THE TAXONOMY AND SYSTEMATICS OF NEW ZEALAND LYCOSIDAE (WOLF SPIDERS)

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The taxonomy and systematics of New Zealand Lycosidae (wolf spiders)

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The 27 species of Lycosidae found in New Zealand were revised. One species in the genus *Allotrochosina* Roewer, 1960; twenty species in the genus *Anoteropsis* L. Koch, 1878, of which 11 were new species (*alpina*, *blesti*, *cantuaria*, *forsteri*, *halli*, *insularis*, *lacustris*, *litoralis*, *montana*, *okatainae*, and *westlandica*); three new species in the genus *Artoria* Thorell, 1877 (*hospita*, *segrega*, and *separata*); one species in the genus *Geolycosa* Montgomery, 1904; one species in the new genus *Notocosa*; one species in the genus *Venatrix* Roewer, 1960. All genera and species were described, with information on synonymy, type data, material examined, geographical distribution and subfamilial status. A key to adults was constructed and habitus images of adults, illustrations of important structural features and distribution maps have been provided. A phylogeny for the genus *Anoteropsis* was inferred using parsimony analysis of morphological characters and contained significant phylogenetic structure.

The phylogeny of *Anoteropsis* was further investigated using molecular data to test for congruence with the morphological data and the monophyly of widespread species. Data sets from the mitochondrial gene regions NADH dehydrogenase subunit I (ND1) and cytochrome c oxidase I (COI) of the 20 species in the New Zealand genus *Anoteropsis* were generated. Two species of *Artoria* were also sequenced and used as an outgroup. Species with a large distribution within New Zealand were represented by two or more specimens to test for monophyly or cryptic species. Sequence data were phylogenetically analysed using parsimony and maximum likelihood analyses. Sequence data was combined with a previously generated morphological data set and phylogenetically analysed using parsimony. The ND1 region sequenced included part of tRNA$^{Leu(CUN)}$, which appears to have an unstable amino-acyl arm and no TψC arm in lycosids.

Analyses supported the existence of five main species groups within *Anoteropsis* and the monophyly of the species. Maximum likelihood analyses appears to provide better resolution of the deeper phylogenetic structure within *Anoteropsis*. Phylogenies generated from the COI data set show inconsistencies with the ND1 and morphological trees and caution is advised when using COI to estimate spider phylogenies. A radiation of *Anoteropsis* species within the last five million years is inferred from the ND1 likelihood phylogram, habitat and geological data.

The relationship of New Zealand wolf spiders to Australian, Asian and Holarctic genera was investigated to ensure the correct generic placement of New Zealand species. A data set from the mitochondrial 12S rRNA gene subunit of 11 Australasian lycosid species (six New Zealand species and five Australian species), three North American lycosid species, one European lycosid species and one New Zealand pisaurid (outgroup) were generated. They were combined with the published sequences of 12 European lycosids, two Asian lycosids and one Asian pisaurid and were phylogenetically analysed using parsimony and maximum likelihood analyses.

Analysis revealed that Australasian species form clades distinct from Palearctic and Holarctic species providing further evidence against the placement of Australasian species in Northern Hemisphere genera. There is evidence that New Zealand wolf spiders are related to a subset of Australian genera whereas the other Australian lycosid genera are related to Asian/Holarctic faunas.

12S gene sequences were useful when examining relationships between closely related genera, but were not as informative for deeper generic relationships.

Keywords: **Lycosidae, New Zealand, Australia, lycosid genera, lycosid subfamilies, taxonomic revision, *Allotrochosina*, *Anoteropsis*, *Artoria*, *Geolycosa*, *Notocosa*, *Venatrix*, phylogeny, 12S, ND1, COI, combined analysis.**

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Contents

Chapter 1

Introduction

New Zealand has been at the forefront of spider taxonomy and systematics since the 1950s when the late Ray Forster, New Zealand's greatest arachnologist (see Patrick *et al.* 2000), began working on our diverse and unique spider fauna. Forster's discoveries challenged the arachnological taxonomic dogma developed in the Northern Hemisphere. Relative to its area, New Zealand has a large (estimated at more than 2500 species) spider fauna of which several major families, including the Lycosidae, remain largely undescribed. New Zealand's spider fauna has many ancestral taxa and, therefore, has often been an import part of the development of taxonomy and systematics of spiders.

Up until the 1970s most spider revisions were purely taxonomic with little or no mention of the phylogenetic relationships. Since the emergence of cladistics (Hennig 1966) as a system of constructing phylogenetic relationships using parsimony the recent trend in revisions of spider taxa has been to include a phylogenetic analysis of the group based mainly on morphological characters (e.g., Platnick & Shadab 1978, Raven 1985, Griswold 1991, Hormiga 1994, Griswold 2001). It is not surprising that arachnologists have been quick to embrace cladistic methodology, as some of the major proponents of cladistics are also spider systematists (e.g., Norman Platnick, Jonathan Coddington).

Ten years ago, Rosemary Gillespie and colleagues obtained molecular sequence data from Hawaiian tetragnathid spiders (Croom *et al.* 1991) and since then there has been an increasing number of studies that have utilised molecular data to derive spider phylogenies. Almost all have been based on the mitochondrial gene regions 12S (e.g., Gillespie *et al.* 1994, Zehethofer & Sturmbauer 1998, Hedin 2001), 16S (e.g., Huber *et al.* 1993, Bond *et al.* 2001), COI (e.g., Garb 1999, Hedin & Maddison 2001a) and ND1 (e.g., Hedin 1997, Hedin & Maddison 2001a). The few studies utilising nuclear gene sequence data have used the regions 28S (e.g., Hausdorf 1999, Hedin 2001) and EF-1 α (Hedin & Maddison 2001b).

The Lycosidae

Lycosids form a monophyletic family (Dondale 1986, Griswold 1993) found in all habitats worldwide. It is the fourth most speciose spider family (Platnick 2001) and, like most other spider families, there are many more species as yet undescribed in Australasia, Africa, South America and the Tropics.

There is some structure at the subfamily level. Dondale (1986) divided the Lycosidae into five subfamilies and examined the relationships between them, but only 25 of the 99 currently recognised lycosid genera were explicitly assigned to these subfamilies. Other subfamilies have since been added (Alderweireldt & Jocqué 1993, Zyuzin 1993) but they are all based on Holarctic and African species.

At the generic level, lycosids are a mess. Although European lycosid generic placements are well established (e.g., Heimer & Nentwig 1991) and some Nearctic and African genera have been recently revised (e.g., Dondale & Redner 1978a, Dondale & Redner 1978b, Russell-Smith 1982, Dondale & Redner 1983a, Dondale & Redner 1983b, Alderweireldt & Jocqué 1991, Alderweireldt 1999), a large number of the 2245 lycosid species (Platnick 2001) would seem to be misplaced. Some of the confusion can be attributed to Roewer (1951, 1955a, 1955b, 1959, 1960) who described 65 lycosid genera of which only 31 are currently recognised (Platnick 2001); 12 of these are monotypic and many others contain only two species. Roewer's generic descriptions were short, based on non-genitalic characters and many subsequent authors did not accept his taxonomic decisions. In Brignoli's (1983) catalogue, which followed Roewer's otherwise useful "Katalog der Araneae" (Roewer 1942, 1955a, 1955b), he stated "it is apparent that most recent students of this group give little value to most of the genera described by Roewer in 1954 [1955] and 1960: still it is necessary to list them as no acceptable new 'system' has been yet proposed". Roewer cannot be held entirely responsible for the state of lycosid genera. Many of the generic problems are due to the morphological conservatism of the Lycosidae and the consequential lack of useful characters to define and separate genera. Many early workers placed New Zealand and Australian lycosid species into genera that they were familiar with in their native Europe (e.g., Koch 1877). In particular, *Lycosa* Latreille 1804, which is now considered to be a Mediterranean genus (Zyuzin & Logunov 2000, C.D. Dondale, pers. com.), has been a convenient genus in which to dump many new species or as a temporary home when genera need revising (e.g., McKay 1975).

As mentioned above, the Lycosidae is one of the major families in New Zealand that has received little taxonomic attention. All but one of the 25 species listed as occurring in New Zealand (Platnick 2001) were described before 1926. Many of the descriptions are difficult to interpret, as they were short, based on somatic characters and lacking important, diagnostic genitalic characters. Forster (1975) hypothesised the relationships between ecological groups of New Zealand wolf spiders but provided no supporting evidence. Forster (1975) stated there were "two or three widespread endemic species of wolf spiders probably derived from the subalpine fauna" inhabiting New Zealand pasture land. Species diversity of endemic lowland tussock lycosids appears to be highest in the Otago region (Forster & Forster 1973, Forster 1975). In subalpine and alpine herb fields, lycosids are the dominant spider species, along with small linyphiids; there are also "many" species of lycosids found on scree slopes and rock faces (Forster, 1975). Alpine lycosids, and other spiders, that inhabit the scree slopes, are mainly dark coloured and unusually large in size (Forster, 1975). Unlike many other spider families, the subalpine and alpine lycosids do not show a direct evolutionary relationship to the forest dwelling species (Forster, 1975). Lycosids form the most conspicuous part of the spider fauna of shingle riverbeds and Forster (1975) hypothesised that they appeared to be derived from high country scree spiders. Dark coloured lycosids inhabit New Zealand's shingle beaches and pale coloured lycosids are found on sandy beaches; "some of these spiders are directly related to riverbed species" (Forster, 1975).

In 1996, I completed a Master of Science thesis on the taxonomy and systematics of 10 species of New Zealand Lycosidae (Vink 1996). In the later stages of this study, it became apparent that there were a lot more than 10 lycosid species in New Zealand. Due to time limits and small sample sizes I decided it was best to limit this study to species that were more commonly found, plus the outgroup species for the morphological phylogenetic analysis.

Morphological conservatism in lycosids makes obtaining sufficient numbers of morphological characters for phylogenetic analyses very difficult. However, sequence data are likely to provide many more characters. Before the work in this thesis, only two studies (Zehethofer & Sturmbauer 1998, Fang *et al.* 2000) had used lycosid sequence data to derive phylogenies. One other study (Hudson & Adams 1996) has used allozyme data to examine relationships between lycosid species.

A taxonomic revision of New Zealand lycosids and molecular based phylogenetic studies can only improve the current generic mess in Lycosidae.

Aims

This thesis is a comprehensive treatment of the taxonomy and systematics of the Lycosidae of New Zealand. There are three main questions that this thesis aims to answer:

1) How are the species of Lycosidae found in New Zealand related to the Australian and world lycosid fauna and do they form monophyletic groups?

2) What are the species of Lycosidae found in New Zealand?

3) How are the species of Lycosidae found in New Zealand related to each other?

The first question is addressed in chapter 2 and was investigated using sequence data from the third domain of mitochondrial small subunit (12S) ribosomal RNA. The second question resulted in a taxonomic revision of the Lycosidae found in New Zealand, which is chapter 3. The third question is explored by chapter 4, the molecular analyses of sequence data from partial sequences of the mitochondrial gene regions cytochrome c oxidase I and NADH dehydrogenase subunit I.

Thesis structure

This thesis comprises work undertaken under the supervision of my supervisors Dr Adrian M. Paterson (Ecology & Entomology Group, Lincoln University) and Dr Marie-Claude Larivière (Invertebrate Systematics, Landcare Research) and my associate supervisor Dr Rowan M. Emberson. It consists of three connected but independent parts. Each chapter is a separate entity and each has the sections required in a manuscript. The chapters have been prepared for submission to various journals (listed below), which explains the slight discrepancies in format between them. The order of the chapters is:

- **Chapter 2**: *A preliminary molecular analysis of phylogenetic relationships of Australasian wolf spider genera (Araneae: Lycosidae)*. Phylogenetic analyses of 12S molecular data is used to infer the relationship of New Zealand genera to Australian, Asian, North American, European, Holarctic and Palaearctic genera. There is evidence that New Zealand wolf spiders are related to a subset of Australian genera whereas the other Australian lycosid genera are related to Asian/Holarctic faunas. This chapter has been accepted for publication in the *Journal of Arachnology*.

- **Chapter 3**: *Lycosidae (Arachnida: Araneae): Taxonomy, systematics, geographical distribution and biology*. The 27 species of Lycosidae found in New Zealand are taxonomically revised and all that is known of the family in New Zealand is summarised. A phylogenetic analysis of the revised New Zealand genus *Anoteropsis* based on morphological characters is presented. The known geographical distribution and biology of each species is presented. This chapter has been submitted to the *Fauna of New Zealand* series.

- **Chapter 4**: *Phylogenetic analyses of the New Zealand genus Anoteropsis L. Koch (Araneae: Lycosidae)*. Phylogenetic analyses of the revised New Zealand genus *Anoteropsis* based on two molecular data sets molecular data sets (ND1 & $tRNA^{Leu}$ and COI) are presented. The phylogenies inferred are compared with each other and with the phylogeny derived from the morphological data set in chapter 2. This chapter will be submitted to *Invertebrate Systematics.*

- **Chapter 5**: *General conclusions.* Chapters 2-4 are summarised, in particular the taxonomy and systematics of New Zealand Lycosidae. Genera and subfamilies are also discussed.

Appendices

These papers (all published or in press) are work that was carried out during the course of my thesis. Although not explicitly concerned with the taxonomy and systematics of New Zealand Lycosidae, they contribute to the understanding of this family. The order of the appendices is:

- **Appendix 1**: *A revision of the genus Allotrochosina Roewer (Araneae: Lycosidae).* The Australasian genus *Allotrochosina*, which contains two species, is reinstated and redefined. Notes on subfamilial placement, biology, distribution and biogeography are given. This paper was published in *Invertebrate Taxonomy.*

  Vink, C.J. 2001: A revision of the genus *Allotrochosina* Roewer (Lycosidae: Araneae). *Invertebrate Taxonomy 15(4):* 461-466.

- **Appendix 2**: *12S DNA sequence data confirms the separation of Alopecosa barbipes and Alopecosa accentuata (Araneae: Lycosidae).* Phylogenetic analyses of 12S DNA sequence data supports the relationship of *A. accentuata* as sister species to *A. barbipes.* This paper has been accepted for publication in the *Bulletin of the British Arachnological Society.*

  Vink, C.J.; Mitchell, A.D. 2002: 12S DNA sequence data confirms the separation of *Alopecosa barbipes* and *Alopecosa accentuata* (Araneae: Lycosidae). *Bulletin of the British Arachnological Society 12.*

- **Appendix 3**: *Revision of the wolf spider genus Venatrix Roewer (Araneae: Lycosidae).* The Australasian lycosid genus *Venatrix* is reinstated and redefined. There are 22 species, including a species found in New Zealand, and notes on their distribution, zoogeography and subfamilial placement are given. This paper was published in *Invertebrate Taxonomy.*

  Framenau, V.W.; Vink, C.J. 2001: Revision of the wolf spider genus *Venatrix* Roewer (Araneae: Lycosidae). *Invertebrate Taxonomy 15(6)*: 927-970.

- **Appendix 4**: *An evaluation of Lycosa hilaris as a bioindicator of organophosphate insecticide contamination.* The common New Zealand lycosid, *Lycosa* [*Anoteropsis*] *hilaris*, was assessed experimentally as a possible bioindicator of organophosphate insecticide contamination. This paper was published in *New Zealand Plant Protection.*

  Hodge, S.; Vink, C.J. 2000: An evaluation of *Lycosa hilaris* as a bioindicator of organophosphate insecticide contamination. *New Zealand Plant Protection 53:* 226-229.

The chapters have been prepared for submission to a journal and are, therefore, in the format of that journal. Appendices 2 and 3 are presented in the form that they were in when returned to the journal editor after all corrections had been made. Appendices 1 and 4 are presented as reprints. Chapters 2 and 4 and appendices 2, 3 and 4 have been co-authored with others. I have performed the majority of the laboratory work, data analyses and writing for chapters 2 and 4 and appendix 2. Appendix 3 is largely the work of Volker Framenau (Department of Zoology, University of Melbourne). My contribution was the discovery of the monophyly of the genus, the writing of parts of the introduction and discussion, the production of the distribution maps and the extensive critiquing of the early drafts. Appendix 4 was a joint effort between Dr Simon Hodge (formerly of the Ecology & Entomology Group, Lincoln University) and myself.

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Chapter 2

A preliminary molecular analysis of phylogenetic relationships of Australasian wolf spider genera (Araneae: Lycosidae)

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ABSTRACT. A data set from the mitochondrial 12S rRNA gene subunit of 11 Australasian lycosid species (six New Zealand species and five Australian species) was generated. Three North American lycosid species, one European species and one New Zealand pisaurid (outgroup) were also sequenced. The sequence data for the 16 species were combined with the published sequences of 12 European lycosids, two Asian lycosids and one Asian pisaurid and were analysed using parsimony and maximum likelihood analyses. The resulting phylogenetic trees reveals that Australasian species largely form clades distinct from Palearctic and Holarctic species providing further evidence against the placement of Australasian species in Northern Hemisphere genera. New Zealand wolf spiders appear to be related to a subset of Australian genera whereas the other Australian lycosid genera are related to Asian/Holarctic faunas. Gene sequences in the 12S region were useful when examining relationships between closely related genera, but were not as informative for deeper generic relationships.

Keywords: Lycosidae, New Zealand, Australia, lycosid genera, lycosid subfamilies

The monophyly of the Lycosidae is well supported (e.g., Dondale 1986; Griswold 1993), but at the subfamily level there is some disagreement (Dondale 1986; Zyuzin 1993; Dippenaar-Schoeman & Jocqué 1997) and lycosid genera, many of which are paraphyletic and polyphyletic, are in disarray. Although European lycosid generic placements are well established (e.g., Heimer & Nentwig, 1991) and some Nearctic and African genera have been recently revised (e.g., Alderweireldt 1991, 1999; Dondale & Redner 1978, 1979, 1983a, 1983b; Russell-Smith 1982), a large number of the 2245 lycosid species (Platnick 2001) would seem to be misplaced. For example, a revision of the New Zealand lycosid fauna (Vink in press) found that all but one described species were incorrectly placed in mostly Northern Hemisphere genera. Some of the confusion can be attributed to Roewer (1951, 1955, 1959, 1960) who described 65 lycosid genera of which only 31 are currently recognized (Platnick 2001); 12 of these are monotypic and many others contain only two species. Roewer's generic descriptions were short and based on highly variable, non-genitalic characters. Brignoli (1983) stated "it is apparent that most recent students of this group give little value to most of the genera described by Roewer in 1954 [1955] and 1960: still it is necessary to list them as no acceptable new 'system' has been yet proposed". However, Roewer cannot be held entirely responsible for the state of lycosid genera. Many of the generic problems are due to the morphological conservatism of the Lycosidae and the consequential lack of useful characters to define and separate genera.

In New Zealand and Australia, many early workers placed lycosid species into genera with which they were familiar with in their native Europe (e.g., Koch 1877). In particular, *Lycosa* Latreille 1804, which

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is now considered to be a Mediterranean genus (Zyuzin & Logunov 2000), has been a convenient genus in which to place many new species or as a temporary home when genera need revising (e.g., McKay 1975). Many of the large, burrow-dwelling Australian species have been placed in *Lycosa* (e.g., *Lycosa godeffroyi* L. Koch 1865) but do not fit the genus as defined by Zyuzin & Logunov (2000). Rather, they have a genitalic morphology similar to *Geolycosa* Montgomery 1904 (sensu Dondale & Redner 1990).

Lycosids are among the numerically dominant arthropod predators found in open habitats in Australasia (e.g., Forster 1975; Humphreys 1976; Churchill 1993; Sivasubramaniam et al. 1997; Hodge & Vink 2000; Framenau et al. 2002) and recent taxonomic work (Framenau & Vink 2001; Vink 2001, Framenau in press, Vink in press) has addressed the generic placement of some Australasian species. New Zealand's fauna, comprising 27 species, has been revised (Vink in press) with most species (20) in *Anoteropsis* L. Koch 1878. The Australasian genera *Allotrochosina* Roewer 1960 (two species), *Artoria* Thorell 1877 (17 species), *Notocosa* Vink 2002 (one species) and *Venatrix* Roewer 1960 (22 species) have been recently revised or reviewed (Framenau & Vink 2001; Vink 2001, Framenau in press: Vink in press). There are also 12 Australian species that form "a natural grouping" and were placed in *Trochosa* C.L. Koch 1848 (McKay 1979) but none of these species fit the genus as defined by Dondale & Redner (1990). Australia has 141 described lycosid species and at least another 100 undescribed species (V.W. Framenau pers. comm.; CJV pers. obs.). The majority of Australian species appear to belong in *Artoria* and a *Geolycosa*-like genus (V.W. Framenau pers. comm.; CJV pers. obs.). Species in *Venatrix* and the *Geolycosa*-like genus have a pedipalpal configuration that places them in the Lycosinae Simon 1898 (Framenau & Vink 2001; CJV pers. obs.). Vink (2001) placed *Allotrochosina* in Venoniinae Lehtinen & Hippa 1979 (sensu Dondale 1986) and while the simple pedipalps of *Anoteropsis*, *Artoria*, *Notocosa* and the Australian species currently in *Trochosa* do not fit any of the current subfamily definitions (Framenau in press; Vink in press; CJV pers. obs.) they are perhaps closest to Venoniinae (sensu Dondale 1986). The phylogenetic position of Australasian genera within the Lycosidae is unknown.

Because lycosids are morphologically conservative it is unlikely that sufficient numbers of morphological characters could be found to infer phylogenetic relationships of Australasian genera to their counterparts in the rest of the world. Sequence data from a portion of the mitochondrial 12S rRNA gene of the small ribosomal subunit have yielded large data sets for phylogenetic analysis of spiders (e.g., Gillespie et al. 1994). Recently, 12S rRNA sequence data have been used to infer relationships among European lycosids (Zehethofer & Sturmbauer 1998; Vink & Mitchell in press) and the relationship of Asian lycosids to other Lycosoidea (Fang et al. 2000). Zehethofer & Sturmbauer (1998) found that 12S rRNA was especially suitable for resolving relationships higher than the species level.

This preliminary study aimed to examine the relationship of exemplars of the major Australasian genera to exemplars of genera found elsewhere in the world using phylogenetic analyses of 12S rDNA sequence data.

METHODS

Generic placement of species was based on the latest catalog of Platnick (2001) and recent taxonomic revisions (Framenau & Vink 2001; Vink 2001; Framenau in press; Vink in press). Species sequenced, sex, and collection details (locality, date and collectors) are shown in Table 1. All specimens are stored in 95% ethanol and refrigerated in the Ecology & Entomology Group, Lincoln University. Selected Australasian species represented the major species groups of Australia and New Zealand (Framenau & Vink 2001; Vink 2001; Framenau in press; Vink in press; CJV unpublished). The North American species *Geolycosa rogersi*

Wallace 1942, *Varacosa avara* (Keyserling 1877) and *Allocosa georgicola* (Walckenaer 1837) were sequenced and included in the analysis because of the similarity of their male pedipalp morphology to *Lycosa godeffroyi*. It should be noted that *Allocosa georgicola* does not fit the genus *Allocosa* Banks 1900 as defined by Dondale & Redner (1983b).

DNA extraction, amplification and sequencing. - Specimens were washed in sterile deionised, distilled water before DNA extraction. Total genomic DNA was extracted by homogenising 1-2 legs from single individuals (Table 1) using a proteinase-K digestion and high salt precipitation method (White et al. 1990). Mitochondrial 12S regions were amplified using the following 2 primer combinations:
1) 12St-L (5'-GGTGGCATTTTATTTTATTAGAGG-3') (Croom et al. 1991) plus 12Sbi-H (5'–AAGAGCGACGGGCGATGTGT-3') (Simon et al. 1990), or 2) 12SR-N-14594 (5'-AAACTAGGATTAGATACCC-3') plus 12SR-J-14199 (5'-TACTATGTTACGACTTAT-3') (Kambhampati & Smith 1995) (Fig. 1).

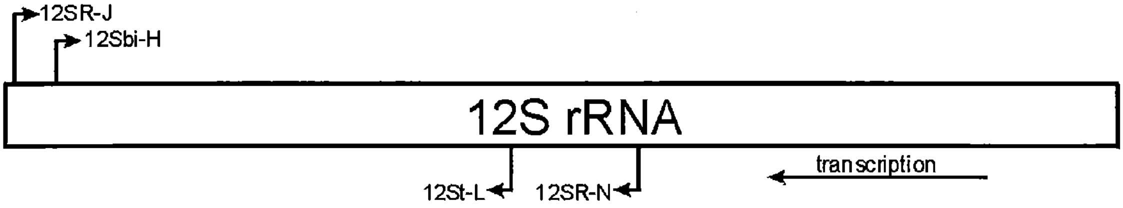


Figure 1.-Gene region coding for 12S rRNA showing areas sequenced by primers and direction of transcription.

Each 25 µl reaction consisted of 1× *Taq* buffer, 0.25 mM dNTPs, 2 mM $MgCl_2$, 0.4 µM of each primer, 1.25 units *Taq* DNA Polymerase (Roche) and 1µl of genomic DNA [which was diluted 1:20 in TE (10 mM Tris, 1 mM EDTA, pH 8.0) and used as a template for the amplification of double-stranded DNA (dsDNA)]. Amplification was performed in a GeneAmp® PCR System 2400 (Perkin–Elmer) thermocycler and the following temperature profile was used: 4 min. at 94°; 40 cycles of 20 s at 94°, 30 s at 50°, 40 s at 72°; 2 min. at 72°. Excess primers and salts were removed from the resulting dsDNA by precipitation with 100% isopropanol in the presence of 2.5M NH_4Ac, followed by a 70% ethanol wash. Purified PCR fragments were sequenced using ABI PRISM® BigDye™ termination mix version 1 (Perkin-Elmer) and separated on an ABI PRISM® 373 automatic sequencer. The sense and antisense strands were sequenced for all species except *Venatrix pictiventris* L. Koch 1877 and *Anoteropsis lacustris* Vink 2002, which were successful only one way. Sequence data were deposited in GenBank (Benson et al. 2000) (see Table 1 for accession numbers).

Data analysis. - Sequences were aligned to 15 previously published sequences (Zehethofer & Sturmbauer 1998; Fang et al. 2000) (Table 2) using Clustal W 1.7 (Thompson et al. 1994), then confirmed by eye. Insertion/deletion events were inferred where necessary based on the secondary structure of 12S rRNA proposed by Hickson et al. (1996). Although Hickson et al. (1996) used the 12S sequence of *Tetragnatha mandibulata* Walckenaer 1842 when constructing their template, helix 42 did not seem to be present in the lycosid or pisaurid sequences. In order to match the data obtained by Zehethofer & Sturmbauer (1998) sequence data that began five bases downstream from where the 12St-L primer annealed to seven bases upstream from where the 12Sbi-H primer annealed were included in the analyses. The analyses were conducted using PAUP* 4.0b4a (Swofford 2000).

Data were analyzed as unordered characters, first using parsimony and the heuristic search (1000 replicates) option in PAUP*. All characters were equally weighted, and zero length branches were collapsed to polytomies. Bootstrap values (Felsenstein 1985) were calculated from 1000 replicate parsimony analyses using the heuristic search option in PAUP*. Modeltest version 3.06 (Posada & Crandall 1998) was used to select the maximum likelihood parameters, GTR+Γ+I. The general time reversible model (Yang 1994) was used to estimate the maximum likelihood tree and branches were collapsed (creating polytomies) if the branch length was less than or equal to 1e-08. The maximum likelihood analysis included 20 taxa. Taxa were pruned if they were part of a well-supported node (bootstrap value >75%) in the parsimony tree leaving one representative of each taxon. Bootstrap values were calculated from 100 replicate likelihood analyses using the heuristic search option in PAUP*.

RESULTS

The primer combination 12St-L plus 12Sbi-H produced a single amplification product for seven species (see Table 1), but two or more bands were amplified for all other taxa. The primer pair 12SR-J-14199 plus 12SR-N-14594 was used to amplify product for sequencing for the taxa that did not produce a single amplification product using the 12St-L plus 12Sbi-H combination (see Table 1). The 12St-L primer site varied considerably in the nine taxa for which the primer pair 12SR-J-14199 plus 12SR-N-14594 was used, which may explain why the primer combination 12St-L plus 12Sbi-H did not work for all taxa. The primer 12St-L was designed as a *Tetragnatha*-specific primer (Croom et al. 1991) so it is not surprising that this site varies in lycosids. There was little variation evident in the 12Sbi-H site even though this primer was designed as specific to insects (Simon et al. 1990).

The nucleotide composition was A + T-rich (44.2% A, 10.0% C, 9.8% G, 36.0% T), which is typical for arthropods (Simon et al. 1994).

Parsimony analysis yielded 2 equally parsimonious trees (Fig. 2), 482 steps long, with a consistency index, excluding uninformative characters, of 0.415 and retention index of 0.577. Of the 330 characters included in the analysis, 172 were variable with 113 of them parsimony informative. Maximum likelihood analysis resulted in six trees with scores of 2092.1969 (Fig. 3). The six trees had the same topology because the branches were collapsed (creating polytomies) if the branch length was less than or equal to 1e-08. The topology of the maximum likelihood trees (Fig. 3) and the parsimony trees (Fig. 2) differed mainly in the lower branches, which had less than 50% bootstrap support.

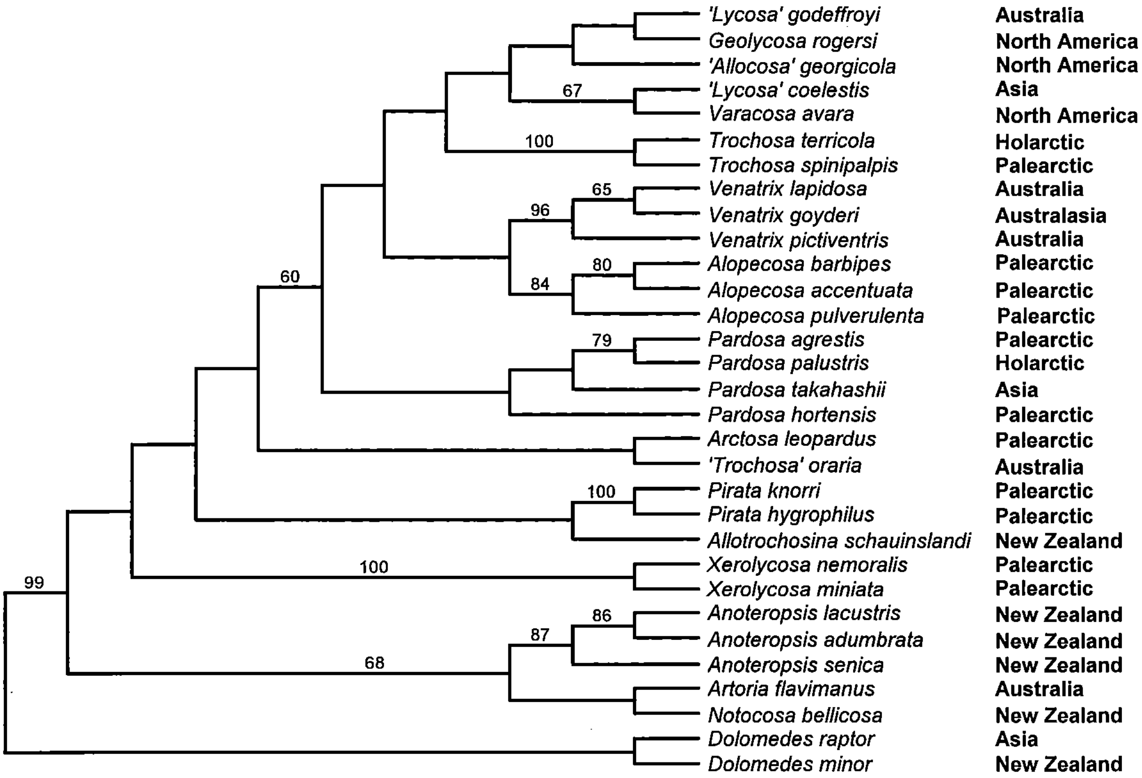


Figure 2.-One of two most parsimonious trees. The other tree differed by switching the positions of *Lycosa godeffroyi* and *Allocosa georgicola*. Bootstrap values above 50% are indicated above branches. Species distributions based on Platnick (2001) are shown on the right. Species that do not fit current generic definitions have the generic name in inverted commas.

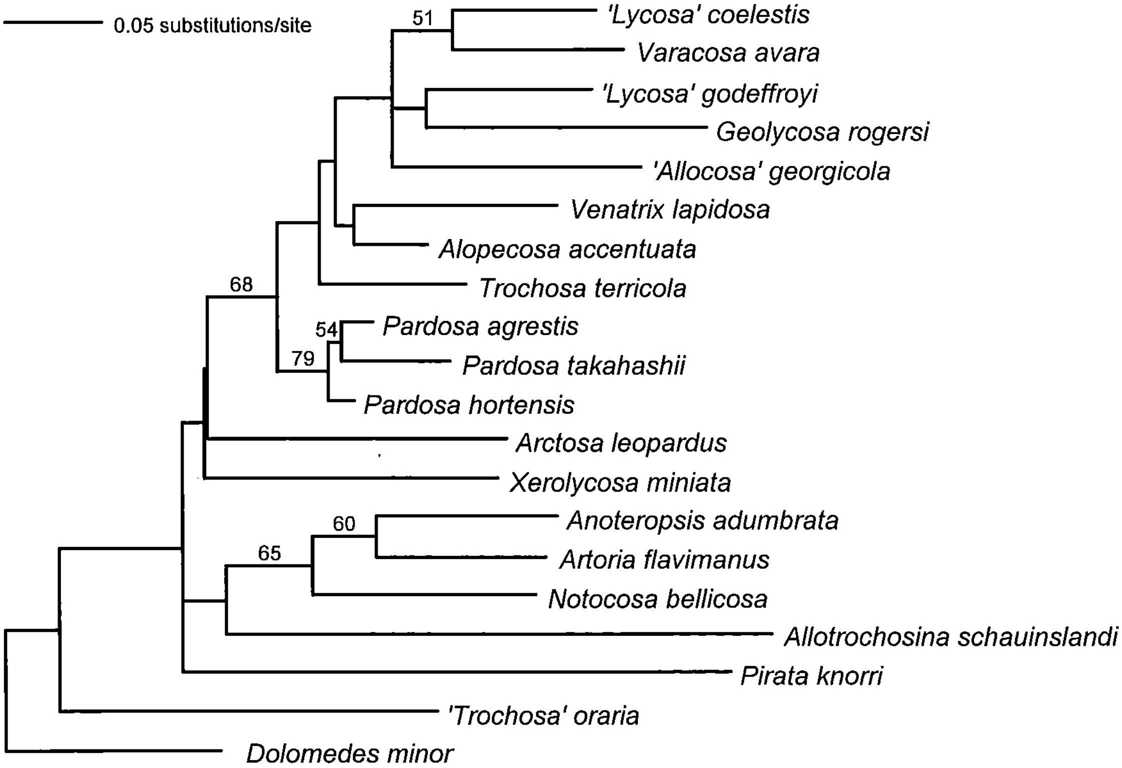
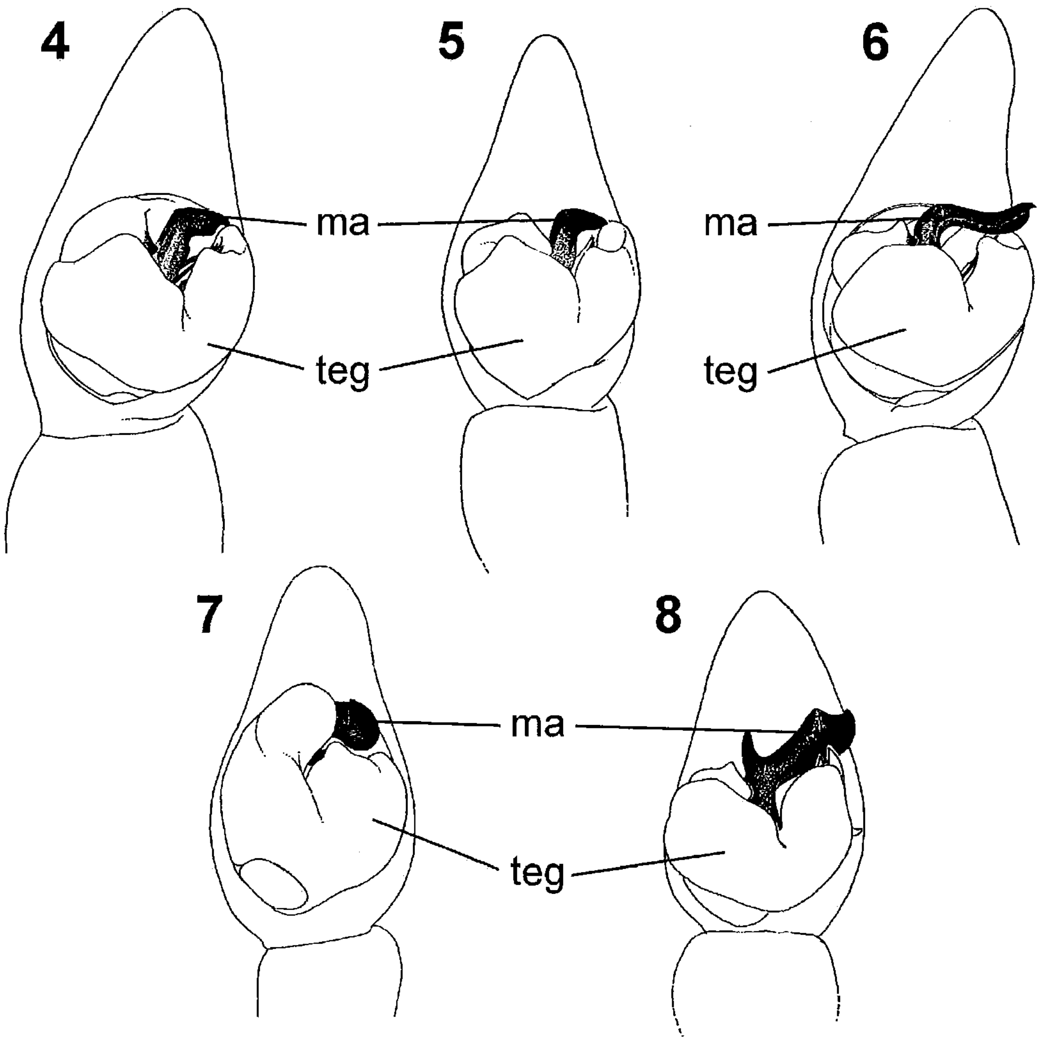


Figure 3.-Strict consensus of the six maximum likelihood trees. Bootstrap values above 50% are indicated above branches. Branch lengths are proportional to nucleotide substitutions. Species that do not fit current generic definitions have the generic name in inverted commas.

DISCUSSION

Molecular analysis confirms that most of the New Zealand or Australian lycosids included in the analysis do not belong in the Northern Hemisphere genera where they have been or are currently placed. This study confirms that *Trochosa oraria* L. Koch 1876 does not belong in the genus *Trochosa* (sensu Dondale & Redner 1990) and the two Holarctic exemplars of *Trochosa* are monophyletic, which is supported by high bootstrap values (Fig. 2). There is support for the monophyly of *Pardosa* C. L. Koch 1847 as the four exemplars form a monophyletic clade that is supported by a high bootstrap value (Fig. 3). Zehethofer & Sturmbauer (1998) also had strong support for the monophyly of the 14 exemplars of *Pardosa* that they included in their analysis. The three exemplars of *Alopecosa* Simon 1885 included in this study form a strongly supported monophyletic clade, as did the six exemplars included in the analysis of Zehethofer & Sturmbauer (1998). The exemplars of *Xerolycosa* Dahl 1908 and *Pirata* Sundevall 1833 both have good support for their monophyly. The molecular evidence suggests that *Allocosa georgicola* belongs in a *Geolycosa*-like genus, however, there is poor bootstrap support and no *Allocosa* species (sensu Dondale & Redner 1983b) were included in this analysis. *Lycosa coelestis* L. Koch 1878 does not fit the genus *Lycosa* as defined by Zyuzin & Logunov (2000) and comes out as sister to *Varacosa avara* in both analyses with reasonable bootstrap support. However, Dondale & Redner (1990) stated that *Varacosa* Chamberlin & Ivie 1942 is restricted to North America. Both trees (Figs. 2 & 3) support the monophyly of the clade containing spiders with *Geolycosa*-like pedipalps (*L. godeffroyi*, *G. rogersi*, *A. georgicola*, *L. coelestis* and *V. avara*) but there is low (<50%) bootstrap support for this clade. The Mediterranean genus *Lycosa* (sensu Zyuzin & Logunov 2000) is unlikely to be appropriate for *L. godeffroyi* but this cannot be inferred from our analyses because we did not sequence any Mediterranean *Lycosa* species. However, both analyses have *L. godeffroyi* coming out with *Geolycosa rogersi*, which is a true *Geolycosa*. The strongly supported, monophyletic clade of three *Venatrix* exemplars supports the monophyly of *Venatrix*. In both analyses (Figs. 2 & 3) *Venatrix* was sister to *Alopecosa* and it has been noted that they share a similar pedipalpal structure (Framenau & Vink 2001). The clade containing the three *Anoteropsis* exemplars is monophyletic, which concurs with Vink (in press). *Anoteropsis* and *Notocosa* appear to be restricted to New Zealand (Vink in press) and *Artoria* are most diverse in Australia but are also found in New Zealand, Papua New Guinea and the Philippines (Framenau in press; Vink in press). The monophyly of the clade containing exemplars from *Anoteropsis*, *Artoria* and *Notocosa* is supported in both analyses and all five species share a similar pedipalp configuration (Figs. 4-8) that includes a partially divided tegulum and similarities in the position and shape of the median apophysis (Vink in press). The relationship of *Notocosa bellicosa* (Goyen 1887) to the other four species in the clade differs between the analyses. The parsimony analysis puts *N. bellicosa* as sister to *Artoria flavimanus* Simon 1909, whereas the bootstrap support (61%) within the parsimony trees and maximum likelihood analysis have *N. bellicosa* as sister to a clade containing the other four species. This clade does not fit current subfamily definitions and, once the genera are revised, may be placed in its own subfamily.

When *Trochosa oraria* is not included in *Trochosa*, the subfamilies Pardosinae Simon 1898 and Lycosinae Simon 1898 as defined by Dondale (1986) are supported, except for *Arctosa* C. L. Koch 1847, which falls outside the Lycosinae in this analysis. Dondale (1986) suggested that the Lycosinae be divided into the "*Trochosa* group" and the "*Lycosa* group" but they are paraphyletic in our analyses. The placement of *Allotrochosina* in the subfamily Venoniinae (which also includes *Pirata* Sundevall 1833) by Vink (2001) is supported by the parsimony tree (Fig. 2) but not by the maximum likelihood tree (Fig. 3). It is worth noting that there is little bootstrap support for the lower branches of either tree. Further sequencing of several other genera may resolve these subfamily relationships.



Figures 4-8.-Palps of (4) *Anoteropsis adumbrata,* (5) *Anoteropsis lacustris*, (6) *Anoteropsis senica*, (7) *Notocosa bellicosa* and (8) *Artoria flavimanus* showing partially divided tegulum (teg) and similarities in position and shape of median apophysis (ma).

While the pattern of distribution fits with a Gondwanan scenario a more detailed study of genetic divergence may reveal a better approximation of the time the faunas have been separated. Preliminary analyses presented here (Fig. 2 & 3) imply that Australasia had an ancestral fauna and was subsequently invaded by lycosine species, possibly via Asia through northern Australia. When New Zealand split away from Australia about 80 million years ago (Stevens et al. 1988), it is likely it retained an ancestral lycosid fauna. Only two lycosine species (*Venatrix goyderi* (Hickman 1944) and *Geolycosa tongatabuensis* (Strand 1911)) are found in New Zealand and it is likely that they have subsequently ballooned across to New Zealand; both species are widely distributed across Australia and the South Pacific respectively but, in New Zealand, they are limited to the warmer north of the North Island.

The phylogenies presented here are somewhat preliminary, as some genera found in Australia are not represented (e.g., *Anomalosa* Roewer 1960, *Venonia* Thorell 1894, *Zoica* Simon 1898). Further resolution of subfamily relationships could also be facilitated by the inclusion of exemplars from Allocosinae Dondale 1986, Sosippinae Dondale 1986, Tricassinae Alderweireldt & Jocqué 1993, and Wadicosinae Zyuzin. The inclusion of at least one exemplar from *Lycosa* (sensu Zyuzin & Logunov 2000) may help to confirm the relationship of that genus to other lycosine genera.

Results presented here suggest 12S DNA sequence data are useful for inferring phylogenies of closely related genera. However, these data appear to be too conservative for adequate resolution at the species level (Vink & Mitchell in press) and too fast for deeper relationships, inferred from bootstrap support of less than 50% shown for the lower branches of the parsimony tree (Fig. 2). Deeper relationships in the Lycosidae may be better resolved by the use of an even more slowly evolving gene region, such as 28S rDNA, which has been used to infer spider phylogeny at the family level (Hausdorf 1999).

In summary, we conclude that many current generic placements of Australasian species are incorrect; the New Zealand fauna is related to a subset of the Australian fauna and parts of the Australian fauna are related to the Asian/Holarctic fauna, suggesting a subsequent invasion. Current subfamilies were found to be largely monophyletic but further work is required to fully resolve subfamily relationships.

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Table 1.–Specimens sequenced showing species, sex, collection localities, collectors and dates collected, primers used and GenBank accession numbers.

Species	**Sex**	**Collection details**	**Primers used**	**GeneBank accession no.**
Allocosa georgicola (Walckenaer 1837)	♀	USA, near Oxford (34°13'N, 89°19'W), 12.x.1999, L. Schaffer	12SR-J + 12SR-N	AF380499
Alopecosa barbipes (Sundevall 1833)	♂	England, Redgrave & Lopham Fen (52°23'N, 01°00'E), 6.x.1999, C.J. Vink & M.A. Hudson	12St-L + 12Sbi	AY028420
Allotrochosina schauinslandi (Simon 1899)	♀	New Zealand, Prices Valley (43°48'S, 172°41'E), 12.vi.1999, C.J. Vink & J.W. Griffiths	12St-L + 12Sbi	AF380502
Anoteropsis adumbrata (Urquhart 1887)	♀	New Zealand, Titan Rocks (45°32'S, 169°00'E), 9.xii.1998, G. Hall, B. Brown & E. Edwards	12St-L + 12Sbi	AF380491
Anoteropsis lacustris Vink 2002	♂	New Zealand, Arthur's Pass (42°56'S, 171°34'E), 9.iv.1999, C.J. Vink & M.A. Hudson	12St-L + 12Sbi	AF380489
Anoteropsis senica (L. Koch 1887)	♂	New Zealand, Franz Josef Glacier (43°25'S, 170°10'E), iv.1999, C.J. Vink & M.A. Hudson	12SR-J + 12SR-N	AF380490
Artoria flavimanus Simon 1909	♂	Australia, Crowea (34°28'S, 116°10'E), 6.v.1999, C.J. Vink	12SR-J + 12SR-N	AF380492
Dolomedes minor L. Koch 1876	♀	New Zealand, Lake Ellesmere (43°43'S, 172°30'E), 20.xi.1999, R.M. Emberson	12SR-J + 12SR-N	AF380503
Geolycosa rogersi Wallace 1942	♀	USA, Avent Park (34°13'N, 89°18'W), 1.iv.2000, G. Stratton, P. Miller & B. Suter	12SR-J + 12SR-N	AF380498
Lycosa godeffroyi L. Koch 1865	♀	Australia, Bellerive (42°52'S, 147°22'E), 11.v.1999, C.J. Vink & J. Cossum	12SR-J + 12SR-N	AF380497
Notocosa bellicosa (Goyen 1887)	♂	New Zealand, Temuka (44°14'S, 171°17'E), iii.1999, M. Ross	12SR-J + 12SR-N	AF380493
Trochosa oraria (L. Koch 1876)	♀	Australia, Lauderdale (42°55'S, 147°29'E), 11.v.1999, C.J. Vink & J. Cossum	12St-L + 12Sbi	AF380501
Varacosa avara (Keyserling 1877)	♂	USA, Sardis Reservoir (34°15'N, 89°28'W), 14.ix.1999, G. Stratton & W. Calvert	12SR-J + 12SR-N	AF380500
Venatrix goyderi (Hickman 1944)	♀	New Zealand, near Matarau (35°38'S, 174°11'E), 15.ii.1999, C.J. Vink	12St-L + 12Sbi	AF380496
Venatrix lapidosa (McKay 1974)	♂	Australia, Avon River (37°48'S, 146°57'E), iii.1999, V.W. Framenau	12SR-J + 12SR-N	AF380495
Venatrix pictiventris (L. Koch 1877)	♂	Australia, Queens Domain (42°52'S, 147°19'E), 9.v.1999, C.J. Vink	12St-L + 12Sbi	AF380494

Table 2.–Other published sequences used in analyses showing species, reference and GenBank accession numbers.

Species	**Reference**	**GenBank accession no.**
Alopecosa accentuata (Latreille 1817)	Zehethofer & Sturmbauer (1998)	AJ008022
Alopecosa pulverulenta (Clerck 1757)	Zehethofer & Sturmbauer (1998)	AJ008025
Arctosa leopardus (Sundevall 1833)	Zehethofer & Sturmbauer (1998)	AJ008032
Dolomedes raptor Bösenberg & Strand 1906	Fang et al. (2000)	AF145031
Lycosa coelestis L. Koch 1878	Fang et al. (2000)	AF145030
Pardosa agrestis (Westring 1861)	Zehethofer & Sturmbauer (1998)	AJ008033
Pardosa hortensis (Thorell 1872)	Zehethofer & Sturmbauer (1998)	AJ008007
Pardosa palustris (Linnaeus 1758)	Zehethofer & Sturmbauer (1998)	AJ008011
Pardosa takahashii (Saito 1936)	Fang et al. (2000)	AF145032
Pirata hygrophilus Thorell 1872	Zehethofer & Sturmbauer (1998)	AJ008015
Pirata knorri (Scopoli 1763)	Zehethofer & Sturmbauer (1998)	AJ008019
Trochosa terricola Thorell 1856	Zehethofer & Sturmbauer (1998)	AJ008017
Trochosa spinipalpis (F. O. P.-Cambridge 1895)	Zehethofer & Sturmbauer (1998)	AJ008016
Xerolycosa miniata (C. L. Koch 1834)	Zehethofer & Sturmbauer (1998)	AJ008021
Xerolycosa nemoralis (Westring 1861)	Zehethofer & Sturmbauer (1998)	AJ008020

Chapter 3

A taxonomic revision of New Zealand Lycosidae

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DEDICATION

This revision is dedicated to the memory of Dr Raymond R. Forster (1922-2000), whose wisdom, friendship and guidance were a key part of my development as an arachnologist. The incredible amount of material collected by Ray was a cornerstone to this revision and he had collected specimens of all but one of the species described here. Although Ray did not revise the New Zealand Lycosidae, it was apparent, by the publications that do mention wolf spiders (Forster 1975, Forster & Forster 1973, 1999) and by the labels in the Otago Museum lycosid collection, that Ray had a deep understanding of the taxonomy of the family. His numerous publications on the taxonomy and systematics of spiders, both of New Zealand and abroad, (see Patrick *et al.* 2000) are an inspiration to me and to other arachnologists.

ABSTRACT

The 27 species of Lycosidae found in New Zealand are revised with one new genus and 14 new species. *Allotrochosina* Roewer, 1960 includes *A. schauinslandi* Simon, 1889. *Anoteropsis* L. Koch, 1878 includes: *A. adumbrata* (Urquhart, 1887), *A. aerescens* (Goyen, 1887) (=*Lycosa maura* Urquhart, 1892 and *Lycosa albovestita* Dalmas, 1917, new synonymies), *A. alpina* sp. nov., *A. arenivaga* (Dalmas, 1917), *A. blesti* sp. nov., *A. canescens* (Goyen, 1887), *A. cantuaria* sp. nov., *A. flavescens* L. Koch, 1878, *A. forsteri* sp. nov., *A. hallae* sp. nov., *A. hilaris* (L. Koch, 1877) (=*Lycosa umbrata* L. Koch, 1877, *Pardosa vicaria* L. Koch, 1877, *Lycosa taylori* Goyen, 1887, *Lycosa tremula* Simon, 1899, *Lycosa virgatella* Roewer, 1951 and *Lycosa subantarctica* Forster, 1964, new synonymies), *A. insularis* sp. nov., *A. lacustris* sp. nov., *A. litoralis* sp. nov., *A. montana* sp. nov., *A. okatainae* sp. nov, *A. ralphi* (Simon, 1905) (=*Lycosa turbida* Simon, 1905, *Lycosa retiruga* Simon, 1905 and *Lycosa algida* Simon, 1905, new synonymies), *A. senica* (L. Koch, 1877) (=*Lycosa goyeni* Roewer, 1951, new synonymy), *A. urquharti* (Simon, 1898) and *A. westlandica* sp. nov. *Artoria* Thorell, 1877 includes: *A. hospita* sp. nov., *A. segrega* sp. nov., and *A. separata* sp. nov. *Geolycosa* Montgomery, 1904 includes *G. tongatabuensis* (Strand, 1911). *Notocosa* gen. nov. includes *N. bellicosa* Goyen, 1888. *Venatrix* Roewer, 1960 includes *V. goyderi* (Hickman, 1944). All genera and species are described, with information on synonymy, type data, material examined, geographical distribution and subfamilial status. Habitus images of adults, illustrations of important structural features and distribution maps are provided. A key to adults is given. A phylogenetic analysis examining the relationships of species in the genus *Anoteropsis* is presented and contains significant phylogenetic structure.

Status - submitted to *Fauna of New Zealand*

CHECKLIST OF TAXA

Genus ***Allotrochosina*** Roewer, 1960
    schauinslandi (Simon, 1889)
Genus ***Anoteropsis*** L. Koch, 1878
    adumbrata (Urquhart, 1887)
    aerescens (Goyen, 1887)
    alpina new species
    arenivaga (Dalmas, 1917)
    blesti new species
    canescens (Goyen, 1887)
    cantuaria new species
    flavescens L. Koch, 1878
    forsteri new species
    hallae new species
    hilaris (L. Koch, 1877)
    insularis new species
    lacustris new species
    litoralis new species
    montana new species
    okatainae new species
    ralphi (Simon, 1905)
    senica (L. Koch, 1877)
    urquharti (Simon, 1898)
    westlandica new species
Genus ***Artoria*** Thorell, 1877
    hospita new species
    segrega new species
    separata new species
Genus ***Geolycosa*** Montgomery, 1904
    tongatabuensis (Strand, 1911)
Genus ***Notocosa*** new genus
    bellicosa (Goyen, 1888)
Genus ***Venatrix*** Roewer, 1960
    goyderi (Hickman, 1944)

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INTRODUCTION

Spiders of the family Lycosidae Sundevall, 1833 (wolf spiders) are found worldwide and constitute the fourth largest spider family with 2253 described species in 100 genera (Platnick 2002). The monophyly of the Lycosidae is supported by four characters: eye arrangement; absence of a retrolateral tibial apophysis on the male pedipalp; egg sac carried on spinnerets of females; and young carried on specialised setae on the dorsal surface of the mother's abdomen (Dondale 1986, Griswold 1993).

