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EFFICIENCY OF CERTAIN PESTICIDES ON SOME BIOLOGICAL ASPECTS OF *SPODOPTERA LITTORALIS* (BIOSD) UNDER FILED AND LABORATORY CONDITIONS

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ABSTRACT: *Efficiency of four pesticides belonging to different groups of chemicals ,namely : Chlorosan, Agrinate , Daizinone and Nasractine on some biological aspects of 2nd and 4th instar larvae of the cotton leaf worm S. littoralis (Boisd) under field and laboratory conditions were investigated . The LC50 and LC 90 values were calculated after 24 , 48 , and 72h. Post – treatment . The obtained results showed that a wide range of toxicity of the tested pesticides , however the insecticide Chlorosan proved itself to be the highest toxic compound to the treated larvae as LC50 and LC90 values after 72h. post – treatment recording 0.01 , 0.83 ppm and 0.13 , 5.23 ppm for 2nd and 4th instar larvae , respectively . On the other hand , the compound Diazinon exhibited the lowest toxicity to the tested larvae at the both levels of toxicity (LC50 and LC90 values after 72h. were 16.86 ,69.31 ppm and 39.59 , 186.67 ppm) for 2nd and 4th instar larvae , respectively . The other tested pesticides occupied an intermediate position. The tested pesticides increased the larval , pupal duration and malformed pupae and decreased the percentage of pupation , adult emergence compared with control.*

Key words : *Efficiency ,pesticides ,biological aspects , Spodoptera littoralis*

INTRODUCTION

The cotton leaf worm ,*S. littoralis* (Boisd) is one of the most important insect pest attacking field and vegetables crops such as cotton , corn , peanut , clover and various fruits in Africa , Asia and Europe (Smagghe and Degheele , 1997 ; EL – Aswad *et al.* ,2003 and Ragaei and Sabry ,2011). The cotton leaf worm is the destructive pest to about 112 host plants from different families in Egypt as well as in Mediterranean and middle East countries (Kandil *et al.* ,2003 ; EL-Sinary *et al.* ,2008 and EL-Zoghby *et al.* ,2011) . To control the attacks of this pest several types of pesticides have been used , including synthetic , pyrethroids , organophosphates and steroidal compounds (Casida *et al.* 1988). The intensive use of conventional pesticides caused some side effects such as pest resurgence , pest resistance and outbreak of secondary pests (Davies *et al.,* 2007; Mosallane *et al.,* 2009). All pesticides cause serious toxicological problems to human and environment (Costa, *et al.* 2008 ; Relyea 2009) . Pesticides cause decreased in larval and pupal weights , growth rate , fecundity level and larval and pupal duration (Marzouk *et al.* 2012).

Therefore , the present work aimed to study the efficiency of seven pesticides against the cotton leaf worm larvae . In addition the effects of tested pesticides on some biological and biochemical aspects of *S. Littoralis* under laboratory conditions.

MATERIALS AND METHODS

Tested insects:

A laboratory strain of cotton leaf worm *S. littoralis* ,was reared in the laboratory on castor bean leaves under constant laboratory conditions of 26_+ 2C and 65_+5%R.H.(EL-Defrawi *et al.,*1964) .The culture of the cotton leaf worm was initiated from freshly collected egg masses supplied from the division of cotton leaf worm, at plant protection research institute ,Dokki , Egypt.

Tested insecticides :

Trade name	Common name	concentration	Production company
Chlorosan(48% EC)	chlorpyrifos	At Recommended rates	Kafer el zaiaat
Agrinate (90%SP)	methomyl	At Recommended rates	Riotaam company
Diazinon(60%EC)	diazinon	At Recommended rates	Wnzho liosheng dongo china
Nasractine (1.8%EC)	abamectin	At Recommended rates	El nasr company

Toxicological studies:

The tested compound were belonged to different groups of chemicals to assess the insecticidal activity of the tested compound were prepared using the commercial formulations the leaf dipping technique was adopted according to Abo- EL-Ghar *et al.* (1994**)** where freshly castor bean leaves were dipped for 5 seconds in one of the prepared concentration pesticides ,the treated leaves were left to natural dryness under laboratory conditions before being introduced to *S. littoralis* larvae . Hundred larvae distributed in five replicates (20 larvae / replicate) were used for each concentrations .Also, larvae were fed on leaves immersed in only water as a control .Newly moulted 4^{th} larval instars were fed on the treated leaves in a glass jar covered with muslin.

