American Research Journal of Nursing and Health Sciences (ARJNHS)
Volume.9, Number 4;October-December, 2023;
ISSN: 2836-8231 | Impact Factor: 7.08
https://zapjournals.com/Journals/index.php/arjnhs
Published By: Zendo Academic Publishing

UNDERSTANDING CHRYSOPERLA CARNEA POPULATION GROWTH ON APHIS GOSSYPII VS. MELANPHIS SACCHARI THROUGH LIFE TABLES

Prof. Mahmoud Ali Osman[1] and Dr. Aisha Mohammed Ibrahim[2]

Article Info

Keywords: Biological control, Chrysoperla carnea, Aphid lions, Integrated pest management, Insect pests

Abstract

The widespread occurrence of insect pests poses a significant threat to both cash and food crops, compelling the use of chemical pesticides to ensure adequate food production for a growing global population. However, the indiscriminate and prolonged use of chemicals has given rise to a multitude of adverse consequences, undermining the viability of this approach. Issues such as the development of pest resistance, resurgences of pests, the emergence of secondary pests, suppression of natural enemies and beneficial insects, as well as negative impacts on human health, wildlife, the environment, and water resources have become increasingly evident.

In response to these challenges, there has been a growing interest in seeking sustainable alternatives to chemical pesticides. Biological control, specifically the use of natural enemies, has emerged as a promising alternative. Among these natural predators, the common green lacewing Chrysoperla carnea, a member of the Chrysopidae family within the Neuroptera order, has garnered significant attention. Chrysoperla carnea, commonly referred to as aphid lions, stands out as one of the most extensively studied species within the Chrysopidae family, primarily due to its wide distribution and adaptable habitat range. The species has gained recognition as an effective biological control agent, owing to its remarkable ability to manage a diverse array of insect pests. Its exceptional searching prowess and adaptability in field conditions have made it a valuable asset in integrated pest management strategies.

This paper delves into the significance of Chrysoperla carnea as a biological control agent and its potential to mitigate the challenges

[1] Biology Department Al-Zaiem Al-Azhari University[1&2]

associated with chemical pesticide use. It examines its biology, behavior, and ecological attributes that contribute to its efficacy in pest management. Additionally, this study explores the cosmopolitan distribution of Chrysoperla carnea and its presence in various biotypes worldwide.

INTRODUCTION

The cash and food crops are attacked and damage by many insect pests. Man resorted to chemicals to protect his crops from these pests and guarantee enough food production for growing population. But the continuous use of chemicals resulted in many side effects and rendered the hope for increasing food production unrealistic. Building of resistance, resurgence of pests, outbreak of secondary pests, suppression of natural enemies and other beneficial insects, undesirable effects on human, wildlife, environment, water resources…etc are all problems associated with the use of chemicals.

These problems prompted man to look for alternatives to the chemicals. One of these alternatives was the biological control by use of natural enemies. The common green lacewing*Chrysoperla carnea* was one of the important predator natural enemies. The species is a member of the family Chrysopidae of the order Neuroptera. It has a cosmopolitan distribution and occurs in various biotypes. It was reported nearly from all parts of the world where the conditions are opportune from development and reproduction (canard *et al* 1984).

Chrysoperla carnea also know as aphid lions is by far the most intensively studied species of Chrysopids, because of its abundance and broad habitat range (Tauber *et al* 2000). It has got a considerable attention as a biological control agent because of its ability to control a variety of insect pests having higher searching ability and wide adaptability in field (Carrillo and Elanov, 2004).

The adults are greenish and or yellowish green in color, have shining golden eyes and average length is about 25mm (Teetes *et al* 1983). The head of the adult had no ocelli, compound eyes glittering metallic bronzy color giving the family the common name golden eyes. The antennae are long and multisegmented. The wings are large and broadly oval, though the hind wing is often narrower (Semeria, 1980).

The biology of the species was studies by many authors. The adults are nectar-feeders and also eat pollen grains. Also some authors (Itagen, 1970, and Blackman, 1974) stated that it is possible to raise the adults on artificial media made from fixed rations of wheat, sugar and yeast. The diet contained artificial ingredients significantly influenced ovipostion and post-oviposition periods and fecundity of females (Adane, 2002). However, when *Chrysoperla carnea* larvae were reared on nymphs of *Shizaphis graminum*, *Bemisia tabaci* as well as artificial diets, significant impact was determined on fecundity, larval duration, hatchability and sex ratio (female/male). During the scarcity of natural foods the artificial diet is the best source for mass rearing of *Chrysoperla carnea* (Jokar and Zarabi, 2012).

