

## BIOLOGICAL AND TOXICOLOGICAL STUDIES ON THE PARASITOID *MICROPLITIS RUFIVENTRIS* KOK.

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### Abstract

The average incubation period of eggs of the parasitoid *Microplites rufiventris* was about 1.23 days, the first larval instar 3.02, the second 2.47 and the third instar 1.28 days, whereas the prepupal and pupal stages lasted on the average about 0.43 and 6.89 days, respectively.

During the first 48 hours after parasitism, slight differences occurred in the body length, body weight and the amount of food eaten by the healthy and parasitized *S.littoralis* larvae. This could be attributed to the fact that the parasitoid was still in the egg stage and both the parasitized and unparasitized larvae consumed approximately the same quantity of castor bean leaves. From the 3rd to 7th days of parasitism, the body length, body weight and the amount of food eaten by parasitized larvae gradually increased till the emergence of the parasite, but not with the same degree as compared to unparasitized larvae. However, the parasitized larvae ceased feeding on the eighth day after the larvae of parasite became full grown till the host died. The ratio of the amount of food eaten by the parasitized and unparasitized larvae was 1: 3.16.

Adults of parasitoid were fed on 15% sucrose solution contaminated with 10, 15, 20, 25, 30 and 35 ppm of baythroid for 24 hours. The LC50 values were 19.0 ppm for males and 21.0 ppm for females.

When males and females were fed on 15% sucrose solution contaminated with 4, 8, 12, 16, 20 and 24 x 10<sup>4</sup> S.U. of a delfin negative relationship was observed between their longevities and the concentrations of the bioinsecticides.

Males and females fed on the contaminated solution of 4, 8, 12, 16, 20, and 24 x 10<sup>4</sup> S.U. of delfin each combined with 9.2 ppm (LC10 level of baythroid) the longevities gradually decreased by increasing the concentrations of insecticides.

Generally, there were positive relationships between the present mortality of the treated adults of parasitoid and the different concentrations of delfin, baythroid and combinations of both of them. Also, females were more tolerant than males of the same age and at the same concentrations. Baythroid caused more damage for males and females of the parasitoid than delfin or a mixture of both of them.

## INTRODUCTION

One of the important cotton leafworm, *S.littoralis* parasitoids is the solitary internal larval parasitoid *Microplitis rufiventris* Kok. (Hymenoptera: Braconidae). Also, it parasitizes the lesser cotton worm *Spodoptera exigua* Hbn. and the american bollworm *Heliothis armigera* Hbn.

The biology of *M.rufiventris* has been studied by many authors (Hammad *et al.*, 1965; Shalaby, 1968; Gerling, 1971; Ibrahim, 1974; Tawfik, 1977; Tawfik *et al.*, 1977; El-Minshawy and Hegazi, 1980).

Body size, body length and body weight of the host larvae after parasitism studied by Watanabe (1938), Hafez (1951), Shalaby (1968) and Lewis (1970). The amount of food consumed by parasitized host larvae in comparing to unparasitized ones observed by Rahman (1970), Ahmad *et al.* (1978), Brewer and King (1978), Kares (1991) and El-Sheikh *et al.* (1993).

The effect of *B.thuringiensis* on the adult parasitoids examined by Dunbar *et al.* (1973), Iman *et al.* (1986) and Morallo-Rejesus *et al.* (1992). Several authors studied the susceptibility of the adult parasitoids to different insecticides (Cate, *et al.*, 1972; Kares, 1978; Varter, 1980; Rosenhein and Hoy, 1988; Chiang and Sun, 1991; Stark *et al.*, 1992).

Several authors tested the additive effects of *B.thuringiensis* with different chemical insecticides on adult parasitoids. Hamilton and Attia (1977) mixed dipel with seven pesticides against *Thyraeella collaris* the parasitoid of *P.xylostella*. Iman *et al.* (1986) used *B.thuringiensis* with pyrethroids against *Diadegma eucrophaga* the parasitoid of *P.xylostella* and Shalaby *et al.* (1993) combined baythroid with delfin against six parasitic species *M.rufiventris*, *Z.chlorophthalma*, *Z.nigricornis*, *Exeristes robarator*, *Tachina larvarum* and *Periboea orbata*.

