EFFECTS OF FORMULATED TAR OIL AS SOLUBLE LIQUID ON THE COTTON BOLLWORMS

AMER, R. A.M.[1], A.H. AZOUZ[1] and A. G. EL – SISI[2]

1. *Plant Protection Research Institute, ARC, Dokki. Giza*
2. *Central Agricultural Pesticides Laboratory, ARC, Dokki. Giza*
   E-mails:- Redaamer85@Gmail.com and dr.ahmed850@yahoo.com

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Abstract

Tar oil was prepared as soluble liquid 95% and tested against the two stages of eggs and newly hatched larvae of the pink bollworm, *Pectinophora gossypiella* (Saunders) in the laboratory as well as determining the total of protein, carbohydrate and lipids in the 4th instar larvae of the pink bollworm treated as newly hatched. In field experiment, the formulated tar oil tested against the pink and spiny bollworms infested cotton crop in 2011 and 2012 cotton seasons in Beni Suef Governorate by spraying the cotton plants twice at 14 day interval using concentrations of 1.5 and 2%. Infestation percentages were determined immediately before spraying and weekly after spraying then reduction percentages were calculated.

The obtained results in the laboratory studies indicated that the toxicity of the prepared tar oil 95% soluble liquid was the most ovicidal action against the 4-day old eggs, followed by 3-day, 2-day and 1-day old eggs of the pink bollworm. On the other hand, the toxicity of tar oil against the newly hatched larvae increased with elapse the time after treatment. Determination of the biochemical contents showed that total protein and carbohydrates in the larvae that had values near from the control. While, total lipids in treated larvae had similar value unsingnificantly different from the control.

In field study, the formulated tar oil concentrations showed more activity against pink bollworm than spiny bollworm since it gave seasonal reduction percentage in infestation 55.69 & 67.09% and 47.52 & 62.45% at concentrations of 1.5 and 2% against pink bollworm during the seasons of 2011 & 2012. In case of spiny bollworm, the reduction percentage were 37.49 & 50% and 27.98 & 58.46% for concentrations 1.5 and 2% during seasons of 2011 & 2012. Generally, it could be concluded that the two tested concentrations 1.5 and 2% had slightly to moderately effect in controlling the two bollworms since they gave seasonal reduction average in infestation 50.2 & 62.19% and 41.08 & 61.15% during the seasons of 2011 & 2012 against the two pests.

INTRODUCTION

Cotton, *Gossypium barbadence* L. is considered the most economical crop in Egypt because its fiber and seeds are used in many industries as textile, food oil, soap and seedcake….exc. Also, the cotton increases the foreign currency when exported to different countries of the world.

Cotton bollworms are the most destructive insect pests infested cotton plants. The pink bollworm, *Pectinophora gossypiella* (Saunders) and the spiny bollworm, *Earias insulana* (Boisd.) larvae damage squares, flower buds, flowers and bolls that cause decreasing in the quality and quantity in the lint and oil of the obtained yield.

To control the cotton bollworms, many chemical insecticides are used. The wide used of insecticides had created some problems such as environmental pollution, pest resistance and toxicity against beneficial insects such as honey bees, many researchers used mineral and plant oils as alternatives of insecticides. Mineral oils have efficient results against eggs and newly hatched larvae of the Pink bollworm in laboratory and field experiments (Hewady *et. al.,* 1993 and Rofail *et al.* 2000) and they exhibited efficacy against cotton leafworm (Badr *et. al.,* 1995). El-Metwally *et al.* (2009) for their results using spinosad and chlorpyrifos against bollworms gave seasonal reduction average of 37.3 and 51.5%, respectively. Also, Zidan, *et. al.* (2012) reported that chlorpyrifos caused reduction rate 62.58% in pink bollworm infestation during 2011 cotton season.

