

Toxicity of Certain Nanopesticides on the Cotton Leaf Worm, *Spodoptera littoralis* (Boisd.) in Egypt and South Africa

By

Khaled Sayed Ahmed Hassan

B.Sc. Agric. Sci., (Biochemistry), Fac. Agric., Cairo Univ., 1997

**M. Sc. Agric. Sci., (Agricultural Science), Institute of Environmental Studies &
Research., Ain Shams Univ., 2008**

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Name of Candidate: Khaled Sayed Ahmed

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Supervisors: Dr. Wafai Z. Mikhail

Dr. Hassan M. Sobhy

Dr. Eman M. M. Radwan

Dr. Taher A. Salaheldin

Department: Natural Resources (Animal Resources- Pesticides)

Approval: / /2020

ABSTRACT

The cotton leafworm, *Spodoptera littoralis* (Boisd.), is one of the most dangerous insect pests in Egypt and South Africa, which causes losses of cotton and economic crop yield. This study devoted to developing a novel synthetic scheme to produce a pesticide nanocomposite of very high efficiency compared to its original ones. The method based on using silver nanoparticles (AgNPS) as a pesticide carrier by loading the Organophosphorus pesticide Profenofos (P) and the Pyrethroid pesticide Lambda-cyhalothrin (L-CYN) encapsulation. The nature of particles binding has been investigated via UV-visible spectral analysis, TEM and FT-IR devices. Nanosilver (AgNPS), nanoprofenofos (AgNPS@P) and nanolambda-cyhalothrin (AgNPS@L-CYN) were detected at wave length of 423, 426 and 433 nm, by using UV-visible spectral, with particle size ranging from 7.52 – 23.62, 11.49 – 30.17 and 3.24 – 15.21nm, respectively by using Transmission Electron Microscope (TEM) device. FTIR analysis revealed the disappearance of one band in AgNPS@P graph in comparing of Profenofos graph and shifting of peaks was found in AgNPS@P and AgNPS@L-CYN than those of P and L-CYN due to the formation of the co-ordinate band between silver atom and starch during the reaction. The toxic effect of Profenofos (P), nanocomposite of profenofos (AgNPS@P), Lambda-cyhalothrin (L-CYN), nanocomposite of Lambda-cyhalothrin (AgNPS@L-CYN) and nanosilver (AgNPS) has been tested against second and fourth instars larvae of laboratory and field strains of cotton leafworm. The LC₅₀ value of P, AgNPS@P, L-CYN and AgNPS@L-CYN and AgNPS reached to 4.49, 0.1, 0.88, 0.027 and 1000.94 ppm for second instar larvae and 45.67, 1.56, 7.42 , 0.29 and 6202.8 ppm for fourth instar larvae of laboratory strain, respectively. These values were 79.52, 0.94, 15.04, 0.30 and 4109.58 ppm for second instar larvae and 356.97, 5.15, 52.68 , 1.53 and 14597.86 ppm for fourth instar larvae of filed strain, respectively. The results indicated that AgNPS@P and AgNPS@L-CYN were more effective on cotton leafworm larvae than that of profenofos (P) and Lambda-cyhalothrin (L-CYN) while nanosilver alone has very low toxic effect. The LC₅₀ of AgNPS@P decreased more than 85 and 69 times, while AgNPS@L-CYN LC₅₀ was decreased more than 50 and 34 times for second and fourth instar larvae of field

strains, respectively. Results indicated to LC₅₀ treatment of nano-Lambda-cyhalothrin caused a significant increase (40.6%) in proteins of treated lab larvae body tissues but profenofos produced a high significant increase (113.9%) in proteins of treated field larvae tissues compared with untreated larvae. Field larvae had a high significant increase (61.4%) in activity of acid phosphatase enzyme than that of lab larvae. The high significant decrease (69.1%) in the activity of acid phosphatase enzyme was presented in profenofos treatment and significant decrease (46.5 and 34.7 %) was detected in Lambda-cyhalothrin and nanosilver treated field larvae. A significant increase (41.1%) in activity of alkaline phosphatase enzyme was detected in field larvae treated with nanoprofenofos, while a significant decrease (42.3%) in enzyme activity was presented in profenofos treated field larvae. A significant increase (29.7 and 24.1 %) in activity of the alpha-esterase enzyme was detected in the field larvae treated with nano-Lambda-cyhalothrin and nanosilver, also, a significant decrease (32.1%) in enzyme activity was detected with profenofos treatment compared with the untreated larvae. A high significant increase (83.7%) in the activity of beta-esterase was detected in the larvae treated with nanosilver but nano-Lambda-cyhalothrin caused a significant increase (25.6%), in this enzymatic activity. Profenofos treatment caused a high significant decrease (74.4%) but Lambda-cyhalothrin caused a significant decrease (27.9%) in beta-esterase of treated field larvae compared to untreated larvae. The treatment of lab *S. littoralis* larvae with LC₅₀ of chemical insecticides, nanocomposite insecticide and nanosilver particles produced some deformations in midgut tissues of these larvae. Nanosilver treatment caused high destroying of midgut tissue of treated larvae, while the chemical pesticides bounded to nanosilver particles produced a highly damage of midgut tissues of larvae, especially nano-lambda- cyhalothrin treatment.

Keywords: cotton leafworm (*Spodoptera littoralis*), Profenofos, Lambda-cyhalothrin, nanosilver, nanocomposite pesticides, total proteins, Acid and Alkaline Phosphatase, Alpha and Beta Esterase, Histological effects, UV-visible spectral, TEM, FTIR.

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