Journal of Plant Protection and Pathology

Journal homepage & Available online at: www.jppp.journals.ekb.eg

Ecological and Biological Aspects of Aphid Parasitoids on Navel Orange Trees in Egypt

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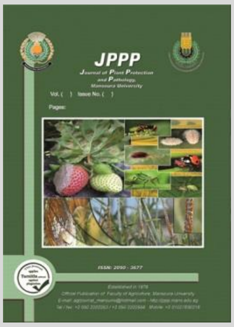

ABSTRACT

The current study aimed to estimate the seasonal abundance of aphid species and their associated parasitoids on navel orange trees across the two seasons of 2021 and 2022 and to evaluate the potential impact of *Aphidius matricariae* Haliday against *Aphis gossypii* (Glover) during the period extended from August 2022 to January 2023. The results showed that the major aphid species were *A. gossypii*, *Aphis citricola* (van der Goot), *Myzus persicae* (Sulzer), and *Aphis craccivora* Koch. Data also revealed that *A. matricariae*, *Trioxys* sp., and *Praon* sp. were recorded as primary parasitoids and *Charips* sp. as a hyperparasitoid parasitoid. The behavior of *A. matricariae* varied according to the different host densities, since increased host density led to increased stings and mummies, and decreased leaf arrival times and host arrival times. By rearing *A. matricariae* on *A. gossypii* for three successive generations, the sex ratio (females: males) was nearly 1: 1 in the first two generations, but males dominated in the third ones (2.83:1). The obtained results showed that the parasitoid *A. matricariae* was the most abundant and efficient species and could be included in future biocontrol programs against *A. gossypii*.

Keywords Aphid parasitoid, ecology, biology, navel orange

INTRODUCTION

Citrus is considered as an important fruit crop worldwide (Al-taha *et al*., 2012). In Egypt, citrus has strategic importance because it is an essential exporting crop. Like other plants, citrus is subjected to infestation with several species of insect pests. Literatures cleared that *Aphis gossypii* Glover, *Aphis craccivora* Koch, *Aphis spirocola* Putch, and *Myzus persicae* (Sulzer) were the most dominant insect species on citrus trees (Uygun and Satar, 2008; Satar *et al*., 2014). The available data on the population fluctuations of citrus aphids are partially few due to the difficulties of sampling (Laphchin *et al*., 1994). High levels of aphid infestation may reduce the market value of citrus fruits directly by sucking phloem sap and secreting honeydew which collects dust and encourages the growth of sooty mold (Kaneke 2007and Marroquin *et al*. 2004). Randomly applying conventional pesticides could result in residual toxicity, environmental damage, and unfavorable effects on creatures that aren't intended targets (Biological Control Task Force, 2005). To avoid any negative consequences of chemical control on the natural enemies, scientists must create a biological control program as part of the Integrated Pest Management (IPM) approach. (Satar *et al*., 2020).

Aphidius matricariae Haliday was one of the most dominant aphid parasitoids species (Hemidi and Laamari, 2020). It appeared to be a promising candidate as a biocontrol agent against *A. gossypii* in the IPM program strategy (Bouhachem, 2014).

Therefore, the objectives of this work are to provide an overview of the aphid species and their parasitoids on navel orange trees and to determine some biological and behavioral parameters of *A. matricariae* as a way to determine its potential effect against *A. gossypii*.

MATERIALS AND METHODS

1. Ecological studies

Survey and estimation of parasitism aphid parasitoids on navel orange trees.

The current investigation was carried out at Kafr Saqr district, Sharkia Governorate, Egypt, during the two successive seasons of 2021 and 2022 to assess the seasonal abundance of aphid species and their associated parasitoids. An experimental area of about two hectares were chosen. For the current investigation, four equally aged, sized, and shaped trees were selected at random. Ten leaves of varying sizes were selected from various sites, peripheral, inner zone, lower and middle sites of the tree, yielding a sample of forty infested leaves/samples. The samples were placed in paper bags and transported to the laboratory. Aphid nymphs and adults were counted directly This area received all the typical recommended agricultural practices without using chemical pesticides..

