

Current status of New Zealand indigenous aphids

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Summary

This report summarises our current knowledge of the New Zealand indigenous aphid fauna.

Size of fauna. Based on present knowledge, estimates of the size of the New Zealand indigenous aphid fauna range from 12 to 16 species. Six indigenous species have been fully described and named. A further six species are almost certainly indigenous to New Zealand but have not been fully described. There is good evidence for the existence of another two species and some evidence for another two species. More species are likely to be discovered.

Taxonomic distinctiveness. The New Zealand indigenous aphids constitute a distinctive taxonomic component of the New Zealand fauna and the world aphid fauna. They have Gondwanan affinities and other unique features. At least two genera are endemic. They also support what appears to be a unique indigenous parasitoid (parasites that kill their hosts) fauna of unknown size.

Biology and ecology. Very little is known about the biology and ecology of any species of indigenous aphid. One characteristic feature of the *Aphis/Paradoxaphis* group is their patchy but very aggregated distribution.

Population status. Only three species, *Neophyllaphis totarae*, *Sensoriaphis nothofagus* and the undescribed aphid on *Dracophyllum*, can be considered to be relatively common. The remaining species are now known from either one or two populations or have not been seen recently.

Survey and collection. Extensive surveys have been completed of some species with little attention given to others. Recent surveys reinforce previous perceptions that, apart from three species, most indigenous species are difficult to find.

Threats to survival. New Zealand indigenous aphids face a number of threats to their continued survival: from habitat destruction, displacement by introduced aphids, and attack from introduced parasitoids and predators. The relative importance of these threats has yet to be determined.

1. Introduction

In comparison to the New Zealand alien or introduced aphid fauna of about 100 species (V F Eastop, pers. comm.) little is known about the indigenous fauna. There is evidence for between 12 and 16 indigenous species in New Zealand, with the possibility that more species will be discovered (see below). However, only six indigenous species have been fully described, five by Cottier (1953) and one by Sunde (1987). The indigenous species constitute a distinctive taxonomic component of the New Zealand fauna and the world

aphid fauna. They have Gondwanan affinities and other unique features. Many species are rare and some are possibly extinct. Very little is known of their biology and ecology. They face threats from habitat destruction, attack from alien parasitoids¹ and predators, and displacement by introduced aphids.

This report summarises our current knowledge of the New Zealand indigenous aphid fauna. It lists the number of described, undescribed and suspected indigenous species found in New Zealand, and details their taxonomic status and uniqueness. It also summarises the small amount of information available on their biology and ecology, and details the status of populations presently found in New Zealand along with the effort spent finding them. Finally, it lists potential threats to their continued survival. Appendix 10.1 provides detailed information on each species.

3. Size of fauna

Only six indigenous species have been fully described and named (Table 1). One other described species that was first found in New Zealand, *Thripsaphis foxttonensis* Cottier (1953), is now thought to be an introduced species because it has no close relatives in New Zealand whereas several are found elsewhere (V F Eastop, pers. comm.).

Table 1: New Zealand indigenous aphids: described species and their host plants.

Described species	Host plant
<i>Aphis coprosmae</i> Laing ex Tillyard ^a	<i>Coprosma</i> spp.
<i>Aphis healyi</i> Cottier ^a	<i>Carmichaella</i> sp.
<i>Aphis nelsonensis</i> Cottier ^a	<i>Epilobium</i> sp.
<i>Paradoxaphis aristoteliae</i> Sunde ^b	<i>Aristotelia</i> spp.
<i>Neophyllaphis totarae</i> Cottier ^a	<i>Podocarpus</i> spp.
<i>Sensoriaphis nothofagi</i> Cottier ^a	<i>Nothofagus</i> spp.

^a See Cottier (1953).

^b See Sunde (1987).

A further six species are almost certainly indigenous to New Zealand but have not yet been fully described (Table 2).

Another two aphids, an *Aphis* sp. on *Hebe elliptica* and a *Neophyllaphis* sp. on *Podocarpus nivalis*, have also been recorded. These appear to be closely related to described species but both were sufficiently different for Dr V F Eastop to suspect that they could be separate species. More effort is needed to determine their taxonomic status.

¹ A parasitoid is a parasite that kills its host, and hence differs from a true parasite which does not. A parasitoid is only parasitic during its immature stages. The adult parasitoid is usually free-living (Dent 1991).

Table 2: New Zealand indigenous aphids: undescribed species and their host plants.

Undescribed species	Host plant
<i>Aphis cottieri</i> MS name ^a	<i>Muehlenbeckia</i> sp.
<i>Aphis</i> sp.	<i>Ozothamnus</i> sp.
<i>Paradoxaphis</i> sp.	<i>Plagianthus</i> sp.
<i>Paradoxaphis</i> sp.	<i>Aciphylla</i> sp.
Taxonomy uncertain	<i>Dracophyllum</i> spp.
<i>Neophyllaphis sinzi</i> MS name	<i>Podocarpus</i> sp.

^a MS name—manuscript name.

A number of unidentified aphid specimens that have been found on indigenous plants are also possibly native to New Zealand. These include one species (possibly *Aphis*) on *Samolus* (V F Eastop pers. comm.) and another species on *Yoania* (R Sunde pers. comm.) as well as two *Rhopalosiphum*-like aphids, one collected from *Cordyline indivisa* and one collected from a sedge (V F Eastop pers. comm.).

The confounding effects of few and limited aphid surveys, rarity, and taxonomic uncertainty, lead specialists to believe that an unknown number of species remains to be discovered (D F Hales, pers. comm.; V F Eastop, pers. comm.).