This work was carried out in order to study the duration of the immature stages of the parasitoid, *Microplitis rufiventris* and the effect of parasitization on body length, body weight and the amount of food eaten by *S.littoralis* larvae. Also, the effect of the bioinsecticide (delfin), the chemical insecticide (baythroid) and a combination of different delfin concentrations with LC10 level of baythroid on adults of *M.rufiventris* were studied.

## MATERIALS AND METHODS

### Rearing of the cotton leafworm, *Spodoptera littoralis* (Boisd.)

The rearing technique described by Ibrahim (1974) was followed in this investigation.

### Rearing of the parasitoid, *Microplitis rufiventris* Kok.

Second instar larvae of *S.littoralis* were put in transparent plastic container (4 x 8.5 cm) with plastic ring like cup fittings cut in a special way to hold silky mesh cloth covering tightly on the cup. At the edge of these containers 1cm diameter circular hole was made (the hole is just about 0.5-1cm from the container edge). An aspirator was used to introduce the adult of the parasitoid through the opening hole in the container.

Parasitoid cocoons of *M.rufiventris* and adults were collected from cotton fields and kept under laboratory conditions, cocoons and adults were isolated in glass vial (10 x 3.5 cm in diameter). Droplets of bee honey were scattered over the inner surface of the vials for nutrition of the adults. Vials were covered with muslin tied with a rubber band. The adults emerging from cocoons were left to their meal of honey for 24 hours and also for mating.

By using an aspirator eight fertilized adult females were sucked from the rearing vials, and introduced into the plastic container (through the circular hole) containing 200 second instar larvae of *S.littoralis*. The larvae were exposed to the parasitoid for six hours to ensure that parasitism took place, after which the female parasites were removed. Parasitized larvae of *S.littoralis* were transferred to a clean breeding jar and provided daily, as usual, with fresh and clean castor-bean leaves. The contents of the vial were examined daily to remove the unparasitized larvae whenever found otherwise, they were likely to attack the parasitized ones, on account of their cannibalistic habit. As soon as the last instar larvae of the parasitoid emerged from the host larvae, they pupated inside a cocoon and they were collected into new vials for the emergence of adults.

### Individual parasitism of *S.littoralis* by *M.rufiventris*

For host larvae parasitized by *M.rufiventris*, the individual parasitism (to insure parasitism) was operated on *S.littoralis* larvae of second instar in glass vial (10 x 3.5 cm). The bottom of the vial was covered with a plastic cover, with a pore in the middle for allowing a brush to enter. The vial containing five parasitoid females (they changed from the rearing stock after the parasitism of 50 larvae indi-

vidually) was directed to a fluorescent lamp, and the host larvae mounted, individually, on a fine hair brush introduced inside the glass vial till reaching the adult females. The faeces of the host contaminated in the brush's hair facilitate the attraction between the parasitoid females and the host to complete the parasitization.

#### **Bioinsecticide (Delfin)**

Delfin, a selective bacterial insecticide containing  $53 \times 10^6$  *Spodoptera* Units (S.U.) of *Bacillus thuringiensis* var. *Kurstaki* / g of product was used .

#### **Chemical insecticide (Baythroid)**

Baythroid 5% E.C. Formulation: Emulsifiable cocentrare containing 50g. a.i./ liter.

#### **Mixture: Combination of different concentrations of bioinsecticide and LC<sub>10</sub> of chemical insecticide**

Different concentrations of delfin were prepared and mixed with the sublethal concentration LC<sub>10</sub> of baythroid.

#### **Tests**

##### **Duration of immature stages of *M.rufiventris***

For studying and estimating the duration of the immature stages of parasite about 200 (2nd instar) larvae of *S.littoralis* were exposed daily to 6 mated females of *M.rufiventris*, Kept in the plastic container. The exposed larvae were transferred to rearing vials. A group of 30 exposed host larvae were dissected twice a day and the incubation period, and the larval stadia were sorted and recorded.

##### **Effect of parasitization on *S.littoralis* body length, body weight and the amount of food eaten by the larvae**

Body length, body weight and the amount of food eaten by *S.littoralis* larvae parasitized with *M.rufiventris* were determined daily from the first day of parasitization till the death of the host larvae (due to the emergence of the parasitic larvae), and at the same age for unparasitized *S.littoralis* larvae (from 5 to 13 days old).

