

Original Research Article

Effect of cold storage of trichocard on adult emergence and parasitization of *Trichogramma chilonis*

Abstract

The present study was carried out to evaluate the temperature for proper storage of trichocards parasitized by *T. chilonis* (Ishii) prepared from host egg *Corcyra cephalonica*. The effect of different temperature treatments on parameters like adult emergence and parasitization of *T. chilonis* and parasitization on stored *Corcyra* egg. Parasitized trichocard and non-irradiated eggs of *Corcyra* were kept at $4\pm 1^\circ\text{C}$, $8\pm 1^\circ\text{C}$, $10\pm 1^\circ\text{C}$ and $12\pm 1^\circ\text{C}$. Storage temperature of $10\pm 1^\circ\text{C}$ showed highest per cent adult emergence (73.00%) for 15 days of storage which was declining (57.50%) when stored for 35 days. For 45 days of storage $4\pm 1^\circ\text{C}$ and $8\pm 1^\circ\text{C}$ recorded highest 50.50 and 51.80 per cent adult emergence of *T. chilonis* respectively. Treatment with storage temperature of $4\pm 1^\circ\text{C}$ showed maximum per cent parasitization (92.30%) by emerged *trichogramma* adult from stored trichocard which was decreasing with increase in temperature and storage days. Per cent parasitization by *Trichogramma* on stored *Corcyra* eggs recorded highest per cent parasitization at $4\pm 1^\circ\text{C}$ for 15 days later it was declining with increase in storage days. Storage was listed that at $4\pm 1^\circ\text{C}$ and $10\pm 1^\circ\text{C}$ were conducive for storage of parasitoid trichocard and eggs of *C. cephalonica* and $12\pm 1^\circ\text{C}$ is not suitable for storage as very low (9%) adult emergence recorded for 15 days with nil per cent parasitization.

Keywords: Adult emergence, Parasitization, *Trichogramma chilonis*, Storage, *Corcyra cephalonica*

Introduction

Chemical pesticides are widely used in Agriculture because of their immediate and tangible effect. However due to heavy use of pesticides causes heavy damage to the living organism and both environment (Gupta and Dikshit 2010) so environment friendly an alternative to solve pressing the need of pest management is Biological control (Ghosh and Ballal 2018). *Trichogramma* species are mostly used in biological control as a egg parasitoid for different insect pest of different crops through augmentation and release. *Trichogramma* insects can be easily reared in laboratories and have a great parasitizing potential against the egg of target host (Nadeem *et al.* 2010).

Comment [jm1]: Suggestions or recommendations for further research?

Trichogrammatids are a group of minute wasps of great importance to biological control. The egg parasitoid *Trichogramma chilonis* is a dominant species in India. *Trichogramma chilonis* is a dominant species in India which is very aggressive parasitoid giving near to 100 per cent parasitization according to availability of favourable conditions as it has the ability to increase its capability (Nagarkata and Nagaraja 1979). Among *Trichogramma* species *Trichogramma chilonis* (Ishii) the egg parasitoid (Hymenoptera; Trichogrammatidae) is an important in IPM of lepidopteran insect pest of crop and vegetables like cotton, tomato, cabbage and apple (Smith 1996). The *Trichogramma* species have proved to be effective when it followed by inundative release against the several pest especially when their development is not interrupted by different chemical pesticides (García *et al* 1995b; Briere *et al* 1999).

Generally, the problem is that parasitoid wasps are not available when farmers demand for them also if they are available at the time of field release the price is high which is not affordable by farmers (Lu *et al* 2019; Tezze and Botto 2004; Ayvazet *al.* 2008). This problem is solved by following the technique of storage of trichocards at cold temperature which helps in mass production and when required (Tezze and Botto 2004). The technique of cold storage must ensure the availability of good parasitized trichocards at the time of release in sufficient numbers (Bigler 1994).

The storage of parasitoid pupae retards their development so as to harmonize their emergence with the vulnerable stages of host in the field. Therefore, the cold storage technique is developmentally most important for biocontrol helping efficient mass production to obtain a desired stage of development for field release of agents and for research. Standardized stocks will be available (Ravensberg, 1992 and Greenberg *et al.* 1996).