3. Taxonomic distinctiveness

The New Zealand indigenous aphids constitute a distinctive taxonomic component of the New Zealand fauna and of the world aphid fauna. Specific characteristics include:

- *Neophyllaphis* and *Sensoriaphis* are both primitive genera with Gondwanan distributions (Carver et al. 1991). The genus *Neophyllaphis* is considered the closest living relative of the ancestral aphid form (V F Eastop, pers. comm.).
- The genus *Paradoxaphis* appears to be endemic to New Zealand (Sunde 1987; Remaudiere & Remaudiere 1997). Species belonging to this genus are not found elsewhere.
- New Zealand native *Aphis* have features that suggest they are closely related to *Paradoxaphis* and could be grouped together as an endemic New Zealand genus (V F Eastop, pers. comm.). As a group, they appear to have had a unique radiation within New Zealand because winged adults of both genera have characters not found in any other species belonging to the genus *Aphis*.
- The undescribed aphid found on *Dracophyllum* appears to be another New Zealand endemic genus (V F Eastop, pers. comm.).

- Many indigenous aphid species are hosts to parasitoids of which many are likely to be endemic to New Zealand. None has been properly described and named. An unpublished manuscript describes one parasitoid species, *Choreopraon totarae* MS name, and assigns it to a newly constructed New Zealand endemic genus.

4. Biology and ecology

There has been very little published work on the biology or ecology of any New Zealand indigenous aphid (Cottier 1953; Sunde 1987; Blackman & Eastop 1994).

Based on present data, all New Zealand indigenous aphid species appear to be host-specific, at least to host plant genera.

Parthenogenetic viviparous (produce live young) females have been recorded for most species. The winged adults of some species have not been recorded, but this is not surprising considering the small number of total specimens recorded for some species.

Oviparous (egg-laying) females and males have been recorded only for *Neophyllaphis totarae* and *Sensoriaphis nothofagi* (Cottier 1953), and wingless oviparous females for the undescribed species on *Dracophyllum* (V F Eastop, pers. comm.). Eggs have been recorded only for *Aphis coprosmae* (Tillyard 1926), *Neophyllaphis* sp. (D F Hales, pers. comm.) and the undescribed species on *Dracophyllum* (in the laboratory) (MAWS personal observation). Alate oviparous females and males of *Neophyllaphis totarae* are found in spring and summer (Cottier 1953; Blackman & Eastop 1994).

One characteristic of the *Aphis/Paradoxaphis* group is their patchy but very aggregated distributions. A number of species in this group (e.g. *Aphis coprosmae*, *A. healyi*, the *Aphis* sp. on *Ozothamnus*, *Paradoxaphis aristoteliae*, and the *Paradoxaphis* sp. on *Plagianthus*) are usually found inhabiting only a few host plants (sometimes only one) in a small area with surrounding host plants uninhabited.

Some indigenous aphids are attacked by hymenopteran parasitoids in the field (e.g. *Aphis coprosmae*, *Aphis healyi*, *Paradoxaphis aristoteliae*, *Paradoxaphis* sp. on *Aciphylla*, *Neophyllaphis totarae*, and the unidentified species on *Dracophyllum*). Except for *Choreopraon totarae* (MS name) from *Neophyllaphis totarae*, there has been little attempt to identify these species. It is likely that a number of these parasitoid species are endemic to New Zealand. At least one introduced hyperparasitoid² has been reported attacking a parasitoid of *Neophyllaphis totarae* in the field (Valentine 1975).

² Hyperparasitoids (also known as 2° parasitoids) parasitise parasitoids (or 1° parasitoids) (Dent 1991).

5. Population status

Table 3 lists New Zealand indigenous aphid species in relation to their relative abundance. Only three species, *Neophyllaphis totarae*, *Sensoriaphis nothofagi*, and the undescribed aphid on *Dracophyllum*, can be considered to be relatively common. The remaining species are now known from either one or two populations or have not been seen recently. These include species that have been recognised for some time and for which extensive surveys have been made, such as *Aphis coprosmae*, *Aphis healyi*, *Paradoxaphis aristoteliae* and *Aphis nelsonensis*. Other species may prove to be more common if more surveys are undertaken, although recent surveys to locate the *Aphis* sp. on *Ozothamnus*, the *Paradoxaphis* sp. on *Plagianthus*, and the *Paradoxaphis* sp. on *Aciphylla* have been unsuccessful (see below and Appendix 10.1).

Table 3: Relative abundance and host plants of New Zealand indigenous aphid populations in February 1998. Underscoring indicates extensive surveys for a given species.

Species	Host	Comment
Relatively common Taxonomy uncertain <u><i>Neophyllaphis totarae</i></u> <u><i>Sensoriaphis nothofagi</i></u>	<i>Dracophyllum</i> <i>Podocarpus totara</i> <i>Nothofagus</i> spp.	Widespread in South Island north of Arthur's Pass In North and South Islands In North and South Islands
1-2 populations <u><i>Aphis coprosmae</i></u> <u><i>Aphis healyi</i></u> <i>Aphis</i> sp. <u><i>Paradoxaphis aristoteliae</i></u> <i>Paradoxaphis</i> sp. <i>Neophyllaphis sinzi</i> MS n.	<i>Coprosma</i> <i>Carmichaelta</i> <i>Ozothamnus</i> <i>Aristotelia</i> <i>Plagianthus</i> <i>Podocarpus ballii</i>	Only 2-3 known popn since 1922 Rediscovered in 1998 Rediscovered in 1998 Only 2-3 popn known since 1982 Possibly 2 popn known since 1972 Possibly 2 popn known since 1972
No known populations <u><i>Aphis nelsonensis</i></u> <i>Aphis cottleri</i> MS n. <i>Aphis</i> sp. <i>Paradoxaphis</i> sp. <i>Aphis</i> sp.	<i>Epilobium</i> <i>Muehlenbeckia</i> <i>Hebe</i> <i>Aciphylla</i> <i>Samolus</i>	Only 2 popn ever recorded Not seen since 1965 Only 1 popn ever recorded in 1972 Only 1 specimen recorded in 1972 Only 1 popn ever recorded in 1983 Details uncertain

Only two species have been recorded in both the North Island and the South Island (*Neophyllaphis totarae* and *Sensoriaphis nothofagi*); the rest have all been recorded from the South Island. This may reflect the relative amount of sampling effort in each island.

