

Method For Mass Production the Seven Spotted Lady Beetle, *Coccinella Septempunctata* (Coleoptera: Coccinellidae) and Suitable Manipulation of Egg Picking Technique

Jazem A. Mahyoub¹, Ashraf A. H. Mangoud², Khaled.M. AL-Ghamdi¹ and Hamed A.Al- Ghramh³

1- Department of Biological Science, King Abdul-Aziz University, Jeddah, KSA.

2- Plant Protection Institute, A.R.C., Dokki, Giza 12618, Egypt.

3- Department of Biological Science King Khaled University, Abha, KSA

ABSTRACT

The seven-spotted ladybird, *Coccinella septempunctata* (Coleoptera: Coccinellidae) is considered one of the most important predatory coccinellid in Egypt. Poor data are available regarding the biology and mass rearing of this predator in Egypt. Both larvae and adults of *C. septempunctata* fed on Bean Aphid (*Aphis fabae*), the adults laid their eggs in clusters, the total numbers of clusters eggs per female ranged from 1 to 25. The sex ratio 1:1. Longevity of female predator ranged from 21 to 26 days, while that of male predators ranged from 24 to 29 days. The incubation period ranged from 2 to 3 days. The larva of *C. septempunctata* passes through four instars. The average number of aphids consumed by each of the four instar larva are 35, 63, 96, and 290, respectively, under laboratory conditions. The total developmental period of the predator occupied from 16 to 21 days under the constant conditions of $23 \pm 2^{\circ}\text{C}$ and $60 \pm 5 \text{ RH}\%$.

A new method for *C. septempunctata* egg manipulation was developed which consists of a plastic cylindrical puts inside the rearing cages to lay eggs in it and after laying eggs-masses transferred to a separated machine to separate the egg-masses from the cylindrical plastic and to be ready to stick on the card to release.

INTRODUCTION

The seven-spotted ladybird, *Coccinella septempunctata* L. (Coleoptera: Coccinellidae) is the most common ladybird beetle known in Egypt. It is an important predator of many species of aphids; eggs and small nymphs of mealybugs, jassids, eggs, and larvae of cotton leafworm (Ibrahim, 1948 & 1955b). The adults and early stages are often encountered in large numbers of the plants infested with aphids. They prey on these harmful insects and often play a certain role in bringing them under control. It preys on eggs, larvae, and adults of many species of insects and most importantly as a predator on aphids (Ibrahim, 1955a). Both the adult and larval stages feed on insects harmful to plants, such as aphids and scale insects (Anonymous 1997). Adults can be known to eat up to 100 aphids a day (Arnett Jr., *et al.* 1980). The ladybug kills its prey outright and then devours it (Waldbauer, 1998).

This research aimed to mass production of the seven-spotted ladybird, *Coccinella septempunctata* L. To release against several insect pests to reduce the number of applications of insecticides in order to reduce the environmental pollution.

MATERIALS AND METHODS

Mass Production of the Seven-Spotted Ladybird, *C. septempunctata* and Its Prey the Bean Aphid, *Aphis fabae*

Mass Production of the Bean Aphid, *Aphis fabae*

The bean aphid, *Aphis fabae* (Homoptera: Aphididae), 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.

Firstly, the broad bean, *Vicia faba*, seeds is planted in plastic trays (25 x 40 x 15 cm) or foam trays (60 x 25x 20 cm with 109 wholes) contained (peat moss). The seeds were down at 1-2 cm deep and followed with irrigation and fertilizers as required. The first leaflet appeared after about one week from cultivation, bean leaves were infested with *A. fabae* which distributed over the new foliage of cultivated trays (Fig.1).



Fig. 1: Plastic or foam trays for planting the broad bean, *Vicia faba* seeds.

The infested trays were monitored until the population of *A. fabae* increased and became suitable for use as prey to the ladybird, *C. septempunctata*.

A. fabae colonies were cultured under laboratory conditions ($23 \pm 2^\circ\text{C}$ and 60 ± 5 RH%) on broad beans (*Vicia faba*) (Fig. 2). Such leaves of beans were infested by different stages of *A. fabae* and were kept under a glass chimney and its upper opening was covered with white muslin. The potted plants were irrigated and fertilized whenever necessary and kept in wooden cages (100 x 135 x 135 cm) with nylon gauze sides using the method described by Mangoud (2003). *A. fabae* were originally collected from infested broad beans, cultivated in Agriculture Research Center Farm.