The corrected mortality of larvae was carried out using Abbott's formula (Abbott , 1925) . The LC50, LC90 and slope values of the tested compounds were calculated using Finney's equation (1971), through soft were computer program.

Biological studies :

Newly moulted 2^{nd} and 4^{th} larval instars were segregated from the stock colony in clean glass Petri dishes and starved for 24hrs (Nasr,1999). Five concentration of pesticides were used .The concentrations were prepared by dissolving the tested pesticides in distilled water to get the appropriate concentrations. Pieces of castor bean leaves were treated by the leaf-dipping technique in the different concentrations of the tested compound and left in the air for 1h to insure that it is completely dry, and then introduced to larvae for feeding . Eighty of starved larvae , distributed in four replicates (20 larvae / replicate) were used for each concentration and allowed to feed for 24hrs on treated castor bean leaves .Unconsumed food , dead larvae and feaces were removed daily before introducing fresh leaves . The same technique described above was used for control except that the larvae were allowed to feed on castor bean leaves that dipped only in distilled water .Daily inspections were carried out until emergence occurred and the number of individuals that managed to develop was recorded larval mortality , larval duration , pupation % ,pupal duration and pupal malformation % were recorded.

Statistical analysis of data :

Data obtained were analyzed for the analysis of variance (ANOVA) to compare the treatments . The ANOVA performed for each sampling of each treatment (SAS Institute Inc. , 1998) and if any significance was found at a risk level of 5% or lower ($p<0.05$) .

RESULTS AND DISCUSSION

1 - Toxicity of some pecticides against the 2^{nd} ,4^{th} instars larvae of *spodoptera littoralis* (Boisd) :

The results presented in Table (1) show that the toxicity of four pesticides : (Chlorosan, Agrinate , Daizinone and Nasractine) against the 2^{nd} larvae instars of *S. littoralis* at different exposure time .

Among the pesticides , Chlorosan was the most effective compound followed by Agrinate while Nasractine was the least effective one followed Diazinon after 24hr , 48hr and 72hrs of exposure .

Table (1): Toxicity of some tested pesticides against 2nd larval instar of *Spodoptera littoralis* (Boisd) by leaf dipping technique at different exposure times .

Insecticides	Time(hrs)	LC50	LC90	Slope values
Chlorosan	24	0.15	10.16	0.701
	48	0.02	1.29	0.7351
	72	0.01	0.83	0.725
Agrinate	24	5.49	84.92	1.055
	48	1.98	33.07	1.048
	72	1.59	20.88	1.147
Nasractine	24	23.94	91.67	2.19
	48	17.37	87.14	1,82
	72	9.79	45.16	1.93
Diazinon	24	35.11	187.36	1.76
	48	21.17	88.55	2.06
	72	16.86	69.31	2.087

The results indicated that there was negative relationship between the time elapsed post treatment and LC50 values of all the tested pesticides .

The LC50 values were 0.15 , 5.49 , 23.94 and 35.11 ppm for Chlorosan , Agrinate, Nasractine and Diazinon after 24hrs of exposure . Increasing the period of exposure from 48 to 72 hrs decreased the LC50 values to reach 0.01 , 1.59 , 9.79 and 16.86 ppm after 72hrs for Chlorosan , Agrinate, Nasractine and Diazinon respectively.

