

<http://www.pjbs.org>

**PJBS**

ISSN 1028-8880

**Pakistan  
Journal of Biological Sciences**

**ANSI***net*

Asian Network for Scientific Information  
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

## Effectiveness of *Microplitis mediator* (HYM. : Braconidae) Against its Hosts *Agrotis segetum* and *A. ipsilon* (Lepidoptera: noctuidae)

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### Abstract

Three days old female of *Microplitis mediator* (Haliday) parasitized 5 days old 2.7, 5.6, 8.7, 9.0 larvae of *Agrotis segetum* and 1.8, 4.0, 7.7, 9.2 *A. ipsilon* larvae in 1, 3, 6 and 12 hours duration respectively. The parasitic female of the same age parasitized 7.1, 8.7, 2.9, 1.4 *Agrotis segetum* and 6.7, 7.6, 3.2, 1.1 *A. ipsilon* larvae of 3, 5, 7, and 10 days old in 6 hours duration respectively. The female parasitized 2.9, 8.7, 8.0, 7.7 *A. segetum* and 4.4., 7.6, 8.8, 10.0 *A. ipsilon* out of 5, 10, 15 and 20 number of each host larvae in 6 hours duration respectively. The female parasitized 37.8, 34.6, 33.6 *A. segetum* and 29.2, 26.6, 25.4 *A. ipsilon* larvae till her death at  $20 \pm 2^\circ\text{C}$ ,  $25 \pm 2^\circ\text{C}$  and  $30 \pm 2^\circ\text{C}$  and 60 - 70 percent r.h. and 14 hours light respectively.

### Introduction

*Microplitis mediator* (Haliday) parasitizes about 40 different hosts in Asia and Europe (Shenefelt, 1972). Khan and Ozer, (1988) recorded it for the first time from *Agrotis segetum* and *A. ipsilon* in Ankara, Turkey and they also studied its biology by using *Agrotis segetum* (Schiff) as its host. Khan (1994) determined the food consumption and utilization by larvae of *Agrotis segetum* parasitized by *M. mediator* and compared that with the un-parasitized ones. The present study was conducted to determine the effectiveness of this parasite against its hosts *A. segetum* and *A. ipsilon*, so that it may be used in the biological control of these pests.

### Materials and Methods

Mass culture of *Agrotis segetum* and *A. ipsilon* were done by using the methods described by Shahid and Khan (1977) and Kaya (1979).

The experiments were conducted in environmental chambers at  $25 \pm 2^\circ\text{C}$ , 60 - 70 percent r.h. and 14 hours light and replicated 10 times. The parasitization was done in glass jars of 300 ml capacity, which opening was covered with muslin cloth with the help of rubber band. For this purpose 3 days old *Microplitis mediator* mated females were used as parasite. *A. segetum* and *A. ipsilon* larvae were used separately.

**Effect of Duration on the Parasitization:** In this case 3 days old larvae of both hosts were held for 1,3,6, and 12 hours with the mated parasitic female. After parasitization these larvae were reared at  $25 \pm 12^\circ\text{C}$ , 60-70 percent r.h. and 14 hours light for 4 days and then dissected under binocular stereoscopic microscope in the saline solution to determine the number of parasitized ones on the basis of presence of the parasitic larvae in their bodies.

**Effect of Host Age on the Parasitization:** To determine the effect of host age on the parasitization of *A. segetum* and *A. ipsilon* by *M. mediator*, 3,5,7 and 10 days old larvae were held with the parasitic female for 6 hours duration.

These host larvae were then dissected under binocular stereoscopic microscope in saline solution to determine the number of parasitized ones.

**Effect of Host Density on the Parasitization:** In this case 5,10,15 and 20 number of both hosts larvae were kept with the parasitic female for 6 hours duration. The host larvae were reared for 4 days at the above mentioned environmental conditions and then dissected under binocular stereoscopic microscope in saline solution to determine the number of parasitized host larvae.

**Effect of Temperature on the Parasitization:** The experiments were conducted in environmental chambers at  $20 \pm 2^\circ\text{C}$ ,  $25 \pm 2^\circ\text{C}$ ,  $30 \pm 2^\circ\text{C}$ , 60 - 70 percent r.h. and 14 hours light and replicated 10 times. For this purpose 5 days old 15 larvae of *A. segetum* and *A. ipsilon* were provided separately daily to the parasitic female just after emergence from pupae till her death and replaced with new ones after each 24 hours intervals at each temperature. The host larvae removed from parasite were reared for 4 days and then dissected under binocular stereoscopic microscope in saline solution to determine the number of parasitized ones. The data were analyzed statistically and significance of differences were determined by LSD test.

### Results and Discussion

The results reveal that both of the hosts were preferred by the parasitic female. There was no significant difference between the parasitized larvae of *Agrotis segetum* and *A. ipsilon*. However, the hosts showed significant difference in the determination of the effect of different temperatures on the parasitization.

