Effect of some insecticides from certain groups on some biological and biochemical parameters of *Spodoptera littoralis* (Boisd.) under laboratory conditions

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ABSTRACT:These study was carried out under laboratory conditions by feeding the 4th of cotton leaf worms *Spodoptera littoralis* on castor leaves treated with different concentrations of Profinofos (organophosphorous),Cypermethrin(synthetic pyrethroids), Chlorofluziuron (insect growth regulators) , as well as Protecto (Bacillus thuringiesis) to determine the values of the LC50 of these compounds to see the extent to which they increase their effectiveness on the insect. The results indicated that the LC50 values of these insecticides were 3.65, 3.13, 1.96 ppm and 5.04 mg/100 ml for chlorpyrifos, Cypermethrin , Chlorofluziuron and Protecto respectively. From the previous results, we conclude that these insecticides it gave a high rate of larvae mortality, also we noted a high rate of mortality of insect pupae, reduced in adult emergency percentage ,egg-laying and egg hatching were observed when its larvae were fed on castor leaves treated with these insecticides with different concentrations respectively. The tested compounds also showed a significant effect on the percentage of total proteins, carbohydrates and acetyl cholinesterase. In general, insecticides should be used in low concentrations, as they gave better results than those observed when using high concentrations of insecticides on pests under laboratory conditions. Which keeps the environment clean and reduces the resistance of insect pests to the action of insecticides, should be performed to develop alternative or additional techniques, which would allow a rational use of pesticides and provides adequate crop protection.

Keywords: Profinofos, Cypermethrin, Chlorofluziuron, Protecto, *Spodoptera littoral*

1.Introduction:

The Egyptian cotton leaf worm, *Spodoptera littorals* (Boisd.) (Lepidoptera: Noctuidae) is considered one of the most severe and destructive insect pests on many field crops throughout the year in Egypt **(Barrania, 2019; El-Sheikh, 2015; Pineda *et al*., 2007).**The management strategy of cotton leaf worm in Egypt has depended on preserving and extending the insecticidal efficacy based on rotating various insecticides including organophosphates, carbamates, insect growth regulators, and pyrethroids every year. The extensive use of conventional insecticidal compounds caused many serious problems such as high resistance to many chemical pesticides, resurgence, and residues of chemical pesticides in the environment **(For gash, 1984; Hawkins *et al*., 2019).** Consequently, consider-able effort should be performed to develop alternative or additional techniques, which would allow a rational use of pesticides and provides adequate crop protection for sustainable food, feed, and fiber production. Among the most promising and excellent alternatives are avermectin insecticide group and insect growth regulators (IGRs) **(Abdel-Baky *et al*., 2019; Barrania & Selim, 2020; Metayi *et al*., 2015)**.The major advantage of using IGRs is that they have impacts on insect growth regulator hormones that are specific for insects and not for animals or humans. In addition, IGRs have great selectivity to the target insect species, so they are likely less harmful to natural enemies when compared with the broader spectrum insecticides **(Grafton-Cardwell *et al*., 2005)**. Recently, many agricultural services companies offer commercial mixture compounds. Using such compounds can grant a noteworthy progress for Insect Pest Management programs (IPMs), including the potential impact for lowering the quantities of each agent used. Such reduction would mean supposedly lowering costs, lowering environmental pollution, lessening damage to beneficial organisms and reducing selection pressure leading to the development of resistance to each agent **(Kandil *et al*., 2020; Korrat *et al*., 2012)**.

The present work was conducted to Study the toxicological, biological and biochemical aspects against the cotton leaf worm *S.littoralis* under laboratory condition.

2.MATERIALS AND METHODS:

2.1.Laboratory rearing of cotton leaf worm

Laboratory strain obtained as egg-masses from Cotton leaf worm Department, Plant Protection Institute, Agric. Res. Cen.,Giza and reared as described by **El-Dafrawy *et al.* (1964)** under laboratory condition at 25±2˚C and 65±5 % relative humidity. The newly molted 4th instar larvae of *S. littoralis* were used in these studies.

2.2.INSECTICIDES

2.2.1. Proticto (Bacillus Thuringiensis WP %9.4
2.2.2. Polytrin (cypermethrin 20 % E.C)
2.2.3. Atabron (chlorfluazuron 5 % E.C)
2.2.4. Profenofos EC%72

2.3.TOXICOLOGICAL STUDEIS

To obtain LC_{50} values for each tested compounds, a serial concentrations from each compound were prepared by diluting the formulation product with distilled water, 25, 12.5, 3.12, 1.56, 0.78 and 0.39 ppm for Profenofos, 30, 15, 7.5, 3.75, 1.87, 0. 93 and 0.46 ppm for cypermethrin, 12.5, 6.2, 3.12, 1.56, 0.78, 0.39 and 0.195 ppm for chlorfluazuron, and 30, 15, 7.5, 3.75, 1.87, 0.93 and 0.46 mg/100 ml for Proticto, then degraded till 7 concentrations. Castor bean leaves were dipped for 15 second in each concentration, then left to dry at room temperature and offered to the newly molted 4th instar larvae of *S. littoralis*. Three replicates were carried out for each concentration, ten larvae for replicate placed inside each jar, three treated leaves of each concentration were transferred to these glasses. Treated larvae were allowed to feed on the treated leaves for 24 hr, in case of both Profenofos and cypermethrin but in case chlorfluazuron and proticto, larvae were fed for 72 hr, then in all cases of feeding periods the larvae were transferred to untreated leaves until pupation. On the other hand, three replicates were dipped in distilled water for the same periods as a check treatment.