Tar oil that used in this study acts 50% waste distillation of charcoal manufacture at 550^{o}C. Tar oils have many toxic compounds as phenols, benzene, sulphate, acids, toluene, perols, aldehide,…exc. Tar oils is used as a surface treatment method for protection of shingle roofs, boats, fences, …exc. (Tomlin, 1994) and (Viitanen, *et al.* 2000). Previous recently researches indicated that tar oil showed high acaricidal effect against wheat grain mite when prepared as dustable powder (El-Sanady and El-Sisi, 2010) also had high ovicidal and larvicidal effect against pink bollworm when prepared as soluble liquid (Amer and El-Sisi, 2011). Coal tar is also used to manufacture paints, synthetic dyes and photographic materials. It can be used in medicated shampoo, soap and ointment, as a treatment for dandruff and psoriasis, as well as being used to kill and repel head lice. When used in the extemporaneous preparation of topical medications, it is supplied in the form of Coal Tar Topical Solution USP, which consists of a 20% w/v solution of coal tar in alcohol. Coal tar concentrations at 5% are safe and effective for psoriasis, and no scientific evidence suggests that the coal tar in the concentrations seen in non-prescription treatments is carcinogenic. Skin treated with topical coal tar preparations should be protected from sunlight (Wikipedia, 2012).

The aim of the present study is preparation the local, cheap and available tar oil in suitable formulation (soluble liquid) as a new alternative of conventional pesticide for evaluating its efficacy against pink bollworm eggs and newly hatched larvae of the pink bollworm. Also, determine total protein, carbohydrate and lipids in

the pest. To control the cotton bollworms, pink bollworm and spiny bollworm in the cotton field.

MATERIALS AND METHODS

Materials

A- Insect rearing

A laboratory strain of newly hatched larvae and eggs of the pink bollworm, *P. gossypiella* were reared in the Bollworms Department, Plant Protection Research Institute, Agricultural Research Center on a semi artificial diet as described by Rashad and Ammar (1985). Rearing conditions were controlled at 27±1°C and 65-75% RH.

B- Tested compound

Tar oil, a crude compound from the waste distillation of charcoal manufacture under 550°C at Egypt New & Renewable Energy Authority (NREA), Seventh district, Nasr City. Crude tar oil had the following properties: its free acidity= 6.86%, its surface tension= 42.15 dyne/cm. and soluble in water up to 5% concentration.

1- Wetting and spreading agent

600 m.L.: It is nonionic surfactant, brief name of polyethylene glycol 600 monolaurate.

2- Preparation of tar oil as soluble liquid formulation

Crude tar oil compound is prepared in formulation by dissolving 5 ml of wetting and spreading agent 600 ml. in 95 ml tar oil.

Part I: Laboratory experiments

A- Toxicity of formulated tar oil against the pink bollworm

I- Ovicidal effect of the tested tar oil on the egg stage

Dipping technique method was used in this study. Three replicates were used for each concentration and each replicate contained batches of eggs (1- 4) days old ranged between 90 and 150 eggs. Piece of paper contained deposited eggs was dipped for 1min in each tested concentrations, another 3 replicates were treated with water for the check. Each treated replicate/each preparation was placed in a clean tube (3x10 cm.) after water evaporation under the controlled conditions (27±1°C & 65-75%R.H). The hatchability rates were assessed.

II- Toxicity of the tested tar oil against the newly hatched larvae

Thin film technique was used as a method of application in the present work. Each Petri-dish was treated with 1.0 ml of the tested preparation, five replicates for each preparation as well as the control were used. The Petri-dish which used as control was treated with water only. Twenty five of newly hatched larvae/replicate

was exposed for one hour to the tar oil film in each Petri-dish. The alive larvae from each treatment were counted and transferred singly to clean vials containing the artificial diet and maintained under controlled conditions (27±1°C and 65-75% R.H.). Then the numbers of alive and dead larvae were counted at three days after treatment.

B-Biochemical contents determination

The pink bollworm, *P. gossypiella* 4th instar larvae were treated as newly hatched larvae by LC_{50} of formulated tar oil. The alive larvae were prepared for determining the biochemical contents. All the biochemical determinations were done at Micro Component Analysis, Plant Protection Research Institute, A.R.C., Egypt.

