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Efficacy of certain insecticides and biocides against the tomato leafminer, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) at Assiut Governorate

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Abstract:

The tomato leafminer, *Tuta absoluta* (Meyrick), is one of the key pests of tomato. Chemical control has been the main method of controlling it. However, reduced efficacy of some of the recommended insecticides has been observed. An experiment was conducted at Manfalout district Assiut Governorate during two successive tomato seasons (2012 & 2013) to evaluate the efficacy of different insecticides for the control of the tomato leafminer, *T. absoluta* on tomato. Eight treatments (five insecticides + control) in randomized complete block design were oriented. Five insecticides Demeron 10% Ec, Avaunt 15% EC, Coragen 20% SC, Proclim 5% SG, Radiant 12% SC, and two biocides' namely; Dipel 65% DF and Mycotal 52% WG were applied. All the insecticides were significantly better than untreated check in reducing pest population after applications. Coragen 20% Sc proved to be the best followed by Dipel 6.5% DF and Radiant 12% Sc.

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Introduction:

Tomato crop is the first vegetable crop in Egypt, with an area of 208.07 thousand feddan and an average yield of 3703.40 thousand tons (Anynomus, 2012). Seventy per cent of the production destination is for consumption in nature and the rest is industrialized (Gomez Riera, 1992). Tomato produced under greenhouses as well as in outdoor areas for fresh consumption in nature brings the highest gross financial return to farmers (Stoppani and Rodriguez, 1992).

The tomato leafminer, *T. absoluta* is a neotropical oligophagous insect, which attacks solanaceous crops. Since the 1960s it has become one of the key pests of tomato crops in many countries (Souza *et al.* 1983, Larrain 1986, Lietti, *et al*, 2005). While it was reported in Europe at the end of 2006 on tomato crop in Spain, it has spread to neighboring European and Mediterranean countries with alarming speed. Egypt among many of North African countries reported as spot of this pest infestation (Bloem and Spaltenstein, 2011). Larvae of *T. absoluta* attack leaves, buds, stem, flowers, cloys and tomato fruit. Both yield and fruit quality can be significantly reduced by direct feeding of larvae, and subsequently by secondary pathogens entering the mines causing fruit rot. Severely attacked tomato losses their commercial value (Robredo-Junco and Cardenoso-Herrero, 2008).

Chemical methods have been the most common control measured used by growers. However, the indiscriminate use of insecticides has led adverse effects, such as the selection of resistance biotypes, causing growers to use ever increasing dosages or repeated application at short time that obtained less satisfactory results over time (Siqueira *et al*, 2000). The newer insecticide classes have provided good activity against this pest (Irac, 2009a). Alternation, sequence or rotation of compounds with different modes of action, usually provides a sustainable and effective approach to managing insecticide resistance (Irac, 2009b).

The objective of the present work was to evaluate the efficacy of some pesticides (insecticides and biocides) against the tomato leafminer, *T. absoluta* on tomato under open field conditions.

Materials and Methods:

The following experiments were conducted during two successive of tomato seasons (2012 and 2013) at the field growing with tomato at Manfalout district Assiut governorate. The experimental area was half of feddan (about 2200 m^2) divided into plots (175 m^2 / each). This area was cultivated by the tomato cultivar Super-Jakal during March in a randomized complete block design. Regular conventional agricultural practices were performed.

The tomato crop was carefully inspected at weekly interval to monitor the tomato leafminer population and insecticides were administered. Five compounds insecticides as well as two compounds biocides were used, as shown in Table (1). Four replicates of tomato plants Super-Jakal were used for each compound in addition to the non sprayed plots (control).

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Table (1): Trade name, common name and application rate of the tested compounds.

