

**Invertebrates and Fungi Associated with Japanese
Honeysuckle, *Lonicera japonica* (Caprifoliaceae), in New
Zealand**

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Summary

Project and Client

A survey of the invertebrate fauna and fungi associated with Japanese honeysuckle, *Lonicera japonica*, in New Zealand was carried out between November 2004 and April 2005 by Landcare Research for regional councils and the Department of Conservation.

Objective

- To survey the invertebrate fauna and fungi associated with Japanese honeysuckle, *Lonicera japonica*, in New Zealand, and identify the herbivores (and their associated predators and parasitoids) and fungal pathogens present.

Method

- The invertebrate fauna and fungi associated with Japanese honeysuckle were sampled at 33 New Zealand sites, ranging from Horeke in the Hokianga Harbour in the north of the North Island to Ross on the West Coast of the South Island in the south.

Results

- No specialist Japanese honeysuckle invertebrates were found during the survey.
- The overall damage that could be attributed to invertebrate herbivory was minimal.
- The most obvious foliage damage appeared to be caused by the larvae of a range of moth species (especially leafrollers) and molluscs (slugs and snails).
- Two sap-feeders, *Scolypopa australis* (the passionvine hopper) and *Siphanta acuta*, were the only invertebrate species found during the survey to be classed as 'abundant'.
- Thrips occasionally produce silvery-coloured patches on Japanese honeysuckle foliage but they probably have little overall effect.
- Generalist predators found on Japanese honeysuckle include spiders, ladybirds, lacewings, earwigs, ants and praying mantids.
- A total of 461 fungal isolates was obtained from 469 Japanese honeysuckle tissues plated.
- A high frequency of fungal colonisation of Japanese honeysuckle was observed with 98.3% of tissue fragments colonised.
- At least 35 fungal species were isolated into culture and identified from diseased Japanese honeysuckle tissues.
- No significant primary leaf, stem or flower pathogens were isolated from Japanese honeysuckle.
- Three primary pathogens were identified directly from diseased specimens.
- *Pseudocercospora lonicera*, a leaf spot pathogen, was present on Japanese honeysuckle at 29 locations throughout New Zealand.
- *Chondrostereum pupureum*, a fungus developed and registered as a mycoherbicide for tree weeds overseas, was collected from the woody base of a vine in Northland.
- Honeysuckle leaf blight, caused by a fungus *Insolibasidium deformans*, was identified on leaves from Auckland.

Conclusions

- Japanese honeysuckle is attacked by a wide range of native and introduced invertebrates in New Zealand but overall damage appears to be minimal and none of the herbivore niches on Japanese honeysuckle are well utilised in New Zealand.
- Foliage feeders (most noticeably lepidopterous larvae, molluscs and thrips) appear to be the most damaging invertebrates currently feeding on Japanese honeysuckle in New Zealand.
- A range of weak and secondary opportunistic leaf pathogens was found to be associated with minor superficial leaf spots on Japanese honeysuckle populations in New Zealand.
- There is little potential to use any of these fungi as either inundative or classical agents against the rapidly expanding Japanese honeysuckle infestations.

Recommendation

- Given that invertebrate herbivore damage to Japanese honeysuckle in New Zealand is minimal and that no specialised pathogenic fungi are known to be present on the weed in New Zealand, we recommend that a classical biological control programme for Japanese honeysuckle should proceed.

1. Introduction

A survey of the invertebrate fauna and fungi associated with Japanese honeysuckle, *Lonicera japonica*, in New Zealand was carried out between November 2004 and April 2005 by Landcare Research for regional councils and the Department of Conservation. This was a recommendation of a feasibility study investigating the prospects of biological control of Japanese honeysuckle in New Zealand (Standish 2002).

2. Background

Japanese honeysuckle, *Lonicera japonica* Thunb. (Caprifoliaceae), is a weed of native forest remnants and shrublands throughout most of the North Island and northern South Island of New Zealand (Standish 2002). It is a perennial climbing and twining woody vine of the honeysuckle family (Caprifoliaceae) and spreads by seeds, underground rhizomes, and above-ground runners. It grows rapidly and can create dense tangled thickets that can smother and engulf small trees and shrubs. In New Zealand Japanese honeysuckle blooms from September to May with sweetly fragrant white flowers, tinged with pink and purple, fading to yellow with age. The fruit, a many-seeded black pulpy berry, matures in autumn.

According to information accessed by the feasibility study conducted by Dr Rachel Standish (Standish 2002), Japanese honeysuckle is native to temperate eastern Asia. It has naturalised in Australia, North America, Hawaii, southwest Britain, southern Chile and Argentina (Williams et al. 2001), southern Brazil (R. Barreto, Universidade Federal de Vicosa, Brazil, pers. comm.), and parts of Europe (Bay of Plenty Regional Council 1998). It was first recorded as being naturalised in New Zealand in 1926 (Webb et al. 1988) but is known to have been cultivated here since 1872.

Japanese honeysuckle affects hedges, roadsides, wastelands, open scrub, shrublands, woodlands, forest margins (including pine plantations), wetlands and riparian zones (Williams et al. 2001). It has spread via deliberate plantings (Auckland Regional Council 1998), stem fragments dumped in garden refuse (Department of Conservation 2001), hedge-cutting machinery, and grazing mammals (Williams et al. 2001). Seeds are dispersed by birds, although seedlings are rare (Williams et al. 2001).

Once introduced to a site, Japanese honeysuckle quickly builds up a mass of vegetative material using host plants and its own stems for support (Williams & Timmins 1999). It is a hardy plant, tolerant of cold winter temperatures (it has been noted as growing until the first frosts) and a wide range of soil substrates including poorly draining soils and those high in salt and heavy metals (Williams et al. 2001). It spans all 13 Department of Conservation conservancies and is regarded as a threat to conservation in all but Canterbury, Otago and Southland conservancies (Standish 2002).

Japanese honeysuckle is generally regarded as a difficult weed to control (Williams et al. 2001; Department of Conservation 2001), and biological control could offer some advantages

over current control methods. Use of host-specific biological control agents would reduce chemical herbicides impacts on desirable flora. Biological control also offers continuous action and self-dispersal that current control methods do not offer. There have been no previous biological control programmes for Japanese honeysuckle elsewhere in the world but other countries may be interested in collaborating with New Zealand on such a programme. Several potential biocontrol agents, including insects and pathogens, are known from the native range of Japanese honeysuckle (Standish 2002), and a thorough survey in the native range would no doubt find many more potential biocontrol agents.

This report describes the results of a survey of the invertebrate fauna and fungi associated with Japanese honeysuckle in New Zealand. The main aims of the survey were to determine whether any specialist Japanese honeysuckle invertebrates or fungi are already present in New Zealand, whether any generalist invertebrate herbivores or fungal pathogens are exerting a significant adverse impact on Japanese honeysuckle in New Zealand, and to record the invertebrate parasitoids and predators associated with the herbivorous invertebrates on Japanese honeysuckle.

3. Objective

- To survey the invertebrate fauna and fungi associated with Japanese honeysuckle, *Lonicera japonica*, in New Zealand and identify the herbivores (and their associated predators and parasitoids) and fungal pathogens present.

4. Methods

4.1 Invertebrates

Invertebrate fauna of Japanese honeysuckle, *Lonicera japonica*, were surveyed at 33 New Zealand sites between November 2004 and April 2005 (Fig. 1). At each site, 10 collection locations were selected randomly. A collecting tray, 80 cm x 80 cm, was placed under suitable parts of selected plants, and the foliage above the tray was hit five times with a solid stick. Most invertebrates that fell onto the tray were collected with an aspirator and preserved in 95% alcohol. Caterpillars (Lepidoptera) and immature stages of other groups (e.g., Heteroptera) were collected live and placed, along with Japanese honeysuckle foliage, in ventilated containers to rear through to adult for identification. Parasitoids emerging from the larvae were identified.

A rapid visual inspection (generally less than 1 minute for each of the 10 collection locations at each site), was made of foliage, growing points, and stems, for signs of invertebrates such as gall-formers, leaf miners, stem borers, and scale insects. Sections of the stems were cut to look for signs of invertebrates or their damage. Invertebrates found during the visual inspections were collected live, along with the plant material they were on, for identification. If fruit was present, approximately 100 berries were collected randomly from each site and stored in ventilated rearing containers to identify fruit-feeders and seed-feeders. At each site,

a visual estimate was made of the amount of herbivore-related damage, and the likely cause of the damage was noted (e.g., adult beetles, leafroller caterpillars).