Thus, low temperature storage is considered an indispensable prerequisite in biological control (Nadeem *et al.* 2010) suggested that the developmental period of parasitoid is directly influenced by the temperature. To get a high rate of emergence in laboratory in summer season, artificial manipulation in temperature is necessary for successful rearing (Rajendran 1999). Long term storage through storability can improve time availability for field release of endoparasitoid also leading to decrease in production cost. If we are able to enhance shelf life of *T. chilonis* and trichocards will be available in off-season thus helpful to entrepreneurs and biological laboratories.

Hence the present experiment was conducted to estimate the effects of storing the pupae of egg parasitoid *T. chilonis* Ishii at low temperature on its emergence and parasitizing potential.

of laboratory reared *T. chilonis* on eggs of its factitious host *Corcyra cephalonica*.

Material and Method

The present study on effect of cold storage on

the adult emergence and parasitization of *T. chilonis* and *Corcyra cephalonica* was carried out at Biocontrol laboratory, College of Agriculture Nagpur. The experiments were carried out for host eggs *C. cephalonica* with

a completely randomized experimental design with four different temperatures as a treatment replicating 5 times

Rearing of *Corcyra cephalonica*

Culture of *C. cephalonica* was obtained from the Biocontrol lab College of Agriculture Nagpur and maintained in controlled condition 27-

30°C temperature $70 \pm 1\%$ humidity (RH) with complete darkness in laboratory for successive generations on sorghum grains in Biocontrol laboratory College of Agriculture Nagpur. The moth emerged from 40th days were collected daily and transferred into specially design egg laying chamber having iron mesh both externally and internally on top and bottom respectively and fresh eggs were collected from egg laying chamber and used for making trichocards.

Culturing of *Trichogramma chilonis*

Experiment was conducted to find out the best storage temperature and duration for the parasitoid.

Nucleus culture of *T. chilonis* was procured from Biocontrol lab College of Agriculture, Nagpur. Eggs obtained from *C. cephalonica* were treated with UV rays (30 WUV tube for 40-45 min) to prevent hatching. 2000 eggs of *Corcyra* counted manually were pasted on the 14×20 cm century card and 5 days after parasitization of this parasitoid card in pupal stage were stored at 4 different temperature regimes viz. $4 \pm 1^\circ\text{C}$, $8 \pm 1^\circ\text{C}$, $10 \pm 1^\circ\text{C}$ and $12 \pm 1^\circ\text{C}$ each for 15, 25, 35 and 45 days in refrigerator and Biological oxygen demand incubators with complete darkness.

Percent adult emergence of *T. chilonis*

After fixed storage days parasitized strips were taken out from the refrigerator and BOD incubators. Per cent adult emergence of *Trichogramma* adult was calculated from *Corcyra* eggs by counting host egg in which there was an orifice intended for exit of adults under stereozoom microscope.

Comment [jm2]: The best time and duration are written down

$$\% \text{ Emergence} = \frac{\text{Total No. of adult emergence}}{\text{Total No. of eggs}} \times 100$$

Percent parasitization by emerged of *T. chilonis*

The adult emerged from stored trichocard at 4±1°C, 8±1°C, 10±1°C and 12±1°C each for 15, 25, 35 and 45 days. The emerged adult of *Trichogramma* were exposed to irradiated *Corcyra* eggs @ 8000 eggs/strips. Percent parasitization were calculated by using formula.

$$\% \text{ Parasitization} = \frac{\text{Total no. of parasitized eggs}}{\text{Total no. of eggsexposed}} \times 100$$

Statistical analysis

Data recorded during present study on percent parasitization by *T. chilonis* on stored *Corcyra* eggs were statistically analyzed by using OPSTAT software which is available online on Hissar Agricultural University, Hissar.

