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Potentiality of Specific Predators in Controlling Certain Aphid Species on a Balady Orange Tree.

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Abstract

This study was aimed to assess the role of predators against the balady orange aphid species *Aphis gossypii* (Glover), *Aphis citricola* (van der Goot), *Myzus persicae* (Sulzer), and *Aphis craccivora* Koch. over the seasons of 2022 and 2023 successive Balady orange. The aphid species found on balady orange plants were *Aphis gossypii* and *Aphis citricola.* In the first season, three abundance peaks of *A. gossypii* were recorded, opposed to two peaks in the second season. In 2022, peaks of abundance were recorded in the fourth week of April and May, and the third week of June, with 378, 443, and 395 individuals per 40 leaves, respectively. In 2023, peaks of abundance were observed during the second weeks of April and May represented by 429 and 260 individuals per 40 leaves, respectively.During the 2022 and 2023 seasons, *A. gossypii* accounted as the majority of the aphid species found, with percentages of 65.92 and 64.59%. Following closely behind were *A. citricola* at 19.52 and 25.42%, A. c

Key words: Predators –Aphids – Balady orange - Potentiality.

Introduction

Various types of commercial citrus fruits are categorized into different groups, such as sweet oranges, clementine, and lemons.Citrus is the highest yielded fruit crop globally, primarily cultivated in tropical and subtropical areas. Aphids are common pests that can lead to a decrease in citrus production and significant damage under optimal conditions **(Bonnemain, 2010).**Aphids are an intriguing and thoroughly studied group of insects, with 4,000 species worldwide, approximately 250 of which are major agricultural pests (**Sullivan 2008**). Aphids are a highly significant pest group in agriculture due to their unique feeding and reproduction behaviors. In cooler climates, they are considered the foremost insect pest, particularly when infestations lead to the spread of plant-damaging viruses (**Minks and Harrewijn, 1989 and, Kamel 2010**).Predatory insects such as Coccinellidae and Chrysopidae are frequently employed to control aphids in agriculture. These predators feed on small insects and pests such as aphids, white flies, jassids, and mites throughout their growth stages (**Mohamed *et al.*, 2018**). A number of Egyptian scientists are investigated the impact of predators on *A. gossypii* and *M. persicae* (**Jabbar *et al.*, 2020**). Most of the pest control strategies, currently, rely on chemical insecticides in the form of direct contact sprays or dusts, which have negative consequences for the environment. The answer to this issue lies in biological control tools, utilizing effective parasitoids and predators (**Zawrah *et al.*, 2020**).

The study was carried out to analyze the yearly population fluctuations of aphids and their predators on balady orange trees at Kafr Saqr district, Sharkia, Governorate during the 2022/23 growing seasons.

Materials and Methods

Survey and seasonal abundance of aphid species and their predators' spp. on balady orange trees.

Experiments were conducted at Kafr Saqr district, Sharkia, Governorate for two consecutive years (2022/23) on samples picked from of balady orange trees in orchards. The trials were carried out to assess to survey and seasonal abundance of aphid species, and their associated predators on balady orange trees 40 leaves per week for four randomly chosen balady orange trees grown in the citrus orchard (one Fadden) with balady orange trees, was selected for this study. No chemical control was applied and normal agricultural practices were followed. In spite of the lack of any chemical insecticidal treatment, this area had all normal recommended agricultural practices. The same chosen trees almost the same age, sizeand shape were selected randomly and marked for present study. Ten leaves infested (varying sizes) were selected from different areas and strata of a tree, totaling forty

infested leaves per sample. These samples were transported to the laboratory in paper bags for inspection. The presence and counts of aphid nymphs and adults were recorded, with most predators counted directly, while some immature stage of predators were reared untilmaturity in the laboratory at (22±2°C&70±5 RH.) for accurate identification. The tested aphid species and their predators were subjected for one way analysis of variance (ANOVA), and the means were separated using Duncan`s Multiple Range Test **(Cohort Software, 2004).**

Results and Discussion

Insect Predators of Aphids Species recorded with Balady Orange Trees

Coccinellids:*Coccinella septempunctata* L., *C. undecimpunctata* L. and *Cydonia vicinia isis* Muls. (Coleoptera, : Coccinellidae).

