Biological Control of *Myzus Persicae* (Sulzer) By Release *Coccinella Septempunctata* L. On Strawberry Plants Under Glasshouse Conditions

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ABSTRACT

This study was carried out to evaluate the management of *Myzus persicae* (Sulzer) (Hemiptera: Aphididae) which infesting strawberry plants *Fragaria ananassa* (L.) by releasing different levels of the seven spotted lady beetle, *Coccinella septempunctata* L. (Coleoptera: Coccinellidae). This study was carried out under glasshouse conditions at two locations (Governorates), Nobariya (Behera governorate) and Perkas (Giza governorate) during season 2019/2020. The seven spotted lady beetle, *C. septempunctata* was released for one time at the beginning of February on strawberry plants at the two locations at rates of 30, 60 and 90 eggs/plant. In the first level of release (30 eggs/plant), at Behera Governorate the reduction percentages in the population of *M. persicae* increased gradually whereas it was 21.0, 31.0, 41.0, 44.0 and 50.0% in mid-February, first-March, mid-March, first-April and mid-April, respectively. The same trend was achieved at Giza Governorate. Also, in the second level of release (60 eggs/plant), at Behera Governorate the reduction percentages in the population of *M. persicae* increased gradually whereas it was 27.0, 33.0, 44.0, 48.0 and 55.0% in mid-February, first-March, mid-March, first-April and mid-April, respectively. The same trend was achieved at Giza Governorate. Lastly, at the third level of release (90 eggs/plant), at Behera Governorate the reduction percentages in the population of *M. persicae* increased gradually whereas it was 29.0, 37.0, 41.0, 49.0 and 52.0% in mid-February, first-March, mid-March, first-April and mid-April, respectively. In addition, the same trend was achieved at Giza Governorate.

INTRODUCTION

Strawberry plants *Fragaria ananassa* (L.) consider one of the most important vegetable plants in Egypt and all over the world which is cultivated in the open field and under glasshouse conditions. Also, its cultivated area increased gradually during the last years, especially in the newly reclaimed areas for purposes of local consumption and exportation to the foreign markets. Francisco, *et al.* (2011)

Egypt considers one of the largest producers and exporters of strawberry (seedlings and fruits) all over the world where it ranks fifth in the world in the production and export
MATERIALS AND METHODS

Mass Rearing Of The Seven Spotted Lady Beetle, Coccinella septempunctata L. and Its Prey The Cowpea Aphid, Aphis craccivora (Koch):

1. Mass Rearing of A. craccivora As A Prey:

*Aphis craccivora* is considered the most preferable prey for the mass production of *C. septempunctata*. A strong culture of this aphid should be available during the rearing time to maintain the predator rearing process.

The broad bean, *Vicia faba* seeds were planted in plastic trays (25X 40X15 cm) or foam trays (60X25X20 cm with 109 wholes) that contained peat mull. The seeds were planted at 1-2 cm deep and followed with irrigation and fertilizers as required. When the first leaflet appeared after about one week from cultivation. Bean leaves were infested with *A. craccivora* which distributed over the new foliage of cultivated trays. Culturing of faba bean plants and artificial aphid infestation was a continuous process carried out at weekly intervals.

The infested trays were followed until the population of *A. craccivora* increased and become suitable for use as prey to the lady beetle, *C. septempunctata*. *A. craccivora* colonies
were cultured under laboratory conditions (23±2℃ and 60±5% R.H.) on broad beans (*Vicia faba*). Such leaves of beans were infested by different stages of aphids and kept under a glass chimney which its upper opening was covered with white muslin. The potted plants were irrigated and fertilized whenever necessary and kept in wooden cages (100X135X135 cm) with nylon gauze sides using the method described by (Mangoud 2003 and Mahyoub *et al.*, 2013). *A. craccivora* and *C. septempunctata* instars were originally collected from an agricultural field.

2. Mass Rearing of *C. septempunctata*:

When the population of *A. craccivora* increased and reached suitable density individuals (approximately 100 individuals/plant,) on faba bean plants these plants were inoculated with *C. septempunctata*. The stock culture of the ladybird was obtained from infested plants and transferred to the laboratory. Only 10 adults ♂ + 10 adults ♀ of ladybird (to prevent larval cannibalism) were transferred to rearing cages (30 cm diameter X 25 cm high) and kept in wooden cages (100X135X135 cm) with nylon gauze sides. To maintain the predator culture, a suitable number of the prey was daily offered to the predator (Mahyoub *et al.*, 2013).

