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Original Research Article

Life-Fecundity Tables of *Chrysoperla zastrowisillemi* (Esben-Petersen) on Mealy Bugs and Aphid

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Mealy bugs, aphid, life-fecundity tables

A B S T R A C T

The survival of immature stages (lx) to the extent of 0.70, 0.59 and 0.52 per individual within a pivotal age of 22, 24 and 24 days, the net reproductive rate (R_0) to the tune of 136.31, 63.26and 31.088females per female per generation, the mean length of generation time (T) to the extent of 33.20, 35.75 and 35.07 days, innate capacity for increase in numbers to the tune of 0.1480, 0.1160 and 0.0980 female per female per day and finite rate of increase in numbers (λ) to the extent of 1.16, 1.12 and 1.102 females per female, were recorded in respect of *C. z. sillemi* when reared on second instar nymphs of *A. gossypii*, *P. solenopsis* and *M. hirsutus*, respectively.

Introduction

In India, 65 species belonging to 21 genera had been recorded from various crop ecosystems (Singh and Jalali, 1994). *Chrysoperla zastrowisillemi* (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). 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). *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). The integration of chemical and biological control is an essential requirement for the success of an integrated pest management (IPM) program for arthropod pests (El-Wakeil and Vidal 2005). Hence, the present study was undertaken to understand life-fecundity tables of *C. z. sillemi* on Mealy bugs and aphid during 2014-15.

Materials and Methods

The life-fecundity tables of *C. z. sillemi* when reared on second instar nymphs of *A. gossypii*, *P. solenopsis* and *M. hirsutus* were constructed by studying 100 eggs in a group of 20 in each replication. All the larvae soon after hatching were reared individually on preys. The observations were made daily on egg hatching, larval and pupal development, successful adult emergence, fecundity and

age-specific mortality in eggs, larvae, pupae and adults. Adults emerged on a particular day were transferred into a separate oviposition cage (30 x 30 x 45cm) in the ratio of 1:1 for determining the age-specific fecundity. A black century thick paper was placed on inner surface and top of the oviposition cage to serve as oviposition substrate. The food in the form of cotton swabs soaked in drinking water, 50 per cent honey solution and proteinex mixture and castor pollens were provided daily to the adults.

According to the Southwood (1968), the number of female births (m_x) was calculated by dividing the number of eggs laid per female by two, considering the sex ratio of 1:1. The life-fecundity tables were constructed by using the following column headings proposed by Birch (1948), elaborated by Howe (1953) and Atwal and Bains (1974).

X = pivotal age in days, lx = survival of females at age 'x', m_x = age schedule for female births at age 'x'.

Results and Discussion

The survival of immature stages (Ix) of *C. z. sillemi* was 0.70, 0.59 and 0.52 per individual within a pivotal age of 22, 24 and 24 days on second instar nymphs of *A. gossypii*, *P. solenopsis* and *M. hirsutus* respectively (Table 1). The results in respect of life-table and age-specific fecundity of *C. z. sillemi* on second instar nymphs of *A. gossypii*, *P. solenopsis* and *M. hirsutus* are presented in Tables 2, 3 and 4 respectively. It is clear from the given Tables 2, 3 and 4 that the net reproductive rate ($R_{0)}$ to the tune of 136.31, 63.26 and 31.08 of females per female per generation on second instar nymphs of *A. gossypii*, *P. solenopsis* and *M. hirsutus*. The results in respect of mean length of generation, intrinsic rate of increase in numbers and finite rate of increase in numbers *C. z. sillemi* on second instar nymphs of *A. gossypii*, *P. solenopsis* and *M. hirsutus* are summarized in Table 5. The mean length of generation time (T) was maximum (35.75 days) on *P. solenopsis* followed by *M. hirsutus* (35.07 days) and *A. gossypii* (33.20 days). The innate capacity for increase in numbers (r_m) to the tune of 0.1480, 0.1160 and 0.0980 female per female per day.

The data on calculation of the intrinsic rate of natural increase (rm) are presented in Table 5.The finite rate of increase in numbers (λ) were 1.16, 1.12 and 1.102 females per female, respectively. The studies on similar line were also conducted by Adsul (2009). According to him, *C. carnea* when fed on *L. erysimi*, *B. brassicae*, *A. craccivora* and *U. carthami* recorded the survival of immature stages (l_x) to the extent of 0.56, 0.54, 0.52 and 0.47 per individual within a pivotal age of 28, 21, 22 and 27 days, the net reproductive rate (R_0) to the tune of 28.29, 28.33, 22.75 and 20.01 females per female per generation, the precise generation time (T) to the extent of 33.09, 17.06, 19.34 and 41.38 days, innate capacity for increase in numbers (r_m) to the tune of 0.1010, 0.1954, 0.1615 and 0.0724 female per female per day and finite rate of increase in numbers (λ) to the extent of 1.26, 1.56, 1.45 and 1.18 females per female, respectively.

