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Host Suitability of *Trichogrammatoidea Bactrae* Nagaraja on Different Host Eggs

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Abstract

Trichogrammatoidea bactrae Nagaraja (Hymenoptera: Trichogrammatoidea) is a highly effective egg parasitoid for controlling lepidopteran pests. This study evaluates its host suitability and biological characteristics across various lepidopteran eggs, specifically Corcyra cephalonica Stainton (Lepidoptera: Pyralidae), Spodoptera litura Fabricius (Lepidoptera: Noctuidae), Helicoverpa armigera Hubner (Lepidoptera: Noctuidae), Spodoptera frugiperda (J.E. Smith) (Lepidoptera: Noctuidae), and Pectinophora gossypiella Saunders (Lepidoptera: Gelechiidae). The results indicate that T. bactrae shows the highest parasitization rates on C. cephalonica, followed by P. gossypiella, S. litura, H. armigera, with the lowest rate occurring on S. frugiperda. The adult emergence rate for T. bactrae is notably highest on Corcyra eggs at 92.95%, while it drops to 73.55% on S. frugiperda. The total developmental period for T. bactrae ranges from 7.22 days on C. cephalonica to 8.7 days on S. litura. Moreover, female T. bactrae consistently demonstrates a longer total life cycle compared to their male counterparts across all studied species, with the longest life cycle observed in S. litura and the shortest in C. cephalonica. Given these findings, C. cephalonica emerges as the optimal host for the factitious rearing of T. bactrae. Additionally, T. bactrae is highlighted as the most effective option for parasitizing pink bollworm eggs.

Keywords: Host eggs, host suitability *Trichogrammatoidea bactrae, Corcyra cephalonica, Helicoverpa armigera, Pectinophora gossypiella, Spodoptera litura, Spodoptera frugiperda,* development and parasitization

INTRODUCTION

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Trichogramma is an egg-parasitic wasp with over 100 described species. These wasps lay their eggs in host insects, where they feed and develop until emerging as adults. *Trichogramma* species are primary egg parasitoids of lepidopteran insects and often target the eggs of beetles, bugs, flies, thrips, crickets, and grasshoppers [1]. As a result, they are widely utilized as natural enemies of economically important pests around the world [2]. One of the notable species, *Trichogrammatoidea bactrae* Nagaraja (Hymenoptera: *Trichogrammatidae*), targets a variety of insect pests that affect vegetables, fruits, cotton, and sugarcane, with a particular focus on the pink bollworm, *Pectinophora gossypiella* [3]. Studies have shown that *T. bactrae* can also parasitize the eggs of other pests, including *Helicoverpa armigera, Antherigona soccata Earias vitella, and Achaea janata* [4, 5].

The integration of *Trichogramma* species into pest control programs has produced positive results,

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achieving significant levels of pest management in the field [6–8]. This parasitoid is well known for its ability to parasitize the eggs of numerous agricultural pests, effectively preventing the emergence of destructive larvae [9]. Host suitability and biology are crucial factors influencing its efficiency as a biocontrol agent. Understanding the interaction between *T. bactrae* and various host eggs provides insights into its reproductive potential, parasitization efficacy, and adaptability to different pest species. The main lepidopteran pests affecting cotton include *Spodoptera litura, H. armigera,* and *P. gossypiella.* Additionally, the fall armyworm *(Spodoptera frugiperda),* which primarily targets maize, is known to feed on a wide variety of host plants. Therefore, this study aims to evaluate the biology and host suitability of *T. bactrae* on different host eggs, specifically *S. litura, P. gossypiella, H. armigera, S. frugiperda,* and *Corcyra cephalonica,* to facilitate its effective utilization in sustainable pest management strategies.

MATERIALS AND METHODS

Collection and Sourcing of Host Eggs

The eggs of *S. litura*, *P. gossypiella*, *H. armigera*, and *S. frugiperda* were obtained from the ICAR-National Bureau of Agricultural Insect Resources (NBAIR) in Bangalore. Additionally, the eggs of *C. cephalonica* were sourced from the biological control laboratory in the Department of Agricultural Entomology, Dr. P.D.K.V, Akola.