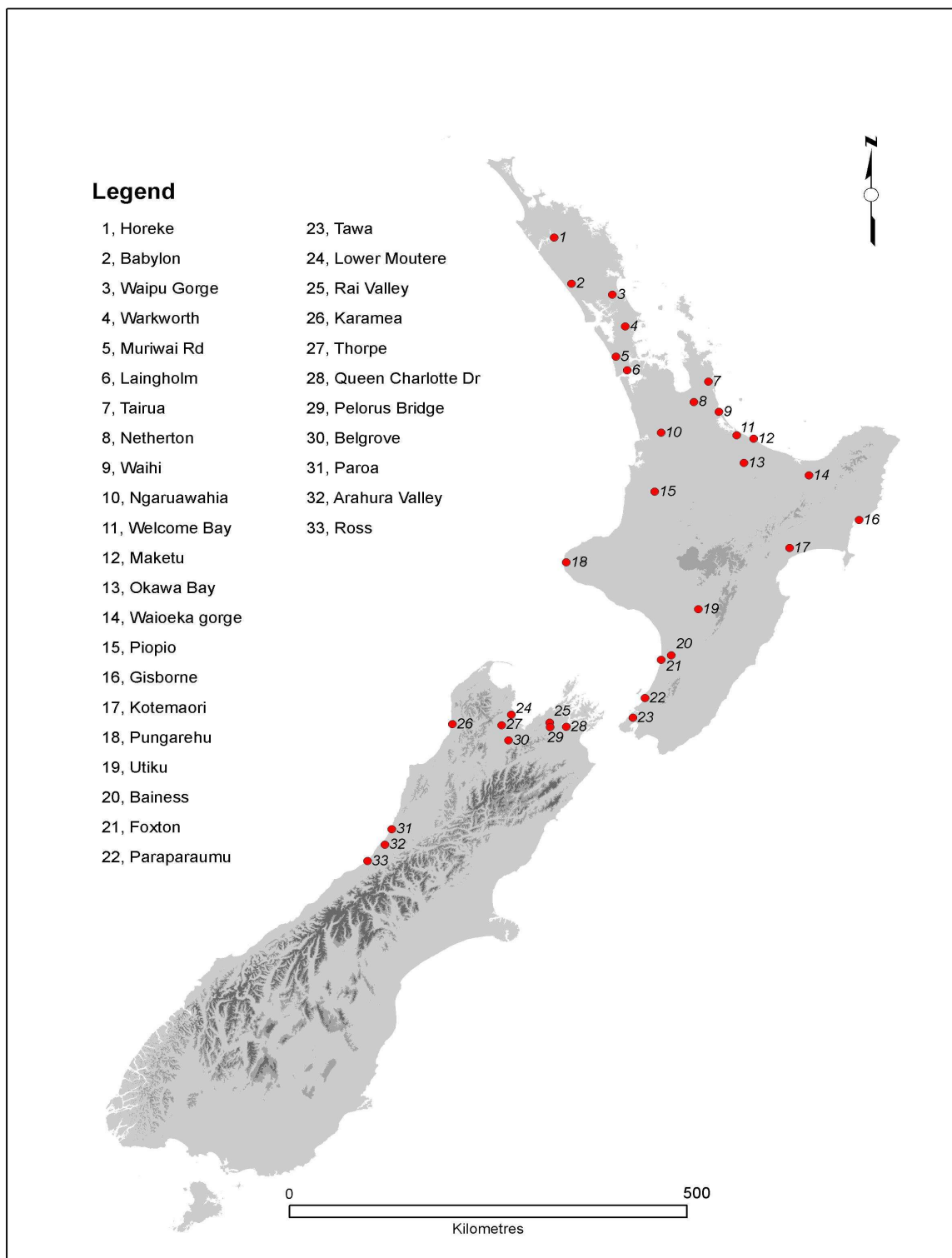


Fig. 1 Japanese honeysuckle (*Lonicera japonica*) sites sampled for fungi and invertebrates (2004–05)

The invertebrates collected were identified to species or genus level where feasible. However, some invertebrates were placed into groups of related species (e.g., ‘spiders’). They were then ranked on a scale of abundance according to the total number of individuals collected, and the number of sites at which they were present. They were classed as rare, occasional, common or abundant according to the definitions below:

rare: fewer than 5 individuals collected
occasional: 5–24 individuals collected, **or** present at fewer than five sites
common: 25+ individuals collected **and** present at five or more sites
abundant: 200+ individuals collected **and** present at 10 or more sites

4.2 Fungi

Fungi associated with Japanese honeysuckle were surveyed at the same 33 sites (Fig. 1) from which invertebrates were collected. At each site, plants at each of the 10 invertebrate collection points were also inspected closely for signs of pathogen damage. Other Japanese honeysuckle plants in the area were examined more superficially for obvious disease symptoms and any fungi collected were allocated a unique specimen number. Diseased leaves, leaf petioles, stems, flowers, flower petioles, or pods were placed in paper bags and kept cool in transit before processing. Collected material was examined within 5 days of collection.

In the laboratory, disease symptoms were recorded and photographed. A dissecting microscope was used to search necrotic areas for fungal reproductive structures. Small pieces of tissue (c. 3 × 3 mm) were cut from the edge of diseased areas and surface sterilised. Sterilisation was by immersion in 2% hypochlorite for 1 minute, followed by rinsing in two beakers of sterile water. The tissue fragments were blotted dry with sterile filter paper and placed on potato dextrose agar (Difco Labs, Detroit, MI, USA) with 0.02% streptomycin (Sigma, St Louis, MI, USA), contained in 9-cm Petri dishes. Plates were incubated under near-ultraviolet and white light (12 h photoperiod) at temperatures of 22 ± 2°C (day) and 18 ± 2°C (night).

Fungal colonies that grew out of the tissue fragments and produced spores were identified to the species level where possible. Taxonomic literature and fungal systematists were consulted to determine which of the identified fungi were likely to be causing the damage with which they were associated. Each identified isolate was given a unique number.

Basidiocarps (or fruiting bodies) of *Chondrostereum purpureum* were collected from the base of a vine at a single site (Waipu Gorge, Northland). Methods to isolate this fungus in pure culture were as follows. Tissues of the basidiocarp as well as the infected vine wood where the fruiting body was attached, were dissected with a scalpel, surface sterilised (as described above, except immersion in 2% hypochlorite was for 5 minutes) and plated onto Nobles agar amended with 0.02% streptomycin antibiotic. Nobles agar is a type of Malt Extract Agar, in which 6.25 grams of Malt Extract (Difco) is mixed with 10 grams agar (Difco) into 500 mls distilled water. Plates were incubated in the dark at temperatures of 22 ± 2°C (day) and 18 ± 2°C (night).

5. Results

5.1 Invertebrates

A full list of invertebrates found in association with Japanese honeysuckle during this survey is presented in Appendix 1. None are specialists on Japanese honeysuckle.

Herbivores

A total of 108 herbivorous invertebrate species was recorded from Japanese honeysuckle during this survey. An additional 12 groups of taxonomically related herbivorous species were recorded (where identification to species level was not feasible). Two herbivorous species, *Scolypopa australis* (Walker) (the passionvine hopper) and *Siphanta acuta* (Walker), were classed as 'abundant'. A further 16 herbivorous species or taxonomic groupings were classed as 'common', 30 were classed as 'occasional', and 72 were classed as 'rare' (Appendix 1). A list of the abundant, common and occasional herbivorous invertebrates is given below (Table 1).

Foliage feeders: At many survey sites more than 25% of the Japanese honeysuckle leaves examined showed signs of invertebrate herbivory but most of this damage was minor. Leaves that were more than 20% consumed were rare, and the overall amount of foliage that appeared to have been consumed or damaged by herbivores was estimated to be less than 5%. Feeding damage was most obvious on older foliage.

The most obvious foliage damage appeared to be caused by the larvae of a range of moth species, especially tortricid larvae (leafrollers) and to a lesser extent noctuid larva. If the families Tortricidae and Noctuidae were treated as taxonomic groups they would be classed as 'abundant' and 'common' respectively, and these rankings have been included in Table 1 next to these families to emphasize their relative importance. Leafroller larvae were sometimes found still inside 'rolled' leaves on the plant, but more commonly they were collected from the beating tray after being dislodged. A number of moth larvae, collected to rear through to adult for identification, died during rearing, and parasitoids emerged from some of them (Table 3).

Foliage (especially foliage close to the ground) often showed typical slug or snail damage and slime trails were sometimes visible. If snails and slugs were treated as a combined group (Gastropoda) they were classed as 'abundant' (Table 1).

Banana silvering thrips, *Hercinothrips bicinctus* (Bagnall) and greenhouse thrips, *Heliiothrips haemorrhoidalis* (Bouche), were collected from six and four sites respectively. At some sites they were very numerous, producing distinctive silvery-coloured patches on the foliage, especially during late summer/autumn.

Forty-six species, or groups of taxonomically related species, of herbivorous adult beetles were collected during the survey but foliage damage attributed to beetles was minimal.

Fruit feeders: Little or no damage that could be attributed to invertebrates was observed on the fruit. However, four species of sap-feeding shield bugs (Pentatomidae) were found during the survey and they are known to feed on fruit as well other parts of plants (Larivière 1995).

Omnivorous European earwigs, *Forficula auricularia* Linnaeus, were ‘common’ in the survey and are known to damage the fruit of a number of plant species (<http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn74102.html>). Fruit that was collected and stored produced a variety of saprophytic or fungivorous invertebrates, but they would probably not damage living fruit.

Flower feeders: Little damage that could be attributed to invertebrates was observed on the flowers. However, the New Zealand flower thrips, *Thrips obscuratus* (Crawford), were commonly found during the survey and they are known to be capable of causing considerable damage to flowers of a wide range of plant species (Mound & Walker 1982). Moth larvae and European earwigs, *Forficula auricularia*, may also consume Japanese honeysuckle flowers (<http://www.rosecare.com/pests.html>).

Sap-feeders: *Scolypopa australis* (the passionvine hopper) and *Siphanta acuta* were the only sap-feeding invertebrates found during the survey to be classed as ‘abundant’. A further 35 species, or groups of taxonomically related species, of sap-feeders were found during the survey (Appendix 1). The damage caused by sap-feeders, either directly by the removal of nutrients or indirectly by puncturing the plant and possibly allowing entry of pathogens, is very difficult to quantify.

Leaf miners: No leaf-mining invertebrates were found on Japanese honeysuckle during this survey.

Stem borers: Long-horn beetle (family Cerambycidae) adults were commonly found on Japanese honeysuckle, but Japanese honeysuckle stems that were checked did not show evidence of attack by stem-boring long-horn beetle larvae, or any other stem borers. Most of the Japanese honeysuckle material sampled was growing in close association with other vegetation and it is possible the long-horn beetles found on Japanese honeysuckle were associated primarily with the other plants on which Japanese honeysuckle was growing.

