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Effects of adult diets on adult longevity, oviposition period and fecundity of *Chrysoperla zastrowi sillemi* (Esben-Peterson)

Satya Narayan Satapathy and SMA Mandal

Abstract
A study was conducted in the Biocontrol laboratory, Department of Entomology, College of Agriculture, OUAT, Odisha during 2020-21 to determine the effects of different artificial adult diets on adult longevity, oviposition period and fecundity of green lacewing, *Chrysoperla zastrowi sillemi* (Esben-Peterson). Six adult diets i.e. T1 (Water: Honey: Protinex:: 40: 40: 20), T2 (Water: Honey: Castor pollen:: 40: 40: 20), T3 (Water: Honey: Protinex: Castor pollen:: 40: 40: 10: 10), T4 (Water: Molasses: Protinex:: 40:40:20), T5 (Water: Molasses: Castor pollen:: 40: 40: 20) and T6 (Water: Molasses: Protinex: Castor pollen:: 40: 40: 10: 10) were evaluated along with control (T7=Water: Honey:: 50: 50). T1 was adjudged as the best adult diet which produced maximum male longevity of 35.18 days with 8.41% increase over control, maximum female longevity of 48.07 days with 10.13% increase over control, highest oviposition period of 25.45 days with 13.81% increase over control and highest fecundity of 333.47 with 19.81% increase over control. T1 was closely followed by T2 with the respective data of 34.89 days and 6.90%, 47.38 days and 8.55%, 24.94 days and 11.54% and, 325.20 and 16.83%.

Keywords: *C. zastrowi sillemi*, adult diets, adult longevity, oviposition period, fecundity

Introduction
In India, 65 species of chrysopids belonging to 21 genera have been recorded from various crop ecosystems. Some species are distributed widely in various agro-ecosystems as important natural enemies of aphids, jassids, whiteflies and other soft bodied insects. Amongst them, *Chrysoperla zastrowi sillemi* (Esben-Peterson) is the most common, belonging to the order, Neuroptera (Sunil *et al*., 2016) [1]. It has great potential in controlling a large number of insect and mite pests in different crops and cropping systems (Jalali and Singh, 1944; Gautam *et al*., 2003 and Pathan *et al*., 2010) [3, 2, 4]. The larvae are predatory while adults feed on honeydew and, nectar and pollen of many flowers in nature. It is not practically feasible and economical to collect honeydew and/ or nectar from nature for rearing the predator. Many earlier workers (Gautam and Paul, 1988; Venkatesan *et al*., 2000; Tesfaye and Gautam, 2002; Senthilkumar and Gautam, 2007) [5, 8, 6, 7] tested different semisynthetic diets for mass rearing of green lacewing in the laboratory. Six adult diets comprising carbohydrates and protein ingredients were tested in the present investigation along with one control (only carbohydrate ingredients) to determine their effects on adult longevity and fecundity.

Materials and Methods
The experiment was conducted during 2020-21 in the Biocontrol Laboratory of Department of Entomology, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha. The experiment was laid out in Completely Randomized Design (CRD) with three replications each having five pairs of adult *C. zastrowi sillemi*. These adults were confined in the glass jars (3 liters capacity). Twenty one such glass jars were maintained for seven treatments and three replications. Adult diets were prepared in petri dishes mixing different food ingredients (details in the Tables) aseptically. The petri dishes were kept in the refrigerator at 5^0C for subsequent uses. The mouth of the jars were covered by black colour papers and tightened with rubber bands. Perforations were made with a pin on the black paper for aeration. Cotton swabs soaked in different adult diets were stuck on the inner wall of the respective glass jars. The cotton swabs along with the diets were changed at weekly intervals. Adults were released in the glass jars just after their emergence from cocoons. The females lay eggs on the inner side of the black papers after completing pre-oviposition period.

The black papers covering the mouth of the jars were replaced every day. The replaced papers were examined to notice the first egg laying and to count the eggs laid per days. The last day of egg laying was recorded and oviposition period was determined. The dates of death of the adults were recorded and the post-oviposition period and adult longevity were determined.