Thirty leaves of castor-bean (small, fresh, clean, and 1gm weight) were put each in a glass vial of (10.5 x 3.5cm), ten unparasitized larvae were introduced to each of the first ten vials, and ten parasitized larvae were put in each of the other

ten glass vials, while the last group of ten vials was left without any treatment as control. The opening of each glass vial was covered with towel paper and tied with a rubber band. The leaf in each vial was weighed before introducing the host larvae, then weighed again every 24 hours after being cleaned from the larval faeces. The decrease in weight in the last ten leaves showed the amount of loss in moisture. Consequently, the mean loss in moisture for every leaf could be calculated.

Also, in the same experiment the ten unparasitized and the ten parasitized larvae were weighed and the body length determined every 24 hours till the death of the host parasitized larvae.

#### **Effect of bioinsecticide, chemical insecticide and the combination of both of them on adults of *M.rufiventris***

1. Males and females of *M.rufiventris* which had been isolated as cocoons were treated with the different concentrations of delfin, baythroid and the combinations of different concentrations of delfin and LC<sub>10</sub> of baythroid.
2. For delfin, sugar solution (12% sucrose) contained the same concentrations as for the larvae were used. For baythroid, volumes of 2, 3, 4, 5, 6 and 7 ml of stock solution (500 ppm) were diluted with a constant volume of 100 ml of sugar solution to obtain the concentrations of 10, 15, 20, 25, 30 and 35 ppm. Males and females were treated with the combination of different concentrations of delfin (4, 8, 12, 16, 20 and 24 × 10<sup>4</sup> S.U.) and LC<sub>10</sub> baythroid (of each male and female) in 12% sugar solution.
3. For each treatment 3, replicates of ten females or males of the parasitoid *M.rufiventris* were placed in a glass vial (10 × 3.5 cm) containing 10 droplets of sugar solution containing the desired insecticide concentration scattered on the inner surface.
4. Exposure period to the toxic food lasted for 24 hours (for chemical insecticide) and for 48 hours (for bioinsecticide) after which the survived adult parasitoids were transferred to new vials containing droplets of uncontaminated sugar solution. Mortality counts were recorded daily until the death of all parasitoids.
5. The control tests were conducted using droplets of uncontaminated sugar solution.

These experiments were conducted under laboratory conditions of 28 ± 1°C and 65 ± 4 % R.H.

## **RESULTS AND DISCUSSION**

### **Duration of immature stage of *M.rufiventris***

The incubation period of eggs average about 1.23 days, the first larval instar

3.02, the second 2.47 and the third instar 1.28 days. Whereas the prepupal and pupal stages lasted on the average about 0.43 and 6.89 days, respectively at  $65 \pm 4\%$  R.H., Table 1.

Table 1. Duration of immature stages of *M.rufiventris* at  $28 \pm 1^\circ\text{C}$  and  $65 \pm 4\%$  R.H.

Stage	Duration (days)		Average $\pm$ S.E.
	Minimum	Maximum	
Egg stage	1.00	1.50	$1.23 \pm 0.058$
Larval stage			
First larval instar	2.60	3.50	$3.02 \pm 0.095$
Second larval instar	2.10	2.80	$2.47 \pm 0.068$
Third larval instar	1.00	1.75	$1.28 \pm 0.050$
Total larval instar	6.70	9.55	$6.77 \pm 0.213$
Prepupa	0.35	0.50	$0.43 \pm 0.027$
Pupal stage	6.50	7.25	$6.89 \pm 0.101$
Total developmental period	13.55	17.30	$15.32 \pm 0.399$

#### Effect of parasitization on the body length, body weight and the amount of food eaten by *S.littoralis* larvae

Table 2 indicates that slight differences in body length, body weight and the amount of food eaten among the healthy and parasitized *S.littoralis* existed throughout the first 48 hours of treatments. This could be attributed to the fact the parasitoid was still in the egg stage and that both the unparasitized and parasitized larvae consumed approximately the same quantity of castor bean leaves. The higher body weight of the parasitized *S.littoralis* larvae than the unparasitized ones, may be due to the eggs laid by the parasitoid female inside the host. These results agree with Kares (1991) who reported that both the parasitized and unparasitized *Phthorimaea operculella* larvae consumed approximately the same quantity of food when the parasitoid *A.litae* var. *operculellae* was still in the egg stage inside the host.

