Studies on the effect of *Bacillus thuringiensis* as a microbial control agent against the greater sugarcane borer, *Sesamia cretica* (Lederer)

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SUMMARY

This study was conducted to evaluate the efficacy of the bio-insecticide *Bacillus thuringiensis* (Dipel 2x® 6.4 % WP) against, 1st and 2nd instar Larvae of *Sesamia cretica* compared with Methomyl (Lannate 90%). The obtained results may be summarized as follow:

1- Biological studies:

After 48 hours from treatment, The LC$_{50}$ value of *B. thuringiensis* for 1st instar and 2nd larvae were 0.00526 and 0.7 gm, respectively. While the LC$_{50}$ of Methomyl after 24h. for 1st instar and 2nd larvae were 3394 and 5481 ppm, respectively.
Results showed that, after treatment of 1\textsuperscript{st} and 2\textsuperscript{nd} instars larvae of \textit{Sesamia cretica} with LC\textsubscript{50} concentrations (one for each instar) of \textit{B. thuringiensis}, the average larval duration of \textit{Sesamia cretica} were (36.53 & 24.69) and (33.78 & 20.31 days) for 1\textsuperscript{st} and 2\textsuperscript{nd} instar larvae (treated & control), respectively. The pupation % were (47 & 92) and (18 & 84 %) for (treated & control) on 1\textsuperscript{st} and 2\textsuperscript{nd} instars larvae, respectively. The larval mortality % were (53 & 8) and (82 & 16 %) for (treated & control) of 1\textsuperscript{st} and 2\textsuperscript{nd} \textit{Sesamia cretica} instars larvae, respectively. The pupal weight for (treated & control), \textit{Sesamia cretica} were (0.1887 & 0.184 gm) and (0.1842 & 0.1601 gm) when it treated as 1\textsuperscript{st} and 2\textsuperscript{nd} instars larvae, respectively. Furthermore, the pupal duration were (12.14 & 10) and (10.44 & 9.83 days) for (treated &control), when \textit{Sesamia cretica} treated as 1\textsuperscript{st} and 2\textsuperscript{nd} instar larvae, respectively. For pupal mortality %, it was (6.67 & zero) for 1\textsuperscript{st} instar larvae and (zero & zero) for 2\textsuperscript{nd} instar larvae for each (treated & control), respectively. The total emergence % for 1\textsuperscript{st} instar larvae were (94 & 100%) and (100 & 100%) for 2\textsuperscript{nd} instar larvae for each (treated & control), respectively.

On the other hand results indicated that , after treatment of 1\textsuperscript{st} and 2\textsuperscript{nd} instar larvae of \textit{Sesamia cretica} with LC\textsubscript{50} concentrations (one for each instar) of Methomyl (Lannate 90%), the average larval duration of \textit{Sesamia cretica} were (31.41 & 24.69) and (33.87 & 20.31 days) when it treated as 1\textsuperscript{st} and 2\textsuperscript{nd} instars larvae (treated & control), respectively. The pupation % were (34 & 92) and (28 & 84 %) for (treated & control) when \textit{Sesamia cretica} treated as 1st and 2nd instars larvae, respectively. The larval mortality % were (66 & 8) and (72 & 16 %) for (treated & control) when \textit{Sesamia cretica} treated as 1\textsuperscript{st} and 2\textsuperscript{nd} \textit{Sesamia cretica} instars larvae, respectively. The pupal weight for (treated &control), \textit{Sesamia cretica} were (0.1626 & 0.184) and (0.1994 & 0.1601 gm) for 1st and 2nd instars
larvae, respectively. The pupal duration were (12.41 & 10) and (10.83 & 9.83 days) for (treated & control), when it treated as 1st and 2nd instars larvae, respectively. For pupal mortality %, it were (zero & zero) for 1st instar larvae and (14.3 & zero) for 2nd instar larvae for each (treated & control), respectively. Data also showed that the total emergence % for 1st instar larvae were (100 & 100%) and (85.7 & 100%) for 2nd instar larvae for each (treated & control), respectively.

2- Biochemical Studies:

This section of the present study is to indicate the direct influence of B. t. and Methomyl on some physiological parameters of Sesamia cretica.

2.1. Proteolytic enzymes activity:

Data revealed that the activity of protease decreased in case of B. t. compared with control. Statistically, there is significant difference between B. t. and control protease values were 65 and 106.67 O.D unit x 10³, respectively. While there is no significant difference between Methomyl and control. The protease value for Methomyl was 105.33.

2.2. Carbohydrates hydrolyzing enzymes:

2.2.1. Amylase:

Amylase activity decreased in B. t. and Methomyl treatment while increased in control, values were 401, 396, 513 µg Glucose/g/min. Statistical analysis showed a significant difference between all treatments and the untreated control.

2.2.2. Invertase:

Data indicated that the tested B. t. and Methomyl caused significant decreases in Invertase activity in treated larvae of Sesamia
cretica than the untreated ones; values were 417.9, 402.5 and 590.9 Glucose/g/min.

2.2.3. Trehalase:

Results showed that Trehalase activity decreased in at LC$_{50}$ of B. t., LC$_{50}$ of Methomyl and control respectively. Sesamia cretica Trehalase activity values were 418.13, 409.23 and 448.63 Glucose/g/min.

2.3.1. α – Esterase:

Data revealed that α – Esterase activity decreased in B. t. and Methomyl treatment while increased in control, values were 52.37, 66.62, 64.1 (α -naphthol/g/min.). Statistical analysis showed a significant difference between all treatments and the untreated control.

2.3.2. β – Esterase:

Results indicated that the tested B. t. and Methomyl caused a significant decrease in β – Esterase activity in treated larvae of Sesamia cretica than the untreated ones; values were 10.26, 22.63 and 11.6 (β - naphthol /g/min.) at LC$_{50}$ of B. t., LC$_{50}$ of Methomyl and control respectively.

2.4. The main metabolic components:

2.4.1. Total proteins:

Data revealed that Methomyl caused a high significant increase in the total proteins of Sesamia cretica compared with the control, the values were, 3.07 and 1.8 (mg/g), respectively. While B. t caused 1.57 (mg/g).

2.4.2. Total carbohydrates:
Data showed that Methomyl caused high significant increase in the total carbohydrate level than control and B. t.. The values were 3.18, 2.5 and 1.41 (mg/g) for Methomyl, control and B. t., respectively.

2.4.3. Total lipids:

Results indicated that Methomyl caused increase in the total lipids of Sesamia cretica. Total lipid values were 1.6, 0.9 and 0.78 (mg/g) for Methomyl, control and B. t., respectively.

Histopathological Studies

The histopathological observations obtained from histological sections of midgut of Sesamia cretica larvae treated as 2nd instar show a progressive loss of epithelial cell definitions and considerable disorganization. In addition, the epithelial cells sloughed off into the midgut lumens, appearing as vesicle-like structures. Extensive cellular disintegration was also observed.