Fig. 2: Mass production of the bean aphid, *Aphis fabae*.

Mass Production of *C. septempunctata*

C. septempunctata laid their eggs in clusters, the total numbers of clusters eggs per female ranged from 1 to 25. The sex ratio 1:1. Longevity of female predator ranged from 21 to 26 days, while that of male predators ranged from 24 to 29 days. The incubation period ranged from 2 to 3 days. The larva of *C. septempunctata* passes through four instars. The average number of aphids consumed by each of the four instar larva are 35, 63, 96, and 290, respectively, under laboratory conditions. The total developmental period of the predator occupied from 16 to 21 days under the constant conditions of $23 \pm 2^{\circ}\text{C}$ and 60 ± 5 RH%. It was found that a parasite attacks larvae and pupae stages (the braconid wasp, *Perilitus coccinellae* (Schrank)). When about pupate, the 4th larval instar ceased to feed and thus no food was provided for them and transferred to carton plats in cages to pupation on. Ladybird beetle is brightly colored. This is the warning colour that tell the predator that the ladybirds are toxic. When disturbed, some of them may emit a strong smelling yellow liquid as a deterrent against predators. Newly emerged adults are bright yellow with no markings an hour later the markings emerge. The colour reddens much more gradually.

Some notes were observed about the seven-spotted ladybird, *Coccinella septempunctata* Linnaeus: the egg colour turned to grey before hatching. This process takes five minutes, after hatching the corn appears as a transparent white empty shell. After hatching, the first instar rest in groups for about 1 hour and then crawl out to search about food, When the population of the aphid bean, *A. fabae*, was increased and reached suitable density individuals (approximately 100 individuals/plant) of *C. septempunctata*, the stock of ladybird was obtained from infested plants and transferred to laboratory. Only 10 adult males (σ) + 10 adult females (ρ) of ladybird (to prevent larval cannibalism) (Fig. 3) were transferred to rearing cages (30 cm diameter x 25 cm high) (Fig. 4) and kept in wooden cages (100 x 135 x 135 cm) with nylon gauze sides to make the predator culture giving the predator a suitable numbers of the prey per day.



Fig. 3: Larval cannibalism.



Fig. 4: Rearing cages.

RESULTS AND DISCUSSION

Method for Egg Picking

The method for egg laying [a plastic cylindrical (10 cm length x 2 cm diameter) put inside the rearing pots] (Fig. 5) after laid egg-masses were transferred to separated machine (Fig. 6) to separate the egg-masses from the cylindrical plastic and to be ready to stick on the card to release (Fig. 7). The plastic cylinder must be checked twice a day for egg-masses because of the cannibalistic habits of the adult, especially when there was a serve 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 advance of their development.



Fig. 5: A plastic cylinder for egg laying.



Fig. 6: A machine to separate the egg-masses.

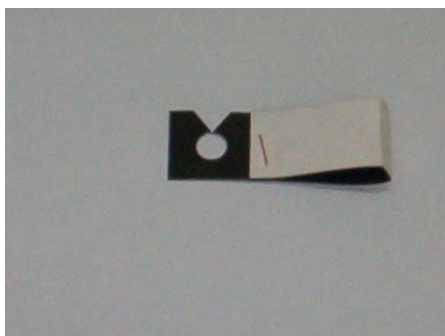


Fig. 7: An eggs card of *Coccinella septempunctata*.

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

Notes about *C. septempunctata*

The egg is spindle in shape with both ends slightly rounded. The egg is orange in colour. The egg colour turned to grey before hatching. This process takes five minutes, after hatching the chorion appears as a transparent white empty shell. After hatching, the first instar rest in groups for about 1 hour and then crawl out to search about food (Fig. 8).

