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TOXICITY OF BACTERIAL PRODUCT (ABAMECTIN), NEEM EXTRACT (BIOSAL) IN COMPARISON TO SYNTHETIC PYRETHROID (LAMBDA CYHALOTHRIN) IN LABORATORY AGAINST 2ND AND 3RD INSTARS LARVAE OF COTTON LEAF HOPPER *AMRASCA DEVASTANS* (DISTANT) (HOMOPTERA: CICADELLIDAE)

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ABSTRACT

The toxicity of Abamectin, a bacterial product, and a neem extract (Biosal) was determined and compared with synthetic pyrethroid lambda cyhalothrin by topical method in laboratory against 2nd and 3rd nymphal instars of cotton leaf hopper *Amrasca devastans* (Distant) (Homoptera: Cicadellidae). The observations were made after 24 hours of treatment. The LC_{50} value was calculated through log-probit graph paper. All three pesticides proved to be highly toxic against the pest. The calculated LC_{50} was found to be 0.018 µg/cm^2 for Abamectin whereas it was 0.05 µg/cm^2 for lambda cyhalothrin and 45.0 µg/cm^2 for biosal against the 2nd and 3rd instars. The potency of pesticides was found to be Abamectin > lambda cyhalothrin > biosal to the early Instars of the pests.

KEYWORD: Toxicity, $LC_{50,}$ IPM, Neem extract, Pyrethroid, Abamectin, Leaf hopper, Cicadellidae.

INTRODUCTION

The Cotton leaf hopper, *Amrasca devastans* (Distant), belongs to the homopteran family Cicadellidae of the order Hemiptera. Leaf hoppers being a cosmopolitan pest infests wide variety of crops and vegetables like brinjal, lady finger, potato, tomato, rice and fiber crops including cotton in the Indo-Pak subcontinent. The 2nd and 3rd instars are found to be as injurious as the adults. By their double barrel sucking type of mouth parts they puncture the epidermal tissue, sucking the sap of the plants and are capable of transmitting viral and other infectious diseases in the field.

Synthetic pyrethroids are popular in conventional insect pests control practice due to their rapid knock down and killing potency but the scientists are reluctant to its promotion due to its persistency, long half life and residual effect that causes environmental pollution. Biosal is an extract of neem (*Azadirachta indica* A. Juss) and is gaining fame due to its insecticidal properties, repellant activity, as a growth inhibitor and for its low mammalian toxicity. Its toxicity and insecticidal effects were earlier described by Pruthi (1937) and Siddique (1942). The most active constituent of neem is azadirachtin, which was isolated by Butterworth and Morgan (1971) and its chemistry was reported by Nakanishi (1975). A number of neem products are isolated from neem tree by Lavie and Gabrielith (1967), Zanno (1974), Sankaram *et al*., (1987), Siddique *et al*. (1987), and Siddique *et al*. (1990). Wislocki *et al.* (1989) reported that abamectin is used to control insect and mite pests of a range of crops, fruits, vegetables and ornamentals, and it is used by home owners for control of fire ants. Later Hayes and Laws (1990) described that the insecticidal avermectins were derived from the soil bacterium *Streptomyces avermitilis* or it was a natural fermentation product of this bacterium. It is classified as toxicity class IV, practically nontoxic. Wardhaugh & Mahon (1998), Ishaaya *et al.* (2002), Lawson & Dahlsten (2003) and Zhu *et al.* (2006) described different aspects of insecticidal activity of the new class of pesticide. The aim of the present study is to find out the comparative efficacy of the bacterial product Abmectin, neem extract (biosal) and a pyrethroid (lymbda cyhalothrin) against the 2nd and 3rd instars of cotton leaf hopper. It will be helpful in construction of comparatively safer integrated pest management (IPM) program against the pest of cotton in Pakistan as well as help reducing ecological degradation due to pesticides contamination.

