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Monitoring the Susceptibility of *Pectinophora gossypiella* Adults Collected from Field Strains of Beni Suef, Monufia and Beheira Governorates to Several Insecticides

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Abstract

The susceptibility of three different field strains collected from Beni Suef, Monufia and Beheira Governorates of the pink bollworm, *Pectinophora gossypiella* (Saunders) (Lepidoptera: Gelechiidae) to chlorpyrifos, profenofos, alpha-cypermethrin, esfenvalerate, lambda-cyhalothrin, emamectin benzoate, spinetoram and spinosad was evaluated by bioassay tests in Central Agricultural Pesticides Laboratory. The results indicated that spinosad was the most toxic to all strains studied and in all tested seasons, 2017, 2018 and 2019. Its LC_{50} values were 31.6, 40.0 and 67.2 mg/L in 2017, 60.0, 69.4 and 47.7 mg/L in 2018 and 42.0, 27.8 and 20.0 mg/L in 2019 of Monufia, Beheira and Beni Suef, respectively. Both chloropyrifos and alphacypermethrin were the lowest toxic to the three strains investigated.

Keywords: *Pectinophora gossypiella*, Beni Suef, Monufia, Beheira, Toxicity.

Introduction

Pink bollworm *Pectinophora gossypiella* (Saunders) (Lepidoptera: Gelechiidae), is a serious key pest of cotton, the larvae of pink bollworm feed on flowers, squares and bolls of cotton. Newly hatched larvae drill into cotton bolls and complete its larval development inside the boll feeding upon seeds. When the 4th instar larvae exit from cotton bolls, it leaves rounded exit hole which is characteristic symptom of pink bollworm damage (**Moustaf *et al.*, 2021**). Cotton is a host for about 166 different species of insect pests throughout its growth cycle. Cotton bollworms are the most destructive insects to cotton plants causing considerable economic losses to crop production (**Mamta and Narkhede, 2012**). Many insect species attack the cotton during the different stages of its growth (**Abd El – Mageed *et al.*, 2007**). The Pink Boll Worm (PBW), *Pectinophora gossypiella* (Saunders) (Lepidoptera: Gelechiidae) is one of the most serious insect pests infesting cotton plants in Egypt, it is a worldwide key pest of cotton and its larvae burrow into cotton bolls to feed on the seeds. It causes serious damage in cotton bolls resulting high reduction in quantity and quality of cotton yield, so the success in controlling such pests considered a great economic importance (**Korejo *et al.*, 2000; Unlu, 2004; El-Aswad and Aly, 2007**). Protection of the cotton plant and mass production of harvested cotton fibers mainly depend on the efficient control of this pest. As part of the pest management program, many insecticides belonging to the organophosphate and pyrethroid groups used effectively to control pink bollworm infestation (**Leonard *et al.*, 1988; Magdy *et al.*, 2009**). The continuous and intensive use of insecticides against this cotton pest has led to the emergence of strains that are more tolerant and resistant to these insecticides (**Khurana and Verma, 1990; Kranthia *et al.*, 2002**), and this insect has become difficult to control.

Conventional bioassay methods used for making management decisions, are considered the basic techniques used for continuous monitoring of resistance levels to various insecticides in field populations (**Margaritopoulos *et al.*, 2008**). This information is essential for changing to a different insecticide class or to an alternative control strategy to avoid increasing selection pressure on populations (**Prabhaker *et al.*, 1996**).

To control the PBW, many chemical insecticides are used, and their wide use had created some problems such as environmental pollution, pest resistance and toxicity against beneficial insects including honeybees, therefore many researchers have used mineral and plant oils as alternatives to insecticides. To avoid unfavorable side effects of the pesticides on the environment, the beneficial insects, and to reduce outbreaks of secondary cotton pests, alternative materials have been initiated recently, to minimize the hazards of pesticides.

The present study aims to evaluate the susceptibility levels of *p. gossypiella* (saund.) adults collected from three field strains of Beni Suef, Monufia and Beheira Governorates to eight recommended insecticides, belonging to the organophosphate, synthetic pyrethroid and bioinsecticide groups.

Materials and Methods

Insect populations:

Three colonies of the pink bollworm were collected from the cotton fields several representing locations of Beni Suef, Monufia and Beheira Governorates during three seasons from 2017 season until 2019 season by collecting thousands of the infested green bolls in September. Disposed larvae released carefully from the double-infested seeds, and allowed in the petri dish (12cm diameter) with a piece of cotton to pupation and adult emergence.

