

Original Research Article

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Comparative efficacy of acaricides on tick infestation in dairy cattle

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The present study aimed to evaluate the acaricidal activity of TANUVAS nanomethicone, polyherbal spray, and deltamethrin in cross-bred dairy cattle. This study was conducted at Naraikinaru and Pillipakuttai villages in Namakkal district. A total of 20 animals were randomly distributed in 4 groups, with 5 animals in each group. Group I was taken as control (C), Group II was treated with TANUVAS nanomethicone, Group III was treated with polyherbal spray, and Group IV was treated with deltamethrin. All the selected animals were heavily infested with ticks (6-7 ticks/square inch) at the beginning of the experiment. The number of ticks in the select area (3 inches x 3 inches) was counted during pre-treatment (0 days) and post-treatment (7, 14, 21, 28, and 35 days) periods. The efficacy of all treatments was calculated. There was a complete disappearance of ticks from the animal sprayed with TANUVAS nanomethicone and deltamethrin after 3 days of treatment and reinfestation did not occur up to the 28th day and the 14th day in TANUVAS nanomethicone and deltamethrin respectively. Further, the tick population was significantly ($P < 0.01$) decreased in polyherbal spray up to the 14th day after treatment and significantly ($P < 0.01$) increased from the 21st day. The results of this study revealed that TANUVAS nanomethicone gives a longer period of protection and effectively controls tick infestation in cross-bred dairy cattle.

Keywords: Acaricide, Deltamethrin, Efficacy, Nanomethicone, Polyherbal, Tick

Introduction

India is a tropical country where the environmental conditions are suitable for the growth of ticks (1). Tick infestation is a major threat to dairy animals (2). Tick infestation and related diseases decrease growth rate and milk production, induce anemia, and have adverse effects on reproduction which causes economic loss to dairy farmers (3, 4). The most common predilection site of a tick is the udder followed by the inner thighs, perineum, neck legs, ear, belly, and tail in cattle (5).

The most common method to control tick infestation is synthetic acaricides (6). The most commonly used synthetic acaricides under field conditions are ivermectin, deltamethrin, cypermethrin, and flumethrin (7). Indiscriminate use of acaricides emerges in resistance among different strains of the tick population (8). Precautionary measures should be taken before applying synthetic acaricides to animals. To overcome the pressure of resistant strains as well as to reduce the side effects of chemical acaricides, there is a need to investigate the efficacy of alternative, eco-friendly, and residue-free acaricides to control tick infestation (9). Dimethicone and Phyto-acaricide are safe and eco-friendly alternatives to synthetic acaricides to control ticks in livestock. Traditionally various plants have acaricidal, insecticidal, growth inhibitory, anti-molting, and repelling properties (10). In India, *Azadirachta indica* (Neem) is a popular herb used in conventional medicine for centuries. However, the utility of neem as a natural acaricide was identified

about 26 years ago (11). The leaves, flowers, fruit, roots, and bark of *Vitex negundo* have medicinal properties. The active phytochemical compound found in the *Vitex negundo* has acaricidal properties like flavonoids, flavones, glycosides, triterpenes, and tannins (12). Hence, the present study attempted to compare the efficacy of TANUVAS nanomethicone, polyherbal medication, and deltamethrin in cross-bred dairy cattle.

Materials and Methods

The study was conducted in the Naraikinaru and Pillipakuttai villages of Namakkal district. A total number of 20 animals were randomly distributed in 4 groups with 5 animals in each group. Group I was taken as control (C), Group II was treated with TANUVAS nanomethicone (T1), Group III was treated with the polyherbal spray, and Group IV was treated with deltamethrin. The polyherbal formulation was prepared with 2.5 kg of Neem leaves in 4 liters of lukewarm water and 1 kg of nagod leaves (*Vitex negundo*) in 2 liters of lukewarm water and these extracts were mixed (3:1) and these stock solutions were mixed in 3.6 liters of water. All the selected animals were heavily infested with ticks (6-7 ticks/sq inch) at the beginning of the experiment. The number of ticks in the selected area (3 inches x 3 inches) was counted during pre-treatment (0 days) and post-treatment (7, 14, 21, 28, and 35 days) periods. The efficacy of all treatments was calculated (7, 14, 21, 28 and 35 days) by using the following formula.

Percent efficacy = No of animals cured/No of animals treated x 100

The data were analyzed by using SPSS one-way ANOVA.

Results

The effect of acaricides on tick infestation in cross-bred dairy

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cattle is presented in Table 1. A complete disappearance of ticks was observed from the animal sprayed with TANUVAS nanomethicone and deltamethrin after 3 days of treatment and reinfestation did not occur up to the 28th day and 14th day in TANUVAS nanomethicone and deltamethrin respectively. However, the polyherbal spray significantly ($P<0.01$) decreased the tick population up to the 14th day after treatment followed by the 21st day onwards tick population significantly ($P<0.01$) increased up to the 35th day. At the end of the experiment (35th day) the tick population was significantly ($P<0.01$) decreased in the TANUVAS nanomethicone group compared to other treatment groups including the control.

