

USING THE SEVEN SPOTTED LADY BEETLE, *COCCINELLA SEPTEMPUNCTATA* FOR CONTROLLING *APHIS GOSSYPII* AND *MYZUS PERSICAE* AGGREGATIONS ON APPLE TREES

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Abstract

The seven-spotted ladybird, *Coccinella septempunctata* L. (Coleoptera : Coccinellidae), is an important predator of aphids, playing a good role in reducing the population density of the cotton aphid, *Aphis gossypii* (Glover) and the green peach aphid, *Myzus persicae* (Sulzer) (Homoptera : Aphididae) complex attacking apple trees. *C. septempunctata* was released (one time), at early April 2004 and repeated in 2005, at Qalubiya Governorate at rates of 30, 60 and 90 eggs/tree. During the first season (2004), the reduction percentages in the population of *A. gossypii* and *M. persicae* increased gradually with elapse of time reaching the maximum. The achieved average reductions in aphid population were 72.94, 79.85 and 93.14% at the end of November for the three releasing levels, respectively in the first year (2004). However, the same trend was achieved in the second season (2005).

The present work, has shown that the seven-spotted ladybird, *Coccinella septempunctata* L. could used successfully, as a biocontrol agent in an integrated program for controlling incorporated both of the cotton aphid and the green peach aphid on the apple trees.

INTRODUCTION

The cotton aphid, *Aphis gossypii* (Glover), (Homoptera: Aphididae) being primarily a pest of cotton and fruit trees, is a polyphagous feeder (Hameed and Giamzo, 1975 and Mangoud, 1994&2000). This pest constitutes one of the major and important economic pests of plants in Egypt whereas it causes heavy losses in many cropping seasons (Hassanein *et al.*, 1971). Also, the green peach aphid, *Myzus persicae* (Sulzer) is a serious pest of many crops and fruit trees and also has been considered as an insect pest of economic importance on young terminal apple leaves (Mangoud, 1994 & 2000). The two aphid pests feed together in colonies of large numbers on young new emerging leaves, mostly on the under-surface and on tender parts and cause considerable damage. They suck the cell sap from leaves, lowering its vitality, turn yellow and crinkled. In addition, honeydew excretions and transmission of virus diseases are important problems (Mangoud, 2000).

The seven-spotted ladybird, *Coccinella septempunctata* L. (Coleoptera : Coccinellidae) is the commonest ladybird beetle known in Egypt, it is an important predator of many aphid species; eggs and small nymphs of mealybugs, jassids, eggs

and larvae of cotton leafworm (Ibrahim, 1948 & 1955a and b). The adults and early stages are often encountered in large numbers on the plants infested with aphids. They feed on these harmful insects and often play a great role in suppressing them under control. Both the adult and larval stages feed on insects harmful to plants, such as aphids and scale insects (Anonymous, 1997). Adults can be consuming up to 100 aphids per day (Arnett *et al.*, 1980). The ladybug kills its prey outright and then devours it (Waldbauer, 1998).

The present work aimed to evaluate the management of the cotton aphid, *Aphis gossypii* (Glover) and green peach aphid, *Myzus persicae* (Sulzer), (Homoptera: Aphididae) by releasing the seven spotted lady beetle, *Coccinella septempunctata* (Coleoptera : Coccinellidae) on apple trees at Qalubiya Governorate.

MATERIALS AND METHODS

1. Mass rearing of the seven-spotted ladybird, *Coccinella septempunctata* and its prey the cowpea aphid, *Aphis craccivora* (Koch):

1.1. Mass rearing of *A. craccivora* as a prey:

A. craccivora is considered the most preferable prey for mass production of *C. septempunctata*. 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) contained peat muss. 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 using as prey to the ladybird, *C. septempunctata*.

A. craccivora colonies were cultured under laboratory conditions ($23\pm 2^{\circ}\text{C}$ and $60\pm 5\%$ 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). *A. craccivora* instars were originally collected from infested broad beans, cultivated in Agriculture Research Center Farm.