Corrected mortality percentage was obtained using check treatment and **Abbott formula (1925)**. Calculation of LC_{50} values were subjected to probit analysis **(Finney, 1971)**

Pupae resulted from treated larvae, were kept in plastic tubes and the pupal mortality was recorded until adult emergence. Moths resulted from treated and untreated larvae were sexed (male & female) and p0ut in a cage and han0ded with sugar solution 10 % till egg-mass depositions throughout their life span. For each egg- mass, the eggs were calculated and put in a clean jar with untreated castor bean leaves until hatching. Newly hatched larvae were recorded to calculate the hatchability %

2.4.Biochemical studies

2.5.Tissue preparation

Total body tissue samples were collected from *S. littorallis* as 4th instars larvae fed on treated castor leaves with LC50 values of three compounds. Insect bodies were ho-mogenized in distilled water (one gm. insect bodies / 5 ml) using a chilled glass Teflon tissue grinder for 3 min. Ho-mogenates were centrifuged at 8000 r.p.m for 15 min at 2 C^{O} in a refrigerated centrifuge. The supernatant can be used directly or stored at 5 C^{O} until use for biochemical determination

2.6.Enzymes measures

Total carbohydrates were determined according to **(Duboisetal., 1956).**

Total proteins were determined according to **(Bradford, 1976)**

Total lipids were determined according to **(Knightetal., 1972)**

Acetylcholine esterase(stitch) was measured according to the system described by **Simpson *et al*. (1964).**

3.RESULTS:

Results in Table 1 state` the LC50 of profenofos, cypermethrin, chlorfluazuron and protecto to 4th instar larvae of *S. littoralis* were 3.65, 3.13, 1.96 ppm and 5.04 mg, respectively.

3.1.Effect of the tested compounds on larval mortality percentage of the 4th instars larvae of *S. littoralis*

Results in Table 2 indicate that profenofos at 0.39 ppm caused 10.39 larval mortality; in case of increasing the concentration the larval mortality was increased. Profenofos at 0.78 ppm caused 20.05 larval mortality while at 1.56 ppm caused 33.67 larval mortality, also (12,5 and 25 ppm) larval mortality was 79.88 and 89.54 % after 24 hrs post treatment when the 4th instar of *S. littoralis* were fed on castor bean

leaves treated with different concentration of profenofos, respectively. Toxicity of cypermethrin to the 4th instar larvae of *S. littoralis* is shown in the same table indicating that the lowest concentration 0.46 ppm caused 15.56 % larval mortality. Still increasing concentration reacted in great proliferation of cypermethrin toxicity. Cypermethrin at (3.12 and 7.5 ppm) caused 32.13 and 48.12% larval mortality, also, at high concentration 15 and 30 ppm caused 62.04 and 87.63 % larval mortality, respectively. Data in Table 2 show that lowest concentration of chlorfluazuron (0.195, 0.39 and 0.78 ppm) caused 10.61 and 12.32 and 18.26 % larval mortality after 72 hrs post treatments but increasing its concentration gradually increased larval mortality percent, chlorfluazuron at the high concentration (3.12, 6.25 and 12.5 ppm) caused 62.34, 85.46 and 92.23 % larval mortality 72 hrs after treatment, respectively.

Data in Table 2 show that lowest concentration of chlorfluazuron (0.195, 0.39 and 0.78 ppm) caused 10.61 and 12.32 and 18.26 % larval mortality after 72 hrs post treatments but increasing its concentration gradually increased larval mortality percent, chlorfluazuron at the high concentration (3.12, 6.25 and 12.5 ppm) caused 62.34, 85.46 and 92.23 % larval mortality 72 hrs after treatment, respectively.

Table 1: Toxicity effect of the tested compounds at different concentrations to the 4th instars larvae of *S. littoralis*

Compounds	LC_{50}	Lower limited	Upper limited	Slope ± SD
profenofos	3.65 ppm	3.02	4.39	1.22 ± 0.08
Cypermethrin	3.13ppm	2.62	3.7	1.39±0.098
Chlorfluazuron	1.96 ppm	1.38	2.85	156 ± 0.108
protecto	5.04 mg/100ml	4.11	6.28	1.12± 0.091

Toxicity of protecto to the 4th instar of *S. littoralis* is shown in the same table indicating that the lowest concentration 0.46 gm/100ml, caused 15.56 larval mortality, increasing its concentration gradually increased larval mortality percent, protecto at (0.93,1.87 and 3.75 gm/100ml) caused 21.32, 35.16 and 42.13% larval mortality, also, at high concentration 7.5, 15 and 30 gm/100ml caused 49.15, 75.25 and 85.55% larval mortality, respectively