MATERIAL AND METHODS

The treatment of 2nd & 3rd instars leaf hoppers was done in the seven sets of petridishes (each of 9-cm diameter) provided with leaves of alternate host of lady finger, *Abelmosclus esculentus* (L.). The dilutions of abamectin and cyhalothrin were made in distilled water and of biosal in ethanol. 0.1ml of five different concentrations of these pesticides was spread on each Petri dish by means of pipette. Besides these one petridish was kept untreated and was marked as control to determine the effects of environmental factors and one petridish was treated only with the 0.2ml for ethanol (check) to determine the effect of solvent present in biosal. After preliminary experiments the selected concentrations of abamectin for the 2nd and 3rd instars of *A. devastans* were 0.0123 µg/cm^2, 0.02459 µg/cm^2, 0.049 µg/cm^2, 0.098 µg/cm^2 & 0.196 µg/cm^2., whereas the concentration of cyhalothrin were 0.0245 µg/cm^2, 0.049 µg/cm^2, 0.098 µg/cm^2, 0.196 µg/cm^2 & 0.39 µg/cm^2. In the case of biosal the 2nd and 3rd instars of *A. devastans* were treated with

19.68 µg/cm^2, 39.37 µg/cm^2, 59.05 µg/cm^2, 78.77 µg/cm^2 & 98.45 µg/cm^2. The observatios were made after 24 hours of the treatment. The data were analyzed statistically trough Minitab 11 and probit mortality graph was drawn. The observed mortality was corrected by using Tattersfield and Morris (1924) formula:

$$P = \frac{P_o - P_c}{100 - P_c} \text{ X } 100$$

P = Corrected mortality, P_o = Observed mortality, P_c = The control mortality

RESULTS

Mortality percentages by abamectin against 2nd and 3rd Instars of *A. devastans* by topical method was found to be 33.0% ± 3.87, 63.52% ± 3.33, 8405% ±2.06, 97.1% ± 2.06, and 99.4% ± 0.00 at 0.0123 µg/cm^2 , 0.0245, 0.049, 0.098, & 0.19 respectively(Table 1) with calculated LC_{50} to be 0.018 µg/cm^2 (Fig. 1). The mortality caused by cyhalothrin against the 2nd & 3rd Instars of *A devastans* after 24 hours of treatment was found to be 24.0% ± 0.593%, 48.5% ± 3.82%, 72.0% ± 4.95%, 88.5% ± 5.21%, and 98.0% ± 2.0% at 0.0245, 0.049, 0.098, 0.196 and 0.39 µg/cm^2 respectively (Table 2) with calculated LC_{50} was 0.05 µg/cm^2 (Fig. 2). Mortality against 2nd and 3rd Instars of *A. devastans* due to biosal was found to be 32.0% ± 3.74%, 44% ± 5.1%, 58.0% ±3.74, 70.0% ± 4.47%, and 92.0% ± 3.74 % at 19.68 µg/cm^2 , 39.37, 59.05, 78.77, & 98.45 respectively (Table 3) with calculated LC_{50} as 45.0 µg/cm^2 as shown in (Fig. 3).

DISCUSSION

A number of researchers have reported toxicity of different pesticides for different insect pests by various methods. Rembold *et al.* (1980) in their study on *Ephestia kuehniella* (Zell.) and *Apis mellifera* (L.) reported abnormality in development when last instar larvae of the former and 3rd instar larvae of the later were treated with azadirachtin. They reported highest larval mortality at 0.5 µg/ larva in 3rd instar larvae of *A. mellifera.* In the present investigations 45.0cm^2 of biosal and .05 µg /cm^2 of lambda cyhalothrin produced 50% mortality among 2nd and 3rd instars of *A. devastans* in laboratory condition. The difference in the result might be due to difference in insects or different mode of treatment. The differences between present and the findings of Redfern *et al.* (1981) i.e. 83% mortality of 3rd and 4th instar larvae of *Spodoptera frugiperda* after topical treatment with 10µg of azadirachtin/insect could be due to difference in experimental insects and mode of treatment.

