

**BIOLOGY OF MICROPLITIS RUFIVENTRIS KOK. PARASITISING
HELIOTHIS ARMIGERA HB. IN EGYPT
(HYMENOPTERA : BRACONIDAE : LEPIDOPTERA: NOCTUIDAE)**

By

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SUMMARY

The biology of *Microplitis rufiventria* Kok., parasitising the larvae of the American bollworm, *Heliothis armigera* Hb. was studied under laboratory conditions of $27 \pm 2^\circ\text{C}$. and 60-70% R.H. The duration of the immature stages was estimated. The mean durations of the egg, larval, pre-pupal and Pupal periods were 24.6, 224.5, 22.4 and 81.2 hours, respectively. Mating occurs few hours after emergence of adults. The female parasite deposits its eggs inside the host's larva. It prefers the end of first larval instar or the beginning of the second larval instar rather than the other larval instars. The mated female deposits a number of eggs ranging between 67-110 eggs with an average of 93.2 eggs during its lifespan which lasts 18-35 days with an average of 20.1 days. The maximum number of eggs laid by a mated female in one day was 16 eggs. The pre-oviposition, oviposition and postoviposition periods were 1-4 days with an average of two days, 16-32 days with an average of 20.8 days and 1-4 days with an average of 1.5 days, respectively. The unmated females deposit eggs inside the host larvae and all the developing adults are males. Longevity of both males and females of the parasite was estimated under the same laboratory conditions.

INTRODUCTION

The earliest record of *Microplitis rufiventris* Kok. was reported by Kokujev (1914) parasitising *Spodoptera littoralis* Boisd. in Turkestan. Latert Tompson (1946) recorded *M. rufiventris* on *Heliothis armigera* Hb. and *S. exigua*. However, Gerling (1971) stated that this parasite has distributed in both Middle East and Europe where it attacks several noctuid species including *H. armigera*.

The biology of this parasite on *S. littoralis* was studied by Hammad *et al.* (1965), Shalaby (1968) and Ibrahim (1974). Ibrahim (1974) studied the morphology and biology of *M. rufiventris* on *S. littoralis* in Egypt and erroneously mentioned that *S. littoralis* is the only host of *M. rufiventris*. The biology of *M. rufiventris* when parasitising *H. armigera* has never been conducted in Egypt.

The aim of this study is thus to throw some light on the biology of *M. rufiventris* when parasitising *H. armigera* in the laboratory.

MATERIALS AND METHODS

In order to secure a large number of *M. rufiventris*, the following methods proved satisfactory for rearing the parasite and its host *H. armigera* in the laboratory, at $27 \pm 2^\circ\text{C}$ and $65 \pm 5\%$ R.H.

Host rearing :

Moths of *H. armigera* were confined for oviposition in glass chimneys, 17 cm. high and 8.2 cm. in diameter, set on half petri-dishes. Inside the chimneys pieces of toilet tissue papers were hanged and fixed to the top of the chimneys by means of the cover, usually a piece of cloth, and rubber bands. Within each chimney, the moths were provided a piece of cotton-wool soaked in 10% sugar or honey solution and placed in plastic stoppers of small medicine containers for feeding.

Strips carrying eggs were transferred to breeding jars, 11 x 7 cm. The newly hatched larvae were provided with semi-synthetic diet (Shorey and Hale, 1965) until they reach the second instar. The larvae were then separated and kept individually in glass vials 7 x 2 cm. until pupation. The pupae were placed in glass jars 11 x 7 cm. containing dry sterilized sand on the bottom to a depth of 5 cm., and covered with muslin cloth kept in position by means of rubber bands.

Parasite rearing :

Adults of *M. rufiventris*, emerging in the laboratory from parasitised larvae of *H. armigera*, were offered the choice to mate. Each pair was confined in a glass vial 12 x 4 cm. covered with muslin. Small droplets of a mixture of honey and protein hydrolyzate were scattered on the vials wall to serve as food.

Larvae of *H. armigera*, in the second instar, were introduced to the mated females of the parasite, ten larvae per vial for 24 hours after which the larvae were removed. Fresh larvae were then introduced and so on until the death of adult parasites. Each parasitised larvae was placed in a glass vial 7 x cm. stoppered with a piece of cotton-wool. The parasitised larvae were provided with semi-synthetic diet until the mature parasite larvae have come out from the host larvae and spinned their cocoons.

To ascertain the progress of the different developmental stages of the parasite, certain number of parasitised *H. armigera* larvae that were exposed to mated females of the parasite, for one hour only, were dissected at 12 hours intervals.

RESULTS AND DISCUSSION

Durations of immature stages :

The durations of various immature stages of *M. rufiventris* when parasitising *H. armigera* larvae are presented in table (1).