Chrysopid: *Chrysoperla carnea* Steph. (Neuroptera, : Chrysopidae).

Syrphids: *Metasyrphus corollae* F. (Diptera, : Syrphidae).

Paederus alfierii (Koch) (Coleoptera, : Staphylinidae).

The most important predatory species found attacked citrus aphids balady orange trees were *C. undecimpunctata, Ch. carnea, A. aphidimyza* and *Metasyrphus corollae*. **Shalaby *et al.* (2008) and Ali (2009)** documented the existence of five insect predators which belong to four orders and four families of aphids infesting navel orange leaves. Among them were *C. undecimpunctata, A. aphidimyza, O. albidipennis, Ch. carnea* and *M. corolla* were among these species.

Population density of aphid species infesting Balady orange trees:

The results (Figs.1a&b) cleared that among infestations by the aphids, *A. gossypii*, was the highest as it reached 65.92 and 64.59 % of the total number of aphids through the 2022 and 2023 seasons, respectively, *A. citricola* aphid was the second most dominant constituting 19.52 and 25.42 % followed by *A. craccivora* 10.87 and 8.27 %, and *M. persicae* 3.69 and 1.72 % respectively. In Egypt, **Youssif *et al.*, (2021)** noted that the following insect species had the highest rates of relative density in 2020 and 2021 seasons: were *Orius* sp. (Hemiptera: Heteroptera),*Ch. carnea* (Neuroptera),. *M. corollae* and *Paragus aegyptius* (Diptera) and other species included *C. undecimpunctata ,C. septempunctata, ,C. vicina nilotica, C. vicina isis* (Coccinellidae) and *P. alfierii* (Staphylinidae) order of Coleoptera.

Population density of predators associated with aphid species on Balady orange trees:

The density of *C. undecimpunctata* was the highest and represented by (37.22 and 33.25 %), then *Ch. carnea* (28.61 and 23.91 %), *C. septempunctata* (12.05 and 12.74 %), *C. vicinia isis* (7.15 and 7.16 %), *M. corolla* (8.08 and 14.32 %), *P. alfierii* (3.18 and 4.85 %), and few true spiders, respectively 3.71 and 3.77 percent during 2022 and 2023.(Figs 2a&b).

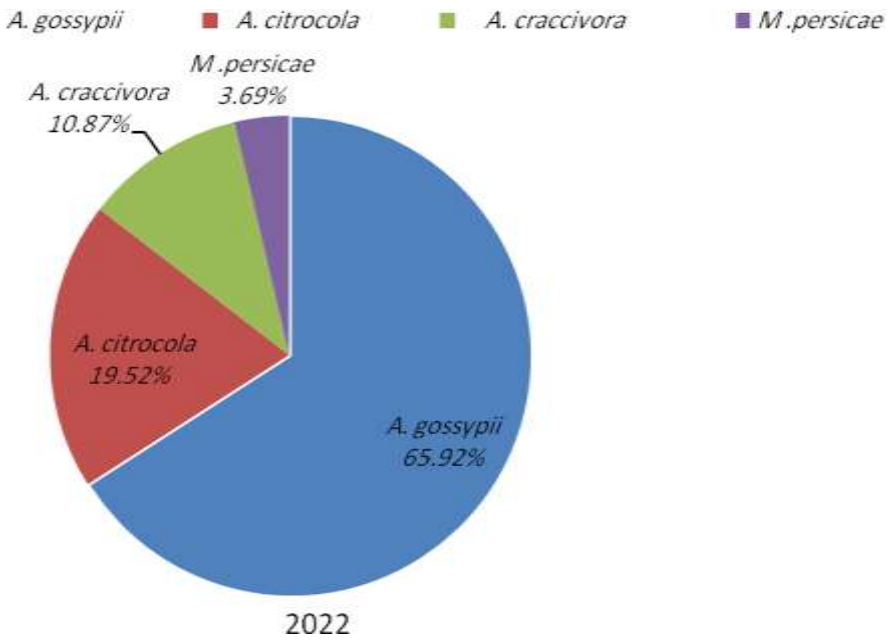

Fig. (1a): Occurrence percentages of aphid species (*A. gossypii, A. citrocola, A.craccivora* and *M. persicae*) on Balady orange trees during 2022 **.**

