

Comparative efficacy of insecticides against the American bollworm, *Helicoverpa armigera* "Hüb." of cotton

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Abstract

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Larvin 80DF, Lannate 40SP, Lorsban 40EC, Fastac 5EC, Decis 10EC and Fury-F18.1EC were tested with recommended doses against 3rd instar larvae of American bollworm, *Helicoverpa armigera* "Hüb." under controlled laboratory conditions. Lorsban 40EC showed maximum efficacy 92.0 % in terms of mortality after 24 hours. Maximum mortality was shown by Lorsban 40EC (100%) followed by Larvin 80DF (72.0%), Lannate 40SP (52.0%), Decis 10EC & Fastac 5EC (16.0%) and Fury-F 18.1EC (8.0%) after 48 hours of application. Similarly, the maximum effectiveness was shown by Lorsban 40EC (100%) after 72 hours followed by Larvin 80DF (80.0%), Lannate 40SP & Fury-F 18.1EC (60.0%), Decis 10EC (52.0%) and Fastac 5EC (44.0%). It is concluded from the results obtained that Lorsban 40EC is the most effective insecticide compared to other carbamate and pyrethroid groups of insecticides against 3rd instar larvae of American bollworm, *H. armigera*.

Key words : *Helicoverpa armigera*, 3rd instar larvae, insecticides, Larvin, Lannate, Lorsban, Fastac, Decis & Fury-F

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Cotton (*Gossypium hirsutum* L.) is one of the main cash crops of Pakistan. It is primarily grown for fiber, but its seed provides edible oil for human and cake for cattle. The cotton lint, cloth, yarn and garments are a big source of foreign exchange and accounts for 2.9% of GDP of Pakistan. It is cultivated on an area about 2,927,000 hectares with the total annual production of 10,732,000 bales (Anonymous, 2001). This production is less than that in many advanced countries. One of the causes for its low yield (20-30%) is the attack of insect pests and diseases. The hot and humid climate is conducive to the proliferation of insect pests, especially the American bollworm, *Helicoverpa armigera* "Hüb." that causes considerable losses (Lohar, 1994).

Insecticides had been found very effective for the control of chewing and sucking insect pests in the early 1980s (Herve, 1985). However, with their extensive use, a widespread resistance to pyrethroids occurred in *H. armigera* in Pakistan in 1990s (Ahmad *et al.*, 1997 & Kranthi *et al.*, 1997). There are some statements of scientists on the use of insecticides against insects. According to Osman *et al.* (1991), the National Research Council in America recommended that pesticides should be used against life stages of pests that are less prone to developing resistance. It was further reported that the rate of development of resistance could be lowered by directing insecticides against stages such as adults and early instars because later instars have greater enzymatic activity and fall into the higher risk category. Strategies on insecticides resistance were followed on the rational use of insecticides, restriction of treatments and alternation with compounds of different modes of action in order to prevent selection for resistance (Sawicki & Denholm, 1987). Under these conditions, an experiment was conducted to determine the efficacy of widely used insecticides against resistant 3rd instar larvae of the American bollworm, *H. armigera*.

Material and Methods

Larvae of the American bollworm were reared on cotton squares and bolls in NIAB laboratory at 28 ± 2 °C and 65 ± 2% R.H. with a photoperiod of 16:8 (L:D) h. Third instar larvae of the American bollworms were treated with thiodicarb (Larvin 80DF), methomyl (Lannate 40SP), chlorpyrifos (Lorsban 40EC), alpha cypermethrin (Fastac 5EC), cyclohexanone (Decis 10EC) and zeeta cypermethrin (Fury-F 18.1EC) by using a leaf dip method (Busvine, 1971). Formulations of test compounds were prepared in distilled water as parts per millions of active ingredients i.e., 100 ppm. Cotton leaf disks (5 cm diameter) were cut and dipped into the test solutions for 15 seconds with gentle agitation. They were allowed to surface-dry on a paper towel and then placed into petri-dishes containing moistened filter papers to avoid desiccation of leaves. Larvae were transferred to the leaf disks by tapping lightly to dispense 5 larvae per petri-dish per replicate. Each treatment was replicated 5 times along with an untreated control under complete randomized design. The whole experiment was run under controlled laboratory conditions at 28 ± 2 °C and 65 ± 2% R.H with a photoperiod of 16:8 (L:D) h. Mortality was assessed after 24, 48 and 72 hours of insecticides application. Insects were considered dead if they gave no response to stimulation by touch. Results were expressed as percentage mortality with correction for untreated (control) mortality using Abbott's formula (Abbott, 1925). The data were subjected to ANOVA and LSD tests.

