Number 94, 1982 ISSN 0362-0069

New York's Food and Life Sciences Bulletin

Cornell University Agricultural Experiment Station, New York State College of Agriculture and Life Sciences, a Statutory College of the State University, at Cornell University, Ithaca, New York

Establishment of a European Lady Beetle in New York State

1. An adult *Coccinella septempunctata* feeding on aphids

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Many of our serious agricultural and forest insect pests in North America have been accidentally introduced from other parts of the world (e.g., the European corn borer, gypsy moth, alfalfa weevil, and Japanese beetle). A relatively neglected method of controlling these introduced pests is the importation and release of natural enemies from the pest's homeland. Such a method is termed *classical biological control.*

As a means of insect pest management, classical biological control shares the advantages of other biological control methods in that (1) no harmful chemical residues are introduced in the environment; (2) the insect pest cannot develop resist ance to the beneficial species because the natural enemy adapts as the pest changes; (3) once a biological control agent becomes established, the control of the pest is usually permanent; and (4) a small initial investment in biological control usually results in" a large return in the safe, permanent management of an insect pest.

As early as the late 1800s classical biological control was recognized as an important insect pest management tactic when the importation of the predacious vedalia beetle saved the citrus industry in California from the cottonycushion scale. Since then this tactic has been used successfully against a number of insect pests (1). Using this method, we recently released and established the predacious European sevenspotted lady beetle, *Coccinella septempunctata,* in Tompkins County. It is a predator of immigrant aphid pests (e.g., the pea aphid, green peach aphid) and also of native aphid pests (e.g., potato aphid).

The project began in November 1977, when we received approximately 1,000 adult *C. septempunctata* from the USDA Beneficial Insects Research Laboratory at Newark, Delaware. We overwintered these adults in screen cages, insulated with leaves, near the border of alfalfa fields. A second release was made in November 1978. Most of these beetles were overwintered in screen cages near potato fields in Freeville, New York. Periodically, during the spring and summer of 1979, 1980, 1981, and 1982, we searched for the seven-spotted lady beetle in alfalfa and potato fields in the Ithaca, New York area. Our field collections indicate that this beetle can overwinter and develop successfully in upstate New York and that it can contribute to the biological control of many of our aphid pests.

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Life History

The sevenspotted lady beetle belongs to the family Coccinellidae, whose common name is lady beetle, lady bug, or ladybird beetle. Almost all lady beetles are predators and feed on many different kinds of soft-bodied insects (2).

Adult sevenspotted lady beetles are large (about 3/8 of an inch); they have red wing covers with seven black spots and distinctive black and white head markings. Females lay clusters of 10 to 30 yellow eggs on foliage near the insects they prey upon. The larvae grow and moult through 4 stages as they feed on aphid prey; the rate of development is determined by temperature and the quality and quantity of food. The large fourth-stage larvae consume more aphids than the three previous stages combined; subsequently they form immobile pupae from which the adults emerge.

Adult sevenspotted lady beetles overwinter in small aggregations on the ground in litter or under stones near the base of plants. These overwintering sites are usually near the fields in which the beetles fed and reproduced. Studies in England show that the adult beetles begin to move from overwintering sites in early spring and start feeding on aphids in nearby bushes. Gradually the beetles move into field crops and begin to lay their eggs. The closeness of overwintering sites affects the presence of sevenspotted lady beetles in field crops.

C. *septempunctata* produces one or two generations during each season. It is considered a late breeding insect, which may produce a second summer generation in late August or early September. In the Ithaca area, we have observed that adults leave their overwintering sites by the end of May and that adults and larvae are most common in alfalfa and potato fields during late July and August.