In each sample date, 50 aphid individuals were selected randomly and kept with leaves of orange in Petri - dish till the formation of mummies to estimate the parasitism rates. The mummified aphids were separated and kept in small glass tubes until adult parasitoids emerged. The successful emerged wasps were categorized and identified with the assistance of Prof. Dr. A. El-Heneidy, Biological Control Department. Agricultural Research Center. Giza, Egypt. The parasitism percentage was calculated according to formula of Ferrell and Stufkens (1990).

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DOI: 10.21608/jppp.2023.203345.1139

2.Biological studies

Life cycle of *A. matricariae* on *A. gossypii*

The laboratory culture of the cotton aphid, *A. gossypii* was kept under controlled conditions 20. 0°C ±1°C and 65 ±2RH%. during an experimental period extended from August 2022 to January 2023. Aphid were reared on immature, caged navel orange seedlings, or on young, detached leaves laid flat on the bottom of a clear plastic jar. The jar was inverted so that the aphids fed in a natural position on the underside of the leaf that was changed daily. The laboratory culture of *A. matricariae* began with mummies collected from the field samples. These mummified aphids were placed singly in small glass tubes and the emerged adults were provided with sugar solution until used. To assess the durations of various immature stages of the parasitoid, *A. matricariae*, it kept with its host, *A. gossypii*, for four hours . For the purpose of monitoring the development of the parasitoid, forty aphid nymphs were dissected every day.

Sex ratio:

A culture was established by three successive generations to calculate the sex ratio of *A. matricariae* adults reared on the third nymphal instar of *A. gossypii*. By dividing the total number of emerging females by the total number of emerged males found in field mummies, the sex ratio (female: male) was determined during the three successive generations of *A. matricariae*. The proportion of adults who successfully emerged was also estimated.

Effect of aphid density on parasitoid behavior

The parasitoid's behavior was observed and recorded for 30 minutes. During this period the time between the introduction and first contact of female with the whole food, leaf (leaf - arrival time) and host (host- arrival time), number of stings, and number of mummified aphids were determined. The experiment was replicate five times, each with a new parasitoid female.

Statistical analysis

One-way ANOVA was used to compare the biological characteristics of the parasitoid *A. matricariae* on *A. gossypii*, and Duncan's(1955) Multiple Range Test was used to separate the means (Cohrot Software, 2004).

RESULTS AND DISCUSSIONS

Results

1.Ecological studies

Survey and estimation of parasitism aphid parasitoids on the navel orange trees

The aphid species, *Aphis gossypii* (Glover), *Aphis citricola* (van der Goot), *Myzus persicae* (Sulzer), and *Aphis craccivora* Koch, all of which are members of the Homoptera, were observed on navel orange leaves. Total aphid species had three peaks of abundance in the first seasons which were during the third weeks of April and May and the second week of June (519, 632, and 545 individuals / 40 leaves). However, in the second season, one peak only was recorded (629 individuals/40 leaves) during the fourth week of April .

Four hymenopterous parasitoid species were recorded during the study, three of them were primary parasitoids, Aphidius matricariae, Trioxys sp., Praon sp., and one was a secondary parasitoid, Alloxysta (Charips) sp. The most prevalent aphid species on navel orange trees was A. gossypii, while the main parasitoid species was A. matricariae.

The relative occurrence of the parasitoids

In the first season, the primary parasitoid, *A. matricariae* was detected at a very high density (100%) during the fourth and third weeks of March. The corresponding temperature ranged from 17.07 to 20.71 °C. *A. matricariae* maintained a high density until the third week of April (45.45–66%). This average annual density of the parasitoid was 51.91% (Table 1). The same trend was observed in the second season, where *A. matricariae* accounted for 100% of all parasitoids from the second week of March through the end of March, making it the most common species. The temperatures at this time ranged from 16.67 to 17.28 °C and from 53.56 to 55.60 RH%. The high relative density of *A.matricariae* persisted (28.57 to 75.90 %). The average annual density of the parasitoid was 50.29% (Table 2).