3. Egg Picking:

The method for egg-laying [black polyethylene strips fixed inside a plastic cylindrical (10 cm length X 2 cm diameter) for laying eggs and put in the rearing pots]. After laid egg-masses, they were removed from plastic cylinders to separate the egg-masses from the cylindrical plastic and to be ready to stick on the carton paper card for release. The plastic cylinder was checked twice/day for egg-masses because of the cannibalistic habits of the adults, especially when there was a shortage of host food. In order to provide the developing larva with sufficient food throughout their developmental period, it was necessary to increase the amount of food with the advancement of their development (Mahyoub *et al.*, 2013).

2. Release of *C. septempunctata*:

Releasing study was conducted on strawberry plants which are grown in two locations (governorates), Nobariya (Behera governorate) and Perkash (Giza governorate) during season 2019/2020 under glasshouse conditions.

The selected plants for the present investigation were away from any pesticide contamination. Both in the two places, the glasshouse divided into three plots (3x5m for each) for strawberry (fresh seedlings) which were cultivated in September month 2019. Each plot for each release level and each plot also divided into three replicates for that release level and another three replicates as control. The normal release and recommended agricultural practices were applied, also no chemical control against aphid was used during the whole experimental period.

Naturally, the numbers of *C. septempunctata* stages were recorded. Therefore, three levels of *C. septempunctata* eggs; the first level consists of 30 eggs (one card), the second level consists of 60 eggs (two cards) and the third one consists of 90 eggs (three cards) were released to encouragement the normal predator population to reduce the aphid. *C. septempunctata* were released (one time) by the beginning of February on strawberry plants at the two places in the 2020 season.

Samples were randomly taken bi-weekly at the two places and counting started from the beginning of February in strawberry plants. Twenty new plants were examined from each plot (five leaves for each plant), were made by a hand lens for counting the alive insects and the predator and took the mean numbers. Both surfaces of the leaf were inspected for the presence of aphid (Mangoud 2000).
Statistical Analysis:
The percent reduction of The Green Peach aphid *M. persicae* after *C. septempunctata* was released was calculated according to Henderson and Tilton equation (1955).

The data were subjected to analysis of variance (ANOVA) and the means were compared by L.S.D. test at 0.05 level, using SAS program (SAS Institute, 1988).

**RESULTS AND DISCUSSION**

This study was carried out to evaluate the management of *Myzus persicae* (Sulzer) (Hemiptera: Aphididae) which infesting strawberry plants by releasing three levels (30, 60 and 90 eggs) of the seven spotted lady beetle, *Coccinella septempunctata* L. (Coleoptera: Coccinellidae). This study was carried out under glasshouse conditions at two locations (Governorates), Nobariya (Behera governorate) and Perkash (Giza governorate) during season 2019/2020.

**Nobariya (Behera Governorate):**

Three levels of *C. septempunctata* eggs; the first level (30 eggs on one card), the second level (60 eggs on two cards) and the third level (90 eggs on three cards) were released (one time) by the beginning of February 2020 on strawberry plants.

1. **First Level of Release (30 eggs/plant):**

Results in Table (1) and Figure (1) indicated that the number of *M. persicae* in the 1st release plot decreased gradually from 35 on the 1st February to 30, 23, 15, 10 and 6 individuals/plant, in mid-February, first-March, mid-March, first-April and mid-April, respectively as compared to control which aphid populations changed from 37 individuals/plant on first-February to 40, 44, 50, 59 and 70 individuals/plant in the same dates, respectively. The present results showed that the percent reduction of *M. persicae* in the 1st release plot increased gradually to reach 21.0, 31.0, 41.0, 44.0 and 50.0% in mid-February, first-March, mid-March, first-April and mid-April, respectively.

