

The Decline of C-9—New York’s State Insect

Erin J. Stephens and John E. Losey

In 1980 fifth-grader Kristina Savoca sent a letter—along with a petition bearing 152 signatures—to New York state assemblyman Robert C. Wertz, urging him to introduce legislation designating the lady beetle as the official state insect. The proposal languished for a number of years, passing in the Assembly but not being considered by the Senate. Approval finally came in 1989, after Cornell University entomologists suggested that Wertz propose the nine-spotted lady beetle (*Coccinella novemnotata*, usually abbreviated to C-9) as the state insect because it was one of the most important native lady beetles and was believed to be common. The red-and-

black insect is also widely recognizable to the public as a “ladybug.”

All fifty states have designated both plants and animals as official symbols of their unique character. To represent their invertebrate biological heritage, forty states have named official state insects. Although five of these are lady beetles, New York may have the distinction of designating a formerly ubiquitous species possibly extirpated at the time of designation. As the fifteenth anniversary of the official designation approaches, the rapid decline of C-9 in New York—and across most of the United States—beckons both as a compelling mystery and as a cautionary tale



Until recently the nine-spotted lady beetle (*Coccinella novemnotata*) was abundant across much of the United States and Canada. In many areas the only specimens that now remain are in museums. Photograph by Stephen A. Marshall.



The seven-spotted lady beetle (*Coccinella septempunctata*) was introduced from Europe as a biological-control agent for aphids on crops. Now it is implicated in the decline of the native nine-spotted lady beetle (*Coccinella novemnotata*). Photographed in Oregon by Edward S. Ross.

with implications for other native lady beetles. The most appropriate recognition of this anniversary might be two new designations for C-9: “endangered” in New York state and “threatened” nationally.

Biologists have long recognized the important ecological role of lady beetles (family Coccinellidae). They are common and economically important predators in natural and agricultural systems, preying upon a wide range of soft-bodied insects, including aphids and scales. In gardens and on farm crops, where coccinellids are dominant predators, they are an important pest-control agent. North America has five hundred species of lady beetles, a biologically based form of pest control that is widespread and free. C-9, for example, could eat a variety of aphid species and could live in many different natural areas and

among a variety of crops, including corn and other vegetables, fruits, and alfalfa. In addition to their role as predators, lady beetles are sensitive to such limiting factors as natural enemies and anthropogenic influences (e.g., habitat degradation), and thus are indicators of ecological health.

The public’s perception of lady beetles as industrious workers helping to control pests in the field almost certainly predates any scientific quantification of their role. By the year 1500 lady beetles were already recognized as important predators in Old World agroecosystems. Their pleasing shape and bright coloration (together with their lack of sting or bite) also make them—along with butterflies and fireflies—a favorite among children and adults. The lady beetle image has become a cultural icon for invertebrates, nature, and



The convergent lady beetle (*Hippodamia convergens*) is a native species that is in demand to control garden pests. Harvested in the wild by gathering clusters in the mountains, it is now apparently in decline. Photographed in Arizona by Edward S. Ross.

environmentally sound agriculture.

Among the several dozen species of lady beetles in New York state, C-9 was the clear choice in 1989 because it had been—and was assumed still to be—the most common lady beetle in New York and the northeastern United States. It ranged across the United States and through southern Canada. However, several recent surveys in New York and the Northeast in general have not recovered any individuals of C-9, and only a few individuals have been collected in the Midwest and West. The latest reported collection in the Northeast was in 1992, although C-9 may have persisted beyond this date in low densities. The latest known collection date

in New York was 1970. It is now clear that C-9 occupies only a tiny fraction of its former range in North America.

This leads us to a mystery as compelling in its own way as the lost colonists of Roanoke Island or the Anasazi of Mesa Verde. What caused the precipitous decline of this most common species of a very common insect family? Why would a species once so common decline so quickly until just a handful of populations remained?

C-9's decline went unnoticed because of a lack of general predator surveys and, unfortunately, the beetles left no mysterious messages scrawled on trees or long-abandoned cliff dwellings. So three essential questions remain: 1)

What forces contributed to this species' demise? 2) What are the implications of its extirpation from most of its former range? 3) How can the same fate be avoided for other native coccinellids?

In pursuing answers to the first question for any species, a scene from Charles Dickens' *A Christmas Carol* provides an apt metaphor. The Ghost of Christmas Present raises his coat to reveal two ghastly children, Ignorance and Want. If the Ghost of Biodiversity Lost were to raise his coat, Degradation and Invasion would surely be revealed. While extinction is usually due to many interacting factors, the primary forces in most cases can be traced to habitat degradation caused by a combination of development and fragmentation, and the invasion of non-native species facilitated intentionally or accidentally by human movement. Although we will never know exactly why C-9 declined, it seems likely it succumbed to some combination of these two forces.