Matting of adults started 1-2 hours after emergence and lasted for 2-5 minutes (Bashir, 1986). Oviposition takes place during nigh and the maximum numbers of eggs are laid within the 2-3 hours which follow sunset (Butler and Ritchle, 1970). The full grown larva was 9mm long in average and 2mm width. The duration of the larval period differ according to the type of food and temperature. Newly emerged larvae were colourless and transparent. Bashir (1986) found that predator during its first, second and third larval instars consumed 14.4, 24.7 and 64.4 individuals of the aphid *Myzus persica* respectively. The average total of aphids consumed during the larval period was 103.5 aphids. Ahmed (1988) stated that the number of aphid *Melanphis sacchari* consumed by the three larval stages was 19.5, 23.8 and 56 respectively.

C. carnea is a polyphagous predator. It was found attacking different types of aphids in addition to eggs and nymphs of *Bemisia tabaci* and *Empoaseca* sp. Peterson (1960) showed that the larvae is the predaceous stage attack mainly aphids, scale insects, mealy bugs, leaf minor, bollworm eggs and other small insects.

The chrysopid predator was used as biocontrol agent. It was used successfully against *Aphis crsccivora* in cowpea and mange to reduce its density by 94% six days after release (Radziviouskaya and Daminova, 1980). Rossman and Fortaman (1989) confirmed that*C. carnea* was used for control of lettuce pest under field conditions in Germany. The uses of the first and second instar of the predator tolerate a wide range of doses of many synthetic compounds (Shower, 1980). Pree *et al* (1989) gave similar remarks about the tolerance of the larval stages of the predator to insecticides. They confirmed that the immature stages of the predator were found resistant wide range of chemical including most of the commonly used pyrethroids, organophosphorws and carbamotes. According Adachevich (1987), *C. carnea* (aphid lion)is the most promising natural enemy against sucking insect pest of cotton and some other field crops.

MATERIAL AND METHODS

Green lacewing (*C. carnea*) was collected from Shambat Demonstration Farm from cotton and barseem crops. The collected of both the predator and its prey started in February and continued up to April of season 1997/98. The field collected samples were reared in oviposition cages inside the laboratory; each consists of hurricane lamp, glass bottle of 12cm in diameter, piece of hard paper and piece of cloth. The cage was assembled as describedby El Abjar (1985).The adults of the predator were provided with sugary material for food. Every day the food was replaced by new one.

The eggs were collected from the cages using a fire brush and placed in a petri dish lined with moist filer paper. The hatched larvae were reared separately on *A. gossypii* and *M. sacchari* . For the compilation of life table data, ten pairs of newly emerged adults (male and female) were selected from reared immature stages and confined each pair separately in an oviposition cage described by El Abjar (1985).The two pairs were daily provided with the fresh food and their longevity and the number of eggs deposited were recorded until the death of the female. In case that the male died first it will be replaced by a new a one from the stock culture inside the laboratory.

The data collected was analyzed according to Birch (1948) formula. The stock culture started with 200 eggs. Egg hatchability, number and duration of each larval instar and the pupal stage were followed and recorded.

RESULTS AND DISCUSSION

Table (1) and (2) shows the life tables data of the predator when raised on *A. gossypii* and *M. sacchari* respectively. The survival rate (Lx) was 0.72 and 0.69 in case of *A. gossypii* and *M. sacchari* respectively. Figure (1) shows the survivorship curves and figure (2) shows the oviposition curves for *C. carnea* when raised on dura and cotton aphids respectively.

The data pertaining to *M. sacchari* showed that the percent of immature stages reached the adult stage was 72; the percent of mortality among the adults was 20 in the first 10 days 50 in the second ten days and 80 in the last 10 days. The death of single adult decreases the longevity by 0.72.The net reproductive rate (RO) was 150.74, the weight generation time (T) was 32.62, the innate capacity for numerical increase (rm) was 0.07, and the doubling time was 9.86.

The data pertaining to *A. gossypii* showed that the percent of survival was 69. Most of the mortality occurred during the egg stage. The egg deposition of the predator was highly affected by the age. With progress of time, the fecundity decreases and get lower. The mortality among the adults was 30% in the first 10 days, 50% in the second 10 days and 70% in the third ten days. The net reproductive rate (RO) was 106.54, the weight generation time (T) was 32.82, the innate capacity for numerical increase (rm) was 0.06, and the doubling time was 0.06.

