COOLING CERTAIN LEPIDOPTEROUS INSECT EGGS IN RELATION TO THEIR HATCHABILITY

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Abstract

Different ages of the pink stalk borer, *Sesamia cretica* (Led.); European corn borer, *Ostrinia nubilalis* (Hubn.), cotton leaf worm, *Spodoptera littoralis* (Boisd.) and greasy cutworm, *Agrotis ipsilon* (Hufn.) eggs were cooled at 5±0.5, 10±0.5 and 15±0.5°C for different periods to evaluate their viability under these conditions. The following results were achieved:

- Cooling eggs of the considered insects delayed hatching in most cases and decreased their viability.

- It could successfully keep *Sesamia* eggs, 2 days old, for 5, 9 and 11 days at the three mentioned temperatures, respectively without affecting their viability (100%).

- *Ostrinia* eggs, aged 2-3 days, could be kept at 10±0.5°C for about 2 days with 88.6 - 100.0% viability. At higher temperature, eggs of 3 days old were successfully kept for a longer period (9 days) with a complete viability.

- *Agrotis* eggs (2 days old) could be kept for 10, 3 and 2 days with their normal viability at three cooling degrees, respectively. *Spodoptera* eggs of the same age were kept for relatively shorter periods; 1, 4 and 4 days at these degrees with their complete viability.

INTRODUCTION

Different researches have been carried out specially against major insect pests such as *Sesamia cretica, Ostrinia nubilalis Spodoptera littoralis* and *Agrotis ipsilon*. Numerous of these researches are done using a certain stage such as those of the toxicological experiments and those of infesting plants, artificially, with eggs or larvae. Sometimes, these stages are being under handling before the time at which they will be used, then it will be necessary to keep them at optimum conditions until need.

This study was undertaken to determine capability of keeping eggs, different ages, of the four studied insects with their normal viability at three low temperatures; 5±0.5, 10±0.5 and 15 ± 0.5°C.

MATERIALS AND METHODS

Effect of three low temperatures; 5±0.5, 10±0.5 and 15±0.5°C on hatching of *S.cretica, O.nubilalis, S.littoralis* and *A.ipsilon* eggs was studied during 1997. The needed eggs were obtained in the laboratory from mated moths resulted from a culture belonged to each insect. Daily deposited eggs were put in glass Petri-dishes provided with small pieces of wetted cotton and kept at 27±0.5°C until used. When *Sesamia* eggs aged 2 days, were distributed in 150-200/vials has at its bottom a thin layer of wetted cotton and tightly plugged with cotton. Three groups of these vials each was kept at one of the three mentioned temperatures. This technique was followed for two ages (2 and 3 days) of *Ostrinia* eggs and also two ages (1 and 2 days) of both *Spodoptera* and *Agrotis* eggs. In the same time, vials contained eggs of each case were kept in an incubator adjusted at 27±0.5°C as a control. Two vials of each treatment, at each temperature, were daily transferred to the incubator. All vials of the different experiments were daily inspected to receive new water-drops. Number of hatched eggs were determined and percentage of egg hatch was then recorded.

RESULTS AND DISCUSSION

The results of the experimental series are shown in Tables 1 to 5. Table 1 shows the effect of cooling *S.cretica* eggs for different periods on hatching percentages. It is appeared that cooling at the lowest temperature for 5 days has no effect on the viability and all cooled eggs hatched. More than 5 cooling days, the viability sharply decreased to 0.8-10.0%. When the cooling was attempted at 10±0.5°C for 9 days, the eggs had vigor tolerance and hatched completely. This viability decreased to 53.1 and 6.5% when the cooling period was increased to 11 and 12 days, respectively. Eggs cooled at 15±0.5°C possessed relatively the highest viability; 100, 70.9, 48.7, 39.0 and 23.5% after 11, 12, 13, 14 and 15 cooling days, respectively. Although the general trend of these results agreed with that of Lutfallah and Awadallah (1984), the capability of *Sesamia* eggs, they used, to tolerate the low temperatures was not similar in both cases, may be due to the differences of eggs and also the cooled eggs in their case were directly collected from the field.

Table 1. Cooling *S.cretica* eggs (2 days old) at 5±0.5, 10±0.5 and 15±0.5°C for different periods, in relation to their hatchability.

