

## SPECIES

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## Author Affiliation:

Department of Zoology, Shivaji University, Kolhapur 416004, Maharashtra, India

## \*Corresponding Author

Department of Zoology, Shivaji University, Kolhapur 416004, Maharashtra, India  
Email: [smg\\_zoo@unishivaji.ac.in](mailto:smg_zoo@unishivaji.ac.in)

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# Parasitism in biocontrol agent *Cheilomenes sexmaculata* (Fabricius, 1781) (Coleoptera: Coccinellidae) by *Tetrastichus bilgiricus* Narendran (2007) (Hymenoptera: Eulophidae)

Sumit Ravi Mali, Sunil Madhukar Gaikwad\*

## ABSTRACT

The adult pair of ladybird beetles, along with their pupa, were spotted on the Lima bean *Phaseolus lunatus*. They were collected and taken to the laboratory for further study. The Ladybird beetle *Cheilomenes sexmaculata* is a biocontrol agent that preys on crop pests such as white flies and aphids. The pupa of *C. sexmaculata* was discovered to be parasitized by the Eulophid wasp *Tetrastichus bilgiricus*. This observation from the study will contribute valuable information about the natural enemies of biocontrol agents.

**Keywords:** Ladybird, Lima bean, *Phaseolus lunatus*, Eulophid wasp

## 1. INTRODUCTION

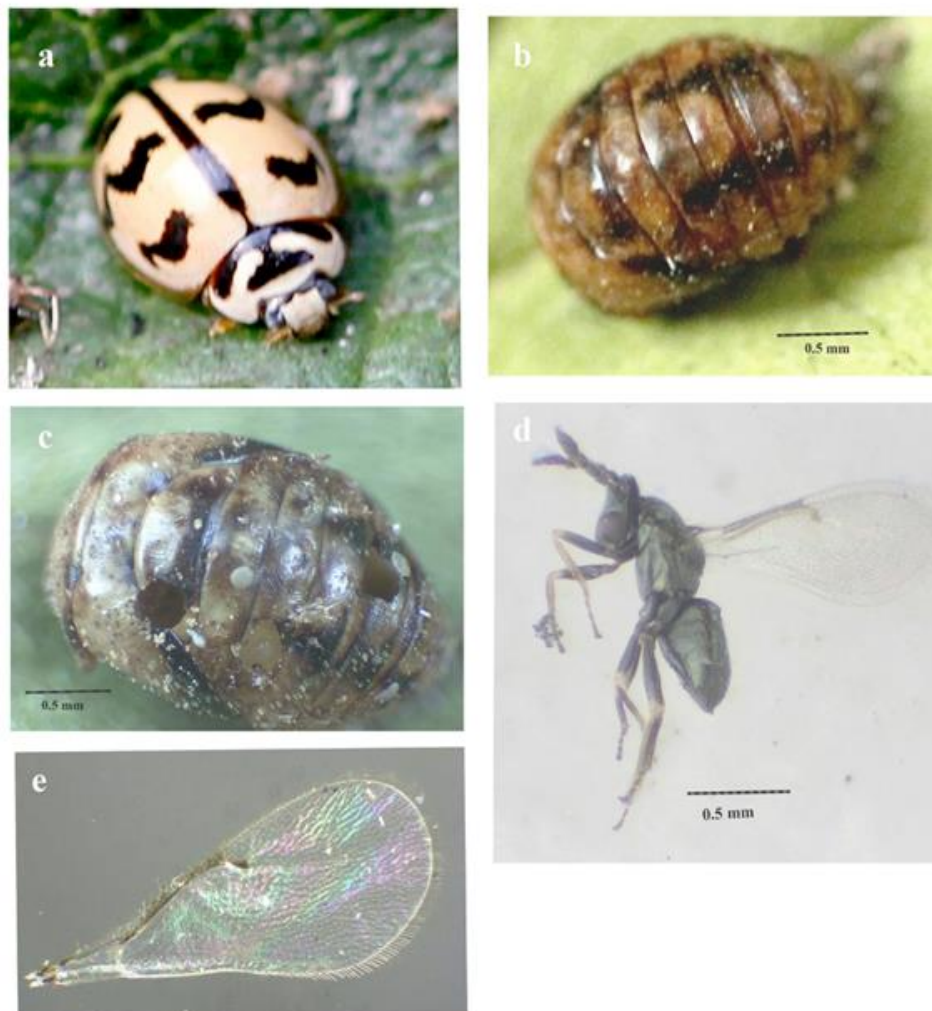
Under natural conditions, most predators, parasitoids, bacteria, fungi, and viruses control the population of insect pests. Insects are a diverse group of natural enemies, including predatory and parasitoid insects (Atwal and Dhaliwal, 2015). According to Fei et al., (2023), Coccinellidae is one of the largest families in the order Coleoptera, containing more than 6000 species, with most species acting as predators. Ladybugs are important for controlling the population of small insect pests, and they are also targeted by parasitic wasps in their larval or pupal stages (Megha et al., 2015). These wasps primarily target a variety of insect pests from different groups, such as the Ichneumonidae and Chalcidoidea superfamily (Atwal and Dhaliwal, 2015). The Chalcidoidea superfamily, which includes the Eulophidae family, has over 4500 species, and their numbers are increasing (Shree and Singh, 2015). Eulophid species are mainly parasitic or hyperparasitic, meaning they parasitize various hosts (Rasool et al., 2022). This study documents the pupal parasitoid *Tetrastichus bilgiricus* on *Cheilomenes sexmaculata*, which will provide insight into integrated pest management strategies under field conditions.