Rearing technique:

The adult moths were sexed and each pair was transferred to glass chimney cages provided with a gauze cover as oviposition site and provided by 10 % sucrose solution as food. Egg deposition on the gauze and the newly hatched larvae transferred to an artificial diet in a glass tube (2 x 7 cm) until adult emergence. The different larval instars fed on a semi-artificial diet as mentioned. The resulting pupae kept in a glass tube (2 x 7 cm) until adult emergence, which used directly for assays. All strains maintained under laboratory conditions.

Insecticides:

1. Organophosphates:

a. Common name: Chlorpyrifos

Trade name: Dursban' 48% E.C producing by Dow AgroSciences.

Chemical name: *O,O*-diethyl *O*-(3,5,6-trichloro-2-pyridinyl) phosphorothioate.

b. Common name: Profenofos

Trade name: Teleton, 72% EC producing by Agrochem.

Chemical name: O-(4-bromo-2-chlorophenyl)-)-ethyl S-propyl phosphorothioate.

2. Pyrethroids:

a. Common name: Alpha-cypermethrin

Trade name: Super Alpha 10% EC producing by ElHelb Pesticides & Chemicals.

Chemical name: [1-(*S**),3-]-(±)-cyano(3-phenoxyphenyl)methyl 3-(2,2-dichloroethenyl)-2,2-dimethylcyclopropanecarboxylate

b. Common name: Esfenvalerate

Trade name: Ventrat S 10% E.C producing by Sumitomo.

Chemical name: [*S*-(*R**,*R**)]-cyano(3-phenoxyphenyl)methyl 4-chloro-2-(1-methylethyl) benzeneacetate

c. Common name: Lambda-cyhalothrin

Trade name: Axon 5% E.C producing by Chem.

Chemical name: [1-(*S**),3-(*Z*)]-(±)-cyano(3-phenoxyphenyl)methyl 3-(2-chloro-3,3,3-trifluoro-1-propenyl)-2,2-dimethylcyclopropanecarboxylate

3. Bio pesticides:

a. Common name: Emamectin Benzoate

Trade name: Excellent 1.9%E.C producing by Kafr El Zayat Pesticides& Chemicals Co..

Chemical name: (4"*R*)-5-*O*-demethyl-4"-deoxy-4"-(methylamino)avermectin A_{1a} + (4"*R*)-5-*O*-demethyl-25-de(1-methylpropyl)-4"-deoxy-4"-(methylamino)-25-(1-methylethyl)avermectin A_{1a} (9:1).

b. Common name: Spinetoram

Trade name: Radiant 12% SC producing by Dow AgroSciences.

Chemical name: (3aR,5aR,9S,13S,14R,16aS,16bR)-13-{[(2R,5S,6R)-5-(Dimethylamino)-6-methyltetrahydro-2H-pyran-2-yl]oxy}-9-ethyl-14-methyl-7,15-dioxo-2,3,3a,4,5,5a,5b,6, 7,9,10,11,12,13,14,15,16a, 16b-octadecahydro-1H-as ;-indaceno[3,2-d]oxacyclododecin-2-yl 6-deoxy-3-O-ethyl-2,4-di-O-methyl-α-L-mannopyranosidec.

c. Common name: Spinosad

Trade name: Spintora 24% SC producing by AgroBio.

Chemical name: 2-[(6-deoxy-2,3,4-tri-*O*-methyl- α -L-mannopyranosyl)oxy]-13-[[5-(dimethylamino)tetrahydro-6-methyl-2*H*-pyran-2-yl]oxy]-9-ethyl-2,3,3a,5a,5b,6,9,10,11,12,13,14,16a,16b-tetradecahydro-14-methyl-1*H*-*as*-indaceno (3,2-*d*)oxacyclododecin-7,15-dione (spinosyn A), mixture with 2-[(6-deoxy-2,3,4-tri-*O*-methyl- α -L-mannopyranosyl)oxy]-13-[[5-(dimethylamino)tetrahydro-6-methyl-2*H*-pyran-2-yl]oxy]-9-ethyl-2,3,3a,5a,5b,6,9,10,11,12,13,14,16a,16b-tetradecahydro-4,14-dimethyl-1*H*-*as*-indaceno(3,2-*d*)oxacyclododecin-7,15-dione (spinosyn D).