The collected data were subjected to statistical analysis after necessary transformations wherever required by using OPSTAT online software for statistical interpretations.

Results

Data on adult longevity have been presented in Table-1. Highest male longevity of 35.18 days was recorded in T1 (Water: Honey: Protinex:: 40: 40: 20) with 8.41% increase in longevity over control (T7=Water: Honey:: 50: 50) followed by 34.89 days in T3 (Water: Honey: Protinex: Castor pollen:: 40: 40: 10: 10) with 6.90% increase in longevity over control. These two treatments were statistically at par and significantly superior to all other treatments. The same trend was observed in female longevity. Highest longevity was observed in T1 i.e. 48.07 days with 10.13% increase over control followed by T3 i.e. 47.38 days with 8.55% increase over control. These two treatments were at par and significantly superior to all other treatments. Lowest male and female longevity of 32.45 and 43.65 days, respectively were observed in control.

Table 1: Effect of adult diets on longevity of *C. zastrowi sillemi* adults

Tr. no.	Treatments	Adult longevity (days)			
		Male	Increase (%) over control	Female	Increase (%) over control
T1	Water: Honey: Protinex:: 40: 40: 20	35.18	8.41	48.07	10.13
T2	Water: Honey: Castor pollen:: 40: 40: 20	34.11	5.12	46.79	7.19
T3	Water: Honey: Protinex: Castor pollen:: 40: 40: 10: 10	34.89	6.90	47.38	8.55
T4	Water: Molasses: Protinex:: 40:40:20	33.76	4.04	46.23	5.91
T5	Water: Molasses: Castor pollen:: 40: 40: 20	32.78	1.02	45.44	4.10
T6	Water: Molasses: Protinex: Castor pollen:: 40: 40: 10: 10	33.55	3.39	46.07	5.54
T7	Water: Honey:: 50: 50 (Control)	32.45	-	43.65	-
SE(m)±		0.172	-	0.347	-
CD (0.05)		0.53	-	1.07	-

Data presented in Table-2 depicted that the maximum pre-oviposition period was recorded in T1 (Water: Honey: Protinex:: 40: 40: 20) i.e. 7.48 days followed by T3 (Water: Honey: Protinex: Castor pollen:: 40: 40: 10: 10) i.e.7.46 days and T2 (Water: Honey: Castor pollen:: 40: 40: 20) i.e.7.43 days with 4.76%, 4.48% and 4.06% increase over control (T7=Water: Honey:: 50: 50), respectively. These three treatments were statistically at par and significantly superior to all other treatments. The highest oviposition period was recorded in T1 i.e. 25.45 days followed by T3 i.e. 24.94 days with 13.81% and 11.54% increase over control, respectively. These two treatments were statistically at par and significantly superior to all other treatments. The maximum post-oviposition period was recorded in T1 i.e. 15.14 days followed by T3 i.e.14.98 days with 6.99% and 5.87% increase over control, respectively. These two treatments were statistically at par and significantly superior to all other treatments. The lowest pre-oviposition, oviposition and post-oviposition periods of 7.14, 22.36 and 14.15 days, respectively were recorded from control.

Data on fecundity have been presented in Table-3. Fecundity varied from 278.34 to 333.47 among the treatments and there were significant differences. Highest fecundity (333.47) was recorded from T1 (Water: Honey: Protinex:: 40: 40: 20) closely followed by T3 (Water: Honey: Protinex: Castor pollen:: 40: 40: 10: 10) (325.20) registering 19.81% and 16.83% increase in fecundity over control, respectively. These two treatments were statistically at par and significantly superior to all other treatments.