Trade name	Common name	Chemical group	Application rate
1-Demeron 10% EC	Hexaflumuron	Benzoylureas	100 ml/100 L
2-Avaynt15% EC	Indoxacarb	Indoxacarb	25 ml/100 L
3- Coragen 20% SC	Cholorantraniliprole	Indoxacarb	30 ml/100 L
4- Proclim 5% SG	Emamectin benzoate	Avermectins	60 gm/ 100 L
5- Radiant 12% SC	Spinetoram	Spinosyns	50 ml / 100 L
6- Mycotal 52% WG	Mycotal	*Lecanicillium muscurium*	250 gm / 100L
7- Dipel 6.5% DF	*B. t.* var. kurstaki		200 gm/100 L

Samples of 10 leaves / replicate were taken and kept in polyethylene bags until examined in the laboratory by using stereomicroscope. Samples were taken and examined before spray and consequently after 3, 5, 7 and 10 days after treatments. Numbers of alive larvae were counted and recorded.

Collected data were analyzed statistically for analysis of variance to determine the significant difference among the treatments. Reduction (%) was calculated according Henderson and Tilton (1955).

Results and Discussion:

Field experiments were conducted to evaluate five insecticides, i.e. Demeron 10% EC, Avaunt 15% EC, Coragen 20% SC, Proclim 5% SG, Radiant 12% SC as well as two biocides namely: Mycotal 52% WG and Dipel 6.5% DF against *T. absoluta* larvae on tomato plants during 2012 and 2013 seasons. The tested insecticides were applied one time in two seasons.

Data in Tables (2 & 3) show the larvicidal action of the tested insecticides. It is obvious that the number of alive larvae / leaf was significantly decreased after insecticides application. Counting the surviving larvae may be more accurate method. Data indicated that all the tested insecticides had significantly affected the insect population at larval stage.

During 2012, the results in Table 2 show mean number of the tomato leafminer larvae / leaf and their respective percent mortality caused by insecticides after 3, 5, 7 and 10 days intervals. All the evaluated insecticides were significantly better than the control plots. After 3-days of spray, the percentage reductions were 72.41, 80.73, 65.31, 65.51, 55.17, 67.24 and 49.88% mortality. After 5-days, percent mortalities were 71.79, 79.94, 71.34, 76.92, 82.05, 81.05 and 74.21% and were significantly better than control. After 7 and 10-days the highest percent mortality was recorded for Coragen 20% SC and Proclim 5% SG while lowest percent mortality was observed again for Demeron 10% EC and Avaunt 15% EC.

During 2013, the results in Table (3) indicated that the mean number larvae of the pest per leaf and percent mortality caused by insecticides after 3, 5, 7 and 10-days intervals respectively were quite effective. All the insecticides evaluated against the tomato leaf miner on tomato crop were significantly better than the control plots. The highest percent mortality was recorded for Coragen (82.45 %) followed by Dipel 6.5% DF (81.49 %) and lowest value of (71.52 %) was shown by Demeron 10% Ec, and Mycotal 52% WG (71.98%).

In general, regardless of the seasons the highest percent reduction were recorded for Coragen 20% SC, Dipel 10% Ec, and Radiant 12% SC while the lowest percent mortality was recorded for Mycotal 52% WG and Demeron 10% Ec.

The results obtained in this study are quite in conformity with the findings of previous workers who used synthetic insecticides for the management of the tomato leafminer in different parts of the world and got a considerable knock down effect (Gontijo *et al*., 2013, Hanafy and El-Sayed, 2013 and Khodary, 2013)

In general, it can state that Coragen 20% SC at 30 ml/100 L have given best results than all the other pesticides. Therefore it can be recommended to use against the tomato leafminer. Also, Tomato plants should be regularly inspected for the tomato leaf miner attack and if the number increased to it should be sprayed with the recommended insecticide at the mentioned dose.

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Table (2): Mean number of *T .absouluta* larvae per tomato leaf and percent reduction after spray at various intervals at Assiut, 2012.