Table 1. Abundant, common, and occasional herbivorous invertebrates, collected from Japanese honeysuckle at 33 New Zealand sites during 2004–2005

| Taxon | Common Name | Feeding Site | Frequency | Origin |
|--------------------------|---------------------------------|---------------------|-------------------------------------------|---------------|
| Phylum Mollusca | molluscs | | | |
| Class Gastropoda | slugs and snails | foliage | all gastropod species combined – abundant | |
| | <i>Cantareus asperses</i> | foliage | common | introduced |
| | unidentified snails | foliage | common | |
| | unidentified slugs | foliage | occasional | |
| Phylum Arthropoda | | | | |
| Class Arachnida | | | | |
| Acarina | mites and ticks | | | |
| Tydeidae | | | | |
| | <i>Orthotydeus californicus</i> | foliage | occasional | introduced |

| Taxon | Common Name | Feeding Site | Frequency | Origin |
|--------------------------------------------------------|-------------------------|---------------------------------------------------------------------|------------------|---------------|
| Class Insecta | Insects | | | |
| Coleoptera | Beetles | | | |
| Cerambycidae | longhorn beetles | | | |
| <i>Hybolasius crista</i> | | adults: foliage | occasional | native |
| <i>Psilocnaeia</i> spp. | | adults: foliage | occasional | native |
| <i>Xylotoles griseus</i> | | adults: foliage | occasional | native |
| <i>Xylotoles griseus</i> or <i>Xylotoles laetus</i> | | adults: foliage | occasional | native |
| Chrysomelidae | leaf beetles | | | |
| <i>Eucolaspis</i> sp. | bronze beetle | foliage | common | native |
| Curculionidae | Weevils | | | |
| <i>Asynonychus cervinus</i> | Fuller's rose weevil | foliage | common | introduced |
| <i>Catoptes</i> spp. | | foliage | common | native |
| <i>Irenimus</i> spp. | | foliage | common | native |
| <i>Microcryptorhynchus</i> sp. | | foliage | occasional | native |
| <i>Peristoreus</i> spp. | | foliage | occasional | native |
| <i>Phlyctinus callosus</i> | garden weevil | foliage | occasional | introduced |
| Elateridae | click beetles | | | |
| <i>Conoderus exsul</i> | pasture wireworm | adults: foliage/flowers larvae: plant roots and invertebrates | common | introduced |
| Melandryidae | leaping beetles | | | |
| <i>Hylobia</i> spp. | | foliage | occasional | native |
| Dermaptera | Earwigs | | | |
| <i>Forficula auricularia</i> | European earwig | omnivorous: leaves/flowers/fruit and insects | common | introduced |
| Hemiptera | Bugs | | | |
| Acanthosomatidae | | | | |
| <i>Oncacantias vittatus</i> | | sap feeder | occasional | native |
| Aphididae | Aphids | | | |
| <i>Aulacorthum solani</i> | foxglove aphid | sap feeder | occasional | introduced |
| Aphrophoridae | spittle bugs | | | |
| <i>Carystoterpa vegans</i> | | sap feeder | occasional | native |
| <i>Philaenus spumarius</i> | meadow spittle bug | sap feeder | common | introduced |
| Cicadellidae | leafhoppers | | | |
| <i>Batracomorpha</i> sp. | | sap feeder | occasional | |
| Cixiidae | | | | |
| <i>Oliarus oppositus</i> | | sap feeder | occasional | native |
| <i>Koroana rufifrons</i> | | sap feeder | occasional | native |

| Taxon | Common Name | Feeding Site | Frequency | Origin |
|-----------------------------------------------------------------|-------------------------------------|---------------------|-----------------------|---------------|
| Flatidae | planthoppers | | | |
| <i>Siphanta acuta</i> | green planthopper | sap feeder | abundant | introduced |
| Lygaeidae | seed bugs | | | |
| <i>Rhypodes</i> sp. | | sap/seed feeder | occasional | native |
| Membracidae | | | | |
| <i>Acanthucus trispinifer</i> | | sap feeder | occasional | introduced |
| Miridae | mirid bugs | | | |
| <i>Chinamiris</i> spp. | | sap feeder | occasional | native |
| <i>Diomocoris</i> spp. | | sap feeder | occasional | native |
| <i>Sidnia kinbergi</i> | Australian crop mirid | sap feeder | occasional | introduced |
| Pentatomidae | shield bugs | | | |
| <i>Cuspicona simplex</i> | green potato bug | sap feeder | occasional | introduced |
| <i>Nizara viridula</i> | green vegetable bug | sap feeder | common | introduced |
| Ricaniidae | planthoppers | | | |
| <i>Scolytopa australis</i> | passionvine hopper | sap feeder | abundant | introduced |
| Rhyparochromidae | seed bugs | | | |
| <i>Metagerra</i> sp. | | sap/seed feeder | common | native |
| <i>Targarema</i> sp. | | sap/seed feeder | occasional | native |
| Lepidoptera | moths and butterflies | | | |
| Noctuidae | armyworms, cutworms | | all noctuid species | |
| | | | combined – common | |
| <i>Graphania ustistriga</i> | | foliage | occasional | native |
| unidentified Noctuidae | | foliage | occasional | |
| Tortricidae | leaf rollers | | all tortricid species | |
| | | | combined – abundant | |
| <i>Ctenopseustis obliquana</i> or <i>Ctenopseusti herana</i> | | foliage | common | native |
| <i>Epalxiphora axenana</i> | sharp-tipped bell moth | foliage | occasional | native |
| <i>Epiphyas postvittana</i> | light-brown apple moth | foliage | occasional | introduced |
| <i>Planotortrix excessana</i> or <i>Planotortrix octo</i> | | foliage | occasional | native |
| unidentified Tortricidae | | foliage | common | |
| Orthoptera | crickets, grasshoppers, weta | | | |
| Tettigoniidae | long-horned grasshoppers | | | |
| <i>Caedicia simplex</i> | katydid | foliage | common | native |
| <i>Conocephalus</i> sp. | field grasshopper | foliage | occasional | native |
| Thysanoptera | thrips | | | |
| <i>Heliothrips</i> <i>haemorrhoidalis</i> | greenhouse thrips | foliage | occasional | introduced |

| Taxon | Common Name | Feeding Site | Frequency | Origin |
|--------------------------------|---------------------------|---------------------|------------------|---------------|
| <i>Hercinothrips bicinctus</i> | banana silvering thrips | foliage | common | introduced |
| <i>Thrips obscuratus</i> | New Zealand flower thrips | flowers | common | native |

Predators

Predatory species that may inhibit introduced biological control agents were recorded (Table 2 and Appendix 1).

Table 2. Predatory invertebrates collected from Japanese honeysuckle at 33 New Zealand sites during 2004–2005.

| Taxon | Common Name | Frequency | Origin |
|-------------------------------|-------------------------|------------------|-----------------------|
| Acarina | mites and ticks | | |
| Anystidae | | | |
| <i>Anystis baccarum</i> | whirlygig mite | occasional | |
| <i>Anystis</i> sp. | whirlygig mite | common | introduced |
| Bdellidae | | | |
| unidentified Bdellidae | | rare | |
| Cunaxidae | | | |
| unidentified Cunaxidae | | rare | |
| Phytoseiidae | | | |
| <i>Phytoseius</i> sp. | | occasional | |
| Stigmaeidae | | | |
| <i>Zetzellia maori</i> | | rare | |
| Araneida | spiders | | |
| unidentified Araneida | | abundant | native and introduced |
| Opiliones | harvestmen | | |
| unidentified harvestmen | | occasional | |
| Pseudoscorpiones | pseudo-scorpions | | |
| unidentified pseudo-scorpions | | occasional | |
| Insecta | | | |
| Coleoptera | beetles | | |
| Cantharidae | soldier beetles | | |
| <i>Malthodes pumilus</i> | | rare | introduced |
| Carabidae | ground beetles | | |
| <i>Amarotypus edwardsii</i> | | rare | native |
| <i>Demetrida lineella</i> | | occasional | native |
| <i>Scopodes</i> sp. | | rare | native |

| Taxon | Common Name | Frequency | Origin |
|-----------------------------------|----------------------------|----------------------------------------------|-------------------------------------------|
| Cleridae | checkered beetles | | |
| <i>Phymatophaea</i> sp. | | rare | native |
| Coccinellidae | ladybirds | all coccinellid species combined – common | |
| <i>Adalia bipunctata</i> | two-spotted ladybird | occasional | introduced |
| <i>Adoxellus</i> sp. | | rare | native |
| <i>Coccinella undecimpunctata</i> | eleven-spotted ladybird | occasional | introduced as a biocontrol agent (BCA) |
| <i>Cryptolaemus montrouzieri</i> | mealybug ladybird | rare | introduced (BCA) |
| <i>Halmus chalybeus</i> | steely-blue ladybird | occasional | introduced (BCA) |
| <i>Rhyzobius</i> sp. | | rare | |
| <i>Stethorus</i> sp. | | rare | |
| Melyridae | flower beetles | | |
| unidentified Melyridae | | common | native |
| Scirtidae | marsh beetles | | |
| unidentified Scirtidae | | abundant | native |
| Staphylinidae | rove beetles | | |
| <i>Anotylus</i> sp. | | rare | native |
| <i>Astenus guttula</i> | | rare | introduced |
| unidentified Staphylinidae | | occasional | |
| Dermaptera | earwigs | | |
| <i>Forficula auricularia</i> | European earwig | common | introduced |
| Hemiptera | bugs | | |
| Anthocoridae | | | |
| unidentified Anthocoridae | | common | |
| Miridae | mirid bugs | | |
| <i>Deraecoris maoricus</i> | | occasional | native |
| <i>Sejanus albisignatus</i> | | occasional | native |
| Nabidae | | | |
| <i>Nabis biformis</i> | | common | native |
| <i>Nabis</i> sp. | | occasional | |
| Pentatomidae | shield bugs | | |
| <i>Cermatulus nasalis</i> | brown soldier bug | occasional | native |
| <i>Oechalia schellenbergii</i> | Schellenberg's soldier bug | occasional | native |
| Reduviidae | assassin bugs | | |
| unidentified Reduviidae | | occasional | |
| Hymenoptera | bees, wasps, ants | | |
| Formicidae | ants | | |
| <i>Monomorium</i> sp. | | rare | |

| Taxon | Common Name | Frequency | Origin |
|----------------------------------|-------------------------------------|------------------|---------------|
| <i>Ochetellus glaber</i> | | rare | introduced |
| <i>Paratrechina vaga</i> | garden ant | common | introduced |
| <i>Prolasius advena</i> | small brown bush ant | rare | native |
| <i>Tetramorium bicarinatum</i> | | occasional | introduced |
| <i>Technomyrmex albipes</i> | white-footed house ant | common | introduced |
| Mantodea | praying mantids | | |
| <i>Miomantis caffra</i> | African praying mantis | common | introduced |
| <i>Orthodera novaezealandiae</i> | New Zealand praying mantis | common | native |
| Neuroptera | lacewings | | |
| <i>Micromus tasmaniae</i> | Tasmanian lacewing | common | introduced |
| <i>Psectra nakaharai</i> | | rare | introduced |
| Orthoptera | crickets, grasshoppers, weta | | |
| Anostomatidae | | | |
| Raphidophoridae | cave weta | | |
| unidentified Raphidophoridae | | rare | |

Parasitoids

Parasitic species that may inhibit introduced biological control agents were recorded (Table 3 and Appendix 1).

