UGA studies explain spread of invasive ladybugs

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A University of Georgia researcher studying invasive ladybugs has developed new models that help explain how these insects have spread so quickly and their potential impacts on native species.

In recent years, some people have noticed swarms of ladybugs amassing in the fall, even infesting their homes. These are Asian lady beetles, insects native to eastern Asia, introduced to the U.S. as a biocontrol for aphids and have since spread throughout the country and into Canada. When he found the beetles in his own home, Assistant Research Scientist Richard Hall, of the UGA Odum School of Ecology, was motivated to learn more about them.

Hall knew that the Asian lady beetle had only recently, in 2004, arrived in his native England, and is already found all over the U.K. Data collected as part of a citizen science effort based at Cambridge University shows it to be one of the fastest documented invasions ever by an insect. He also knew that in the U.S., the Asian lady beetle has excluded many indigenous ladybugs from parts of their original range.

"I wanted to know how this insect could have invaded the U.K. so quickly," Hall said. "And I also wanted to know what the impacts on native species are likely to be." He has just published two new papers that explore these questions in the journals *Biology Letters* and *Ecology*.

"What makes this insect a good biocontrol also makes it a good invader," Hall said. "It has multiple generations per year, compared to just one for native British ladybugs. It tolerates a wide range of environmental conditions. And it has a generalist diet—it likes aphids, but it will also eat other ladybugs. In other words, it eats its own competition."

Hall explained that when an invader expands into an open niche, with no native competitors present, invasion happens faster than if a competitor was already there; native competitors slow the rate of invasion. If an invader can eat the native competitor, however, it not only gains a source of nutrition but also reduces competition for lower-level food resources. If the resource benefit is a good one—the native competitor is a rich source of nutrition—the invader that eats its competition can invade even faster than if there were no competition at all. This may be the case with the Asian lady beetle.

Hall developed a model, published in the current issue of *Biology Letters*, that explains his findings and predicts that invasive species that feed on both lower-level food sources and species that compete for these same food sources will be more successful, and spread faster, than those that only feed on lower-level sources.

Predicting the potential impacts on native species was more complicated.

Native ladybugs in the U.K. have a natural enemy, a parasitoid wasp that lays eggs in adult ladybugs. When the eggs hatch, the larvae emerge and use the ladybug as both food and protection against predators. These wasps are now parasitizing Asian lady beetles in the U.K.

In a paper in the February 2011 issue of the journal *Ecology*, Hall described a model he developed to explain the interaction between the three species—invasive ladybug, native ladybug and the parasitoid wasp that is their common predator—and predict effects.

"The shared natural enemy changes the equation," said Hall. "There are a couple of possible outcomes. If the wasp prefers to lay its eggs in the invader, that might allow the native species to persist. But the invader may turn out to be a 'sink' host—the wasps may have less reproductive success on the invasive ladybugs, since they didn't co-evolve. In that case, you could lose both the native ladybug and its native predator, the ladybug due to predation and competition by the invader and the wasp due to reproductive failure."

Hall said that both models could be applied to other species where the invader preys on, as well as competes with, a native species. "It is important to take into account the effects of a natural enemy on that interaction in order to avoid incorrect predictions about which species will persist," he said. "And accurate predictions are crucial for developing successful management strategies."

Provided by University of Georgia

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