6. Survey and collection

The first indigenous aphids recorded, *Aphis coprosmae* and *Neophyllaphis totarae*, were collected in the 1920s. *Neophyllaphis totarae* was initially thought to be *Neophyllaphis podocarpis* originally described from Japan (Cottier 1953). With only one apparently indigenous species (*Aphis coprosmae*), it was initially thought that indigenous aphids might be entirely lacking in New Zealand and that eventually it would be discovered that this one species was introduced (Cottier 1953). This view may have discouraged any serious collection of indigenous aphids in New Zealand until 1953, when Cottier published his seminal book on 'Aphids of New Zealand' which included descriptions of six indigenous species.

Table 4 details collections of indigenous aphid species by decade from 1920 based on collections in the New Zealand Arthropod Collection, Auckland; the Natural History Museum, London; any published records; and collections made by Crop & Food Research's Lincoln-based Aphid Group (largely by MAW Stufkens). Table 4 illustrates that collecting of New Zealand indigenous aphids between 1920 and 1970 was spasmodic. Nevertheless, during this time A J Healy found two new species (*Aphis healyi* and *Aphis nelsonensis*) and W Cottier was actively collecting *Neophyllaphis totarae*. A further new species (*Sensoriaphis nothofagi*) was found by J M Dingley in 1947. Based on information found in his unpublished correspondence, A D Lowe carried out some surveys for indigenous aphids in the 1960s. During the 1970s and 1980s a considerable amount of aphid collecting was carried out by a number of entomologists. This activity included collections by foreign scientists, including the world renowned aphidologist V F Eastop, who visited New Zealand on several occasions. It is notable that all four new but still undescribed species discovered in the 1970s were found by overseas visitors.

These collections (Table 4) show that only two species, *Neophyllaphis totarae* and *Sensoriaphis nothofagus*, have been regularly collected since they were first discovered. Lack of collection records for other species provides some indication of their rarity. This is reinforced by anecdotal evidence on some species. Persons intimately associated with the discovery of *Aphis healyi*, *Aphis nelsonensis* (A J Healy) and *Paradoxaphis aristoteliae* (R Sunde) have both indicated that they carried out a reasonable amount of surveying for their respective species but with very little success (pers. comm to DAJT).

Since 1993 Crop & Food Research's Aphid Group has carried out regular surveys for indigenous aphids to include in quarantine tests for introduced aphid parasitoids (see Stufkens & Farrell 1994). These surveys reinforce previous perceptions that only two species, *Neophyllaphis totarae* and *Sensoriaphis*

nothofagi, are relatively common. Based on the results of the latest surveys (1997 and 1998) a third species, the undescribed aphid on *Dracophyllum*, can be added to this group. All other species are very difficult to find (Table 3).

There appear to be few reports of native aphids in surveys for flying aphids in crop areas (see Lowe 1968; DAJT unpubl. data).

Table 4: Collections of New Zealand indigenous aphid species by decade from 1920 based on specimens in the NZ Arthropod Collection, the Natural History Museum, published records, and collections made by Crop & Food Research's Lincoln-based Aphid Group. Bold indicates first record for a given species.

Decade	Species	Collector(s) and year (s) of collection
1920-29	<i>Aphis coprosmae</i> <i>Neophyllaphis totarae</i>	A Philpott & R J Tillyard: 1922 ^b , 1923 ^{ab} (see Tillyard 1926; Cottier 1953) G S Gourlay: 1920? ^b (see Miller 1925; Cottier 1953)
1930-39	<i>Neophyllaphis totarae</i> <i>Neophyllaphis totarae</i>	L J Dumbleton: 1930 ^{ab} W Cottier: 1930 ^a , 1931 ^b , 1936 ^{ab} , 1937 ^a
1940-49	<i>Aphis healyi</i> <i>Aphis nelsonensis</i> <i>Neophyllaphis totarae</i> <i>Sensoriaphis nothofagi</i>	A J Healy: 1943 ^{ab} , 1944 ^{ab} (see Cottier 1953) A J Healy: 1946 ^{ab} (see Cottier 1953) W Cottier: 1949 ^a J M Dingley: 1947 ^a (see Cottier 1953)
1950-59	<i>Sensoriaphis nothofagi</i>	J Dingley: 1958 ^{ab}
1960-69	<i>Aphis healyi</i> <i>Aphis nelsonensis</i>	A J Healy: 1969 A D Lowe: 1965 ^b
1970-79	<i>Aphis</i> sp. on <i>Hebe</i> <i>Aphis cottieri</i> MS name <i>Paradoxaphis</i> on <i>Plagianthus</i> <i>Aphid</i> sp. on <i>Dracophyllum</i> <i>Neophyllaphis totarae</i> <i>Neophyllaphis totarae</i> <i>Neophyllaphis sinzi</i> MS name <i>Sensoriaphis nothofagi</i> <i>Sensoriaphis nothofagi</i> <i>Sensoriaphis nothofagi</i> <i>Sensoriaphis nothofagi</i> <i>Sensoriaphis nothofagi</i> <i>Sensoriaphis nothofagi</i>	V F Eastop: 1972 ^b D F Hales (née White): 1972 ^c V F Eastop (with A D Lowe): 1972 ^b L A Mound: 1979 ^b D F Hales (née White): 1972 ^b V F Eastop: 1972 ^b D F Hales (née White): 1972 ^c D F Hales (née White): 1972 ^b V F Eastop: 1972 ^b R Sunde: 1971 & 1972 (see Sunde 1973) R Sunde: 1975 ^b & 1977 ^{ab} L L Deitz, G Hall, B Barthow, M F Tocker: 1976 ^a & 1977 ^a J S Dugdale: 1977 ^a

