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COMPARISON BETWEEN LIMIT STORAGE OF EGGS AND PUPAE OF THREE COCCINELLID SPECIES UNDER LOW TEMPERATURE

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ABSTRACT

Eggs and pupae of the *Coccinella septempunctata* L., *Coccinella undecimpunctata* L. and *Chilocorus bipustulatus* L. can be stored at 8 °C., below their zero of development, for several days. In general, viability of both stages decreased by increasing the storage period. For eggs, the maximum of storage period, for the three species, was detected after 3 days (71-83%) and decreased gradually to reach (1-9%) after 15 days. For pupae, viability was 100 % up to 6 days and decreased to (71-75%) after 27 days and reached (1.6-2.9%) after 39 days of storage, The relationship between number of living eggs and pupae with time obey the sigmoid Boltzman equation.

INTRODUCTION

Ladybirds (Coccinellids) have been recorded as predators for many different species of aphids (Mills, 1981). Sunil Joshi *et al.* (1999) reared three coccinellid predators; *Coccinella septempunctata, Coccinella transversalis,* and *Cheilomenes sexmaculata* on many species of aphids and they noticed that all preys are wide host range. Kalushkov and Hodek (2001) recorded the occurrence of coccinellids associated with some aphid-species. Ladybird is an important biological control agent and highly effective against aphids in greenhouses (Semyanove, 1997). El-Habi, *et al* (1999) controlled, successfully, *Aphis_gossypii* by *C. septempunctata.* El-Batran (1991) found that *Exochomus flavipes* can reduce numbers of *Aphis gossypii,* under laboratory conditions, at different temperatures. Abou-Elhagag (1998) studied the seasonal abundance of certain cotton pests and their associated natural enemies. He found that *C. undecimpunctata* fed on cotton aphids and reduced their numbers to minimum levels.

Storage of eggs and pupae of such predators make it available, at limited time, to produce larvae and adults of Coccinellids for controlling aphids and many other pests, in a suitable time.

Storage of *Chrysoperla carnea* eggs was possible for up to 20 days at 8 °C., without loss of viability (Osman and Selman, 1993).

Developmental stages of *C. undecimpunctata* were stored at 6.0 °C. for various storage periods in a refrigerator (Abdel-Salam and Abdel-Baky, 2000).They found that egg hatching was 65% after 7 days of storage. Senyanov (1996) recorded that, pupae of *Harmonia dimidiata* (Fabr.) (Coccinellidae) can be stored under temperature less than 12 °C. if duration of storage was less than 3 months, and when the storage period prolonged (up to 1 year), it was necessary to feed adults, before release with honey or sugar solution.

The present study aimed to evaluate the effect of storage of eggs and pupae of some coccinellids at 8 °C.

MATERIALS AND METHODS

Ladybird adults of *Coccinella septempunctata* L., *Coccinella undecimpunctata* L., and *Chilocorus bipustulatus* L. were collected from Mansoura University Farm during 1999 and 2000 summer seasons. Cotton aphids, *A. gossypii* were collected from cotton plants from the same farm, as a preferred food for these predators. Twenty eggs and twenty pupae were taken from each specie of the three predators, and put in a Petri dish (10 cm diameter). All dishes were stored at 8 °C. and examined, regularly, every three days and the number of livings and dead individuals were recorded .The procedures were repeated five times in every season.

The Boltzman (Draper et al., 1966) equation is used to fit the experimental data in a form of survivorship curve as follows:

$$y = \frac{A_1 - A_2}{1 + e^{(x - x_o)/dx}} + A_2$$

Where: (y) is the residual number of eggs,
(x) is the duration of storage in days,
(A_1) and (A_2) are constants,
(x_o) is the value of (x) at the midpoint of (y),
(dx) is the width.

RESULTS AND DISCUSSION

1. Egg storage

Table (1) shows the changes in the percentage survival of eggs of the three predators (stored at 8 °C.) every three days. Results indicate that, eggs of C. *septempunctata* can be stored for more time than eggs of the other two predator- species. Eggs of the *Ch. bipustulatus*, in general, show less order of viability. By the end of two weeks of storage, the survival of eggs was 9, 1, and 7 % for the three predators, respectively. The variation of the number of lived eggs of these predators with storage time as represented in survivorship curve, according to Boltzman equation, are given in Fig. (1). In general, viability of eggs decreased by increasing time of storage.

