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Biology of *Trichogrammatoideabactrae* Nagaraja on Eggs of Different Bollworms

M.S. Kuyate, V.K. Bhamare and D.G. Ingale
Department of Agricultural Entomology, College of Agriculture,
Latur (MS) India-413 512
Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani (MS) India-431 402
E-mail: manishakuyate2013@gmail.com

Abstract

The present investigation on "Biology of Trichogrammatoideabactrae Nagarajaon eggs of different bollworms" was carried out at Bio-control Laboratory, Department of Agricultural Entomology, College of Agriculture, Latur (VNMKV, Parbhani), Maharashtra-India during 2018-19.Its biological parameters were studied on two different bollworms viz., Helicoverpa armigera Hubner and PectinophoragossypiellaSaunders under laboratory conditions at ambient room temperature of 28 ± 3°Cwere carried out in a Completely Randomized Design replicated 5 times. The per cent parasitisation of Tr. bactraeon two different host eggs ranged from 66 to 69 per cent. The egg-larval period ranged from 4.60 to 4.98 days. The prepupal-pupal period ranged from 3.20 to 3.82 days. The total developmental period ranged from 7.80 to 8.80 days. The per cent adult emergence ranged from 77.27 to 79.71 per cent. The highest female parasitoid recovery was registered from the eggs of H. armigera (1:1.83)followed by P. gossypiella (1:1.5). The adult longevity of male Tr. bactraevaried from 1.20 to1.80 days. The adult longevity of female Tr. bactraevaried from 5.40 to 6.60 days.

Key words: Biology, Trichogrammatoideabactrae, Bollworms

Introduction

Trichogrammatids are smallest insects, ranging in size from 0.2 to 1.5 mm, solitary or gregarious idiobiontendoparasitoids of insect eggs. The family Trichogrammatidae is represented by over 800 described species in approximately 90 genera worldwide and is recognized from all vegetated terrestrial habitats.

Trichogrammatoideabactrae Nagaraja is an egg parasitoid widely distributed in the oriental region of the world, adapted to terrestrial humid habitats and known to attack various insect-pests of cotton, sugarcane, fruits and vegetables[6]. *Tr. bactrae* found to attack eggs of many lepidopterous insect-pests such as *Helicoverpa armigera* Hubner, *Eariasvittella* Fabricius, *Achaea janata* Linnaeus, *Pectinophoragossypiella* Saunders, *Plutellaxylostella* Linnaeus, *Chiloinfuscatellus* Snellen, *Epiphyaspostvittana* Walker, *Ctenopseustisobliquana* Walker[11].

Use of *Trichogrammatoidea* sp. in different pest control programme proves satisfactory as it gives high level of pest suppression in the field[2,3]. However, the success of its release depends upon the factors such as interaction with target host, strain released and different biological characters that determine the efficacy of parasitism[1]. Keeping this in view, the biology of *Tr. bactrae*on different host eggs need to be investigated so as to generate information pertaining to most suitable host eggs of bollworm on cotton for effective parasitisation and ultimately the management of the pests.

Materials and Methods

The studies on biology of *Tr. bactrae* on two different host eggs *viz*., *H. armigera* and *P. gossypiella* were carried out in a Completely Randomized Design replicated 5 times. Eggs of bollworms were obtained from laboratory reared culture of the host insects at Bio-Control Laboratory.

One hundred freshly laid eggs of respective host were obtained from the oviposition cage in order to study the biology of *Tr. bactrae*. Freshly laid eggs of respective host were exposed to Ultra Violet (U.V.) radiation in a U.V. chamber for 45 min at a height of 15 cm so as to kill the embryo. This U.V. irradiated 20 eggs of respective host were pasted on yellow paper card strip (measuring 4 x 2 cm) separately with the help of diluted gum arabic as one replication. This paper card strip was air dried and exposed to 3 pre-mated adult females of *Tr. bactrae* from mass culture in a small glass tube. The adults of *Tr. bactrae*were fed on 80 per cent honey solution soaked in cotton swab. The cotton swab was changed periodically. The paper card strip was exposed to pre-mated females of *Tr. bactrae* till their mortality. Then the paper card strip was removed and kept in separate glass tube for further development of parasitoid. The separate experiment was conducted to study the biology of *Tr. bactrae* on respective host eggs.