These results agree with the former studies. **Abdel HAMID; H.F.M *et al* (2015)**. Set up that Imidacloprid was the most toxic insecticides against the 2nd and 4th larval instars of *Spodoptera littoralis*. The LC50 values were 90 and 170 ppm for the two instars, respectively. Whereas Diflubenzuron was the alternate insecticides with the LC50 values of 150 and 200 ppm, respectively. Diplel DF was the least insecticides, LC50 values were 270 and 330 ppm, respectively. **Moataz A. M. Moustafa (2017)**. Cited that the larvae of 2nd instar of *Spodoptera littoralis* were displayed a high vulnerability to chlorantraniliprole after 96 hrs. In distinction, when pupae were dipped in chlorantraniliprole different concentration, the result showed no significant pupal mortality(20 %) in the lower concentration (200- 800 ppm), while the highest concentration (800 mg/ l) showed 43.3 % pupal mortality, also, also, letant effect of chlorantraniliprole at LC25 (0.036 mg/l) on 2nd instar showed that the developmental time of larval and pupal stages has been prolonged and the percentage of hatchability was reduced as contrasted to untreated larvae. Mohamed, Osman, Mahmoud Farag Mahmoud 2009) proved that Dipel 2x, BioFly, Agrin, BioGaurd, Spinosad, Neemix, Mectin and Match handed advanced mortality in the first instar larvae comparing to the third and fifth instar larvae ,of *S. littoralis* although Match, Mectin and Spinosad showed also excellent effectiveness against third larval stage of *S. littoralis* at all tested attention. Also, Match showed 100 mortality of fifth instar naiads at all tested concentration. **Zhuo- Kun Liu *et al* (2022)** cited that LC10, LC20 and LC50 of Emamectin benzoate to third instar larvae of *Spodoptera frugiperda* after 24 h. were 0.0127 mg/L, 0.0589 g/L,and 0.1062 mg/L, respectively. **Mery M.S *et al.* (2019)** cited that lufenuron was more effective on the 2nd instar larvae of *Spodoptera littoralis* than chlorphyrifos and spinosad after 24 and 72 hours with LC25 values for lufenuron, chlorphyrifos and spinosad were 0.0005, 2.21 and 8.1 ppm **(Abd- EL- Mageed *et al*., 2006)** reported that spinosad gave relatively original and residual effect on *S . littoralis* when tested alone.**(Abdullah,R.R.H., 2021)** set up that cypermethrin was the loftiest poisonous insecticides against the 2nd instar larvae of *S. littoralis* followed by Methomyl and Chlorpyrifos but Biossiana was the least poisonous bone. **(Nourhan Z. Awad *et al*, 2019)** set up that insecticides bestban showed to be the loftiest poisonous emulsion effect against 2nd and 4th instar larvae, with LC50 and LC90 values after 72 hr, post treatment recording 0.05, 0.22 mg/ l and 0.15, 1.10 mg/l of *S. Coastlands* respectively. On the other hand, the biopesticide biovar displayed the smallest toxin to the tested larvae at both situations of toxin (LC50; LC90 values after 72hr., recording 414; 856 mg/ l and 1100; 1740 mg/ l) for 2nd and 4th instar larvae, respectively. **El- Sayed Mokbel and Amal Huesien (2020)** showed that emamectin benzoate proved high toxin against *S. coastlands* with LC50 value of 0.019 mg liter .

Affect the tested compounds on pupation percent of *S. littoralis*

Data in Table 2 indicated that profenofos at the less concentration similar as 0.39 ppm gave 71.02 % pupation, but increasing the concentration gradationally redounded in great drop in pupation of the 4th instar larvae of *S. littoralis*. profenofos at 0.78 and 1.56 ppm caused 62.33 and 58.46 % pupation, also profenofos at both 3.12 and 6.25 ppm gave 45.02 and 35.56 pupation, still at high concentration 12.5 and 25 ppm gave 10.0 and 8.56 pupation, compared with 92.32, respectively

Data in the same table indicated that cypermethrin at the smallest concentration similar as 0.46 ppm recorded the loftiest rate of pupation (65.43) pupation, but increasing the concentration gradationally redounded in great drop in pupation percent of the 4th instar larvae of *S. littoralis*. Cypermethrin at 0.93, 1.87, 3.75, 7.5, 15 and 30 ppm caused 55.36, 45.34, 35.62, 28.22, 15.65 and 7.50 % pupation, compared with 92.26 % pupation, in control, respectively. Data in Table 2 indicate that chlorfluazuron at the smallest concentration (0.195 ppm) recorded the loftiest rate of pupation (51.22 %) but increasing the concentration gradationally redounded in great dropped in pupation. Chlorfluazuron at 0.39, 0.78, 1.56, 3.12, 6.25 ppm caused 42.03, 21.13, 18.01, 10.50 and 4.21% pupation ,compared with 91.23 %, pupation in control, respectively.

Data in the same table indicated that protecto at the smallest concentration 0.46 mg/100ml recorded the loftiest rate of pupation77.34, but adding the concentration - gradationally redounded in great dropped in pupation. For illustration, proticto at 0.93, 1.87, 3.75, 7.5, 15 and 30 mg/100ml caused 65.35, 52.23, 35.56, 24.23, 18.22 and11.12 % pupation, compared with 95.34% pupation, in control, respectively. These, results agree with results recorded by numerous authors **(Zhuo- Kun Liu *et al*., 2022)** cited that Sublethal concentration (LC20) of Emamectin benzoate significantly dragged the pupal period of manly and increased the pupal weight of manly but not of womanish, and significantly delayed the oviposition period and life of adult *Spodoptera frugiperda*. **(Abdel- Meged *et al*., 1986 a, b)**. They reported that chlorfluazuron was more effective than triflumuron in precluding pupation ofS. coastlands. **(Abaza *et el*., 2008)** cited that both lufenuron as acylurea (chitin conflation impediments) and spinosad as bioinsecticides dropped the pupation chance of, *S. littoralis*.

