



RESIDUAL TOXICITY OF INDOXACARB AND SPINOSAD ON *APROSTOCETUS PURPUREUS* CAMERON AND *TACHARDIAEPHAGUS TACHARDIAE* HOWARD - THE PARASITIDS OF LAC INSECT *KERRIA LACCA* (KERR)

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ABSTRACT

Laboratory evaluation of two pesticides namely indoxacarb and spinosad was carried out for their residual efficacy against adult stage of two major parasitoids associated with lac insect viz., *Aprostocetus purpureus* Cameron and *Tachardiaephagus tachardiae* Howard by residual film contact method. Indoxacarb caused 51.8, 37.5 and 32.7% mortality of *A. purpureus* within 6 h of treatment and 86.1, 65.6 and 67.2% mortality within 24 h, at 0.0145, 0.0073 and 0.0035% concentrations, respectively. Whereas, mortality of *A. purpureus* to the tune of 97.0, 100, 73.7 and 46.7% was recorded within 6 h and 100% within 24 h of treatment with spinosad at the concentrations of 0.0075, 0.005, 0.0025 and 0.0012%, respectively. Similarly, spinosad caused 66.7, 76.2, 80.0, 82.1, 83.3, 86.7% mortality of *T. tachardiae* at 0.0006, 0.0012, 0.0025, 0.005, 0.007, 0.014% concentrations, respectively within 1 h and 100% within 4 h of treatment. Based on mortality within 24 h of treatment it can be concluded that the spinosad is more effective than indoxacarb as far as *A. purpureus* is concerned. The effectiveness of spinosad on both parasitoids is almost at par and sufficient number of parasitoids died within very short span of time.

Key words: *Aprostocetus purpureus*, *Tachardiaephagus tachardiae*, *Kerria lacca*, spinosad, indoxacarb, residual toxicity

Lac is a natural resin of insect origin secreted by lac insect, *Kerria lacca* (Kerr). Lac crop is prone to several predators and parasitoids. *Aprostocetus purpureus* Cameron (Hymenoptera: Eulophidae) and *Tachardiaephagus tachardiae* Howard (Hymenoptera: Encyrtidae) are the most abundant parasitoids of *rangeeni* lac insect (Srivastava and Mehra, 1980). The source of parasitoids for new crop is broodlac and adjoining lac crop. In order to prevent the crop from attack of parasitoids, the broodlac sticks are kept inside 60 mesh net bag at the time of inoculation, enabling trapping of parasitoids but allowing only lac crawlers to come out for settlement on new shoots (Malhotra, 1983). However, if standing lac culture is infested with these parasitoids, there is little chance for survival. These cause substantial loss specially during winter period (January to March) which coincides with early larval stage of *rangeeni* lac insect for summer crop (October-November to June-July). Sometimes complete failure of *rangeeni* lac crop occurred due to parasitization of *A. purpureus*. Laboratory evaluation of two insecticides namely indoxacarb (0.0035, 0.0073 and 0.0145%) and spinosad (0.0012, 0.0025, 0.0050 and 0.0075%) have been carried out against adults of *A. purpureus* and spinosad (0.0006, 0.0012, 0.0025, 0.005, 0.07 and 0.014%) on *Tachardiaephagus tachardiae* by exposing the adults to the residual film.

MATERIALS AND METHODS

The adults of *A. purpureus* and *T. tachardiae* were obtained by caging the harvested broodlac in laboratory. The residual film was prepared by pouring the insecticidal solution in glass tube of 30 ml capacity. The glass tubes were allowed to dry under ceiling fan and then 1-2 day old adults were released and mouth of tube tied with muslin cloth. The tubes were kept in laboratory under normal room temperature in such a way so that bottom end faces toward light. The observations on mortality were recorded at different intervals after release. This facilitated maximum number of insects to remain in contact with residual film of insecticides. At the time of observation each tube was placed vertically upward so that open end of tube covered with muslin cloth is downwards. The dead and moribund insects fell on muslin cloth while living ones crawled all around glass surface. The observations were recorded at 1, 1.5-4, 6, 6-18 and 24 h of treatment. The moribund insects were also counted as dead.

