*J. of Plant Protection and Pathology, Mansoura Univ., Vol. 15(10):355 - 358, 2024*

# Journal of Plant Protection and Pathology

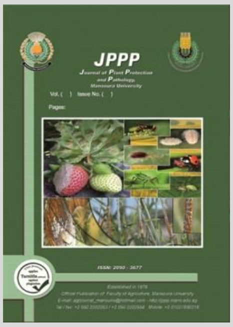
**Journal homepage & Available online at: www.jppp.journals.ekb.eg**

# Toxicological and Physiological Impacts of Some Insecticides on the Cotton Leafworm, *Spodoptera littoralis* (Boisd.) (Lepidoptera: Noctuidae)

**Suzan M. S. Badr* and Neven M. Faiz**

Department of Cotton Leafworm Research, Plant Protection Research Institute, Agricultural Research Center, Dokki, Giza, P.O.Box 12611, Egypt.

Cross Mark




## ABSTRACT

The cotton leafworm, *Spodoptera littoralis* (Boisd.) is a serious pest of cotton and other crops in Egypt. Bioassay was carried out to evaluate the toxicity of some biochemical insecticides (emamectin benzoate, spinosad, and *Bacillus thuringiensis*)against 2nd larval instar of *S. littoralis* (Boisd). The $LC_{50}$ values determined for emamectin benzoate, spinosad, and *Bacillus thuringiensis* against *S. littoralis* larvae were 1.38, 114.09, and 54.19 ppm respectively. Based on the $LC_{50}$ values, emamectin benzoate was more toxic to *S. littoralis* than the other compounds. Biochemical studies were done to detect the effect of tested compounds on total carbohydrates, proteins, lipids, amylase, invertase, trehalase, and alpha and beta-esterase enzymes. The total results indicated that carbohydrates, total proteins, and lipids were decreased significantly after treatment with *Bacillus thuringiensis* than the other compounds. The tested insecticides significantly reduced the amylase, invertase, and trehalase activity. A significant increase in alpha and beta esterase was induced by all tested compounds.

***Keywords:*** Cotton leafworm, *Bacillus thuringiensis*, pesticides, chemical constitutes of larvae, enzymes.

## INTRODUCTION

Throughout the year, several economically significant crops are attacked by cotton leaf worm *Spodoptera littoralis* (Boisd.), as one of the most significant lepidopteron pests that results in financial losses. Because cotton satisfies both local and export demands and makes a major contribution to industry, employment, agriculture, and export revenue, it is essential to the nation's economy FAO (2022). Cotton leaf worm is reported as a pest on a variety of other commercially significant crops, fruits, and vegetables. Its broad host range, about 40 plant families and high reproductive potential, make it a detrimental pest of Egyptian crops Ahmed *et al.,(*20190 and Zaka *et al.* 92014).

Resistance to several pesticides has been developed in the last decades due to the extensive use of pesticides against *S. littoralis*, making control of it more challenging Ismail *et al.,* (2020).

The three most widely used biochemical insecticides in the world are *Bacillus thuringensis*, spinosad, and emamectin benzoate. According to Aziz and Mohamed (2019), emamectin benzoate is a semisynthetic side of the bioinsecticide abamectin. This compound has a wide range of applications for controlling lepidopteran insects, such as *Spodoptera littoralis* . Emamectin affects muscles and stops the feeding of insects resulting in the insect's deathFritz *et al.,* (1979).

Nowadays, all researchers do their best to develop new agents with novel biochemical targets to overcome resistance problems in the insect Ismail, (2020). Spinosad is a neurotoxic insecticide that affects insects' nervous system when they touch it or swallow it. Their muscles twitch wildly, paralysis and eventual death result. It is also not harmful to mammals Barazani, (2001).

Entomopathogenic bacteria *B.t var. kurstaki* represents an effective example of biological control. According to Dent (2000), this bacterium has a remarkable effect in managing certain insect pests in agriculture. The target organ of insecticides is the midgut, at which digestion and absorption occur. Insecticides can penetrate the perimicrovillar membrane, causing harm and epithelial cell destruction. Castro *et al*., (2021 and Santos-Junior *et al.,(*2020)

The current work aimed to evaluate the efficiency of the sub-lethal rates of these insecticides against the cotton leafworm larvae and the enzymatic changes resulting from the treatment.

