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Host preference of green lace wing, *Chrysoperla zastrowi sillemi* (Esben-Petersen) (Chrysopidae: Neuroptera) fed on various hosts

Beerendra, Priyanka Nagdev and Jayalaxmi Ganguli

Abstract
Studies on the host preference of green lace wing, *Chrysoperla zastrowi sillemi* (Esben-Petersen) (Chrysopidae: Neuroptera) fed on various hosts was conducted at the Bio-control Laboratory, IGKV, Raipur, Chhattisgarh during 2020-2021 and 2021-2022. Larval stages of *C. zastrowi sillemi* were evaluated for its feeding preferences on various hosts and results revealed *C. zastrowi sillemi* as one of the best biological control agent for predating lepidopteran eggs and sucking pests. Result revealed that maximum host preference of 1st instar larvae (grub) was recorded for eggs of *C. cephalonica* (24.00 percent) and minimum in case of *C. cirripediformis i.e.* (10.00 percent). Maximum host preference of 2nd and 3rd instar larvae (grub) was recorded in *L. erysimi* (21.50 percent) and (24.00 percent) with a minimum in case of *C. cirripediformis i.e.* (12.50 percent) and (10.00 percent).

Keywords: *Chrysoperla zastrowi sillemi* (Esben-Petersen), host-preference

Introduction
The Indian green lace wing, *Chrysoperla carnea* (Stephens) has been taxonomically confirmed as *Chrysoperla zastrowi sillemi* (Esben-Petersen) (Venkatesan *et al*. 2008, Henry *et al*. 2010) is a common predator, abundantly occurs in various agro-ecosystem. The grub of the lacewing is a potential predator of soft-bodied Hemipterans and in active stages of Lepidopteran pests infesting wide range of field crops including the vegetables. It is an important biological control agent with high frequency of occurrence, broad prey range, effective searching ability and resistance to many widely used insecticides (Hoffman and Frodsham 1993) [4] and tolerance to ecological factors (Ulhaq *et al*. 2006) [6]. The larva of *C. zastrowi sillemi* are voracious feeder of exposed eggs, small larva, aphids, jassids, thrips, white fly, scales and mealy bugs. Although it can be easily mass reared in the laboratory on the natural preys, suitability of different prey for ideal biological parameters of the predators depends on array of factors. The biological attributes which are very important for the fitness of the insect as an ideal bio-control agent is influenced by multiple factors. eggs of *Corcyra cephalonica* and two species of aphids *i.e*, mustard aphid (*Lipaphis erysimi*), safflower aphid (*Uroleucon compositae*), *guava* mealy bug (*Ferrisia virgata*), scale insect (*Ceroplastes cirripediformis*) and ficus thrips (*Gynaikothrips uzeli*) are some of the common pests prevalent in the field crops, vegetable crops and ornamental crops predated by green lace wing, *C. zastrowi sillemi.*
It is a general predator but their relative preference, biological parameters, growth and preying efficiency depends on the prey concern. Clearly, the investigation of the effects of different prey species on predator development are pre-requisite for utilization of the predators in biological control in a particular agro-ecosystem. In this back ground, a laboratory experiment was conducted at the Bio-control Laboratory, IGKV, Raipur, Chhattisgarh during 2020-2021 and 2021-2022. to assess the extent of consumption by the grub and the biological attributes of *C. zastrowi sillemi* on several prey regimes including the natural preys prevalent in field crops, vegetable crops and ornamental crops ecosystem and the laboratory prey used for mass rearing.

Materials and Methods
Host preference of grubs of *C. zastrowi sillemi* on different hosts were carried out in completely randomized design replicated five times under laboratory controlled conditions of 27 ± 1 °C temperature and 65 ± 5% RH.

Experiments were conducted to determine the host preference of *C. zastrowi sillemi* for its preference on different hosts *viz;* eggs of rice meal moth, *Corcyra cephalonica* and two species of aphids *i.e.* mustard aphids (*Lipaphis erysimi*), safflower aphid (*Uroleucon compositae*), guava mealy bug (*Ferrisia virgata*), the barnacle scale (*Ceroplastes cirripediformis*) and ficus thrips (*Gynaikothrips uzeli*).

