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Biology of *Chrysoperla zastrowi sillemi* (Esben-Petersen) on different hosts

Kancharla Mounika, SS Gosalwad and PS Neharkar

Abstract
Laboratory experiments were conducted at Department of Agricultural Entomology, VNMKV, Parbhani during 2020-2021 to study the biology of green lacewing, *Chrysoperla zastrowi sillemi* (Esben-Petersen) on unsterilized and sterilized eggs of *Corcyra cephalonica, Aphis craccivora, Aphis gossypii, Brevicoryne brassicae* and *Uroleucon compositae*. This study was observed under different biological parameters. Incubation period of *Chrysoperla sp.* ranged from 3.84 to 4.41 days on different preys while egg hatching percentage recorded highest when reared on *Corcyra cephalonica* with 94.77 per cent. Larval and pupal period were minimum with 9.00 and 5.43 days on unsterilized eggs of *Corcyra cephalonica.* Oviposition period and fecundity were highest on unsterilized eggs with 29.57 days and 371.6 eggs, respectively. These results revealed that unsterilized eggs of *Corcyra cephalonica* was most suitable host for mass multiplication of the predator in the laboratory.

Keywords: Biology, *Chrysoperla zastrowi sillemi*, unsterilized eggs of *Corcyra cephalonica, Aphis sp., Brevicoryne brassicae*

Introduction
The Indian green lacewing, *Chrysoperla zastrowi sillemi* (Esben-Petersen) (Neuroptera: Chrysopidae) often known as aphid lion or golden eyes comprises an eminent group of predators for its amiability to mass production and great potentiality for biological control. These predators feed on insects (> 80 species) and on mites (> 12 species) (Kharizanov and Babrikova, 1978) [8]. Indian green lacewing, *Chrysoperla carnea* (Stephens) has taxonomically modified to *Chrysoperla zastrowisillemi* (Esben-Petersen) (Venkatesan *et al.*, 2008; Henry *et al.*, 2010) [15, 7]. It is a prolific predator of sucking pests such as aphids, mealybugs, thrips, whiteflies (Abd-rabou, 2008) [1] and spider mites (Saminathan *et al.*, 1999) [14]. It is a predominant species, where the larva is predatory in nature and adults are free living (Villenave *et al.*, 2005) [16]. *Chrysoperla spp.* has been considered as one of the most useful natural enemy in insect management due to its host preference, diverse habit, easy mass multiplication, shorter life cycle, voracious larval feeding capacity, resistance to insecticides and wide geographical distribution. The adult green lacewings are pale green with thread like antenna, transparent wings and golden coloured compound eyes. Head is marked with reddish brown occasionally red spot on gena (Brooks, 1994) [3].
With the growing potential of biocontrol agents in suppressing pests has gained prominence. Thus, to implement biological control programme, it is vital to understand its biology on particular prey species for determining its predating efficiency and suitability.

Materials and Methods
The Laboratory experiments were conducted in the Laboratory of Insect Parasitology Research Scheme, Department of Agricultural Entomology, VNMKV, Parbhani during 2020-21 to study the biology of *Chrysoperla zastrowisillemi*) (Esben-Petersen) on different hosts.

Rearing of Preys
Rearing of *Corcyra cephalonica*: Eggs of *Corcyra cephalonica* were obtained through the culture multiplied on large scale under laboratory conditions. The culture was maintained on sorghum based artificial diet.

Procurement of hosts from different crops: Cabbage, Cotton and Safflower aphids were collected from pesticide free fields located at Department of Agricultural Entomology, Parbhani. Cowpea local variety was sown in a small plot for obtaining aphids.

This plot was maintained untreated.

Rearing of *Chrysoperla zastrowisillemi*

Mass rearing of *Chrysoperla zastrowisillemi* was done in the laboratory to obtain pure, hygenic and required culture. The initial culture of eggs of *Chrysoperla zastrowi sillemi* was procured from ICAR - NBAIR (National Bureau of Agricultural Insect Resources) Bangalore, Karnataka, India. The eggs of *Chrysoperla zastrowi sillemi* was were kept in a container for hatching. After hatching, larvae until pupation were fed with eggs of *Corcyra cephalonica.* Immediately after adult emergence, they were transferred to oviposition chamber and maintained in the lids of plastic containers. The freshly laid eggs on black paper sheet were collected and transferred into vials. These freshly laid eggs were used for further study.

Biological studies

The biology was studied in the laboratory under Completely Randomized Design (CRD) with five replications and six treatments *viz.,* Unsterilized eggs of *Corcyra cephalonica.* Sterilized eggs of *Corcyra cephalonica, Brevicoryne brassicae, Aphis craccivora, Aphis gossypii* and *Uroleucon compositae*.

