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Bionomics and Feeding Potential of an Eminent Predator: *Chrysoperla cornea* Stephens

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Abstract

The lacewing's role as a generalist predator in biological pest control is highlighted, with a specific focus on its mass rearing using the eggs of the rice moth *Corcyra cephalonica*. The developmental stages of *Chrysoperla carnea* reared on rice moth eggs are detailed, encompassing the incubation period, three larval instars, pupal stage, and overall development duration. Furthermore, variations in the adult period between male and female lacewings are discussed. The feeding potential of *Chrysoperla carnea* on various hosts is investigated, revealing its efficiency in consuming aphids and other soft-bodied arthropods. The ecological dynamics of *Chrysoperla carnea*, shedding light on its potential as an effective agent in integrated pest management strategies. The findings underscore the importance of considering host-specific variations in understanding the broader ecological roles of predators in maintaining ecosystem balance.

Keywords: *Chrysoperla cornea*, Biology, Host and Insecticides effects.

Introduction

Models and recent meta-analyses of field studies suggest that in ecosystems characterized by few species and minimal spatial and temporal heterogeneity, top-down regulation of herbivores is more probable (Hawkins *et al*., 1999). Even with their temporal instability, annual crops represent terrestrial habitats where predators can exert the most significant regulation on herbivore populations. This is also a context where herbivores might inflict the highest levels of plant damage if predators are unable to control those (Halaj & Wise, 2001). In the biological control of insect pests within diverse cropping systems, the common green lacewing (*Chrysoperla* sp., carnea-group) serves as a crucial generalist predator. Its mass rearing in laboratories involves utilizing the eggs of the rice moth *Corcyra cephalonica* Stainton. (Gupta & Rai, 2006). *Chrysoperla carnea*

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serves as a potential predator and is employed in Integrated Pest Management to decrease the population of aphids (Milvoj, 1999). Additionally, it targets other pests like coccids, mites, mealybugs, lepidopteran eggs, and small larvae, along with various other slow or non-moving soft-bodied arthropods (Singh *et al.*, 2003). They have received significant emphasis within their family due to their effective foraging, widespread occurrence, ease of rearing, and habitat adaptability. The larvae primarily consume various arthropods, while adults primarily feed on plant products and byproducts (El Serafi *et al.*, 2000). Cannibalistic behavior is observed among the larvae of *Chrysoperla carnea.*

Biology of *Chrysoperla carnea* reared on rice moth (Than *et al.*, 1999)

- The incubation period of *Chrysoperla carnea* eggs is 3 to 4 days.
- The larval stage consists of three instars, with a duration ranging from 10 to 12 days.
- The pupal period lasts for 8 to 10 days.
- The entire development period spans from 21 to 24 days.
- Adult periods span for 30 to 32 days and 44 to 46 days of male and female, respectively.

The biology of *Chrysoperla carnea* may be observed differently on another host such as *Aphis gossypii*, *Aphis craccivora*, Eggs and larvae *Earias vitella* and Eggs and larvae *Helicoverpa armigera* (Than *et al.*, 1999).

Feeding potential of *Chrysoperla cornea* on different host

- During each larval period, *Chrysoperla carnea* larvae, as reported by Vivek *et al.* (2013), consume a range of 395 to 400 aphids (*Aphis craccivora*) as well as the larvae of *Chrysoperla carnea* feed on 330 to 335 aphids (*Aphis gossypii*), 260 to 265 aphids (*Rhopalosiphum maidis*) and 130 to 135 aphids (*Lipaphs erysimi*) per larval period.
- According to Than *et al.* (1999), the larvae of *Chrysoperla carnea* consume a varying range of 640 to 645 eggs of *Helicoverpa armigera* in each larval period. Similarly, the *Chrysoperla carnea* larvae ingest 610 to 615 eggs of Earias vitella and 400 to 405 eggs of *Corcyra cephalonica* during each larval period.

Undesirable consequences of pesticides on *Chrysoperla cornea*

Currently, employing pesticides stands as a highly efficient strategy in pest control. However, taking into account the adverse effects of chemical control, such as the emergence of resistance in pests,

environmental pollution, and harm to natural enemies and non-target organisms, it is advisable to diminish their usage through integrated pest management programs (Croft, 1990). The compatibility of pesticides with biological control agents is considered a significant concern by practitioners of integrated pest management (IPM). It is deemed crucial to possess an understanding regarding the impact of insecticides on pests, non-target insects, and the environment (Stark *et al.*, 2004). While lower risks to both humans and the environment are posed by certain modern insecticides, adverse effects on arthropod natural enemies within agricultural systems are still exhibited by some. Consequently, the potential occurrence of secondary pest outbreaks may be facilitated (Crampton *et al.*, 2010). Many of the requirements of an effective biological control agent are fulfilled by larval lacewings, and they are voracious active predators with an excellent search capacity (Bond, 1980).

I. Harmful Insecticides against *Chrysoperla cornea*

Maximum larval mortality obtains when the grubs are exposed to Acetamiprid, Thiamethoxam, Imidacloprid (Shah *et al.*, 2012), lufenuron (Ahmed *et al.*, 2017), Chlorpyrifos-methyl and methomyl formulations (Korrat *et al.*, 2019).

II. Safer Insecticides for *Chrysoperla cornea*

- ✓ Emamectin benzoate
- ✓ *Metarhiziuma anisoplae*
- ✓ Diafenthiuron
- ✓ Buprofezin
- ✓ Thiodicarb

Conclusion

Chrysoperla carnea emerges as a pivotal generalist predator in the biological control of insect pests across diverse cropping systems. The mass rearing of these lacewings involves utilizing the eggs of the rice moth *Corcyra cephalonica*. The predatory role of *Chrysoperla carnea* extends to aphids and various other pests like coccids, mites, mealybugs, lepidopteran eggs, and small larvae. The feeding potential of *Chrysoperla carnea* on different hosts, as detailed in the article, demonstrates its effectiveness in consuming a wide range of aphids and insect eggs during each larval period. *Chrysoperla carnea* larvae to certain chemicals, resulting in maximum larval mortality. Conversely, safer alternatives are presented, including Emamectin benzoate, *Metarhizium anisopliae*, Diafenthiuron, Buprofezin, and Thiodicarb.

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