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 identify the ideal temperature for proper storage of trichocards prepared from host egg *Corcyra cephalonica* parasitized by *T. chilonis* (Ishii). The effect of differential temperature on adult emergence of *T. chilonis* and parasitization *on* stored *Corcyra* eggs was assessed. Parasitized trichocards as well as non-irradiated eggs of *C. cephalonica* were maintained at 4±1°C, 8±1°C, 10±1°C and 12±1°C. The trichocards maintained at 10±1°C for 15 days resulted in highest per cent adult emergence of 73 percent which declined to 57.5 percent by 35 days of storage . By 45 days of storage , the temperatures of 4±1°C and 8±1°C recorded the highest adult emergence of 50.50 and 51.80 per cent respectively. Highest efficiency of parasitization (92.3%) was achieved by the parasitoids emerged from trichocards maintained at 4±1°C which significantly decreased with increase in temperature and duration of storage. Influence of storage of C. cephalonica eggs was observed to be significant with highest per cent parasitization on *Corcyra* eggs stored at 4±1 for 15 days which declined thereafter. The temperatures of 4±1°C and 10±1°C were found conducive for storage of parasitoid trichocard and eggs of *C. cephalonica* .

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 cause high damage to the living organisms and environment (Gupta and Dikshit 2010). An environment -friendly alternative to solve the pressing need of pest management is biological control (Ghosh and Ballal 2018). *Trichogramma* species are mostly used in biological control as egg parasitoids for different insect pests of many crops through inundative releases. Trichogrammatids have great potential as egg parasitoids and can be easily reared in hosts (Nadeem *et al.*2010). In India, among the trichogrammatids *Trichogramma chilonis* is the most dominant species that gives near to 100 per cent parasitization under favourable conditions (Nagarkata and Nagaraja 1979) and world- over is considered an important in IPM of lepidopteran insect pest of

crop s such as cotton, tomato, cabbage and apple (Smith 1996). The *Trichogramma* species have proved to be effective when it is used as inundative releases against the several pests especially when the its development is not interrupted by different chemical pesticides (Garcia *et al* 1995b; Briere *et al* 1999).

Generally, the issue with the applied biocontrol is the mismatch between the demand and supply. The parasitoid wasps are not available when farmer requires them and further if it is available at the time of field release, the price is unaffordable to farmers (Lu *et al* 2019; Tezze and Botto 2004; Ayvaz *et al*. 2008). The developmental period of parasitoid is directly influencedby the temperature (Nadeem *et al.* 2010) and artificial manipulation of temperature is necessary for successful rearing during summers (Rajendran 1999). These problems could be managed by following proper storage of trichocard at cold temperature in required quantity (Tezze and Botto 2004) which would ensure the availability good parasitized trichocard at the right time at desired numbers (Bigler 1994) thus playing a major role in effective mass production for field releases (Ravensberg,1992 and Greenberg *et al.*1996).

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

Material and Method

The present study on the 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 4±1°C, 8±1°C, 10±1°C and 12±1°C for different durations 15, 25, 35 and 45 days with five replications for each of the temperatures as well as durations.

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±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 after inoculation of *Corcyra* eggs in the medium of sorghum grains were collected daily and transferred into oviposition chamber 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. On century cards (14×20 cm), 2000 as the original number of *Corcyra* eggs used for experiment which were manually counted and pasted at the rate of 2000 eggs per card and were exposed to the parasitoid for 5 days. Such cards had the parasitoid in pupal stage which were stored at four different temperature regimes *viz.*, 4±1°C, 8±1°C, 10±1°C and12±1°C each for 15, 25, 35 and 45 days in refrigerator and Biological oxygen demand incubators with complete darkness.

Rate of adult emergence of *T. chilonis*

After each specific storage period, parasitized cards (Trichocards) were retrieved from the refrigerator. Observations on adult emergence was made under stereozoom microcope by counting the host eggs with adult emergence holes. Per cent adult emergence of *Trichogramma* was calculated using the formula:

$$\% \text{ Emergence} = \frac{\text{Total numbers of eggs with emergence holes}}{2000} \times 100$$

Parasitization efficacy of *T. chilonis*

The adults emerged from trichocards stored at 4±1°C, 8±1°C, 10±1°C and 12±1°C for different durations of 15, 25, 35 and 45 days. The emerged adults of *Trichogramma* were exposed to irradiated *Corcyra* eggs pasted at the rate of 8000 eggs/ card. Per cent parasitization were calculated by using formula:

$$\% \text{ Parasitization} = \frac{\text{Total no. of parasitized eggs}}{8000} \times 100$$