1.2. Mass rearing of *C. septempunctata*:

When the population of *A. craccivora* increased and reached to suitable density individuals (approximately 100 individuals/plant) on faba bean plants these plants were inoculated with *C. septempunctata*. The stock culture of ladybird was obtained from infested plants and transferred to laboratory. Only 10 adult ♂ + 10 adult ♀ 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.

1.3. 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 releasing. 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.

2. Release of *C. septempunctata*:

Releasing study was conducted on Balady apple trees *Pyrus malus* (Mill) (Anna/MM 106 variety), at Qalubiya Governorate during 2004 and 2005 years. The selected apple trees for the present investigation were away from any pesticide contamination for five months. The trees were about 15 years old, with about 5-6 meters in height similar in size, age, shape, height and vegetation as possible and infested by *A. gossypii* and *M. persicae*.

Naturally, the numbers of *C. septempunctata* stages were rare, therefore, three levels of *C. septempunctata* eggs; first level consists of 30 eggs (one card), 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 complex. *C. septempunctata* were released (one time), by the beginning of April 2004 and repeated in the same time in 2005 years. The apple trees were divided into 4 replicates, each replicate consists of 4 trees (16 trees) for each plot. Another 16 trees were selected to be as a check plot. *C. septempunctata* were released by hanging the carton cards including egg-mass near from the infestation (terminal shoots) of each tree as described by Mangoud (2003).

Samples were randomly taken monthly and counting started from the beginning April till the beginning November, which consider as the best time for release (Mangoud, 2003).

Twenty new leaves were examined from the terminal shoots (terminal part of branch), twenty mature leaves (mid leaves) were examined from the mid part and other twenty mature leaves (base leaves) were examined from the base parts of the same branch. Examination of the leaves in the field was made by a hand lens for counting the alive nymphs, adult females and their predators. Both surfaces of the leaf were inspected for the presence of aphid Mangoud, 2000).

3. Statistical analysis

The percent reduction of aphid species complex aphids after *C. septempunctata* released was calculated according to Henderson and Tilton equation (1955).

RESULTS AND DISCUSSION

The seven-spotted ladybug, *Coccinella septempunctata* L. lives in a wide variety of habitats. Any place where there are plants and aphids may attract this species (Fleming, 2000).

I. Release of *C. septempunctata*:

I.1. First year (2004)

Three levels of *C. septempunctata* eggs; first level (30 eggs on one card), second level (60 eggs on two cards) and the third level (90 eggs on three cards) were released (one time), by the beginning of April 2004.

I.1.a. First level of release (30 eggs/tree)

In first level of release, the pre-count in the releasing area with aphid species complex was 55 individuals/leaf, while it was also 52 individuals/leaf in (check trees).

The results in Fig. (1) indicated that the number of aphid species complex in the 1st release plot decreased gradually from 52 on April to 50, 44, 34, 25, 23, 17 and 11 on May, June, July, August, September, October and November, respectively as compared to check plot (aphid populations changed from 55 individuals/leaf on April to 73, 84, 96, 81, 77, 62 and 43 individuals/leaf in the same dates, respectively. In addition, the results show that the percent reduction of aphid species complex in 1st release plot increased gradually to reach 27.56, 44.60, 62.54, 67.36, 68.41, 71.00 and 72.94% on May, June, July, August, September, October and November, respectively.

I.1.b. Second level of release (60 eggs/tree)

In the second level of release, the pre-count numbers of aphid species complex in release area were 63 individuals/leaf, while reached 67 individuals/leaf in (check trees).

