectoparasite parasitizing these animals. Considering the production potential of buffaloes, the control of parasitic infection is crucial to prevent economic losses (Veneziano *et al.*, 2007).

Despite the disadvantages of using acaricides, such as environmental contamination, potentially harmful residues in meat and milk and toxicity to workers who apply them, these drugs are still essential to control tick infestations in the world (De Castro,1997).

In the present study an attempt has been made to evaluate the efficacy of deltamethrin 7.5% pour on against hard tick in cattles and suckling lice in buffaloes.

MATERIALS AND METHODS

A farm study:

The trial was conducted on governmental cows and buffaloes farm located in Kafr- Elsheikh with a confirmed presence of ticks and louse infestation. Ticks were collected from infested cows and identified according to the morphological description given by Walker, *et al.* (2003).

Live louse were collected from infested buffaloes and the identification was based on the morphological description given by Meleney and Kim (1974).

In vivo, evaluation of deltamethrin 7.5 % pour on against hard ticks

Application of acaricide on cattle

The degree of infestation and the number of ticks per unit area (7.5 X 7.5 cm.) on twenty infested cows were counted before application of the insecticide as per method described by (Maiti *et al.*, 1997). Animal having one tick per unit area was graded as light infestation, two ticks as moderate and three and more per unit area as

severe infestation. Ten severely infested and 5 moderate infested cows with *Boophilus annulatus* ticks were used in insecticide application. Five cows having light infestation were kept as non-treated control.

Deltamethrin 7.5 % pour on was applied for fifteen cows infested with *Boophilus annulatus* (10 severely infested and 5 moderately infested) along with mid line from shoulder to tail with a dose of 10 ml to each animal irrespective of weight. Assessment of the acaricidal efficacy was done on the basis of absence of ticks on the body after treatment and freedom from reinfestation.

The studied animals were observed periodically for the first day of study (three times, every 4 hour) for possible adverse reactions, then daily for 1 week and then once a weekly until the end of the trial. Skin examination was carried out using a modified Draize scoring system (Draize *et al.*, 1944). A score of 0-4 was applied to each treated cows in respect of (A) erythema and schar formation, (B) edema formation and (C) hair loss at site of application, with the score 0 indicating the absence of change and the scores 1-4 indicating increasing severity of dermal change.

The efficacy of acaricide was calculated at 7, 14, 21, 28 and 35 day post treatment using the following formula,:

Insecticide efficacy % = No. of animals cured/total number of animals treated X 100

In vitro, evaluation of deltamethrin 7.5 % pour on against hard ticks

On days 7, 14, 21, 28 and 35 after treatment of cows with deltamethrin 7.5 % pour on, some hair was cut off from different body sites and placed into plastic bags and immediately transported to the laboratory. Sixty engorged females *Boophilus annulatus* weighting between 160 and 300 mg, with no signs of injury, were used for each body site treated hair (50 for the test divided into five groups, A1, A2, A3, A4, A5 and A6 as control). Ticks were mingled with treated hair for ten minutes; Control group was left with untreated hairs. After the exposition period, the exposed ticks were taken out and placed in breeding tube and kept at 25°C and 75 % RH for observation daily for 7 day for each group. The efficacy of acaricide was calculated as mentioned before.

Testing for pediculicidal activity in vivo:

Twelve buffaloes infested with *Haematopinus tuberculatus* lice were selected for testing the acaricide. Individual louse count at eight predilection sites of buffalo body was carried out. The predilection sites were determined on the basis of louse distribution studies on buffaloes (Veneziano, *et al.*, 2003).