1980-89	<i>Paradoxaphis aristoteliae</i> <i>Paradoxaphis aristoteliae</i> <i>Paradoxaphis aristoteliae</i> <i>Paradoxaphis</i> on <i>Aciphylla</i> <i>Neophyllaphis totarae</i> <i>Sensoriaphis nothofagi</i> <i>Sensoriaphis nothofagi</i>	C Butcher: 1982 ^a (see Sunde 1987) J Butel: 1983 ^{ab} (see Sunde 1987) V F Eastop, A Walker, R Sunde: 1983 ^{ab} (see Sunde 1987) J M Cox: 1983 ^b V F Eastop: 1983 ^b V F Eastop: 1983 ^b T Green: 1987 ^a
1990-99	<i>Aphis coprosmae</i> <i>Aphis healyi</i> <i>Aphis</i> sp. on <i>Ozothamnus</i> <i>Aphis</i> sp. on <i>Ozothamnus</i> <i>Paradoxaphis aristoteliae</i> <i>Paradoxaphis</i> on <i>Plagianthus</i> Aphid sp. on <i>Dracophyllum</i> <i>Neophyllaphis totarae</i> ? <i>Neophyllaphis sinzi</i> MS name <i>Sensoriaphis nothofagi</i>	MAW Stufkens (with V F Eastop in 1997): 1993-98 MAW Stufkens: 1998 J Ward: 1994 MAW Stufkens: 1997-98 MAW Stufkens: 1993-98 MAW Stufkens (with V F Eastop in 1997): 1997 & 1998 MAW Stufkens (with V F Eastop in 1997): 1997 & 1998 MAW Stufkens: 1993-98 MAW Stufkens: 1998 Various: 1993-98

^a Specimens in the New Zealand Arthropod Collection, Auckland.

^b Specimens in the Natural History Museum, London.

^c Specimens in the Australian National Insect Collection.

7. Threats to survival

New Zealand indigenous aphids face a number of threats to their continued survival. The relative importance of these threats has yet to be determined. Threats include:

- Habitat destruction. This includes major disruption in the form of the complete removal of habitat and host plants as well as less obvious destruction in the form of animals browsing the young growing shoots of aphid host plants, which are the preferred habitat for some aphid species (e.g. *Aphis healyi* on *Carmichaelia*). Even small-scale habitat destruction may be detrimental to aphid species in the *Aphis/Paradoxaphis* group because of their patchy and highly aggregated distribution. The removal of one plant may bring about the destruction of the only aphid population in a given area.
- Displacement by introduced aphids. The 100 or so introduced aphid species in New Zealand constitute a considerable proportion of the 1000 total insect invaders of New Zealand reported by Taylor et al. (1997). The ratio of alien to indigenous aphid species is extremely high and continues to rise regularly because of accidental introductions (12:1 in

1953, 16:1 in 1973, 20:1 in 1996) (Cottier 1953; Lowe 1973). A number of indigenous aphid species may be threatened as a result of displacement from their host plants by introduced species. For example, *Aphis nelsonensis*, which has not been recorded for over 30 years, may have been displaced on *Epilobium* by *Aphis* nr. *epilobii*. Likewise, up to five introduced aphid species are now found on *Aciphylla* (Cottier 1953), but the undescribed indigenous *Paradoxaphis* sp. has not been found. Other introduced aphids are commonly found on native plants in natural habitats.

- Attack from introduced parasitoids and predators. Indigenous aphids may be threatened by attack from alien parasitoids and predators, including vespid wasps. A number of introduced parasitoids have been found to attack and kill several indigenous aphid species in the laboratory (Stufkens & Farrell 1994; Teulon & Stufkens, unpub. data). At least one introduced aphid predator, *Coccinella unidecimpunctata*, has displaced its indigenous counterpart, *C. leonina*, in many areas of New Zealand (Watts 1986) and probably includes indigenous aphids amongst its prey.
- Climate change. Climate change represents a significant threat to global biodiversity and ecosystem integrity, including New Zealand indigenous aphid species and their host plants.

8. Acknowledgements

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10. Appendices

10.1 SPECIES SUMMARIES

Aphis coprosmae Laing ex Tillyard **Coprosma Aphid (Aphidinae)**

Host plant(s): *Coprosma rigida*, *C. crassifolia*

Description: Medium sized (=1.6 mm) aphids usually completely covered in fluffy white wax which is also deposited on the branches inhabited by the aphids.

Morphs: Winged & wingless viviparous females

First record: 1922 on *C. rigida* near Nelson by A Philpott and R J Tillyard

Plant part: On twigs near growing tips

Distribution³: Sth Is.: NN, BR
 Sth Is.: Nelson-Marlborough

Land status of Aniseed Valley -Transit NZ
collection sites: Lake Rotoroa - Nelson Lakes National Park

Natural enemies: Coprosma aphids on a single plant near Lake Rotoroa, Nelson Lakes, were found to be heavily parasitised by unidentified aphelinids (black mummies) and aphidiines (brown mummies) in February 1997.

Rarity: It appears that only three populations of this aphid have ever been observed: one in the Aniseed Valley (near Nelson) in 1922-23 (Tillyard 1926; Cottier 1956), one in the Aniseed Valley from 1993 to the present, and one near Lake Rotoroa (Nelson Lakes) from 1997 to the present. In each case the aphid was found on only one plant, even though similar plants of the same species were close by. On the last visit to the Aniseed Valley population in January 1998 no aphids were observed. MAW Stufkens has carried out regular searches for this aphid from 1993 to the present in the North and South Islands with only two populations (see above) being discovered.

Notes: According to Tillyard (1926) this species lays large, dark grey, oval eggs in rows along the stem of the plant; these hatch in September, producing black larvae. Winged adults have been found in February and December and wingless adults in February, March, and December. The two recent collections of this aphid have been from *C. crassifolia*.

³ Distribution localities are based on New Zealand Arthropod Collection boundaries (see Appendix 10.2) (Crosby et al. 1976) and New Zealand Conservancies (Molloy & Davis 1994).