## MATERIALS AND METHODS

### Tested compounds

1. Protecto 9.4% WP (*Bacillus thuringensis var. kurstaki, (32000 I.U. /mg)* bacterial insecticides. It was provided by Bioinsecticide ProductionUnit, Plant Protection ResearchInstitute, Agricultural Research Centre, Giza, Egypt
2. Master Top 25% SC. Active ingredients (spinosad), spinosyns group. It was provided by Syngenta Company.
3. Core 10% EC. Active ingredients (emamectin benzoate), avermectin group. It was provided by United Phosphorus Ltd.

### Insect culture

Larvae in the current study were reared in the laboratory of the cotton leafworm research department, Sakha station. Insects were reared on leaves of castor according to Abdel-Salam and Hassan (1962). Insects were kept under laboratory conditions.Metayi *et al.,* (2015).

### Bioassay

The toxicity of the tested compounds was detected by the leaf-dipping technique Abdel-Halim *et al.,* (2019). leaves were immersed in the insecticidal preparations for 10 sec then let to dry. Treated leaves were transferred to cups, that have 10

* **Corresponding author.**
**E-mail address: suzanbadr20@gmail.com**
**DOI: 10.21608/jppp.2024.314081.1253**

starved larvae. Control was treated with distilled water. Each treatment was represented by five replicates. Mortality percentages were recorded after two, four and six days after treatment Shawer *et al.,* (2018a). Mortality rates were calculated by using the Abbott formula Abbott, (1925) and probit analysis was performed according to Finney (1971) by using LdPLine® software.

**Biochemical Studies**

**Insect analysis: -**

Insect samples were performed according to Amin (1998). They were grinded in distilled water (50 mg /1 ml), then, centrifuged at 8000 r.p.m. for 15 min at 2 ºC. The pellet was left and the supernatant was stored at 5 ºc without the loss of activity. Samples were used for:

**a.** determination of total carbohydrates as described byDubois *et al.,* (1956)

**b.** determination of total protein as described by Brad Ford,( 1976)

**c.** determination of lipids according to Knight *et al.,* (1972)

**d.** determination of α- and β-esterases according to Van Asperen, (1962)

**e.** The activities of invertase, amylase, and trehalase were evaluated according to Ishaaya (1971) and Ishaaya and Swirski (1970).

**Statistical data analysis**

The determined toxicity and biochemical parameters were analyzed. based on four replicates, and the values are expressed as mean ± standard error. The data were statistically analyzed separately. for each experiment and were subjected to analysis of variance (ANOVA) using costat software. Means were compared according to Snedecor and Cochran (1980). and were considered significant at $P \leq 0.05$. Differences between the treatments were determined by Duncan's Multiple Range Test ($P \leq 0.05$) Duncan (1955).

## RESULTS AND DISCUSSION

Table (1) shows the $LC_{50}$ values of the compounds against 2nd instar larvae recording 1.38, 114.09, and 54.19 ppm, for emamectin, benzoate spinosad, and *Bacillus thuringiensis*, respectively. Based on the $LC_{50}$ values emamectin benzoate is more toxic to*S. littoralis* than other compounds. Spinosad and *B. thuringiensis* were lower than mamectin benzoate. Our results agree with those of E l- Moursy *et al.* (2000) as the latent effect of the Delfin (*B. thuringensis* ) compound was lower than pyrethroid. El-Naggar (2013) showed that the spinetoram was more toxic than spinosad.

**Table 1.Susceptibility of *Spodoptera littoralis* larvae to *Bacillus thuringiensis*, emamectin benzoate and spinosad.**

| Insecticide | $LC_{50}$ (ppm.) | 95% Conf. limits (ppm.) Lower limit | 95% Conf. limits (ppm.) Upper limit | Slope ± SE |
|---|---|---|---|---|
| Emamectin benzoate | 1.38 | 0.84 | 2.09 | 1.87± 0.34 |
| Spinosad | 114.09 | 47.32 | 2.77 | 1.56±0.43 |
| *Bacillus thuringiensis* | 54.19 | 46.27 | 63.56 | 0.73±0.26 |

Results in Table (2) showed that the tested compounds led to a decrease in total carbohydrates which is obvious in *B.t var. kurstaki* compared with control. Total carbohydrate contents were 45.3, 52.2, and 60.3 (mg/g.b.wt) for *B.t var. kurstaki* . Emamectin benzoate, Spinosad, respectively, while it was 73.1 with control. According to Chapman (1998), carbohydrates are essential for the insect's development, flight muscles, metabolism, metamorphosis, and embryonic development. Our results coincide with Abd El-Kareem *et al.,* (2022) who explained, that under toxicant stress, the carbohydrate content shortage could increase the metabolism. Also, low carbohydrates in stress conditions could activate the glycogenolysis and glycolytic to provide excess energy. Li, *et al*., (2018) studied the metabolism of carbohydrates in *Spodoptera exigua* larvae infected with the *Heliothis virescens* ascovirus. They found that carbohydrate content was significantly lower in the infected larva than in the control.