Table (1): Viability numbers and percentages of eggs of three predators with time of storage at 8 °C.

Storage (days)	viability of Eggs					
	Coccinella septempunctata		*Coccinella undecimpunctata*		*Chilocorus bipustulatus*	
	Number	%	Number	%	Number	%
0	20	100	20	100	20	100
3	16.7±0.22	83.5±1.1	15.5±0.42	77.5±2.1	14.2±0.26	71±1.3
6	12.9±0.32	64.5±1.6	11.6±0.36	58±1.8	10.9±0.58	54.5±2.9
9	8.0±0.30	40±1.5	7.9±0.44	39.5±2.2	7.8±0.42	39±2.1
12	4.5±0.24	22.5±1.2	3.3±0.28	16.5±1.4	4.3±0.26	21.5±1.3
15	1.8±0.18	9±0.9	0.2±0.08	1±0.4	1.4±0.08	7±0.4

Constant values (A_1), (A_2), (x_o) and (dx) for the tested predators are recorded in Table (2).

Table (2): The constants of Boltzman equation (eggs) for the three predators.

Predator	A_1	A_2	x_o	dx
C. septempunctata	152.80	-9.4827	-21.704	14.255
C. undecimpunctata	28.061	-6.3995	6.8049	5.6723
Ch. bipustulatus	25.687	-2.3453	6.3406	4.8613

2. Pupal stage

The changes in residual numbers of pupae for the three predators are given in Table (3), and are graphically illustrated as survivorship curves in Fig (2). The residual number of pupae is approximately constant during the first 3 weeks and then ebruptly decreases. Data in Table (3) show that, pupae of the three predators can be stored safely, at 8 °C. within 27 days where the percentage of survival ranged between 71.5% and 75.5%. The decrease in the pupal viability, for the three predators is very rapidly at the rest time of storage till death. The experimental data obeys also the sigmoid Boltzman equation which representing the change of residual pupae with the duration of storage for the three predators.

Constants of equation of the three predators are given in Table (4)

Table (3):Viability numbers and percentages of pupae of three predators with time of storage at 8 °C.

Storage (Days)	Viability of pupae					
	C. septempunctata		*C. undecimpunctata*		*Ch. bipustulatus*	
	Number	%	Number	%	Number	%
0	20	100	20	100	20	100
3	20	100	20	100	20	100
6	20	100	20	100	20	100
9	19.9±0.06	99.5±0.3	19.7±0.10	98.5±0.5	20	100
12	19.5±0.10	97.5±0.5	19.4±0.14	97±0.7	19.8±0.08	99±0.4
15	19.2±0.12	96±0.6	19.1±0.22	95.5±1.1	19.6±0.10	98.5±0.5
18	19.0±0.14	95±0.7	18.2±0.38	91±1.9	19.5±0.10	97.5±0.5
21	18.9±0.14	94.5±0.7	17.4±0.54	87±2.7	18.8±0.26	94±1.3
24	16.4±0.32	87±1.6	16.3±0.72	81.5±3.6	17.7±0.48	88.5±2.4
27	15.1±0.48	75.5±2.4	14.3±0.80	71.5±4.0	15.0±0.64	75±3.2
30	12.1±0.66	60.5±3.3	12.0±0.72	60±3.6	11.5±0.66	57.5±3.3
33	8.3±0.54	41.5±2.7	9.1±0.68	45.5±3.4	7.8±0.66	39±3.3
36	5.3±0.40	26.5±2.0	5.2±0.64	26±3.2	4.2±0.46	21±2.3
39	2.9±0.20	14.5±1.0	2.1±0.44	10.5±2.2	1.6±0.22	8±1.1
42	0.3±0.10	1.5±0.5	0.4±0.14	2±0.7	0.3±0.10	1.5±0.5