From the third to the seventh days of parasitization (the age of host ranged from seven to eleven days), the body length, body weight and the amount of food eaten showed either significant or highly significant difference between the healthy and parasitized *S.littoralis* larvae.

The results show clearly that the body length and body weight of the parasitized

Table 2. The effect of parasitization on body length, body weight and the amount of food eaten by *S. Littoralis*.

Days after parasitization	Age of host larvae in days	Length (cm)			weight (cm)			Eat on castor-bean leaves (g/day) by larvae			Unparasitized : T-test parasitized ratio
		Unparasitized larvae	Parasitized larvae	T-test	Unparasitized larvae	Parasitized larvae	T-test	Unparasitized larvae	Parasitized larvae	T-test	
1	5	0.37±0.02	0.38±0.03	N.S.	0.0063±0.0006	0.0070±0.0002	N.S.	0.025±0.001	0.028±0.002	N.S.	1:0.89
2	6	0.50±0.02	0.48±0.03	N.S.	0.0087±0.0004	0.0074±0.0005	N.S.	0.055±0.002	0.049±0.002	N.S.	1:1.12
3	7	0.70±0.04	0.58±0.03	S.	0.0122±0.0014	0.0087±0.0004	S.	0.100±0.002	0.073±0.003	H.S.	1:1.37
4	8	1.01±0.03	0.90±0.02	S.	0.0189±0.0013	0.0150±0.0004	S.	0.130±0.002	0.085±0.002	H.S.	1:1.53
5	9	1.15±0.05	0.95±0.05	S.	0.0255±0.0008	0.0186±0.0006	H.S.	0.192±0.001	0.091±0.002	H.S.	1:2.11
6	10	1.26±0.03	1.03±0.02	H.S.	0.0333±0.0026	0.0240±0.0007	H.S.	0.205±0.002	0.078±0.002	H.S.	1:2.63
7	11	1.70±0.04	1.08±0.03	H.S.	0.0390±0.0022	0.0278±0.0017	H.S.	0.222±0.002	0.039±0.003	H.S.	1:5.69
8	12	2.061±0.02	1.06±0.03	H.S.	0.0503±0.0032	0.0167±0.0008	H.S.	0.231±0.001	0.000±0.000	H.S.	0:0.23
9	13	2.57±0.02	1.06±0.02	H.S.	0.0760±0.0036	0.0150±0.0006	H.S.	0.239±0.001	0.000±0.000	H.S.	0:0.24
				Total	1.399±0.014	0.443±0.016					1:3.16

N.S. : Insignificant difference

S: Significant difference

H.S. : Highly significant difference

tized larvae gradually increased till the emergence of the parasitoid, but not with the same degree as compared to unparasitized larvae. Our results agree with those recorded by Watanabe (1938), Hafez (1951), Shalaby (1968) and Lewis (1970) who found that parasitized host larvae of *Porthesia similis* (Fuessly) by *Microplitis ceru-rae*., *S.littoralis* by *M.demolitor*, *S.littoralis* by *M.rufiventris* and *Heliothis zea* by *M.croceips*, respectively had small body size, body length and body weight. Rahman (1970) indicated that the larvae of *Pieris rapae* parasitized by the solitary endoparasite *Apanteles rubecula*, ate less than half of the quantity taken by the unparasitized larvae. Ahmad *et al.* (1978) found that *Lymantria dispar* parasitized by *A.melanoscelus* between the 3rd and the 17th day, consumed less diet than the unparasitized ones. Brewer and King (1978) observed that *Diatraea saccharalis* larvae parasitized by *Lixophaga diatraeae* consumed less food and gained less weight than unparasitized ones. Kares (1991) reported that the parasitized *Phthorimaea opercul-ella* larvae between the 5th and 14th days ate less food than the unparasitized ones. Also, El-Sheikh *et al.* (1993) indicated that *Mythimna (= Leucania) loreyi* (Dup.) larvae parasitized by *Meteorus gyrator* Thun. consumed less food and gained less weight than healthy 5 days, 7 days and 9 days old larvae.