Bioassay tests:

The toxicity of the tested insecticides against the pink bollworm was estimated by the dipping technique, the action of insecticides against adult (zero-day-old) used. Glass chimney cages (6 x 9 cm) were dipped in water dilution for each insecticide for 20 seconds and left to dry at room temperature five concentrations for each insecticide, five replicates for each concentration, 10 adults for each replicate. The adults transferred into the treated glass chimney cages, and they covered with muslin cloth and maintained in an incubator at laboratory conditions after twenty-four hours post treatment, which inspected for mortality. Mortality was recorded after 24 h of treatment, converted to percentage, and corrected as compared to control moths according to the Abbott formula (Abbott, 1925). The LC_{50} and slope values for each insecticide were calculated by Probit analysis using Ldp-line software according to Finney (1971), and the toxicity index (TI) was calculated using the following equation (Sun, 1950):

***Toxicity index (TI) = (LC_{50} of the most toxic insecticide / LC_{50} of the least toxic insecticide)* × 100**

Statistical analysis

A probit computer program of Noack and Reichmuth (1978) and Finney (1971) was used for determining the dosage mortality response for the tested insecticides.

Results and Discussion

The obtained results of the cotton season 2017 (Table 1) indicated that the spinosad gave LC_{50} values of 31.6, 40.0 and 67.2 mg/L in Monufia, Beheira and Beni Suef, respectively. Profenofos gave LC_{50} values of 75.0, 86.8 and 99.3 mg/L in Beheira, Beni Suef and Monufia, respectively. These were the highest toxic insecticides compared with the toxicity of the other tested insecticides based on the calculated toxicity index. Alphacypermethrin, Chloropyrifos and Lambda-cyhalothrin in Monufia Governorate were the least toxic insecticides, which had LC_{50} values of 1254.2, 1007.8 and 970.9 mg/L, respectively.

The cotton season, 2018 (Table 2) revealed that the spinosad and profenofos were the highest toxic insecticides with LC_{50} values of 47.7 and 55.7 mg/L in Beni Suef Governorate. Spinosad came in the next rank toxicity. It had LC_{50} values of 60 and 69.4 mg/L in Monufia and Beheira Governorates, respectively. It followed by profenofos with LC_{50} values of 71.9 and 72 mg/L in Beheira and Monufia Governorates, respectively. Both chloropyrifos and alphacypermethrin were the least toxic insecticides, which gave LC_{50} values of 679.3and 371.1mg/L, 480 and 457.3 mg/L and 335.9 and 497.1 mg/L in Beni Suef, Monufia and Beheira Governorates, respectively.

The results of cotton season 2019 (Table 3) showed that spinosad in Beni Suef, spinosad and profenofos in Beheira and spinosad in Monufia Governorate were the highest toxic insecticides, which gave LC_{50} values of 20, 27.8, 34.7 and 42 mg/L, respectively. While both chloropyrifos and alphacypermethrin in Beni Suef, Monufia and Beheira Governorates were the least toxic insecticides, which had LC_{50} values of 368.3 and 309.4 mg/L, 526.6 and 349.9 mg/L and 480 and 418.1 mg/L, respectively.

In the same trend, **Radwan and El- Malla (2015)** evaluated in the laboratory the toxicity of organophosphorus insecticides against laboratory and field female moths of *P. gossypiella* collected from three lower Egypt Governorates, profenofos showed very high levels of resistance against insects in Sharkia, Monufia and Gharbia Governorates, respectively compared with laboratory. Chlorpyrifos and fenpropathrin had the lower toxic effect with high levels of resistance (25.5, 48.4 and 31.6 fold) for Gharbia, Monufia and Sharkia insects, respectively. Moreover, the efficiency of five insecticides belonging to three different chemical groups, pyrethroids, OPs and carbamates on the bollworms, which infested cotton plant was evaluated in a field trial during the 2010 and 2011 seasons. The obtained results indicated the toxic effect of the tested compounds against pink bollworm (PBW) in the 2010 cotton season, however, they were applied once, twice and triple, while based on the general mean of reduction percentage in infestation of PBW it was ranged between 63.03 to 81.96 %.

El-Hadek (2016) studied the toxicity of thirteen organophosphorus insecticides against *Pectinophora gossypiella* (saund) laboratory and two field strains (collected from Fayoum and Dakahlia Governorates. The results indicate that, resistance ratios (RR) varied from one Governorate to another. In Fayoum Governorate data can be classified to three categories. The first category showed low resistance, where the resistance ratios were (6.86 and7.91) folds. The second category was moderate resistance the resistance ratios and fluctuated between 11.64and 26.2 fold. As for The third category, resistance ratios were high and ranged from 40.43- to 96.00- fold for insecticides against *P. gossypiella*. While Dakahlia Governorate, also data can be classified to three different categories. However, the levels of resistance to the tested insecticides were higher in Fayoum Governorate than those in Dakahlia Governorate.

