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EFFICACY OF *DODONAEA viscosa* PLANT EXTRACT ON SOME INSECT PESTS INFESTING COTTON PLANTS UNDER FIELD CONDITIONS

[51]

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ABSTRACT

Cotton plants var. Moubarak-93 are attacked during their growing stages (from seedling till harvest) with many insect pests such as *Aphis gossypii, Bemisia gossypiperda* (*Bemisia tabaci*) and *Thrips tabaci* as well. Early cotton cultivation (March 10), caused low infestation with aphids, whitefly and thrips, while late cultivation (April 8) caused high infestation with these insect pests. No significant differences were noticed between cultivated dates and infestation percentages as a whole, or the infestation percentage with cotton bollworms. Application of *Dodonaea viscosa* plant extract mixed with kerosene significantly reduced infestations of cotton seedlings with aphids, whitefly and thrips. However, highly significant differences were recorded between the percent of infestation of untreated cotton (check) and those treated with Dodonia extract. On the other hand, highly significant difference was recorded between infestation percentages of cotton bolls with pink and spiny bollworms on the untreated cotton plants and those treated with Dodonia extract but no significant difference was found in case of American bollworm attacking bolls of treated and untreated cotton plants. Increasing the extract concentration increased the repellent effect against cotton bollworms adults for 15 days following treatment. Difference between the average number of predators on the treated and untreated plants was insignificant.

Keywords: *Dodonaea viscosa, Aphis gossypii, Bemisia gossypiperda, Thrips tabaci, Pectinophora gossypiella, Earias insulana Helicoverpa armigera*

INTRODUCTION

In Egypt, cotton plants suffer greatly from the attack by numerous insect pests such as aphids, *Aphis gossypii*, white fly, *Bemisia gossypiperda* (*B. tabaci*) and thrips, *Thrips tabaci*. Moreover, cotton plants are attacked by the pink bollworm *Pectinophora gossypiella*, the spiny bollworm *Earias insulana* and the american bollworm *Helicoverpa armigera* (*Heliothis armigera*), causing a great drop in cotton yield.

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Recently, biological control was recommended by many authors such as **Natarajan *et al* (1991), Mogahed (1998), Mogahed and Abbas (1998), Mann *et al* (2001), Ali and Rodina (2002) and Wang *et al* (2002)** as a tool in the integrated pest management programme.

The aim of the present work is to evaluate the efficacy of *Dodonaea viscosa* plant extract mixed with kerosine against certain insect pests attacking cotton plants in early and late seasons under field conditions.

MATERIAL AND METHODS

Experiments were carried out under field conditions of National Research Centre Farm, Qualubyia Governorate, during the season 2003. Cotton plants *Gossypium hirsutum* var. Moubarak-93 were cultivated in an area of 300m on three dates (March 10, March 25 and April 8). This area was divided into experimental plots. The regular agriculture practices were carried out without using any pesticide treatments. In the field, the infestation levels of insect pests (aphids, thrips and whiteflies), on cotton seedlings were studied by taking 100 cotton sample starting from seedlings till ripening of the plant with about two weeks intervals, and the percent infestation was recorded at intervals starting from seedling stage till the ripening of bolls. Moreover, the percent infestations of cotton bolls with the bollworms (pink bollworm, spiny and American bollworms) were estimated in the laboratory by examining randomly cotton bolls of 100 plant at lower, medium and upper heights of the plant during the fruiting period of the plants.

Repellent effect of *Dodonaea viscosa* plant extract towards insect pests infesting the cotton plants in early season

The infestation percentages of aphids, thrips and whitefly on cotton plants was recorded before spraying *Dodonia viscosa* plant extract. Randomly, 100 plants were selected and labelled. The selected plants were divided into three treatments. Each treatment contain 30 plants sprayed with one concentration. Ten plants were left without treatment as a check (control). Three concentrations (0.25, 0.5 and 1.0%) of the extract were used against aphid thrips and whitefly infesting cotton seedlings. To prepare the extract mixture, 500gm of the terminal foliage of *D. viscosa* plants were dried, ground for 10 minutes, added to one liter of water and mixed in a blender. Five ml of Kerosin were then added and shacked for 5 minutes using a magnetic stirrer. Tween-90 (2.5 ml) was added as emulsifier, then stirring for 3 minutes at high speed (2000rpm). The resulted mixture was kept under room conditions for 3 days. The immersed extract was filtered, the mixture extract was taken and kept in refrigerator as a stock mixture extract.

