

Toward a Noah's Ark for native ladybirds in Belgium?

Tim Adriaens¹, Gilles San Martin², Louis Hautier³, Etienne Branquart⁴ & Dirk Maes¹

¹Research Institute for Nature and Forest (INBO), Kliniekstraat 25, B-1070 Brussels, Belgium; ²Behavioural Ecology & Conservation Group - Biodiversity Research Centre - Université catholique de Louvain (UCL) - Croix du Sud 4, B-1348 Louvain-la-Neuve, Belgium; ³Département Lutte biologique et Ressources phylogénétiques - Centre wallon de Recherches agronomiques, Rue de Liroux, 2, B-5030 Gembloux, Belgium; ⁴Belgian Biodiversity Platform - Service Public de Wallonie, Département de l'Etude du Milieu Naturel et Agricole (DGARNE), Avenue Marechal Juin, 23, B-5030 Gembloux- Belgium.

Corresponding author: Tim.Adriaens@inbo.be

The first feral field populations of *Harmonia axyridis* Pallas (HA) in Belgium were discovered in 2001 and most probably originated from a laboratory population nearby (Adriaens *et al.*, 2003). This discovery immediately raised concern over the potential impact of this natural enemy introduction. Studies in North America showed that the species was able to rapidly colonise large areas and become the predominant species in aphidophagous guilds (e.g. Tedders & Schaefer, 1994). Moreover, HA was ranked as a high-risk species in an environmental risk assessment of exotic natural enemies used in inundative biological control (van Lenteren *et al.*, 2003, 2008). Adriaens *et al.* (2003) noted that the species was invading a wide range of semi-natural habitats in Belgium and that it could become a potential threat for native ladybird species and other aphid predators. By 2007, HA had indeed invaded all kinds of urban, agricultural and semi-natural habitats in Belgium. It now also occurs in ecoregions that are rich in native coccinellids and other arthropod groups such as butterflies (Adriaens *et al.*, 2008). Meanwhile, it has already spread to 13 European countries (Brown *et al.*, 2008) and the expansion is still ongoing (e.g. Tomov *et al.*, 2009).

The species is a well-known intraguild predator of almost all western European ladybird species in the laboratory (e.g. Ware *et al.*, 2009, Ware & Majerus, 2008, Kenis *et al.* in prep.). Detailed monitoring of ladybird communities in pine, lime and maple in the Brussels urban area in 2003, 2005 and 2008 revealed changes in native ladybird assemblages and detected a significant decline in the abundance of several ladybird species including the native *Adalia bipunctata* L. and *A. decempunctata* L. This decline coincided with an increase of the HA population (Ottart, 2005, San Martin, 2003). Moreover, analysis of exogenous alkaloid content of HA larvae, sampled on Brussels trees, revealed high levels of intraguild predation (IGP) on native coccinellids, mainly *Adalia* spp., and, to a lesser extent, *Calvia* spp. as well as *Propylea quatuordecimpunctata* L. (Hautier *et al.*, 2008, Hautier *et al.*, 2010).

In Belgium, data on a national level are available through a large scale mapping scheme. These data show that HA has become as common as the generalist species *Coccinella septempunctata* L., occurring in over 83% of the sampled area. Niche overlap analysis based on spatio-temporal overlap as well as plant use similarity shows that HA has a high degree of niche overlap with native species, especially with generalist and tree dwelling coccinellids in Belgium, which constitute about 50% of the native macroladybird (Coccinellinae, Epilachninae, Chilocorinae) fauna (Adriaens *et al.*, 2008). Preliminary analysis for only a few ladybird species has been performed based on 2000-2008 data of proportional occurrence (defined as the number of grid cells with species x in year y, divided by the number of sampled squares in year y). The results show that the expansion in range of HA coincides

with a range decline in some native species, notably the generalist *A. bipunctata* and the deciduous tree species *A. decempunctata*. We detected a decrease of 40% in collection events (defined as the unique combination of date, observer and grid cell) with *A. bipunctata* and a decrease of 80% in the percentage of *A. bipunctata* observations in less than 10 years (2001-2008) on a national scale.

We hypothesize that intraguild predation may be one important mechanism for species displacement in the native ladybird guild based on the high degree of niche overlap with HA in species that are showing a range decline. Moreover, we hypothesize that *H. axyridis* may further expand its range in Europe and that an ongoing increase in HA abundance might eventually lead to local species extinction.

Future work will concentrate on analysing trends in native ladybird species before and after establishment of *H. axyridis* and verifying whether the reported changes in native ladybird community structure in Belgium are consistent throughout Europe. We aim at relating trends in native ladybirds to their ecology, in order to set up the profile of a native species sensitive to invasion by a potential intraguild non-native predator. This should be possible through enhanced international cooperation and joint analysis of available field data of well-known ladybird faunas (e.g. UK, Switzerland).

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