



Research Note

Performance of *Trichogramma chilonis* under different rearing temperatures

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ABSTRACT: Influence of rearing temperature on biological parameters of *Trichogramma chilonis* (Ishii) was studied under laboratory conditions during 2017-18. Maximum per cent parasitization and adult emergence of 74.2% and 78.91%, respectively was observed at 25+1°C followed by 71.8% and 65.21 % at 30±1°C. However, the temperature of 40+1°C was found detrimental to *T. chilonis* recording only 20.2% parasitization, the progeny of which has failed to complete the development and the adults could not emerge out. The developmental period was maximum (8 days) at 25+1°C. Also, maximum male and female longevity (5 and 12 Days, respectively) and maximum mean per day fecundity of 17 eggs per female/day were recorded at 25+1 °C. The progeny was found to be male dominated with a female- male ratio of *T. chilonis* to be 0.69, 0.74 and 0.96 at 25, 30 and 35°C, respectively.

KEY WORDS: Biological parameters, BOD incubator, rearing temperatures, *Trichogramma chilonis*

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Egg parasitoids belonging to *Trichogrammatidae* are one of the most commonly utilized bioagents to control lepidopteran pests in different crops *viz.*, cotton, rice, sugarcane, tomato, castor, etc. The success of inundative releases of *Trichogramma* species against insect pests in the field are dependant on the parasitoid survival and reproduction. Temperature is the most crucial factor for survival and its activities under field conditions. High temperature during summer and low temperature during winter prevailing in different parts of Indian subcontinent is observed to have varying influence on performance of *Trichogramma* parasitoid. It is a well known fact that the developmental rate, adult emergence, fecundity, longevity and sex ratio of *Trichogramma* spp. are affected by temperature (Consoli and Parra, 1995).

In Vidarbha region of Maharashtra State, *Trichogramma chilonis* Ishii is being used widely in cotton agro-ecosystem against bollworms. In case of non Bt cotton area, *Trichogramma* has wide scope for inundative releases. As Vidarbha is heat proven area and during the peak release, temperature in the field rises up to 35-40°C in the month of September-October popularly called 'October heat', the studies on performance

of *Trichogramma* at different temperature regimes will be highly beneficial.

Fluctuating temperatures from upper and lower extreme limits are prevailing in natural environment of insects for which they have to adapt (Hassan, 1994). Therefore, the present study on *T. chilonis* was undertaken to evaluate the impact of exposure to different temperatures on the biological parameters of *T. chilonis*, which could be usefully employed for mass and quality production of the parasitoid under local environmental conditions and to explore its potential as a bio-control agent against lepidopteran pests of agricultural importance.

Fresh culture of *T. chilonis* was procured and maintained in the Biocontrol Laboratory, Department of Entomology, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, on the eggs of *Corcyra cephalonica* Stainton at ambient temperature.

Freshly laid, U.V irradiated 50 eggs of *C. cephalonica* were pasted on a small yellow paper card (Tricho card) strip (4 x 3.5 cm) with the help of diluted

gum which were then air dried and mass exposed to freshly emerged *T. chilonis* adults in the ratio of 1:6 (Parasitoid: host). After 24 hrs, such trichocard strips were removed and kept in separate polythene bags at different temperature regimes (25, 30, 35, and 40°C) and constant humidity (40±5%) under BOD incubator and biological parameters of *T. chilonis* viz., Per cent parasitisation, Per cent adult emergence, Development time for the parasitoid, Fecundity, Adult longevity and Sex ratio, from respective host trichocards kept at different temperatures were recorded separately.

Per cent parasitization by *T. chilonis* was found to be significantly influenced by the rearing temperatures as presented in Table 1. Lowest temperature tested, 25°C was observed to be significantly best treatment recording maximum parasitization of *Corcyra* eggs to the tune of 74.2% which is closely followed by 71.8% at 30°C, both being at par with each other and significantly superior over other two temperature treatments. Treatment of rearing under 35°C was found to be tolerable to *Trichogramma* recording parasitization 59.2 per cent. However, rearing temperature of 40°C was found to be detrimental recording only 20.2% parasitization.

The data on per cent adult emergence also revealed significant differences among the treatments. Maximum per cent adult emergence (78.91%) was observed at 25±1°C followed by 35±1°C (67.85%) and 30±1°C (65.21%), in that order. However, no adult emergence was observed at 40±1°C (0%) indicating the detrimental effect of higher temperature particularly at 40±1°C adversely affecting the growth and development of *T. chilonis*.