Gist and Charles (1985) reported the synergistic activity of synthetic pyrethroid with piperonyl butoxide (1:8) against armyworm *Sporoptera frugiperda* and calculated the LD_{50} range between 0.213 µg/insect to 5.41 µg/insect among 6th instar larvae, while in the present investigation the cyhalothrin also showed higher toxicity as compared to neem extract against the 2nd and 3rd instars of cotton leaf hopper. In the present findings cyhalothrin reduced 50% population of 2nd and 3rd instars of cotton leaf hopper by topical method, when applied at 0.05 µg /cm^2. Synergistic approach of pesticide was not taken into consideration in present study. Nizam *et al.* (1986) also investigated the LD_{50} dose i.e 5.0 µg /insect of neem extract (factor B) against the nymph and adults of *B. germenica.* In the present investigation the toxicity of biosal against the 2nd and 3rd instars cotton leaf hopper. The LC_{50} value was 45.0µg /cm^2, the variations in the present findings might be due to difference in treatment technique and also due to difference in the different insect pests.

Saito and Miyata (1988) determined the comparative toxicities of some synthetic pyrethroids and reported cypermethrin as the most toxic to housefly *Musca domestica* by topical method. In the present work the synthetic pyrethroid cyhalothrin proved to be more toxic than the biosal a neem extract but less toxic than abamectin a bacterial product against the immature of sucking pests of cotton. The present study proved the findings of Wislocki *et al*. (1989) that reported abamectin could be used to control insect and mite pests of a range of agronomic, fruit, vegetable and ornamental crops.

Naqvi *et al*. (1990) compared the toxicity of two neem compounds (NC and H-34) with the toxicity of pyrethroid (solfac) and two OPs .The order of efficacy was DDVP> perfection> solfac > Margosan-O^{TM} > NC > H-34. The result appears in agreement with the present work showing high efficacy of a ferment product abamectin and a pyrethroid lambda cyahlothrin as compared to neem extract i.e. Abamectin > lambda cyahlothrin > Biosal.

Tabassum *et al*. (1996) compared toxicity of two neem extracts (N-6a and N-6b) on 3rd instar larvae of *Musca domestica* L. (PCSIR strain) and reported LC_{50} of N-6a as 18.0mg/ g and for N-6b it was 3.6mg/g. Presently the LC_{50} of neem extract biosal is 45 µg/cm^2 which is comparable with the above findings, the difference in result might be associated with difference in insects.

Bostanian *et al*. (2001) reported lambda cyhalothrin is slightly toxic to the nymph and highly toxic to the adult of *Hyalides vitripennisi* (Say) in present study lambda cyhlothrin is found to be more toxic than biosal but less toxic to abamectin against the 2nd and 3rd instars of cotton leaf hopper the difference might be due to different species as well as difference in experimental chemicals. Tuncer *et al*. (2007) reported high toxicity of lambda cyhalothrin against hazelnut weevil in laboratory bioassays and experimentally no toxicity of azadirechtin is might be comparable to present findings in which labda cyahlothrin proved to be very toxic against the immature of leafhoppers i.e., 2nd and 3rd instars of the pest as compare to Biosal the neem extract. Nathan *et al*. (2007) reported that the azadirachtin (AZA) was most potent against 3rd and 4th instar of brown leafhopper *Nilapervata lugens* at 0.5 ppm and higher concentration as well as simple NSKE (aqueous, ethanolic or both) effectively inhibit the growth and survival. In present work biosal in ethanol showed 50% mortality against the 2nd and 3rd instars of cotton leafhopper at the 45.0 µg/cm^2 in laboratory conditions.

Table 1. Toxicity of Abamectin against (2nd and 3rd) instars of *A. Devastans* after 24 hours of treatment.

Dosage µg/cm²	% Mortality	S.E. (±)	P-value
Control	6.00	2.45	0.00
0.0123	21.00	3.87	0.00
0.0245	50.00	3.33	0.001
0.049	80.84	2.06	0.002
0.098	95.1	2.06	0.017
0.196	99.4	0.45	0.00

Table 2. Toxicity of Lymda Cyhalothrin against (2nd and 3rd) instars of *A. Devastans* after 24 hours of treatment.