The eyes are in three rows (see Figs. 30-32); the anterior row consists of four small eyes, the eyes in the middle row (formed by the two posterior median eyes) and in the posterior row (formed by the two posterior lateral eyes) are much larger. The posterior median eyes and the posterior lateral eyes have the strongest visual acuity (Rovner 1993). The anterior lateral, posterior median and posterior lateral eyes have a layer of light-reflecting cells called the grate-shaped tapetum (Homann 1971). Presence of the grate-shaped tapetum is a synapomorphy for the superfamily Lycosoidea (Griswold 1993). Within the Lycosoidea both Pisauridae Simon, 1890 and Trechaleidae Simon, 1890 have eye arrangements that are similar to lycosids but the posterior median and the posterior lateral eyes are not as enlarged nor are the eye rows that they form as strongly recurved as those of Lycosidae.

Unlike closely related spider families (see Griswold 1993), Lycosidae lack a retrolateral tibial apophysis (RTA). The loss of this structure is believed to be the derived character state (Dondale 1986, Griswold 1993). Males of some species in the subfamily Venoniinae Lehtinen & Hippa, 1979 possess a tibial apophysis that is small, weak and situated near the base of the tibia on the ventral surface (Lehtinen & Hippa 1979, Hippa & Lehtinen 1983). The location and nature of this apophysis suggests it is not homologous with the RTA found in related families (Dondale 1986).

All species of the Lycosidae carry their spherical egg sacs on spinnerets. Trechaleidae, a possible sister family, also carry egg sacs in this way but their egg sacs are hemispherical (van Berkum 1982, Carico 1993). In Lycosidae active transport of young (see Fig. 36) is made possible by special setae that the young cling to (Rovner *et al.* 1973) while in Trechaleidae young are carried on the empty egg sac (Carico 1993).

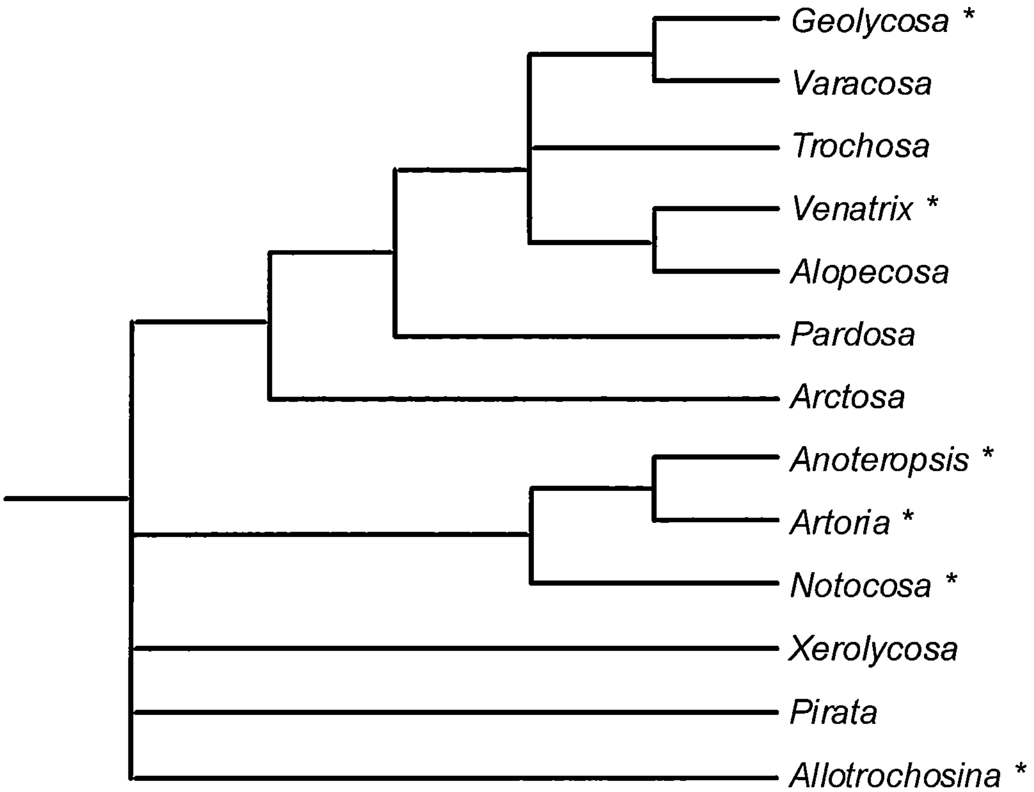
Lycosids, like all spiders, are predators and their main prey is arthropods, mostly insects (Stratton 1985, Nentwig 1987). Apart from some extralimital genera (*Anomalomma* Simon, 1890, *Hippasa* Simon, 1885, *Venonia* Thorell, 1894), lycosids do not build a web for prey capture and are sit-and-wait predators (Kronk & Riechert 1979). Adult size in lycosids is extremely variable (e.g., Miyashita 1968, Workman 1979, Uetz *et al.* 1992). Lycosid life cycles can extend over one (e.g., Framenau *et al.* 2002), two (e.g., Framenau *et al.* 1996) or three years (e.g., Humphreys 1976, Workman 1979) and *Pardosa glacialis* (Thorell, 1872) may live up to six years (Leech 1966). Within a species, life cycle length and synchrony may vary with altitude and latitude (e.g., Edgar 1971, Workman 1979). New Zealand lycosid adults occur in greatest numbers from late spring to late summer (Martin 1983, pers. obs.) and females are usually seen with egg sacs in late spring/early summer and in late summer/early autumn (pers. obs.).

Early instar lycosids disperse by ballooning on long buoyant strands of silk (Richter 1970, Greenstone 1982, Greenstone *et al.* 1987, pers. obs.) and can travel hundreds of kilometres. As a result, lycosid species are often not restricted by geographic boundaries but are often confined to a particular habitat (e.g., McKay 1974) and, despite their wide distribution, can be restricted to local areas of suitable habitat (e.g., Halloran *et al.* 2000). Lycosids are found in a wide range of habitats but are most common in open country. The majority of studies examining the role of lycosids in ecosystems have focused on agroecosystems. Within a given habitat, lycosids are numerically abundant predators, e.g., up to 76/m^2 (Workman 1978) and, in New Zealand, they have been found to be among the numerically dominant arthropod predators in agroecosystems (Martin 1983, Sivasubramaniam *et al.* 1997, Topping & Lövei 1997, Hodge & Vink 2000). Because of its abundance in agroecosystems, *Anoteropsis hilaris* (L. Koch, 1877) has been investigated as a possible bioindicator (Hodge & Vink 2000) and biomarker (Van Erp *et al.* 2000) for organophosphate insecticide contamination. In natural ecosystems, such as subalpine and alpine herb fields, lycosids have been reported as the dominant spider family along with Linyphiidae (Forster 1975).

The first lycosid to be described from New Zealand was *Lycosa nautica* Walckenaer, 1837, however, this species is here excluded from the New Zealand fauna - see note below. Most New Zealand lycosid species (23 species) were described between 1877 and 1925. Except for the description of *Lycosa subantarctica* Forster, 1964 (here synonymised with *Anoteropsis hilaris*), no further taxonomic publications on New Zealand lycosids were produced until 2001, which saw the publication of revisions of the Australasian genera *Allotrochosina* Roewer, 1960 (Vink 2001) and *Venatrix* Roewer, 1960 (Framenau & Vink 2001), both of which included species found in New Zealand. In 1996, I completed a thesis as part of a Master of Science degree (Vink 1996) on the taxonomy and systematics of a group of 10 New Zealand lycosids. This work was not published, as there were many more New Zealand species of Lycosidae that awaited description and the Australian fauna needed to be considered before correct generic placements could be made.

Most of the New Zealand lycosid species that have been previously described have been placed in genera that are otherwise Holarctic. Two generic names in particular, *Lycosa* Latreille, 1804 and *Pardosa* C. L. Koch, 1847, have been frequently used in New Zealand and elsewhere as convenient genera in which to "dump" new lycosid species. *Lycosa* is considered to be a Mediterranean genus (Zyuzin & Logunov 2000) and *Pardosa* appears to be Holarctic (Vink *et al.* in press). The redefinition of *Lycosa* (Zyuzin & Logunov 2000) and recent taxonomic work on *Pardosa* (Alderweireldt & Jocqué 1992, Dondale 1999, Kronestedt 1975, 1981, 1986, 1987, 1993) shows that they have no synapomorphic characters in common with New Zealand species. Other genera in which previously described New Zealand species have been placed include *Allocosa* Banks, 1900, *Alopecosa* Simon, 1899, *Arctosa* C.L. Koch, 1847, *Hogna* Simon, 1885, and *Schizocosa* Chamberlain, 1904. These genera are also considered to be Holarctic and none of the characters in recent revisions that define them (e.g., Dondale & Redner 1978, 1979, 1983a, 1983b, 1990) are found in New Zealand species.

Vink *et al.* (in press) analysed DNA sequence data from a portion of the mitochondrial 12S rRNA gene of the small ribosomal subunit for several New Zealand, Australian and Northern Hemisphere taxa. The phylogeny they developed showed that most New Zealand species are basal in the Lycosidae and related to the Australian fauna (Text-fig. 1). Many New Zealand and Australian species do not fit in the current lycosid subfamilies (Dondale 1986, Zyuzin 1985, Alderweireldt & Jocqué 1993, Zyuzin 1993), which are based on Holarctic and African species. The two species of the derived Lycosinae (*Geolycosa tongatabuensis* and *Venatrix goyderi*) found in New Zealand appear to be more recent arrivals.



Text-fig. 1 A reconstruction of the phylogeny of wolf spider genera based on Vink *et al.* (in press). An asterisk indicates genera present in New Zealand.

SPECIES NOT CONSIDERED PART OF THE NEW ZEALAND FAUNA

***Lycosa leuckarti* (Thorell, 1870).** In 1985, a female specimen of this large Australian species was collected in a warehouse in Dunedin and labelled by R.R. Forster as “ex Australia?” (OMNZ). This one-off introduction is likely to have come from Australia in cargo (the label does not specify which type) and is not considered part of the fauna.

***Allocosa palabunda* (L. Koch, 1877).** Koch’s original description (Koch 1877) is based on specimens from Australia and the South Sea Islands (presumably Polynesia). I have examined many specimens of *A. palabunda* from Australia and I have not seen any examples from New Zealand. The erroneous New Zealand record of this species can be traced to Dalmas (1917), who included it (preceded by a question mark) in his list of New Zealand spiders. Dalmas (1917) wrote (translated from French) “The habitat given by the author [Koch] includes Australia and the South Sea Islands (Polynesia I think). The distribution could extend to New Zealand because young individuals collected at various localities seems to belong to this species”. It is possible that Dalmas mistook juveniles of *Geolycosa tongatabuensis* (Strand) for *A. palabunda*, which are of a similar size, appearance and coastal habitat. In any case, *A. palabunda* should not be considered part of the New Zealand fauna unless adult specimens are found, as it is difficult to identify juvenile specimens with any certainty.

Lycosa nautica **Walckenaer, 1837.** Walckenaer (1837) listed this species from [or as occurring in] Australia and New Zealand. His description was superficial and the type has been lost. Roewer (1955b: 1565) listed this species as "*nicht zu deuten!*" (cannot be determined) in his catalogue. It was listed as a *nomen dubium* by Platnick (2002). Walckenaer's brief description is poor even by the standards at the time of its publication. It was possible, however, to determine that the species he "described" is not one of the lycosid species found in both Australia and New Zealand. It should remain as a *nomen dubium*.

Pirata piraticus **(Clerck, 1757).** Simon (1899) recorded this Holarctic species from a specimen(s) collected by H.H. Schauinsland at French Pass (40°56'S, 173°50'E). He noted that *Diplocephalus cristatus* (Blackwall, 1833), a Holarctic linyphiid spider, was also found in New Zealand. Following his note, on the next page in the same publication he described *Allotrochosina schauinslandi* (Simon), a New Zealand endemic species that, like *P. piraticus*, is found in marshes and other damp habitats. *P. piraticus* was listed in the catalogues of New Zealand spiders of Dalmas (1917) and Parrott (1946). I have collected extensively and examined lycosid specimens from throughout New Zealand and no specimens of *P. piraticus* have been found in this country since Simon's (1899) publication. There are three possibilities: 1) a European specimen of *P. piraticus* was accidentally included in Schauinsland's collection at the MNHN prior to Simon's examination; 2) *P. piraticus* was introduced to New Zealand by European settlers but, unlike *D. cristatus*, it was not successful in establishing; 3) Simon misidentified a specimen(s) of *A. schauinslandi* as *P. piraticus*, which has similar markings, size and simple male and female genitalia. Whichever scenario is contemplated, *P. piraticus* is not here considered part of the New Zealand fauna.

MORPHOLOGY AND TERMINOLOGY

The morphological structures required for the identification of New Zealand Lycosidae are referred to in Fig. 28 - 32, 37, 94a-b, and explained in the glossary of technical terms (Appendix A), and Forster (1967). The male pedipalp and the female epigyne are crucial when identifying lycosids to species (or even to genera). Juveniles, therefore, are often impossible to identify to species with certainty. The morphological nomenclature follows Dondale & Redner (1978) and Dondale (1986).

A character-based phylogenetic species concept (Baum & Donoghue 1995) has been implemented in this study. It defines a species as the smallest group of populations diagnosable by a unique combination of character states in comparable individuals.

METHODS AND CONVENTIONS

Collecting. Lycosids can be collected by a variety of methods. Pitfall trapping is effective but unless the specimens are collected within a couple of days of being caught they can start to decay, which can make identification difficult. Decay can be prevented by the use of a good preservative such as ethylene glycol. Another useful method is daytime hand searching, either by looking for specimens directly on the ground or by picking up substrate (e.g., litter, clumps of grass) and shaking them onto a large white sheet. The best method for collecting lycosids is with a strong head torch at night (about two hours after sunset, is when a large number of species appear to be most active, pers. obs.). The light is reflected in the tapeta of the eyes and the spider's presence is indicated by a bluish sparkle.

Preservation. Lycosids are best preserved in 70-75% ethanol. They can be stored in 95-100% ethanol to preserve DNA, however, this makes them brittle and unsuitable for morphological examination.

Preparation. Specimens should be labelled with the locality (including area code (Crosby *et al.* 1976, Crosby *et al.* 1998) and, if known, latitude and longitude), collection date, collector's name and habitat data.

Most morphological features used for identifications can be seen under an ordinary dissecting microscope. When examining specimens in alcohol they should be rested in washed quartz sand to provide support for the spider. External sclerites of the epigyne can be viewed *in situ*. Occasionally, however, the abdomen is distended, which can change the appearance of the epigyne, or shrivelled, which can result in the epigyne being obscured. The features of the male pedipalp are best viewed by removing the left pedipalp at the junction between the trochanter and the femur and viewed ventrally. Some figures of the male pedipalp are slightly tilted to one side to show the differences in the median apophysis (Figs 38, 42, 48, 49, 52, 56).

Internal genitalia were prepared for examination by placing the dissected genitalia in 10% KOH solution for one hour at 50°C to dissolve soft tissue. An alternative to KOH is the use of trypsin (Griswold 1993). Internal genitalia were illustrated for representative species from all genera as they show too much intra-species variation to be useful diagnostic characters at the species level. In the majority of species the external structures are just as and often more informative than internal genitalia. Male pedipalps were expanded to reveal obscured sclerites. They were immersed in 10% KOH for 30 minutes at 50°C and then placed in water until they had fully expanded. None are shown here as no useful diagnostic characters were found.

Measurements. All measurements are in millimetres (mm). Where the measurements are expressed as a fraction, the numerator refers to the length of the structure and the denominator refers to its width. Measurements outside parentheses are for males and inside parentheses for females. The order of leg lengths is given in a four-digit sequence, longest to shortest (e.g., 4123). The size range given for each species represent the smallest and largest individual of each sex found in all specimens examined.

Types. Type specimens were examined whenever possible. New Zealand collections were searched and enquiries were made at all major overseas collections for type specimens of New Zealand lycosids. It was possible to locate and examine the type specimens of only seven out of 27 previously described species; the remainder have apparently been lost or destroyed through damage of European museums during World War II.

In the descriptive part of this work, the status, repositories and full label data for all type specimens examined are given. Label data are listed as follows: different labels are denoted by a solidus (/) and different lines on a label by a semicolon. All other punctuation is as it appears on the label. Additional information not included on the label is placed between square brackets.

Descriptions. New species' illustrations, digital images, measurements and colour pattern descriptions were made from a designated holotype male and an allotype female. For existing species, when types were lost, damaged, faded or brittle, illustrations, digital images, measurements and colour pattern descriptions were prepared from a non-type representative male and female specimen (with collection information shown).

Epigynal and male pedipalpal illustrations omit the setae for clarity. Shading in the illustrations of male pedipalps was applied only to the diagnostic median apophysis.

Descriptions of colours are for alcohol-preserved specimens. It should be noted that colours and colour patterns can fade in older specimens that have not been stored away from light.

Characters diagnostic in other spider families (e.g., eye size and position, leg spination) were not diagnostic for Lycosidae and have not been included in the descriptions.

Digital images. Habitus images (Fig. 1-27) and external genitalia images (Fig. 65-91) were made at Landcare Research using the computer software package Auto-Montage (Syncroscopy) and a video camera attached to a stereomicroscope. Auto-Montage software gives an increased depth of field by producing a focused montage image from a series of partially focused source images. For the habitus images a Z-stepper was also used, which allows the Auto-Montage software to automatically capture a series of images.

Line drawings were made using a drawing tube attached to a stereomicroscope. Setae were omitted from illustrations for clarity. Images were scanned at a resolution of 600 dpi (dots per inch).

Map images were created using the geographic information system (GIS) software ArcView (ESRI).

All final figure layouts and the addition of text and symbols were prepared using CorelDRAW® version 8.0 (Corel).

Text conventions. The area codes of Crosby *et al.* (1976, 1998) are used in collection records.

The following acronyms for repositories are used:

AMNZ	Auckland Museum, Auckland, New Zealand
CMNZ	Canterbury Museum, Christchurch, New Zealand
LUNZ	Entomology Research Museum, Lincoln University, New Zealand
MNHN	Muséum National d'Histoire Naturelle, Paris, France
MONZ	Museum of New Zealand Te Papa Tongarewa, Wellington, New Zealand
NHMW	Naturhistorisches Museum, Vienna, Austria
NZAC	New Zealand Arthropod Collection, Auckland, New Zealand
OMNZ	Otago Museum, Dunedin, New Zealand
SMF	Forschungsinititut und Naturmuseum Senckenberg, Frankfurt, Germany.

PHYLOGENETIC ANALYSIS

Methods. A reconstruction of the phylogenetic history of New Zealand lycosid species was attempted using a cladistic analysis of morphological characters. The analysis included all species of *Anoteropsis* and the three New Zealand *Artoria* species as the outgroup taxa. *Allotrochosina schauinslandi*, *Geolycosa tongatabuensis* and *Venatrix goyderi* were not included in the analysis as they were polyphyletic to *Anoteropsis* and *Artoria* (see Vink *et al.* in press). *Artoria* appears to be the sister genus to *Anoteropsis* (Vink *et al.* in press) and was, therefore, selected as an outgroup (see Watrous & Wheeler 1981 and Maddison *et al.* 1984 for a discussion of outgroups). *Notocosa bellicosa* was considered too distant from *Anoteropsis* and

Artoria (see Vink *et al.* in press) to be a meaningful outgroup taxon in the analysis. Although it has been argued that the outgroup need not be the sister group of the ingroup (Nixon & Carpenter 1993), the inclusion of *N. bellicosa* in the data matrix lowered the resolution of the cladogram.

Eight morphological characters used in the analysis were from male pedipalpal morphology. Male genitalia are commonly used in spider phylogenetic analyses (e.g., Coddington 1990, Hormiga 1993, Griswold 2001). Characters were also taken from somatic morphology (seven), female genitalia (six) and ecology (one). Distinct gaps in ratios and measurements were used to separate character states.

Character list

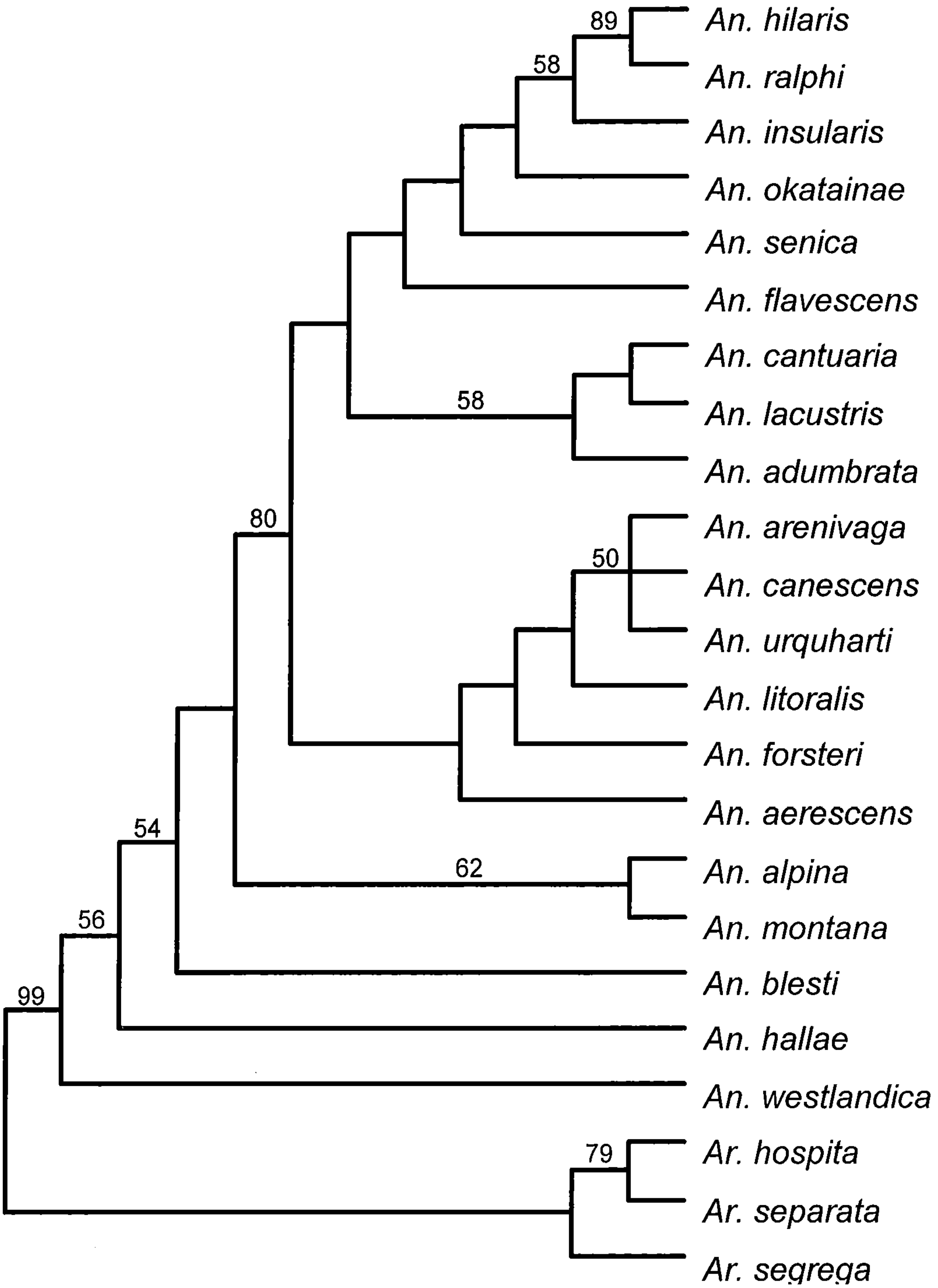
1. *Anterior eye row*: (0) slightly procurved or straight; (1) strongly procurved.
2. *Anterior eye row*: (0) no more than one eye width apart; (1) more than one eye width apart.
3. *Retromarginal cheliceral teeth*: (0) three - none reduced; (1) three - proximal reduced.
4. *Scopulae on tarsi and metatarsi I and II*: (0) absent; (1) weak (comparatively large spaces between adjacent scopulae); (2) intermediate (small spaces between adjacent scopulae); (3) dense (an almost solid mass, scopulae contiguous).
5. *White pubescence below PME*: (0) absent; (1) present.
6. *Cymbium/tibia length ratio*: (0) more than 2.1; (1) 2.0 - 1.5; (2) less than 1.4.
7. *Minimum adult body length*: (0) less than 8 mm; (1) greater than 9 mm.
8. *Basoembolic apophysis*: (0) without spur; (1) with short spur (small, sclerotised bump); (2) with long spur (at least ¼ length of median apophysis).
9. *Lobe at base of terminal apophysis*: (0) no lobe; (1) weak lobe; (2) rounded lobe; (3) tooth-like lobe.
10. *Length of median apophysis after bend*: (0) without bend; (1) median apophysis just bends; (2) less than or equal to length before bend; (3) longer than before bend.
11. *Median apophysis dorso-ventrally flattened*: (0) no; (1) partially.
12. *Median apophysis with basal spur*: (0) absent; (1) present.
13. *Median apophysis shape after bend*: (0) absent; (1) pointing anteriorly; (2) wave-like; (3) straight; (4) pointing posteriorly.
14. *Median apophysis tip*: (0) rounded; (1) mesially directed tooth; (2) one laterally directed tooth; (3) two laterally directed teeth; (4) one laterally directed tooth and blunt protrusion below tooth.
15. *Tip of terminal apophysis*: (0) pointed; (1) rounded; (2) multifaceted.
16. *Epigynal hoods*: (0) absent; (1) shallow; (2) regular; (3) deep.
17. *Posterior lip*: (0) absent; (1) present.
18. *Median septum*: (0) not raised; (1) raised and unsclerotised; (2) raised and sclerotised.
19. *Bends in internal genitalia*: (1) 1; (2) 2; (3) 3; (4) 4; (5) 5 or more.
20. *Epigyne raised either side of septum*: (0) no; (1) yes.
21. *Genitalia lateral sclerites*: (0) absent; (1) present.
22. *Habitat*: (0) grassland - including open scrub and swamp; (1) stony or sandy - including riverbed, scree and beach; (2) forest - including forest litter.

Table 1 Character state distribution matrix for phylogenetic analysis of *Anoteropsis*.

Taxa	Character states
Artoria hospita	1100010030010121021002
Artoria segrega	0100000020010121021012
Artoria separata	1100000030010121021002
Anoteropsis adumbrata	0002010122003203102000
Anoteropsis aerescens	0002010023002402113001
Anoteropsis alpina	0003021022002210101011
Anoteropsis arenivaga	0012010023101402113001
Anoteropsis blesti	0001010021000001102011
Anoteropsis canescens	0011110023101402113000
Anoteropsis cantuaria	0012010122003203103001
Anoteropsis flavescens	0002010213102402121000
Anoteropsis forsteri	0002110023003402113001
Anoteropsis hallae	0001010021000300102012
Anoteropsis hilaris	0011010203003312115000
Anoteropsis insularis	0003010113004312104001
Anoteropsis lacustris	0012010122003203113001
Anoteropsis litoralis	0012110023003402113001
Anoteropsis montana	0002021021000000102011
Anoteropsis okatainae	0011010003002412123101
Anoteropsis ralphi	0011010103004312115000
Anoteropsis senica	0002010103002412122101
Anoteropsis urquharti	0012110023101402113001
Anoteropsis westlandica	0001010021000321102012

Results. The data matrix (Table 1) was analysed with PAUP* version 4.0b8 (Swofford 2001) using the branch and bound search, which finds all most parsimonious trees. Characters 8, 16 and 19 were ordered. Polarity was not assigned to any characters and all characters had equal weighting *a priori*, as there was no obvious weighting scheme. All 22 characters were phylogenetically informative. Characters were excluded *a priori* from the analysis that were autapomorphic or appeared to be homoplasious (e.g., colour pattern, which varied intraspecifically). Bootstrap values (Felsenstein 1985) were calculated from 1000 replicate parsimony analyses using the closest addition sequence of the taxa and the heuristic search option in PAUP*.

Parsimony analysis produced one most parsimonious tree (Text-fig. 2), with a length of 77 steps, a consistency index of 0.571 and a retention index of 0.761.



Text-fig. 2 The most parsimonious tree for *Anoteropsis* and the three New Zealand *Artoria* species. Numbers above the branches indicate the bootstrap percentages of 1000 replicates.

Relationships. There is strong (>75%) bootstrap support for *A. hilaris* and *A. ralphi* as sister species. *Anoteropsis alpina*, *A. blesti*, *A. hallae*, *A. montana* and *A. westlandica* appear to be basal within *Anoteropsis* and all other species form a derived clade, with strong bootstrap support. *Anoteropsis arenivaga*, *A. canescens* and *A. urquharti* are morphologically similar and form an unresolved trichotomy.

The Lycosidae is a morphologically conservative family, which makes it difficult to generate large morphological datasets for phylogenetic analysis. Because of this the data matrix was relatively small (fewer characters than taxa), however, there was still good resolution and bootstrap support within the tree. Further resolution through additional phylogenetic analyses was carried out on *Anoteropsis* species using data from partial sequences from cytochrome c oxidase I and NADH dehydrogenase subunit I plus tRNA$^{Leu(CUN)}$ DNA

(Vink & Paterson, in prep.). The phylogenies inferred from these molecular data were significantly similar (p<0.001) to the phylogeny presented here.

KEY TO NEW ZEALAND LYCOSIDAE

N.B. *Anoteropsis hilaris* is the most common New Zealand species (see Fig. 12a-g, 35-37, 49, 76a-c, 93) but it was not possible to have it key out until the end of the key. Some figures of the male pedipalp are slightly tilted to one side to show the differences in the median apophysis (Fig. 38, 42, 48, 49, 52, 56).

1 Pedipalp tibial length subequal to length of cymbium in males and to pedipalpal tarsus in females. First pair of legs longest in male (Fig. 33). Male pedipalp, when viewed ventrally, with pommel shaped median apophysis (Fig. 38). Cymbium tip without macrosetae. Female epigyne with hoods extending posteriorly from epigynal area.

Allotrochosina schauinslandi **Simon**

Pedipalp tibial length much less than length of cymbium or pedipalpal tarsus. Fourth pair of legs longest in males. Male pedipalp not as above. Cymbium tip with macrosetae. Female epigyne not as above.

...2

2(1) Distance between anterior lateral eyes and anterior median eyes greater than the width of two anterior lateral eyes (Fig. 31).

Artoria ...3

Distance between anterior lateral eyes and anterior median eyes equal to or less than the width of one anterior median eye (Fig. 30, 32).

...5

3(2) Anterior eye row strongly procurved when viewed anteriorly (Fig. 31). Male pedipalp with a mesially directed hook-like spur near the base of the median apophysis (Fig. 59, 61). Epigyne with a large, spatulate median septum (Fig. 86, 88).

...4

Anterior eye row not strongly procurved when viewed anteriorly. Male pedipalp with weak spur near the base of the median apophysis (Fig. 60). Epigyne with a relatively undeveloped median septum (Fig. 87).

Artoria segrega **sp. nov.**

4(3) Hook-like spur nearer to the middle of the median apophysis. Male pedipalp as in Fig. 59. Spatulate median septum short. Epigyne as in Fig. 86.

Artoria hospita **sp. nov.**

Hook-like spur nearer to the base of the median apophysis. Male pedipalp as in Fig. 61. Spatulate median septum long. Epigyne as in Fig. 88.

Artoria separata **sp. nov.**

5(2) Male fang with tubercle (Fig. 32). Claw-like macrosetae at tip of cymbium (Fig. 64). Epigyne forming a triangular opening (Fig. 91).

Venatrix goyderi **(Hickman)**

Male fang without tubercle. No claw-like macrosetae at tip of cymbium. Epigyne not forming a triangular opening.

...6

6(5) Males with elongate cymbium. Male bulb with sickle-shaped terminal apophysis, embolus long, slender, curved and parallel to terminal apophysis (Fig. 62). Epigyne with large median septum shaped like inverted "T" (Fig. 89).

Geolycosa tongatabuensis **(Strand)**

Males without elongate cymbium. Male bulb not as above. Epigyne not as above.

...7

7(6) Median apophysis of male bulb large with spherical tip (Fig. 63). Epigyne simple with large, wide median septum (Fig. 90).

Notocosa bellicosa **(Goyen)**

Male bulb not as above. Median apophysis with a laterally directed distal bend. In most species an approximate 90° bend, shaped like an inverted "L" (e.g., Fig. 49). In some species the bend is very slight (Fig. 43, 48, 53, 58). Epigyne not as above and with sclerotised posterior lip (e.g., Fig. 76).

Anoteropsis ...8

8(7) Patch of white pubescence lateral to posterior lateral eyes (e.g., Fig. 20).

...9

No patch of white pubescence lateral to posterior lateral eyes.

...12

9(8) Carapace pale yellow to light orange-brown. Abdomen light yellow to yellow-orange with black blotches.

...10

Carapace brown to black. Abdomen mostly grey to dark grey.

...11

10(9)

Median apophysis tip straight (Fig. 52). Posterior lip of epigyne wide (Fig. 79).

Anoteropsis litoralis **sp. nov.**

Median apophysis tip slightly bent posteriorly (Fig. 47). Posterior lip of epigyne not wide (Fig. 74).

Anoteropsis forsteri **sp. nov.**

11(9) Median apophysis approximately twice as long after bend than before bend. Male bulb as in Fig. 57. Epigyne as in Fig. 84.

Anoteropsis urquharti **(Simon)**

Median apophysis slightly longer after bend than before bend. Male bulb as in Fig. 44. Epigyne as in Fig. 71.

Anoteropsis canescens **(Goyen)**

12(8) Carapace straw colour to yellow, and abdomen light yellow to yellow-orange with black splotches. Male bulb as in Fig. 50. Epigyne as in Fig. 77.

Anoteropsis insularis **sp. nov.**

Carapace and abdomen not as above. Male bulb not as above. Epigyne not as above.

...13

13(12) Carapace dark orange-brown, brown or dark brown and abdomen brown to grey-brown, grey or dark grey.

...14

Carapace and abdomen not as above.

...16

14(13) Median apophysis with rounded tip. Male bulb as in Fig. 53. Epigyne as in Fig. 80. Large spiders (body length 9.1 – 15.9 mm).

Anoteropsis montana **sp. nov.**

Median apophysis with arrow-like tip. Male bulb as in Fig. 41. Epigyne as in Fig. 71 with "M" shaped sclerites. Large spiders (body length 11.0 - 17.4 mm).

Anoteropsis alpina **sp. nov.**

Median apophysis not rounded or arrow-like at tip. Male bulb not as above. Epigyne not as above. Maximum body length 5.2 - 16.2 mm.

...15

15(14) Median apophysis shorter after bend than before bend. Tip of median apophysis directed mesially. Male bulb as in Fig. 51. Epigyne with deep hoods (Fig. 78).

Anoteropsis lacustris **sp. nov.**

Median apophysis longer after bend than before bend. Tip of median apophysis directed anteriorly. Male bulb as in Fig. 42. Epigyne as in Fig. 69 without deep hoods.

Anoteropsis arenivaga **(Dalmas)**

Median apophysis longer after bend than before bend and wave-like after bend. Tip of median apophysis directed mesially. Male bulb as in Fig. 40. Epigyne as in Fig. 67a-b, without deep hoods.

Anoteropsis aerescens **(Goyen)**

16(13) Median apophysis wave-like after bend. Epigyne with raised areas adjacent to median septum.

...17

Median apophysis not wave-like after bend. Epigyne without raised areas adjacent to median septum.

...18

17(16) Median apophysis long, extending to or past edge of cymbium. Male bulb as in Fig. 56. Female epigyne as in Fig. 83. Large sized spiders (body length 7.4 - 15.8 mm).

Anoteropsis senica **(L. Koch)**

Median apophysis not extending to edge of cymbium. Male bulb as in Fig. 54. Female epigyne as in Fig. 81. Medium sized spiders (body length 4.2 - 7.6 mm).

Anoteropsis okatainae **sp. nov.**

18(16) Median apophysis with an approximate 90° bend, shaped like inverted "L" (e.g., Fig. 49). Female epigyne without lateral sclerites (e.g., Fig. 76).

...21

Median apophysis with weak bend (e.g., Fig 58). Female epigyne with lateral sclerites (e.g., Fig. 85)

...19

19(18) Median apophysis weakly bifurcate. Male bulb as in Fig. 43. Female epigyne with weak posterior lip (Fig. 70).

Anoteropsis blesti **sp. nov.**

Median apophysis strongly bifurcate with crescent-shaped tip. Male bulb not as above. Female epigyne not as above.

...20

20(19) Median apophysis wide at tip (Fig. 58). Posterior lip of epigyne V-shaped (Fig. 85).

Anoteropsis westlandica **sp. nov.**

Median apophysis tapers towards tip (Fig. 48). Posterior lip of epigyne not V-shaped (Fig. 75).

Anoteropsis hallae **sp. nov.**

21(18) Median apophysis the same length, or shorter after bend than before bend. Basoembolic apophysis with very small spur (e.g., Fig. 39). Epigynal hoods deep or directed posteriorly and close to posterior lip.

...22

Median apophysis longer after bend than before bend. Basoembolic apophysis with medium to long spur (e.g., 49). Epigynal hoods not as above.

...23

22(21) Male bulb as in Fig. 45. Epigynal hoods directed posteriorly. Female epigyne as in Fig. 72.

Anoteropsis cantuaria **sp. nov.**

Male bulb as in Fig. 39. Epigynal hoods not as above. Female epigyne as in Fig. 66.

Anoteropsis adumbrata **(Urquhart)**

23(21) Median apophysis directed slightly anteriorly after bend and dorso-ventrally flattened after bend. Basoembolic apophysis with long anteriorly directed spur. Male bulb as in Fig. 46. Female epigyne as in Fig. 73. Median septum long and sclerotised.

Anoteropsis flavescens **L. Koch**

Median apophysis directed posteriorly after bend and not dorso-ventrally flattened. Basoembolic apophysis short to medium length and directed mesially. Male bulb as in Fig. 55. Female epigyne as in Fig. 82. Median septum not long and sclerotised.

***Anoteropsis ralphi* (Simon)**

Median apophysis directed slightly anteriorly after bend and not dorso-ventrally flattened. Basoembolic apophysis medium length and directed slightly anteriorly. Male bulb as in Fig. 49. Female epigyne as in Fig. 76a-c. Median septum not long and sclerotised.

***Anoteropsis hilaris* (L. Koch)**

BIOSYSTEMATICS

Family LYCOSIDAE

Small to large, three clawed spiders. Eyes in three rows (Fig. 30-32). Trochanters with a notch on the distal edge of the ventral side. Male pedipalp without retrolateral tibial apophysis. Females carry the eggsac attached to the spinnerets and spiderlings, after hatching, are carried on the abdomen.

Genus *Allotrochosina* Roewer

Allotrochosina Roewer, 1960: 927-928 (listed but not described in Roewer 1955a: 213). – Vink, 2001: 462.

Type species: *Lycosa maunganuiensis* Berland, 1925 (= *Lycosa schauinslandi* Simon, 1899), by monotypy.

Description. Body length 2.0 - 9.7 mm. Carapace orange-brown with darker bands extending from the fovea. Abdomen yellow-brown with blackish patterning. Chelicerae with three promarginal teeth and two retromarginal teeth. Legs in descending order of length usually 4123 (male and female) with the fourth leg always longest, except males of *Allotrochosina schauinslandi*, in which the first leg is the longest. Male: without macrosetae at cymbium tip; pedipalp tibial length subequal to length of cymbium; embolus and terminal apophysis reduced and crowded together at the tip of the bulb; subtegulum elongated and along prolateral margin of tegulum. Female: genital openings extend posteriorly from epigynal area; internal genitalia simple, consisting of a straight copulatory duct and spermatheca at right angles to each other; pedipalp tibiae and tarsi subequal in length.

Remarks. *Allotrochosina schauinslandi* is the only New Zealand species in the genus; the only other known species, *A. karri* Vink 2001, is found in karri forest (*Eucalyptus diversicolor* F. Muell.) in the southwest of Western Australia (Vink 2001).

Allotrochosina was placed in the subfamily Venoniinae by Vink (2001). Dondale (1986) defined the subfamily by the following characters; “median apophysis enlarged and oriented longitudinally on genital bulb”, “terminal apophysis small, situated distally on bulb and functioning as conductor” and “embolus small, situated distally”. The reduced embolus and terminal apophysis, both crowded together at the tip of the male bulb, place *Allotrochosina* in the Venoniinae. *Allotrochosina* lacks the usual venoniine characters of terminal apophysis acting as conductor and median apophysis enlarged. However, these two characters may have been secondarily lost or may be irrelevant to the subfamily classification (C.D. Dondale pers. comm.). The elongated subtegulum along the prolateral margin of the tegulum is shared with other venoniine genera (e.g., *Pirata* Sundevall 1833, *Trabea* Simon 1876, *Trabeops* Roewer 1959 and *Proevippa* Purcell 1903).

Allotrochosina is known only from New Zealand and the southwest of Western Australia. Species in the genus appear to be dependent on high humidity as they are usually found in damp habitats.

Allotrochosina schauinslandi (Simon)

Fig. 1, 33, 38, 65, 92; Map 1

Lycosa schauinslandi Simon, 1899: 428-429.
Lycosa maunganuiensis Berland, 1925: 298-299, plate 43, figs 11-15. – Vink, 2001: 462.
Allotrochosina mananganuiensis [sic] (Berland). - Roewer, 1955a: 213.
Alopecosa schauinslandi (Simon). - Roewer, 1955a: 224.
Trochosa maunganuiensis (Berland). - McKay, 1979b: 278.
Allotrochosina schauinslandi (Simon). - Vink, 2001: 461-466.

Diagnosis. Distinguished from all other New Zealand species of this family by the following characters. Male: leg length in decreasing order 1423; cymbium tip without macrosetae; pedipalp tibial length subequal to length of cymbium; embolus and terminal apophysis reduced and crowded together at tip of bulb; subtegulum elongated and along prolateral margin of tegulum. Female: pedipalp tibiae and tarsi subequal in length; genital hoods extending posteriorly from epigynal area.

Description. Colour: carapace orange-brown with darker bands extending from the fovea (Fig. 1); sternum orange-brown; abdomen yellow-brown with blackish pattern (Fig. 1); ventral surface yellow-brown with three blotchy blackish longitudinal stripes; legs orange-brown with faint darker annulations.

Chelicerae with three promarginal teeth and two retromarginal teeth. Male bulb (Fig. 38) with pommel-shaped median apophysis (when viewed ventrally); macrosetae absent from tip of cymbium. Legs long and slender. Epigyne (Fig. 65) with genital hoods extending posteriorly from epigynal area.

Dimensions (mm). Male NN, Riwaka River (female NN, Motueka River Mouth): total length 7.4 (8.9); carapace 4.0/3.0 (4.0/2.9), height 1.5 (1.2); abdomen 3.8/2.2 (4.3/2.9); sternum 1.9/1.7 (1.9/1.0). Leg formula (in descending order of length) 1423 (male), 4123 (female).
Size range. Male body length 6.3 - 9.2, female body length 6.7 - 9.7.

Type data. Syntypes of *Lycosa schauinslandi*: 1 male, 1 female (MNHN 21415) labelled "N. Zeal. [New Zealand], French Pass [40°56'S, 173°50'E], Sch. [H.H. Schauinsland, collected Dec 1896 - Jan 1897] [handwritten]."
Lectotype of *Lycosa maunganuiensis* (designated by Vink 2001): female (MNHN) labelled "Chatham Islands, Maunganui [43°46'S, 176°46'W], 15.xii.1923, G. Archey [handwritten]".

Paralectotype of *Lycosa maunganuiensis* (designated by Vink 2001): female (MNHN), same data as lectotype.

Material examined. Syntypes of *Lycosa schauinslandi* and a lectotype of *Lycosa maunganuiensis*, plus 511 non-type specimens (168 males, 343 females) - see Appendix B for collection details of specimens examined.

Distribution (Map 1). Found throughout New Zealand, including Chatham Island and South East Island (ND, CL, AK, BP, GB, TO, TK, HB, RI, WI, WN, WA, SD, NN, BR, KA, MB, NC, WD, MC, CH, SC, FD, DN, CO, SL, SI).

Biology. *Allotrochosina schauinslandi* inhabits forests, swampland, riverbeds and damper parts of grassland and open scrub. It appears to be dependent on high humidity as it died in a short time when kept in a dry container (Forster & Forster 1973, 1999). *Allotrochosina schauinslandi* is a nocturnal hunter and is found under logs or among leaf litter in the daytime. Adults have been found throughout the year but most commonly in December and January. The courtship behaviour of *A. schauinslandi* was briefly described by Forster and Forster (1973). Females produce a bluish eggsac, which is smaller than eggsacs produced by other comparable-sized New Zealand lycosid species (Forster & Forster 1973, 1999). The female carries the eggsac under the abdomen rather than behind (Forster & Forster 1973, 1999). Eggsacs have been found from August to February and females carrying spiderlings have been seen between December and February.

Despite thorough searching by me in December 1999 and extensive invertebrate surveys on other occasions (e.g., Emberson *et al.* 1996), only three specimens (all females) of *A. schauinslandi* have been collected from Chatham Island. It is possible that *A. schauinslandi* is now rare on Chatham Island due to predation by the introduced buff weka, *Gallirallus australis hectori* (Hutton), which occurs in higher numbers than on the New Zealand mainland (Marchant & Higgins 1993). Several other Chatham Islands invertebrates, including the spider *Dolomedes schauinslandi* Simon, 1899 (Pisauridae), are now only found on weka-free islands (Dugdale & Emberson 1996).

DNA. 12S rRNA and NADH dehydrogenase subunit I plus tRNA$^{\mathrm{Leu(CUN)}}$ partial DNA sequences for this species are listed in GenBank (Benson *et al.* 2000) under accession numbers AF380502 and AY059996 respectively.

Remarks. In the Lycosidae leg IV is normally the longest leg (McKay 1985), however, in male *Allotrochosina schauinslandi* leg I is the longest, which is also the case for *Artoria flavimanus* Simon, 1909 from Australia (Framenau 2002).

Genus *Anoteropsis* L. Koch

Anoteropsis L. Koch, 1878: 971, plate 85, fig. 1a-b. – Simon, 1898b: 314. Forster, 1979: 11. McKay, 1985: 73. Type species: *Anoteropsis flavescens* L. Koch, 1878, by subsequent designation of Simon, 1898b.

Dalmasicosa Roewer, 1960: 730. Type species: *Lycosa arenivaga* Dalmas, 1917, by original designation of Roewer, 1960. New synonymy.

Description. Body length 4.2 - 17.4 mm. Carapace ranging from pale yellow to dark brown. Some species have distinct markings on carapace. Abdomen often with light heart stripe; colour pattern ranges from monochromatic to stripes and blotches and varies between and within species. Chelicerae with two to three promarginal teeth (distal tooth often reduced) and three retromarginal teeth (proximal tooth often reduced). Legs in descending order of length usually 4123 (male and female) with the fourth leg always longest. Male: with 2 to 8 macrosetae at cymbium tip; pedipalp tibial length shorter than cymbium length; terminal apophysis and lobe of the tegulum form the conductor together; terminal apophysis with a groove in which the embolus rests; all species have a laterally directed bend in the median apophysis, in most species the median apophysis has an approximate 90° bend (shaped like inverted "L"); basoembolic apophysis bent ventrally, sometimes with spur; tegulum partially divided; subtegulum at posterior lateral margin of tegulum. Female: epigyne with sclerotised posterior lip and paired hoods; internal genitalia consisting of a copulatory duct with one or more bends before the spermatheca.

Remarks. *Anoteropsis* shares the ventrally bent basoembolic apophysis with *Artoria* and *Notocosa*, but it is much broader in *Artoria* and never with a spur. The synapomorphy for *Anoteropsis* is the enlarged and longitudinally oriented median apophysis with a laterally directed bend.

Anoteropsis is known only New Zealand (including the Chatham Islands, Snares Islands and Auckland Islands); however, three other species have been listed from New Caledonia (*A. flavovittata* Simon, 1880), Australia (*A. longipes* L. Koch, 1878) and Papua New Guinea (*A. papuana* Thorell, 1881). *Anoteropsis flavovittata* has a retrolateral tibial apophysis and, therefore, cannot be a lycosid; it is here placed *incertae sedis* in the Lycosoidea. Koch's (1878) description and illustrations of a female *A. longipes* (the type is missing) do not conform to *Anoteropsis*. *Anoteropsis papuana* is described but not illustrated (Thorell 1881) from a female specimen (type not seen) and also does not conform to *Anoteropsis*. Both *A. longipes* and *A. papuana* belong in other lycosid genera, but as the genera of the Lycosidae are in a state of flux it is not possible to better place them. They are here considered *incertae sedis* in the Lycosidae.

Dalmasicosa is a junior synonym of *Anoteropsis*. Roewer's (1960) diagnosis of *Dalmasicosa* was short and lacked a description of key genitalic characters. However, the type species of *Dalmasicosa*, *Lycosa* [*Anoteropsis*] *arenivaga*, clearly conforms to *Anoteropsis*. The Hawaiian species *Dalmasicosa virgata* (Karsch, 1880) (not an Australian species as incorrectly noted by Roewer 1955a) (type examined) is not a species of *Anoteropsis* but is likely to belong to an undescribed pacific genus (see *Geolycosa tongatabuensis* remarks). It is here considered *incertae sedis* in the Lycosidae.

Anoteropsis was originally described as a lycosid genus by Koch (1878). Simon (1898b) transferred it to Pisauridae when he added *A. flavovittata* to the genus and designated *A. flavescens* as the type species. *Anoteropsis* was returned to the Lycosidae from the Pisauridae by Forster (1979) and McKay (1985).

Anoteropsis does not fit any of the five main lycosid subfamilies as defined by Dondale (1986), or the additional Evippinae Zyuzin, 1985, Wadicosinae Zyuzin, 1985, Piratinae Zyuzin, 1993 or Tricassinae Alderweireldt & Jocqué, 1993. The lobe of the tegulum forming part of the conductor is similar to some genera in the subfamily Lycosinae Simon, 1898 (*sensu* Dondale 1986). However, the enlarged and longitudinally oriented median apophysis and the terminal apophysis functioning as a conductor are characters that Dondale (1986) listed as occurring Venoniinae. The groove in the terminal apophysis, in which the embolus rests, is known only from *Anoteropsis* spp. and *Artoria* spp. (C.D. Dondale, pers. comm.). The terminal apophysis forming part of the conductor, the partially divided tegulum and the ventrally bent basoembolic apophysis, are shared with *Artoria* Thorell, 1877 and *Notocosa* gen. nov. Molecular data also support this relationship and places these genera basally in the Lycosidae (Vink *et al.* in press). Further revisions of Australasian lycosids may result in a separate subfamily at least for *Anoteropsis*, *Artoria* and *Notocosa*.

Anoteropsis adumbrata (Urquhart) new combination

Fig. 2a-c, 28, 29, 30, 39, 66; Map 2

Lycosa adumbrata Urquhart, 1887: 114-115.
Pardosa adumbrata (Urquhart) - Bryant 1933: 8, plate 3, fig. 24, plate 4, fig. 41 (f).

Diagnosis. Distinguished from all other *Anoteropsis* species by the shape of the median apophysis of the male bulb and the external sclerites of the female epigyne, especially the deep hoods. This species is very similar in appearance to the common *A. hilaris* and both can be found in the same habitat. However, the species can be easily differentiated by their genitalia. The bulb of *A. adumbrata* is similar to *A. cantuaria* and *A. lacustris*, however, *A. adumbrata* has a strong, mesially directed tooth. The epigyne is similar to *A. lacustris*, however, *A. adumbrata* has a straight posterior lip, deeper hoods and is a smaller spider.

Description. Colour: carapace orange-brown with three yellow-brown longitudinal stripes, two stripes run adjacent to the edge of the cephalothorax, the other stripe runs from the ALE to the posterior (Fig. 2a-c); sternum brown; abdomen variable in colour (see Fig. 2a-c) but usually grey-brown with a yellow heart stripe to half way along dorsal midline, female has black markings surrounding the heart stripe and black markings on the posterior midline; legs yellow-brown (femora orange-brown) with darker annulations.

Chelicerae with three promarginal teeth (distal tooth very reduced in female) and three retromarginal teeth. Tarsi and metatarsi with scopulae, especially evident on legs I and II. Male bulb (Fig. 39) with an approximate 90° bend in the median apophysis, which is subequal in length before and after bend. Epigyne with deep hoods (Fig. 66). Internal genitalia with two bends in the copulatory duct.

Dimensions (mm). Male WD, Arthur's Pass (female MC, Klondyke Corner): total length 8.2 (8.9); carapace 4.7/3.5 (4.5/3.2), height 1.5 (1.6); abdomen 3.7/2.9 (4.7/3.1); sternum 2.2/1.7 (2.0/1.6).
Size range. Male body length 5.6 – 8.2, female body length 4.9 – 10.4.

Type data. Holotype: female (CMNZ) labelled "*L. adumbrata* [handwritten] / Female.; Holotype.; *Lycosa adumbrata* Urquhart.; Loc. TE KARAKA. [37°06'S, 174°52'E]; Urquhart, A. T., Trans. N.Z. Inst., Vol.19, p. 114,; 1887."

Material examined. Type specimen plus 452 non-type specimens (196 males, 256 females) - see Appendix B for collection details of specimens examined.

Distribution (Map 2). Found throughout New Zealand, including Stewart Island (ND, AK, WO, BP, GB, TO, TK, HB, WA, RI, WN, NN, MB, BR, KA, WD, NC, MC, MK, OL, FD, DN, CO, SL, SI).

Biology. *Anoteropsis adumbrata* inhabits high altitude grassland, damp grassland and open scrub. Adults have been found throughout the year but most commonly in December and January. Eggsacs have been found from November to May and females carrying spiderlings have been seen in December and April to June.

DNA. 12S rRNA, two cytochrome c oxidase I and two NADH dehydrogenase subunit I plus tRNA$^{\mathrm{Leu(CUN)}}$ partial DNA sequences for this species are listed in GenBank (Benson *et al.* 2000) under accession numbers AF380491, AY059961, AY059962, AY059998 and AY059999 respectively.

Anoteropsis aerescens (Goyen) new combination

Fig. 3a-b, 40, 67a-b; Map 3

Lycosa aerescens Goyen, 1887: 206-207.
Lycosa maura Urquhart, 1892: 246-247. New synonymy.
Lycosa albovestita Dalmas, 1917: 412-413. New synonymy.
Pardosa aerescens (Goyen) - Roewer, 1955a: 185.
Geolycosa albovestita (Dalmas) - Roewer, 1955a: 242.
Artoriella maura (Urquhart) - Roewer, 1955a: 233. – Framenau, 2002: 211.
Dalmasicosa albovestita (Dalmas) - Roewer, 1960: 730.

