

EFFECT OF EXTRACT AND OIL OF SOME AROMATIC PLANTS ON THE TWO PARASITOIDS *Eretmocerus mundus* (Mercet) and *Encarsia lutea* (Masi) OF The Whitefly *B. tabaci* (Gennadius)

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ABSTRACT

The efficacy of extract and oil of some aromatic plants on the two parasitoids of *B. tabaci* infested kidney bean plants at Kafr El-Sheikh were determined.

The extracts of the hot-pepper, sweet basil and geranium augmented the parasitism percentage of the parasitoid *Eretmocerus mundus*, 82.80, 81.80 and 80.47%, respectively, where it was 22.48 and 48.06% from the Actellic insecticide treatment and the untreated one, respectively, during 2006 season. This parameter for parasitoid *Encarsia lutea* was 16.16, 15.51 and 13.73% on sweet basil, geranium and spearmint treatments, respectively, comparable by 7.07 and 7.47 on the insecticide and the control. Similar results were obtained during season 2007.

However, on the same plant host, spraying oils of sweet basil, geranium, hot pepper and spearmint increased parasitism percentage of *Er. mundus* more than 70% during the two seasons of study. Similar results were obtained with parasitoid *En lutea* during the two seasons of study 2006 and 2007.

Results showed decreasing effect on the number of *B. tabaci* nymphs and increasing one on the numbers of each parasitoid/sample on the kidney bean plants treated by either the extracts or the oils of these aromatic plants. So, spraying either extract, or the oils of these aromatic plants showed triple effects, which are avoidance the number of *B. tabaci* nymphs, augment the number of the two parasitoids of *B. tabaci* as well as the parasitism percentage

INTRODUCTION

The whitefly *Bemisia tabaci* (Gennadius) (Aleyrodidae: Homoptera) has increasingly become a serious pest of horticultural and agronomic crops; throughout warm regions of the world (Brown *et al.*, 1995; Abd El-Salam, 2000; Anon., 2000; Hemeida *et al.*, 2001; Radwan and Zidan, 2003 and Inbar and Gerling, 2008) and considered

key pest throughout the world in tropical and subtropical regions (Hilije, 2001). In addition, to cause mechanical damage, *B. tabaci* has been associated with several new plant disorders and dozens of new geminiviruses (Polston and Anderson, 1997). The demand for alternative pest control strategies is increasing. In order to further development the utilization of semiochemicals or mixing planting strategies is reinvestigated in pest management in polycultures. Volatile chemical compounds emitted from plant tissues are most likely originated to repel the attacking pest, and also serve as a secondary function as it attracts the parasitoids and predators in search of prey.

The objective of this work was to investigate the role of both plant extract and oil of the five aromatic plants sweet basil, geranium, spearmint, peppermint and hot-pepper, which diversified in the agroecosystem of northern Egypt.

MATERIALS AND METHOD

Extracts of the five aromatic plants; sweet basil *Ocimum basilicum* L.; geranium, *Pelargonium graveolens* L.; Spearmint, *Mentha spicata* L.; peppermint, *Mentha piperita* L. and hot-pepper, *Capsicum annuum* L. cv. long red coyenne were prepared according to Gerard Ezhilan *et al.* (1994), and the oils were done as reported by Momen *et al.* (2001).

Field experiment was conducted at the Experimental Farm of the Fac. of Agric., Kafrelsheikh Univ. from June 17th until October 23rd of the two seasons 2006 and 2007. An area of 3150 m² was divided into 48 plots (each about 65.62 m²) in randomized complete block design. Treatments of crude extracts; oils of the five aromatic plants and the Actellic insecticide were weekly applied from July 17th until October 23rd (15 times) by using Solomotor 20 liters to complete coverage treated plants and it was cleaned twice after each application by water and sodium carbonate.

Weekly sample was continued from July 17th until Oct. 23rd each sample consisted of 20 leaflets from *B. tabaci* infested kidney bean of each treatment. Selected samples were cut off, then put in labeled paper sacs and transferred to the laboratory where the sedentary *B. tabaci* nymphs were examined on the two leaf surfaces with the aid of a stereo-microscope and only live specimens were counted and recorded. Lower end of stalks of sampled leaflets were embedded in moistened cotton pieces and put in glass-tube cages (3 cm diameter, 20 cm long) covered by muslin tissues and fitted by rubber bands. These cages were daily observed for each parasitoid emergence. Parasitoid adults were acquired by an aspirator then identified and counted.

The insecticide (Actellic), pirimiphos methyl 50% commercial name Actellic, at a rate of 3.75 ml/L of water. Actellic insecticide was tested because it is usually used by the growers for controlling the whitefly.