**Effect of Duration on the Parasitization:** The parasitic female parasitized 5 days old 1 - 6 with an average 2.7 *A. segetum* and 1 - 3 with an average of 1.8 *A. ipsilon* larvae in an hour duration. In 3 hours it parasitized 2 - 8 with an average 5.6 *A. segetum* and 3 - 8 with an average 4.0 *A. ipsilon*

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larvae. During 6 hours the female parasitized 8 - 10 with an average 8.7 *A. segetum* and 5 - 9 with an average 7.7 *A. ipsilon*, while in 12 hours 7 - 10 with an average 9.0 *A. segetum* and 8 - 10 with an average 9.2 *A. ipsilon* larvae (Table 1).

According to the statistical analysis the parasitic female parasitized significantly less number of both hosts compared to parasitized in 3, 6 and 12 hours durations. The number of hosts larvae parasitized in 3 hours also significantly different from that of parasitized in 6 and 12 hours durations. The *A. segetum* larvae parasitized in 6 and 12 hours durations were found non-significantly different from each other, while *A. ipsilon* larvae were found different significantly at these tested durations. These results reveals that the number of parasitized hosts were increased with the increase of captivity time duration from one hour up to 12 hours.

Table 1: Effect of captivity duration on parasitization

Duration (Hours)	<i>Agrotis segetum</i>		<i>Agrotis ipsilon</i>	
	Range	Mean ± SE	Range	Mean ± SE
1	1 - 6	2.7±0.45 C	1 - 3	1.8±0.24 D
3	2 - 8	5.6±0.57 B	3 - 8	4.0±0.47 C
6	8 - 10	8.7±0.25 A	5 - 9	7.7±0.40 B
12	7 - 10	9.0±0.32 A	8 - 10	9.2±0.24 A

Means followed by different letter are significantly differ from each other at P = 0.01.

**Effect of Host Age on the Parasitization:** Table 2, indicates that the parasitic female preferred 5 days old larvae of both hosts, as it parasitized 8-10 with an average 8.7 *A. segetum* and 4-9 with an average 7.6 *A. ipsilon* larvae. The next preferred age stage of host larvae was 3 days. At this age stage it parasitized 5-9 with an average 7.1 *A. segetum* and 5-9 with an average 6.7 *A. ipsilon*, The number of parasitized larvae in the of 7 days were 1-7 with an average 2.9 *A. segetum* and 1 - 6 with an average 3.2 *A. ipsilon*. The 10 days old larvae were least preferred by parasite, as it parasitized 1 - 3 with an average 1.4 *A. segetum* and 1 - 2 with an average 1.1 *A. ipsilon*.

Table 2: Effect of host age on the parasitization

Host age (Days)	<i>Agrotis segetum</i>		<i>Agrotis ipsilon</i>	
	Range	Mean ± SE	Range	Mean ± SE
3	5 - 9	7.1±0.41 B	5 - 9	6.7±0.35 A
5	8 - 10	8.7±0.25 A	4 - 9	7.6±0.47 A
7	1 - 7	2.9±0.57 C	1 - 6	3.2±0.44 B
10	1 - 3	1.4±0.21 C	1 - 2	1.1±0.09 C

Means followed by different letter are significantly differ from each other at P = 0.01.

Statistical analysis of the data show that the parasitic female parasitized significantly more hosts larvae of 5 days old. The next preference was given by the parasitic female

to 3 days old host larvae. No significant difference was recorded in number of parasitized larvae of these two age groups in case of *A. ipsilon*. However, the female parasitized significantly more number of *A. segetum* larvae of 5 days old compared to 3 days old. The parasite significantly least preferred 7 and 10 days old as very less number of larvae were found parasitized by the parasite in 6 hours duration. However, no significant difference was found in the number of parasitized *A. segetum* larvae of these age groups, while in case of *A. ipsilon* the parasitized larvae in these two groups were found significantly different from each other as more parasitized larvae of 7 days old were found compared to 10 days old larvae.

**Effect of Host Density on the Parasitization:** Female of *M. mediator* parasitized 2 - 5 with an average 2.9 *A. segetum* and 3 - 5 with an average 4.4 *A. ipsilon* out of 5 host larvae. It parasitized 8 - 10 with an average 8.7 *A. segetum* and 6 - 9 with an average 7.6 *A. ipsilon* out of 10 host larvae. Out of 15 and 20 host larvae, it parasitized 6 - 10 with an average 8.0 *A. segetum*, 5 - 11 with an average 8.8 *A. ipsilon* and 5 - 10 with an average 7.7 *A. segetum*, 6 - 11 with an average 10.0 *A. ipsilon* respectively (Table 3).

