Invasive harlequin ladybird causes severe decline of two-spotted ladybird, new study shows

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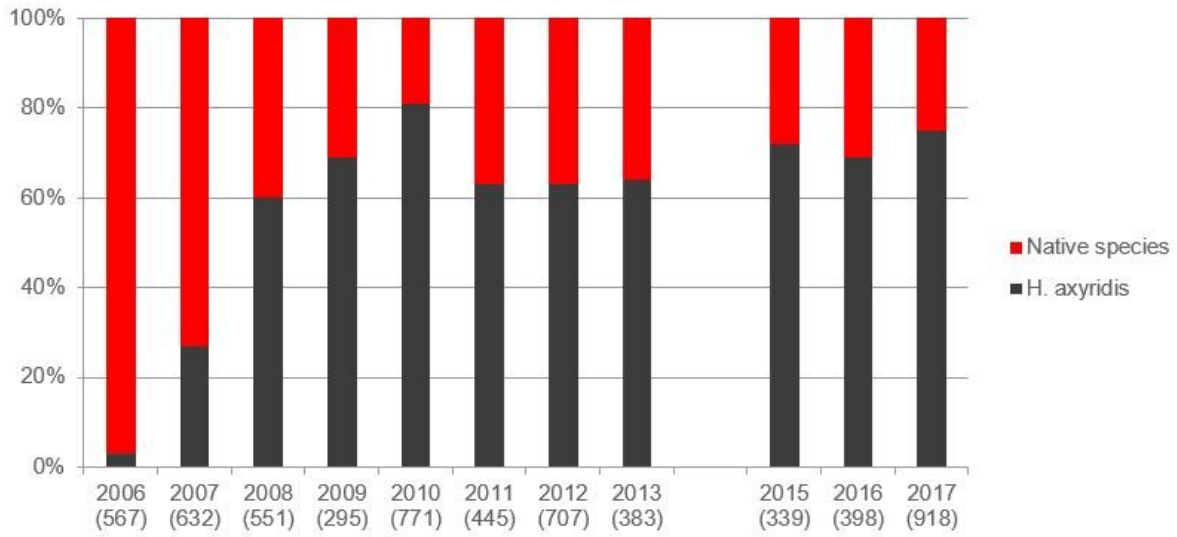

Figure 1. Proportion of *Harmonia axyridis* and native species at the 15 broadleaved hedges from 2006 to 2017. Numbers between parentheses indicate the number of adult ladybirds collected.

Credit: CABI

CABI scientists have led an 11-year study which shows how the invasive harlequin ladybird (*Harmonia axyridis*) caused the severe decline of the two-spotted ladybird (*Adalia bipunctata*) on broadleaved trees and shrubs in northern Switzerland.

Lead author Dr. Marc Kenis, Head of Risk Analysis and Invasion Ecology based at CABI's Swiss Centre in Delémont, of the research—published in the journal *Insects* - said the two-spotted ladybird was the most abundant ladybird at the 40 sites surveyed before the harlequin ladybird took hold between 2006 and 2017.

The scientists discovered that the harlequin ladybird—which is a predator native to Central and East Asia and whose presence was confirmed in Switzerland in 2004—quickly dominated the broadleaved hedges representing 60-80% of all specimens collected in this habitat.

However, while the harlequin ladybird was the second most abundant species in pine stands it was not abundant in meadows and spruce stands. Furthermore, the total number of ladybirds feeding on aphids did not decline during the study period—suggesting that the arrival of the harlequin ladybird did not affect the predation pressure on aphids.

The harlequin ladybird is considered a human nuisance when it aggregates in buildings in autumn and can taint wine when harvested and crushed with grapes. Of most concern, however, is its impact on biodiversity.

Due to its predatory and competitive abilities, *H. axyridis* may affect many native species, including non-pest aphids and aphidophagous insects. In particular, native ladybirds may suffer from competition for resources and intra-guild predation (IGP) on larvae and eggs.

In North America, several studies showed that *H. axyridis* is displacing native ladybirds. Similar observations were made in Chile, where it is also invasive. In Europe, first analyses made a few years after the establishment of *H. axyridis* in UK, Belgium and Switzerland suggested that several native ladybird species had started declining.

Dr. Kenis said, "Our long-term survey of ladybirds in north-western Switzerland showed that, on broadleaved trees and shrubs, *H. axyridis* has become by far the most abundant species just a few years after its arrival in Switzerland. Similar levels of dominance on broadleaved trees were also found recently in other European countries such as England, Czech Republic and Italy.

"Although it is known that ladybird populations can vary greatly from year to year, the fact that *A. bipunctata* has almost disappeared from our records since 2010 strongly suggests that this decline in populations is not due to natural fluctuations in populations but more probably to the presence of *H. axyridis*."

The researchers argue that *Adalia bipunctata*, a Holarctic species, is one of the species that shows the strongest decline in Eastern North America following the invasion of *H. axyridis* and three other exotic ladybird species.

However, they suggest that in none of the European and American studies previously carried out was the decline as strong as in their surveys in north-western Switzerland. For example, in England, *A. bipunctata* abundance in 2016 was reduced to approximately 16% of the total from the first surveys in 2006.

Co-author Dr. René Eschen said, "Our long-term monitoring of ladybird populations in north-western Switzerland clearly showed that *H. axyridis* quickly became the dominant species on broadleaved trees and shrubs just a few years after its arrival, but not yet on conifers and grasses.

"Only one native species, *A. bipunctata*, clearly declined following the invasion of *H. axyridis*, but this once dominant species almost disappeared from the region. The severe decline of *A. bipunctata* deserves further investigations."

The long-term field trial was set up in north-western Switzerland in the cantons Jura, Basel-Landschaft, Basel-Stadt and Aargau, based on 40 permanent sites established within a 40 km distance from the town of Delémont.

While it was dominant on broadleaved trees, the scientists also found that the harlequin ladybird was only the second most abundant species in pine stands and was not abundant in meadows and in spruce stands.

More information: Marc Kenis et al, Long Term Monitoring in Switzerland Reveals That Adalia bipunctata Strongly Declines in Response to Harmonia axyridis Invasion, *Insects* (2020). DOI: 10.3390/insects11120883

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