RESULTS AND DISCUSSION

Aromatic plant extracts

In the 1st season, parasitism percentage of *Er. mundus* was the highest (82.80%) from hot-pepper treatment, followed by those treated by the extracts of sweet basil (81.80%), geranium (80.47%), spearmint (76.64%), peppermint (72.65%) and the lowest percentage (22.48% and 48.60%) were obtained from Actellic treatment and untreated plants respectively (Table 1). These results are similar to those of Hafez *et al.* (1979) who indicated that the two parasitoids *Er. mundus* and *Encarsia* sp. emerged throughout the year from *B. tabaci* infesting different host plants. *Er. mundus* was the most important parasitoid of *B. tabaci* in Egypt. Abd el-Kariem (1998) reported that the parasitoid *Er. mundus* has a high searching rate than *En. lutea*.

Parasitism % of *En. lutea* was the highest (16.16%) from sweet-basil treatment, followed by 15.51% from geranium; 13.73% from spearmint; 12.77% from hot-pepper; 10.16% from peppermint treatments, whereas, it was 7.07 and 7.47% from Actellic treatment and the untreated kidney bean plants, respectively (Table 1).

Total parasitism % of combined parasitoids was more than 90% from sweet basil, geranium, hot-pepper and spearmint. Similar results were obtained during the 2nd season 2007 (Table 1).

Total number of *B. tabaci* nymphs was clearly decreased, whereas, number of each parasitoid/sample was obviously increased on kidney bean plants treated by the extract of the five aromatic plants (Table 1).

Aromatic plant oils:

Results of spraying oil of the five aromatic plants and the Actellic insecticide indicated that, parasitism % of *Er. mundus* and *En. lutea* was generally increased on *B. tabaci* infesting kidney bean plants treated by the oil of the five aromatic plants during 2006 and 2007 seasons (Table 2). Parasitism % of *Er. mundus* ranged 77.50-68.29% and 79.10-69.05% during 2006 and 2007, respectively, where those of *En. lutea* were 15.25-9.44% and 14.97-9.75%, during the same periods, respectively. This parameter of the combined parasitoids was 92.75-77.73% and 94.07-78.80% during 2006 and 2007 seasons, respectively. High parasitism percentages were obtained from spraying sweet-basil oil followed by, geranium, spearmint, hot-pepper and peppermint oils (Table 2).

Table (1): Total number, parasitism percentage and mean number per sample of *Eretomcerus mundus* and *Encarsia lutea* singly and together, after spraying *B. tabaci* infesting kidney bean by five plant extracts and the Actellic insecticide at Kafr El-Sheikh during 2006 and 2007 seasons under natural conditions.

Treatments	Total no. of <i>B. tabaci</i> nymphs		<i>Er. mundus</i>	<i>En. lutea</i>	Two parasitoids
2006 season					
Sweet basil extract	8434	Total no. of parasitoid	6899	1363	8262
		Parasitism %	81.8 j	16.16 h	97.96 m
		Mean no. of parasitoid	459.93	90.87	55.80
Hot-pepper extract	8564	Total no. of parasitoid	7091	1094	8185
		Parasitism %	82.8 i	12.77 f	95.57 L
		Mean no. of parasitoid	472.73	72.93	545.67
Geranium extract	8261	Total no. of parasitoid	6648	1281	7929
		Parasitism %	80.47 j	15.51 f	95.98 L
		Mean no. of parasitoid	443.20	85.40	528.60
Spearmint extract	7799	Total no. of parasitoid	5977	1071	7048
		Parasitism %	76.64 h	13.73 e	90.37 j
		Mean no. of parasitoid	398.47	71.40	469.87
Pepper mint extract	7466	Total no. of parasitoid	5424	792	6216
		Parasitism %	72.65 e	10.61 b	83.26 g
		Mean no. of parasitoid	361.60	52.80	41.40
Actellic insecticide	8003	Total no. of parasitoid	1799	566	2365
		Parasitism %	22.48 a	7.07 a	29.55 a
		Mean no. of parasitoid	119.93	37.73	157.67
Untreated kidney bean	11374	Total no. of parasitoid	5466	850	6316
		Parasitism %	48.06 b	7.47 a	55.53 b
		Mean no. of parasitoid	364.40	56.67	421.07
2006 season					
Sweet basil extract	8434	Total no. of parasitoid	6983	1317	8300
		Parasitism %	82.73 i	15.60 g	98.33 m
		Mean no. of parasitoid	465.53	87.80	553.33
Hot-pepper extract	8564	Total no. of parasitoid	7165	1073	8238
		Parasitism %	83.25 j	12.47 e	95.72 L
		Mean no. of parasitoid	477.67	71.53	549.20
Geranium extract	8261	Total no. of parasitoid	6774	1251	8025
		Parasitism %	78.61 h	14.52 f	93.13 L
		Mean no. of parasitoid	451.60	83.40	535.00
Spearmint extract	7799	Total no. of parasitoid	6329	1135	7464
		Parasitism %	77.81 g	13.95 e	91.76 g
		Mean no. of parasitoid	421.93	75.67	497.60
Pepper mint extract	7466	Total no. of parasitoid	5568	765	6333
		Parasitism %	73.95 e	10.16 b	84.11 i
		Mean no. of parasitoid	371.20	51.00	422.20
Actellic insecticide	8003	Total no. of parasitoid	1981	633	2614
		Parasitism %	23.69 a	7.57 a	31.26 a
		Mean no. of parasitoid	132.07	42.20	174.27
Untreated kidney bean	11374	Total no. of parasitoid	6245	852	7097
		Parasitism %	50.69 b	6.79 a	57.61 b
		Mean no. of parasitoid	416.33	56.80	473.13

