

The Multicoloured Asian Ladybird *Harmonia axyridis* Pallas (Coleoptera : Coccinellidae), a threat for native aphid predators in Belgium?

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The Multicoloured Asian Ladybird (*Harmonia axyridis* Pallas 1773) is native to large parts of Asia. It preys mostly on tree-dwelling hemipteran insects such as psyllids, scale insects and aphids (1). It is a commercially attractive bio-control agent for aphid populations because its larvae are very voracious, polyphagous and easy to rear (2-4). *H. axyridis* is widely used for reducing pest aphid populations in greenhouses, orchards and gardens in North America since 1916 and in Western Europe since 1982, where it is sold by different private companies (e.g. Biotop SAS, BioBest and Koppert) (1,4). Little attention has been paid to the development of feral populations of *H. axyridis* in Europe. This is surprising given the rapid colonisation of a wide range of American ecosystems, and growing concerns over the negative impact of natural enemy introductions (5-7). Recent observations suggest that this species is now invading (semi-)natural ecosystems in Belgium and may become a potential threat for native ladybird species and other aphid predators.

Adults of *H. axyridis* are strongly oval and convex in shape, measure 5-8 mm and are larger than most of the indigenous ladybird species. The elytra usually display a wide "keel" at the apex. They are highly colour polymorphic with elytra ranging from pale yellow-orange to black bearing 0-19 spots. The head, antennae, and mouthparts are generally straw-yellow but are sometimes tinged with black. The pronotum is similarly straw-yellow with up to five black spots or with lateral spots usually joined to form two curved lines, an M-shaped mark, or a solid trapezoid.

Larvae are elongate, somewhat flattened, and adorned with strong tubercles and spines. The mature larva is distinctively and strikingly coloured. The overall ground colour is mostly black to dark bluish-grey, with a prominent bright yellow-orange patch extending over the dorsolateral lobes of abdominal segments 1-5 on each side. A more detailed description of the species is given by (1).

A large scale field survey of ladybirds was launched in Belgium in 1999 by the *Coccinula* working group, initiated by "Jeunes & Nature" and the Research Centre for Nature, Forests and Wood in the Walloon Region and the

"Jeugdbond voor Natuurstudie en Milieubescherming" and the Institute of Nature Conservation in the Flemish Region. The number of collaborators increased rapidly (about 450 at present) and a large part of the Belgian territory is now being surveyed for ladybirds.

Although *H. axyridis* has been used for biological control in Belgium since 1997 (8), no observations in the wild were reported until September 2001 (Ghent). Since then, the number of observations increased steadily (Fig. 1), especially in the provinces of Brabant and Antwerp (Fig. 2).

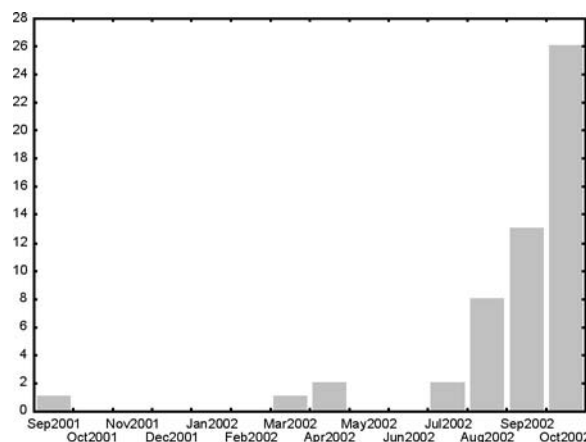


Fig. 1. – Trend in the number of field observations of *Harmonia axyridis* until October 2002.

Although numerous observations originated from cities and anthropogenic sites, individuals were also found in (semi-)natural habitats such as forests and meadows (e.g. Wilrijk, Houwaart, Olen and Koersel). Most individuals were found on deciduous trees, especially lime (*Tilia* sp.) and maple (*Acer* sp.). Observations of eggs, larvae and pupae are now widespread and demonstrate that the Multicoloured Asian Ladybird reproduces successfully in many places. Overwintering aggregations were also observed in houses (e.g., Brussels and Antwerp) since the end of October 2002. Observations of feral populations elsewhere in Europe have recently been reported in Greece (9), Southern France (4,10), and Germany (11).

Studies of the expansion of *H. axyridis* in North America showed that it can rapidly colonise large areas. After some time, this species often becomes the

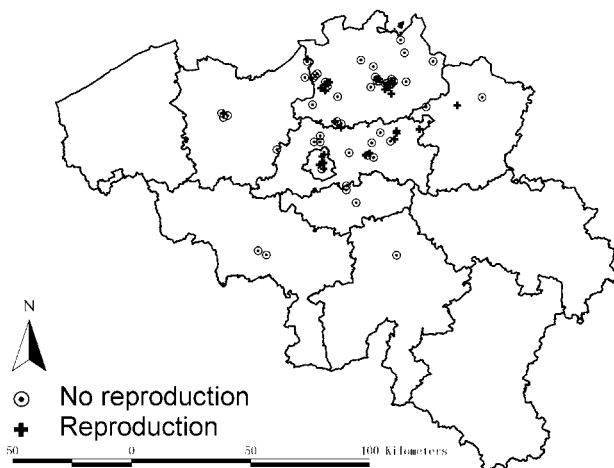


Fig. 2. – Sites with observations of *H. axyridis* since September 2001. Reproduction is indicated when eggs, larvae and/or pupae were observed.

predominant species in aphidophagous guilds and can induce the decline of native ladybird species (12-14). Furthermore, it is a very good colonizer and is very competitive because it :

- has a wide trophic niche and a high level of phenotypic plasticity for several life-history traits (15),
- is very voracious and is often involved in intraguild interactions with other aphidophagous species, including *Adalia bipunctata* (L.) and *Coccinella septempunctata* L., two ladybird species native to Western Europe. In this case, it frequently behaves as an intraguild predator (16-18),
- has strong dispersal capacities and undertakes long range migrations to overwintering sites (19-21).