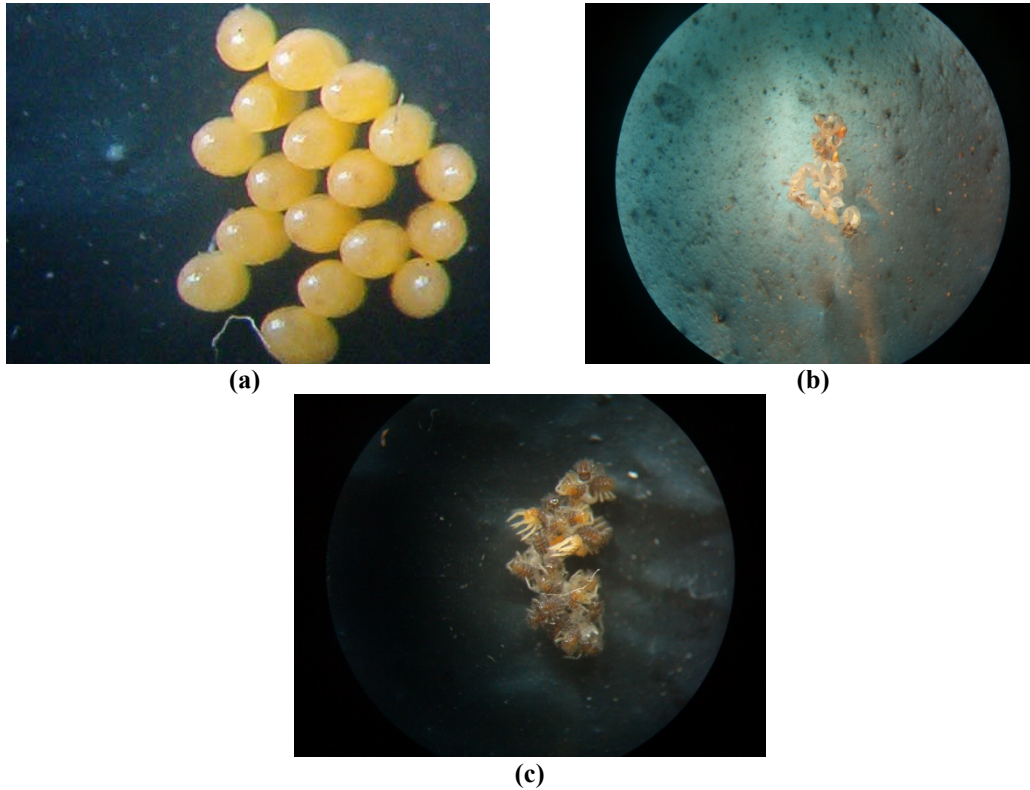


Figure 8: The egg (a), egg shell after hatching (b), and egg cluster after hatching (c).

C. septempunctata laid their eggs in clusters, the total numbers of clusters eggs per female ranged from 1 to 25 under controlled conditions $23 \pm 2^{\circ}\text{C}$ and 60 ± 5 RH%. These results are in agreement with those obtained by Dixon (2000), who found that the ladybirds which feed on aphids develop faster, age faster, move faster, typically are larger, and lay their eggs in clusters.

The sex ratio 1:1.

Longevity of female predator ranged from 21 to 26 days, while that of male predator ranged from 24 to 29 days under controlled conditions of $23 \pm 2^{\circ}\text{C}$ and 60 ± 5 RH%.

The incubation period ranged from 2 to 3 at $23 \pm 2^{\circ}\text{C}$ and 60 ± 5 RH%.

The larva of *C. septempunctata* passes through four instars (Fig. 9). The durations of these instars under the aforementioned conditions were 1-2, 2-4, 2-4, and 2-4 days, respectively. Total larval period ranged from 6 to 9 days. The pupal stages lasted from 5 to 8 days. These results are not in agreement with those obtained by Kamal (1951), who stated that *Coccinella undecimpunctata* has three larval instars only, but agrees with those obtained by Ibrahim (1955a).

The average number of aphids consumed by each of the four instar larva are 35, 63, 96, and 290, respectively, under laboratory conditions. These results are in agreement with those obtained by Ibrahim (1955b).

The total developmental period of the predator occupied from 16 to 21 days under the constant conditions of $23 \pm 2^\circ\text{C}$ and $60 \pm 5 \text{ RH}\%$.

It was found that a parasite attacks larvae and pupae of *C. septempunctata*. The braconid wasp, *Perilitus coccinellae* (Schrank) attacks *Coccinella septempunctata* (Ibrahim, 1955b and Obrycki *et al.* 1985).

When about pupate, the 4th larval instar ceased to feed and thus no food was provided for them and then were transferred to carton plats in cages to pupation on (Fig. 10).

