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Consumption capacity of *Chrysoperla zastrowi sillemi* (Esben-Peterson) on mealy bugs and aphids

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Abstract
The consumption capacity of 1st, 2nd, and 3rd instar larvae of *C. zastrowi sillemi* on 2nd instar nymphs of different preys *viz*, *Aphis gossypii*, *Phenacoccus solenopsis*, *Maconellicoccus hirsutus* revealed that each predator larva consumed 353.37 *A. gossypii* in 11.36 days, 135.45 *P. solenopsis* in 12.87 days and 89.56 *M. hirsutus* in 12.61 days.

Keywords: Consumption capacity, *Chrysoperla zastrowi sillemi*, mealy bug, aphid

Introduction
Chrysoperla zastrowi sillemi (Neuroptera: Chrysopidae) is a generalist predator of soft bodied sucking insects like aphids, mealy bugs, immature scales, whiteflies, thrips, spider mites and other sucking insect pests (Saminathan and Baskaran, 1999) [11]. This predator has a tremendous predacious potential and can consume many species of insect pests, such as whiteflies, aphids, thrips and eggs of bollworms (Atlihan *et al*.), The larvae of *Chrysoperla* is a voracious predator of soft bodies insects and their adults were free living in nature feeding upon the pollen and nectar (Villenave *et al.*, 2005) [17]. *C. z. sillemi* predators has the immense potential in inundative release measures in insect management because of their ability to inhabit diverse habitats, shorter life cycle, easy mass multiplication and inherent ability to tolerate pesticides (Amarasekare and Shearer, 2013) [2]. The natural population of *C. carnea* in the field is not adequate to suppress the pest population of their own. It becomes necessary to mass produce them in laboratory for release in the field. The concepts of Integrated Pest Management (IPM) with the use of predators and parasitoids can give a low cost plant protection, with environment friendly biological control (Hashami, 2001) [7]. It is widely recommended for biological control programme against insect pests of cotton, sunflower, tobacco and groundnut (Singh and Jalali, 1994) [14]. Keeping these facts in the view the experiment on Consumption capacity of *C. z. sillemi* on mealy bugs and aphids was conducted.

Materials and Methods
Predator, *C. z. sillemi* was obtained from the insectary of National Bureau of Agriculturally Important Resources (NBAIR), Bangalore. Consumption capacity of *C. z. sillemi* on different preys *viz*., 2nd instar nymphs of *Aphis gossypii*, *Phenacoccus solenopsis* and *Maconellicoccus hirsutus* were conducted at the Department of Agricultural Entomology, College of Agriculture, Latur under controlled condition of 25+2°C temperature during 2014-15. The experiment on the feeding potential of *C. z. sillemi* was conducted in the Completely Randomized Design (CRD) with five replications Fifty larvae of predator comprising of 10 larvae in each replication were used to fed upon the preys *viz*., 2nd instar nymphs of Mealybugs and aphid mentioned below:
T1: *A. gossypii* (Glover)
T2: *P. solenopsis* (Tinley)
T3: *M. hirsutus* (Green)

The known number of preys was provided to the larvae of *C. z. sillemi* daily until pupation. The observations on the number of prey consumed by each larval instar of *C. z. sillemi* were recorded daily after 24 hours of exposure till pupation.

Results and Discussion

The results showed that significantly more number of second instar nymphs of *A. gossypii* (38.68 in 3.22 days) were consumed by I larval instar of *C. z. sillemi* over rest of the preys. The significantly more number of second instar nymphs of *A. gossypii* (94.88 in 3.42 days) were consumed by II larval instar of *C. z. sillemi* followed by *P. solenopsis* (35.63 in 4.45 days) and *M. hirsutus* (32.21 in 4.22 days). However, the consumption of all preys were at par with each other. *A. gossypii* (219.81 in 4.73 days) were consumed by III larval instar of *C. z. sillemi* followed by *P. solenopsis* (91.62 in 5.24 days) and *M. hirsutus* (44.93 in 4.98 days). However, consumption of all preys were at par with each other. The significantly minimum duration to the extent of 11.37 days was required to complete the entire larval development of *C. z. sillemi* by feeding on 353.37 2nd instar nymphs of *A. gossypii* followed by 12.59 days by feeding on 89.56 2nd instar nymphs of *M. hirsutus* and 12.88 days by feeding on 135.45 2nd instar nymphs of *P. solenopsis.* (Table 1).

