

TOXICOLOGICAL STUDIES OF NATURAL PHYTO-COMPOUNDS

3. EFFICIENCY OF SOME VOLATILE OILS ON THE 4th
INSTAR LARVAE OF COTTON LEAF-WORM SPODOPTERA
LITTORALIS (BOISD.).

BY

Mesbah, H.A., Tayeb, E.H., Abdo, M.Z.[✉], and Nagda El-sayed, Faculty of Agriculture (Saba-Basha), Alexandria University and ✉ Institute of Plant Protect., Agric. Res. Center, El-Sabaheia, Alexandria, Egypt.

ABSTRACT

The volatile oils of dill, red basil, clove and peppermint were evaluated for their use as biologically active substances against the susceptible strains of the cotton leaf worm S.littoralis.

Generally, all the tested volatile oils were efficient against the treated 4th instar larvae after 3,5,7 and 9 days post treatment. Red basil was the most effective volatile oil upon the treated larvae. They have been found to have some effects upon certain bio-physiological characteristics. Where their delayed effect on the survived 4th instar larvae post treatment was reflected on the rates of pupation, adult emergence, number of deposited eggs/female; and hatching percentage.

INTRODUCTION

The large scale use of hazardous insecticides against insects of either agricultural or medical importance, frequently leads to the development of various degrees of

resistance against insecticides applied, beside environmental pollution.

Many naturally occurring chemicals were found to be toxic to certain insect-species. A group of particular interest are the volatile oils (El-Gayar, 1966, Lichtenstein et al., 1974 Abbassy, 1981 and Kesbah et al. 1985 a, 1990).

Therefore, it would be of extreme importance to evaluate the efficiency of certain volatile oils upon the injurious larvae of S.littoralis as a mean of preventing or reducing the probable occurrence of hazardous pollutions during cotton leaf worm control.

MATERIALS AND METHODS

A. The volatile oils.

All the tested volatile oils were obtained from the Res. Lab. of Medicinal Plants, Agric. Res. Centre, El-Sabaheia, Alex., Egypt.

1. Peppermint oil:

Contain 45% menthol and 4.9% menthyl acetate. Extracted from Mentha piperita, L. (Family Labiatae).

2. Red Basil oil:

Contain 40-48% linalol and 21-33% methyl chavicol. Extracted from Ocimum basilicum, L. (Family Labiatae).

3. Dill oil:

Extracted from seeds of dill plants Anethum graneculus L. The extract contains up to 60% of d-carvone, dill

apiol and myristicin (Lichtenstein, 1974).

4. Clove oil:

Extracted from Eugenia armomatica; it contains Eugenol (85-90%), acetyl eugenol, and methyl-pentyl ketone vanillin.

B. Bioassay of volatile oils:

The 4th instar larvae which and been raised under laboratory conditions, were sprayed with four progressive concentrations of the used volatile oils (0.25, 0.5, 0.75 and 1%). These progressive dilutions (V/V) of each tested oil were prepared by dissolving the volatile oil in acetone. The control larvae were also sprayed with acetone. Treatments were run in two replicates; each replicate included 15 larvae. After spraying, the larvae were allowed 2 min. to be dried along., they were transferred to 1 litre glass Jar containing fresh castor-bean leaves.

The efficiency of all tested volatile oils was determined throughout 3,5,7 and 9 days post larval treatment as bioassay intervals. Larval mortality and developmental characteristics were recorded. The dead larvae were those not responding or showing any visible movement during 30 sec. observation. The remained alive larvae, in particular, those treated with medium or/and lower concentrations, were reared till complete of their life cycle and moth emergence. Pairs of both emerged sexes were provided with nutritive dilution of 5% sugar and 5% honey. The number of deposited eggs as well as the percentage of hatching were recorded. The resulting adult-deformities after treatments were also detected and described.

