

Controlling of cotton leafworm using some manufacturing Botanical formulations

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ABSTRACT

Three synthetic botanical materials which are Camphour, Menthol and Thymol were prepared as suitable formulations: Camphour as 25% emulsifiable concentrate, both Menthol and Thymol as 20% concentrated emulsion. Prepared formulations sprayed on tomato plants at concentrations 1.0, 1.5 and 2.0% (V. /V.). Direct effect on present 2nd and 4th instar larvae of cotton leafworm was determined by taking tomato leaves samples directly after spraying and introducing these leaves samples to larvae in laboratory, for studying latent effect, treated leaves samples were taken each two days and introduced to the rest alive larvae, mortality counts was recorded each two days, then mortality percentages were calculated. Residual effect was determined by the same method mentioned before, by taking leaves samples after 7 days of treatment and introducing to larvae in laboratory, other samples taken each two days and introduced to the rest alive larvae. Antifeedent effect also was determined by determination the consumed amount of treated tomato leaves and untreated, then reduction percentage in food consumed was calculated. Results obtained indicated that the tested materials at all tested concentrations showed high toxic effect directly against the present larvae or residual after 7 days against new infestation if occurred. Also, the tested materials showed antifeedent effect against 4th instar larvae to be more than 50% at 1% concentration. For economic consideration, concentration 1% could be recommended for controlling larvae of cotton leafworm infested tomato.

Keywords: cotton leafworm - Botanical formulations – control

INTRODUCTION

Tomato (*Lycopersicon esculentum* L.) is an important vegetable crop grown in Egypt. It attacked by several insect pests such as *Bemisia tabaci* Genn., *Aphis gossypii* Glover, *Myzus persica* Sulzer, *Thrips tabaci* Lind, *Empoasca* spp., *Spodopteralittoralis* Boisid., and *Liriomyza* Sp. (Ahmad 2006).

Among of these insects the cotton leafworm *Spodopteralittoralis* (Boisd) is a polyphagous insect, is a key pest of cotton and other crop in the Mediterranean area and middle eastern countries (Campion *et al.*, 1977; Gomez-Clemente and Delrivero, 1951; Nasr *et*

al., 1984; Ahmad, 1988; Dominguez, 1993) known to infest approximately 112 host plants belonging to different families.

A wide range of chemicals have been marketed for controlling pests because its effectiveness and speed controlling of insect pests (Omar *et al.*, 1996, Elfakharany 2005). Also plant oil was used because cheaper and more safe to human and environment Abd-Elaziz *et al.*, (2002) El fakharany (2005 and 2010) Appiagyei (2010) and Mochiah *et al.*, (2011) indicated the effect of petroleum oil and plant oil against insect pests and predators.

Therefore, the aim of the present work was to evaluate the efficiency of these three manufacturing botanical formulations (Camphour, Menthol and Thynol) for controlling *S. littoralis* in addition to evaluate the residual effect of these treatment against 2nd and 4th instar larvae of cotton leafworm.

MATERIALS AND METHODS

The present work was conducted to study both direct and latent effect of three manufacturing botanical formulations on both 2nd and 4th instar larvae of cotton leafworm *Spodopteralittoralis* (Boisd).

Manufacturing potential formulation

Camphour 99%: is a waxy, white or transparent solid with a strong odor. It is a terpenoid.

Chemical name: IUPAC name: 1,7,7-Trimethylbicyclo (2.2.1) heptanes.

Chemical formula: C₁₀ H₁₆ O.

It was supplied from Gomhoria Company, Cairo.

Menthol 99%: (Mentapulegium L. (Mint). Is an organic compound made synthetically, it is a waxy crystalline substrate, clear or white in color, which is solid at room temperature.

Chemical name : IUPAC name : (1R,2,5,5R) -2-isopropyl-5-cyclohexanol

Chemical formula: C₁₀ H₂₀ O.

Productive Company: SDFCL (sd Fine-Chem Limited), India.

Thymol 99%: It is a natural monoterpene phenol. white crystalline substrate of a pleasant aromatic odor.

