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## Determination of efficacy of commercial acaricides against *Ornithodoros savignyi* ticks collected from Haryana

**Surbhi, Snehil Gupta, Arun K Sangwan and Nirmal Sangwan**

**Abstract**

A Gaushala at Madhogarh village of Mahendergarh district in Haryana was found heavily infested with *Ornithodoros savignyi*. Laboratory standardized adult immersion test was employed for efficacy trials at different concentration of deltamethrin following 10-minute protocol and 14 days as observation period. The ticks were adjudged dead on the basis of their immobility. Probit analysis of the data generated showed LC<sub>50</sub> and LC<sub>95</sub> values to be 60.95 ppm and 370.68 ppm, respectively. In addition, the ticks were also employed to adult immersion test with discriminating dose (AIT-DD). Results of the test revealed 86.67%, 60% and 86.67% survivability against cypermethrin, amitraz and fipronil, respectively at the country specific discriminating dose suggested for *Rhipicephalus (Boophilus) microplus* indicating a need for the separate discriminating dose for *Ornithodoros* ticks.

**Keywords:** Acaricide trial, *Ornithodoros savignyi*, synthetic pyrethroids, amitraz, fipronil, Haryana

**1. Introduction**

Ticks and tick borne disease affect 80% of the cattle population around the globe [16]. It is estimated that the global cost of controlling tick and tick borne diseases (TTBDs) and production losses are around 13.9 to 18.7 billion USD annually over two decades ago [4]. There are around 904 species of tick recognised in the world, of which 705 are hard ticks, 198 are soft ticks and there is a family Nuttalliellidae with single tick species (Burger *et al.*, 2014). Literature is commonly available on the efficacy of drugs and on development of acaricide resistance against hard ticks [8, 13, 15, 6] but information on efficacy of drugs against soft tick is still in infancy [11]. Soft ticks are mainly found in semi-arid/ arid zone especially on sandy ground or slightly below ground level causing discomfort, irritation and toxicosis on account of tick bite in animals. *Ornithodoros savignyi* is a common soft tick found in semi-arid and arid zones of Haryana. Soft ticks play an important role in transmission of lyme disease, tick borne encephalitis, African swine fever virus, Alkurma haemorrhagic fever virus, blue tongue virus, *Borrelia duttoni* in livestock, humans and companion animals [14]. Nowadays most commonly used acaricide class against ticks are synthetic pyrethroids, formamidines and fipronil. Thus, the present study was aimed to determine efficacy of deltamethrin against *O. savignyi* ticks collected from Haryana. Majority of the acaricide trials related literature against ticks is focused upon *Rhipicephalus (Boophilus) microplus*, the present study also evaluates the discriminating concentration estimated for *R. (B.) microplus* against *O. savignyi*.

**2. Materials and Methods**

**2.1 Tick collection and identification:** Live adult soft ticks were collected from a Gaushala located at Madhogarh village of Mahendergarh district in Haryana. Workers and other persons were regularly attacked by the ticks. The ticks were collected and identified as per the tick identification keys of Walker *et al.* [18].

**2.2 Laboratory maintenance of ticks:** Ticks collected were washed, cleaned, dried and placed in BOD incubator at 28 ± 2 °C and 85 ± 5% relative humidity over a period of 14 days. The presence of eggs, if any, was confirmed at 48 hour intervals throughout the incubation period.

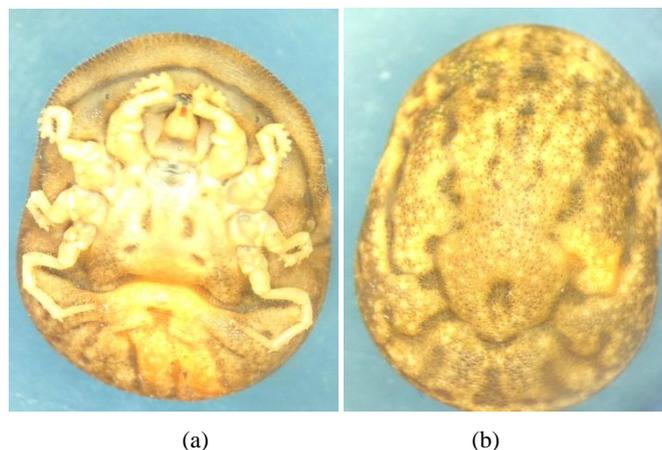
**2.3 Acaricides:** The commercially available preparation of deltamethrin (Butox 1.25% EC, Intervet) was used at the concentration of 35, 70, 140 and 280 ppm in distilled water from stock solution. Other acaricide used were cypermethrin (Ektomin 100 EC, Novartis), amitraz (Tactic12.5% EC, Intervet) and fipronil (Protektor 0.25%, Cipla). The country specific discriminating dose in India for cypermethrin, amitraz and fipronil is 698.2 ppm, 975.4 ppm and 12.4 ppm, respectively [13, 10, 9].

**2.4 Adult Immersion Test (AIT):** Laboratory standardized adult immersion test was employed at different concentration of deltamethrin following 10-minute protocol and 14 days as observation period [6]. In addition, adult soft ticks were also used in adult immersion test with discriminating dose (AIT-DD) of cypermethrin, amitraz and fipronil. The dose was recommended against *R. (B.) microplus* [13, 10, 9]. The ticks of control group were dipped in distilled water. The ticks were adjudged dead on the basis of their immobility.

**2.5 Statistical analysis:** Dose response data was analysed by probit method [5] using Microsoft excel software. Line regression curve of adult mortality is plotted against various values of drug concentration to determine LC<sub>50</sub> and LC<sub>95</sub> values of deltamethrin.