RESULTS AND DISCUSSION

The observed mortalities of S. littoralis 4th instar larvae sprayed with different dilutions of the tested volatile oils are graphically illustrated in Figures 1, 2, 3 and 4. All the tested volatile oils were found to be toxically efficient after 3, 5, 7 and 9 days post treatment. The lower concentration of clove and peppermint volatile oils indicated, more or less increased mortalities than the higher ones. Conversely, the lowest concentration of red basil oil (0.25%) was highly effective upon the treated larvae than the same lowest concentrations of the other tested volatile oils.

The estimated toxic efficiency of different tested concentrations of these evaluated compounds were compared to the basis of calculated mortality percentages after 9 days post-treatment. The 100% mortalities were recorded for the applied concentration rates of 0.5 and 1% dill oil and 1% red basil oil, while for the other concentrations of all used compounds, the calculated percentages of mortalities ranged from 55.5-88.5%. It could be also observed from Table 1 and figures 1, 2, 3 and 4 that the utmost efficient volatile oil along the adopted interval of 9 days post treatment at all its applied concentration rates of 0.25, 0.5, 0.75 and 1% was dill oil. The calculated r^2 (regression coefficient) values comprised 0.86, 0.97, 0.99 and 1.0 respectively.

Fig.1-4. The relationship between the mortality percentage and the exposed time (days) at different concentration of the tested volatile oil.

