

MORPHOLOGY OF THE COMMON GREEN LACEWING (*CHRYSOPIDAE*, *CHRYSOPERLA CARNEA*)

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Abstract: This article presents a scientific analysis of the morphological characteristics and biology of *Chrysoperla carnea*. This species belongs to the family Chrysopidae within the order Neuroptera. The study describes the morphogenesis, anatomical structure, and functional features of the egg, larval, pupal, and adult (imago) stages. Particular attention is given to the campodeiform larval morphology, piercing-sucking mouthparts, the mandibulo-maxillary feeding canal enabling extraoral digestion, and its entomophagous behavior. Changes in pigmentation during diapause associated with carotenoids, as well as the ecological significance of the species as a biological control agent in agroecosystems, are also discussed.

Keywords: *Chrysoperla carnea*, Chrysopidae, Neuroptera, morphology, campodeiform larva, mandible, maxilla, diapause, entomophage, biological control, metamorphosis, imago, pupa.

Introduction: *Chrysoperla carnea* is a widely distributed Palearctic species belonging to the order Neuroptera and the family Chrysopidae. The species was first described in 1836 by the English entomologist James Francis Stephens. It is naturally distributed across Europe, Central Asia, and North America, inhabiting a wide range of agrocenoses, including cotton, alfalfa, vegetable, and melon crops.

According to the data presented in the article, this species is an effective entomophagous predator of phytophagous pests. It feeds on spider mites, lepidopteran larvae, and especially aphids. The larval morphology, particularly its campodeiform body shape, forward-projecting sickle-shaped mandibles, and maxillae forming a specialized feeding canal, ensures its predatory efficiency.

The article further provides a detailed description of the species' morphology across all developmental stages egg, larva, pupa, and adult. Special emphasis is placed on morphological adaptations such as pigmentation changes during diapause, wing venation patterns, distribution of setae, and other diagnostic external features.

This insect belongs to the order Neuroptera and the family Chrysopidae (green lacewings). The species was first studied by the English entomologist James

Francis Stephens in 1836. It is a widely distributed Palearctic species, occurring extensively in Europe, Central Asia, and North America.

The distribution range of this species extends from the Arctic regions to Mauritania, Sudan, the Near East, and Central Asia. Under the conditions of Uzbekistan, it is widely distributed on cotton, alfalfa, vegetable and melon crops, as well as on wild-growing plants (Abdurakhmanova, 1975; Allashukurova, 1970; Vokhidov, 1971; Luppova, 1963, 1966, 1971; Mangutova, 1970; Muratov, 1978; Uspensky, 1951, 1960). On cotton, it feeds on spider mites, bollworms, and the larvae and young instars of other pest insects.

This species was introduced into India and New Zealand, but failed to acclimatize there. In the USA, Pakistan, and Central Asia, it is used for biological control to prevent the proliferation of the tobacco whitefly (*Bemisia tabaci*) damaging tobacco and cotton crops.

Currently, this insect is found on all continents except Australia and Antarctica, inhabiting both lowland and mountainous regions up to 3000 m above sea level.

It occurs on cotton, in orchards, and on other crops. The adult body length ranges from 23-30 mm, with two pairs of wings. Its coloration is pale green, with a longitudinal whitish-yellow stripe along the dorsal side. Due to the presence of carotenoids in the body, individuals entering diapause (both males and females) change color from whitish-green to yellowish-brown. The longitudinal veins of the wings are green, whereas the cross-veins are nearly black.

The head is spotless, smooth, with a black-bordered neck, sometimes bearing reddish markings. The setae on the ventral sternites of the abdomen are dark in color. The head, thorax, and abdomen are green, with reddish-brown longitudinal stripes along the neck. The antennae are located between the eyes.



Figure 1. Body and head structure of the common green lacewing (*Chrysoperla carnea* Stephens). 1-vertex (dorsal part of the head capsule);

2-frons (frontal sclerite); 3-compound eye (faceted eye); 4-antenna (filiform sensory appendage); 5-maxilla (paired mouthpart involved in food

manipulation); 6-labium (lower lip, forming part of the feeding apparatus); 7-mandible (piercing-sucking mouthpart element).