Statistical analysis

Data recorded during present study on per cent adult emergence and parasitization by emerged *T. chilonis* on *Corcyra* eggs were Statistically analyzed by using WASP (Webagri Stat Package) programme

Results

Per cent emergence of *T. chilonis*

The rate of adult emergence of *T. chilonis* observed after storage of trichocards for a duration of 15 days were significantly different at different temperatures with the maximum adult emergence of

73per cent and lowest of 9 per cent at 10±1°C and 12±1°C respectively (Table 1). After twenty-five days of storage trichocard gives maximum 68 per cent adult emergence at 10±1°C. Corresponding reductions in adult emergence was observed with the increase in the duration of storage and temperature tested. The present finding of appreciable adult emergence up to 35 days at 10±1°C agrees with the study of Mohamed *et al*. (2020) who elucidated pupal stage of *Trichogrammatoidae bactrae* could be stored at 10°C up to 28-30 days giving maximum performance of adult emergence 93.8 per cent. However, release of trichocards are to be doubled for field release to achieve maximum emergence if the trihocards are under cold storage for 45 days. Similar results have been reported by Geetha (2010) showing that trichocard can be stored up to 3 weeks at 10±1°C and Singh *et al*. (1997) showing that *T. chilonis* can be stored at 5°C up to 3 weeks without hampering adult emergence. Further Ayvaz *et al*. (2008) showed that pupae of *Trichogramma evanescens* could be stored 4^0C for upto 3 weeks without affecting performance of *T. evanescens*.

Parasitization rate of *T. chilonis* adults

Adult emergence and parasitization by *T. chilonis* were found to decrease with increase in temperature and duration of the storage. The per cent parasitization of *T.chilonis* adults emerged from the trichocards after fifteen days storage, significantly varied with temperature. At 4±1°C, the highest parasitization (85.24%) was observed (Table 2) followed by 8±1°C. However, the lowest parasitization (76%) of *T. chilonis* observed from 10±1°C when trichocard stored for 15 days. Storage of Trichocards for 45 days resulted in highest parasitization at 4±1°C (60.87%) followed by 8±1°C (51.37%). No adult emergence at 12±1°C after 45 days of storage could be noted and thus no parasitization could be observed. Singh *et al*. (1997) found no decrease in parasitization efficiency if *T. chilonis* was stored at 5°C upto 3 weeks. However, Tezeand Botto (2004) indicated that storage of trichocards upto 50 days at 4±1°C did not affect the parasitization by *T.chilonis* .

Conclusions

Storage of trichocards at 4±1^o and 8±1^{o}C upto 35 and 45 days was found to be the effective for maximum adult emergence and per cent parasitization . The findings would be useful to improve the availability of trichocards during offseasons of production for field release.

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

No of storagedays	Per cent 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

*Fig in parentheses are arc sin transformed value.

