BIOLOGICAL NOTES ON *CAMPOPLEX (EULIMNERIUM) XANTHOSTOMA* GRAV. (HYMENOPTERA : ICHNEUMONIDAE)

By

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SUMMARY

Campoplex (Eulimnerium) xanthostoma Grav. is recorded for the first time as a larval parasite of *Heliothis armigera* Hb. in Egypt during March, 1975 by the present authors. It was known in Egypt as a parasite of *Spodoptera littoralis* Boisd., *S. exigua* Hb. and *Agrotis ipsilon* Rott. Some biological studies were carried out at 25-27°C and 60-70% R.H. Incubation period of the egg lasts three days on an average. The total larval period, inside the host larva, ranges between 13-16 days with an average of 14.2 days. The parasite larva leaves the host larva and develops to pre-pupa during three days. The pre-pupa takes two days on an average to develop to pupa. The pupa lasts 5 days on an average. The total developing period (egg-adult) ranges between 22-26 days with an average of 23.4 days. Mating occurs immediately after emergence of adults and it ranges between 3.2-4.2 minutes with an average of 3.33 minutes. The number of eggs laid by a female in one host larva ranges between 2-11 eggs with an average of 6.7 eggs. In all cases only one parasite larva develops in the host larva. Sex ratio was found to be 3♂ : 1♀. Longevity of females ranges between 22-29 days with an average of 23.4 days and that of the male 17-21 days with an average of 19.3 days. Encapsulation takes place where the parasite egg is surrounded by haemocytes in the body of host larva which prevents the hatching of the egg and the development of the parasite inside the host body.

INTRODUCTION

Campoplex (Eulimnerium) xanthostoma Grav. is recorded as a larval parasite of the cotton bollworm, *Heliothis armigera* Hb. for the first time in Egypt during March 1975 by the present authors (unpublished data). In Egypt, it was recorded as a parasite of the greasy cutworm, *Agrotis ipsilon* Rott. (Bishara, 1932), the cotton leafworm, *Spodoptera littoralis* Boisd. (Kamal, 1951) and the lesser cotton leafworm, *S. exigua* Hb. (Afify *et al*, 1970). It was also recorded in Russia as a parasite of different insect species including *Heliothis dispasea* L. (Shchegolev, 1929), *Ostrinia nubilalis* Hb. (Ellinger and Sachtleben, 1929) and *Loxostege sticticalis* L. (Borcea and Suster, 1930; Meier, 1930 Lebedyanskaya, 1931; Shorkin, 1934).

Previous studies carried out on *C. xanthostoma* were concentrated on its survey as a parasite of certain insect species.

In the present investigation, some biological studies are carried out on *C. xanthostoma* as a parasite of the cotton bollworm, *H. armigera* with special emphasis on encapsulation process.

MATERIALS AND METHODS

Samples of *H. armigera* larvae were collected from different localities and different host plants. The larvae were placed individually in glass vials (7 x 2 cm) covered with cotton wool. They were fed on semi-synthetic diet prepared in the laboratory (Shorey and Hale, 1965) until the emergence of parasite adults. The adults of *C. xanthostoma* emerged twice from samples collected from Abu Rawash, near Cairo, on 15.3.1975 and 17.4.1976. *H. armigera* larvae, second and third instars, were exposed for 24 hours to mated parasite females after which they were dissected at intervals to study the different stages of the parasite. The differentiation between males and females of the parasite was made and the sex ratio was estimated. The percentage of encapsulation was estimated between host larvae after oviposition of the parasite females and the economic importance of the parasite was evaluated.

THE LIFE CYCLE

Egg Stage :

Kidney shaped,translucent, colour gradually changes to reddish brown as the embryo grows,length ranges between 0.46-0.85 mm with an average of 0.56 mm, width ranges between 0.15-0.25 mm with an average of 0.21 mm.