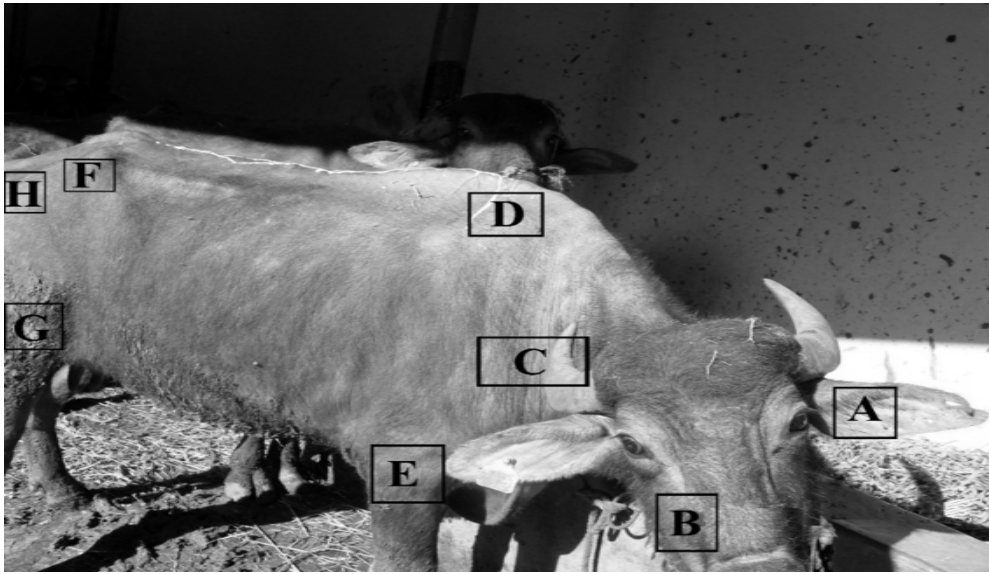


Fig. 1. The predilection sites of the louse counts on the different parts of the buffalo's body:

A.Ear, B.Cheek. C.Neck & dewlap, D.Withers, E.Foreleg (axilla), F.Back, G.Hind leg (inguinal), H. tail head and perineum

The predilection sites were as follows:

1. Cheek (5X 10 cm area), right and left.
2. Ear (5 X 10 cm area), right and left.
3. Neck and dewlap (10X 20 cm area), right and left.
4. Withers (10X10 cm area), right and left.
5. Fore leg (axilla)(10X10 cm area), right and left.
6. Back (10X10 cm area), right and left.
7. Hind leg (inguinal) (10X10 cm area), right and left.
8. Tail head and perineum (10X10 cm area).

For deltamethrin 7.5 % pour on suspension evaluation (Intervet productions S.A. Rue de Lyons. 27460 Igoville/France), ten buffaloes severely infested with *H. tuberculatus* lice (tested group) and another two animals kept as infested non treated control group were selected. Deltamethrin 7.5 % pour on was applied a long with mid line from shoulder to tail of buffaloes with a dose of 10 ml to each animal irrespective of weight. Assessment of the acaricidal efficacy was done on the basis of absence of lice on the body after treatment and freedom from reinfestation.

Testing for pediculicidal activity *in vitro*:

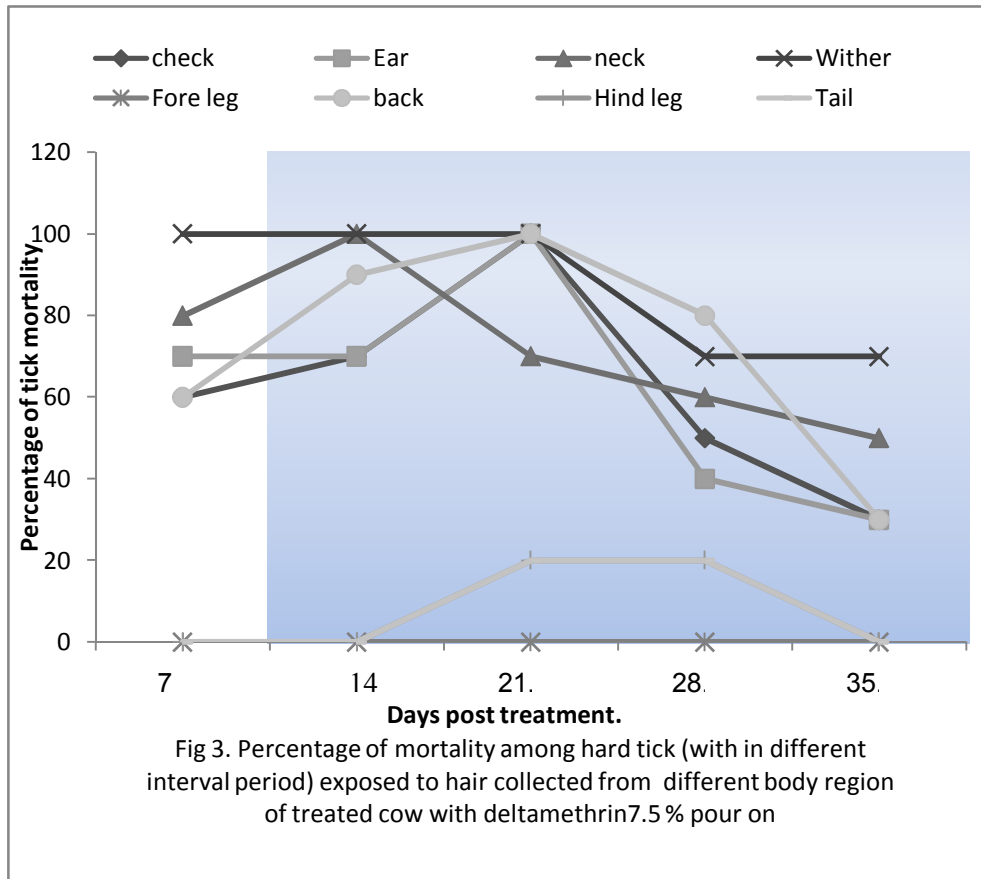
The method used to assess the pediculicidal activity of deltamethrin 7.5 % pour on was applied according to Priestley, *et al.* (2006). A volume of 600 µl of the insecticide was distributed evenly over a 9 cm diameter filter paper held in 9 cm glass petridish. After 15 mins, the liquid had spread out, the filter, paper was fully impregnated and no excess was left in the dish. Thirty buffaloe's lice, male and female, were placed on the top of filter paper disc. The control group (20 buffaloe's lice) was treated with distilled water only. Lice were examined under a dissecting microscope at ten different time intervals (1, 2, 3, 4, 8, 10,15, 20, 30, and 60 mins). Death was defined as the lack of limb and gut movement, and the failure to respond when the legs were stroked with a forceps. The number of fatalities was recorded.