Table 2: Effect of different group of insecticides at different concentration on the 4th instar larvae of *S. littoralis* under laboratory condition

compounds	conce	% Larval mortality	% pupation	% pupal mortality	% Adult emmergence	Mean number eggs/female	% haichability
	0.39	10.39	71.02	25.48	65.11	165.5±22	51.32
	0.78	20.05	62.33	35.45	51.34	136.1 ±4.2	45.18
	1.56	33.67	58.46	51.35	45.05	125.5±6.3	35.55
profenofos	3.12	49.91	45.021	60.02	39.51	120.5±7.6	28.53
	6.25	66.20	35.56	75.51	28.15	118.0±2.8	18.55
	12.5	79.88	10.50	79.45	22.14	85.55 ±2.8	8.55
	25	89.54 .	8.56	82.12	8.50	65.55±3.2	0.0
Control	-	-	92.32	0.0	90.16	815.55 ±3.5	91.13
	0.46	15.56	65.43	20.50	75.55	202.5±3.5	75.59
	0.93	21.31	55.36	18.21	67.25	198.5±4.9	62.25
	1.87	32.13	45.34	30.21	54.23	186.5±2.12	58.53
cypermthrin	3.75	48.12	35.62	55.25	48.25	178.5±4.9	45.55
	7.5	55.16	28.22	64.31	37.32	132.5±2.12	35.38
	15	62.04	15.65	70.14	25.50	112.5±3.5	24.32
	30	87.63	7.50	91.32	14.23	85.55±2.4	10.55
Control	-	0.0	92.14	0.0	94.23	822.5±2.1	95.55
	0.195	10.61	51.22	31.03	45.55	55.5±3.5	45.18
	0.39	12.32	42.03	37.93	34.32	42.2±3,5	35.54
	0.78	18.26	21.13	58.62	30.04	31.5±2.1	24.14
chlorflzuron	1.56	35.32	18.01	79.31	22.14	24.5±3.5	11.55
	3.12	62.34	10.50	85.55	18.55	16.5±2.12	5.55
	6.25	85.46	4.21	93.10	8.55	8.22±3.12	0.0
	12.5	92.23	0.0	100.0	2.5	0.0	0.0
Control	-	0.0	92.12	0.0	95.5	811.5±2.1	94.14
	0.46	15.56	77.34	17.85	79.23	57.5±2.12	67.78
	0.93	21.32	65.35	32.14	67.55	36.5±2.12	60.05
	1.87	35.16	52.23	42.85	58.12	32.5±2.12	53.32
proticto	3.75	42.13	35.56	60.71	45.55	22.5±3.5	45.55
	7.5	49.15	24.23	75.0	35.55	10.75±4.3	37.22
	15	75.25	18.22	78.57	28.13	8.0±1.41	25.55
	30	85.55	11.12	89.28	16.61	0.0	0.0
Control	-	0.0	91,22	0.0	89.92	822.5±2.1	95.5

(Abdel- Rahim *et al.*, 2008) set up the pupation of the alternate and the 4th instar larvae of *A. ipselon* treated with spinosad were obviously affected.

(Table 2). Effect of different group of insecticides at different concentration on the 4th instar larvae of *S. littoralis* under laboratory condition

3.2.Effect of the tested compounds on pupal mortality of *S. Littoralis.*

The results in Table 2 indicated that profenofos at high concentration recorded loftiest rate of pupal mortality from than the smallest concentration. For illustration, 0.39 ppm causes 25.48% pupal mortality. profenofos at 0.78 ppm caused 35.45% pupal mortality, also at 1.56, 3.12 and 6.25 ppm gave 51.35, 60.02 and 75.51% pupal mortality, also79.45 and 82.12 pupal mortality were observed when the 4th instar larvae of *S. littoralis* were fed on castor bean leaves treated with12.5 and 25 ppm, respectively. Also, effect of cypermethrin to the 4th instars of *S. littoralis* is shown in the same table indicates that all treatments of cypermethrin increased the pupal mortality percent. For illustration, cypermethrin at 0.46 ppm, caused 20.50% pupal mortality, also, at 0.93, 1.87, 3.75 ppm lead to 18.21, 30.21, and 55.25% pupal mortality, but, increasing the concentration led to in great of cypermethrin efficacity. Cypermethrin at and 30 ppm caused 64.31, 70.14 and 91.32 pupal mortality, respectively. Also, data in Table 2 showed that all treatments of chlorfluazuron increased the pupal mortality percentage. For illustration chlorfluazuron at smallest concentration 0.195 ppm, caused 31.01% pupal mortality, also, at 0.39 ppm convinced 37.93% pupal mortality, but, increasing the concentration gradationally led to in great of chlorfluazuron efficacy. Chlorfluazuron at 3.12 ppm caused 85.55% pupal mortality; also, at high attention12.5 ppm caused100.0 pupal mortality respectively

Data in the same table indicate to the pupal mortality as affected by feeding 4th instar larvae of *S. littoralis* on castor bean leaves treated with different concentration of protect0o. The results showed that all treatments of proticto increased the pupal mortality percentage. For illustration, proticto at 0.46 and.0.93 mg/100ml caused 17.85 and 32.14% pupal mortality but increasing the concentration gradationally redounded in great proliferation of pupal mortality. proticto at 1.87 and 3.75 mg/100ml caused 42.85 and 60.71% pupal mortality, still at high concentration 30 and 15 mg/100ml gave 89.28 and 78.57% pupal mortality, respectively.

These results agree with results recorded by **Abdel-Meged *et al.* (1986)**. They reported that chlorfluazuron was more effective than triflumuron in preventing pupation of S. littorals0 **Abdel-Rahim *et al.* (2008)** cited that the biological activities of treated larvae of *A ipsilon* with spinosad were obviously affected specially with the second instar larvae treatments.

3.3.Effect of the tested compounds on adult emergence percent of *S. littoralis*

Data in Table 2 showed that adult emergence percent of *S. littoralis* as affected by feeding the 4th instar larvae on castor bean leaves treated with different concentrations of profenofos. For instance, profenofos at 0.39 and.0.78 ppm caused 65.11 and 51.34 % adult emergence, respectively, but increasing the concentrations gradually resulted in great decrease of adult emergence. Profenofos at 1.56 and 3.12 ppm caused 47.06 and 45.05 % adult emergence, however at high concentrations 6.25 and 12.5 ppm gave 28.15A and 22.14% adult emergence, respectively, also, at 25 ppm caused 8.50% Average adult emergence, respectively.

