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IMPACT OF STORAGE DAYS ON THE EMERGENCE OF *TRICHOGRAMMA JAPONICUM* ASHMEAD (HYMENOPTERA : TRICHOGRAMMATIDAE)

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Trichogramma japonicum Ashmead is commonly used biocontrol agent through inundative field release. The impact of storage of *T. japonicum* for different days (10, 15, 20, 25 and 30 days after parasitization) for different life stages (egg, larval and pupal) at 10°C was studied under laboratory condition. It was observed that there was significant reduction in adult emergence from parasitized *Corcyra cephalonica* (Stainton) eggs containing egg, larval and pupal stages of *T. japonicum* due to storage. Maximum adult emergence (59.4%) was observed when the egg stage of *T. japonicum* was stored for 10 days and percent adult emergence decreased upto 34.7% when storage period extended to 30 days. The percentage of adult emergence ranged from 55.8% (at 10 days after storage) to 33.7% (at 30 days of storage) in larval stage. Storage of *T. japonicum* at pupal stage (7 days after parasitization) exhibited maximum adult emergence (64.5%) as compared to both egg and larval stages.

Key words : Biocontrol, Hyperparasitization, Innundative, Dysfunction, Conservation.

INTRODUCTION

Trichogramma japonica (Hymenoptera : Trichogrammatidae) species of egg parasitoids are ubiquitous and are most widely used as potential biocontrol agent against insect pests. They occur naturally in nearly every terrestrial habitat and cause efficient destruction of the eggs of over 200 insect species through hyperparasitization.

T. japonica have been used for control of lepidopteran pests in rice, cotton, sugarcane, vegetables etc through inundative field releases. About nine species of *T. japonica* are produced commercially in insectaries around the world with 30 countries releasing them. The biocontrol agents particularly parasitoids and predators have short life span and they cannot be stored for long.

Weather plays an important role in tritrophic interactions among poikilotherms, as it influences the level of control that natural enemies exert. Lack of success in biological control programs has often been caused by high mortality of natural enemies due to climatic extremes (Kaleybi *et al.*, 2005). Development in sub-optimal conditions can lead to drastic impact on the life parameters and morphological structure of insects particularly biocontrol agents. Low temperature can cause physiological dysfunction (Colinet & Biovin, 2011), depletion of energy reserves (Chen *et al.*, 2008) and morphological alterations like malformation of reproductive organs, reduction in body size (Rundle *et al.*, 2004) and deformation in wing structure (Tezze & Botto, 2004). Authors have also reported reduction in percentage of adult emergence (Bayram *et al.*, 2005).

Field release of *T. javonica* has other major constraints as it is very sensitive to both conventional and new generation pesticides (Uma *et al.*, 2013). Thus, the storage is an important pre-release aspect of *Trichogramma* so that its release can be scheduled in accordance with chemical sprays to avoid detrimental effect of chemicals on them

In this regard it is very important to evaluate the shelf life of *Trichogramma* for mass production and distribution. Thus the present investigation entitled 'Impact of storage days on the emergence of *T. japonicum* was undertaken in the biocontrol laboratory of Central Integrated Pest Management Centre, Ernakulam in 2014-2015.

MATERIALS AND METHODS

Material source : The stock culture of *Corcyra cepalonica* eggs were procured from the State Biocontrol Laboratory, Mannuthy, Thrissur. *T. japonicum* was reared on the factitious host, rice moth *Corcyra cephalonica* (Stainton) (Lepidoptera : Pyralidae) reared in the laboratory at temperature 30 ± 2^0C and relative humidity $70 \pm 2\%$.

The egg parasitoid *T. japonicum* was mass cultured on the eggs of rice moth, *C. cephalonica* in the laboratory. Freshly laid eggs of *C. cephalonica* were collected in the morning and cleaned from scales and other dust particles. The cleaned *C. cephalonca* eggs were sprinkled on sticky cards of 10 x 5 cm^2 size and were irradiated with UV rays of 30 watts for 45 minutes at a distance of 2 ft, to prevent hatching of *Corcyra* larvae. These *Corcyra* egg cards were then kept in polythene bags along with a nucleus trichocard at 6 : 1 ratio for 3-4 days to get parasitized by *T. japonicum*.