Table 2 also, indicates that the two days after emergence of full grown larval parasitoid, the body length, body weight and the amount of food eaten were higher and different significantly between the healthy and parasitized *S.littoralis* larvae. However, the parasitized larvae ceased feeding on the the eighth day after emergence of full grown larval parasitic till the host died. Our findings agree with those of Swan (1964) who indicated that the gypsy moth *L.dispar* larvae parasitized by *A.melanoscelus* ceased feeding before death. Rahman (1970) noticed that when *P.rapae* larvae were parasitized by *A.rubecula*, consumption index started declining above 2 days before the parasite emerged. El-Sheikh *et al.* (1993) showed that *M.loreyi* parasitized by *M.gyrator* stopped feeding about 1-2 days before the parasitoid's emergence.

Also, from our results the total ratio of the amount of food eaten between the parasitized *S.littoralis* larvae by *M.rufiventris* and the unparasitized ones was 1: 3.16, Table 1.

#### **Effect of delfin, baythroid and the combination of them on the adult parasitoids of *M.rufiventris***

Males and females of the parasitoid, *M.rufiventris* were treated after the 1st



day of their emergence from cocoons with delfin, baythroid and combination of different concentrations of delfin with calculated LC<sub>10</sub> level of baythroid.

#### a. Effect of baythroid against the adult parasitoids

The corrected mortality of adult parasitoids fed on 15% sucrose solution contaminated with baythroid and the data are presented in Table 3.

Table 3. The effect of baythroid against adult parasitoids (males and females) of *M.rufiventris*.

Concentration	Males	Females
0.00	6.66	3.33
10	14.29	13.33
15	32.14	30.00
20	53.57	50.00
25	67.86	63.33
30	78.57	73.33
35	89.29	80.00
LC50	19.0 ppm	21.0 ppm
Slope	1.75	1.8
Confidence limits at (P=0.05)		
LC50	21.28 : 16.96	23.73:18.58
Slope	1.18 : 1.06	1.19:1.07

Computed from 24 hours of the mortality data.

Similar to our results, Cate et al. (1972) indicated that monocrotophos aldicarb and disulfoton (applied topically and orally) were toxic to the adult parasitoid *Campoletis perdinctus*. Kares (1978) found that the oral administration of tamaron, cyolane and tokuthion in sugar solution was toxic at all the tested concentrations to females of the larval parasitoid *M.rufiventris* and the egg, larval parasitoid *C.inanitus*, the parasitoids of *S.littoralis*. While Zaki et al. (1987) proved that dimilin and dowco 439 reduced the adult longevity of the braconid *Bracon brevicornis*, the parasitoid of *S.exigua*. Also, Rosenhein and Hoy (1988) mentioned that the organophosphorous compounds reduced the longevity of the parasitoid *Aphytis melinus* De Bach by 73-85% and depressed progeny production. Chiang and Sun (1991) indicated that both *A.plutellae* and *Diadegma semiclausum*, the parasitoid of *P.xylostella* were

susceptible to malathion and methyl parathion. In addition, Morallo Rejesus *et al.* (1992) found malathion, metamidophos, cartap and deltamethrin were toxic to *Cotesia plutellae* and *D.semiclausum*, the parasitoid of *P.gossypiella*. Dejiu *et al.* (1992) found that *D.eucerothaga* treated with sublethal doses of nomolt (25 ppm) was significantly lower than the untreated one, but was not significantly different as compared to that treated with 20 ppm of cypermethrin.

#### b. Effect of delfin on adult longevities

Data presented in Table 4 indicate that adult males and females fed on 15% sucrose solution contaminated with different concentrations of delfin showed insignificant effect as compared to control at low concentrations of 4, 8, 12 and  $16 \times 10^4$  S.U. The longevities were  $7 \pm 0.47$ ,  $6.6 \pm 0.16$ ,  $6.4 \pm 0.16$ , and  $5.8 \pm 0.22$  days for males and  $8.6 \pm 0.16$ ,  $8.6 \pm 0.27$ ,  $8.4 \pm 0.16$  and  $8.4 \pm 0.27$  days for females at the same concentrations, respectively.

Table 3. Effect of delfin and combination of both delfin concentrations and LC10 laythroid on the longevity of adult parasitoids.