Chemical name: 2- isopropyl-5-methyl phenol.

Chemical formula: C₁₀ H₁₄O.

Productive Company: ALPHA CHEMIKA, India.

Preparation of the botanical materials as formulations:

Laboratory tests for the above materials indicated that they did not soluble in water, but they soluble in xylene solvent at ratio 40% (weight/volume), therefore they were

prepared emulsifiable concentrate or concentrated emulsion. Camphour prepared as 25% emulsifiable concentrate by dissolving 25 g. camphour in 70ml. xylene then emulsifier polyethyleneglycol 600 mono laurate was added at rate 5%, while both menthol and thymol were prepared as concentrated emulsion by dissolving 20g. of active ingredient in 55ml. xylene then 25ml. of emulsifier potassium polyaryl alkyl sulfonate solution in water was added and mixed well.

Reared culture:

Laboratory reared culture of cotton leafworm according to El-defrawi *et al.*, (1964) was used. Synchronized second instar larvae were chosen for the experiment.

The insecticidal activity of these three treatments was assessed on 2nd and 4th instar larvae of *S. littoralis*. Three concentrations 20, 15 and 10 ml/liter were used for each manufacturing potential formulation.

Experimental design:

The experiment was conducted according to Ministry of Agriculture Protocol (1993) and Mohamed *et al.*, (2001). In 2013 tomato grown field at Banha district, Qalubia Governorate. The experiment area which was 4 kerate were divided into three plots (one for each treatment). In addition to 1 kerate for untreated control, each plot was divided into three for each concentration.

Procedures of evaluation:

Initial and latent toxicity against larvae of cotton leafworm:

This experiment represents the effect against present infestation which was carried out by taking tomato leaves samples directly after spraying when plant became dry then treated leaves were transferred to the laboratory and introduced to 2nd and 4th instar larvae of cotton leafworm, *Spodopteralittoralis* (Boisd). Under constant conditions of 25°C ± 1 and 70 ± 5 % RH. three replicates for each treatment each have 15 larvae. For studying the latent effect against

treated leaves other samples were taken each 2days from field continuously and introduced to the rest alive larvae.

Mortality count was recorded each 2days then mortality percentages were calculated.

Residual activity of different treatment against larvae of cotton leaf worm: Tomato leaves samples were taken after 7 days of spraying and introduced to 2nd and 4th instar larvae in laboratory, other samples were taken each two days and introduced to the rest alive larvae. Mortality count were recorded each 2days then mortality percentages were calculated.

Antifeedent effect of the different treatment against 4th instar larvae of cotton leaf worm: New moulted 4th instar larvae were fed on tomato leaves accurately weighed, previously dipped in concentration 2,1,0.5 and 0.25 % for each material compared with control which fed on untreated leaves,3 replicate each have 15 larvae. After 24 hrs. of feeding ,the rest leaves were weighed in each replicate, then consumed of amount of leaves were calculated and antifeedent effect were calculated as Waldbouer (1968) equation Antifeedent:

$$\% \text{ Reduction in food consumption} = \frac{C_c - C_t}{C_c} \times 100$$

Where:

C_c= Consumed amount in untreated

C_t= Consumed amount in treated

RESULTS AND DISCUSSION

The insecticidal efficiency in this study includes studying both toxicity and antifeedent effect of the tested materials.

Toxicity of the tested botanical formulations against larvae of cotton leafworm.

Toxicity against present infestation:

Results shown in Table 1 about the toxicity against 2nd instar larvae and in table 2 about the toxicity against 4th instar larvae of cotton leafworm indicated that: the toxicity increased as both concentration and period of feeding with treated leaves increased. It showed be said there are different between different concentrations in toxicity after 2 days of feeding, this differentiation in toxicity increased after 4days of feeding to reach the same effect (100% mortality) after 6 days of feeding. Also, indicated that there are already similar toxicity between 2nd and 4th instar larvae.

Table 1: Insecticidal efficiency of the tested materials against 2nd instar larvae of cotton leafworm infested tomato leaves.

