

## **Influences of Several Insecticides on Survival of**

### ***Lysiphlebus japonicus*\***

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When pesticides are used to control soybean aphids, a fraction of larvae, pupae (mummies) and adults of *Lysiphlebus japonicus* survive. To understand the influence of pesticides on the development of those surviving parasitoids, we carried out toxicity experiments of pesticides commonly used in the field and surveyed the survival of parasitoids.

### **1. Materials and Methods**

**1.1 Insecticides:** 2.5% Deltamethrin, 80% Dichlorvos, and 40% Omethoate.

**1.2 Methods:** One hundred clean soybean plants (30 cm high) were used in the experiments. After inoculation of 30 late soybean aphids on each plant, the plants were covered with nylon screen to protect soybean aphids from natural parasitism. Parasitoids were inoculated as soybean aphids were 2-3 instar. After parasitoids developed to larval or mummy stage, regular volume of diluted pesticides were sprayed on the soybean plants. Clean water was sprayed as control. All plants were individually labeled and covered with nylon screen after spray. Survey was conducted 4 h after spray. Mortality, emergence rate, development speed, fecundity, sex ratio and life span were surveyed once every afternoon, and 1000 parasitoids were counted in each experiment.

### **2. Results and Analysis**

#### **2.1 Survival of adult parasitoids**

Over 90% of parasitoids treated with pesticides were killed and this result was significantly different from control. Surviving adult parasitoids were stagnant and feeble, but these symptoms disappeared gradually after 3-5 d. They were not able to mate and lay eggs, and died quickly. Female parasitoids had a better resistance to pesticides. Parasitoids in the control groups had normal behaviors (Table 1).

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\* Note from translator: *Lysiphlebus japonicus* was a synonym of *Lysiphlebia japonica*.

Table 1 Survival of adult parasitoids

Treatment	No. adult parasitoids treated	No. dead adults 6 h after treatment	No. adults alive		Mortality (%)
			Female	Male	
3.5% Deltamethrin 2000 x	1,000	987	1	22	98.7
80% Dichlorvos 1000 x	1,000	921	6	73	92.1
40% Omethoate 800 x	1,000	903	19	78	90.3
Water	1,000	3	520	467	0.3

Note: Virgin adult parasitoids (2 d after emergence) were used in all experiments.

## 2.2 Influence of poisoned parasitoid larvae on the survival

Soybean aphids died immediately after poison because parasitized aphids had reduced their resistance to pesticides. Larval parasitoids died with their hosts, but the survival of late larvae were about 23% and this may be attributed to the fact that larval parasitoids had finished feeding on the aphid hosts. Only 45% of surviving late larvae became mummies, but they developed significantly slowly.

Table 2 Survival of larval parasitoids

Treatment	Mortality of young larvae (%)	Mortality of late larvae (%)	Mummification rate (%)	Mummification speed (day)	Emergence rate (%)
Dichlorvos 1000 x	97	77	0	7.5 ± 2	13
Omethoate 800 x	94	81	43	6.5 ± 1.5	0
Deltamethrin 2000 x	98	72	37	8 ± 2	0
Water	0	0	100	5 ± 1	89

Note: Development speed refers to the time interval from late larva to mummy.

All pesticides caused high mortality to young larval parasitoids (Table 2). Some of late larvae survived from the pesticides, but only few were able to develop as mummies.

## 2.3 Mummy development, emergence, sex ratio and fecundity of parasitoids

Because of the protection of mummy shell, the mortality of parasitoid mummies was only 15%, but pesticides permeating into aphid hosts affected pupal development and emergence and fecundity of adult parasitoids (Table 3).

Table 3 Survival of mummies

Treatments	Mummies treated	Emergence rate (%)	Sex ratio (♀ : ♂)	Eggs per female	Emergence time (day)
Dichlorvos1000 x	1,000	87.6	1:1.7	72	7
Omethoate 800 x	1,000	67.7	1:2.3	67	7
Deltamethrin 2000 x	1,000	74.4	1:2.4	84	8
Water	1,000	96.7	1:1.4	107	6

Omethoate and Deltamethrin led to higher mortality and lower emergence rates of mummies and more time to emerge than Dichlorvos. Adult parasitoids laid fewer eggs and, had lower sex ratios (about 1:2.3) and about 3 d delay of development when treated with Omethoate and Deltamethrin. However, Dichlorvos had little influence on mummies. Adult parasitoids laid eggs normally and had normal sex ratios.