Table 3. Parasitic invertebrates collected from invertebrate species associated with Japanese honeysuckle at 33 New Zealand sites during 2004–2005.

| Taxon | Common Name | Frequency | Origin |
|-------------------------------------------------------------|--------------------------------|------------------|-------------------------------------------------|
| Diptera | flies | | |
| Tachinidae | bristle flies | | |
| <i>Pales funestra</i> | NZ leafroller tachinid | rare | native |
| <i>Trigonospila brevifacies</i> | Australian leafroller tachinid | common | introduced as a biocontrol agent (BCA) |
| Hymenoptera | bees, wasps, ants | | |
| Braconidae | | | |
| <i>Dolichogenidea tasmanica</i> | | rare | introduced (BCA) |
| <i>Glyptapanteles demeter</i> | | occasional | native |
| <i>Meteorus pulchricornis</i> | | occasional | introduced |
| Eulophidae | | | |
| <i>Sympiesis</i> sp. 1 (of Berry) | | occasional | |
| <i>Sympiesis</i> sp. (species with partially orange gaster) | | occasional | |

| Taxon | Common Name | Frequency | Origin |
|---------------------------------|-------------|-----------|--------|
| Ichneumonidae | | | |
| <i>Campoletis</i> sp. | | rare | native |
| <i>Campoplex</i> sp. 9 of Gauld | | rare | native |
| <i>Campoplex</i> sp. | | rare | native |

5.2 Fungi

A low level of disease was observed on all plants sampled at all surveyed sites. Field observations were that symptoms were usually sporadic and superficial leaf necrosis that caused minor/insignificant damage to the weed. A total of 38 fungal species was identified from these mild to moderate necroses exhibited on Japanese honeysuckle in New Zealand. Three of these fungi were identified directly from symptomatic plant tissues with the remainder being isolated out from tissues into pure culture.

A total of 461 fungal isolates was obtained from 469 plant tissue plated. Fungal colonisation ([total number of fungal isolates/number of tissue fragments] \times 100) averaged across all tissue types (leaf and flower) was 98.3%. The mean fungal colonisation observed for Japanese honeysuckle was at the high end of the range recorded from Landcare Research pathogen weed surveys. Other surveys that recorded similar high levels of fungal colonisation were of Darwin's barberry, *Berberis darwinii*, 98.4%; barberry, *B. glaucocarpa*, 95.7%) woolly nightshade, *Solanum mauritianum* (92%); nassella tussock, *Nassella trichotoma* (95%); and Chilean needle grass, *Nassella neesiana* (98%) (Smith et al. 2004).

A total of 59 recognisable taxonomic units (RTUs) was isolated into culture from symptoms of leaf or flower necrosis, with 35 identified to genus and/or species level (Table 4) based on cultural morphology. A large number of isolates (64), were classified into RTUs belonging to the sterile fungi class Agonomycetes (*Mycelia sterilia*), which does not form reproductive spores under culture conditions. Identification of these fungi would require molecular methods using, e.g., genetic ITS sequence data, but was unnecessary for the purposes of this survey as most were considered to be endophytes, weak/secondary pathogens or saprophytes (Table 4).

The most frequently encountered group of fungi isolated from diseased leaf tissues was the Coelomycetous fungi, generally associated with minor and superficial leaf spots collected from all 33 sites. A total of 230 Coelomycete isolates was obtained in pure culture (Table 4). These were *Colletotrichum gloeosporioides* (24 isolates), *Microsphaeropsis* sp. (11 isolates), *Pestalotiopsis* sp. (9 isolates), *Phoma* spp. (58 isolates), *Phomopsis* spp. (49 isolates), as well as a range of unidentified Coelomycetous isolates (79). Many of these were regarded as secondary pathogens or saprophytes as they were isolated from leaf spots caused by the primary infection of *Pseudocercospora lonicerae*.

The remainder of leaf isolates obtained in the survey were Hypomycetous species such as *Fusarium avenaceum* and *Botrytis cinerea*, which again were either weak or secondary pathogens (Table 4).

Disease damage observed on flower tissues was minimal; mainly comprising discolouration and browning along with the appearance of tiny speckled lesions. A total of 20 diseased

flower tissues was plated from 3 sites. The fungi isolated from diseased flowers at two locations were saprophytic species, (*Alternaria alternata*, *Aureobasidium pullulans*, *Epicoccum purpurascens*, *Penicillium* spp., Yeasts), and at the third location were a minor disease complex comprising weak/secondary pathogens already described from minor leaf spots (*Fusarium* sp., *Phoma* sp., *Phomopsis* sp.).

Table 4. Relative abundance of fungi collected from Japanese honeysuckle at 33 sites throughout New Zealand 2004–05. (¹ = number of sites where each fungi present, ² = total no. of isolates, L³ = + recorded from leaf/stem tissue, F⁴ = + recorded from flower tissue)

| Species | Sites ¹ | Total ² | L ³ | F ⁴ | Comments |
|--------------------------------------------|--------------------|--------------------|----------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ascomycetes | | | | | |
| <i>Apiospora montagnei</i> | 1 | 1 | + | | Saprophyte |
| <i>Chaetomium globosum</i> | 2 | 2 | + | | Saprophyte |
| Basidiomycetes | | | | | |
| <i>Aureobasidium pullulans</i> | 11 | 21 | + | + | Saprophyte |
| <i>Chondrostereum purpureum</i> | 1 | * | | | Primary pathogen Broad host range Virulent pathogen successfully used for the inundative biocontrol of invasive shrub/tree species |
| Coelomycetes | | | | | |
| <i>Pseudocercospora lonicerae</i> | 29 | * | + | | Primary pathogen |
| <i>Colletotrichum gloeosporioides</i> | 15 | 24 | + | | Primary and secondary plant pathogen Broad host range Virulent host specialised strains are known to exist on some plant hosts and have been successfully used for weed biocontrol |
| <i>Microsphaeropsis</i> sp. | 8 | 11 | + | | Weak or secondary pathogen Broad host range |
| <i>Pestalotiopsis</i> sp. | 4 | 9 | + | | Primary and secondary plant pathogen Broad host range |
| <i>Phoma</i> spp. (>7 species isolated) | 16 | 58 | + | + | Saprophytes Primary and secondary plant pathogen Broad host range Virulent strains have been used successfully for |

| Species | Sites ¹ | Total ² | L ³ | F ⁴ | Comments |
|--------------------------------------------------|--------------------|--------------------|----------------|----------------|---------------------------------------------------------------------------------------------------------------------------------|
| | | | | | weed biocontrol |
| <i>Phomopsis</i> sp. (2 species isolated) | 22 | 49 | + | + | Primary and secondary plant pathogen Broad host range |
| unidentified Coelomycete spp. | 26 | 79 | + | | Weak or secondary pathogens and/or saprophytes |
| Hyphomycetes | | | | | |
| <i>Acremonium</i> spp. (2 species isolated) | 4 | 4 | + | | Saprophyte Secondary plant pathogen |
| <i>Alternaria alternata</i> | 14 | 40 | + | + | Saprophyte Secondary plant pathogen Broad host range |
| <i>Botrytis cinerea</i> | 9 | 19 | + | | Saprophyte Primary and secondary plant pathogen Broad host range |
| <i>Cladosporium cladosporioides</i> | 11 | 16 | + | | Saprophyte |
| <i>Epicoccum purpurascens</i> | 10 | 22 | + | + | Saprophyte |
| <i>Fusarium</i> spp. (6 species isolated) | 14 | 26 | + | + | Primary and secondary plant pathogens Broad host range Some species have previously been investigated for weed biocontrol |
| <i>Gyoerffyella rotula</i> | 1 | 2 | + | | Weak or secondary pathogen |
| <i>Penicillium</i> spp. (>4 species isolated) | 5 | 6 | + | + | Saprophytes |
| <i>Trichoderma</i> sp. | 1 | 1 | + | | Saprophyte |
| <i>Xylaria</i> spp. (2 species isolated) | 3 | 5 | + | | Endophytic symbiont of many plant hosts |

| Species | Sites ¹ | Total ² | L ³ | F ⁴ | Comments |
|-------------------------------------------|--------------------|--------------------|----------------|----------------|-------------------------------------------------------------------------------------------|
| Other | | | | | |
| <i>Insolibasidium deformans</i> | 1 | * | + | | Obligate primary pathogen of <i>Lonicera</i> genus, also known as Honeysuckle leaf blight |
| Sterile fungi (<i>Mycelia sterilia</i>) | 19 | 64 | + | | Endophytic symbionts, saprophytes or weakly pathogenic |
| unidentified yeast | 1 | 1 | | + | Saprophyte |
| Zygomycetes | | | | | |
| <i>Mortierella gamsii</i> | 1 | 1 | + | | Saprophyte |

* Although *Pseudocercospora lonicerae*, *Chondrostereum purpureum* and *Insolibasidium deformans*, were collected and identified, none were isolated into culture and they are therefore not included in the total number of isolates tally.

The most common leaf spot damage on Japanese honeysuckle was that caused by *Pseudocercospora lonicerae*, which was observed on samples from 29 of the 33 sites surveyed. Its initial symptom was a characteristic brown circular spot at the leaf edge. As the disease progressed the lesion increased in size, spreading from the leaf margin, and becoming irregular shaped. Surrounding leaf tissue then became discoloured, turning yellow until the entire leaf was discoloured and dry (Fig. 2). A representative specimen exhibiting these symptoms was deposited into Landcare Research's PDD Herbarium collection at Auckland (Herbarium accession number = PDD 82491).



Fig. 2 Progression of leaf disease on Japanese honeysuckle caused by *Pseudocercospora lonicerae*.

Basidiocarps of *Chondrostereum purpureum* were collected from the basal stem of a Japanese honeysuckle vine (Fig. 3) at a single site at Waipu Gorge, Northland (Site 3, Fig. 1). There were no visible signs that infection by this pathogen had reduced the growth or health of this plant at the time of collection. Despite several attempts to isolate the pathogen onto Nobles agar, no cultures were obtained.

Samples exhibiting a fungal leaf blight disease from a single site, in the Auckland region, were also observed in the survey. The disease was identified as *Insolibasidium deformans*, which is commonly known as honeysuckle blight. Blight symptoms recorded from these

samples were that infected younger leaves showed a silvery-white discolouration. Discolouration had progressed on older infected leaves turning them tan to brown. These brown areas often covered the entire leaf and were necrotic and dry.



Fig. 3 Fruiting body (basidiocarp) of *Chondrostereum purpureum* on the excised vine of Japanese honeysuckle collected from Northland.