Table (2): Total number, parasitism percentage and mean number per sample of *Eretomcerus mundus* and *Encarsia lutea* singly and together, after spraying *B. tabaci* infesting kidney bean by five plant oils and the Actellic insecticide at Kafr El-Sheikh during 2006 and 2007 seasons under natural conditions.

Treatments	Total no. of <i>B. tabaci</i> nymphs		<i>Er. mundus</i>	<i>En. lutea</i>	Two parasitoids
2006 season					
Sweet basil oil	8434	Total no. of parasitoid	6971	1372	8343
		Parasitism %	77.50 e	15.25 g	92.75 k
		Mean no. of parasitoid	464.73	91.47	556.20
Hot-pepper oil	8564	Total no. of parasitoid	6281	1169	7450
		Parasitism %	71.02 e	13.22 e	84.24 h
		Mean no. of parasitoid	418.73	77.93	496.67
Geranium oil	8261	Total no. of parasitoid	6345	1229	7574
		Parasitism %	75.45 g	14.62 e	90.07 j
		Mean no. of parasitoid	423.00	81.93	504.93
Spearmint oil	7799	Total no. of parasitoid	5833	1037	6870
		Parasitism %	71.80 e	12.77	84.57 g
		Mean no. of parasitoid	388.87	69.13	458.00
Pepper mint oil	7466	Total no. of parasitoid	5484	758	6242
		Parasitism %	68.29 e	9.44 b	77.73 f
		Mean no. of parasitoid	365.60	50.53	416.13
Actellic insecticide	8003	Total no. of parasitoid	1799	566	2365
		Parasitism %	22.48 a	7.07 a	29.55 a
		Mean no. of parasitoid	119.93	37.73	157.67
Untreated kidney bean	11374	Total no. of parasitoid	5466	850	6316
		Parasitism %	48.06 b	7.47 a	55.53 b
		Mean no. of parasitoid	364.40	56.67	421.07
2007 season					
Sweet basil oil	8434	Total no. of parasitoid	7007	1326	8333
		Parasitism %	70.10 h	14.97 f	94.07 k
		Mean no. of parasitoid	467.13	88.40	555.53
Hot-pepper oil	8564	Total no. of parasitoid	6769	958	7727
		Parasitism %	77.26 g	10.93 b	88.20 j
		Mean no. of parasitoid	451.27	63.87	155.13
Geranium oil	8261	Total no. of parasitoid	6388	1171	7559
		Parasitism %	76.46 g	14.01 e	90.47 j
		Mean no. of parasitoid	425.87	78.07	503.93
Spearmint oil	7799	Total no. of parasitoid	6205	1010	7215
		Parasitism %	75.76 f	12.33 d	88.09 g
		Mean no. of parasitoid	413.67	67.33	481.00
Pepper mint oil	7466	Total no. of parasitoid	5437	768	6205
		Parasitism %	69.05 g	9.75 b	78.80 f
		Mean no. of parasitoid	362.47	51.20	413.67
Actellic insecticide	8003	Total no. of parasitoid	1981	633	2614
		Parasitism %	23.69 a	7.57 a	31.26 a
		Mean no. of parasitoid	132.07	42.20	174.27
Untreated kidney bean	11374	Total no. of parasitoid	6245	852	7097
		Parasitism %	50.70 b	6.79 a	57.61 b
		Mean no. of parasitoid	416.33	56.80	473.13

As a results, numbers of *B. tabaci* nymphs infesting kidney bean plants that treated by the oil of the five aromatic plants showed evident decreases which vary owing to the species of the aromatic plant (Table 2). However, the decreases were greater than those treated by the extracts of these aromatic plants. Also, numbers of each parasitoids per sample were clearly increased.