RESULTS AND DISCUSSION

Effect on *Aprostocetus purpureus*

For the three concentrations of indoxacarb tried, the mortality varied 32.7 to 51.9 and 28.1 to 34.5%

within 6 h and 6 to 18 h, respectively. The total mortality within 24 h of treatment varied 67.2 to 86.1%. The recommended concentration (0.007%) for the management of lepidopteran and neuropteran predators of lac insect exerted 37.5 and 28.1% mortality within 6 and 24 h of treatment and thus at this concentration 65.6% mortality was observed within 24 h. Two folds of recommended concentration (0.0145%) caused 51.9 and 86.1% mortality within 6 h and 24 h. This concentration was recommended safe to lac insect (Singh *et al.*, 2011). In respect of spinosad, the mortality varied 46.7 to 97.0% with 0.0012 to 0.0075% concentrations within 6 h of treatment and there was 100% mortality within 24 h. Its recommended concentration (0.005%) for the management of lepidopteran and neuropteran predators of lac insect (Singh *et al.*, 2009) caused 88.5 and 11.5% mortality within 6 h and 6 to 18 h, respectively. There was no mortality in control. Considering mortality within 24 h of treatment on *A. purpureus*, spinosad caused thus 100% mortality even at a very low concentration (0.0012%) and thus was more effective than indoxacarb (Table 1). Better effectiveness of spinosad in comparison to indoxacarb through residual action had been shown on lepidopteran larvae of *Ostrinia nubilalis* (Boiteau and Noronha, 2007).

Effect on *Tachardiaephagus tachardiae*

Out of six concentrations of spinosad assessed, the mortality varied 66.7 to 86.7% within 1 h of treatment.

100% mortality was observed even with lowest concentration (0.0006%) within 24 h of treatment. In fact, all died within 4 h of treatment even with lowest concentration tried and 82.1% mortality occurred within 1 h of treatment at recommended concentration ((0.005%) (Table 2).

Endosulfan (Malhotra and Katiyar, 1975), dichlorvos (Mishra *et al.*, 1995; 1996), cartap hydrochloride (Bhattacharya *et al.*, 2005), ethofenprox (Jaiswal *et al.*, 2007), indoxacarb, fipronil and spinosad (Singh *et al.* 2009) are the recommended insecticides, safe to lac insect but effective against insect predators. Earlier study on effect of residual film of endosulfan and dichlorvos on *Pristomerus sulci*, *Brachymeria tachardiae* and *Elasmus claripennis*, the hyperparasitoids (parasitoids of lepidopteran predators of lac insect) was carried out by Sushil *et al.*, 1997 and found toxic. The topical application of ethofenprox, cartap hydrochloride and endosulfan on *rangeeni* rainy season crop under field condition though effective in reducing incidence of lepidopteran predators, was found ineffective on *A. purpureus* and *T. tachardiae* (Jaiswal *et al.*, 2006). Recently both parasitoids become destructive especially for *rangeeni* lac insect in many lac growing areas of India. These insecticides usually recommended lac culture on tender shoots of lac host trees for management of neuropteran and lepidopteran predators. These applied insecticides also fell on other surface area and remained there for

Table 1. Effect of indoxacarb and spinosad residues on adult *Aprostocetus purpureus*

Insecticide	Conc (%)	Total number of insects bio-assayed	Mortality within 6 h of treatment *	Mortality between 6 to 18 h of treatment *	Total mortality within 24 h of treatment *
Indoxacarb	0.0145	79	41 (51.9)	27 (34.2)	98 (86.1)
	0.0073	64	24 (37.5)	18 (28.1)	42 (65.6)
	0.0035	55	18 (32.7)	19 (34.5)	37 (67.2)
Spinosad	0.0075	33	32 (97.0)	1 (3.0)	33 (100)
	0.0050	26	23 (88.5)	3 (11.5)	26 (100)
	0.0025	19	14 (73.7)	5 (26.3)	19 (100)
	0.0012	30	14 (46.7)	16 (53.3)	30 (100)
Control	-	35	0 (0.0)	0 (0.0)	0 (0.0)

* Figures in parentheses indicate % of mortality out of total insects bio-assayed

Table 2. Effect of spinosad residue on adult *Tachardiaephagus tachardiae*

Conc (%)	Total number of insects bio-assayed	Mortality within 1 h of treatment *	Mortality between 1.5 to 4 h of treatment *	Total mortality within 24 h of treatment *
0.014	60	52 (86.7)	8 (13.3)	60 (100)
0.007	24	20 (83.3)	4 (16.7)	24 (100)
0.005	28	23 (82.1)	5 (17.9)	28 (100)
0.0025	40	32 (80.0)	8 (20.0)	40 (100)
0.0012	42	32 (76.2)	10 (23.8)	42 (100)
0.0006	24	16 (66.7)	8 (33.3)	24 (100)
Control	60	0 (0.0)	0 (0.0)	0 (0.0)

* Figures in parentheses indicate % of mortality out of total insects bio-assayed

some time. Though lac insects are parasitized by these parasitoids at early stage and larvae feed on lac insect but the adult stage of these crawl on the shoots and thus come in contact with residual film of insecticides. The present study on residual toxicity is indicative for its effect under field conditions if adult stages crawl after application of insecticide.

It can be inferred that while applying these insecticides for the control of neuropteran predators (*Chrysopa* spp) and lepidopteran predators (*Eublemma amabilis* and *Pseudohypatopa pulverea*), population of *A. purpureus* and *T. tachardiae* could be reduced if adult stage of these species are available in the field.

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