

Studying the expansion of *H. axyridis* in Poland

Ladybird Conquers the World

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A substantial majority of contemporary biological invasions are initiated intentionally or unintentionally by man. This holds true for the expansion of the harlequin ladybird

Harmonia axyridis, a beetle originating from east and central Asia, is known in English as the harlequin ladybird or multicolored Asian lady beetle. As an effective control agent of aphids and other invertebrates, for decades it has been used in various parts of the world to

protect crops against pests. It was first introduced outside its native range in California back in 1916, but most of its subsequent introductions occurred in the 1970s, 80s, and 90s. In 1995, laboratory-produced *H. axyridis* came to be offered by companies selling biological pest control methods, leading to several years of uncontrolled "private" introductions of the insect.

Harlequins in the wild

H. axyridis therefore had many opportunities to stage its invasion, but considerable time passed before that actually occurred. The first known harlequin population established outside its natural range was discovered in North America (Louisiana) in 1988. Since then events have gained momentum. In the 1990s, *H. axyridis* colonized large areas of North America (nearly the entire US, parts of Canada and Mexico). The next continents



Artiom Chernyshevich, www.ssc.hu

Although Poland's native seven-spot ladybirds, shown here, do sometimes bite humans, they do so much less often than the invasive Harlequin ladybird

to be overrun by the Asian invader were Europe, South America, and Africa.

In Europe, harlequin ladybird expansion has been recorded since 1999, when it was discovered at two sites in Germany - one in Hamburg, the other on the outskirts of Frankfurt am Main. Between then and 2007 *H. axyridis* managed to conquer nearly all of Western Europe, with the exception of its southern and northern peripheries, and it also turned up in certain Central European countries (the Czech Republic, Austria, Poland).

In Poland, *H. axyridis* was first detected in Poznań and the vicinity of Wronki in autumn 2006, yet only one year later it was already observed not just in that region but also in Lower Silesia, Pomerania, and Mazovia. Since spring of 2008, the expansion of the Asian beetle in Poland has been closely monitored in a project coordinated by the Center for Ecological Research, Polish Academy of Sciences. Thanks to great commitment shown by the staff of several research centers and the widespread public response to our appeal to report sightings of *H. axyridis*, we now have a fairly up-to-date picture of its distribution in Poland (as of mid-2008). That range encompasses the western and central parts of the country, up to a limit running more or less along the line traced by the Vistula River. In not quite two years since its first documented appearance in Poland, *H. axyridis* has managed to colonize a large part of the country, even becoming a common species in some places.

Key to success

In terms of its food and habitat requirements, the harlequin ladybird is amazingly flexible. Although it prefers to feed on aphids which inhabit deciduous trees and shrubs, it also adapts well to other conditions. It can be found in various synanthropic, semi-natural, and natural habitats. Apart from aphids it can also feed on scale insects, psyllids, spider mites, the eggs and larvae of various insects, and also plant food such as pollen, nectar, or fruit. *H. axyridis*'s fondness for feeding on ripe fruit makes it a frequent orchard crop pest.

Food and habitat generalism (a lack of specialization) are probably the most important, but not the only, traits of *H. axyridis* responsible for its high degree of invasiveness. Other factors contributing to the Asian ladybird's success include: an almost complete lack of natural enemies in the areas it colonizes, its ability to effectively eliminate competitors, and its exceptional ability to spread geographically, chiefly related to the long-distance flights it makes in the autumn in search of suitable wintering sites.

Unchecked invasion

Animal populations are exploited by various types of natural enemies, like pathogens, parasites, parasiti-



Piotr Czapliński

Eliminating rivals by eating them is not exclusively a trait of *H. axyridis*. Here, a *Coccinella septempunctata* larva consumes the larva of the same species

toids, and predators. Founder populations of the species invading new areas frequently have no specific natural enemies, or their natural enemies are unable to survive in the new conditions. If local species of pathogens, parasites, or parasitoids cannot adapt to limit the invasive species, populations of the latter can expand practically unchecked.

If the harlequin ladybird populations expanding in North America and Europe are controlled by natural enemies at all, it is only to a slight degree. On both continents, specific ladybird parasitoids (flies and wasps) do parasitize *H. axyridis* sporadically, but these beetles usually survive their attacks and the parasitoids die in the egg or larva stage. Harlequin ladybirds also turn out to be highly resistant to the fungal infections that can decimate populations of many other ladybird species and other insects. Invertebrate and vertebrate predators, in turn, do not pose a serious danger either to *H. axyridis* or to other ladybirds. Those predators avoid eating ladybirds because the alkaloids they secrete are bitter and toxic.

Natural born killers?

Upon appearing in new areas, *H. axyridis* usually quickly becomes the dominant aphidophagous ladybird, causing a distinct drop in the numbers of certain local species. This is because the Asian species has a set of characteristics which give it a competitive edge over other aphid-eaters. Media reports especially stress its aggressive behavior towards rivals, leading to their physical elimination. Indeed, *H. axyridis* larvae can

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Poland's native ladybird species most threatened by the *H. axyridis* invasion is likely the small two-spot ladybird, shown here

kill and eat the eggs and larvae of ladybirds and other predators, especially if there is a shortage of aphids. Nevertheless, such behavior is not an exclusive attribute of *H. axyridis*. It is normal that when food becomes scarce, the larvae of predatory ladybirds will eat rivals from either their own species (cannibalism) or other species (intraguild predation). The difference between *H. axyridis* and other ladybirds is purely a quantitative one: in such interspecies interactions, *H. axyridis* larvae are much more frequently the predators than the victims.

Aside from such aggressiveness towards other insects, reports also frequently describe the invasive

Asian species as being aggressive towards humans. People do often complain of getting bitten by *H. axyridis*, and unfortunately most of those complaints are justified. Although our native ladybirds, such as the seven-spot ladybird, do also sometimes bite humans, that occurs much more rarely. Joseph Kovach from Ohio State University tested how prone *H. axyridis* is to bite people on his own skin, finding that 25% of the approx. 640 specimens tested showed such a tendency.

These biting ladybirds are a nuisance to humans especially when they enter residential buildings in numbers, seeking suitable places to overwinter. Aside from possible bites, harlequin ladybirds can also cause allergic reactions in certain people or stain parts of the household with a yellow defensive fluid they release when agitated. ■



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Of the three color forms of the Asian ladybird occurring in Europe, the most common is *H. axyridis* f. *succinea*

Further reading:

<http://www.cbe-pan.pl/harmonia>
 Koch R.L. (2003). The multicolored Asian lady beetle, *Harmonia axyridis*: A review of its biology, uses in biological control, and non-target impacts. *Journal of Insect Science*, 3, 1-16; (http://www.insectscience.org/3.32/Koch_JIS_3_32_2003.pdf).
 Soares A.O., Borges I., Borges P.A.V., Labrie G., Lucas É. (2008). *Harmonia axyridis*: What will stop the invader? *BioControl*, 53, 127-145.