Procedure of testing of host preference

For testing the host preference of *C. zastrowi sillemi* (grubs), experiment was conducted using a thermocol sheet. In the centre a plastic container (17.0 cm) in diameter was fixed. The container was holed and connected with six plastic pipes of (15.0 cm) length. These pipes were further connected with six small plastic containers of (8.5 cm) diameter (Plate: 1).

Ten first instar grubs of *C. zastrowi sillemi* were released in the central plastic container, providing fixed number of different hosts *viz;* eggs of *C. cephalonica* and two species of aphids that is, *L. erysimi, U. compositae,* mealy bug (*F. virgata*), scale insect (*C. cirripediformis*) and ficus thrips (*G. uzeli*) were kept in peripheral plastic containers. Observations were recorded after 24 hrs on the number *C. zastrowi sillemi* (grubs) moved to different hosts. The expenment was replicated five times.

Similarly, for studying host preference of 2nd and 3rd instar grubs of *C. zastrowi sillemi* observation were recorded after 24 hrs for the number of respective instars moved in search of their preferred hosts under separate experiments. Experiments were repeated five times for each instars. The data were subjected to arcsine transformation and statistically analysed with CRD using OPSTAT.

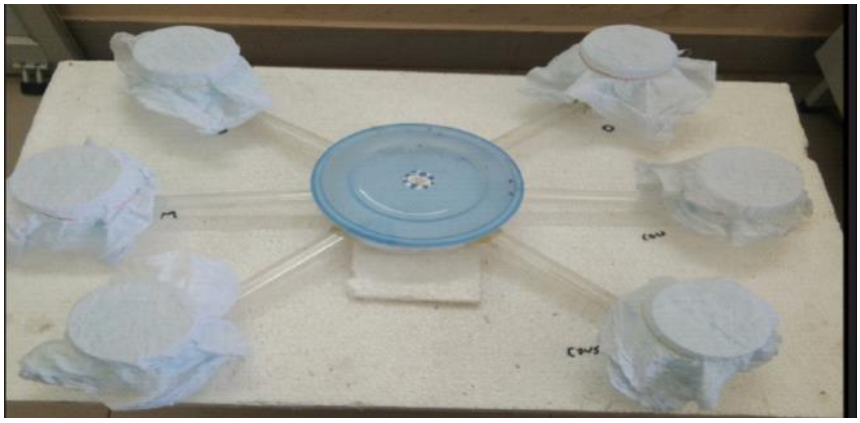

Plate 1: Experiment setup for studying host preference of larvae (grubs) *C. zastrowi sillemi*

Results and Discussion

In the present experiment s studies conducted on the host preference of 1st, 2nd and 3rd instar grubs of *C. zastrowi sillemi* observations were recorded after 24 hrs for the number of respective instars moved in search of their preferred hosts under separate experiments. Results of host preference of all the three larval instar of *C. zastrowi sillemi*are discussed as under:

Result of the host preference of 1st instar grubs showed maximum preference (24.00%) for eggs of *C. cephalonica* which was significantly higher than all others, followed by *L. erysimi* (22.00%), *U. compositae* (18.00%), *F. virgata* (14.00%), *G. uzeli* (12.00%) and *C. cirripediformis* was the least preferred host with (10.00%) (Table: 1 and fig: 1).

When 2nd instar grubs were observed for their feeding preference on six different hosts, maximum preference (21.50%) of the grubs were found to prefer *L. erysimi* which was significantly higher than other hosts, followed by *U. compositae* (20.00%), eggs of *C. cephalonica* (17.50%), *F. virgata* (14.50%), *G. uzeli* (14.00%) and *C. cirripediformis* was least preferred with (12.00%) (Table: 1 and fig: 2).

Result of the host preference of 3rd instar grubs showed maximum preference (24.00%) for *L. erysimi* which was significantly higher than all other hosts choice. Second preference was for *U. compositae* with 20.00% followed by *C. cephalonica* (18.00%), *F. virgata* (16.00%), *G. uzeli* (11.50%) and *C. cirripediformis* was least preferred with 10.00% (Table: 1 and fig: 3).

Thus, from the above studied it can be conducted that earliar developmental stage of *C. zastrowi sillemi i.e.* 1st instars preferred eggs because first instar larvae is very weak, 2nd and 3rd instar larvae fed on nymphal and adults stages of sucking pests.

Table 1: Feeding preference of *C. zastrowi sillemi* on different hosts.