Aly and Ali (2024), disagree with our results. They showed that thiocyclam increased the carbohydrate content in 2nd instar, while novaluron and thiocyclam increased the carbohydrate content in 5th instar compared with control and other tested insecticides.

The total protein content of 2nd instar larva decreased with all compounds. The total proteins were 35.8, 41.0, and 45.2 mg/g.b.wt with *B.t var. kurstaki* , emamectin benzoate, and spinosad, respectively, by comparing with control (47.3 mg/g. b. wt). El-Barky *et al.* (2008) reported similar findings, they used spinetoram on *S. littoralis* and found that total proteins significantly decreased. A decreased total protein value was also seen in *S. littoralis* treated with spinetoram, which is associated with the inhibitory impact on the neurosecretory receptors that control protein secretion Hamouda and Dahi (2008). According to De França *et al.* (2017), insecticides, particularly those of the methomyl class, target ion channels and muscle ryanodine receptors. This reduces nutritional indicators including proteins, carbs, and lipids that impair *Agrotis ipsilon* larvae development Xu *et al.,* 2016). During the pupal stage, the protein hemolymph acts as a supply of protein required for the adult stage's development. Wilkinson (1976) showed that proteins aid in microsomal enzyme synthesis, which aids in the removal of toxins that are ingested by insects. Proteins are the primary biological constituents of insects that bind foreign substances.

All compounds caused a reduction in lipids that was more obvious with *Bacillus thuringiensis* than with the other compounds. They were 37.3, 37.6, and 41.5 (mg/g.b.wt) for *B.t var. kurstaki*, emamectin benzoate, and spinosad, respectively as compared with control (48.0 mg/g.b.wt). Lipid accumulation is directly related to a shortage of juvenile hormones, according to Hill and Izatt's (1974) findings. Administering the tested insecticide does not affect the corpora allata, which is the place where the juvenile hormone is secreted.

**Table 2. Effect of $LC_{50}$ of tested compounds on total proteins, carbohydrates, and lipids in the *Spodoptera littoralis* larvae treated as 2nd instar larvae**

| Tested compound | Total proteins (μg/g b.w.) (Mean ± S.E.) | Total carbohydrate (μg/g b.w.) (Mean ± S.E.) | Total lipids (μg/g b.w.) (Mean ± S.E.) |
|---|---|---|---|
| *B.t var. kurstaki* | 35.8 ± 0.3$^{c}$ | 45.3 ± 1.4$^{d}$ | 37.3 ± 1.2$^{c}$ |
| Emamectin benzoate | 41.0 ± 1.3$^{b}$ | 52.2 ± 0.7$^{c}$ | 37.6 ± 0.7$^{c}$ |
| Spinosad | 45.2 ± 0.6$^{b}$ | 60.3± 0.7$^{b}$ | 41.5 ± 0.7$^{b}$ |
| Control | 47.3 ± 1.1$^{a}$ | 73.1 ± 0.9$^{a}$ | 48.0 ± 1.1$^{a}$ |
| Df | 3 | 3 | 3 |
| F-value | 73.0 | 430.79 | 72.3 |
| P-value | 0.0000$^{***}$ | 0.0000$^{***}$ | 0.0000$^{***}$ |

**Means in the same column with the same letter(s) are not significantly different. ($P < 0.05$)**

*** Very Highly significant effect.**

Our results in Table (3) showed a decrease in the activity of amylase, invertase, and trehalase enzymes. These results match with those of Salem *et al.,* (2023a) who observed a remarkable decrement in amylase activity after treating 4th instar larvae of *S. frugiperda* with lethal doses of spinerotam. Also, amylase, invertase, and trehalase enzyme activity were decreased when *Helicoverpa armigera*, larvae were exposed to a spectrum of pesticides Al-shannaf *et al.,* (2012). The same finding in treated *S. littoralis* has also been detected by earlier investigators (Rashwan, 2013 and Salem *et al.*, 2023b).