Results

Percent emergence of *T. chilonis*

The result on per cent adult emergence of *T. chilonis* observed that storage of trichocard at different temperature for storage of 15 days recorded significantly maximum adult emergence 73.00 per cent and lowest 9.00 per cent from 10±1°C and 12±1°C respectively (Table 1). After twenty-five days of stored trichocard gives maximum 68.00 per cent adult emergence when it stored at 10±1°C. The moderate and lowest adult emergence recorded at 10±1°C and 12±1°C is 57.50 and 3.20 per cent respectively. When trichocard stored up to thirty-five days significantly maximum adult emergence obtained from different temperature. It was evidenced that results mentioned from present study *T. chilonis* adult emergence per cent was reduced as increase in temperature and number of storage days. The present study enunciated that adult emergence up to 35 days at 10±1°C is pertinent with the study of Mohamed *et al.* (2020) who elucidated pupal stage of *Trichogrammatoidea bactrae* could be stored at 10°C up to 28-30 days giving maximum performance of adult emergence 93.80 per cent. However, at 45 days of storability rate of trichocards are to be doubled for field release to achieve maximum emergence. Thus the present study is in collaborated with the studies of Singh *et al.* (1997) who reported that *Trichogramma chilonis* Ishii can be stored at 5°C up to 3 weeks without hampering their per cent adult emergence and Ayvazet *al.* (2008) who investigated that pupae of *Trichogramma evanescens* can be stored at 4°C for up to 3 weeks without affecting performance of *T. chilonis*.

Percent parasitization by emerged *T. chilonis*

The result on per cent parasitization of *Trichogramma chilonis* revealed that after fifteen days storage, the parasitization percent was differed in accord with different low temperature. At $4\pm 1^\circ\text{C}$, the highest parasitization (85.24%) was observed (Table 2) followed by $8\pm 1^\circ\text{C}$. However, the lowest parasitization (76%) of *T. chilonis* observed from $10\pm 1^\circ\text{C}$ when trichocard stored for 15 days. The highest parasitization percentage of *T. chilonis* obtain when it was reared at $4\pm 1^\circ\text{C}$ (70.24%) followed by $10\pm 1^\circ\text{C}$ (60.00%). The lowest percent parasitization of *T. Chilonis* assessed, when it was reared at $8\pm 1^\circ\text{C}$ (56.75%) for thirty-five days of storage. Trichocard storage at forty-five days obtained results on parasitization were remarkable by parasitoid. The topmost per cent parasitization of *T. Chilonis* listed at $4\pm 1^\circ\text{C}$ (60.87%) followed by $8\pm 1^\circ\text{C}$ (51.37%) when trichocard stored for forty-five days. Emergence was lowest and totally nil at $12\pm 1^\circ\text{C}$ so there was no parasitization occurred. It was evidenced that results mentioned from present study *T. chilonis* adult emergence per cent was reduced as increase in temperature and number of storage days. The present study is in collaborated with the studies of Singh *et al.* (1997) who reported that *Trichogramma chilonis* Ishii can be stored at 5°C upto 3 weeks without hampering their percent efficiency of parasitization. Similarly Tezze and Botto (2004) reported storage of trichocards upto 50 days at $4\pm 1^\circ\text{C}$ without affecting performance of *T. chilonis* on parasitization.

Comment [jm3]: up to

Conclusions

Obtained results proved that pupae of *T. chilonis* stored at $4\pm 1^\circ$ and $8\pm 1^\circ\text{C}$ were found to be the effective for maximum adult emergence and percent parasitization after storage of trichocard upto 35 and 45 days. The treatment $10\pm 1^\circ\text{C}$ found significant upto 15 days for storage of trichocard for adult emergence of *T. chilonis* followed by 25 and 35 days. However, treatment $12\pm 1^\circ\text{C}$ recorded non-significant at 15 to 45 days of storage. The data recorded during present study may be utilized for improving the availability of trichocard in off season for field release.

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Table 1: Effect of storage of *T. chilonis* on adult emergence (%)

No of storage days	Percent adult emergence at different temperature			
	4±1°C	8±1°C	10±1°C	12±1°C
15	66.72 (54.78)	69.90 (56.72)	73.00 (58.72)	9.00 (17.41)
25	62.00 (51.98)	66.50 (54.74)	68.00 (55.57)	5.30 (13.23)
35	55.80 (48.37)	56.30 (48.66)	57.50 (49.33)	3.20 (10.26)
45	50.50 (44.94)	51.80 (46.04)	0.00 (0.32)	0.00 (0.32)
F test	Sig	Sig	Sig	NS
SD(±m)	1.67	2.05	0.97	0.55

CD@1%	5.06	6.22	2.93	1.69
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*Fig in parentheses are arcsin transformed value.