Table 2: Effect of adult diets on pre-oviposition, oviposition and post-oviposition periods of *C. zastrowi sillemi*

Tr. no.	Treatments	Pre-oviposition (days)		Oviposition (days)		Post-oviposition (days)	
		Mean	Increase (%) over control	Mean	Increase (%) over control	Mean	Increase (%) over control
T1	Water: Honey: Protinex:: 40: 40: 20	7.48	4.76	25.45	13.81	15.14	6.99
T2	Water: Honey: Castor pollen:: 40: 40: 20	7.43	4.06	24.49	9.53	14.87	5.08
T3	Water: Honey: Protinex: Castor pollen:: 40: 40: 10: 10	7.46	4.48	24.94	11.54	14.98	5.87
T4	Water: Molasses: Protinex:: 40:40:20	7.41	3.78	23.97	7.20	14.85	4.94
T5	Water: Molasses: Castor pollen:: 40: 40: 20	7.35	2.94	23.38	4.56	14.71	3.95
T6	Water: Molasses: Protinex: Castor pollen:: 40: 40: 10: 10	7.39	3.50	23.88	6.79	14.80	4.59
T7	Water: Honey:: 50: 50 (Control)	7.14	-	22.36	-	14.15	-
	SE(m)±	0.019	-	0.299	-	0.081	-
	CD (0.05)	0.06	-	0.92	-	0.25	-

Table 3: Effect of adult diets on fecundity of *C. zastrowi sillemi*

Tr. no.	Treatments	Fecundity	Increase (%) over control
T1	Water: Honey: Protinex:: 40: 40: 20	333.47 (18.29)	19.81
T2	Water: Honey: Castor pollen:: 40: 40: 20	318.37 (17.87)	14.38
T3	Water: Honey: Protinex: Castor pollen:: 40: 40: 10: 10	325.20 (18.06)	16.83
T4	Water: Molasses: Protinex:: 40:40:20	311.74 (17.68)	12.00
T5	Water: Molasses: Castor pollen:: 40: 40: 20	298.45 (17.31)	7.22
T6	Water: Molasses: Protinex: Castor pollen:: 40: 40: 10: 10	304.03 (17.46)	9.23
T7	Water: Honey:: 50: 50 (Control)	278.34 (16.71)	-
	S.E(m)±	(0.127)	-
	CD (0.05)	(0.39)	-

Figures in parentheses are square root (√X+1) transformed values

Discussion

In the present investigation, six adult diets (prepared by combining two carbohydrate food ingredients i.e. honey and molasses and, two protein food ingredients i.e. Protinex and castor pollen) were evaluated. It was evident from the results that diets containing honey were preferred over the diets containing molasses irrespective of protein food ingredients and diets containing protinex were preferred over the diets containing castor pollen irrespective of carbohydrate food ingredients. The differential preferences might be due to the differential composition of nutrients in the food ingredients. As a result, it was observed that the treatment, Water: Honey: Protinex:: 40: 40: 20 was the best followed by Water: Honey: Protinex: Castor pollen:: 40: 40: 10: 10 in increasing the longevity of male and female, oviposition period and, fecundity. Earlier researchers reported that the adult chrysopids required a diet rich in protein, besides carbohydrates and other nutrients (Burke and Martin, 1956; Vanderzant, 1973; Rousset, 1980; Williams, 1999) [13, 15, 14, 16]. According to Geetha *et al.* (1997) [17], the females of *C. carnea* had a longer oviposition period when fed with protinex-R diet. Nandan *et al.* (2014) [18] reported that the females (*C. zastrowi sillemi*) fed with proteinex 50% + honey 50% registered extended longevity and oviposition period of 39.63 days and 28.14 days, respectively. Hence, the results of the present study are in conformity with the findings of the aforementioned earlier workers.

Conclusion

Among the six adult diets tested along with control (Water: Honey:: 50: 50) for their effectiveness in mass culturing of *C. zastrowi sillemi* in the laboratory, the diet containing Water: Honey: Protinex:: 40: 40: 20 was considered the best as this diet produced maximum male and female longevity, maximum oviposition period and highest fecundity closely followed by Water: Honey: Protinex: Castor pollen:: 40: 40: 10: 10.

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