RESULTS

In vivo, the results of evaluation of deltamethrin 7.5 % pour on revealed that single application caused 100% elimination of hard ticks from naturally infested cows under treatment after two weeks, table (1) & fig (2). There was neither any reinfestation nor undesirable side effects up to 35 days post treatment. In the present study, deltamethrin 7.5% pour on seems to be very effective against tick infested cows, safe for use and easy for application.

Table 1. *In vivo* evaluation of deltamethrin 7.5 % pour on against hard ticks (*Boophilus annulatus*)

Days Post treatment	Treated group				Untreated control group (5 cows)	
	Severely infested group (10 cows)		Moderately infested group (5 cows)			
	Cured animal					
	No.	%	No.	%	No	%
7	3	30	3	60	5	-
14	6	60	2	40	5	-
21	1	10	0	0	5	-
28	0	0	0	0	5	-
35	0	0	0	0	5	-
Insecticidee fficacy	100 %		100 %		-	



In table (2) & fig (3) *B. annulatus* tick species exposed to hair (10 minutes) collected from treated cows showed some degree of paralysis and mortality which varied according to time of hair collection post treatment. Hair collected 14-21 days post treatment were the most effective (70% - 100% mortality), while hair collected 35 days post treatment was the least (30%- 70% mortality), The speed of killing activity slowed down gradually with time pass.

Table 3. Distribution of lice on different body sites of infested (10) buffaloes

Sites of lice	Cheek	Ear	Neck and dewlap	Wither and abdomen	F.Leg	Back	H.Leg	Tail
Number and % of lice	1 (0.16%)	5 (0.80%)	280 (45%)	296 (47.6%)	10 (1.6%)	10 (1.6%)	15 (2.4%)	5 (0.80%)

Table (3) shows the predilection sites of lice among buffaloes which were the wither region (47.6%) followed by the neck and dewlap (45%), while the cheek (0.16%) was the lowest predilection site for buffalo lice.

Table 4. Testing for in vivo pediculicidal activity of deltamethrin 7.5% pour on

Day post treatment	Control untreated group	Deltamethrin treated group	
	Total no. of lice	Total no. of lice	Efficacy%
1	25	622	0
7	23	0	100
14	26	0	100
21	32	0	100
28	31	0	100
35	34	0	100

Table (4) shows that the efficacy of deltamethrin 7.5% pour on against buffaloe's lice was 100% on day 7 post treatment compared to control group. Animals showed relief from symptoms of itching which continued for 35 day post treatment.

Table 5. In vitro mortality of lice exposed to deltamethrin 7.5 % pour on.