The collection dates for this species in Cottier (1953) appear to be incorrect. Cottier (1953) states that the Aniseed Valley collections were made on 3 December 1933 but specimen slides in the New Zealand Arthropod Collection, Auckland, and the Natural History Museum, London, only indicate 23 March 1922 and 3 December 1923 for collections. Presumably the dates on the specimens are correct.

Specimen(s): New Zealand Arthropod Collection, Auckland
Natural History Museum, London

References: Tillyard (1926), Cottier (1956)

Aphis sp.

(Aphidinae)

Host plant(s): *Hebe ?elliptica*

Description: Unknown

Morphs: Only one wingless female

First record: 1972 on *Hebe ?elliptica* near Greymouth by V F Eastop

Plant part: Unknown

Distribution: Sth Is.: BR
Sth Is.: West Coast

Land status of
collection sites: Unknown

Natural enemies: Unknown

Rarity: V F Eastop collected only one specimen in October 1972 from Greymouth.

There is unlikely to have been much effort exerted on searching for this aphid before 1997. Since then, MAW Stufkens has searched for this aphid on the West Coast on two occasions, without success.

Notes: As only one specimen was collected from *Hebe* there is some question as to whether this plant is its true host.

Specimen(s): Natural History Museum, London

***Aphis healyi* Cottier**

(Aphidinae)

Host plant(s): *Carmichaelia subulata*

Description: Large (2.0-2.2 mm) dark-green to black aphids.

Morphs: Winged & wingless viviparous females

First record: 1943 from Mount Cass near Waipara by A J Healy (Cottier 1953)

Plant part: Aphids congregate on the terminal parts of the shrubs, especially new growth, flowers and seed pods

Distribution: Sth Is.: KA, NC, SL, OL
Sth Is.: Nelson-Marlborough, Canterbury, Southland, Otago

Land status of collection sites: Hokonui Hills - Private farm
Crown Range - ?Private farm

Natural enemies: Dark brown mummies, indicating parasitism, were collected in January 1998 from the Hokonui (Southland) population. The identity of these parasitoids is unknown at this stage.

Rarity: Until very recently this species had been recorded on only four occasions by one person (A J Healy) on *Carmichaelia* in the hills to the east of the inland road between Waipara and Kaikoura in the South Island. The insect was first collected at Mount Cass in May 1943 and a second collection was made from the Hitchen Hills, Hurunui River, in November 1944. It was also recorded, but not collected, in Cheviot in November 1944 (Cottier 1953). Except for the Hurunui site, where the aphids were found on *Carmichaelia* shrubs covering about 1.5 acres (0.6 ha), A J Healy states that the aphids were not common. In personal communication with A J Healy in February 1998 he stated that while working on nasala tussock in North Canterbury between 1944 and 1978 he kept 'an eye out for the aphid', although he was not actively searching for it. He observed the aphid only once more during this time on a single plant in November 1969 by the Charwell River bridge on the inland Kaikoura Road.

Between 1993 and 1998 MAW Stufkens and co-workers revisited all of A J Healy's sites on several occasions, as well as many other sites throughout New Zealand, specifically to find the aphid, but without success. In January 1998, however, MAW Stufkens rediscovered *A. healyi* on several plants in a patch of *Carmichaelia* (approx. 0.25 ha) in the Hokonui Hills in Southland. A few days later he also found this aphid on one small *Carmichaelia* plant close to the road in the Crown Range, Central Otago, after searching many plants in the area.

Notes: Both winged and wingless adults have been collected in January, May and November.

At this time we are awaiting confirmation of the identity of the Southland and Otago collections from the Natural History Museum, London, but it is unlikely that they are any species other than *A. healyi*.

Specimen(s): New Zealand Arthropod Collection, Auckland
Natural History Museum, London

Aphis nelsonensis Cottier

(Aphidinae)

Host plant(s):	<i>Epilobium</i> sp.
Description:	Small aphid (=1.3 mm long)
Morphs:	Winged and wingless viviparous females
First record:	1946 from Whangamoia Hills, Nelson, by A J Healy (Cottier 1953).
Plant part:	Leaves and stems
Distribution:	Sth Is.: NN, MC Sth Is.: Nelson-Marlborough, Canterbury
Land status of collection sites:	Unknown
Natural enemies:	Unknown

Rarity: This aphid has only been collected on two occasions, once by A J Healy about a mile from the summit, Whangamoia Hills, between Rai Valley and Nelson at an altitude of about 900 feet in November 1946 (Cottier 1953); and once by A D Lowe from Cass, Canterbury, in January 1965 (Natural History Museum, London). The aphid has not been seen since, despite concerted efforts to find it by MAW Stufkens between 1993 and 1998.

Notes: Winged adults have only been collected in January and wingless adults in January and November.

The *Epilobium* species could not be identified by A J Healy because the leaves and stems were so badly malformed due to the presence of the aphid (Cottier 1953) and the host plant from A D Lowe's collections were not identified to the species level either (Natural History Museum).

Cottier (1953) records that the original collection of this aphid was on 25 November 1946 in Nelson by A J Healy (see above) although slides in both the New Zealand Arthropod Collection and the Natural History Museum indicate that the location for aphids collected on this date by A J Healy was Blenheim. It appears that the slides were labelled incorrectly. A J Healy (pers. comm. February 1998) stated that the original collections were made on 25 November 1946 in Nelson, as described in Cottier (1953), and that he did not collect any *A. nelsonensis* in Blenheim.

In recent aphid surveys of *Epilobium* another aphid species, the introduced *Aphis* nr *epilobii*, is the only species that has been found. This species was first observed in New Zealand in 1962 (Lowe 1966) and has possibly displaced *A. nelsonensis* on *Epilobium*.

Specimen(s):	New Zealand Arthropod Collection, Auckland Natural History Museum, London
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References: Cottier (1953), Lowe (1966)

***Aphis cottieri* MS name (Aphidinae)**

Host plant(s): *Muehlenbeckia ?complexa* (probably *M. australis*)

Description: Large brown-black aphids

Morphs: Wingless viviparous females

First record: 1972, 29 miles (46 km) north of Te Anau on Milford Road (D F Hales pers. comm.)