One hundred *Chrysoperla zastrowi sillemi* was eggs freshly laid were housed in five petri plates until they hatched. Each replication has a total of 20 eggs. Individually, newly hatched larvae were reared in clean plastic enclosures on their respective preys. The larvae's diet was changed every day until they pupated. They were kept in an oviposition chamber after adult emergence and fed daily with castor pollen and cotton swabs dipped in drinking water, 50 percent honey solution, and proteinex combination. The interior surface and top of the oviposition cage were covered with black cotton paper to act as a substrate. Each female was counted for number of eggs deposited till it died.

After oviposition period male and female adults were separated to note their longevity. Adults were differentiated as male or female based on the thickness of their abdomens. Males have a narrow and thin abdomen, while females have a bulging abdomen.

The Growth index was calculated by using Howe's (1953) formula.

Under this study, incubation period, percent egg hatch, larval duration, percent larva pupated, pupal duration, adult emergence, preoviposition period, oviposition period, fecundity, adult longevity, Life cycle duration were also recorded.

Results and Discussion

Egg

$$\text{Growth index} = \frac{\text{Per cent larva pupated}}{\text{Mean larval duration (days)}}$$

Eggs were oval shaped and pale green in color, laid singly on the end of long silken slender stalks and turn grey towards hatching (Plate1). The present investigation shows that incubation period of *Chrysoperla zastrowisillemi* was 3.84, 3.87, 4.02, 4.07, 4.22 and 4.41 days on *Aphis craccivora,* unsterilized eggs of *Corcyra cephalonica, Aphis gossypii, Brevicoryne brassicae,* sterilized eggs of *Corcyra cephalonica* and *Uroleucon compositae,* respectively (Table 1). The present results are in conformity with the findings of earlier workers. Incubation period of *Chrysoperla zastrowi arabica* of 3.77, 4.07 and 3.95 days on eggs of *Corcyra cephalonica, Aphis gossypii, Aphis craccivora,* respectively (Naruka and Meena, 2017) [13].

Egg hatching percentage of *Chrysoperla zastrowisillemi* ranged between 78.77 to 94.77 on different hosts (Table1). Similarily, Naruka *et al.* (2017) [13] also observed egg hatching percentage of *Chrysoperla zastrowisillemi* on eggs of *Corcyra cephalonica, Aphis gossypii* and *Aphis craccivora* as 94.99, 94.68 and 90.81 percent, respectively.

Larva

Total larval duration ranged from 9.00 days to 11.17 days on different hosts (Table 1). Shortest larval duration of 9.00 days was observed by the larvae reared on unsterilized eggs of *Corcyra cephalonica* with first, second and third instar as 2.63, 2.77 and 3.60 days, respectively. This was followed by sterilized eggs of *Corcyra cephalonica* and longest duration was noticed on *Uroleucon compositae*. These results were found similar with Vivek *et al.* (2013) [17] and Naruka and Ameta (2015) [12].

Pupa

The highest percentage of larvae pupated was notice on unsterilized eggs of *Corcyra cephalonica* (89.12) followed by sterilized eggs (86.48) and lowest was noticed on *Uroleucon compositae* (74.5). The results obtained were confirmative with the findings of Bhujabal (2010) [2] who recorded 88 per cent when *Chrysoperla carnea* was reared on unsterilized eggs of *Corcyra cephalonica.* Pupal period ranged from 5.43 to 8.14 days on different hosts (Table 1).Similar results were also reported by Chakraborty and Korat (2010) [4] who recorded pupal duration of *Chrysoperla carnea* on *Corcyra cephalonica* as 5.80 ± 0.11 days. Nandan *et al.,* (2014) [11] reported pupal duration of *Chrysoperla zastrowisillemi* 7.59 days on *Brevicoryne brassicae* which was similar to present results 7.52 days.

Developmental period, adult emergence and growth index

Total developmental period was significantly lowest on unsterilized eggs of *Corcyra cephalonica* and highest on *Uroleucon compositae* (Table 2). Saminathan *et al.* (1999) [14] and Halder and Rai (2014) also reported similar results, where lowest developmental period was noticed when reared on *Corcyra cephalonica.* The highest growth index and adult emergence were observed to be on unsterilized eggs of *Corcyra cephalonica.* These were in conformity with Halder and Rai (2014) and Mhaske *et al.* (2017) [10].

Oviposition, longevity and fecundity

Significantly lowest pre-oviposition period (4.47 days) and highest oviposition period (29.57 days) was observed on unsterilized eggs of *Corcyra cephalonica.* The present investigation was in accordance with Geethalakshmi *et al.,* (2000) [5] who reported pre-oviposition period of *Chrysoperla carnea* 4.0 ± 0.5 days when reared on *Corcyra cephalonica*.