**Table 3. Effect of $LC_{50}$ of tested compounds on amylase, invertase, and trehalase in the *Spodoptera littoralis* larva treatment as 2nd instar larvae**

| Tested compound | Amylase (µg glucose/min. /gm b.w.) Mean ± S. E. | Invertase (µg glucose/min. /gm b.w.) Mean ± S. E. | Trehalase (µg glucose/min. /gm b.w.) Mean ± S. E. |
|---|---|---|---|
| *B.t var. kurstaki* | 200.6 ± 0.7$^{c}$ | 563.0 ± 2.1$^{d}$ | 383.6 ± 2.7$^{b}$ |
| Emamectin benzoate | 206.0 ± 0.6$^{b}$ | 583.0 ± 3.0$^{b}$ | 405.0 ± 2.9$^{a}$ |
| Spinosad | 211.2 ± 0.6$^{a}$ | 560.3± 0.7$^{d}$ | 341.5 ± 0.7$^{b}$ |
| Control | 213.6 ± 0.9$^{a}$ | 652.6 ± 1.4$^{a}$ | 409.6 ± 2.6$^{a}$ |
| Df | 3 | 3 | 3 |
| F-value | 155.0 | 4831.0 | 463.0 |
| *P*-value | 0.0000$^{***}$ | 0.0000$^{***}$ | 0.0000$^{***}$ |

**Means in the same column with the same letter(s) are not significantly different. (P < 0.05)**
*** Very Highly significant effect.**

Table (4) shows values of Alpha and beta esterase. Alpha esterase was activated by emamectin benzoate (217.6) as compared with control (196.3). Also, activation occurred with emamectin benzoate 221.6 in beta esterases, while it was 208.0 with control. Alpha esterases were highly activated with emamectin benzoate (217.6) followed by *B.t var. kurstaki* (206.0) and Spinosad (200.5). In beta esterases, there was a significant increase in emamectin benzoate (221.6), and spinosad (215.3) compared with control (208.0), while there was no significant change between *B.t var. kurstaki* (211.6) and control (208.0).

**Table 4. Effect of $LC_{50}$ of tested compounds on alpha and beta esterases in the *Spodoptera littoralis* larvae treated as 2nd instar larvae**

| Tested compound | α-esterase (µg α-naphthol/min./g.b.wt) (Mean ±S.E.) | β-esterase (µg α-naphthol/min./g.b.wt) (Mean ±S.E.) |
|---|---|---|
| *B.t var. kurstaki* | 206.0 ± 0.6$^{b}$ | 211.6 ± 1.3$^{a}$ |
| Emamectin benzoate | 217.6 ± 6.3$^{c}$ | 221.6 ± 14.6$^{c}$ |
| Spinosad | 200.5 ± 1.3$^{b}$ | 215.3±0.6$^{b}$ |
| Control | 196.3± 2.6$^{a}$ | 208.0 ± 10$^{a}$ |
| Df | 3 | 3 |
| F-value | 176.33 | 426.29 |
| *P*-value | 0.0000 | 0.0000 |

**Means in the same column with the same letter(s) are not significantly different. (P < 0.05)**
*** Very Highly significant effect.**

According to Vanhaelen *et al.* (2001), esterases are essential for the detoxification of both naturally occurring and chemically manufactured pesticides. Mahmoud, *et al*,(2024) found that esterase activities significantly increased in larvae treated with spinosad, chlorpyrifos, and methomyl.

Enzymes involved in metabolism, like esterase and mixed-function oxidase (MFO), can have their functions changed by insecticides. This matches the findings documented by Abd El-Mageed and Elgohary (2006), who verified that the exposure of the 4th instar larva of *S.littoralis* to spinosad varies the esterase activity. Similar to the study of Abd El-Samei *et al.* (2019), spinosad's LC25 was found to significantly activate α- and β-esterases in larvae in their 3rd and 5th instars after 48 hours. Bakr *et al.,* (2013), explained that IGRs may result in varying degrees of alterations in the α and βesterases in *S. littoralis*.

## REFERENCES


Abbott, W. S. (1925). A method of computing the effectiveness of an insecticide. J. Econ. Entomol. 18: 265- 267.

