



Resistance Status of Synthetic Drugs against Ticks in Organized and Farmer Goat Flock

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Abstract: Resistance status of synthetic pyrethroid (cypermethrin and deltamethrin) has done with farm and field strains of *B. microplus* at different-different concentration. The results revealed that cypermethrin is very effective than deltamethrin against village strain.

Keywords: Cypermethrin, Deltamethrin, *B. microplus*, Ectopar.

1. Introduction

Livestock rearing provides employment and supplement income to the vast majority of rural people but the problem of ectoparasites are quite intensive. Therefore, the attention has been given to this group of parasite. The ectoparasitic infestation in animals is clinically managed by using various synthetic arsenical compounds, chlorinated hydrocarbons, organophosphorus compounds and pyrethroids etc. These drugs are applied in the form of dipping, spray, dust, pour-on preparation for tick prevention. Although, these synthetic compounds are effective but have some well established serious complications like drug residual effects in milk and meat, environmental contamination, human exposures, the development of drug resistance to continuous use of some medicines. These ectoparasiticide drugs contaminate food and water resources used for human beings and animals.

There is scope for goats (*Capra hircus*) to play an important role for smallholder farmers in accessing these new markets. Their significance, which is now being exploited in several countries, is that they are a small livestock in high demand and can thrive on low inputs and local resources.

Realizing these aspects, specific attention is needed towards systematic research, therefore, the present study on the resistance status of synthetic drugs against ticks in organized and farmer's goat flock is designed.

2. Materials and Methods

2.1 Animals

The present study was planned for the epidemiological survey (seasonal incidence and distribution) of ticks in organized farms of Jamunapari and Barbari goats maintained at Central Institute for Research on Goats, Mkhdoom, Farah, Mathura and farmer's flock of goats. The general topography of the Institute area is mostly undulating with differences of up to 5-6 meters between the low level land and top. The geo-climatic conditions, as per the report of the National Bureau of soil survey and land use planning points to the alluvial nature of Jamuna belt and the ecology of this region boarding arid conditions. The Jamunapari breed was founded in Chambal ravines and kept for meat and milk, whereas the Barbari is medium sized and is reared for meat production owing to its high proficiency. The management of Institute flocks involves grazing/browsing for 6-8 hrs daily and supplementary feeding with concentrated. Goats were housed in shades, (one for each breed/flock) during inclement weather. The epidemiology of ticks population was also investigated from village Jalal on non-descriptive breed of goats from the farmer's flock.

The animals of farmers generally grazed/browse from 8 AM to 5 PM. Some of the farmers also provide supplementary feeding along with concentrate. Farmers keep their goats in open coral made up of thatched huts.

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2.2 Chemical

Methanol was used as a solvent for the extraction of medicinal plants. The chemical was supplied by Sisco Research Laboratories Pvt. Ltd, Mumbai. All the chemicals/ reagents used were of analytical grade. Biochemical Kits were obtained from Span Diagnostics Ltd, Surat, India. The following kits have been used for biochemical estimation in blood serum.

2.3 Drug resistance studies

Adult ticks (*Boophilus microplus*) were collected from an organized flock of Barbari goat of the Institute livestock farm. Cypermethrin and deltamethrin were used for the dipping of goats since last 8 years twice a year for the control of ectoparasites (Ticks) in the flock. The ticks that were collected from organized farm were categorized as farm strain. The parasites (Ticks) were also collected from the village flock of goats with no history of use of cypermethrin and deltamethrin organophosphorus compounds for the control of ectoparasites and these ticks were categorized as field strain. *In vitro*, adult immersion test was carried out to find out the resistance of drugs as per the methods of Kumar *et al.*, [1]. Different concentrations of cypermethrin (Ectomin* Novartis) and deltamethrin (Butox) were prepared in distilled water. 20 adult tick was used in *in vitro* tests in each concentration. Each group of the adult ticks were placed in mesh cloth pieces and dipped for 60 seconds in a 100ml solution of drugs of each concentration of test chemical and the solution was continuously stirred during the process. The ticks were then dried and kept in Petri dishes having filter paper (Whatman No.1) impregnated with 0.5 ml of the same concentration of cypermethrin and deltamethrin, while one group served as control where the filter paper was sprayed with 0.5 ml of distilled water. These Petri dishes were kept at $25 \pm 2^\circ\text{C}$ and $80 \pm 5\%$ relative humidity in an incubator for 24 hours. The mortality of ticks in all groups was observed after different time intervals. Probit analysis was done on mortality data (Finney, 1971) [2] to calculate LC_{50} value. Relative resistance factor (R.R.F) against cypermethrin and deltamethrin was calculated by dividing LC_{50} value of farm strain by LC_{50} value of field strain.