Observation on Biological Parameters Of *Trbactrae*

Per cent parasitisation

The observation on parasitisation was recorded four to five days after oviposition. Blackening due to deposition of black granules in inner surface of chorion of host eggs was observed for determining per cent parasitisation.

Egg-larval period

The egg-larval period was recorded from stinging to blackening of vitelline membrane of the host eggs.

Prepupal-pupal period

The prepupal-pupal period was recorded from the blackening of vitelline membrane of the host eggs to the emergence of the parasitoid.

Total developmental period

The total developmental period was recorded from stinging to adult emergence.

Per cent adult emergence

Out of total parasitised eggs, the number of parasitoids emerged were counted and per cent adult emergence was determined.

Sex ratio

To determine sex ratio, the emerged adults were first killed by keeping them under refrigerator at 0^{o}C. From those killed adults, sexing was done by observing individual parasitoid under stereoscopic microscope based.

Male: Male was darker and usually smaller than female. Head and antenna fulvous, eyes (ocelli) carmine. Antenna flagellum with 22 to 26 long hairs. Pro and mesothorax fulvous black. Club segmented. Abdomen black.Wings with setae, vein track Rs1 absent.

Female: Female was pale in colour and larger than male. Pedicel half of the scape. Antennal flagellum 1:2 times the length of the scape. Pro and mesothoraxcolour same as in male. Club width slightly less than half of the wing length. Wing with seate.

Adult longevity

Newly emerged five male and female adult parasitoids were kept individually in a small glass vial (measuring 7.5 x 7 cm) without food till mortality. The adult longevity of parasitoid was worked out from emergence till death.

Results and Discussion

Per cent parasitisation of *Tr. bactrae*on different host eggs

Among the host eggs accepted, the significantly highest parasitisation was exhibited on the eggs of *P. gossypiella* (69 per cent) followed by eggs of *H. armigera* (66 per cent). Thus, it is proved that host eggs influences the per cent parasitisation due to *Tr. bactrae*.

The average parasitisation rate of *Tr. bactrae* on *Tutaabsoluta* across all releasing densities and distances was 51.82 and 55.17 per cent, respectively. Chaubey*et al*. (2014) indicated that a single female of *Tr. bactrae* had the potential to parasitise 21-32 eggs of *Plutellaxylostella* effectively with 90.0 to 100.0 per cent parasitism.

The egg-larval, prepupal-pupal and total developmental period of *Tr.bactrae*in different host eggs

Among the parasitised eggs of different hosts, the significantly minimum egg-larval period of *Tr. bactrae* was noticed in the eggs of *H. armigera* (4.60 ± 0.24 days) and maximum egg-larval period recorded in the eggs of *P. gossypiella*(4.98 ± 0.11 days).

The results of present investigation are in harmony with findings of others who evidenced that the egg-larval duration of *Tr. bactrae*on eggs of *P. gossypiella* ranged from 4.731 to 4.324 days between 30 to 40^{o}C. The egg-larval duration of *Tr. bactrae* on eggs of *P. gossypiella*varied from 4.99-27.43 days at 13 to 28^{o}C temperature levels[4,8].

Statistical analysis

The data in respect of biological parameters of *Tr. bactrae*was statistically analyzed by standard 'analysis of variance'. The null hypothesis was tested by 'F' test of significance at 5 per cent level.

Among the parasitised eggs of different hosts, the significantly minimum prepupal-pupal period of *Tr. bactrae* was revealed in the eggs of *H. armigera* (3.20 ± 0.16 days) and the maximum prepupal-pupal period observed in the eggs of *P. gossypiella* (3.82 ± 0.08 days).

The results of present investigation are in accordance with findings of earlier scientists, who evidenced that the pupal duration of *Tr. bactrae*on eggs of *P. gossypiella* ranged from 2.542 to 2.208 days between 30 to 40^{o}C. Further Malik (2000) reported that the pupal duration of *Tr. bactrae* on eggs of *P. gossypiella*varied from 3.73-23.00 days at 13 to 28^{o}C temperature levels[5].