Dosage µg/cm²	% Mortality	S.E. (±)	P-value
Control	4.00	2.45	0.00
0.0245	24.0	0.593	0.00
0.049	48.5	3.82	0.00
0.098	75.08	4.95	0.016
0.196	88.30	5.21	0.136
0.39	98.00	2.00	0.208

Table 3. Toxicity of Biosal (Neem extract) against (2nd and 3rd) instars of *A. Devastans* after 24 hours of treatment.

Dosage µg/cm²	% Mortality	S.E. (±)	P-value
Control	8.0	2.0	0.016
Check	16.0	2.4	0.002
19.66	32.0	3.74	0.001
39.37	44.0	5.1	0.001
59.05	58.0	3.74	0.001
78.77	70.0	4.47	0.000
98.45	92.0	3.74	0.000

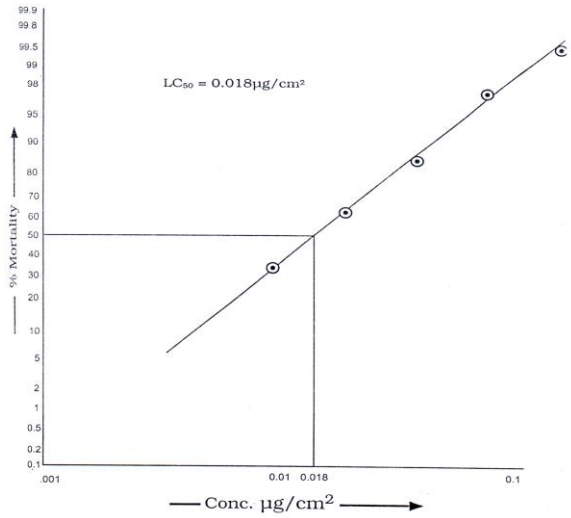

Fig. 1. LC_{50} curve of Abamectin against the 2nd & 3rd instars of *A. devastans* on log probit graph.

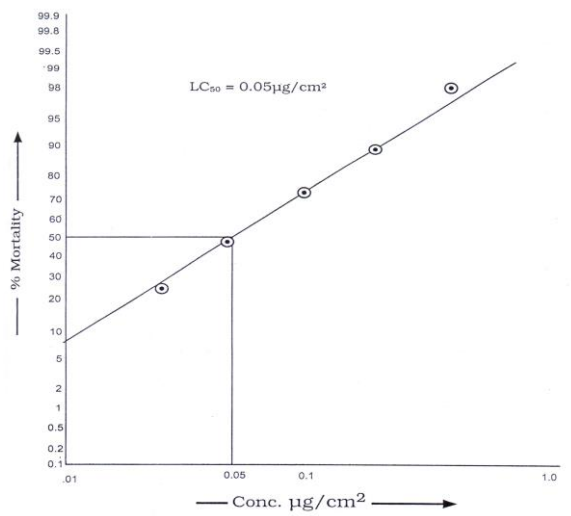

Fig. 2. LC_{50} curve of cyhalothrin against the 2nd & 3rd instars of *A. devastans* on log probit graph.

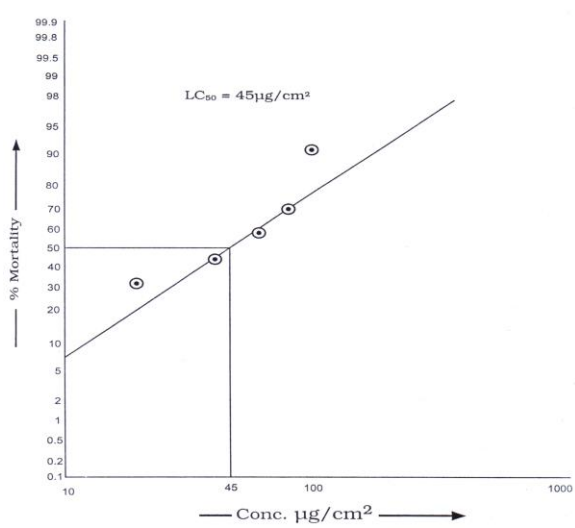

Fig. 3. LC_{50} curve of Biosal (Neem Extract) against the 2nd & 3rd instars of *A. devastans* on log probit graph.

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