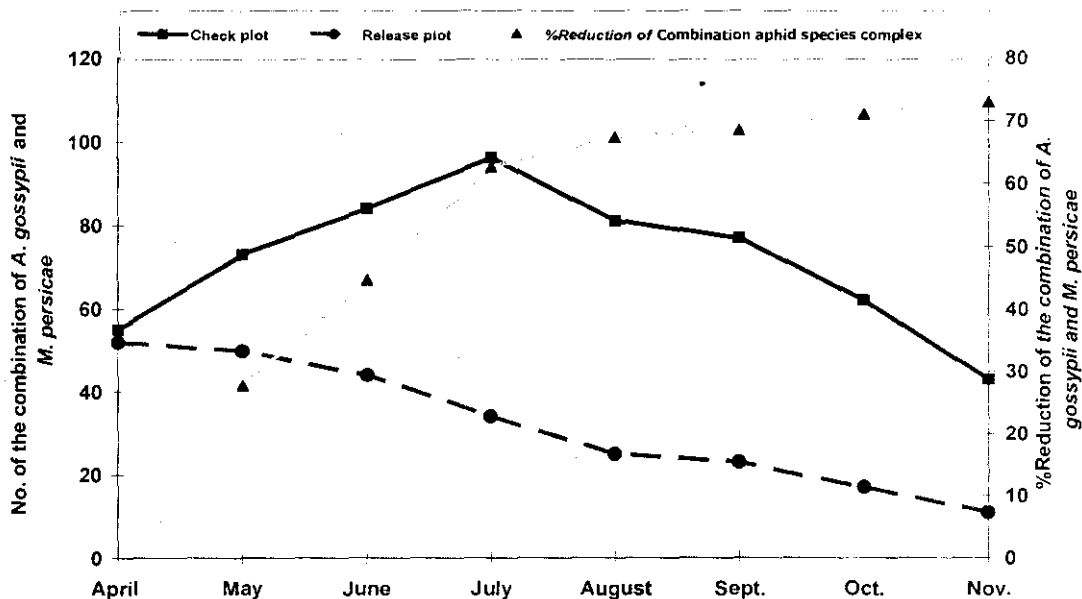


Fig. 1. Fluctuation in the population numbers of aphid species complex in the 1st plot release at level of (30 eggs) and the corresponding %reduction of the aphid density on apple trees during 2004.

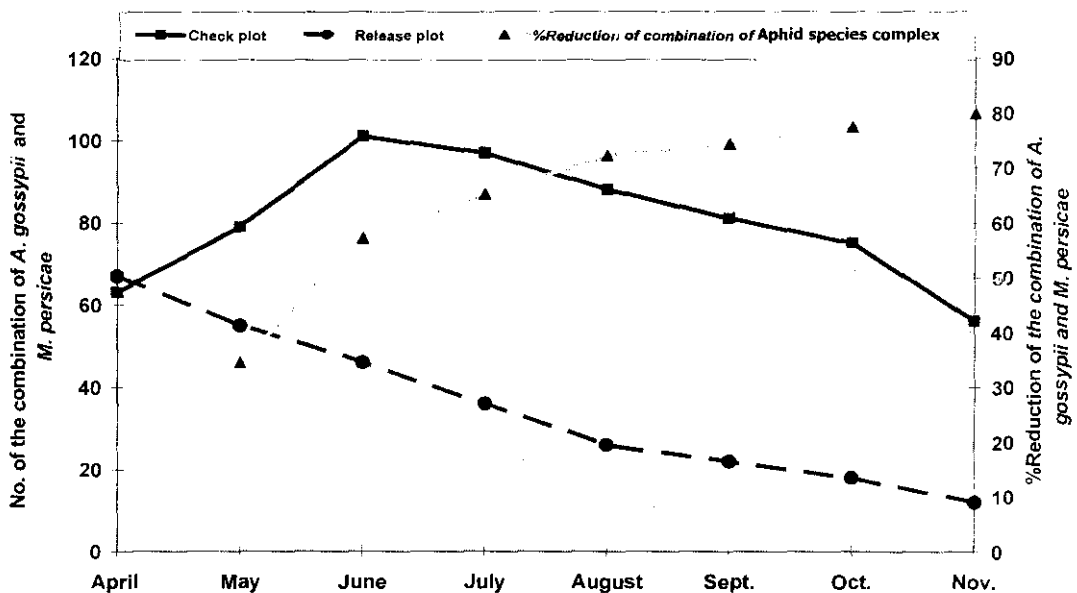


Fig. 2. Fluctuation in the population numbers of aphid species complex in the 2nd plot release at level of (60 eggs) and the corresponding %reduction of the aphid density on apple trees during 2004.

