THE EFFICIENCY OF *CHRYSOPA CARNEA* STEPH ON EGGS AND LARVAE OF *HELIOTHIS ARMIGERA* HB. (NEUROPTERA, CHRYSOPIDAE, LEPIDOPTERA, NOCTUIDAE)

By

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SUMMARY

Some biological information on *Chrysopa carnea* Steph. are reported in the present investigation. Its laboratory rearing is described at 27-30-^{0}C. and 60-70% R.H.

When the predator larva was fed on eggs of *Heliothis armigera* Hb., the periods of the three larval instars averaged 2.6, 2.9 and 4.4 days, respectively. The total larval period, pupal period and total developing period (egg - adult) averaged 10.2, 6.7 and 16,6 days, respectively. When feeding on newly hatched larvae, the periods of the three larval instars of the predator averaged 3.3, 3.9 and 8.4 days, respectively. The total larval period, pupal period and total developing period averaged 15.8, 7.9 and 22.6 days, respectively.

Sex ratio was approximately 1 : 1 in both cases of feeding.

The numbers of eggs consumed during the three larval instars averaged 24.1, 40.5 and 113,7, respectively. The respective newly hatched larvae consumed averaged 37.9, 95.8 and 757.7. The average number of eggs or newly hatched larvae consumed per larva per day in the three larval instars of the predator averaged 9.8, 14.3 and 26.2 eggs or 11.8, 24.0 and 90.3 newly hatched larvae, respectively.

INTRODUCTION

Chrysopa carnea Steph. (Neuroptera : chrysopidae) is very common in cotton, corn and clover fields as well as on fruit trees and hedges. It is usually found on plants infested with aphids, some other small insects, immature forms of the cotton leaf worm, *Spodoptera littoralis* Boisd. and the American bollworm, *Heliothis armigera* Hb.

It was recorded in Egypt as a predator of aphids and eggs and newly hatched larvae of the cotton leaf worm (Bishara, 1934; Willcocks 1937, kamal, 1951, Hassanein, 1956, Azab *et al.* 1965 Hafez and Abd El-Hamid, 1965. It was not recorded as a predator of *H. armigera* in Egypt, while recorded in Tanganyike (Reed, 1965) and U.S.A. (Butler, 1971, Butler and Ritchie, 1971).

The aim of this study was to evaluate the efficiency of C. *carnea* larvae on eggs and on newly hatched larvae of *H. armigera*. The effect of prey stage on the life cycle of the predator was also studied.

MATERIALS AND METHODS

Adults of *C. carnea* were collected from the field and confined in glass chimneys, open from upper and lower sides. Each chimney was placed on a half-petri dish (8 cm in diameter) furnished with a moistened filter paper to provide humidity for the insects. A piece of cotton wool soaked in sugar solution in a small plastic container was placed inside. Honey dew obtained from a culture of mealybug, was added for feeding *Chrysopa* adults. The insects were placed inside the chimneys and the latter were covered with a piece of black cloth for attracting females to oviposit. The eggs were collected daily and were isolated singly in glass tubes 7×2 cm until hatching. Soon after hatching, the larvae were provided daily with an excess number of eggs or newly hatched larvae of *H. armigera*. The amount of preys were increased gradually as the larvae grew. Moulting and the daily amount of preys consumed were determined until the larvae have spinned their cocoons. The sex ratio of *Chrysopa* adults was determined in both feeding cases

This investigation was carried out at a room temperature of 27-30°C. and 60-70% R.H.

DURATION OF IMMATURE STAGES

Egg stage :

Under laboratory conditions, eggs were laid, hanged from their stalks, on the black cloth cover of the chimney. The incubation period ranged between 2-4 days with an average of 3.2 ± 0.184 days.

Larval stage :

The larva is the predaceous stage and has three instars whose duration differs with different types of food material. The durations of the three larval instars were estimated by feeding on eggs or newly hatched larvae of *H. armigera* at 27-30°C. and 60-70% *R.H.* Results are shown in tables 1 and 2.

Data shown in table 1 indicate that, when *Chrysopa* larvae were fed on eggs of *H. armigera*, the total larval period occupied an average of 10.2 ± 0·189 days· The three larval instars averaged 2·6± 0·096, 2·9±0·096 and 4·4±0·166 days, respectively· When the larvae of the predator were fed on newly hatched larvae of *H. armigera*, the total larval period averaged 15·8±0.521 days· The three larval instars averaged 3·3±0·116, 3·9±0·175 and 8·4±0·450 days, respectively (Table 2)·

TABLE 1.—**Durations of immature stages and effieciency of larvae of** *C. Carnea* **when fed on eggs of** *H. armigera*

Stage	No. of observations	Durations in days			Average daily consumption of eggs by the larva								Aver. No. of eggs consumed perlarva per day
		Min.	Max.	Aver.	1	2	3	4	5	6	7	Total	
1*st* larval instar	38	2	4	2.6±0.096	8.7	9.4	9.7	10.0	—	—	—	24.1±1.65	9.8±0.60
2*nd* larval instar	38	2	4	2.9±0.096	11.9	14.2	16.0	18.4	—	—	—	40.5±1.60	14.3±0.93
3*rd* larval instar	37	2	7	4.4±0.166	20.2	23.2	27.3	29.5	31.7	29.5	34.0	113.7±5.06	26.2±1.41
Total larval period	37	6	12	10.2±0.189						176.2±7.3			17.3±1.24
Pupa	31	5	9	6.7±0.275									
Total developing period(egg -adult)	31	15	20	16.6±0.248									

