

LABORATORY STUDIES ON THE EFFECT OF THE  
ECTOPARASITIC MITE *PYEMOTES HERFSI* (OUDEMANS)  
ON THE COTTON BOLLWORM *PECTINOPHORA*  
*GOSSYPIELLA* (SAUNDERS)

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**Abstract**

Time elapsed for *Pectinophora gossypiella* (Saunders) larvae to die after exposed to *pyemotes herfsi* (oudemans) varied according to number of parasitic mite individuals and cotton bollworm larval instar.

Death of larvae took place after 24 hours of infestation in the 1st instar larva exposed to 1.5 or 10 parasitic mites. Also, 2nd and 4th instars exposed to 5 and one parasitoid, respectively.

The duration before death of insect larva increased as larva developed. when the 2nd instar larva was individually exposed to one or ten parasitic mites the duration of death averaged 1.7 and 1.3 days, respectively.

The duration before death averaged 3.2, 4.3 and 3.0 days when one, five or ten parasitic mites, respectively were introduced to the 3rd instar insect larva.

This duration averaged 5.2 and 4.8 days when five or ten mites, respectively were introduced to a 4th instar larva.

**INTRODUCTION**

The strategy of the Egyptian Ministry of Agriculture for plant protection is to use IPM system. One of the major elements of this system is to use predators and parasitoids. Studies on predaceous mites and insects are numerous, while on parasitic mites are very rare.

The ectoparasitic mite, *P. herfsi* plays an important role as a controlling agent which limits greatly the population of *P. gossypiella* in cotton seeds and in dry bolls stored on the roofs of the farmers houses. Tawfik and Awadallah (1970) studied the biology of this ectoparasitoid at 15.7, 30 and 35°C and stated that the male did not live more than 2 days after birth.

Willcocks (1913) and Tawfik and Awadallah (1970) emphasized the need to learn more about the nutrition and reproduction of pyemotid mites and to develop

methods to produce large numbers of them (or their host species) if expanded field tests are to be initiated.

Kandeel (1977) stated that the pyemotid mite *P. herfsi* was expected to be found associated with the pink bollworm *P. gossypiella*, *Tribolium confusum*, *Callosobruchus chinensis*, *Earias insulana*, cotton seed and cotton seed meal. It severely attacked the larvae of the pink bollworm during spring and winter.

The present work evaluates the preference of adult ectoparasitoid mite *P. herfsi* to different larval instars of the pink bollworm and the potentiality of the parasitoid to produce progeny (egg-sacs). Such a study may be helpful in the biological control study to reduce the population of *P. gossypiella* during the resting stage in the dry bolls at the end of the cotton season.

## MATERIALS AND METHODS

**Samples:** different instars of the cotton bollworm *P. gossypiella* larvae were obtained from laboratory rearing at Plant Protection Research Institute at Dokki, while individuals of the parasitic mites *p. herfsi* were collected from samples of cotton bolls obtained from gin at Itay El - Baroud, Bahaira Governorate in early December, 1996

**Isolation of ectoparasitic mite adults:** Cotton boll samples were put in Tullgren funnel, using 60 watt bulb for 24 hours, and received parasitic mites in a clean Petri-dish were added to cotton bollworm larvae to maintain a culture of the mite.

Rearing of mite was carried out in rearing rectangular plastic cells, 10 cm long, 5 cm wide and 1 cm deep with a circular groove of 2.5 cm in diameter and 1 cm depth. A glass slide of the same area was put under the cell. Cuts of mulberry leaves (*Morus alba* L.) were put on cotton pads on a glass slide. To prevent mites from escaping, another slide was put as a cover and tied by a rubber band to the plastic cell and the former glass slide

Insect 1st instar larvae were individually exposed to 1, 5 and 10 parasitic mites. Inspection was done every 24 hours and number of dead larvae was recorded.

The previous procedure was done for the 2nd, 3rd and 4th instar larvae. This experiment was carried out under laboratory conditions at temperature of  $27 \pm 1^{\circ}\text{C}$  and relative humidity of  $65 \pm 5\%$ .

## RESULTS AND DISCUSSION

Data presented in Table 1 show that all larval instars exposed to one parasitic mite died within 1-3 days. Larvae exposed to five mites died within 1-5.2 days. In case of exposing to 10 individuals of the parasitic mite, larvae died within 1-4.8 days.

Data in Table 2 show that 1.5 and 10 of *P.herfsi* could not produce egg-sacs when introduced to one day old 1st instar larvae. However, the parasitoid produced egg-sacs when introduced to 2-4 day- old larvae, but no progeny was produced.

The previous results may be explained by Tawfik and Awadallah (1970) due to the feeding habits of the *P.herfsi* adults. It was observed in the present study that upon finding a host, the young mite female selected a favourable location on the host to insert its chelicerae in the larval integument. Before settling down, it might feed on a number of places on the same larva for a period that extended to 24 hours. After feeding for a day, the parasite developed quickly. So, the newly hatched larvae (24h old) was not synchronized with the searching time of the parasite to be attacked.

When the mite was introduced to 2nd instar larvae, the percentage of egg-sacs produced ranged 50-90%, but emergence of progeny was 0-20%

The 3rd and 4th larval instars seemed to be the most suitable host for the parasitoid. The percent of egg-sacs produced was 90-100% for the 3rd instar and 70-100% for the 4th instar. Emergence percent were 70-100% and 0-100%, respectively.