The results in Fig. (2) indicated that the number of aphid species complex in the 2nd release plot decreased gradually from 67 on April to 55, 46, 36, 26, 22, 18 and 12 individuals/leaf on May, June, July, August, September, October and November, respectively as compared to check plot (aphid populations changed from 63 individuals/leaf on April to 79, 101, 97, 88, 81, 75 and 56 individuals/leaf in the same dates, respectively). Also, the results show that the percent reduction of combination of *A. gossypii* and *M. persicae* in 2nd release plot increased gradually showing 34.54, 57.17, 65.10, 72.22, 74.46, 77.43 and 79.85% on May, June, July, August, September, October and November, respectively.

I.1.c. In third level of release (90 eggs/tree)

In the third level of release, the pre releasing numbers of aphid species complex before release were 71 individuals/leaf, while reached 69 individuals/leaf in (check trees).

The results in Fig. (3) indicated that the number of aphid species complex in the 3rd release plot decreased dramatically from 69 on April to 51, 39, 28, 17, 12, 9 and 3 individuals/leaf on May, June, July, August, September, October and November, respectively as compared to check plot (aphid populations changed from 71 individuals/leaf on April to 84, 98, 112, 87, 64, 60 and 45 individuals/leaf in the same dates, respectively). Accordingly, the percent reduction of aphid species complex in 3rd release plot increased gradually to reach 37.53, 59.05, 74.28, 79.89, 80.71, 84.57 and 93.14% on May, June, July, August, September, October and November, respectively. These results are in agreement with those obtained by Mangoud, 2007 (in press) the seven-spotted ladybird, *Coccinella septempunctata* L. (Coleoptera : Coccinellidae) 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.

I.2. Second year (2005)

Also, three levels of *C. septempunctata* eggs; first level (30 eggs on one card), second level (60 eggs on two cards) and the third level (90 eggs on three cards) were released (one time), by the beginning of April 2005 year.

I.2.a. First level of release (30 eggs/tree)

In first level of release, the pre-count in the releasing area with aphid species complex was 68 individuals/leaf, while it was also 65 individuals/leaf in (check trees).

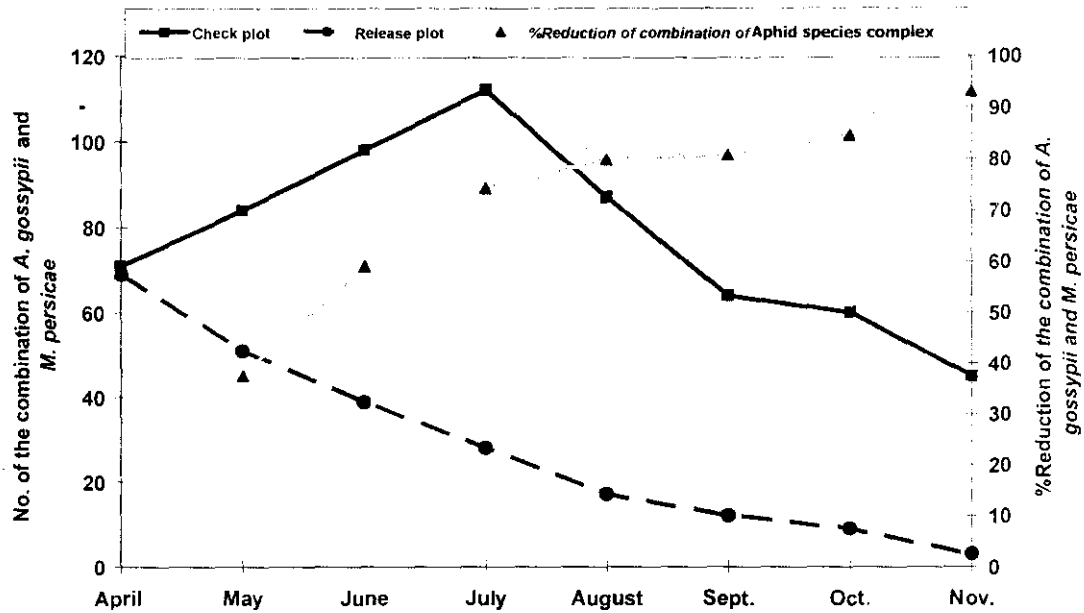


Fig. 3. Fluctuation in the population numbers of aphid species complex in the 3rd plot release at level of (90 eggs) and the corresponding %reduction of the aphid density on apple trees during 2004.

