



## FUNCTIONAL RESPONSE AND PARASITISM BY *COTESIA SESAMAE* (CAMERON) ON LARVAE OF *TARUCUS ROSACEA* (AUSTAUT) FROM IRAQ

HUSIEN ALI MAHDI AL AMERY<sup>1</sup> AND MUSLIM ASHOR AL-ETBY<sup>1\*</sup>

<sup>1</sup>Department of Plant Protection, College of Agriculture, University of Basra, Iraq

\*Email: muslim.abdel\_wahed@uobasrah.edu.iq (corresponding author):

ORCID ID 0000-0002-7628-2679

### ABSTRACT

This study evaluated the biocontrol potential of the parasitoid *Cotesia sesamae* (Cameron) on jujube blue butterfly, *Tarucus rosacea* (Austaut), under field and laboratory conditions in Iraq, from September 2023 to May 2024. Field surveys recorded natural parasitism rate of 85.7% ( $\pm 5.2$ ). A strong density-dependent relationship was observed ( $R^2 = 0.9276$ ). Laboratory studies revealed a clear host stage preference, with the highest parasitism occurring in the fourth larval instar. Functional response analysis indicated that a Holling Type III model best described the parasitoid's behaviour, with an adaptive attack rate of 0.139 and a handling time of 0.043, demonstrating efficient host searching and adaptive foraging. These results strongly support the incorporation of *C. sesamae* in a biocontrol based IPM program.

**Key words:** Biological control, Braconidae, functional response, *Cotesia sesamae*, koinobiont, *Tarucus rosacea*, parasitism, host stage preference, *Ziziphus spina-christi*

The jujube tree, *Ziziphus spina-christi* (L), is known from arid and semi-arid ecosystems across the Middle East and Africa. Its productivity and health are frequently threatened by herbivorous insects, among which the jujube blue butterfly, *Tarucus rosacea* (Austaut) (Lepidoptera: Lycaenidae) is a prominent pest. Its larvae caused considerable damage by feeding on young leaves and floral buds, leading to reduced photosynthetic capacity and significant yield losses, thereby compromising the tree's overall vitality (Alle et al, 2024). Using insecticides causes many ecological hazards and more sustainable and ecologically sound IPM strategies are necessary, of which the biological control is a major one (Krishnamoorthi et al. 2024). Parasitoid wasps of the family Braconidae, Subfamily Microgasterinae, particularly those in the genus *Cotesia*, are among the most effective and widely studied agents in biological control (Pennacchio and Strand, 2006). Recent field surveys have identified *Cotesia sesamae* (Cameron) as a key natural enemy of *T. rosacea* (Al-Jorany, 2018). To properly assess its potential, it is crucial to quantify its parasitic capabilities. Key parameters for such an evaluation include host stage preference and the functional response, which describes how a parasitoid's attack rate changes with host density (Nonaka and Kaitala, 2020). This study provides the first comprehensive assessment of *C. sesamae* as a biocontrol agent against *T. rosacea*. Objectives include: confirming species identity; seasonal dynamics and field

parasitism rates; determine host instar preference under laboratory conditions; and characterize its functional response.

### MATERIALS AND METHODS

Initial populations of *T. rosacea* and its parasitoid, *C. sesamae*, were sourced from larvae collected from jujube trees *Ziziphus spina-christi* of Basra, Iraq, Al-Jabbasi (30.65°N, 47.65°E), and Abu Al-Khasib (30.45°N, 47.98°E). Parasitoid identity was confirmed using the keys of Wilkinson (1932) and the Wasp Web database (Mifsud et al. 2019). Both insect colonies were maintained at  $26 \pm 2^\circ\text{C}$ ,  $65 \pm 5\%$  RH, and a 14:10 h (L:D) photoperiod. The *T. rosacea* colony was reared on fresh jujube leaves, while the *C. sesamae* culture was sustained by weekly exposure to fourth-instar host larvae. All experiments used 2- to 3-day-old, mated female parasitoids, pre-conditioned by 24 hr of host deprivation. Regular field surveys assessed the dynamics of natural populations and the rate of parasitism from September 2023 to May 2024, with weekly visits to each site. During each visit, randomly selected trees were examined, and the number of larvae present on 3 branches from each tree was recorded. Larval samples were collected and reared in the laboratory to determine the natural parasitism rate. To identify the preferred host instar (2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, or 5<sup>th</sup>), a single female wasp was exposed to 20 larvae of a single instar in a Petri dish for 24h. Larvae were then reared individually to