Abd El-Kareem, S. M. I.; El-Sabagh, M. M M. and El-Banna, A. A. (2022). Acomparative study between a commercial mixture compound and its individual active ingredients on the cotton leafworm, *Spodoptera littoralis* (Boisd.) (Lepidoptera: Noctuidae) on tomatoes under semi feld conditions. J. Basic and Appl. Zool. 83:23.

Abd El-Mageed, A.E.M.A. and Elgohary, L.R.A. (2006). Impact of spinosad on some enzymatic activities of the cotton leafworm. Pakistan Journal of Biological Sciences, 9, 713-716.

Abd El-Samei, E. M., Hamama, H. M., El-Enien, M. G. A. A. and Awad, H. H. (2019). Interaction of spinosad and *Bacillus thuringiensis* on certain toxicological, biochemical and molecular aspects in the Egyptian cotton leaf worm, *Spodoptera littoralis* (Boisduval) (Lepidoptera: Noctuidae). African Entomology, 27(2), 508-522.

Abdel-Halim, K. Y., EL-Sayed, A. A. K., Tasamoh, K., Mona, K., & Marwa, M. T. (2019). Esterases and Glutathione-S-Transferase Activities Related Responses in Cotton Leaf Worm, *Spodoptera littoralis* (Boisd.) (Lepidoptera: Noctuidae) After Insecticides Exposure. International Journal of Innovative Science and Research Technology, 4(8), 2456-2165.

Abdel-Salam, F., & Hassan, S. (1962). Laboratory rearing procedure for the Egyptian cotton leafworm, *Prodenia litura* (F.), for toxicological studies. 3rd Cotton Confr. Cairo.

Ahmed, K., Mikhail, W. Z., Sobhy, H. M., Radwan, E. M. M., El Din, T. S., & Youssef, A. (2019). Effect of Lambda-Cyahalothrin as nanopesticide on cotton leafworm, *Spodoptera littoralis* (Boisd.). Egyptian Journal of Chemistry, 62(7), 1263-1275.

Al-shannaf, H. M., Mead, H. M., Sabry, Al. H. (2012): Toxic and Biochemical Effects of Some Bioinsecticides and IGRs on American Bollworm, *Helicoverpa armigera* (hüb.) (noctuidae: lepidoptera) in Cotton Fields. Journal of Biofertilizers & Biopesticides, 3:1.

Aly, M., & Ali, A. (2024). Toxicity and biochemical effects of some insecticides on the cotton leafworm, *Spodoptera littoralis* (Boisd.) (Lepidoptera: Noctuidae) under laboratory. *Egyptian Journal of Crop Protection*, *19*(1), 27-46. doi: 10.21608/ejcp.2024.264221.1026

Amin, T. R. (1998). Biochemical and physiological studies of some insect growth regulators on the cotton leafworm, *Spodoptera littoralis* (Boisd.). Ph.D. Thesis, Faculty of Science, Cairo Univ. Egypt.

Aziz, A., & Mohamed, F. (2019). Effects of some insecticide mixtures on toxicity and some biochemical parameters of cotton leafworm, *Spodoptera littoralis* (Boisd.). Egyptian Academic Journal of Biological Sciences, F. Toxicology & Pest Control, 11(3), 139-148.

Bakr, R. F.; Hafez, J. A.; Khamiss, O. A. and Zyaan, O. H. (2013). Biochemical studies on the effect of chitin synthesis inhibitor, (flufenoxuron) and SpliMNPV on the cotton. Egypt. Acad. J. Biol. Sci., 6(2): 29 -38.

Barazani, A. (2001). Rimon, an IGR insecticide. Phytoparasitica, 29: 59-60

Bradford, M.M., (1976). A rapid and sensitive method for the quantitation of microgram quantities of proteins utilizing the principle of protein-dye binding. Anal. Biochem., 72: 248-254.

Castro, B.M.C., Martínez, L., Plata-Rueda, A., Soares, M.A., Wilcken, C., Zanuncio, A.J.V., Fiaz, M., Zanuncio, J.C. and Serrão J.E. (2021): Exposure to chlorantraniliprole reduces locomotion, respiration, and causes histological changes in the midgut of velvetbean caterpillar *Anticarsia gemmatalis* (Lepidoptera: Noctuidae). Chemosphere, 263:128008.

Chapman, R. F. (1998). The insects: structure and function. Cambridge Univ. press, Cambridge, UK, 770 pp.