The legs measure several millimeters in length; the tarsi are green, cursorial, and composed of five segments. The tarsi are green, while the ventral surface is pale brownish. As in all neuropteran larvae, three pairs of legs are present and labial palps are absent. The larval legs terminate in a five-segmented tarsus bearing two claws.

The egg is oval in shape, measuring $0.9 (0.84-0.96) \times 0.4$ mm, and is borne on a stalk 5-7 mm in length. Newly laid eggs are green, turning grayish-brown by the end of embryonic development.

The larva measures 10-12 mm and passes through three instars, molting twice during development. First-instar larvae reach 1.5-2 mm in length. The body is compact anteriorly and posteriorly, adapted for rapid movement. The larva is predatory, with the body gradually tapering posteriorly; the thoracic and abdominal segments are laterally covered with large hooked setae.

The larval mouthparts are of the piercing-sucking type. The larvae are campodeiform, predatory, with sickle-shaped mandibles projecting forward. The head is flattened, and the mandibles are dagger-like, oblique, and sharp.

The maxillae closely adjoin the mandibles, forming a closed feeding canal. Through this canal, digestive enzymes are injected into the prey, and the liquefied internal contents are subsequently sucked out. Between the tarsal claws, an empodium is present. The larval head bears two indistinct horn-like projections.

Digestive system: in addition, neuropteran larvae do not excrete undigested food residues; instead, these accumulate throughout development. This is associated with the presence of a non-functional septum between the midgut and hindgut. Upon adult emergence, the connection between the midgut and hindgut is established, and accumulated are expelled.

Larvae of the common green lacewing and related species feed on aphids, including cabbage aphids. Lacewings appear rapidly in cabbage fields following aphid infestations. By late July August, their numbers increase, with an average of one larva per plant.

The common green lacewing has also been observed to significantly reduce populations of apple aphids.

The larvae are predatory; a single larva can consume 60-80 aphids per day. In addition to aphids, they also feed on spider mites. The size of the larva is important in pest suppression: larvae measuring 4-5 mm consume 25-30 aphids per hour, while larger larvae (6-7 mm) consume approximately twice as many.

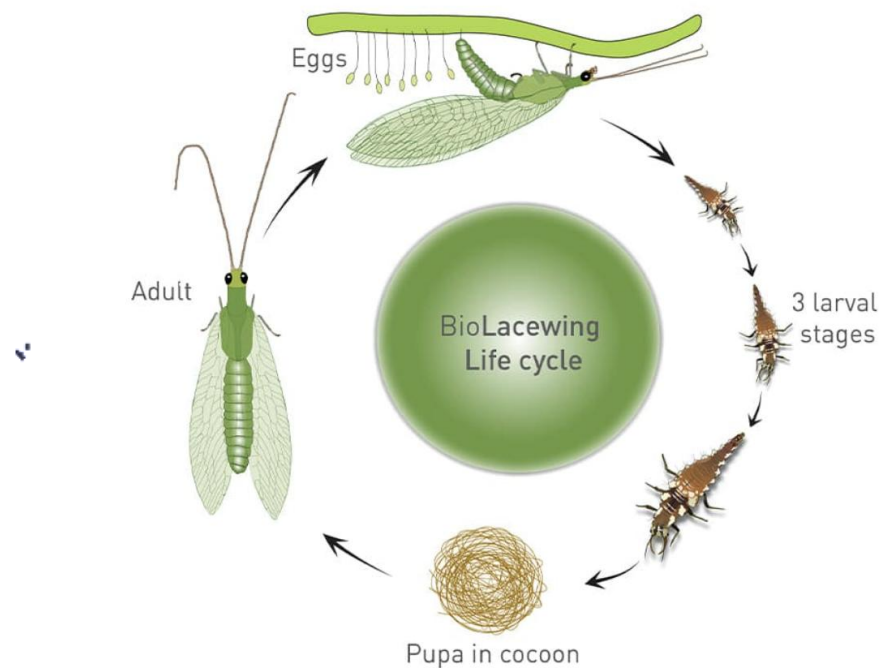


Figure 2. *Chrysoperla carnea* egg stage on stalks, three larval instars, pupation within a silken cocoon, and adult imago stage.