Mohamady (2017) evaluated the efficacy of five recommended insecticides, belonging to the organophosphate and synthetic pyrethroid groups under the laboratory conditions against two field populations of *P. gossypiella* collected from the Sharqia and Fayoum Governorates in Egypt. Additionally, insecticide resistance level was monitored using the residual thin film technique. Results showed that, pyrethroid lambda cyhalothrin was the most effective insecticide with low to moderate resistance levels, whereas the organophosphate chlorpyrifos was the least toxic insecticide with high resistance level. Faiyum insects exhibited higher resistance levels to all tested insecticides compared to those from Sharqia. According to the LC_{50} values and toxicity index results revealed that profenofos was the most effective insecticide against the lab-strain moths of *P. gossypiella*, followed by lambda-cyhalothrin and esfenvalerate, while fenpropathrin and chlorpyrifos showed least efficacy. On the other hand, in the field moth populations from Sharqia and Faiyum, lambdacyhalothrin was the most effective insecticide, followed by esfenvalerate, profenofos, fenpropathrin. Chlorpyrifos showed the least toxicity on moths from Sharqia and Faiyum, respectively. Level of resistance in two field populations of *P. gossypiella* compared with the lab-strain, the field population collected from the Fayoum Governorate exhibited higher resistance ratios to all tested insecticides at the LC50 level than that collected from Sharqia Governorate. The highest level of resistance (RR: 92.81- and 51.58-fold) were obtained with chlorpyrifos treatment in Faiyum and Sharqia population, respectively followed by profenofos (40.53-fold) in Faiyum moths. Whereas moderate resistance level (RR: 20.09-fold) was obtained with profenofos treatment in Sharqia moths.

Table 1. The main criteria of the toxicity regression lines of certain field strains of the pink bollworm, *P. gossypiella* adults to commonly used insecticides in 2017 cotton season.

Insecticides	Insecticide Toxicity to *P. gossypiella* Adults of Field Strains in Season 2017											
	Beni Suef				**Monufia**				**Beheira**			
	LC_{50} (mg/L)	**F.L.**	**Slope±S.E**	**TI**	**LC_{50} (mg/L)**	**F.L.**	**Slope±S.E**	**TI**	**LC_{50} (mg/L)**	**F.L.**	**Slope±S.E**	**TI**
Chloropyrifos	**668.0**	**(404.5–1077.9)**	**2.2±0.5**	**10.1**	**1007.8**	**(593.0-2067.3)**	**1.8±0.5**	**3.1**	**371.3**	**(218.2-677.0)**	**2.2±0.7**	**10.8**
Profenofos	**86.8**	**(35.3–213.3)**	**1.2±0.3**	**77.4**	**99.3**	**(51.0–161.03)**	**2.3±0.7**	**31.8**	**75.0**	**(46.4-134.8)**	**2.4±0.7**	**53.3**
Alphacypermethrin	**445.3**	**(260-820.7)**	**1.7±0.4**	**15.1**	**1254.2**	**(734.6-3011.3)**	**1.7±0.5**	**2.5**	**524.9**	**(308.9-1076.7)**	**1.8±0.5**	**7.6**
Esfenvalerate	**175.0**	**(103.0–358.9)**	**1.9±0.6**	**38.4**	**485.4**	**(311.2-883.2)**	**2.5±0.7**	**6.5**	**418.1**	**(244.9-1003.8)**	**1.2±0.5**	**9.6**
Lambda-cyhalothrin	**178.6**	**(87.1 –303.5)**	**1.9±0.5**	**37.6**	**970.9**	**(622.5-1840.5)**	**2.5±0.7**	**3.3**	**349.9**	**(205.9-717.8)**	**1.8±0.5**	**11.4**
Emamectin Benzoate	**168.5**	**(99.2–278.3)**	**2.2±0.5**	**39.9**	**425.1**	**(280.4-680.8)**	**2.5±0.9**	**7.4**	**199.5**	**(117.4-409.1)**	**1.8±0.5**	**20.1**
Spinetoram	**287.8**	**(160.2–465.3)**	**1.8±0.5**	**23.3**	**167**	**(101.1-269.5)**	**2.2±0.5**	**18.9**	**240**	**(142.4-404.5)**	**2.0±0.5**	**16.7**
Spinosad	**67.2**	**(39.5 –138.7)**	**1.8±0.5**	**100**	**31.6**	**(20.1-48.5)**	**2.8±0.8**	**100**	**40.0**	**(24.8-71.9)**	**2.4±0.7**	**100**

Table 2. The main criteria of the toxicity regression lines of certain field strains of the pink bollworm, *P. gossypiella* adults to commonly used insecticides at 2018 cotton season.