According to Birch (1948), the comparison of two or more population by means of their net reproductive rates may be quite misleading unless the mean length of generation are the same. Two or more populations may have the same reproductive rate but their intrinsic rates of increase may be quite different because of different length of their generations.

Table.1 Survival of life-stages of *C. z. sillemi* on mealy bugs and aphids

Preys	No. of eggs observed	No. of survived life-stages				
		Egg Duration	Larval Duration	Pupal Duration	Sex	
					Male	Female
A. gossypii	100	89 (0-4)	89 (5-15)	70 (16-22)	29	41
P. solenopsis	100	86 (0-4)	86 (5-16)	59 (17-24)	33	26
M. hirsutus	100	83 (0-4)	83 (5-16)	52 (17-24)	22	30

Table.2 Life-table and age-specific fecundity of *C. z. sillemi*on *A. gossypii*

Pivotal age in days	Survival of females at different age intervals	Age schedule for female birth		
X	l_x	m_x	l_xm_x	l_xm_xX
0-22 days	0.70	Immature stages		
23-26	0.70	Pre-oviposition period		
27	0.70	6.75	4.73	127.58
28	0.70	8.25	5.78	161.70
29	0.70	9.80	6.86	198.94
30	0.70	11.55	8.09	242.55
31	0.70	12.90	9.03	279.93
32	0.69	14.60	10.07	322.37
33	0.69	15.60	10.76	355.21
34	0.69	16.50	11.39	377.09
35	0.69	**16.90**	11.66	408.14
36	0.69	15.80	10.90	392.47
37	0.68	13.80	9.38	347.21
38	0.68	11.10	7.55	286.82
39	0.68	9.10	6.19	241.33
40	0.68	7.65	5.20	208.08
41	0.68	6.55	4.45	182.61
42	0.67	6.20	4.15	174.47
43	0.67	4.10	2.75	118.12
44	0.67	3.25	2.18	95.81
45	0.66	2.55	1.68	75.74
46	0.66	1.90	1.25	57.68
47	0.66	1.40	0.92	43.43
48	0.66	1.05	0.69	33.26
49	0.65	0.70	0.46	22.30
50	0.65	0.25	0.16	8.13
51	0.65	0.05	0.03	1.66
			$\sum l_xm_x$= **136.31**	$\sum l_xm_xX$= 4772.61

Table.3 Life-table and age-specific fecundity of *C. z. sillemi* on *P. solenopsis*

Pivotal age in days	Survival of females at different age intervals	Age schedule for female birth		
X	l_x	m_x	l_xm_x	l_xm_xX
0-24 days	0.59	Immature stages		
25-28	0.59	Pre-oviposition period		
29	0.59	3.40	2.01	58.17
30	0.59	3.80	2.24	67.26
31	0.59	4.65	2.74	85.05
32	0.59	6.55	3.86	123.66
33	0.57	7.05	4.02	132.61
34	0.57	7.95	4.53	154.07
35	0.57	9.00	5.13	179.55
36	0.57	**10.10**	5.76	207.25
37	0.57	9.65	5.50	203.52
38	0.57	8.80	5.02	190.61
39	0.56	7.55	4.23	164.89
40	0.56	7.20	4.03	161.28
41	0.56	6.55	3.67	150.39
42	0.51	4.95	2.52	106.03
43	0.51	4.30	2.19	94.30
44	0.50	3.75	1.88	82.50
45	0.50	3.00	1.50	67.50
46	0.50	2.70	1.35	62.10
47	0.48	1.15	0.55	25.94
48	0.48	1.00	0.48	23.04
49	0.48	0.10	0.05	2.35
			$\sum l_xm_x$= **63.26**	$\sum l_xm_xX$= 2342.08

Table.4 Life-table and age-specific fecundity of *C. z. sillemi* on *M. hirsutus*