2. **The Second Level of Release (60 eggs/plant):**

Results in Table (2) and Figure (2) indicated that the number of *M. persicae* in the 2nd release plot decreased gradually from 33 on the 1st February to 27, 21, 14, 9 and 5 individuals/plant on mid-February, first-March, mid-March, first-April and mid-April, respectively as compared to control which aphid populations changed from 35 individuals/plant on first-February to 39, 45, 53, 65 and 79 individuals/plant in the same dates, respectively. The obtained results showed that the percent reduction of *M. persicae* in the 2nd release plot increased gradually to reach 27.0, 33.0, 44.0, 48.0 and 55.0% in mid-February, first-March, mid-March, first-April, and mid-April, respectively.

| Date       | Release plot | Chick plot (Control) | % Reduction |
|------------|--------------|----------------------|-------------|
| First February | 35           | 37                   | -           |
| Mid February  | 30           | 40                   | 21.0        |
| First March   | 23           | 44                   | 31.0        |
| Mid March     | 15           | 50                   | 41.0        |
| First April   | 10           | 59                   | 44.0        |
| Mid April     | 6            | 70                   | 50.0        |
| **F (0.05)** |              | **235.41**           |             |
| **LSD**      |              | **1.22**             |             |
Biological Control of *Myzus Persicae* (Sulzer) By Release *Coccinella Septempunctata* L. On Strawberry Plants

Fig.1: Fluctuation in the population numbers of *M. persicae* in the 1st plot release at level (30 eggs) of *C. septempunctata* at Behera Governorate.

Table 2: Fluctuation in the population numbers of *M. persicae* in the 2nd plot release at level (60 eggs) of *C. septempunctata* at Behera Governorate.

| Date            | Release plot | Chick plot (Control) | % Reduction |
|-----------------|--------------|----------------------|-------------|
| First February  | 33           | 35                   | -           |
| Mid February    | 27           | 39                   | 27.0        |
| First March     | 21           | 45                   | 33.0        |
| Mid March       | 14           | 53                   | 44.0        |
| First April     | 9            | 65                   | 48.0        |
| Mid April       | 5            | 79                   | 55.0        |
| **F (0.05)**    | **245.75**   |                      |             |
| **LSD**         | **1.42**     |                      |             |

Fig.2: Fluctuation in the population numbers of *M. persicae* in the 2nd plot release at level (60 eggs) of *C. septempunctata* at Behera Governorate.

3. The Third Level of Release (90 eggs/plant):

Results in Table (3) and Figure (3) indicated that the number of *M. persicae* in the 3rd release plot decreased gradually from 31 on the 1st February to 27, 20, 15, 9 and 5 individuals/plant on mid-February, first-March, mid-March, first-April and mid-April, respectively as compared to control which aphid populations changed from 33
individuals/plant on first-February to 40, 47, 59, 69 and 79 individuals/plant, in the same dates, respectively. The results showed that the percent reduction of *M. persicae* in the 3rd release plot increased gradually to reach 29.0, 37.0, 41.0, 49.0 and 52.0% in mid-February, first-March, mid-March, first-April and mid-April, respectively.

**Table 3:** Fluctuation in the population numbers of *M. persicae* in the 3rd plot release at level (90eggs) of *C. septempunctata* at Behera Governorate.

| Date               | Release plot | Chick plot (Control) | % Reduction |
|--------------------|--------------|----------------------|-------------|
| First February     | 31           | 33                   | -           |
| Mid February       | 27           | 40                   | 29.0        |
| First March        | 20           | 47                   | 37.0        |
| Mid March          | 15           | 59                   | 41.0        |
| First April        | 9            | 69                   | 49.0        |
| Mid April          | 5            | 79                   | 52.0        |
| **F (0.05)**       | **235.27**   |                      |             |
| **LSD**            | **1.32**     |                      |             |
Table 4: Fluctuation in the population numbers of *M. persicae* in the 1st plot release at level (30eggs) of *C. septempunctata* at Giza Governorate.

| Date          | Release plot | Chick plot (Control) | % Reduction |
|---------------|--------------|----------------------|-------------|
| First February| 37           | 40                   | -           |
| Mid February  | 32           | 44                   | 22.0        |
| First March   | 27           | 51                   | 28.0        |
| Mid March     | 21           | 58                   | 32.0        |
| First April   | 13           | 67                   | 47.0        |
| Mid April     | 7            | 78                   | 54.0        |

F (0.05) 265.27
LSD 1.44

Fig.4: Fluctuation in the population numbers of *M. persicae* in the 1st plot release at level (30eggs) of *C. septempunctata* at Giza Governorate.