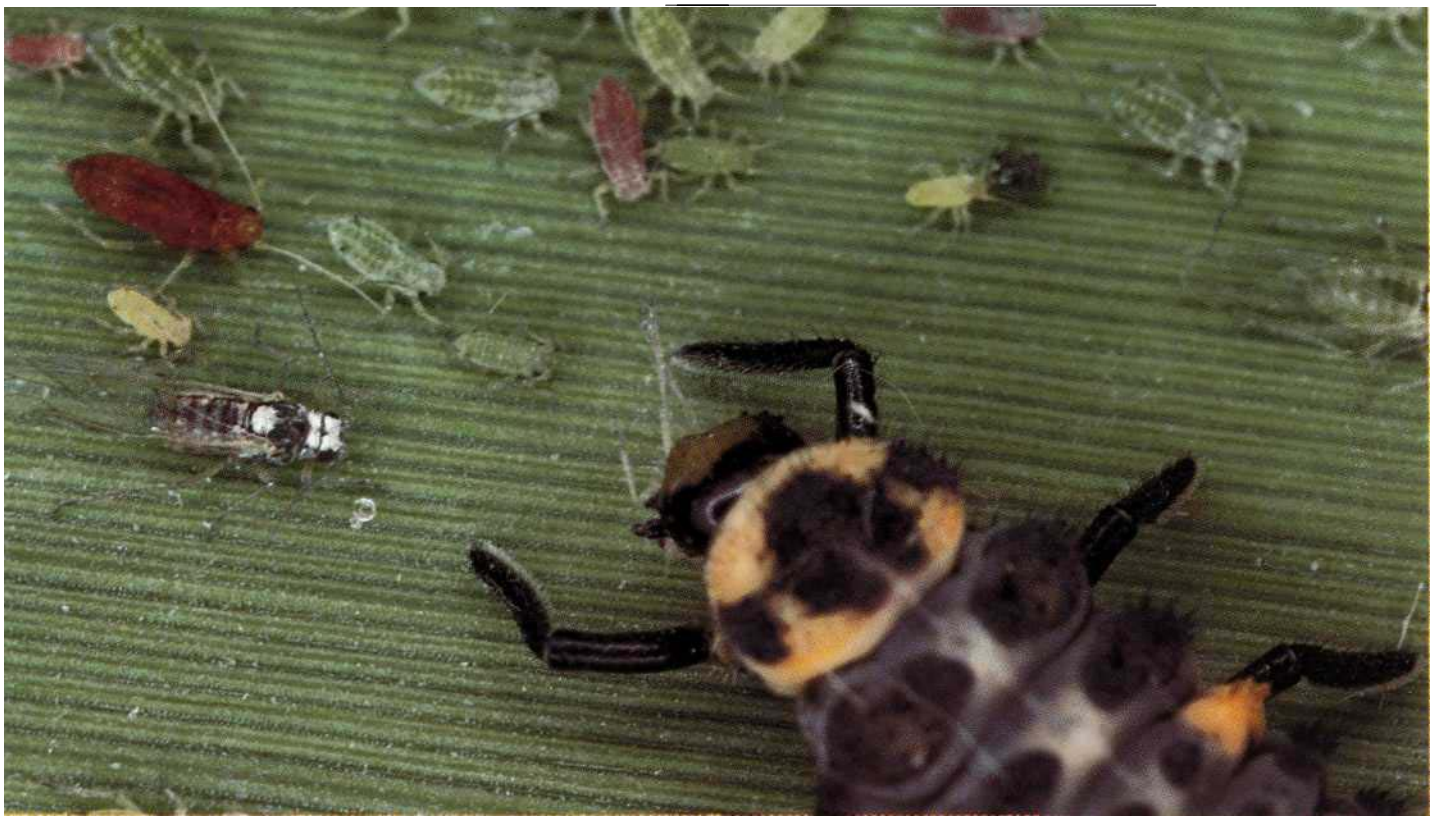
Biological Control

C. septempunctata has several favorable characteristics that would make it a useful biological control agent in New York crops. First, the widespread distribution of *C. septempunctata* throughout Europe and most of Asia indicates that this species is capable of adapting to diverse environments. It ranges from Scandinavia and the Ukraine to Southern Europe and the Middle East. Second, it occurs on a variety of host plants, such as apples, oats, winter wheat, potatoes, sugar beets, and beans.