Egg Parasitoid, T. Bactrae Culture

Fresh cultures of *T. bactrae* Nagaraja were obtained from the Biological Control Laboratory in the Department of Agricultural Entomology at Dr. P.D.K.V. Akola. These cultures were maintained in the laboratory on the eggs of a factitious host, *C. cephalonica* Stainton, at ambient temperature for further studies [10].

The study aimed to investigate the host suitability and biological parameters of *T. bactrae* on different host eggs. The various host eggs, including *C. cephalonica*, *P. gossypiella*, *S. litura*, *S. frugiperda*, and *H. armigera*, under laboratory conditions. The card bioassay methodology was modified and improved based on host eggs [11] for each treatment, two hundred freshly laid eggs from various hosts were utilized. These eggs were exposed to UV light in a UV chamber for 45 to 60 minutes to eliminate the embryos. Fifty irradiated eggs from each host were then glued onto yellow paper card strips (measuring 4 x 2 cm), with each strip representing one replication. The card strips were shade-dried for at least one hour before being exposed to pre-mated female adults of *T. bactrae* from a mass culture, which was placed in small glass tubes (measuring 15 cm in length and 2.5 cm in diameter). The adults were fed a 50% honey solution positioned at the top of the glass tube. After a 24-hour exposure, each card strip was removed and placed into separate glass tubes for the further development of the parasitoid. The experiment was conducted using a completely randomized design replicated four times. Several observations were recorded including parasitization, egg-larval period, pupal period, total developmental period, adult emergence, adult longevity, and total life cycle.

Statistical Analysis

To obtain accurate results, the above trials regarding the developmental profile of the *T. bactrae* were replicated four times on different hosts' eggs. The obtained data were summarized with the mean, standard error, and Coefficient of variance of all the replicates performed. The results are interpreted and presented below.

RESULTS

The parasitization efficiency, developmental parameters, and adult emergence of *T. bactrae* varied significantly among the different host eggs (Table 1). *C. cephalonica* was the most suitable host, showing the highest percent parasitization (92 ± 0.81%) and adult emergence (92.95%), with the shortest total developmental period (7.22 days). This indicates its superior compatibility with *T. bactrae*. Among other hosts, *P. gossypiella* exhibited moderate suitability with 77.5 ± 2.5% parasitization and 81.92% adult emergence, while *H. armigera* showed relatively lower values for both

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parasitization (69.4 ± 2.21%) and adult emergence (77.65%), suggesting reduced compatibility. *S. litura* and *S. frugiperda* also showed intermediate suitability, with parasitization rates of 74 ± 2.94% and 73.5 ± 2.06%, respectively, and adult emergence percentages of 84.60% and 73.55%.

The adult longevity of *T. bactrae* exhibited significant variation across different host eggs, with females consistently living longer than males (Figure 1). The longest female longevity was observed on *P. gossypiella* (6.2 days), followed by *S. litura* (6.1 days) and *S. frugiperda* (5.85 days), while the shortest was recorded on *C. cephalonica* (5.6 days). Male longevity was highest on *P. gossypiella* (1.6 days) and *S. litura* (1.5 days) and lowest on *C. cephalonica* (1.2 days). Among the various host eggs, *S. litura* supported the longest life cycle for both males (10.2 days) and females (14.8 days), followed by *P. gossypiella* (male: 10.13 days, female: 14.73 days). The shortest total life cycle was observed on *C. cephalonica*, with males and females living 8.42 days and 12.82 days, respectively (Figure 2).

Table 1. Parasitization efficiency, developmental parameters of T. bactrae on different host eggs.

