



ARGOS RESEARCH NOTE: NUMBER 23, NOVEMBER 2006

## Cicada Species in Kiwifruit Orchards

### Introduction

Cicadas are being monitored each year by ARGOS in three different types of NZ kiwifruit orchards - KiwiGreen Hayward ('Green'), KiwiGreen Hort16A ('Gold') and Organic Hayward ('Organic'). We monitor cicadas partly because they can sometimes be a pest, but also because they may be convenient indicators of ecosystem health and their skins (shells) are easy to see and count. Cicada shells may look much the same to most people, but differences in their size (length) and colour can be used to rapidly tell the species apart (Figure 1).

In the summer of 2006, we collected shells for the first time from each of the 30 ARGOS orchards in the Bay of Plenty (10 of each type) to identify the cicada species present. We wanted to see if the different types of orchards tended to harbour different species. If so, this may be another indicator of different ecological consequences of orchard management systems.

### Results

Altogether we identified 6744 shells – a somewhat tedious way to while away a winter's day or two! Science is like that: long hours of methodical drudgery punctuated by excitement when you put the figures together to try to solve a mystery. Two main species were found: the chorus cicada, *Amphipsalta zelandica*, and the clapping cicada, *A. cingulata*. The red-tailed cicada, *Rhodopsalta cruentata*, was also

found but the incidence was less than 1%. Consequently we have ignored it as a potential indicator species. Across all sites, more *A. zelandica* occurred on Organic and Gold orchards, while more *A. cingulata* occurred on Green orchards (Figure 2, top). If we can find out what affects these main two species differently (e.g. sprays, soil conditions, soil fertilization, vegetation, age of orchard, some combination of several factors?), we can link the long-term trends in particular cicada species, or in the proportion of the two species, to changing orchard management.



**Figure 1. The two main Cicada species found on kiwifruit orchards, *Amphipsalta cingulata* (Left) and *A. zelandica*, can be differentiated rapidly by the colour of their shells.**

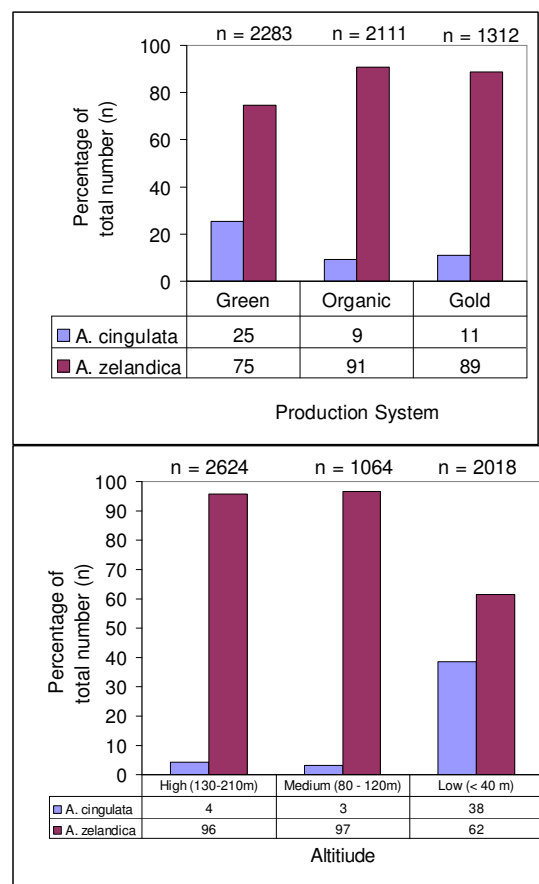
The distribution of species also differed with elevation i.e. compared to higher altitude orchards, the proportion of *A. cingulata* was much higher in the low altitude orchards but the proportion of *A. zelandica* was much lower (Figure 2, bottom). This finding is consistent with other work which found shells of *A. zelandica* to be more common in blocks further from the coast (i.e. higher altitude) while shells of *A. cingulata* were found to be more common in blocks of low altitude (Logan and Connolly, 2005). It helps to find these broader 'ecological landscape' patterns for our pest and indicator species, partly because they give clues on the ecological conditions that drive changes and so leads us to where and when management could best intervene. Monitoring indicator species does not help much if we do not know what changes in species composition is indicating.

The observed altitudinal effect confirms the usefulness of the ARGOS 'cluster' study design. A 'cluster' contains one of each of the three types of orchards being studied with the orchards being close together (see Research Note 29 for more details on the study design for kiwifruit). Consequently influences like elevation, soil type, rainfall have been 'filtered out' of the mix to allow us to more reliably check whether Green, Organic or Gold have different effects on the environment and biota. In this case, had more of the Green orchards been at high elevations, we would have blurred any sign that they had more *A. cingulata*. Having filtered out landscape effects by clustering, the clusters are spread through the main kiwifruit growing areas so that overall the ARGOS results should be more broadly representative of all kiwifruit orchards.

## Conclusions

Cicadas are a convenient multiple species complex to indicate long-term changes in orchard environmental health, especially of soils. The two main species differ in their altitudinal preferences and seem to be affected differently by KiwiGreen and Organic orchard management. From now on ARGOS will monitor the two species separately and investigate what effects cicada abundance and species composition

in different years and different orchard types. You can read more about the choice of spiders and cicadas for ecological monitoring in ARGOS Research Notes 3 and 5.



**Figure 2. Percent species composition of cicadas in different kiwifruit production systems (top) and at different altitudes (bottom).**

## Reference:

Logan, D. and P. Connolly, 2005. Cicadas from kiwifruit orchards in New Zealand and identification of their final instar exuviae (Cicadidae: Homoptera). *New Zealand Entomologist* **28**, 37-48.

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