Another notable attribute of the sevenspotted lady beetle is its adaptable feeding behavior. Larvae are capable of completing their development, with few deaths, on a variety of aphid species associated with numerous crops and noncrop plants. During periods of low aphid abundance, adult beetles may leave agricultural fields in favor of nearby uncultivated areas where other prey are available. Later, when the aphid pests become plentiful, C. *septempunctata* adults are attracted back into the crop. Thus, the beetles may respond to increasing aphid densities and make pest outbreaks less likely. Even under conditions of extreme prey scarcity, C. *septempunctata* larvae can survive on as few as seven green peach aphids per day. Also, adult beetles endure periods of temporary food shortages by feeding on nectar and pollen.

A successful predator not only adjusts to periods of prey scarcity, but also has the ability to take advantage of prey abundance. *C. septempunctata* achieves this in two ways. First, when prey densities are high, the beetles consume more. At high aphid densities one larva can eat between 200 and 300 aphids during its development, and one egg-laying female can consume over 200 aphids in a single day. Second, when aphid densities increase, the number of beetles in the area increases. This is done by reproduction in the area or by beetles moving from areas with low aphid densities to fields with high aphid densities.

C. septempunctata has contributed to a number of successful biological control programs around the world. In the Soviet Union, it was used to control aphids in



2. The predacious larva of *Coccinella septempunctata* eating aphids

apple orchards, and in other parts of Europe, release of the beetle resulted in lower pest populations on sugar beets. In Maine, this beetle has been periodically released against aphids on potatoes. And recently, the USDA Beneficial Insects Research Laboratory has released this predacious beetle in several areas of the United States (3, 4).

Current Research on *C. septempunctata* at Cornell

We are continuing to monitor field populations of the sevenspotted lady beetle in alfalfa and potato fields. Additionally, we have examined the factors that play a role in the beetle's seasonal development. This information allows us to predict that at high temperatures during July and August, C. *septempunctata* will develop and reproduce faster than several other lady beetles (5). Thus the beetle has the potential to control mid- to late summer aphid populations.

Another aspect of our research is to determine the effect of pest-resistant crop varieties on beneficial insect species, including *C. septempunctata.* This is an important consideration because of the increasing use of insect-resistant varieties in crop production. Thus, it is necessary to determine that new cultivars are compatible with beneficial species.

The prospects are good for *C. septempunctata* to make a lasting contribution to the control of aphid pests on New York crops, based on its recent successful establishment in upstate New York, its favorable characteristics, and its history as a successful biological control agent.

Acknowledgments

We thank J. M. Tropp, G. W. Angalet, and R. J. Dysart of USDA Beneficial Insects Research Laboratory for their cooperation. Photographs were supplied by the USDA-ARS.

References

1. DeBach, P. 1974. *Biological control by natural enemies.* Cambridge Univ. Press. 323 pp.
2. Hodek, I. 1973. *Biology of Coccinellidae.* The Hague: Junk; Prague: Academia. 260 pp.
3. Angalet, G.; Tropp, J. M.; and Eggert, A. N. 1979. *Coccinella septempunctata* in the United States: Recolonizations and notes on its ecology. *Environ. Entomol.* 8:896-901.
4. Hoebeke, E. R., and Wheeler, A. G. 1980. New distribution records of *Cocci nella septempunctata* L. in the eastern United States. *Coleop. Bui.* 34:209-12.
5. Obrycki, J. J., and Tauber, M. J. 1981. Phenology of three Coccinellid species: Thermal requirements for development. *Ann. Entomol. Soc. Amer.* 74:31-36.

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3. An aggregation of *Coccinella septempunctata* adults