The parasite female lays its eggs directly under the skin or between the inner contents of the host larvae. The egg hatches after three days on an average at 25-27°C. and 60-70% R.H. Hatching takes place by causing an elongate split at the anal part of the egg resulting from the peristaltic movements of the embryo inside. The first instar larva hatches from the egg with its tail first and moves its body backwards until it comes out leaving the egg shell behind.

Larval Stage :

The larva has three instars and lasts inside the host larva for a period ranging between 13-16 days with an average of 14.2days at 25-27°C. and 60-70% R.H. The mature parasite larva leaves its host after tearing it completely and stays beside its remains. It develops to pre-pupa during three days after leaving the host larva. The meconium of the parasite larva could be seen at the anal end of the pre-pupa. The pre-pupa develops to pupa after two days on an average.

Pupal stage:

The pupal stage lasts five days on an average at 25-27°C and 60-70%R.H after which the adult emerges.

The period elapsed between leaving of the host larva by the parasite larva and emergence of parasite adult ranges between 8-11 days with an average of 10 days. The total developing period (egg-adult) ranges between 22-26 days with an average of 23.4 days.

Adult stages

Mating:

Mating takes place immediately after emergence of adults. The male follows the female from one place to the other and moves its antennae and wings vigorously. He then jump on the female's back holding her with its fore legs at the first third of her abdomen. The middle legs are situated at the end of her abdomen while the hind legs extend behind her abdomen. When the female is ready for mating, she stands very quite and raises the anal part of her abdomen. She moves her antennae from time to time and then moves the last sternites of the abdomen up-down movements. At this moment, the male bends the end of his abdomen downwards and pierces his organ through the female's aperture, his antennae vibrate continuously. The mating process lasts 3.20-4.20 minutes with an average of 3.33 minutes.

The female keeps very calm after mating. She moves the end of her abdomen up and down and shakes the antennae lightly for about two minutes after which she returns to normality. The male becomes unstable and moves fastly.

In some cases the female rejects the male and bends the anal end of her abdomen downwards and to the front so that the male cannot by any means pierce his organ.

Oviposition:

When a larva of *H. armigera* is exposed to a mated parasite female, the parasite becomes aware of its presence and touches it with her antennae. At this moment, the parasite attacks the host larva and pierces the ovipositor several times in any part of the body in a very quick manner until the ovipositor settles inside the host larva. The time of one pierce ranges between 5-8 seconds. During oviposition process, the antennae are vertical on the head. Sometimes, the host larva resists the attacks of the parasite female during her attempts to pierce her ovipositor inside its body by moving the front part of the body and attacks the parasite, but the latter succeeds to oviposit inside the larva if it is in the second or third instar, the most favourable age for parasitism. The 4th instar host larva attacks the parasite strongly and the latter may fail to deposit eggs.

After the female deposits her eggs, it moves to attack another host larva or may attack the same host.

The host larva moves nervously after the parasite oviposites inside her body especially the front part to left and right several times and a drop of the body fluid is secreted at oviposition site.

The number of eggs laid by the female inside one host larva ranges between 2-11 eggs with an average of 6.7 eggs. In all cases one parasite larva only continues its development.

Sex ratio :

The sex ratio was found to be 3 ♂ : 1 ♀ .

Longevity :

Longevity of the female ranges between 22-29 days with an average of 23.4 days and that of the male 17-21 days with an average of 19.3 days.

Encapsulation :

Encapsulation was noted in larvae of *H. armigera* exposed to mated females of *C. xanthostoma* (Fig. 1). A number of 112 second and third instar host larvae were exposed individually for 24 hours to mated females of the parasite in glass vials (7 x 2cm) covered with cotton wool and oviposition was observed. Twelve larvae were dissected in the third day of exposure and only two first instar larvae were found. The other ten

