



## Intra-guild predation of harlequin ladybird larvae by lacewing larvae

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During the summer I go swimming in the Colchester Royal Grammar School open air pool, which is five minutes, by bike, from where we live. Bikes are usually left in the playground against a railing (Photo 1), which this year seemed to have quite a few ladybirds strutting up and down. They were mostly harlequins *Harmonia axyridis* (Coleoptera: Coccinellidae), plus others that I wasn't so familiar with. Incidentally, the former were extremely abundant in our front garden last autumn but not at all this year. Now, I must tell you that since members of the AES were asked to help collect ladybird data (Ware et al., 2005) I've entered the ladybird world, and here I am reporting on progress.

Why so many ladybirds in such an apparently barren place?

In my puzzlement I started looking around, taking lots of photos, and gradually expanding my range to the brick wall at right angles to the railing, plus adjacent building, and the mature oak tree *Quercus robur* (Fagaceae) nearby (Figure 1). What did I see? Lots of very interesting invertebrates, most of them new to me, however after many emails, and a fair bit of reading, I finally had a notion of what was going on.

Starting from the tiniest, at under 1 mm, there were many clusters of shiny black soil mites, aptly called beetle mites (Acari: Oribatidae) not only in the railing joints but on the shadier side of the brick wall too. These mites feed on lichens and other soil debris (Norton, 1990; Moran, 2006) and soon afterwards I was pleasantly surprised to discover other colonised brick walls in our neighbourhood. Ladybirds, larvae, pupae (Figure 2), and imagines, could be found near the mites. However, I never saw any ladybirds feeding on them, just mysterious dark patches, perhaps festive remains of their exoskeletons.

Next, there were much paler patches of what turned out to be bark-lice Psocids (Psocoptera: Psocidae), 2-4 mm long, (Aldrete, 1990; Meyer, 2006). They also liked to be together and were mostly on the brick wall; but were much more mobile, they quickly reassembled when disturbed, behaving a bit like a herd of deer. Also, given the opportunity, they clustered under fallen acorn cups (Fremlin, 2006). They are a woodland species and surely must have fallen down from



Figure 1 - General view of the CRGS playground where lots of ladybirds were found on the railing, low wall and the building wall, facing east, also on the oak tree trunk. Note that none were found on the little garden the left of the building, and on the hedge on the right. Picture taken on 13/08/2006.

Figure 2 - Harlequin ladybird pupa next to beetle mites in a joint of the galvanised steel railing. Note the whitish spines at the base of the pupa, they are part of the skin shed by the larva as it pupated. Ladybirds pupate in the open, a rather exposed situation, however any intruder approaching them from behind, if it gets past the spines, will get snapped up by their dorsal clefts as they promptly flip upwards; you just try tickling one. 06/08/2006

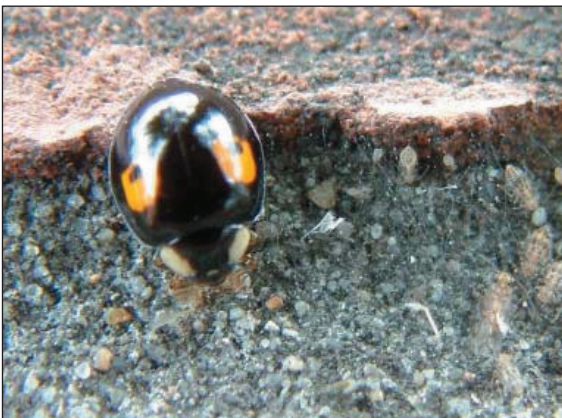


Figure 3 - Harlequin ladybird *H. axyridis* f. *conspicua* feeding on a bark-louse. Note the little group, right, of the sand coloured barklice close together. 31/08/2006.



Figure 4 - Harlequin ladybird larva feeding underneath the vulnerable part of a pupa of its own species. Note that the pupa is somewhat deflated compared to the one in the Photo 2. 17/08/2006.

Figure 5 - Cannibalism between last instar harlequin ladybird larvae, feeding underneath sideways thus avoiding their dorsal spines and tubercles, a strong defensive armature. Note also the beetle mites and the lichens on the mortar between the bricks. 18/08/2006.



Figure 6 - Left, green pupa of a micro moth which was probably eaten, soon afterwards, by the harlequin ladybird *H. axyridis* f. *spectabilis*. On the right is a dead harlequin ladybird larva, probably sucked dry by a larva of which species I'm also not sure of. 17/08/2006.