Data in Table (2) showed that LC50 values of all the tested pesticides were 0.48, 10.05 , 23.59 and 52.11 ppm for Chlorosan , Agrinate, Nasractine and Diazinon after 24hrs of exposure . Increasing the period of exposure from 48 to 72 hrs decreased the LC50 values to reach 0.26 , 6.55 , 20.32 and 46.68 ppm at 48hrs and 0.13 , 5.39 , 16.44 and 39.59 ppm at 72 hours for Chlorosan , Agrinate , Nasractine and Diazinon , respectively .

Generally ,the 2nd larval instar was found to be more sensitive to the tested compounds than 4th instar . The obtained low values of slope function indicated the homogenous response of the treated larvae to different concentrations of the tested compounds . The above obtained results are in agreement with those obtained by **(**Badr,2000 ; Culter *et al.* 2005 and Han *et al*.2006).

The 4th larval instar tolerance could be due to the changes in anatomy , physiology and size through which the compounds passes or may be due to difference in liability to toxicant penetration (Busvine , 1971) .

2- Sub lethal effect of some pesticides on some biological aspects of *Spodoptera littoralis :*

The main biological aspects of *S. littoralis* after feeding the 2nd and 4th instar larval for 24hours , 48 hours for tested insecticides on castor bean leaves treated were shown in Table (3,4) .

Among the pesticides , Chlorosan was the most effective compound followed by Agrinate while Diazinon was the least effective one followed Nasractine after 24hr , 48hr after treatment.

The mortality percentage of 2nd instar larvae were 100 , 90 , 70 , 66 , 56 , 48 ; 96 , 90 , 76 , 70 , 50 , 40 ; 50 , 64 , 58 , 44 , 22 , 24 ; 50 , 70 , 50 , 44 , 28 and 22 after 1,3,5,7,11 and 14 days for Chlorosan , Agrinate , Nasractine and Diazinon , respectively , after 24hrs post treatment under field condition , residual effects were 71.7 , 70.3 , 43.7 and 44 % ; while the mortality percentage of 4th instar larvae were 84 , 80 , 62 , 60 , 40 , 40; 80 , 76 , 68 , 48 , 44 , 38 ; 50 , 36 , 38 , 28 , 30 , 22 ; 44 , 50 , 36 , 36 , 18 and 20 after 1,3,5,7,11 and 14 days for Chlorosan , Agrinate , Nasractine and Diazinon , respectively , after 24hrs post treatment under field condition , residual effects were 61.6 , 59, 34 and 34 %.

The mortality percentage of 4th instar larvae were 84 after one day to 40 after 14 days for Chlorosan ,80 to 38 for Agrinate , 44to 20 for nasractine and 50 to 22 for diazinon after 24hrs post treatment under field condition. Data shows that residual effect of Chlorosan was 72.8% ,Agrinate 69.5 % , Diazinon 42% and Nasractine 39%

The mortality percentage of 2nd instar larvae were 100 , 96 , 74 , 68 , 56 , 48 ; 100 , 94 , 80 , 72 , 58 , 40 ; 60 , 64 , 60 , 44 , 28 , 30 and 64 , 72 , 56 , 44 , 40 , 24 after 1,3,5,7,11 and 14 days for Chlorosan , Agrinate, Nasractine and Diazinon ,respectively , after 48 hrs post treatment under field condition , residual effects were 73.7 , 74 , 47.7 and 50 % ; while the mortality percentage of 4th instar larvae were 100 , 88 , 66 , 60 , 48 , 42 ; 88 , 80 , 72 , 66 , 44 , 46 ; 58 , 44 , 38, 32 , 32 , 24 and 50 , 62, 38, 40 ,33 and 28 after 1,3,5,7,11 and 14 days for Chlorosan , Agrinate , Nasractine and Diazinon , respectively , after48hrs post treatment under field condition , residual effects were 67.3 , 66 , 38 and 40 %.

Table (2): Toxicity of some tested pesticides against 4th larval instars of *Spodoptera littoralis* (Boisd) by leaf dipping technique at different exposure times .