## 2. MATERIALS AND METHODS

During a field survey on March 13, 2023, in Tamgaon, Kolhapur, Maharashtra, we collected adult and pupae of *Cheilomenes sexmaculata* using the handpicking method and brought them to the laboratory. We reared them at a temperature of 28°C and a humidity of 22% and made observations. The parasitoid *T. bilgircus* was identified by Narendran, (2007) and Gupta and Kannan, (2014), while the ladybird beetle *C. sexmaculata* was identified by (Poorani and Lalitha, 2018). We photographed the specimens using an Olympus CX31RTSF microscope and a Canon 550D DSLR camera. The images were stacked in Helicon Focus 7 software and edited in Photoshop CC64. We measured the specimens using IMAGE J software. All specimens were preserved using dry and wet preservation methods, according to (Ambrose, 2015).

## 3. RESULTS AND DISCUSSION

During field surveys of vegetable pests, we found pupa and adults of *C. sexmaculata* on the fruit vegetable Lima bean, *Phaseolus lunatus* (Figure 1a, b). After four days, the pupa turned dark brown (Figure 1b). On the 5th day, five parasitoids emerged from the pupa, creating an exit hole on the dorsal side (Figure 1c). The parasitoid was identified as *Tetrastichus bilgircus* (Hymenoptera: Eulophidae) (Figure 1d) based on the submarginal vein on the forewing (Figure 1e), which is the most identifying characteristic of the genus *Tetrastichus*. The *T. bilgircus* parasitoid was black-bodied, approximately 1.5 mm long, with nine segmented dark brown antennae, hyaline wings, and brown veins. Its submarginal vein had one seta (occasionally 2-4), and its propodeum had an inverted Y-shaped para-spiracular carina and a hind coxa with prominent reticulations.



**Figure 1** (a) Adult of *Cheilomenes Sexmaculata*, (b) Parasitized pupa, (c) Parasitized pupa with parasitoid exit hole, (d) Adult parasitoid *Tetrastichus bilgircus*, (e) Forewing

## Remarks

Predation, parasitism, and hyperparasitism are common in insects (Patra et al., 2023; Vyas et al., 2023; Tripathy & Priyadarshini, 2022; Priyadarshini & Satapathy, 2021). However, parasitism in biocontrol agents like coccinellid beetles is of great interest. Many researchers have studied parasitism in insects. For example, Kosheleva and Kostjukov, (2014) reported the presence of an egg larval parasitoid, *Tetrastichus coeruleus*, on the beetle *Crioceris asparagi*, as well as larval-pupal parasitoids *Tetrastichus epilachnae*, *Tetrastichus legionarius*, and *Tetrastichus hylotomarum* on the beetle *Epilachna chrysomelina*, the fly *Lipara lucens*, and members of the Hymenoptera family Argidae, respectively.

They also documented the presence of the larval-pupal parasitoid *Tetrastichus crinicornis* on the fly *Cecidomyia urticae*, and pupal parasitoids *Tetrastichus litoreus*, *Tetrastichus nigricoxae*, and *Tetrastichus shandongensis* on the moth *Hyphantria cunea*. Based on the studies mentioned above, it is evident that there is very limited information available on the parasitoid *T. bilgircus*. Gupta and Kannan, (2014) were the first to record *T. bilgircus* as a pupal parasitoid on the butterfly *Euthalia aconthea meridionalis*, marking the first host record for this parasitoid. The taxonomical characteristics of the reported *T. bilgircus* can be found in the studies by (Gupta and Kannan, 2014; Rasool et al., 2022).

## 4. CONCLUSION

The discovery of the parasitoid *T. bilgircus* on the pupa of the biocontrol agent *C. sexmaculata* represents a new host for this parasitoid. This is significant because *C. sexmaculata* is an important biocontrol agent for many crop pests.

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## Authors' Contribution

SMG participated in designing the research, identifying specimens, and writing the manuscript. SRM collected, reared, identified, and gathered biological data of the species under study.

## Ethical approval & declaration

In this article, as per the animal regulations in Department of Zoology, Shivaji University, Maharashtra, India, the authors observed the parasitism in biocontrol agent *Cheilomenes sexmaculata* (Fabricius, 1781) (Coleoptera: Coccinellidae) by *Tetrastichus bilgircus* Narendran (2007) (Hymenoptera: Eulophidae). The Animal ethical guidelines are followed in the study for species observation, identification & experimentation.

## Conflicts of interests

The authors declare that there are no conflicts of interests.

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## Data and materials availability

All data associated with this study are present in the paper.

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