Among the parasitised eggs of different hosts, the significantly minimum total developmental period of *Tr. bactrae* was registered on the eggs of *H. armigera* (7.80 ± 0.17 days) and the maximum total developmental period noticed on the eggs of *P. gossypiella*(8.80 ± 0.07 days).

The results of present investigation are matching with the findings of many others who evidenced that the total developmental time (egg to emergence) of *Tr. bactrae*on eggs of *P. gossypiella* ranged from 7.273 to 6.532 days between 30 to 40^{o}C. The total developmental time (egg to emergence) of *Tr. bactrae* on eggs of *P. gossypiella* varied from 8.72-50.31 days at 13 to 28^{o}C temperature levels[4,5]

others revealed that the rate of development of *Tr. bactrae* in eggs of *E. insulana* was significantly lower than in eggs of *P. gossypiella* immature developmental time of *Tr. bactrae* on eggs of *P. gossypiella*ranged from 11.1-7.3 and 11.0-9.1 days at constant and fluctuating temperatures, respectively[7].

Per cent adult emergence of *Tr.bactrae*from different host eggs

Among the parasitised eggs of different hosts, the maximum per cent adult emergence was noticed on the eggs of *P. gossypiella*(79.71 per cent) and the lowest adult emergence observed on the eggs of *H. armigera* (77.27 per cent).

It was indicated 87-91 per cent *Tr. bactrae* adult emergence from the eggs of *P. xylostella*. The percentage of emerged progeny of *Tr. bactrae* from fertile and infertile eggs of *P. gossypiella*and *A.ipsilon* was 86.49 and 62.01 and; 95.3 and 67.43 per cent, respectively[10].

Sex ratio (Male:Female) of *Tr. Bactrae* adults emerged from different host eggs

The sex ratio of *Tr. Bactrae* was female biased on all the host eggs. The highest female parasitoid recovery was registered from the eggs of *H. armigera* (1:1.83) and lowest in case of *P. gossypiella* (1:1.5).

It was exhibited that the percentage of *Tr. bactrae* females in progeny from fertile and infertile eggs of *P. gossypiella*and *A.ipsilon* were 66.26 and 51.01 and; 62.64 and 59.29 per cent, respectively[10].

Adult longevity of male and female *Tr. bactrae*

Among the different host eggs, *Tr. bactrae*male parasitoid emerged from the eggs of *P. gossypiella* lived longer (1.80 ± 0.07 days) followed *H. armigera* (1.20 ± 0.07 days).

Among the different host eggs, *Tr. bactrae*female parasitoid emerged from the eggs of *P. gossypiella* lived longer (6.60 ± 0.10 days) followed by *H. armigera* (5.40 ± 0.12 days).

The *Tr. bactrae* adults showed a mean longevity of 7.9 days (range 1-15 days) on the eggs of *C. cephalonica*. The highest longevity of *Tr. bactrae* was 7.9 ± 0.2 days when parasitoid adults were fed with 50 per cent bee honey while the lowest longevity was 1.5 ± 0.2 days on distilled water[6,9].

Table 1 Overall biological parameters of *Tr. bactrae*on different bollworms

Sr. No.	Biological parameters		Different host eggs		S.E. ±	C.D.	C.V.
			H. armigera	*P. gossypiella*			
1.	Per cent parasitisation (%)		66	69	0.37	1.15	6.19
2.	Egg-larval period (day)		4.60	4.98	0.08	0.26	4.01
3.	Prepupal-pupal period (day)		3.20	3.82	0.05	0.17	3.60
4.	Total developmental period (day)		7.80	8.80	0.06	0.18	1.59
5.	Per cent adult emergence (%)		77.27	79.21	0.97	0.81	5.6
6.	Sex ratio (M:F)		1:1.83	1:1.5	-	-	-
7.	Adult longevity	Male (day)	1.20	1.80	0.03	0.10	4.71
		Female (day)	5.40	6.60	0.05	0.15	1.86

Conclusion

In conclusion it is to state that in the present investigation *P. gossypiella* was the most suitable host for the development of *Tr. bactrae* on eggs as compared to *H. armigera*. Thus, it is proved thatthe different host of *Tr. Bactrae*

influenced the growth and survival of developing parasitoid including the longevity, development period and sex ratios. The percentage of parasitisation was also more on the eggs of *P. gossypiella* followed by *H. armigera.*

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