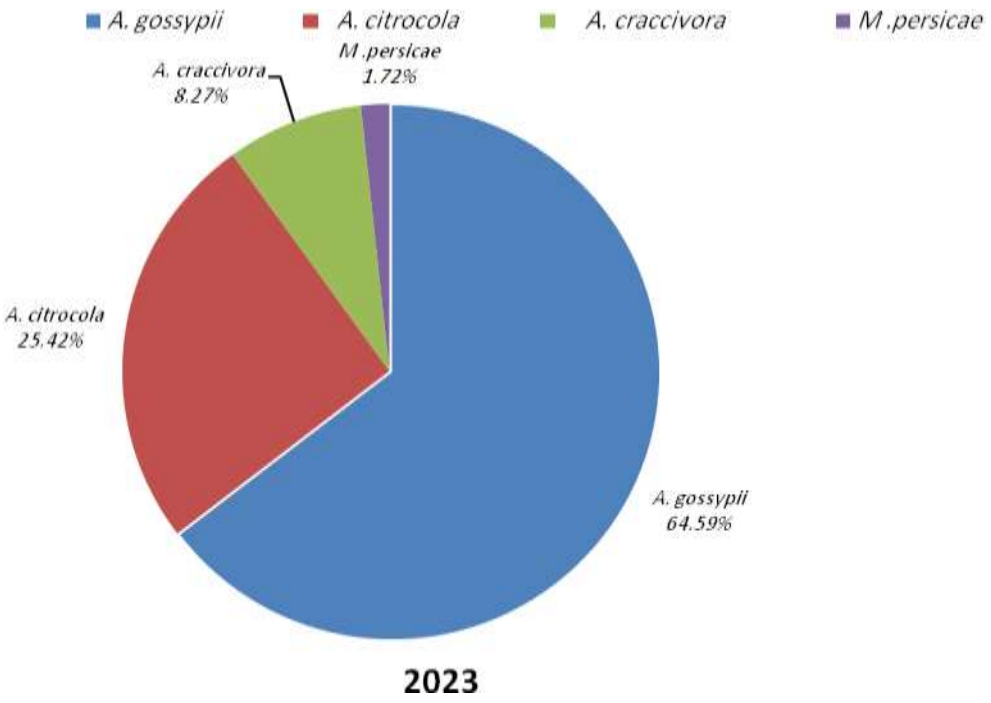

Fig. (1b): Occurrence percentages of aphid species (*A. gossypii*, *A. citrocola*, *A.craccivora* and *M. persicae*) on Balady orange trees during 2023 season.