Results showed that spraying oils of the tested aromatic plants clearly decreased numbers of *B. tabaci* nymphs, whereas the differences among mean values of parasitism % for the used treatments were, highly significant (Table 1 & 2).

Similar plant materials on the same insect pest were not encountered in the literature. Therefore, extracts and/or oils of one or more of these aromatic plant species were used with one or other insect pests (El-Sheikh *et al.*, 2006; Abbassy *et al.*, 1998; Abdel-Latif and Al-Moajel, 2004). Therefore, recent efforts have expanded research and utilization of habitat management techniques for conservation biological control of arthropods in various systems (Landis *et al.*, 2000). These efforts include planting annual or perennial hosts that are tolerant to desert soils and climate, easy to maintain, host moderate populations of *B. tabaci*, and are attractive to natural enemies (Naraujo, 2001).

Vinson (1999) mentioned that plants play a pivotal role in host selection, this suggestion was based on many earlier studies which showed that parasitoids in the fields would respond to plants (Vimon, 1975) or parasitoids were attracted to plant extracts or volatiles.

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تأثير المستخلصات النباتية والزيوت العطرية لخمسة نباتات عطرية على طفيليين
Eretmocerus mundus (Mercet) and *Encarsia lutea* (Masi) للذبابة
 البيضاء على نباتات الفاصوليا تحت ظروف الإصابة الطبيعية في منطقة كفر الشيخ

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 ** قسم وقاية النباتات - مركز البحوث الزراعية

عند رش المستخلصات النباتية لكلا من الشطة والريحان والعتر على نباتات
 الفاصوليا المصابة بحوريات الذبابة البيضاء أدى ذلك الى زيادة نسبة التطفل بطفيل
Er. mundus. حيث كانت ٨٢,٨٠ ، ٨١,٨٠ ، ٨٠,٤٧% على التوالي ، بينما كانت
 ٢٢,٤٨ ، ٤٨,٠٦% في معاملة المبيد الكيماوى الأكتيليك ونباتات الفاصوليا الغير
 معاملة على التوالي ، وذلك خلال موسم ٢٠٠٦م، بينما كانت نسبة التطفل بطفيل *En.*
lutea ١٦,١٦ ، ١٥,٥١ ، ١٣,٧٣% فى معاملات الريحان ، العتر ، النعناع البلدى
 على التوالي مقارنة بـ ٨,٠٧ ، ٧,٤٧% فى معاملة الأكتيليك ونباتات الفاصوليا الغير
 معاملة على التوالي وذلك أثناء موسم ٢٠٠٦م

كانت نسبة التطفل للطفيليين معا أكثر من ٩٠% فى معاملات الريحان والعتر
 والشطة والنعناع البلدى وكانت النتائج خلال موسم ٢٠٠٧م مماثلة لما سبق خلال
 موسم ٢٠٠٦. عند رش نباتات الفاصوليا المصابة بحوريات الذبابة البيضاء بالزيوت
 العطرية للنباتات العطرية (الريحان ، العتر ، الشطة ، النعناع البلدى) خلال موسمي
 الدراسة أدى ذلك إلى ارتفاع نسبة التطفل بطفيل *Er. mundus* أكثر من ٧٠% بينما
 كانت نسبة التطفل له ٢٢,٤٨ ، ٤٨,٠٦% خلال موسم ٢٠٠٦م و ٢٢,٠٩ ،
 ٥٠,٦٩% أثناء موسم ٢٠٠٧م فى معاملة الأكتيليك والفاصوليا الغير معاملة على
 التوالي. كانت نسبة التطفل بطفيل *En. lutea* فى نفس الاتجاه ومشابهة لطفيل *Er.*
mundus خلال موسمي الدراسى مع انخفاض تعداده ونشاطه عن الطفيل الأخر وذلك
 خلال موسمي الدراسة. أظهرت النتائج أن رش المستخلصات النباتية والزيوت لأى من
 النباتات العطرية على نباتات الفاصوليا المصابة بالذبابة البيضاء أدى الى زيادة تعداد
 كل طفيل على حدة عن ما فى معاملة الأكتيليك ونباتات الفاصوليا الغير معاملة. نجد
 أن الزيوت العطرية كان تأثيرها الإيجابى أقل من المستخلصات للنباتات العطرية.

عند رش مستخلصات وزيوت النباتات العطرية السابق ذكرها أدى ذلك إلى
 خفض تعداد حوريات الذبابة البيضاء وزيادة أعداد الطفيليين السابق ذكرهما وأيضا
 زيادة نسبة التطفل لكل طفيل على حدة أو الاثنين معا.