2. Second Level of Release (60 eggs/plant):

Results in Table (5) and Figure (5) indicated that the number of *M. persicae* in the 2nd release plot decreased gradually from 35 on the 1st February to 30, 24, 17, 10 and 4 individuals/plant in mid-February, first-March, mid-March, first-April and mid-April, respectively as compared to control which aphid populations changed from 37 individuals/plant on first-February to 42, 49, 58, 69 and 77 individuals/plant in the same dates, respectively. In addition, the results showed that the percent reduction of *M. persicae* in the 2nd release plot increased gradually to reach 25.0, 32.0, 41.0, 51.0 and 65.0% in mid-February, first-March, mid-March, first-April and mid-April, respectively.

Table 5: Fluctuation in the population numbers of *M. persicae* in the 2nd plot release at level (60eggs) of *C. septempunctata* at Giza Governorate.

| Date          | Release plot | Chick plot (Control) | % Reduction |
|---------------|--------------|----------------------|-------------|
| First February| 35           | 37                   | -           |
| Mid February  | 30           | 42                   | 25.0        |
| First March   | 24           | 49                   | 32.0        |
| Mid March     | 17           | 58                   | 41.0        |
| First April   | 10           | 69                   | 51.0        |
| Mid April     | 4            | 77                   | 65.0        |

F (0.05) 241.28
LSD 1.35
Fig. 5: Fluctuation in the population numbers of *M. persicae* in the 2nd plot release at level (60 eggs) of *C. septempunctata* at Giza Governorate.

3. In Third Level of Release (90 eggs/plant):

Results in Table (6) and Figure (6) indicated that the number of *M. persicae* in the 3rd release plot decreased gradually from 33 on the 1st February to 29, 22, 15, 8, and 3 individuals/plant on mid-February, first-March, mid-March, first-April and mid-April, respectively as compared to control which aphid populations changed from 35 individuals/plant on first February to 40, 49, 58, 67 and 75 individuals/plant on the same dates respectively. In addition, the results showed that the percent reduction of *M. persicae* in the 3rd release plot increased gradually to reach 24.0, 39.0, 43.0, 54.0 and 67.0% on mid-February, first-March, mid-March, first-April and mid-April, respectively.

**Table 6:** Fluctuation in the population numbers of *M. persicae* in the 3rd plot release at level (90 eggs) of *C. septempunctata* at Giza Governorate.

| Date           | Release plot | Check plot (Control) | % Reduction |
|----------------|--------------|----------------------|-------------|
| First February | 33           | 35                   | -           |
| Mid February   | 29           | 40                   | 24.0        |
| First March    | 22           | 49                   | 39.0        |
| Mid March      | 15           | 58                   | 43.0        |
| First April    | 8            | 67                   | 54.0        |
| Mid April      | 3            | 75                   | 67.0        |

F (0.05) 286.33
LSD 1.27

Fig. 6: Fluctuation in the population numbers of *M. persicae* in the 3rd plot release at level (90 eggs) of *C. septempunctata* at Giza Governorate.
Biological Control of *Myzus Persicae* (Sulzer) By Release *Coccinella Septempunctata* L. On Strawberry Plants

Statistical analysis showed that highly significant differences between the three releasing levels (30, 60 and 90 eggs/plant) of *C. septempunctata* predator in the reduction of *M. persicae* at both the two locations compared to control, whereas (F 0.05) value and (LSD) were (235.41, 1.22), (245.75, 1.42) and (235.27, 1.32), respectively for the three releasing levels (30, 60 and 90 eggs/plant) of *C. septempunctata* predator at Behera Governorate. Also, at Giza Governorate statistical analysis show highly significant differences between the three releasing levels (30, 60 and 90 eggs/plant) of *C. septempunctata* predator in a reduction of *M. persicae* compared to control whereas (F 0.05) value and (LSD) were (265.27, 1.44), (241.28, 1.35) and (286.33, 1.27), respectively for the three releasing levels (30, 60 and 90 eggs/plant) of *C. septempunctata* predator at Giza Governorate.