Insecticides	Mean number of *T. absouluta* larvae / leaf and percent reduction									General reduction %
	Pre	3-days		5-days		7-days		10-days		
		Mean number	% reduction	Mean number	% reduction	Mean number	% reduction	Mean number	% reduction	
Demeron 10% EC	0.95	0.40	72.41	0.55	71.79	0.45	80.85	0.35	89.39	78.61
Avaunt 15% EC	0.85	0.45	65.31	0.50	71.34	0.35	83.35	0.35	88.15	77.04
Coragen 20% SC	0.95	0.50	65.51	0.45	76.92	0.15	93.62	0.05	98.98	83.64
Proclim 5% SG	0.95	0.65	55.17	0.35	82.05	0.15	93.61	0.10	96.97	81.95
Radiant 12% SC	0.90	0.45	67.24	0.35	81.05	0.25	88.77	0.10	96.80	83.47
Mycotal 52% WG	0.85	0.65	49.88	0.45	74.21	0.25	88.11	0.10	96.61	77.21
Dipel 6.5% DF	0.85	0.25	80.73	0.35	79.94	0.25	88.11	0.45	84.75	83.38
Control	0.95	1.45	----	1.95	----	2.35	----	3.30	----	----

Table (3): Mean number of *T. absouluta* larvae per tomato leaf and percent reduction after spray at various intervals at Assiut, 2013.

Insecticides	Mean number of *T.absouluta* larvae / leaf and percent reduction									General reduction %
	Pre	3-days		5-days		7-days		10-days		
		Mean number	% reduction	Mean number	% reduction	Mean number	% reduction	Mean number	% reduction	
Demeron 10% EC	0.30	0.25	68.39	0.30	66.67	0.25	74.54	0.25	76.49	71.52
Avaunt 15% EC	0.43	0.35	68.76	0.35	72.55	0.25	82.03	0.10	93.36	79.17
Coragen 20% SC	0.58	0.65	57.12	0.20	88.41	0.25	86.72	0.05	97.55	82.45
Proclim 5% Sc	0.50	0.75	43.10	0.45	70.00	0.25	84.72	0.15	91.54	72.34
Radiant 12% SG	0.40	0.40	62.07	0.30	75.00	0.15	88.54	0.10	92.95	79.64
Mycotal 52% WG	0.60	1.05	33.62	0.60	66.67	0.15	92.36	0.10	95.29	71.98
Dipel 6.5% DF	0.95	0.89	64.46	0.60	78.94	0.45	85.53	0.10	97.03	81.49
Control	0.55	1.45	----	1.65	----	1.80	----	1.95	----	----

فعالية مبيدات حشرية وحيوية مختلفة ضد حشرة صانعة أنفاق الطماطم *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) باسيوط

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الملخص:

تعتبر حشرة صانعة أنفاق الطماطم واحدة من أهم الآفات الحشرية التي تصيب نباتات الطماطم. يعتبر استخدام المبيدات الحشرية الطريقة الرئيسية لمكافحة هذه الآفة على الرغم من قلة فعالية معظم المبيدات الحشرية المستخدمة.

أجريت الدراسة الحالية بأسيوط خلال موسمين من مواسم زراعة الطماطم (٢٠١٢، ٢٠١٣) وذلك لتقييم فعالية سبعة مبيدات حشرية ضد صانعة إنفاق الطماطم تحت الظروف الحقلية. استخدم في هذه الدراسة خمسة مبيدات حشرية ومبيدين حيويين بالإضافة إلى معاملة ثامنة للمقارنة في تصميم قطاعات كاملة العشوائية. المبيدات المستخدمة هي:

Demeron 10% EC, Avaunt 15% EC, Coragen 20% SC, Proclim 5% SG, Radiant 12% SC, and two biocides' namely; Dipel 6.5% DF and My-cotal 52% WG.

اتضح من الدراسة أن جميع المركبات المستخدمة كان لها فعالية في خفض التعداد بالمقارنة بالكنترول بدون استخدام مبيدات.

أظهرت النتائج أيضا أن كل من Coragen 20% يليه Dipel 6.5% DF ، Radiant 12% من أهم المبيدات التي يمكن استخدامها في مكافحة الآفة في حقول الطماطم.