



## Effect of low temperature storage on the efficiency of three species of trichogrammatids

PARMINDER KUMAR, MANINDER SHENHMAR and K. S. BRAR

Department of Entomology  
Punjab Agricultural University  
Ludhiana, 141 004, Punjab, India

**ABSTRACT:** The effect of low temperature ( $4 \pm 0.5^{\circ}\text{C}$ ) and refrigerator storage on three trichogrammatids, viz *Trichogramma chilonis* Ishii, *T. pretiosum* Riley and *T. brasiliense* Ashmead was studied under laboratory conditions. *T. chilonis* and *T. pretiosum* can be stored for 20 days whereas *T. brasiliense* for 10 days without adversely affecting their emergence and parasitisation efficiency taking 60 per cent emergence and 60 per cent parasitism as standard. The emergence in *T. brasiliense* reached zero per cent after 34 days of storage whereas 20.3 per cent was recorded in *T. chilonis* and 15.7 per cent in *T. pretiosum* after 60 days of storage. *T. chilonis* showed the highest emergence and parasitization efficiency followed by *T. pretiosum* and *T. brasiliense*.

**KEY WORDS:** Emergence, parasitization efficiency, storage, trichogrammatids

### INTRODUCTION

*Trichogramma chilonis* Ishii, *T. pretiosum* Riley and *T. brasiliense* Ashmead are important parasitoids of *Helicoverpa armigera* (Hübner) in India. Storage of parasitized host eggs at low temperature is an essential prerequisite in biological control. This retards the development of parasitoids so as to synchronize their emergence in large numbers with availability of vulnerable stage of the host in the fields. Gautam (1986) reported that 7-day-old eggs parasitized by *Telenomus remus* Nixon could be stored for 10 days at  $10^{\circ}\text{C}$ . A differential response was noticed when 4 species of *Trichogramma* were stored at 2, 5, and  $10^{\circ}\text{C}$  for 7-49 days (Jalali and Singh, 1992). Singh *et al.* (1997) reported that 7-day-old eggs parasitized by *T. chilonis* could be stored for 20 days in the

refrigerator without adversely affecting the adult emergence, their parasitization efficiency and sex-ratio. Therefore, the present studies were undertaken to find out the effect of refrigerator storage on the emergence, sex-ratio and parasitization efficiency of three trichogrammatids, viz. *T. chilonis*, *T. pretiosum* and *T. brasiliense*.

### MATERIALS AND METHODS

The studies were conducted in the Biological Control Laboratory, Department of Entomology, Punjab Agricultural University, Ludhiana during 2002. Three tricho-cards (10 x 15cm) each with ten thousand *Corcyra* eggs parasitized by each of the three trichogrammatids were stored in the refrigerator at  $4 \pm 0.5^{\circ}\text{C}$ . Small pieces (1 x 2cm) of tricho-cards of each species having 100 eggs were

removed from the refrigerator daily up to sixty days and kept in the laboratory at  $27 \pm 2^{\circ}\text{C}$  and  $60 \pm 5$  per cent relative humidity to observe their adult emergence. The effect of storage on the parasitization efficiency was studied by exposing 100 fresh *Corcyra* eggs for 24 hours to 12 mated female emerged from stored parasitized eggs daily for sixty days. The per cent adult emergence from the parasitized eggs was also noted. The experiment was conducted in a Completely Randomized Design with three replications. The data were subjected to analysis of variance.

## RESULTS AND DISCUSSION

The data presented in Table 1 revealed that the mean percentage of adult emergence of trichogrammatids was very high (95.6%) after one day of storage and it was on par with emergence on 2<sup>nd</sup> (95.1%) and 3<sup>rd</sup> day (94.4%). The mean emergence from 4<sup>th</sup> day to 55<sup>th</sup> day was significantly different from each other. The mean emergence after 20 days was 65.5 per cent, while after 40 days of storage it was 26.5 per cent. Subsequently, it declined and was only 12.0 per cent after 60 days of storage. The