Diagnosis. Distinguished from all other *Anoteropsis* species by the shape of the median apophysis of the male bulb and the external sclerites of the female epigyne, especially the wide median septum. *Anoteropsis aerescens* is morphologically similar to *A. arenivaga*, *A. canescens*, *A. urquharti* and darker specimens of *A. litoralis*. Males are distinguishable by the median apophysis, which has a wave-lake after the bend and does not taper or point anteriorly. It is difficult to differentiate females but there are subtle differences in the shape of the posterior lip and median septum. *Anoteropsis aerescens* does not have the white pubescence below the PME found in *A. canescens*, *A. litoralis* and *A. urquharti.*

Description. Colour: carapace dark brown with slight reddish tinge and with white pubescence (Fig. 3a-b); sternum dark brown with orange tinge; abdomen grey with black blotches with faint grey-yellow heart stripe, female with four yellow-brown blotches (Fig. 3a-b); legs dark brown with yellow-brown annulations.

Chelicerae with three promarginal teeth (distal tooth reduced) and three retromarginal teeth (proximal tooth reduced in male). Tarsi and metatarsi with scopulae, especially evident on legs I and II. Male bulb (Fig. 40) with an approximate 90° bend in the median apophysis with the section after the bend longer and wave-like. Epigyne with wide median septum (Fig. 67a-67b). Internal genitalia with three bends in the copulatory duct.

Dimensions (mm). Male TK, Mt Egmont (female TK, Mt Egmont): total length 9.4 (12.5); carapace 5.3/3.9 (4.9/3.6), height 2.2 (2.0); abdomen 4.5/2.9 (7.5/4.6); sternum 4.7/4.0 (2.3/1.9).
Size range. Male body length 5.2 – 10.3, female body length 5.9 – 12.5.

Type data. **Syntypes** of *Lycosa aerescens*: Not seen. Original description (Goyen 1887) based on an unspecified number of male specimens and a single female specimen from Waitaki Valley (44°41'S, 170°25'E). The bulk of Goyen's collection has been destroyed (Forster 1967) and what remains of it are in OMNZ. Despite my thorough search of the collection these syntypes were not found and are presumed lost.

Syntypes of *Lycosa maura*: Not seen. Original description (Urquhart 1892) based on a male specimen and a female specimen from near Mount Cook (43°44'S, 170°06'E) in "Mr. H. Suter's collection". The syntypes were not found in any of the New Zealand collections and are presumed lost.

Lectotype of *Lycosa albovestita* (here designated): male (MNHN) labelled "*Lycosa albovestita* n.sp.; Temuka, Murchison [handwritten]." A second, undecipherable, hand written label is also present with the specimens. The only adult syntype is designated here as a lectotype in order to fix this taxonomic concept of *Lycosa albovestita*; the immature syntypes lacked many characters necessary for the identification and confirmation of this species concept.

Paralectotypes of *Lycosa albovestita* (here designated): 23 immatures (MNHN) labelled "*Lycosa albovestita* n.sp.; Temuka, Murchison [handwritten]." A second, undecipherable, hand written label is also present with the specimens.

Material examined. Lectotype and paralectoypes of *Lycosa albovestita* plus 83 non-type specimens (37 males, 46 females) - see Appendix B for collection details of specimens examined.

Distribution (Map 3). Found throughout New Zealand (TO, TK, RI, WI, WN, WA, MK, SC, WD, OL, CO, SL, FD).

Biology. *Anoteropsis aerescens* is found in stony riverbeds, rocky lakeshores and mountain scree. Adults have been found from August to May and eggsacs in September, December and January. Females with spiderlings have been found in January.

DNA. Three cytochrome c oxidase I and three NADH dehydrogenase subunit I plus $\text{tRNA}^{\text{Leu(CUN)}}$ partial DNA sequences for this species are listed in GenBank (Benson *et al.* 2000) under accession numbers AY059963, AY059964, AY059965, AY060000, AY060001 and AY060002 respectively.

Remarks. Despite the type of *Lycosa aerescens* not being found, the description (Goyen 1887) is adequate to identify the species. The types of *Lycosa maura* are missing and the species was considered *nomen dubium* by Framenau (2002). However, the description (Urquhart 1892) was adequate enough to be sure it is synonymous with *A. aerescens*.

Anoteropsis alpina new species

Fig. 4, 41, 68; Map 4

Diagnosis. Distinguished from all other *Anoteropsis* species by its large size, the arrow-like tip of the median apophysis of the male bulb and the external sclerites of the epigyne, especially the long, posteriorly directed lateral sclerites.

Description. Colour: carapace dark brown with reddish tinge, blackish stripes radiating from fovea and black around eye group (Fig. 4); sternum brown with reddish tinge; abdomen brown to grey brown; legs dark brown with reddish tinge with darker annulations.

Chelicerae with two promarginal teeth and three retromarginal teeth. Tarsi and metatarsi with dense scopulae, especially evident on legs I and II. Male pedipalp (Fig. 41) with dorsal cymbium yellow and with an approximate 90° bend in the median apophysis, which is subequal in length before and after bend and with arrow-like tip. Epigyne with long posteriorly directed lateral sclerites (Fig. 68). Internal genitalia with one bend in copulatory duct.

Dimensions (mm). Male holotype (female allotype): total length 13.9 (17.2); carapace 7.7/4.5 (7.5/5.7), height 2.2 (2.5); abdomen 6.6/4.4 (10.1/6.5); sternum 3.4/2.6 (3.5/2.7).
Size range. Male body length 11.0 – 15.1, female body length 14.3 – 17.4.

Type data. Holotype: male (OMNZ) labelled "St. Bathan's Mt [44°44'S, 169°46'E]; 6000 ft scree; D.R. + S. Forster; 27-xi-1971 [handwritten]."
Allotype: female (OMNZ) labelled "6000' Hawkdun Ra [44°42'S, 169°57'E]; 12.xii.71; scree slopes; ♀ in retreat beside stone / Retreat entrance; of silk. Gravel; damp within retreat,; ♂ in attendance [handwritten]."

Paratypes: 5 males, 1 female: 2 ♂, 1 ♀, CO, Hawkdun Range, 2000m, 44°42'S, 169°57'E, 12.xii.1971, OMNZ; 3 ♂, Michael Peak, 2000m, 44°45'S, 169°46'E, 27.xi.1971, S. Forster, OMNZ.

Material examined. Type specimens and 6 non-type specimens (3 males, 3 females) - see Appendix B for collection details of specimens examined.

Distribution (Map 4). Found only in alpine areas in the South Island (BR, MC, MK, CO).

Biology. *Anoteropsis alpina* is found in alpine scree and rocky areas. Females appear to build silk lined retreats between rocks and stones. Adults have been found from November to April.

DNA. Cytochrome c oxidase I and NADH dehydrogenase subunit I plus tRNA$^{Leu(CUN)}$ partial DNA sequences for this species are listed in GenBank (Benson *et al.* 2000) under accession numbers AY059966 and AY060003 respectively.

Etymology. The specific name is derived from *alpinus* (Latin, alpine) and refers to the habitat of the species.

Anoteropsis arenivaga (Dalmas) new combination

Fig. 5, 42, 69; Map 5

Lycosa arenaria Urquhart, 1891: 182-183 (primary homonym of *Lycosa arenaria* Audouin, 1827).
Lycosa arenivaga Dalmas, 1917: 412 (replacement name for *Lycosa arenaria* Urquhart).
Geolycosa arenivaga (Dalmas) - Roewer, 1955a: 242.
Dalmasicosa arenivaga (Dalmas) - Roewer, 1960: 730.

Diagnosis. Distinguished from all other *Anoteropsis* species by the shape of the median apophysis of the male bulb and the external sclerites of the epigyne, especially the wide median septum. *Anoteropsis arenivaga* is morphologically similar to *A. aerescens.*, *A. canescens*, *A. urquharti* and darker specimens of *A. litoralis*. Males are distinguishable by the median apophysis, which tapers towards the tip and points anteriorly. It is difficult to differentiate females but there are subtle differences in the shape of the posterior lip and median septum. *Anoteropsis arenivaga* does not have the white pubescence below the PME found in *A. canescens*, *A. litoralis* and *A. urquharti*.

Description. Colour: carapace brown with white pubescence (Fig. 5); sternum brown; abdomen dark grey with light grey heart stripe and three pairs of light grey blotches, markings fainter and sometimes absent (Fig. 5); legs orange-brown with faint darker annulations.

Chelicerae with three promarginal teeth (distal tooth very reduced) and three retromarginal teeth (proximal tooth reduced in females). Tarsi and metatarsi with scopulae, especially evident on legs I and II. Male bulb (Fig. 42) with an approximate 90° bend in the median apophysis, which is longer after bend than before bend and with anteriorly directed tip. Epigyne with wide median septum (Fig. 69). Internal genitalia with three bends in the copulatory duct.

Dimensions (mm). Male MC, Kaitorete Spit (female MC, Kaitorete Spit): total length 7.5 (7.8); carapace 3.6/2.5 (3.6/2.5), height 1.5 (1.2); abdomen 3.9/2.4 (4.4/2.7); sternum 1.7/1.4 (1.6/1.4).
Size range. Male body length 5.6 – 7.6, female body length 6.6 – 9.1.

Type data. Syntypes of *Lycosa arenaria* Urquhart: Not seen. Original description (Urquhart 1891) based on an unspecified number of female specimens from an unspecified location in New Zealand. Most of Urquhart's type material has been lost (Forster 1967, Court & Forster 1988) and what remains of it is in CMNZ. Despite my thorough search of the collection this type was not found and is presumed lost.

Material examined. 50 non-type specimens (25 males, 25 females) - see Appendix B for collection details of specimens examined.

Distribution (Map 5). Found in the South Island south of 42°S (MB, NC, MC, MK, SC, CO).

Biology. *Anoteropsis arenivaga* is found in sandy riverbeds, lake edges and beaches. In life it is well camouflaged against the grey rocks and sand and is difficult to see when not moving. Adults are more commonly found at night and immatures during the day. Adults have been found throughout the year, but are most common in summer months. A female with an eggsac, which hatched three days after, was found in December.

DNA. Two cytochrome c oxidase I and two NADH dehydrogenase subunit I plus $\text{tRNA}^{\text{Leu(CUN)}}$ partial DNA sequences for this species are listed in GenBank (Benson *et al.* 2000) under accession numbers AY059967, AY059968, AY060004 and AY060005 respectively.

Remarks. Although the syntypes of *Lycosa arenaria* Urquhart were not found the description is sufficient to identify the species.

Anoteropsis blesti new species

Fig. 6, 43, 70; Map 6

Diagnosis. Distinguished from all other *Anoteropsis* species by the weak bend of the median apophysis of the male bulb and the strong lateral sclerites and hoods of the epigyne.

Description. Colour: carapace orange-brown with blackish bands extending from fovea, area around fovea clear of any stripes, blackish band around base of carapace and eye area black (Fig. 6); sternum orange-brown; abdomen orange brown with heart stripe and brown and blackish regular blotches (Fig. 6); legs yellow-brown with blackish annulations.

Chelicerae with three promarginal teeth (distal tooth reduced) and three retromarginal teeth. Tarsi and metatarsi with weak scopulae, especially evident on legs I and II. Male bulb (Fig. 43) with weak bend in median apophysis, which is weakly bifurcate. Epigyne (Fig. 70) with lateral sclerites and weak posterior lip. Internal genitalia with two bends in the copulatory duct.

Dimensions (mm). Male holotype (female allotype): total length 6.5 (6.8); carapace 3.6/2.6 (3.7/2.9), height 1.4 (1.4); abdomen 3.4/2.1 (3.2/2.5); sternum 1.6/1.4 (1.8/1.5).
Size range. Male body length 5.0 – 7.6, female body length 5.9 - 12.5.

Type data. Holotype: male (LUNZ) labelled "NEW ZEALAND, CL, Waitekuri R; 36°45'[S] 175°36'[E]; under stones in riverbed; 26.i.2000 (moulted Oct 2000); C.J. Vink and A.D. Blest [handwritten]."

Allotype: female (LUNZ) labelled "NZ, CL, Waitekuri River, 36°45'[S] 175°36'[E]; under stones in riverbed; 17.ii.2000 C.J. Vink [handwritten]."

Paratypes: 7 males, 5 females: 3 ♂, 1 ♀, CL, Waitekuri River, 36°45'S, 175°36'E, 26.i.2000, C.J. Vink & A.D. Blest, LUNZ; 2 ♀, 16.ii.2000, C.J. Vink, LUNZ; 4 ♂, 2 ♀, 17.ii.2000, C.J. Vink, LUNZ.

Material examined. Type specimens, plus 10 non-type specimens (1 male, 9 females) - see Appendix B for collection details of specimens examined.

Distribution (Map 6). Found only in the north of the North Island (ND, CL, AK, BP).

Biology. *Anoteropsis blesti* is found in riverbeds under and on stones beside watercourses. Adults and juveniles are active during the day and at night. This species ran on and dived below the water surface when escaping capture. One adult was observed feeding on a juvenile. Adults have been found from December to April and eggsacs in December and January.

DNA. Cytochrome c oxidase I and NADH dehydrogenase subunit I plus tRNA$^{\mathrm{Leu(CUN)}}$ partial DNA sequences for this species are listed in GenBank (Benson *et al.* 2000) under accession numbers AY059969 and AY060006 respectively.

Etymology. The specific name is in honour of my friend and colleague David Blest, who collected the holotype specimen of this species with me.

Anoteropsis canescens (Goyen) new combination

Fig. 7, 44, 71, 94a-b; Map 7

Lycosa canescens Goyen, 1887: 203-204.
Pardosa canescens (Goyen) - Hogg, 1911: 300.

Diagnosis. Distinguished from all other *Anoteropsis* species by the dense patch of white pubescence below the PLE, the shape of the median apophysis of the male bulb and the external sclerites of the epigyne. *Anoteropsis canescens* is morphologically similar to *A. aerescens.*, *A. arenivaga*, *A. urquharti* and darker specimens of *A. litoralis*. Males are distinguishable by the shorter median apophysis, which tapers towards the tip and points anteriorly. It is difficult to differentiate females but there are subtle differences in the shape of the posterior lip and median septum.

Description. Colour: carapace brown with blackish lines radiating from fovea, orange -brown area at centre, black around eye area, white pubescence all over with a dense patch below the PLE (Fig. 7); sternum orange-brown; abdomen grey with black blotches, faint grey heart stripe, two paired dirty cream to yellow-brown blotches at posterior (Fig. 7); legs yellow-brown to orange-brown with brown annulations.

Chelicerae with three promarginal teeth (distal tooth very reduced) and three retromarginal teeth (proximal tooth reduced in females). Tarsi and metatarsi with weak scopulae, especially evident on legs I and II. Male bulb (Fig. 44) with an approximate 90° bend in the median apophysis, which is slightly longer before bend than after bend with anteriorly directed tip. Epigyne (Fig. 71). Internal genitalia with three bends in the copulatory duct (Fig. 94a-b).

Dimensions (mm). Male MC, McLeans Island (female MC, McLeans Island): total length 6.0 (7.1); carapace 3.2/2.3 (3.1/2.1), height 1.2 (1.3); abdomen 2.9/1.9 (3.7/2.6); sternum 1.6/1.2 (1.4/1.1).
Size range. Male body length 5.6 – 7.8, female body length 7.1 – 10.3.

Type data. Syntypes of *Lycosa canescens*: 1 male, 1 female (OMNZ) labelled "Lycosa canescens [hand written] / Labelled by Goyen; Lycosa canescens Goyen; male and female; Goyen Collection" – the typed label was inserted by C.L. Wilton (R.R. Forster, pers. comm.). The handwritten label (presumably written by Goyen) was faded and torn in two. The writing was visible only when the label was dried and viewed under an ultraviolet light source (method suggested by M.S. Harvey pers. comm..). Specimens collected by Goyen from Otago (Goyen 1887).

Material examined. Syntypes of *Lycosa canescens* plus 86 non-type specimens (60 males, 26 females) - see Appendix B for collection details of specimens examined.

Distribution (Map 7). Found throughout the South Island (NN, NC, MC, OL, MK, CO).

Biology. *Anoteropsis canescens* inhabits dry grassland, open scrub and riverbeds. Adults have been found from August to May.

DNA. Cytochrome c oxidase I and NADH dehydrogenase subunit I plus tRNA$^{Leu(CUN)}$ partial DNA sequences for this species are listed in GenBank (Benson *et al.* 2000) under accession numbers AY059970 and AY060007 respectively.

Anoteropsis cantuaria new species

Fig. 8a-b, 45, 72; Map 8

Diagnosis. Distinguished from all other *Anoteropsis* species by the shape of the median apophysis of the male bulb and the external sclerites of the epigyne, especially the shallow, posteriorly directed hoods. *Anoteropsis cantuaria* is morphologically similar to *A. lacustris*, but is usually lighter in coloration. The bulbs of the two species are very similar but the median apophysis of *A. cantuaria* has a slightly rounder bend than *A. lacustris*. Females of *A. cantuaria* have deep, posteriorly directed hoods.

Description. Colour: carapace red-orange-brown (Fig. 8); sternum orange-brown; abdomen black-brown with faint heart stripe (Fig. 8a-b); legs yellow-brown with very faint darker annulations.

Chelicerae with three promarginal (distal tooth very reduced) and three retromarginal (proximal tooth very reduced in female). Tarsi and metatarsi with scopulae, especially evident on legs I and II. Male bulb (Fig. 45) with an approximate 90° bend in the median apophysis, which is subequal in length before and after bend. Epigyne with shallow, posteriorly directed hoods (Fig. 72). Internal genitalia with three bends in the copulatory duct.

Dimensions (mm). Male holotype (female allotype): total length 8.2 (9.9); carapace 4.1/3.0 (5.0/3.9), height 1.6 (1.7); abdomen 3.9/2.4 (5.5/3.6); sternum 1.9/1.5 (2.4/1.9).
Size range. Male body length 6.8 – 10.0, female body length 8.0 – 11.6.

Type data. Holotype: male (LUNZ) labelled "NEW ZEALAND, MC Banks Peninsula; 29.iv.1994 C.J. Vink; Prices Valley [43°46'S, 172°43'E]; under stones in river-bed."

Allotype: female (LUNZ) labelled "NEW ZEALAND, MC Banks Pen; Prices Valley [43°46'S, 172°43'E]; under stones in river-bed; 22.xi.1990 C.J. Vink [handwritten]."

Paratypes: 2 male, 8 females: 1 ♂, 4 ♀, MC, Prices Valley, 43°46'S, 172°43'E, 30.x.1990, C.J. Vink, LUNZ; 3 ♀, 22.xi.1990, C.J. Vink, LUNZ; 1 ♂, 1 ♀, 29.iv.1994, C.J. Vink, LUNZ.

Material examined. Type specimens plus 37 non-type specimens (14 males, 23 females) - see Appendix B for collection details of specimens examined.

Distribution (Map 8). Found only in Canterbury (NC, MC, SC).

Biology. *Anoteropsis cantuaria* inhabits riverbeds and lives among rocks and stones. Adults have been found from September to April. Eggsacs have been found in October and a female carrying spiderlings was found in January.

DNA. Cytochrome c oxidase I and NADH dehydrogenase subunit I plus tRNA$^{\mathrm{Leu(CUN)}}$ partial DNA sequences for this species are listed in GenBank (Benson *et al.* 2000) under accession numbers AY059971 and AY060008 respectively.

Etymology. The specific name refers to the Canterbury Province, where the species is found.

Anoteropsis flavescens L. Koch

Fig. 9, 46, 73; Map 9

Anoteropsis flavescens L. Koch, 1878: 971-973, plate 85, fig. 1.

Diagnosis. Distinguished from all other *Anoteropsis* species by the anteriorly directed long sclerite on the basoembolic apophysis, the shape of the median apophysis of the male bulb and the external sclerites of the epigyne, especially the long, thick median septum.

Description. Colour: carapace orange-brown with two brown longitudinal bands, blackish lines radiating from fovea and a brownish marginal band (Fig. 9); black around eye area; sternum orange-brown with brown u-shape; abdomen dark orange-brown with brown-yellow heart stripe and two blackish, longitudinal bands on the posterior half of dorsal surface; legs orange-brown, femora yellow-brown with olive tinge.

Chelicerae with three promarginal teeth (distal and proximal teeth reduced) and three retromarginal teeth. Tarsi and metatarsi with scopulae, especially evident on legs I and II. Male bulb (Fig. 46) with long, anteriorly directed spur on the basoembolic apophysis; median apophysis with an approximate 90° bend, which is longer after bend than before bend and dorso-ventrally flattened after bend. Epigyne with long, sclerotised median septum (Fig. 73). Internal genitalia with one bend in the copulatory duct.

Dimensions (mm). Male DN, Swampy Summit (female DN, Swampy Summit): total length 7.4 (9.4); carapace 4.0/2.9 (4.5/3.2), height 1.3 (1.3); abdomen 3.6/2.5 (5.1/3.1); sternum 1.8/1.4 (1.8/1.5).
Size range. Male body length 6.5 – 9.1, female body length 7.4 – 9.7.

Type data. Holotype: Not seen. Original description based on a female specimen from an unspecified locality in New Zealand listed by Koch (1878) as deposited in "k. k. Hofcabinet zu Wien" (NHMW), but could not be found there (J. Gruber, pers. comm.) and is presumed lost.

Material examined. 20 non-type specimens (14 males and 6 females) - see Appendix B for collection details of specimens examined.

Distribution (Map 9). Found only in the southeast of the South Island (DN, CO, SL).

Biology. *Anoteropsis flavescens* appears to be restricted to swamp and marshy grassland although Forster (1979) stated that this species is "one of a group which inhabit the riverbeds of the South Island, New Zealand". Adults have been found from September to May.

DNA. Cytochrome c oxidase I and NADH dehydrogenase subunit I plus tRNA$^{\mathrm{Leu(CUN)}}$ partial DNA sequences for this species are listed in GenBank (Benson *et al.* 2000) under accession numbers AY059972 and AY060009 respectively.

Remarks. Although the type appears to be lost, Koch's (1878) stylised illustrations are adequate to identify this species. This is the type species for *Anoteropsis* (Simon 1898b).

Anoteropsis forsteri new species

Fig. 10, 47, 74; Map 10

Diagnosis. Distinguished from all other *Anoteropsis* species by its yellow to yellow-orange dorsal surface with black markings, the shape of the median apophysis of the male bulb and the external sclerites of the epigyne. *Anoteropsis forsteri* has similar colouration to *A. insularis* and *A. litoralis*, but the median apophysis is longer after the bend than *A. insularis* and the tip points posteriorly, unlike *A. litoralis*. In females, the median septum is thicker than *A. insularis* and the posterior lip is thinner than *A. litoralis*.

Description. Colour: carapace pale yellow with blackish lines radiating from fovea, two irregular blackish longitudinal bands, blackish splotches around margin and eye area black, patch of white pubescence next to PLE (Fig. 10); sternum orange-brown to brown with blackish blotches; abdomen yellow to yellow-orange with black blotches and heart stripe (Fig. 10); legs whitish with orange tinge (femora off white) with blackish blotchy annulations.

Chelicerae with three promarginal teeth (distal tooth reduced) and three retromarginal teeth. Tarsi and metatarsi with scopulae, especially evident on legs I and II. Male bulb (Fig. 47) with an approximate 90° bend in the median apophysis, which is longer after bend than before bend with slightly posteriorly directed tip. Epigyne (Fig. 74). Internal genitalia with three bends in the copulatory duct.

Dimensions (mm). Male holotype (female allotype): total length 5.5 (10.0); carapace 3.1/2.2 (4.5/3.1), height 0.8 (1.9); abdomen 2.7/2.0 (5.5/4.2); sternum 1.4/1.3 (2.0/1.7).

Size range. Male body length 5.5 – 8.5, female body length 7.1 – 10.0.

Type data. Holotype: male (LUNZ) labelled "NZ, SL, Oreti Beach, sand dunes at night; 46°26'[S] 168°14'[E]; 21.xi.2000, C.J. Vink [handwritten]."

Allotype: female (LUNZ) labelled " NZ, SL, Oreti Beach 46°26'S 168°14'E; sand dunes at night; 21.xi.2000, C.J. Vink [handwritten]."

Paratypes: 2 males: SL, Oreti Beach, 46°26'S, 168°14'E, 2.ii.2000, C.J. Vink, LUNZ.

Material examined. Type specimens, plus 14 non-type specimens (10 males, 4 females) - see Appendix B for collection details of specimens examined.

Distribution (Map 10). Found only in the southeast of the South Island and Stewart Island (DN, SL, SI).

Biology. *Anoteropsis forsteri* inhabits sand dunes and beaches. The colour and pattern of the dorsum provide good camouflage and make specimens difficult to see against the sand. Juveniles are more commonly found running around during daytime and adults are most common at night. Adults have been found from September to July.

DNA. Cytochrome c oxidase I and NADH dehydrogenase subunit I plus tRNA$^{\mathrm{Leu(CUN)}}$ partial DNA sequences for this species are listed in GenBank (Benson *et al.* 2000) under accession numbers AY059973 and AY060010 respectively.

Etymology. The specific name is in honour of my mentor the late Ray Forster, New Zealand's greatest arachnologist.

Anoteropsis hallae new species

Fig. 11, 48, 75; Map 11

Diagnosis. Distinguished from all other *Anoteropsis* species by the crescent-shaped tip of the median apophysis of the male bulb and the external sclerites of the epigyne. Morphologically similar to *A. westlandica* but the median apophysis of the bulb tapers slightly towards the tip and the posterior lip of the epigyne is not "V" shaped.

Description. Colour: carapace brown with yellow-brown longitudinal and marginal bands, blackish lines radiating from fovea, very dark brown around eye area (Fig. 11); sternum brown; abdomen brown with yellow heart stripe (Fig. 11); legs orange-brown (femora yellow-brown) with dark brown annulations.

Chelicerae with three promarginal teeth (distal tooth very reduced) and three retromarginal teeth. Tarsi and metatarsi with weak scopulae, especially evident on legs I and II. Male bulb (Fig. 48) with a weak bend in the median apophysis, which is bifurcate and crescent-shaped at tip. Epigyne (Fig. 75) with lateral sclerites and strong posterior lip. Internal genitalia with two bends in the copulatory duct.

Dimensions (mm). Male holotype (female allotype): total length 5.4 (5.2); carapace 3.0/2.1 (2.9/2.1), height 1.0 (1.1); abdomen 2.6/1.7 (2.4/1.9); sternum 1.4/1.1 (1.3/1.1).

Type data. Holotype: male (NZAC) labelled "NEW ZEALAND, NN, Heaphy Track; Heaphy Hut to Lewis Hut [40°58'S, 172°07'E], 7 Nov 1999; G. Hall."

Allotype: female (NZAC) labelled "Capleston [42°05'S, 171°55'E] 4½ km SE Cronadun; N.Z.F.S. Nelson-Westland Scheme; 8 Nov [19]71, J.C. Watt; Litter 71/134 [handwritten]."

Material examined. Type specimens - see type data above or Appendix B for collection details of specimens examined.

Distribution (Map 11). Known only from the northwest of the South Island (NN, BR).

Biology. *Anoteropsis hallae* appears to be restricted to native forest, which is unusual for New Zealand lycosids. The only two known specimens were collected in November.

DNA. Cytochrome c oxidase I and NADH dehydrogenase subunit I plus tRNA$^{Leu(CUN)}$ partial DNA sequences for this species are listed in GenBank (Benson *et al.* 2000) under accession numbers AY059974 and AY060011 respectively.

Etymology. The specific name is in honour my friend and collector extraordinaire Grace Hall, who collected the holotype specimen.

Anoteropsis hilaris (L. Koch) new combination

Fig. 12a-g, 35, 36, 37, 49, 76a-c, 93; Map 12

Lycosa hilaris L. Koch, 1877: 920-921, 979-980, plate 79, fig. 6.
Lycosa umbrata L. Koch, 1877: 921-922, plate 79, fig. 7. New synonymy.
Pardosa vicaria L. Koch, 1877: 965-966, plate 84, fig. 3. New synonymy.
Lycosa hilaris (L. Koch) - Koch, 1878: 979-980, plate 85, fig. 6.
Lycosa virgata Goyen, 1887: 201-203 (primary homonym of *Lycosa virgata* Karsch, 1880).
Lycosa taylori Goyen, 1887: 204-205. New synonymy.
Lycosa tremula Simon, 1899: 429-430. New synonymy.
Lycosa virgatella Roewer, 1951: 439 (replacement name for *Lycosa virgata* Goyen). New synonymy.
Pardosa taylori (Goyen) - Roewer, 1955a: 185.
Pardosa virgatella (Roewer) - Roewer, 1955a: 185.
Arctosa tremula (Simon) - Roewer, 1955a: 230.
Avicosa umbrata (L. Koch) - Roewer, 1955a: 236.
Arctosella tremula (Simon) - Roewer, 1960: 671.
Lycosa subantarctica Forster, 1964: 89-90, figs 99-101. New synonymy.

Schizocosa umbrata (L. Koch) - Platnick, 2002.

Diagnosis. Distinguished from all other *Anoteropsis* species by the hooked sclerite on the basoembolic apophysis, the shape of the median apophysis of the male bulb and the external sclerites of the epigyne, especially the triangular median septum. *Anoteropsis hilaris* is morphologically similar to *A. ralphi*. The hooked sclerite on the basoembolic apophysis is longer in *A. hilaris* and the tip of the median apophysis is not directed posteriorly. The epigynes are similar, however, the median septum of *A. hilaris* is generally thicker.

Description. Colour: carapace brown with yellow-brown longitudinal stripe and marginal stripes (Fig. 12a-g); sternum orange-brown; abdominal colour pattern variable (Fig. 12a-g) but usually brown with yellowish heart stripe (Fig. 12a); leg coxae, trochanters and femora yellow-brown; other segments orange-brown, legs are annulated with darker bands.

Chelicerae with three promarginal teeth (distal tooth extremely reduced) and three retromarginal teeth (proximal tooth sometimes reduced). Tarsi and metatarsi with weak scopulae, especially evident on legs I and II. Male bulb (Fig. 49) with medium to long, tooth-like spur curved towards cymbium tip on basoembolic apophysis; median apophysis with an approximate 90° bend, which is longer after bend than before bend. Epigyne with triangular median septum (Fig. 76a-c). Internal genitalia with at least five bends in the copulatory duct (Fig. 93).

Dimensions (mm). Male MC, Lincoln University (female MC, Christchurch): total length 7.2 (10.8); carapace 4.0/3.0 (4.0/3.2), height 1.5 (1.6); abdomen 3.4/2.2 (6.6/4.4); sternum 1.8/1.4 (1.8/1.5).
Size range. Male body length 4.9 – 11.0, female body length 4.9 – 11.8.

Type data. Type(s) of *Lycosa hilaris*: Not seen. Original description based on a male specimen(s) from an unspecified locality in New Zealand listed by Koch (1877) as deposited in "Mr. Bradley's Sammlung" (Bradley Collection, Macleay Museum, University of Sydney), but could not be found there (M. Humphrey, pers. comm.). It was also not found at the Zoologisches Institut und Zoologisches Museum, Hamburg (Rack 1961, H. Dastych, pers. comm.) where much of Koch's collection is held.

Holotype of *Lycosa umbrata*: Not seen. Original description based on a female specimen from an unspecified locality in New Zealand listed by Koch (1877) as deposited in "k. k. Hofcabinet zu Wien" (NHMW), but could not be found there (J. Gruber, pers. comm.) and is presumed missing.

Holotype of *Pardosa vicaria*: Not seen. Original description based on a female specimen from an unspecified locality in New Zealand listed by Koch (1877) as deposited in "k. k. Hofcabinet zu Wien" (NHMW), but could not be found there (J. Gruber, pers. comm.) and is presumed missing.

Syntypes of *Lycosa virgatella*: 1 male, 1 female, 1 immature (OMNZ) labelled "*Ly. Virgata* [handwritten] / Lycosa variegata [sic] Goyen; Id. By Goyen; Goyen Collection" - label inserted by C.L. Wilton (R.R. Forster, pers. comm.). Specimens collected by Goyen from Otago.

Holotype of *Lycosa taylori*: Not seen. Original description based on a male specimen from Leith Valley (45°50'S, 170°30'E). The bulk of Goyen's collection has been destroyed (Forster 1967) and what remains of it are in OMNZ. Despite my thorough search of the collection this type was not found and is presumed lost.

Holotype of *Lycosa tremula*: Not seen. Original description based on a subadult female specimen collected by H.H. Schauinsland in 1896-1897 from either French Pass (40°56'S, 173°50'E), Waikawa (41°16'S, 174°03'E) or Stephens Island (40°38'S, 174°00'E). Schauinsland's specimens were probably in the Naturhistorische Museum, Lübeck and would have been destroyed during the Second World War (M. Grasshoff, pers. comm.). Lycosid types from the Schauinsland collection have been found at both MNHN and SMF, however, the type of *Lycosa tremula* was not found at either institution (C. Rollard, pers. comm., M. Grasshoff, pers. comm.). The type of *Lycosa tremula* is presumed lost.

Holotype of *Lycosa subantarctica*: Not seen. Original description based on a female specimen from Auckland Island (50°35'S, 166°09'E) listed by Forster (1964) as in MONZ, where it was not found and is presumed missing.

Material examined. Syntypes of *Lycosa virgatella* plus, 1204 non-type specimens (573 males, 631 females) - see Appendix B for collection details of specimens examined.

Distribution (Map 12). Found throughout New Zealand, including Stewart Island, Three Kings Islands, Snares Islands and Auckland Islands (TH, ND, CL, AK, WO, BP, TO, TK, HB, RI, WI, WA, WN, SD, NN, MB, KA, BR, NC, WD, MC, MK, SC, FD, OL, CO, DN, SL, SI, SN, AU). Simon (1905) recorded *A. hilaris* from the Chatham Islands but was likely to be a misidentification of the very similar *A. ralphi*. Despite thorough searching by me in December 1999 and extensive invertebrate surveys on other occasions (e.g., Emberson *et al.* 1996), *A. hilaris* has not been found on the Chatham Islands. Roewer (1955a) listed *A. hilaris* as occurring in Tasmania, Australia but presented no evidence. I have examined the collection at the Tasmanian Museum and Art Gallery, Hobart, and collected in Tasmania but have found no evidence of the presence of *A. hilaris*. I consider Roewer's (1955a) listing as an error. Roewer (1955a) also incorrectly recorded *P. vicaria* from New Caledonia, which was most likely a typographical error.

Biology. *Anoteropsis hilaris* inhabits grasslands and open scrub from sea level to sub-alpine areas. This species is common in human modified open habitats such as gardens, pasture and orchards. *Anoteropsis hilaris* is one of the most abundant arthropod predators found in agroecosystems (e.g., Sivasubramaniam *et al.* 1997) and has been investigated as a possible bioindicator species (Hodge & Vink 2000). Adults have been found throughout the year but most commonly in December and January. Eggsacs have been found from September to March and females carrying spiderlings have been seen in December to March. The eggsac has a pinkish tinge when new and is carried behind the spinnerets. A detailed account of eggsac production is shown in Forster & Forster (1973, 1999).

DNA. Four cytochrome c oxidase I and three NADH dehydrogenase subunit I plus $\text{tRNA}^{\text{Leu(CUN)}}$ partial DNA sequences for this species are listed in GenBank (Benson *et al.* 2000) under accession numbers AY059975, AY059976, AY059977, AY059978, AY060012, AY060013 and AY060014 respectively.

Remarks. Despite the type of *Lycosa hilaris* not being found, the illustration of the male bulb (Koch, 1877) shows the structures of the median apophysis, apophysis and tegulum clearly enough for specimens to be identified. The types of *Lycosa umbrata* and *Pardosa vicaria* were also not found, however, Koch's (1877) illustrations of the epigyna are clearly the same as the epigyne of *A. hilaris*. The descriptions by Goyen (1887) of *L. taylori* and Simon (1899) of *L. tremula* are sufficient to confirm a synonymy with *A. hilaris*.

Forster's (1964) description and illustration of *L. subantarctica* were also sufficient to identify it as *A. hilaris*. Other non-type specimens examined from the Auckland Islands were *A. hilaris*.

It is not surprising that there are so many junior synonyms of *A. hilaris* as most early spider taxonomists based their descriptions on non-genitalic characters. The large variation in this species' colour pattern (Fig. 12c-i are from the same population) would have led them to believe they were describing a new species. There is also some variation in the appearance of the epigyne (Fig 76a-c) but this is usually a result of the degree to which the abdomen is distended.

Anoteropsis insularis new species

Fig. 13a-b, 50, 77; Map 13

Diagnosis. Distinguished from all other *Anoteropsis* species by its pale yellow to yellow dorsal surface with dark brown markings, the shape of the median apophysis of the male bulb and the external sclerites of the epigyne. *Anoteropsis insularis* has similar colouration to *A. forsteri* and *A. litoralis*, but the median apophysis is shorter after the bend than *A. forsteri* and the tip points posteriorly, unlike *A. litoralis*. In females, the median septum is thinner than *A. insularis* and the posterior lip is thinner than *A. litoralis*.

Description. Colour: carapace pale yellow to yellow with faint blackish bands extending from fovea, dark brown around eye area with white pubescence (Fig. 13a); sternum yellow-brown to orange brown, blackish at margin and down midline; abdomen pale yellow with dark brown blotches (Fig. 13a) and five white dots on posterior half of dorsal surface; legs pale yellow (femora white) with faint blackish patches. An unusually dark specimen is shown in Fig. 13b.

Chelicerae with three promarginal teeth (distal tooth reduced) and three retromarginal teeth. Tarsi and metatarsi with dense scopulae, especially evident on legs I and II. Male bulb (Fig. 50) with an approximate 90° bend in the median apophysis, which is longer after bend than before bend with posteriorly directed tip. Epigyne (Fig. 77). Internal genitalia with four bends in the copulatory duct.

Dimensions (mm). Male holotype (female allotype): total length 8.5 (8.2); carapace 4.2/3.4 (3.9/3.0), height 1.6 (1.6); abdomen 4.2/3.0 (5.0/3.5); sternum 2.0/1.7 (1.7/1.5).
Size range. Male body length 6.4 – 8.5, female body length 8.2 – 9.1.

Type data. Holotype: male (LUNZ) labelled "NZ, CH, near Red Bluff 43°55'S 176°32'W; on sand dunes at night; 7.xii.1999, C.J. Vink [handwritten]."

Allotype: female (LUNZ) labelled "NZ, CH, near Red Bluff 43°55'S 176°32'W; on sand dunes at night; 7.xii.1999, C.J. Vink [handwritten]."

Paratypes: 3 males 1 female: CH, near Red Bluff, 43°55'S, 176°32'W, 7.xii.1999, C.J. Vink, LUNZ.

Material examined. Type specimens plus 11 non-type specimens (9 males, 2 females) - see Appendix B for collection details of specimens examined.

Distribution (Map 13). Found only on Chatham Island and Pitt Island (CH).

Biology. *Anoteropsis insularis* is found in sand dunes. The colour and pattern of the dorsum provide good camouflage and make specimens difficult to see against the sand. Adults are more commonly active at night and immatures during the day. Females construct small burrows in the sand. Adults have been found in November and December.

DNA. Cytochrome c oxidase I and NADH dehydrogenase subunit I plus $\text{tRNA}^{\text{Leu(CUN)}}$ partial DNA sequences for this species are listed in GenBank (Benson *et al.* 2000) under accession numbers AY059979 and AY060015 respectively.

Etymology. The specific name is derived from *insula* (Latin, an island) and refers to Chatham Island where the species is found.

Anoteropsis lacustris new species

Fig. 14, 51, 78; Map 14

Diagnosis. Distinguished from all other *Anoteropsis* species by the shape of the median apophysis of the male bulb and the external sclerites of the epigyne. *Anoteropsis lacustris* is morphologically similar to *A. cantuaria,* but is usually darker in coloration. The bulbs of the two species are very similar but the median apophysis of *A. cantuaria* has a slightly squarer bend than *A. lacustris.* Females of *A. lacustris* have deep hoods, but not posteriorly directed like *A. cantuaria.*

Description. Colour: carapace dark orange-brown with black stripes radiating from fovea, black around eye area with some white pubescence (Fig. 14); sternum orange brown; abdomen grey; legs dark yellow-brown with blackish annulations.

Chelicerae with three promarginal teeth (distal tooth very reduced) and three retromarginal teeth (proximal tooth reduced). Tarsi and metatarsi with scopulae, especially evident on legs I and II. Male bulb (Fig. 51) with an approximate 90° bend in the median apophysis, which is subequal in length before and after bend. Epigyne (Fig. 78) with deep hoods. Internal genitalia with three bends in the copulatory duct.

Dimensions (mm). Male holotype (female allotype): total length 11.1 (13.3); carapace 5.4/4.1 (6.8/5.2), height 1.3 (2.6); abdomen 5.7/3.2 (6.7/4.0); sternum 2.5/2.0 (3.1/2.6).
Size range. Male body length 7.0 – 11.5, female body length 7.2 – 16.2.

Type data. Holotype: male (LUNZ) labelled "NEW ZEALAND, NC, Arthur's Pass; Bealey River [42°56'S, 171°33'E], under rock in riverbed; 30.iv.1998, Kelly Rennie [handwritten]."

Allotype: female (LUNZ) labelled "NZ, NC, Arthur's Pass, Bealey River [42°56'S, 171°33'E]; under stones in riverbed; 9.iv.1999, C.J. Vink + M.A. Hudson [handwritten]."

Paratypes: 3 males, 3 females: NC, Bealey River, 42°56'S, 171°33'E, 9.iv.1999, C.J. Vink & M.A. Hudson, LUNZ.

Material examined. Type specimens plus 84 non-type specimens (14 males, 70 females) - see Appendix B for collection details of specimens examined.

Distribution (Map 14). Found only in the South Island (NN, BR, NC, WD, MC, SC, MK, OL, FD, CO, SL).

Biology. *Anoteropsis lacustris* is found throughout the South Island. Adults are more commonly active at night and immatures during the day. Adults have been found from October to May but most commonly in January. Eggsacs have been found from October to February and females carrying spiderlings have been seen in January and February.

DNA. 12S rRNA, cytochrome c oxidase I and NADH dehydrogenase subunit I plus tRNA$^{\mathrm{Leu(CUN)}}$ partial DNA sequences for this species are listed in GenBank (Benson *et al.* 2000) under accession numbers AF380489, AY059980 and AY060016 respectively.

Etymology. The specific name is derived from *lacustris* (New Latin, pertaining to a lake) and refers to the main habitat of the species. It was originally conceived by Ray Forster.

Anoteropsis litoralis new species

Fig. 15a-c, 52, 79; Map 15

Diagnosis. Distinguished from all other *Anoteropsis* species by its light yellow dorsal surface with black markings, the shape of the median apophysis of the male bulb and the external sclerites of the epigyne. *Anoteropsis litoralis* has similar colouration to *A. forsteri* and *A. insularis*, but the median apophysis is straight after the bend and not directed posteriorly. In females, the posterior lip of the epigyne is thicker.

Description. Colour: carapace light yellow to light orange-brown with two brownish longitudinal stripes but can vary (see Fig. 15a-c), patch of white pubescence next to PLE; sternum light yellow with grey blotches; abdomen has a light yellow to orange brown heart stripe dorsal surface is usually mottled black on light yellow background (Fig. 15 a-b) but sometimes all grey (Fig. 15c); legs light yellow (femora cream) with faint annulations.

Chelicerae with three promarginal teeth (distal tooth reduced) and three retromarginal teeth (proximal tooth reduced). Tarsi and metatarsi with scopulae, especially evident on legs I and II. Male bulb (Fig. 52) with an approximate 90° bend in the median apophysis, which is longer after bend than before bend and straight after bend. Epigyne (Fig. 79). Internal genitalia with three bends in the copulatory duct.

Dimensions (mm). Male holotype (female allotype): total length 6.2 (9.5); carapace 2.9/2.1 (3.8/2.7), height 1.2 (1.4); abdomen 5.0/1.9 (4.7/3.4); sternum 1.4/1.2 (1.7/1.5).
Size range. Male body length 5.2 – 8.3, female body length 5.9 – 9.1.

Type data. Holotype: male (LUNZ) labelled "NEW ZEALAND, MC, Banks Peninsula; Kaitorete Spit [43°49'S, 172°36'E], yellow pan traps; in *Desmoschoenus spiralis* and debris; in dunes; Feb, 1993, C.J. Vink & A.B. Freeman."

Allotype: female (LUNZ) labelled "A.B. Freeman; NEW ZEALAND, MC; Banks Peninsula; Kaitorete Spit [43°49'S, 172°36'E]; 16.viii.[19]91 / yellow pan traps; in *Desmoschoenus*; *spiralis* in dunes."

Paratypes: 7 males, 4 females: 1 ♀, MC, Kaitorete Spit, 43°49'S, 172°36'E, 1.viii.1991, A.B. Freeman, LUNZ; 1 ♀, 9.viii.1991, A.B. Freeman, LUNZ; 7 ♂, 2 ♀, ii.1993, C.J. Vink & A.B. Freeman, LUNZ.

Material examined. Type specimens plus 35 non-type specimens (25 males, 10 females) - see Appendix B for collection details of specimens examined.

Distribution (Map 15). Found on New Zealand coastlines north of 44°S (CL, BP, HB, WN, WA, NC, MC).

Biology. *Anoteropsis litoralis* inhabits sand dunes and beaches. The colour and pattern of the dorsum provide good camouflage and make specimens difficult to see against the sand. Adults are more commonly active at night and immatures during the day. Adults have been found from October to August.

DNA. Two cytochrome c oxidase I and NADH dehydrogenase subunit I plus tRNA$^{Leu(CUN)}$ partial DNA sequences for this species are listed in GenBank (Benson *et al.* 2000) under accession numbers AY059981, AY059982, AY060017 and AY060018 respectively.

Etymology. The specific name is derived from *litoralis* (Latin, belonging to the sea shore) and refers to the habitat of the species.

Anoteropsis montana new species

Fig. 16, 53, 80; Map 16

Diagnosis. Distinguished from all other *Anoteropsis* species by the rounded tip of the median apophysis of the male bulb, and the lateral sclerites of the epigyne and the "U" shaped posterior lip.

Description. Colour: carapace brown with blackish stripes radiating from fovea and darker at margin, dark brown eye area with some white pubescence (Fig. 16); sternum orange-brown to dark brown with reddish tinge; abdomen dark grey; legs dark orange-brown with brown annulations.

Chelicerae with three promarginal teeth (distal tooth reduced) and three retromarginal teeth. Tarsi and metatarsi with scopulae, especially evident on legs I and II. Male bulb (Fig. 53) with a weak bend in the median apophysis with rounded tip. Epigyne (Fig. 80) with lateral sclerites. Internal genitalia with two bends in the copulatory duct.

Dimensions (mm). Male holotype (female allotype): total length 10.1 (15.9); carapace 5.2/3.8 (7.2/5.7), height 2.2 (2.7); abdomen 5.2/3.1 (8.6/6.1); sternum 2.4/1.9 (3.5/2.6).

Size range. Male body length 9.1 – 11.5, female body length 10.3 – 15.9.

Type data. Holotype: male (MONZ) labelled "Seaward Kaikoura Range,; N. Branch Hapuku River, [42°17'S, 173°41'E]; KA, New Zealand,; 29 Apr. 1991 - 1 May 1991 [handwritten]."

Allotype: female (LUNZ) labelled "NEW ZEALAND, MB, nr Princess Bath; 2.i.1993 G.N. Bawden; alpine grassland."

Paratypes: 2 females: 1 ♀, MB, Molesworth, 42°09'S, 172°44'E, 11.ii.1988, J. Arund, LUNZ; 1 ♀, KA, Molesworth, 42°19'S, 173°06'E, 6.xii.1987, J. Arund, LUNZ.

Material examined. Type specimens plus 14 non-type specimens (8 males, 6 females) - see Appendix B for collection details of specimens examined.

Distribution (Map 16). Found in the north half of the South Island (NN, MB, KA, BR, NC, MC, MK)

Biology. *Anoteropsis montana* is found in scree and riverbeds in mountainous areas. Adults have been found from October to May. An eggsac has been found in January and a female carrying spiderlings in February.

DNA. Cytochrome c oxidase I and NADH dehydrogenase subunit I plus tRNA$^{\mathrm{Leu(CUN)}}$ partial DNA sequences for this species are listed in GenBank (Benson *et al.* 2000) under accession numbers AY059983 and AY060019 respectively.

Etymology. The specific name is derived from *montanus* (Latin, of mountains) and refers to the habitat of the species.

Anoteropsis okatainae new species

Fig. 17, 54, 81; Map 17

Diagnosis. Distinguished from all other *Anoteropsis* species by the shape of the median apophysis of the male bulb and the external sclerites of the epigyne, especially the raised areas adjacent to the median septum. There are similarities in the morphology of the bulb and the epigyne to the much larger *A. senica.* The median apophysis is shorter and the hoods of the epigyne are not as developed as *A. senica.*

Description. Colour: carapace yellow-brown with blackish bands extending from the fovea, blackish band around base of carapace and eye area black (Fig. 17); sternum pale yellow with blackish blotches around edge; abdomen with yellow heart stripe and variable black and red-brown pattern (Fig. 17); legs orange-brown (femora pale yellow) with blackish annulations.

Chelicerae with three promarginal teeth (distal tooth reduced) and three retromarginal teeth (proximal tooth reduced). Tarsi and metatarsi with weak scopulae, especially evident on legs I and II. Male bulb (Fig. 54) with an approximate 90° bend in the median apophysis, which is longer after bend than before bend and wave-like after bend. Epigyne with raised areas adjacent to median septum (Fig. 81). Internal genitalia with three bends in the copulatory duct.

Dimensions (mm). Male holotype (female allotype): total length 5.1 (6.6); carapace 2.6/1.9 (2.9/2.1), height 1.0 (1.1); abdomen 2.6/1.6 (3.9/2.6); sternum 1.4/1.1 (1.3/1.1).
Size range. Male body length 4.2 – 5.1, female body length 5.1 – 7.6.

Type data. Holotype: male (LUNZ) labelled "NZ, BP, Lake Okataina 38°08'S 176°25'E; lake shore at night; 17.ii.2000 C.J. Vink [handwritten]."

Allotype: female (LUNZ) labelled " NZ, BP, Lake Okataina 38°08'S 176°25'E; lake shore at night; 17.ii.2000 C.J. Vink [handwritten]."

Paratypes: 2 females: BP, Lake Okataina, 38°08'S, 176°25'E, 17.ii.2000, C.J. Vink, LUNZ.

Material examined. Type specimens plus 5 non-type specimens (2 males, 3 females) - see Appendix B for collection details of specimens examined.

Distribution (Map 17). Known only from the fine gravel shores of Lake Okataina (BP).

Biology. *Anoteropsis okatainae* was found at night on the shore of Lake Okataina. Adults have been found in February and October.

DNA. Cytochrome c oxidase I and NADH dehydrogenase subunit I plus tRNA$^{\mathrm{Leu(CUN)}}$ partial DNA sequences for this species are listed in GenBank (Benson *et al.* 2000) under accession numbers AY059984 and AY060020 respectively.

Etymology. The specific name refers to the type locality, Lake Okataina.

Anoteropsis ralphi (Simon) new combination

Fig. 18a-c, 55, 82; Map 18

Lycosa ralphi Simon, 1905: 421.
Alopecosa ralphi (Simon) - Roewer, 1955a: 224.
Lycosa turbida Simon, 1905: 422. New synonymy.
Dingosa turbida (Simon) - Roewer, 1955a: 240.
Lycosa retiruga Simon, 1905: 422-423. New synonymy.
Allocosa retiruga (Simon) - Roewer, 1955a: 206.
Lycosa algida Simon, 1905: 423-424. New synonymy.

Diagnosis. Distinguished from all other *Anoteropsis* species by the shape of the median apophysis of the male bulb and the external sclerites of the epigyne. *Anoteropsis ralphi* is morphologically similar to *A. hilaris*, however, the basoembolic apophysis has a short spur and the tip of the median apophysis id directed posteriorly. The median septum of the female epigyne is usually thinner than *A. hilaris*.

Description. Colour: carapace orange-brown with yellow longitudinal band, blackish lines radiating from fovea, dark brown at carapace margin and yellow-brown longitudinal bands above margin, black around eye area (Fig. 18); sternum orange-brown with faint brown markings, abdomen brown with a yellow-brown heart stripe but does vary (see Fig. 18a-c); legs orange brown (femora yellow-brown) with blackish annulations.

Chelicerae with three promarginal teeth (distal tooth reduced) and three retromarginal teeth (proximal tooth reduced). Tarsi and metatarsi with weak scopulae, especially evident on legs I and II. Male bulb (Fig. 55) with short to medium, tooth-like spur on basoembolic apophysis; median apophysis with an approximate 90° bend, which is longer after bend than before bend with posteriorly directed tip. Female epigyne (Fig. 82). Internal genitalia with at least five bends in the copulatory duct.

Dimensions (mm). Male CH, Mairangi (female CH, Mairangi): total length 7.6 (7.7); carapace 4.1/2.8 (3.9/2.7), height 1.3 (1.1); abdomen 3.6/3.0 (4.0/2.6); sternum 2.0/1.5 (1.7/1.4).
Size range. Male body length 5.5 – 7.6, female body length 6.1 – 9.8.

Type data. Syntypes of *Lycosa ralphi*: Not seen. Original description based on male and female specimens collected by H.H. Schauinsland in 1896-1897 from the Chatham Islands. Schauinsland's specimens were probably in the Naturhistorische Museum, Lübeck and would have been destroyed during the Second World War (M. Grasshoff, pers. comm.). Lycosid types from the Schauinsland collection have been found at both MNHN and SMF, however, the types of *Lycosa ralphi* were not found at either institution (C. Rollard, pers. comm., M. Grasshoff, pers. comm.). The types of *Lycosa ralphi* are presumed lost.

Holotype of *Lycosa turbida*: Not seen. Original description based on a female specimen collected by H.H. Schauinsland in 1896-1897 from the Chatham Islands and is considered lost (see note above).

Holotype of *Lycosa retiruga*: Not seen. Original description based on a female specimen collected by H.H. Schauinsland in 1896-1897 from the Chatham Islands and is considered lost (see note above).

Holotype of *Lycosa algida*: female (SMF RII/4968) labelled "Arachn. Coll. Roewer ~ Lfd.No. 4968; Araneae: Lycosidae No. 269; *Lycosa algida* Sim[on].; 1♀ Chatham-Inseln, ex coll. Schauinsland; Typ.-Simon, det. 1905. [handwritten on a pre-printed Roewer Collection label]."

Material examined. Holotype of *Lycosa algida* plus 100 non-type specimens (42 males, 58 females) - see Appendix B for collection details of specimens examined.