Insecticides	Time(hrs)	LC50	LC90	Slope values
Chlorosan	24	0.48	11.70	0.925
	48	0.26	8.41	0.8501
	72	0.13	5.23	0.8009
Agrinate	24	10.05	95.64	1.309
	48	6.55	60.91	1.323
	72	5.39	43.69	1.41
Nasractine	24	23.59	88.28	2.236
	48	20.32	67.67	2.45
	72	16.44	49.69	2.66
Diazinon	24	52.11	258.40	1.84
	48	46.68	240.62	1.79
	72	39.59	186.67	1.90

Table 3

Table 4

Generally , Chlorosan induces the highest larval mortality followed by Agrinate , respectively. Mode of the mortality of larval from insecticides investigated that the nerve synapses of insects contain a chemical mediator known as Acetylcholine (Ach) , through which nerve impulses transmits from one nerve axon to another . Acetylcholine esterase hydrolyzes Acetylcholine to prevent its accumulation at the nerve synapses since its accumulation leads to death as a result of disruption of nerve transmission .In insects , the mode of action of chlorosan which is toxic to insects by acting as nerve poison and killing insect by inhibition of acetylcholine esterase (Du – Bois, 1961).

Pesticides efficiency in larval mortality reviewed by many authors (Abdel – Fattah , 1970 ; EL- Sheakh , 1988 ; and Abd EL – Kader *et al.,* 1995 EL-Naggar *et al.* 2013)

All the tested pesticides resulted a significant increase in both larval and pupal durations as well as malformed pupae in compared to control were shown in Table (5). Also, these effects were more pronounced for Chlorosan , Agrinate than all tested pesticides .

The larval duration were 8.1 , 7.6, 9.2 and 9.1 days for Chlorosan , Agrinate , Diazinon and Nasractine ,respectively , in compared with control (12.4 days) , while pupal duration were 5.5 , 5.0 , 6.7 and 8.0 days for the previous pesticides ,respectively in compared to the control (8.3 days). The percentage of malformed pupae ranged from 50 % to 14 % in compared to 3% for the control . On the other hand , the tested pesticides induced a significant suppression in pupation and adult emergence when compared with control . Also, there was insignificant difference between the effect of the tested pesticides with exception of Chlorosan effect on pupation as it induced the highest percentage 20%. However , the pupation varied from 25 % to 18% in compared to 97 % for the control . The adult emergence ranged from 79 % to 50% in compared to 93 % for the control. However , the decrease in adult emergence could be due to the fact that the toxic blocks the maturation of imaginal discs which are primordial for many adult integument structure in endopetrygote insect (Schniederman 1972).

Table (5): Effect of some pesticides on some biological aspects of the cotton leaf worm *Spedoptora littoralis*

Pesticides	Mean larval weight (g)	Larval duration (days)	Mean pupal weight (g)	Pupal duration (days)	% pupation	% malformed pupae	% Adult emergence	Adult longevity (days)
Chlorosan	0.337d	8.167b	0.223b	5.500a	20.000e	44.333a	50.000b	2.333a
Agrinate	0.387d	7.667e	0.260b	5.000a	18.000e	50.000a	58.667b	3.333a
Diazinon	0.527b	9.267b	0.373a	6.733a	38.667d	28.667b	79.333a	4.000a
Nasractine	0.620a	9.167b	0.360a	8.000a	25.333e	14.000e	74.000a	5.500a
Control	0.660a	12.433a	0.423a	8.300a	97.000a	3.667c	93.333a	8.033a
F. test	**	**	**	**	**	**	**	**
LSD	0.052	1.81	0.053	1.341	8.532	7.623	10.5	1.5

**significant at 0.01.

In general, it was observed that pesticide Chlorosan was more effective in all the mentioned measured parameters ,however, the reduction in the efficiency of converting ingested and digested food (Senthil – Nathan *et al.* 2005) pupal mortalities in this study were obvious and recorded after treatment of both 2nd and 4th larval instars with the used , there were close – dependent effect on pupation and pupal mortalities , the results are in harmony with the results obtained by (Butter *et al.* 2003 ; Biddinger *et al.* 2006 ; Salokhe *et al*. 2008 and; EL- Khely *et al.* 2014) .Total inhibition of adult emergence in the biological studies were recorded for the treated larvae with the used , it was obvious that the percents of inhibition were in positive relationship with the increase of concentrations these results are in agreement with those obtained by (Butter *et al*. 2003; Biddinger *et al*. 2006 ; Saloke *et al.* 2008 ; Wang – Tian. 2009 and EL- Sheikh *et al.* 2013)