Cooling		Egg-hatching*
Degree (±0.5°C)	Period (day)	(%)
5	1-5	100
	6-9	1.6-10.0
	10	0.8
	11	0.0
10	1-9	100
	10	64.3
	11	53.3
	12	6.5
	13	0.0
15	1-11	100
	12	70.9
	13	48.7
	14	39.0
	15	23.5
	16	0.0
Control*	–	100

* At 27±1°C

As for O.nubilalis eggs, Table 2 revealed that when 2 days old eggs were cooled at 10±0.5°C, their hatch delayed and also decreased with increasing the cooling period. Egg viability in this case, recorded 88.6% after one cooling day, 73.3-76.7% after 206 cooling days, 54.8-65.7% after 7-8 cooling days and dropped to 16.7% after 9 cooling days. Older eggs (3 days) kept at the same degree had more hatching percentages; 87.5-100.0, 71.3-75.0 and 31.0-44.7% after 3, 4-6 and 7-9 cooling days, respectively, Table 2. Raising this temperature to 15±0.5°C increased the hatching of 2-days old eggs to 100.0 and 72.0-81.8% after 1-2 and 3-7 cooling days, repectively. Viability of older eggs was not affected (100 % hatching) when stayed at this temperature for 9 days, Table 3. This result is in agreement with that reported by kirollos and Moustafa (1980) when cooled *O.nubilalis* eggs at 7±1°C for 4 days. It was appeared from the previous results that *S.cretica* eggs tolerated the cooling conditions more than *Ostrinia* eggs. While egg hatching recorded 100% in case of the first insect after 9 cooling-days at 10±0.5°C. It decreased to 76.7% after 2 days only in the second insect. Also, at 15±0.5°C, while a complete hatching was recorded for *Sesamia* eggs after 11 cooling days, this viability was recorded for *Ostrina* eggs after 2 cooling days only, and all eggs failed to hatch on the third day of cooling.

Table 2. Cooling *O.nubilalis* eggs (2 & 3 days old) at 10±0.5°C for different periods, in relation to their hatchability.

Egg age (day)	No.of cooling days	Egg-hatching* (%) after:												Total hatching (%)
		1	2	3	4	5	6	7	8	9	10	11	12	
2	1				60.0	28.6								88.6
	2					76.7								76.7
	3					77.5								77.5
	4					31.4	31.4	15.0						77.8
	5						15.6	22.2	40.0					77.8
	6								73.3					73.3
	7									37.1	26.6			63.7
	8										20.8	34.0		54.8
	9											16.7		16.7
control	-		43.6	56.4										100
3	1			82.1	17.9									100
	2			96.4										96.4
	3			87.5										87.5
	4				65.9	9.1								75.0
	5				76.9									76.9
	6						71.3							71.3
	7				43.4				1.3					44.7
	8				33.9									33.9
	9				23.5				4.9		1.4	1.2		31.0
control	-	100												100

* At 27 ± 1°C

Results of the cooled *S.littoralis* eggs are shown in Table 4. The results pointed to that as temperature increased the hatching and viability increased. Similar to this result, was noticed on *S.littoralis* eggs at higher temperature (20-35ºC) by Dahi (1989) who reported that the time required for completion of embryogenesis decreased as the temperature increased. He added also that the highest percentage of egg hatch was recorded at 25°C and the lowest was at 35°C. Abdel-Hafez et al. (1993) also found a negative relationship between temperature and percentage of egg hatch of *P.gossypiella*. Data in the same table showed that eggs cooled at 5±0.5°C were severely affected and lost their entire viability (0.0%) within 48h. Cooling at 10±0.5°C, for four days, all eggs hatched but this viability decreased to 70.0% in case of young eggs and was completely lost in older ones. In the same time, one-day old eggs could be successfully kept at 15±0.5°C for 10 days with a complete hatching. Most of older eggs had the same high viability after 4 cooling days at this temperature and all remained eggs hatched also on the 5th day of cooling.

A.ipsilon eggs had relatively more tolerance against cooling when compared with those of *Spodoptera*. The first insect eggs (1 and 2 days old) could be kept for 10 days at the lowest temperature without affecting their viability (100% hatching), Table 5. Also, 100% hatching could be obtained for the young eggs when kept for 10 and 6 days at 10±0.5°C and 15±0.5°C, respectively. Most of older eggs completely hatched after shorter periods, 2 and 1 cooling days, at these respective temperatures and the remained numbers hatched also directly on the 3rd and 2nd days, Table 5. It was noticed from this investigation that *Agrotis* eggs had relatively the highest tolerance against the severe cooling condition (5±0.5°C) since 100% hatching occurred after 10 cooling-days followed with *sesamia* eggs (100%) after five-cooling days. On the other hand, when cooling was attempted at higher temperatures, *Sesamia* eggs could be kept for the longest periods (9-11 days) with the complete viability followed with *Spodoptera* (4 days) and *Agrotis* eggs (1day).

It is to be noted that, in the control treatment of all trials, the eggs gave 100% hatchability.

Table 3. Cooling *O.nubilalis* eggs (2 & 3 days old) at 15±0.5°C for different periods, in relation to their hatchability.