6. Conclusions

6.1 Invertebrates

A wide range of native and introduced invertebrates is associated with Japanese honeysuckle in New Zealand but no specialised Japanese honeysuckle feeding invertebrates were found during this survey, and damage caused by invertebrate herbivory could not be regarded as serious. Foliage feeders (most noticeably lepidopterous larvae, molluscs and thrips) appear to be the most damaging invertebrates currently feeding on Japanese honeysuckle in New Zealand.

The total amount of Japanese honeysuckle foliage that appeared to have been consumed or damaged by herbivorous invertebrates at our survey sites was estimated to be less than 5%. As a comparison, the amounts of foliage estimated to have been consumed or damaged by herbivorous invertebrates for other weeds in New Zealand are: less than 10% for banana passionfruit, probably mainly by lepidopterous larvae (Winks & Fowler 2000); less than 5% for boneseed, mostly attributed to two weevil species – *Phlyctinus callosus* and, to a lesser extent, *Asynonychus cervinus* (Winks et al. 2000); less than 5% for woolly nightshade, probably mainly by lepidopterous larvae (Winks et al. 2001); less than 2% for tradescantia (Winks et al. 2003); and less than 2% for moth plant (Winks et al. 2004).

The combined effect of generalist predators such as spiders, earwigs, ants, and praying mantids, could inhibit the effectiveness of some potential invertebrate biological control agents for Japanese honeysuckle. The parasitoids identified during this survey could particularly affect some potential lepidopteran biological control agents.

Specialised Japanese honeysuckle biocontrol agents are unlikely to meet with any significant competition from resident herbivores as none of the ‘herbivore niches’ on Japanese honeysuckle are well utilised in New Zealand, and some (e.g., leaf-mining) do not appear to be utilised at all. Therefore there is considerable scope for the introduction of host-specific invertebrate biocontrol agents that could markedly reduce the vigour of Japanese honeysuckle in New Zealand.

6.2 Fungi

Although honeysuckle blight, *Pseudocercospora lonicerae*, was widespread in distribution, leaf damage to Japanese honeysuckle infestations was limited and did not reduce plant health to any useful extent. Its biocontrol potential is therefore considered to be low. This pathogen has been recorded from Japanese honeysuckle four times previously on the target weed in New Zealand (NZ Fungi Database <http://nzfungi.landcareresearch.co.nz/> data retrieved 29 August 2005), but associated symptoms were also minor leaf spot damage (Braun et al. 2003) and therefore biocontrol potential of endemic strains is similarly regarded to be low. This pathogen was listed as a known leaf spot pathogen of Japanese honeysuckle in North America and a potential candidate for classical biocontrol prior to this survey (Standish 2002). However, as the strain(s) currently in New Zealand appear to be weakly pathogenic, surveys in the native range would be needed to determine if more aggressive biotypes of this pathogen are present, and are likely to be possible candidates for importation to augment the endemic strains already present on the target.

The observation of *Chondrostereum purpureum* on Japanese honeysuckle in this survey is a new host record for this pathogen in New Zealand, and possibly also a new international record. The pathogen has, however, been reported on other *Lonicera* species (Setcliff 2002), including the shrubby relative *L. tatarica* in New Zealand (Pennycook 1989). This fungus is a widespread wound pathogen, commonly known as silver leaf disease, and is a serious horticultural disease as it has a broad host range across many woody plant species including those of economic and cultivated importance, e.g., *Malus*, apple; *Prunus*, stonefruit; *Magnolia* (Farr et al. 1989). Despite this, the fungus has also been successfully used and registered as a ‘cut and paste’ mycoherbicide against resprouting tree weeds in North America, South Africa and Europe, and has also been used against gorse in New Zealand. The application of *C. purpureum* for inundative biocontrol of Japanese honeysuckle would be minimal and logistically difficult as its pathogenicity is limited to wounded woody tissues so

could only possibly be used to prevent resprouting from old mature vines that were being cut back during physical weed removal (which is not the conventional control strategy currently used for most environmental infestations). It would not be effective against the rapid invasion of herbaceous Japanese honeysuckle vines in many areas.

The observation of honeysuckle leaf blight caused by *Insolibasidium deformans* in this survey was to be expected as it is a ubiquitous pathogen with a worldwide distribution. Most known species and varieties in the honeysuckle (*Lonicera*) genus are susceptible to the blight. It has been recorded three times previously on Japanese honeysuckle in New Zealand as well as on *L. tatarica* (Pennycook 1989) and recently in Australia on *L. nitida* (Cunnington & Pascoe 2003). The blight is a major problem for cultivation of seedlings causing significant economic problems to the nursery and garden industry in North America where honeysuckle is an important ornamental plant (Beales et al. 2004). Infected seedlings become discoloured and defoliate prematurely. Severe defoliation results in stem dieback and reduced growth so that stock may have to be retained in the nursery for an additional year.

Honeysuckle blight is totally reliant on climatic conditions being both cool and wet, as the infection only occurs when the relative humidity is near or at 100% during sustained periods for at least 2 days, and where the leaves are less than 20 days old. The disease will continue throughout the growing season only if conducive weather is present.

The biocontrol potential of this disease is low as attack on adult plants is sporadic due to its requirement for a relatively narrow range of climatic conditions. Therefore the disease will rarely be able to undertake sustained attack at an effective level on the weed in its current expanding range across all regions.

As flower damage was minimal, with mostly saprophytic species, e.g., yeasts, being associated with very minor symptoms, it was likely that damage was not caused by premature infection by a primary pathogen but rather due entirely to natural senescence of the delicate flower tissues.

Leaf disease was also observed to be very minor caused by a sporadic range of minor primary pathogens and/or secondary pathogens. Coelomycetes, such as *Phoma* and *Phomopsis*, were generally the cause of such leaf spot symptoms, and these have been previously reported on Japanese honeysuckle both in New Zealand (e.g., *Phoma*, NZ Fungi Database <http://nzfungi.landcareresearch.co.nz/> data retrieved 29 August 2005) and overseas (e.g., *Phomopsis* leaf spot in North America, Farr et al. 1989). Such superficial and almost cosmetic damage would not significantly reduce plant growth, biomass or reproduction, and therefore none of the isolated fungi would have potential for effective biocontrol.

7. Recommendations

In light of our conclusions that invertebrate herbivore damage to Japanese honeysuckle in New Zealand is not serious, and that no specialised pathogenic fungi are known to be present on the weed in New Zealand, we recommend that:

1. A classical biological control programme for Japanese honeysuckle should proceed as follows:
 - (a) Survey herbivorous invertebrates and fungi associated with Japanese honeysuckle in its native range.
 - (b) Prioritise potential biocontrol agents according to their potential to damage Japanese honeysuckle and the likelihood of adequate host-specificity.
 - (c) Undertake host-range tests with selected invertebrates and fungi on plant species of importance to New Zealand.
 - (d) Introduce host-specific invertebrates and pathogenic fungi to New Zealand as classical biocontrol agents.

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Appendix 1 Invertebrates associated with Japanese honeysuckle, *Lonicera japonica*, at 33 New Zealand sites (2004–2005)

Key: Definitions of frequency categories

rare: fewer than 5 individuals collected in total

occasional: 5–24 individuals collected, **or** present at fewer than five sites

common: 25+ individuals collected **and** present at five or more sites

abundant: 200+ individuals collected **and** present at 10 or more sites

| Taxon | Common Name | Feeding Mode | Frequency and (total number) | Collection Sites |
|---------------------------------------|-------------------------|--------------|------------------------------|------------------------------------------------------------|
| Phylum Mollusca | molluscs | | | |
| Class Gastropoda | slugs and snails | | | |
| <i>Cantareus asperses</i> Müller | brown garden snail | herbivorous | common (186) | 2,6,9,10,11,12,13, 14,15,16,17,18,19, 20,21,22,23,29 |
| unidentified snails | | herbivorous | common (51) | 1,2,3,4,9,11,12,14, 16,26,27,30,32,33 |
| unidentified slugs | | herbivorous | occasional (20) | 12,14,15,17,22,25, 31,32,33 |
| Phylum Arthropoda | | | | |
| Class Crustacea | | | | |
| Amphipoda | | | | |
| unidentified Amphipoda | | saprophytic | rare (2) | 31 |
| Isopoda | slaters | | | |
| unidentified Isopoda | | saprophytic | abundant (380) | 2,4,5,7,9,10,12,13, 15,16,18,26,31 |
| Class Arachnida | | | | |
| Acarina | mites and ticks | | | |
| Anystidae | | | | |
| <i>Anystis baccarum</i> (Linnaeus) | whirlygig mite | predatory | occasional (12) | 1,11,15,16,19 |
| <i>Anystis</i> sp. | whirlygig mite | predatory | common (30) | 9,17,19,24,29 |

| Taxon | Common Name | Feeding Mode | Frequency and (total number) | Collection Sites |
|----------------------------------------------|--------------------|---------------------|-------------------------------------|--------------------------------------------------------------------------------------------------------|
| Bdellidae | | | | |
| unidentified Bdellidae | | predatory | rare (3) | 3 |
| Cunaxidae | | | | |
| unidentified Cunaxidae | | predatory | rare (4) | 10,13 |
| Phytoseiidae | | | | |
| <i>Phytoseius</i> sp. | | predatory | occasional (8) | 10,21 |
| Stigmaeidae | | | | |
| <i>Zetzellia māori</i> Gonzalez-Rodriguez | | predatory | rare (1) | 13 |
| Tenuipalpidae false spider mites | | | | |
| unidentified Tenuipalpidae | | herbivorous | rare (2) | 10 |
| Tetranychidae spider mites | | | | |
| <i>Bryobia</i> sp. | | herbivorous | rare (1) | 3 |
| Tydeidae | | | | |
| <i>Orthotydeus californicus</i> (Banks) | | herbivorous | occasional (14) | 9,10,12,21 |
| unidentified Tydeidae | | herbivorous | rare (3) | 11 |
| Oribatida oribatid mites | | | | |
| unidentified Oribatida | | fungivorous | rare (2) | 9 |
| Araneida spiders | | | | |
| unidentified Araneida | | predatory | abundant (667) | 1,2,3,4,5,6,7,8,9, 10,11,12,13,14,15, 16,17,18,19,20,21, 22,23,24,25,26,27, 29,30,31,32,33 |

