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Biological characteristics and control effect of *Lysiphlebia japonica* [Hym.: Braconidae] on *Aphis glycines* [Hom.: Aphididae]*

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Lysiphlebia japonica is the vital natural enemy of soybean aphid *Aphis glycines* in Jilin Province. Investigation of *Lysiphlebia japonica* was conducted during 1979-1992, and the results were shown as follows.

1. Natural control effect of *Lysiphlebia japonica* on *Aphis glycines*

Parasitism rate of *Lysiphlebia japonica* on soybean aphid is high in nature. The systematic investigations in 1985-1990 found the parasitism rates were 10.3-52.6% in the fields. *Lysiphlebia japonica* could control effectively the soybean aphids in the early season while the aphids developed normally, and significantly depress the aphid density of next generation. For example, the aphid density of first generation was 237 per 100 plants in 1980, and the parasitism rate was 34.2%. The aphid density of second generation was low, and 2447 aphids were found per 100 plants on 6/30. The aphid density of first generation was 231 per 100 plants in 1983, and the parasitism rate was 11.3% only. The aphid density of second generation was up to 8474 per 100 plants on 6/30. The parasitism rates varied in different year and different environment (see table).

Natural parasitism rates of *Lysiphlebia japonica* on *Aphis glycines* (6/25)

Environments	Parasitism rates (%)				
	1985	1986	1987	1989	1990
Monoculture (black soil)	11.7	14.7	13.2	16.2	10.3
Monoculture (sandy soil)	47.6	52.3	47.8	51.4	47.2
Interplant	52.6	50.4	45.6	48.3	50.1
Monoculture (optimal growing conditions)	17.4	20.1	19.3	21.4	21.2
Monoculture	24.5	20.7	21.2	18.6	17.6

Notes: Investigations were performed in the same site on 6/25 every year. Twenty spots and 1000 aphids were checked each plot.

2. Biological characteristics of *Lysiphlebia japonica*

(1) Development time and duration

Development time: Overwintering adult wasps emerged in mid-late April, developed 1-2

* Note from translator: The author seemed to misspell the generic name of the parasitoid as *Lysiphleia* in stead of *Lysiphlebia*.

generations on the weeds, migrated to the soybean fields and parasitized the soybean aphids in early June, migrated back to the weeds for reproduction in late July, and then the late larvae overwintered in the soybean aphids from mid October. The parasitoids developed 7-8 generation each year.

Development duration: The development duration of parasitoids was as follows under $19 \pm 3^{\circ}\text{C}$ and 60 % R. H., 1-1.5 d, 6-9 d, 4-6 d, and 5-8 d for egg, larva, pupa and adult respectively. Each generation lasted 12-15 d.

(2) Habits of adult wasp

The pupation rate of wasps was high. The pupation rates were up to 97 % except that the overwintering generation and forth generation had high hyperparasitism rates. The pupation rates were over 80 % even after the wasps were stored 15 d at 2 and 4°C . Most adult wasps emerged before 10 am and they accounted for over 77.5 % of all adults. The adults had strong tendency to light and their activities were affected by light and temperature. They moved around and laid eggs at 12°C in the field, and flew at 17°C . The adults were very active when the temperature went up to 23°C , but they stayed motionless on the back of plant leaves at 28°C . The adults preferred to move from 7 to 11 am and after 3 pm, and moved during the whole day if it was cloudy. The light rain did not affect on their activities. The wasps preferred to parasitize 2-3 instar larvae, but they also parasitized the alatae when the hosts were not enough. The aphids still fed on the soybean for 3-4 d after being parasitized. The aphids moved slowly 4 d later, stopped feeding and then became light brown mummies gradually. Usually the adult wasps could lay eggs after emergence.

(3) Sex ratio and reproductive ability

The sex ratios varied significantly in different generations. The first generation after overwintering had a sex ratio (female:male) of 1:2.4, and on average per female wasp produced 147 eggs. The sex ratios of the second and third generations were about 1:1.3, and 234-357 eggs were produced per female. The sex ratio was not stable because of the high parasitism rate in the forth generation. The sex ratio was about 1:1.1-1.3 when the wasps migrated back to the weeds in mid July, and 150-300 eggs were produced and only 1 egg was laid in each host.

3. Hyperparasitism and natural predacious enemies

Aphisencyrtus aphidivorus, *Ceraphron* ?(translator: species name unclear) and *Pachyneuron aphidis* Bonche were the main hyperparasites of *Lysiphlebia japonica*. They were found mostly in mid and later July, and the hyperparasitism rates varied in different year. The hyperparasitism rate was 83.4 % in 1987, but usually it was about 27.6 %. The hyperparasitism rate in monoculture field of soybean was higher than that of interplant, and sandy soil field had higher hyperparasitism rate than black soil field. The predacious enemies included mainly ladybugs, lacewings and spiders.

4. Protection of overwintering *Lysiphlebia japonica*

The natural survival rates of overwintering *Lysiphlebia japonica* were only 20.5-31.7 %, 63.2-72.3 %, and 57.9-71.4 % in black soil fields, sandy soil fields, and sun-facing fields, respectively. Experiments of protection of overwintering wasps were conducted in 1990-1992. The parasitoid pupae were stored in vacant houses, basements and outdoor grooves. The survival rates of pupae were over 90 % in the basement and vacant houses, and the emerged wasps were strong with high capacity of laying eggs and high sex ratios (female:male).