3. Results

Adult ticks (*Boophilus microplus*) collected from the organized farm and village flock of goats were tested for resistance status against cypermethrin and deltamethrin organ phosphorous compounds generally used for the control of ectoparasites in animals. The tick specimen collected from organized farm and village flock was designated as 'farm strain' and 'village strain' respectively. The detailed results of the resistance status of ticks against cypermethrin and deltamethrin have been portrayed in Table 1 and 2. The mortality percentage at different hour's interval in ticks treated with cypermethrin was higher in village strain at 5 $\mu\text{l/ml}$ concentration. Percent resistance of farm strain ticks were 76.67, 51.67 and 26.67% at 2 hr in 1, 3 and 5 $\mu\text{l/ml}$ concentrations while 63.34, 35.00 and 10.00% at 4 hours in the same concentrations respectively, while in village strain resistance percentage were 90.00, 41.67 and 11.67% at 2 hr in 1, 3 and 5 $\mu\text{l/ml}$ concentrations and 83.34, 35.00 and 0.00 % at 4 hr intervals. The percentage mortality of ticks and resistance against cypermethrin was inversely proportional; however, resistance was higher in farm strain in comparison to village strain of ticks. The calculated LC_{50} values of cypermethrin against ticks of village strain in a concentration of 1, 3 and 5 $\mu\text{l/ml}$ revealed 7.70, 3.91, 3.25 and 1.68 at 30 min, 1, 2 and 4 hrs, while it was 4.88, 4.13, and 2.69 at the same time intervals in village strain respectively. The results of LC_{50} values indicated comparatively higher level of resistance in ticks of farm strain. The relative resistance factor was 1.49, 0.94 and 1.20 which further denotes the resistance in farm strain. Almost similar resistance status of ticks of farm strain and village strain of ticks against deltamethrin was found. When the resistance status of ticks from two different sources was compared against cypermethrin and deltamethrin, it was observed that resistance percentage was moderately higher against deltamethrin. The LC_{50} values against deltamethrin were 4.79, 4.12 and 3.10 at 30 min, 1 and 2 hrs while 5.92, 4.80, 3.25 and 2.90 in the same time interval in the village strain observed. The relative resistance factor was 0.80, 0.85 and 0.95 which indicate slightly more resistance of ticks against deltamethrin in village strain of ticks.

Table 1. Resistance status of ticks collected from organized farm and village flock of goats against Cypermethrin.

Tick Specimen	Conc.	No. of ticks	Percent mortality (Mean \pm S.E.)						Resistance (%)	
			30 min	1 hr	2 hr	4 hr	6 hr	24 hr	2 hr	4 hr
Organized farm strain	1 $\mu\text{l/ml}$	20	0.00 \pm 0.00	15.0 \pm 0.63	23.33 \pm 1.27	36.66 \pm 1.33	71.66 \pm 2.87	73.33 \pm 2.66	76.67	63.34
	3 $\mu\text{l/ml}$	20	11.66 \pm 1.66	40.00 \pm 0.63	48.33 \pm 1.66	65.00 \pm 1.63	85.00 \pm 1.00	88.33 \pm 1.66	51.67	35.00
	5 $\mu\text{l/ml}$	20	36.66 \pm 0.22	58.33 \pm 1.32	73.33 \pm 1.00	90.00 \pm 2.00	100.0 \pm 0.00	100.0 \pm 0.00	26.67	10.00
	LC_{50}		7.70	3.91	3.25	1.68				
Village strain	1 $\mu\text{l/ml}$	20	0.00 \pm 0.0	5.00 \pm 0.09	10.00 \pm 0.00	16.66 \pm 1.66	26.66 \pm 0.66	28.33 \pm 0.00	90.00	83.34
	3 $\mu\text{l/ml}$	20	21.66 \pm 1.66	31.66 \pm 1.66	58.33 \pm 1.40	65.00 \pm 1.88	70.00 \pm 0.90	73.33 \pm 1.66	41.67	35.00
	5 $\mu\text{l/ml}$	20	71.66 \pm 1.40	81.66 \pm 2.33	88.33 \pm 1.66	100.0 \pm 0.00	100.0 \pm 0.00	100.0 \pm 0.00	11.67	0.00
	LC_{50}		4.88	4.13	2.69					
Control		20	00 \pm 0.00	00 \pm 0.00	00 \pm 0.00	00 \pm 0.00	00 \pm 0.00	10 \pm 0.00	0.00	0.00
Relative resistance factor			1.49	0.94	1.20					

Table 2. Resistance status of ticks collected from organized farm and village flock of goats against Deltamethrin.