1. Total proteins

Total proteins were determined by the method of Bradford (1976). Protein reagent was prepared by dissolving 100 mg of Coomassie Brilliant Blue G-250 in 50 ml. 95% ethanol. Solution of 100 ml. 85% (w/v) phosphoric acid were added. The resulting solution was diluted to a final volume of 1 liter. Sample solution (50 µl) for preparation of standard curve 50 µl of serial concentrations containing 10 to 100 µg bovin serum albumin were pipetted into test tubes. The volume in the test tube was adjusted to 0.1 ml with phosphate buffer (PH 6.6). 5 millimeters of protein reagent were added to test tube and the contents were mixed either by inversion or vortexing. The absorbance at 595 nm was measured after 2 min and before 1h against blank prepared from 0.1 ml of phosphate buffer (PH 6.6) and 5 ml of protein reagent.
Total protein was expressed as mg/g.b.w.

2. Total carbohydrates

Total carbohydrates were estimated in acid extract of the sample by the phenol-sulphuric acid reaction of Dubois, *et. al.* (1956). Total carbohydrates were extracted from the sample and prepared for assay according to Crompton and Birt (1967). Sample was homogenized in 0.3N $HClO_4$ (5ml) at 0°C for 1 min. The homogenate was kept in ice for further 10 min. Insoluble matter was removed by centrifugation for 3 min at 2000 r.p.m and washed twice in ice cold $HClO_4$ (5ml) by redispertion and centrifugation. The three supernatant combined into acid extract. Hundred microliters of the acid extract were added into a colorimetric tube to 0.5 ml of phenol (20 percent w/v). Then 5 ml of concentrated sulfuric acid were added rapidly with shaking. The tubes were allowed to stand 10 min, and then they were shaken and placed for 10-20 min in water bath at 25 to 30°C before reading. Blanks were prepared by substituting distilled water for the sugar solution. The absorbance of characteristic yellow-orange color is measured at 490 nm against blank. Total carbohydrate is expressed as µg glucose/gm fresh weight.

3- Total lipids

Total lipids were estimated by the method of Knight, *et al.*(1972) using phosphovanillin reagent prepared by dissolving of 0.6 gm pure vanillin in 10 ml ethanol and completed to 100 ml with distilled water. Then 400 ml conc. Phosphoric acid were added. 250 µl of sample were added to conc. Sulphuric acid (5ml) in a test tube and heated in a boiling water bath for 10 min. After cooling to room temperature, the digest was added to phosphovanillin reagent (6ml). After 45 min, the devolved color was measured at 525 nm against reagent blank. Optical density was compared to that of a reference standard and results expressed as mg lipids/ml heamolymph.

Part II- Field experiments

Field experiments were carried out to evaluate the efficacy of tar oil against *P. gossypiella* and *E. insulana* infesting cotton plants during 2011 & 2012 growing seasons in Beni suef Governorate.

Tar oil formulation was tested at rate 15ml/L (1.5%) and 20 ml /L (2%).

The experimental area was conducted according to the complete randomized block design including four replicates for each treatment, each replicate was 6x7 m (1/100 fed.).

A dorsal motor (capacity of 20 liter) was used for applying the tar oil as foliar treatment. The tar oil applications started when the percent infestation of green bolls reached 4% for the pink bollworm and 1% for spiny bollworm.

The tested tar oil was applied two times at 14 days intervals. The first spray was applied at 23th of July and 2nd spray on 6th August in the season 2011. While, 1st spray at 11st of July and 2nd spray on 25th of July in the season 2012. Boll samples were collected at random before applying the compounds and then weekly after application. One hundred bolls (25 bolls x 4 replicates) were collected from each treatment and inspected.

The percent reduction in population and infestation were calculated according to Handerson and Telton formula (1955):

% Reduction = 100 (1- (Ta x Cb/ Tbx Ca)).

Where Ta = number of infested bolls from the treatment after application.

Tb = number of infested bolls from the treatment before application.

Ca = number of infested bolls from the control after application.

Cb = number of infested bolls from the control before application.

C- Statistical analysis

Larval population, infestation and the percent of reductions were analyzed using Costat statistical program software, 1990 and Duncan's multiple range test (Duncan, 1955) at 5% probability level to compare the differences among time means.

