

Correlation between Aphids, Aphidiinae and Hyperparasitoids in Different Habitats

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Aphids are one of the major pests of economical crops in China. Field surveys showed that *Macrosiphum avenae*, *Rhopalosiphum padi*, *Schizaphis graminum*, *Myzus persicae*, *Aphis glycines* and *Lipaphis erysimi* are the main aphid species found in agricultural fields. Besides lady beetles and spiders, aphidiine braconids also play an important role in controlling aphids, including *Ephedrus plagiator*, *E. nacheri*, *Aphidius euenae*, *Diaeretiella rapae*, *A. ervi*, and *A. picipes*. However, Aphidiinae are also attacked by many hyperparasitoids, which include *Aphidencyrthus aphidivorus*, *Pachyneuron aphidis*, *Asaphes vulgaris*, *Lygocerus koebelae* and *Figites* sp.

1 Materials and methods

1.1 Field surveys

In May 1995, representative plots were chosen for survey in the Farm of Huazhong Agricultural University. Five-spot sampling technique was applied in the survey. A number of aphids and mummies were checked in soybean, wheat, and oilseed rape fields, and brought back to the lab for further observation. Because aphids tended to feed on the young parts of plants, aphids and mummies were collected from young leaves only, and the whole leaves were cut with aphids and mummies together.

1.2 Aphid rearing

The leaves with aphids and/or mummies were put into glass jars covered by gauze with wet filter paper laid at the bottom. The jars were placed in environmental chambers maintained at 21°C. The leaves on which aphids fed were changed every 2 d and they all were taken from the same fields where aphids were collected. Water was sprayed into the jars to maintain humidity. Fresh leaves were provided until all aphidiine braconids and hyperparasitoids emerged. Counts of aphids, aphidiines and hyperparasitoids were made after all of them died.

2. Results and analysis

Parasitoids usually began to emerge during the 2nd day after collection from the fields, and emerged mostly at 3rd-4th day with one more peak at 6th day. Aphidiines emerged in the first peak while hyperparasites emerged in the second one. The study revealed that population density of aphidiines increased with growth of aphid population in different plots. This fact showed aphidiines played a large role in controlling aphids. When aphid density was over 201 (per leaf) in soybean fields, the mummification rates almost increased steeply as aphid populations grew. In wheat fields, mummies increased rapidly only if aphid densities were within certain range, while the number of mummies had a slow growth if aphid densities were

above or below this range. The results showed that aphidiines in wheat fields had the highest parasitism rate when aphid density was in a certain range. Higher hyperparasitism rates in wheat fields may have affected the controlling efficacy of aphidiines on aphids. In oilseed rape fields, aphidiine braconids were important in suppressing aphid populations with mummification rates up to 80%. Hyperparasitoids increased slowly with growth of the aphidiine population. Thereafter, under the circumstance of not considering other natural enemies, aphidiine braconids can be used to control aphids in early summer. Hyperparasitoids had a negative affect on the populations of aphidiines, and decreased the density of aphidiines and the parasitism rates of the next generation, which led to weak control of aphidiine braconids on aphids and a rapid increase of aphid density.

Key words: aphids, Aphidiinae, hyperparasitoids, correlation