Distribution (Map 18). Known only from the Chatham Islands (CH). Roewer (1955a) listed *A. ralphi* as occurring on Hawaii but presented no evidence to support this. *Anoteropsis ralphi* has not been found on Hawaii and Roewer's (1955a) listing is considered an error (Nishida 1992).

Biology. *Anoteropsis ralphi* is found in grassland and open scrub throughout the Chatham Islands. Adults have been found from September to April. Eggsacs have been found from November to March and a female carrying spiderlings was found in December.

DNA. Cytochrome c oxidase I and NADH dehydrogenase subunit I plus tRNA$^{Leu(CUN)}$ partial DNA sequences for this species are listed in GenBank (Benson *et al.* 2000) under accession numbers AY059985 and AY060021 respectively.

Remarks. Despite the types of *Lycosa ralphi*, *L. turbida* and *L. retiruga* not being found, the descriptions (Simon 1905) are adequate enough to identify them as the same species. It is not surprising that there are so many junior synonyms of *A. ralphi* as Simon (1905) based his descriptions on non-genitalic characters and the large variation in this species colour pattern (see Fig. 18a-c) would have led him to believe he was describing different species. *Anoteropsis ralphi* is similar in genitalic and non-genitalic appearance to *A. hilaris* and this may explain why Simon (1905) mistakenly identified a specimen from the Chatham Islands as *A. hilaris*.

Anoteropsis senica (L. Koch) new combination

Fig. 19a-b, 56, 83; Map 19

Lycosa senica L. Koch, 1877: 915, plate 79, fig. 3.
Hogna senica (L. Koch) - Roewer, 1955a: 253.
Lycosa uliginosa Goyen, 1887: 136 (primary homonym of *Lycosa uliginosa* Westering, 1862).
Lycosa goyeni Roewer, 1951: 439 (replacement name for *Lycosa uliginosa* Goyen). New synonymy.
Pardosa goyeni (Roewer) - Roewer, 1955a: 185.

Diagnosis. Distinguished from all other *Anoteropsis* species by the shape of the median apophysis of the male bulb and the external sclerites of the epigyne, especially the raised areas adjacent to the median septum. There are similarities in the morphology of the bulb and the epigyne to the much smaller *A. okatainae*. The median apophysis is longer and the hoods of the epigyne are deeper than *A. okatainae*.

Description. Colour: carapace orange-brown with blackish markings extending from fovea (Fig. 19a-b); sternum orange-brown; abdomen dark grey with two light yellow blotches towards the posterior and numerous small light yellow blotches (Fig. 19a-b), male with yellow-orange heart stripe, which is duller in female; legs orange-brown (femora yellow-brown) with faint darker annulations.

Chelicerae with three promarginal teeth (distal tooth very reduced) and three retromarginal teeth. Tarsi and metatarsi with scopulae, especially evident on legs I and II. Male bulb (Fig. 56) with an approximate 90° bend in the median apophysis, which is longer after bend than before bend and wave-like after bend. Epigyne with raised areas adjacent to median septum (Fig. 83). Internal genitalia with two bends in the copulatory duct.

Dimensions (mm). Male WD, Fox Glacier (female WD, Fox Glacier): total length 11.0 (11.0); carapace 6.0/4.5 (5.6/4.2), height 2.0 (2.2); abdomen 5.2/3.6 (5.3/3.9); sternum 2.9/2.1 (2.7/2.1).
Size range. Male body length 7.4 - 11.7, female body length 8.2 - 15.8.

Type data. Type(s) of *Lycosa senica*: Not seen. Original description based on a female specimen(s) from an unspecified locality in New Zealand listed by Koch (1877) as deposited in "Mr. Bradley's Sammlung" (Bradley Collection, Macleay Museum, University of Sydney), but could not be found there (M. Humphrey, pers. comm.). It was also not found at the Zoologisches Institut und Zoologisches Museum, Hamburg (Rack 1961, H. Dastych, pers. comm.) where much of Koch's collection is held.

Syntypes of *Lycosa uliginosa* Goyen: 2 females and 14 spiderlings (OMNZ) labelled "No data: Goyen Collection" - label inserted by C.L. Wilton (R.R. Forster, pers. comm.).

Material examined. Syntypes of *Lycosa uliginosa* plus 241 non-type specimens (67 males, 174 females) - see Appendix B for collection details of specimens examined.

Distribution (Map 19). Found throughout New Zealand south of 37°S and Stewart Island (GB, TO, TK, RI, WA, SD, NN, WN, KA, BR, WD, NC, MC, SC, CO, FD, OL, DN, SL, SI).

Biology. *Anoteropsis senica* inhabits alluvial river beds and is well camouflaged against the surrounding rocks and gravel. This species is a nocturnal hunter. Adults are found throughout the year but most commonly in December and January. Females have been found from September to January in scooped-out depressions under stones in riverbeds with their eggsacs (Forster & Forster 1973, 1999, pers. obs.). Females with spiderlings have been seen in December and January.

DNA. 12S rRNA, two cytochrome c oxidase I and two NADH dehydrogenase subunit I plus $\text{tRNA}^{\text{Leu(CUN)}}$ partial DNA sequences for this species are listed in GenBank (Benson *et al.* 2000) under accession numbers AF380490, AY059986, AY059987, AY060022 and AY060023 respectively.

Remarks. The type of *Lycosa senica* could not be located, however, the illustration of the female genitalia and the description (Koch, 1877) are sufficient to confirm its identity. *Lycosa uliginosa* was described by Goyen (1887) from an unspecified number of female and male specimens collected on the shores of Lake Wanaka (44°42'S, 169°07'E). Forster (1967) stated that most of Goyen's material has been lost, however, two female specimens were found in what remains of the Goyen Collection at OMNZ. The male type specimen[s] was not located and is presumed lost.

Anoteropsis urquharti (Simon) new combination

Fig. 20, 57, 84; Map 20

Lycosa urquharti Simon, 1898a: 28-29.
Hogna urquharti (Simon) - Roewer, 1955a: 253.

Diagnosis. Distinguished from all other *Anoteropsis* species by the dense patch of white pubescence below the PLE, the shape of the median apophysis of the male bulb and the external sclerites of the epigyne. *Anoteropsis urquharti* is morphologically similar to *A. aerescens*, *A. arenivaga*, *A. canescens* and darker specimens of *A. litoralis*. Males are distinguishable by the median apophysis, which tapers towards the tip and points anteriorly. It is difficult to differentiate females but there are subtle differences in the shape of the posterior lip and median septum.

Description. Colour: carapace brown to black with blackish lines radiating from fovea, orange -brown area at centre, black around eye area, patch of white pubescence next to PLE (Fig. 20); sternum dark yellow-brown with faint blackish markings; abdomen grey with black blotches, faint yellow-grey heart stripe, two paired yellow-brown blotches at posterior (Fig. 20); legs yellow-brown with blackish annulations.

Chelicerae with three promarginal teeth (distal tooth reduced) and three retromarginal teeth (proximal tooth reduced). Tarsi and metatarsi with scopulae, especially evident on legs I and II. Male bulb (Fig. 57) with an approximate 90° bend in the median apophysis, which is longer after bend than before bend and wave-like after bend. Epigyne (Fig. 84). Internal genitalia with three bends in the copulatory duct.

Dimensions (mm). Male OL, near Rees Valley (female CO, Rock and Pillar Range): total length 7.0 (7.7); carapace 4.0/2.7 (4.4/3.0), height 1.3 (1.9); abdomen 2.9/2.2 (3.5/2.6); sternum 1.7/1.6 (2.0/1.7).
Size range. Male body length 5.8 – 8.4, female body length 6.9 – 9.5.

Type data. Type(s) of *Lycosa urquharti*: Not seen. Original description based on a female specimen(s) from an unspecified locality in montane New Zealand (Simon, 1898a). Most of Simon's existing types are housed in MNHN but the type of *L. urquharti* was not located there (C. Rollard, pers. comm.) and is presumed lost.

Material examined. 19 non-type specimens (12 males, 7 females) - see Appendix B for collection details of specimens examined.

Distribution (Map 20). Found in mountainous regions of the South Island south of 43°S (MC, OL, CO).

Biology. *Anoteropsis urquharti* inhabits mountain scree and stony ground. Adults have been found from September to April.

DNA. Three cytochrome c oxidase I and NADH dehydrogenase subunit I plus tRNA$^{\mathrm{Leu(CUN)}}$ partial DNA sequences for this species are listed in GenBank (Benson *et al.* 2000) under accession numbers AY059988, AY059989, AY059990, AY060024, AY060025 and AY060026 respectively.

Remarks. Although the type(s) could not be found, Simon's (1898a) description, including habitat, are sufficient to confirm its identity.

Anoteropsis westlandica new species

Fig. 21, 58, 85; Map 21

Diagnosis. Distinguished from all other *Anoteropsis* species by the crescent-shaped tip of the median apophysis of the male bulb and the external sclerites of the epigyne, especially the posterior lip. Morphologically similar to *A. hallae* but the median apophysis is wider at the tip and the posterior lip of the epigyne is "V" shaped.

Description. Colour: carapace brown with faint yellow-brown longitudinal stripes near margins and a wide yellow longitudinal stripe (Fig. 21); sternum orange-brown; abdomen dark brown with light yellow heart stripe; legs yellow-brown (femora with olive tinge) with orange-brown annulations.

Chelicerae with three promarginal teeth (distal tooth reduced) and three retromarginal teeth. Tarsi and metatarsi with weak scopulae, especially evident on legs I and II. Male bulb (Fig. 58) with a weak bend in the median apophysis, which is bifurcate and crescent-shaped at tip. Epigyne (Fig. 85) with lateral sclerites and raised posterior lip. Internal genitalia with two bends in the copulatory duct.

Dimensions (mm). Male holotype (female allotype): total length 6.3 (7.2); carapace 3.3/2.5 (4.0/3.0), height 1.4 (1.8); abdomen 2.7/1.8 (3.7/2.9); sternum 1.5/1.3 (1.7/1.5).
Size range. Male body length 4.4 – 7.3, female body length 6.0 – 8.1.

Type data. Holotype: male (LUNZ) labelled "NEW ZEALAND, WD, Franz Josef Glacier [43°24'S, 170°11'E]; nr glacier car park; running on streambed; 15.xi.1995 C.J. Vink [handwritten]."

Allotype: female (OMNZ) labelled "NEW ZEALND, WD, Lake Paringa [43°43'S, 169°24'E]; 6-9.xii.1960; J.I. Townsend & P.R. Kettle [handwritten]."

Paratypes: 5 males, 2 females: 1 ♀, WD, Lake Paringa, 43°43'S, 169°24'E, 6-9.xii.1960, J.I. Townsend & P.R. Kettle, OMNZ; 5 ♂, 1 ♀, 11-14.xii.1994, C.J. Vink, LUNZ.

Material examined. Type specimens plus 15 non-type specimens (2 males, 13 females) - see Appendix B for collection details of specimens examined.

Distribution (Map 21). Found only in the West of the South Island (NN, WD, FD). One specimen was collected east of the Southern Alps near the headwaters of Havelock River (SC) but may have accidentally ballooned over the mountains.

Biology. *Anoteropsis westlandica* inhabits forest and damp forest margins. Adults have been found from November to March and June. Eggsacs have been found in December and January.

DNA. Cytochrome c oxidase I and NADH dehydrogenase subunit I plus tRNA$^{Leu(CUN)}$ partial DNA sequences for this species are listed in GenBank (Benson *et al.* 2000) under accession numbers AY059991 and AY060027 respectively.

Etymology. The specific name is a noun in apposition taken from the Westland region of New Zealand, where the species is found.

Genus *Artoria* Thorell

Artoria Thorell, 1877: 531. – Barrion & Litsinger, 1995: 364. Framenau, 2002: 210-211. Type species: *Artoria parvula* Thorell, 1877, by monotypy

Artoriella Roewer, 1960: 563. - Framenau, 2002: 210.

Trabaeola Roewer, 1960: 582. - Framenau, 2002: 210.

Description. (Based on Framenau 2002) Body length 2.6 - 9.5 mm. Carapace orange-brown to black (always orange-brown in New Zealand species). Anterior eyes procurved (strongly in *A. hospita* and *A. separata*, see Fig. 31) and, in all New Zealand species, the distance between anterior lateral eyes and anterior median eyes is greater than the width of two anterior lateral eyes. New Zealand species with yellow-brown to orange-brown abdomen, often with faint heart stripe. Legs in descending order of length usually 4123 (male and female), in all New Zealand species the fourth leg is longest. Male: varying amounts of macrosetae at cymbium tip; pedipalp tibial length shorter than cymbium length; median apophysis either spoon shaped or (as in all New Zealand species) bifurcate; basoembolic apophysis broad and bent ventrally; embolus varies in shape (slim to thick); terminal apophysis functions as a conductor, sometimes forming a groove in which the embolus rests; subtegulum at posterior lateral margin of tegulum. Female: epigyne variable; all New Zealand species with a developed median septum (very much so in *A. hospita* and *A. separata*); internal genitalia simple, consisting of a slightly curved copulatory duct leading to a rounded spermatheca.

Remarks. Framenau (2002) has redefined *Artoria* and has described seven new species and redescribed seven others. *Artoria* shares the ventrally bent basoembolic apophysis with *Anoteropsis* and *Notocosa*, but it is much broader in *Artoria*. The bulk of *Artoria* species are found in Australia, where there are more than 50 species (pers. obs., V.W. Framenau, pers. comm.). Australia is the centre of *Artoria* diversity and all three New Zealand species are restricted to the warmer, northern half of the North Island. It seems likely that *Artoria* species arrived in New Zealand after the *Anoteropsis* radiation.

Artoria does not fit any of the current lycosid subfamilies defined by Dondale (1986), Alderweireldt and Jocqué (1993) or Zyuzin (1985, 1993). The lobe of the tegulum forming part of the conductor is similar to some genera in the subfamily Lycosinae (*sensu* Dondale 1986). However, the enlarged and longitudinally oriented median apophysis and the terminal apophysis functioning as a conductor are characters that Dondale (1986) listed as found in Venoniinae. The groove in the terminal apophysis in which the embolus rests, is known only from *Artoria* spp. and *Anoteropsis* spp. (C.D. Dondale, pers. comm.). The terminal apophysis forming part of the conductor, the partially divided tegulum and the ventrally bent basoembolic apophysis are shared with *Anoteropsis* and *Notocosa* gen. nov. Molecular data also support this relationship and places these genera basally in the Lycosidae (Text-fig. 1 Vink *et al.* in press). Further revisions of Australasian lycosids may result in a separate subfamily at least for *Anoteropsis*, *Artoria* and *Notocosa*.

Artoria hospita new species

Fig. 22, 59, 86; Map 22

Diagnosis. Distinguished from all other New Zealand *Artoria* species by the male bulb and female epigyne. Morphologically similar to *A. separata* but the mesially directed hook-like spur is nearer to the middle of the median apophysis and the medium septum of the epigyne is shorter.

Description. Colour: carapace orange-brown with faint blackish stripes radiating from fovea, black around eye area (Fig. 22); sternum yellow-brown with faint blackish longitudinal band; abdomen orange-brown with brown blotches and faint heart stripe (Fig. 22); legs yellow-brown with faint blackish annulations.

Chelicerae with three promarginal teeth (distal tooth reduced) and three retromarginal teeth. Male bulb (Fig. 59) with mesially directed hook-like spur near the base of the median apophysis. Epigyne (Fig. 86) with a large, spatulate median septum. Internal genitalia bulbous.

Dimensions (mm). Male holotype (female allotype): total length 5.1 (6.6); carapace 2.9/2.1 (2.9/2.1), height 1.2 (1.0); abdomen 2.1/1.7 (3.5/2.5); sternum 1.2/1.1 (1.2/1.1).
Size range. Male body length 5.1 – 6.2, female body length 4.3 – 8.0.

Type data. Holotype: male (MONZ) labelled "Mt Ngongotaha [38°05'S, 176°13'E], Rotorua, BP,; New Zealand. Ex leaf mould.; Coll: R.G. Ordish,; 13 May 1971."

Allotype: female (NZAC) labelled "NEW ZEALAND, BP Rotorua; L. Okataina [38°08'S, 176°25'E], Western Walkway 400m; 11 Mar 1995 M.C. Larivière Litter 95/2."

Paratypes: 1 male, 1 female: 1 ♂, BP, Mt Ngongotaha, 38°05'S, 176°13'E, 13.v.1971, R.G. Ordish, MONZ; 1 ♀, 1962, C.W. O'Brien, OMNZ (Honolulu Collection).

Material examined. Type specimens plus 15 non-type specimens (7 males, 8 females) - see Appendix B for collection details of specimens examined.

Distribution (Map 22). Found in the northern half of the North Island (CL, AK, BP, TO).

Biology. *Artoria hospita* is found in or near forests (usually in leaf litter). Adults have been found throughout the year and a female carrying spiderlings was found in January.

Etymology. The specific name is derived from *hospitus* (Latin, a visitor), as this species is likely to be a comparatively recent arrival from Australia.

Artoria segrega new species

Fig. 23, 60, 87; Map 23

Diagnosis. Distinguished from all other New Zealand *Artoria* species by its small size, the weak spur near the base of the median apophysis of male bulb and the relatively undeveloped median septum of the female epigyne.

Description. Colour: carapace orange-brown with weak blackish lines radiating from fovea, blackish margin, black around eye area (Fig. 23); sternum orange-brown with weak blackish blotch in centre; abdomen yellow-brown covered with brownish blotches (Fig. 23); legs orange-brown (femora yellow-brown) with weak blackish annulations.

Chelicerae with three promarginal teeth (distal and proximal teeth very reduced) and three retromarginal teeth. Male bulb (Fig. 60) with weak spur near the base of the median apophysis. Epigyne (Fig. 87) with a raised median septum. Internal genitalia bulbous.

Dimensions (mm). Male holotype (female allotype): total length 4.3 (4.4); carapace 2.4/1.5 (2.4/1.6), height 0.7 (1.3); abdomen 1.7/1.2 (2.0/1.3); sternum 1.0/0.8 (1.1/0.9).
Size range. female body length 4.4 – 5.3.

Type data. Holotype: male (NZAC) labelled "NEW ZEALAND ND, Poor Knights; Is, Tawhiti Rahi [35°27'S, 174°43'E] 100 m; 7-12 Sep 1980. J.C. Watt; pit trap 80/81 / *Lycosa* sp. ♂; Det. D.J. Court; 195 [circled] [handwritten]."

Allotype: female (NZAC) labelled "NEW ZEALAND ND, Poor Knights; Tawhiti Rahi [35°27'S, 174°43'E], 5 Dec 1980; G. Kuschel. Sifted decayed wood; & litter on plateau 80/136 / Lycosid imms.; unidet. imms. 37 [circled]; Det. D.J. Court [handwritten]."

Paratype: 1 female: ND, Tawhiti Rahi, 35°27'S, 174°43'E, 3-10.xii.1980, J.C. Watt, NZAC.

Material examined. Type specimens - see Appendix B for collection details of specimens examined.

Distribution (Map 23). Found only on Tawhiti Rahi, Poor Knights Islands (ND).

Biology. *Artoria segrega* appears to be litter dwelling. Adults have been found in September and December.

Etymology. The specific name is derived from *segregus* (Latin, separated) as this species is separated from the vast majority of its congeners, which are found in Australia.

Artoria separata new species

Fig. 24, 31, 61, 88, 95; Map 24

Diagnosis. Distinguished from all other New Zealand *Artoria* species by the male bulb and female epigyne. Morphologically similar to *A. hospita* but the mesially directed hook-like spur is nearer to the base of the median apophysis and the medium septum of the epigyne is longer.

Description. Colour: carapace orange-brown with blackish stripes radiating from fovea, black around eye area (Fig. 24); sternum pale yellow to light orange-brown; abdomen orange-brown with brown blotches and faint heart stripe (Fig. 24); legs yellow-brown to orange-brown with faint darker annulations.

Chelicerae with three promarginal teeth (distal tooth reduced) and three retromarginal teeth. Male bulb (Fig. 61) with mesially directed hook-like spur near the base of the median apophysis. Epigyne (Fig. 88) with a large, spatulate median septum. Internal genitalia (Fig. 95).

Dimensions (mm). Male holotype (female allotype): total length 5.8 (7.3); carapace 3.6/2.6 (3.2/2.3), height 1.3 (1.1); abdomen 2.3/2.0 (3.8/2.7); sternum 1.4/1.3 (1.3/1.2).
Size range. Male body length 4.6 – 6.0, female body length 5.8 – 7.3.

Type data. Holotype: male (MONZ) labelled "New Zealand: North Is.; Taranaki: Kaitake Ra.; West. [39°10'S, 173°58'E]; 27.vii.1996; Coll. J. Clark [handwritten]."

Allotype: female (MONZ) labelled "New Zealand: North Is.; Taranaki, Tarata [39·09'S, 174°22'E]; ex forest floor; 24.vii.1996; coll. J. Clark [handwritten]."

Paratypes: 1 male, 1 female: TK, Kaitake Range, 39°10'S, 173°58'E, 27.vii.1996, J. Clark, MONZ.

Material examined. Type specimens plus 26 non-type specimens (11 males, 15 females) - see Appendix B for collection details of specimens examined.

Distribution (Map 24). Found in the northwest of the North Island (ND, WO, TK).

Biology. *Artoria separata* inhabits forest and forest litter. Adults have been found throughout the year. Eggsacs have been found in December.

DNA. Cytochrome c oxidase I and NADH dehydrogenase subunit I plus tRNA$^{Leu(CUN)}$ partial DNA sequences for this species are listed in GenBank (Benson *et al.* 2000) under accession numbers AY059993 and AY060029 respectively.

Etymology. The specific name is derived from *separatus* (Latin, separated) as this species is separated from the vast majority of its congeners, which are found in Australia.

Genus *Geolycosa* Montgomery

Geolycosa Montgomery, 1904: 292-293. – Wallace, 1942: 2, 5. Katson, 1948: 316-318. Roewer, 1960: 701. Dondale & Redner, 1990: 26-27. Zyuzin & Logunov, 2000: 308-309. Type species: *Geolycosa latifrons* Montgomery, 1904 by original designation.
Scaptocosa Banks, 1904: 113. – Dondale & Redner, 1990: 30.

Description. (Based on Dondale & Redner 1990) Body length 8.5 - 18.0 mm. Carapace elevated anterior to fovea (not so in *G. tongatabuensis*). Anterior row of eyes straight or slightly procurved. Chelicerae with three promarginal teeth and three retromarginal teeth. Legs in descending order of length 4123 (male and female).

Found in deep, vertical burrows. Male: without macrosetae at cymbium tip (not so in *G. tongatabuensis*); pedipalp tibial length shorter than cymbium length; bulb with sickle-shaped terminal apophysis; embolus long, slender, curved and parallel to terminal apophysis; median apophysis triangular with mesially directed spur; subtegulum at posterior lateral margin of tegulum. Female: epigyne with hoods, median septum large and shaped like inverted "T"; internal genitalia with large, bulbous spermathecae, often with nodules.

Remarks. *Geolycosa* has been a convenient genus in which to dump many new burrowing wolf spider species. Dondale and Redner (1990) have redefined the genus and believed that *Geolycosa* was restricted to North America, however, Zyuzin and Logunov (2000) have shown that two Palaearctic species belong in *Geolycosa*.

Geolycosa tongatabuensis (Strand)

Fig. 25, 62, 89, 96; Map 25

Tarentula tongatabuensis Strand, 1911: 207. - Strand, 1915: 258, plate 14, fig 21, plate 19, fig 99.
Tarentula tanna Strand, 1913: 121-122. - Strand, 1915: 260, plate 19, fig. 96a-b.
Lycosa tanna (Strand) – Berland, 1938: 182-183, figs 147-149. - Ledoux & Hallé, 1995: 7.
Scaptocosa tongatabuensis (Strand) – Roewer, 1955a: 291.
Varacosa tanna (Strand) – Roewer, 1955a: 305.
Varacosa tanna (Strand) - Chrysanthus, 1967: 424, figs 73, 78-79.
"*Lycosa*" *tongatabuensis* (Strand). – Ledoux & Hallé, 1995: 7, figs 5A-C.
Geolycosa tongatabuensis (Strand). - Platnick, 1997: 554.

Diagnosis. Distinguished from all other New Zealand lycosid species by the elongated cymbium, the sickle-shaped terminal apophysis of the male bulb and the inverted "T"-shaped median septum of the female epigyne.

Description. Colour: carapace orange-brown with yellow-orange medial band, yellow-orange with blackish blotches at carapace edge, black around eyes and blackish stripes radiating from fovea (Fig. 25); sternum yellow-brown; abdomen pale yellow with grey blotches (Fig. 25); legs orange-brown, femora yellow-brown.

Chelicerae with three promarginal teeth and three retromarginal teeth. Tarsi and metatarsi with scopulae, especially evident on legs I and II. Male pedipalp (Fig. 62) with four macrosetae at cymbium tip; elongate cymbium; sickle-shaped terminal apophysis; embolus long, slender, curved and parallel to terminal apophysis. Epigyne (Fig. 89) with large median septum shaped like an inverted "T". Internal genitalia (Fig. 96) bulbous with nodules.

Dimensions (mm). Male KE, Curtis Island (female KE, Raoul Island): total length 10.2 (16.5); carapace 6.1/4.7 (7.8/5.8), height 2.2 (3.7); abdomen 4.7/3.4 (8.6/4.7); sternum 2.6/2.1 (3.4/2.4).
Size range. Male body length 8.5 – 10.2, female body length 10.1 – 16.5.

Type data. Lectotype of *Tarentula tongatabuensis* (here designated): female (SMF 2199) labelled "*Tarentūla tongatabūensis* Strand; 2♀ Typūs; Nūkū alafa aūf Tongatabū [Nuku'alofa, Tongatupu, Tonga 21°07'S, 175°12'W]; E. Wolf [4 June] 1909 [handwritten]."

Paralectotype of *Tarentula tongatabuensis* (here designated): juvenile (SMF 2199) labelled "*Tarentūla tongatabūensis* Strand; 2♀ Typūs; Nūkū alafa aūf Tongatabū [Nuku'alofa, Tongatupu, Tonga 21°07'S, 175°12'W]; E. Wolf [4 June] 1909 [handwritten]." The adult syntype is designated here as a lectotype in order to fix this taxonomic concept of *Tarentula tongatabuensis*; the immature syntype lacked many characters necessary for the identification and confirmation of this species concept.

Holotype of *Tarentula tanna*: female (SMF 2167) labelled "*Tarentūla tannae* [sic] Strand; 1♀ Typūs; Tanna: Neū Hebriden [Tanna, Vanuatu, 19°30'S, 169°20'E]; E. Wolf S. [23 May] 1909 [handwritten]."

Material examined. Lectotype and paralectotype of *Tarentula tongatabuensis* and holotype of *Tarentula tanna* plus 11 non-type specimens (3 males, 8 females) - see Appendix B for collection details of specimens examined.

Distribution (Map 25). Found on the Kermadec Islands, Northland and Coromandel (KE, ND, CL). Also found in Tonga, Vanuatu, French Polynesia, Papua New Guinea and Western Samoa.

Biology. *Geolycosa tongatabuensis* inhabits beaches and sand dunes. Adults have been found from September to April. A female with an eggsac was found in December.

DNA. 12S rRNA and NADH dehydrogenase subunit I plus tRNA$^{\mathrm{Leu(CUN)}}$ partial DNA sequences for this species are listed in GenBank (Benson *et al.* 2000) under accession numbers AY059959 and AY059994 respectively.

Remarks. The pedipalpal and epigynal morphology of *G. tongatabuensis* conform to Dondale and Redner's (1990) definition of *Geolycosa*. However, the macrosetae at the tip of the cymbium and the uniform height of the carapace do not fit their definition but are listed as characteristics of *Hogna* Simon, 1885 (Dondale & Redner 1990). *Geolycosa* was chosen over *Hogna* because genitalic structure seems to be more important than somatic characters in lycosid classification. Genitalic morphology indicates that *G. tongatabuensis* is closely related to *Trochosa papakula* (Strand, 1911), *Hogna galapagoensis* (Banks, 1902) and *Lycosa howarthi* Gertsch, 1973. These species may be part of an undescribed Pacific genus that requires the examination of more material before it can be established.

Genus *Notocosa* new genus

Type species: *Lycosa bellicosa* Goyen, 1888, here designated.

Description. Body length 8.9 –11.5 mm. Cephalothorax orange-brown. Abdomen blackish with cream heart stripe; female with four cream coloured patches around the heart stripe. Legs in descending order of length 4123 (male and female). Chelicerae with three promarginal teeth and three retromarginal teeth. Male: eight or more macrosetae at cymbium tip; pedipalp tibial length shorter than cymbium length; bulb (Fig. 63) with a large median apophysis with shiny, spherical tip, which is the synapomorphy for the genus; embolus short, thin and curved; embolus and terminal apophysis at tip of bulb; small basoembolic apophysis, bent ventrally; subtegulum at posterior lateral margin of tegulum. Female: epigyne (Fig. 90) simple with a large, wide median septum; internal genitalia simple consisting of a short, wide copulatory duct ending in bulbous spermatheca (Fig. 97).

Remarks. *Notocosa* is a monotypic genus. No other species have been found in New Zealand and Australia despite extensive collecting and examination of collections in both countries.

The small embolus and terminal apophysis at the tip of the male bulb, the enlarged median apophysis, the terminal apophysis functioning as a conductor conforms with Dondale's (1986) definition of Venoniinae. The partially divided tegulum and the ventrally bent basoembolic apophysis are shared with *Anoteropsis* and *Artoria*. Molecular data also support this relationship and place these genera basally in the Lycosidae (Vink *et al.* in press).

Etymology. The generic name is derived from *noto* (Greek, the south quarter) and *-cosa* (New Latin, a genus of Lycosidae), and refers to the distribution of the monotypic species, *Notocosa bellicosa*, in New Zealand. It is considered feminine gender.

Notocosa bellicosa (Goyen) new combination

Fig. 26, 34, 63, 90, 97; Map 26

Lycosa bellicosa Goyen, 1888: 138-139.
Pardosa bellicosa (Goyen) - Roewer, 1955a: 185.

Diagnosis. Distinguished from all other New Zealand lycosid species by the large, spherically tipped median apophysis of the male bulb and the simple female epigyne with a large medium septum.

Description. Colour: carapace orange-brown (Fig. 26); sternum orange-brown; abdomen blackish with cream heart stripe, female has four cream coloured patches around the heart stripe; legs orange-brown with faint, darker annulations.

Chelicerae with three promarginal teeth and three retromarginal teeth. Tarsi and metatarsi with dense scopulae, especially evident on legs I and II. Male bulb (Fig. 63) with a large, spherically tipped median apophysis. Epigyne (Fig. 90) simple with large median septum. Internal genitalia (Fig. 97) simple with one bend in copulatory duct.

Dimensions (mm). Male MC, Birdlings Flat (female MC, Birdlings Flat): total length 9.8 (9.5); carapace 4.7/3.5 (4.4/3.1), height 1.9 (1.7); abdomen 4.8/3.0 (5.0/3.0); sternum 2.1/1.7 (1.9/1.4).
Size range. Male body length 8.9 – 9.6, female body length 9.5 – 11.5.

Type data. Type(s): Not seen. Original description based on a female specimen(s) from Clutha Valley (46°06'S, 169°31'E). The bulk of Goyen's collection was destroyed (Forster 1967) and what remains of it is in OMNZ. Despite my thorough search of the collection this type was not found and is presumed lost.

Material examined. 105 non-type specimens (77 males, 28 females) - see Appendix B for collection details of specimens examined.

Distribution (Map 26). Found south of 43°S in the South Island (MC, SC, MK, CO, DN).

Biology. *Notocosa bellicosa* inhabits grassland and open scrub. It builds a vertical burrow approximately 10 cm deep and extends the opening with a rim of silk into which it incorporates a few pieces of debris (Goyen 1888, Forster & Forster 1973, 1999). The spider remains in the burrow and attacks passing prey, which it feeds on in the burrow. The female remains in the tunnel once she has produced an eggsac and warms it on sunny days by facing head down so that the eggsac, held by her spinnerets, protrudes from the burrow into the sun (Forster & Forster 1973, 1999). Adults are found from September to May. The higher proportion of males caught suggests that females are more sedentary. Females with spiderlings have been found in January and March. Fig. 34 shows a male and female copulating.

DNA. 12S rRNA, cytochrome c oxidase I and NADH dehydrogenase subunit I plus $\text{tRNA}^{\text{Leu(CUN)}}$ partial DNA sequences for this species are listed in GenBank (Benson *et al.* 2000) under accession numbers AF380493, AY059960 and AY059995 respectively.

Remarks. Although the type appears to be lost, Goyen's (1888) description (especially of the burrowing behaviour) is adequate to identify this species.

Genus *Venatrix* Roewer

Venatrix Roewer, 1960: 745 (listed but not described in Roewer 1955a: 307). – Framenau & Vink, 2001: 928-929. Type species: *Venator fusca* Hogg, 1900 (= *Lycosa funesta* C.L. Koch, 1847), by original designation.

Description. (Based on Framenau and Vink, 2001) Body length 5.2 –21.0 mm. Carapace brown to dark brown, with a light median band. Two predominant abdominal patterns: a) brown, with a wide, light median band and two pairs of black sickle-shaped markings in posterior half of abdomen; b) uniformly brown with faint heart mark in anterior half and pairs of light spots in posterior half. Chelicerae with three promarginal teeth and three (rarely two) retromarginal teeth. Male with tubercle on the outer curve of fangs (Fig. 32). Legs in descending order of length 4123 (male and female), except *V. fontis* (4132). Male: large claw-like macrosetae at the tip of the cymbium; pedipalp tibial length shorter that cymbium length; long and slender embolus originating on prolateral side of the palea; terminal apophysis either sickle-shaped (originating at the base of the embolus or proximally on palea) or modified (wave-like or bifurcate tip, originating retrolaterally on palea); subtegulum at posterior lateral margin of tegulum. Female: epigyne anchor- or inverted "T"-

shaped, most species with distinct median transverse part; internal genitalia consisting of a copulatory duct with one or more bends before the spermatheca.

Remarks. This genus was revised by Framenau and Vink (2001) and all known species but one are found only in Australia, with the exception found also in New Zealand.

Venatrix belongs in the subfamily Lycosinae as defined by Dondale (1986): "median apophysis transverse, with a ventrally directed spur" and "median apophysis with sinuous channel on dorsal surface". Venatrix shares a similar male pedipalpal morphology with *Alopecosa* Simon, 1885 and there is support from molecular data that *Venatrix* is close to *Alopecosa* (Vink *et al.* in press). The claw-like macrosetae at the tip of the cymbium is also found in *Alopecosa fabrilis* (Clerck, 1757), but not in any other central European *Alopecosa.*

Venatrix goyderi (Hickman)

Fig. 27, 32, 64, 91, 98; Map 27

Lycosa goyderi Hickman, 1944: 33-34, plate 2, Fig. 21
Mustelicosa goyderi (Hickman) - Roewer, 1955a: 280.
Piratosa goyderi (Hickman) - Roewer, 1960: 915.
Arctosa goyderi (Hickman) - McKay, 1973: 380.
Lycosa howensis McKay, 1979a: 237-238, figure 1a-e. - Framenau & Vink, 2001: 963.
Venatrix goyderi (Hickman) – Framenau & Vink, 2001: 963-965, Fig. 44.

Diagnosis. Distinguished from all other New Zealand species of this family by the male bulb, the triangular opening of the female epigyne, claw-like macrosetae at the tip of the male cymbium and the tubercle on the outer fang of adult males.

Description. Colour: carapace dark orange-brown with orange-brown medial band, dark brown at carapace edge, black around eyes and blackish stripes radiating from fovea (Fig. 27); sternum orange-brown with blackish "v" shape; abdomen yellow-brown with grey pattern (Fig. 27); legs orange-brown (femora yellow-brown) with blackish annulations.

Chelicerae with two promarginal teeth (three in female with distal tooth extremely reduced) and two retromarginal teeth. Tarsi and metatarsi with scopulae, especially evident on legs I and II. Male fang with tubercle on outer curve. Male with claw-like macrosetae at cymbium tip (Fig. 64). Epigyne (Fig. 91) with triangular opening. Internal genitalia (Fig. 98) with one bend in copulatory duct.

Dimensions (mm). Male ND, Matarau (female ND, Matarau): total length 5.7 (8.1); carapace 3.3/2.4 (4.2/3.0), height 1.2 (1.6); abdomen 2.4/1.6 (4.1/2.8); sternum 1.5/1.2 (1.7/1.5).
Size range. Male body length 5.3 – 7.0, female body length 6.3 – 10.5 (Framenau & Vink 2001).

Type data. Holotype: Not seen. Original description based on a female specimen from Goyders Lagoon Bore, South Australia (27°01'S, 138°54'E) Simpson Desert Expedition 1939 (Australian Museum, KS49705) (V.W. Framenau pers. comm.).

Material examined. 5 non-type specimens (3 males, 2 females) - see Appendix B for collection details of specimens examined.

Distribution (Map 27). In New Zealand, this species has been found only near Matarau (ND). Found also in Australia (South Australia, Victoria, New South Wales, including Lord Howe Island, Queensland and the Northern Territory).

Biology. *Venatrix goyderi* appears to prefer shaded, open areas close to water. The only New Zealand records of this species are in or near grass fields near Matarau (ND). In South Australia, it was found in a salt lake lagoon (Hickman 1944) and the population on Lord Howe Island inhabited grass-covered ground in disturbed rainforest near the beachfront (McKay 1979a). *Venatrix goyderi* was collected on riparian gravel banks in Victoria, but only in very low numbers (Framenau and Vink 2001). *Venatrix goyderi* appears to tolerate a wide climatic range, as it can be found in arid central Australia, temperate Victorian Alps, and on Lord Howe Island, an isolated, subtropical oceanic island. All recent records of adult spiders are limited to January and February.

DNA. The 12S rRNA partial DNA sequence for this species is listed in GenBank (Benson *et al.* 2000) under accession number AF380496.

Remarks. 'This is the only species in the genus *Venatrix* found in New Zealand. All other *Venatrix* species are found in Australia, where the genus is presumed to have originated. The widespread distribution of this species across Australia and on Lord Howe Island (Framenau & Vink 2001) and absence of other congeners in New Zealand points to *V. goyderi* being a relatively recent introduction (either natural or human) from Australia.

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APPENDIX A: Glossary of technical terms

ALE - anterior lateral eyes or eye; located at the end of the front row

AME - anterior median eyes or eye; middle pair of the front row

annulations - rings of different colours.

abdomen - posterior division of the spider body; sometimes referred to as the opistosoma

apophysis - sclerotised cuticular process arising from the segments of the pedipalp or legs

bulb - refers to the male pedipalpal organ as a whole

carapace - the hard dorsal covering of the cephalothorax

cephalothorax - anterior division of the spider body; sometimes referred to as the prosoma

chelicerae - first pair of appendages of the cephalothorax, consisting of two segments (the distal segment is called the fang)

coxa - first or basal segment of the legs

cymbium - tarsus of the adult male pedipalp

distal - near the apex

dorsal - upper (surface)

epigyne - sclerotised area around the gonopores of the female genital area

femur - third segment of the legs and pedipalps

fovea - depression on the thoracic region of the carapace where muscles of sucking stomach are attached internally; longitudinal in Lycosidae

genital bulb – male pedipalpal organ

labium - median sclerite on the ventral surface of the cephalothorax between the maxillae and anterior to the sternum to which it may be attached.

lateral eyes - eyes at the end of each row

macrosetae - setae conspicuously larger than adjacent setae

maxilla - paired mouthparts lateral to the labium; formed by the coxa of the pedipalp

median eyes - the two middle eyes of each row

mesially - at or toward the middle

metatarsus - sixth segment of the legs; absent in the pedipalps

pedipalp - six-segmented second appendage of the cephalothorax, anterior to legs I

patella - fourth segment of the legs and pedipalp

PLE - posterior lateral eyes or eye; in Lycosidae the posterior pair of eyes in the second row.

PME - posterior median eyes or eye; in Lycosidae the anterior pair of eyes in the second row.

procurved - when a line is drawn through the centres of the four eyes in a row produces an arc in which the arms point forwards (i.e., the lateral eyes are in front of the median eyes)

promarginal - anterior margin

proximal - near the base.

recurved - when a line is drawn through the centres of the four eyes in a row produces an arc in which the arms point backwards (i.e., the lateral eyes are behind the median eyes)

retrolateral - on the outer side i.e., the surface nearer to the posterior end of the body

retromarginal - posterior margin

sclerotised - hardened by sclerotin or other substances in the cuticle

scopula - brush of hairs

seta (plural **setae**) - a sclerotised hair-like projection arising from the cuticle

spermathecae - the seminal receptacles in the epigynum

spinnerets - abdominal appendages at the posterior end of the abdomen

sternum - plate on the ventral surface of the cephalothorax between the coxae of the legs

tarsus - last segment of the legs and pedipalp

tibia - fifth segment of legs and pedipalp

trochanter - second segment of the leg and pedipalp

ventral - lower (surface)

APPENDIX B: Collection details of specimens examined

Localities (including co-ordinates in decimal degrees) and dates collected, collectors, and institutions of specimens examined. CJV = C.J. Vink; RRF = R.R. Forster; ADB = A.D. Blest; CLW = C.L. Wilton.

Allotrochosina schauinslandi

ND. 2 ♀, Mangamuka, -35.2167, 173.5500, 19.viii.1953, B.J. Marples, OMNZ; 2 ♀, Kohukohu, -35.3667, 173.5333, 28.viii.1953, B.J. Marples, OMNZ; 1 ♂, Mimiwhangata, -35.4324, 174.4040, 10-17.xii.1970, J. Darby, OMNZ; 1 ♂, Awapokanui Stream, -35.5000, 173.4167, 5.ii.1994, CJV, LUNZ; 1 ♀, Waiarohia Stream, -35.5167, 173.3833, 4.ii.1994, ADB, LUNZ; 1 ♀, 1 imm, Matarau, -35.6324, 174.1986, 20.xi.1998, CJV, LUNZ. **CL**. 1 ♂, 1 ♀, Cuvier Island, -36.4333, 175.7667, 15.xii.1996, B.M. Fitzgerald, MONZ; 1 ♀, Whangapoua, -36.7167, 175.6167, 25.i.2000, CJV & ADB, LUNZ; 1 ♀, 25.i.2000, CJV, LUNZ; 1 ♀, Dam Stream, -37.1500, 175.7500, 1.vi.1952, J.S.Dugdale, OMNZ. **AK**. 1 ♀, Waitakere, -36.8522, 174.5351, 14.vi.1943, RRF, OMNZ; 2 ♂, Waitakere Ranges, -36.9833, 174.5333, 25.i.1997, CJV & G. Hall, LUNZ; 1 ♂, 1 ♀, Cornwallis, -37.0167, 174.6000, 22.i.1997, CJV & ADB, LUNZ. **BP**. 1 ♂, Te Aroha, -37.5333, 175.7000, 27.v.1996, CJV & ADB, LUNZ; 1 ♀, Papatea Bay, -37.6500, 177.8500, 5.ii.1993, J.S.Dugdale, NZAC; 1 ♂, Pukeamaru, -37.6833, 178.2667, 29.x.1992, J.S.Dugdale, NZAC; 1 ♀, Lake Rotoehu, -38.0393, 176.5235, 4.x.1969, CLW, OMNZ. **GB**. 1 ♀, Karakatuwhero Valley, -37.6167, 178.3333, 1.v.1993, G. Hall, NZAC. **TO**. 1 ♂, Kuratau Dam, -38.8696, 175.7122, 20.v.1966, R.W. Huttan, OMNZ; 1 ♀, Waitetoko, -38.9066, 175.9295, 25.i.1966, R.W. Huttan, OMNZ; 1 ♀, 8-11.v.1968, R.W. Huttan, OMNZ; 1 ♀, Stump Bay, -38.9500, 175.8167, 9.xi.1994, CJV & ADB, LUNZ; 1 ♀, Hinemihi's Track, -39.0167, 175.7333, 25.v.1996, CJV, LUNZ. **TK**. 1 ♀, New Plymouth, -39.0530, 174.0694, 1923, H. Bellringer, OMNZ; 1 imm, Lucys Gully, -39.1502, 173.9406, 1.xii.2000, ADB & CJV, LUNZ; 1 ♂, 1 ♀, Opunake, -39.4500, 173.8500, ix.1954, L. Simpson, OMNZ. **HB**. 1 ♀, Taradale, -39.5416, 176.8445, 12.ix.1965, R.W. Huttan, OMNZ; 1 ♀, R.W. Huttan, OMNZ; 1 ♂, Hastings, -39.6377, 176.8279, 6.x.1946, R.R. Fortser, OMNZ; 2 ♂, Waipatiki, -40.3747, 176.2831, R.W. Huttan, OMNZ. **RI**. 1 ♀, Hynish, -39.7333, 176.4500, i.1954, J.S.Dugdale, OMNZ. **WI**. 1 ♀, Waitapu, -40.0610, 175.6428, 1.ix.1966, R.W. Huttan, OMNZ; 1 ♂, Feilding, -40.2201, 175.5462, 2.x.1959, RRF, OMNZ; 2 ♂, 1.x.1942, RRF, OMNZ; 1 ♂, 3.x.1942, RRF, OMNZ; 1 ♀, 4.x.1942, RRF, OMNZ; 5 ♂, 10 ♀, 6.x.1942, RRF, OMNZ; 1 ♂, 6.xii.1942, RRF, OMNZ; 1 ♀, 15.xii.1942, RRF, OMNZ; 1 ♂, 1 ♀, 23.xii.1942, RRF, OMNZ. **WA**. 1 ♀, Dannevirke, -40.2000, 176.1000, 11.vii.1942, RRF, OMNZ; 2 ♀, 12.iv.1943, RRF, OMNZ; 1 ♂, Mt Bruce, -40.7532, 175.5962, 1-8.x.1969, CLW, OMNZ; 1 ♀, upper Waingawa, -40.7667, 175.4500, 16-31.viii.1972, CLW, MONZ; 1 ♂, Mangareia Stream, -40.7996, 175.8294, 14.xii.1946, CLW, OMNZ; 1 ♀, Mangareia, -40.7996, 175.8294, 3.xi.1946, CLW, OMNZ; 1 ♂, 1 ♀, x.1957, CLW, OMNZ; 1 ♀, Gladstone, -41.0833, 175.6333, 20.v.1953, B.J. Marples, OMNZ; 1 ♀, 15.ix.1967, CLW, OMNZ. **WN**. 1 ♀, Levin, -40.6167, 175.2833, 5.i.1943, RRF, OMNZ; 1 ♂, 4 ♀, Stokes Valley, -41.1848, 174.9872, 30.xi.1947, R.K. Dell, OMNZ; 1 ♂, Somes Island, -41.2599, 174.8520, 19.x.1954, R.K. Dell, MONZ; 1 ♀, Karori, -41.2833, 174.7333, 16.vi.1942, RRF, OMNZ; 1 ♀, 12.vii.1942, RRF, OMNZ; 1 ♂, 1 ♀, Karori, -41.2833, 174.7333, 3.iv.1948, D. Hurley, OMNZ; 1 ♀, 25.i.1997, P.J. Sirvid, MONZ; 1 ♀, Orongorongo Valley, -41.3667, 174.9000, 16.v.1996, ADB, LUNZ. **SD**. syntype ♂, syntype ♀, French Pass, -40.9333, 173.8333, xii.1896-i.1897, H.H. Schauinsland, MNHN 21415. **NN**. 4 ♀, Riwaka River, -41.0500, 172.9167, 2.xii.1994, ADB, LUNZ; 1 ♂, 2.xii.1994, CJV, LUNZ; 1 ♀, 14.ii.1998, ADB, LUNZ; 2 ♀, Motueka River Mouth, -41.0833, 173.0167, 4.xii.1994, CJV & ADB, LUNZ; 1 ♂, Karamea, -41.2474, 172.1034, 28.ix.1966, RRF & CLW, OMNZ; 3 ♀, Karamea, -41.2500, 172.1167, i.1950, RRF, OMNZ; 1 ♂, 1 ♀, Maitai, -41.2912, 173.318, 29.xii.1949, J.G. Dawber, OMNZ; 1 ♀, Sherry Valley, -41.4128, 172.7266, 18.xii.1949, J.G. Dawber, OMNZ; 2 ♀, Motupiko River, -41.5023, 172.7959, 18.xii.1961, B.J. Marples, OMNZ; 1 ♂, Boulder Creek, -41.6833, 172.6167, 5.xii.1994, ADB, LUNZ; 1 ♂, 1 ♀, Birchfiled, -41.6833, 171.8, 28.xii.1949, R.J. Scarlett, OMNZ. **BR**. 1 ♂, Lake Rotoroa, -41.8000, 172.5833, 9.iii.1965, G. Kuschel & J.I. Townsend, NZAC; 1 ♂, 1 ♀, 8.ii.1997, CJV, LUNZ; 1 ♂, 2 ♀, Lake Rotoiti, -41.8167, 172.85, 19.vi.1965, CLW, OMNZ; 1 ♂, 8.ii.1997, CJV, LUNZ; 1 ♂, Woodpecker Bay, -42.0167, 171.3833, 19.i.1950, RRF, OMNZ; 1 ♀, 22.i.1950, RRF, OMNZ; 1 ♂, Perpendicular Point, -42.0855, 171.3280, i.1957, L.R. Jackson, OMNZ; 2 ♂, Punakaiki, -42.1092, 171.3278, 27.ix.1966, RRF & CLW, OMNZ; 1 ♀, Punakaiki, -42.1167, 171.3333, 30.x.1970, Entomology Department, LUNZ; 1 ♂, Greymouth, -42.4500, 171.2000, 5.viii.1973, S. Lauder, OMNZ; 1 ♂, Greymouth, -42.4500, 171.2000, 10.v.1956, L.R. Jackson, CMNZ; 4 ♂, 4 ♀, Moana, -42.5833, 171.4833, 10.iii.1950, RRF, OMNZ; 2 ♀, Grey River (east), -43.1667, 172.4833, 17.i.1921, G. Archey, OMNZ. **KA**. 1 ♀, Puhi Puhi Valley, -42.2904, 173.7232, 12.x.1966, A.K. Walker, NZAC; 1 ♂, 13.x.1966, A.K. Walker, NZAC; 2 ♂, 3 ♀, Kowhai Bush, -42.3589, 173.5667, 4.i.1996, ADB, LUNZ; 1 ♀, Mt Fyffe Forest, -42.3589, 173.5934, 3.xii.1995, CJV, ADB, S.J. Crampton, LUNZ; 1 ♀, 14.ii.2000, ADB, LUNZ; 3 ♂, 1 ♀, Conway River Mouth, -42.6167, 173.4667, 12.v.1955, RRF, OMNZ. **MB**. 1 ♀, Hanmer, -42.5439, 172.7853, i.1966, T. Poppelwell, OMNZ. **NC**. 1 ♀, Lake Taylor, -42.7667, 172.2333, 14.iv.1952, RRF, OMNZ; 3 ♀, Cheviot, -42.8167, 173.2667, 2.vi.1952, J.S.Dugdale, OMNZ; 2 ♀, Ashley Gorge, -43.2320, 172.2224, 29.xii.1957, R.L.C. Pilgrim, OMNZ; 6 ♂, 8 ♀, 3 imm, Coopers Creek, -43.3000, 172.1667, 15.x.1953, RRF, OMNZ; 1 ♀, 21.v.1955, RRF, OMNZ; 1 ♀, Woodend, -43.3201, 172.6582, 25.x.1948, W. Dukes, OMNZ. **WD**. 1 ♀, Lake Kaniere, -42.8327, 171.1457, 1.i.1950, J.H. Sorensen, OMNZ; 1 ♂, 2.ix.2001, S.M. Pawson, LUNZ; 1 ♀, Otira, -42.8333, 171.5667, iii.1945, T.P. Harris, OMNZ; 1 ♀, Otira Valley, -42.8982, 171.5439, 28.v.1954, J.S. Dugdlae, OMNZ; 7 ♂, 7 ♀, 1 imm, Pukekura, -43.0167, 170.6667, viii.1952, M. Warren, OMNZ; 1 ♂, 6 ♀, Okarito, -43.2167, 170.1667, 7.xii.1949, RRF, OMNZ; 3 ♂, 1 ♀, 1 imm, Whataroa, -43.2667, 170.3667, viii.1952, M. Warren, OMNZ; 1 ♂, Canavans Knob, -43.3833, 170.1667, 12.ix.1982, A.B. Miller, MONZ; 2 ♀, Franz Josef, -43.4000, 170.1833, 6.xii.1955, B.J. Marples, OMNZ; 4 ♀, 11.xii.1994, CJV & ADB, LUNZ; 3 ♂, 2 ♀, 15.xi.1995, CJV & ADB, LUNZ; 1 ♂, 1 imm, 11.iv.1999, CJV & M.A. Hudson, LUNZ; 1 ♀, Fox Gacier, -43.4667, 170.0167, viii.1950, M. Warren, OMNZ; 2 ♂, 1 ♀, 1.ix.1951, M. Warren, OMNZ; 2 ♂, 16.xi.1995, CJV & ADB, LUNZ; 1 ♂, 4 ♀, Copland Track start, -43.5833, 169.8167, 13.xii.1994, CJV, LUNZ; 3 ♂, 4 ♀, Bruce Bay, -43.6090, 169.5913, iv.1946, W.A.B. Keay?, OMNZ; 2 ♂, 2 ♀, Lake Moeraki, -43.7333, 169.2833, 12.xii.1994, CJV & ADB, LUNZ; 4 ♂, 4 ♀, Paringa River, -43.7407, 169.5032, 27.ix.1966, RRF & CLW, OMNZ; 1 ♂, Taumaka Island, -43.8596, 168.8710, 31.xii.1971, M.E. Miller, OMNZ; 2 ♀, Jackson Bay, -44.0000, 168.6500, 22.i.1960, R.E. Leech, OMNZ; 2 ♀, Pyke River (Lower), -44.5000, 168.1833, i.1956, H. Walker, OMNZ; 1 ♀, Head of Lake McKerrow, -44.5167, 168.0667, 6.ii.1959, RRF, OMNZ. **MC**. 1 ♀, Cass, -43.0333, 171.7500, 27.vi.1949, L. Wolf, OMNZ; 1 ♂, Bealey, -43.0333, 171.6333, 19.x.1959, B.A. Holloway, OMNZ; 1 ♀, Mt Algidus, -43.2333, 171.3500, 14.ii.1946, RRF, OMNZ; 2 ♀, Springfield, -43.3333, 171.9333, 17.v.1998, A.E. Singleton, LUNZ; 1 ♀, Harewood, -43.4811, 172.5461, 30.i.1960, R.E. Leech, OMNZ (Honolulu Collection); 2 ♀, 6.ii.1960, R.E. Leech, OMNZ (Honolulu Collection); 3 ♀, Christchurch Airport, -43.4876, 172.5339, 22.x.1958, P. Young, OMNZ (Honolulu Collection); 1 ♀, 22.x.1959, R.E. Leech, OMNZ (Honolulu Collection); 2 ♀, 6.ii.1960, R.E. Leech, OMNZ (Honolulu Collection); 1 ♀, Travis Marsh, -43.5000, 172.7000, 27.xii.1995, R.P. Macfarlane, LUNZ; 2 ♂, 2 ♀, Rakaia Gorge, -43.5167, 171.65, 30.iv.1950, RRF, OMNZ; 4 ♀, Deans Bush, -43.5333, 172.5833, 19.xii.1949, J.S.Dugdale, OMNZ; 1 ♂, 2 ♀, 20.xii.1949, J.S.Dugdale, OMNZ; 1 ♀, Riccarton Bush, -43.5333, 172.5833, 18.xii.1994, ADB, LUNZ; 1 ♀, 31.xii.1994, ADB, LUNZ; 1 ♂, 5 ♀, 1 imm, 1.i.1995, ADB, LUNZ; 1 ♀, 10.i.1999, ADB, LUNZ; 1 ♀, Christchurch, -43.5333, 172.6333, 27.ii.1944, A.W. Parrott, OMNZ; 1 ♂, 8 ♀, 7 imm, A.W. Parrott, OMNZ; 1 ♂, Govenors Bay, -43.6333, 172.6500, 2.i.1948, I.D.R. Cresswell, OMNZ; 1 ♂, 12.i.1949, I.D.R. Cresswell, CMNZ; 1 ♀ , 22.i.1949, I.D.R. Cresswell, OMNZ; 1 ♂, Lincoln University, -43.6432, 172.4581, 30.x.1991, A.M Henood, LUNZ; 1 ♀, 20.ix.1994, CJV, LUNZ; 1 ♀, 17.vii.1996, CJV, LUNZ; 1 ♂, 1 ♀, Taitapu, -43.6667, 172.55, iii.1933, A.W. Parrott, OMNZ; 4 ♂, 2 ♀, Kaituna Valley, -43.7167, 172.7167, 11.ix.1944, RRF, OMNZ; 1 ♂, 3 ♀, 28.ix.1952, RRF, OMNZ; 1 ♀, Lake Ellesmere, -43.7167, 172.4500, 20.viii.1992, CJV, LUNZ; 2 ♀, Kaituna Valley, -43.7364, 172.6952, 16.i.1960, C.W. O'Brien, OMNZ (Honolulu Collection); 1 ♂, 1 ♀, 13.iv.1967, RRF & CLW, OMNZ; 1 ♂, 24.v.1975, RRF, OMNZ; 1 ♂, 4 ♀, Okuti Valley, -43.7833, 172.8167, 22.xi.1975, RRF, OMNZ; 1 ♀, Prices Valley, -43.8000, 172.6833, 13.iv.1967, CLW, OMNZ; 5 ♂, 1 ♀, 12.vi.1999, CJV & J.W. Griffiths, LUNZ; 1 ♀, Harts Creek, -43.8016, 172.3232, 10.xii.43, A.W. Parrott, OMNZ; 1 ♀, Hinewai, -43.8333, 173.0667, 7.ii.1995, CJV, LUNZ; 1 ♀, 27.viii.1996, CJV, LUNZ; 8 ♂, 4 ♀, 1 imm, 21.xi.1997, J.B. Ward, LUNZ. **CH**. 2 ♀, Manganui, -43.7667, -176.7667, 15.xii.1923, G. Archey, MNHN; 1 ♀, Taiko Camp, -44.0667, -176.6333, 18.xi.1997, A. Tennyson, MONZ; 1 subadult ♂, South East Island, -44.3500, -176.1667, 14.xii.1979, A. Wright, OMNZ. **SC**. 1 ♀, 6 imm, Peel Forest, -43.9167, 171.2667, 30.ix.1966, CLW, OMNZ; 1 ♂, 3 ♀, 2.ii.1997, CJV, LUNZ; 6 ♂, 9 ♀, Waihi, -44.0220, 171.1751, 7.xii.1939, A.W.Parrott, OMNZ; 1 ♀, 10.xii.1939, A.W.Parrott, OMNZ; 6 ♀, 1 imm, 12.xii.1939, A.W.Parrott, OMNZ; 1 imm, Opuha River, -44.0994, 170.9822, 25.i.1987, RRF, OMNZ; 1 ♀, Geraldine, -44.1000, 171.2333, 8.xi.1975, A.C. Harris, OMNZ; 1 ♀, Waimate Creek, -44.7000, 170.9667, 29.iv.1952, J.S.Dugdale, OMNZ. **FD**. 2 ♀, 1 imm, Martins Bay, -44.3667, 168.0000, 31.i.1955, RRF & J.S.Dugdale, OMNZ; 3 ♀, 2 imm, 1.ii.1955, RRF & J.S.Dugdale, OMNZ; 1 ♀, Hollyford Track, -44.6167, 168.1167, 14.v.1960, J. Winter, OMNZ; 1 ♀, 22.i.1998, G. Hall & D.M. Gleeson, NZAC; 1 ♀, Hidden Falls, -44.6321, 168.1226, 21.i.1955, RRF & J.S.Dugdale, CMNZ; 1 ♀, 1 imm, 21.i.1955, RRF & J.S.Dugdale, OMNZ; 1 ♀, Cascade Creek, -44.8976, 168.0844, 12.i.1971, R.R. Fortser, OMNZ; 3 ♂, 3 ♀, Eglinton Valley, -45.1000, 167.9667, 30.v.1963, OMNZ; 2 ♀, Rowallan, -46.0616, 167.5976, 25.xi.1970, RRF & CLW, OMNZ, **DN**. 1 ♀, Duntroon, -44.8667, 170.6833, 18.v.1948, B.J. Marples, OMNZ; 1 ♀, Sutton, -45.5688, 170.1240, 17.x.1965, CLW, OMNZ; 3 ♂, 2 ♀, Waitati, -45.7500, 170.5833, 26.ix.1995, L.J. Boutin, MONZ; 1 ♀, Pipikaretu, -45.8028, 170.7431, 11.i.1962, B.J. Marples, OMNZ; 1 ♂, Sulivans Dam, -45.8079, 170.5244, 11.xi.1966, RRF, OMNZ; 1 ♂, 29.xi.1966, RRF, OMNZ; 1 ♂, 19.xii.1966, RRF, OMNZ; 1 ♀, 1.xi.1966, RRF, OMNZ; 1 ♀, Whare Flat, -45.8149, 170.4271, 4.i.1966, CLW, OMNZ; 1 ♀, Leith Saddle, -45.8333, 170.5167, 20.iii.1967, RRF, OMNZ; 1 ♂, 25.vi.1967, RRF, OMNZ; 1 ♂, 22.vii.1967, RRF, OMNZ; 1 ♀, Flagstaff, -45.8561, 170.5299, 11-29.iv.1971, CLW, OMNZ; 1 ♀, 10.xii.1975, RRF, OMNZ; 1 ♂, 1 ♀, 2.iii.1977, RRF, OMNZ; 1 ♂, 1 ♀, 26.i.1978, RRF, OMNZ; 1 ♀, i.1979, RRF, OMNZ; 7 ♀, 27.xii.1979, RRF, OMNZ; 1 ♂, Opoho Bush, -45.8561, 170.5299, i.1946, T. Smith, OMNZ; 2 ♂, 4 ♀, 21.iii.1971, CLW, OMNZ; 2 ♀, 3.iv.1971, CLW, OMNZ; 4 ♂, 2 ♀, 11-29.iv.1971, CLW, OMNZ; 2 ♀, 17.v.1971, CLW, OMNZ; 1 ♀, Mt Charles, -45.8667, 170.7000, 14.x.1952, B.J. Marples, OMNZ; 1 ♀, Dunedin, -45.8833, 170.5000, 10.x.1958, RRF, OMNZ; 1 ♀, iii.1960, RRF, OMNZ; 1 ♂, 4 ♀, v.1961, W.T. Poppelwell, OMNZ; 1 ♀, xii.1966, RRF, OMNZ; 1 ♀, Allans Beach, -45.8833, 170.6833, 8.x.1953, B.J. Marples, OMNZ; 1 ♀, 8.ix.1966, RRF, OMNZ; 1 ♀, Saint Clair, -45.9136, 170.4840, 11.iv.1966, RRF, OMNZ; 1 ♂, 1 ♀, Henley, -45.9832, 170.1656, 20.iv.1975, RRF, OMNZ; 1 ♂, Lake Tuakitoto, -46.2255, 169.8236, 14.ix.1967, RRF, OMNZ; 2 ♀, Balclutha, -46.2333, 169.7333, 20.xi.1958, RRF, OMNZ. **CO**. 1 ♂, Shag Valley, -45.3206, 170.5407, 13.ix.1966, RRF, OMNZ; 1 ♀, Tawhiti, -45.3833, 169.2833, 29.x.1958, RRF, OMNZ; 1 ♀, near Middlemarch, -45.4867, 170.0833, 10.ii-7.iii.1999, C. Rufaut, LUNZ; 2 ♀, Middlemarch, -45.5099, 170.1252, 10.iv.1971, B. Beatson, OMNZ; 1 ♂, Craig Flat, -45.7333, 169.4833, 21.xii.1985, B.I.P. Barratt, NZAC. **SL**. 1 ♂, 2 ♀, Tuatapere, -46.1299, 167.6902, 1.vi.1963, OMNZ; 3 ♂, 6 ♀, 1 imm, Orepuki, -46.2833, 167.7500, 9.v.1949, RRF, OMNZ; 1 ♀, 11.ix.1949, J.H. Sorensen, OMNZ; 4 ♀, 26.xi.1970, RRF & CLW, OMNZ; 1 ♂, 20 ♀, Colac Bay, -46.3606, 167.8769, 24.x.1970, RRF & CLW, OMNZ; 1 ♀, Otatara Scenic Reserve, -46.4333, 168.3000, 3.ii.2000, CJV, LUNZ (100%OH); 1 imm, Awarua Plains, -46.5167, 168.5000, 1.ii.2000, CJV & ADB, LUNZ. **SI**. 1 ♂, Stewart Island, -46.8416, 167.8760, 25.iv.1962, W.T. Popplewell, OMNZ. **Unknown locality**. 2 ♂, 1 ♀, Wrights Farm, 25.v.1968, R.W. Huttan, OMNZ.