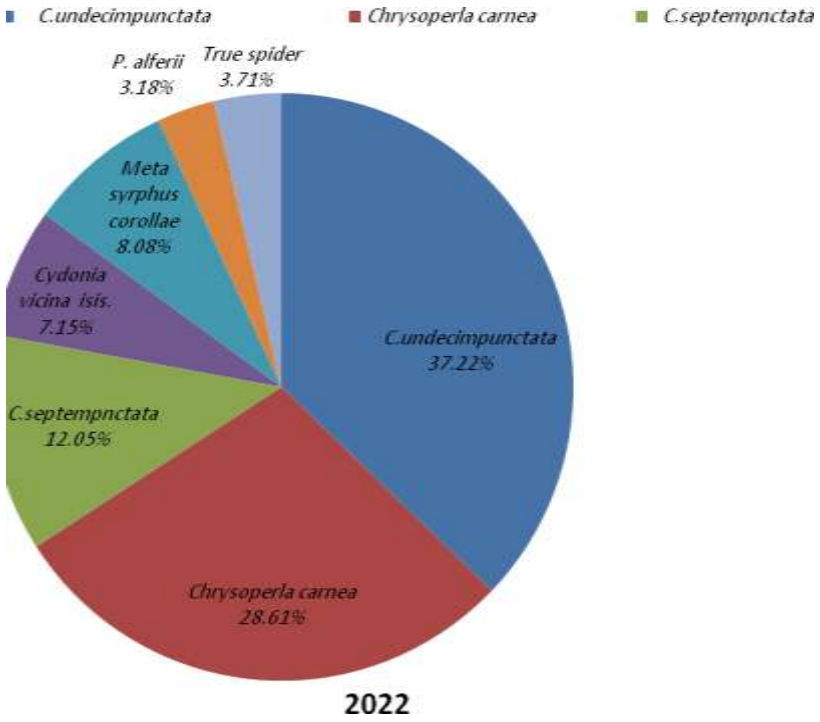

Fig. (2a): Occurrence percentages of predators' species on Balady orange trees during 2022.

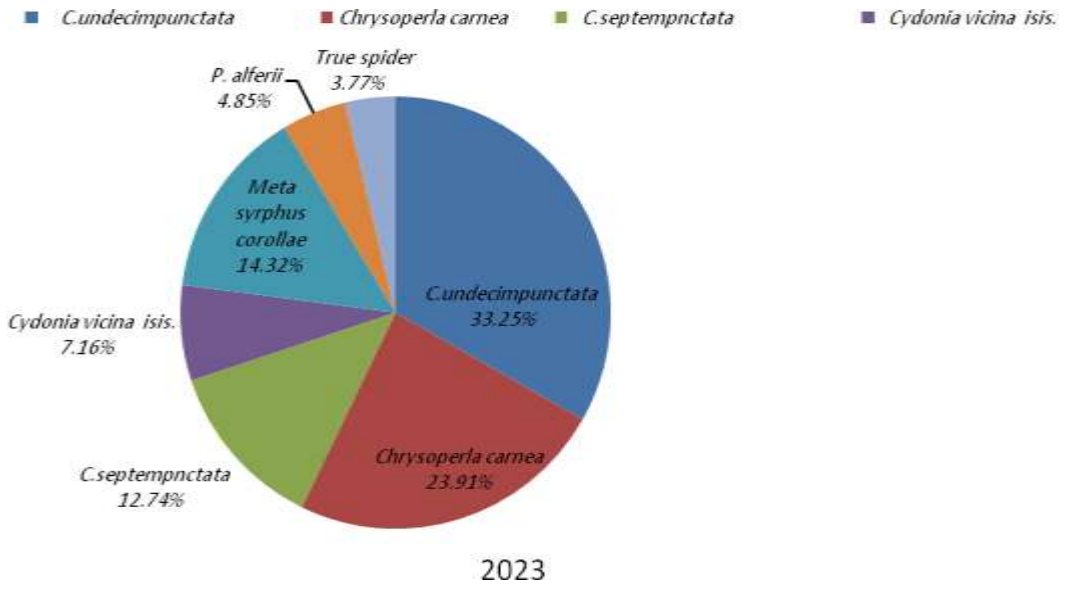

Fig. (2b): Occurrence percentages of predators' species on Balady orange trees at Kafr Sakr district during 2022 season.

Seasonal abundance of aphids' species infesting Balady orange leaves

a) Population of *Aphis gossypii*:

Data illustrated in (Fig.3&4) showed that aphids' infestations with *A. Gossypii* started in the second week of March on balady orange trees in the first season 2022,the infestations started with 8 individuals per 40 leaves, then three peaks were recorded, each per 378, 443, and 395 individuals/40 leaves respectively. Meanwhile, in the 2023 season, *A. gossypii* was observed at the beginning of March with 48 individuals/40 leaves in balady orange trees. These countries had the second most active populations during the second week of April and May where there were populations of 429 and 260 individuals per 40 leaves respectively (Figs. 3&4).

b) Population of *Aphis citrocola;*

Figs (3&4) indicate that *A. citrocola* was observed on balady orange trees in the second week of March (5 individuals/40 leaves) during the first season, while in the second season, it appeared in the third week of March 2023 (35 individuals/40 leaves). In the first season, a single peak of activity was recorded, with 208 individuals per 40 leaves in the fourth week of April 2022, indicating the highest level of activity. Also, one peak was noted in the second season of 2023, occurring in the second weeks of May (244 individuals/40 leaves) (Figs 3 and 4).