Time by minutes	Mortality rate of lice in relation to the exposure time	
	Treated group (30)	Control group (20)
1	0	0
2	0	0
3	0	0
4	0	0
8	0	0
10	0	0
14	10 (33.3%)	0
20	12 (40%)	0
30	8 (26.7%)	1 (5%)
60	0	2 (10%)

Table (5) shows that the mortality of lice were started 15 minutes after exposure (33.3%) and completed after 30 minutes from exposure to insecticide.

DISCUSSION

Among synthetic pyrethroids, deltamethrin is of particular importance, contrary to other pyrethroids. It is a single cis-isomer which is considered to be more effective than isomer combinations. Deltamethrin repel ectoparasites by the "hot foot effect" which is typical for pyrethroids. An insect after it had a touchdown on such an animal, redraws its feet suddenly from treated hair. Even after a very short contact, for only a few seconds to treated hair, a "knock-down effect" occur since insects and ticks die soon after the open nerve ends at their feet got into contact with the insecticide (Elias, 2013).

Any type of stress (physiological, drug, nutritional, disease, environmental) causes increase in circulatory biogenic amines (histamine, tryptamine and tyramine) which reduce the metabolic activity of animal and thus adversely affect the growth, production, reproduction and general performance of animal by suppressing beneficial hormones of the animal (Singh and Handa, 2005). Pour on drugs seem to have no adverse effect on animal production, as usually in all drug administration (oral/parental/ external), Pour on drugs can be recommended for young, growing, working and lactating animals as they are easy to administrator, safe, nontoxic, water resistant, economically as well as kill and control many ecto/endoparasites. They are safe for dung beetles which help in increasing soil fertility, soil aeration as well as removing breeding sites for worm larvae (Singh, 2009).

Our experimental study clearly showed that the insecticide deltamethrin 7.5% pour on when applied on the hair of cattle and buffaloes has killing effects on both *Boophilus annulatus* hard ticks and *Haematopinus tuberculatus* lice of buffaloes. Dealing with cattle infested with *Boophilus annulatus*, the efficacy of deltamethrin was reached to 100% after two week among moderately infested group while it was 21 days for severely infested cows.

In vitro testing the insecticidal efficacy of deltamethrin by using hair collected from treated cattle on different interval periods (7, 14, 21, 28 and 35 days) post insecticide application, ticks were exposed to collected hair for 7 days. Our result demonstrated that the mortality among ticks exposed to hair collected from the different body region was varied between 0 - 100% according to the origin of collected hair and time of hair cut from treated animal. The pour on drugs lost its efficacy in fore leg of animal and reach to 20% in both hind legs and tail. The slower killing of hard ticks may be explained by the fact that in cattle, the product was exclusively poured on the backline of animals therefore, the way of the product to reach at the tail and both legs may be longer and need more time to reach to these sites.

Other studies on the efficacy of deltamethrin on *Rhipicephals microplus* in Brazil were varied from 61.22% to 76.84% (Luciana *et al.*, 2011), meanwhile Pereira (2006) and Furlong, *et al.* (2007) reported that the efficacy was 25.39% and 15.3% respectively. The difference in efficacy of acaricide could be related to the way of use such as inadequate spraying, under dosage or over dosage and/or high frequency of use causing the development of resistant population (Furlong and Martins, 2000).

The present study shows that, the hard tick *B. annulatus* are sensitive to deltamethrin being poured on the skin of cattle. The product reach to most of the body region of animal in different acceptable degree.

The high density of animal in intensive breeding favors the increase of ectoparasites, in particular, obligate parasites, such as the lice *H. tuberculatus*. The

treatment of ectoparasitic disease of buffaloes is more than hampered by the limited availability of products licensed for use in this species. On buffaloes, insecticide has to be used taking into account information extracted from the use of insecticide drugs on cattle. The louse infection are widespread in buffalo's farm in different countries (Veneziano *et al.*, 2007 and Kakar and Kakarsulemankhel, 2009).

In our study, the louse distribution on buffaloes body region was completely differ where the withers (47.6 %), neck and dewlap (45 %) are the predilection sites while the lowest number of louse which in hind leg (2.4 %), fore leg (1.6%), back (1.6%), tail (0.80 %), ear (5%) and check (0.16%) in a accordance.