Different Hosts Eggs	% Parasitization	Egg-Larval Period	Pupal Period	Total Development Period	% Adult Emergence
C. cephalonica	92	4.22	3	7.22	92.95
P. gossypiella	77.5	4.75	3.78	8.53	81.92
H. armigera	69.4	4.7	3.64	8.34	77.65
S. litura	74	4.9	3.8	8.7	84.60
S. frugiperda	73.5	4.66	3.4	8.06	73.55
C.D.	4.425	0.36	0.27	0.52	3.98
SE (m)	1.45	0.15	0.04	0.25	1.32
C.V.	4.77	4.51	3.78	4.16	4.03

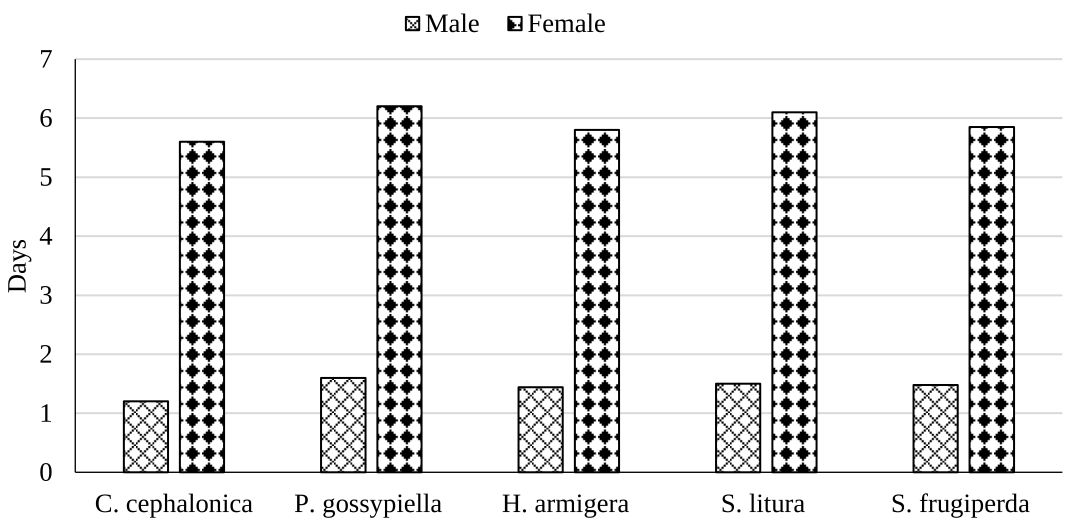

Figure 1. Adult longevity of *T. bactrae* male and female on different hosts.

DISCUSSION

The results of the present investigation align with previous studies that have examined the biological performance of *T. bactrae* across various host eggs. The high parasitization rates observed in this study are supported by Kaushik et al. (2021) [11] who reported maximum parasitization on *Corcyra cephalonica* eggs reared on a mixed diet of job's tear and rice bran, with lower rates observed on rice bran alone. Similarly, Mohamed et al. (2016) [12] demonstrated a parasitization range of 35–66% on

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C. cephalonica eggs, with higher rates achieved through increased parasitoid density and proximity to host eggs. The findings also correspond to Murthy et al. (2024) [13] who reported moderate parasitization rates of *Tuta absoluta*, emphasizing that host species and rearing conditions significantly influence parasitism efficiency. The developmental periods observed in this study align with the findings of Malik (2001a), who reported that *T. bactrae* took between 6.5 and 7.3 days to develop on *Pectinophora gossypiella* eggs at temperatures ranging from 30 to 40°C. In contrast, at lower temperatures between 13 and 28°C, the developmental duration varied significantly, taking anywhere from 8.72 to 50.31 days [14–16] noted comparable developmental periods of 6 to 9 days on *C. cephalonica* eggs under controlled conditions. These findings underscore the adaptability of *T. bactrae* to various host species and environmental conditions, which is essential for its use in biological control programs. Adult emergence rates observed in this study are also in agreement with the findings of Manjunatha et al. (2019) [17] who reported the highest adult emergence on *C. cephalonica* reared on mixed diets [18]. Demonstrated similarly high emergence rates from *P. xylostella* eggs, while Sarhan et al. (2015) and Zang et al. (2021) [19, 20] observed emergence rates ranging from 59.7% to 84.0% for closely related *Trichogramma* species. Adult longevity results also align with prior research [21] reported longer female longevity on eggs reared on mixed diets, while Chaubey et al. (2014) [1] observed 5–6 days of female longevity on *P. gossypiella* eggs [14] also reported variations in longevity based on temperature, demonstrating the impact of environmental factors on parasitoid performance [5] highlighted its effectiveness as a biological control agent against key bollworm pests, *H. armigera* and *P. gossypiella*. Conducted under controlled conditions, the study showed high parasitization rates (66%–69%), a rapid life cycle (7.80–8.80 days), and high adult emergence rates (77.27%–79.71%), indicating the parasitoid's strong reproductive efficiency. The study also observed a female-biased recovery ratio, with females exhibiting longer lifespans (5.40–6.60 days) than males (1.20–1.80 days), which supports sustained parasitization. These findings underline the potential of *T. bactrae* in integrated pest management programs, especially in cotton ecosystems, and provide a foundation for further field evaluations to optimize its use in pest control.