Table 3: Effect of host density (No. of hosts) on the parasitization

Host density	<i>Agrotis segetum</i>		<i>Agrotis ipsilon</i>	
	Range	Mean ± SE	Range	Mean ± SE
5	2 - 5	2.9±0.30B	3 - 5	4.4±0.21C
10	8 - 10	8.7±0.25A	6 - 9	7.6±0.35B
15	6 - 10	8.0±0.45A	5 - 11	8.8±0.53AB
20	5 - 10	7.7±0.40A	6 - 11	10.0±0.45 A

Means followed by different letter are significantly differ from each other at P= 0.01.

Table 4: Effect of different temperatures on parasitization

Temp.	<i>Agrotis segetum</i>		<i>Agrotis ipsilon</i>	
	Range	Mean ± SE	Range	Mean ± SE
20 ± 2°C	31-46	37.8±1.50A	26-32	29.2±0.65 A
25 ± 2°C	30-37	34.6±0.60AB	23-32	26.6±1.02 B
30 ± 2°C	25-38	33.6±1.31 B	22-29	25.4±0.728

Means followed by different letter are significantly differ from each others at P = 0.01

There was no significant difference in the number of host larvae parasitized in the density of 10, 15 and 20 *A. segetum* larvae offered to the parasite for 6 hours duration. In case of *A. ipsilon* it parasitized more larvae in the density of 20 compare to 15,10 and 5 host larvae. The parasitized larvae in 10 & 15 and 15 & 20 were found non-significantly different from each other. The number of parasitized larvae of both hosts out of 5 offered to the parasitic female was

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significantly different ( $P < 0.01$ ) from the rest of the densities.

**Effect of Temperature on the Parasitization:** The parasitic female started parasitization of host larvae after one day of its emergence from pupa at  $20 \pm 2^\circ\text{C}$ . Maximum number of 4 - 7 with an average of 5.2 *A. segetum* and 4 - 6 with an average of 4.8 *A. ipsilon* were parasitized on 5th day. The rate in number of parasitized host larvae were decreased afterward and reached to 0 - 3 with an average of 1.8 *A. segetum* and 0 - 2 with an average of 1.2 *A. ipsilon* on 13th day of its life.

At  $25 \pm 2^\circ\text{C}$  the parasitic female started parasitization of host larvae just after a few hours of its emergence from pupa and parasitized 3-5 with an average of 4.0 *A. segetum* and 2-5 with an average of 2.6 *A. ipsilon* on the same day. Maximum host larvae were parasitized by the female parasite in the age of 3 days. It parasitized 9-10 with an average of 9.4 *A. segetum* and 8-9 with an average of 8.4 *A. ipsilon* larvae. The number of parasitized host larvae were decreased with the advancement of age of parasite and reached to 3 - 5 with an average of 3.6 *A. segetum* and 1-3 with an average of 2.2 *A. ipsilon* on 6th day of its life.

The life duration was lasted for very short period at  $30 \pm 2^\circ\text{C}$  as compared to the other low temperatures. It started parasitization just after emergence from pupa and parasitized 6-9 with an average of 7.2 *A. segetum* and 5-8 with an average of 6.4 *A. ipsilon* larvae on the same day. On second day of its life the female parasitized 8-10 with an average of 9.0 *A. segetum* and 7-9 with an average of 7.8 *A. ipsilon*. On the 5th day the female parasitized 2-5 with an average of 3.0 *A. segetum* and 1-3 with an average of 2.0 *A. ipsilon* larvae. At  $20 \pm 2^\circ\text{C}$  the parasitic female lived for longer duration and it parasitized a total of 31- 46 with an average of 37.8 *A. segetum* and 26 - 32 with an average of 29.2 *A. ipsilon* larvae during its life period. At  $25 \pm 2^\circ\text{C}$  it parasitized a total of 30-37 with an average of

34.6 *A. segetum* and 23-32 with an average of 26.6 *A. ipsilon* hosts while at  $30 \pm 2^\circ\text{C}$  it parasitized a total of 25.38 with an average of 33.6 *A. segetum* and 22 - 29 with an average of 25.4 *A. ipsilon* hosts larvae (Table 4). Statistical analysis of the results reveal that the parasit female parasitized significantly higher number of host larvae at  $20 \pm 2^\circ\text{C}$ . While the number of host larvae were parasitized at  $25 \pm 2^\circ\text{C}$  and  $30 \pm 2^\circ\text{C}$  were non-significant different from each others.

It is concluded from this study that the parasite can be successfully mass-cultured in the laboratory for biological control of *Agrotis segetum* and *A. ipsilon* at  $20 \pm 2^\circ\text{C}$ , 60 to 70 percent r.h. and 14 hours light. For this purpose the parasitic female be held with 5 days old 20 hosts larvae for 12 hour.

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