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فعاليه بعض المبيدات على السمات البيولوجيه لدوده ورق القطن تحت الظروف المعملية والحقلية

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الملخص العربى

تم دراسه فعاليه وكفاءه اربعه من المبيدات الحشريه والتي تندرج تحت المجاميع الكيماويه المختلفه وهم الكلوروسان ، اجريمنت ، دايازون ، ناصراكتين ، بوما على بعض السمات البيولوجيه والبيوكيماويه على العمر التاني والرابع ليرقات دوده ورق القطن تحت الظروف المعمليه . تم تقدير التركيز القاتل ل ٥٠% و ٩٠% من الافراد بعد ٢٤ ، ٤٨ ،٧٢ بعد المعامله . ان النتائج المتحصل عليها اوضحت مدي واسع من سميه هذه المبيدات. لقد اظهر مبيد كلورسان اعلى درجه سميه على اليرقات المختبره من خلال قيم التركيز القاتل ل ٥٠% و ٩٠% بعد ٧٢ ساعه من المعامله عند تركيزات ٠١, ، ٨٣ , ، ١٣, ، ٥,٢٣ جزء فى المليون علي العمر الثاني والرابع لليرقات على الترتيب . على الجانب الاخر اوضح المركب ديازون انه ضعيف السميه بعد ٧٢ ساعه عند تركيزات ١٦,٨٦ ، ٦٩,٣١ ، ٣٩,٥٩ ، ١٨٦,٦٧ للعمر اليرقي الثاني والرابع على الترتيب . واوضحت النتائج ان جميع المبيدات المحتبره زادت من مده الطور اليرقي والعذراء والشرانق المشوهه ونقصت من النسبه المئويه للتعذر وخروج الحشرات الكامله مقارنه بالكنترول .

Table (3) : Efficiency of some Pesticides against cotton leaf worm *Spedoptora littoralis* 2nd and 4th instar larvae after 24h. post treatment under field condition .

Pesticides	Mortality % of 2nd instar larvae								Mortality % of 4th instar larvae							
	1 day	3 d.	5 d.	7 d.	11 d.	14 d.	Residual. effect	General Mean	1 day	3 d.	5 d.	7 d.	11 d.	14 d.	Residual. effect	General Mean
Chlorosan	100	90	70	66	56	48	71.7	85.8	84	80	62	60	44	40	61.6	72.8
Agrinate	96	90	76	70	50	40	70.3	83.2	80	76	68	48	44	38	59	69.5
Diazinon	50	64	58	44	22	24	43.7	46.8	50	36	38	28	30	22	34	42
Nasractine	50	70	50	44	28	22	44	47	44	50	36	36	18	20	34	39

Table (4) : Efficiency of some Pesticides against cotton leaf worm *Spedoptora littoralis* 2nd and 4th instar larvae after 48h.post treatment under field condition .

Pesticides	Mortality % of 2nd instar larvae								Mortality % of 4th instar larvae							
	1 day	**3 d.**	**5 d.**	**7 d.**	**11 d.**	**14 d.**	**Residual effect**	**General Mean**	**1 day**	**3 d.**	**5 d.**	**7 d.**	**11 d.**	**14 d.**	**Residual effect**	**General Mean**
Chlorosan	100	96	74	68	56	48	73.7	86.8	100	88	66	60	48	42	67.3	83.7
Agrinate	100	94	80	72	58	40	74	87	88	80	72	66	44	46	66	77
Diazinon	60	64	60	44	28	30	47.7	53.8	58	44	38	32	32	24	38	48
Nasractine	64	72	56	44	40	24	50	57	50	62	38	40	22	28	40	45