Treatments	Conc. % (V./V.)	% Mortalities after indicated days of exposure		
		2	4	6
Camphour	1.00	37.78	77.68	100
	1.50	55.56	81.11	100
	2.00	71.11	84.44	100
Menthol	1.00	35.56	88.98	100
	1.50	60.00	97.00	100
	2.00	77.78	97.78	100
Thymol	1.00	55.56	91.11	100
	1.50	71.11	95.56	100
	2.00	80.00	97.00	100
Untreated		0.00	5.00	9.00

Table 2: Insecticidal efficiency of the tested materials against 4th instar larvae of cotton leafworm infested tomato leaves.

Treatments	Conc. % (V.\V.)	% Mortalities after indicated days of exposure		
		2	4	6
Camphour	1.00	26.67	71.11	100
	1.50	41.33	82.56	100
	2.00	73.33	93.33	100
Menthol	1.00	40.00	68.89	100
	1.50	60.00	75.56	100
	2.00	80.11	86.68	100
Thymol	1.00	31.11	64.33	100
	1.50	42.11	80.44	100
	2.00	51.22	93.00	100
Untreated		0.00	6.11	9.00

Residual effect: Results in table 3 about the residual toxicity after 7days of spray against 2nd instar larvae in table 4 against 4th instar larvae indicated that the effect increased as concentration and period of feeding with treated leaves increased to be 100% mortality after 4days of feeding for all tested materials at all tested concentrations. Results of direct toxicity and residual toxicity indicated that the materials showed high direct and residual toxicity against two tested instar larvae. This mean that spraying with this materials are effective against present infestation and new infestation after 7days of spraying. Results of toxicity for these botanical materials against larvae of cotton leaf worm. The results obtained agree with Abdel- All (2012) who studied

the effect of four plant oils Mentha Pluegium, Onion, Mustard and Garlic in controlling cotton leafworm, *Spodopteralittoralis*. Also, Abdel- Wahab (2002) who studied the biological and biochemical effect of some potenical extracts on cotton leafworm., El-Ghareeb (1992) found that Chlorfluazuorn was toxic than Diflubenzuron against 3rd and 5th instar larvae of *Spodopteralittoralis* in the laboratory. Also Bayoumi *et al.*, (1998) found that 3rd instar were more sensitive to Chlorfluazuron and Flufenoxuron, compared with 5th instar of *Spodopteralittoralis* (Boisd). andIshaayaet *al.*, (1995) indicated that Tebufenozide is potentially potent insecticide for controlling larvae of *Spodopteralittoralis* (Boisd).

Table 3: Residual activity of the tested materials against 4th instar larvae of cotton leavewrm infested tomato leave after 7 days of treatment.

Treatments	Conc. % (V.\V.)	% Mortalities after indicated days of exposure		
		2	4	6
Camphour	1	28.89	56.11	100
	1.5	44.44	72.66	100
	2	54.22	80	100
Menthol	1	37.11	66.66	100
	1.5	51.78	72	100
	2	62.11	87.11	100
Thymol	1	53.89	60	100
	1.5	58.33	74.11	100
	2	62.22	80	100
Untreated		0	5	10

Table 4: Residual activity of the tested materials against 4th instar larvae of cotton leavewrm infested tomato leave after 7 days of treatment.

Treatments	Conc.% (V.V.)	% Mortalities after indicated days of exposure		
		2	4	6
Camphour	1.00	17.78	60.00	89.11
	1.50	42.22	70.66	90.00
	2.00	50.00	80.00	90.00
Menthol	1.00	15.55	55.66	80.00
	1.50	35.11	63.44	90.22
	2.00	51.11	72.11	92.66
Thymol	1.00	15.56	66.12	97.11
	1.50	35.56	74.11	98.11
	2.00	54.11	81.44	96.44
Untreated		0.00	2.00	6.00