These results are in agreement with those obtained by Mangoud (2009) the seven spotted lady beetle, *C. septempunctata* is an important predator of aphids play a good role in reducing the population density of the woolly apple aphid, *Eriosoma lanigerum* (Hausmann) (Homoptera: Aphididae) attacking apple trees. Also, these results are in agreement with those obtained by Mangoud (2003) who stated that the seven spotted lady beetle, *C. septempunctata* is an important predator of aphids play a good role in reducing the population density of the green peach aphid, *Myzus persicae* and the cotton aphid, *Aphis gossypii* (Hausmann) (Homoptera: Aphididae) attacking apple trees.

Also, these results are in harmony with those obtained by Hoyt and Madsen (1960) found that the control of aphid species complex is complicated by the continued dispersal of aphids from the roots to the aerial portions of the tree, and a corresponding dispersal in the opposite direction. Brar and Kanwar (1994) in field experiments in India found *C. septempunctata* was an effective predator against *A. craccivora* infesting fenugreek germplasm. El-Aish et al. (2004) stated that the role of the predator *C. septempunctata* in biological suppressing of cereal aphids showed that the eggs last 2-3 days and the 1st, 2nd, 3rd and 4th larval instars have lasted 3, 2, 2 and 4 days, respectively, the pupal stage lasted 8 days at the room temperature. The adult predator consumed 46.13 aphids, while the larval consumed 26.9 aphids daily. Fang et al. (1984) found the coccinellids, *C. septempunctata* good controlling *B. brassicae* in cotton fields at yellow river valley in China.

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ARABIC SUMMARY

المكافحة الحيوية لحشرة من الخوخ الأخضر *Myzus persicae* تحت ظروف الصوب الزجاجية *Coccinella septempunctata* L. على نباتات الفراولة

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معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقي - الجيزة - مصر

أجري هذا البحث لتقييم مستويات مختلفة من إطلاق أبو العيد ذو السبع نقاط *Coccinella septempunctata* L. على نباتات الفراولة بمحافظة البحيرة والجيزة خلال موسم 2019/2020 تحت ظروف الصوب الزجاجية. حيث أدى إطلاق مفترس أبو العيد ذو السبع نقاط 30 بيضة/نبات في منطقة النوبارية (محافظة البحيرة) إلى خفض نسبة الإصابة من الخوخ الأخضر بنسبة تدرجت من 21، 31، 41، 44، 50 % وذلك في منتصف فبراير وبداية مارس ومنتصف مارس وبداية أبريل ومنتصف أبريل علي التوالي. وعلى نفس المنوال تدرجت الفاعلية في منطقة برقاش (محافظة الجيزة) حتى وصلت أقصاها في منتصف أبريل. بينما أدى إطلاق هذا المفترس بمستوى 60 بيضة/نبات إلى خفض نسبة الإصابة بنسبة تدرجت من 27، 33، 44، 48، 55 % وذلك في منتصف فبراير وبداية مارس ومنتصف مارس وبداية أبريل ومنتصف أبريل علي التوالي وذلك بمنطقة النوبارية (محافظة البحيرة) وعلى نفس المنوال تدرجت الفاعلية في منطقة برقاش (محافظة الجيزة) حتى وصلت أقصاها في منتصف أبريل. كما أدى إطلاق هذا المفترس بمستوى 90 بيضة/نبات إلى خفض نسبة الإصابة بمن الخوخ الأخضر بنسبة تدرجت من 29، 37، 41، 49، 52 % وذلك في منتصف فبراير وبداية مارس ومنتصف مارس وبداية أبريل ومنتصف أبريل على التوالي بمحافظة البحيرة، وعلى نفس المنوال تدرجت الفاعلية في منطقة برقاش (محافظة الجيزة) حتى وصلت أقصاها في منتصف أبريل. ومن النتائج السابقة يمكن التوصية باستخدام المفترس الحشرى أبو العيد ذو السبع نقاط *C. septempunctata* بنجاح كأحد عناصر المكافحة البيولوجية الفعالة في برامج المكافحة المتكاملة لحشرة من الخوخ الأخضر *M. persicae* على نباتات الفراولة.