Observations on unusual phenology in parasites of *Cardiaspina fiscella:* (A lerp making psyllid)

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Cardiaspina fiscella (the brown lace lerp) was first found in Auckland in1996. It has now spread to eucalypts covering half of the north island. This psyllid is causing severe damage to *Eucalyptus botryoides E. saligna* and related tree species. We set out in 1997 to find a possible biocontrol for this insect pest and as usual found some unanswered questions.

In Australia we found several species of Encyrtidae which included primary parasitoids and hyperparasitoids. Our objective was to find and identify a good candidate for a biocontrol programme which could be cultured free of hyperparasites. We were successful in this endeavour and rapidly identified several candidates. One parasitoid was common, demonstrated good control and was not difficult to breed free of the hyperparasites. This species *Psyllaephagus gemitus* (Hymenoptera: Encyrtidae) is the subject of an application to ERMA to import into quarantine in New Zealand for safety and efficacy testing.

An unusual observation was made during the course of this work and we hope some of our readers can either help or speculate upon what was happening if we outline the story.

Cardiaspina fiscella was easy to find in and around Sydney during November. There were high populations in many eucalypt stands with an accompanying suite of parasitoids and hyperparasites. We successfully isolated several primary parasites from their hyperparasites.

During this period emergence of conspecifics was reasonably synchronous (usually emerging from the puparia within two or three days of each other). During November there was a two day period when the temperature in Sydney exceeded 38°C and on one day the thermometer read in excess of 40°C. As all of us who paid attention in insect temperatures 101 know, many insects either die or aestivate at these temperatures. *Cardiaspina fiscella* is no different (even if it is an Australian). When we returned to the field to collect more insects for our experiments we found that the populations had collapsed. All of the lerps we examined were empty and there was no evidence of crawlers (psyllid nymphs which have not settled down to feed). We did find many parasitoid pupae still on the trees. These we collected and took back to the laboratory for addition to our breeding colony.

The pupae were separated and placed individually in closed petri dishes. This is when our observations became interesting. Previous to this the parasitoid adults emerged synchronously. Although the pupae all appeared to be of the same age and stage of development, the adults began to emerge over longer periods of time. This sequential emergence lasted almost three weeks. One could speculate that they had pupated at different times, but this was a colony we were very familiar with. We had collected insects from these trees every day in the previous weeks and had a good understanding of what was occurring on the trees.

We, like most entomologists who don't know the answer, began to speculate.

- We were incorrect in our previous observations and this was happening all the time but we missed it because of the larger numbers of psyllids and parasites present.
- *Psyllaephagus gemitus*, in the pupal stage, is sensitive to temperature and goes into a longer diapause when temperatures are high. Emergence may be cued by lower temperatures being maintained for given periods of time and what we observed was merely variation between the environment in different petri dishes.
- If the parasitoid emerges after a period of very high temperatures it is unlikely to find suitable hosts. However, if the pupa goes into an extended period of diapause with no particular cue to emergence ie different individuals may emerge from the pupa at different times because the only cue could be high temperatures causing extended diapause.

This would lead to an indiscriminate emergence across the whole population and result in what we observed as 'sequential emergence'. This sequence may be an artefact of the laboratory population size, and in the field large numbers may emerge at one time. However, from an evolutionary standpoint this makes good sense. If the host/prey population periodically collapses to undetectable levels and there is no mechanism for detecting this and taking some action to ensure the survival of the population then the parasite species may become locally extinct. If this collapse is detected and the predator species aestivates/hibernates then the likelihood of survival of the species is enhanced if emergence is sequential. The prey (*C. fiscella*) may take some time to become reestablished and having the population emerge over an extended period of time means that there is a higher probability that they may find host/prey items and maintain the viability of the population of parasitoids.

We have no experimental results from these hypotheses but we thought it would be interesting for The Weta readers to speculate upon the mechanisms at work here. We couldn't find a great deal in the literature on this subject but we know there are many clever people reading this who may have similar observations or replies to our speculations.

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