Data in the same table indicate to the adult emergence percentage of the 4th instar larvae of *S. littoralis* as affected by feeding on castor bean leaves treated with different concentrations of cypermethrin. For example, cypermethrin at 0.46 and.0.93 ppm caused 75.55 and 67.25 % adult emergence but increasing the concentration gradually resulted in great decreased in adult emergence. Cypermethrin at 1.87 and 3.75 ppm caused 54.23 and 48.25 % adult emergence, also, at 7.5 ppm caused 37.32 % adult emergence, however at 15 and 30 ppm caused 25.50 and 14.23% adult emergence compared with 87.55 % in control respectively.

Also, Data in Table 2 showed that adult emergence percent of *S. littoralis* as affected by feeding 4th instar larvae on castor bean leaves treated with different concentrations of chlorfluazuron. For example, chlorfluazuron at 0.195 ppm, caused 45.55 % adult emergence, also, at 0.39, 0.78 and 1.56 ppm gave 34.32, 30.04 and 22.14 % adult emergence, but, increasing the concentration resulted in great increment of chlorfluazuron efficacy. Chlorfluazuron at 3.12 and 6.25 ppm caused 18.55 and8.55 % adult emergence, also, at 12.5 ppm gave 2.5 % compared with 92.16 % in control treatments, respectively.

Also, data in the same table indicate to adult emergence percent of S. littoralis as affected by feeding the 4th instar larvae on castor bean leaves treated with different concentrations of protecto. The results showed that lowest concentrations recorded highest rate of adult emergence. For that protecto at 0.46 and.0.93 ppm caused 79.23and 67.55 % adult emergence, respectively, but increasing the concentration gradually resulted in great decrease of adult emergence. Protecto at 1.87 and 3.75 ppm caused 58.12 and 45.55 % adult emergence, however at 7.5 and 15 ppm gave 35.55 and 28.13% adult emergence, also, at 30 ppm caused16.61 % emergence, % compared with 90.18 % in control treatments, respectively.

These results agree with those found by many authors. **Zhuo-Kun Liu *et al.* (2022)** cited that Sub lethal concentration (LC20) of Emamectin benzoate significantly prolonged the pupal period of male and increased the pupal weight of male but not of female, and significantly delayed the oviposition period and longevity of adult Spodoptera frugiperda . sublethal concentrations significantly increased the mortality of pupae and pre-adults, and reduced the development time of larvae and pre-adult male and female , sublethal concentrations significantly increased the mortality of Spodoptera frugiperda pupae and pre-adults, and reduced the development time of offspring larvae and pre-adult male and female.Sublethal concentrations (LC10 and LC20) of Emamectin benzoate significantly decreased the Spodoptera frugiperda oviposition period.However, only LC10 significantly reduced Spodoptera frugiperda female fecundity. Also **Abdel-Kader *et al.* (1995)** showed that the adult lifespan of S. littoralis was shortened when larvae were fed on chlorfluazuron and teflubenzuron **Abdel-Rahim *et al.* (2008)** found that when treated the 4th instar larvae A. ipselon with spinosad the adult emergence percentage were decreased.

3.4.Effect of the tested compounds on fecundity of *S. littoralis*

Data in Table 2 showed that fecundity of *S. littoralis* female moths surviving from the treated the 4th instar larvae on castor bean leaves treated with different concentrations of profenofos,. The results indicated that all concentrations of profenofos were prevented or decreased the eggs lying by the moths female compared to control treatments,. For example, profenofos at 0.39 and 0.78 ppm the deposited eggs were 165.5±22 and 136.12 ±4.24 eggs / female, respectively, but increasing the concentration gradually resulted in great decrease of the mean number eggs laid per female, profenofos at 1.56 and 3.12 ppm caused 125.5±6.36 and 120.5±17.67 mean number of eggs per female, respectively, however at high concentration 6.25 and 12.2 ppm induced 118.0±2.8 and 85.55 ±2.8 mean number of eggs / female, respectively, also, at 25 ppm caused 65.55 % oviposition, compared with 815.55 ±3.5 in control respectively

Also, data in the same table indicated the mean number of eggs laid per female of adult emerged from *S. littoralis* as affected by feeding the 4th instar larvae on castor bean leaves treated with different concentrations of cypermethrin. The results showed that all concentrations of cypermethrin prevented or decreased rate of eggs laid per female. For example, mean number of eggs laid per female resulted from treatments with cypermethrin at 0.46 and 0.93 ppm were 202.5±3.5 and 198.5±4.9, respectively, but increasing the concentration gradually resulted in great decrease of the mean egg number per female, cypermethrin at 1.87 and 3.75 ppm caused 186.5±2.12 and 178.5±4.9mean number of eggs per female, however at 7.5 and 15 ppm reduced mean number of eggs per female to 132.5±2.12 and 112.5±3.5, respectively, also, at 30 ppm caused 85.55± 3.2 oviposition, compared with 822.5±2.12 in control, respectively

Also, data in the same table shows that all concentrations of chlorfluazuron prevented or decreased the number of eggs laid per female as compared to control treatments. For example, mean number of eggs laid per female resulted from the treatments with chlorfluazuron at 0.195 and.0.39 ppm were only 55.5±3.5 and 42.2±3.5 eggs laid per female, respectively, but increasing the concentration gradually resulted in great decrease of the mean number eggs laid female, chlorfluazuron at 0.78 and 1.56 ppm caused 31.5±2.12 and 24.5±3.5mean number of eggs laid per female, however chlorfluazuron at 3.12 and 6.25 ppm caused only 16.5±2.12 and 8.22 mean number of eggs laid female, but at 12.5 ppm inhibited completely eggs laid per female compared with 822.5±2.1 in control, respectively.