De França, S. M., Breda, M. O., Barbosa, D. R., Araujo, A. M., Guedes, C. A. and Shields,V. D. C. (2017): The sublethal effects of insecticides in insects. Biological control of pest and vector insects, 23-39.

Dubios, M., K.A. Gilles, P.A. Rebers and Smith, F. (1956). Colorimetric method for determination of sugars and related substances. Analyl. Chem., 28: 350- 356.

Duncan, D.B. (1955). Multiple Range and Multiple F Tests. Biometrics 11:1. https://doi.org/10.2307/3001478

El-Barky, N.M.; Dahi, H. F. and El-Sayed, Y. A. (2008). Toxicological evaluation and biochemical impacts for radiant as a new generation of spinosyn on *Spodoptera littoralis* (Boisd.) larvae. Egypt. Acad. J. Biol Sci., 1(2): 85 97.

El-Moursy, A.A.; Kares, E.A.; ZohdyN.; Abdel – Rahman, A.M. and El Mandarawy, M.B.R. (2000). Effect of *Bacillus thuringiensis* Berliner, a chemical insecticide and its mixtures against unparasitized and parasitized *Spodoptera littoralis* (Boisd.) larvae. Egypt. J. Agric. Res., 78 (4): 1587–1601.

El-Naggar J.B.A. (2013). Sublethal effect of certain insecticides on biological and physiological aspects of *Spodoptera littoralis* (Boisd.). Nat. and Sci. 11(7), 19-25.

Finney, D. (1971). Probit analysis. 3rd. Eddn. Cambridge University press: Cambridge, UK.

Food and Agriculture Organization. (2022). https://www.fao.org/country-showcase/selected-product-detail/en/c/1287947/.

Fritz, L. C., Wang, C. C., & Gorio, A. (1979). Avermectin B1a irreversibly blocks postsynaptic potentials at the lobster neuromuscular junction by reducing muscle membrane resistance. Proceedings of the National Academy of Sciences, 76(4), 2062-2066.

Hamouda; L. S. and Dahi, H. F. (2008). Neurotoxic effect of spinetoram on Spodoptera littoralis (Boisd.) Larvae. Egyptian Academic Journal of Biological Sciences, (An Entomology), 1 (2) 27-36.

Hill, L. and Izatt, E. G. (1974). The relationships between corpora allata and fat body and hemolymph lipids in the adult female desert locust. J. Insect Physiol., 20:2143-2156.

Ishaaya, I. (1971). Observations on the phenoloxidase system in the armored scales Aonidiella aurantii and Chrysomphalus aonidum. Comp Biochem Physiol -- Part B Biochem 39:935–943.

Ishaaya, I. and Swirski, E. (1970). Invertase and amylase activity in the armoured scales *Chrysomphalus aonidum* and *Aonidiella aurantii.* J Insect Physiol 16:1599–1606. Ismail SM (2020). Field persistence of certain new insecticides and their efficacy against black cutworm, Agrotis ipsilon (Hüfnagel). Bulletin of the National Research Centre, 45 (1), 17-24

Ismail S.M. (2020). Field persistence of certain new insecticides and their efficacy against black cutworm, *Agrotis ipsilon* (Hüfnagel). Bulletin of the National Research Centre, 45 (1), 17-24.

Knight, J.A.; Anderson, S. and Rawle, J.M. (1972). Chemical basis of the sulfo-phospho-vanillin reaction for estimating total serum lipids. Clin Chem 18:199–202.

Li, Z. Q., Yu, H., & Huang, G. H. (2018). Changes in lipid, protein and carbohydrate metabolism in Spodoptera exigua larvae associated with infection by Heliothis virescens ascovirus 3h. *Journal of invertebrate pathology*, *155*, 55–63. https://doi.org/10.1016/j.jip.2018.05.005

Mahmoud, A. B Mervat., Farouk A. Abdel-Galil., Zeinab Heussien., Zeinab Al-Amgad, Hassan F. Dahi, and Sherehan A. R. Salem. Biochemical and Histopathological Impacts Induced by the Lethal Toxicity of Chlorpyriphos, Methomyl, and Spinosad against the Fall Armyworm *Spodoptera frugiperda* (Lepidoptera: Noctuidae) in Egypt Egypt. Acad. J. Biolog. Sci. (A. Entomology) Vol. 17(1) pp.31-46 (2024)

Metayi, M. H., Ibrahiem, M. A., & El-Deeb, D. A. (2015). Toxicity and some biological effects of emamectin benzoate, novaluron and diflubenzuron against cotton leafworm. Alexandria Science Exchange Journal, 36 (OCTOBER-DECEMBER), 350-357.

