Invasive Insects: Risks and Pathways Project

HARLEQUIN LADYBIRD

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Invasive insects are a huge biosecurity challenge. We profile some of the most harmful insect invaders overseas to show why we must keep them out of Australia.

Species

Harlequin ladybird / *Harmonia axyridis*. Also known as the multi-coloured Asian lady beetle.

Main impacts

Displaces native ladybirds and other insects it preys on. Taints wine, congregates inside houses and causes allergic reactions.

Native range

East Asia.[1]

Invasive range

North America, South America, Europe, Middle East, a few parts of Africa, New Zealand.[1,2]

Main pathways of global spread

- Unintentional introduction as a contaminant of nursery material, food and plants, with timber, and as a hitchhiker on ships and boats.
- Intentional introduction as a biological control agent.
- Natural dispersal across borders.[3]

The harlequin ladybird. Photo: Gilles San Martin | Flickr | CC BY-SA 2.0

ENVIRONMENTAL IMPACTS OVERSEAS

The harlequin ladybird has been described by biologists as 'perhaps the most infamous of invasive insects in the twenty-first century'[4]. In many parts of North America and Western Europe it is now the most abundant ladybird[4]. The adults and larvae are voracious predators – typically eating 15 to 65 aphids a day – and they compete with and prey on other aphid predators ('intraguild predation'), especially native ladybirds[1,5]. The large larvae are particularly aggressive predators of the eggs and larvae of other aphid predators, and all life stages appear to have superior physical and chemical defences against counter-attacks by these predators[6,7].

In Britain, seven native ladybird species (out of eight assessed) have declined since the arrival of harlequin ladybirds in 2003[8]. The formerly common two-spot ladybird (*Adalia bipunctata*) declined by 44% within five years[8] and ladybird communities on lime trees went from consisting of 99.8% native species to just 30.7% in 11 years[9]. In a central European study, harlequin ladybirds were found to be the dominant ladybirds on trees, the abundance of native ladybirds on all plants having declined by 50–70% since the 1980s[10]. Harlequins are only partly to blame for this, because the native ladybirds had been declining before they arrived.

Other prey species are scale insects, psyllids, mites, leaf beetles, weevils and butterflies, as well as other aphid predators, including lacewings, midges and hoverflies[1]. Impacts on other species are likely, but these have mostly not been studied. A risk assessment of predation by harlequin ladybirds on the eggs and larvae of monarch butterflies (*Danaus plexippus*) predicted potentially serious declines[11]. The harlequins also eat nectar, pollen, fruit and young plant tissues, which has caused economic losses.

The harlequin ladybird can carry spores of a parasitic microsporidia benign to them but lethal to other ladybird species which, it has been proposed, 'may function like a biological weapon'[12]. Harlequin ladybirds have a high reproductive potential, producing (under laboratory conditions) up to 3800 eggs at a rate of 25 a day[5].

HUMAN AND ECONOMIC IMPACTS OVERSEAS

In the United States and Canada, harlequin ladybirds have caused millions of dollars of losses in the wine industry[13]. They feed on grapes at harvest time, and

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WHAT TO LOOK OUT FOR

The adult harlequin ladybird is one of the most variable-looking species in the world (hence the name 'harlequin'), making identification difficult. Some are red or orange with 0 to 21 black spots; others are all black or black with 2 or 4 orange or red spots. Most have white on the pronotum (the first segment behind the head) with black spots that usually form an 'M' or 'W' shape (the easiest way to identify them). The small head is mainly black and white. They range in size from 5.5 mm to 8.5 mm.

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even small numbers in the wine-making process can taint the wine, producing an aroma compared to burnt peanut butter[14]. They are considered a threat to the wine industry in New Zealand after being accidentally introduced there in 2016, the first record for Oceania[15]. The harlequin ladybird can also damage fruit crops, including grapes, stone fruit, apples, pumpkins and berries[1].

Harlequin ladybirds are a nuisance to humans when they form large overwintering aggregations in buildings, staining carpets and furnishings if they are crushed[1]. A 2006 report from the Isle of Wight described 'clouds' of ladybirds 'smothering vegetation', 'covering outside walls and window frames' and 'clogging up footpaths'[16]. In houses they can trigger allergic reactions[17].

AUSTRALIAN CONCERNS

Given its very wide distribution (at least 59 countries)[2] and multiple pathways for spread, there is a high risk the harlequin ladybird will arrive in Australia. It has been intercepted at Australian ports[18].

As indicated by its very broad invasive range, this ladybird is able to thrive in many habitats and climates[1]. Climate modelling indicates that most coastal and many inland areas of Australia are suitable[20] and host material is likely to be available all year round[21].

Should the harlequin ladybird establish in Australia, we must be concerned about the fate of native ladybirds and other insects that prey on the aphids and scale insects eaten by the harlequin as well as other prey species. Australia has about 500 species of ladybird, mostly endemic, with about half yet to be described[19].