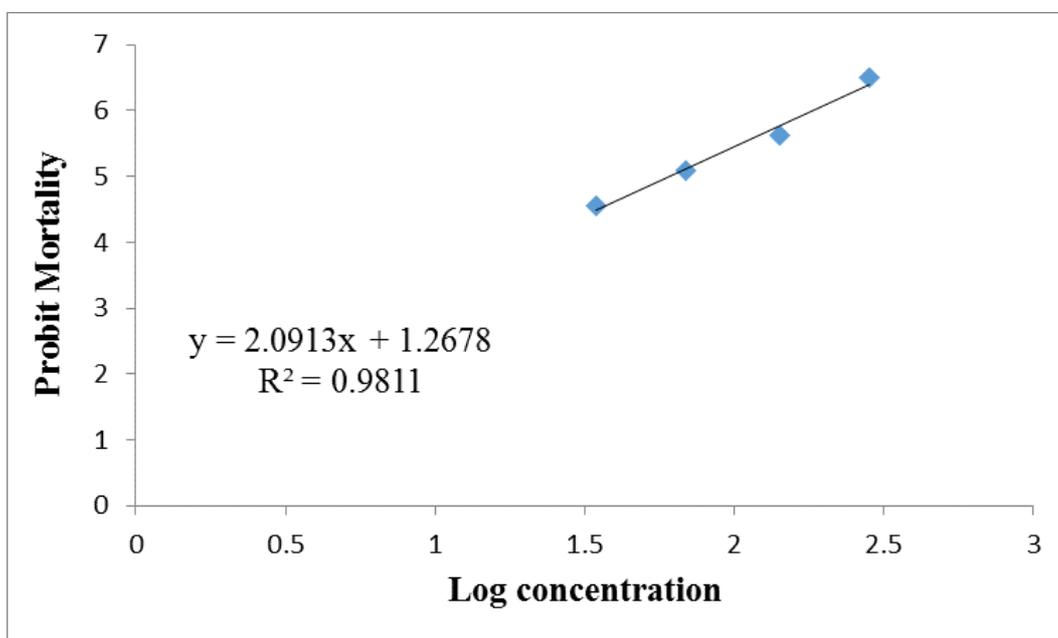
**3. Results**

The ticks collected were identified as *Ornithodoros savignyi* [18] based on morphological features such as presence of eyes on supracoxal folds, large sized semilunar genital aperture, clearly defined anus, light brown to cream integument with wrinkles and fine granulations (Figure 1).



**Fig 1:** Microscopic view of the adult soft tick *Ornithodoros savignyi*: (a) ventral view; (b) dorsal view.

Probit analysis of the data generated showed LC<sub>50</sub> and LC<sub>95</sub> values of deltamethrin to be 60.95 ppm and 370.68 ppm, respectively. Tick mortality was increased with the increasing concentration of acaricides. Steep slopes of dose response curve and high value of goodness of fit (R<sup>2</sup>) indicated that field collected *O. savignyi* population was highly homogenous in response to deltamethrin (Figure 2). AIT-DD bioassay with country specific discriminating concentration prescribed for control of *R. (B.) microplus* on *O. savignyi* ticks showed 86.67%, 60% and 86.67% survivability against cypermethrin, amitraz and fipronil, respectively (Table 1).



**Fig 2:** Dose-mortality response of *Ornithodoros savignyi* ticks against deltamethrin in Adult Immersion Test (AIT)

**Table 1:** Dose mortality response of *Ornithodoros savignyi* against discriminating concentration of various acaricides recommended for *Rhipicephalus (Boophilus) microplus*

	Discriminating dose of <i>Boophilus microplus</i>	Number of ticks treated	Number of tick died	% Resistance/ Survivability
Cypermethrin	698.2 ppm	15	2	86.67%
Amitraz	975.4 ppm	15	6	60%
Fipronil	12.4 ppm	15	2	86.67%

#### 4. Discussion

Similar steep slopes and high degree of cypermethrin resistance was also reported in soft ticks collected from Iran [17]. In an *in vitro* drug trial [11] on *Ornithodoros* spp., it was concluded that the egg laying capacity got arrested at deltamethrin (Butox) concentration of 9.375 ppm and above, however, information on the mortality of ticks at varied concentration was lacking in the report. Larval packet test on *Ornithodoros* collected from North Gujarat showed 70% and 38.46% larval mortality at the manufacturer recommended dosage of deltamethrin and cypermethrin, respectively [14]. They reported that LC<sub>50</sub> and LC<sub>95</sub> values of the ticks was 16.66 and 428.22 ppm respectively against deltamethrin. The LC<sub>50</sub> value was lower and the LC<sub>95</sub> value was higher than the present study indicating a heterogenous population and pointing towards acaricide resistance in *Ornithodoros* sp. ticks collected from North Gujarat. *O. savignyi* ticks were found resistant to coumaphos and susceptible to diazinon, dieldrin and cypermethrin using larval packet test (LPT) in Nigeria [2]. However, the present study was based on adult mortality and found very low efficacy of commercially available acaricides at the recommended dosage.

#### 5. Conclusion

In general, application of commercially available acaricides, forms the backbone of tick control strategy. Inadvertently farmers use the same dose of acaricides for control of tick infestation in animals irrespective of the species of ticks infesting the animal. The present study indicates separate discriminating concentration need to be calculated for commonly prevailing ticks to develop an effective tick control program. There are several references in literature where commercial formulations of deltamethrin, cypermethrin, fenvalerate and fipronil were found ineffective for hard ticks [1, 7, 12, 15]. Adult soft ticks are intermittent blood feeders, thus they have comparatively short duration of contact with acaricide sprayed on the host and more survivability providing adequate environment to develop resistance mechanism. Therefore, monitoring tick susceptibility to commercial formulations of acaricides is essential tick control strategy and needs constant watch.

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