RESULTS AND DISCUSSION

Part I: Laboratory experiments

A-Toxicity of formulated tar oil against the eggs and newly hatched larvae of the pink bollworm

1- Egg stage

The ovicidal action of the formulated tar oils against different aged eggs of the pink bollworm could be descendingly arranged in order as follows: 4, 3, 2 and 1-day old. The corresponding LC_{50} values were 0.0179, 0.1045, 7.0572 and 19.981%, respectively, the corresponding LC_{90} levels were 0.3826, 9.3967, 525.94 and 3574.5%, respectively. It is obvious that the susceptibility of the eggs to the formulated tar oil increased with increasing the age of eggs.

Table 1. Toxicity of formulated tar oils against different aged eggs of P. gossypiella.

LC_{50}(%) 95%Confidence limits	**LC_{90}(%) 95%Confidence limits**	**Slope**
1-day old egg		
19.981 13.379±32.736	3574.5 1225.6±16589.9	0.33
2-day old eggs		
7.0572 5.2029±9.8348	525.94 289.90±1081.4	0.4
3-day old eggs		
0.1045 0.0760±0.1460	9.3967 4.519±25.313	0.3
4-day old eggs		
0.0179 0.0025±0.0572	0.3826 0.1058±15.922	0.6

2- Newly hatched larvae

Table (2) showed that the formulated tar oil had toxicity against the newly hatched larvae of the pink bollworm at 1 hour post treatment (LC_{50}: 0.2912%). The toxicity was increased after 24 hours (LC_{50}: 0.0856%) and more increased after 5-day from treatment (LC_{50}: 0.0171%). The highest toxicity of formulated tar oil against the newly hatched larvae was (LC_{50}: 0.0059%) after 7-day from treatment.

The toxicity of tar oil against both eggs and newly hatched larvae of pink bollworm is due to its contents of phenols, creosote and anthrathane (Tomlin, 1994) and Viitanen, *et. al.,* 2000).

Table 2. Toxicity of formulated tar oil against the newly hatched larvae of P. gossypiella.

LC_{50}(%) **95%Confidence limits**	**LC_{90}(%)** **95%Confidence limits**	**Slope**
After one hour		
0.2912 0.1825±0.519	15.134 5.0619±21.422	0.35
After 24 hours		
0.0856 0.0535±0.1428	4.1261 1.6884±14.956	0.38
After 5- day		
0.0171 0.0099±0.0275	0.8044 0.3836±2.4313	0.5
After 7- day		
0.0059 0.0035±0.0082	0.0946 0.0565±0.2002	0.5

B-Effect of formulated tar oil on some biochemical determination in the pink bollworm larvae.

1- Total proteins.

Total proteins in the pink bollworm 4th instar larvae affected by formulated tar oil treatment increased slightly to be 36.6 mg/g.b.wt than the control (34.1 mg/g.b.wt.) as shown in table (3).

Table 3 . Effect of formulated tar oil on total protein, carbohydrate and lipids of *P. gossypiella.*

Determination (mg/g.b.wt)	Formulated Tar oil	Control	Biochemical content ratio	$L.S.D_{0.05}$
Total protein	36.6^{a}	34.1^{b}	1.073	1.843
Total carbohydrates	10.69^{a}	9.38^{b}	1.139	0.872
Total lipids	14.08^{a}	14.29^{a}	0.985	0.541

$$\text{Biochemical content ratio} = \frac{\text{Biochemical content in the treated larvae}}{\text{Biochemical content in the untreated larvae}}$$

2-Total carbohydrates

Table (3) showed that the total carbohydrates in the pink bollworm larvae had slightly increase which being 10.69 mg/g.b.wt as affected by formulated tar oil compared with the control value that was 9.38 mg/g.b.wt.

3-Total lipids

Total lipids in 4th instar larvae of the pink bollworm didn't affect approximately by formulated tar oil, the value was 14.08 mg/g.b.wt compared with control which reached 14.29 mg/g.b.wt as in illustrated table (3).