Anoteropsis adumbrata

ND. 1 ♂, 1 ♀, Waipoua Forest, -35.6164, 173.5515, 8.vi.1966, J.I. Townsend, NZAC; 1 ♀, Pukenui Forest, -35.7180, 174.2658, 14.ix.1998, G. Hall, NZAC. **AK**. holotype ♀, Te Karaka, -37.1041, 174.8727, A.T. Urquhart, CMNZ. **WO**. 1 ♂, Torehape, -37.3420, 175.4102, 14.xii.1999, C. Watts, NZAC;**BP**. 1 ♂, 3 ♀, Te Aroha, 900m, -37.5333, 175.7000, 17.ix.1994, CJV & S.J. Crampton, LUNZ; 1 ♂, Motu River, -37.8846, 177.6526, 27.ix.1995, P.J. Sirvid, NZAC; 1 ♂, Lake Okataina, -38.1141, 176.4203, 18.ii.1999, CJV, LUNZ; 1 ♀, Mt Ngongotaha, -38.1201, 176.1976, 18.xii.1995, ADB, LUNZ. **WO**. 1 ♂, Pirongia Mountain, -37.9929, 175.0891, 28.x.1968, H. Oliver, OMNZ. **GB**. 1 ♀, Aniwaniwa, -38.7465, 177.1657, 13.xii.1944, RRF, OMNZ; 1 ♀, Waikaremoana, -38.7584, 177.1548, 4.i.1969, R.W. Huttan, OMNZ; 1 ♂, Maranui Bay, -38.7711, 177.0763, 19-26.xi.1996, L.J. Boutin, MONZ; 1 ♀, Lake Waikaremoana, -38.7711, 177.0763, 26.xi.1996, L.J. Boutin, MONZ. **TO**. 1 ♀, Hatepe, -38.8557, 176.0058, 11.i.1969, R.W. Huttan, OMNZ; 1 ♂, Hinemihis Track, -39.0102, 175.7445, 9.xi.1994, CJV & ADB, LUNZ; 1 ♂, 1 ♀, 1 imm, 25.v.1996, CJV, LUNZ. **TK**. 1 ♂, 1 ♀, Mount Messenger, -38.8957, 174.5942, 21.ii.1966, A.K. Walker, NZAC; 1 ♂, Kaitake Saddle, -39.1958, 173.9868, 13.xi.1994, CJV & ADB, LUNZ; 1 ♂, 1 ♀, near Waiwhakaino River, -39.2374, 174.1009, 24.v.1996, CJV & ADB, LUNZ; 1 ♂, Ahukawakawa Swamp, -39.2524, 174.0504, 27.xi.1975, J.S. Dugdale, NZAC; 1 ♀, Mt Taranaki, ski field, -39.2833, 174.0833, 12.xi.1994, CJV, LUNZ. **HB**. 1 ♀, Tutira, -39.2095, 176.8813, 30.xii.1953, B.J. Marples, OMNZ; 1 ♀, Hukanui, -39.2500, 176.5500, 24.iii.1996, A. Tennyson, MONZ; 1 ♀, Taradale, -39.5416, 176.8445, 3.iv.1969, R.W. Huttan, OMNZ. **WA**. 1 ♀, Dannevirke, -40.2000, 176.1000, 12.iv.1943, RRF, OMNZ; 10 ♂, 1 ♀, Eketahuna, -40.6508, 175.7118, 1-8.x.1969, CLW, OMNZ; 5 ♂, 4 ♀, Mt Bruce, -40.7532, 175.5962, 1-8.x.1969, CLW, OMNZ; 1 ♂, 1 ♀, Atiwhakatu Valley, -40.8727, 175.4534, 1-16.xi.1972, CLW, MONZ; 2 ♂, 2 ♀, 16-31.x.1972, CLW, OMNZ; 7 ♂, Mt Holdsworth, -40.8751, 175.4167, 16.xi.1972, CLW, OMNZ; 4 ♂, 1 ♀, Opaki, -40.8943, 175.6620, 1-8.x.1969, CLW, OMNZ; 2 ♂, 1 ♀, Masterton, -40.9543, 175.6670, 25.v.1968, R.W. Huttan, OMNZ; 2 ♂, 2 ♀, Taratahi, -40.9833, 175.5833, 15.30.ix.1972, CLW, MONZ; 1 ♂, 15.x.1972, CLW, OMNZ; 1 ♂, 1 ♀, 1-16.xi.1972, CLW, MONZ; 1 ♂, 1 ♀, Wainuioru River, -41.1333, 175.7667, 1.iv.1968, CLW, OMNZ. **RI**. 1 ♀, near Woodville, -40.3441, 175.8732, 1-8.x.1969, CLW, OMNZ. **WN**. 1 ♂, 1 ♀, Mangatainoka, -40.4190, 175.8462, 1-8.x.1969, CLW, OMNZ; 1 ♀, Akatarawa Valley, Campbell's Mill, -41.0490, 175.1162, 26.x.1941, RRF, MONZ; 3 ♂, Akatarawa Valley, -41.0490, 175.1162, iv.1996, R. Pederson, MONZ; 1 ♂, 2 ♀, Tauherenikau Valley, -41.0670, 175.3010, 26.iv.1947, M. Laird, MONZ; 1 ♀, Stokes Valley, -41.1848, 174.9872, 30.xi.1947, R.K. Dell, OMNZ; 1 ♂, 2 ♀, Orongorongo Valley, -41.3667, 174.9000, 16.viii.1995, B.M. Fitzgerald, MONZ; 1 ♂, 15.v.1996, ADB, LUNZ. **NN**. 1 ♀, Heaphy Track, -40.8771, 172.2761, v.1974, D.R. Penman, LUNZ; 1 ♀, 6.xi.1999, G. Hall & R. Leschen, NAZC; 1 ♀, 7.xi.1999, G. Hall & R. Leschen, NAZC; 1 ♀, 9.xi.1999, G. Hall & R. Leschen, NAZC; 1 ♀, Pages Saddle, -40.9405, 172.8979, 3.xii.1994, CJV, LUNZ; 1 ♂, Takaka Hill, -41.0333, 172.9166, 17.iii.1960, C.W. O'Brien, OMNZ (Honolulu Collection); 1 ♂, Riwaka River, -41.0500, 172.9167, 14.ii.1998, ADB, LUNZ; 1 ♀, Mt Domett 1250m, -41.0646, 172.3112, 25.xi.1971, T. McBurney, NZAC; 1 ♀, 30.xi.1971, G. Kuschel, NZAC; 2 ♀, Salisbury Rock Shelter, -41.1833, 172.6667, 4.i.1998, A. Tennyson, MONZ; 1 ♀, Flora Hut, -41.1854, 172.7304, 24.xi.1971, J.S. Dugdale, NZAC; 1 ♂, 1 ♀, Sherry Valley, -41.4128, 172.7266, 18.xii.1949, J.G. Dawber, OMNZ; 4 ♂, 1 ♀, Pretty Bridge Valley, -41.4237, 172.9178, 3.xi.1965, G. Hitchings, NZAC; 1 ♀, 2.ii.1966, G. Hitchings, NZAC; 1 ♀, 6.iv.1966, G. Hitchings, NZAC; 1 ♀, 8.vi.1966, G. Hitchings, NZAC; 1 ♂, 7.xii.1966, G. Hitchings, NZAC; 1 ♀, Lee Valley, -41.4348, 173.1498, 9.viii.1966, J.I. Townsend, NZAC; 1 ♀, Head of Falls Creek, -41.5000, 172.0500, 8.ii.1972, K. Mason, OMNZ; 1 ♀, 1 imm, NW Nelson, -41.6000, 172.3167, 7.i.1996, A. Tennyson, MONZ; 2 ♂, 1 ♀, Glenhope, -41.6502, 172.6428, 12.ii.1969, CLW, OMNZ; 1 ♀, Mt Augustus, 800m, -41.6779, 171.8570, 8.x.1969, J.S. Dugdale, NZAC; 1 ♀, Denniston, -41.7384, 171.7872, 7.x.1969, J.S. Dugdale, NZAC. **MB**. 1 ♂, Pelorus Bridge, -41.2986, 173.5629, 10.x.1964, G. Kuschel, NZAC; 1 ♀, Hanmer, -42.5439, 172.7853, i.1966, T. Poppelwell, OMNZ. **BR**. 1 ♀, ♂any imm, Mangles River, -41.7833, 172.3667, 12.ii.1969, CLW, OMNZ; 2 ♂, 1 ♀, St Arnaud, -41.7999, 172.8467, 9.ii.1997, CJV & ADB, LUNZ; 1 ♂, Murchison, -41.8062, 172.3284, 10.ii.1969, CLW, OMNZ; 6 ♀, Okari River, -41.8210, 171.4970, 29.x.1970, Entomology Department, LUNZ; 1 ♂, Mt Robert, -41.8341, 172.8111, 5.viii.1964, J.I. Townsend, NZAC; 1 ♀, 8.vi.1965, J.I. Townsend & L.P. M., NZAC; 1 ♀, Braeburn Track, -41.8753, 172.5981, 9.iii.1965, G. Kuschel & J.I. Townsend, NZAC; 1 ♀, Woodpecker Bay, -42.0167, 171.3833, 22.i.1950, RRF, OMNZ; 1 ♂, 1 ♀, Reefton, -42.1167, 171.8667, x-xi.1992, M.J. Meads, MONZ; 1 ♀, Lewis Pass, -42.3810, 172.4030, 11.iii.1960, C.W. O'Brien, OMNZ; 1 ♂, Lewis Pass, -42.3810, 172.4030, 12.xi.1964, G. Kuschel, NZAC; 2 ♀, Greymouth, -42.4500, 171.2000, vi.1956-i.1957, L.R. Jackson, OMNZ; 1 ♀, 5.viii.1973, S. Lauder, OMNZ; 1 ♀, 28.viii.1973, S. Lauder, OMNZ; 1 ♂, 1 ♀, Moana, -42.5833, 171.4833, 10.iii.1950, RRF, OMNZ. **KA**. 1 ♂, 3 ♀, Mt Fyffe Forest, -42.3589, 173.5934, 3.xii.1995, CJV, ADB, S.J. Crampton, LUNZ. **WD**. 1 ♀, Kumara, -42.6324, 171.1879, xi.1929, W. Campbell, OMNZ; 1 ♀, i.1957, L.R. Jackson, OMNZ; 1 ♀, Hokitika, -42.7153, 170.9508, 4.xii.1955, B.J. Marples, OMNZ; 1 ♀, Arahura Valley, -42.7356, 171.1175, 7.xii.1972, Entomology Department, Lincoln

College, LUNZ; 1 ♀, 17 km S of Hokitika, -42.8667, 170.8667, 26.ii.1976, L.L. Deitz, NZAC; 1 ♀, Otira, -42.8982, 171.5439, 1945, P.P. Harris, OMNZ; 1 ♂, 1 ♀, Otira Valley, -42.8982, 171.5439, 28.v.1954, J.S. Dugdlae, OMNZ; 1 ♂, Arthur's Pass, -42.9077, 171.5493, 14.xii.1994, CJV, LUNZ; 9 ♂, 4 ♀, 2 imm, Ross Creek, -42.9236, 170.8168, 22.xi.1955, B.J. Marples, OMNZ; 1 ♂, Pukekura, -43.0167, 170.6667, viii.1952, M. Warren, OMNZ; 1 ♀, Whataroa, -43.2667, 170.3667, viii.1952, M. Warren, OMNZ; 8 ♀, Franz Josef, -43.4000, 170.1833, 20.i.1971, RRF, OMNZ; 2 ♀, 24.i.1971, RRF, OMNZ; 2 ♀, 15.xi.1995, CJV, LUNZ; 1 ♂, 3 ♀, 16.xi.1995, CJV, LUNZ; 2 ♂, 11.iv.1999, CJV & M.A. Hudson, LUNZ; 1 ♀, Fox Gacier, -43.4667, 170.0167, 1.ix.1951, M. Warren, OMNZ; 2 ♀, 20.i.1971, RRF, OMNZ; 1 ♀, 16.xi.1995, CJV, LUNZ; 1 ♂, Karangarua, -43.5370, 169.8276, 27.ix.1966, RRF, OMNZ; 1 ♂, Copland Track start, -43.5833, 169.8167, 13.xii.1994, ADB, LUNZ; 1 ♀, 13.xii.1994, CJV, LUNZ; 1 ♀, Bruce Bay, -43.6090, 169.5913, iv.1946, W.A.B. Keay?, OMNZ; 1 ♂, 1 ♀, Lake Paringa, -43.7167, 169.4000, 11-14.xii.1994, CJV, LUNZ; 1 ♀, Lake Moeraki, -43.7333, 169.2833, 26.ix.1966, RRF & CLW, OMNZ; 2 ♀, 12.xii.1994, CJV & ADB, LUNZ; 1 ♂, 1 ♀, Paringa River, -43.7407, 169.5032, 3.vi.1954, J.M. Moreland, OMNZ; 1 ♀, Thomas River, -43.8853, 169.2232, 18.iii.1966, RRF, OMNZ; 1 ♀, Hapuka Estuary, -43.9075, 168.8985, 17.xi.1995, CJV, LUNZ; 2 ♀, Jackson Bay, -44.0000, 168.6500, 22.i.1960, R.E. Leech, OMNZ (Honolulu Collection); 1 ♀, Wills Valley, -44.0404, 169.4400, 3.vii.1971, K. Mason, OMNZ; 1 ♀, Woodhen Creek, -44.1807, 168.4878, MONZ; 1 ♂, Olivine Range, -44.2331, 168.5526, 10.i.1972, K. Mason, OMNZ; 2 ♀, Makarora, -44.2378, 169.2330, 12.xii.1977, RRF, OMNZ; 1 ♀, Lake Alabaster, -44.5303, 168.1498, 11.i.1967, A.K. Walker, NZAC. **NC**, 2 ♂, 1 ♀, Klondike Corner, -43.0000, 171.5833, 19.xii.1994, ADB, LUNZ; 2 ♀, 19.xi.1995, CJV, LUNZ; 2 ♂, Chalk Hill, -43.2667, 172.1667, 3.v.1952, RRF, OMNZ. **MC**. 1 ♀, Bealey, -43.0333, 171.6333, 19.x.1959, B.A. Holloway, OMNZ; 1 ♀, Mt Torlesse, -43.2572, 171.8217, 5.ii.1950, RRF, OMNZ; 2 ♂, Canterbury, 1939, OMNZ. **MK**. 1 ♂, 1 ♀, near Hooker River, -43.7073, 170.1003, 6.i.2001, CJV & M.A. Hudson, LUNZ; 7 ♂, 1 ♀, Unwin Hut, -43.7500, 170.1167, 14.xii.1992, CJV, LUNZ; 3 ♀, 14-17.xii.1992, CJV, LUNZ. **OL**. 1 ♀, Gillespie Pass, 1500m, -44.1589, 169.0752, 8.i.1972, S.R. Forster, OMNZ; 1 ♂, Albert Burn, -44.3426, 169.0215, iv.1974, K. Mason, OMNZ; 1 ♂, 3 ♀, Niger Peak, -44.5249, 168.8450, 18.iii.1996, G. Hall, NZAC; 1 ♀, Lake Hawea, -44.6141, 169.2660, 20.viii.1957, B.J. Marples, OMNZ; 1 ♀, Aurum Creek, -44.7915, 168.6365, S.R. Forster, OMNZ; 1 ♂, Parawa, -45.5429, 168.5304, 5.ix.1948, OMNZ. **FD**. 2 ♀, Martins Bay, -44.3667, 168.0000, 1.ii.1955, RRF & J.S.Dugdale, OMNZ; 1 ♀, Southside Tutoko Bench, -44.6000, 168.0000, 4.i.1977, J.S. Dugdale, NZAC; 3 ♀, Hidden Falls, -44.6321, 168.1226, 21.i.1955, RRF, OMNZ; 1 ♀, Bowen Falls, -44.6670, 167.9266, 11.i.1971, RRF, OMNZ; 1 ♀, Hollyford Valley, -44.7500, 168.1333, 6.ii.1981, OMNZ; 1 ♀, Homer Tunnel, -44.7664, 167.9766, 12.i.1971, RRF, OMNZ; 1 ♀, Lake Howden, -44.8213, 168.1365, 14.xii.1966, A.K. Walker & K.Z. Wilson, NZAC; 1 ♀, Lake Hankinson, -45.0622, 167.5719, ii.1980, RRF, OMNZ; 1 ♀, Eglinton Valley, -45.1000, 167.9667, 30.v.1963, OMNZ; 2 ♀, Secretary Island, -45.2313, 166.9283, 24.xi.1981, A.C. Harris, OMNZ; 1 ♀, 26.xi.1981, A.C. Harris, OMNZ; 2 ♀, Tunnel Burn Valley, -45.2968, 167.7098, xii.1949, B. Wisely, OMNZ; 1 ♀, Hall Arm, -45.4598, 167.1148, Otago University Biological Society, OMNZ; 1 ♂, 2 ♀, 1 imm, Disappointment Cove, -45.6068, 166.6693, 10.i.1998, G. Hall & D.M. Gleeson, NZAC; 1 ♂, Green Lake, -45.7972, 167.3964, 15.xi.1975, A.C. Harris, OMNZ; 1 ♀, Lake Hauroko, -45.9470, 167.3022, 25.xi.1970, RRF & CLW, OMNZ; 1 ♂, 1 ♀, Rowallan, -46.0616, 167.5976, 25.xi.1970, RRF & CLW, OMNZ. **DN**. 2 ♂, Duntroon, -44.8667, 170.6833, viii.1948, B.J. Marples, OMNZ; 1 ♂, Evansdale Glen, -45.7217, 170.5728, 10.x.1978, RRF, OMNZ; 1 ♂, Double Hill, Waitati, -45.7522, 170.5272, xi.1961, W. Poppelwell, OMNZ; 9 ♂, Sullivans Dam, -45.8079, 170.5244, 12.x.1966, RRF, OMNZ; 10 ♂, 2 ♀, 1.xi.1966, RRF, OMNZ; 3 ♂, 1 ♀, 11.xi.1966, RRF, OMNZ; 2 ♂, 19.xii.1966, RRF, OMNZ; 5 ♂, 1 ♀, Leith Saddle, -45.8333, 170.5167, 20.iii.1967, RRF, OMNZ; 2 ♀, 2.iv.1967, RRF, OMNZ; 1 ♂, 2 ♀, 8.iv.1967, RRF, OMNZ; 2 ♀, 22.iv.1967, RRF, OMNZ; 1 ♀, 25.vi.1967, RRF, OMNZ; 1 ♀, 5.viii.1967, RRF, OMNZ; 2 ♂, 20.iv.1968, RRF, OMNZ; 1 ♀, 18.v.1968, RRF, OMNZ; 1 ♀, 18.v.1968, RRF, OMNZ; 1 ♂, Flagstaff, -45.8336, 170.4613, 24.ix-29.x.2000, S.M. Pawson, LUNZ; 1 ♀, Lake Mahinerangi, 430m, -45.8352, 169.8866, 15.i.1965, G. Kuschel & J.I. Townsend, NZAC; 1 ♀, Opoho Bush, -45.8561, 170.5299, i.1946, T. Smith, OMNZ; 1 ♂, Flagstaff, -45.8561, 170.5299, 10.iii.1962, W.T. Poppelwell, OMNZ; 1 ♂, 1 ♀, 9.xii.1970, CLW, OMNZ; 1 ♂, 1 ♀, 21.iii.1971, CLW, OMNZ; 1 ♀, 7.x.1975, A.C. Harris, OMNZ; 1 ♀, 10.xii.1975, RRF, OMNZ; 1 ♀, Allans Beach, Rabbit Meadow, -45.8824, 170.6870, 16-30.iv.1953, B.J. Marples, OMNZ; 1 ♀, 24.xi.1953, B.J. Marples, OMNZ; 1 ♀, Dunedin, -45.8828, 170.5137, 10.ii.1959, RRF, OMNZ; 2 ♀, xi.1959, RRF, OMNZ; 1 ♂, 11.iii.1973, S.R. Forster, OMNZ; 1 ♀, Lawrence, -45.9160, 169.6913, 2.i.1970, CLW, OMNZ; 1 ♂, Tuapeka West, -45.9372, 169.8450, 21.xii.1985-18.i.1986, B.I.P. Barratt, NZAC; 1 ♀, Henley, -45.9832, 170.1656, 20.iv.1975, RRF, OMNZ; 1 ♀, Taieri Mouth, -46.0562, 170.1933, 19.x.1999, S. Clifford, OMNZ; 2 ♂, Bull Creek, -46.1833, 170.1333, 14.v.1967, R.W. Huttan & CLW, OMNZ. **CO**. 2 ♀, Cardrona River, -44.9167, 168.9833, 11.i.1999, CJV, LUNZ; 1 ♀, 2.ii.1999, CJV, LUNZ; 1 ♀, near Middlemarch, -45.4867, 170.0833, 10.ii-7.iii.1999, C. Rufaut, LUNZ; 1 ♂, 1 ♀, Titan Rocks Track, -45.5292, 169.0032, 9.xii.1998, G. Hall, B. Brown & E. Edwards, LUNZ; 1 ♀, Station Ridge, 860m, above Waikoia Valley, -45.5571, 168.9622, 28.iii.1976, K.D. Mason, OMNZ; 1 ♀, 1 imm, Waikaia, -45.7235, 168.8492, 4.ii.1998, G. Hall & D.M. Gleeson, NZAC; 4 ♂, 5 ♀, Craig Flat, -45.7382, 169.4937, 16.xi-21.xii.1985, B.I.P. Barratt, NZAC; 1 ♂, 2 ♀, Waipori, -45.8268, 169.8820, 10-24.x.1978, B.I.P. Barratt, OMNZ; 1 ♀, Waitahuna Bridge, -45.8533, 169.8166, 2.i.1970, CLW, OMNZ. **SL**. 2 ♂, 8 ♀, Island Block, -45.7218, 169.4559, 18.i-9.iii.1986, B.I.P. Barratt, NZAC; 3 ♀, Dean Forest, -45.8774, 167.6010, 26.i.1998, G. Hall & D.M. Gleeson, NZAC; 2 ♂, 3 ♀, Kelso, -45.9076, 169.2317, 23.xi-7.xii.1969, CLW, OMNZ; 9 ♂, 1 ♀, near Kelso, -45.9076, 169.2317, 23.xi-7.xii.1969, CLW, OMNZ; 1 ♀, Tapanui, -45.9471, 169.2682, vi.1961, W.T. Poppelwell, OMNZ; 6 ♂, 1 ♀, Pomahaka, -46.0104, 169.2376, 23.xi-7.xii.1969, CLW, OMNZ; 1 ♀, Balclutha, -46.2316, 169.7337, 10.xi.1958, RRF, OMNZ; 10 ♀, 20.xi.1958, RRF, OMNZ; 5 ♂, 1 ♀, Orepuki, -46.2833, 167.7500, 9.v.1949, J.H. Sorensen & RRF, OMNZ; 2 ♂, 3 ♀, 11.viii.1949, J.H. Sorensen, OMNZ; 1 ♂, Longwood River, West Side, -46.3451, 167.9558, 1.ix.1948, J.H. Sorensen, OMNZ; 2 ♀, Colac Bay, -46.3606, 167.8769, 24.xi.1970, RRF & CLW, OMNZ; 1 ♀, 19.iii.1975, A.C. Harris, OMNZ; 1 ♀, Owaka Valley, -46.4296, 169.5820, 3.i.1966, CLW, OMNZ; 1 ♀, Tautuku, -46.5848, 169.4211, 14.ii.1979, RRF, OMNZ. **SI**. 1 ♂, Lee Bay, -46.8621, 168.1230, 25.xii.1975, A.C. Harris, OMNZ; 1 ♀, Halfmoon Bay, -46.8924, 168.1527, i.1939, B.J. Marples, OMNZ; 1 ♂, 22.xi.1946, OMNZ; 1 ♂, 10.iii.1948, O. Allan, OMNZ; 1 ♀, 14.iii.1949, O. Allan, OMNZ; 1 ♂, vi.1950, O. Allan, OMNZ; 1 ♀, Oban, -46.8924, 168.1527, i.1956, I. Mannering, OMNZ; 1 ♀, 29.iii.1975, A.C. Harris, OMNZ; 1 ♂, 2 ♀, Golden Bay, -46.9054, 168.1224, 13-21.xi.1958, M.N. Watts, OMNZ; 1 ♂, 1 ♀, i.1959, M.N. Watts, OMNZ; 1 ♂, Big South Cape Island, -47.2398, 167.4006, 11.ii.1969, A.C. Eyles, NZAC; 1 ♂, Stewart Island, 25.xi.1965, T. Bruce, OMNZ; 1 ♀, 1.1956, M.N. Watt, OMNZ. **Unknown locality**. 1 ♂, Panikiri Track, 11.xii.1946, OMNZ; 1 ♀, T.K. Lomas, OMNZ; 1 ♀, OMNZ.

Anoteropsis aerescens

TO. 1 ♂, Waipakihi Riverbed, -39.1634, 175.9005, 26.i.1982, D.J. Court, OMNZ; 1 ♀, Lower Tama Lake, 1280m, -39.2000, 175.6000, 16.i.1967, I.R. Harding, AMNZ; 1 ♀, Ruapehu, 1300m, -39.2805, 175.5669, 13.i.1969, R.W. Huttan, OMNZ. **TK**. 1 ♂, Mt Egmont, 2130m, -39.2977, 174.0636, 2.i.1976, A.K. Walker, NZAC; 2 ♀, i.1978, OMNZ; 3 ♂, 2 ♀, Mt Egmont, -39.3050, 174.0833, 2.xii.2000, CJV, LUNZ; 1 ♂, East Egmont, 1700m, -39.3063, 174.1230, 29.i.1973, K.J. Fox, OMNZ; 1 ♀, Fanthams Peak, 2000m, -39.3124, 174.0660, 16.i.1955, G.W. Ramsay, OMNZ; 1 ♂, Dawson Falls, -39.3233, 174.1049, 14-21.i.1955, J.T. Salmon, OMNZ. **RI**. 1 ♂, Mangaweka, -39.8172, 175.7860, 1.xii.1978, A.C. Harris, OMNZ. **WI**. 1 ♂, Feilding, -40.2333, 175.5667, 18.i.1959, RRF, OMNZ. **WN**. 2 ♀, Orongorongo Valley, -41.3667, 174.9000, 16.viii.1995, B.M. Fitzgerald, MONZ; 2 ♀, 12-13.xii.1998, A. Tennyson, MONZ; 1 ♀, 5 imm, 31.i.1995, B.M. Fitzgerald, MONZ; 4 ♀, Orongorongo River, -41.4167, 174.9000, 3.xii.2000, CJV & P.J. Sirvid, LUNZ. **WA**. 1 ♀, Palliser Bay, -41.4195, 175.0534, v.1969, E.G. Turbott, OMNZ. **MK**. 1 ♀, Hooker Galcier, -43.6886, 170.1005, 6.i.2001, M.A. Hudson & CJV, LUNZ. **SC**. 5 ♀, Orari River, -44.0500, 171.2500, 30.ix.1966, RRF & CLW, OMNZ. **WD**. 1 ♂, Fantail Falls, -44.0802, 169.3872, 18.xi.1995, CJV, LUNZ. **OL**. 1 ♂, OL, Albert Burn, -44.3426, 169.0215, iv.1974, K. Mason, OMNZ; 1 ♂, 2 ♀, Kidds Bush, -44.4440, 169.2680, 9.iv.1979, RRF, OMNZ; 1 ♀, Hawea, -44.6141, 169.2660, 30.i.1975, RRF, OMNZ; 6 ♂, 6 ♀, 10.iv.1979, RRF, OMNZ; 9 ♂, 3 ♀, Wanaka, -44.7080, 169.1238, 7.x.1959, RRF, OMNZ. **CO**. 1 ♀, Clutha River, near Lowburn, -44.9167, 169.2833, 22.xi.1974, J.S. Dugdale, NZAC; 8 ♂, 4 ♀, Arrowtown, -44.9448, 168.8175, 20.v.1972, RRF, OMNZ; 1 ♂, 2 ♀, Ophir Riverbed, -45.1112, 169.6090, 2.viii.1961, RRF, OMNZ; 1 ♀, Mt Dasher, -45.1499, 170.4849, 17.v.1980, R.A. Savill, CMNZ. **SL**. 1 ♂, Te Anau, -45.4170, 167.6990, 4.iv.1958, R. Marples, OMNZ. **FD**. 1 ♀, near Monowai, -45.6000, 167.7000, 14.i.1971, RRF, OMNZ; 2 ♀, Lake Monk, -46.0193, 166.9592, 9.v.1954, J.S. Dugdale, OMNZ.

Anoteropsis alpina
BR. 1 ♀, Mount Hopeless, 2150m, -41.9496, 172.7393, 8.i.1964, L.J. Strang, OMNZ. **MC**. 1 ♂, Mount Cloudsley, 1950m, -43.2078, 171.6423, 27.xii.2000, M.H. Bowie, LUNZ; 1 ♂, Colin Campbell Glacier, 1270m, -43.3321, 170.7392, 20.i.1975, K. Mason, OMNZ; 1 ♀, Tent Peak, 2423m, -43.3440, 171.0206, 20.xi.1953, A.C. Clough, OMNZ; 1 ♀, Amazon Peak, 2500m, -43.3558, 170.8420, 17.iv.1963, B. Fineran, OMNZ. **MK**. 1 ♂, Haast Ridge, 2000m, -43.5821, 170.1939, 31.xii.1964, B. Fineran, OMNZ. **CO**. 2 ♂, allotype ♀, 1 ♀ paratype, Hawkdun Range, 2000m, -44.7007, 169.9491, 12.xii.1971, OMNZ; holotype ♂, Mt St Bathans, 2000m, -44.7357, 169.7627, 27.xi.1971, D.R. Forster & S. Forster, OMNZ; 3 ♂ paratypes, Michael Peak, 2000m, -44.7500, 169.7666, 27.xi.1971, S. Forster, OMNZ.

Anoteropsis arenivaga
MB. 1 ♂, near Lake Tennyson, -42.2083, 172.7500, 24.iii.1988, J. Arund, LUNZ. **NC**. 1 ♀, Hawdon Riverbed, -42.9363, 171.7436, 9.xii.1953, R.L.C. Pilgrim, OMNZ; 1 ♀, Rough Creek, -42.9522, 171.5502, 19.i.2000, M.P. Anstey, LUNZ; 1 ♂, 1 ♀, Chalk Hill, -43.2667, 172.1667, v.1952, RRF, OMNZ; 1 ♂, 1 ♀, Coopers Creek, -43.3000, 172.1667, 1.xii.1948, RRF, OMNZ. **MC**. 1 ♂, Waimakariri River, near Bealey, -43.0333, 171.6333, 29.ix.1966, RRF & CLW, OMNZ; 1 ♂, Cass River, -43.0667, 171.7333, 26.viii.1928, G.A.H. Helson, OMNZ; 2 ♂, 1 ♀, Porter River, -43.2167, 171.7333, 1.xii.2000, M.P. Anstey, LUNZ; 2 ♂, Lake Lyndon, -43.3037, 171.7004, 26.iv.1945, RRF, OMNZ; 1 ♂, Kaitorete Spit, -43.8170, 172.5999, 12.v.1954, J.S. Dugdale, OMNZ; 1 ♂, 1 ♀, 1.v.1960, OMNZ; 2 ♂, 1.viii.1991, A.B. Freeman, LUNZ; 1 ♀, 1.xi.1991, CJV, LUNZ; 1 ♂, ii.1993, CJV & A.B. Freeman, LUNZ; 1 ♂, 16.vii.1996, CJV, LUNZ; 2 ♂, 1 ♀, 16.vii.1996, CJV & D. Nicholls, LUNZ; 1 ♀, 16.vii.1996, CJV, LUNZ; 4 ♂, 6 ♀, 11.vi.1999, CJV & J.W. Griffiths, LUNZ; 2 ♂, 1 ♀, Birdlings Flat, -43.8256, 172.6955, 14.iv.1967, RRF & CLW, OMNZ; 1 ♀, 11.i.2000, M.P. Antsey & M. Zabka, LUNZ; 2 ♀, MC, Hinds Stream, -44.0338, 171.6161, 12.ix.1954, RRF, OMNZ;. **MK**. 1 ♀, near Ball Shelter, -43.6282, 170.1922, 15.xii.1992, CJV, LUNZ; 1 ♀, Hooker Galcier, -43.6636, 170.1258, 14.iv.2001, C.B. Phillips, LUNZ; 2 ♀, near Dunstan Downs, -44.5019, 169.7577, 26.vii.1967, RRF, OMNZ. **SC**. 2 ♀, Orari River, -44.0500, 171.2500, 30.ix.1966, RRF & CLW, OMNZ. **CO**. 1 ♂, Luggate, -44.7477, 169.2690, 4.xi.1958, RRF, OMNZ. **Unknown locality**. 1 ♂, J.R.J., OMNZ.

Anoteropsis blesti
ND. 4 ♀, Mangamuka, -35.2167, 173.5500, 31.i.1981, RRF, OMNZ; 2 ♀, 1 subadult ♂, Moehau, -35.4397, 173.6088, 30.xii.1946, OMNZ. **CL**. 2 ♀, Waitekauri River, -37.3838, 175.7774, 1997, K. Collier, LUNZ; holotype ♂, Waitekuri River, -36.7586, 175.5656, 26.i.2000 (moulted Oct 2000), CJV & ADB, LUNZ; 3 ♂ paratypes, 1 ♀ paratype, 1 imm, 26.i.2000, CJV & ADB, LUNZ; 2 ♀ paratypes, 16.ii.2000, CJV, LUNZ; allotype ♀, 4 ♂ Paratypes, 2 ♀ paratypes, 17.ii.2000, CJV, LUNZ;. **AK**. 1 ♀, Huia, -37.0003, 174.5628, 25.i.1956, G. Chamberlain, OMNZ. **BP**. 1 ♂, 2 imm, Wairere Stream, -37.7458, 175.8694, 17.iv.2000, K. Collier, LUNZ.

Anoteropsis canescens
NN. 1 ♂, Westport, -41.7518, 171.5825, 12.i.1944, A.W. Parrott, OMNZ. **NC**. 1 ♀, Lake Taylor, -42.7685, 172.2309, 14.iv.1952, RRF, OMNZ; 1 ♂, Waipara Gorge, -43.0667, 172.7333, 1.v.1959, OMNZ; 1 ♂, lower Waipara River, -43.1333, 172.7750, 14.xii.1955, RRF, CMNZ. **MC**. 1 ♀, Mistake Creek, -43.2056, 171.2214, 15.v.1955, J.S. Dugdale, CMNZ; 1 ♀, Hydra Island, -43.2703, 171.3517, 14.v.1955, J.S. Dugdale, CMNZ; 10 ♂, 1 ♀, McLeans Island, -43.4667, 172.4748, 21-31.i.1997, R.P. Macfarlane, LUNZ; 1 ♀, 20-29.i.1997, R.P. Macfarlane, LUNZ; 9 ♂, Christchurch Airport, -43.4876, 172.5339, viii.1968, A. Moeed, OMNZ; 10 ♂, 4 ♀, ix.1968, A. Moeed, OMNZ; 9 ♂, x.1968, A. Moeed, OMNZ; 5 ♂, 1 ♀, xii.1968, A. Moeed, OMNZ; 3 ♀, iv.1969, A. Moeed, OMNZ; 3 ♀, v.1969, A. Moeed, OMNZ; 1 ♀, MC, Dunsandel, -43.6633, 172.1974, xii.1998, P.M. Denholm, LUNZ; 3 ♂, 2 ♀, xii.1999, P.M. Denholm, LUNZ; 1 ♀, iii.2000, P.M. Denholm, LUNZ. **OL**. 1 ♀, Toi Toi Flat, Landsborough, -43.8833, 169.7000, 20.iv.1971, K. Mason, OMNZ. **MK**. 1 ♀, Snowy Gorge, -44.3072, 169.6768, 15.ii.1984, J. Hunt, OMNZ. **CO**. 1 ♂, Luggate, -44.7477, 169.2690, 17.viii.1961, RRF, OMNZ; 1 ♀, Danseys Pass, -44.9761, 170.4880, 17.xi.1979, A.C. Harris, OMNZ; 3 ♂, Kawarau Gorge, -45.0239, 169.0957, viii.1952, B.J. Marples, OMNZ; 3 ♂, 2 ♀, near Cromwell, -45.0455, 169.1865, 16.viii.1961, RRF, OMNZ; 1 ♂, Alexandra, -45.2557, 169.3755, 20.viii.1957, B.J. Marples, OMNZ; 1 ♂, 3.viii.1961, RRF, OMNZ; 1 ♀, near Butchers Dam, -45.2969, 169.3422, 3-6.ix.1959, V.E.D., OMNZ; 2 ♂, near Shingle Creek, -45.4227, 169.2813, 14.viii.1961, RRF, OMNZ.

Anoteropsis cantuaria
NC. 1 ♂, Waipara Gorge, -43.0667, 172.6000, 2.i.2000, CJV, LUNZ; 1 ♀, 2.i.2000, CJV & M.A. Hudson, LUNZ; 1 ♀, 2.i.2000, CJV, M.A. Hudson & S.J. Crampton, LUNZ. **MC**. 1 ♂, Kowai River, -43.3333, 171.8666, 4.xii.1955, B.J. Marples, OMNZ; 1 ♂, Menzies Bay, -43.6410, 172.9663, 1.ix.1959, Dept of Zoology, C.U.C., OMNZ; 1 ♂, Purau Stream, -43.6620, 172.7542, 16.ix.1962, R.S. Bigelow, OMNZ; 1 ♂ paratype, 4 ♀ paratypes, Prices Valley, -43.7694, 172.7105, 30.x.1990, CJV, LUNZ; allotype ♀, 3 ♀ paratypes, 22.xi.1990, CJV, LUNZ; holotype ♂, 1 ♂ paratype, 1 ♀ paratype, 29.iv.1994, CJV, LUNZ; 1 ♂, 20.x.1999, CJV, LUNZ; 1 ♂, 3 ♀, 20.x.1999, CJV, LUNZ; 2 ♂, 2 ♀, 20.x.1999, CJV & H. Ranson, LUNZ. **SC**. 1 ♀, Waihi Gorge, -44.0016, 171.1408, 23.i.1982, RRF, OMNZ; 3 ♂, 1 ♀, Waihi, -44.0220, 171.1751, 10.xii.1939, A.W.Parrott, OMNZ; 2 ♀, Opihi River, Fairlie, -44.1000, 170.8333, 19.i.1982, RRF, OMNZ; 1 ♂, 6 ♀, Waihao River, -44.7892, 171.0092, 30.ix.1966, OMNZ. **Unknown locality**. 2 ♂, 6 ♀, Ar 1/78, OMNZ.

Anoteropsis flavesens
DN. 1 ♀, Swampy Summit, -45.7907, 170.4731, 24.ix.2000, S.M. Pawson, LUNZ; 2 ♂, 26.ix-29.x.2000, S.M. Pawson, LUNZ; 2 ♂, 2 ♀, 30.x.2000, S.M. Pawson, LUNZ; 3 ♂, Mt Cargill, -45.8146, 170.5546, 23.ix-29.x.2000, S.M. Pawson, LUNZ; 1 ♀, Leith Saddle, -45.8333, 170.5167, 6.v.1967, RRF, OMNZ; 1 ♂, Flagstaff, -45.8336, 170.4613, 24.ix-29.x.2000, S.M. Pawson, LUNZ; 3 ♂, 1 subadult ♂, Allans Beach, -45.8824, 170.6870, 11.i.1956, B.J. Marples, OMNZ. **CO**. 2 ♂, Blue Moutains (N), 900 m, -45.9088, 169.3675, 5-27.i.1985, B.I.P. Barratt, OMNZ; 1 ♂, Blue Moutains (N), 1000m, 5-27.i.1985, B.I.P. Barratt, OMNZ. **SL**. 2 ♀ (genitalia missing in one), Orepuki, -46.2833, 167.7500, 9.v.1949, RRF, OMNZ.

Anoteropsis forsteri
DN. 1 ♂, Island in Blueskin Bay, -45.7282, 170.5757, 1.x.1950, B.J. Marples, OMNZ; 2 ♂, Allans Beach, -45.8824, 170.6870, 16.ix.1951, B.J. Marples, OMNZ; 1 ♂, 29.ix.1951, B.J. Marples, OMNZ; 1 ♂, 21.viii.1966, RRF, OMNZ; 1 ♂, Chrystalls Beach, -46.2077, 170.0726, 6.v.1967, CLW, OMNZ; 1 ♂, Toko Mouth, -46.2257, 170.0447, 30.xi.1968, D. Forster, OMNZ; 1 ♀, Dunedin?, OMNZ; 1 ♂, A08.211, OMNZ. **SL**. 2 ♂ paratypes, Oreti Beach, -46.4333, 168.2333, 2.ii.2000, CJV, LUNZ; holotype ♂, allotype ♀, 21.xi.2000, CJV, LUNZ; ; 1 ♂, Cannibal Bay, -46.4736, 169.7569, 9.vi.1974, G. Lockere, OMNZ; 1 ♂, Long Beach, -46.6301, 169.2645, 10.ix.1947, OMNZ. **SI**. 1 ♀, Maori Beach, -46.8418, 168.0822, 23.xii.1975, A.C. Harris, OMNZ; 1 ♀, Mason Bay, -46.9530, 167.7041, 20.xii.1970, D.S. Horning, NZAC; 1 ♂, Stewart Island, -46.9530, 167.7041, 16.iv.1971, J. Child, OMNZ; 1 ♀, Golden Bay, -46.9054, 168.1224, i.1959, M.N. Watt, OMNZ.

Anoteropsis hallae

NN. holotype ♂, between Heaphy and Lewis Huts, -40.9667, 172.1333, 7.xi.1999, G. Hall, NZAC. **BR**. allotype ♀, Capleston, -42.0694, 171.9159, 8.xi.1971, J.C. Watt, NZAC.