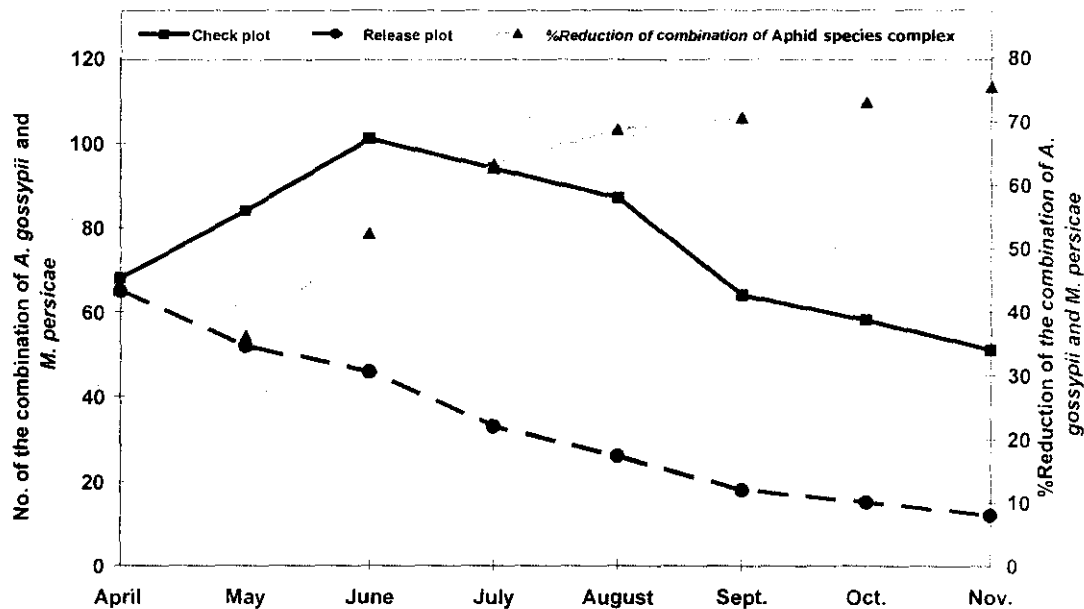


Fig. 4. Fluctuation in the population numbers of aphid species complex in the 1st plot release at level of (30 eggs) and the corresponding %reduction of the aphid density on apple trees during 2005.

The results in Fig. (4) indicated that the number of aphid species complex in the 1st release plot decreased gradually from 68 on April to 84, 101, 94, 87, 64, 58, and 51 on May, June, July, August, September, October and November, respectively as compared to check plot (aphid populations changed from 65 individuals/leaf on April to 52, 46, 33, 26, 18, 15 and 12 individuals/leaf in the same dates, respectively). Also, the results show that the percent reduction of aphid species complex in 1st release plot increased gradually to reach 36.24, 52.35, 63.27, 68.74, 70.58, 72.94 and 75.38% on May, June, July, August, September, October and November, respectively.

I.2.b. Second level of release (60 eggs/tree)

In the second level of release, the pre-count numbers of aphid species complex in release area were 70 individuals/leaf, while reached 66 individuals/leaf in (check trees).

The results in Fig. (5) indicated that the number of aphid species complex in the 2nd release plot decreased gradually from 70 on April to 49, 40, 35, 29, 22, 18 and 8 individuals/leaf on May, June, July, August, September, October and November, respectively as compared to check plot (aphid populations changed from 66 individuals/leaf on April to 81, 115, 111, 98, 87, 69 and 42 individuals/leaf in the same dates, respectively). Also, the results show that the percent reduction of aphid species complex in 2nd release plot increased gradually showing 42.96, 67.20, 70.27, 72.10, 76.16, 75.40 and 82.04% on May, June, July, August, September, October and November, respectively.

I.2.c. In third level of release (90 eggs/tree)

In the third level of release the pre-releasing numbers of aphid species complex before release were 87 individuals/leaf, while reached 83 individuals/leaf in (check trees).