For infestation with 5 parasitic mites, the percent of egg-sacs produced on 2-4 days old larvae was 10%, 80% on the 2nd instar and 100% on both 3rd and 4th instars. Range of egg-eacs produced was (1-5) for 2-4 days- old, (3-5) egg -sacs on both 2nd & 3rd instars and (2-5) egg-sacs on the 4th instar larvae. The percent of emergence and produced mite individuals was nil among the egg-sacs on the first instar larvae (2-4 days old). This egg-sacs did not enlarge and dropped off the insect larvae. This might be due to the dryness of the insect larval tissues. On the opposite, this percent was very high (100%) among the egg-sacs on the 3rd and 4th instar larvae, while it was 20 % for the egg-sacs on the 2nd insect instar larvae.

Similar trend was recorded when inoculation was done with 10 parasitoid

mites. The percent of egg-sacs produced was very high on all insect instar larvae. This percent was 90% on the first instar (2-4 days old) and egg-sacs produced ranged (7-8) per larva. Also, the same percent (90%) of egg-sacs was produced on the 2nd instar, when egg-sacs ranged 4-10, some of which increased in size for a period of 3 days, but did not enlarge and dropped off the larvae. Thus, the percent of emergence and produced individuals was nil. The percent of egg-sacs produced on both 3rd and 4th instar was very high (100%); egg-sacs ranged 6-10 & 8-10, respectively. The percent of emergence was very high among the egg-sacs on the two instars. The newly emerged mites attacked the same infected instar larvae. This observation is in agreement with that of Tawfik and Awadallah (1970) that *p.herfsi* might feed on a number of places on the same host (larvae).

Conclusion of the previous results is that, generally, the parasitism process of the ectoparasitoid mites *p.herfsi* shortened the duration time of survival for all larval instars used. Moreover, there were some symptoms led to the death of the host (PBW), such as change in color from pink to pale brown and the dryness of the host insect tissues. This is in agreement with Strand (1986) who stated that host often showed extreme pathological changes during the development of parasitoids. They were, for the most part a manifestation of a complex factors, some of which are indirect, consequence of feeding by the parasitoid, while others due to factors secreted by the immature parasitoid.

As a conclusion, there was a considerable variation in the percent of emergence and produced progeny related to the host larval instar and the number of parasitoids attacked a larva.

The most efficient larval instar of pink bollworm to produce progeny of *P.herfsi* was the 3rd instar followed by the 4th one and finally the 2nd.

### REFERENCES

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Table 1. Mean duration of mortality of different larval instars of *Pectinophora gossypiella* exposed to different numbers of the ectoparasitic mite *Pyemotes herfsi*.

No. of adult parasitic mites introduced to PBW larva	Mean duration of mortalities (in days)						
	1st		2nd 6-days-old	3rd 9-days-old	4th 14-days-old		
	24 h	4 days old					
1 individual	1.0 ± 0.0	1.0 ± 0.0	1.7 ± 0.95	3.0 ± 0.00	1.0 ± 0.00		
5 individuals	1.0 ± 0.0	1.0 ± 0.0	1.0 ± 0.0	4.3 ± 1.89	5.2 ± 2.22		
10 individuals	1.0 ± 0.0	1.0 ± 0.0	1.3 ± 0.48	3.0 ± 0.00	4.8 ± 1.03		
Control (PBW larvae without inoculation)	14-15 days		11-12 days	7-8 days	3-4 days		

Table 2. The influence of *Pectinophora gossypiella* larval instars on the production of egg-sacs and emergence of progeny of the ectoparasitoid mite, *Pyemotes herfsi*.

Insect instar larvae No. parasitoid mites inoculated /PBW larvae	1st						2nd instar 6-days old			2rd instar 9-days old			4th instar 14-days old		
	24 h			2-4 days			% egg sacs	Range	% Emer- gence	% egg sacs	Range	% Emer- gence	% egg sacs	Range	% Emer- gence
	% egg sacs	Range	% Emer- gence	% egg sacs	Range	% Emer- gence									
1 individual	-	-	-	-	-	-	50	1	20	90	1	70	70	1	0
5 individuals	-	-	-	10	(1-5)	0	80	(3-5)	20	100	(3-5)	100	100	(2-5)	100
10 individuals	-	-	-	90	(1-8)	0	90	(4-10)	0	100	(8-10)	100	100	(6-10)	100

## دراسات معملية علي تأثير الحلم المتطفل خارجيا

### *Pyemotes herfsi* علي دودة اللوز القرنفلية

#### *Pectinophora gossypiella*

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تختلف فتره موت يرقات دوده اللوز القرنفليه بعد تعريضها لاكاروس بيوموتس هيرفسي تبعاً لعدد افراد الاكاروس وعمر يرقات دود اللوز القرنفليه بكتونوفورا جوسيبيليا.

ويحدث موت يرقات ديدان لوز القطن بعد ٢٤ ساعه في الحالات الاتيه:

١ - عند وضع يرقة واحده من العمر الاول (٢٤ساعه) او يرقة عمرها ٤ايام مع فرد واحد او خمسه او عشره افراد من الاكاروس المتطفل الخارجي.

٢ - عند وضع يرقة واحده من العمر الاول مع خمسه افراد من الاكاروس المتطفل .

وكان متوسط فتره ما قبل الموت ٤,٨ و ٥,٢ يوما عندما وضعت يرقة حشريه واحده من العمر الرابع مع عشره افراد ، خمسه افراد من الاكاروس علي التوالي .

وتزداد فتره الموت ليرقات الحشره بتقدمها في العمر ، فعند وضع يرقة من العمر الثاني مع فرد واحد او عشره افراد من الاكاروس المتطفل تزداد فتره الموت الي ١,٧ و ١,٣ يوما في المتوسط علي التوالي . بينما كان متوسط فتره الموت ٢,٠ و ٣,٢ و ٤,٢ ايام عند وضع يرقة حشريه واحده مع عشره افراد أو فرد واحد أو خمسة أفراد من الاكاروس المتطفل علي التوالي