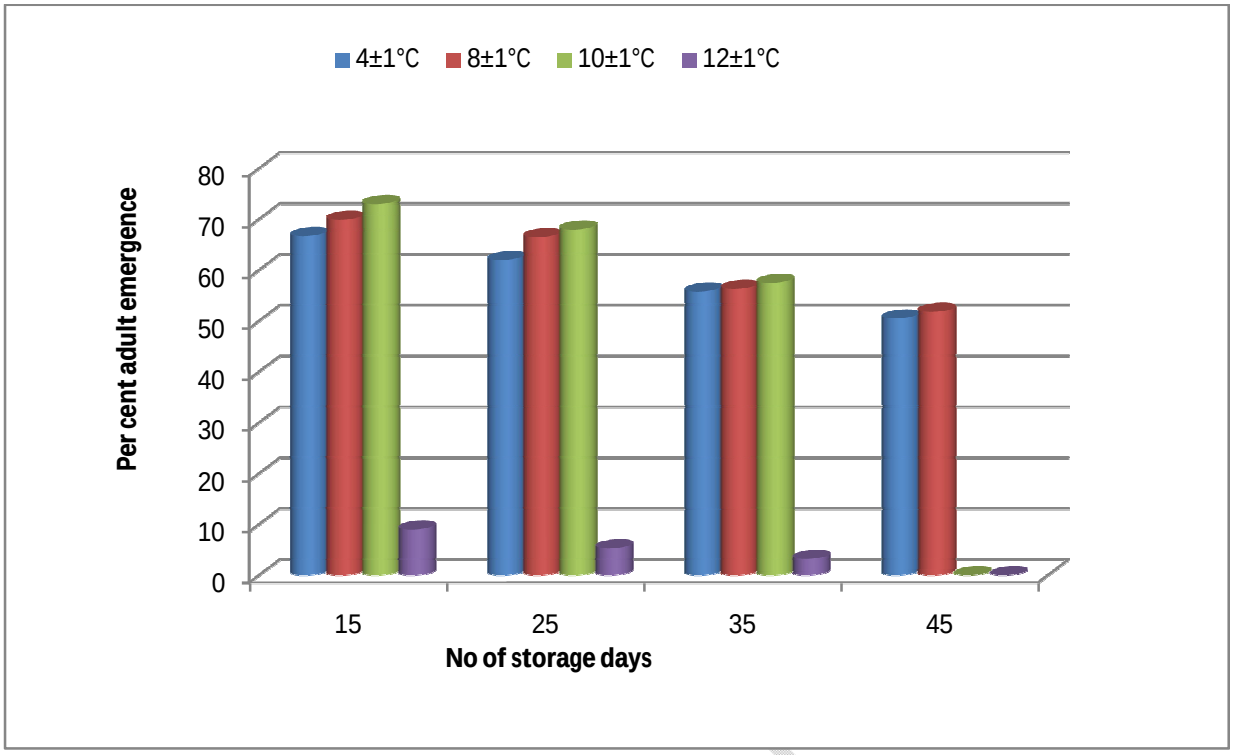

Fig 1: Per cent adult emergence of *T.chilonis*

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

No of storage days	Per cent parasitization by emerged *T.chilonis* 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)
F test	Sig	Sig	Sig	NS
SD (±m)	2.78	2.74	3.06	
CD@1%	8.43	8.30	9.27	

*Fig in parentheses are arc sin transformed value

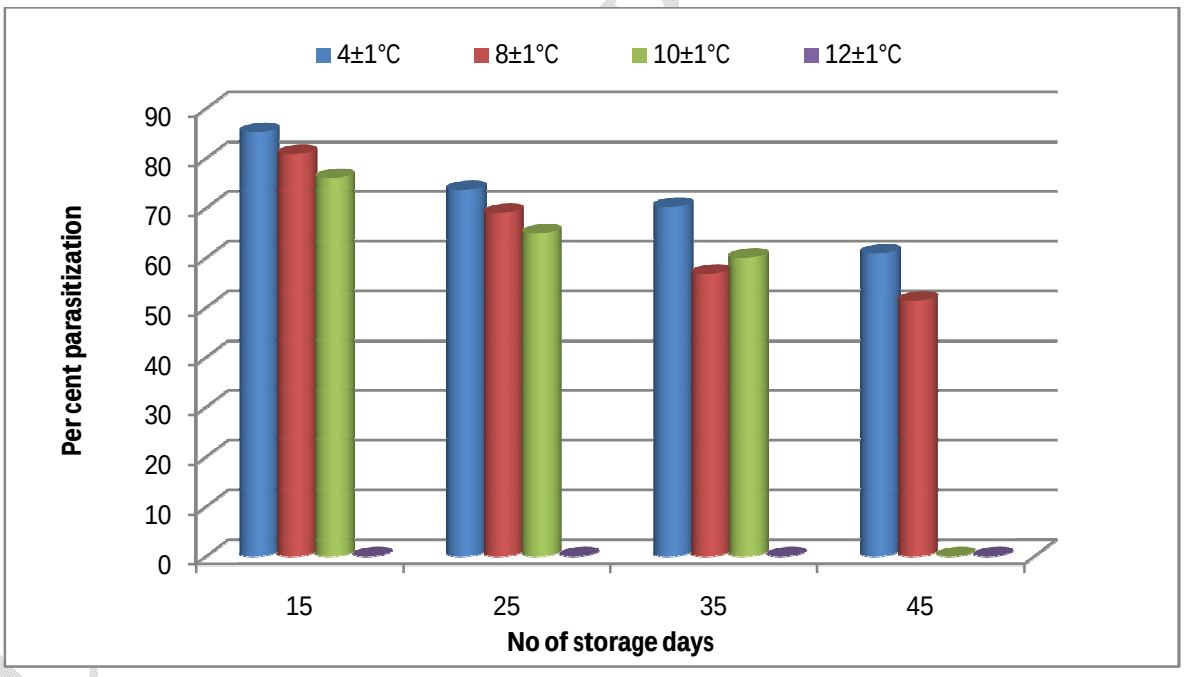

Fig 2: Per cent parasitization by emerged *T.chilonis* from stored trichocard