| Taxon | Common Name | Feeding Mode | Frequency and (total number) | Collection Sites |
|-------------------------------------------------------------|------------------------|---------------------|-------------------------------------|-----------------------------------------------------------------------------|
| Opiliones | harvestmen | | | |
| unidentified Opiliones | | predatory | occasional (10) | 13,17,18,20,31,33 |
| Pseudoscorpiones | false scorpions | | | |
| unidentified Pseudoscorpiones | | predatory | occasional (14) | 2,3,8,22,31 |
| Class Diplopoda | millipedes | | | |
| unidentified Diplopoda | | saprophytic | rare (1) | 17 |
| Class Collembola | springtails | | | |
| unidentified Collembola | | saprophytic | occasional (14) | 3,16,17,30 |
| Class Insecta | insects | | | |
| Blattodea | cockroaches | | | |
| <i>Celatoblatta vulgaris</i> Johns | | saprophytic | rare (4) | 14,18,25 |
| <i>Celatoblatta</i> sp. | | saprophytic | common (156) | 3,4,6,8,9,10,11,12, 13,14,15,16,17,18, 19,22,23,24,26,27, 31,32,33 |
| <i>Celeriblattina major</i> Johns | | saprophytic | occasional (10) | 7 |
| <i>Celeriblattina</i> sp. | | saprophytic | rare (1) | 7,11,16,17 |
| <i>Drymaplaneta semivitta</i> (Walker) | Gisborne cockroach | saprophytic | rare (4) | 17 |
| <i>Drymaplaneta</i> sp. | | saprophytic | rare (1) | 17 |
| <i>Parellipsidion latipennis</i> (Brunner von Wattenwyl) | | saprophytic | occasional (8) | 7,16,17 |
| <i>Parellipsidion</i> sp. | | saprophytic | common (74) | 5,7,11,13,16,17 |

| Taxon | Common Name | Feeding Mode | Frequency and (total number) | Collection Sites |
|-----------------------------------------------|-------------------------|---------------------|-------------------------------------|-------------------------|
| Coleoptera | beetles | | | |
| Anthicidae | ant beetles | | | |
| <i>Macratrria</i> sp. | | saprophytic | rare (1) | 3 |
| <i>Sapintus deitzi</i> Werner and Chandler | | saprophytic | rare (2) | 2 |
| <i>Sapintus pellucidipes</i> (Broun) | | saprophytic | occasional (12) | 3,9,13,22,23,25,26 |
| <i>Sapintus</i> sp. | | saprophytic | occasional (16) | 3,9,14 |
| Anthribidae | fungus weevils | | | |
| <i>Euciodes suturalis</i> Pascoe | | fungivorous | rare (1) | 4 |
| <i>Sharpius brouni</i> (Sharp) | | fungivorous | occasional (7) | 3,7,9,12,27 |
| Cantharidae | soldier beetles | | | |
| <i>Malthodes pumilus</i> (Brebisson) | | predatory | rare (1) | 5 |
| Carabidae | ground beetles | | | |
| <i>Amarotypus edwardsii</i> Bates | | predatory | rare (2) | 26 |
| <i>Demetrida lineella</i> White | | predatory | occasional (12) | 23,26,27,29,30,31 |
| <i>Scopodes</i> sp. | | predatory | rare (1) | 17 |
| Cerambycidae | longhorn beetles | | | |
| <i>Bethelium signiferum</i> (Newman) | wattle longhorn | herbivorous | rare (1) | 9 |
| <i>Coptomma sulcatum</i> (Fabricius) | | herbivorous | rare (2) | 23 |
| <i>Hybolasius crista</i> (Fabricius) | | herbivorous | occasional (6) | 5,8 |
| <i>Hybolasius vegetus</i> Broun | | herbivorous | rare (1) | 21 |
| <i>Hybolasius</i> sp. | | herbivorous | rare (1) | 27 |

| Taxon | Common Name | Feeding Mode | Frequency and (total number) | Collection Sites |
|--------------------------------------------------------------------------|--------------------------|---------------------|-------------------------------------|-------------------------------|
| <i>Microlamia pygmaea</i> Bates | | herbivorous | rare (1) | 2 |
| <i>Oemona hirta</i> (Fabricius) | lemon tree borer | herbivorous | rare (1) | 1 |
| <i>Psilocnaeia</i> spp. | | herbivorous | occasional (17) | 1,2,8,13,16,21, 22,23,30 |
| <i>Xuthodes punctipennis</i> Pascoe | speckled longhorn | herbivorous | rare (1) | 9 |
| <i>Xylotoles griseus</i> (Harris) | | herbivorous | occasional (10) | 6,7,8,11,18,22,23, 29 |
| <i>Xylotoles griseus</i> (Harris) or <i>Xylotoles laetus</i> White | | herbivorous | occasional (6) | 8,11,16,17 |
| <i>Xylotoles</i> spp. | | herbivorous | rare (4) | 3,5,13,22 |
| <i>Zorion</i> spp. | flower longhorn | herbivorous | rare (3) | 8,27 |
| Chrysomelidae | leaf beetles | | | |
| <i>Dicranosterna semipunctata</i> (Chapuis) | | herbivorous | rare (1) | 9 |
| <i>Eucolaspis</i> sp. | bronze beetle | herbivorous | common (134) | 1,5,7,8,22,23,24, 25,27,29 |
| <i>Peniticus</i> sp. | | herbivorous | rare (2) | 19 |
| <i>Trachytetra rugulosa</i> (Broun) | | herbivorous | rare (1) | 8 |
| Ciidae | | | | |
| <i>Orthocis undulates</i> (Broun) | | fungivorous | rare (1) | 8 |
| Cleridae | checkered beetles | | | |
| <i>Phymatophaea</i> sp. | | predatory | rare (2) | 23,27 |
| Coccinellidae | ladybirds | | | |
| <i>Adalia bipunctata</i> (Linnaeus) | two-spotted ladybird | predatory | occasional (6) | 8,10,16,19 |

| Taxon | Common Name | Feeding Mode | Frequency and (total number) | Collection Sites |
|--------------------------------------------|-------------------------|----------------------|-------------------------------------|-----------------------------------------------|
| <i>Adoxellus</i> sp. | | predatory | rare (2) | 14,29 |
| <i>Coccinella undecimpunctata</i> Linnaeus | eleven-spotted ladybird | predatory | occasional (10) | 4,6,8,12,16,18,20,26 |
| <i>Cryptolaemus montrouzieri</i> Mulsant | mealybug ladybird | predatory | rare (1) | 9 |
| <i>Halmus chalybeus</i> (Boisduval) | steely-blue ladybird | predatory | occasional (14) | 6,7,10,11,14,16,24 |
| <i>Rhyzobius</i> sp. | | predatory | rare (3) | 2,9,25 |
| <i>Stethorus</i> sp. | | predatory | rare (2) | 3,13 |
| Corylophidae | hooded beetles | | | |
| <i>Sericoderus</i> sp. | | fungivorous | occasional (9) | 1,2,12,13,17,27 |
| Cryptophagidae | cryptic beetles | | | |
| <i>Cryptophagus</i> sp. | | fungivorous | rare (1) | 30 |
| <i>Micrambina</i> spp. | | pollen/fungus feeder | common (56) | 6,9,10,12,13,18,22,23,25,26,31 |
| <i>Paratomaria</i> spp. | | pollen/fungus feeder | abundant (403) | 1,3,14,17,19,20,22,24,25,26,27,29,30,31,32,33 |
| Curculionidae | weevils | | | |
| <i>Asynonychus cervinus</i> (Boheman) | Fuller's rose weevil | herbivorous | common (55) | 7,8,10,15,18,26 |
| <i>Catoptes</i> spp. | | herbivorous | common (38) | 14,16,29,30,31,32,33 |
| <i>Didymus</i> sp. | | herbivorous | rare (2) | 26,33 |
| <i>Irenimus</i> spp. | | herbivorous | common (29) | 2,9,12,13,14,16,17,18,22,26,30 |
| <i>Microcryptorhynchus</i> sp. | | herbivorous | occasional (5) | 8,9,32 |

| Taxon | Common Name | Feeding Mode | Frequency and (total number) | Collection Sites |
|--------------------------------------------|----------------------|--------------------------------|-------------------------------------|-------------------------|
| <i>Microtribus huttoni</i> Wollaston | | herbivorous | rare (1) | 16 |
| <i>Otiorhynchus ovatus</i> (Linnaeus) | | herbivorous | rare (1) | 30 |
| <i>Otiorhynchus rugosostriatus</i> (Goeze) | | herbivorous | rare (1) | 4 |
| <i>Pactola</i> sp. | | herbivorous | rare (1) | 33 |
| <i>Peristoreus</i> spp. | | herbivorous | occasional (5) | 16,24,32 |
| <i>Phlyctinus callosus</i> Boheman | garden weevil | herbivorous | occasional (10) | 13,18,20 |
| <i>Praolepra</i> sp. | | herbivorous | rare (4) | 1,5 |
| <i>Rhopalomerus</i> spp. | | pollen feeder | rare (3) | 27,29 |
| <i>Sericotrogus subaenescens</i> Wollaston | | larvae and adults in dead wood | occasional (20) | 1,2,7,8,9,16,18 |
| <i>Sitona discoideus</i> Gyllenhal | sitona weevil | herbivorous | rare (1) | 16 |
| <i>Sitona lepidus</i> Gyllenhal | clover root weevil | herbivorous | rare (2) | 15,18 |
| <i>Sphenophorus brunnipennis</i> (Germar) | | herbivorous | rare (1) | 2 |
| <i>Stephanorhynchus curvipes</i> White | | herbivorous/ pollen feeder | rare (3) | 7 |
| Unidentified Cossinae | | | rare (1) | 16 |
| Dermestidae | hide beetles | | | |
| <i>Trogoderma</i> sp. | | pollen feeder | rare (1) | 2 |
| Elateridae | click beetles | | | |
| <i>Conoderus exsul</i> (Sharp) | pasture wireworm | herbivorous | common (30) | 4,6,7,9,11,14,15,16 |
| <i>Metablax cinctiger</i> (White) | | herbivorous | rare (1) | 9 |
| Elmidae | | | | |
| <i>Hydora</i> sp. | | herbivorous | rare (1) | 10 |