Anoteropsis hilaris

TH. 1 ♀, Bayliss Stream, -34.1667, 172.1333, 14.iv.1999, A.M. Booth, NZAC; 1 ♀, Tasman Valley, -34.1667, 172.1333, 25.xi.1970, G.W. Ramsay, NZAC; 1 ♂, 1 ♀, Castaway Valley, -34.1667, 172.1333, 6.xii.1996, G.L.F. Carlin, NZAC; 1 ♀, Castaway Camp, -34.1667, 172.1333, 29.xi.1970, G.W. Ramsay, OMNZ; 1 ♀, 3 imm, 29.xi.1970, G.W. Ramsay, OMNZ. **ND**. 1 ♀, Houhora, -34.7966, 173.1030, 24.viii.1953, B.J. Marples, OMNZ; 5 ♂, Motukawanui Island, -35.0027, 173.9193, 1-7.i.1979, L. Roberts, OMNZ; 1 ♂, Kaitaia, -35.1093, 173.2485, 30.i.1981, RRF, OMNZ; 1 ♂, Kerikeri Basin Reserve, -35.21666, 173.9500, 14.vi.2000, G. Hall, LUNZ; 1 ♀, Kohukohu, -35.3635, 173.5418, 19.viii.1953, B.J. Marples, OMNZ; 1 ♀, 22.viii.1953, B.J. Marples, OMNZ; 4 ♂, 2 ♀, Mimiwhangata, -35.4324, 174.4040, 10-17.xii.1970, J. Darby, OMNZ; 3 ♂, 1 ♀, Tawhiti Rahi Island, -35.4563, 174.7182, 6-12.ix.1980, J.C. Watt, NZAC; 3 ♂, 3 ♀, 1 imm, 2-10.xii.1980, J.C. Watt, NZAC; 1 ♂, 1 ♀, Aorangi Island, -35.4802, 174.7262, 11-17.xi.1981, J.C. Watt, NZAC; 1 ♂, Waiarohia Stream, -35.5215, 173.4011, 4.ii.1994, ADB, LUNZ; 1 ♀, Waipoua Forest, -35.6164, 173.5405, 29.x.1980, G. Kuschel, NZAC; 1 ♀, near Matarau, -35.6335, 174.1909, 21.iii.1995, C.A. Stewart, LUNZ; 1 ♀, Whangarei, -35.7215, 174.2981, 6.ii.1981, RRF, OMNZ; 1 ♀, Onerahi, -35.7676, 174.3597, 16.ii.2000, R. Leschen, G. Hall & R.J.B. Hoare, LUNZ; 1 ♂, Ocean Beach, -35.8396, 174.5626, 5.vi.1970, D.J. Court, OMNZ; 25 ♂, Ruakaka, -35.9122, 174.4536, 6.ii.1976, C. Butcher, NZAC; 2 ♂, Redhill, -36.0675, 173.8786, 4.ii.1976, C. Butcher, NZAC; 8 ♂, 18.ii.1976, C. Butcher, NZAC. **CL**. 1 ♀, Motairehe, -36.1206, 175.3752, xi.1964, J. Hall, MONZ; 1 ♀, House at Barrier Isalnd, -36.1206, 175.3752, 7.x.1945, E.G. Turbott, MONZ; 1 ♀, Motairehe, -36.1206, 175.3752, 12.xi.1963, R.G. Ordish, OMNZ; 2 ♀, Motairehe, -36.1206, 175.3752, 18.xi.1963, R.G. Ordish, OMNZ; 1 ♂, Little Barrier Island, -36.1984, 175.1129, 20.xi.1947, E.G. Turbott, OMNZ; 1 ♀, 23.xi.1954, G. Ramsay, OMNZ; 1 ♂, 26.xi.1954, G. Ramsay, OMNZ; 1 ♂, 2 ♀, Whangaparapara, -36.2435, 175.3993, 21.viii.1972, D.J. Court, OMNZ; 2 ♂, 3 ♀, Cuvier Island, -36.4367, 175.7386, 25.ii-2.iii.1982, G. Hall, NZAC; 1 ♀, Cuvier Island, -36.4322, 175.7745, 28.iii.1994, B.M. Fitzgerald, MONZ; 1 ♀, Whangapoua, -36.7167, 175.6167, 16.ii.2000, CJV, LUNZ; 1 ♂, Kuaotunu, -36.7228, 175.7231, 26.i.2000, CJV, LUNZ; 1 ♀, Matarangi, -36.7333, 175.6667, 17.vi.2000, J.W. Griffiths & C.N.L. Chambers, LUNZ; 1 ♀, Opoutere, -37.1000, 175.8833, 15.vi.2000, J.W. Griffiths & C.N.L. Chambers, LUNZ; 1 ♀, near Thames, -37.1428, 175.5330, 26.i.1993, CJV, LUNZ. **AK**. 1 ♂, Dome Valley, -36.3735, 174.6197, 25.iv.1946, E.G. Turbott, OMNZ; 1 ♀, Motuora Island, -36.5115, 174.7938, 5.iv.1996, A. Tennyson, MONZ; 1 ♀, Tiritiri Matangi Island, -36.6016, 174.9014, 23.xi.1961, A. Wright, OMNZ; 1 ♀, Motuhoropapa Island, -36.6911, 174.9665, 17.i-16.ii.1978, L.L. Deitz & J.S. Dugdale, NZAC; 2 ♂, 23.x-17.xii.1978, D.W. Helmore & J.M. Cleary, NZAC; 1 ♂, 26.x-9.xii.1979, M. Tocker, B. Bradshaw, C. Butcher & J. Watt, NZAC; 1 ♂, Otata Island, -36.6977, 174.9780, 22.x-18.xii.1978, D.W. Helmore & J.M. Cleary, NZAC; 1 ♂, 3 ♀, 1 imm, 18.xii.1978-25.ii.1979, D.W. Helmore, J.M. Cleary & M. Tocker, NZAC; 1 ♀, Waiheke Island, -36.7822, 174.9656, xii.1943, G. Chamberlain, MONZ; 1 ♀, 24.i.1997, CJV, LUNZ; 1 ♂, Birkenhead, -36.8186, 174.7284, ix.1943, J.A. Marsden, MONZ; 1 ♀, x.1943, J.A. Marsden, MONZ; 1 ♂, 2 ♀, Auckland, -36.8396, 174.7624, M.P. Büchler, OMNZ; 1 ♂, 1 ♀, winter, M.P. Büchler, OMNZ; 2 ♂, ix.1941, D. Spiller, OMNZ; 1 ♀, 11.vi.1957, M. Lane, OMNZ; 1 ♀, Parnell, -36.8586, 174.7822, 8.vi.1947, E.G. Turbott, OMNZ; 1 ♂, Matupu Reserve, -36.8652, 174.4628, 25.i.1997, CJV, LUNZ; 3 ♀, Remuera, -36.8781, 174.7992, 30.viii.1946, S.A. Rumsey, OMNZ; 2 ♀, Oakley Creek Reserve, Waterview, -36.8802, 174.6948, 16.ii.1999, CJV & G. Hall, LUNZ; 1 ♀, Mt Albert, -36.8931, 174.7201, 28.iv.1948, F. Dell, OMNZ; 1 ♂, Ihumoana Island, -36.8947, 174.4293, 5.vii.1995, A. Tennyson, MONZ; 10 ♂, 2 ♀, Bethells, -36.8980, 174.4354, 19.ix-21.x.1983, M.F. Tocker & B.G. Bennett, NZAC; 9 ♂, 1 ♀, 11.vi-18.vii.1984, M.F. Tocker, NZAC; 1 ♀, Avondale, -36.8988, 174.6940, 19.i.1993, G. Hall, LUNZ; 1 ♀, nr Waitakere Reservation, -36.9070, 174.5277, 24.i.1993, CJV, LUNZ; 6 ♂, 4 ♀, Three Kings, -36.9079, 174.7553, 18-27.i.1993, CJV, LUNZ; 1 ♀, Waikowhai Reserve, -36.9301, 174.7386, 16.ii.1999, G. Hall & CJV, LUNZ; 1 ♂, 1 ♀, Cutty Grass Track, -36.9333, 174.5333, 17.ii.1999, CJV, LUNZ; 1 ♀, Titirangi, -36.9402, 174.6567, 22.x.1969, F.A. Alack, NZAC; 2 ♂, 2 ♀, 22.iv.1972, N.A. Martin, NZAC; 1 ♀, Mangere, -36.9768, 174.7971, 15.xii.1975, N.A. Martin, NZAC; 5 ♀, Papatoetoe, -36.9794, 174.8421, 16.viii.1978, D.W. Helmore, NZAC; 1 ♀, near Clevedon, -36.9875, 175.0489, 24.i.2001, CJV, LUNZ; 1 ♀, Totara Park, -37.0000, 174.9500, 18.vi.2000, R.J.B. Hoare, LUNZ; 7 ♀, Olive Davis Reserve, -37.0000, 174.9500, 30.x.1999, G. Hall, NZAC; 1 ♂, 3 ♀, Miranda, -37.1889, 175.3182, 29.xi.1953, B.J. Marples, OMNZ; 1 ♀, Pukekohe, -37.2086, 174.8978, 19.ii-19.iv.1977, N.A. Martin, NZAC; 2 ♂, 21.ii-21.iii.1977, N.A. Martin, NZAC; 11 ♂, 4 ♀, 17.iv-17.v.1977, N.A. Martin, NZAC; 7 ♂, 6 ♀, 4.x.1977, N.A. Martin, NZAC; **WO**. 2 ♂, 4 ♀, Torehape, -37.3420, 175.4102, 14.xii.1999, C. Watts, NZAC; 1 ♂, near Hamilton, -37.7826, 175.2727, 19.vii.1965, M.L., OMNZ; 3 ♂, 3 ♀, Matamata, -37.8079, 175.7787, 10.ix.1984, D.J. Court, OMNZ; 1 ♂, Pirongia Mountain, -37.9929, 175.0891, 28.x.1968, H. Oliver, OMNZ; **BP**. 3 ♀, Otaketake, -37.5327, 177.1869, 19-22.xi.1964, C.J. Robertson, AMNZ; 4 ♂, Te Aroha, -37.5382, 175.7154, 27.v.1996, CJV, LUNZ; 1 ♂, 4 ♀, Whangaparaoa Beach, -37.5741, 177.9672, 25.xi-29.i.1993, R.C. Henderson, NZAC; 5 ♂, 2 ♀, Whangaparaoa, -37.5741, 177.9672, 29.i-12.iii.1993, J.S. Dugdale, NZAC; 1 ♂, Tokata, -37.6248, 178.3321, 2-4.ii.1993, R.C. Henderson, NZAC; 1 ♀, 1 imm, Mt Otanewainuku, -37.9053, 176.2039, 30.i.1996, A. Tennyson, MONZ; 4 ♂, 5 ♀, Whakatane, -37.9693, 176.9924, 2-6.x.1969, CLW, OMNZ; 3 ♂, 2 ♀, Kawerau, -38.0796, 176.7004, 14.v.1973, RRF, OMNZ; 1 ♀, Mt Ngongotaha, -38.0833, 176.2166, 19.xii.1995, ADB, LUNZ; 1 ♂, Lake Okataina Scenic Reserve, -38.1136, 176.3901, 26.v.1996, CJV, LUNZ; 1 ♀, Lake Okataina, -38.1141, 176.4203, 19.xii.1995, ADB, LUNZ; 1 ♀, 19.ii.1999, CJV, LUNZ; 5 ♂, Ngongotaha, -38.1201, 176.1976, 26.v.1996, CJV & ADB, LUNZ. **TO**. 1 ♂, 1 ♀, Rangitoto Station, -38.3532, 175.4800, 10.xi.1996, G. Hall, NZAC; 1 ♂, Mt Pureora, -38.5528, 175.6285, 14.x.1982, G. Kuschel, NZAC; 2 ♂, Waitetoko, -38.9066, 175.9295, 12.xii.1965, R.W. Huttan, OMNZ; 1 ♀, R.W. Huttan, OMNZ; 1 ♂, 6 ♀, Stump Bay, -38.9500, 175.8167, 9.xi.1994, CJV & ADB, LUNZ; 1 ♂, Tokaanu, -38.9666, 175.7539, R.W. Huttan, OMNZ; 1 ♂, Hinemihi's Track, -39.0167, 175.7333, 9.xi.1994, CJV & ADB, LUNZ; 1 ♂, Ruapehu, -39.2805, 175.5669, 12.iv.1968, R.W. Huttan, OMNZ; 1 ♂, 1 ♀, Desert Road, -39.3179, 175.6688, 5.i.1967, RRF, OMNZ. **TK**. 1 ♂, Fitzroy, -39.0500, 174.1000, 30.xi.2000, CJV, LUNZ; 1 ♂, 3 ♀, Oakura, -39.1167, 173.9500, 1.xii.2000, CJV, LUNZ; 1 ♂, 2 ♀, Lucys Gully, -39.1502, 173.9406, 1.xii.2000, CJV, LUNZ; 1 ♀, Pouakai, 1371 m, -39.2394, 174.0135, 3.xii.1975, J.S. Dugdale, NZAC; 1 ♀, Mt Egmont skifield, -39.3083, 174.1000, 2.xii.2000, CJV, LUNZ; 1 ♀, Dawson Falls, -39.3233, 174.1049, 12.xi.1994, CJV & ADB, LUNZ; 1 ♀, Stratford, -39.3456, 174.2672, 22.ii.1967, CLW, OMNZ. **HB**. 1 ♀, White Pine Bush, -39.2895, 176.8803, R.W. Huttan, OMNZ; 2 ♀, Taradale, -39.5416, 176.8445, 12.iv.1968, R.W. Huttan, OMNZ; 1 ♀, 13.v.1968, R.W. Huttan, OMNZ; 1 ♀, 4.ix.1969, R.W. Huttan, OMNZ; 1 ♀, 30.xii.1968, R.W. Huttan, OMNZ; 1 ♀, R.W. Huttan, OMNZ; 1 ♂, R.W. Huttan, OMNZ; 1 ♂, Te Awanga, -39.6353, 176.9913, 24.iv.1942, RRF, OMNZ; 1 ♀, Hastings, -39.6377, 176.8279, 25.xii.1946, RRF, OMNZ; 2 ♂, 1 ♀, Waipatiki, -40.3747, 176.2831, 8-11.v.1968, R.W. Huttan, OMNZ; 1 ♀, R.W. Huttan, OMNZ. **RI**. 3 ♀, Doch-Royle, 640 m, -39.6647, 175.8469, x.1982, M. Scott, NZAC; 2 ♀, Hikurangi, -39.7952, 176.0879, 28.i.1952, C. McCunn, OMNZ; 5 ♂, 1 ♀, near Woodville, -40.3441, 175.8732, 1-8.x.1969, CLW, OMNZ. **WI**. 1 ♂, Wanganui, -39.9341, 175.0282, viii.1981, M.A. Ordish, MONZ; 1 ♂, Turakina, -40.0459, 175.2133, vii.1992, A. Styche, MONZ; 1 ♂, Feilding, -40.2201, 175.5462, 6.xii.1942, RRF, OMNZ; 1 ♂, 1 ♀, 19.xi.1949, RRF, OMNZ; 2 ♀, i.1959, RRF, OMNZ; 1 ♀, 2.i.1967, RRF, OMNZ; 1 ♂, Palmerston North, -40.3493, 175.5513, 20.viii.1976, J.M. Esson, NZAC. **WA**. 1 ♀, Dannevirke, -40.2137, 176.0948, 11.vii.1942, RRF, OMNZ; 1 ♂, x.1978, H.M. Anderson, MONZ; 7 ♂, 3 ♀, Hamua, -40.5615, 175.7424, 1-8.x.1969, CLW, OMNZ; 10 ♂, 4 ♀, Newman, -40.6179, 175.7139, 1-8.x.1969, CLW, OMNZ; 1 ♂, near Eketahuna, -40.6454, 175.7092, 1-8.x.1969, CLW, OMNZ; 5 ♂, Kaiparoro, -40.7052, 175.6527, 1-8.x.1969, CLW, OMNZ; 1 ♀, Mangareia, -40.7996, 175.8294, 28.xii.1957, OMNZ; 1 ♂, 1 ♀, x.1958, CLW, OMNZ; 1 ♂, 3 ♀, 10.i.1960, CLW, OMNZ; 1 ♂, CLW, OMNZ; 3 ♂, Bideford, -40.8688, 175.8676, 9.ix.1967, S. Willis, OMNZ; 5 ♀, 23.xi.1967, S. Willis, OMNZ; 1 ♂, 2 ♀, Opaki, -40.8943, 175.6620, 1-8.x.1969, CLW, OMNZ; 1 ♀, 3 imm, Castle Point, -40.9138, 176.2211, OMNZ; 4 ♂, 5 ♀, Te Whiti, -41.0089, 175.6739, 5-13.ix.1970, CLW, OMNZ; 3 ♂, Kourarau, -41.0942, 175.6969, 5-13.ix.1970, CLW, OMNZ; 1 ♀, Pahaoa River mouth, -41.2252, 175.8326, 4.iv.1968, CLW, OMNZ. **WN**. 1 ♂, 4 ♀, Manawatu Gorge, -40.3295, 175.8112, 1-8.x.1969, CLW, OMNZ; 1 ♀, Kapiti Island, -40.8503, 174.8765, v.1947, RRF, OMNZ; 1 ♀, Akatarawa, -40.9512, 175.1086, 2.i.1943, RRF, OMNZ; 1 ♂, Wallaceville, -41.1357, 175.0611, 9.viii.1995, B.M. Fitzgerald, MONZ; 1 ♀, Stokes Valley, -41.1848, 174.9872, viii.1948, P. Watts, OMNZ; 1 ♂, 19.vi.1994, B.M. Fitzgerald, MONZ; 1 ♂, v.1994, B.M. Fitzgerald, MONZ; 1 ♀, 19.vi.1995, B.M. Fitzgerald, MONZ; 1 ♀, Makara, -41.2202, 174.7032, 22.xii.1980-22.i.1981, N. Elvidge & C.W. Hornabrook, MONZ; 1 ♂, Wellington, -41.2824, 174.7946, 18.v.1943, RRF, OMNZ; 1 ♂, 1945, J.L.Mandero, MONZ; 2 ♀, 13.i.1969, R.W. Huttan, OMNZ; 1 ♀, Brooklyn, -41.3105, 174.7570, 17.x.1995, A. Tennyson, MONZ; 15 ♂, 5 ♀, 5 imm, Moa Point, -41.3464, 174.8021, viii.1992, MONZ; 2 ♀, Red Rocks, -41.3605, 174.7263, 15.xii.1980-21.i.1981, N. Elvidge & C.W. Hornabrook, MONZ; 4 ♀, 15.xii.1980-22.i.1981, N. Elvidge & C.W. Hornabrook, MONZ; 1 ♂, 1 ♀, Orongorongo Valley, -41.3667, 174.9000, 15.iii.1993, B.M. Fitzgerald, MONZ; 3 ♂, 19.iv.1993, B.M. Fitzgerald, MONZ; 1 ♀, 16.ii.1994, B.M. Fitzgerald, MONZ; 1 ♀, Turakirae Head, -41.4422, 174.9044, 22.i.1981, N. Elvidge & C.W. Hornabrook, MONZ. **SD**. 1 ♂, 1 ♀, Stephens Island, -40.6662, 174.0026, 7.i.1975, G.Y. Walls, NZAC; 1 ♂, 1 ♀, 1.v.1996, A. Tennyson, MONZ; 1 ♂, Mt Woore, -40.8170, 173.8431, 23.viii.1960, I. Mannering, OMNZ; 1 ♂, 1 ♀, Greville Harbour, -40.8327, 173.7946, 28.viii.1960, M. Williams, OMNZ; 2 ♀, near French Pass, -40.9278, 173.8497, 27.viii.1965, J.I. Townsend & L.P. Marchant, NZAC; 1 ♂, 2 ♀, North Brother Island, -41.1136, 174.4441, 7-10.ii.1993, J.W.M. Marris, LUNZ; 1 ♀, The Brothers, -41.1136, 174.4441, 14.ix.1948, R.K. Dell, OMNZ; 3 ♀, 16.v.1958, P. Dwyer, OMNZ. **NN**. 1 ♀, Kahurangi Homestead, -40.8066, 172.2335, viii.1970, F. Alack, NZAC; 1 ♂, 1 ♀, Totaranui Beach, -40.8267, 173.0056, 8.ii.2000, CJV, LUNZ; 1 ♀, Heaphy Track, -40.8771, 172.2761, 6.xi.1999, G. Hall & R. Leschen, LUNZ; 1 ♂, Portia Creek, -40.8993, 172.5868, 22.iv.1962, R.G. Ordish, OMNZ; 1 ♀, near Heaphy Hut, -40.9897, 172.1095, 11.xi.1998, G. Hall, NZAC; 1 ♀, Heaphy Beach, -41.0017, 172.0958, 12.xi.1998, G. Hall, NZAC; 1 ♀, Takaka Hill, -41.0229, 172.9266, 21.vi.1965, CLW, OMNZ; 1 ♀, Riwaka River, -41.0500, 172.9167, 1.ii.1969, CLW, OMNZ; 3 ♀, Riwaka River, -41.0500, 172.9167, 2.xii.1994, ADB, LUNZ; 1 ♀, Motueka River Mouth, -41.0833, 173.0167, 4.xii.1994, CJV & ADB, LUNZ; 1 ♂, Lake Sylvester, -41.1087, 172.6285, 31.iii.1968, J.S. Dugdale, NZAC; 2 ♂, Whangamoa, -41.1627, 173.5271, NZAC; 1 ♂, Whangamoa Saddle, -41.2212, 173.4369, 26.vi.1965, J.I. Townsend & A.K. Walker, NZAC; 5 ♀, 2 imm, Ruby Bay, -41.2381, 173.0895, 11.ii.1969, CLW, OMNZ; 3 ♀, West Haven Inlet, -41.2443, 173.2985, 28.x.1968, J.I. Townsend, NZAC; 1 ♂, Tahuna[nui], -41.2878, 173.2386, vi.1965, CLW, OMNZ; 1 ♀, Sherry Valley, -41.3869, 172.7327, 18.xii.1949, J.G. Dawber, OMNZ; 1 ♂, Pretty Bridge Valley, -41.4237, 172.9178, 26.x.1966, G. Hitchings, NZAC; 1 ♀, Parkes Farm, -41.4750, 173.0000, 6.iv.1971, N.A. Martin, OMNZ; 1 ♂, 8.v.1971, N.A. Martin, OMNZ; 1 ♀, 18.v.1971, N.A. Martin, OMNZ; 2 ♂, 25.viii.1970, N.A. Martin, OMNZ; 1 ♂, Lee Valley, -41.4946, 173.1752, 9.viii.1966, J.I. Townsend, OMNZ; 1 ♂, 1 ♀, Matiri Range, -41.6000, 172.3250, 5.i.1996, A. Tennyson, MONZ; 1 ♀, Gordons Knob, -41.6057, 172.9371, 16.v.1963, J.I. Townsend, NZAC; 1 ♂, 2 imm, Glenhope, -41.6502, 172.6428, 12.ii.1969, CLW, OMNZ. **MB**. 1 ♀, Johnson Peak, -41.3740, 173.5638, 13.iii.1969, J.S. Dugdale, OMNZ; 1 ♂, 1 ♀, Mount Fell, -41.4496, 173.4092, 13.viii.1969, A.C. Eyles, NZAC; 1 ♀, 6 imm, near Spring Creek, -41.4638, 173.9633, 16-25.iii.1969, RRF & CLW, OMNZ; 2 ♀, 2 imm, Dashwood, -41.6468, 174.0653, 16-25.iii.1969, RRF & CLW, OMNZ; 2 ♂, 2 ♀, Molesworth, 1000 m, -42.0868, 173.2526, 19-22.iii.1968, J.C. Watt, NZAC; 2 ♀, Hanmer, -42.5439, 172.7853, i.1966, T. Poppelwell, OMNZ. **KA**. 5 ♂, 2 ♀, 9 imm, Blind River, -41.6873, 174.1304, 16-25.iii.1969, RRF & CLW, OMNZ; 1 ♂, 1 ♀, 2 imm, near Clarence River, -42.1580, 173.9293, 16-23.iii.1969, RRF & CLW, OMNZ; 1 ♀, Molesworth, -42.2083, 172.8250, 27.i.1988, J. Arund, LUNZ; 1 ♀, Irongate Stream, -42.2680, 173.7763, 16.iii.1969, RRF & CLW, OMNZ; 1 ♀, Kowhai Riverbed, -42.2891, 173.5946, 3.xii.1995, CJV & S.J. Crampton, LUNZ; 1 ♀, Puhi Puhi Reserve, -42.2904, 173.7232, 12.x.1966, A.K. Walker, NZAC; 1 ♂, Mt Fyffe, 1200 m, -42.3127, 173.6118, 27.viii.1995, B. Brown, LUNZ; 1 ♂, 1 imm, Hapuku, -42.3208, 173.7385, 16-25.iii.1969, RRF & CLW, OMNZ; 5 ♂, 1 ♀, 7 imm, Middle Creek, -42.3684, 173.6387, 16-25.iii.1969, RRF & CLW, OMNZ; 1 ♂, 3 imm, Kaikoura, -42.4040, 173.6855, i.1961, Poppelwell, OMNZ; 1 ♂, 1 ♀, 26.viii.1962, R.S. Bigelow, OMNZ; 1 ♂, 2 ♀, 5 imm, 30.viii.1962, R.S. Bigelow, OMNZ; 1 ♂, Goose Bay, -42.4789, 173.5233, 27.vii.1966, CLW, OMNZ; 2 ♂, 2 ♀, 5 imm, near Oaro, -42.5164, 173.5080, 15-25.iii.1969, RRF & CLW, OMNZ; 1 ♀, Conway River Mouth, -42.6098, 173.4641, 12.v.1955, RRF, OMNZ; 1 ♀, 15 imm, Glen Colwyn Stream, -42.6233, 173.3775, 15-23.iii.1969, RRF & CLW, OMNZ. **BR**. 1 ♀, near Cupola Basin, -41.9747, 172.7264, 21.i.1962, J.T. Salmon, MONZ; 1 ♀, Mt Dewar, 1400 m, -42.0842, 171.5453, 3.xii.1968, J.C. Watt, NZAC; 1 ♂, Lewis Pass, above 1500m, -42.3810, 172.4030, xii.1961, RRF, OMNZ; 1 ♂, Greymouth, -42.4524, 171.1776, 10.v.1956, L.R. Jackson, OMNZ. **NC**. 1 ♂, 3 ♀, Glen Wye Creek, -42.6333, 172.7666, 26.x.1960, R.E. Leech, OMNZ (Honolulu Collection); 1 ♀, Lake Sumner, -42.7096, 172.1412, 10.iv.1950, L. Wolfe, OMNZ; 2 ♂, 7 ♀, Lake Taylor, -42.7845, 172.2690, 14.iv.1952, Field Club, OMNZ; 6 ♂, 2 ♂, 6 imm, Cheviot, -42.8176, 173.2652, 15-25.iii.1969, RRF & CLW, OMNZ; 1 ♂, 1 ♀, Hurunui River, -42.9029, 173.1349, 15-25.iii.1969, RRF & CLW, OMNZ; 1 ♀, Temple Basin, -42.9087, 171.5793, 2.iii.1968, P.C. Mason, OMNZ; 1 ♀, 17.iii.1968, P.C. Mason, OMNZ; 1 ♀, 10.xii.1968, P.C. Mason, OMNZ; 1 ♂, Hawdon Valley, -42.9363, 171.7436, 29.viii.1929, G.A.H. Helson, OMNZ; 1 ♂, 1 ♀, Waipara Gorge, -43.0667, 172.6000, 1.v.1949, RRF, OMNZ; 1 ♂, Woodend Beach, -43.3368, 172.7098, 25.x.1992, CJV, LUNZ. **WD**. 1 ♀, E of Hokitika, -42.7333, 171.0000, 9.i.2000, S. Pearson, LUNZ; 1 ♂, 1 ♀, 1 imm, Bruce Bay, -43.6090, 169.5913, x.1946, A.W. Parrott, OMNZ; 1 ♂, Taumaka Island, -43.8596, 168.8710, 20.viii.1970, D.S. Horning, OMNZ; 7 ♂, 1 ♀, 5.i.1971, M.E. Miller, OMNZ; 1 ♂, 9.i.1971, M.E. Miller, OMNZ; 1 ♂, 19.i.1971, M.E. Miller, OMNZ; 3 ♂, 1 ♀, 28.i.1971, M.E. Miller, OMNZ; 2 ♂, 2 ♀, 31.xii.1971, M.E. Miller, OMNZ; 1 ♀, Wilson Pass, 1700 m, -43.9963, 169.5890, 10.i.1975, K. Mason, OMNZ. **MC**. 1 ♂, Cass, -43.0382, 171.7507, 28-29.x.1992, CJV, LUNZ; 2 ♀, 29.x.1992, CJV, LUNZ; 1 ♂, 25-26.xi.1993, CJV, LUNZ; 1 ♂, 25-26.xi.1993, CJV, LUNZ; 1 ♂, Nervous Knob, 1524 m, -43.1226, 171.6807, 24.ii.1976, K.H. Milligan, NZAC; 1 ♀, Harper River, -43.1637, 171.6012, 8.v.1954, J.S. Dugdale, OMNZ; 1 ♀, Craigeburn, -43.1667, 171.7333, 1.xii.2000, M.P. Anstey, LUNZ; 1 ♀, Broken River, -43.2022, 171.7520, 29.ix.1966, CLW, OMNZ; 3 ♂, 3 ♀, 1 imm, McLeans Island, -43.4667, 172.4748, 21-31.i.1997, R.P. MacFarlane, LUNZ; 2 ♀, Christchurch Airport, -43.4876, 172.5339, 22.x.1959, R.E. Leech, OMNZ (Honolulu Collection); 1 ♂, 2 ♀, ix.1968, A. Moeed, OMNZ; 5 ♀, xii.1968, A. Moeed, OMNZ; 1 ♀, iii.1969, A. Moeed, OMNZ; 2 ♂, 1 ♀, v.1969, A. Moeed, OMNZ; 2 ♀, Travis Swamp, -43.5000, 172.7000, 21.xii.1995, R.P. MacFarlane, LUNZ; 1 ♂, New Brighton Beach, -43.5113, 172.7302, 14.viii.1995, CJV, LUNZ; 1 ♀, New Brighton, -43.5278, 172.7341, 12.xi.1995, ADB, LUNZ; 1 ♀, Christchurch, -43.5503, 172.6118, v.1948, E.W. Dawson, OMNZ; 1 ♀, 6.v.1949, W.H. Dukes, OMNZ; 1 ♀, xi.1957, R.L.C. Pilgrim, LUNZ; 1 ♀, 20.ii.1992, S.P. Worner, LUNZ; 2 ♂, 20.xi.1994, L.E. Hussey, LUNZ; 1 ♀, Spreydon, -43.5579, 172.6054, 7.i.1995, CJV, LUNZ; 1 ♂, Beckenham, -43.5628, 172.6404, 8.vii.1996, CJV, LUNZ; 1 ♀, Cashmere, -43.5737, 172.6265, 2.x.1993, CJV, LUNZ; 1 ♂, Victoria Park, -43.5935, 172.6451, 30.x.1959, R.E. Leech, OMNZ (Honolulu Collection); 2 ♀, Kennedys Bush, -43.6319, 172.6245, 30.xi.1946, RRF, OMNZ; 9 ♂, 36 ♀, Lincoln College, -43.6432, 172.4581, 2.iv.1970, P.A. Campbell, OMNZ; 1 ♂, 1 ♀, Lincoln University, -43.6432, 172.4581, 17.viii.1992, CJV, LUNZ; 1 ♀, 25.i-1.ii.1993, M.H. Bowie, LUNZ; 1 ♂, 30.v.1995, CJV, LUNZ; 1 ♂, 29.v.1997, M.H. Bowie, LUNZ; 1 ♂, 6.viii.1999, CJV, LUNZ; 1 ♀, Ahuriri Reserve, -43.6663, 172.6071, 12.xi.1991, CJV, LUNZ; 1 ♀, Okains Bay, -43.6900, 173.0746, 18.iv.2000, CJV & M.A. Hudson, LUNZ; 1 ♀, 22.x.2000, CJV & M.A. Hudson, LUNZ; 1 ♂, Mt Herbert, -43.6911, 172.7414, 28.xii.1992, CJV, LUNZ; 1 ♀, McQueens Valley, -43.7303, 172.6249, 9.i.1967, R. MacFarlane, OMNZ; 1 ♀, Kaituna Valley, -43.7364, 172.6952, 25.ix.1952, RRF, OMNZ; 1 ♀, 12.iv.1960, RRF, OMNZ; 1 ♀, 12.v.1967, J.I. Townsend, NZAC; 1 ♀, Rakaia River, -43.7582, 172.0627, 31.x.1966, RRF, OMNZ; 1 ♂, Lake Ellesmere, -43.7860, 172.4814, 6.viii.1992, CJV, LUNZ; 3 ♂, 5 ♀, Winchmore, -43.7913, 171.8008, 29.i.1991, R.G. Townsend, LUNZ; 1 ♂, 14.iv.1992, R.G. Townsend, LUNZ; 1 ♂, 3 ♀, Prices Valley, -43.8000, 172.6833, 29.iv.1994, CJV, LUNZ; 1 ♀, 20.x.1999, CJV & H. Ranson, LUNZ; 24 ♂, 1 ♀, Kaitorete Spit, -43.8170, 172.5999, 19.xi.1992, CJV, LUNZ; 10 ♀, ii.1993, CJV & A.B. Freeman, LUNZ; 3 ♀, 1993, A.B. Freeman, LUNZ; 1 ♂, 2 ♀, Hinewai, -43.8333, 173.0667, 2.iv.1997, R.P. MacFarlane, LUNZ; 1 ♂, 22.x.1997, J.B. Ward, LUNZ; 1 ♀, Dromore, -43.8472, 171.8447, 1-3.xi.1969, CLW, OMNZ; 4 ♂, 2 ♀, 1 imm, Taumutu, -43.8564, 172.3592, 11.i.1961, RRF, OMNZ. **MK**. 1 ♀, 1 ♂, Godley River, 1600 m, -43.5116, 170.4900, 6.ii.1984, J.E. Hunt, OMNZ; 1 ♂, Ball Shelter, -43.6282, 170.1922, 15.xii.1992, CJV, LUNZ; 15-16.xii.1992, CJV, LUNZ; 1 ♀, Tasman River, -43.8370, 170.1377, 14.xii.1992, CJV, LUNZ; 1 ♂, Godley Peaks, -43.8650, 170.4645, 20.xii.1983, OMNZ; 1 ♀, Lake Tekapo, -44.0021, 170.4646, 5.i.2001, M.A. Hudson & CJV, LUNZ; 2 ♂, Burkes Pass, -44.0912, 170.5970, 17.iii.1996, G. Hall, NZAC; 1 ♀, Lake Pukaki, -44.1054, 170.1979, 26-28.i.1976, C. Smith, NZAC; 1 ♂, Ohau Forest, -44.2146, 169.7389, v.1958, Otago University Scientific Association, OMNZ; 6 ♂, 5 ♀, Twizel, -44.2578, 170.0808, 1.iv.1975, T.R. Beatson, OMNZ. **SC**. 1 ♀, Peel

Forest, -43.9167, 171.2667, 14.xii.1995, ADB, LUNZ; 1 ♀, Peel Forest, -43.9167, 171.2667, 30.ix.1966, RRF & CLW, OMNZ; 2 ♀, Waihi, -44.0220, 171.1751, 10.xii.1939, A.W.Parrott, OMNZ; 1 ♂, 3 ♀, Orari River, -44.0500, 171.2500, 30.ix.1966, RRF & CLW, OMNZ; 1 ♂, 1 ♀, 1 imm, Rangitata, -44.0677, 171.3750, 1-3.xi.1969, CLW, OMNZ; 1 ♂, 1 ♀, 1 imm, Kakahu, -44.1593, 171.0559, 30.iv.1950, RRF, OMNZ; 1 ♀, Temuka River, -44.2311, 171.2654, 10.xii.1955, B.J. Marples, OMNZ. **FD.** 1 ♂, 2 imm, Red Mountain, 1220 m, -44.3226, 168.3447, 28.i.1975, G.W. Ramsay, NZAC; 1 ♀, Simonin Pass, -44.3402, 168.3617, 28.i-1.ii.1975, J.S. Dugdale, NZAC; 1 ♀, 3.ii.1975, J.S. Dugdale, NZAC; 1 ♀, Tempest Spur, -44.3402, 168.3617, 27.i.1975, J.S. Dugdale, NZAC; 1 ♀, Simonin Stream, -44.3448, 168.3376, 23.i-1.ii.1975, J.S. Dugdale, NZAC; 1 ♂, Mount Annetta, -44.3708, 168.2722, 2.ii.1975, J.S. Dugdale, NZAC; 1 ♀, Red Stream, -44.3831, 168.2834, 2.ii.1975, J.S. Dugdale, NZAC; 1 ♂, 1 ♀, Forgotten River, -44.4391, 168.3524, xi.1960, M.A. Chapman, NZAC; 2 ♀, Tutoko Bench, -44.6000, 168.0000, 14.i.1974, J.S. Dugdale, NZAC; 1 ♀, 10.i.1977, K.J. Fox, OMNZ; 2 ♀, 13.i.1977, J.S. Dugdale, NZAC; 3 ♀, 13.i.1977, J.S. Dugdale, NZAC; 2 ♀, 9-15.i.1977, J.S. Dugdale, NZAC; 2 ♀, Gertrude, -44.7418, 168.0061, 23.i.1946, RRF, OMNZ; 1 ♀, Homer Saddle, -44.7617, 167.9836, 20.i.1946, RRF, OMNZ; 1 ♀, Mt Balloon, -44.8016, 167.7879, 26.i.1948, RRF, OMNZ; 2 ♂, 1 ♀, Lake Te Anau, -45.1517, 167.4949, 28.v.1962, S.S.A., OMNZ; 4 ♀, Thompson Sound, -45.2241, 166.9710, 21.i.1958, RRF, OMNZ; 3 ♀, 21.i.1958, R.A. Chapman, OMNZ; 4 ♂, 4 ♀, Plateau Creek, 1020 m, -45.2423, 167.5302, 1-4.xii.1980, R.M. Emberson & C.A. Muir, LUNZ; 6 ♂, 3 ♀, McKenzie Burn, 1050 m, -45.2614, 167.4119, 5-8.xii.1980, R.M. Emberson & C.A. Muir, LUNZ; 1 ♂, Secretary Island, -45.2858, 166.9621, 27-30.xi.1981, C.F. Butcher, NZAC; 2 ♀, 27.xi.1981, A.C. Harris, OMNZ; 1 ♀, near Te Ana-au Glow-Worm Caves, -45.2968, 167.7267, 2.iv.1972, CLW, OMNZ; 1 ♀, Mt Barber, 1100 m, -45.5035, 167.2133, 8.i.1970, J.S. Dugdale & J. Hoy, NZAC; 1 ♀, Turret Range, -45.5328, 167.3401, 16.i.1970, J.S. Dugdale, OMNZ; 1 ♂, Mt Grey, 1000 m, -45.5547, 167.2479, 14.ii.1959, Otago University Biological Society, OMNZ; 1 ♀, near Percy Saddle, 1250 m, -45.5654, 167.3150, 16.i.1970, G.W. Ramsay, NZAC; 1 ♀, Wairaki Island, -45.5925, 166.6270, iv.1996, K. Schöps, LUNZ; 2 ♀, Five Finger Peninsula, -45.7430, 166.4294, 16.iv.1996, K. Schöps, LUNZ; 1 ♂, Lake Monk, -46.0193, 166.9592, 18.i.1960, J. Kikkawa, OMNZ; 1 ♂, 21.i.1960, M.A. Chapman, OMNZ; 1 ♂, 1 ♀, 4 imm, 22.i.1960, M.A. Chapman, OMNZ. **OL.** 1 ♂, Kidds Bush, -44.4440, 169.2680, 9.iv.1979, RRF, OMNZ; 1 ♂, near Mt Aspiring, 2500 m, -44.4800, 168.6576, 7.ii.1971, S. Forster, OMNZ; 3 ♀, 2 imm, Hawea, -44.6141, 169.2660, 22.viii.1972, RRF, OMNZ; 1 ♀, Treble Cone, 1300 m, -44.6343, 168.8974, 18.iii.1996, G. Hall, LUNZ; 1 ♀, Wanaka, -44.7080, 169.1238, 7.x.1959, RRF, OMNZ; 1 ♀, 2 imm, Wanaka district, -44.7080, 169.1238, i.1955, B.J. Marples, OMNZ; 1 ♂, Coronet Peak, -44.9242, 168.7277, 16.i.1971, J.S. Dugdale, OMNZ; 2 ♀, Arrowtown, -44.9448, 168.8175, 4.ix.1968, RRF, OMNZ; 1 ♀, Queenstown Hill, -45.0103, 168.6923, 16.xii.1952, B.J. Marples, OMNZ; 1 ♂, Parawa, -45.5429, 168.5304, 5.ix.1948, OMNZ. **CO.** 4 ♂, 2 ♀, Dunstan Range, 1800 m, -44.6003, 169.7128, 22.ii.1974, RRF, OMNZ; 3 ♂, 2 ♀, Grandview Mountain, 1433 m, -44.6450, 169.3515, 12.i.1971, J.S. Dugdale, OMNZ; 1 ♂, Hawkdun Range, -44.7007, 169.9491, 12.xii.1971, J. Child, OMNZ; 3 ♂, Pisa Range, -44.8489, 169.2182, 23.xi.1974, RRF, OMNZ; 1 ♂, 1 ♀, Lake McKay, 1740 m, -44.8508, 169.2081, 28.xi.1974, J.C. Watt, OMNZ; 2 ♂, 3 ♀, 2 imm, Mt Pisa, -44.8738, 169.1907, 4.i.1970, D.R. Forster, OMNZ; 1 ♂, 1 ♀, Danseys Pass, -44.9761, 170.4880, 17.xii.1979, A.C. Harris, OMNZ; 2 ♀, 2 imm, 17.xi.1979, A.C. Harris, OMNZ; 1 ♀, 6.iv.1995, B. Brown, LUNZ; 2 ♂, Kawerau Gorge, -45.0150, 169.0867, 24-27.x.1981, J.C. Watt, NZAC; 2 ♂, 1 ♀, Roaring Meg, -45.0150, 169.0867, 14-17.xi.1977, J.C. Watt, NZAC; 2 ♂, 1 ♀, 24-27.x.1981, J.C. Watt, NZAC; 6 ♂, Kawerau Gorge, -45.0150, 169.0867, 23-27.x.1981, J.C. Watt, NZAC; 2 ♀, Wedderburn, -45.0358, 170.0143, 9.ii.1968, CLW, OMNZ; 14 ♀, 1 imm, Cromwell, -45.0455, 169.1865, 7.xi.1958, RRF, OMNZ; 1 ♂, 1 ♀, 19-28.xi.1974, J. Child, OMNZ; 2 ♂, 1 ♀, Remarkables Ski Field, -45.0531, 168.8155, 20.iii.1996, G. Hall, NZAC; 1 ♀, Wye Creek, -45.0900, 168.8155, 23-25.iv.1977, P. Mason, OMNZ; 1 ♀, Omakau, -45.0974, 169.6040, 6.x.1959, RRF, OMNZ; 1 ♀, 1 imm, Maniototo Station, -45.1234, 170.0296, 21.ii.1968, CLW, OMNZ; 1 ♀, Kyeburn, -45.1484, 170.2482, 6.i.1968, CLW, OMNZ; 1 ♂, Watts Rock, -45.1654, 169.0767, 14.iii.1975, J.C. Watt, NZAC; 2 ♀, Ben Nevis, 1950 m, -45.1693, 168.8483, 16.iii.1975, B.M. May, OMNZ; 1 ♂, Old Woman Range, -45.2530, 169.0590, 20.xi.1974, J.C. Watt, NZAC; 1 ♀, Alexandra, -45.2557, 169.3755, 3.viii.1961, RRF, OMNZ; 1 ♀, Tiroiti, -45.2601, 170.2644, 8.i.1966, CLW, OMNZ; 4 ♂, 4 ♀, Patearoa, -45.2743, 170.0548, 23.v.1968, CLW, OMNZ; 1 ♂, Hyde, -45.2979, 170.2507, 18.iv.1968, CLW, OMNZ; 5 ♂, 29.viii.1968, CLW, OMNZ; 1 ♀, near Shag Valley Station, -45.3206, 170.5407, 13.ix.1966, RRF, OMNZ; 1 ♂, 2 ♀, near Obelisk, Old Man Range, 1695m, -45.3242, 169.2069, 13.i.1999, CJV, LUNZ; 1 ♀, Old Man Range, -45.3340, 169.2089, 15.iii.1975, J.C. Watt, OMNZ; 1 ♀, 15.ii.1976, L.L. Deitz, NZAC; 1 ♂, 15.xi.1985, RRF, OMNZ; 1 ♀, Garvie Mts, -45.3439, 168.9708, 9.iii.1985, G.M. Mason, OMNZ; 1 ♂, 10.iii.1985, G.M. Mason, OMNZ; 1 ♂, 1 ♀, Deepdell, -45.3734, 170.3675, 15.i.1969, CLW, OMNZ; 2 ♂, 3 ♀, Dunback, -45.3828, 170.6270, 30.vii.1968, CLW, OMNZ; 3 ♀, Rock and Pillar Range, -45.3884, 170.1179, 16.xi.1968, J. Child, OMNZ; 5 ♀, 31.xii.1968, J. Child, OMNZ; 1 ♂, Old Man Range, 1800 m, -45.3893, 169.1974, 21.ii.1974, RRF, OMNZ; 1 ♂, 4 ♀, 22.ii.1974, RRF, OMNZ; 4 ♂, 24.ii.1974, RRF, OMNZ; 8 ♂, 4 ♀, 1 imm, Rock & Pillar Range, 1500 m, -45.4656, 170.0488, 15.iv.1971, J. Child, OMNZ; 1 ♀, Rock & Pillar Range, 1000 m, -45.4656, 170.0488, 29.xi.1983, RRF, OMNZ; 1 ♀, Logan Burn, 900 m, -45.4749, 169.9056, 7-12.x.1982, B.I.P. Barratt, OMNZ; 9 ♂, 15-30.xi.1982, B.I.P. Barratt, OMNZ; 5 ♂, 1 ♀, 2-15.xii.1982, B.I.P. Barratt, OMNZ; 3 ♂, 5 ♀, 5 imm, 11-23.ii.1983, B.I.P. Barratt, OMNZ; 2 ♀, 23.ii-7.iii.1983, B.I.P. Barratt, OMNZ; 3 ♂, 4 imm, near Blue Lake, -45.4772, 168.9276, 7.iii.1983, A.C. Harris, OMNZ; 1 ♂, near Middlemarch, -45.4867, 170.0833, 10.ii-3.iii.1999, C. Rufaut, LUNZ; 1 ♂, Middlemarch, -45.5099, 170.1252, 10.iv.1971, B. Beatson, OMNZ; 5 ♂, 12.iv.1971, B. Beatson, OMNZ; 1 ♂, Titan Rocks Track, -45.5316, 168.9910, 9.xii.1998, G. Hall, B. Brown & E. Edwards, LUNZ; 2 ♀, near Salt Lake, -45.5775, 170.0880, 8.i.1956, B.J. Marples, OMNZ; 1 ♂, 1 ♀, Teviot Swamp, -45.6387, 169.6382, 8.v.2001, A.M. Evans, LUNZ; 3 ♂, Millers Flat, 500 m, -45.6627, 169.4144, viii.1978, B.I.P. Barratt, OMNZ; 2 ♂, x.1978, B.I.P. Barratt, OMNZ; 1 ♂, 1 ♀, 4 imm, Millers Flat, 1400 m, -45.6627, 169.4144, viii.1978, B.I.P. Barratt, OMNZ; 1 ♂, Rocklands, -45.6665, 169.9890, 21.xi-5.xii.1978, B.I.P. Barratt, OMNZ; 1 ♂, 1 imm, Lammermoor, -45.6836, 169.7567, 2.v.2001, A.M. Evans, LUNZ; 2 ♀, Craig Flat, -45.7382, 169.4937, 21.xii-18.i.1985, B.I.P. Barratt, NZAC; 1 ♀, Waipori, 520 m, -45.8268, 169.8820, 20.ix.1977, RRF, OMNZ; 1 ♂, 10-24.x.1978, B.I.P. Barratt, NZAC; 4 ♀, 5 imm, Blue Mountains, -45.9088, 169.3675, 5-27.i.1985, B.I.P. Barratt, OMNZ; 3 ♂, 1 ♀, Waianakarua, -45.2710, 170.8039, 22.v.1971, T.R. Beatson, OMNZ. **DN.** 1 ♂, 2 ♀, Waianakarua, -45.2710, 170.8039, 22.v.1971, T.R. Beatson, OMNZ; 9 ♂, 1 ♀, Waianakarua, -45.2710, 170.8039, 22.v.1971, B. Beatson, OMNZ; 1 ♂, Waitati Stream, -45.7667, 170.5500, 26.ix.1995, L.J. Boutin, MONZ; 1 ♂, 2 ♀, Aramoana, -45.7782, 170.6930, 15.v.1966, CLW, OMNZ; 1 ♂, Otakou, -45.8056, 170.7061, 27.xii.1965, CLW, OMNZ; 3 ♂, 2 ♀, Sullivans Dam, -45.8079, 170.5244, 1.xi.1966, RRF & CLW, OMNZ; 1 ♂, 1 ♀, Whare Flat, -45.8149, 170.4271, 28.ix.1961, W. Poppelwell, OMNZ; 1 ♂, Leith Saddle, -45.8333, 170.5167, 15.xi-1.xii.1976, A.C. Harris, NZAC; 1 ♀, i.1977, A.C. Harris, NZAC; 6 ♀, Flagstaff, -45.8342, 170.4662, 7-21.ii.1971, CLW, OMNZ; 1 ♂, Allans Beach, -45.8824, 170.6870, 13.xi.1952, B.J. Marples, OMNZ; 1 ♂, 1 ♀, 1 imm, 19.ii-1.iv.1953, RRF, OMNZ; 2 ♀, 8.x.1953, B.J. Marples, OMNZ; 1 ♀, 25.x.1953, B.J. Marples, OMNZ; 1 ♂, 15.xi.1953, B.J. Marples, OMNZ; 1 ♀, 11.viii.1966, RRF, OMNZ; 1 ♂, 2 ♀, 21.viii.1966, RRF, OMNZ; 2 ♀, 4 imm, 7.ix.1966, RRF, OMNZ; 2 ♂, 2 ♀, 1 imm, Rabbit Meadow, -45.8824, 170.6870, 1-16.iv.1953, B.J. Marples, OMNZ; 1 ♂, 1 ♀, 16-30.iv.1953, B.J. Marples, OMNZ; 3 ♂, 3 ♀, 14-28.v.1953, B.J. Marples, OMNZ; 1 ♂, 2 ♀, 9-23.vii.1953, B.J. Marples, OMNZ; 1 ♂, 2 imm, 23.vii-6.viii.1953, B.J. Marples, OMNZ; 1 ♀, Dunedin, -45.8828, 170.5137, v.1961, W.T. Poppelwell, OMNZ; 1 ♂, 4.x.1961, W.T. Poppelwell, OMNZ; 1 ♂, 20.ii.1962, W.T. Poppelwell, OMNZ; 1 ♂, Tainui, -45.9028, 170.5192, 2.x.1966, J. Dineen, OMNZ; 1 ♀, Corstorphine, -45.9037, 170.4661, OMNZ; 1 ♀, Saint Clair, -45.9136, 170.4840, iv.1970, RRF, OMNZ; 1 ♂, 4.x.1970, M.R. Forster, OMNZ; 1 ♀, Taieri Mouth, -46.0562, 170.1933, 19.x.1999, S. Clifford, OMNZ; 2 ♀, Balclutha, -46.2333, 169.7333, 20.xi.1950, RRF, OMNZ; 1 ♀, Takitimu Mts, -45.7498, 167.8268, 2.iv.1974, K. Mason, OMNZ. **SL.** 2 ♂, near Kelso, -45.9076, 169.2317, 23.xi-7.xii.1969, CLW, OMNZ; 1 ♂, 1 ♀, Pomohaka, -46.0104, 169.2376, 23.xi-7.xii.1969, CLW, OMNZ; 1 ♀, Tuatapere, -46.1332, 167.6953, 1.vi.1963, OMNZ; 1 ♀, Colac Bay, -46.3606, 167.8769, 19.iii.1975, A.C. Harris, OMNZ; 1 ♂, 2 ♀, Riverton, -46.3667, 168.0167, 2.ii.2000, CJV, LUNZ; 1 ♀, Pig Island, Foveaux Strait, -46.4069, 167.9939, 12.i.1999, E. Edwards, LUNZ; 1 ♀, Fortrose, -46.5751, 168.8016, i.1963, Poppelwell, OMNZ. **SI.** 1 ♀, Solander Island, -46.5655, 166.9000, 16.ii.1996, A. Tennyson, MONZ; 1 ♀, 17.ii.1996, A. Tennyson, MONZ; 2 ♀, 28.ii.1996, A. Tennyson, MONZ; 1 ♀, Codfish Island, -46.7759, 167.6224, OMNZ; 1 ♀, Stewart Island, -46.8416, 167.8760, i.1956, B.J. Marples, OMNZ; 1 ♂, 1 ♀, ii.1960, M.N. Watt, OMNZ; 1 ♀, 25.iv.1962, W.T. Poppelwell, OMNZ; 1 ♀, Lee Bay, -46.8621, 168.1230, 25.xii.1975, A.C. Harris, OMNZ; 1 ♂, 1 ♀, Horseshoe Bay, -46.8753, 168.1452, 5.xii.1954, R.J. Scarlett, OMNZ; 1 ♂, Halfmoon Bay, -46.8937, 168.1094, 14.iii.1949, D. Allan, OMNZ; 1 ♀, 30.x.1960, R.G. Ordish, OMNZ; 1 ♂, Oban, -46.8937, 168.1094, iii.1960, G. Collett, OMNZ; 3 ♂, 1 ♀, Golden Bay, -46.9054, 168.1224, i.1960, M.N. Watt, OMNZ; 2 ♀, 1 imm, xi.1960, M.N. Watt, OMNZ; 1 ♂, 2 ♀, 2 imm, i.1961, M.N. Watt, OMNZ; 1 ♀, Tin Range, 1640', -47.1212, 167.7582, 27.ii.1972, R.G. Ordish, MONZ; 1 ♀, Mokoniu Island, -47.1520, 167.4101, 28.i.1955, R.K. Dell & B.A. Holloway, OMNZ; 1 ♀, 1 imm, Easy Harbour, -47.1610, 167.5681, 26.i.1955, B.A. Holloway & R.K. Dell, OMNZ. **SN**. 1 ♀, Signpost Hill, -48.0152, 166.5986, 26.i.1972, D.S. Horning, NZAC. **AU**. 1 ♀, Disappointment Island, -50.6083, 165.9750, 11.xii.1976, J.A. Bartle, MONZ.

Anoteropsis insularis
CH. 2 ♂, 4 imm, Ohira Bay, -43.8083, -176.6500, , 28.xi.2000, R.M. Emberson & J.B. Johnson, LUNZ; 1 ♂, Waitangi Bay, -43.9166, -176.5333, 6.xii.1999, CJV, LUNZ; 6 ♂, 1 ♀, 6.xii.1999, CJV & J.C. Banks, LUNZ; holotype ♂, allotype ♀, 3 ♂ paratypes, 1 ♀ paratype, near Red Bluff, -43.9166, -176.5333, 7.xii.1999, CJV, LUNZ; 1 ♀, Motutapu Point, -44.2833, -176.2833, 5.xii.1997, A. Tennyson, MONZ.