The comparative efficacy of TANUVAS nanomethicone, polyherbal spray, and deltamethrin on tick infestation is presented in Table 2. TANUVAS nanomethicone maintained 100 % efficacy up to the 28th day of treatment and on the 35th day the efficacy was reduced to 60 %. Whereas in deltamethrin group showed 100 % efficacy only up to 14 days and it was reduced to 80 % on the 21st day after treatment. In contrast, polyherbal spray does not show 100 % efficacy after treatment. Further, on the 35th day onwards the ticks were present in all treated groups of crossbred dairy cattle.

Discussion

Tick infestation is the most important economic issues in cross-bred dairy cattle. Recently there has been an increase in tick infestation due to the development of resistance to several existing acaricides. The results of the present study revealed that the protective period of TANUVAS nanomethicone on tick infestation was higher than polyherbal spray and deltamethrin. TANUVAS nanomethicone contains dimethicone which occludes the breathing (spiracles) hole of the respiratory system and causes the death of the tick (9). Similar to the results of the present study deltamethrin showed a residual effect for 14 days (13, 5). In contrast, protective period of deltamethrin on tick infestation was extended up to 20 days after treatment in cross-bred dairy cattle (16). In this study, the low protective period of deltamethrin was due to the development of resistance. Similarly, deltamethrin showed less acaricidal efficiency compared to chlorpyrifos (5). The frequent use of deltamethrin and cypermethrin to control of tick populations developed resistance (19, 18).

Table 1. Effect of acaricides on tick infestation in cross-bred dairy cattle.

Group	Drug used	No of ticks present in 9 sq inch area							Pooled SEM	P Value
		Infestation before treatment	Infestation after treatment					35 th day		
			3 rd day	7 th day	14 th day	21 st day	28 th day			
Group I	Control	65.12	66.21 ^c	67.66 ^c	72.37 ^c	76.26 ^d	76.27 ^c	77.27 ^c	1.48	0.071
Group II	TANUVAS nanomethicone	64.66 ^a	Nil	Nil	Nil	Nil	Nil	3.87 ^{ap}	5.06	$P<0.01$
Group III	Polyherbal spray (NIF-DST)	63.21 ^t	28.36 ^{brs}	17.45 ^{bpqr}	8.33 ^{bp}	15.23 ^{cpq}	24.52 ^{bqrs}	34.56 ^{bs}	3.89	$P<0.01$
Group IV	Deltamethrin	68.323 ^t	Nil	Nil	Nil	7.4 ^{bq}	18.21 ^{br}	32.33 ^{bs}	5.26	$P<0.01$
	Pooled SEM	1.83	8.23	8.43	9.11	9.12	8.58	8.05		
	P Value	0.83	$P<0.01$	$P<0.01$	$P<0.01$	$P<0.01$	$P<0.01$	$P<0.01$		

^{abc} Means bearing different superscript within the same column differ significantly ($P<0.01$) and the

^{pqr} Means bearing same row differ significantly ($P<0.01$)

The deltamethrin showed high resistance on tick infestation compared to amitraz (17). To overcome the acaricidal resistance, researchers engaged on the development of phytoacaricides which are safe to use for animals (18). The majority of the herbal plants are used for developing community-driven tick control programs in livestock (19). The aqueous extract of neem leaf at 10 % and 20 % caused structural alteration during oocyte development in adult ticks (20). The bioactive compound present in *Azadirachta indica* is Azadiractin which has an antifeedant effect (21), inhibits protein synthesis, disrupts digestion (22), and impairs reproduction (23) of ticks.

The acaricide activity of *Vitex negundo* leaves was lower than the *Cymbopogon winterianus*, and *Withania somnifera*. However, extracts of leaves of *Vitex negundo* inhibit oviposition and hatching of eggs of ticks (12). The *Vitex negundo* leaves prevent the wax coating of the egg and disrupt the reproduction of the tick (24). The leaf extracts from *Vitex negundo* exert acaricidal activity against larva of tick in cattle (25). The ecofriendly, residue-free acaricides are a recent area of research and future tool to reduce the resistance and residue in animal products (26).

Conclusion

The results of the current study indicated that the TANUVAS nanomethicone provides a longer period of protection against ticks compared to deltamethrin and polyherbal spray and it effectively controls tick infestation in crossbred dairy cows. TANUVAS nanomethicone does not have residual acaricidal activity and requires a periodic application to control hard ticks. The acaricide activity of polyherbal spray is due to the presence of single compound or combination of more than one active compound in the plant. The bioactive compounds of the plants produce beneficial effects in different ways. Hence development of resistance is difficult in phyto-acaricides in combination. Further, studies are needed to identify the bioactive compounds of the plants that cause tick mortality.

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Table 2. Comparative efficacy (%) of acaricides on tick infestation in cross-bred dairy cattle.

Group	Drug used	Efficacy of drug after treatment					
		3 rd day	7 th day	14 th day	21 st day	28 th day	35 th day
Group I	Control	-	-	-	-	-	-
Group II	TANUVAS nanomethicone	100	100	100	100	100	60
Group III	Polyherbal spray (NIF-DST)	60	60	40	40	0	0
Group IV	Deltamethrin	100	100	100	80	20	0

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