Treated plants at the required concentration were examined at 1, 7, 15 and 20 days post-treatment and infestation percentages with the insects were recorded.

Repellent effect of *Dodonaea viscosa* plant extract towards insect pests infesting cotton bolls

Three hundred uninfected new cotton bolls were selected and labelled. The marked bolls were divided into three groups (100 bolls/ group), and each one

was subdivided into groups containing 10 replicates each. Then each group was sprayed with one of the three tested concentrations before sunset in the cotton field.

The treated cotton bolls were inspected 1, 7, 15 and 20 days after treatment. Percent infestation was recorded and the larvae classified according to the insect species (spiny, pink and American cotton bollworms).

Insect predators such as *Paederus alferii, Chrysopa vulgaris* and some beetles belonging to family Coccinellidae found on the treated cotton plants were recorded.

RESULTS AND DISCUSSION

Table (1) shows that percent infestation of cotton plants with *Aphis gossypii* and *Thrips tabaci* was highest during April and May months, while infestation rate gradually decreased during June, and reached its minimum during July and August. Infestation rate began to increase again at the beginning of September.

The appearance of *B. gossypiperda* started during the last week of April and gradually increased throughout the season of cotton plantation and reached its peak in September.

It is noticed that early plantation of cotton (March 10) was less subjected to infestation with aphids, whitefly and thrips, while late plantation cultivated on April 8 was highly subjected to infestation with *A. gossypii* (100%), *T. tabaci* (85%) throughout April. The present results suggested that *A. gossypii* and *B. gossypiperda* followed by *T. tabaci* were the most frequent insect pests attacking cotton plants from the seedling stage till harvesting of the cotton.

The statistical analysis of data showed insignificant difference in percent infestation with thrips, aphids and whitefly infesting cotton plants cultivated at different dates. Also, there was no significant difference recorded between percent infestation at each date of cultivation of cotton plants (Table 1).

Data in Table (1) show that, early plantation dates of cotton on March 10 are exposed to infestation reaching 17.60, 11.75 and 4.88% for *P. gossypiella, E. insulana* and *H. armigera*, respectively. While in the late plantation date on April 8, the infestation of cotton bolls reached 16.33, 13.21 and 6.32%, respectively for the aforementioned insect species. On the other hand, the cotton plants cultivated on March 25 were infested with *P. gossypiella, E. insulana* and *H. armigera* reaching 12.08, 13.25 and 6.93%, respectively.

Statistical analysis of data showed no significant difference between percentages of infestation of cotton plants with pink, spiny and American bollworms neither in each date of cultivation nor between percentages of insect and other insect in the same date of cotton cultivation.

Data given in Table (2) show that *Dodonaea viscosa* extract mixture caused a great decrease in infestation of cotton seedlings with *A. gossypii, B. gossypiperda* and *T. tabaci.* All tested concentrations used on the foliage of cotton seedlings showed complete repellent effect towards *B. tabaci* and *T. tabaci.* Meanwhile, the infestation with *A. gossypii* ranged between 2.0 and 3.6% after one day of treatment. It was noticed that the repellent effect of the extract gradually decreased with increasing post-treatment period. Infestation of seedlings with the insect pests reached 15, 9.0 and 30% for *B. gossypiperda, T. tabaci*

Table 1. Effect of plantation date on the infestation of cotton plant (var. Moubarak-93):

(A) with *Aphis gossypii, Thrips tabaci, Bemisia gossypiperida*

Plantation date	Insect pests	% Infestation of cotton plants with insect							
		Apr.	May	June	July	Aug.	Sept.	Mean	F-value
10 March	*T. tabaci*	70.0	36.0	6.0	1.5	1.5	7.3	20.38a	
	A. gossypii	97.0	40.0	10.0	3.5	4.0	45.7	33.37a	0.247 N.S
	B. gossypiperda	1.0	3.0	5.0	15.0	48.5	81.0	25.58a	
25 March	*T. tabaci*	82.0	63.0	13.0	4.0	1.0	4.4	27.90a	
	A. gossypii	100	60.0	11.0	3.0	7.0	57.3	39.72a	0.343 N.S
	B. gossypiperda	2.0	2.0	3.0	7.5	40.5	83.3	23.05a	
8 April	*T. tabaci*	85.0	65.0	17.0	5.0	1.5	2.5	29.33a	
	A. gossypii	100	90.0	15.0	5.0	10.0	58.7	46.45a	0.636 N.S
	B. gossypiperda	1.0	3.0	7.0	12.5	37.0	80.0	23.42a	
F-value	*T. tabaci*								0.125 NS
	A. gossypii								0.167 NS
	B. gossypiperda								0.011 NS