Table 1. Parasitism rate of aphid species (*A. gossypii, A. citricola, M. persicae, A. craccivora*) on navel orange season 2021

Sample date	Total aphid species	Mummies	% Parasitim	Emerged parasitoid						Hyper parasitoid		Total	Total	
				A.matricariae		Trioxys sp.		Praon sp.		Charips sp.			Temp.	RH%
				No.	RD%	No.	RD%	No.	RD%	No.	RD%			
March,3rd	15	0	0	0	0	0	0	0	0	0	0	0	17.07	56.02
4th	42	2	4.76	1	100	0	0	0	0	0	0	1	18.01	54.36
April 1st	79	7	8.86	5	100	0	0	0	0	0	0	5	23.8	57.71
2nd	152	10	6.58	7	100	0	0	0	0	0	0	7	21.02	49.49
3rd	519	24	4.62	19	100	0	0	0	0	0	0	19	20.71	40.61
4th	335	29	8.66	13	59.09	6	27.27	3	13.64	0	0	22	21.2	54.82
May, 1st	454	43	9.47	19	51.35	10	27.03	8	21.62	0	0	37	25.31	62.12
2nd	491	69	14.05	40	65.57	12	19.67	9	14.75	0	0	61	28.8	60.39
3rd	632	83	13.13	49	66.22	13	17.57	8	10.82	4	5.41	74	27.8	56.41
4th	487	78	16.07	30	54.55	10	18.18	7	12.73	8	14.55	55	29.06	58.95
June,1st	453	62	13.69	28	52.83	12	22.64	8	15.09	5	9.43	53	30.13	53. 25
2nd	545	59	10.83	23	46.94	14	28.57	9	18.37	3	6.12	49	30.39	62.14
3rd	391	31	7.93	10	45.45	6	27.27	4	18.18	2	9.09	22	31.1	61.38
4th	403	20	4.96	8	47.06	5	29.41	2	11.76	2	11.76	17	28.5	58.59
July,1st	205	6	2.93	2	50.0	1	25.0	0	0	1	25.0	4	30.43	62.08
2nd	126	2	1.59	0	0	0	0	0	0	1	0	1	31.5	61.27
3rd	64	0	0	0	0	0	0	0	0	0	0	0	31.13	63.10
4th	33	0	0	0	0	0	0	0	0	0	0	0	30.8	61.08
Total	5426	525	128.12	254	986.27	89.0	242.61	58.0	136.96	26.0	81.36	427		
Mean	301.44 ± 49.26	29.17± 6.90	7.12± 1.21	14.40± 3.50	51.91± 7.76	4.94± 1.29	13.48± 2.94	3.22± 0.89	7.61± 1.93	1.44± 0.53	4.52± 1.07	23.72± 5.83		

. No.=Number RD%= Relative density

Table 2 Parasitism rate of aphid (A. gossypii, A.citricola, M. persicae, A. craccivora) on navel orange season 2022