Insecticides	Insecticide Toxicity to *P. gossypiella* Adults of Field Strains in Season 2018											
	Beni Suef				**Monufia**				**Beheira**			
	LC_{50} (mg/L)	**F.L.**	**Slope± S.E**	**TI**	**LC_{50} (mg/L)**	**F.L.**	**Slope± S.E**	**TI**	**LC_{50} (mg/L)**	**F.L.**	**Slope± S.E**	**TI**
Chloropyrifos	**679.3**	**(397.8-1403.3)**	**1.8±0.5**	**7.0**	**478.0**	**(284.8-809.0)**	**1.7±0.5**	**12.5**	**335.9**	**(197.7-689.1)**	**1.8±0.51**	**20.7**
Profenofos	**55.7**	**(32.7-101.6)**	**2.2±0.7**	**85.6**	**72.0**	**(42.7-121.4)**	**2.0±0.5**	**83.3**	**71.9**	**(40.1–116.3)**	**2.4±0.72**	**96.5**
Alphacypermethrin	**371.1**	**(224.7-598.8)**	**2.2±0.5**	**12.8**	**457.3**	**(254.1-918.5)**	**1.5±0.4**	**13.1**	**497.1**	**(276.4-1041.8)**	**1.5±0.38**	**14.0**
Esfenvalerate	**103.1**	**(60.2–185.0)**	**1.8±0.4**	**46.2**	**133.8**	**(74.7-309.7)**	**1.6±0.5**	**44.9**	**207.7**	**(120.5-368.6)**	**1.9±0.54**	**33.4**
Lambda-cyhalothrin	**237.0**	**(149.6–400.9)**	**2.2±0.6**	**20.1**	**250.2**	**(154.8-450.0)**	**2.4±0.7**	**24.0**	**333.5**	**(206.3-599.3)**	**2.4±0.71**	**20.8**
Emamectin benzoate	**104.2**	**(58.0–197.8)**	**1.7±0.5**	**45.7**	**137.0**	**(80.7-237.7)**	**1.9±0.6**	**43.8**	**222.4**	**(130.3-534.0)**	**1.7±0.51**	**31.2**
Spinetoram	**172.9**	**(107.3-288.0)**	**2.5±0.8**	**27.6**	**83.5**	**(50.6-134.7)**	**2.2±0.5**	**71.9**	**116.5**	**(74.7-220.9)**	**2.5±0.74**	**59.6**
Spinosad	**47.7**	**(21.7-103.3)**	**1.6±0.4**	**100**	**60.0**	**(35.6-101.1)**	**2.0±0.5**	**100**	**69.4**	**(43.5-116.0)**	**2.2±0.54**	**100**

On the other hand, compared to the labstrain moths, all tested pyrethroids showed low resistance levels that ranged from 4.03- to 6.31-fold in Sharqia moths and moderate resistance levels in Faiyum moths that ranged between 10.92- to 15.17-fold. It is clear from these results that the lambda cyhalothrin was the most toxic compound with low or moderate resistance levels in Sharqia and Faiyum moths, respectively, whereas, the organophosphate chlorpyrifos was the least toxic compound with high resistance levels in both field populations. To effectively counter this phenomenon, a different class of insecticides or alternative control strategies could be used to avoid increasing selection pressure on these populations (**Prabhaker *et al.,* 1996**). Similarly, **Armes *et al.,* 1996** found higher resistance levels in *H. armigera* in regions where the excessive application of chlorpyrifos is common. This observation explains the importance of the seasonal differences in chlorpyrifos resistance at locations under investigation (**Kanga *et al.,* 2003**). Thus, the evaluation of resistance in the field to commonly used insecticides is important for both establishment and maintenance of a successful insect pest management strategy (**Kristensen, 2005**). Resistance to insecticides in field populations may also appear in regions with low insecticides use due to the high migration rate of insects and the genetic mixing of populations, which can facilitate the rapid spread of resistance alleles among isolated populations.

