


STUDY ON PARASITISATION ABILITY OF *Trichogramma chilonis* (HYMENOPTERA: TRICHOGRAMMATIDAE) ON THE EGGS OF *Corcyra cephalonica* REARED ON DIFFERENT MEDIA AT LABORATORY CONDITIONSRajasekhar L¹ Divya J² and Lavanya N³

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ABSTRACT: Biological control of crop pest is a safe, economic and eco friendly approach in integrated pest management. Recent research emphasises the importance of mass rearing of bio control agents for augmentation and field releases. *Trichogramma chilonis* is widely distributed in the Indian subcontinent in several crops and efficiently controls many lepidopteran insect pest by way of end parasitisation of their eggs. Although there are several egg parasitoids commonly used throughout the world, *Trichogramma* spp., have been the most extensively studied. *Trichogramma chilonis* is the choice of present experiment as it is an egg parasitoid on many lepidopterans playing vital role in bio control programmes. For mass production of *Trichogramma* spp., and many parasitoids, *Corcyra cephalonica* has been the most suitable host insect in many laboratories. The rearing host media is of potential importance for the nutritional quality of host eggs and the survival of *Trichogramma* and other egg parasitoids released in to the environment as biological control agents (Hunter, 2003). Host egg size and quality is a considerable factor which can effect developmental period, longevity, parasitism, adult emergence of parasitoids (Pathak, 2010). In view of its potential importance to biological control programmes, an attempt was made in the present study to determine the economic efficiency of rearing media for *Corcyra* using sorghum, Pearl millet (bajra), finger millet (raagi), broken rice and foxtail millet (korra) in different combinations with the objective to study parasitisation ability of *Trichogramma chilonis* on the eggs of *Corcyra cephalonica* influenced by diet combinations. The present experiment was conducted in the period from 02.03.2014 to 25.06.2014 at Centre for biological control (CBC), National institute of plant health management (NIPHM), Hyderabad to determine efficient, low cost rearing medium for rearing *Corcyra cephalonica*. Experiment was carried out at controlled conditions i.e. 25±1 °C and 55±10% RH. The seven different rearing media were evaluated for the it effect on seven different biological parameters of host insect as well as *Trichogramma chilonis*. T1 (Bajra+sorghum) proved better in influencing percent parasitisation ability of *Trichogramma chilonis* and followed by T4 (bajra+raagi) which is statistically on par with T1. T6 (Bajra+Broken rice) was also found promising in percent parasitisation when compared over the remaining treatments like maize and sorghum based diet combinations.

Key words: Parasitoid, *Corcyra cephalonica*, Endoparasitisation, *Trichogramma* spp.

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INTRODUCTION

Biological control of crop pest is a safe, economic and eco friendly approach in integrated pest management. Recent research emphasises the importance of mass rearing of bio control agents for augmentation and field releases. For mass production of many predators and parasitoids, *Corcyra cephalonica* has been the most suitable host insect in many laboratories *Corcyra cephalonica* Sanction (Rice moth) is cosmopolitan in distribution which is basically stored grain pest attacks rice, millets and other cereal grains. It prefers broken grains and flour rather than whole grain. Its amenability to mass produce throughout the year enable us to use it as host insect for mass rearing of many parasitoids and predators.

The important among them are egg parasitoids—*Trichogramma* spp., egg-larval parasitoids—*Chelonus* spp., larval parasitoid- *Bracon* spp., *Goniozus* spp., *Cotesia* spp., insect predators-*Chysoperla carnea*, predatory spiders and Reduviids. Besides some entomophagous nematodes such as *Steinernema* spp., is also reared on *Corcyra cephalonica* (Kumar and Murthy, 2000). In India Rice moth is being utilized in various biocontrol research, developmental and extension units for mass production of number of natural enemies (Jalali and Singh, 1992).