TABLE 2.—**Duration of immature stages and efficiency of larvae of *C. carnea* when fed on newly hatched larvae of *H. armigera*.**

Stage	Durations in days			Average daily consumption of newly hatched larvae by the larvae													Average number of larvae consumed per larvae per day
	Min.	Max	Average	1	2	3	4	5	6	7	8	9	10	11	12	Total	
1*st* Larval instar 35	2	5	3.3±0.12	9.9	10.4	13.6	14.8	13.5	—	—	—	—	—	—	—	37.9±2.23	11.8±0.36
2*nd* Larval instar 25	2	7	3.9±0.18	17.5	18.8	26.2	32.7	35.4	60.0	60.0	—	—	—	—	—	95.8±11.62	24.0±1.32
3*rd* Larval instar 20	5	12	8.4±0.45	42.7	57.4	73.1	86.4	99.8	110.3	115.5	112.7	109.7	116.0	105.3	115.0	757.7±53.8	90.3±3.93
Total larval period 20	11	20	15.8±0.521	—	—	—	—	—	—	—	—	—	—		—	897.8±51.8	56.8±2.12
Pupa 20	6	8	6.9±0.171														
Total developing period (egg-adult) 19	17	27	22.6±0.60														

From the results shown in tables 1 and 2 the following are the summary of the findings:

1.—The duration of the first larval instar of *C. carnea* is the shortest and the duration of the third larval instar is the longest.

2.—The durations of the three larval instars and the pupa of the predator are shorter in case of feeding on eggs than in case of feeding on newly hatched larvae.

3.—The high rate of death between larvae of the predator, especially the young larvae, when they were fed on newly hatched larvae. This rate became less when the predator larvae grew. The rate of death was 30%, 20% and 10% in the three larval instars, respectively. This did not increase more than 3 % when the larvae of the predator were fed on eggs. This high rate of death may due to the botheration of larvae of *H. armigera* to the delicate larvae of the predator especially during moulting, also because of the secretion of silk threads by the prey's larvae and this does not occur when feeding on the prey's eggs.

Pupal stage :

The full grown larvae spin white spherical cocoons and chage to pupae. These cocoons are found stuck with plant leaves. The adults make holes in their cocoons and then emerge. Under conditions of this study, the period of the pupa ranged between 5-9 days with an average of 6.7 ± 0.275 days when the predator larva was fed on eggs of *H. armigera* (Table 1) while rangd between 6-8 days with an average of 6.9 ± 0.171 days when fed on newly hatched larvae of the prey (Table 2).

Sex ratio :

The sex ratio in adults fed on eggs or newly hatched larvae was 1:1.

Feeding capacity

The feeding capacity of the three larval instars of *C. carnea* was determined at 27-30°C. and 60-70% R.H. in asssociation with eggs and newly hatched larvae of *H. armigera*. Data shown in Table 1 indicate that the numbers of eggs consumed during the three larval instars were successively 24.1 ± 1.65, 40.5 ± 1.60 and 113.7 ± 5.06 as averages and a total consumption averaged 176.2 ± 7.3 eggs. The average consumption of eggs per larva per day in the three larval instars was 9.8 ± 0.60, 14.3 ± 0.93 and 26.2 ± 1.41 eggs, respectively. The maximum consumption of eggs per larva per day in the three larval instars was 10,21 and 36 eggs, respectively. Data shown in Table 2 indicate that the numbers of the newly hatched larvae consumed during the three larval instars were successively 37.9 ± 2.23, 95.8 ± 11.62 and 757.7 ± 53.8 larvae as averages and a total consumption averaged 897.8 ± 54.8 larvae. The average consumption of the predator larva per day in the three larval instars was 11.8 ± 0.36, 24.0 ± 1.32 and 90.3 ± 3.93, respectively. The maximum consumption of larvae per the predator larva per day in the three larval instars was 15, 60 and 120 larvae, respectively.

From the results shown in tables 1 and 2 the following are the summary of the findings :

1.—The average number of newly hatched larvae of *H. armigera* consumed per larva of any of the three instars of *C. carnea* per day was greater than the average number of eggs cosumed by any of the three larval instars of the predator. This may be due to resistence of the prey's larva against attacks of the predator larva so that the later cannot obtain all prey's contents. In the case of eggs, the predator larvae consumed all the contents of its prey so that it was satisfied by feeding a less number of prey's individuals.

2.—The second instar larva of the predator feeds on a number of eggs and newly hatched larvae of *H. armigera* greater than the number of preys consumed by the first instar larva. The third instar larva of the predator feeds on a number of eggs and newly hatched larvae of the prey greater than that consumed by both first and second instar larvae.

3.—In other tests, more advanced *H. armigera* larvae were given to *Chrysopa* larvae. When second instar *Heliothis* larvae were given, few of them were consumed, but the predator larvae could not continue to live and they gradually started to die. When third instar *Heliothis* larvae were offered, *Chrysopa* larvae could not actually feed on them though some attempts of attack were observed. Some of the prey's larvae were injured in the process and eventualy died, whereas all the predator's larvae died through starvation.

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