Part II: Field experiment

A-Efficacy of formulated tar oil against the green bolls infestation of cotton bollworms

Data presented in Table (5) indicated that application of the formulated tar oil caused higher reduction in the pink bollworm infestation than the spiny bollworm. General mean reduction percentages in pink bollworm infestation due to treatment with tar oil at rates 1.5 and 2% were 55.69 and 67.09%, respectively during season, 2011 whereas the corresponding reduction rates in the spiny bollworm infestation were 37.49 and 50%, respectively. On the other hand, the corresponding reduction rates in the two bollworms together were 50.2 and 62.19%, respectively (Table, 5). Similar trend of infestation and reduction rates associated to pink and spiny bollworms as shown in tables (6 and 7) was noticed.

The formulated tar oil at 1.5 and 2% which gave seasonal reduction percentage of 50.2 & 62.19% and 41.08 & 61.15% in the two bollworms together in this field of study during the seasons of 2011 & 2012, respectively. Rofail, *et al.* (2000) evaluated the performance of some natural oils for controlling bollworms using Solar oil E.C., CAPL-2 and plant oil Jojoba E.C. They stated that 2nd and 3rd spray gave the highest insecticidal efficiency as it was applied during the appearance of new generation. CAPL-2 oil gave the highest reduction in population (42.75 and 15.27%), solar oil (26.8 and 21.87) and Jojoba oil E.C. (20.06 and 8.83%) for 1997 and 1998 cotton seasons.

Table 4. % Infestation of the cotton bollworms before and after application with the tested tar oil during 2011 cotton season.

Treatments Conc. (v./v.)	**% Infestation of the cotton bollworms before and after spraying (in days)**							
	Sample Before spraying	1st spray			2nd spray			General seasonal average
		7- day	14-day	Avg.	7- day	14-day	Avg.	
P. gossypiella								
Tar oil 1.5%	4^a	3^b	3^b	3^b	7^b	10^b	8.5^b	5.4^b
Tar oil 2%	4^a	2^b	1^c	1.5^c	6^b	9^b	7.5^b	4.4^b
Untreated	4^a	6^a	12^a	9^a	15^a	18^a	16.5^a	11^a
$L.S.D_{0.05}$	0	4.534	4.719	2.618	2.702	4.816	4.504	2.702
E. insulana								
Tar oil 1.5%	1^a	1^b	3^b	2^b	4^b	7^b	5.5^b	3.2^b
Tar oil 2%	1^a	1^b	2^c	1.5^b	3^b	6^b	4.5^b	2.6^b
Untreated	1^a	2^a	4^a	3^a	6^a	12^a	9^a	5^a
$L.S.D_{0.05}$	0	1.309	1.402	1.240	2.112	4.288	3.982	1.351
Total bollworms (*P. gossypiella* and *E. insulana*)								
Tar oil 1.5%	5^a	4^b	6^b	5^b	11^b	17^b	14^b	8.6^b
Tar oil 2%	5^a	3^b	3^c	3^c	9^c	15^c	12^c	7^c
Untreated	5^a	8^a	16^a	12^a	20^a	30^a	25^a	16^a
$L.S.D_{0.05}$	0	2.433	0.756	2.267	3.532	3.982	2.889	3.822

Means in the same row followed by the same letter are not significantly different at $p<0.05$.

Table 5. Average percent reduction in infestation of the cotton bollworms after application with the tested tar oil during 2011 cotton season.

Treatments Conc. (v./v.)	**Percent reduction in infestation after spraying (in days)**						
	1st spray			2nd spray			General mean Reduction %
	7- day	14-day	Avg.	7- day	14-day	Avg.	
P. gossypiella							
Tar oil 1.5%	50^b	75^b	62.5^b	53.34^b	44.45^b	48.88^b	55.69^b
Tar oil 2%	66.7^a	91.67^a	79.19^a	60^a	50^a	55^a	67.09^a
$L.S.D_{0.05}$	44.72	9.937	22.36	42.23	2.484	7.452	9.937
E. insulana							
Tar oil 1.5%	50^b	25^b	37.5^b	33.5^b	41.67^b	37.49^b	37.49^b
Tar oil 2%	50^a	50^a	50^a	50^a	50^a	50^a	50^a
$L.S.D_{0.05}$	12.421	5.240	4.898	4.968	9.937	2.584	2.484
Total bollworms (*P. gossypiella* and *E. insulana*)							
Tar oil 1.5%	50^b	62.5^b	56.25^b	45^b	43.3^b	44.15^b	50.2^b
Tar oil 2%	62.5^a	81.25^a	71.88^a	55^a	50^a	52.5^a	62.19^a
$L.S.D_{0.05}$	7.452	2.484	7.952	12.42	17.39	4.968	7.452

Means in the same row followed by the same letter are not significantly different at $p<0.05$.