Trichogramma chilonis is widely distributed in the Indian subcontinent in several crops and efficiently controls many lepidopteran insect pest (Bhushan et al., 2012) by way of endoparasitisation of their eggs. Although there are several egg parasitoids commonly used throughout the world, *Trichogramma* have been the most extensively studied. *Trichogramma chilonis* is the choice of present experiment as it is an egg parasitoid on many lepidopterans playing vital role in bio control programmes.

Mass rearing of *T. chilonis* is done on eggs of *Corcyra cephalonica* in many of the laboratories. Host egg quality is a considerable factor which can effect developmental period, longevity, parasitism, adult emergence of parasitoid. The rearing host media is of potentially important for the nutritional quality of host eggs and the survival of *Trichogramma* and other egg parasitoids released in to the environment as biological control agents (Hunter, 2003). The results of the experiments conducted by Nathen et al. (2006) revealed that rearing *C. cephalonica* on a high quality nutrient source resulted in high quality eggs, which ultimately resulted in high quality production of *T. chilonis* reared on such host eggs. Host egg size and quality is a considerable factor which can effect developmental period, longevity, parasitism, adult emergence of parasitoids (Pathak et al., 2010). Therefore it is necessary to study the effect of host rearing media on nutritional quality of *Corcyra* eggs on which *Trichogramma chilonis* is reared. In view of its potential importance to biological control programmes, an attempt was made in the present study to determine the economic efficiency of rearing media for *Corcyra* using sorghum, Pearl millet (bajra), finger millet (raagi), broken rice and foxtail millet (korra) in different combinations with the following objectives

1. To study the effect of different rearing media on average longevity of adult *Corcyra* moths and 100 egg weight.
2. To study on parasitisation ability of *Trichogramma chilonis* on the eggs of *Corcyra cephalonica* reared on different media at laboratory conditions.

MATERIALS AND METHODS

Biology of *Corcyra cephalonica*:

Adult moth is light greyish-brown in colour measuring 10- 12 mm long and with a wing span of about 15 mm, without any markings on the wings but veins are slightly darkened. Head bears a projected tuft of scales. Moths are short lived but realise a fecundity of 150—200 eggs per female within a few days after emergence. Eggs are laid either singly or in clusters. Eggs are whitish, oval in shape, 0.5 mm long and having an incubation period of 3- 4 days. Tiny larva after hatching is creamy-white, with a prominent head. It moves about actively and feeds on broken grains for some time and then starts spinning web to join grains. Full grown larva is pale whitish in colour, 15 mm long with short scattered hairs and no markings on body. Larval period is 25-35 days in summer and may be extended in winter. Pupation takes place inside an extremely tough, opaque whitish cocoon that is surrounded by webbed grains. Pupal period is about 10 days but may extend to 40-50 days to tide over winter months. Moths commence mating and egg laying immediately after emergence.

Biology of *Trichogramma chilonis*:

These are smallest insects of Trichogrammatidae difficult to identify because of their size ranging from 0.2 to 1.5 mm. Earlier studies showed that development of *Trichogramma* spp. is optimum at 28±2°C at which total life cycle is completed in 8 to 10 days. Fecundity of female ranges from 20 to 200 depending on the species and host density. The host parasitoid ratio is 1:10 in general.

Experimental details

The present experiment was conducted in the period from 02.03.2014 to 25.06.2014 at Centre for biological control (CBC), National institute of plant health management (NIPHM), Hyderabad to determine low cost, efficient rearing medium for rearing *Corcyra cephalonica* (Stainton, 1865) (Lep., Pyralidae) and to compare the diet options in terms of *Corcyra* Biology. Efficacy of *Trichogramma chilonis* Ishii reared on eggs of *Corcyra cephalonica* (Stainton) adults whose larval growth and development had been monitored on seven different rearing media is also studied. The stock culture of *Corcyra cephalonica* was procured from Centre for biological control, NIPHM, Hyderabad and the experiment was carried out at controlled conditions i.e. 25±1 °C and 55±10% RH. The seven different rearing media were prepared by using cereal grains like sorghum, bajra, raagi (Finger millet), korra (Foxtail millet), maize and broken rice in combinations.