**Table 1. Effect of low temperature storage on the emergence of trichogrammatids**

Storage period (Days)	Mean emergence of trichogrammatids (%)			Mean ( $\bar{x}$ )
	<i>T. pretiosum</i>	<i>T. chilonis</i>	<i>T. brasiliense</i>	
1	95.6 (77.97)	96.0 (78.49)	95.3 (77.51)	95.6 (77.99) <sup>a</sup>
2	94.7 (76.67)	95.6 (77.97)	95.0 (77.09)	95.1 (77.24) <sup>a</sup>
3	94.3 (76.21)	95.0 (72.22)	94.0 (76.67)	94.4 (76.71) <sup>a</sup>
4	93.3 (75.01)	93.6 (75.40)	92.7 (74.50)	93.2 (74.97) <sup>b</sup>
5	91.6 (73.19)	92.0 (73.62)	89.3 (71.35)	91.0 (72.72) <sup>c</sup>
10	84.3 (66.71)	87.3 (69.18)	79.7 (62.97)	83.8 (66.28) <sup>d</sup>
15	78.6 (62.50)	81.6 (64.67)	67.3 (55.13)	75.8 (60.76) <sup>e</sup>
20	72.3 (58.25)	75.6 (60.45)	48.7 (44.22)	65.5 (54.31) <sup>f</sup>
25	65.7 (54.12)	68.3 (55.74)	26.6 (31.05)	53.5 (46.97) <sup>g</sup>
30	58.3 (49.78)	60.3 (50.94)	14.7 (22.43)	44.4 (41.05) <sup>h</sup>
35	48.7 (44.02)	52.6 (46.51)	0.5 (4.05)	33.9 (31.53) <sup>i</sup>
40	37.3 (37.64)	41.7 (40.18)	0.5 (4.05)	26.5 (27.29) <sup>j</sup>
45	29.3 (34.01)	34.6 (36.04)	0.5 (4.05)	21.4 (24.71) <sup>k</sup>
50	24.7 (29.73)	29.3 (32.76)	0.5 (4.05)	18.2 (22.18) <sup>l</sup>
55	19.3 (26.04)	24.7 (29.73)	0.5 (4.05)	14.8 (19.94) <sup>m</sup>
60	15.7 (24.79)	20.3 (26.76)	0.5 (4.05)	12.2 (18.53) <sup>m</sup>
Mean ( $\bar{x}$ )	62.7 (54.16) <sup>n</sup>	65.5 (55.98) <sup>n</sup>	44.1 (38.57) <sup>n</sup>	

CD (P=0.05) = Days = 1.47, Parasitoid = 1.04, Days x parasitoid = 2.54

Note: Mean of three replications. Figures in parentheses are arcsine transformed values.

performance of trichogrammatids revealed that three species showed significant variation. The mean emergence in *T. chilonis* was 65.53 per cent and it was on par with *T. pretiosum* (62.73%) but was significantly higher than *T. brasiliense* (43.83%). The interaction between species and days of storage was significant. *T. chilonis* showed good performance up to 35 days of storage with mean emergence of 52.6 per cent and *T. pretiosum* up to 30 days of storage with mean emergence of 58.3 per cent whereas *T. brasiliense* showed good performance only up to 15 days with 67.3 per cent mean emergence. The mean emergence in *T. brasiliense* reached zero per cent after 34 days of storage whereas 20.3 per cent was recorded in *T.*

*chilonis* and 15.7 per cent in *T. pretiosum* 60 days of storage.

The mean parasitization efficiency of trichogrammatids adults emerging from the stored host eggs during first three days varied from 88.1 to 91.2 per cent and there was no significant difference between them (Table 2). The mean parasitization of the host eggs from 4<sup>th</sup> day to 30<sup>th</sup> day was significant from each other. The mean parasitization after 30 days of storage was 33.4 per cent. More than 50 per cent mean parasitization was recorded in *T. chilonis* (55.3%) and *T. pretiosum* (52.7%) up to 25 days of storage and in case of *T. brasiliense* it was 53.3 per cent up to 15 days of

**Table 2. Effect of low temperature storage on the parasitism of host eggs by trichogrammatids**

Storage period (Days)	Mean parasitism by trichogrammatids (%)			Mean (x)
	<i>T. pretiosum</i>	<i>T. chilonis</i>	<i>T. brasiliense</i>	
1	91.6(73.23)	92.6(74.21)	89.3(70.93)	91.2(72.82) <sup>a</sup>
2	91.0(72.58)	91.3(72.97)	87.6(69.43)	89.1(71.65) <sup>a</sup>
3	88.7(72.34)	89.3(70.99)	86.3(68.33)	88.1(70.55) <sup>a</sup>
4	84.3(66.70)	87.7(69.51)	84.3(66.70)	85.4(67.63) <sup>b</sup>
5	82.6(65.43)	85.6(67.80)	80.6(63.90)	82.9(65.71) <sup>c</sup>
10	75.3(60.22)	77.3(61.57)	68.7(55.96)	73.8(59.24) <sup>d</sup>
15	69.6(56.58)	71.7(57.84)	53.3(46.89)	64.9(53.76) <sup>e</sup>
20	63.3(52.72)	66.3(54.52)	38.6(38.42)	56.1(48.56) <sup>f</sup>
25	52.7(46.51)	55.3(48.04)	21.7(27.69)	43.2(40.75) <sup>g</sup>
30	43.6(41.34)	47.3(43.45)	9.3(17.68)	33.4(34.15) <sup>h</sup>
Mean (x̄)	74.3(60.76) <sup>h</sup>	76.4(62.10) <sup>a</sup>	61.9(52.59) <sup>c</sup>	
CD(P=0.05)				
Days	=	1.84		
Parasitoid	=	1.01		
Days x parasitoid	=	3.19		
Note: Mean of three replications. Figures in parentheses are arcsine transformed values.				