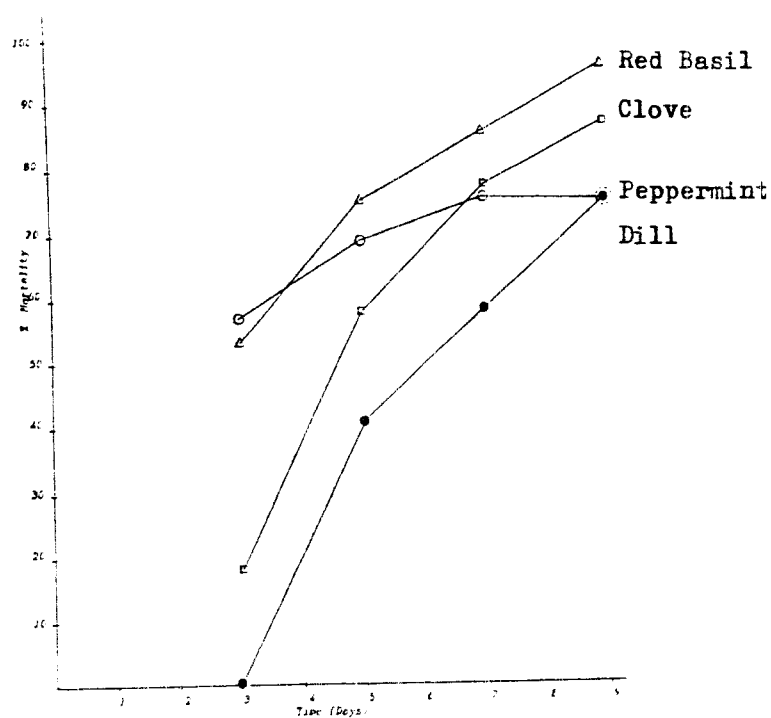


Fig.1. At concentration = 0.25%

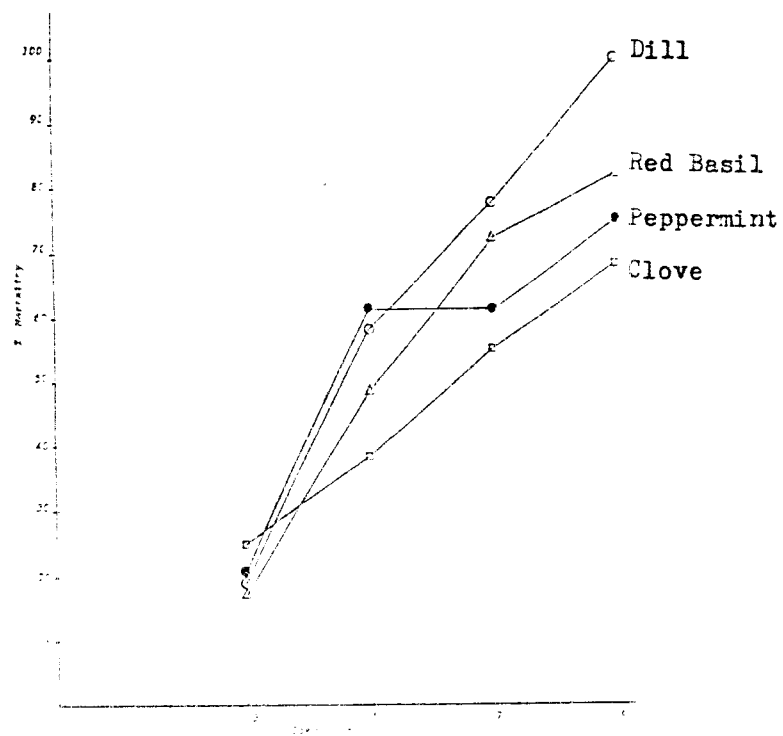


Fig. 2. At concentration 0.50%

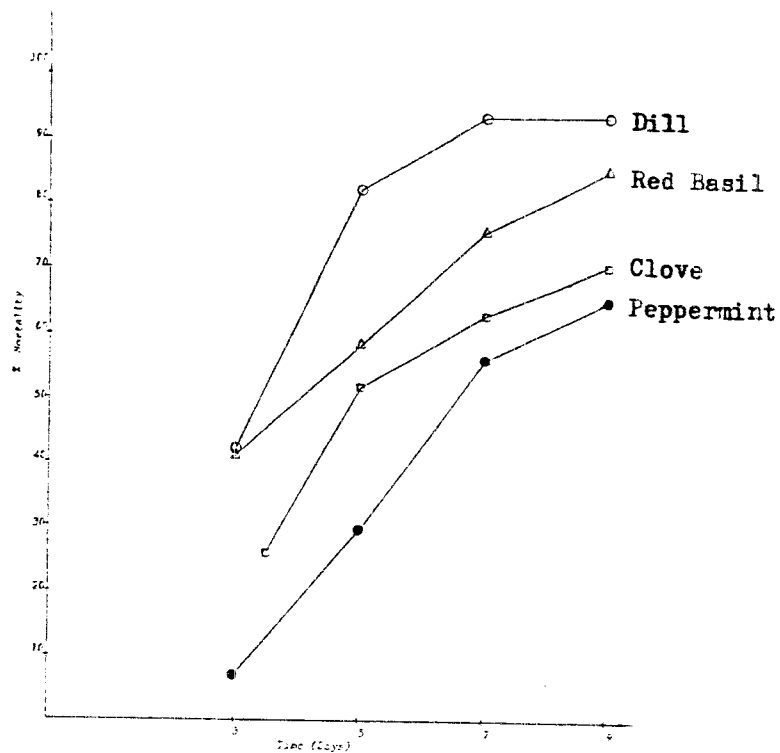


Fig. 3. At concentration = 0.75 %

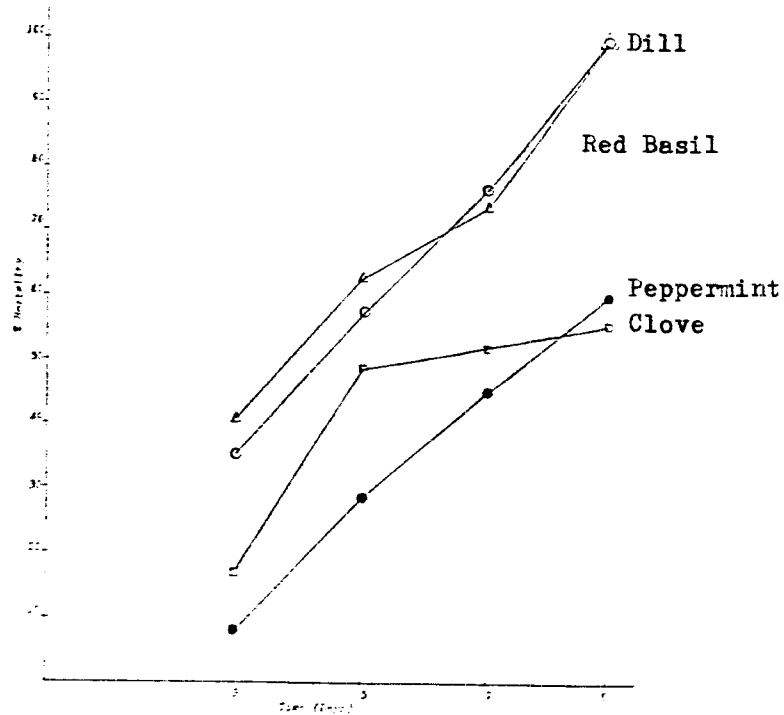


Fig. 4. At concentration = 1%

Table 1. The regression of mortality percentages (y) on the bioassay period of 9 days (x).

Conc. Certification	Dill plant	Red basil	Clove oil	peppermint oil
0.25%	$y = 51.71 + 2.895 x$ $\pm 5.35^{(A)}, 0.836^{(B)}$ $r^2 = 0.86$	$y = 36.7 + 6.74 x$ $\pm 6.43, 1.005$ $r^2 = 0.96$	$y = -6.92 + 6.74 x$ $\pm 6.43, 1.005$ $r^2 = 0.61$	$y = -29.23 + 12.13 x$ $\pm 13.24, 2.068$ $r^2 = 0.59$