Sample date	Total aphid species	Mummies	% Parasitim	Emerged parasitoid								Total	Total	
				A. matricariae		Trioxys sp.		Praon sp.		Charips sp.			Temp.	RH%
				No.	RD%	No.	RD%	No.	RD%	No.	RD%			
March,1st	35	0	0	0	0	0	0	0	0	0	0	0	18.85	57.82
2nd	57	3	5.26	2	100	0	0	0	0	0	0	2	16.67	53.56
3rd	105	8	7.62	5	100	0	0	0	0	0	0	5	18.48	52.2
4th	195	17	8.72	11	100	0	0	0	0	0	0	11	17.28	55.6
April,1st	390	47	12.05	26	66.67	13	33.33	0	0	0	0	39	21.02	58.4
2nd	423	68	16.08	36	70.59	9	17.65	6	11.76	0	0	51	20.71	47.49
3rd	427	63	14.75	31	56.37	20	36.36	4	7.27	0	0	55	22.2	49.62
4th	629	109	17.33	69	75.83	14	15.38	8	8.79	0	0	91	25.1	67.9
May, 1st	590	115	19.49	63	75.90	12	14.46	5	6.02	3	3.62	83	28.3	56.6
2nd	567	91	16.05	47	71.21	9	13.63	7	10.61	3	4.55	66	29.06	56.41
3rd	489	86	17.59	35	54.69	8	12.50	14	21.88	7	10.93	64	25.5	59.7
4th	598	82	13.71	29	52.73	7	12.73	10	18.18	9	16.36	55	30.7	59.5
June, 1st	371	46	12.39	11	30.56	6	16.67	9	25.0	10	27.77	36	28.92	58.3
2nd	282	30	10.63	9	39.13	5	21.74	5	21.74	4	17.39	23	30.13	63.3
3rd	215	19	8.84	5	33.33	2	13.34	6	40.0	2	13.33	15	30.4	60.5
4th	160	10	6.25	2	28.57	0	0	2	28.57	3	42.86	7	28.9	60.7
July, 1st	79	3	3.79	0	0	0	0	0	0	1	100	1	30.39	56.6
2nd	39	0	0	0	0	0	0	0	0	0	0	0	30.25	61.9
3rd	0	0	0	0	0	0	0	0	0	0	0	0	30.9	59.5
Total	5651		190.55	381.0	955.56	105	207.79	76.0	199.82	42	236.81	604		
Mean	297.4± 49.69		10.03± 1.44	20.05± 5.04	50.29± 7.89	5.53± 1.39	10.94± 2.62	4.00± 0.98	10.52± 2.78	2.21± 0.74	12.46± 5.55	31.79± 7.02		

. No.=Number RD%= Relative density

The primary parasitoid, *Trioxys* sp. began to appear in the fourth week of April by 27.27% (21.20 °C and 54.82% R.H.). The parasitoid density ranged from 17.57 % in the third week of May (27.80 °C and 56.41 R.H.%) to 29.41% in the fourth week of June (28.50 °C and 58.59 R.H.%). This average annual density was 13.48%. (Table 1). In the second season, *Trioxys* sp. initially appeared in the first week of April (2022, 33.33%). The parasitoid density ranged from 12.50 % by the fourth week of December (25.50 °C and 59.70 R.H.) to 36.36 % in the third week of April (22.20 °C and 49.62 R.H.). The average annual parasitoid's average density was 10.94% (Table 2).

The first occurrence of the primary parasitoid, *Praon* sp., was in the fourth week of April (13.64%) in 2021 season . The relative occurrence of the parasitoid ranged from 10.82% in the third week of May to 21.62% in the first week of May, with an annual average of 7.61% (Table 1). In the second season, *Praon* sp. appeared to debut with 11.76%. The relative occurrence of the parasitoid ranged from 6.02% in the first week of May to 40.00% in the third week of June with an annual average of 10.52% (Table2).

The hyper parasitoid, *Charips* sp. began to appear (5.41%) in the third week of May during the first season of the study. The first week of July had the highest parasitoid occurrence (25.00%). The average annual occurrence of the parasitoid was 4.52% in the first season (Table 1). The first occurrence of *Charips* sp. in the second season was on May 1st (3.62%). The first week of July showed the highest density of the parasitoid (100.0 %) with an annual average of 12.46% (Table 2).

Parasitism %:

In 2021 season, parasitism ranged from 1.59 to a maximum of 16.07% in the fourth week of May with an annual mean of 7.12%, (Table 1). In the second season (2022), it ranged from 3.79 to a maximum of 19.49% in the first week of May with an annual mean of 10.03 % (Table 2).

Relative densities of aphid parasitoids

As seen in Table 3, three main parasitoid species were recorded, and they could be arranged in descending order according to their general relative densities during the two study seasons as follows: *Aphidius matricariae* Haliday, *Trioxys* sp., *Praon* sp., and one hyperparasitoid, *Charips* sp. representing by 59.49, 20.84, 13.58, 6.09% and 63.08, 17.39, 12.58, 6.95% of the total parasitoids collected, consecutively.