| Taxon | Common Name | Feeding Mode | Frequency and (total number) | Collection Sites |
|---------------------------------------------|--------------------------------|------------------------------|-------------------------------------|------------------------------------------------------|
| Erotyliidae | handsome fungus beetles | | | |
| <i>Loberus depressus</i> (Sharp) | | saprophytic | rare (2) | 2 |
| <i>Loberus nitens</i> (Sharp) | | saprophytic | rare (1) | 16 |
| Latridiidae | mildew beetles | | | |
| <i>Aridius bifasciatus</i> (Reitter) | | fungivorous | common (27) | 3,9,10,12,13,16,17, 18,19,32 |
| <i>Aridius nodifer</i> (Westwood) | | fungivorous | occasional (5) | 1,17 |
| <i>Melanophthalma</i> sp. | | fungivorous | common (183) | 1,2,3,10,11,12, 13,15,16,17,18,19, 22,23,24,31 |
| <i>Rethusus</i> sp. | | fungivorous | rare (1) | 3 |
| unidentified Latridiidae | | fungivorous | occasional (17) | 6,8,17,19,21,22,23 |
| Lycidae | net winged beetles | | | |
| <i>Porrostoma rufipenne</i> (Fabricius) | | adults: nectar and pollen | rare (1) | 7 |
| Melandyriidae | leaping beetles | | | |
| <i>Hylobia plagiata</i> Broun | | herbivorous | rare (1) | 33 |
| <i>Hylobia</i> spp. | | herbivorous | occasional (9) | 9,10,15,18,32 |
| Melyridae | flower beetles | | | |
| unidentified Melyridae | | predatory | common (43) | 2,22,24,28,29 |
| Mordellidae | pintail beetles | | | |
| <i>Mordella jucunda</i> (Broun) | | herbivorous | rare (1) | 20 |
| <i>Stenomordellaria neglecta</i> (Broun) | | herbivorous | rare (1) | 28 |

| Taxon | Common Name | Feeding Mode | Frequency and (total number) | Collection Sites |
|---------------------------------------------|-----------------------------|---------------------|-------------------------------------|--------------------------------------------------------|
| <i>Zeamordella monacha</i> Broun | | herbivorous | rare (1) | 7 |
| Mycetophagidae | fungus beetles | | | |
| <i>Litargus vestitus</i> (Sharp) | | fungivorous | occasional (5) | 12,16,18 |
| <i>Triphyllus hispidellus</i> (Broun) | | fungivorous | rare (2) | 5 |
| Nitidulidae | sap beetles | | | |
| <i>Aethina nigra</i> (Reitter) | | pollen feeder | occasional (5) | 6 |
| Salpingidae | bark mould beetles | | | |
| <i>Salpingus bilunatus</i> Pascoe | | fungivorous | rare (1) | 9 |
| <i>Salpingus</i> sp. | | fungivorous | rare (3) | 7,10,14 |
| Scarabaeidae | scarab beetles | | | |
| <i>Odontria</i> sp. | | herbivorous | rare (1) | 10 |
| Scraptiidae | soft leaping beetles | | | |
| <i>Nothotelus</i> sp. | | herbivorous | rare (2) | 24,29 |
| Scirtidae | marsh beetles | | | |
| unidentified Scirtidae | | predatory | abundant (293) | 1,2,3,5,7,8,9,15,19, 20,21,22,23,24,27, 28,32,33 |
| Silvanidae | flat beetles | | | |
| <i>Cryptamorpha desjardinsi</i> (Guérin) | Desjardin's flat beetle | fungivorous | rare (1) | 12 |
| <i>Cryptamorpha brevicornis</i> (White) | shorthorned flat beetle | fungivorous | rare (1) | 10 |
| Staphylinidae | rove beetles | | | |
| <i>Anotylus</i> sp. | | predatory | rare (1) | 17 |
| <i>Astenus guttula</i> Fauvel | | predatory | rare (1) | 11 |

| Taxon | Common Name | Feeding Mode | Frequency and (total number) | Collection Sites |
|------------------------------------------------|---------------------------------|---------------------------|-------------------------------------|----------------------------------------|
| unidentified Staphylinidae | | predatory | occasional (8) | 15,16 |
| Tenebrionidae | darkling beetles | | | |
| <i>Lorelus</i> sp. | | herbivorous | rare (2) | 6 |
| Zopheridae | false darkling beetles | | | |
| <i>Bitoma insularis</i> White | | herbivorous | rare (1) | 2 |
| <i>Tarphiomimus indentatus</i> Wollaston | | herbivorous | rare (1) | 4 |
| Dermaptera | earwigs | | | |
| <i>Forficula auricularia</i> Linnaeus | European earwig | omnivorous | common (45) | 5,8,9,10,11,12,13, 15,16,18,20,21,23 |
| Diptera | flies | | | |
| Bibionidae | March flies | | | |
| <i>Dilophus nigrostigma</i> (Walker) | blossom fly | adults: nectar and pollen | rare (4) | 5,19,22,24 |
| Stratiomyidae | soldierflies | | | |
| Unidentified Stratiomyidae | | adults: nectar and pollen | rare (1) | 27 |
| Tachinidae | bristle flies | | | |
| <i>Pales funestra</i> (Hutton) | New Zealand leafroller tachinid | parasitoid | rare (4) | 26,33 |
| <i>Trigonospila brevifacies</i> (Hardy) | Australian leafroller tachinid | parasitoid | common (27) | 4,6,9,10,11,14,18, 30 |
| Hemiptera | bugs | | | |
| Acanthosomatidae | | | | |
| <i>Oncacontias vittatus</i> (Fabricius) | | sap feeder | occasional (37) | 26,32 |
| <i>Rhopalimorpha lineolaris</i> Pendergrast | | sap feeder | rare (2) | 5,23 |
| Anthocoridae | | | | |
| unidentified Anthocoridae | | predatory | common | 1,3,6,8,9,10,11,12, 13,14,17,19,20,23, |

| Taxon | Common Name | Feeding Mode | Frequency and (total number) | Collection Sites |
|----------------------------------------------------|---------------------|---------------------|-----------------------------------------|--------------------------------------------------|
| | | | (53) | 26,31,32 |
| Aphididae | aphids | | | |
| <i>Aulacorthum solani</i> (Kaltenbach) | foxglove aphid | sap feeder | occasional (7) | 7,21 |
| Aphrophoridae | spittle bugs | | | |
| <i>Carystoterpa fingsens</i> (Walker) | | sap feeder | rare (2) | 7,9 |
| <i>Carystoterpa vegans</i> Hamilton and Morales | | sap feeder | occasional (8) | 19,32 |
| <i>Philaenus spumarius</i> (Linnaeus) | meadow spittle bug | sap feeder | common (43) | 9,11,17,18,19,20, 21,23,24,28,29,30, 32,33 |
| Berytidae | | | | |
| <i>Bezu wakefieldi</i> (White) | | sap feeder | rare (4) | 9,22 |
| Cicadellidae | leafhoppers | | | |
| <i>Batracomorphus</i> sp. | | sap feeder | occasional (25) | 8,19 |
| <i>Limotettix</i> sp. | | sap feeder | rare (1) | 9 |
| <i>Nesoclutha pallida</i> (Evans) | | sap feeder | rare (2) | 9,11 |
| Cixiidae | | | | |
| <i>Aka duniana</i> (Myers) | | sap feeder | rare (3) | 24 |
| <i>Aka westlandica</i> Larivière | | sap feeder | rare (1) | 32 |
| <i>Cixius</i> sp. | | sap feeder | rare (2) | 3 |
| <i>Oliarus oppositus</i> (Walker) | | sap feeder | occasional (10) | 7,9,20,22 |
| <i>Koroana rufifrons</i> (Walker) | | sap feeder | occasional (10) | 3,7,22,28 |
| Coccidae | soft scales | | | |
| <i>Saissetia oleae</i> (Olivier) | olive scale | sap feeder | rare (2) | 7 |

| Taxon | Common Name | Feeding Mode | Frequency and (total number) | Collection Sites |
|----------------------------------------------|--------------------------|---------------------------|------------------------------|--------------------------------------------------------------------------|
| Coreidae | | | | |
| <i>Acantholybas brunneus</i> (Breddin) | | sap feeder | rare (2) | 2,5 |
| Delphacidae | | | | |
| <i>Anchodelphax</i> sp. | | sap feeder | rare (4) | 9,12,18 |
| <i>Ugyops</i> sp. | | sap feeder | rare (2) | 2,11 |
| Flatidae planthoppers | | | | |
| <i>Anzora unicolor</i> (Walker) | grey planthopper | sap feeder | rare (3) | 17,25,30 |
| <i>Siphanta acuta</i> (Walker) | green planthopper | sap feeder | abundant (379) | 5,6,7,8,9,10,11,12, 13,16,17,18,19,21, 22,23,24,25,26,27, 29,31 |
| Lygaeidae seed bugs | | | | |
| <i>Rhypodes</i> sp. | | sap/seed feeder | occasional (6) | 6,9,15,24 |
| Membracidae | | | | |
| <i>Acanthucus trispinifer</i> (Fairmaire) | | sap feeder | occasional (25) | 32 |
| Miridae mirid bugs | | | | |
| <i>Chinamiris</i> spp. | | sap feeder | occasional (48) | 24 |
| <i>Deraecoris maoricus</i> Woodward | | predatory | occasional (8) | 14,31,32 |
| <i>Diomocoris</i> sp. | | sap feeder | occasional (22) | 7,8,24 |
| <i>Halormus velifer</i> Eyles & Schuh | | sap feeder | rare (4) | 8 |
| <i>Sejanus albisignatus</i> (Knight) | | predator/pollen feeder | occasional (6) | 11,24 |
| <i>Sidnia kinbergi</i> (Stål) | Australian crop mirid | sap feeder | occasional (6) | 10,14,16,19,24 |
| <i>Stenotus binotatus</i> (Fabricius) | slender crop mirid | sap feeder | rare (2) | 20 |
| <i>Xiphoides</i> sp. | | sap feeder | rare (2) | 27 |
| unidentified Orthotylinae | | | rare (1) | 19 |

