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Spiders in Kiwifruit Orchards

Biodiversity on orchards

Spiders were chosen as a potential focal species, partly because they may benefit kiwifruit growing, but mainly as indicators of the effects of orchard management on biodiversity. The preliminary results show some interesting differences among orchard type and are used here to illustrate what needs to be considered when selecting an indicator.

Spiders - beneficial predators

Spiders are a conspicuous component of the orchard fauna, but the number of species involved and the ecology of each have not been studied. All spiders are predators, however the type of prey chosen varies considerably. Important pests, such as leafroller moths and passion-vine hoppers, are eaten by web-forming spiders (Fig. 1). 'Wolf spiders' have also been observed feeding on passion-vine hoppers in kiwifruit. Spiders are also food for birds and valuable invertebrates in their own right, so they are worth investigating on orchards.



Fig. 1. An orb-web spider in a Kiwifruit orchard

Spiders as 'indicator species'

Not only are spider webs conspicuous and so readily seen, but they are almost universally distributed. This meets two requirements of a good indicator: ease of use and applicability across many situations.

It is crucial that indicator species are sensitive to a key part of the farm management. Spiders can be directly affected by the chemicals used for pest control, for example by the synthetic pyrethroid permethrin. This chemical was widely used as a component of the broad-spectrum products Attack™ and Averte™. Although use of these products on kiwifruit ceased in 2003-04, other broad spectrum-sprays remain. Different species of spider will be affected to different extents depending on species susceptibility and the degree of exposure to harmful sprays.

Orchard management may indirectly affect spider numbers by altering prey abundance or habitat suitability. For example, composting may increase the numbers of insects and in turn spiders. The web of life is complex - unravelling why an indicator changes may take a lot of time and effort, but is worth it because it provides the key to interpreting the long-term results. We need to be sure just exactly what spiders are indicating about the orchard environment before investing years of effort.

Not all spiders spin permanent webs (Fig. 2). However for this preliminary study we counted webs as being the simplest approach. The ARGOS team is often forced into this type of compromise to simplify the problem and save time but yet still capture the essence of the environmental consequences on orchards from different orchard practices.

Fig. 2. Jumping spiders are not associated with a web and therefore would not have been monitored in our preliminary survey.



Counting spider webs

All 10 clusters of ARGOS orchards in the Bay of Plenty were sampled in autumn 2004. ARGOS is also monitoring clusters at Kerikeri and Nelson, but it is more efficient to trial and perfect monitoring protocols at Bay of Plenty before applying them everywhere. There are 3 kiwifruit orchards per cluster: one organic Hayward, one KiwiGreen Hayward and one KiwiGreen Hort 16A. KiwiGreen is an integrated pest management (IPM) system.

On each orchard, the number, type and position of spider webs on three vines in the central row of each sample block was counted. We counted only on the central row so as to filter out potential influences of shelterbelts and neighbouring orchards or habitats so that our spider counts would be more likely to directly reflect the management on each orchard.

Results

On average there were less than half the number of spider webs per vine in Hort 16A orchards (Fig. 3). This difference was consistent and statistically significant. In part this difference may relate to the younger age of Hort 16A vines. Older vines have more pruning spurs and so offer more sites suitable for web building.

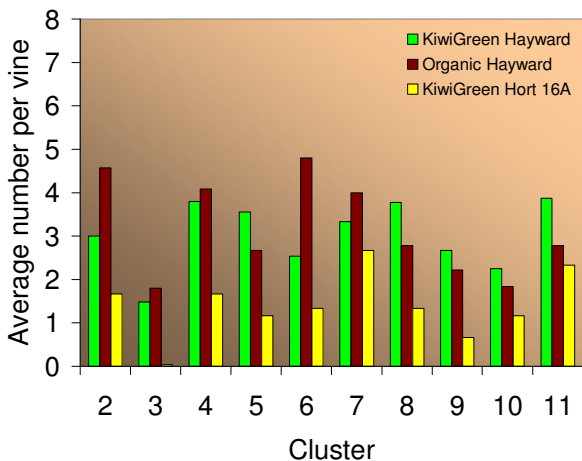


Fig. 3: Number of spider webs in Bay of Plenty ARGOS orchards, autumn 2004.

However most webs were associated with the support structures on which kiwifruit vines are grown, so we think that the vine age explanation is less likely.

There were very similar numbers of spider webs on Hayward vines regardless of whether they were being grown following organic or KiwiGreen (IPM) practices. This may be because few sprays are applied in autumn when we did our survey and when harvest occurs. We will have to follow some of our more changeable indicator species throughout the growing season to get the full picture.

Spider web numbers were similar among the 10 clusters. This contrasts with cicada abundance where the differences among clusters were even greater than differences between orchard type (see ARGOS Research Note 4). All other things being equal, we are more likely to pick focal species for long-term monitoring that are relatively stable in numbers between orchards of the same type. Erratic fluctuations in numbers make it much harder to get a statistically reliable indication of trends and average differences between orchard types.

Where to now with spiders?

Different numbers of web-building spiders in kiwifruit orchards following different production systems show that biodiversity is affected by how kiwifruit is grown. However caution is needed in interpreting this preliminary study which mainly set out to test methods.

Spiders do have potential as an indicator or focal group, but their usefulness and the practicality of monitoring will first need to be compared with other groups. ARGOS is spending much of its first year of field work in screening a huge range of environmental, economic, social indicators and orchard management indicators to pick the best ones for the long haul.

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