Table 3. The main criteria of the toxicity regression lines of certain field strains of the pink bollworm, *P. gossypiella* adults to commonly used insecticides at 2019 cotton season**.**

Insecticide Toxicity to *P. gossypiella* Adults of Field Strains in Season 2019												
Insecticides	**Beni Suef**				**Monufia**				**Beheira**			
	LC_{50} (mg/L)	**F.L.**	**Slope± S.E**	**TI**	**LC_{50} (mg/L)**	**F.L.**	**Slope± S.E**	**TI**	**LC_{50} (mg/L)**	**F.L.**	**Slope± S.E**	**TI**
Chloropyrifos	**368.3**	**(170.5-660.7)**	**1.6±0.5**	**5.4**	**526.6**	**(292.8-999.6)**	**1.7±0.5**	**8.0**	**480.0**	**(284.8-809.0)**	**2.0±0.5**	**5.8**
Profenofos	**90.3**	**(55.7-159.2)**	**2.1±0.5**	**22.1**	**65.2**	**(40.2-127.2)**	**2.3±0.7**	**64.4**	**34.7**	**(21.7–58.0)**	**2.2±0.5**	**80.2**
Alphacypermethrin	**309.4**	**(181.8-564.2)**	**2.2±0.7**	**6.5**	**349.9**	**(205.9-717.8)**	**1.8±0.5**	**12.0**	**418.1**	**(244.9-1003.8)**	**1.7±0.5**	**6.7**
Esfenvalerate	**124.3**	**(69.1–260.5)**	**2.1±0.5**	**16.1**	**94.1**	**(58.0-165.9)**	**2.1±0.5**	**44.6**	**84.8**	**(54.5-153.7)**	**2.2±0.6**	**32.8**
Lambda-cyhalothrin	**89.1**	**(52.0 –164.2)**	**1.7±0.4**	**22.5**	**165.5**	**(94.6-305.4)**	**1.6±0.4**	**25.4**	**250.9**	**(154.8-442.3)**	**2.1±0.5**	**11.1**
Emamectin benzoate	**52.1**	**(29.0–98.9)**	**1.7±0.5**	**38.4**	**89.1**	**(52.5-168.9)**	**1.9±0.5**	**47.1**	**264.5**	**(147.1-554.2)**	**1.5±0.4**	**10.5**
Spinetoram	**107.5**	**(67.6-170.9)**	**2.7±0.8**	**18.6**	**58.2**	**(31.9-99.0)**	**2.2±0.7**	**72.2**	**75.3**	**(46.4-132.7)**	**2.1±0.5**	**36.9**
Spinosad	**20.0**	**(12.4-36.0)**	**2.4±0.7**	**100**	**42.0**	**(24.7-86.1)**	**1.8±0.5**	**100**	**27.8**	**(16.9-44.9)**	**2.2±0.5**	**100**

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رصد حساسية سلالات حقلية لديدان اللوز القرنفلية التي تم جمعها من محافظات بني سويف والمنوفية والبحيرة لبعض المبيدات الحشرية

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1. المعمل المركزي للمبيدات – مركز البحوث الزراعية – وزارة الزراعة

2. قسم وقاية النبات – كلية الزراعة – جامعة بنها

لتقييم حساسية الحشرة الكاملة لدودة اللوز القرنفليه (Lepidoptera: (Gelechiidae) (Saunders) *Pectinophora gossypiella* لبعض المبيدات تم إجراء التقدير الحيوى للمبيدات الحشرية الاتية chlorpyrifos, profenofos, alpha-cypermethrin, esfenvalerate, lambda-cyhalothrin, emamectin benzoate, **spinetoram,** spinosad على ديدان اللوز القرنفليه لثلاثة سلالات حقلية جمعت من محافظات بنى سويف والمنوفية والبحيرة وأشارت النتائج إلى أن سمية مبيد سبينوساد كانت الأعلى فى كل مواسم الدراسة 2017 و 2018 و 2019 وفى كل المحافظات تحت الدراسة وكانت التركيزات النصفية المميته لمبيد سبينوساد 31.6 و 40.0 و 67.2 ملجم / لتر لموسم 2017 ، و 60.0 و 69.4 و 47.7 ملجم / لتر لموسم 2018 ، و 42.0 و 27.8 و 20.0 ملجم / لتر لموسم 2019 في محافظات المنوفية والبحيرة و بنى سويف على التوالى. كما أوضحت النتائج أن كلا من مبيد كلوروبيروفوس والفاسيبرميثرين كانت الأقل سمية للسلالات الحشرية فى المحافظات والمواسم تحت الدراسة.