Seasonal abundance of Predators associated with aphids, species infesting Balady oranges;

a.) Coccinella undecimpunctata:

From the collected data represented in fig.(3), it is evident that balady *C. undecimpunctata* started appearing during the first week of April (3 individuals/40 leaves) on the balady oranges in first season , Two active peaks were observed in the first season with the highest peaks observed in the second and fourth weeks of May (33 and 39 individuals/40 leaves)at 24.16, 26.27 ºC and 40.29,47.19 % RH.

b.) Chrysoperla carnea:

The study documents the population dynamics of *Ch. carnea* on balady orange trees across two seasons. In the first season, this species was first recorded in early April 2022 with a peak of 27 individuals per 40 leaves in late April (Fig.3). In the second season, *Ch. carnea* appeared again in early April 2023, with two peaks in early May and June, reaching counts of 28 and 24 individuals, respectively (Fig.4). These observations support previous research indicating *Ch. carnea*'s role as a predator of aphids' particularly *A. gossypii*, on various citrus trees (**Aliev and Kurbanov, 1981).** The findings align with historical data that highlighted the relationship between predator **s'** abundance and aphid **s'** population peaks in orange orchards.

Figs (3&4) indicate that *Ch. carnea* was observed on balady orange trees in the second week of April (7 individuals/40 leaves) during the first season, while in the second season, it appeared in the first week of April 2023 (7 individuals/40 leaves). In the first season, a single peak of activity was recorded, with 27 individuals per 40 leaves in the fourth week of April 2022, indicating the highest level of activity. Furthermore, two peaks were noted in the second season of 2023, occurring in the first week of May and June (28 and 24 individuals/40 leaves, respectively). (Figs. 3 and 4).

The latest results were consistent with those of **Aliev and Kurbanov (1981)** in USSR, who observed that *Ch. Carnea* is a highly active

chrysopid species that preys on *A. gossypii* on citrus trees, including navel orange and mandarin trees. **Michelena and Sanchis (1997)** in Spain indicated that *Ch. carnea* and *C. septempunctata* were abundant during peaks in aphid populations, with chrysopids appearing later as aphid numbers declined in orange orchards. According to **(Wilder *et al.* 2013)** the main predators of citrus aphids on navel orange trees were *C. undecimpunctata, C. carnea, A. aphidimyza,* and *S. corolla.* **Ali (2009)** identified five insect predators species belonging to four orders and four families associated with aphids on navel orange leaves, namely *C. undecimpunctata, A. aphidimyza, O. albidipennis, Ch. carnea,* and *M. corollae.*

c.) ***Coccinella septempunctata***

This predacious species was first detected in early April of both 2022 and 2023, with initial counts of 2 and 3 individuals per 40 leaves, respectively. The 2022 season featured two significant activity peaks in May, being 13 and 10 individuals / 40 leaves. Similarly, the 2023 season showed two peaks in early May and mid-June, with counts of 16 and 14 individuals per 40 leaves,respectively (Figs.3&4)

d.) *Cydonia vicina isis*

Cydonia vicina isis was first detected in late April 2022, with an initial counts of 3 individuals per 40 leaves. In 2023, the species appeared slightly earlier, in the third week of April, with 5 individuals noted. The peak activity for the species occurred in the fourth week of May 2022, (Fig. 3) with 10 individuals/40 leaves, while in 2023, two activity peaks were detected with 9 individuals in the fourth week of April and with 11 individuals in the third week of May (Fig. 4)