Egg age (day)	No.of cooling days	Egg-hatching* (%) after:										Total hatching (%)
		1	2	3	4	5	6	7	8	9	10 days	
2	1			20.0	80.0							100
	2					70.6	29.4					100
	3						77.3	4.5				81.8
	4					64.0			16.0			80.0
	5						50.0		31.8			81.8
	6							4.5	33.8	38.4		76.7
	7								31.4	41.6		72.0
	8									27.3	6.1	33.4
control	9								0.0	0.0	0.0	0.0
	-		32.4	67.6								100
3	1	100										100
	2		72.2	27.8								100
	3		100									100
	4				100				29.2			100
	5				70.8			14.3				100
	6				85.7							100
	7				100							100
	8				100							100
	9				100							100
control	-	100										100

* At 27 ± 1°C

Table 4. Cooling *S.littoralis* eggs (1&2 days old) for different periods at different temperatures in relation to their hatchability.

Temp. (±0.5°C)	Egg age (day)	No.of cooling days	Egg-hatching* (%) after:					Total
			1	2	3	4	5 days	
5	1	1		100				100
		2			0.0			0.0
	2	1	100					100
		2	0.0					0.0
10	1	1-2		100				100
		4					100	100
		6					70	70
		8					0.0	0.0
	2	1-2		100				100
		4	100					100
		6		0.0				100
15	1	1-2		100				100
		4-10	100					100
	2	1		100				100
		2-4	100					100
		6-10	Complete hatching on the 5th cooling day					100
Control*	1	-	100					100
	2	-	100					100

* At 27±1°C

Table 5. Cooling *A.ipsilon* eggs (1& 2 days old) for different periods, at different temperatures in relation to their hatchability.

Temp. (±0.5°C)	Egg age (day)	No.of cooling days	Egg-hatching* (%) after:		Total
			1	2 days	
5	1	1-10		100	100
	2	1-10	100		100
10	1	1-2		100	100
		4-10	100		100
	2	1-2	100		100
		4-10	Complete hatching on the 3rd cooling day		100
15	1	1		100	100
		2-6	100		100
		8-10	Complete hatching on the 7th cooling day		100
	2	1	100		100
		2-10	Complete hatching on the 7th cooling day		100
Control*	1	-	100		100
	2	-	100		100

* At 27±1°C

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تبريد بيض بعض حشرات حرشفية الأجنحة وتأثير ذلك على الفقس

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معهد بحوث وقاية النباتات – مركز البحوث الزراعية – الدقى – الجيزه .

تم فى هذا البحث تبريد أعمار مختلفة من بيض دودة القصب الكبيرة، دودة الذرة الأوربية، دودة ورق القطن والدودة القارضة على درجات ٥ ± ٠,٥ ، ١٠±٠,٥ م وذلك لفترات مختلفة ثم نقله إلى درجة ٢٧±٠,٥ م لتسجيل نسبة الفقس. وظهر من الدراسة ما يأتى:-

أدى تبريد البيض الى تأخير الفقس بصفة عامة وخفض حيويته فى حالات معينة. أمكن حفظ بيض دودة القصب الكبيرة (عمر ٢ يوم) بكامل حيويته (١٠٠٪) لفترات ٥,٩، ١١ يوما على درجات الحرارة المذكورة على التوالى. عند حفظ بيض دودة الذره الاوربية (عمر ٢ – ٣ يوما) لمدة يومين على درجات حرارة ١٠±٠,٥ م تراوحت نسبة الفقس بين ٨٨,٦ – ١٠٠,٠٪، أما عند درجة ١٠ ± ٠,٥ م فأمكن حفظه عليها لمدة ٩ أيام وبكامل حيويته. ظهر من الدراسة أيضا أن تبريد البيض عمر يومين للدودة القارضة عند درجات الحرارة الثلاثة أمكن حفظه لفترات ١٠ ، ٣ ، ٥ يوما على التوالى مع الحصول على فقس ١٠٠٪ . زيادة هذه الفترات أكثر من ذلك أدى الى فقس البيض أثناء حفظه وبنفس النسبة أيضا. كان بيض دودة ورق القطن (عمر يوم واحد) أكثر تأثرا بالتبريد حيث أنه لم يحتفظ بحيويته الكاملة سوى لمدة يوم واحد فقط على درجة ١٥±٠,٥ م ولمدة ٤ يوم على درجة ١٠±٠,٥ م ولمدة ١٠ أيام على درجة ١٥ ± ٠,٥ م كما أمكن حفظ أعداد من هذا البيض (عمر يومين) بكامل حيويته لمدة أربعة أيام ، سواء على درجة ١٠±٠,٥ م أو ١٥ ± ٠,٥ م.