Also, data in the same table show the mean number of laid eggs per female of S. littoralis as affected by feeding the 4th instar larvae on castor bean leaves treated with different concentrations of protecto. The results indicate that all concentrations prevented or decreased the rate of eggs laid per female for protecto treatments.For example, resulted eggs laid per female from adult emerged from larvae treated with protecto at 0.46 and 0.93 mg/100ml were 77.5±2.12 and 71, 31±2.12 eggs per female, respectively, but increasing the concentration gradually resulted in great decrease of eggs laid per female. protecto at 1.87 and 3.75 mg/100ml caused 65.55±2.12 and 62.52±3.5mean number of laid eggs per female, respectively, however at 7.5 and 15 mg/100ml gave 40.75±4.3 and 28.04±1.41 mean number of laid eggs per female but at 30 mg/100ml inhibited completely eggs laid per female compared with 815.5±2.1 in control, respectively

3.5.Effect of the tested compounds on hatchability percent of *S. littoralis*

Data in Table 2 indicated the effect of profenofos on hatchability percentage from *S. littoralis* as affected by feeding the 4th instar larvae on castor bean leaves treated with different concentrations of profenofos. The results showed that all concentrations of profenofos decreased the rate of hatching eggs, compared with control treatments. For example, profenofos at 0.39 and. 0.78 ppm caused 51.32 and 45.18 % hatchability, respectively, but increasing the concentration gradually resulted in great decrease of the hatchability percent. Profenofos at 1.56 and 3.12 ppm lead to 35.55 and 28.53% hatchability respectively, however profenofos at 6.25 and 12.5 ppm caused 18.55 and 8.556 % hatchability, but at 25 ppm inhibited hatchability compared with 95.5 in control, respectively.

Also, data in the same table show the effect of cypermethrin on eggs hatchability percentage of *S. littoralis* as affected by feeding the 4th instar larvae on castor bean leaves treated with different concentrations of cypermethrin. The results showed that all concentrations of cypermethrin decreased in rate of hatchability percent in eggs, either. For example, eggs resulted from adult emerged from larvae treated with cypermethrin separately at 0.46 and.0.93 ppm resulted in 75.59 and 62.25% hatchability. respectively, but increasing the concentration gradually resulted in great decrease of the hatchability, cypermethrin at 1.87 and 3.75 ppm induced 58.53and 45.55%, hatchability respectively, however cypermethrin at 7.5 , 15 and 30 ppm caused 35.38 , 24.32 and 10.55 % hatchability, respectively.

Also, data in the same table indicate to the effect of chlorfluazuron on hatchability percentage of *S.littoralis* adult female as affected by feeding the 4th instar larvae on castor bean leaves treated with different concentration of chlorfluazuron. The results showed that all concentrations of chlorfluazuron prevented or decreased in rate hatchability percent, compared with in control treatments. For example, eggs resulted from adult emerged from larvae treated with chlorfluazuron at 0.195, 0.39, 0.78, 1.56 and 3.12 ppm caused 45.18, 35.54, 24.14, 11.55and 5.55 % hatchability, respectively, but at 6.25 and 12.5 lead to suppress in hatchability percent compared with 91.13 in control , respectively

Data in the same table show the effect of protecto on eggs hatchability percentage of *S. littoralis* adult as affected by feeding the 4th instar larvae on castor bean leaves treated with different concentrations of protecto. The results showed that all concentrations of protecto decreased in the rate of hatchability, compared with control treatments. For example, hatchability percent resulted from adult emerged from larvae treated with protecto separately at 0.46, 0.93, 1.87, 3.75 and 7.5 mg/100ml were 67.78, 60.05, 53.32, 45.55% and 37.22%, respectively, but at 15 and 30 mg/100ml the hatchability were 25.55 and 10.55 compared with 95.55 % in control, respectively

These results agree with **Abdel HAMID;H.F.M *et al* (2015)** set up that all the treated larvae of *S. littoralis* were biologically affected by the three tested composites. The effect was varied according to the larval instars and tested composites. Thus, the treated larvaesA\ were redounded in dropped pupation and adult emergence probabilities, and the 2nd instar treated with both Imidacloprid and Diflubenzuron had the strongest effect in this respect. The treatment of 2nd instar with the three composites convinced the loftiest increase larval, pupal duration and adult contortion probabilities. While, the 2nd and