- 1) Sorghum+Bajra (1:1)
- 2) Maize+Sorghum (1:1)
- 3) Sorghum+Broken rice (1:1)
- 4) Raagi+Bajra (1:1)
- 5) Korra+raagi (1:1)
- 6) Bajra+Broken rice (1:1)
- 7) Sorghum+Bajra+Raagi+Broken rice (1:1:1:1)

Each treatment was maintained in 5 replications and compared with control rearing medium where only Sorghum grain was taken. The efficiency of treatment was analysed based on the data of biological parameters recorded viz; Fecundity of females, 100 egg weight, average longevity of male and female. With the help of following available cheap material experiment was carried out. Plastic tubs of 16' dia, Grain material of Sorghum, Bajra, Raagi, Maize, Broken rice and korra, Muslin cloth, Plastic funnels (10' X 10') Normal mosquito net, honey, yeast extract, Vitamin E capsules, Streptomycin sulphate, Camel hair brush, Paint brush, Specimen tubes, enamel trays, rubber band, measuring cylinder, hot air oven, Sieve, absorbent cotton 10% formaldehyde, blotting paper, soap solution, electronic balance. Plastic tubs of 16' dia were used to maintain optimum thickness of diet. Tubs were cleaned thoroughly with soap solution in tap water followed by sun drying for 3-4 h. They were surface sterilized with 10% formaldehyde to avoid fungal contamination. Cereal grains were cleaned to separate physical impurities and ground into broken grains with the help of blender. After that they were sterilized in hot air oven at 100°C for 1 h to kill other insects if any and cooled down to room temperature. For each rearing tubs 1 kg grain, 2 g yeast and 0.2 g Streptomycin sulphates were added and stirred well. Streptomycin was used to avoid bacterial contaminations. Fresh Eggs of 0-24 h old have been collected in glass vials after sieving and cleaning with camel hair brush to remove moth wing scales and leg parts. The rate of hatching is more with fresh eggs. As the recommendation of standard protocol, 0.2 cc (2500 eggs) of *Corcyra* eggs per each tub have been taken with measuring cylinder and sprinkled in the medium evenly and the tubs have been covered with muslin cloth, secured by rubber band tightly. Tubs were checked after 3-4 days for webbing and maintained undisturbed up to 30 days at 25±1°C and 55±10% RH. Ants were taken care with cypermethrin 5% chalk and all precautions were taken to prevent entry of *Bracon spp* and lizards by keeping the tubs in separate room having double door entry. After 30 days of egg charging, all the rearing tubs were observed every day for adult emergence. Freshly emerged *Corcyra* adults have been collected manually with small injection vials into oviposition cages made up of plastic funnel stitched with mosquito net. 50% diluted honey solution (50ml water+50ml honey+ 5 capsules Vitamin E) was offered with small cotton swab as feed to these adults regularly. These were maintained at 25±1°C and 55±10% RH. Eggs have been collected from the oviposition cages every day in the morning with the help of paint brush into blotting paper and cleaned by using sieve and camel hair brush to remove scales and leg parts of adult moths. The cleaned eggs have been maintained in glass vials for recording observation.

Parameters recorded

- 1) Fresh eggs which were collected during morning times from oviposition cages by using paint brush into blotting paper which has been collected into specimen vials after thorough cleaning. 100 eggs were counted with the help of magnifier from each treatment for 3 consecutive days and weighed on analytical balance. The mean was compared in different treatments.
- 2) Freshly emerged adult moths 20 no. male and 20 no. female have been collected in separate oviposition cages treatment wise and maintained until their death by feeding them with 50% honey solution along with vitamin E. Mean longevity of male and female recorded in days and compared in different treatments.
- 3) **Percent parasitisation by *Trichogramma chilonis***
Corcyra egg cards of 5*3 cm were prepared with fresh egg collected from ovipositoin cages of each treatment @ 150 eggs per card. These egg cards were exposed to U.V for 15 minutes and kept in 20 cm*3 cm glass tubes containing freshly emerged *T.chilonis* adults (30 adults per each glass tube) and closed with cotton plugs. Observations were recorded after 4 days i.e. number of eggs turned to black colour in each card and percent parasitisation was calculated by % parasitisation= Number of eggs parasitized x 100/ Total no. Of eggs exposed. Observations were recorded up to 7th day of inoculation.