Anoteropsis lacustris
NN. 1 ♂, Mokinui River, -41.5333, 171.9833, 20.v.1956, L.R. Jackson, OMNZ. **BR**. 1 ♂, Lake Rotoiti, -41.8167, 172.8500, 7.ii.1997, CJV, LUNZ; 1 ♀, 15.ii.1998, CJV, LUNZ. **NC**. 1 ♀, Foible Stream, -42.5748, 172.1826, 23.xii.1952, W. Dukes, OMNZ; holotype ♂, Bealey River, -42.9077, 171.5493, 30.iv.1998, K. Rennie, LUNZ; allotype ♀, 3 ♂ paratypes, 3 ♀ paratypes, 9.iv.1999, CJV & M.A. Hudson, LUNZ. **WD**. 1 ♀, Otira Valley, -42.8982, 171.5439, 28.v.1954, J.S. Dugdlae, OMNZ; 1 ♂, Franz Josef, -43.4000, 170.1833, 29.iv.1951.RRF, CJV, OMNZ; 1 ♂, 16.xi.1995, CJV, LUNZ; 1 ♀, 11.iv.1999, CJV & M.A. Hudson, LUNZ; 1 ♀, Fox Glacier, -43.4667, 170.0167, 14.xii.1994, CJV & ADB, LUNZ; 1 ♀, 16.xi.1995, CJV & ADB, LUNZ; 1 ♀, Ohinetamatea Creek, -43.5200, 169.9092, 17.xi.1995, CJV, LUNZ; 1 ♀, Thomas Riverbed, -43.8853, 169.2232, 18.iii.1966, RRF, OMNZ; 1 ♂, head of Diorite Stream, -44.4333, 168.2833, xi.1960, M.A. Chapman, OMNZ; 2 ♀, Head of Lake McKerrow, -44.5167, 168.0667, 6.ii.1955, RRF & J.S. Dugdale, CMNZ. **MC**. 1 ♀, Mt Algidus, -43.2333, 171.3500, 29.xi[?].1913, I. Hall, OMNZ; 1 ♀, Fog[gy] Peak, Porters Pass, 1300m, -43.2811, 171.7483, 19.xii.1954, RRF, CMNZ. **SC**. 1 ♀, Frances River, -43.3833, 170.7833, i.1975, K. Mason, OMNZ. **MK**. 1 ♂, Elcho Stream, 1000m, -43.9166, 169.7833, 28.iii.1973, K. Mason, OMNZ; 1 ♀, Ohau ski field, -44.2283, 169.7833, 13.xi.1984, C. Butts, OMNZ. **OL**. 1 ♀, Head of Dart Valley, -44.5083, 168.5500, 22.iii.1980, K. Mason, OMNZ; 2 ♀, Hawea, -44.6141, 169.2660, 29.i.1975, RRF, OMNZ; 4 ♀, 30.i.1975, RRF, OMNZ; 15 ♀, Frankton, -45.0220, 168.7201, 15.ii.1973, RRF, OMNZ; 2 ♀, Queenstown, -45.0429, 168.6452, 12.ii.1962, B.J. Marples, OMNZ; 2 ♂, 4 ♀, Lake Wakatipu, -45.0750, 168.5000, 12.i.1999, CJV, LUNZ. **FD**. 1 ♀, Lower Hollyford, -44.5500, 168.0833, 12.i.1971, RRF, OMNZ; 1 ♀, Gertrude shingle slide, -44.7500, 168.0166, 23.i.1940, RRF, OMNZ; 1 ♀, Cleddau Portal, Homer Tunnel, -44.7664, 167.9766, 26.i.1957, RRF, OMNZ; 1 ♀, Homer Tunnel, -44.7664, 167.9766, 28.xii.1943, OMNZ; 1 ♂, 5.iv.1958, R. Marples, OMNZ; 1 ♀, 23.i.1962, P.M. Johns, OMNZ; 1 ♂, 4 ♀, 16.ii.1966, RRF, OMNZ; 1 ♀, ii.1966, RRF, OMNZ; 5 ♀, 11.i.1970, RRF, OMNZ; 2 ♀, 12.i.1971, RRF, OMNZ; 1 ♀, Cascade Creek, -44.8976, 168.0844, 12.i.1971, RRF & L.M. Forster, OMNZ; 1 ♀, Wilmot Pass, -45.5097, 167.1843, 20.ii.1959, Otago University Biological Society, OMNZ; 1 ♀, Lake Earnslaw, -45.5990, 167.1885, xii.1976, K. Mason, OMNZ. **CO**. 1 ♀, Luggate, -44.7477, 169.2690, 22.x.1959, RRF, OMNZ; 3 ♀, 21.xi.1974, J.S. Dugdale, NZAC; 1 ♀, Cardrona River, -44.9167, 168.9833, 11.i.1999, CJV, LUNZ; 1 ♀, 2.ii.1999, CJV, LUNZ; 1 ♀, Clutha River, nr Cromwell, -45.0667, 169.2333, 21.xi.1974, J.S. Dugdale, NZAC. **SL**. 1 ♀, Spence Hut, 1000m, -45.7050, 167.8833, 5.vi.1973, K. Mason, OMNZ. **Unknown locality**. 1 ♂, A 1/78, OMNZ; 3 ♂, 4/77, OMNZ.

Anoteropsis litoralis
CL. 2 ♂, Whangapoua, -36.7166, 175.6166, 25.i.2000, CJV, LUNZ; 1 ♂, 1 ♀, 16.ii.2000, CJV, LUNZ; 1 ♂, Opoutere, -37.1000, 175.8833, 15.vi.2000, J.W. Griffiths & C.N.L. Chambers, LUNZ. **BP**. 1 ♂, Whale Island, -37.8517, 176.9750, 27.viii.1970, Auckland University Field Club, OMNZ; 1 ♂, Ohope Beach, -37.9633, 177.0344, 2.x.1969, CLW, OMNZ. **HB**. 1 ♂, Pourerere Beach, -40.1010, 176.8722, 20.iv.1984, J.C. Watt, NZAC. **WN**. 1 ♀, Waitarere Beach, -40.5500, 175.2000, 21.iii.1969, OMNZ; 1 ♂, Waikanae Beach, -40.8644, 175.0086, 11.i.1996, A. Tennyson, MONZ; 1 ♀, Red Rocks, -41.3605, 174.7263, 29.xi.1941, F.A. Bodley, OMNZ. **WA**. 1 ♀, 5.5km S of Mataikona, -40.8167, 176.2500, 11.vii.2000, B. Tennyson, MONZ. **NC**. 1 ♀, Woodend Beach, -43.3333, 172.7000, 12-18.i.1958, R.L.C. Pilgrim, OMNZ. **MC**. 1 ♀, Spencer Park beach, -43.4333, 172.7166, 9.xi.1958, R.L.C. Pilgrim, OMNZ; 1 ♂, New Brighton, -43.5077, 172.7216, 25.x.1960, R.E. Leech, OMNZ (Honolulu Collection); 11 ♂, 4 ♀, Okains Bay, -43.6900, 173.0746, 18.iv.2000, CJV & M.A. Hudson, LUNZ; 3 ♂, 1 ♀ paratype, Kaitorete Spit, -43.8170, 172.5999, 1.viii.1991, A.B. Freeman, LUNZ; 1 ♀ paratype, 9.viii.1991, A.B. Freeman, LUNZ; allotype ♀, 16.viii.1991, A.B. Freeman, LUNZ; holotype ♂, 7 ♂ paratypes, 2 ♀ paratypes, ii.1993, CJV & A.B. Freeman, LUNZ; 1 ♂, Taumutu, -43.8564, 172.3592, iv.1956, R.L.C. Pilgrim, OMNZ; 1 ♂, 21.x.1999, S.J. Crampton & CJV, LUNZ.

Anoteropsis montana
NN. 1 ♀, Lockett Range, -41.0667, 172.5667, 7.i.1998, A. Tennyson, MONZ; 1 ♀, Mount Arthur, 1800m, -41.2197, 172.6815, 29.i.1948, J.T. Salmon, OMNZ; 1 ♀, Mount Arthur, 1463-1751m, 23.iv.1971, J.S. Dugdale, ACNZ. **MB**. 1 ♂, Black Birch Range, 1500m, -41.7299, 173.8321, 21.x.1970, J.S. Dugdale, ACNZ; 1 ♂, 1 ♀, Mt Altimarlock, 1830m, -41.7500, 173.7667, 21.x.1970, J.S. Dugdale, ACNZ; 1 ♀ paratype, Molesworth, -42.1417, 172.7333, 11.ii.1988, J. Arund, LUNZ; allotype ♀, near Princess Bath, -42.1849, 172.6898, 2.i.1993, G.N. Bawden, LUNZ. **KA**. holotype ♂, Hapuku River, North branch, -42.2889, 173.6786, 29.iv-1.v.1991, MONZ; 1 ♀ paratype, Molesworth, -42.3167, 173.1083, 6.xii.1987, J. Arund, LUNZ. **BR**. 1 ♂, Lewis Pass, above 1500m, -42.3810, 172.4030, xii.1961, RRF, OMNZ. **NC**. 1 ♂, Castle Hill at Casey Stream, 1500m, -42.8870, 171.8346, 22.xi.1961, RRF, OMNZ; 1 ♀, Temple Basin, -42.9087, 171.5793, 23.i.1959, P.M. Johns, OMNZ. **MC**. 2 ♂, Anti Crow River, -43.0217, 171.4720, xii.1950, I. Cresswell, OMNZ; 1 ♀, Foggy Peak, -43.2811, 171.7483, 14.xi.1999, H. Ranson, LUNZ; 1 ♂, 1 subadult ♀, Springfield, -43.3365, 171.9216, i.1953, C. Talbot, OMNZ. **MK**. 1 ♂, Godley River, 1650m, -43.5116, 170.4900, 6.ii.1984, J. Hunt, OMNZ.

Anoteropsis okatainae
BP. 1 ♂, Lake Okataina, -38.1141, 176.4203, 20.x.1984, D.J. Court, OMNZ; 1 ♂, 2 ♀, 18.ii.1999, CJV, LUNZ; holotype ♂, allotype ♀, 2 ♀ paratypes, 17.ii.2000, CJV, LUNZ. **Unknown locality**. 1 ♀, OMNZ.

Anoteropsis ralphi
CH. 2 ♂, Mairangi Road, -43.7000, -176.6000, 7-8.xii.1999, CJV & J.C. Banks, LUNZ; 3 ♂, 3 ♀, Mairangi, -43.7000, -176.6333, 7.xii.1999, CJV, LUNZ; 1 ♂, Kaingaroa, -43.7333, -176.2666, 30.ix.1974, A. Wright, NZAC; 1 ♀, 28.i.1954, RRF, OMNZ; 1 ♀, 4 imm, Titirangi, -43.8000, -176.5000, 1.ii.1954, RRF, CMNZ; 1 ♀, Hapupu Reserve, -43.8000, -176.3500, 9.xii.1999, CJV, LUNZ; 1 ♀, Ohira Bay, -43.8083, -176.6500, 28.xi.2000, R.M. Emberson & J.B. Johnson, LUNZ; 1 ♀, Port Hutt, -43.8166, -176.7000, 9.ii.1954, RRF, OMNZ; 1 ♂, Henga Reserve, -43.8500, -176.5667, 8.xii.1999, CJV, LUNZ; 1 ♀, 29.xi.2000, R.M. Emberson & J.B. Johnson, LUNZ; 3 ♂, 2 ♀, Waitangi Bay, -43.9166, -176.5333, 6.xii.1999, CJV, LUNZ; 7 ♂, 3 ♀, near Te Ranga, -43.9166, -176.4833, 9.xii.1999, CJV, LUNZ; 2 ♂, Te One, -43.9250, -176.5250, 13.i.1997, R.M. Emberson, LUNZ; 1 ♀, Waitangi Beach, -43.9500, -176.5417, 26.viii.1997, R.M. Emberson, LUNZ; 2 ♀, Owenga, -44.0333, -176.3666, 5.ii.1954, J. McIntyre, OMNZ; 1 ♀, Taiko Camp, -44.0667, -176.6333, 5.xii.1992, J.W. Early, AMNZ; 1 ♀, 18.xi.1997, A. Tennyson, MONZ; 1 ♀, 19.xi.1997, A. Tennyson, MONZ; 1 ♀, 30.xi.1997, A.

Tennyson, MONZ; 1 ♀, Star Keys, -44.2166, -175.9666, 23.i.1998, J.W.M. Marris, LUNZ; 1 ♂, Motutapu Point, Pitt Island, -44.2333, -176.2333, 5.xii.1997, A. Tennyson, MONZ; 1 ♀, NE Pitt Island, -44.2500, -176.1833, 9.xii.1997, A. Tennyson, MONZ; 1 ♂, North Head, Pitt Island, -44.2666, -176.1666, 23.xi - 1.xii.1992, R.M. Emberson & P. Syrett, LUNZ; 1 ♂, Mangere Island (Big Island), 27.xi.1961, I. Hogarth, MONZ; 1 ♀, 29.xi.1977, A. Wright, OMNZ; 10 ♂, 13 ♀, 1.vi.1978, A. Wright, OMNZ; 4 ♀, 22.xi.1992, J.W. Early, AMNZ; 1 ♀, 2.xii.1992, J.W. Early, AMNZ; 1 ♂, 1 ♀, K. Schöps, LUNZ; 8 ♂, 3 ♀, 10-13.xii.1994, K. Schöps, LUNZ; 1 ♀, Caravan Bush, Pitt Island, -44.2750, -176.1667, 2.xii.2000, R.M. Emberson & J.B. Johnson, LUNZ; 2 ♀, Waipaua Reserve, Pitt Island, -44.3000, -176.2333, 3.xii.2000, R.M. Emberson & J.B. Johnson, LUNZ; 7 ♀, Rangiauria Reserve, Pitt Island, -44.3250, -176.2666, 22.xi.1992, J.W. Early, AMNZ; 1 ♀, The Pyramid, -44.4333, -176.2500, 20.ix.1974, A. Wright, ACNZ; 1 ♀, Chatham Island, ii.1952, J. Eyles, OMNZ; 1 ♂, 1 imm, Chatham Islands, Ar. 27/8 & Ar. 27/9, OMNZ.

Anoteropsis senica

GB. 2 ♀, Karakatuwhero River, -37.6667, 178.25, 1.v.1993, G. Hall, MONZ; 3 ♀, Papaotehiwera Bay, -38.7711, 177.0763, 19-26.xi.1996, L.J. Boutin, MONZ. **TO**. 1 ♀, Lake Kuratau, -38.8696, 175.7122, 20.v.1966, R.W. Huttan, OMNZ; 1 ♂, Taumarunui, -38.882, 175.2622, i.1974, RRF, OMNZ; 2 ♀, Whakapapanui Dam, -39.1633, 175.5143, 13.i.1967, K.A.J. Wise, AMNZ. **TK**. 1 ♀, Stony River, -39.25, 173.95, 13.xi.1994, CJV, LUNZ; 1 ♀, Dawson Falls, -39.3274, 174.1078, 2.xii.2000, CJV, LUNZ. **RI**. 1 ♀, Totara Reserve, Pohangina Valley, -40.1738, 175.7817, 25.v.1979, RRF, OMNZ. **WA**. 1 ♂, 1 ♀, Kiriwhakapapa, -40.816, 175.5747, 6.iii.1966, CLW, OMNZ. **SD**. 1 ♂, Greville Harbour, -40.8467, 173.8004, 20.viii.1960, I. Mannering, OMNZ. **NN**, 1 ♀, Riwaka River, -41.05, 172.9167, 1.xii.1994, CJV & ADB, LUNZ; 1 ♀, 2.xii.1994, CJV, LUNZ; 1 ♀, Lake Sylvester, -41.1087, 172.6285, 28.iv.1969, J.S. Dugdale, NZAC; 2 ♀, Kakapo River, -41.3445, 172.3107, 14.x.1959, P. Rowlex, CMNZ; 1 ♂, 2 ♀, Mokihinui River, -41.5333, 171.9833, 28.ix.1966, RRF & CLW, OMNZ; 1 ♀, Larrikin Creek, -42.6, 172.2167, 24.iv.1995, B. Brown, LUNZ. **WN**. 1 ♀, Rimutaka State Forest, -41.25, 175.0833, iii.1996, L.J. Boutin, MONZ; 2 ♂, 3 ♀, Rimutaka Creek, -41.25, 175.1, 27.iii.1996, P.J. Sirvid & L.J. Boutin, MONZ; 1 ♂, 4 ♀, Orongorongo Valley, -41.3667, 174.9, 16.viii.1995, B.M. Fitzgerald, MONZ; 1 ♀, Orongorongo River, -41.4167, 174.9, 3.xii.2000, CJV & P.J. Sirvid, LUNZ. **KA**. 1 ♀, Waima River, -41.9, 174.1167, 16.iii.1969, RRF, OMNZ; 1 ♀, Oaro River, -42.4628, 173.4488, 1.vi.1952, J.S. Dugdale, OMNZ; 1 ♂, Waiau River (upper), -42.5833, 172.5833, 18.v.1979, RRF, OMNZ; 1 ♀, Conway River Mouth, -42.6167, 173.4667, 12.v.1955, RRF, OMNZ. **BR**. 1 ♂, Punakaiki, -42.1092, 171.3278, 27.ix.1966, RRF & CLW, OMNZ; 1 ♂, Reefton, -42.1167, 171.8667, 10.iv.1920, W.L. Parham, OMNZ; 1 ♂, Blackball, -42.3667, 171.4167, 10.iv.1950, P.J. Hughson, OMNZ; 1 ♀, Grey River (east), -43.1667, 172.4833, 17.i.1921, G. Archey, OMNZ. **WD**. 1 ♀, Arahura Valley, -42.7356, 171.1175, 7.xii.1972, Entomology Department, Lincoln College, LUNZ; 1 ♂, 1 ♀, Pukekura, -43.0167, 170.6667, viii.1952, M. Warren, OMNZ; 1 ♂, Whataroa, -43.2667, 170.3667, viii.1952, M. Warren, OMNZ; 1 ♂, Canavans Knob, -43.3833, 170.1667, 26.iv-5.v.1982, A.B. Miller, NZAC; 2 ♀, Waiho River, -43.3833, 170.1667, 19.xi.1995, CJV, LUNZ; 3 ♀, Franz Josef, -43.4, 170.1833, xii.1960, P.R. Kettle & J.I. Townsend, OMNZ; 2 ♂, 1 ♀, 15.iv.1967, R.R. Huttan, OMNZ; 1 ♀, 20.i.1971, RRF, OMNZ; 1 ♀, 11.xii.1994, CJV, LUNZ; 5 ♀, 16.xi.1995, CJV, LUNZ; 1 ♂, 10.iv.1996, CJV, LUNZ; 3 ♂, 2 ♀, 10.iv.1999, CJV & M.A. Hudson, LUNZ; 2 ♀, Fox Gacier, -43.4667, 170.0167, 20.i.1971, RRF, OMNZ; 2 ♀, 14.xii.1994, CJV & ADB, LUNZ; 2 ♂, 2 ♀, 16.xi.1995, CJV, LUNZ; 1 ♀, Saltwater Creek, -43.5262, 171.1752, 27.ix.1966, RRF, OMNZ; 1 ♀, Karangarua, -43.537, 169.8276, 27.ix.1966, RRF, OMNZ; 1 ♂, 1 ♀, Bruce Bay, -43.609, 169.5913, 15.iv.1967, R.W. Huttan, OMNZ; 7 ♂, 7 ♀, Lake Moeraki, -43.7177, 169.2721, 26.ix.1966, RRF & CLW, OMNZ; 1 ♀, Rata Creek, -43.75, 169.3833, 12.xii.1994, CJV, LUNZ; 1 ♀, Otoko River, -43.75, 169.5167, 6.v.1973, K. Mason, OMNZ; 7 ♂, 1 ♀, Waita River, -43.8108, 169.1605, 15.iii.1966, RRF, OMNZ; 1 ♂, 1 ♀, Thomas River, -43.9333, 169.1666, 18.iii.1966, RRF, OMNZ; 1 ♀, Jackson Bay, -44, 168.65, 22.i.1960, R.E. Leech, OMNZ; 3 ♂, 2 ♀, 15.iii.1966, RRF, OMNZ; 2 ♀, Fantail Falls - Haast River, -44.0833, 169.3833, 18.xi.1995, CJV, LUNZ; 1 ♀, N of Haast Pass, -44.1079, 169.348, 21.i.1960, R.E. Leech, OMNZ (Honolulu Collection); 3 ♀, Makarora, -44.2378, 169.233, 17.iii.1966, RRF, OMNZ; 10 ♀, 12.xii.1977, RRF, OMNZ; 1 ♂, North end of Lake McKerrow, -44.3833, 168.0167, 9.ix.1983, D.H., OMNZ; 1 ♀, Head of Lake McKerrow, -44.5167, 168.0667, 6.ii.1959, RRF & J.S. Dugdale, OMNZ. **NC**. 1 ♀, Hurunui River (South Branch), -42.7752, 172.1826, 23.xii.1957, R.L.C. Pilgrim, OMNZ; 1 ♀, Arthur's Pass, -42.9077, 171.5493, 14.xi.1922, J.G. Myers, OMNZ; 1 ♀, 28.iii.1961, C. Mitchell, OMNZ (Honolulu Collection); 1 ♀, Waipara River, -43.0667, 172.7333, 1.iii.1949, OMNZ; 1 ♀, 22.vi.1997, M. Provis, LUNZ; 1 ♂, 3 ♀, Ashley Gorge, -43.25, 172.2, 16.x.1949, RRF, OMNZ; 1 ♂, Chalk Hill, -43.2667, 172.1667, 4.xi.1951, RRF, OMNZ; 1 ♂, 1 ♀, 3.v.1952, RRF, OMNZ; 4 ♀, Coopers Creek, -43.3, 172.1667, 1.xii.1948, RRF, OMNZ; 1 ♀, 11.xii.1948, RRF, OMNZ. **MC**. 1 ♂, 1 ♀, Waimakariri River, -43.0333, 171.6333, 29.ix.1966, CLW, OMNZ; 1 ♂, Clyde River, -43.4673, 170.8337, moulted 14.iii.1975, K. Mason, OMNZ; 2 ♀, Hinds River, -44.1113, 171.6652, 12.ix.1954, RRF, OMNZ. **SC**. 1 ♂, 2 ♀, Peel Forest, -43.9167, 171.2667, 8.v.1996, ADB, LUNZ; 3 ♀, Rangitata River, -43.9167, 171.2667, 30.ix.1966, RRF & CLW, OMNZ; 1 ♀, Waihi, -44.022, 171.1751, 10.xii.1939, A.W.Parrott, OMNZ; 3 ♀, Orari River, -44.05, 171.25, 30.ix.1966, RRF & CLW, OMNZ; 1 ♂, 6 ♀, Waihao River, -44.7892, 171.0092, 30.ix.1966, OMNZ;CO, 1 ♀, Ahuriri River, Omarama, -44.4867, 169.9558, 18.i.1982, RRF & L.M. Forster, OMNZ; 1 ♂, 1 ♀, Lindis River, -44.8833, 169.35, 26.vii.1967, RRF, OMNZ; 3 ♂, 5 ♀, 10.x.1985, RRF, OMNZ; 7 ♂, 11 ♀, Ophir Riverbed, -45.1112, 169.609, 2.viii.1961, RRF, OMNZ; 1 ♀, Swin Burn, -45.135, 170.3306, 9.ii.1968, CLW, OMNZ; 2 ♀, Shag Valley Station, -45.3206, 170.5407, 13.ix.1966, RRF, OMNZ; 1 ♀, Filly Burn, -45.3427, 170.2874, 16.i.1968, RRF & CLW, OMNZ; 2 ♀, Gorge Creek, -45.3814, 169.2754, 12.xii.1967, RRF, OMNZ; 1 ♀, Tawhiti, -45.3833, 169.2833, 27.vi.1956, RRF, OMNZ. **FD**. 4 ♀, Lower Hollyford River, -44.55, 168.1, 12.i.1971, OMNZ; 1 ♀, Hollyford Track, -44.6167, 168.1167, 22.i.1998, G. Hall & D.M. Gleeson, NZAC; 2 ♀, Homer Tunnel, -44.7664, 167.9766, 11.i.1971, L.M. Forster & RRF, OMNZ; 2 ♀, Cascade Creek, -44.8976, 168.0844, 12.i.1971, RRF & L.M. Forster, OMNZ; 1 ♀, Rugged Burn, -45.0203, 167.5211, 15-18.xii.1953, G. Ramsay, OMNZ; 1 ♂, Eglinton Valley, -45.1, 167.9667, 23.xii.1943, J.W., OMNZ; 1 ♂, Secretary Island, -45.2313, 166.9283, 24.xi.1981, A.C. Harris, OMNZ; 1 ♂, Gair Loch, -45.6333, 167.1167, 27.ii.1996, A. Tennyson, MONZ; 1 ♀, near Monowai, -45.7833, 167.6119, 15.i.1971, RRF, OMNZ; 1 ♀, Islet Cove, -45.95, 166.75, 18.iv-3.v.1979, R.A. Savill, CMNZ. **OL**. 12 ♀, Wanaka, -44.708, 169.1238, 7.x.1959, RRF, OMNZ; 1 ♂, 1 ♀, Queenstown, -45.0333, 168.6667, viii.1949, P.O. Braddle, OMNZ; 1 ♀, Mataura River - head of, -45.4, 168.5833, 12.i.1999, CJV, LUNZ. **DN**. 1 ♀, Inch Valley, -45.4105, 170.6389, 20.iii.1966, T. Bruce, OMNZ; 1 ♀, Waitati Stream, -45.7667, 170.55, 6.xii.1970, RRF, OMNZ; 1 ♀, 12.xii.1970, RRF, OMNZ; 1 ♂, 2 ♀, 26.ix.1995, L.J. Boutin, MONZ. **SL**. 1 ♂, Te Anau, -45.417, 167.699, 4.iv.1980, C. Forster, OMNZ; 1 ♀, Whare Creek, -45.6573, 167.7214, 2.iv.1974, K. Mason, OMNZ; 1 ♀, Coal Creek, -45.6667, 168, 5.iv.1974, K. Mason, OMNZ. **SI**. 1 ♀, Oban, -46.8924, 168.1527, 29.iii.1975, A.C. Harris, OMNZ. **Unknown locality**, 1 ♂, 1 ♀, Waituna, R.W. Huttan, OMNZ; 1 ♀, T.K. Lomas, OMNZ; 1 ♀, OMNZ.

Anoteropsis urquharti

MC. 1 ♀, Porters Pass, -43.2972, 171.7386, 25.vi.2000, CJV & M.A. Hudson, LUNZ. **OL**. 1 ♂, near Rees Valley, 1700m, -44.6083, 168.5417, 3.xi.1970, D.R. Forster, OMNZ; 1 ♀, Treble Cone, 1300m, -44.6340, 168.8726, 18.iii.1996, G. Hall, NZAC; 1 ♂, Copper Creek, -44.7911, 168.6253, 26.xii.1970, S. Forster, OMNZ; 1 ♂, Cardrona Ski Field, -44.8706, 168.9419, 10.i.1999, CJV, LUNZ; 1 ♂, top of Cardrona Valley, -44.9916, 168.9416, ii.1999, CJV, LUNZ; 1 ♀, slopes of Ben Lomond, -45.0088, 168.6154, 12.iv.1952, B.J. Marples, OMNZ. **CO**. 1 ♂, Mt Kyeburn, -44.9329, 170.2980, 16.ix.1973, S. Forster, OMNZ; 1 ♂, top of Cardrona Valley, -44.9922, 168.9417, 2.ii.1999, CJV, LUNZ; 1 ♀, Lake Alta, -45.0654, 168.8109, OMNZ; 1 ♂, Ridge of Remarkables, -45.0685, 168.7982, 2.iv.1971, D. Forster & S. Forster, OMNZ; 1 ♂, Remarkables, -45.0685, 168.7982, 1.x.1970, M.R. Forster, OMNZ; 1 ♀, Remarkables, 1000m, opposite Bayonet Peaks, -45.0685, 168.7982, 23-25.iv.1977, P. Mason, OMNZ; 3 ♂, near Mt Pisgah, -45.0818, 170.3919, 7.ix.1974, J. Child, OMNZ; 1 ♀, Rock and Pillar Range, 1300m, -45.4656, 170.0488, 14.x.1983, D.H., OMNZ; 1 ♀, Logan Burn, 900m, -45.4749, 169.9056, 7-21.x.1982, B.I.P. Barratt, OMNZ; 1 ♂, Mt Pleasant, Lake Wakatipu, ii.1960, RRF, OMNZ.

Anoteropsis westlandica

NN. 1 ♂, Upper Cobb Valley, -41.0500, 172.5167, 6.i.1998, A. Tennyson, MONZ. **WD**. 2 ♀, 2 imm, Saltwater Forest, -43.1333, 170.4333, 25.ii.1991, P. Walsh, MONZ; 1 ♀, vi.1991, P. Walsh, MONZ; 1 ♂, Franz Josef, -43.4000, 170.1833, 6.xii.1955, B.J. Marples, OMNZ; 3 ♀, 20.i.1971, RRF, OMNZ; holotype ♂, 15.xi.1995, CJV, LUNZ; allotype ♀, 1 ♀ paratype, Lake Paringa, -43.7167, 169.4000, 6-9.xii.1960, J.I. Townsend & P.R. Kettle, OMNZ; 5 ♂ paratypes, 1 ♀ paratype, 11-14.xii.1994, CJV, LUNZ. **SC**. 1 ♀, Head of Havelock River, -43.4167, 170.7000, xii.1961, OMNZ. **FD**. 1 ♀, Martins Bay, -44.3667, 168.0000, 1.ii.1955, J.S. Dugdale, CMNZ; 1 ♀, Cascade Creek, -44.8976, 168.0844, 12.i.1971, RRF & L.M. Forster, OMNZ; 1 ♀, Thompson Sound, -45.2000, 167.0000, 23.i.1958, RRF, OMNZ; 1 ♂, Hall Arm, -45.4598, 167.1148, Otago University Biological Society, OMNZ; 1 ♀, Disappointment Cove, -45.6167, 166.6500, 10.i.1998, G. Hall & D.M. Gleeson, NZAC; 1 ♀, Knob below "top camp", -45.6833, 166.7667, 23.i.1958, E.G. Turbott, CMNZ.

Artoria hospita

CL. 4 ♂, 3 ♀, Little Barrier Island, -36.1984, 175.1130, ix.1996, C.J. Green, MONZ; 1 ♂, AK, Waitakere, -36.8522, 174.5351, 14.vi.1943, RRF, OMNZ; 1 ♀, AK, Cutty Grass Track, -36.9333, 174.5333, 24.i.1993, CJV, LUNZ. **AK**. 1 ♀, 1 imm, Captains Bush, -36.9333, 174.7500, 10.ii.1992, NZAC; 1 ♂, Lynfield, -36.9333, 174.7204, 4.xii.1974, G. Kuschel, NZAC; 1 ♂, 1 ♀, Olive Davis Reserve, -37.0000, 174.9500, 3-7.viii.1983, J.C. Watt, NZAC. **BP**. 1 ♀, Papatea Bay, -37.6500, 177.8500, 30.x.1992, G. Hall, NZAC; holotype ♂, 1 ♂ paratype, Mt Ngongotaha, -38.0833, 176.2166, 13.v.1971, R.G. Ordish, MONZ; 1 ♀ paratype, 1962, C.W. O'Brien, OMNZ (Honolulu Collection); allotype ♀, Lake Okataina, -38.1333, 176.4166, 11.iii.1995, M-C Larivière, NZAC. **TO**. 1 ♀, Taupo, -38.6971, 176.0706, 21.iv.1965, N.A. Walker, NZAC.

Artoria segrega

ND. holotype ♂, Tawhiti Rahi, -35.4563, 174.7182, 7-12.ix.1980, J.C. Watt, NZAC; 1 ♀ paratype, 3-10.xii.1980, J.C. Watt, NZAC; allotype ♀, 5.xii.1980, G. Kuschel, NZAC.

Artoria separata

ND. 1 ♂, Omahuta Forest, -35.2291, 173.6663, 30.vi.1965, M.G., OMNZ. **WO**. 1 ♀, near Manganui River, -38.5390, 174.7083, 20.viii.2000, M-C. Larivière & A. Larochelle, NZAC. **TK**. 1 ♀, near Ohura, -38.8410, 174.9852, 6.xii.2000, G.Hall, NZAC; 4 ♂, 1 ♀, White Cliffs, -38.8500, 174.5667, 21.vi.1991, L. Stanley, MONZ; 1 ♂, 4.vii.1991, L. Stanley, MONZ; 1 ♂, 30.viii.1991, L. Stanley, MONZ; 2 ♂, 30.xi.1991, L. Stanley, MONZ; 5 ♀, 31.i.1993, L. Stanley, MONZ; 3 ♀, 28.ii.1993, L. Stanley, MONZ; 1 ♀, Mount Messenger, -38.8957, 174.5942, 21.iii.1969, RRF, OMNZ; 2 ♀, Pouiatoa State Forest, -39.0833, 174.5166667, i.1999, G.M. Coombe, LUNZ; allotype ♀, Tarata, -39.1500, 174.3667, 24.vii.1996, J. Clark, MONZ; 1 ♀, Lucys Gully, -39.1502, 173.9406, 1.xii.2000, CJV, LUNZ; holotype ♂, 1 ♂ paratype, 1 ♀ paratype, Kaitake Range, -39.1667, 173.9667, 27.vii.1996, J. Clark, MONZ; 2 ♂, Oaonui, -39.3885, 173.8076, 20.v.1966, M.G., OMNZ.

Geolycosa tongatabuensis

KE. 1 ♀, Meyer Island, -29.2450, -177.8667, 24.ix.1944, J.H. Souvenser, OMNZ; 1 ♀, 1 subadult ♀, Raoul Island, -29.2667, -177.9167, 1944, J.H. Souvenser, OMNZ; 1 ♀, 22.iii.1965, W.G. Little, MONZ; 1 ♂, Curtis Island, -30.5333, -178.6000, 15.ix.1988, A. Tennyson, MONZ. **ND**. 1 ♀, Cavalli Islands, -35.0000, 173.9333, Auckland University Biological Survey, OMNZ; 2 ♀, 1 subadult ♀, Matauri Bay, -35.0369, 173.9162, 20.xi.1970, D.J. Court, OMNZ; 1 ♀, Ahipara Beach, -35.1539, 173.113, 1.ii.1981, RRF, OMNZ; 1 ♀, Mimiwhangata, -35.4324, 174.4040, 17.xii.1970, J.T. Darby, OMNZ; 1 ♂, Waipoua State Forest, -35.6164, 173.5515, 24.xii.1978, A.C. Harris, OMNZ. **CL**. 1 ♂, Kuaotunu, -36.7167, 175.7333, 16.ii.2000, CJV, LUNZ; 1 subadult ♀, Matarangi, -36.7333, 175.6667, 17.vi.2000, J.W. Griffiths & C.N.L. Chambers, LUNZ.

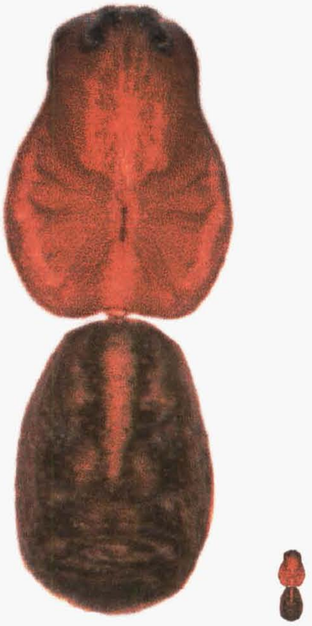
Notocosa bellicosa

MC. 1 ♀, Mt Bailey, -43.0833, 171.7500, 16.ii.1962, E.G. White, OMNZ; 11 ♂, McLeans Island, -43.4667, 172.4667, 30.xii.1996, R.P. Macfarlane, LUNZ; 9 ♂, 3 ♀, 21-31.i.1997, R.P. Macfarlane, LUNZ; 2 ♀, Christchurch Airport, -43.4833, 172.5333, ix.1968, A. Moeed, OMNZ; 1 ♀, x.1968, A. Moeed, OMNZ; 3 ♀, xii.1968, A. Moeed, OMNZ; 3 ♂, ii.1969, A. Moeed, OMNZ; 10 ♂, iii.1969, A. Moeed, OMNZ; 1 ♂, 3 ♀, iv.1969, A. Moeed, OMNZ; 1 ♀, v.1969, A. Moeed, OMNZ; 3 ♂, Hornby, -43.5475, 172.5261, 14.ii.1997, Y.J. Wei, LUNZ; 2 ♂, Birlings Flat, -43.8333, 172.7000, 9-13.iii.1992, A.B. Freeman, LUNZ; 5 ♂, 1 ♀, ii.1993, CJV & A.B. Freeman, LUNZ. **SC**. 1 ♂, Temuka, -44.2367, 171.2841, iii.1999, M. Ross, LUNZ. **MK**. 1 ♀, Longslip Creek, -44.5535, 169.6943, 11.i.1984, C. Butts, OMNZ. **CO**. 2 ♀, near Naseby Forest, -45.0157, 170.0975, 6.i.1968, CLW, OMNZ; 3 ♂, 21.ii.1968, CLW, OMNZ; 1 ♀, Cromwell, -45.0455, 169.1865, 19-28.xi.1974, J.C. Watt, NZAC; 2 23.iii.1975, S. Connelly, NZAC; 2 ♂, Little Keyburn, -45.0500, 170.2500, 9.ii.1968, CLW, OMNZ; 4 ♂, between Naseby and Kyeburn, -45.0833, 170.2000, 21.ii.1968, CLW, OMNZ; 2 ♂, 1.iii.1968, CLW, OMNZ; 1 ♀, Maniototo Station, -45.1234, 170.0296, 6.i.1968, CLW, OMNZ; 3 ♂, 21.ii.1968, CLW, OMNZ; 1 ♀, Kyeburn, -45.1484, 170.2482, 6.i.1968, CLW, OMNZ; 1 ♂, 1.iii.1968, CLW, OMNZ; 2 ♂, 21.ii.1968, CLW, OMNZ; 1 ♂, near Swinburn Peak, -45.1768, 170.3465, 21.ii.1968, CLW, OMNZ; 2 ♂, Kokonga, -45.2117, 170.2462, 9.ii.1968, CLW, OMNZ; 1 ♀, 14.iii.1968, CLW, OMNZ; 9 ♂, Patearoa, -45.2743, 170.0548, 27.i.1969, CLW, OMNZ; 1 ♂, Hyde, -45.2979, 170.2507, 1.iii.1968, CLW, OMNZ. **DN**. 1 ♀, Taieri [River], -45.5248, 169.7537, x.1957, [B.J.] Marples, ; 1 ♀, Allans Beach, -45.8824, 170.6870, 25.x.1953, B.J. Marples, OMNZ; 1 ♀, Rabbit Meadow, -45.8824, 170.6870, 26.xii.1952-8.i.1953, B.J. Marples, OMNZ. **Unknown locality**. 1 ♀, Ar. 1/74, OMNZ.

Venatrix goyderi

ND. 2 ♂, near Matarau, -35.6335, 174.1909, 21.iii.1995, C.A. Stewart, LUNZ; 1 ♂, 2 ♀, 15.ii.1999, CJV, LUNZ.

ILLUSTRATIONS



(1) *Allotrochosina schauinslandi* MC

(2a) *Anoteropsis adumbrata* WN

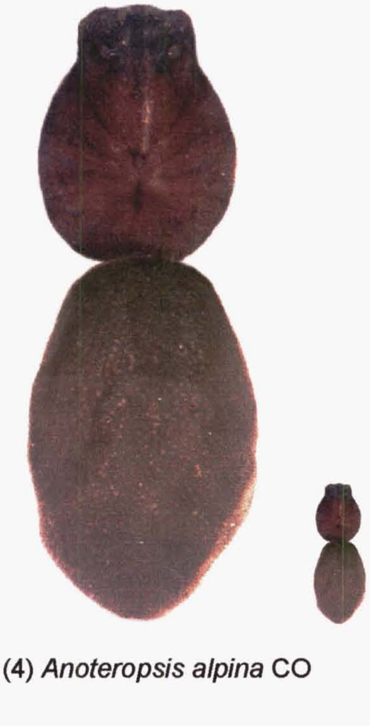
(2b) *Anoteropsis adumbrata* MC

(2c) *Anoteropsis adumbrata* KA

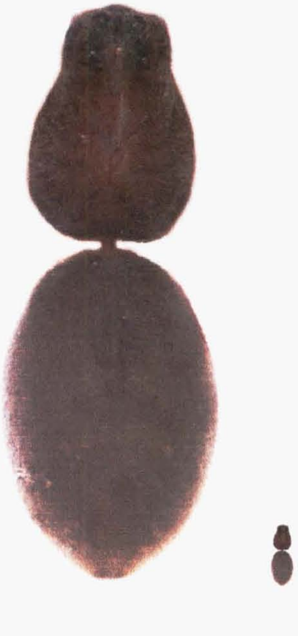
Fig. 1-27 Habitus images of Lycosidae known from New Zealand: 2a-c, 3a-b, 8a-b, 12a-g, 13a-b, 15a-c, 18a-c and 19a-b show variation. The two letter area code shows where the specimen was collected. Adult females, except 11. Actual size on right.

(3a) *Anoteropsis aerescens* TK

(3b) *Anoteropsis aerescens* WN



(4) *Anoteropsis alpina* CO



(5) Anoteropsis arenivaga MC

(6) *Anoteropsis blesti* CL

(7) *Anoteropsis canescens* MC

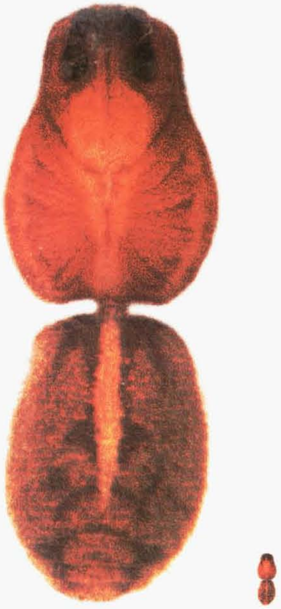
(8a) *Anoteropsis cantuaria* MC

(8b) *Anoteropsis cantuaria* MC

(9) *Anoteropsis flavescens* DN

(10) *Anoteropsis forsteri* SL

(11) *Anoteropsis hallae* NN



(12a) *Anoteropsis hilaris* AU

(12b) *Anoteropsis hilaris* CO

(12c) *Anoteropsis hilaris* CO

(12d) *Anoteropsis hilaris* CO

(12e) *Anoteropsis hilaris* CO

(12f) *Anoteropsis hilaris* AK

(12g) *Anoteropsis hilaris* FD

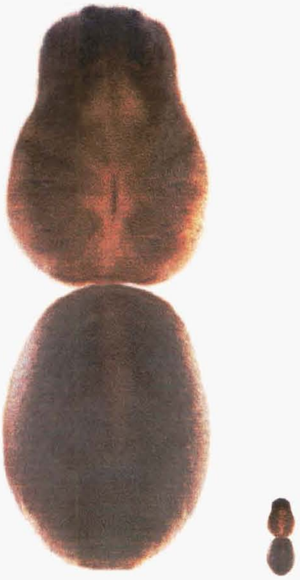
(13a) *Anoteropsis insularis* CH

(13b) *Anoteropsis insularis* CH

(14) *Anoteropsis lacustris* NC

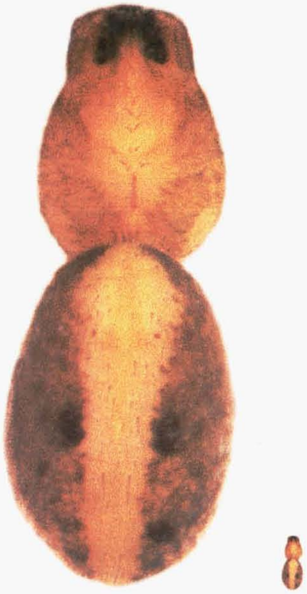
(15a) *Anoteropsis litoralis* MC

(15b) *Anoteropsis litoralis* CL



(15c) *Anoteropsis litoralis* MC

(16) *Anoteropsis montana* MB



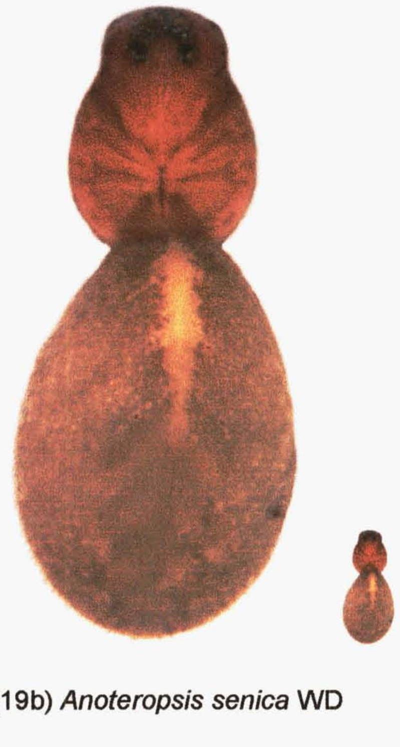
(17) *Anoteropsis okatainae* BP

(18a) *Anoteropsis ralphi* CH

(18b) *Anoteropsis ralphi* CH

(18c) *Anoteropsis ralphi* CH

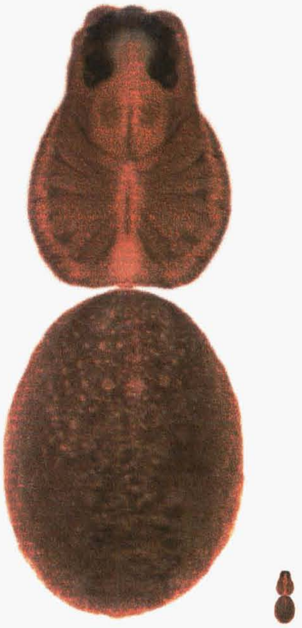
(19a) *Anoteropsis senica* WD



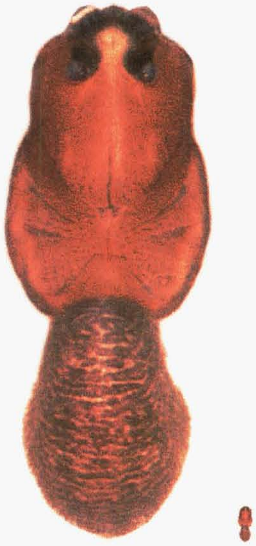
(19b) *Anoteropsis senica* WD

(20) *Anoteropsis urquharti* OL

(21) *Anoteropsis westlandica* WD



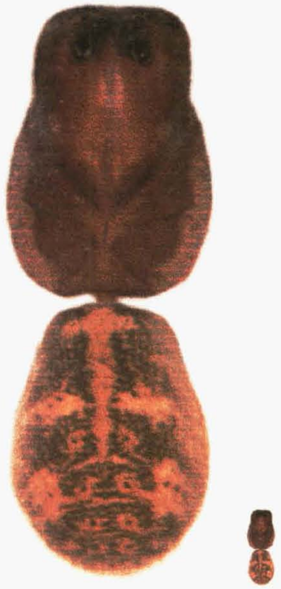
(22) *Artoria hospita* BP



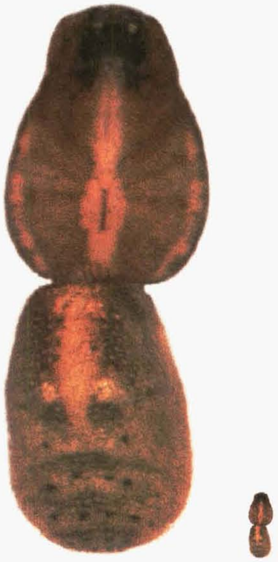
(23) *Artoria segrega* ND

(24) *Artoria separata* TK

(25) *Geolycosa tongatabuensis* KE



(26) *Notocosa bellicosa* MC



(27) *Venatrix goyderi* ND

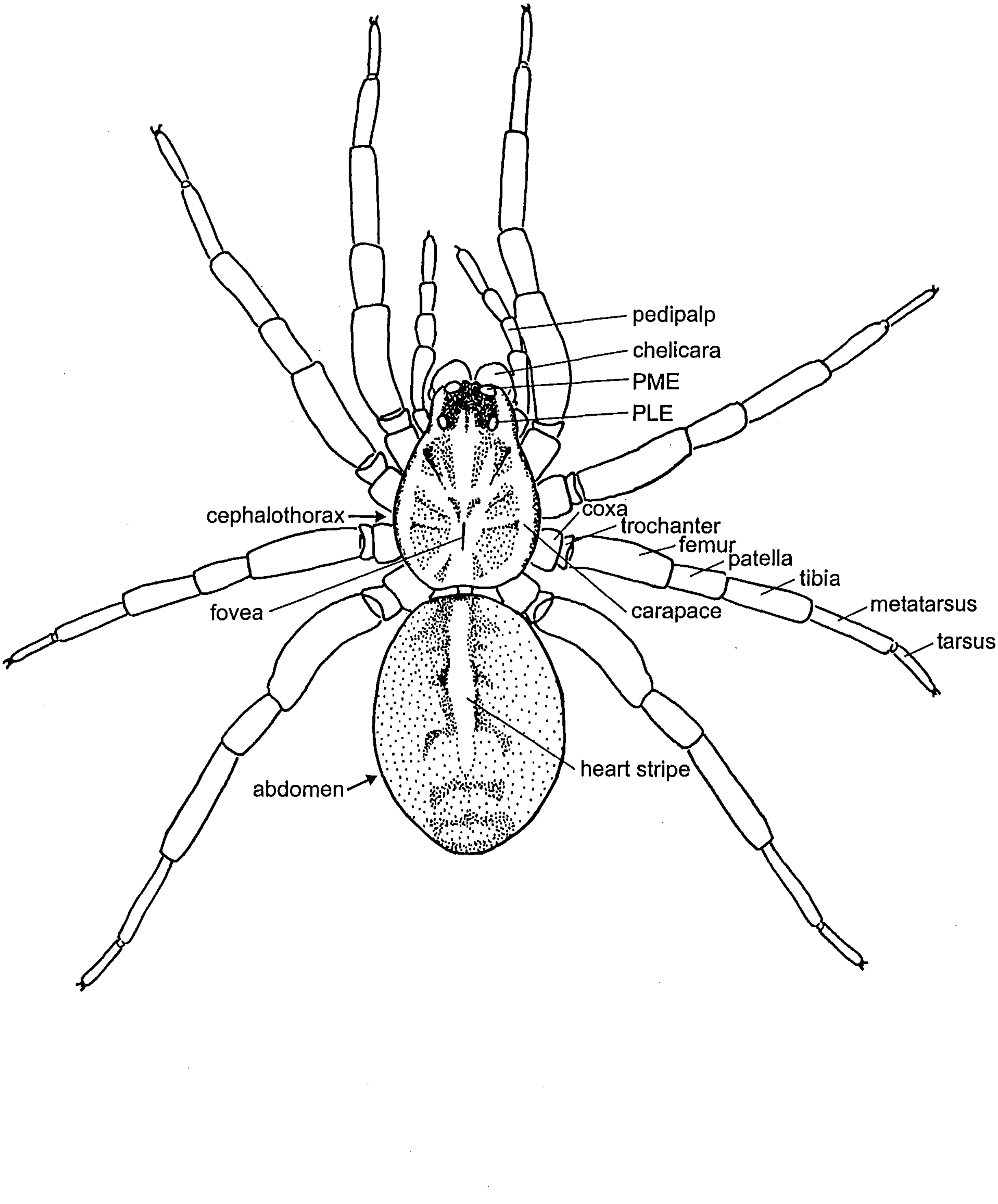


Fig. 28 Schematic dorsal view, *Anoteropsis adumbrata*, female (PLE - posterior lateral eye; PME - posterior median eye).

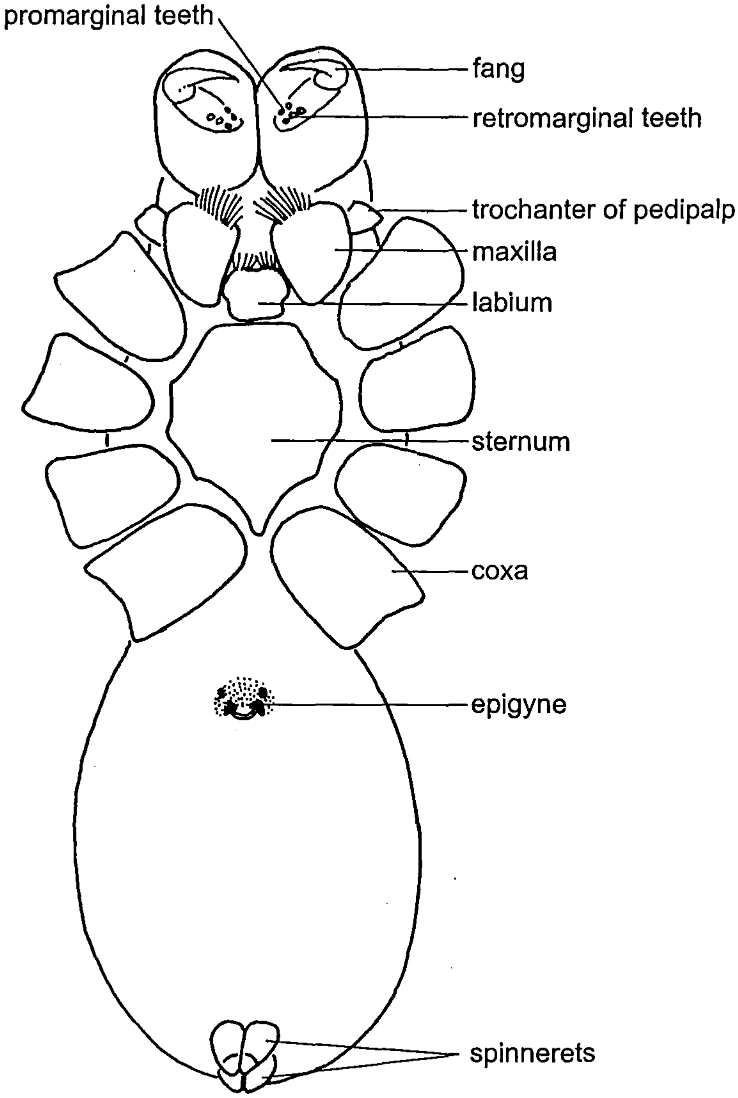
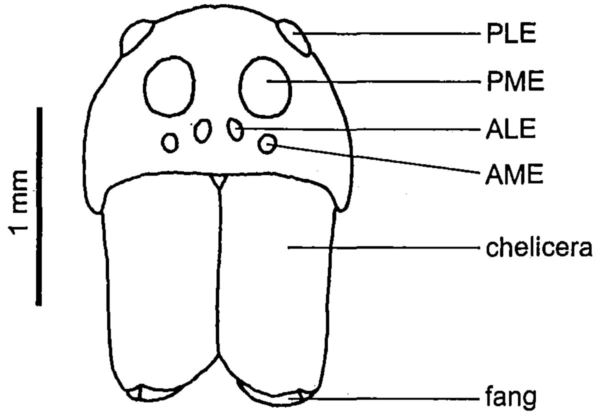


Fig. 29 Schematic ventral view, *Anoteropsis adumbrata*, female.



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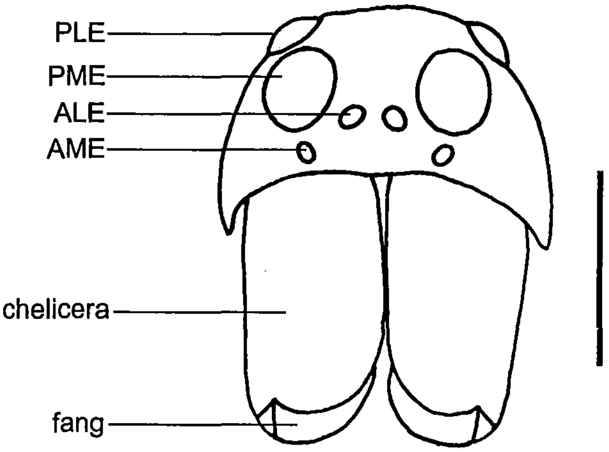

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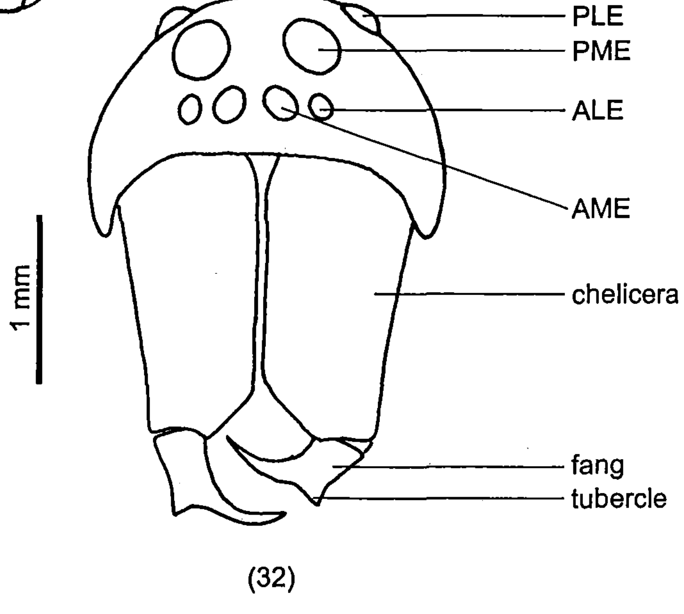


(32)

Fig. 30 *Anoteropsis adumbrata*, female: anterior view of cephalothorax, showing recurved anterior eye group (PLE - posterior lateral eye; PME - posterior median eye; ALE - anterior lateral eye; AME anterior median eye).
Fig. 31 *Artoria separata*, female: anterior view of cephalothorax, showing strongly recurved anterior eye group.
Fig. 32 *Venatrix goyderi*, male: anterior view of cephalothorax, showing straight anterior eye group and tubercles on fangs.