Fecundity (Number of eggs laid per female) recorded highest on unsterilized eggs of *Corcyra cephalonica* (371.6 eggs) and lowest on *Uroleucon compositae* (113.4 eggs). The present results were confirmative with the findings of Kubavat *et al.,* (2017) [9] who recorded 352.9 eggs of *Chrysoperla zastrowisillemi* when reared on eggs of *Corcyra cephalonica.* Vivek *et al.,* (2013) [17] recorded 250.8 eggs, Naruka and

Ameta (2015) [12] recorded 274.73 eggs and Nandan *et al.*, (2014) [11] 260.70 eggs on *Aphis craccivora.*

Conclusion

From the above, it can be concluded that factitious host *i.e.*, eggs of *Corcyra cephalonica* was found to be most suitable for laboratory rearing of *Chrysoperla zastrowisillemi.* In absence of factitious host, field hosts like *Aphis craccivora* and *Aphis gossypii* can be utilized. This results clearly indicate that *Chrysoperla zastrowisillemi* can be used as an efficient biocontrol agent in eco-friendly management of aphids on agricultural crops. It enhances potential of predators.

Table 1: Biology of *Chrysoperla zastrowisillemi* on different hosts

Preys	Incubation period	% Egg hatch	Larval period	% Larvae pupated	Pupal duration
Unsterilized *Corcyra* eggs	3.87	94.77	9.00	89.12	5.43
Sterilized *Corcyra* eggs	4.22	91.05	9.46	86.48	6.26
Brevicoryne brassicae	4.07	84.18	10.50	79.44	7.52
Aphis gossypii	4.02	86.35	10.59	81.70	6.93
Aphis craccivora	3.84	89.89	10.10	78.94	7.27
Uroleucon compositae	4.41	78.77	11.17	74.50	8.14
S.E ±	0.07	0.44	0.12	1.95	0.08
C.D at 5%	0.22	1.29	0.35	5.70	0.24
C.V	4.17	1.13	2.63	5.34	2.66

Table 2: Biology of *Chrysoperla zastrowisillemi* on different hosts

Preys	Developmental period	Growth index	% Adult emergence	Oviposition period	Fecundity
Unsterilized *Corcyra* eggs	18.30	9.90	90.20	29.57	371.6
Sterilized *Corcyra* eggs	20.03	9.14	86.96	29.95	338.8
Brevicoryne brassicae	22.09	7.57	82.46	23.78	153.8
Aphis gossypii	21.54	7.72	84.79	22.83	281.4
Aphis craccivora	21.21	7.82	80.91	26.00	262.2
Uroleucon compositae	23.72	6.68	76.60	20.26	113.4
S.E ±	0.16	0.21	1.78	0.27	5.38
C.D at 5%	0.47	0.59	5.21	0.79	15.70
C.V	1.72	5.54	4.77	2.42	4.74

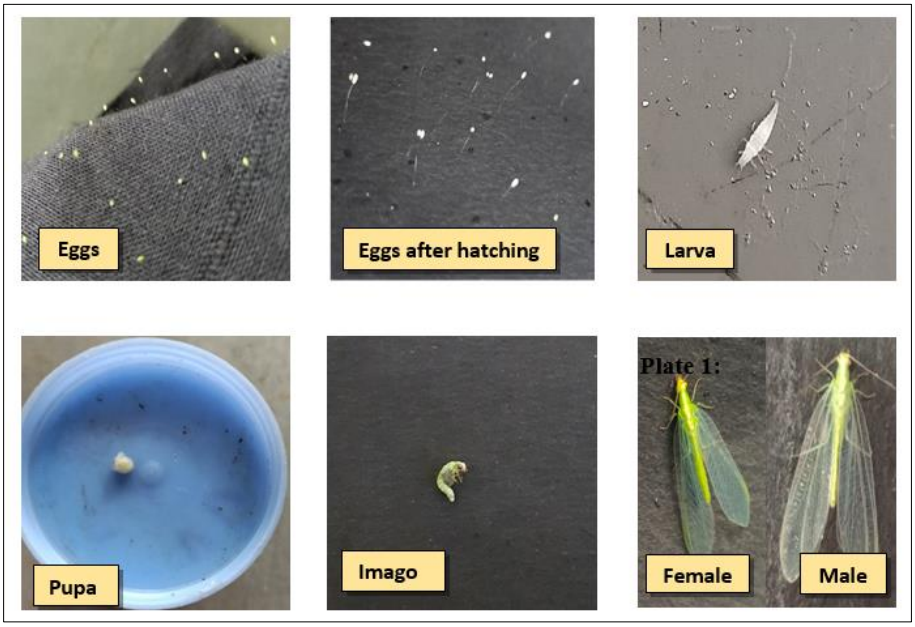

Fig 1: Life stages of *Chrysoperla zastrowisillemi*

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