Rashwan, M. H. (2013). Biochemical impacts of rynaxypyr (Coragen) and spinetoram (Radiant) on *Spodoptera littoralis* (Boisd.). Nature and Science, 11(8), 40-47.

Santos-Junior, V.C., Martinez L.C., Plata-Rueda, A., Fernandes, F.L., Tavares, W.S., Zanuncio, J.C. and Serrão, J.E. (2020): Histopathological and cytotoxic changes induced by spinosad on midgut cells of the non-target predator *Podisus nigrispinus* Dallas (Heteroptera: Pentatomidae). Chemosphere, 238:124585..

Shawer, R., Donati, I., Cellini, A., Spinelli, F., & Mori, N. (2018a). Insecticidal Activity of Photorhabdus luminescens against *Drosophila suzukii*. Insects, 9(4), 148.

Snedecor, G.W. and Cochran, W.G. (1980). Statistical methods, 7th edn. The Iowa State University Press, Ames, IA

Van Asperen, K., (1962). A study of housefly esterase by means of sensitive colourimetric method. J. Insect Physiol., 8: 401-416.

Vanhaelen, N., Haubruge, E., Lognay, G. and Francis. F., (2001): Housefly glutathione S - transferase and effect of Brassicaceae secondary metabolites. *Pesticide Biochemistry and Physiology*, 71: 170 -177.

Wilkinson, F. (1976). Insecticide biochemistry and physiology. Plenum Press, New York.

Xu, C., Zhang, Z., Cui, K., Zhao, Y., Han, J., Liu, F. and Mu, W. (2016): Effects of sublethal concentrations of cyantraniliprole on the development, fecundity and nutritional physiology of the black cutworm *Agrotis ipsilon* (Lepidoptera: Noctuidae). *PLoS One*. 2016; 11(6): e0156555. doi: 10.1371/journal. pone. 0156555.

Zaka, S. M., Abbas, N., Shad, S. A., & Shah, R. M. (2014). Effect of emamectin benzoate on life history traits and relative fitness of *Spodoptera litura* (Lepidoptera: Noctuidae). Phytoparasitica, 42(4), 493-501.


# التأثيرات السُمية والفسيولوجية لبعض المبيدات الحشرية على دودة ورق القطن


**سوزان محمد سعد بدر[1] ونيفين محمد فايز[1]**

قسم بحوث دودة ورق القطن - معهد بحوث وقاية النباتات - مركز البحوث الزراعية – الجيزة - مصر


## المخلص


دودة ورق القطن هي آفة تصيب القطن والعديد من المحاصيل في مصر. تم إجراء اختبار حيوي لتقييم سمية بعض المبيدات الحشرية الكيميائية الحيوية (إيمامكتين بنزوات ، سبينوساد وباسيلاس ثيورينجنسس) ضد الطور اليرقي الثاني لدودة ورق القطن. كانت قيم lc50 ضد دودة ورق القطن للمركبات (إيمامكتين بنزوات، سبينوساد وباسيلاس ثيورينجنسس) هى ١,٣٨ ، ١١٤,٠٩ ، ٥٤,١٩ جزء فى المليون على التوالى ، وكان إيمامكتين بنزوات هو الأكثر سمية لدودة ورق القطن. أجريت دراسات بيوكيميائية للكشف عن تأثير المركبات المختبرة على إجمالي الكربوهيدرات والبروتينات والدهون وأنزيمات الأميليز والإنفرتاز والتريهاليز وألفا وبيتا استريز. أشارت النتائج إلى أن إجمالي البروتينات ومحتوى الدهون انخفض بشكل ملحوظ مع جميع المركبات المختبرة، بينما حدث انخفاض ملحوظ فى الكربوهيدرات فى الباسيلاس ثيورينجنسس اكثرمن المركبات الاخرى. أدت المبيدات الحشرية المختبرة إلى تقليل نشاط الأميليز والإنفرتاز والتريهاليز بشكل ملحوظ. حدثت زيادة كبيرة في نشاط ألفا وبيتا إستريز بواسطة جميع المركبات.