0.5 %	$y = -14.752 + 11.092 x$ $\pm 10.135, 1.593$ $r^2 = 0.97$	$y = -10.23 + 10.68 x$ $\pm 8.56, 10.63$ $r^2 = 0.97$	$y = 2.485 + 7.415 x$ $\pm 1.34, 7.415$ $r^2 = 1$	$y = 6.24 + 8.115 x$ $\pm 18.65, 2.629$ $r^2 = 0.75$
0.75%	$y = 11.825 + 3.625 x$ $\pm 3.05, 0.483$ $r^2 = 0.99$	$y = 20.48 + 7.42 x$ $\pm 4.173, 0.653$ $r^2 = 0.98$	$y = 9.39 + 7.21 x$ $\pm 9.723, 1.513$ $r^2 = 0.92$	$y = 20.61 + 12.01 x$ $\pm 8.49, 1.31$ $r^2 = 0.97$
1 %	$y = 3.04 + 10.71 x$ $\pm 1.724, 0.253$ $r^2 = 1$	$y = 12.425 + 9.475 x$ $\pm 5.316, 0.985$ $r^2 = 0.98$	$y = 8.015 + 5.89 x$ $\pm 15.3, 2.39$ $r^2 = 0.75$	$y = -15.83 + 3.54 x$ $\pm 2.93, 8.53$ $r^2 = 0.99$

(A) SD = Standard error for interception.

(B) SD = " " for slope.

(C) r^2 = Regression coefficient.

Table 2. Effect of tested volatile oils concentrations on certain biological parameters of the cotton leaf worm.