The life cycle of *T. japonicum* at 30 ± 2^0C and relative humidity $70 \pm 2\%$ was studied. It was observed that three days after parasitisation corresponds to egg stage, five days after parasitisation corresponds to larval stage and seven days after parasitisation corresponds to pupal stage.

Trichocards containing egg, larval and pupal stage of *T. japonicum* corresponding to 3, 5 and 7 days after parasitisation were inserted in test tubes and were placed in B.O.D. incubator maintained at 10^0C. All the three life stages of *T. japonicum* were exposed to 10^0C for 10, 15, 20, 25 and 30 days respectively and were then shifted to culture room for adult emergence. Cotton swabbed with 50% honey was kept inside the tube as adult food. An uninterrupted control was also maintained where in *T. japonicum* was allowed to continue its life stages without ant storage. The experiment was conducted in Completely Randomised Design and for each treatment four replications were maintained. Data on percentage adult emergence was analyzed after square root transformation. For parasitized *C. cephalonica* eggs laid individually, emergence was assessed by counting the number of eggs with exit holes indicating the emergence of *T. japonicum*.

RESULTS AND DISCUSSION

The results of impact of storage of various life stages of *T. japonicum* at 10^o C for 10, 15, 20, 25 and 30 days are summarized in Table I.

The results indicate significant difference in the rate of adult emergence due to storage. Storage of egg stage at 10^0C exhibited significant difference among treatments in a range of 34.7% to 59.4%.the percentage emergence of *T. japonicum* showed a decreasing trend as period of storage increased. Maximum adult emergence (59.4%) was

Table I : Mean percentage of adult *T. japonicum* emergence for storage at 10°C for 10, 15, 20, 25 and 30 days after storage.

Number of days under storage	Mean percentage of adult *T. japonicum* emergence for storage at 10°C for		
	Egg stage	Larval stage	Pupal stage
10 days	59.4 (7.7395)[b]	55.8 (7.5033)[b]	64.5 (8.0623)[b]
15 days	55.8 (7.5033)[c]	50.7 (7.1554)[c]	62.5 (7.9373)[c]
20 days	42.9 (6.5897)[d]	39.6 (6.3328)[d]	61.3 (7.8613)[d]
25 days	40.2 (6.3797)[e]	39.2 (6.3008)[e]	59.7 (7.7589)[e]
30 days	34.7 (5.933)[f]	33.7 (5.8481)[f]	55.8 (7.7266)[f]
Control	80.75 (1.1167)[a]	79.75 (1.1043)[a]	81.00 (1.1198)[a]

Figures in parentheses are square root ($\sqrt{x + 0.5}$) transformed values; In a coloumn, means superscripted by a common letter are not significantly different by DMRT (P=0.05)

was observed when the egg stage of *T. japonicum* was stored for 10 days and percent adult emergence decreased upto 34.7% when storage period extended to 30 days whereas untreated control exhibited an adult emergence of 80.75%. Five days after parasitisation corresponds to larval stage of *T. japonicum* and the larval stage exposure to storage temperature also exhibited significant difference in the rate of adult emergence. The percentage of adult emergence ranged from 55.8% (at 10 days after storage) to 33.7% (at 30 days of storage). Storage of *T. japonicum* at pupal stage (7 days after parasitization) exhibited maximum adult emergence as compared to both egg and larval stages. Maximum percentage of adult emergence was observed at 10 days after storage (64.5%) which significantly decreased by 62.5%, 61.3%, 59.7% and 55.8% at 15, 20, 25 and 30 days after storage at 10°C. untreated control had an adult emergence of 81%.