The harmful effect of higher rearing temperature of 40±1°C on per cent parasitization and emergence could be due to intolerance of immature stages of *Trichogramma* to higher temperature which they could not sustain and died

Table 1. Effect of different rearing temperatures on performance of *T. chilonis*

Treatments (Temp.)	Per cent parasitization	Per cent Adult emergence	Developmental Period (Days)
30°C	71.8 (58.31)	65.21 (53.96)	7
35°C	59.2 (50.38)	67.85 (55.61)	6
40°C	20.2 (26.02)	-	0
SE(m)+	2.16	1.42	-
CD at 5%	6.21	4.12	-

before moulting into adult stage. Cabezas *et al.* (2013) found significant values of emergence when evaluating three strains of *T. pretiosum* on eggs of *Spodoptera cosmioides* at 25°C. However, as observed in the study herein, Bari *et al.* (2015) also recorded lower emergence rates in extreme temperatures for *T. zahiri* on eggs of *Dicladispa armigera*.

Similarly, the harmful effect of higher temperature of 40±1°C on growth and development of *T. chilonis* as observed in the present findings was supported by the work of Ramesh and Baskaran (1996) who have observed that rearing at 40°C was highly lethal for the developmental parameters of adult parasitoids of *Trichogramma*.

The time for the complete development of the parasitoid was found to decrease as the temperature was increased, recording the developmental period of *T. chilonis* inside the host eggs as 8, 7 and 6 days at 25°, 30° and 35°C, respectively. Whereas, no development of parasitoids was noted at 40°C temperature as no emergence was recorded. Similarly, the longevity of male and female *T. chilonis* adults was also found to be influenced by different rearing temperatures recording 5, 2, 2 and 12, 5, 3 at 25°, 30° and 35°C, respectively.

Progeny of *T. chilonis* emerged from parasitized host eggs, exposed to different temperature regimes (25+1°C to 35+1°C) and number of host eggs parasitized per female per day was recorded. The data presented in Table 2 revealed that per day fecundity of *Trichogramma* female was found significantly maximum at 25°C and minimum was at 35°C. Thus, the highest number of host eggs parasitized per female per day was 17 eggs at 25°C followed by 13 and 12 eggs/female/day at 30°C and 35°C, respectively.

Calvin *et al.* (1984) reported that the fecundity of *T. pretiosum* at temperatures below 30°C decreased from 18.0 to 9.0 eggs host parasitized/female. Similarly, Haile *et al.*

Table 2. Effect of different rearing temperatures on adult longevity and fecundity of *T. chilonis*

Treatments (Temp.)	Adult longevity (Days)		Fecundity per day per female	No. of females/male	Sex ratio
	Male	Female			
25°C	5	12	17 (4.12)	0.69	1: 0.69
30°C	2	5	13 (3.60)	0.74	1: 0.74
35°C	2	3	12 (3.46)	0.96	1: 0.96
40°C	-	-	-	-	-
SE(m)+	-	-	0.05	0.11	-
CD at 5%	-	-	0.19	NS	-

(2002) concluded that *T. chilonis* from India could complete its development even at 34°C but, the fertility was reduced as the temperature was increased from 25°C to 34°C. Also, Ghosh *et al.* (2017) recorded highest mean daily fecundity for *T. chilonis* at 26°C whereas for *T. achaeae* at 31°C which is in line with the present findings indicating 25°C temperature to be optimum for the growth and development of *T. chilonis*.

The observations were also recorded on number of males and females in the progeny after rearing the *Trichogramma* at different temperature regimes and the results revealed that highest male-female ratio of 1:0.96 was found at 35°C and it was lowest (1:0.69) at 25°C (Table 2). The male dominated progeny obtained in the present investigations could be due to low relative humidity which was upto 40% during the experimentation, as Qian *et al.* (2013) concluded that the sex ratio of *T. ostrinae* could be affected by relative humidity, especially in low relative humidity (RH<55%). It was also reported that the sex ratio of *T. ostrinae* was influenced by the age of foundress. The proportion of males increased with the increasing foundress age.

Thus, it is concluded that the temperature plays a significant role in growth, development and performance of *T. chilonis*, however, temperature above 40°C was found to be detrimental for the growth and development of *T. chilonis*, which could adversely affect its efficacy under field condition.

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