Plant part: Vine

Distribution: Sth Is.: FD
Sth Is.: Southland

Land status of collection sites: Milford Road - Fiordland National Park

Natural enemies: Unknown

Rarity: This aphid has not been seen since its first discovery by D F Hales (nee White) in 1972, despite three explicit searches by MAW Stufkens in 1997 and 1998 in the area where it was originally found.

Notes: The single collection of wingless adults was in February.

There is some possibility that this species was collected by A D Lowe in Springburn, Canterbury, in February 1967. Lowe sent aphid specimens from *Muehlenbeckia australis* to V F Eastop in March 1968 (unpublished correspondence of A D Lowe). Eastop replied that the aphid 'looks interesting, but needs remounting: I am almost certain they are not *Aphis gossypii*' (unpublished correspondence of V F Eastop). The specimens in question are being searched for at this time, but V F Eastop (pers. comm to DAJT) states that it seems likely that this record was *A. cottieri*.

Specimen(s): Australian National Insect Collection, Canberra

***Aphis* undescribed species (Aphidinae)**

Host plant(s): *Ozothamnus leptophylla* (formally *Casinia*)

Description: Yellowish aphid with darker thorax

Morphs: Winged and wingless viviparous females

First record: 1994 in a malaise trap, Tautuku Bay, Catlins by J Ward

Plant part: Flower heads and dense compact growth

Distribution: Sth Is.: SL
Sth Is.: Otago

Land status of
collection sites: Catlins - Education Centre Campus, Tautuku Bay

Natural enemies: Unknown

Rarity: In February 1997 MAW Stufkens identified the host plant of this species as *Ozothamnus leptophylla*. He found the aphid to be abundant in one small area (=1 ha) of the Education Centre Campus, Tautuku Bay, in the Catlins. It was not found on other *Ozothamnus* plants close by and has not been found in extensive surveys of other areas of the South Island.

Notes: Winged adults have been collected in January and December and wingless adults in December.

An introduced and parasitised *Brachycaudus* species is also common on this plant in close association with the native aphid. The native aphid may be at risk from displacement by the introduced species or by attack from its parasitoid.

It is possible that this is the same species as that found on *Samolus* (V F Eastop, pers comm to DAJT).

Specimen(s): Natural History Museum, London

***Aphis* undescribed species**

(Aphidinae)

Host plant(s): *Samolus*

Description: Unknown

Morphs: Unknown

First record: Punakaiki, Westland

Plant part: Unknown

Distribution: Sth Is.: WD
Sth Is.: West Coast

Land status of
collection sites: ?Paparoa National Park

Natural enemies: Unknown

Rarity: Only recorded once. MAW Stufkens has searched for this aphid three times since January 1996, but without success.

Notes: V F Eastop has recently found these specimens and suspects they are the same species as that found on *Ozothamnus* (Eastop pers comm to DAJT).

Specimen(s): Natural History Museum, London

***Paradoxaphis aristoteliae* Sunde (Aphidinae)**

Host plants: *Aristotelia serrata*

Description: Reddish-brown black head and dusky thorax (Blackman & Eastop 1994)

Morphs: Winged and wingless viviparous females

First record: 1982 from *Aristotelia serrata*, Dolamore Park, Gore, Southland, by C Butcher

Plant part: Leaves

Distribution: Sth Is.: BR, SL
Sth Is.: Nelson-Marlborough, Southland

Land status of collection sites: Dolamore Park - the trees are on Transit New Zealand land just outside the park.
Lake Rotoroa - Nelson Lakes National Park

Natural enemies: Brown mummies, indicating parasitism, have been found in January 1997 and 1998 from samples from Dolamore Park.

Rarity: This aphid has only been recorded from two places in New Zealand. It was collected in Dolamore Park, Gore, in 1982 and 1983 by C Butcher and J Butel and more recently from 1993 to 1998 by MAW Stufkens. Since 1993 MAW Stufkens has observed the aphid regularly in Dolamore Park, but it was almost always restricted to one plant. The second location at which this aphid has been recorded is Lake Rotoroa, Nelson Lakes, where it was collected in 1983 by A K Walker, R G Sunde and V F Eastop. MAW Stufkens and co-workers (including V F Eastop on one occasion) have searched for this aphid in Nelson Lakes on a number of occasions from 1993 to 1998 but have not rediscovered the aphid in this area.

A. serrata shrubs growing in the Waitakere Ranges, 25 km west of Auckland, and in Christchurch, were examined on several occasions but no specimens of this aphid were found (Sunde 1987). Since 1993 MAW Stufkens has looked for this aphid in other areas throughout New Zealand on numerous occasions without success.

Notes: Collected from November to February

Specimen(s): New Zealand Arthropod Collection, Auckland
Natural History Museum, London

References: Sunde (1987), Blackman & Eastop (1994)

***Paradoxaphis* undescribed species (Aphidinae)**

Host plant(s): *Plagianthus regius* (formerly *P. betulinus*)

Description: Small to medium sized (1.3 - 2.0 mm) oval brown aphids with a median dorsal green strip on the abdomen

Morphs: Winged and wingless viviparous females

First record: 1972 on *Plagianthus regius* in the Christchurch Botanic Gardens by V F Eastop and A D Lowe

Plant part: Leaves and twigs near new growth and older leaves

Distribution: Sth Is.: MC
Sth Is.: Canterbury

Land status of collection sites: Canterbury - Christchurch Botanic Gardens and Riccarton Bush, Christchurch City Council

Natural enemies: Unknown

Rarity: This aphid has been recorded very infrequently. A D Lowe mentions a species collected from *Plagianthus* in Christchurch in August 1966 (unpublished correspondence of A D Lowe) but no specimens can be found in any collections. It was collected again from *Plagianthus* in the Christchurch Botanic Gardens by V F Eastop and A D Lowe in 1972; a specimen from this date is found in the Natural History Museum. Apparently this was the same tree upon which the original aphid was found (V F Eastop, pers. comm.). Lowe revisited this tree regularly until he died in 1980 but did not record the aphid again (V F Eastop pers. comm.). In January 1997, however, MAW Stufkens along with V F Eastop rediscovered the aphid on what was probably the same tree described in the other records. A few specimens were also caught in a malaise trap in Riccarton Bush, Christchurch, in late 1996.