Our results shown a maximum adult emergence of 64.5% which is contrary with the findings of Maceda *et al.* (2003). They reported an emergence of 89% in *Trichogramma pretiosum* at different temperature regimes of 15°C, 20°C, 25°C and 30°C. This may be attributed to the different host selected for rearing (*Anagasta kuehniella*) or the varying climatic condition prevalent there. Similar reports have been reported for other species of *Trichogramma* by Harrison *et al.* (1985) and Consoli & Parra (1995).

The work by Hansen & Jensen (2002) revealed that the highest fecundity occurred at intermediate temperatures of 20°C and a very conservative estimate of host-feeding showed that it accounts for approximately half of the mortality of host eggs at 20 and 25°C and thus could constitute a major mortality factor for the host population.

The results are in line with the findings of Rundle *et al.* (2004) who studied the effect of storage temperature (4°C, 8°C, and 10°C) and duration (1-8 week) for *T. carverae*. For all species, percentage of emergence was lowered after an initial diapause induction period (28 days). No wasps emerged after 2 month of storage, suggesting that true diapause was not induced. Also in storage temperature lower than 10°C and storage duration 3 week or longer had a negative impact on emergence and longevity and effects were not additive. Negative effects may partly reflect size changes, because size decreased in response to storage period, and there was an interaction between duration and temperature effects on size. Storage period was the major factor influencing fecundity and field success; both fitness measures were reduced after storage of 3 week or longer.

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REFERENCES

CHEN, W.L., LEOPOLD, R.A. & HARRIS, M.O. 2008. Cold storage effects on maternal and progeny quality of *Gonatocerus ashmeadi* Girault (Hymenoptera : Mymaridae). *Biol. Control.* **46** : 122-132.

COLINET, H. & BOIVIN, G. 2011. Insect parasitoids cold storage: A comprehensive review of factors of variability and consequences. *Biol. Control.* **58** : 83-95.

CONSOLI, F.L. & PARRA, J.R.P. 1995. Effects of constant and alternating temperatures on *Trichogramma galloi* Zucchi (Hymenoptera : Trichogrammatidae), development and thermal requirements. *J. Appl. Entomol.* **119** : 415-418.

HANSEN, L.S. & JENSEN, K.M.V., 2002. Effect of temperature on parasitism and host feeding of *Trichogramma turkestanica* (Hymenoptera : Trichogrammatidae) on *Ephestia kuehniella* (Lepidoptera : Pyralidae). *J. Econ. Entomol.* **95** : 50-56.

HARRISON, W.W., KING, E.G. & OUTZ, J.D. 1985. Development of *Trichogramma exiguum* and *Trichogramma pretiosum* at five temperature regimes. *Environ. Entomol.* 14 : 118-121.

KALEYBI, A., OVERHOLT, W.A., SCHULTHESS, F., MUEKE, J.M., HASSAN, S.A. & SITHANANTHAM. S. 2005. Functional response of six indigenous Trichogrammatid egg parasitoids (Hymenoptera : Trichogrammatidae) in Kenya : influence of temperature and relative humidity. *Biol. Control.* **32** : 164-171.

MACEDA, A., HOHMANN, C.L. & SANTOS. H.R. 2003. Temperature effect on *Trichogramma pretiosum* Riley and *Trichogramma anulata. Brazilian archueves of Biol. and Tech.* **46** : 27-32.

RUNDLE, B.J., THOMSON, L.J. & HOFFMANN, A.A. 2004. Effects of cold storage on field and laboratory performance of *Trichogramma carverae* (Hymenoptera : Trichogrammatidae) and the response of three *Trichogramma* spp. (*T. carverae, T. nr. brassicae, and T. funiculatum*) to cold. *J. Econ. Entomol.* **97**(2) : 213-221.

UMA, S., JACOB, S. & LYLA, K.R. 2013. Acute contact toxicity of selected conventional and novel insecticides to *Trichogramma japonicum* Ashmead (Hymenoptera : Trichogrammatidae).
J. Biopest. 7(1) : 1-5.

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