The efficacy of deltamethrin 7.5% pour on against *H. tuberculatus* was 100% within the first week throughout the study period (35 days). Veneziano, *et al.* (2004) found prinomectin pour on at cattle dose (500 mg/Kg.b.w.) to be completely effective on water buffaloes naturally infested with *H. tuberculatus* with a total control of the lice 56 days after treatment. Hussain, *et al.* (2006) using a topical application of cypermethrin (1ml/200ml water) reported an efficacy of 94.7% at the day 28 after treatment. Lau and Singh (1985) evaluate the efficacy of ivermectin against *H. tuberculatus*, although louse numbers were reduced by 85% and 100% in buffaloes treated S/C of a dose 200 or 400mg/Kg b.w. respectively, efficacy diminished to 50% by day 33 after treatment. Similarly, Suphaluksana and Ching (1991) observed a limited efficacy (84%) in number of *Haematopinus spp.* 28 days after treatment following a 200 mg/Kg b.w. S/C dose of ivermectin. Ahmed, *et al.* (2009) reported similar result 80% and 83% using ivermectin and doramectin injection, respectively. Similarly Khatar, *et al.* (2009) observed that D-phenothrin (0.6ml/Kg b.w.) pour on was totally effective (100%) 9 days post treatment against *H. tuberculatus* on buffaloes naturally infested. Khatar, *et al.* (2009) proved that topically application of some essential oils (camphor, peppermint, chamomile and onion) could be used for controlling lice of buffaloes.

In the present study, vitro bioassay indicated that 100% lousicidal efficacy was achieved after 30 minutes post application with deltamethrin 7.5% pour on. Likewise, high efficacy for the same materials had been reported against the buffalo's *H. tuberculatus* by Khater, *et al.* (2009). The control group in present study showed an increasing trend of lice infestation during the course of study.

In conclusion, deltamethrin 7.5% pour on was quite effective for the management of cattle's ticks as well as buffalo's lice. It can be recommended for young, growing, working and lactating animals as they are easy to administer, safe, non-toxic, water resistant, economically as well as control many ectoparasites.

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تقييم كفاءة دلتامثرين ٧.٥% صب لمكافحة بعض الطفيليات الخارجية التي تصيب الأبقار و الجاموس

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إن النتائج الحقلية لإختبار كفاءة مبيد الدلتامثرين ٧.٥% صب قد وصلت إلى ١٠٠% فى التخلص من القراد الجامد للأبقار المصابة به طبيعياً والتي تم شفائها خلال إسبوعين بالإضافة إلى عدم ظهور الإصابة مرة أخرى أو أى عرض جانبى غير مرغوب فيه خلال ٤٥ يوم بعد العلاج. وبذلك أظهر مبيد الدلتامثرين ٧.٥% صب كفاءته على القراد المصابة به الأبقار طبيعياً إلى جانب الأمان فى استخدامه والسهولة فى تطبيقه.

عند إختبار المبيد معملياً وذلك بتعريض القراد من نوع البوفلس أنيولاتا لشعر تم جمعه من أبقار معالجه بالدلتامثرين ٧.٥% صب شوهدت بعض درجات الشلل والموت على القراد تختلف تبعاً للوقت الذى تم فيه تجميع الشعر بعد العلاج. وقد وجدت أعلى درجة تأثير للشعر الذى جمع بعد مضى ١٤ يوم من العلاج وأقل تأثير كانت للشعر الذى جمع بعد ٣٥ يوم من العلاج مما يؤكد أن كفاءة المبيد تقل تدريجياً بمرور الوقت.

وبالنسبة للقمم فقد وجد أعلى نسبة إصابة له فى الأماكن المفضلة لتواجده على جسم الجاموس المصاب عند منطقة الحارك (٤٧.٦%) ويليه منطقة الرقبة واللب (٤٥%) وبينما اقل نسبه إصابة كانت بالخد (٠.١٦%). وإختبار كفاءة المبيد الدلتامثرين ٧.٥% صب على قمل الجاموس حقلياً وجد انها وصلت إلى ١٠٠% فى اليوم السابع من العلاج مقارنة مع المجموعة الضابطة كما لوحظ إختفاء أعراض الحكه والتي إستمرت ٣٥ يوم بعد العلاج. وبإجراء الإختبارات المعملية لتحديد كفاءة المبيد الدلتامثرين على قمل الجاموس بدأ نفوقه بعد ١٥ دقيقة من بداية التعرض للمبيد واكتمل بعد ٣٠ دقيقة.