RESULTS AND DISCUSSION

The present experiment was conducted in the period from 02.03.2014 to 25.06.2014 at Centre for biological control (CBC), National institute of plant health management (NIPHM), Hyderabad.

Longevity of adults

Longevity of adult moths enable increased ovi position period of female which yields in more egg production. In our study adult feed used was 50% honey solution in which Vitamin-E capsules were mixed which could improve the longevity of adult moths. It was observed that the mean longevity of female moths in T1(Bajra+sorghum), T4(Bajra+raagi) and T6 (Bajra+broken rice) was 9days which was better compared to other treatments. However Bernardi *et al.* (2000) in their study concluded that longevity of adult moths was remained unaffected by different feeds where they evaluated rice, maize and wheat and ground nut in rearing media.

Weight of 100 eggs

Weight of 100 eggs represents the size of egg which is desirable parameter in mass multiplication of egg parasitoids for which *Corcyra* is used as host insect. Egg hatching is more in large sized healthy eggs. In this study it was observed that Bajra based medium T4 (Bajra+raagi) resulted in significantly higher 100egg weight (5.12 mg), followed by 4.92 mg in T1 (Bajra+sorghum) which were statistically superior over rest of treatments. These results were in agreement with finding of a study conducted by Marak (2013) where bajra medium was found superior over maize and broken rice media to support 100 egg weight. Mehendale *et al.* (2014) in his experiment observed that diet offered to host had significant effect on size of eggs produced and he found sorghum+gram+yeast medium as best performer with 3.73 mg per 100 eggs.

It was also observed that the adults feed with Vitamin -E along with 50% honey solution could lay healthy eggs compared to those feed with only honey solution.

Percent parasitisation by *Trichogramma chilonis*

The 0-12 h old eggs of *Corcyra* reared on different media in this experiment were exposed to *Trichogramma chilonis* for parasitisation. Age of the host eggs offered to *T. chilonis* is most important influencing its parasitisation ability. Guang and Oloo (1990) and Schmidt *et al.* (1999) found that *T. chilonis* significantly decreased its parasitization when the eggs were older than 48 h at the time of encounter. Farid *et al.* (2001) found that *T. chilonis* preferred young eggs when offered along with older eggs simultaneously. Old eggs were not parasitized in the presence of younger eggs. these media were superior over others with significant difference. T1 (Bajra+sorghum) (68.67 %) proved better in influencing percent parasitisation ability of *Trichogramma chilonis* and followed by T4 (bajra+raagi)(68.33 %) which is statistically on par with T1. T6 (Bajra+broken rice) (68 %) was also found promising in percent parasitisation when compared over the remaining treatments like maize and sorghum based diet combinations. These results were in agreement with finding of a study conducted by Marak (2013) where bajra medium was found superior over maize and broken rice media.

Table No. 1 data showing about percent parasitisation

Treatment	Diet combinations (rearing media)	Per cent parasitisation
T1	Sorghum+Bajra	68.67 (55.96)*
T2	Maize+Sorghum	60.00 (50.77)
T3	Sorghum+Broken rice	56.00 (48.45)
T4	Bajra+Raagi	68.33 (55.73)
T5	Korra+Raagi	54.67 (47.68)
T6	Bajra+Broken rice	68.00 (55.55)
T7	S+B+R+BR	60.00 (50.77)
CONTROL	Sorghum	57.33 (49.22)
CV		1.34
CD (5%)		1.20
S.E m		0.40