The data (Table 2) showed that the II and III instar larvae of *C. z. sillemi* consumed significantly maximum number of 2nd instar nymphs of *A. gossypii* to the extent of 27.74, 46.47 per day followed by 2nd instar nymphs of *P. solenopsis* (8.01 and 17.48 per day) and 2nd instar nymphs of *M. hirsutus* (7.60 and 9.02 per day), respectively and I instar larvae of *C. z. sillemi* consumed significantly minimum number of 2nd instar nymphs of *P. solenopsis* to the extent of 2.58 per day followed by *M. hirsutus* (3.66 per day) and 2nd instar nymphs of *A. gossypii* to the extent (12.01 per day).

Thite and Shivpuje (1999) [16] reported that first, second and third instar larvae of *C. carnea* consumed 32.4, 32.47 and 47.20 nymphs of *A. gossypii* per day. Saminathan *et al*. (2003) [11] recorded that predatory potential of *C. carnea* was 399.20, 368.20 and 374.40 nymphs of *A. gossypii* infesting cotton, okra and guava.

Table 1: Consumption capacity of *C. z. sillemi* on different preys.

Preys	I st instar		II nd Instar		III rd instar		I to III instar	
	Duration (days)	Total Consumption	Duration (days)	Total Consumption	Duration (days)	Total Consumption	Duration (days)	Total Consumption
A. gossypii	3.22	38.68 (6.21)	3.42	94.88 (9.74)	4.73	219.81 (14.82)	11.37	353.37 (18.80)
P. solenopsis	3.19	8.20 (2.87)	4.45	35.63 (5.97)	5.24	91.62 (11.64)	12.88	135.45 (11.64)
M. hirsutus	3.39	12.42 (3.52)	4.22	32.21 (5.66)	4.98	44.93 (9.47)	12.59	89.56 (9.47)
S.E +	0.04	0.53	0.07	1.47	0.09	1.88	0.13	0.59
C.D at5 %	0.13	1.63	0.22	4.52	0.29	5.79	0.39	1.83
C.V. (%)	2.93	5.98	4.01	6.05	4.31	3.54	2.33	0.69

Figures in parentheses indicate arcsine transformed values

Table 2: Mean per day consumption capacity of *C. z. sillemi* on different preys.

Preys	Larval consumption per day during different instars		
	I	II	III
A. gossypii	12.01 (3.46)	27.74 (5.27)	46.47 (6.81)
P. solenopsis	2.58 (1.60)	8.01 (2.82)	17.48 (4.17)
M. hirsutus	3.66 (1.91)	7.63 (2.75)	9.02 (3.00)
S.E +	0.16	0.34	0.36
C.D at 5 %	0.49	1.05	1.12
C.V. (%)	5.95	5.29	3.34

Figures in parentheses indicate arcsine transformed values

Chakraborty and Korat (2010) [5] reported that first, second and third instar larvae of *C. carnea* consumed 61.50+18.72, 74.43+16.25 and 95.40+31.74 nymphs of *A. gossypii*. Gosalwad *et al*. (2010) [6] reported that larvae of *C. carnea* consumed 278.90 of *A. gossypii.* Arvind *et al.* (2012) [4] studied that larvae of *C. z. sillemi* consumed 261.72 of *A. gossypii.* Khan *et al.* (2012) [9] reported that significant differences in consumption rate were observed between all instars of *C. carnea* when they were fed on first instar of *P. solenopsis*. However, it did not differ significantly when second and third instars of *P. solenopsis* were exposed to second and third instars of *C. carnea*.

Rashid *et al*. (2012) [10] recorded consumption capacity of I, II and III larval instars of *C. carnea* to the tune of 406.0 ± 1.15, 426.3 ± 2.15 and 645.9 ± 2.45, 62.12 ± 2.25, 73.23 ± 1.95 and 144.70 ± 1.66 and 31.13 ± 3.15, 59.67 ± 2.99 and 122.2 ± 1.88 I, II and III nymphal instars of *P. solenopsis*, respectively. Solangi *et al.* (2013) [15] studied the feeding potential of *C. carnea* on *A. gossypii* and cotton mealy bugs. They reported that I, II and III instar larvae of *C. carnea* consumed 22.44, 42.66 and 59.11 and 5.32, 38.74 and 50.42 second instar nymphs of *A. gossypii* and cotton mealy bugs per day, respectively. The results in respect of consumption capacity of *C. carnea* on mealy bugs and aphids in the present investigation are in good agreement with the results reported by above referred workers. The significantly highest number (353.37 in 11.37 days) of second instar nymphs of *A. gossypii* was consumed by larvae of *C. z. sillemi* over rest of prey.

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