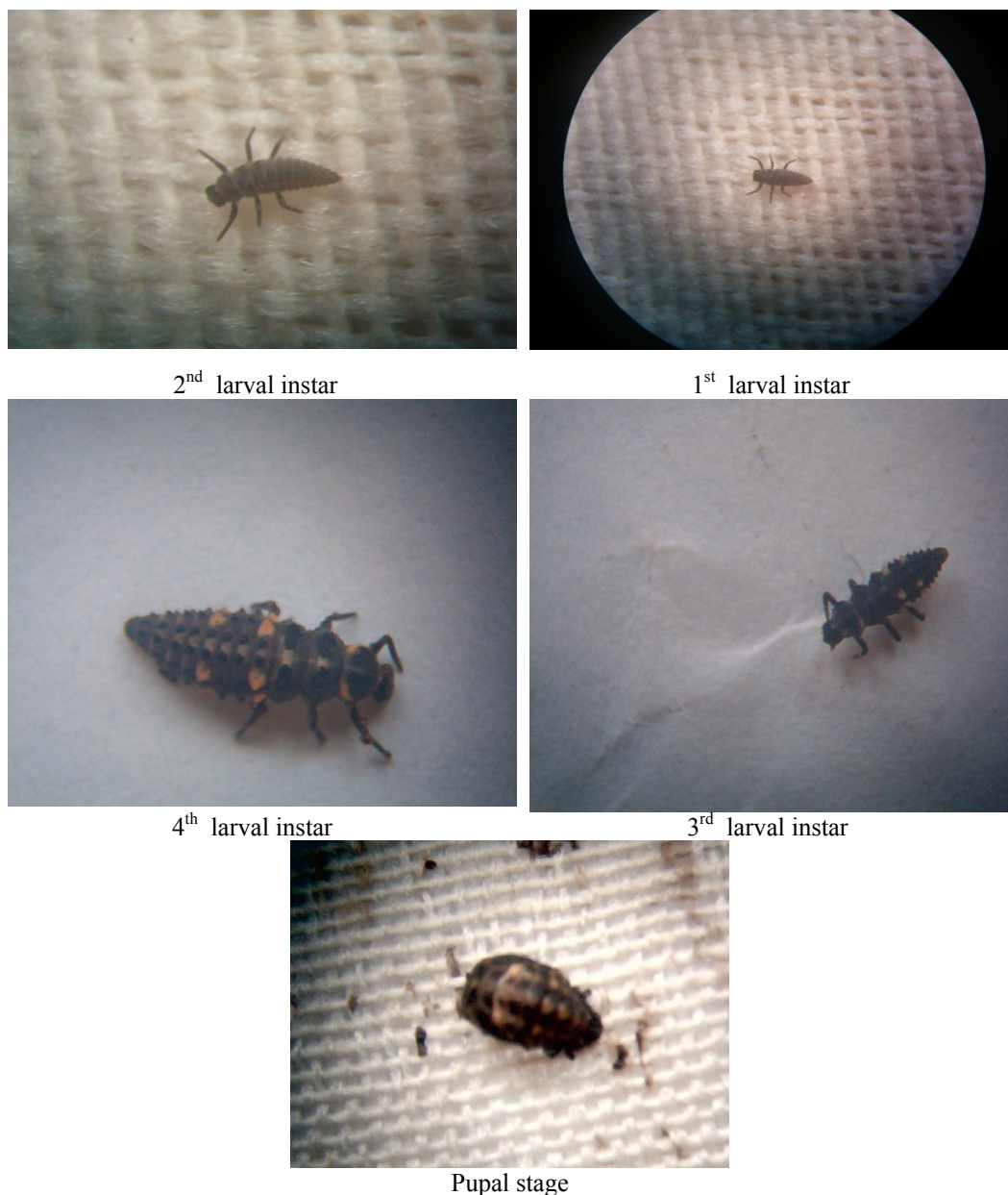


Fig. 9: Different larval instars and pupal stage of *C. septempunctata*.

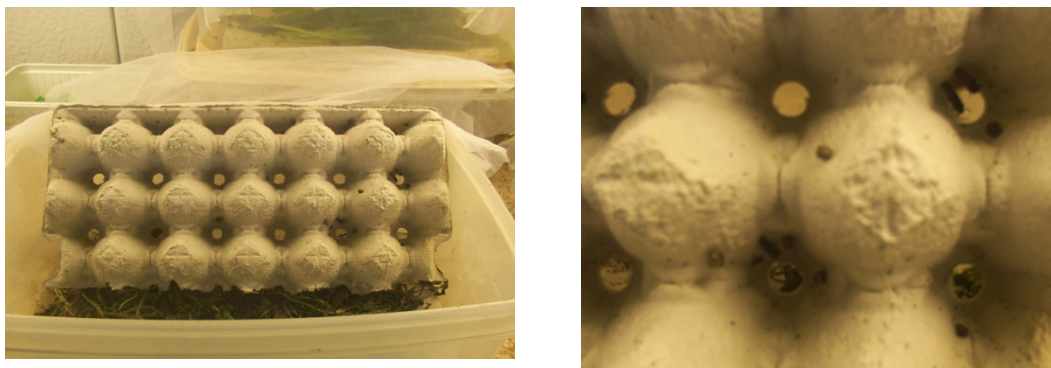


Fig. 10: Carton plats in cages to pupation.