e) *Metasyrphus corollae*

According to fig.(3), *M. corollae* individuals were first detected in the 2022 season in the first week of April, with a count of only individual per 40 leaves. This species then exhibited two notable peaks of activity in the second and fourth weeks of June 2022, with 8 and 9 individuals per 40 leaves, respectively (Fig. 3). In 2023 season *M. Corolla*started to be foundin the first week of April, recording 5 individuals per 40 leaves, followed by three peaks of activity in the second week of May (16 individuals) and the first and third weeks of June (10 and 11 individuals per 40 leaves, respectively, (Fig.4). In contrast, *Paederus alfierii* and true spiders were found scarcely. During the 2022 season, the predator population on balady orange trees reached two peaks, with counts of 79 and 76 predators per 40 leaves in the third and fourth weeks of May, respectively. In the 2023 season, a peak was recorded in the second week of May, with 113 predators per 40 leaves.

Guanilo and Martinez (2007), Gullan and Cranston (2017), and Lokma *et al.* (2023) have emphasized the critical function of coccinellids in managing aphid populations. This observation is consistent with earlier research that underscores the role of coccinellid beetles as natural predators in Egyptian agricultural fields, as noted by **Boraei *et al.* (2005), and Youssif *et al.* (2021)** documented fluctuations in monthly counts of predators and aphids, revealing a ratio of 1:16.64 throughout the season. Furthermore, **Saleh and Ali (2012)** reported significant aphid consumption rates by *Ch. carnea* larvae, indicating a variation in female longevity. In a subsequent study by **Saleh *et al.* (2017),** it was found that when *Ch. carnea* was fed *A. gossypii*, the entire developmental period from egg hatching to adult emergence lasted approximately 23.8±1.36 days. Each *Ch. carnea* larva was observed to consume an average of 367.31±50.28 *A. gossypii* individuals, highlighting the complex interactions between the predator and the prey in ecological systems and the essential role of *Ch. carnea* in regulating *A. gossypii* populations. The present study emphasizes the importance of comprehending the feeding habits and behavioral routes of predatory insects towards their prey specieswithin agricultural and ecological frame works.