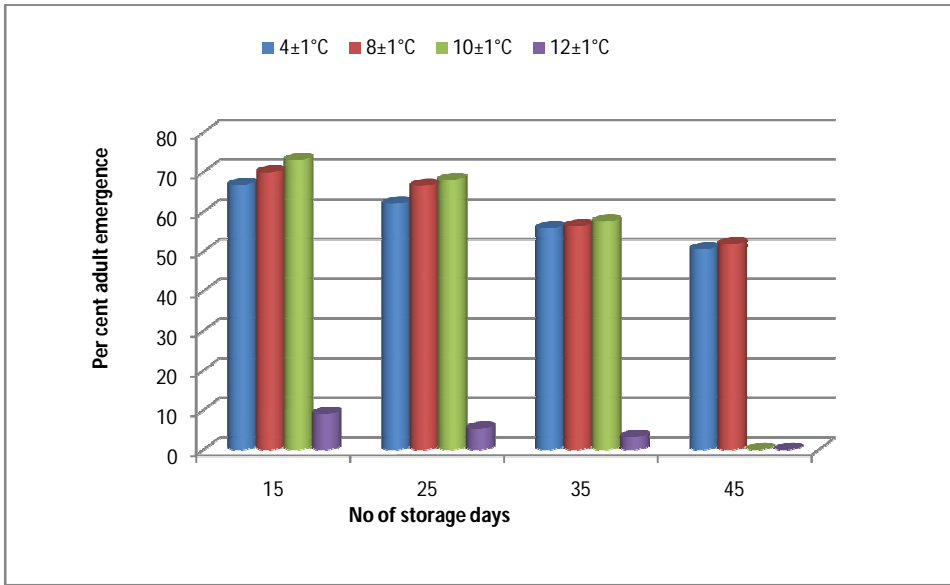


Fig 1: Percent adult emergence of *T. chilonis*

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Table 2: Effect of storage on percent parasitization by emerged *T. chilonis* from stored trichocard (%)

No of storage days	Percent parasitization by emerged <i>T. chilonis</i> at different temperature			
	4±1°C	8±1°C	10±1°C	12±1°C
15	85.24 (68.21)	80.82 (65.19)	76.00 (61.67)	0.00 (0.32)
25	73.63 (59.16)	69.00 (56.30)	64.87 (53.74)	0.00 (0.32)
35	70.24 (57.24)	56.75 (48.89)	60.00 (52.48)	0.00 (0.32)
45	60.87 (51.35)	51.37 (45.79)	0.00 (0.32)	0.00 (0.32)
Ftest	Sig	Sig	Sig	NS
SD(±m)	2.78	2.74	3.06	
CD@1%	8.43	8.30	9.27	

*Fig in parentheses are arcsin transformed value

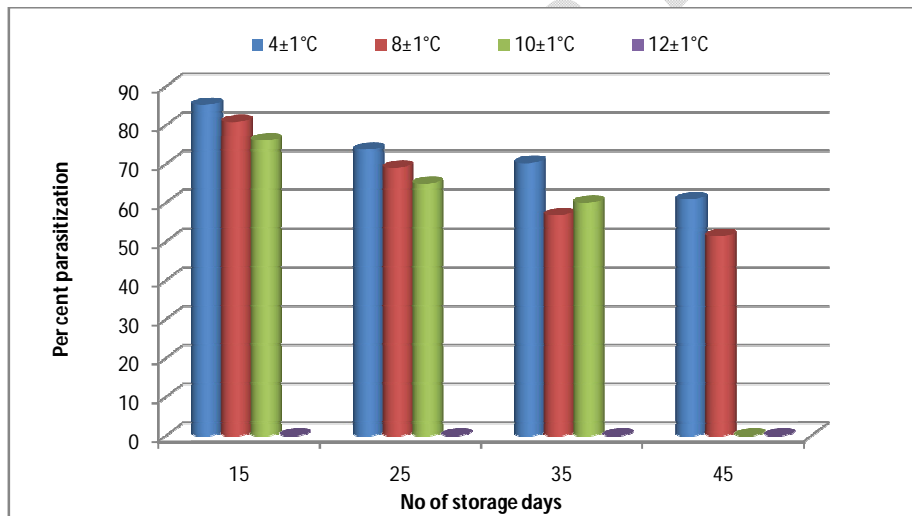


Fig 2: Percent parasitization by emerged *T. chilonis* from stored trichocard