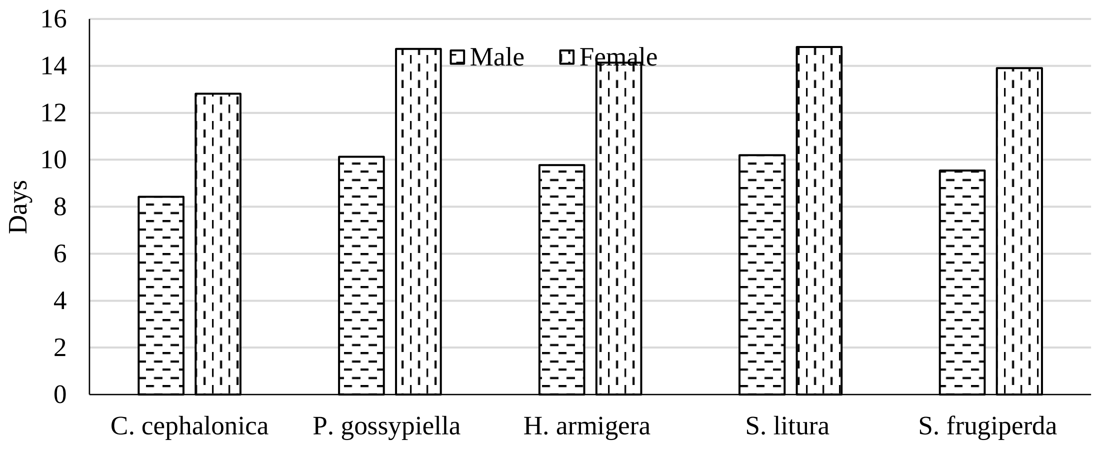

Figure 2. Total life cycle of male and female *T. bactrae* on different host eggs.

CONCLUSIONS

The study revealed significant variations in the biological performance of *Trichogrammatoidea bactrae* across different host eggs, emphasizing the critical role of host selection in enhancing its effectiveness for biological control. Among the hosts, *C. cephalonica* demonstrated superior suitability, with high parasitization rates, faster development, and better adult emergence. *P. gossypiella* and *S. litura* showed moderate compatibility, while *H. armigera* and *S. frugiperda* were less favourable. These findings establish *C. cephalonica* as the most optimal host for mass-rearing *T. bactrae*, providing a reliable basis for its use in integrated pest management programs.

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Author Contribution Statement

- *Jasti Sri Vishnu Murthy:* Conceptualization, methodology, data curation, formal analysis, writing – original draft.
- *N. S. Satpute:* Supervision, investigation, visualization, writing – review and editing.
- *Mani Chellappan:* Supervision, writing – review and editing.
- *Ranjith M. T.:* Supervision, writing – review and editing.