Notes: Collection dates include September, November, December and January.

Specimen(s): Natural History Museum, London

***Paradoxaphis* undescribed species (Aphidinae)**

Host plant(s): *Aciphylla* sp.

Description: Unknown

Morphs: Wingless viviparous females

First record: 1983 from the Cardrona Valley, Central Otago, by J M Cox

Plant part:

Distribution: Sth Is.: either CO or OL (Cardrona Valley is the boundary)
Sth Is.: Otago

Land status of
collection sites: Otago - Probably private farmland

Natural enemies: The records in the Natural History Museum note that at least one specimen was parasitised. The identity of this parasite is unknown.

Rarity: This species has only been recorded once by J M Cox in January 1983. From 1996 MAW Stufkens and co-workers have searched the Cardrona Valley on two occasions and *Aciphylla* plants from many localities throughout the South Island, but have not recorded this species anywhere.

Notes: At least four introduced aphid species (i.e. *Cavariella aegopodii*, *Macrosiphum euphorbiae*, *Brachycaudus helichrysi*, *Myzus persicae*) have been recorded from *Aciphylla* during searches for the native species suggesting that the introduced species may have displaced the native species. Cottier (1953) recorded five introduced aphid species on *Aciphylla*.

Specimen(s): Natural History Museum, London

Undescribed species (taxonomy uncertain) (Aphidinae)

Host plant(s): *Dracophyllum pronum*, *D. uniflorum*, *D. palvister*

Description: Large oval dark green aphid

Morphs: Wingless viviparous females, wingless oviparous females

First record: 1972 from Lake Sylvester (nr. Cobb Valley), Nelson by L A Mound

Plant part: Found on the leaves (needles)

Distribution: Sth. Is.: WD, NN, BR, MB, NC
Sth. Is.: West Coast, Nelson-Marlborough, Canterbury

Land status of
collection sites: Various including Arthur's Pass National Park, Nelson Lakes National Park, Kahurangi National Park, Lake Sumner Conservation Park

Natural enemies: An unidentified aphidiine has been reared from mummies. This parasitoid was found in appreciable numbers on two occasions.

Rarity: Not recorded since its discovery in 1972 until 1997/98 when MAW Stufkens (with V F Eastop in 1997) carried out an extensive South Island survey. It is now known from a number of places in the South Island, but only north of Arthur's Pass, and appears to be quite common. The North Island has not been surveyed for this species.

Notes: Wingless forms of this species have been found from November to February but winged forms have not yet been discovered. Eggs were laid on *Dracophyllum* in February in a laboratory culture. Found up to 4000 feet (1220 m).

Specimen(s): Natural History Museum, London

***Neophyllaphis totarae* Cottier Totara aphid (Neophyllaphidinae)**

Host plants: *Podocarpus totara*, *P. hallii*, *P. nivalis*, *P. acutifolia*, *P. waihoensis*

[Records from *P. hallii* and *P. nivalis* may relate to separate species]

Description: Wingless morphs are dark purplish-brown, dusted with whitish powder usually feeding singly on leaves or in small colonies on young twigs

Morphs: Winged & wingless viviparous females, winged and wingless oviparous females, winged males

First record: Before 1925 from Westland by C R Foweraker (Miller 1925)

Plant part: Usually found singly on leaves or in small groups on young leaves and twigs (Cottier 1953)

Distribution: Nth Is.: WI, AK, TO, BP, WO, WN
Nth Is.: Wanganui, Auckland, Tongariro-Taupo, Waikato, Bay of Plenty, Wellington
Sth Is.: WD, NN, NC, MC, DN, FD, MB
Sth Is.: West Coast, Nelson-Marlborough, Canterbury, Otago, Southland

Land status of collection sites: Various including National Parks

Natural enemies: *Choreopraon totarae* MS name. Endemic 1° parasitoid. Whitish to light-brown mummy found beneath the host remains. Distribution - NN, WD, AK. *N. totarae* was heavily parasitised by an aphidiine (probably *C. totarae*) in Auckland in 1983 (V F Eastop, pers. comm.).

Rarity: A relatively common species found in the North and South Islands. It has been found consistently by a number of workers since first recorded in the 1920s.

Notes: Wingless parthenogenetic adults collected from September to April (winged: October to March). Winged oviparae and are found in spring and summer (Blackman & Eastop 1994). D F Hales has observed eggs on a *Neophyllaphis* sp. on *P. nivalis* in February.

This aphid infests its hosts sparsely. It does not seem to form large colonies. It is usually found singly on leaves or in small groups on young twigs (Cottier 1953).

This species was initially thought to be the introduced *N. podocarpi* (see Miller 1925 and Cottier 1953), which is not found in New Zealand.

Specimens collected by D F Hales (nee White) from *P. nivalis* in Arthur's Pass at 3000 feet may be a separate species (V F Eastop, pers. comm.). According to M Carver (pers. comm. to DAJT) Hales' collections included wingless oviparae.

Specimen(s): New Zealand Arthropod Collection, Auckland
Natural History Museum, London

References: Miller (1925), Cottier (1953), Blackman & Eastop (1994)

***Neophyllaphis sinzi* MS name (Neophyllaphidinae)**

Host plants: *Podocarpus hallii*

Description: Similar to *N. totarae* except it has longer antennae and possesses extensive and well defined wax glands

Morphs: A single wingless viviparous female and nymphs only

First record: 1972 from *P. hallii* from Canavan's Knob near Franz Joseph Glacier by D F Hales (nee White) (Carver in prep.)