storage. The performance of trichogrammatids revealed that the three species showed significant variation. The mean parasitisation of 76.44 per cent was recorded in *T. chilonis*, which was significantly higher than *T. pretiosum* with 74.27 per cent, which in turn was significantly better than *T. brasiliense* with 61.97 per cent parasitisation. The interaction between species and days of storage was also significant. The highest parasitisation (92.6%) was recorded in *T. chilonis*, one day after storage and it was significantly higher than all other combinations except in *T. chilonis* on 2<sup>nd</sup> day and *T. pretiosum* on first two days.

The mean per cent emergence of trichogrammatids irrespective of the species from parasitized host eggs was higher being 87.9 per

cent on first day of storage and it was on par with second day of storage, which in turn was on par with the third day of storage (Table 3). The emergence of trichogrammatid adults declined sharply and reached 49.1 per cent on 20<sup>th</sup> day of storage. More than 50 per cent emergence was recorded in *T. chilonis* (61.6%) and *T. pretiosum* (59.3%) up to 20 days of storage whereas 62.3 per cent up to 10 days of storage in *T. brasiliense*. The performance of trichogrammatids revealed that the three species showed significant variation. The mean performance of *T. chilonis* was significantly better with mean emergence of 71.77 per cent than by *T. pretiosum* (69.03%), which in turn was significantly better than *T. brasiliense* with mean emergence of 56.33 per cent.

**Table 3. Effect of low temperature storage on the trichogrammatids from parasitized host eggs**

Storage period (Days)	Mean emergence of trichogrammatids (%)			Mean ( $\bar{x}$ )
	<i>T. pretiosum</i>	<i>T. chilonis</i>	<i>T. brasiliense</i>	
1	88.0(69.75) <sup>a</sup>	90.3(71.96)	85.3(67.51)	87.9(69.74) <sup>a</sup>
2	86.6(68.57)	88.3(70.07)	84.6(66.99)	86.5(68.55)
3	83.3(65.89)	86.6(68.64)	83.3(65.91)	84.4(66.81)
4	81.6(64.64)	83.7(66.19)	79.3(62.96)	81.5(64.60)
5	78.7(62.47)	81.3(64.41)	75.6(60.45)	78.5(62.45)
10	67.3(55.13)	70.6(57.20)	62.3(52.13)	66.7(54.83)
15	62.6(52.33)	66.3(54.52)	47.7(43.64)	58.9(50.17)
20	59.3(50.36)	61.6(51.73)	26.3(30.84)	49.1(44.32)
25	44.6(41.92)	47.7(43.65)	13.6(21.61)	35.3(35.73)
30	38.3(38.23)	41.3(39.99)	5.3(13.11)	28.3(30.45)
Mean ( $\bar{x}$ )	69.03(56.93) <sup>b</sup>	71.77(58.84) <sup>a</sup>	56.33(48.52) <sup>c</sup>	
CD (P=0.05)				
Days	=	1.80		
Parasitoid	=	0.99		
Days x parasitoid	=	3.12		
Note: Mean of three replications. Figures in parentheses are arcsine-transformed values.				

**Table 4. Effect of low temperature storage on sex-ratio of trichogrammatids**

Storage period (Days)	Sex-ratio (M : F) of trichogrammatids		
	<i>T. pretiosum</i>	<i>T. chilonis</i>	<i>T. brasiliense</i>
1	1:1.14	1:1.20	1:1.00
10	1:1.50	1:1.29	1:1.60
20	1:1.38	1:1.60	1:1.55
30	1:1.82	1:1.73	1:1.52
40	1:2.10	1:2.00	
50	1:2.17	1:2.16	
60	1:1.25	1:2.33	

The data presented in Table 4 revealed that the sex-ratio was in favour of female throughout the experiment, which showed that they could tolerate the storage conditions slightly better than males. The data on sex-ratio of trichogrammatids did not reveal much variation except that with the prolonged storage, the sex-ratio shifted in favour of females in all the three species.

It can be concluded that *T. chilonis* and *T. pretiosum* can be stored for 20 days whereas *T. brasiliense* for 10 days without adversely affecting their adult emergence and parasitization efficiency. Singh *et al.* (1997) reported this period to be 20 days in case of *T. chilonis*. Killincer *et al.* (1990), however, reported that storage of the *Trichogramma* spp. as the parasitized *Sitotroga cerealella* Olivier eggs up to 30 days does not adversely affect their emergence. Jalali (1992) observed that at 8°C storage, the parasitoid reached zero emergence after 60 days of storage and this period was found to be 49 days when stored at 10°C. Khosa and Brar (2000) reported that different populations of *T. chilonis* can be stored for 22 days.

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