SOURCES

1. Roy HE, Brown PMJ, Adriaens T, Berkvens N, Borges I, Clusella-Trullas S, *et al.* (2016): The harlequin ladybird, *Harmonia axyridis*: global perspectives on invasion history and ecology. *Biological Invasions*. 18: 997–1044.

2. Camacho-Cervantes M, Ortega-Iturriaga A, del-Val E (2017): From effective biocontrol agent to successful invader: the harlequin ladybird (*Harmonia axyridis*) as an example of good ideas that could go wrong. *PeerJ*. 5: e3296.

3. *Invasive Insects Risks and Pathways project unpublished data* (2019): Monash University and Invasive Species Council.

4. Roy HE, Majerus MEN (2010): Coccinellids in a changing world. *Aphid biodiversity under environmental change*. Patterns and processes. Springer, pp 149–170.

5. Koch RL (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.

6. Roy HE, Brown PMJ (2015): Ten years of invasion: *Harmonia axyridis* (Pallas) (Coleoptera: Coccinellidae) in Britain. *Ecological Entomology* 40: 336–348.

7. Pell JK, Baverstock J, Roy HE, Ware RL, Majerus MEN (2008): Intraguild predation involving Harmonia axyridis: a review of current knowledge and future perspectives. *BioControl*. 53: 147–168.

8. Roy HE, Adriaens T, Isaac NJB, Kenis M, Onkelinx T, Martin GS, et al. (2012): Invasive alien predator causes rapid declines of native European ladybirds: Alien predator causes declines of native ladybirds. *Diversity and Distributions*. 18: 717–725.

9. Brown PMJ, Roy HE (2018): Native ladybird decline caused by the invasive harlequin ladybird *Harmonia axyridis*: evidence from a long-term field study. *Insect Conservation and Diversity*. 11: 230–239.

10. Honek A, Martinkova Z, Roy HE, Dixon AFG, Skuhrovec J, Pekár S, Brabec M (2019): Differences in the phenology of *Harmonia axyridis* (Coleoptera: Coccinellidae) and native coccinellids in central Europe. *Environmental Entomology*. 48: 80–87.

11. Koch RL, Venette RC, Hutchison WD (2006): Predicted impact of an exotic generalist predator on monarch butterfly (Lepidoptera: Nymphalidae) populations: a quantitative risk assessment. *Biological Invasions*. 8: 1179.

12. Vilcinskas A, Stoecker K, Schmidtberg H, Rohrich CR, Vogel H (2013): Invasive harlequin ladybird carries biological weapons against native competitors. *Science*. 340: 862–863.

13. Galvan TL, Burkness EC, Hutchinson WD (2006): *Wine grapes in the Midwest: Reducing the risk of the multicolored Asian lady beetle*. Report, University of Minnesota, Extension Service.

14. Botezatu A, Pickering G (2010): Ladybug (Coccinellidae) taint in wine. *Managing Wine Quality*. Elsevier, pp 418–431.

15. Kirkeby L (2019, April 30): Wine growers beware the harlequin ladybird is likely near. *Stuff*. Retrieved May 12, 2019, from https://www.stuff.co.nz/business/112332753/wine-growers-beware-the-harlequin-ladybird-is-likely-near.

16. McCarthy M (2006, November 6): Alien ladybirds "spell disaster" for British species. *The Independent*. Retrieved May 12, 2019, from https://www.independent.co.uk/environment/nature/alien-ladybirds-spell-disaster-for-british-species-423214.html.

17. Nakazawa T, Satinover SM, Naccara L, Goddard L, Dragulev BP, Peters E, Platts-Mills TAE (2007): Asian ladybugs (Harmonia axyridis): A new seasonal indoor allergen. *Journal of Allergy and Clinical Immunology*. 119: 421–427.

18. Department of Primary Industries (2015): *Exotic pest alert: multicoloured Asian lady beetle*. Primefact 1389. NSW Government.

19. Slipinski A (2013): *Australian Ladybird Beetles (Coleoptera: Coccinellidae)*. CSIRO Publishing.

20. Poutsma J, Loomans AJM, Aukema B, Heijerman T (2007): Predicting the potential geographical distribution of the harlequin ladybird, Harmonia axyridis, using the CLIMEX model. *From Biological Control to Invasion: the Ladybird Harmonia axyridis as a Model Species*. Springer, pp 103–125.

21. Department of Agriculture, Fisheries and Forestry (2013): *Final non-regulated analysis of existing policy for Californian table grapes to Western Australia*. Australian Government.

ABOUT THIS PROJECT

The Invasive Insects: Risks and Pathways Project is a partnership between Monash University and the Invasive Species Council. To find out more visit invasives.org.au/risks-and-pathways.