Table 3 Relative densities of aphid parasitoids on navel orange trees in during two successive seasons.

Species	2021		2022	
	No.	RD%	No.	RD%
Primary parasitoids:				
1-Aphidius matricariae	254	59.49	381	63.08
2- Trioxys sp	89	20.84	105	17.39
3- Praon sp	58	13.58	76	12.58
Hyperparasitoids: Alloxysta (Charips) sp	26	6.09	42	6.95
Total	427	100	604	100

. No=Number RD%= Relative density

2.Biological studies

Life cycle of *A. matricariae* on *A. gossypii*

Results given in Table (4) show clearly that the average incubation period for egg stage was 2.85 ± 0.10 days.The larval and pupal stages lasted 5.67 ± 0.12 and 5.12 ± 0.24 days, respectively. Total developmental time for the parasitoid *A. matricariae* was 13.64 ± 0.38 days.

Table 4. Life cycle of *A. matricariae* reared on *A. gossypii* under laboratory condition

Period in days		Range	Mean ± Se
Egg		2 -3	2.85± 0.10
Larva		4 -7	5.67± 0.12b
Pupa		4 -6	5.12±0.24b
Life cycle (Egg – Adult)		12 -15	13.64±0.38a
Longevity	Female	4-6	5.09±0.11d
	Male	2 -4	3.04±0.10f
L.S.D 0.05			0.01967

The behavior of the parasitoid *A. matricariae* at varying host densities:

As shown in Table 5, the leaf-arrival and host-arrival times (host-searching time) are measures of the attractive potency of the semiochemicals emitted by food plants and hosts, respectively. Data also included that the arrival time of the leaf and the arrival time of the host decreased with increasing host density, reaching 6.68 minutes at 25 individuals (*A. gossypii*) and 0.76 minutes at 150 individuals. In addition, *A. gossypii*'s host arrival time also reduced with host density, lasting 7.26 minutes for 25 individuals and 1.24 minutes for 150 individuals. (*A. gossypii*).

Sex ratio In addition to three laboratory generations of *A. matricariae* , the sex ratio and proportion of individuals that emerged from mummies in the field were noted. With a sex ratio of 2.83 females to 1 male, the percentage of parasitoid emergence in the field was 80.56%. While in the lab, the percentage of adults emerging from host mummies in the first generation was 72.16% with a sex ratio of 1.17 female: 1 male and the percentage emerging from host mummies in the second generation was 65.32% with a sex ratio of 1.12 female: 1 male. Third-generation emergence rates from host mummies were 48.33%, with a male to female sex ratio of 0.9 (Table 6)

Table 5. Behavior of the parasitoid *A. matricariae* on navel orange trees at varying *A. gossypii* densities 20. 0°C ±1°C and 65 ±2RH%.

Host density	Leaf –arrival time (min.)	Host -arrival time (min.)	First sting time (min.)	No. of sting (oviposition)	No. of mummies
25	6.68 ± 0.26^{a}	7.26 ± 0.23^{a}	16.76 ± 0.28^{a}	8.2 ± 0.86^{d}	4.60 ± 0.71^{d}
50	4.99 ± 0.34^{b}	5.98 ± 0.18^{b}	14.65 ± 0.24^{b}	31.8 ± 2.15^{c}	9.60 ± 0.58^{c}
100	1.19 ± 0.16^{c}	2.80 ± 0.22^{c}	12.05 ± 0.22^{c}	52.00 ± 2.23^{b}	12.0 ± 0.51^{b}
150	0.76 ± 0.19^{c}	1.24 ± 0.10^{d}	6.35 ± 0.10^{b}	72.20 ± 1.56^{a}	15.80 ± 0.38^{a}
F. test	***	***	***	***	***
L.S.D.0.05	0.3822	1.4018	2.3554	19.8405	2.2580

Means followed by the same letter in a column are not significantly different at the 5% level of probability (Duncan's Multiple Range Test) .