Table 6. % Infestation of the cotton bollworms before and after application with the tested tar oil during 2012 cotton season.

Treatments Conc. (v./v.)	**% Infestation of the cotton bollworms before and after spraying (in days)**							
	Sample Before spraying	1st spray			2nd spray			General seasonal average
		7- day	14-day	Avg.	7- day	14-day	Avg.	
P. gossypiella								
Tar oil 1.5%	4^a	3^b	4^b	3.5^b	7^b	11^b	9^b	6.25^b
Tar oil 2%	4^a	2^b	3^b	2.5^b	5^b	8^c	6.5^c	4.5^c
Untreated	4^a	7^a	10^a	8.5^a	12^a	16^a	14^a	11.25^a
$L.S.D_{0.05}$	0	2.646	3.786	3.215	3.606	4.041	3.819	3.503
E. insulana								
Tar oil 1.5%	2^a	2^b	4^b	3^b	5^b	7^b	6^b	4.5^b
Tar oil 2%	2^a	1^c	2^c	1.5^c	3^c	5^c	4^c	2.75^c
Untreated	2^a	3^a	5^a	4^a	7^a	10^a	8.5^a	6.25^a
$L.S.D_{0.05}$	0	1	1.528	1.258	2	2.517	2.255	1.75
Total bollworms (*P. gossypiella* and *E. insulana*)								
Tar oil 1.5%	6^a	5^b	8^b	6.5^b	12^b	18^b	15^b	10.75^b
Tar oil 2%	6^a	3^c	5^c	4^c	8^c	13^c	10.5^c	7.25^b
Untreated	6^a	10^a	15^a	12.5^a	19^a	26^a	22.5^a	17.5^a
$L.S.D_{0.05}$	0	3.606	5.132	4.368	5.568	6.557	6.062	5.210

Means in the same row followed by the same letter are not significantly different at $p<0.05$.

Table 7. Average percent reduction in infestation of the cotton bollworms after application with the tested tar oil during 2012 cotton season.

Treatments Conc. (v./v.)	**Percent reduction in infestation after spraying (in days)**						
	1st spray			2nd spray			General mean Reduction %
	7- day	14-day	Avg.	7- day	14-day	Avg.	
P. gossypiella							
Tar oil 1.5%	57.14^b	60.0^b	58.57^b	41.67^b	31.25^b	36.46^b	47.52^b
Tar oil 2%	71.43^a	70.0^a	70.72^a	58.33^a	50.0^a	54.17^a	62.45^a
$L.S.D_{0.05}$	10.11	7.071	8.591	11.78	13.26	12.52	10.56
E. insulana							
Tar oil 1.5%	33.33^b	20^b	26.67^b	28.57^b	30^b	29.29^b	27.98^b
Tar oil 2%	66.67^a	60^a	63.34^a	57.14^a	50^a	53.57^a	58.46^a
$L.S.D_{0.05}$	23.57	28.28	25.93	20.20	14.14	17.17	21.55
Total bollworms (*P. gossypiella* and *E. insulana*)							
Tar oil 1.5%	50^b	46.67^b	48.34^b	36.84^b	30.77^b	33.81^b	41.08^b
Tar oil 2%	70^a	66.67^a	68.34^a	57.89^a	50.0^a	53.95^a	61.15^a
$L.S.D_{0.05}$	14.14	16.14	18.24	14.88	13.59	14.24	14.19

Means in the same row followed by the same letter are not significantly different at $p<0.05$.