(B) With *Pectenophora gossypiella, Erias insulana* and *Helicoverpa armigera*

Plantation date	Insect pests	% Infestation of cotton plants with insect							
		Apr.	May	June	July	Aug.	Sept.	Mean	F-value
10 March	*P. gossypiella*	0.0	0.0	4.0	12.5	25.0	64.1	17.60a	
	E. insulana	0.0	0.0	2.0	5.5	16.0	47.0	11.75a	0.758 N.S
	H. arimigera	0.0	0.0	6.0	10.5	8.5	4.3	4.88a	
25 March	*P. gossypiella*	0.0	0.0	2.0	4.0	13.5	53.4	12.08a	
	E. insulana	0.0	0.0	0.0	3.0	21.8	54.7	13.25a	0.208 N.S
	H. arimigera	0.0	0.0	5.0	9.0	7.0	20.6	6.93a	
8 April	*P. gossypiella*	0.0	0.0	1.0	9.7	14.2	73.2	16.33a	
	E. insulana	0.0	0.0	0.0	3.0	15.0	61.3	13.21a	0.331 N.S
	H. arimigera	0.0	0.0	7.0	11.0	6.5	13.4	6.32a	
F-value	*P. gossypiella*								0.081 N.S
	E. insulana								0.009 N.S
	H. arimigera								0.185 N.S

(A) Insects infesting cotton plants
(B) Insects infesting bolls of cotton
N.S = Not significant

Table 2. Repellent effect of *Dodonaea viscosa* plant extract (mixture#) on *T. tabaci, A. gossypii* and *B. gossypiperda* insects infesting cotton seedlings, in field experiments

(%) Conc.	% Infested plants Pre-treatment	% infested plants with *B. gossypiperda* post-treatment (day)				
		1	7	15	20	Mean
1.0	70.0	0	2.0	7.0	15.0	6.0b
0.5	79.0	0	2.5	9.0	28.0	9.9b
0.25	80.0	0	4.0	11.0	26.0	10.3b
Control	70.0	78.0	82.0	89.0	100	87.3a
F-value						57.670**
L.S.D.						15.95
(%) Conc.	% Infested plants Pre-treatment	% infested plants with *T. tabaci* post-treatment (day)				
		1	7	15	20	Mean
1.0	40.0	0	5.0	11.0	20.0	9.0b
0.5	60.0	0	9.0	15.0	26.0	12.5b
0.25	55.0	0	11.0	20.0	34.0	16.3b
Control	50.0	56.0	60.0	76.0	82.0	68.5a
F-value						22.763**
L.S.D.						18.16
(%) Conc.	% Infested plants Pre-treatment	% infested plants with *A. gossypii* post-treatment (day)				
		1	7	15	20	Mean
1.0	80.0	2.0	10.0	15.0	30.0	14.3b
0.5	85.0	2.5	14.0	16.0	30.0	15.6b
0.25	83.0	3.6	14.0	16.0	33.0	16.7b
Control	80.0	80.0	85.0	85.0	91.0	85.0a
F-value						44.787**
L.S.D.						16.06

= Mmixture of water extract of *D. viscosa* plant + Kerosine + Tween 90.
** = Highly significant.
NS = Not significant.

Table 3. Repellent effect of *Dodonaea viscosa* plant extract (mixture#) on the pink bollworm, *P. gossypiella*, the spiny bollworm *E. insulana* and the American bollworm *H. armigera*