Table 6. Sex ratio of *A. matricariae* and adults' emergence

Host aphid	Source parasitoid	Mummies	Adults emerged	%Emergence	Females	Males	Sex ratio (M: F)
A. gossypii	In the field	175.0 ± 14.45^{a}	141.0 ± 11.74^{a}	80.56 ± 5.20^{a}	95.33 ± 8.4^{a}	44.0 ± 3.47^{a}	$1: 2.83^{a}$
	First generation	120 ± 11.56^{b}	86.67 ± 7.09^{b}	72.16 ± 0.67^{b}	47.0 ± 6.09^{b}	39.67 ± 2.61^{ab}	$1: 1.17^{b}$
	Second generation	86.67 ± 8.83^{bc}	70.00 ± 6.02^{b}	65.32 ± 7.06^{c}	36.67 ± 3.29^{b}	33.33 ± 4.38^{b}	$1: 1.12^{b}$
	Third generation	61.67 ± 7.27^{c}	30.0 ± 4.36^{c}	48.33 ± 1.35^{d}	14.33 ± 2.41^{c}	16.0 ± 2.52^{c}	$1: 0.91^{c}$
L.S.D 0.05		19.989	25.991	6.152	10.296	3.097	0.0156

Means followed by the same letter in a column are not significantly different at the 5% level of probability (Duncan's Multiple Range Test)

Discussion

The previous investigation revealed that *A. gossypii, A. citricola, M. persicae,* and *A. craccivora* were the key aphid species on navel orange trees. These outcomes are consistent with those of Abo Kaf (2005), Ali (2009), Youssif (2015), Lebbal and Laamari (2016), Mohsen (2019), Kalaitzaki *et al.* (2019), and Youssif et al. (2021), who surveyed the main insect pests on navel trees and reported that the highest densities were obtained by *A gossypii, A.citricola, M. persicae,* and *A. craccivora.*

As displayed from the achieved results, three primary parasitoids; *A. matricariae*, *Trioxys* sp., and *Praon* sp., and a secondary parasitoid; Cynipidae: *Alloxysta* (*Charips*) sp., emerged from the mummified aphid. The present findings are in conformity with those of Bouhachem (2011**)**, who identified 16 species of natural enemies, including eight predatory species and eight parasitoids associated with citrus aphid on navel trees. The parasitoids included *A. matricariae*, *A. colemani, Ephedrus persicae* Froggatt, *L. fabarum*, L. *testaceipes*, *Praon volucre* (Haliday), *Trioxys angelicae* Haliday, and *D. rapae*. Also, Abo Kaf (2005) and Ali (2009) reported that citrus aphid-infested trees of navel oranges were attacked by the parasitoids *D. rapae*, *Aphidius* sp., and *Charips* sp. *Aphidius* sp., *Diaeretiella*, *Ephedrus*, *Lysiphlebus*, *Praon*, and *Binodoxys*) and the subfamily Aphelininae (Hymenoptera: Chalcidoidea, Aphelinidae), represented by just one species of the genus. And Hemidi and Laamari (2020**)** recorded 18 species of primary parasitoids collected from 22 species of aphids. And mentioned that *A. matricariae* and *L. testaceipes* were the most dominant species.The present research findings differed from those of Tomanović *et al.*(2009),who indicated that *Ephedrus* sp. was the major parasitoid on citrus aphid species on navel trees.

The above results showed that the abundance percentages of *A. matricariae*, *Trioxys* sp., *Praon* sp., and *Charips* sp. were 59.49, 20.84, 13.58, 6.09% and 63.08, 17.39, 12.58, 6.95% of the total parasitoids during the first and the second seasons, subsequently. These results are in harmony with those of Ali (2009**)**, who mentioned that the parasitoids *D. rapae*, *Aphidius* sp., and *Charips* sp. were observed on navel orange trees that are afflicted with citrus aphids. And that citrus aphid infestation of navel oranges by *D. rapae* began in the first week of May and peaked in June (5.1%).