Concentration	Adult Parasitoid longevity (days)	
	Males Average $\pm$ S.E.t-Test*	Females Average $\pm$ S.E.t-Test*
(S.U.)	<b>Bioinsecticide</b>	
0.00	$7 \pm 0.76$	$8.8 \pm 0.13$
$4 \times 10^4$	$7 \pm 0.47$ N.S.	$8.6 \pm 0.16$ N.S.
$8 \times 10^4$	$6.6 \pm 0.16$ N.S.	$8.6 \pm 0.27$ N.S.
$12 \times 10^4$	$6.4 \pm 0.16$ N.S.	$8.4 \pm 0.16$ N.S.
$16 \times 10^4$	$5.8 \pm 0.22$ N.S.	$8.4 \pm 0.27$ N.S.
$20 \times 10^4$	$5.2 \pm 0.13$ S.	$7.8 \pm 0.39$ S.
$24 \times 10^4$	$5.0 \pm 0.21$ S.	$7.4 \pm 0.45$ S.
S.U. + ppm	<b>Combined effect of delfin + LC10 baythroid</b>	
0.00	$7 \pm 0.76$	$8.8 \pm 0.13$
$4 \times 10^4 + 9.2$	$5.8 \pm 0.22$ N.S.	$8.2 \pm 0.33$ N.S.
$8 \times 10^4 + 9.2$	$5.6 \pm 0.27$ N.S.	$8.0 \pm 0.42$ N.S.
$12 \times 10^4 + 9.2$	$4.2 \pm 0.77$ S.	$7.6 \pm 0.45$ S.
$16 \times 10^4 + 9.2$	$4.2 \pm 0.65$ S.	$7.0 \pm 0.76$ S.
$20 \times 10^4 + 9.2$	$3.6 \pm 0.17$ H.S.	$6.0 \pm 1.10$ S.
$24 \times 10^4 + 9.2$	$3.2 \pm 0.42$ H.S.	$4.8 \pm 0.98$ H.S.

\* t-Test between the average of control and that of each concentration.

The male and female longevities decreased gradually by increasing the delfin concentrations. At higher concentrations of 20 and 24 x 10<sup>4</sup> S.U., the longevities were significantly different as compared to 5.2 ± 0.13 and 5.0 ± 0.21 days for males and 7.8±0.39 and 7.4±0.45 days for females, respectively.

The data clearly indicate that females had longer life spans than males at the same age and the same concentrations of treatment. Consequently, the females are more tolerant than males under the same conditions.

Dunbar et al. (1973) found that the *Bacillus* was non toxic to *A.melanoscelus* (the parasitoid of the gypsy moth *L.dispar*). Also, Thoms and Waston (1986) indicated that the mean duration of the pupal and adult stages for *Hyposoter exiguae* emerging from *Bacillus* treated host larvae of *Heliothis virescens* were generally not significantly different from those of the control, thus *B.thuringiensis* did not appear to be pathogenic to the parasitoids. Morallo-Rejesus et al. (1992) observed that *B.thuringiensis* var. *Kurstaki* was relatively non toxic to both *Cotesia plutellae* and *Diadegma semiclausum* the parasitoids of *P.xylostella*.

### c. Effect of the combinations of delfin with LC<sub>10</sub> of baythroid on adult longevities

The longevities of males and females fed on contaminated solution with the mixture of delfin and LC<sub>10</sub> baythroid were insignificantly different as compared to the control at the two low concentrations of 4 and 8 x 10<sup>4</sup> S.U. + 9.2 ppm. The longevities were 5.8±0.22 and 5.6±0.27 days for males; 8.2 ± 0.33 and 8.0±0.42 days for females at the same concentrations, respectively. While at the concentrations of 12 and 16 x 10<sup>4</sup> S.U. +9.2 ppm, the longevities were significantly different as compared to the control (4.2±0.77 and 4.2±0.65 for males; 7.6±0.45 and 7.6±0.76 for females, respectively). At higher concentrations of 20 and 24 x 10<sup>4</sup> S.U. + 9.2 ppm, the longevities for males were highly significantly different as compared to the control. Their were 3.6±0.17 and 3.2 ± 0.42 days, respectively. However, females showed significant differences at the concentration of 20 x 10<sup>4</sup> S.U. + 9.2 ppm and highly significant differences at 24 x 10<sup>4</sup> S.U. + 9.2 ppm. The longest life spans were 6.0 ± 1.10 and 4.8 ± 0.98 days, respectively, Table 4.