4th instars treated with chitun conflation impediments, dimilin convinced deformed larval percent, while the treatment of 2nd instar with Imidacloprid convinced the loftiest pupal deformations (20). Whereas, the larval treatment of 2nd instar with Imidacloprid and Diflubenzuron had the most potent in inhibiting of both the adult fecundity (zero eggs/ female) and eggs laid (0), in comparison with control (558 eggs/ female and 98.3). Hence, the larval treatment of 2nd and 4^{th} instars with Diflubenzuron and Diplel DF gave the shortest period of adult life, as compared to control. The larval treatment of 2nd and 4th instars with the three tested emulsion increased the adult males and dropped the adult female probabilities, expressed as coitus rate of both males and female of control, thus, the treatment of 2nd instar with Admire and 4th instar with Diflubenzuron had the strongest effect in this respect.**(Abdel- Sattar and EL- Gundy, 1988)** set up that all INSECTICIDES of 25 ml Spinosad with Consult, Atabron and Dursban at their half- recommended rates per feddan increased their exertion against the 3^{rd} instars larvae of cotton leaf worm *S. littoralis* Also, **Helalia *et al.* (2006)** set up that the toxin of the biocides was greatly enhanced when used at low rates of conventional germicides similar as pyrethroids and some organophosphorus composites in combination with *B. thuringiensis* proved to be suitable to control the cotton splint worm *S. littoralis*. **Abd- EL- Mageed *et al.* (2006)**, reported that spinosad gave relatively original and residual effect when tested alone whereas the most pronounced original effect was achieved when spinosad was mixed with methoxyfenozide. Also, they reported that the loftiest residual exertion was noticed when spinosad was mixed with chlorpyrifos to control the cotton splint worm *S. littoralis*. **NourhanZ. Awad, *et al.* (2019)** showed that, the tested insecticidesconvinced a clear reduction in mean larval weight and mean pupal weight compared with the control. The tested germicides affected the larval duration, pupal duration, pupation, adult emergence and adult life of *S. littoralis* **Abaza *et el.* (2008)** cited that both lufenuron as acylurea chitin conflation impediments and spinosad as bioinsecticides suppressed pronouncedly the eggs hatchability of *S. littoralis*. **El- Sayed Mokbel and Amal Huesien (2020)** showed that treatments with LC5 and LC15 onS. coastlands dragged larval period, mean life of males and ladies, mean generation time (T), doubling time (DT), adult preovipositional period (APOP), and total preovipositional period (TPOP) compared with control. On the negative, net reduplication rates (R0), natural rates of increase (r), finite rate (λ), fecundity, gross reproductive rate (GRR), and relative fitness were dropped compared tocontrol.**Abaza *et el.* (2008)** cited that both lufenuron as acylurea chitin conflation and spinosad as bioinsecticides suppressed pronouncedly the eggs hatchability of *S. littoralis*. Therefore, it could be mentioned that using low boluses of germicide or IGRs gave excellent control of the insects compared to their high boluses at the same time also minimize the environmental pollution

3.6.Biochemical aspects in 4th instar larvae of *S. littorallis*.

Data represented in Table 3 indicated that the effect of the tested insecticides on the total protein content in the fourth instar larvae of the cotton leafworm, *S. littorallis*. Results indicated that chlorfluazuron wasthe highest decrease in total protein (24.23±0.60 mg./g.b.wt) followed by Proticto (25.51±0.55 mg./g.b.wt) and Cypermethrin with (28.23±0.60 mg./g.b.wt), however, profenofos was the least in order (30.55±0.44 mg./g.b.wt) compared with untreated larvae (34.76 ±0.26). Also, data in the same table showed the effect of the tested insecticides at LC50 on the total carbohydrates content in the fourth larval instar of the cotton leafworm, *S. littorallis*. Results indicated that, the least total carbohydrates content after treatment with Profenofos at LC50 values (10.45±0.31 mg./g.b.wt.), followed by Cypermethrin with (12.22±0.90 mg./g.b.wt.) and chlorfluazuron with (13.22±0.9 mg./g.b.wt), and Proticto with (14.13±0.34 mg./g.b.wt compared with (18.24±0.67 mg./g.b.wt.). in control treatments. Concerning total lipids content in the fourth larval instar of the cotton leafworm, *S. littorallis* treated with LC50 of the tested insecticides, results indicated that Profenofos showed the least total content after treatment with LC50 values (2.23 ±0.14 mg./g.b.wt.), followed by chlorfluazuron (3.25±0.28 mg./g.b.wt.), Cypermethrin with (3.55 ±0.0.28 mg./g.b.wt) and Proticto (4.55 ± 0.14mg./g.b.wt.), compared with (5.22± 0.24 mg./g.b.wt.), in control treatments. Also, data in the same table indicated that the effect of the tested composites on Acelylcolinesterase content in the fourth larval instar of the cotton leafworm,*S. littoralis* treated with LC50 of the tested composites. Results indicated that Profenofos showed the least Acelylcolinesterase content with (20.51±0.60 µg AchBr/ min/g.b.wt), followed by Cypermethrin with (24.15±5.8µg AchBr/min/g.b.wt), Proticto (25.57 µg AchBr/min/g.b.wt), and chlorfluazuron with (26.15 µg AchB.

These results are in agreement with those of **(El-barky *et al*., 2008)** in Egypt, who observed that significant drop in carbohydrates content at S. littorallis, 5th larval instar, after treatment by radiant (Spinetoram) with LC50. **El- Gabaly (2015)** indicated that the chlorpyrifos, lufenuron, and protecto at their LC50 values caused a drop in the total protein content of 4th larval instar ofS. littorallis may by arrangement in descedisly as and37.8 my/g.bwt which recorded ofpost-treatment spinetoram relative to control. **(Assar *et al*., 2016)** in Egypt indicated that the total proteins, total carbohydrates, and total lipids content were dropped when treated 4th larval instar ofS.littoralis with emamectin and teflubenzuron as nonentity growth controllers. Also **Awadalla *et al*. (2017)** reported that protecto showed the loftiest total carbohydrate content

Table 3: Effects of the tested compounds at LC_{50} on the biochemical aspects in 4th instar larvae of cotton leafworm *S. littorallis*