(%) Conc.	% Infested plants Pre-treatment	% infested plants with *B. gossypiperda* post-treatment (day)				
		1	7	15	20	Mean
10	10.0	0.0	2.0	4.0	8.0	3.5b
15	11.0	0.0	1.0	3.0	6.0	2.5b
25	10.6	0.0	0.0	2.0	5.0	1.8b
Control	0	10.0	10.5	11.0	13.0	11.1a
F-value						11.550**
L.S.D.						3.93
(%) Conc.	% Infested plants Pre-treatment	% infested plants with *T. tabaci* post-treatment (day)				
		1	7	15	20	Mean
10	12.0	0	3.0	4.0	9.0	4.0b
15	11.0	0	1.0	5.0	7.0	3.3b
25	12.0	0	2.0	3.0	5.0	2.5b
Control	0	10.0	10.0	13.0	18.0	12.8a
F-value						8.437**
L.S.D.						5.08
(%) Conc.	% Infested plants Pre-treatment	% infested plants with *A. gossypii* post-treatment (day)				
		1	7	15	20	Mean
10	5.0	0	1.0	6.0	10.0	4.3b
15	6.0	0	2.0	7.1	8.0	4.3b
25	6.0	0	2.0	5.0	5.0	3.0b
Control	0	5.0	5.0	8.0	11.0	7.3b
F-value						1.024 NS
L.S.D.						---

= Mmixture of water extract of *D. viscosa* plant + Kerosine + Tween 90.
** = Highly significant.
NS = Not significant.

Table 4. Effect of *Dodonia viscosa* extract on *Paederus alferii, Chrysopa vulgaris* and coccinellids under field conditions

Beneficial Insect	Average number of insects pre-treatment/sweep	Average number of insects/sweep throughout 10 days post-treatment at different concentrations (%)			
		1	0.5	0.25	Control
P. alferii	3.0	3.0	2.9	3.5	3.0
C. vulgaris	4.0	2.9	4.0	3.0	4.0
Coccinella sp.	4.0	4.5	3.6	5.0	5.0

and *A. gossypii*, respectively 20 days after treatment with 1.0% concentration, while infestation rate reached 26, 34 and 33% for the respective mentioned insect species, 20 days after of spraying with 0.25% concentration of the extract.

Natarajan *et al* (1991) in India found that the natural products fish oil, rosin soap, neem oil and mineral oil controlled *B. gossypiperda*, while fish oil rosin soap was also effective against thrips and aphids.

The present results show that 1.0% extract mixture was more effective against the tested insect pests than other concentrations. The percent infestation reached 6.0, 9.0 and 14.3% with *B. gossypiperda*, *T. tabaci* and *A. gossypii*, respectively, meanwhile the infestation was 10.3, 16.3 and 16.7% with *B. gossypiperda*, *T. tabaci* and *A. gossypii*, respectively 20 days after treatment with the concentration of 0.25% compared to 87.3, 68.5 and 85.0% for the respective mentioned insect species on untreated plants.

Highly significant differences were found between mean percentages of infestation of treated and untreated cotton seedlings infested with whitefly, thrips and aphids.

In the available literature, Ali and **Rodina (2002)** stated that the petroleum ether extracts of *Anagallis arvensis* (shoots) and the ethanol extracts of *Withania somnifera* (seeds) caused the highest toxicity to *Aphis gossypii* Glov. under laboratory conditions.

Data in Table (3) show that the different concentrations of *D. viscosa* extract mixture caused high repellent effect towards cotton bollworms (*P. gossypiella*, *E. insulana* and *H. armigera*). Percent infestation reached Zero percent after one day of treatment. However, 25.0% of the mixture extract was the most efficient throughout 15 days post treatment of cotton bolls, where the infestation reached 1.8, 2.5 and 3% for *P. gossypiella*, *E. insulana* and *H. armigera*, compared to untreated cotton bolls with percentages infestation of 11.1, 12.8 and 7.3%, respectively.

The statistical analysis showed highly significant differences between percentages of insect infestation of treated and untreated cotton bolls infested with pink bollworm and spiny bollworm. No significant difference was recorded between infestation percentages of treated and untreated cotton bolls infested with American bollworm.

As shown in Table (4), the application of *D. viscosa* plant extract mixture did not affect the activity and/or the abundance of insect predators such as *Coccinella undecimpunctata, Paederus alferii* and *Chrysoperla vulgaris*.

