

Carabids from pitfall traps in kiwifruit orchards and adjacent native forest

David Logan¹, Joanne Poulton¹ and Christina Rowe²

¹The New Zealand Institute for Plant and Food Research Limited, Private Bag 92169, Auckland 1142, New Zealand

²The New Zealand Institute for Plant and Food Research Limited, 412 No. 1 Road, RD2, Te Puke 3182, New Zealand

Email: david.logan@plantandfood.co.nz

Abstract

Carabids were trapped using pitfalls in kiwifruit orchards and adjacent native forest near Te Puke, North Island. Six carabid species (three endemic) were recorded from pitfall traps in kiwifruit orchards. Five of the species are typical of a wide range of modified habitats including home gardens, cultivated fields and pasture. The most abundant carabid was the adventive species *Lecanomerus vestigialis*. Seven endemic species were captured in pitfall traps in native forest next to kiwifruit orchards. The most abundant species were the medium sized species *Mecodema curvidens* and *Holcaspis ?sinuiventris*. One of the seven endemic species, *Neocicindela spilleri*, also occurred in kiwifruit orchards.

Introduction

Carabids are a well-collected group and often used as indicators of habitat modification. In New Zealand, the development of production landscapes at the expense of native forests has probably led to a decline in the range and abundance of native carabids (McGuinness 2007). From a conservation point of view, knowing what native and endemic carabid species still persist in the remaining fragments of native forest and other vegetation, and whether the production landscape is also a habitat for them, is important. Pine forests, pastures and cultivated fields can host

some native and endemic carabid species (Larochele and Larivière 2001, Berndt et al. 2008). Kiwifruit orchards also provide some habitat for carabids. Lövei (1991) reported that more carabids occurred in a commercial organic kiwifruit orchard than in an abandoned one, but did not list the species. Todd et al. (2011), in a survey of the insect biodiversity on ten conventionally-managed and ten organically-managed kiwifruit orchards in the Bay of Plenty, listed six carabid species in their supplementary material (*Haplanister crypticus*, *Lecanomerus vestigialis*, *Mecodema occiputale*, *Prosopogmus oodiformis*, *Rhytisternus miser* and *Scopodes* sp.) that were captured by pitfall traps, pan traps or flight intercept traps.

Here we provide additional records of carabids found in pitfalls in two separate studies in kiwifruit orchards in the Bay of Plenty. The aim of the first study was to assess the non-target effects of an insecticide application (bifenthrin) on the epigeic fauna of kiwifruit orchard blocks. There were no or weak effects on carabids so the records from all treatments are included here. In a second study, the carabids were a bycatch in pitfall traps established in kiwifruit orchards and adjacent native forest to capture final-instar nymphs of the chorus cicada *Amphipsalta zelandica*.

Methods

In Study 1, pitfall traps (n=24 at one site and 36 at two sites) were established in three kiwifruit orchard blocks (*Actinidia chinensis* var. *deliciosa*, ‘Hayward’) near Te Puke in the Bay of Plenty (Sites 1–3, Figure 1) on 12 January 2012 and removed 7 days later. The traps were plastic containers (560 mL) partly filled with approximately 200 mL of soapy water. Pairs of pitfall traps separated by 5 m were in plots of 40 m² that were distributed randomly throughout each of the three orchard blocks (0.65–1.21 ha in size). The ground at Sites 1 and 3 was mostly free of vegetation while approximately one-third of Site 2 was covered by the weed *Tradescantia fluminensis*.

In Study 2, pitfall traps (n=30 plastic containers with soapy water as above) were established in native forest bordering streams and in adjacent kiwifruit orchard blocks at three sites (Sites 4–6, Figure 1). Within native forest, placement of pitfall traps was constrained to ledges of relatively flat ground where these could be found on the slopes of the stream banks. In

kiwifruit orchard blocks, traps ($n=30$) were placed near support posts to avoid damage from mowing and distributed to sample an area of about 0.5 ha closest to the kiwifruit/forest boundary. For consistency, only kiwifruit orchard blocks with conventionally managed 'Hayward' vines were sampled. All sites were in the vicinity of Te Puke. The orchard ground at Sites 4 and 5 was well grassed, but was sparsely vegetated at Site 6. Traps were established in mid-January 2013 and checked at approximately weekly intervals for 29 or 30 days.

