



Morphological study of *Chrysoperla zastrowi sillemi* and its role as a biological control agent in cotton pest management, under natural field condition near Ghugus area, Chandrapur District, Maharashtra, India

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ABSTRACT

The predatory insect *Chrysoperla zastrowi sillemi* (Esben-Petersen) widely recognized as the golden-eyed lacewing or aphid lion, is a cosmopolitan species found across diverse agricultural habitats. As a polyphagous predator, it sustains itself on an extensive repertoire of prey organisms, predominantly includes a diverse assemblage of soft bodied arthropods. Among its favoured targets are thrips, aphids, mites and early-stage lepidopteran caterpillars. A distinguishing feature of this species is its non-predatory nature in adult stage, where adults feed exclusively on pollen, nectar, and aphid honeydew. This study was conducted from August to December 2025. Field observations took place at three randomly selected sites within each of two study villages. Results indicate that third-instar larvae of *C. zastrowi sillemi* consume more prey than first and second-instar larvae, highlighting its potential as an excellent biocontrol agent for season-long organic pest management in crops.

Keywords: Biological control, Green lacewings, *Chrysoperla zastrowi sillemi*, Hemiptera.

Citation: Sushma K. Prajapati and Rajlaxmi R. Kulkarni [2026]. Morphological study of *Chrysoperla zastrowi sillemi* and its role as a biological control agent in cotton pest management, under natural field condition near Ghugus area, Chandrapur District, Maharashtra, India. *Journal of Diversity Studies*. DOI: <https://doi.org/10.51470/JOD.2026.5.1.351>

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Article History: Received 22 March 2026 | Revised 18 April 2026 | Accepted 17 May 2026 | Available Online June 21, 2026

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Introduction

Insects, diseases, weeds, and nutritional deficiencies pose major constraints to both the quality and quantity of crop yields. Among the spectrum of insect pests, aphids and mites rank foremost significant threats to various crops. Aphids inflict damage by sucking the phloem sap from plants and serving as vectors for viruses to transmit diseases to the healthy ones. These pests infest a wide array of farm products, including horticultural, grains, and oilseeds varieties. To minimize pesticide use, it is essential to promote the conservation of naturally derived predators within agricultural field. The common green lacewing is a key generalist predator, stands out as one of the most effective biocontrol agents [1]. Green lacewings of the genus *Chrysoperla* sp. (order Neuroptera: family Chrysopidae) are widely distributed in agricultural ecosystems worldwide, encompassing about 1,300 recognized species across 87 genera and 3 subfamilies. In India, 65 species of these chrysopid predators have been documented across various environments and classified within 21 genera. Dominating as the most prevalent species throughout Asia is *Chrysoperla carnea* which actually represents a cryptic complex of sibling species including *C. carnea*, *C. lucasina*, *C. plorabunda*, and *C. nipponensis*, sustained as reproductively isolated by their unique mating songs [2].

The Indian green lacewing, initially described as *Chrysoperla carnea* (Stephens) but taxonomically confirmed as *Chrysoperla zastrowi sillemi* (Esben-Petersen), is a common predator found abundantly across various agro-ecosystems.

Its grub stage serves as a potent predator of soft-bodied Hemipterans and inactive stages of Lepidopteran pests affecting a wide range of field crops, including vegetables. As a key biological control agent, it exhibits a high frequency of occurrence, a broad prey spectrum, effective foraging ability, resistance to many common insecticides, and tolerance to diverse ecological factors. The larvae of *C. zastrowi sillemi* are voracious feeders on exposed eggs, small larvae, aphids, jassids, thrips, whiteflies, scales, mealybugs, and mites. While it can be readily mass-reared in laboratories using natural prey, the suitability of different prey for optimal biological parameters depends on various factors [3]. Biological control means using living organisms like parasitoids, predators, and disease-causing microbes to naturally reduce the number of pests. These natural enemies keep pest populations lower than they would be without them. When farmers use biological control, they can reduce the use of chemical pesticides, which makes farming safer for the environment and more sustainable. In crop fields, these natural enemies are very important and can be used either instead of chemicals or along with them to manage pests effectively [4].

Materials and Methods

A field study was conducted under natural conditions in cotton fields at three randomly selected sites in each of two villages i.e., Shengaon and Pandharkawada, near the Ghugus region (19.93°N, 79.13°E).

Whole cotton plants were meticulously examined from top to bottom to investigate the life cycle of the *Chrysoperla zastrowi sillemi* (Esben-Petersen), encompassing its eggs, three larval instars, Pupa in cocoon and adult stages. Early morning observations revealed *Chrysoperla zastrowi sillemi* actively feeding primarily on cotton bolls; photographs of there developmental stages were captured by using a Canon camera, with insect identification confirmed via standard scientific literature.