Iman et al. (1986) observed that a mixture of pyrethroids with the microbial insecticide had a less adverse effect on *D.eucerothaga* the parasitoid of *P.xylostella*.

Generally, the above mentioned results prove the existance of a positive relationship between the present mortality of the treated adult parasitoids and the dif-

ferent concentrations of delphin, baythroid and the combination of them. Also, females were more tolerant than males of the same age and at the same concentration. Additionally, baythroid caused more damage to male and female parasitoids than delphin or the mixture of both of them.

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## دراسات بيولوجية وسمية على طفيل ميكروبلتيس روفيفنترس

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كان متوسط فترة الحضانه لبيض طفيل ميكروبلتيس روفيفنترس ١.٢٣ يوما تقريبا، بينما كان العمر اليرقى الاول ٣.٠٢ يوما والثانى ٢.٤٧ يوما كما كان متوسط العمر اليرقى الثالث ١.٢٨ يوما بينما كان متوسط اعمار مرحلة ما قبل العذراء والعذراء ٠.٤٣ . . يوما ٦.٨٩ يوما على الترتيب وذلك عند درجة حرارة ٢٨ م ورطوبة ٦٥ ± ٤٪.

خلال الـ ٤٨ ساعة الاولى بعد التطفل، ظهر اختلاف طفيف فى طول ووزن وكمية غذاء دودة ورق القطن سواء غير المتطفل عليها او المتطفل عليها، ويشير هذا الى انه عندما يكون الطفيل فى مرحلة البيضة تستهلك اليرقات المتطفل عليها وغير المتطفل عليها تقريبا نفس كمية الغذاء. ويتزايد من اليوم الثالث حتى اليوم السابع من التطفل طول الجسم تدريجيا وكذا وزنه وكمية غذاء اليرقات المتطفل عليها ولكن ليس بنفس درجة اليرقات غير المتطفل عليها. وايضا تتوقف اليرقات المتطفل عليها عن الغذاء فى اليوم الثامن بعد خروج يرقات الطفيل الناضجة وحتى موت يرقات العائل وكانت النسبة الكليه لكمية الغذاء المستهلكه بين اليرقات المتطفل عليها الى غير المتطفل عليها ١ : ٣.١٦ .

تم تغذية الحشرات الكاملة للطفيل لمدة ٢٤ ساعة على ١٥٪ من المحلول السكرى المحتوى على تركيزات البايثرويد بنسبة ١٠ ، ١٥ ، ٢٠ ، ٢٥ ، ٣٠ ، ٣٥ جزء فى المليون. وكان التركيز القاتل لـ ٥٠٪ من اليرقات هو ١٩ جزء من المليون للذكور و ٢١ جزء من المليون للاناث.

وكذلك عندما تغذت ذكور واناث الطفيل على ١٥٪ من المحلول السكرى على المبيد البكتيرى بنسبة ٤ ، ٨ ، ١٢ ، ١٦ ، ٢٠ ، ٢٤ ، ١٠ x وحدة اسبوديترا، لوحظ وجود علاقة سالبة بين طول عمر الحشرات الكاملة للطفيل وتركيزات المبيد البكتيرى.

وقد لوحظ نقص تدريجى فى طول عمر الطفيل بزيادة المبيد وذلك عندما تغذت ذكور واناث الطفيل على محلول ملوث بخليط المبيد البكتيرى عند التركيزات ٤ ، ٨ ، ١٢ ، ١٦ ، ٢٠ ، ١٠ x وحدة اسبوديترا مع تركيز المبيد القاتل لـ ١٠٪ من اليرقات.

يتضح من هذه الدراسة وجود علاقة موجبه بين نسبتي موت حشرات الطفيل المعالجة والتركيزات المختلفة لكل من المبيد البكتيرى والمبيد الكيماى والخليط منهما. وجد أن اناث الطفيل اكثر تحملا من الذكور عند نفس العمر وعند معالجتها بنفس التركيزات. ولكن تسبب البايثرويد فى تدمير اكثر من ذكور واناث الطفيل عنه عند استخدام الديلفين او خليط منهما.