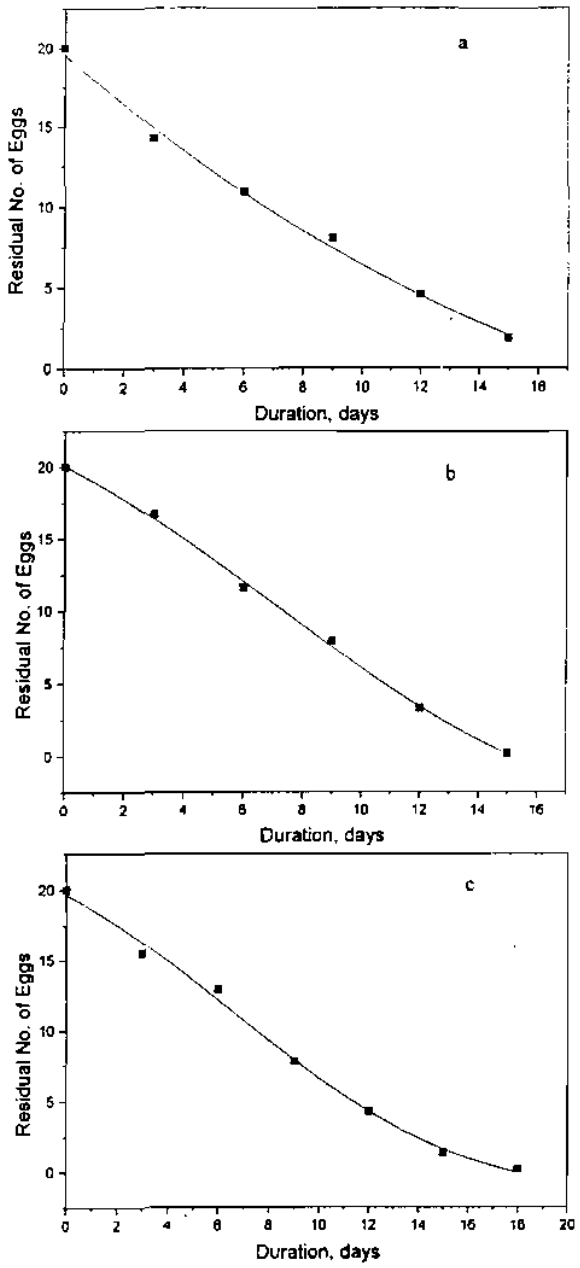

Fig. 1: The change of residual number of eggs against storage time for the three predators.