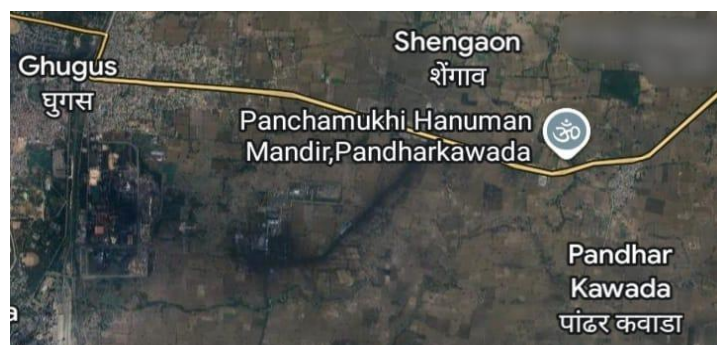
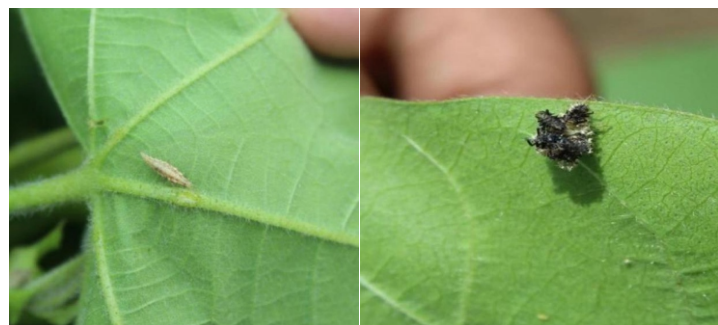


Fig 1: Location of the study area



Eggs (2-5 days)

First instar larva (2-4 days)



Second instar larva (3-5 days)

Third instar larva (3-5 days)



Pupa (5-8 days)

Adult (20-40 days)

Fig 2: Life cycle of Green lacewings (*Chrysoperla zastrowi sillemi*)

Results and Discussion

A field study was conducted under natural conditions in cotton fields to investigate the morphology of developmental stages in green lacewings (*Chrysoperla zastrowi sillemi*).

Eggs

Freshly laid eggs of the green lacewing were pale green and oval-shaped. Females of *C. zastrowi* deposited eggs singly or in groups of 12–14 on top of hair-like stalks to prevent cannibalism. Egg color shifted from green to gray as hatching approached, with an incubation period ranging from 2–5 days (Fig. 2). Similar observation was found by [5].

Larval stages

Newly hatched larvae possessed three pairs of legs and appeared white to pale yellow. Upon emergence, they immediately sought food and grew to 9–12 mm in length. *Chrysoperla zastrowi* underwent three larval instars before pupation, as described below:

First instar larvae are with white to pale yellow colouration. The body elongated gradually, tapering toward the head, and featured small bristles on the lateral sides. This stage lasted 2–4 days. Second instar larva resembled the first instar but were larger in size and darker in colour. Distinct grey or brown colour stripes appeared prominently on the head and thoracic region of larvae, with a duration of 3–5 days. Third instar larvae were the largest and darkest, with prominent gray or brown stripes across the entire body and distinct bristles on the lateral sides. Mature larvae had sickle-shaped mandibles and a well-developed proboscis for capturing and extracting fluids from prey. This stage lasting 3–5 days (Fig. 2). [6] reported comparable findings in their study, by noting that the total larval period ranged from 10–13 days, with a period of time for the first instar was 3–4 days, 3–5 days for the second instar, and 4–5 days for the third instar.

Pupa

Fully grown larvae spun white, spherical cocoons covered in silken threads and pupated within. Cocoons turned green one day before adult emergence. The pupal period lasted 5–8 days (Fig. 2). [7] reported a similar observation on the pupal stage. Fully grown larvae spin white, spherical cocoons approximately 6 mm in diameter and pupate inside these structures, which are covered with silken threads. The cocoons turn green one day before adult emergence, and the pupal period lasts 5–8 days.

Adult

Adults were soft-bodied, typically light green, with transparent wings spanning wider than the body length. Males had narrow, tapering abdomens, while females' abdomens were 2–3 times broader. Compound eyes were copper or golden. In this study, Adult ranged from 20–40 days (Fig. 2). Similar results were reported by [8], that the male lifespan ranges from 22 to 33 days, while females live 28 to 41 days.

Conclusion

Studying the morphology of the predator *Chrysoperla* species is a key to more sustainable farming. Knowing their life cycle, what they eat, and how they hunt helps us to use them effectively as natural pest controllers. As the adults live for about 20–40 days. Its larvae can eat up to 500 aphids during their whole larval stage.

This means that each stage of the green lacewing *C. zastrowi sillemi*, with its long larval period, has strong potential to feed on aphids. The current conclusion of the study reveals that the third instar larvae of *C. zastrowi sillemi* eat much more prey than first and second instar larvae. This feeding behaviour exhibited by third instar larvae renders it an excellent biocontrol agent for organic pest management, helping crops all season long.

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