The results in Fig. (6) indicated that the number of aphid species complex in the 3rd release plot decreased dramatically from 87 on April to 60, 51, 31, 24, 15, 9 and 3 individuals/leaf on May, June, July, August, September, October and November, respectively as compared to check plot (aphid populations changed from 83 individuals/leaf on April to 105, 125, 133, 115, 98, 77 and 51 individuals/leaf in the same dates, respectively). Also, the results show that the percent reduction of aphid species complex in 3rd release plot increased gradually reaching 45.48, 61.08, 77.76, 80.09, 85.40, 88.85 and 94.39% on May, June, July, August, September, October and November, respectively.

These results are in agreement with those obtained by Mangoud, 2007 (in press) who stated that the seven-spotted ladybird, *Coccinella septempunctata* L. (Coleoptera : Coccinellidae) 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.

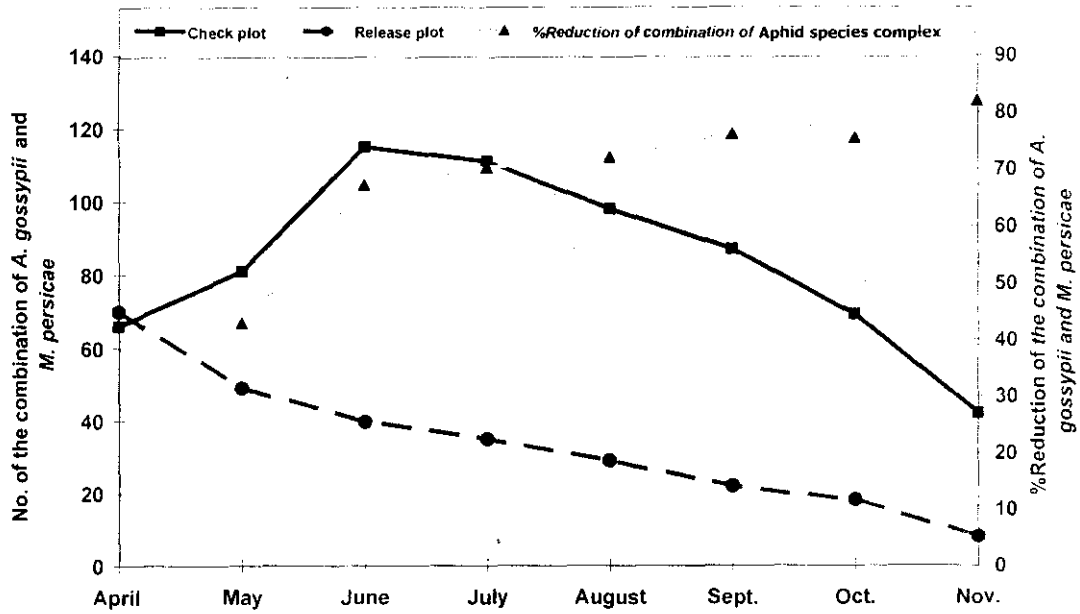


Fig. 5. Fluctuation in the population numbers of aphid species complex in the 2nd plot release at level of (60 eggs) and the corresponding %reduction of the aphid density on apple trees during 2005.