Results and Discussion

The results (Table 1) showed that mean percent mortality of the 3rd instar larvae of the American bollworm, *H. armigera* varied significantly among the treatments and control. The percent mortality varied among periods, i.e., 24, 48 and 72 hours.

The maximum mortality was observed in Lorsban 40EC (92.0%) and 4.0% mortality was

Table 1. Comparative efficacy of insecticides against the American bollworm, *Helicoverpa armigera* "Hüb." of cotton

Insecticides	Recommended doses/acre	Used Conc. (ppm)	% Mortality of 3 rd instar larvae of <i>Helicoverpa armigera</i> (Hüb.) after (hrs.)		
			24	48	72
Larvin 80DF (Thiodicarb)	330-400g	100	4.0 B	72.0 B	80.0 B
Lannate 40SP (Methomyl)	330-500g	100	0.0 D	52.0 C	60.0 C
Lorsban 40EC (Chlorpyrifos)	750-1000 ml	100	92.0 A	100.0 A	100.0 A
Fastac 5EC					
(Alpha Cypermethrin)	200-250 ml	100	0.0 D	16.0 D	44.0 C
Decis 10EC (Cyclohexanone)	200 ml	100	4.0 D	16.0 D	52.0 C
Fury-F 18.1EC					
(Zeeta Cypermethrin)	175 ml	100	0.0 D	8.0 D	60.0 C
Control	—	—	0.0 D	0.0 D	0.0 D

Means within columns and rows with same letter(s) are not significantly different from each other at 5% level of probability.

recorded in Larvin 80DF and Decis 10EC after 24 hours. Lorsban 40EC gave 100.0% mortality followed by Larvin 80DF (72.0%), Lannate 40SP (52.0%), Fastac 5EC and Decis 10EC (16.0%) and Fury-F 18.1EC (8.0%) after 48 hours. Results after 72 hours showed that the maximum percent mortality of the 3rd instar larvae of the American bollworm was recorded in Lorsban 40EC (100%) followed by Larvin 80DF (80%), Lannate 40SP and Fury-F 18.1EC (60%), Decis 10EC (52%) and Fastac 5EC (44%). The maximum mean percent mortality was recorded in Lorsban 40EC (97.3%) followed by Larvin 80DF (52.0%), Decis 10EC (24.0%), Fury-F 18.1EC (22.7%), Fastac 5EC (20.0%) and no mortality was observed in the control treatment after 24, 48 and 72 hours post application.

These results are in line of those obtained by Khurana (1999) who found that Lorsban 40EC and Thiodan 35EC are most effective against early instars (2nd & 4th) of *H. armigera* but Thiodan 35EC was not effective against full grown larvae. In other studies (Ahmad *et al.*, 1999), Lorsban 40EC showed very low resistance against *H. armigera* during 1994-95. According to Sekhar *et al.* (1996), mean percent survival of 3rd instar