Figure 7 - Lacewing larva spearing a last instar harlequin ladybird larva laterally, using the same tactics as the harlequins, but with the added advantage of its long jaws, compare with Photo 5. 15/08/2006.

Figure 8 - Lacewing larva and harlequin ladybird *H. axyridis* f. *spectabilis*, face to face. This larva scurried round the ladybird always keeping its distance. 03/09/06.



Figure 9 - Lacewing imago, probably freshly emerged, next to a harlequin ladybird *H. axyridis* f. *succinea*, both highly unpalatable. 01/09/06.



the oak tree. On closer inspection of the oak trunk though I couldn't find any there, perhaps they were feeding under the bark? However there was plenty of wildlife to be found, for instance, the harlequins and the 10-spot ladybirds (*Adalia 10-punctata*) were also there, the latter are associated with deciduous trees (Majerus et al., 2006). On the railing and immediate surrounds the 10-spot ladybirds were perhaps the most abundant species after the tiny, just over 2mm, black ladybirds *Scymnus auritus* Thun., apparently a widespread species associated with oak woodland (Jerry Bowdrey, pers. comm.), more presents from the oak, no doubt. Now these bark-lice were fed upon with great gusto, a great delicacy, not just by the ladybirds, larvae and imagines, but also by the swift moving lacewing larvae *Chrysoperla carnea* (Neuroptera: Chrysopidae), another first for me. The lacewing activity peaked during warm afternoons and was happening only on either side of the brick wall, running approximately north-east though (Koryszko, 2006). I checked the tree trunk and they were there too, then I took one home and it promptly pupated, thus saving me the trouble of feeding it.

There was indeed a lot of eating going on, not just the feasting on the bark-lice (Figure 3), but other things too including harlequin larvae eating each other and their own pupae (Figures 4 and 5). For instance, I'm pretty sure that a harlequin imago found next to a green micro moth pupa (Figure 6) was responsible for its disappearance, alas while I was swimming, very frustrating. Note that in the same photo the other thing on its right is an apparently shrivelled last instar harlequin larva; there were plenty of those about too, which brings me to the climax of my observations, actually seeing, and being able to photograph, the smaller but swifter lacewing larva having the better of the slower last instar harlequin larvae (Figure 7). The black harlequin ladybird larvae have their backs adorned with tubercles and spines, and during their last instar also have aposematic orange patches – advertising their toxins – possibly the same as in the imagines (Frank et al., 2006); these were the only ladybird larvae that I spotted there. For me it was quite rewarding to observe, mostly by poring over my photos, how the lacewing and harlequin larvae tackled all these defences, and did not seem to mind about the toxins.

Later on, much better informed, I was able to spot a silky lacewing pupa in a crack in the brick wall, and a lacewing larva going round a stationary harlequin imago, showing great respect (Figure 8)? Better still, an imago next to a harlequin imago both brimful of chemical defences (Eisner, 2004; Eisner et al., 2005) and yet seemingly oblivious of each other (Figure 9).



Now I am eager, when the pool opens again next May, to start observing again this amazing habitat around that oak tree, a real oasis surrounded by concrete; one can only start to imagine what could be going on in its canopy. Would the harlequins and lacewings be up there as well?

Coincidentally it was found that individual trees were by far the most valuable for wildlife in general, and the native oaks scored the most points (Alexander, et al., 2006). Just of ladybirds I found underneath it a total of four species, which included the odd two-spot ladybird *Adalia 2-punctata*, plus some spiders, moths, etc.; more photos uploaded in a website (Fremlin, 2006). I've also checked a row of three mature London planes *Platanus acerifolia* (Platanaceae), at the entrance to the playground, and found no signs of ladybirds, or other invertebrates, either on their trunks or on the ground; these trees do score very low (Alexander, et al., 2006). As for the observations on the lacewing larvae feeding on the harlequin larvae, it would certainly be very valuable to collect more field data as in laboratory experiments it was found that it was the other way round; the harlequin ladybird larvae were the most effective intra-guild combatant against lacewing larvae of similar age, albeit a different species, *C. rufilabris* (Michaud, 2003).

Is the harlequin ladybird a threat to our native species? (Ware et al., 2005). Probably not to the lacewings, my observations show that the harlequins have possibly encountered one enemy in one of our native lacewings and perhaps will not find it so easy going in Britain. Who knows?

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