Our results are going on line with those obtained by El-Metwally, *et. al.* (2009) who mentioned that hexaflumuron , spinosad, chlorpyrifos and profenfos caused 35.3, 37.3, 51.5 and 51.9%, reduction in pink bollworm, respectively. Zidan, *et al.* (2012) reported that chlorpyrifos gave reduction 62.58% in Pink bollworm in cotton season, 2011.

Generally, it could be concluded that tar oil had slightly and moderately effect in controlling cotton bollworms infested cotton crop when it used at rates 1.5 and 2% (v./v.).

1- Infestation percentages by spiny bollworm were less than pink bollworm.
2- Infestation percentages by two bollworms were decreased as a result of treatment with tar oil than untreated.
3- Infestation percentages were decreased as concentration of tar oil increased.

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تأثيرات الزيت القطرانى كمحلول قابل للذوبان على ديدان لوز القطن

رضا عبد الجليل محمد عامر[1] ، حسين عبد الحميد أحمد عزوز[1] ، أحمد غازى السيسى[2]

١. معهد بحوث وقاية النباتات – مركز البحوث الزراعية - دقى - جيزة – ج.م.ع
٢. المعمل المركزى للمبيدات – مركز البحوث الزراعية - دقى - جيزة – ج.م.ع

تم تحضير الزيت القطرانى على صورة سائل قابل للذوبان (95%) وذلك لاستخدامه ضد البيض ويرقات الفقس الحديث لدودة اللوز القرنفلية وذلك فى الدراسات المعملية. كما تم أيضا تقدير البروتينات والكربوهيدرات والليبيدات الكلية فى يرقات العمر الرابع لدودة اللوز القرنفلية التى تم معاملتها فى طور الفقس الحديث بالتركيز النصفى المميت للزيت القطرانى.

كما أختبرت الكفاءة الابادية لمستحضر الزيت القطرانى فى الدراسة الحقلية ضد دودتى اللوز القرنفلية والشوكية التى تصيب محصول القطن فى محافظة بنى سويف لموسمى القطن 2011 و2012 وذلك بمعاملة محصول القطن معاملتين متتاليتين بينهما فترة 14 يوم بالزيت القطرانى بتركيزين 1.5% و2%. تم تقدير نسب الاصابة مباشرة قبل الرش واسبوعيا بعد ذلك وتم حساب النسبة المئوية للانخفاض فى الاصابة.

أشارت الدراسات المعملية أن مستحضر الزيت القطرانى كان أكثر سمية على بيض عمر 4 أيام يليه فى ذلك بيض عمر 3أيام ثم 2 يوم و 1يوم على التوالى. كما زادت سمية مستحضر الزيت القطرانى بزيادة المدة من بداية المعاملة ليرقات الفقس الحديث. كما أظهرت الدراسات الكيميائية الحيوية أن قيم البروتينات والكربوهيدرات الكلية كانت أكثر قليلا من قيم الكونترول بينما كانت قيمة الليبيدات الكلية تعادل الكونترول تقريبا.

أظهرت الدراسة الحقلية زيادة أن فعالية الزيت القطرانى المجهز محليا على صورة سائل قابل للذوبان 95% ضد ديدان اللوز تزيد مع زيادة التركيز. أثبتت الدراسة ايضا ان الفعالية ضد دودة اللوز القرنفلية اعلى من دودة اللوز الشوكية حيث بلغ متوسط النسبة المئوية لخفض الاصابة فى حالة دودة اللوز القرنفلية 55.69 و 67.09% لموسم قطن 2011 و 47.52 و 62.45% لموسم قطن 2012 وذلك للتركيزين 1.5 و 2% على التوالى بينما كان فى حالة دودة اللوز الشوكية 37.49 و 50% لموسم 2011 و27.98 و 58.46% لموسم 2012 وذلك للتركيزين 1.5 و 2% على التوالى. بصفة عامة يمكن استنتاج أن كلا التركيزين 1.5 و 2% ذات تأثير منخفض ومتوسط فى مكافحة ديدان اللوز حيث اعطيا نسبة انخفاض موسمى بلغ 50.2 و 62.19% لموسم قطن 2011 و41.08 و 61.15% لموسم قطن 2012 على التوالى ضد نوعى ديدان اللوز.