Tested compounds	Mean Total protein (mg/g.b.wt)	Mean Total carbohydrate mg./g. b.wt ±SE	Mean Total lipids mg./g. b.wt ±SE	µg Ach Br/ min/ g.b.wt) ± SE
Profenofos	30.55±0.44	10.45±0.31	2.23±0.14	20.51±0.60
Cypermethrin	28.23±0.60	12.22±0.90	3.55±0.28	24.15±5.85
chlorfluazuron	24.23±0.60	13.22±0.90	3.25±0.28	26.15±5.85
Proticto	25.51±0.55	14.13±0.34	4.55±0.14	25.57±2.02
Control	34.76±0.26	18.24±0.67	5.22±0.24	28.57 ±0.20

in the treated naiads S. littoralis (16.90 mg/g.b.wt.) than the other products followed by largely, pestban, and ethephon. The chance of the change in the total carbohydrate con- roof in the fourth larval instar treated with the LC50 values recorded the loftiest dwindling chance when treated naiads by factory growth controller ethephon and represented by (48.98). Naiads displayed the loftiest total protein con- roof were treated with largely (38.40 mg/g.b.wt.) followed by bestban, protecto, also ethephon. Loftiest dwindling per- centage of total protein content set up in naiads treated with ethephon and represented by (-30.8). Whereas the loftiest total lipids content was set up in naiads treated with largely (7.94 mg/g.b.wt.) followed by bestban, protecto, ethephon. Loftiest dwindling chance when treated naiads chitin conflation asset, and represented by (-18.60) On the other hand, Lufenuron increases the Acetylcholinesterase exertion significantly. Methomyl act as carbamate insecti- cide through excitation of the nonentity nervous system, which in turn beget an revision in the function of nicotinic and GABA- reopened ion channels which leads to involuntary mus- cle condensation and temblors **(Salgado *et al*., 1998)**. Accord- ing to such an exertion, it was anticipated that similar insecticides may produce cytotoxic effectiveness of Diple thuringiensisvar. kurstaki alone and its admixture with two germicides against action either in neurons ornon-target cells. The cytotoxic action in neurons may alter the neurotransmitter mechanisms through snooping processes of methomyl with the product of acetylcholine in the synaptic region which affect in turn the exertion of the acetylcholinesterase to be in form of false inhibition.**(Abd El- Mageed and Shalaby, 2011)** using IGR's. Reduction in acetylcholinesterase appeared **(Mostafa, 1998)** using teflubenzuron. On other hands, spinetoram convinced a moderate increase in exertion of acetylcholinesterase by **El- Barky *et al.* (2008)**, **Fahmy and kandil (1989)** delved the inhibition of pang by two germicides; chlorpyri- fos and thiodicarb in the head homogenates of two cotton leafworm Spodoptera littorallis strains; laboratory and field strains; cutworm, Agrotis ipsilon, and honey freak Apis millefra. They cited that the pang from different insects is identical in its parcels. largely exertion of pang was de- tected in the head homogenate of adult nonentity of the honey freak. The loftiest inhibition energy was attained with thi- odicarb against all the tested nonentity species. The smallest inhi- bition was attained with thiodicarb and chlorpyrifos against field strain ofS. littorallis compared to laboratory strain. **Nour El- Hoda *et al*., (2012)** indicated that both chlorpyrifos and profenophos expressed advanced situations of Acetylcholines- terase (pang) exertion than the reference (Lab-susceptible) in both PBW and SPW naiads strain.

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تاثيربعض المبيدات من مجاميع مختلفة علي لظواهر البيولوجيه والبيوكميائيه لدودة ورق القطن

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الملخص العربى:

في هده الدراسه تم تغذية العمر الرابع لدودةورق القطن في المعمل علىورق خروع معامل بتركيزات مختلفة من كل من مبيد البروفينوفوس من المبيدات الفسفورية العضوية ومبيد السيبرميثرين من البيريثرويدات المصنعة ومركب الكلورفليوزيورون من منظمات النمو الحشرية وكذلك مركب البروتكتو من المركبات الحيوية البكتريه

وذلك لتحديد قيم آل LC_{50} لهذة المركبات لمعرفة مدي فاعليتها وما هو التركبز الانسب اللدي يمكن استخدامه علي الحشرة موضع الدراسة. وكدالك متابعة كل تركيز علي كل اطوار الحشرة حتي وضع البيض وفقسه

ودلت النتائج علي أن قيم أل LC_{50} لهذة المبيدات كانت . بالنسبه لمبيد الكلوربيريفوس هي 3.65جزء في المليون و كذلك كانت قيمة أل LC_{50} لمركب السيبرميثرين هي 3.13 جزء في المليون كذلك كانت قيمة LC_{50} لمركب الكلورفليوزيورون هي 1.96 جزء في المليون كذلك كانت قيمة أل LC_{50} لمركب الاسبينوساد هي 5.04جزء في المليون ومن النتائج السابقة نستنتج ان هده المبيدات اعطت نسبه عالية من موت اليرقات كما لوحظ ارتفاع معدل موت عذارى الحشره عندما غذيت يرقاتها على أوراق الخروع المعاملة بهده المبيدات بالتركيزات المختلفة كما لوحظ أيضا خروج نسبة قليلة جدا من الفراشات كل المعاملات قللت عمليات وضع البيض وكذلك فقسة.كما اظهرت المركبات المركبات المختبره تاثيرا كبيرا علي كلا من نسبة البروتينات الكليه و والكربوهيدرات والاستيل كولين استريز. عموما يجب استخدام المبيدات الحشرية المبيدات الحشرية بالتركيزات المنخفضة حيث أعطت نتائج أفضل من تلك التي لوحظت عند استخدام التركيزات العالية للمبيدات على ألافه في المعمل. مما يحافظ علي نظافة البيئه ويقلل من مقاومة الافات الحشرية لفعل المبيدات