Carabids were identified from keys and descriptions (Britton 1940, 1941, Butcher 1984, Savill 1999, Seldon and Leschen 2011, Larochelle and Larivière 2005, 2007, 2013), by comparison with New Zealand Arthropod Collection (NZAC) specimens, and by expert advice.

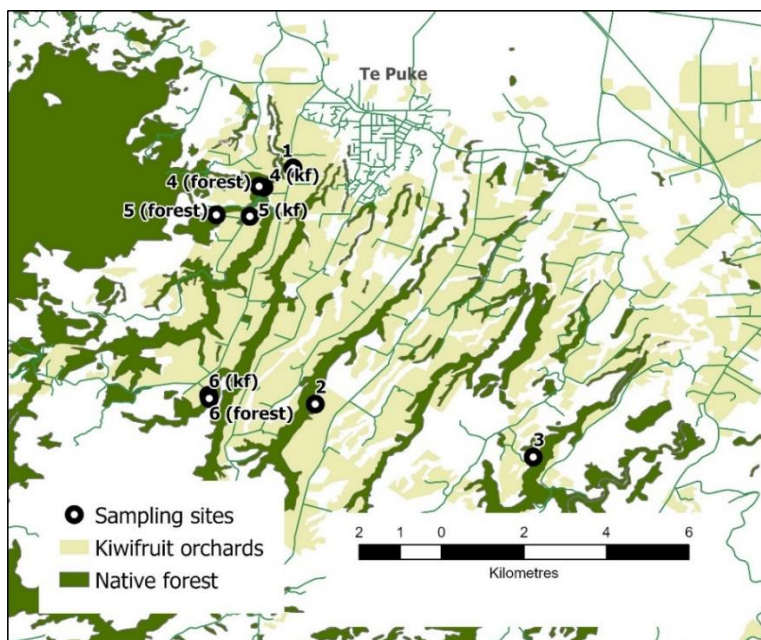


Figure 1. Location of sites where carabids were sampled by pitfall traps in kiwifruit orchards (1, 2 and 3), and in kiwifruit orchards (kf) and adjacent native forest (forest) (4, 5 and 6).

Results

In Study 1, a total of 190 carabids belonging to five species were captured in pitfalls at the three kiwifruit orchards (Table 1). Two adventive species *Lecanomerus vestigialis* (n=108) and *Prosopogmus oodiformis* (n=58) were the most abundant carabids captured.

In Study 2, a total of 186 carabids belonging to 11 species were captured with more individuals found in pitfall traps in native forest (n=172) than in kiwifruit orchards (n=14) (Table 2). Seven species, all endemic, were found in pitfalls in native forest. The medium-sized species *Mecodema curvidens* (n=69) and *Holcaspis ?sinuiventris* (n=50) were the most abundant. Five species were found in pitfalls in kiwifruit orchards with one of these, *Neocicindela spilleri*, also occurring in native forest. The four species found only in kiwifruit orchards (*Neocicindela tuberculata*, *Haplanister crypticus*, *Lecanomerus vestigialis* and *Scopodes fossulatus*) were also trapped in kiwifruit orchard blocks in Study 1.

Table 1. Carabids (individuals per 100 trap days) collected in pitfall traps in three kiwifruit orchards near Te Puke in the Bay of Plenty. Pitfall trapping occurred over 7 days in January 2012. E = endemic, A = adventive.