If the exponential increase in the number of *H. axyridis* populations continues in following years, it is likely that it will invade most of the (semi-)natural ecosystems in Belgium (and in the neighbouring countries), causing harm to native aphidophagous species. In this context, the responsibility of private companies (selling *H. axyridis* or other biocontrol agents) should be pointed out. The example of *H. axyridis* demonstrates the urgent need for risk assessment procedures before biocontrol agents can be sold and spread on a large scale, as is already imposed for environmental dissemination of pesticides and genetically modified organisms. Furthermore, given the example of N-America, studies on feral populations of *H. axyridis* in Belgium, and other affected countries, are urgently needed in order to estimate its impact on the indigenous aphidophagous fauna.

REFERENCES

1. IABLOKOFF-KHNZORIAN, S.M. (1982). *Les Coccinelles (Coleoptera : Coccinellidae)*. Boubée, Paris.
2. FERRAN, A., H. NIKNAM, F. KABIRI, J.L. PICARD, C. DE HERCE, J. BRUN, G. IPERTI & L. LAPCHIN (1996). The use of *Harmonia axyridis* larvae (Coleoptera : Coccinellidae) against *Macrosiphum rosae* (Hemiptera : Aphididae) on rose bushes. *European Journal of Entomology*, 93 : 59-67.
3. DE CLERCQ, P. (2002). Dark Clouds and their silver linings : exotic generalist predators in augmentative biological control. *Neotropical Entomology* 31, in press.
4. MAIGNET, P. (2002). *Bilan de l'introduction en France de la coccinelle Harmonia axyridis Pallas en lutte biologique contre les pucerons*, Oral contribution at the "Deuxième Conférence Internationale sur les Moyens Alternatifs de Lutte contre les Organismes Nuisibles aux Végétaux", Lille, 4-7 mars 2002.
5. SIMBERLOFF, D. & P. STILING (1996). Risks of species introduced for biological control. *Biological Conservation*, 78 : 185-192.
6. HOPPER, K.R. (1998). Assessing and improving the safety of introductions for biological control. *Phytoprotection*, 79 (S) : 84-93.
7. FOLLET, P.A. & J.J. DUAN (1999). *Non-target effects of biological control*. Kluwer Academic Publishers, Boston, 336 pp.
8. ADAM, B., Horpi systems Société Anonyme, pers. comm.
9. KATSOYANNOS P., D.C. KONTODIMAS, G.J. STATHAS & C.T. TSARTSALIS (1997). Establishment of *Harmonia axyridis* on citrus and some data on its phenology in Greece. *Phytoparasitica*, 25(3) : 183-191.
10. IPERTI, G. & E. BERTRAND (2001). Hibernation of *Harmonia axyridis* (Coleoptera : Coccinellidae) in Southern France. *Acta Soc. Zool. Bohem.*, 65 : 207-210.
11. LOOMANS, A., Wageningen University, pers. comm.
12. ELLIOT, N., R. KIECKHEFER & W. KAUFFMAN (1996). Effects of an invading coccinellid on native coccinellids in an agricultural landscape. *Oecologia*, 105 : 537-544.
13. BROWN, M.W. & S.S. MILLER (1998). Coccinellidae (Coleoptera) in apple orchards of eastern west Virginia and the impact of invasion by *Harmonia axyridis*. *Entomological News*, 109(2) : 143-151.
14. COLUNGA-GARCIA, M. & S.H. GAGE (1998). Arrival, establishment, and habitat use of the multicoloured Asian lady beetle (Coleoptera : Coccinellidae) in a Michigan landscape. *Environmental Entomology*, 27(6) : 1574-1580.
15. GRILL C.P., A.J. MOORE & E.D. BRODIE (1997). The genetics of phenotypic plasticity in a colonizing population of the ladybird beetle *Harmonia axyridis*. *Heredity*, 78 (3) : 261-269.
16. COTTRELL, T.E. & K.V. YEARGAN (1998). Intraguild predation between an introduced lady beetle, *Harmonia axyridis* (Coleoptera : Coccinellidae), and a native lady beetle, *Coleomegilla maculata* (Coleoptera : Coccinellidae). *Journal of the Kansas Entomological Society*, 71(2) : 159-163.
17. ASUDA, H. & S. KATSUHIRO (1997). Cannibalism and interspecific predation in two predatory ladybirds in relation to prey abundance in the field. *Entomophaga*, 42(1-2) : 153-163.
18. YASUDA, H., T. KIKUCHI, P. KINDLMANN & S. SATO (2001). Relationships between attack and escape rates, cannibalism, and intraguild predation in larvae of two predatory ladybirds. *Journal of Insect Behavior*, 14(3) : 373-384.
19. NALEPA, C. A., K.A. KIDD et al. (1996). Biology of *Harmonia axyridis* (Coleoptera : Coccinellidae) in winter aggregations. *Annals of the Entomological Society of America*, 89(5) : 681-685.
20. OSAWA, N. (2000). Population field studies on the aphidophagous ladybird beetle *Harmonia axyridis* (Coleoptera : Coccinellidae) : Resource tracking and population characteristics. *Population Ecology*, 42(2) : 115-127.
21. WITH K.A., D.M. PAVUK, J.L. WORCHUCK, R.K. OATES & J.L. FISHER (2002). Threshold effects of landscape structure on biological control in agroecosystems. *Ecological Applications*, 12 : 52-65.

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