larvae to cypermethrin (0.01%) increased from 46.6% (1991-92) to 95.7% (1994-95). Guolei *et al.* (1995) documented that resistance of 3rd instar larvae to Lannate 40SP (methomyl) increased from 0.9-4.9 times in China. Agraw & Shukla (1999) also reported that Lannate 40SP (6 ml/l) proved to be most effective for the control of *H. armigera*. Lannate 40SP and Karate 5EC were effective for the control 3rd and 4th generations of *H. armigera* in cotton fields at Shangdong, China (Yiliang *et al.*, 1995). Lannate 40SP applied at the rate of 75g a.i./hec., was effective for the control of *H. armigera* during winter (Manisegran *et al.*, 1991). Iqbal *et al.* (1997) revealed that lowest percent infestation (6.6) of *H. armigera* was recorded against Larvin 80DF followed by Decis 10EC (7.3) and check treatment (26.2) after first application. Low to moderate resistance to Karate 5EC & Fury-F 18.1EC was recorded by Ahmad *et al.* (1997) against field population in Pakistani strains. Contrary to our findings, Baruah & Chauhan (1996) reported that cypermethrin is 20.10 times more toxic than endosulfan against 1 to 2 days old larvae of susceptible strain of *H. armigera* in India. Cypermethrin showed a strong efficacy against small larvae of *H. armi-*

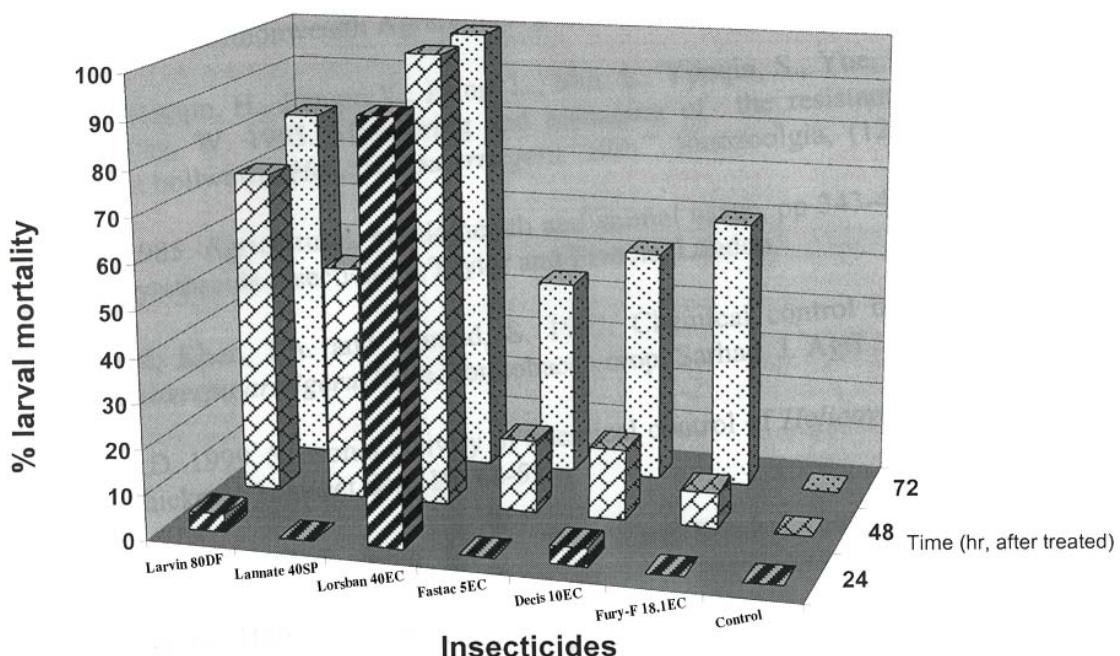


Figure 1. Comparative efficacy of insecticides against the American bollworm, *Helicoverpa armigera* "Hüb." of cotton.

gera but efficiency decreased quickly in successive instars in West Africa (Martin *et al.*, 2002). Findings of most afore-mentioned researchers fully support present achievements, although these insecticides were applied in different doses against various instars and climatic conditions. The present studies, therefore, fully reflect the efficacy of the tested insecticides.

The overall results (Figure 1) showed that Lorsban 40EC is very effective against 3rd instar larvae followed by Larvin 80DF, Lannate 40SP, Fury-F 18.1EC, Decis 10EC and Fastac 5EC.

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