TABLE 1.—Durations of immature stages of *M. rufiventris* at $27 \pm 2^\circ\text{C}$ and $65 \pm 5\%$ R.H. (Data taken from 30 individuals in each larval instar and other immature developmental stages)

Stage	Duration in dours		
	Minimum	Maximum	Average
Egg	22	26	24.6 \pm 0.22
Larva			
First larval instar	21	27	24.4 \pm 0.29
Second larval instar	84	115	93.0 \pm 0.61
Third larval instar	94	124	107.1 \pm 0.83
Pre-pupa	20	25	22.4 \pm 0.19
Pupa	73	93	81.3 \pm 0.32
Total developmental period	314	410	352.8 \pm 5.41

Data recorded in table 1 show that the incubation period of the egg ranged between 22-26 hours with an average of 24.6 hours. The respective averages of the three larval instars were 24.4, 93.0 and 107.1 hours. The total larval period averaged 224.5 hours. The pre-pupal and pupal stages lasted 22.4 and 81.3 hours on the average respectively. The total developmental period of the parasite lasted 352.8 hours on the average.

Prior to pupation the mature larvae of the parasite gnaws with its mandibles through the integument of the host larva.

It then pushes its head and body through a hole made by the parasite larva. This hole is mostly situated in the hind part of the host larva. The hole is easily recognized even after the shedding of the parasite larva from its host. However, the host larvae remain alive for a short period (1-5 days), where they cease feeding and remain still in their places.

Few minutes after shedding off host larva, the parasite larva begins to spin its cocoon. It appears reddish in colour and cylindrical in shape and sometimes takes the form of an imperfect spindle with rounded poles.

Emergence :

When ready to emerge, the adult of *M. rufiventris* pushes up, by the head capsule a preformed operculum located at the wide end of the cocoon. Through this operculum, the adult emerges with the head first, followed by complete emergence of body which is accomplished by the movements of legs. This process lasts about one hour. After leaving the cocoon, the adult becomes quite dry after some minutes, then it starts moving very actively before flying.

Mating :

The two sexes of *M. rufiventris* could be easily differentiated during the imaginal stage by the evidence of the female's ovipositor which appears clearly at the end of its abdomen; and by the antennae which have the flagellum more longer, thicker and darker in the male.

Mating occurs few hours after emergence. It lasts few seconds. The male is often quite attentive, while the female refuses many attempts. However, the couple usually appear rather excited, moving quickly and vigorously. The female is usually perceived by the male only at a short distance of about 5 mm. The couple may meet more than once and touch each other without pairing.

Oviposition :

Oviposition occurs mostly at day light. Upon emergence from cocoon, the ovaries of the parasite female are packed with a number of developed eggs which could be deposited once the female is provided with host larvae. When ready to oviposit, the female attacks its host once she perceives it and stings it mostly in the lateral side of its middle or posterior abdominal segments. However, eggs may be deposited also in any of the body segments other than the head. The parasite female may sting a parasitised larva several times and therefore superparasitism occurs.

The maximum number of eggs found in a single parasitised larva was 13 eggs.

Oviposition activity of the parasite mated female has been studied at $27 \pm 2^\circ\text{C}$ and $65 \pm 2\%$ R.H. (Table 2).

From the data indicated in table 2 and from observations collected during the experiments, the following are the summary of the findings : The pre-oviposition, oviposition, post-oviposition periods and longevity

averages 2.0, 20.8, 1.5 and 19.3 days respectively. The average total number of eggs laid by a mated female was 93.2. The maximum daily number of eggs laid by one female was 16 eggs. The parasite male lived a period ranges between 5-26 days with an average of 15.5 days.

TABLE 2. Oviposition activity of females of *M. rufiventris* parasitising larvae of *H. armigera* at $27 \pm 2^\circ\text{C}$ and $65 \pm 5\%$ R.H.; (Data taken from 10 females)

Oviposition activity	Minimum	Maximum	Average
Pre-oviposition period (days)	1	4	2.0 ± 0.17
Oviposition period (days)	16	32	20.8 ± 1.52
Post-oviposition period (days)	1	4	1.5 ± 0.21
Longevity (days)	4	35	19.3 ± 1.79
Total number of eggs/female	67	110	93.2 ± 4.13

Parthenogenesis :

Unmated female parasite of *M. rufiventris* lays its eggs inside the host larvae of *H. armigera* and the immature stages develop normally inside the host larva. All resulted parasite adults were males.

Sex ratio

The mean sex ratio between adults of *M. rufiventris* emerged from samples collected from the field is $0.75 \text{ ♀} : 1 \text{ ♂}$. Under laboratory conditions an average ratio of $1 \text{ ♀} : 1 \text{ ♂}$ was obtained (Table 3).

TABLE 3. Sex ratio in *M. rufiventris* parasitising *H. armigera* larvae

Conditions	No. of adults collected			Sex ratio	
	♀	♂	Total	♀	♂
Field	165	220	385	0.75	1
Laboratory	173	174	347	1	1

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