Based on obtained results, *A. matricariae* reared on *A. gossypii* completed its development successfully, and the total developmental period was 13.64 ± 0.38 days at 20.00 ± 1°C and 65± 2 RH%. Our results are in partial consonance with those of Saleh (2000), who demonstrated that when reared on *S. avenae*, the total developmental period of *Aphidius* sp. lasted about 13.85 + 0.29 days (at 21.7°C). On the other hand, Stary (1970**)** noted that a variety of elements, including temperature, humidity, feeding, and the presence or absence of hosts, had an impact on the adult life span of parasitoids.

It was shown that when host density increased both the leaf arrival time and the host arrival time reduced, but that stinging and mummies increased. According to Brown et al. (1970), the increased concentrations of kairomones that promote parasitoid activity may be to blame, or the increased surface area of interaction between the hosts, according to Kumar (1988) and Saleh (2008).

The sex ratio was roughly 1 female to 1 male during the first and second generations of the parasitoid *A. matricariae's* three laboratory generations on *A. gossypii*, but males was dominant during the third generation. These results broadly concur with those of Saleh et al. (2009), who reared the parasitoid *D. rapae* on aphids for five successive generations and discovered that the first three generations displayed a roughly 1:1 sex ratio and the fourth and fifth generations were dominated by males.

CONCLUSION

Obtained results offered valuable knowledge on certain ecological and biological attributes of aphid parasitoids on navel orange trees, which can be beneficial in providing basic information on the utilization of parasitoids in the biocontrol program of aphids. By rearing *A. matricariae* on *A. gossypii*, it showed a good parasitism potential. Therefore, it can be concluded that the aphid parasitoid *Aphidius matricariae* could be an effective biocontrol agent against the aphid *Aphis* gossypii.

ACKNOWLEDGEMENT

The authors are thankful to Prof. Dr. A. El-Heneidy, Biological Control Department. Agricultural Research Center, Dokki, Giza, Egypt for his assistance in classification and identification of the parasitoid species in this investigation.

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دراسة الجوانب الإيكولوجية والبيولوجية وإمكانية التطفل لطفيليات المن على أشجار برتقال أبوسره في مصر

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الملخص

اجريت تلك الدراسة بهدف تقييم بعض الجوانب الإيكولوجيه و البيولوجيه لطفيليات المن علي أشجار البرتقال بسره خلال موسمى 2021 و 2022 و كذلك لتقييم التأثير المحتمل لطفيل Aphidius matricariae علي حشرات Aphis gossypii و قد أوضحت النتائج أن الأنواع الرئيسية التي تصيب أشجار البرتقال بسره هي أربعة أنواع من المن Aphis gossypii, A.citricola , Myzus persicae and Aphis craccivora. وأظهرت الدراسة أيضا حصر ثلاث طفيليات أولية Aphidius matricariae, Trioxys sp. , Praon sp. ونوع واحد من الطفيليات الثانوية. Charips sp. وبدراسة سلوك الطفيل A. matricariae على الكثافات المختلفة للعائل A. gossypii أظهرت النتائج قلة وقت الوصول للعائل النباتى وكذلك قلة الوقت للوصول للعائل الحشرى A. gossypii مع زيادة الكثافة العددية للعائل بينما يزداد عدد الوخزات وكذلك عدد المومياوات مع زيادة كثافة العائل. وقد سجلت أعلى نسبة من الإناث 2.83 أنثى : 1 ذكر في الحقل و بعد التربية للطفيل على من القطن لمدة جيلين كان النسبة اجنسية تقريبا 1 أنثى : 1 ذكر بينما كانت الذكور سائدة في الجيل الثالث .و أظهرت النتائج ايضا أن الطفيل A. matricariae هو أكثر الأنواع وفره و فعالية ويمكن أن يدخل ضمن برامج المكافحة المتكاملة لحشرات من القطن.

الكلمات الداله: طفليات المن –ايكولوجى – بيولوجي برتقال أبوسره.