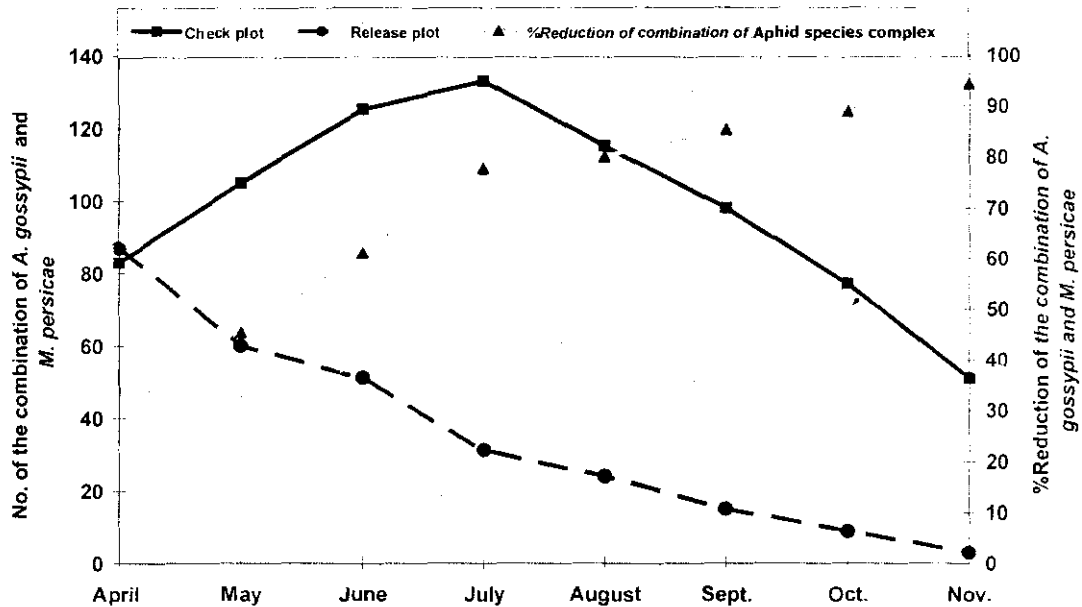


Fig. 6. Fluctuation in the population numbers of aphid species complex in the 3rd plot release at level of (60 eggs) and the corresponding %reduction of the aphid density on apple trees during 2005.

The results which obtained from the first year (2004) showed that as a result of releasing *C. septempunctata* the numbers of aphid species complex which infesting the terminal shoots (new leaves) decreased also the predator could be established in this farm, therefore the infestation by the combination of *A. gossypii* and *M. persicae* in the second year (2005) also sensationally reduced.

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 continue dispersal of aphids from the roots to the aerial portions of the tree, and a corresponding dispersal in the opposite direction. Release *C. septempunctata* adopted here can cope very well with this behaviour.

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تقييم كفاءة أبو العيد ذو السبع نقاط في خفض تعداد من القطن ومن الخوخ الأخضر علي أشجار التفاح

أشرف عبد السلام هندي منجود

معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقي - جيزة

يعتبر المن بنوعيه (من القطن ومن الخوخ الأخضر) من أهم الآفات التي تصيب أشجار التفاح خاصة الأشجار المطعومة علي أصول مقصرة (MM106) في مصر. يرتبط بهذا النوع من المن مفترس قوي وهو أبو العيد ذو السبع نقاط. أجري هذا البحث لتقييم مستويات مختلفة من الإطلاق (٣٠، ٦٠، ٩٠ بيضة موضوعة علي كروت كرتون) في خفض تعداد نوعي المن علي أشجار التفاح بمحافظة القليوبية خلال موسمين متتاليين ٢٠٠٤، ٢٠٠٥.

أدي إطلاق هذا المفترس بمستوي ٣٠ بيضة/شجرة الي خفض نسبة الإصابة بنوعي المن بنسبة وصلت أقصاها ٧٢,٩٤% وذلك في بداية نوفمبر خلال عام ٢٠٠٤. بينما أدي إطلاق هذا المفترس بمستوي ٦٠ بيضة/شجرة الي خفض نسبة الإصابة بنوعي المن وصلت أقصاها الي ٧٩,٨٥% وذلك في بداية نوفمبر خلال عام ٢٠٠٤. بينما أدي مستوي إطلاق المفترس بمعدل ٩٠ بيضة/شجرة الي خفض نسبة الإصابة بنوعي المن وصلت أقصاها الي ٩٣,١٤% وذلك في بداية نوفمبر خلال عام ٢٠٠٤.

في الموسم التالي ٢٠٠٥، أدي إطلاق مفترس أبو العيد ذو السبع نقاط بالمستويات الثلاثة السابقة (٣٠، ٦٠، ٩٠ بيضة موضوعة علي كروت كرتون) الي نفس النتائج تقريبا. ومن النتائج السابقة يمكن استخدام المفترس الحشري أبو العيد ذو السبع نقاط بنجاح كأحد عناصر مكافحة البيولوجية الفعالة في برامج مكافحة المتكاملة لنوعي المن (من القطن ومن الخوخ الأخضر) علي أشجار التفاح.