Plant part: New growth

Distribution: Sth Is.: WD
Sth Is.: West Coast

Land status of collection sites: Westland National Park

Natural enemies: Unknown

Rarity: Basically unknown to New Zealand workers until 1997 because the only specimens have been retained in the Australian National Insect Collection.

Notes: Wingless adults collected in February. MAW Stufkens collected several specimens with wax glands from Hall's totara near Lake Matheson in January 1998. These are being identified by M Carver (CSIRO, Canberra) at this time.

In the original collection, D F Hales identified the host plant as *P. ?acutifolia* but, based on a photocopy of the specimen taken at that time, this plant has been identified as *P. hallii*.

Specimens: Australian National Insect Collection, Canberra

***Sensoriaphis nothofagi* Cottier**

Taiwanaphidinae

Host plants: *Nothofagus truncata*, *N. fusca*, *N. solandri* (var. *cliffortioides*)

Description: Wingless morphs are yellowish-green to brownish on young stems. Alatae become mature on the undersides of leaves (Blackman & Eastop 1994)

Morphs: Winged & wingless viviparous females, wingless oviparous females, winged males

First record: 1947 from Little Barrier Island (Cottier 1953)

Plant part: Young stems and leaves

Distribution: Nth Is.: AK, CL
Sth Is.: BR, FD, DN
Nth Is.: Auckland, Northland
Sth Is.: Nelson-Marlborough, Southland, Otago

Land status of collection sites: Various, including National Parks

Natural enemies: Unknown

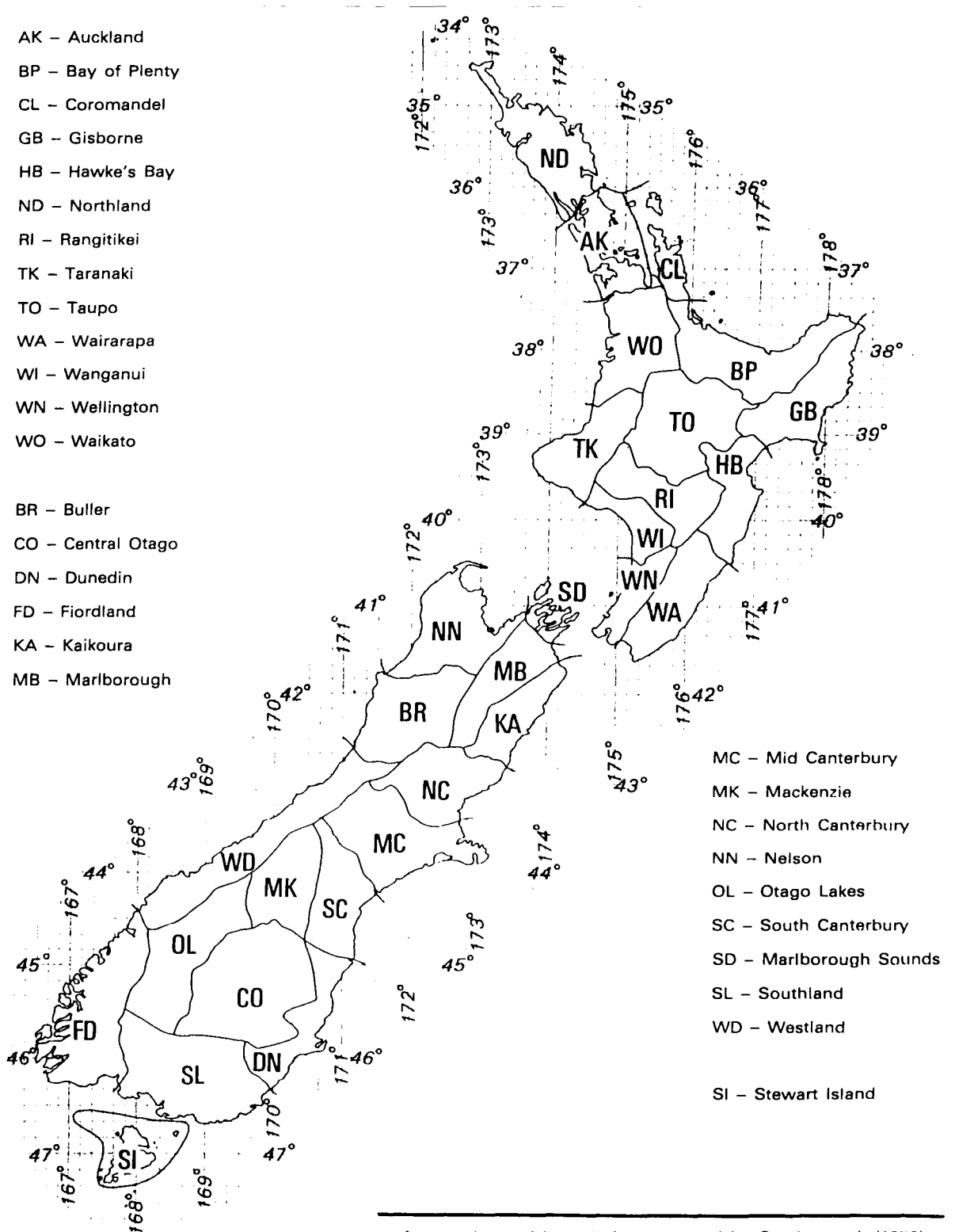
Rarity: Spasmodically common and widespread in New Zealand. The aphid tends to be found on trees close to the forest edge (MAWS personal observations).

Notes: Winged and wingless parthenogenetic adults have been collected from September to May. Oviparae and winged males occur from September to February (Blackman & Eastop 1994).

Specimen(s): New Zealand Arthropod Collection, Auckland
Natural History Museum, London

References: Cottier (1953), Sunde (1973), Blackman & Eastop (1994)

10.2 NEW ZEALAND ARTHROPOD COLLECTION BOUNDARIES



Area codes and boundaries proposed by Crosby et al. (1976) for use with specimen locality data