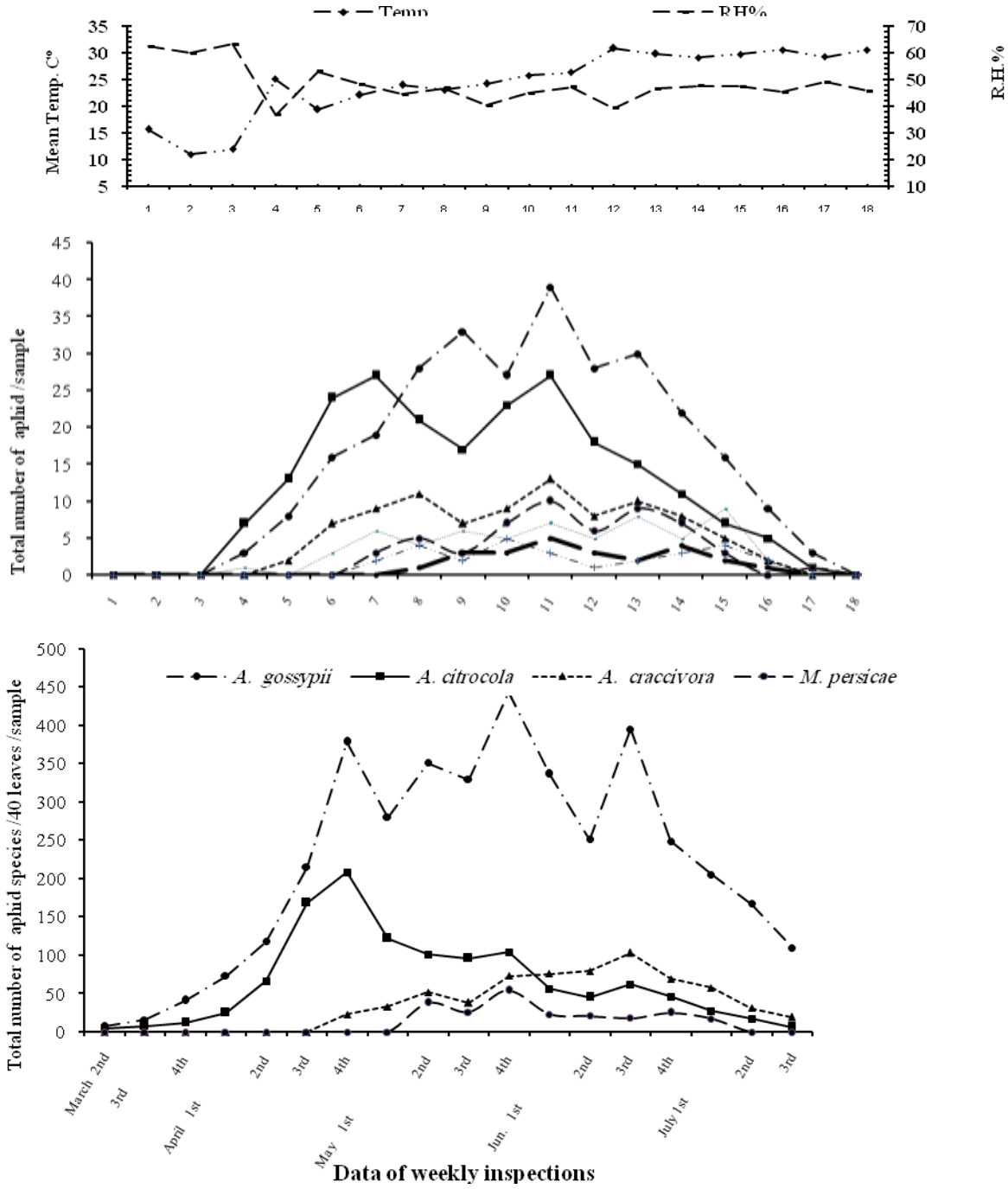

Fig. (3) : Seasonal abundance of aphid species found associated with predators on Balady orange trees at kafr Saker district ,Sharkia Governorate during 2022 seasons.