REFERENCES

Ali, I.H.H. and A.H. Rodina (2002). Toxicity of certain weed extracts and their combinations with aphicides against *Aphis gossypii* Glov. ***Arab. Universities J. Agric. Sci. 10(3): 1105–1113.***

Mann, G.S.; G.S. Dhaliwal and A.K. Dhawan (2001). Field efficiency of neem based insecticides against white fly and their impact on insect pest complex of cotton. ***Pestc. Res. J. (India), 13(1): 79-85.***

Mogahed, M.I. (1998). Impact of yellow sticky traps and *Dodonaea viscosa* extract on the bean leaf miner fly, *Liriomyza congesta* (Diptera:Agromyzidae) infesting the broad bean and its effect on the yield. ***J. Egypt. Ger. Soc. Zool. 27(E), Entomol., : 169-185.***

Mogahed, M.I. and A.A. Abbas (1998). The role of bio-pesticides in controlling the black cutworm *Agrotis ipsilon* (Hunagel) under laboratory and field conditions. ***J. Egypt. Ger. Soc. Zool. 27 (E), Entomol., : 153-167.***

Natarajan, K.; V.T. Sundaramurthy and P. Chidambaram (1991). Usefulness of fish oil rosin soap in the management of whitefly and other sap feeding insects on cotton. ***Entomon. (India) 16(3): 229-232.***

Wang, Y.D.; P. Gao; Y. Zheng and S.G. Liu (2002). The toxicities of the extracts from *Eupatorium adenophorim* against *Aphis gossypii* and their aphid killing mechanism. ***Acta Phytophyl. Sinica, 29(4): 337-340.***

مجلة حوليات العلوم الزراعية ، كلية الزراعة ، جامعة عين شمس ، القاهرة ، م٥٠ ، ع(٢)، ٧٣٩-٧٤٧ ، ٢٠٠٥

فعالية مستخلص نبات الدودنيا ضد بعض الآفات الحشرية التى تصيب نباتات القطن تحت ظروف الحقل

[٥١]

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١- قسم آفات ووقاية النبات - المركز القومى للبحوث - الدقى - القاهرة - مصر

أظهرت الدراسة الحالية أن حشرات من القطن والذبابة البيضاء تحتل مركز الصدارة تليها آفة التربس فى مهاجمة نباتات القطن (صنف مبارك ٩٣) اعتبارا من طور البادرة وحتى نهاية موسم القطن، وأن نباتات القطن المنزرعة مبكرا (١٠ مارس) قد تعرضت لأقل نسبة مئوية من الإصابة بآفات من القطن، ثم الذبابة البيضاء ثم التربس - بينما تعرضت نباتات القطن المنزرعة متأخرا (٨ أبريل) للإصابة بالآفات الحشرية المذكورة بنسب مئوية عالية.

وقد أوضحت التحاليل الإحصائية للنتائج المتحصل عليها أن مواعيد الزراعة ليس لها تأثيرا معنويا على النسب المئوية لإصابة بادرات القطن بالمن والتربس والذبابة البيضاء. كما لم يتضح وجود تأثيرا معنويا لمواعيد الزراعة المختبرة على النسب المئوية لإصابة لوز القطن بديدان اللوز القرنفلية والأمريكية والشوكية.

وتوضح النتائج الحالية أن استخدام مستخلص نبات الدودونيا المخلوط بالكيروسين قد سبب انخفاضا شديدا ومعنويا فى نسب إصابة بادرات القطن بآفات من القطن والذبابة البيضاء والتربس، وذلك عند مقارنتها بالنباتات غير المعاملة (ضابط التجربة).

كما أوضحت نتائج التحليل الإحصائي وجود فرق معنوى بين نسب إصابة لوز القطن فى النباتات غير المعاملة (ضابط التجربة) بديدان اللوز القرنفلية والشوكية وبين لوز القطن فى النباتات المعاملة بمستخلص نبات الدودنيا المخلوط بالزيت المعدنى (الكيروسين). فى حين أنه لا يوجد فرق معنوى فى حالة الإصابة بدودة اللوز الأمريكية التى تهاجم لوز القطن المعامل وغير المعامل، مما يبين أن لمستخلص نبات الدودنيا المختبر كفاءة عالية فى طرد الآفات الحشرية التى تهاجم نبات القطن. كما ثبت فعالية مستخلص نبات الدودنيا المختبر فى طرد فراشات ديدان اللوز القرنفلية والشوكية مما أدى إلى انخفاض شديد فى النسبة المئوية لإصابة لوز القطن المعامل لمدة ١٥ يوما تقريبا- لذا فإن الدراسة الحالية تقترح رش لوز القطن بمستخلص نبات الدودنيا المخلوط بالكيروسين كل ١٥ يوما لحماية لوز القطن ضد الإصابة بدودتى اللوز القرنفلية والشوكية تحت ظروف الحقل.

تحكيم: أ.د أحمد على جمعه أ.د حمزة ثابت فرغلى