Sr. No.	Feeding preference of after 24 hours (%)			
	Hosts	1st instar	2nd instar	3rd instar
1	Eggs of *C. cephalonica*	24.00 (28.92)	17.50 (24.32)	18.00 (24.63)
2	Nymphs and adults of *L. erysimi*	22.00 (27.89)	21.50 (27.52)	24.00 (29.22)
3	Nymphs and adults of *U. compositae*	18.00 (24.64)	20.00 (26.27)	20.50 (26.42)
4	Nymphs and adults of *F. virgata*	14.00 (21.68)	14.50 (22.14)	16.00 (23.31)
5	Nymphs and adults of *C. cirripediformis*	10.00 (18.43)	12.50 (20.51)	10.00 (18.43)
6	Nymphs and adults of *G. uzeli*	12.00 (20.06)	14.00 (21.68)	11.5 (19.54)
	SE(m)	2.033	2.006	2.14
	C.D.	5.968	N/S	6.26

Table in parentheses indicate arcsine transformed values

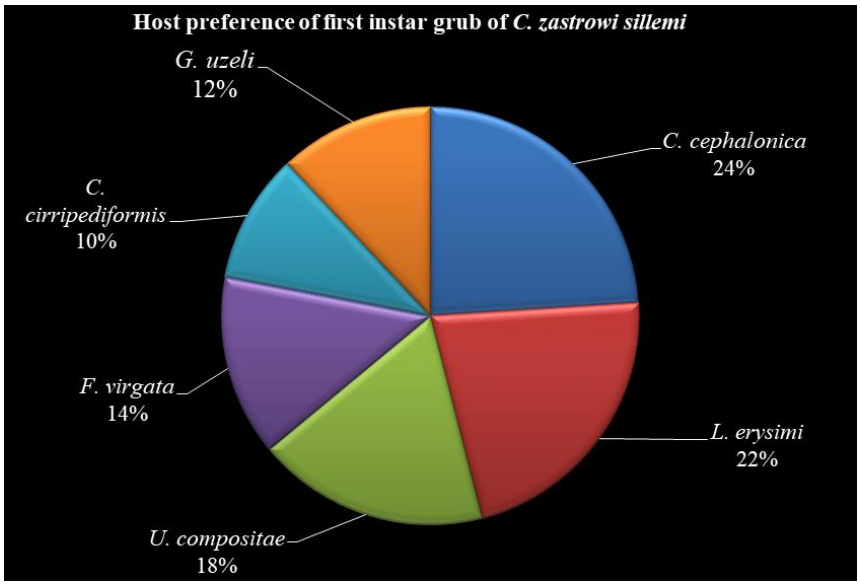

Fig 1: Host preference of 1st instar grubs of *C. zastrowi sillemi* towards different hosts

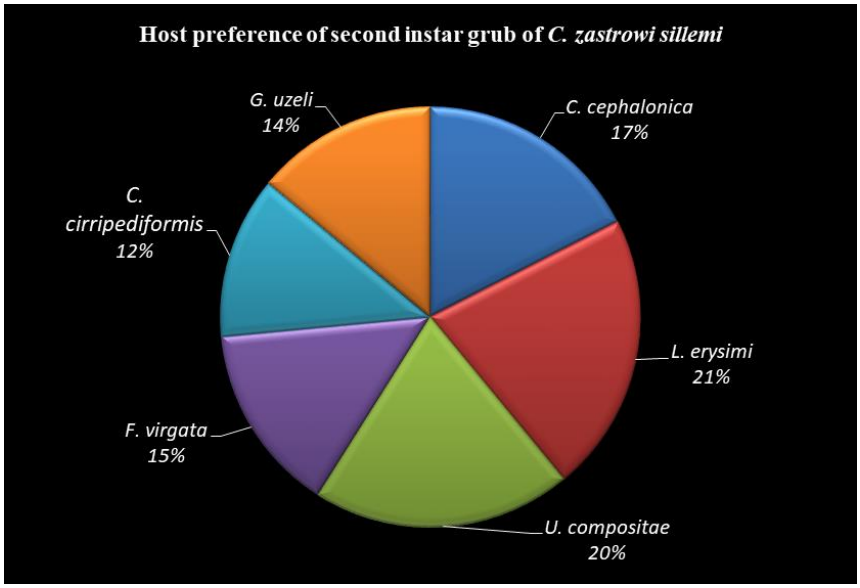

Fig 2: Host preference of 2nd instar grubs of *C. zastrowi sillemi* towards different hosts