| Taxon | Common Name | Feeding Mode | Frequency and (total number) | Collection Sites |
|-----------------------------------------|----------------------------|---------------------|-------------------------------------|---------------------------------------------|
| unidentified Miridae | | | occasional (31) | 2,5,9,20 |
| Nabidae | damsel bugs | | | |
| <i>Nabis biformis</i> (Bergroth) | | predatory | common (44) | 7,8,9,10,27,28 |
| <i>Nabis</i> sp. | | predatory | occasional (6) | 2,19,22 |
| Pentatomidae | shield bugs | | | |
| <i>Cermatulus nasalis</i> (Westwood) | brown soldier bug | predatory | occasional (9) | 8,17,18,32 |
| <i>Cuspicona simplex</i> Walker | green potato bug | sap feeder | occasional (16) | 3,8,17,21,25,33 |
| <i>Dictyotus caenosus</i> (Westwood) | brown shield bug | sap feeder | rare (4) | 11,19 |
| <i>Glaucias amyoti</i> (Dallas) | New Zealand vegetable bug | sap feeder | rare (3) | 16 |
| <i>Nizara viridula</i> (Linnaeus) | green vegetable bug | sap feeder | common (125) | 2,4,5,6,7,9,10,11,12,13,14,15,16,17 |
| <i>Oechalia schellenbergii</i> (Guérin) | Schellenberg's soldier bug | predatory | occasional (12) | 11,15 |
| Reduviidae | assasin bugs | | | |
| unidentified Reduviidae | | predatory | occasional (11) | 8,19 |
| Ricaniidae | planthoppers | | | |
| <i>Scolypopa australis</i> (Walker) | passionvine hopper | sap feeder | abundant (2000 plus) | 4,6,8,9,10,11,12,13,15,16,17,18,24,25,26,30 |
| Rhyparochromidae | seed bugs | | | |
| <i>Margareta dominica</i> White | | sap/seed feeder | rare (2) | 13 |
| <i>Metagerra</i> sp. | | sap/seed feeder | common (34) | 14,17,21,22,27,28,29 |
| <i>Remaudiereana</i> sp. | | sap/seed feeder | rare (1) | 2 |
| <i>Targarema</i> sp. | | sap/seed feeder | occasional (5) | 14,17,22 |

| Taxon | Common Name | Feeding Mode | Frequency and (total number) | Collection Sites |
|--------------------------------------------------------------|------------------------------|---------------------|-------------------------------------|--------------------------------------|
| Hymenoptera | bees, wasps, ants | | | |
| Braconidae | parasitic wasps | | | |
| <i>Dolichogenidea tasmanica</i> Cameron | | parasitoid | rare (4) | 12,20,21,22 |
| <i>Glyptapanteles demeter</i> (Wilkinson) | | parasitoid | occasional (88) | 4,9,20,21 |
| <i>Meteorus pulchricornis</i> Wesmael | | parasitoid | occasional (16) | 6,9,10,13,14,15,17,18,20,21,23,27,32 |
| Eulophidae | | | | |
| <i>Sympiesis</i> sp. 1 (of Berry) | | parasitoid | occasional (25) | 31 |
| <i>Sympiesis</i> sp. (species with partially orange gaster) | | parasitoid | occasional (6) | 26 |
| Formicidae | ants | | | |
| <i>Monomorium</i> sp. | | omnivorous | rare (2) | 2,7 |
| <i>Ochetellus glaber</i> (Mayr) | | omnivorous | rare (1) | 2 |
| <i>Paratrechina vaga</i> (Forel) | garden ant | omnivorous | common (27) | 1,2,8,12,23 |
| <i>Prolasius advena</i> (Smith) | small brown bush ant | omnivorous | rare (4) | 10,13 |
| <i>Tetramorium bicarinatum</i> (Nylander) | | omnivorous | occasional (10) | 8 |
| <i>Technomyrmex albipes</i> (Smith) | white-footed house ant | omnivorous | common (109) | 1,2,5,6,7,9,12,17,21 |
| Ichneumonidae | | | | |
| <i>Campoletis</i> sp. | | parasitoid | rare (1) | 8 |
| <i>Campoplex</i> sp. 9 of Gauld | | parasitoid | rare (1) | 9 |
| <i>Campoplex</i> sp. | | parasitoid | rare (2) | 31,32 |
| Lepidoptera | moths and butterflies | | | |
| (collected as larvae and reared to adult for identification) | | | | |
| Elachistidae | | | | |
| <i>Elachista archaeonoma</i> Meyrick | | herbivorous | rare (1) | 2 |

| Taxon | Common Name | Feeding Mode | Frequency and (total number) | Collection Sites |
|---------------------------------------------|-------------------------------|-----------------------------------------------|-------------------------------------|--------------------------------------|
| Geometridae | looper moths | | | |
| <i>Gellonia dejectaria</i> Walker | brown evening moth | herbivorous | rare (1) | 22 |
| <i>Gellonia pannularia</i> Guenee | | herbivorous | rare (1) | 1 |
| <i>Homodotis megaspilata</i> Walker | | herbivorous | rare (2) | 3,24 |
| <i>Phrissogonus laticostatus</i> Walker | feathered moth | herbivorous | rare (1) | 18 |
| <i>Pseudocoremia suavis</i> Butler | common forest looper | herbivorous | rare (1) | 22 |
| unidentified Geometridae | | herbivorous | rare (4) | 6,21,23 |
| Noctuidae | armyworms, cutworms | | | |
| <i>Chrysodeixis eriosoma</i> (Doubleday) | green looper or silver Y moth | herbivorous | rare (2) | 2,13 |
| <i>Ferdayia graminosa</i> (Walker) | mahoe stripper | herbivorous | rare (1) | 21 |
| <i>Graphania ustistriga</i> Walker | | herbivorous | occasional (8) | 3,5,9,21,23,27 |
| <i>Graphania</i> sp. | | herbivorous | rare (1) | 31 |
| <i>Rhapsa scotosialis</i> Walker | slender owlet | herbivorous | rare (1) | 32 |
| unidentified Noctuidae | | herbivorous | occasional (23) | 5,7,9,10,11,12,18, 21,23,24,26,31 |
| Psychidae | bag moths | | | |
| <i>Lepidoscia heliochares</i> Meyrick | thatched cottage | herbivorous (algal feeder) | rare (1) | 14 |
| <i>Lepidoscia lainodes</i> Meyrick | little log cabin bag moth | herbivorous (algal feeder) | rare (3) | 15 |
| Thyrididae | | | | |
| <i>Morova subfasciata</i> Walker | | gall-former on <i>Meuhlenbeckia</i> sp. | rare (1) | 24 |
| Tortricidae | leaf rollers | | | |
| <i>Apoctena orthropis</i> Meyrick | | herbivorous | rare (1) | 29 |

| Taxon | Common Name | Feeding Mode | Frequency and (total number) | Collection Sites |
|--------------------------------------------------------------------------------------------------|-------------------------------------|---------------------|-------------------------------------|------------------------------------------------------------------------|
| <i>Cnephasia jactatana</i> Walker | black-lyre moth | herbivorous | rare (3) | 8,9 |
| <i>Ctenopseustis obliquana</i> (Walker) or <i>C. herana</i> (Felder and Rogenhofer) | | herbivorous | common (66) | 1,3,5,7,8,9,11,18, 20,22,23,24,26,30, 31,32,33 |
| <i>Epalxiphora axenana</i> Meyrick | sharp-tipped bell moth | herbivorous | occasional (6) | 9,31,33 |
| <i>Epiphyas postvittana</i> (Walker) | light-brown apple moth | herbivorous | occasional (9) | 1,4,5,7,9,12,21,28 |
| <i>Planotortrix excessana</i> Walker or <i>P. octo</i> Dugdale | | herbivorous | occasional (18) | 8,18,20,23,25,26, 30,31,32,33 |
| <i>Pyrgotis plagiata</i> Walker | painted wedge | herbivorous | rare (1) | 33 |
| unidentified Tortricidae | | herbivorous | common (134) | 4,6,8,9,10,11,12, 13,14,15,16,17,18, 20,21,22,26,27,31, 32,33 |
| Mantodea | praying mantids | | | |
| <i>Miomantis caffra</i> Saussure | African praying mantis | predatory | common (47) | 1,4,6,7,10,11,13, 14,16,17,18 |
| <i>Orthodera novaezealandiae</i> (Colenso) | New Zealand praying mantis | predatory | common (29) | 6,7,9,10,11,12,16 |
| Neuroptera | lacewings | | | |
| <i>Micromus tasmaniae</i> (Walker) | Tasmanian lacewing | predatory | common (110) | 4,5,7,8,9,10,11,13, 15,16,17,19,20,22, 24,26,29,30,31,32, 33 |
| <i>Psectra nakaharai</i> New | | predatory | rare (1) | 30 |
| Orthoptera | crickets, grasshoppers, weta | | | |
| Anostostomatidae | | | | |
| <i>Hemideina</i> sp. | | omnivorous | rare (2) | 23 |
| Grillidae | | | | |
| <i>Bobilla</i> sp. | | herbivorous | rare (1) | 33 |

| Taxon | Common Name | Feeding Mode | Frequency and (total number) | Collection Sites |
|---------------------------------------------|---------------------------------|-----------------------------|-------------------------------------|--------------------------------------------------|
| Raphidophoridae | cave weta | | | |
| unidentified Raphidophoridae | | omnivorous | rare (4) | 1,3,13,18 |
| Tettigoniidae | long-horned grasshoppers | | | |
| <i>Caedicia simplex</i> (Walker) | katydid | herbivorous | common (52) | 4,5,6,7,8,10,11,12,13,14,15,17,18,21,22,23,25,30 |
| <i>Conocephalus</i> sp. | field grasshopper | herbivorous | occasional (15) | 1,2,4,7,9,11,12,13,15,17,18,19,20,22 |
| Psocoptera | book lice | | | |
| unidentified Psocoptera | | saprophytic and fungivorous | common (35) | 2,6,7,8,9,13,15,16,17,18,21,30,31,32 |
| Thysanoptera | thrips | | | |
| sub-order Terebrantia | | | | |
| Thripidae | | | | |
| <i>Heliothrips haemorrhoidalis</i> (Bouche) | greenhouse thrips | herbivorous | occasional (46) | 5,6,10,17 |
| <i>Hercinothrips bicinctus</i> (Bagnall) | banana silvering thrips | herbivorous | common (118) | 4,11,12,16,20,21 |
| <i>Thrips obscuratus</i> (Crawford) | New Zealand flower thrips | herbivorous | common (163) | 1,3,5,6,14,19,20,21,22,23,24,27,29,30,31 |
| sub-order Tubulifera | | | | |
| unidentified Tubulifera | | fungivorous | occasional (14) | 3,6,17,19,20,21 |