Tick Specimen	Conc.	No. of ticks	Percent mortality (Mean \pm S.E.)						Resistance (%)	
			30 min	1 hr	2 hr	4 hr	6 hr	24 hr	2 hr	4 hr
Organized farm strain	1 μ l/ml	20	0.00 \pm 0.00	5.00 \pm 0.00	11.66 \pm 1.66	20.00 \pm 0.00	25.00 \pm 0.00	30.00 \pm 0.00	88.34	80.00
	3 μ l/ml	20	11.66 \pm 1.66	21.66 \pm 1.66	46.66 \pm 0.40	56.66 \pm 1.66	58.33 \pm 1.66	65.00 \pm 0.00	53.34	43.34
	5 μ l/ml	20	65.00 \pm 1.88	78.33 \pm 1.44	90.00 \pm 2.88	100.0 \pm 0.00	100.0 \pm 0.00	100.0 \pm 0.00	10.00	0.00
	LC ₅₀		4.79	4.12	3.10					
Village strain	1 μ l/ml	20	0.00 \pm 0.00	10.00 \pm 0.77	20.00 \pm 0.50	33.33 \pm 1.66	70.00 \pm 0.30	71.66 \pm 1.33	80.00	66.67
	3 μ l/ml	20	6.66 \pm 1.66	35.00 \pm 0.63	45.00 \pm 0.75	61.66 \pm 1.33	83.33 \pm 1.66	86.66 \pm 1.33	55.00	38.34
	5 μ l/ml	20	30.0 \pm 0.20	58.33 \pm 0.33	71.66 \pm 1.40	85.00 \pm 1.63	100.0 \pm 0.00	93.33 \pm 1.66	41.67	15.00
	LC ₅₀		5.92	4.80	3.25	2.90				
Control		20	00 \pm 0.00	00 \pm 0.00	00 \pm 0.00	00 \pm 0.00	00 \pm 0.00	10 \pm 0.00	0.00	0.00
Relative resistance factor			0.80	0.85	0.95					

4. Discussion

Drug resistance status of tick (*Boophilus microplus*) collected from organized and village flocks of goats was tested *in vitro* against cypermethrin and deltamethrin drugs which are generally used for the control of ectoparasites in animals. Resistance of ticks to acaricides has spread dramatically in recent years, so changing of acaricides periodically is needed to avoid resistance strains [3]. The mortality percentage at different hour's interval in ticks treated with cypermethrin was higher in village strain in 5 μ l/ml concentration. The LC₅₀ values were calculated for cypermethrin against ticks of organized farm at the concentration of 1, 3 and 5 μ l/ml which revealed 7.70, 3.91, 3.25 and 1.68 at 30 min, 1, 2, and 4 hrs respectively while it was 4.88, 4.13, and 2.69 at 30 min, 1hr and 2hr time intervals in village strain respectively. The results of LC₅₀ values indicated comparatively higher level of resistance in ticks of farm strain. The relative resistance factor was 1.49, 0.94 and 1.20 which further denotes the resistance in farm strain. Almost similar pattern of ticks of farm and village strain of ticks against deltamethrin was found in present study. The results of LC₅₀ values indicated, comparatively higher level of resistance in ticks of farm strain. Kumar *et al.*, [1] evaluated susceptible and relative resistance factor in tick population against cypermethrin in organized farm strain and field strain who have also reported similar findings and in close agreement with present findings. The higher resistance in tick of farm strain might be due to continuous exposure of tick with these organophosphorus compound while in field animals application of acaricides are minimal. The resistance of ticks against pyrethroids, permethrin, flumethrin and Amitraz was reported by many other workers [4-6]. Stuti Vatsya and Yadav (2009) [7] collected several strains of ticks from different geographical location of Uttarakhand state and observed that three isolates were resistant to deltamethrin and two isolates were tolerant. Fernandes (2001) [8] studied topological effect and resistance to pyrethroids in *B. microplus* ticks and found to be

resistant to both deltamethrin and cypermethrin at commercially used concentration; however, tick was susceptible to permethrin at 2500 ppm. Resistance of ticks to pyrethroid compound was reported in other countries including U.S.A [9], Mexico [10], Colombia [11], Australia [12]. The increasing loss of effectiveness of these acaricides in ticks shows the necessity of continual monitoring of susceptibility levels and rational application, together with the use of alternative major ectoparasiticide with lower environmental impact.

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