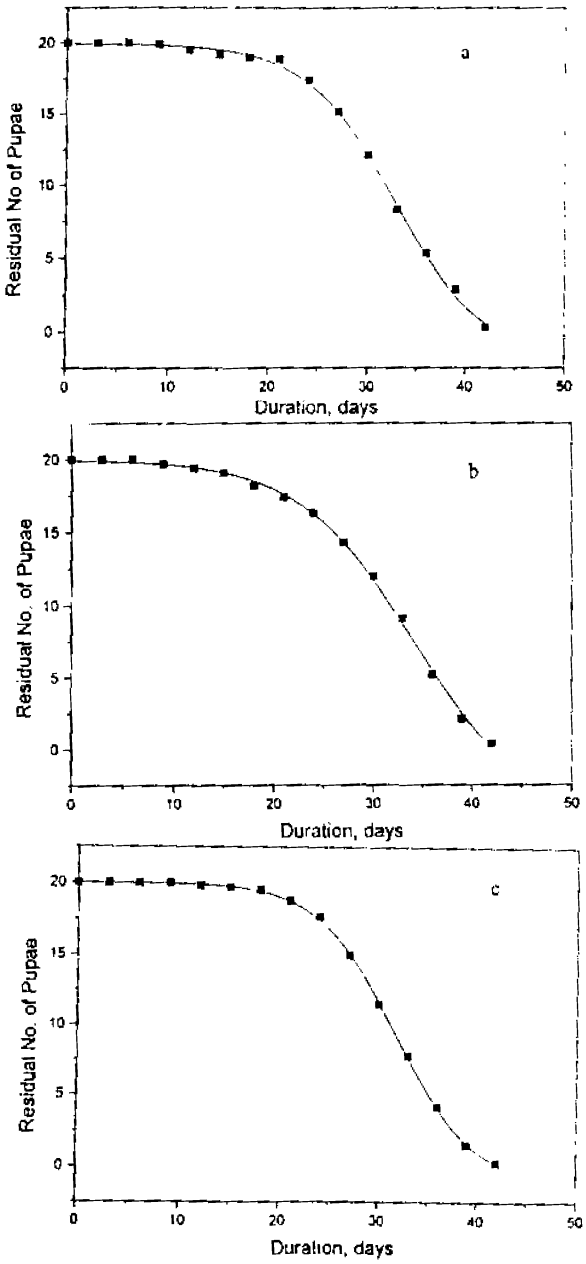

Fig. 2: The change of residual number of pupae against storage time for the three predators.

Table (4): The constants of Boltzman equation (pupae) for the three predators.

Predator	A_1	A_2	x_o	Dx
C. septempunctata	19.956	-1.7125	32.587	4.4614
C. undecimpunctata	20.020	-5.3016	34.272	5.8823
Ch. bipustulatus	20.034	-1.0705	31.647	3.8798

In the available literature, Miller, 1995, stated that lady-beetle eggs of *Eriopis connexa* could not be kept for more than one day at 4 °C. without incurring 30% mortality, and reached to 83% after 14 days. He added that pupae when stored at 4 °C. for three weeks, no mortalities were detected, but when stored for longer than seven weeks, 100% mortality was observed. These results similar to those obtained in the present work for pupae.

In Lativa, Mikhnevich and Shternbergs, 1989, studied the safe storage periods of the different immature stages and adults of lady-beetles when stored between 4 and 10 °C. .They found that eggs can be stored, safely, for few days. On the other hand, they found that pupae and adults can be stored for 12 and 17 days respectively

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مقارنة بين حدود تخزين طورى البيضة والعذراء على درجة حـــرارة منخفضـــة لثلاثة من حشرات أبى العيد

ليلى عبدالستار ا لبطرا ن .
قسم الحشرات الأقتصادية- كلية الزراعة- جامعة المنصورة

تم تخزين بيض وعذارى ثلاثة أنواع من الحشرا ت المفترسة لأبـى العيـد وهـى *Coccinella* *Coccinella undecimpunctata Chilocorus bipustulatus,septempunctata* فى معمـــل القســم خلال موسمى قطن ١٩٩٩-٢٠٠٠ على درجة حرارة ٨ °م. ولقد أوضحت النتائج مايلى :

أولا: تخزين البيض

١- تأثر البيض فى الثلاث مفترسات بصورة ملحوظة بعد ستة ايام وكان نسبة البيـــض المحتفـظ بكـــامل حيويتة بعد هذه الفترة هو ٦٤,٥ ، ٥٨ ، ٥٤,٥% فى المفترسات الثلاثة على التوالى.

٢- وصلت نسبة الموت فى البيض بعد خمسة عشر يوما من التخزين حيث كـــان متوســط نســبة البيــض الحى ٩, ١, ٧ % فى المفترسات الثلا ثة على التوالى.

ثانيا: تخزين العذارى

١- أوضـحت النتائج أن العذارى فى الحشرات المفترسة الثلاث أكثر تحملا من البيض وبدا التأثر الملحـــوظ فى حيويتها بعد نحو حوالى ٣٣يوما من التخزين إذ بلغ متوسط نسبة العذارى المحتفظة بحيويتها بعـــد هذه الفترة ٤١,٥، ٤٥، ٣٩ % على التوالى.

٢- وصلت نسبة العذارى الحية بعد ٤٢ يوما من التخزين إلى ١,٥ ، ٢, ١,٥% فى المفترســـات الثلاثـــة على التوالى .

من الممكن الاستفادة التطبيقية من هذه الدراسة عند تواجد هذه الحشرات المفترسة بأعداد كبيرة فى الحقل بحيث يمكن جمعها وتربيتها وحفظ العذارى لعدة أسابيع على درجة حرارة منخفضة لحين استخدامها فى الوقت المناسب وهى بكامل حيويتها وفى نفس الوقت لا ينصح بحفظ البيض لعدم تحمله التخزين.