Volatile oils Conc. % Replicates	Dill plant				Red basil				Clove oil				peppermint oil				Control
	0.25	0.5	0.75	1	0.25	0.5	0.75	1	0.25	0.5	0.75	1	0.25	0.5	0.75	1	
No. of pupae	2	-	2	-	2	2	2	-	3	4	4	8	2	4	5	8	15
No. of died pupae	-	-	1	-	-	1	-	-	2	2	2	-	2	2	3	4	-
No. of adult	2	-	1	-	2	1	2	-	1	2	2	8	-	2	2	4	15
Sex	2♂	-	♀	-	2♂	2♂	♀	-	-	♀♂	♀♂	4♂4♀	-	2♂	♂♀	2♂	5♂, 6♀
No. of deposited egg/female	-	-	-	-	-	Nil	-	7	1903	Nil	2443	-	-	Nil	-	-	1605
Hatching %	-	-	-	-	-	-	-	-	-	92.3	-	66.2	-	-	-	-	91.15

These results are in agreement with those mentioned in the work of Lichtenstein et al. (1974) who found that dill plants contain insecticidal components. In this study, larval treatment by a sprayer proved to be similar to the field application instead of leaves spraying because the leaves will getting dry and the death will be attributed to the shortage of food. And also, Su et al. (1972), Abbassy (1981) and Mesbah et al. (1985a & b and 1990) who determined the efficiency of several phyto-compounds upon different insect species.

Prabhakar et al. (1986) reported that the development growth rates of all treated larval instars of Trichoplusia ni and Spodoptera exigua were affected by the neem seed extract concentrations of 0.02, 0.2 and 2%.

Table 2 elucidate the delayed effect of these evaluated volatile oils, which has been reflected on the rates of larval pupation, adult emergence, number of deposited eggs and hatching percentages. The least number of resulted pupae or/and emerged adults was noticed for the survived larvae post treatment with dill and red basil oils, respectively; and this is due to their higher killing effect on larvae. Noticeably, in case of coupling the derived adult-females and males after clove oil treatment with concentration rates of 0.5% and 1%, the average number deposited eggs/female was higher than that of control treatment.

Also, at the same both concentrations of clove oil, the estimated percentages of hatchability comprised 82.3 and

86.2%, respectively, while, peppermint oil treatment, completely inhibited egg deposition by the mated adult-moths. Moreover, certain abnormal types of malformed adults were revealed after using the higher concentration rates of peppermint oil. These observed adult-deformities could be summerized in the following types: I. The emerged moth have crumpled fore wings and the obdominal region is totally enclosed in the pupal exuvium. II. Rather minute and tiny vestigeal moths.

Prabhaker et al. (1986) reported that when 5th instar larvae of Trichoplusia ni were exposed to a diet containing a concentration of 0.02% of neam seed extracts, only one nonproductive T.ni adult female was produced and the emerged female had distroted wings but appeared to be normal.

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دراسات تكسيكولوجية على المركبات النباتية الطبيعية

٣ - فعالية بعض الزيوت الطيارة على العمر اليرقي الرابع لدودة ورق القطن .

حسن على مصباح السيد حسن تايب محمد زكي عبده نجدة السيد

تم تقييم فعالية الزيوت الطيارة لكل من الشبث والريحان الاحمر والقرنفل والنعناع على يرقات العمر الرابع لدودة ورق القطن والتي اظهرت فعاليتها ضد اليرقات المعاملة خلال ٣ ، ٧٥ ، ٩ أيام بعد المعاملة .

وقد اتضح ان الريحان الاحمر كان أكفأ هذه الزيوت الطيارة المجربة واكثرها فعالية ضد اليرقات المعاملة حتى عند استخدامه بتركيز ٢٥ % ، كما لوحظ ايضا ان التأثير الممتد المفعول لتلك الزيوت الطيارة المختبرة على يرقات العمر الرابع التي عاشت بعد المعاملة قد انعكس على بعض الصفات البيوفسيولوجية من نسبة التعذير وخروج الحشرات الكاملة وكمية البيض الموضوع وكذلك نسبة الفقس ، بالإضافة الى ظهور بعض التشوهات في الحشرات الكاملة عند استعمال التركيزات العالية من زيت النعناع (٧٥ % ، ١ %) .