Subfamily, Tribe Species, Origin	Site 1	Site 2	Site 3
Carabinae, Cicindelini			
<i>Neocicindela tuberculata</i> (Fabricius), E	3.17	0	0.40
Harpalinae, Pterostichini			
<i>Prosopogmus oodiformis</i> (Macleay), A	0.79	5.35	18.65
Harpalinae, Harpalini			
<i>Haplanister crypticus</i> Moore, A	0	0	0.40
<i>Lecanomerus vestigialis</i> (Erichson), A	22.22	0	20.63
Harpalinae, Pentagoniini			
<i>Scopodes fossulatus</i> , (Blanchard), E	0	4.76	2.38

Table 2. Carabid species from pitfall traps in kiwifruit orchards and adjacent native forest, and their relative abundance (individuals per 100 trap days). Pitfall trapping occurred during 29 or 30 days in Jan–Feb 2013. E = endemic, A = adventive.

Subfamily, Tribe Species, Origin	Kiwifruit			Native forest		
	Site	Site	Site	Site	Site	Site
	4	5	6	4	5	6
Carabinae, Cicindelini						
<i>Neocicindela spilleri</i> Brouerius van Nidek, E	0	0	0.23	0.56	0.80	2.18
<i>N. tuberculata</i> , (Fabricius), E	0	0	0.11	0	0	0
Broschinae, Broscini						
<i>Mecodema curvidens</i> (Broun), E	0	0	0	2.33	2.87	2.64
Harpalinae, Pterostichini						
<i>Aulacopodus ?calathoides</i> , E	0	0	0	0	0.57	0
<i>Holcaspis ?sinuiventris</i> , E	0	0	0	3.11	0.34	2.18
Harpalinae, Harpalini						
<i>Haplanister crypticus</i> Moore, A	0	0	0.11	0	0	0
<i>Lecanomerus sharpi</i> (Csiki), E	0	0	0	0	0.34	0
<i>Lecanomerus vestigialis</i> (Erichson), A	0	0.69	0.11	0	0	0
<i>Parabaris atratus</i> Broun, E	0	0	0	0	0	0.80
Harpalinae, Platini						
<i>Ctenognathis</i> nr. <i>bidens</i> , E	0	0	0	0	0	0.80
Harpalinae, Pentagonicina						
<i>Scopodes fossulatus</i> (Blanchard), E	0.11	0	0.23	0	0	0

Discussion

In total, six carabid species (three endemic) were recorded from pitfall traps in kiwifruit orchards from the two studies reported here. Five of these species are typical of a wide range of modified habitats including home gardens, cultivated fields and pasture (Laroche and Larivière 2001). The sixth species, *Neocicindela spilleri*, is considered to have a strong preference for forest: it was only captured twice in pitfalls in one kiwifruit orchard block. One species, *Haplanister crypticus*, may be mainly phytophagous, while the other species are thought to be predacious (Laroche and Larivière 2001). Most of the carabid species in kiwifruit orchards were relatively rare. There was a large difference in abundance of carabids between sites in the two studies, indicating that there may be significant patchiness in their distribution between orchards.

Todd et al. (2011) reported three of the same species, with a fourth (*Scopodes* sp.) possibly being the widespread species *S. fossulatus* found in this study. In addition, Todd et al. (2011) reported the endemic forest carabid *Mecodema occiputale*, synonymised under *M. curvidens* by Seldon and Buckley (2019), and the adventive species *Rhytisternus miser* (Chaudoir) making eight the total number of carabid species confirmed from kiwifruit orchard blocks. At least one other species, the adventive *Philophlaeus luculentus* (Newman) has also been found in flight intercept traps in kiwifruit orchards (D. Logan, unpubl.).

Seven species of carabids were found in pitfalls in native forest. All are endemic species. Six of these species are nocturnal predators and typical of forested stream margins (Larochelle and Larivière 2001). The seventh species, *Neocicindela spilleri*, is diurnally active and associated with sunny patches in native forest. Their occurrence a short distance from commercial kiwifruit orchards suggests that horticultural activities such as spraying are not incompatible with the survival of epigeic carabid fauna in forest remnants. Consequently native forest remnants in kiwifruit production landscapes have value for the long-term conservation of native and endemic carabids. There may also be value in replanting unused areas of kiwifruit orchards with native trees which could be assessed in future carabid surveys.

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