Ironically, for C-9, habitat degradation may have been in the form of decreasing rather than increasing agricultural land use. Many large expanses of land in the Northeast were abandoned for more fertile land in the Midwest and West. Much of the land left behind was turned into national and state forest, converting the Northeast to a more forested condition than it had been in over two centuries. Succession from crops to trees could have affected the overall density of aphids or aphid species composition. Weedy plants that grow after farmland is abandoned can often support many aphids, but once the land becomes forested again, aphids may be difficult for lady beetles to find.

Another reason may be the impact

of lady beetle species imported intentionally to solve specific pest-control problems. Coccinellids have been relied upon for biological control for the past hundred years and were the first organisms used for classical biological control. When the cottony cushion scale threatened the citrus industry in California in the 1880s, imported *Vedalia* lady beetles rose to the challenge of feasting on the scale and have played an important role in its suppression ever since. However, many coccinellid introductions since then have not been as successful.

The link between the increase in non-native species and the decrease in native species is muddled because interactions between introduced and native lady beetles under field conditions are not well understood. Many entomologists suspect that introduced lady beetles, such as the seven-spotted (*Coccinella septempunctata*) and Asian multi-colored (*Harmonia axyridis*) lady beetles, played a role in C-9's disappearance. These species are particularly voracious, but it is difficult to quantify this factor in an ecologically realistic setting. Qualitatively, several native lady beetle species have declined as first the seven-spotted and then the Asian multi-colored lady beetles established and rose to prominence. Introduced species may also replace each other, as the Asian multi-colored lady beetle's arrival seems to have led to the seven-spotted lady beetle becoming increasingly rare.

The cause for concern is that introduced species may fill the same ecological niche that native species once occupied. This is problematic because many of these species are from Asia and are not well adapted to the harsh Northeastern winters or to climatic ir-

regularities such as droughts. Unlike native lady beetles, which overwinter in hedgerows and the duff of trees, the introduced coccinellids take to people's garages and homes, often by the thousands, creating a considerable nuisance. More important, introduced species may out-compete native species for food and replace them; though this often inflates overall lady beetle numbers, they decline again once the introduced species are exposed to climatic extremes. In the long term, a reduction in the total numbers and biodiversity of this important family may occur.

The release of introduced coccinellids may stave off an imminent pest-management crisis and thus appear justified in the short term. However, if the long-term effects on biodiversity are weighed in the decision to release non-native coccinellids, the benefits may not be as clear. Documenting the possible ecological side effects of biological-control introductions is essential to maximizing the efficiency of such releases while minimizing unexpected ecological side effects.

The plight of C-9 demonstrates that generalist species need monitoring and conservation just as is required for habitat specialists and species endemic to certain regions. Inventories of species assumed to be ubiquitous must also be conducted, perhaps in conjunction with surveys for rare species. Data suggest that C-9 is not the only native member of its family to be experiencing a downward trend. At least four other lady beetles—the convergent (*Hippodamia convergens*), the two-spotted (*Adalia bipunctata*), the three-banded (*Coccinella trifasciata*), and the thirteen-spotted (*C. tredecimpunctata*)—have been

only rarely collected or not collected at all in recent years. Unlike many other rare and endangered insects, coccinellids are well known and appreciated by the public. Extensive monitoring of native coccinellids by pest-management professionals, naturalists, and amateur entomologists is warranted to document declines, current species compositions, and ranges. Their charisma and beneficial properties make them an attractive flagship species.

We can hope that the decline of C-9 and several other conspicuous coccinellids will lead to a greater focus on this valuable family. To call attention to their plight, listing the species as “endangered” in New York state and “threatened” at the national levels is warranted. This is a task that the Xerces Society will be undertaking in the coming months. Other native lady beetles have similar habitat requirements and probably suffer from similar limiting factors, so efforts to survey for and protect C-9 should prove useful for a suite of species. What began as a simple letter from a student to a state assemblyman has resulted in a greater awareness of the threats to apparently ubiquitous creatures often assumed to be safe from the pressures of environmental change.

Erin Stephens is a Ph.D. candidate in entomology at Cornell University. Her research is on the effects of Bt corn on non-target coccinellids.

John Losey is an associate professor in the entomology department at Cornell University, where he teaches a class on insect conservation biology. His research focuses on the impact of pest management on native butterflies and beetles.