Antifeedent effect: Results in table 5 about the antifeedent effect of the tested botanical materials against 4th instar larvae, the most seriously instar in feeding, indicated that all tested concentrations decreased the amount of food consumption than untreated, and this effect was increased as concentration increased, therefore, % antifeedent which expressed % reduction in food consumption which mean protection of treated plant from feeding with this harm stage increase as concentration increased to be more than 50% at 1% concentration. Results of antifeedent

effect against larvae of cotton leafworm are agree with El-Gengahi *et al.*, (1996) who found a significant reduction in the food consumed and a considerable decrease in the body weight gained by the larvae *Spodopteralittoralis* (Boisd) and *Agrotisipsilon* offered castor bean leaves treated with different plant extracts. Also Benard *et al.*, (1991) found that the growth rate of *Spodopteralittoralis* treated with Cyfluthrin was reduced and reduction in weight gain was not compensated until the end of the 4th instar.

Table 5: Antifeedant effect of the tested materials against 4th instar larvae of cotton leafworm.

Treatment	Conc. % (V.V.)	Consumed food (g.)	% Antifeedant
Camphour	2.5	4.08	29.90
	5.0	3.52	39.52
	10.0	3.82	51.87
	20.0	2.58	55.67
Menthol	2.5	3.21	46.39
	5.0	2.55	56.19
	10.0	3.38	41.92
	20.0	2.70	53.61
Thymol	2.5	3.77	35.22
	5.0	3.49	40.03
	10.0	2.83	51.37
	20.0	2.38	59.11
Untreated		5.82	

Where:

C= Consumed food in untreated.

T = Consumed food in treated.

Conclusion: The tested botanical formulation showed both toxic effects

directly against present infestation, or residual after 7 days of spraying against new infestation and also showed antifeedent effects against larvae of cotton leafworm. All concentrations,

considered be successful for controlling this stage of cotton leafworm, but for economic consideration, concentration of 1% could be recommended.

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ARABIC SUMMARY

مكافحة دودة ورق القطن باستخدام مستحضرات نباتية محضرة صناعيا

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تم تحضير ثلاثة مركبات نباتية مخلقة صناعيا وهي الكافور، المنتول والثايمول علي صورة مستحضرات مناسبة للاستخدام. تم تحضير الكافور علي صورة مركز قابل للاستحلاب 25% بينما تم تحضير كلا من المنتول والثايمول علي صورة مستحلبات مركزة 20%. تم رش المستحضرات المجهزة علي نباتات الطماطم بتركيز 1.0، 1.5 و 2.0% (حجم/حجم). تم تقدير التأثير المباشر علي يرقات دودة ورق القطن: العمرين الثاني والرابع بأخذ عينات ورق الطماطم مباشرة بعد الرش وتقديم هذه العينات لليرقات في المعمل، لدراسة التأثير المتأخر تم أخذ عينات ورق أخري كل يومين من المعاملات المرشوشة وتقديمها لليرقات الحية المتبقية. تم تسجيل الموت كل يومين ثم حساب النسبة المئوية للموت. تم تقدير الأثر المتبقي بنفس الطريقة المشار إليها سابقا ولكن بأخذ عينات ورق بعد 7 أيام من الرش وتقديمها لمجموعة جديدة من اليرقات ثم أخذ عينات ورق كل يومين وتقديمها لليرقات الحية الباقية. تم تقدير التأثير المانع للتغذية أيضا بتقدير الكمية المستهلكة من ورق الطماطم بعد 24 ساعة ثم حساب النسبة المئوية للنقص في التغذية عن الغير معاملة. دلت النتائج المتحصل عليها أن كل التركيزات المختبرة أظهرت سمية عالية ضد اليرقات الموجودة مباشرة أو التأثير المتبقي بعد 7 أيام من الرش ضد الأصابات الجديدة إذا حدثت. أيضا أظهر المواد المختبرة تأثير مانع للتغذية ضد العمر اليرقي الرابع يصل إلي أكثر من 50% عند تركيز 1%. وللاعتبارات الاقتصادية يوصي باستخدام تركيز 1% لمكافحة دودة ورق القطن علي محصول الطماطم.