Table (1): Shows the life tables data of the C. carnea when raised on M. sacchari under laboratory conditions

X	LX	MX	LXLM	XLXMX
22	0.720	30.85	22.21	488.7
25	0.720	33.39	24.04	601.0
28	8.648	27.9	18.07	506.2
31	0.576	22.9	13.19	408.9
34	0. 576	24.09	13.87	471.8
37	0.504	37.9	19.10	706.8
40	0.432	40.2	17.36	694.7
43	0.360	31.7	11.41	490.7
46	0.216	28.25	6.10	280.7
49	0.144	21.83	3.14	154.0
52	0.144	15.00	2.16	112.3
55	0.000	00	00	00

Table (2): Shows the life tables data of the Chrysoperla carneawhen raized on A. gossypiiunder laboratory conditions

X	LX	MX	LXLM	XLXMX
23	0.690	28.9	19.94	458.6
26	0.621	39.30	24.41	634.5
29	0.621	15.84	9.83	285.3
32	0.532	30.19	16.66	533.3
35	0. 552	17.82	9.83	344.3
38	0.414	24.00	9.93	377.6
41	0.414	22.50	9.31	381.9
44	0.414	26.20	10.84	477.3
47	0.345	25.21	8.69	408.8
50	0.345	14.90	5.14	257.0
53	0.345	15.69	5.41	286.9
56	0.276	17.53	4.83	270.5
59	0.207	23.50	4.86	287.0
62	0.207	14.11	2.92	181.1
65	0.000	21.23	00	00

Fig (1): Shows the survivorship curves of C. carnea when raised on A. gossypii and M. sacchari

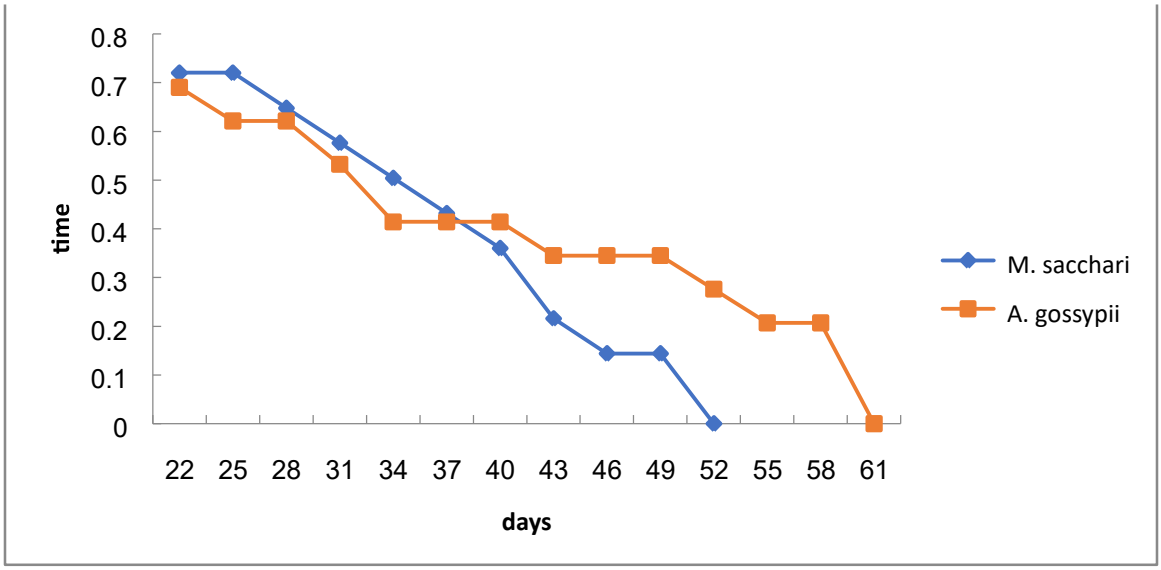

Fig (2): Shows the oviposition curves of C. carnea when raised on A. gossypii and M. sacchari

