

Comparative efficacy of deltamethrin and chlorpyrifos in bovine ticks in and around Jabalpur

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Abstract Efficacy of chlorpyrifos (Classic*20, 20% EC) and deltamethrin (Butox[®], 1.25% EC) was assessed by spraying these drugs on cattle and buffaloes which were naturally infested with ticks at the concentration of 2.5 and 2 ml/l, respectively. Results of the study demonstrated the prolonged effect of chlorpyrifos when compared with deltamethrin. Moreover, residual effect of chlorpyrifos remained even after 14 days of treatment with 28.57% animals showing reinfestation, while in deltamethrin treated animals; the tick number started increasing after 14th day of treatment with 50% animals showing reinfestation on 14th day post-treatment.

Keywords Bovine · Chlorpyrifos · Deltamethrin · Ticks

Introduction

As per Livestock census (2012), India possesses a bovine population of 299.9 millions. Indiscriminate use of acaricides against ticks started showing resistance against some common and least toxic chemical acaricides. “Butox” has

been claimed to be effective even against the acaricide resistant strains of ticks with long time protection against reinfestation (Sinha et al. 2010). Therefore, present study was carried out to compare the therapeutic efficacy of deltamethrin and chlorpyrifos against ticks of cattle and buffaloes.

Materials and methods

The study was carried out in randomly selected 42 animals (21 cattle and 21 buffaloes). The animals were maintained in semi intensive management system and were allowed for grazing in the day time and were kept in the house in night with supplementation of concentrate mixture. The animals were apparently healthy. The sheds were made up of concrete with cemented floor. The animal sheds were apparently tick free. The animals were naturally harbouring heavy tick infestation showing all the stages on the body and counted only a 15 in.² area of dewlap and groin region of cattle and buffalo, respectively. The animals were divided into three groups, each group containing seven cattle and seven buffaloes. Groups-A and B were treated with deltamethrin and chlorpyrifos whereas animals of Group-C acted as control and were treated with tap water. Spraying was carried out to evaluate the percent efficacy and residual effect of both the drugs. Percent efficacy of drugs was evaluated on the basis of reduction in tick count within the observed area of the treated animals on 1st, 3rd, 7th, 14th, 21st and 30th day of treatment using the following formula Sinha et al. 2010. However, treated animals were further observed on 14th, 21st and 30th day of treatment for reinfestation of ticks to evaluate residual effect of the acaricides.

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% efficacy

$$= \frac{\text{No. of ticks on pre-treatment} - \text{No. of ticks on post-treatment}}{\text{No. of ticks on pre-treatment}} \times 100.$$

Results and discussion

It was observed that just on spraying the drugs at recommended dose rates, ticks of all stages started dropping off from the host. The reaction of both the drugs was very quick and spontaneous. The per cent efficacy was observed 100% on 1st day (24 h) of treatment for both the drugs and no ticks were found till 7th day of treatment. But, reinfestation was observed in both the treated groups (Group-A and Group-B) on 14th day of treatment and it was gradually increased during the study period. In deltamethrin treated cattle group 85.7% (6/7) were observed with reinfestation on 14th day of treatment with an average of 11 numbers of ticks (Table 1), while in case of buffalo, 14.28% (1/7) animals were found to be reinfested with eight ticks. In case of chlorpyrifos treated cattle, 57.14% (4/7) animals were observed with reinfestation on 14th day of treatment with an average of 5.25 ticks while in case of buffalo, no reinfestation was recorded on 14th day of treatment. Cattle treated with deltamethrin showed 100% (7/7) reinfestation on 21st day with an average of 25 ticks, whereas buffaloes treated with same drug showed 57.14% (4/7) reinfestation with an average of 11 ticks. For the convenience of the study, the housing systems were categorized as (1) open with cemented floor, (2) open with kachcha floor, (3) rope tied with cemented floor and (4) rope tied with kachcha floor. The health conditions of the animals were not good because of the lacking of proper nutrition and providing of bedding materials.

Chlorpyrifos treated cattle showed 100% (7/7) reinfestation with an average of 15 ticks while buffalo treated with same drug showed 14.28% (1/7) reinfestation with an average of six ticks on 21st day of treatment. In