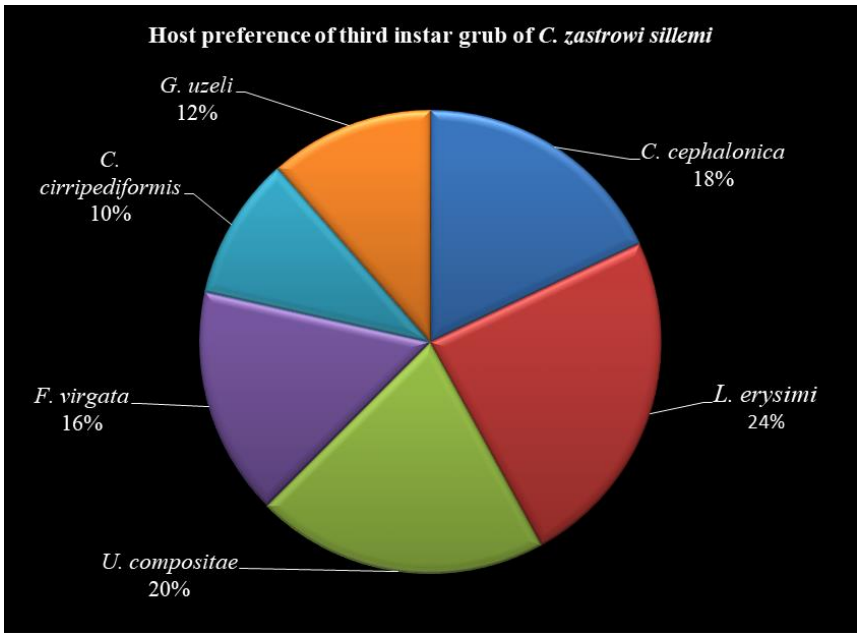

Fig 3: Host preference of 3rd instar grubs of *C. zastrowi sillemi* towards different hosts

Discussion

The present findings confirms that *C. zastrowi sillemi* as an efficient predator of the free-choice conditions which corroborates the findings of Hassan (2014) [2] who also reported that *C. carnea* larvae feeds on the eggs masses of *C. cephalonica, Pectinophora gossypiella* and *Sitotroga cerealella* with an average of 493.6±50.32, 654.3±32.54 and 673.9±31.52 eggs under no choice feeding conditions. However, the host preference (free choice) data revealed that the predatory larva consumed 264.1±68.8, 111.2±56 and 63.3±47 numbers eggs of *C. cephalonica, P. gossypiella* and *S. cerealella,* respectively. Eggs of *C. cephalonica* was the highly preferred host of *C. carnea* with no difference through the 1st & 2nd larval instars than *P. gossypiella* eggs. The 1st, 2nd and 3rd predator larval instars consumed 13.2±6.01, 77.9±31.14 and 264.1±68.8 eggs of *C. cephalonica*, respectively; whereas *S. cerealella* was significantly the least preferred host in free choice preference. The respective predator larval instars consumed (0.8±1.75, 27.9±24.56 and 63.3±47.2 eggs of *S. cerealella*). Also, the present results noticed that predatory potential of *C. carnea* was higher in the older instars of all preys than the younger ones. Balakrishnan *et al.* (2005) [1] mentioned that the final instar grub consumed more number of preys compared to earlier instars. Similarly, Shrestha and Enkegaard (2013) [5] investigated the prey preference of *C. carnea* 3rd instar. They proved that 3rd instar larvae of *C. carnea* had a significant preference for *N. ribisnigri* at two ratios (10 aphids: 80 thrips, 65 aphids: 25 thrips).

Conclusion

Larval stages of *C. zastrowi sillemi* were evaluated for its feeding preferences on various hosts and results revealed *C. zastrowi sillemi* as one of the best biological control agent for predating lepidopteran eggs and sucking pests. Thus, from the above studied it can be conducted that earliar developmental stage of *C. zastrowi sillemi i.e.* 1st instars preferred eggs because first instar larvae is very weak, 2nd and 3rd instar larvae fed on nymphal and adults stages of sucking pests.

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