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Seasonal abundance of *Cotesia ruficrus* (Hymenoptera: Braconidae) and its host tea looper, *Hyposidra talaca* (Lepidoptera: Geometridae) in tea ecosystem

Suman Sarkar[a], Azariah Babu[a], Kaushik Chakraborty[b], Bhabesh Deka[a] and Somnath Roy[c]

[a]Department of Entomology, Tea Research Association, North Bengal Regional R & D Centre, Jalpaiguri, West Bengal 735225, India; [b]Department of Zoology, Raiganj University, Uttar Dinajpur, West Bengal 733134, India; [c]Department of Entomology, Tocklai Tea Research Institute, Jorhat, Assam 785008, India

ABSTRACT

Investigations were undertaken for a better understanding of seasonality, interaction with tea ecosystem, and parasitic impact of an endoparasitoid *Cotesia ruficrus* (Haliday) (Hymenoptera: Braconidae) on the destructive tea looper *Hyposidra talaca* (Walker) (Lepidoptera: Geometridae). The population abundance of *C. ruficrus* was noticed as high in the months of pre-winter and spring seasons which was coincided with the population increase of *H. talaca*. *C. ruficrus* found to foraging and collecting nectar from the flowers of *Lantana camera* L., *Moringa oleifera* Lam., and *Clerodendron infortunatum* L. associated with the tea ecosystem. The life table parameters including intrinsic rate of natural increase (r_m) and net reproductive rate (*Ro*) of *C. ruficrus* were 0.203 per day and 41.11 female offspring/female, respectively, with the gross reproductive rate ($\sum mx$) 50.09 eggs/female. The parasitic impact of *C. ruficrus* has significantly affected the food consumption and development of *H. talaca*. Resultantly, a drastic reduction in body weight, changes in differential hemocyte count (DHC), and morphology of hemocytes were observed in parasitized host larvae. Toxic effect of quinalphos and thiamethoxam on *C. ruficrus* showed 100% mortality followed by bifenthrin > deltamethrin > emamectin benzoate > flubendiamide > fenpyroxymate after 72 h of the application.

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1. Introduction

In tea plantation of Terai, Dooars of West Bengal and Assam in India, the tea looper, *Biston suppressaria* (Guenée) (Lep.: Geometridae), the black looper, *Hyposidra talaca* (Walker) (Lep.: Geometridae), *H. infixaria*, *Ascotis*, and *Ectropis* sp. reported to be the problematic lepidopteran pests (Das et al. 2010; Chutia et al. 2012). Among these black inch looper, *H. talaca* acquire special attention as a serious pest for its harmful characteristics on tea plant (Antony et al. 2011). *H. talaca* has migrated from the forest ecosystem and get acclimatized to the tea ecosystem. The perennial crop tea gets attacked by this pest throughout the year in the tea-growing area. Synthetic pesticides are traditionally being used for the management of this pest, which develops resistance, contaminates the made tea, and affects the environment. To avoid the negative impact of the use of synthetic pesticide application and conservation of biological control agents is one of the tools of pest management worldwide (Basu et al. 2012). Biological control agents play a crucial role in the regulation of pest population keeping the pests under the economic threshold level (ETL) in most of the agricultural fields and forest ecosystems (Sanap et al. 2016). Braconid wasps as promising parasitoids are being considered as potential natural enemies in several agro-ecosystems (Rahman and Bhola 2011). Insect pest management strategy using biological control tools is one of the important challenges for all experts in the relevant field. The fitness of a parasitoid could be assessed by studying its life table and seasonal dynamics, especially the evaluation of bio-ecology of the parasitoid, its relation with lepidopteran pests, and the effect of commonly used pesticides are the basic tools for collecting data about the natural enemies (Hailemichael et al. 1997; Eliopoulos and Stathas 2008; Sarkar et al. 2020). This demographic information can be useful for evaluating and selecting the potential biological control agent, its mass multiplication under laboratory conditions, and augmentative release in the field.

Endoparasitoid belonging to the family Braconidae lay eggs and complete their larval period inside the suitable host insect (Jung et al. 2006).

CONTACT Azariah Babu azariah.babu@gmail.com Deputy Director (Research) & Senior Principal Scientist, Tea Research Association, North Bengal Regional R & D Centre, Nagrakata - 735 225, Jalpaiguri District, West Bengal, India

Suman Sarkar
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