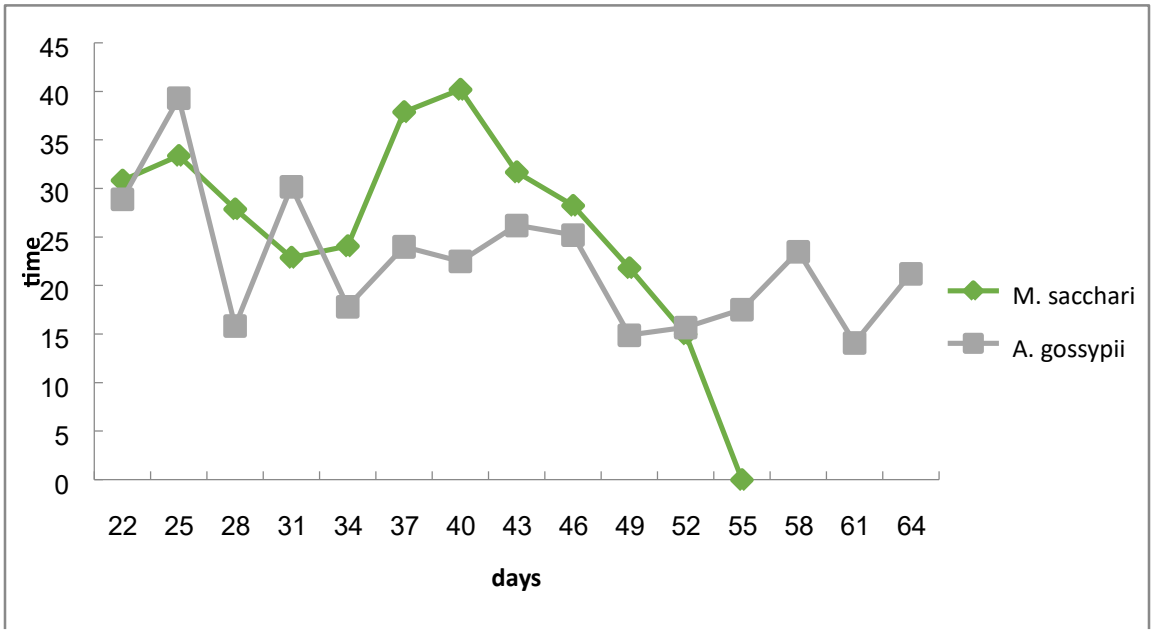

Table (3) summarizes the life table parameters of the predator (*C. carnea*) when raised on *M. sacchari* and *A. gossypii*. It is clear that the two aphids have no clear impact on the life table parameters of the chrysopid predator. The only clear impact is on the net rate of reproduction (RO). The dura aphid gave high value of RO than the cotton aphid. This means that the predator multiply and increase in density better on the latter. But this increment may not be of significance in changing the rm value. The rm is measured as the number of females produced per female per day. It is a very important parameter in influencing the sex ratio. The differences in other parameters are very slight and seem to have no significance in the life table parameter of the predator.

Table (3) summarizes the life table parameters of the predator (C. carnea) when raized on M. sacchari and A. gossypii

Parameter	Generation raized on *M. sacchari*	Generation raized on *A. gossypii*
RO	150.7	142.6
T	32.6	36.4
Rm	0.153	0.136
DT	4.51	5.10
	1.16	1.14

Conclusion

It is concluded that the *M. sacchari* has given a high value of the net rate reproduction (RO) than the *A. gossypii*. The reproductive potential of *Chrysoperla carnea* is increased when fed on *M. sacchari*. It can, therefore, be suggested for application in the field of biocontrol.

References

Adane T, Gautam R D. Biology and feeding potential of green lacewing *Chrysoperla carnea* on rice moth. India Jr Entomol 2002; 64(4):457-464.

Adashkevish, B. P. (1987). The aphid lion; for and against Zaskehitta Ratteni Moskva 7, 29-30.

Ahmed, M.E. (1988). Studies on the life tables and food preference of the predaceous lace wing *Chrysoperla carnea*. M.Sc. thesis. University of Khartoum.

Bahir. M.O. (1968). Studies on the natural enemies of some major pests of brseem in Khartoum province. M.Sc. thesis. University of Khartoum.

Birch, L.C. (1948). The intrinsic rate of natural increase of an insect population J. Ani. Eco 17 , 15-26.

Canard, M, Semeria, Y and New, T. R. (1984). Biology of Chrysopidae. Series Entomologic, Jvnk publishers.

Carrillo, M. and Elanov,P. 2004. The potential of *Chrysoperla carnea* as a biological control agent of *Myzus persicae* in glaas house. Annl. Appl. Biol.32:433-439.

El Abjar, Z. E. (1985). Studies on the natural enemies associated with *A. gossypii* and *Therioaphis trifollii*, Ph. D. thesis, University of Khartoum.

Joker M, Zarabi M. Investigation Effect of Three Diets On Life Table Paraments *Chrysoperla carnea* (Steph) (Neuroptera: Chrysopidae) Under Laboratory Conditions. Egypt Acad Jr Biology Sci 2012; 5 (1): 107-114. Schumtterer, H. (1969). Pests of crops in north east and central Africa with particular reference to Sudan. Gustav Fisher Rerlage, Stultgart.

Siddig, A. S. (1991). Evaluation of neem seed and leaf extract for control of insects in Sudan.ARC, Shambat, Technical Bulletin number 6.

Tauber, M. Tauber,C.A. and Hagen, K.S. 2000. Commercialization of predators green lacewing (Neuroptera:Chrysopidae) J.Am.Entomol. 46:26-38.