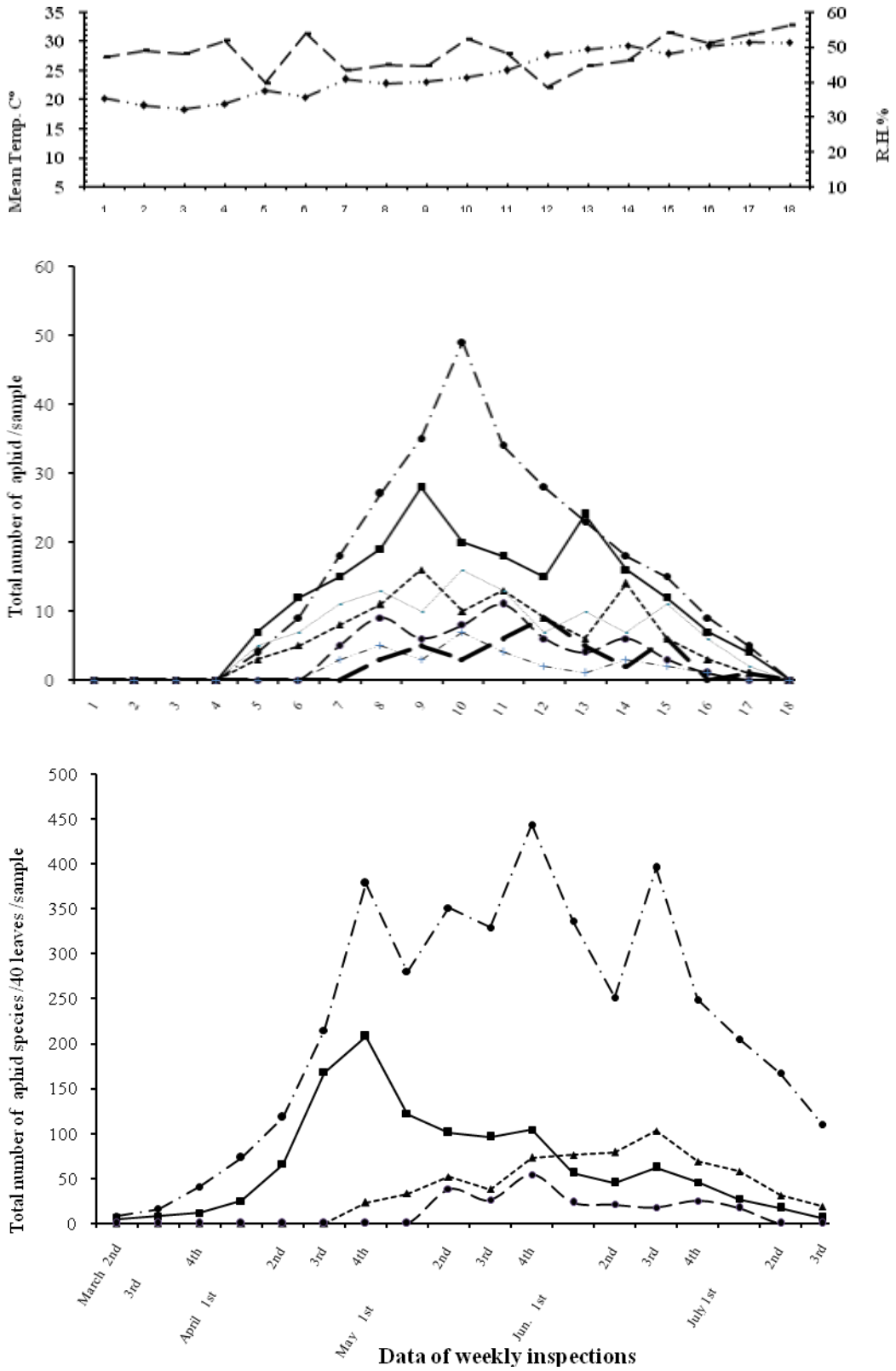

Fig. (4): Predators found attack of aphid species on Balady orange trees at Kafr Saker district, Sharkia Governorate during 2023 seasons

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فعالية بعض المفترسات في مكافحة بعض انواع المَنّ علي أشجار البرتقال البلدي .

هاني محمد محمد مغربى[1]، أحمد أمين أحمد صالح[1] ، عادل عبد الحميد حافظ [2] ، فوزى فائق شلبى[2]

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أجريت التجارب حقلية بمنطقة كفر صقر – محافظة الشرقية خلال موسمي 2022, 2023 لتقييم فاعلية بعض المفترسات كعنصر من عناصر المكافحة البيولوجية لبعض انواع المَنّ في بساتين البرتقال البلدي . أوضحت النتائج وجود أربعة أنواع من المَنّ هي مَنّ القطن ومَنّ الموالح (مَنّ الحمضيات الاخضر) ومَنّ الخوخ الأخضر و مَنّ اللوبيا حيث كان اكثرهم تواجدا مَنّ القطن حيث وجد له ثلاثة قمم خلال موسم الدراسة الاول في الاسبوع الرابع من ابريل ومايو والأسبوع الثالث من يونيه (378 و443 و395 فرد مَنّ /40 ورقة)على التوالي بينما وجد له قمتين في موسم الدراسة الثاني في الاسبوع الثاني من ابريل ومايو(429 و 260 فرد من/40 ورقة) كذلك تم حصر المفترسات الشائعة في حقول البرتقال البلدي وهي أبو العيد ذو أحدي عشر نقطة وأسد المَنّ وابو العيد ذو سبع نقط وابو العيد الأسود وذبابة السيرفس والحشرة الرواغة. وكان للمفترسات قمتين عدديتين (79 و 76 مفترس /40 ورقة) خلال موسم الدراسة الاول بينما وجد قمة واحدة (113 مفترس /40 ورقة) خلال موسم 2023.

الكلمات الدالة: المفترسات – المَنّ – البرتقال البلدي – فاعلية.