REFERENCES

1. Chaubey BK, Srinivasa MK, Jalali SK. Standardisation of host-parasitoid ratio of Plutella xylostella (Linnaeus) and Trichogrammatoidea bactrae Nagaraja. J Biol Control. 2014;28(4):210–213.
2. Elwakil W, Doherty E, Dale A. Trichogramma Wasps Trichogramma spp. (Insecta: Hymenoptera: Trichogrammatidae): IN1382, 12/2022. EDIS. 2022;2022(5).
3. Querino RB, Mendes JV, Costa VA, Zucchi RA. New species, notes and new records of Trichogramma (Hymenoptera: Trichogrammatidae) in Brazil. Zootaxa. 2017;4232(1):137–143.
4. Krishnamoorthy A. Exploitation of egg parasitoids for control of potential pests in vegetable ecosystems in India. Comunicata Sci. 2012;3(1):1–15.
5. Kuyate MS, Bhamare VK, Ingale DG. Biology of Trichogrammatoidea bactrae Nagaraja on eggs of different bollworms. Technofame. 2021;10(2):18–22.
6. Ghosh E, Ballal CR. Short-term storage of the egg parasitoids, Trichogramma and Trichogrammatoidea. Egypt J Biol Pest Control. 2018;28(1):34.
7. Liu SS, Cooper L, Llewellyn RR, Elson-Harris MM, Duff J, Furlong MJ, et al. Egg parasitoids of the diamondback moth, Plutella xylostella (Lepidoptera: Plutellidae), from south-east Queensland. Aust J Entomol. 2004;43:201–217.
8. Malik MF. Some biological attributes of Trichogrammatoidea bactrae (Hymenoptera: Trichogrammatidae), temperatures in pink bollworm Pectinophora gossypiella (Lepidoptera: Gelechiidae) eggs. J Biol Sci. 2001;1(6):485–487.
9. Malik MF. Viability of Trichogrammatoidea bactrae pupae at different temperatures. J Biol Sci. 2001;1(7):593–594.
10. Mamung M, Kumar A. Effect of different diets of Corcyra cephalonica on fecundity, longevity and emergence percentage of Trichogrammatoidea bactrae Nagaraja under laboratory conditions in Arunachal Pradesh. Int J Appl Pure Sci Agric. 2016;2(4):122–126.
11. Kaushik H, Suroshe SS, Jha RK, Singh SK. Evaluation of different *Trichogramma* species for the management of *Helicoverpa armigera* in maize under field conditions. Agric Sci Digest. 2021;41(2):211–215.
12. Mohamed HO, El-Heneidy AH, Ali AG, Awad AA. Non-chemical control of the pink and spiny bollworms in cotton fields at Assuit Governorate, Upper Egypt, II-Utilization of the egg parasitoid, Trichogrammatoidea bactrae Nagaraja. Egypt J Biol Pest Control. 2016;26(4):807–813.
13. Murthy JSV, Satpute NS, Undirwade DB, Bhalkare SK. Biosafety of botanicals to Trichogrammatoidea bactrae Nagaraja. Indian J Entomol. 2024;71–274.
14. Sajid N, Muhammad H. Comparative development and parasitisation of Trichogramma chilonis Ishii and Trichogrammatoidea bactrae Nagaraja under different temperature conditions. Pak J Zool. 2008;40(6):431–444.
15. Begum S, Anis SB. Checklist of Indian Trichogrammatidae (Hymenoptera: Chalcidoidea). Int J Entomol Res. 2014;2(1):7–14.
16. Perera MCD, Hemachandra KS, Sirisena UGAI. Trichogrammatoidea bactrae (Hymenoptera: Trichogrammatidae): A potential biocontrol agent of rice leaf folder. Trop Agric Res. 2015;26(3):537–546.
17. Manjunatha KL, Ganiger PC, Jahir Basha CR. Population dynamics of pests infesting castor and their natural enemies in Southern Karnataka. J Entomol Zoology Stud. 2019;7(1):238–243.
18. Singh BU, Sharma HC. Natural enemies of sorghum shoot fly, Atherigona soccata Rondani (Diptera: Muscidae). Biocontrol Sci Technol. 2002;12(3):307–323.

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19. Sarhan AA, Osman MAM, Mandour NS, Abd El-Hady MA. Parasitisation of four Trichogrammatid species against the tomato leaf miner, Tuta absoluta (Meyrick) (Lepidoptera: Gelechiidae) under different releasing regimes. Egypt J Biol Pest Control. 2015;25(1):107–112.
20. Zang LS, Wang S, Zhang F, Desneux N. Biological control with Trichogramma in China: History, present status, and perspectives. Ann Rev Entomol. 2021;66(1):463–484.
21. Osiemo Z, Linus G, Shadrack M, Rossa N, Joseph B, Srinivasan S. Evaluation of biological attributes of a native egg parasitoid, Trichogrammatoidea sp. nr. lutea (Girault), Kenyan accessions. Asian J Pharm Biol Res. 2012;2(3):172–176.

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