Daily feeding activity lasts 6-8 hours. Feeding duration decreases during evening and nighttime depending on temperature. Under laboratory conditions, a larva placed in a dark chamber during the day consumed 24 aphids between 10:30 and 17:10 (6 hours 40 minutes), averaging about four aphids per hour (Uspensky, 1970).

In addition to parasitoids of the order Hymenoptera, numerous predatory insects feed on aphids, including lacewings, coccinellids, gall midges, syrphids, and larvae of other insect species.

The species overwinters in the adult stage under bark, among vegetation, and in other sheltered places. Overwintering individuals acquire a pale yellow coloration. In spring, activity resumes at temperatures of 10-15 °C.

Adults feed additionally on floral nectar and subsequently mate and oviposit. Females lay eggs within aphid colonies. At a constant temperature of 26 °C, the complete metamorphosis from egg to adult takes 25-30 days. Notably, *Chrysoperla carnea* is tolerant to significant temperature fluctuations. Even at very low temperatures, larvae survive and resume feeding as temperatures gradually rise. Eggs are laid singly or in small clusters on leaves, stems, or shoots. A single female may lay 220-300 eggs per day.

Newly hatched larvae remain immobile for a short period (15-20 minutes up to several hours); after the cuticle hardens, they move along the egg stalk onto

plant surfaces in search of prey. Larvae can survive 3-5 days without food (Popushoi et al., 1977; Dorokhova, 1979; Tryapitsyn et al., 1982). According to Uspensky (1960), the development of one generation in summer lasts 24-36 days, with stages lasting 4-6, 11-14, and 12-16 days, respectively. Meyer (1946) reported that larval development lasted 8-9 days when feeding on certain aphid species, 10-12 days on chrysanthemum aphids, 12 days on blood aphids, and 13-14 days on mealyworms.

During larval development, up to 300 aphids or about 1000 spider mites may be consumed. Female larvae consume up to 1108 eggs of grain moths, while male larvae consume up to 942. Occasionally, they also feed on small caterpillars.

Before pupation, the larva spins a spherical, white, thin silken cocoon (approximately 3 mm in diameter) using secretions from the Malpighian tubules. The pupa is of the exarate type and green in color. Toward the end of development, it becomes active and gnaws open the upper part of the cocoon, which opens like a lid, allowing the adult to emerge.

Optimal conditions for all developmental stages include temperatures of 25-30 °C and relative humidity of 55-80%. At 35 °C, oviposition ceases. The lower developmental threshold for adults is 6.6 °C.

In late autumn, well-fed adults gradually change color from green to yellowish-gray. Depending on photoperiod and at temperatures of 16-27 °C, this process lasts 3-20 days. The species produces 3-4 generations per year.

Several foreign researchers (Beglyarov & Ushekov, 1979; Bondarenko & Moiseev, 1975; Hassan, 1978; Tuovinen et al., 1978) have demonstrated that *Chrysoperla carnea*, widely distributed in the Holarctic, can be used against aphids infesting greenhouse crops such as eggplant, sweet pepper, and leafy greens. However, under greenhouse conditions, elevated temperature and humidity negatively affect larval viability, resulting in insufficient effectiveness against melon aphids on cucumber.

Conclusion: The findings indicate that *Chrysoperla carnea* possesses highly specialized morpho-biological adaptations, with clearly differentiated ontogenetic stages. The campodeiform larval structure, the mandibulo-maxillary piercing-sucking apparatus, extraoral digestion, and high feeding activity characterize it as an efficient entomophagous predator.

In the adult stage, wing venation, body pigmentation, and diapause-related morphological changes reflect a high degree of ecological adaptability. Furthermore, the species plays a significant role in reducing populations of aphids and other agricultural pests, confirming its importance as a biological control agent in agroecosystems.

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