*Values in parantheses are arcsine transformed values

CONCLUSION

The mean longevity of female moths in T1 (Bajra+sorghum), T4 (Bajra+raagi) and T6 (Bajra+broken rice) was 9days which was better compared to other treatments. Bajra based medium T4 (Bajra+raagi) resulted in significantly higher 100 egg weight (5.12 mg), followed by 4.92 mg in T1(Bajra+sorghum) which were statistically superior over rest of treatments. T1 (Bajra+sorghum) (68.67 %) proved better in influencing percent parasitisation ability of *Trichogramma chilonis* and followed by T4 (bajra+raagi) (68.33 %) which is statistically on par with T1. T6 (Bajra+broken rice) (68 %) was also found promising in percent parasitisation when compared over the remaining treatments like maize and sorghum based diet combinations. However most of the parameters were found significantly higher in Bajra based medium T1 (Bajra+sorghum), which can be used profitably in mass multiplication of *Corcyra cephalonica* and the next best alternative to this combination is both T4 and T6 as these two are on par with T1 in majority of parameters.

REFERENCES

- Bernardi, E. B, Haddad, M. L. and Parra, J. R. P. (2000). Comparison of artificial diets for rearing *Corcyra cephalonica* (Stainton, 1865) (Lep., Pyralidae) for *Trichogramma* mass production. *Rev. Brasil. Boil.* 60(1): 45-52.
- Bhushan, S., Singh, R. P. and Shankar, R. (2012). Biopesticidal management of yellow stem borer (*Scirpophaga incertulas* Walker) in rice. *The Bioscan*, 7(2):317- 319.
- Farid, A., Saqib, T. and Khan, A. U. (2001). Host age effect on oviposition preference and development of *Trichogramma chilonis*. *Pakistan Journal of Biological Sciences*, 4(2): 121-122.
- Guang, L. Q. and Oloo, G. W. (1990). Host preference studies on *Trichogramma sp. nr. Mwanzai* Schulten and Feinjen (Hymenoptera: Trichogrammatidae) in Kenya. *Insects Science Application*, 11: 757-763.
- Hunter, M. D., 2003. Effects of plant quality on the population ecology of parasitoids. *J. Agriculture Forest Entomology*, 5:1-8.
- Jalali, S. K. and Singh, S. P. (1992). Effect of infestation of sorghum grains by different dosage of *Corcyra cephalonica* on adult emergence pattern. *Entomon*, 17(1-2):117-119.
- Kumar, S. and Murthy, K. S. (2000). Mass production of *Corcyra*, In: *Training Manual of the second training on mass production of biological control agents*. National Centre for Integrated Pest Management, New Delhi. pp. 10- 20.
- Marak, H. C. (2013). Estimation of production potential of host insect (*Corcyra cephalonica*) and *Trichogramma* Species on different raw materials PGDPHM Project, CBC, NIPHM- Hyderabad (India).
- Mehendale, S. K., Patel, M. B. and Shinde, C. U. (2014). Evaluation of different rearing media for *Corcyra cephalonica* (stainton) under laboratory condition. *The Bioscan*, 9(1): 259-264.
- Nathan, S. S, Kalaivani, K, Mankin, R. W. and Murugan, K. (2006). Effects of millet, wheat, rice, and sorghum diets on development of *Corcyra cephalonica* (Stainton) (Lepidoptera: Galleriidae) and its suitability as a host for *Trichogramma chilonis* Ishii (Hymenoptera: Trichogrammatidae). *Environ. Entomol.* 35(3): 784-788.
- Pathak, S. K, Dubey, M. N. and Yadav, P. R. (2010). Suitability of different diet and their combination for the rearing of *Trichogramma* host *Corcyra cephalonica* (Stainton). *Journal of Experimental Zoology India*, 13(1):29- 31.
- Schmidt, M. Mandel, G. and Schmuck, R. (1999). Impact of *Vairimorpha sp.* (Microsporidia: Burnellidae) on *T. chilonis* (Ishii) a hymenopteran parasitoid of the cabbage moth, *Plutella xylostella* (Lepidoptera: Yponomeutidae). *Journal of Invertebrate Pathology*, 74: 120-126.

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