deltamethrin treated group the rate of reinfestation on 30th day was 100% (14/14) in cattle and buffalo population, with an average of 34 and 14 in cattle and buffaloes, respectively (Table 2). During the study period it was observed that there is a strong positive association exists between the tethered (rope tied) animals with kachcha (un-cemented) floor and open housed animals with kachcha (un-cemented) floor for tick infestation and even it was observed that animals maintained under such conditions noticed anemic due poor managerial practices when compared to animals maintained on cemented floor. However, negative association was observed between the open housed animals with cemented floor and tethered housed animals with cemented floor for tick infestation tick infestation. The animal shed was not tick free zone because cracks and crevices found in the wall and floor and they hide in particular area. Similar results were observed in chlorpyrifos treated group with a reinfestation percentage of 100% (14/14) in cattle and buffalo population, with an average of 25 and 11 ticks in cattle and buffaloes, respectively. The data obtained in this study has shown occurrence of resistance to deltamethrin than chlorpyrifos. Since, it has been long time people has stopped using organophosphorous compounds against ticks and due to their residual effect, and the study was made for single application of acaricides without any further treatments might be the reason why ticks are reverting back slight susceptibility against chlorpyrifos and short reinfestation time. Over the counter availability and irrational use of deltamethrin since long time might be among the possible cause of decrease in its acaricidal efficacy.

Singh et al. (2007) observed variations in the residual effect and knockdown effect of flumethrin and deltamethrin against *Boophilus microplus* and *Hyalomma anatolicum anatolicum*. Flumethrin showed residual effect for 42 days, whereas, deltamethrin for 14 days. Flumethrin led to complete knockdown of ticks in 24 h, whereas deltamethrin did the same in 48 h. Ghosh and Nanda (1997) noted that 2 ml/l deltamethrin was, however, 100%

Table 1 In vivo efficacy of deltamethrin and chlorpyrifos in cattle and buffaloes infested with ticks

Groups	Conc. (ppm)	Animals (no.)	No. of ticks before treatment (mean ± SE)	No. of ticks after treatment						
				Day 1	% Efficacy on day 1	Day 3	Day 7	Day 14	Day 21	Day 30
Group-A (deltamethrin)	25	Cattle (7)	81.43 ± 1.57	0	100	0	0	11	25	34
		Buffalo (7)	74.71 ± 1.95	0	100	0	0	8	11	14
Group-B (chlorpyrifos)	500	Cattle (7)	93.14 ± 2.37	0	100	0	0	5.25	15	25
		Buffalo (7)	75.71 ± 1.49	0	100	0	0	0	6	11
Group-C (control)	Tap water	Cattle (7)	98.43 ± 2.71	103.4	0	100.6	95.6	97.2	94.8	96.4
		Buffalo (7)	77.71 ± 1.73	82.7	0	83.4	75.3	76.6	72.3	72.5

Table 2 Period of reinfestation of ticks in cattle and buffalo

Groups	Conc. (ppm)	Animals	Percentage of animals reinfested		
			14th day	21st day	30th day
Group-A (deltamethrin)	25	Cattle (7)	85.7	100	100
		Buffalo (7)	14.28	57.14	100
Group-B (chlorpyrifos)	500	Cattle (7)	57.14	100	100
		Buffalo (7)	0	14.28	100

effective for complete recovery of *R. microplus* in cross-bred cattle but single application carried only 20 days of residual effect. Recommended dilution (2 ml/l) of deltamethrin, cypermethrin and fenvalerate was not effective against *R. microplus* and on spraying of higher dosage of 4 and 6 ml/l, had showed better performance but side effects were also obvious in cypermethrin and deltamethrin treated animals (Srivastava et al. 2001). A study on in vivo animal efficacy trials to evaluate effectiveness of deltamethrin and amitraz and found 16.59-fold resistance to deltamethrin and 5.86-fold resistance to amitraz (Nicolas et al. 2008).

The results of the present study demonstrated prolonged effect of chlorpyrifos when compared with deltamethrin. Additionally, residual effect of chlorpyrifos was remained even after 14 days of treatment with 28.57% animals showing reinfestation while in case of deltamethrin treated animals, the tick number started increasing after 14-day of treatment with 50% of animals showing reinfestation. So, it is apparent from the results that, there is increase in resistance in widely used pyrethroid compound, reducing its residual effect which in turn may lead to its frequent usage with increased dose rate. Similar results were obtained by Sinha et al. (2010) who has conducted an in vivo study to assess the efficacy of new pyrethroid compound Butox plus against cattle and dogs which were naturally infested with *B. microplus* and *Rhipicephalus sanguineus*, respectively at different concentration of 1 and 2 ml/l. Pre and post-treatment counts of ticks resulted 80.2 and 98.1% reduction of *B. microplus* and *R. sanguineus*, respectively, within 12 h whereas, 100% within 24 h of treatment and period of reinfestation was found to be 24–30 days of treatment.

Conclusion

This study confirms that chlorpyrifos had prolonged effect as compared to deltamethrin when used against ticks of cattle and buffaloes from the study area. Therefore, it appears that, chlorpyrifos is a better acaricide compound as compared to deltamethrin.

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