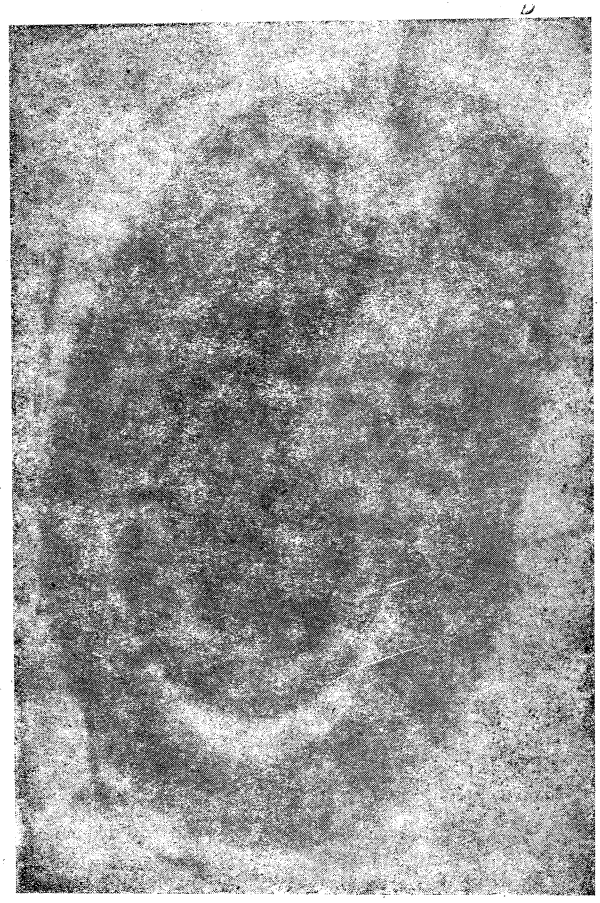

Fig. 1.—The egg of *C. xanthostoma*, with embryo developed inside, surrounded by haemocytes of *H. armigera* larva

larvae have encapsulated parasite eggs. Sixteen larvae were dissected in the fourth day of exposure. Only four first instar larvae were found, the other twelve larvae have encapsulated parasite eggs. The remaining 84 host larvae were left without dissection and were fed on the semi-synthetic diet mentioned earlier. Only five parasites emerged and the other 79 host larvae developed to pupae and adults.

From data obtained above, it could be stated that the percentage of parasitism being 9.8% which may lead to conclude that *C.xanthostoma* is not an efficient parasite against *H. armigera.*

DISCUSSION

Non of the authors has mentioned any biological or ecological informations when dealing with *C.xanthostoma* as a limiting factor of populations of some insect species. Also the economic importance of this parasite was not evaluated before. The low percentage of parasitism by this parasite proved to be a result of encapsulation. This was noticed during carrying out some biological studies on *C. xanthostoma* parasitising *H. armigera.*

Van den Bosch (1964) studied in detail the relationship between *Bathyplectes curculionis* Thomson and its two hosts, *Hypera brunneipennis* Boheman and *H. postica* Gyllenhall. He found that there are some factors that affect the degree of encapsulation such as host age (instar) which affects parasitism positively according to larval instars, and starvation which increases encapsulation among well fed larvae more than that among starved larvae.

Conflicting evidence exist as to the effect of the host age on degree of encapsulation. Thus Muldrew (1953) stated that age has no influence on the degree of encapsulation in the *Pristiphora erichsonii* Hartig-*Mesoleius tenthredinis* Morley relationship.

The data obtained by Van den Bosch(1964) clearly reflect an increasing trend in the degree of encapsulation through the four larval instars of *H. brunneipennis* and *H. postica* and support the findings of Schneider (1950), Salt (1957) and Puttler (1961). This does not mean that Muldrew's contention is invalid for it is entirely possible that this factor may vary from one relationship to another. The data obtained by Van den Bosch (1964) do confirm the fact that in some situations, at least, host age (stage) can affect the degree of encapsulation.

In the present study, the authors did not deal in detail with encapsulation process in *C. xanthostoma.* A separate paper will be published later dealing with this matter in different insect species

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