The adult seven-spotted lady beetle is relatively large (7-8 mm). The body is oval and dome-shaped, and it has a white or pale spot on either side of the head. The black spot pattern on the body is usually 1-4-2, with either red or orange forewings. Lady beetle larva can grow up to 7-8 mm in length and are dark with three pairs of prominent legs (Fig. 11) (Weeden *et. al.*, 1996).

Ladybugs cannot sting, but they probably do taste bad and produce a bad smelling odor, perhaps by way of a fluid from joints in the legs, which may help to protect them. They also will “play dead” when in danger since many predators will not eat an insect that does not move (Fleming, 2000).

Ladybird beetle is brightly colored. This is the warning colour that tells the predator that the ladybirds are toxic. When disturbed, some of them may emit a strong smelling yellow liquid as a deterrent against predators.

Newly emerged adults are bright yellow with no markings. An hour later the markings emerge. The colour reddens much more gradually.



Fig. 11: Adult of *C. septempunctata*.

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ARABIC SUMMARY

تربية كمية تجارية مع بعض الملاحظات لأبو العيد ذو السبع نقاط مع الوصول لطريقة مناسبة للحصول علي البيض

- جازم عبد الله مهيو¹، أشرف عبد السلام هندي منجود²، خالد محمد الغامدي¹ و حامد علي آل غرامة³
- 1- قسم علوم الأحياء -جامعة الملك عبدالعزيز - جدة - المملكة العربية السعودية.
 - 2- معهد بحوث وقاية النباتات - الدقي - جيزة - مصر.
 - 3- قسم الاحياء - جامعة الملك خالد - ابها - المملكة العربية السعودية.

يعتبر مفترس أبو العيد ذو السبع نقاط *Coccinella septempunctata* Linnaeus (Coleoptera : Coccinellidae) من أهم وأكثر المفترسات شيوعا في كثير من دول العالم. فلقد تم التوصل الي طريقة جديدة للحصول علي بيض أبو العيد وذلك عن طريق وضع اسطوانة بلاستيكية لوضع البيض بها ثم تنقل هذه الأسطوانات الي جهاز لفصل البيض تمهيدا للصق علي الكروت وذلك لسهولة عملية الإطلاق. ولقد تضمن هذا العمل بعض الملاحظات عن هذا المفترس منها: أن كتل البيض يتغير لونها الي الرمادي الغامق قبل عملية الفقس و تستمر عملية الفقس لمدة 5 دقائق وبعد عملية الفقس يظهر البيض فارغا ويكون شفاف اللون وبعد الفقس يظل العمر اليرقي الأول موجود ومتجمع علي قمة كتل البيض لمدة ساعة وبعد ذلك يتجول بحثا عن العائل الحشري للتغذية عليه. يضع أبو العيد البيض علي صورة مجاميع تبدأ من 1-25 بيضة كما أن النسبة الجنسية بين الذكور والإناث 1:1 وتعيش الأنثي من 21-26 يوما كما يعيش الذكر من 24-29 يوما وكذلك فترة حضانة البيض من 2-3 أيام. كما وجد أن معدل أستهلاك الأطوار المختلفة من أبو العيد للمن يكون كالأتي 25 و 63 و 96 و 290 لكل من العمر اليرقي الأول ثم الثاني ثم الثالث ثم الرابع علي الترتيب تحت الظروف المعملية. كذلك وجد طفيل يتطفل علي اليرقات والحشرة الكاملة لأبو العيد وهو Braconid wasp, *Perilitus coccinellae* (Schrank) في نهاية العمر اليرقي الرابع ومع بداية عملية التعذير تنقل العذاري الي عبوات بها أطباق كرتون للتعذير عليها. لون الحشرات الكاملة لامع. وعند خروج الحشرة الكاملة تخرج بدون نقط ثم تظهر النقطة بعد ذلك.