Pivotal age in days	Survival of females at Different age intervals	Age schedule for female birth		
X	l_x	m_x	l_xm_x	l_xm_xX
0-24 days	0.52	Immature stages		
25-28	0.52	Pre-oviposition period		
29	0.52	2.40	1.25	36.19
30	0.52	2.40	1.25	37.44
31	0.52	3.00	1.56	48.36
32	0.52	4.15	2.16	69.06
33	0.50	3.95	1.98	65.18
34	0.50	3.95	1.98	67.15
35	0.50	4.25	2.13	74.38
36	0.49	4.55	2.23	80.26
37	0.49	5.00	2.45	90.65
38	0.49	5.65	2.77	105.20
39	0.49	5.55	2.72	106.06
40	0.46	**6.20**	2.85	114.08
41	0.46	3.80	1.75	71.67
42	0.46	2.70	1.24	52.16
43	0.44	2.10	0.92	39.73
44	0.44	1.50	0.66	29.04
45	0.44	1.05	0.46	20.79
46	0.43	0.90	0.39	17.80
47	0.42	0.70	0.29	13.82
48	0.42	0.15	0.06	3.02
			$\sum l_xm_x$= **31.088**	$\sum l_xm_xX$= 1142.04

Table.5 Population growth statistics of *C. z. sillemi* (Esben-Petersen) on mealy bugs and aphids

Preys	Mean growth of generation (days)	Innate capacity for increase in number (female/female/day)	Corrected r_m (female/female/ day)	Corrected generation time (days)	Finite rate of increase in numbers (female/female/day)
A. gossypii	35.01	0.1403	0.1480	33.20	1.16
P. solenopsis	37.02	0.1120	0.1160	35.75	1.12
M. hirsutus	36.73	0.0930	0.0980	35.07	1.102

It is evident that on the basis of net reproductive rates (Ro) and innate capacity for increase in numbers (r_m) the *Aphis gossypii* prey occupied first position.

The life-tables giving the statistics on (r_m) of particular species provide insight into characteristics life patterns of different species (Birch, 1948). The application of these statistics is as diverse as the insect for which the life-tables are developed. The green lacewing, *C. z. sillemi* would multiply 136.31 times per generation on second instar nymph of *Aphis gossyii*, while the corresponding increase was 63.26on *P. solenopsis* and 31.08on *M. hirsutus*. This indicates that the population of *C. z. sillemi* would increase by two folds on second instar nymph of *A.gossypii* than *P. solenopsis* and *M. hirsutus*. From the point of view of multiplication of bioagents, second instar nymph of *A.gossypii* with high (r_m) value would be the most suitable. However, it is preferred to use second instar nymph of *A.gossypii* for mass multiplication of *C. z. sillemi* under laboratory condition.

References

Adsul H G 2009. Biology, life-fecundity and predatory potential of *Chrysoperlacarnea* (Stephens) on aphids. M.Sc. (Agri.) dissertation submitted to Marathwada Agricultural University, Parbhani (Unpublished).

Amarasekare K G and Shearer P W 2013. Comparing effects of insecticides on two green lacewings species, *Chrysoperlajohnsoni* and *Chrysoperlacarnea* (Neuroptera: Chrysopidae). *Journal of Economic Entomology*, 106(3):1126-1133.

Atwal A S and Bains S S 1974. Applied Animal Ecology. Kalyani Publishers, Ludhiyana: 128-135.

Birch L C 1948. The intrinsic rate of natural increase of an insect population. *Journal of Animal Ecology* 17:15-26.

El-Wakeil N E and Vidal S 2005. Using of *Chrysoperlacarnea*in Combination with Trichogramma Species for Controlling *Helicoverpaarmigera*. *Egyptian Journal of Agricultural Research*, 83:891-905.

Howe R W 1953.The rapid determination of intrinsic rate of increase of an insect population. *Annual Review of Applied Biology*40: 134-155.

Saminathan VR and Baskaran R K M 1999. Biology and predatory potential of green lacewing, *Chrysoperlacarnea* (Neuroptera: Chrysopidae) on different insect hosts. *Indian Journal of Agricultural Sciences*, 69 (7): 502-505.

Singh S P and JalaliS K 1994. Production and use of chrysopid predator. Technical Bull. No. 10. Project Directorate of Biological Control, Bangalore. PP: 14

Southwood T R E 1968. Ecological methods. Methuen and Co. Ltd., London PP: 391.

Villenave J, Thierry D, Mamun AA, Lode Tand Rat-Morris E 2005.The pollens consumed by common green lacewings *Chrysoperla* spp. (Neuroptera: Chrysopidae) in cabbage crop environment in western France. *European Journal of Entomology*, 102: 547–552.