(33)

(34)

(35)

(36)

Fig. 33 *Allotrochosina schauinslandi*, male: showing long front pair of legs. Photographer: Cor Vink.
Fig. 34 *Notocosa bellicosa*, male (on top) and female copulating: the male is inserting his right pedipalp into the female's right epigynal opening. Photographer: Andrew McLachlan.
Fig. 35 *Anoteropsis hilaris*, male. Photographer: David Hollander.
Fig. 36 *Anoteropsis hilaris*, female with spiderlings on her abdomen. Photographer: John Marris.

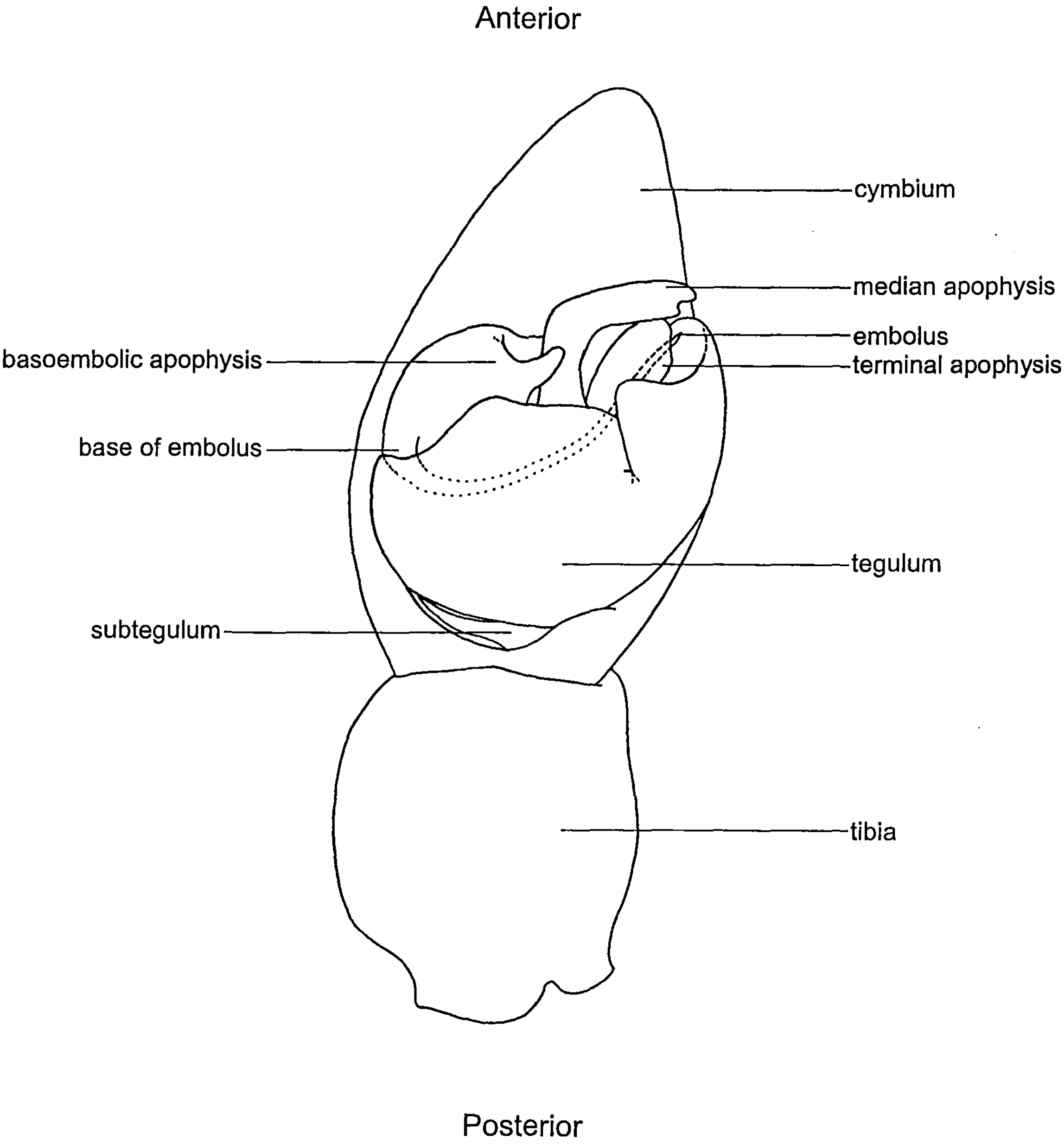
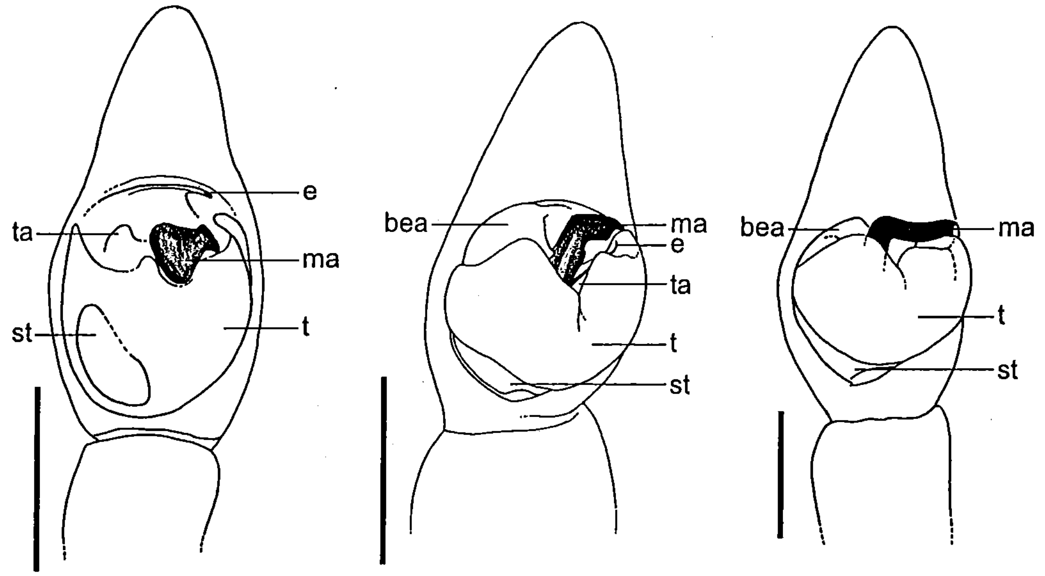
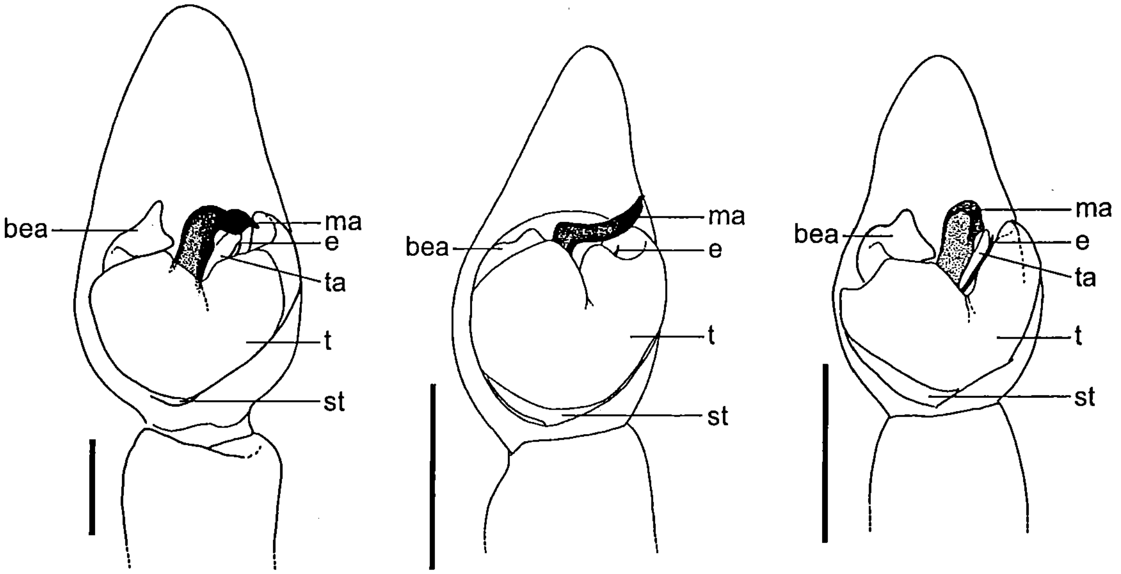


Fig. 37 Schematic ventral view of left male pedipalp, *Anoteropsis hilaris*.

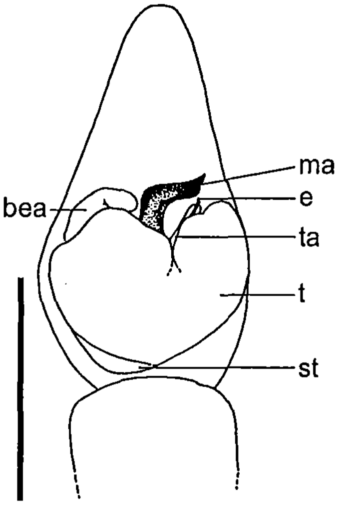


(38) *Allotrochosina schauinslandi* (39) *Anoteropsis adumbrata* (40) *Anoteropsis aerescens*

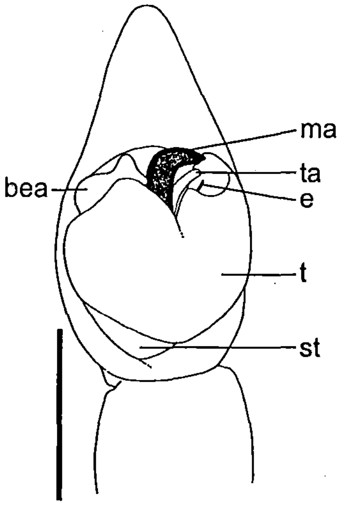


(41) *Anoteropsis alpina* (42) *Anoteropsis arenivaga* (43) *Anoteropsis blesti*

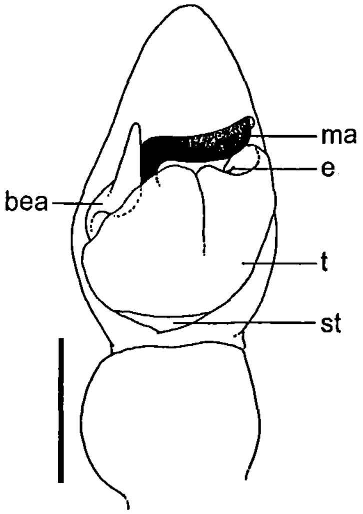
Fig. 38-64 Ventral view of left male pedipalps (ma - median apophysis; e - embolus; t - tegulum; st - subtegulum; ta - terminal apophysis; bea - basoembolic apophysis; tl - tegular lobe): 38, 42, 48, 49, 52, 56 tilted slightly to best show median apophysis. Scale lines are 0.5 mm.



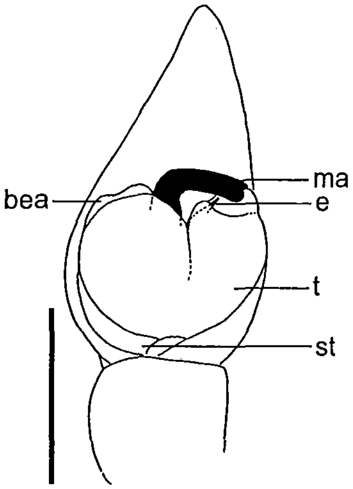
(44) *Anoteropsis canescens*



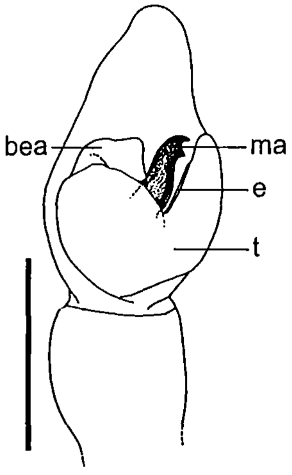
(45) *Anoteropsis cantuaria*



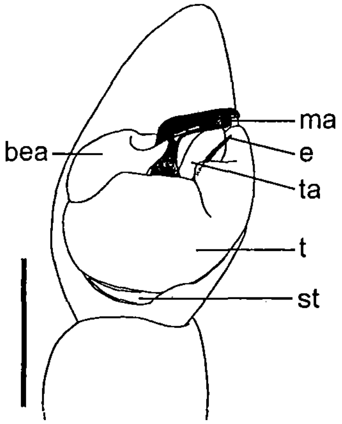
(46) *Anoteropsis flavescens*



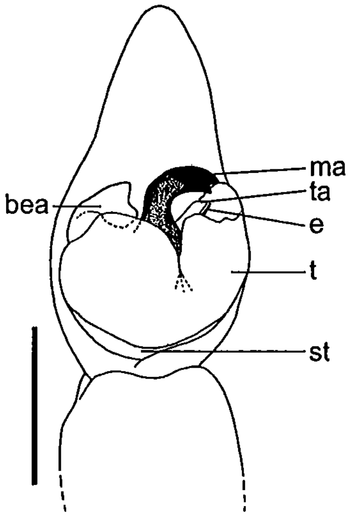
(47) *Anoteropsis forsteri*



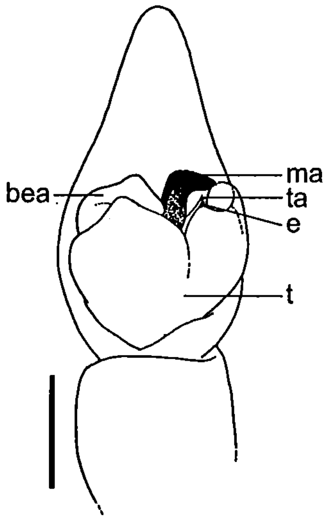
(48) *Anoteropsis hallae*



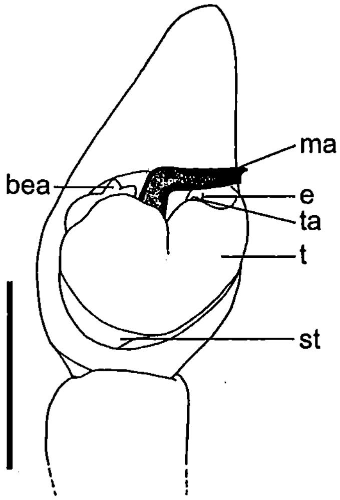
(49) *Anoteropsis hilaris*



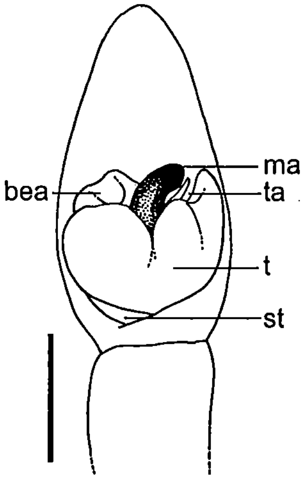
(50) *Anoteropsis insularis*



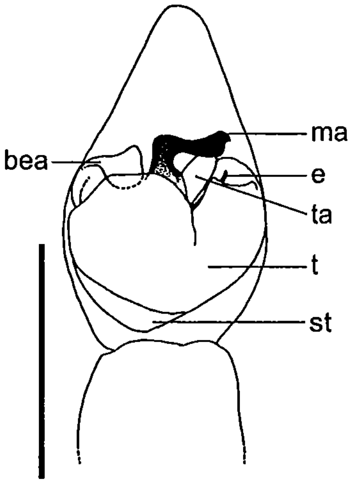
(51) *Anoteropsis lacustris*



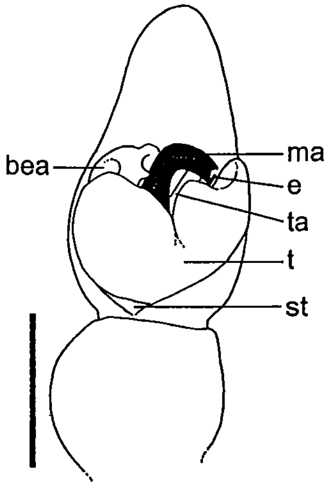
(52) *Anoteropsis litoralis*



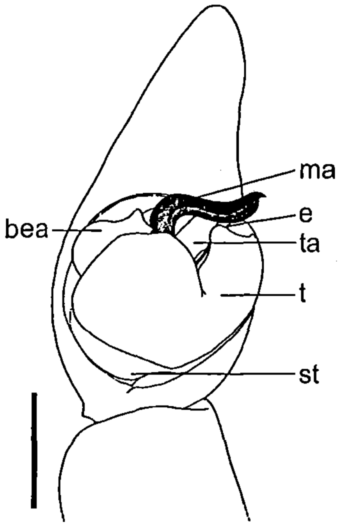
(53) *Anoteropsis montana*



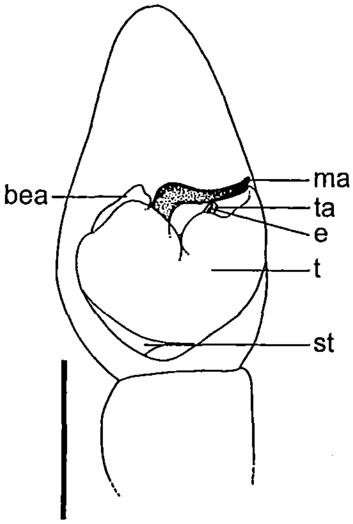
(54) *Anoteropsis okatainae*



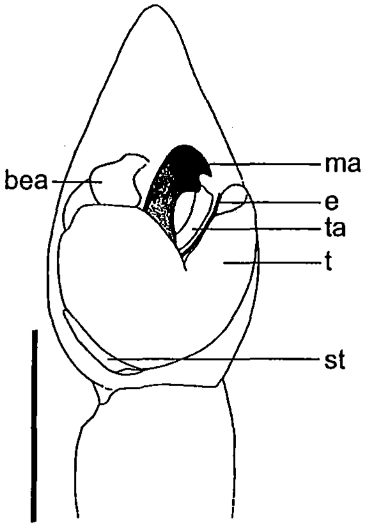
(55) *Anoteropsis ralphi*



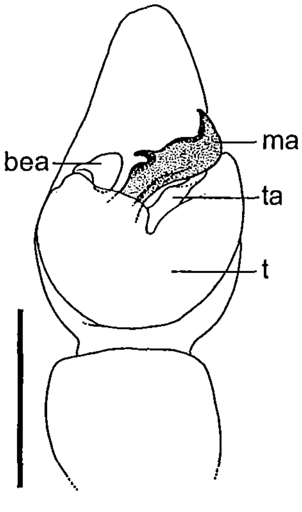
(56) *Anoteropsis senica*



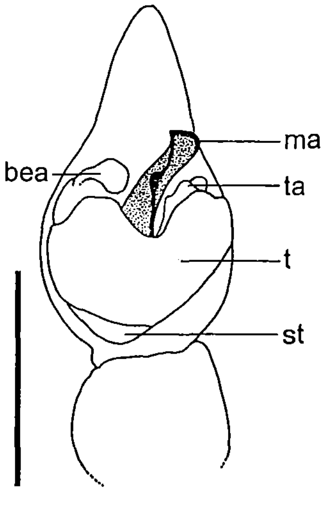
(57) *Anoteropsis urquharti*



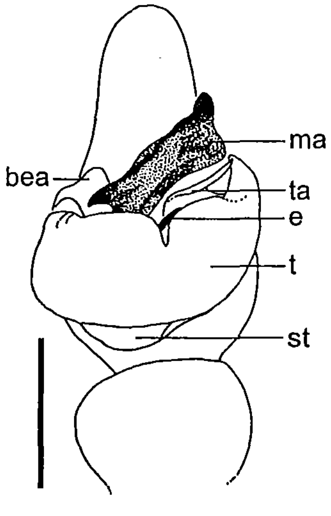
(58) *Anoteropsis westlandica*



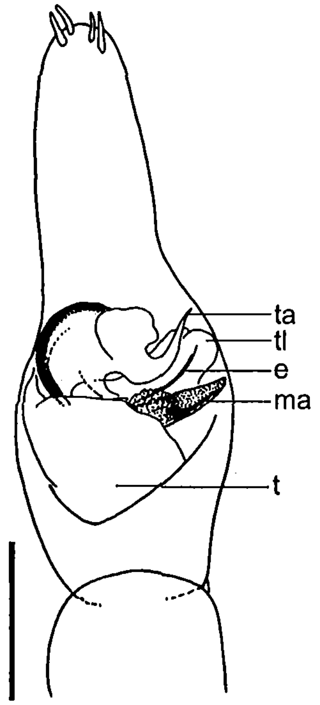
(59) *Artoria hospita*



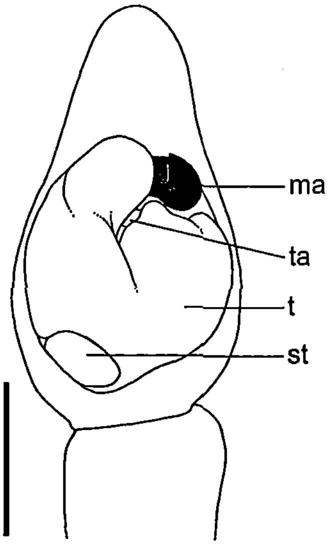
(60) *Artoria segrega*



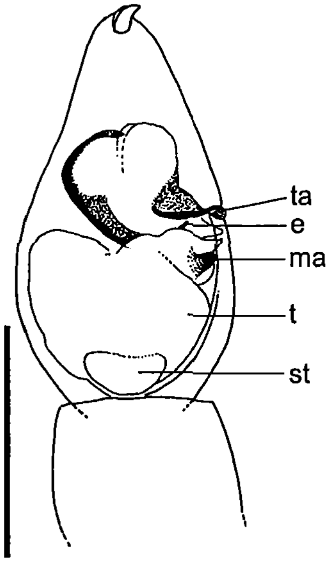
(61) *Artoria separata*



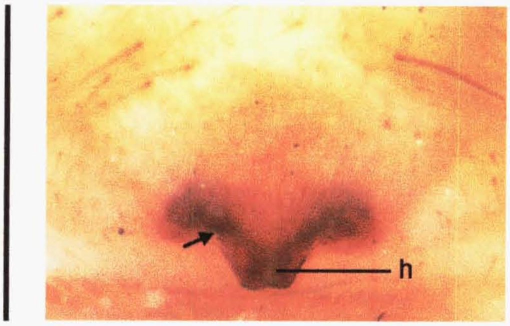
(62) *Geolycosa tongatabuensis*



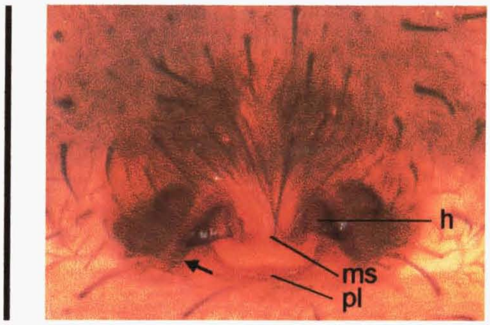
(63) *Notocosa bellicosa*



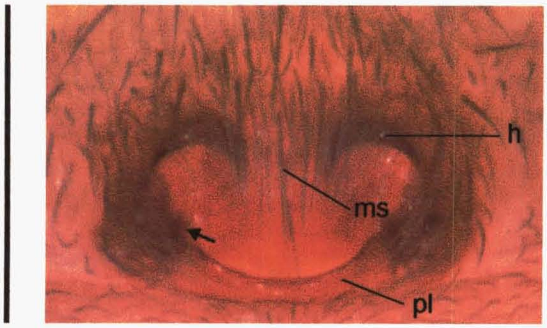
(64) *Venatrix goyderi*



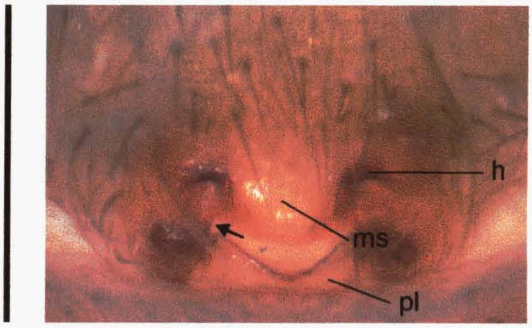
(65) *Allotrochosina schauinslandi*



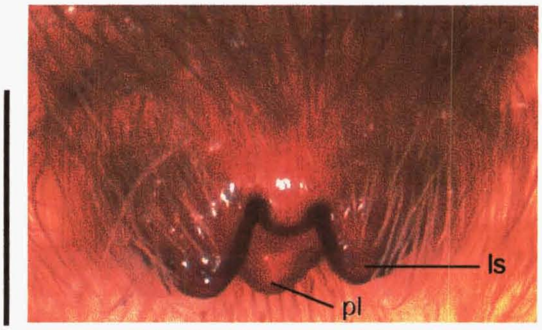
(66) *Anoteropsis adumbrata*



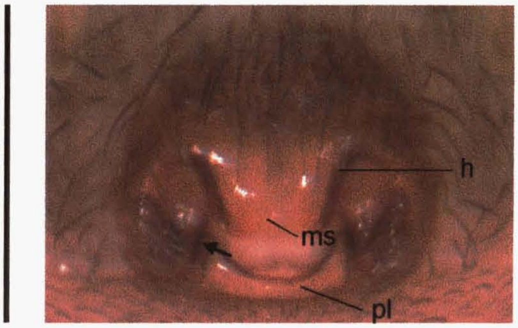
(67a) *Anoteropsis aerescens* WN



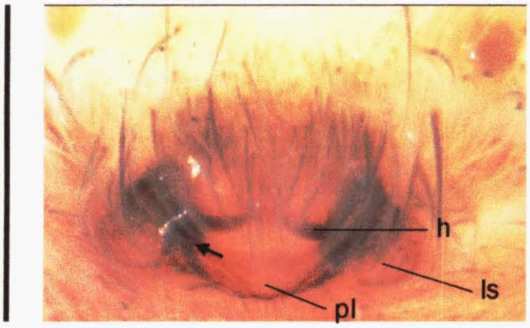
(67b) *Anoteropsis aerescens* MK



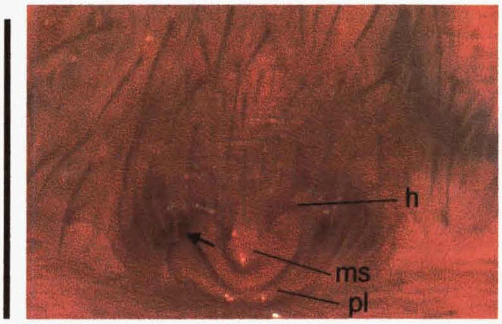
(68) *Anoteropsis alpina*



(69) *Anoteropsis arenivaga*

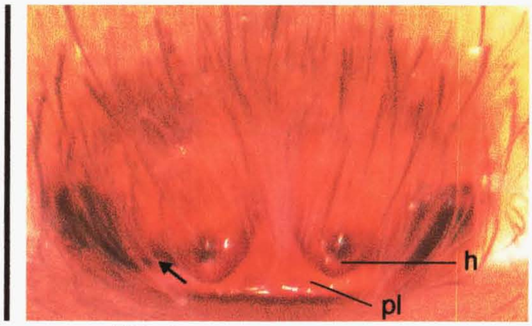


(70) *Anoteropsis blesti*

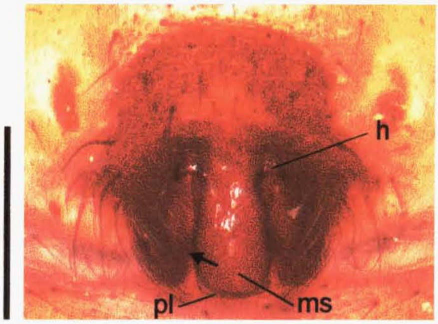


(71) *Anoteropsis canescens*

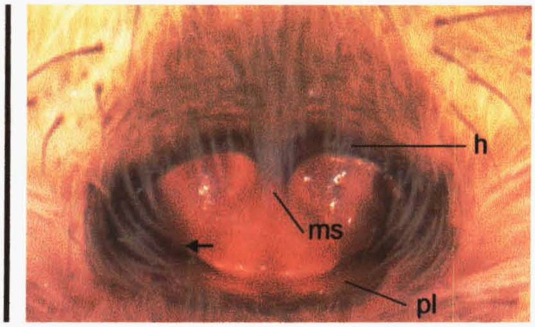
Fig. 65-91 Ventral view of epigynes (arrow - opening to copulatory duct; h - hood; pl - posterior lip; ms - median septum; ls - lateral sclerite): 67a-b and 76a-c show variation. Scale lines are 0.5 mm.



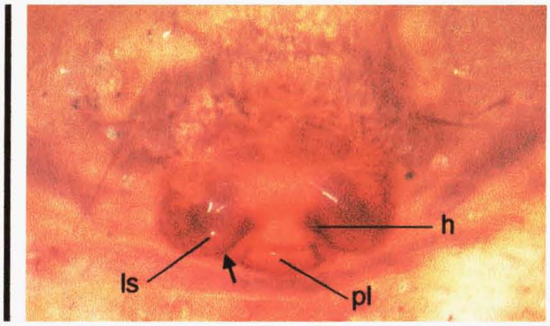
(72) *Anoteropsis cantuaria*



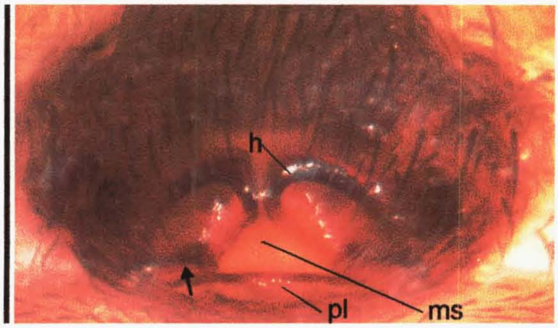
(73) *Anoteropsis flavescens*



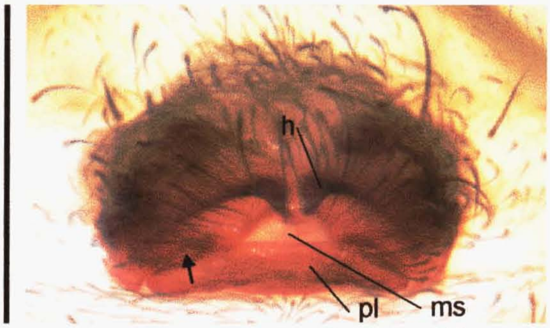
(74) *Anoteropsis forsteri*



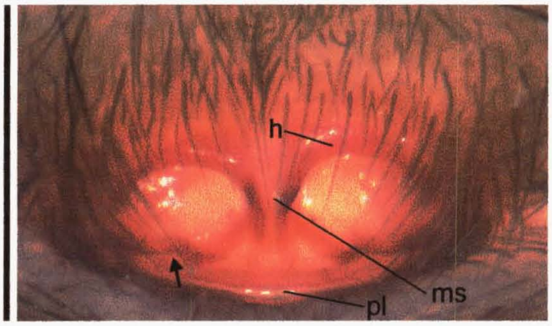
(75) *Anoteropsis hallae*



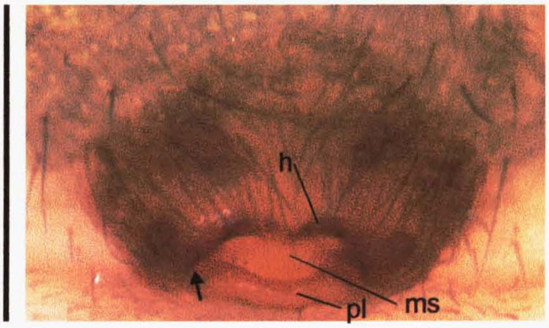
(76a) *Anoteropsis hilaris* FD



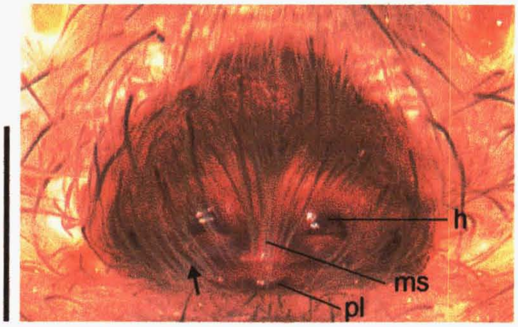
(76b) *Anoteropsis hilaris* AK



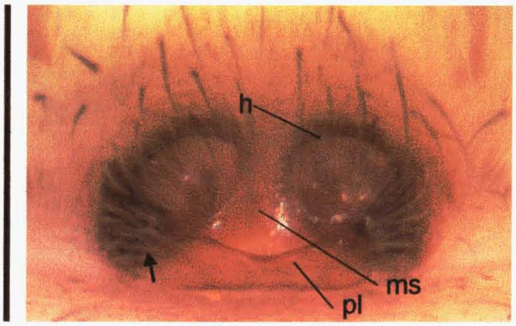
(76c) *Anoteropsis hilaris* CO



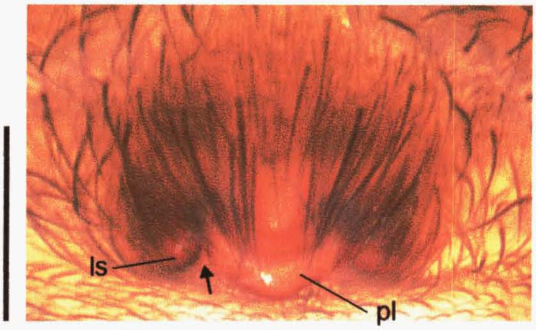
(77) *Anoteropsis insularis*



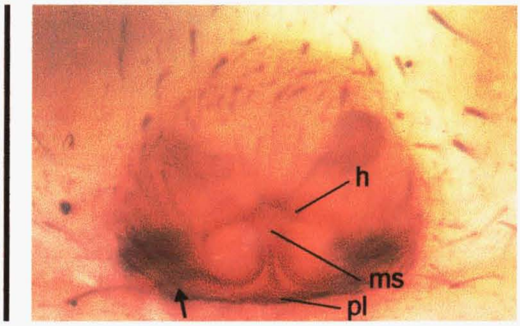
(78) *Anoteropsis lacustris*



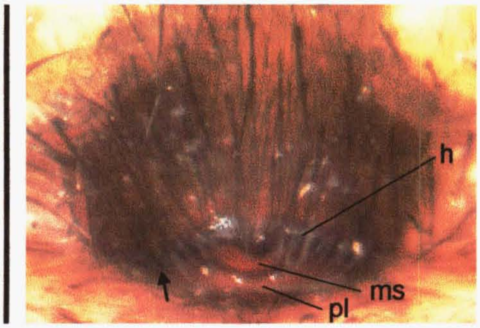
(79) *Anoteropsis litoralis*



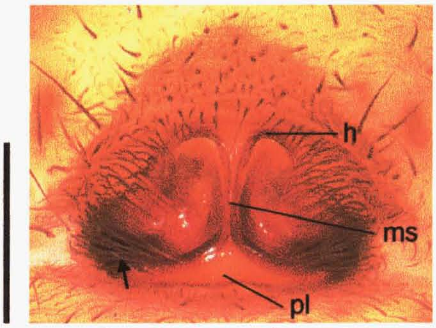
(80) *Anoteropsis montana*



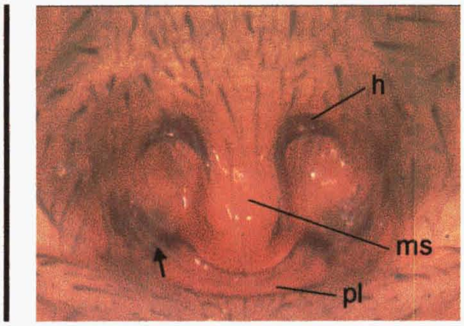
(81) *Anoteropsis okatainae*



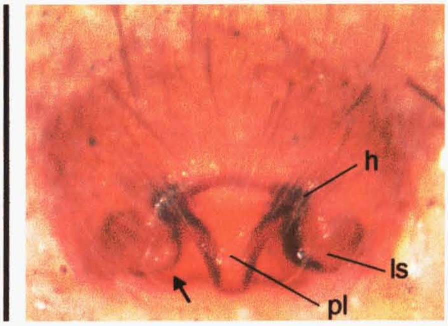
(82) *Anoteropsis ralphi*



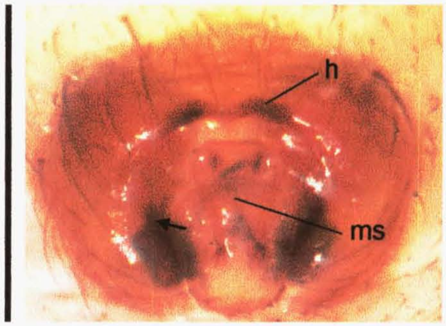
(83) *Anoteropsis senica*



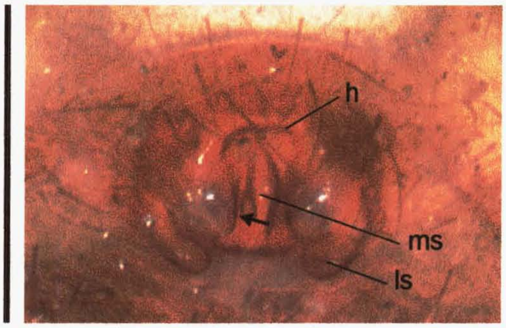
(84) *Anoteropsis urquharti*



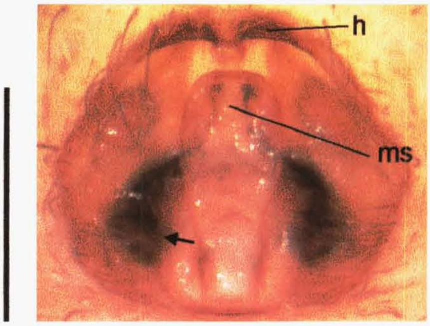
(85) *Anoteropsis westlandica*



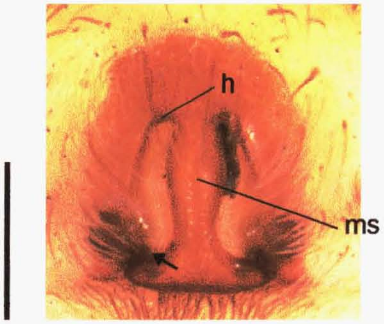
(86) *Artoria hospita*



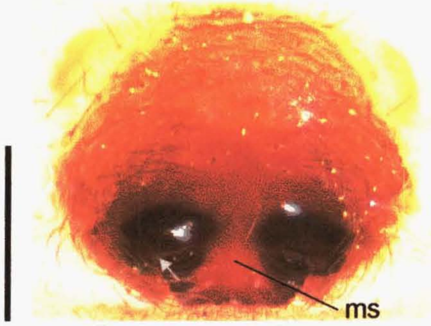
(87) *Artoria segrega*



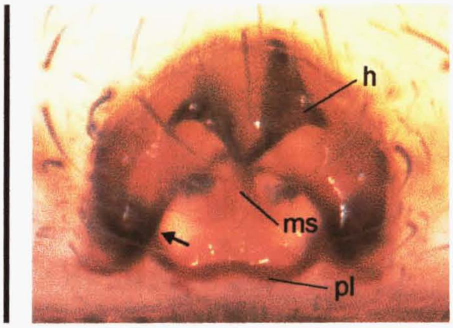
(88) *Artoria separata*



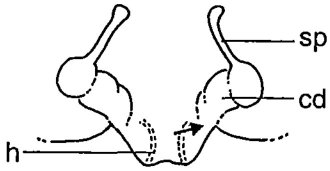
(89) *Geolycosa tongatabuensis*



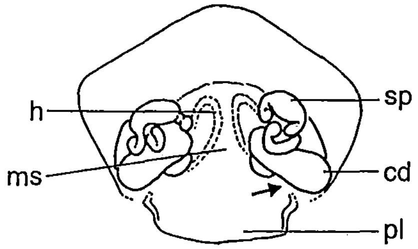
(90) *Notocosa bellicosa*



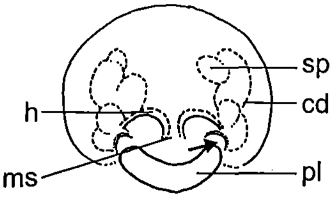
(91) *Venatrix goyderi*



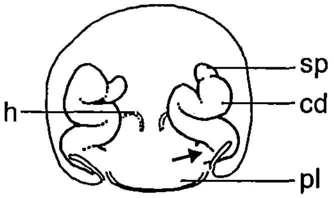
(92) *Allotrochosina schauinslandi*, ventral



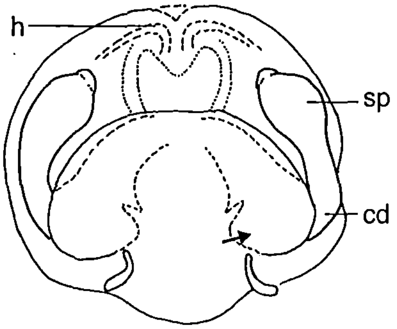
(93) *Anoteropsis hilaris*, ventral



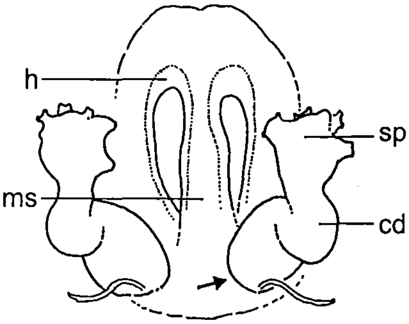
(94a) *Anoteropsis canescens*, dorsal



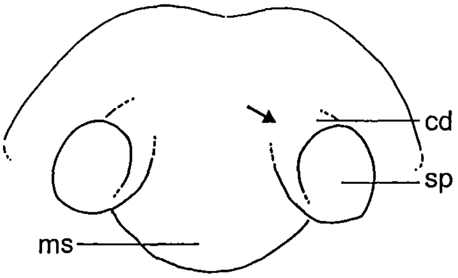
(94b) *Anoteropsis canescens*, ventral



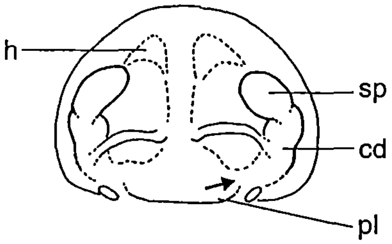
(95) *Artoria separata*, ventral



(96) *Geolycosa tongatabuensis*, ventral

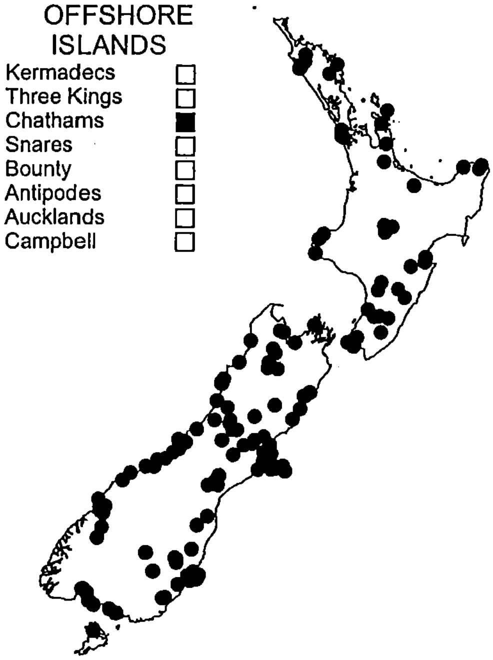


(97) *Notocosa bellicosa*, ventral

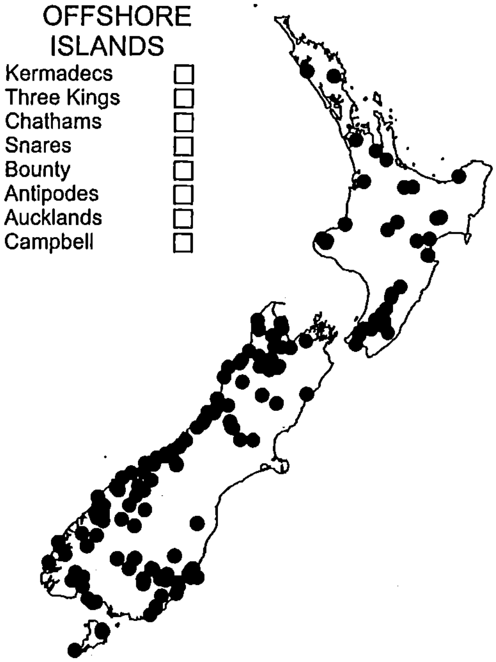


(98) *Venatrix goyderi*, ventral

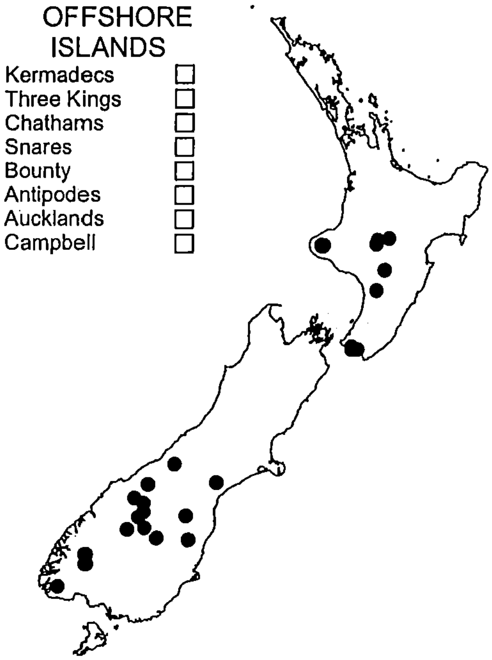
Fig. 92-98 Epigyna, cleared to show internal genitalia (arrow - opening to copulatory duct; cd - copulatory duct; h - hood; pl - posterior lip; ms - median septum; sp - spermatheca). Scale line is 0.5 mm.



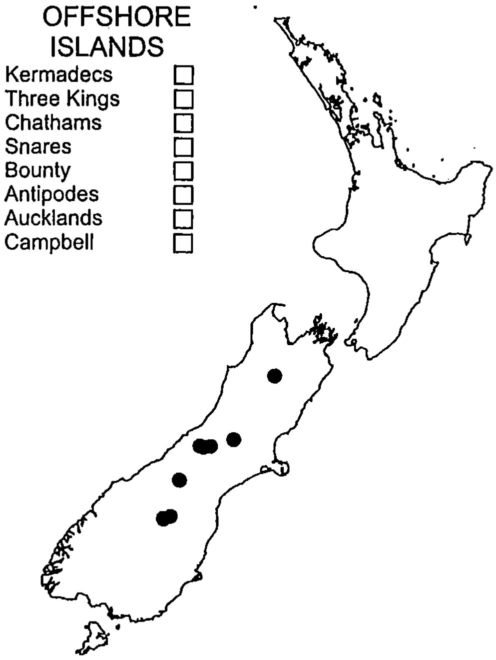
Map 1 Collection localities, *Allotrochosina schauinslandi*.



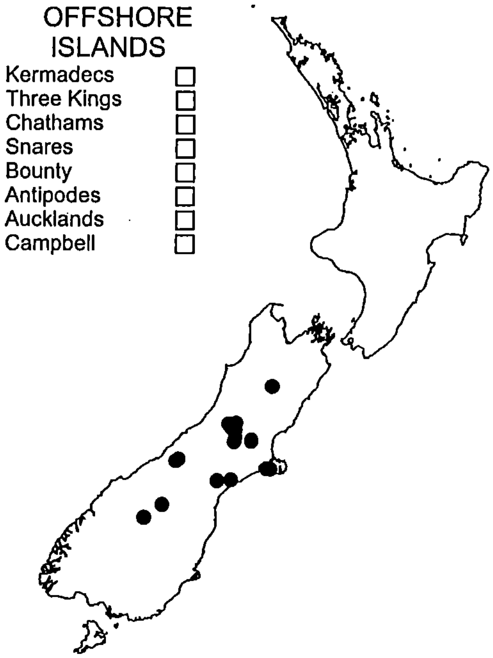
Map 2 Collection localities, *Anoteropsis adumbrata*.



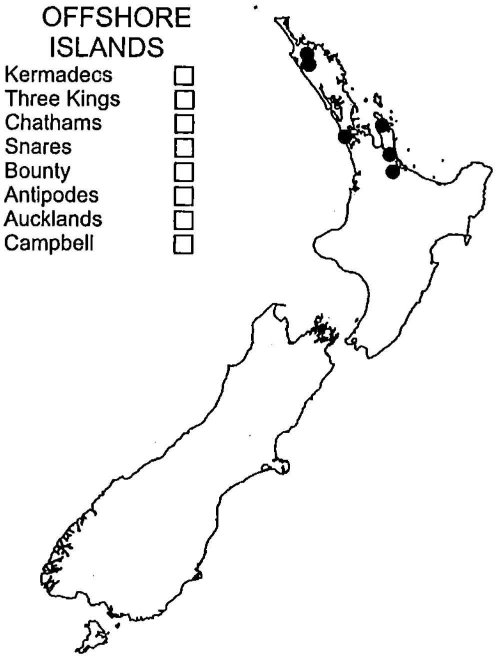
Map 3 Collection localities, *Anoteropsis aerescens*.



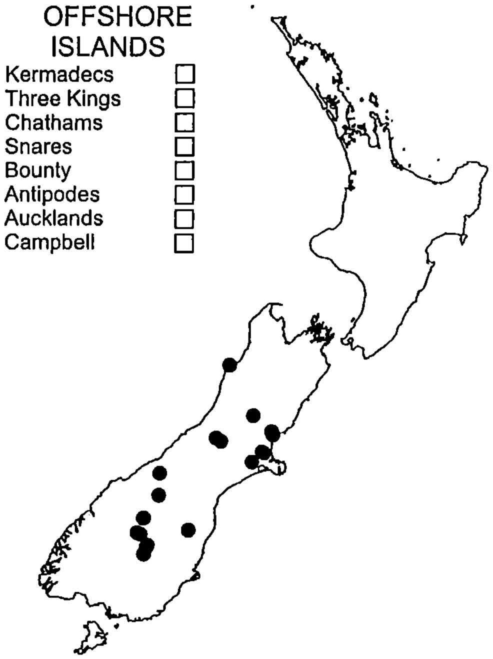
Map 4 Collection localities, *Anoteropsis alpina*.



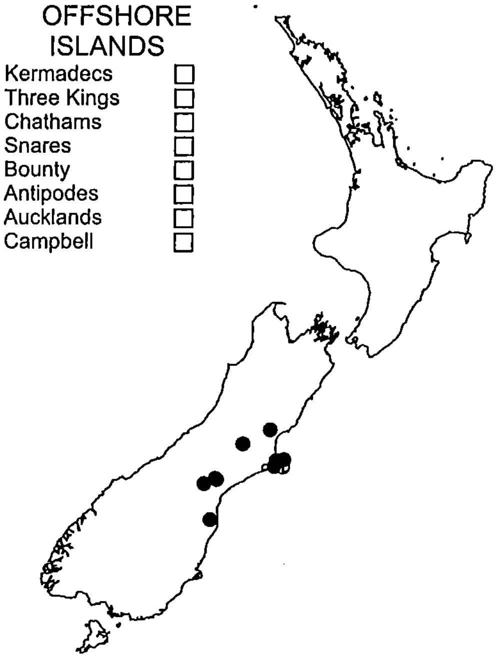
Map 5 Collection localities, *Anoteropsis arenivaga.*



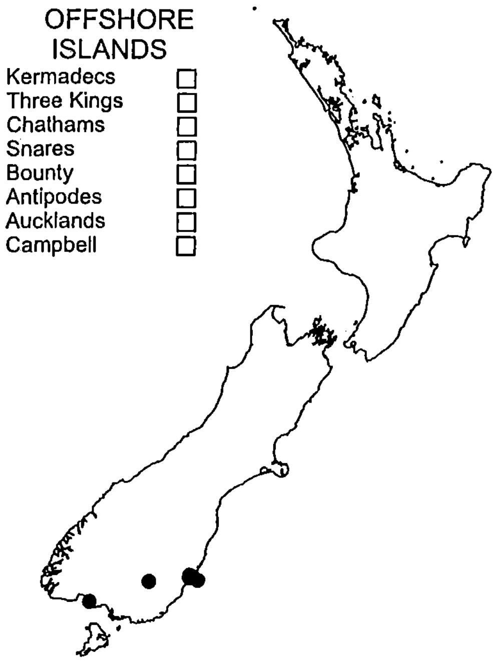
Map 6 Collection localities, *Anoteropsis blesti.*



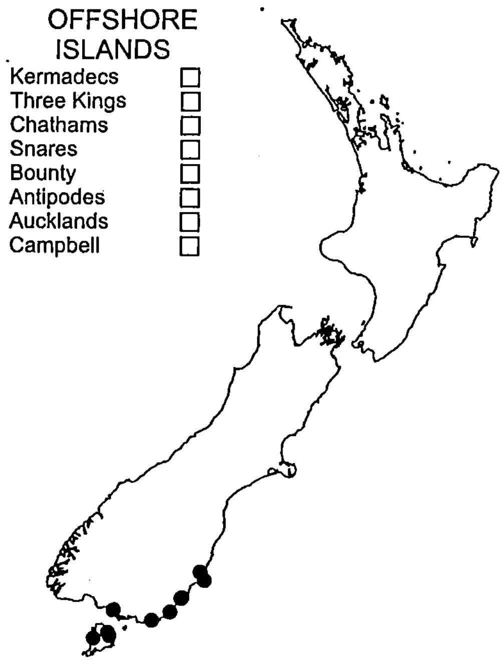
Map 7 Collection localities, *Anoteropsis canescens.*



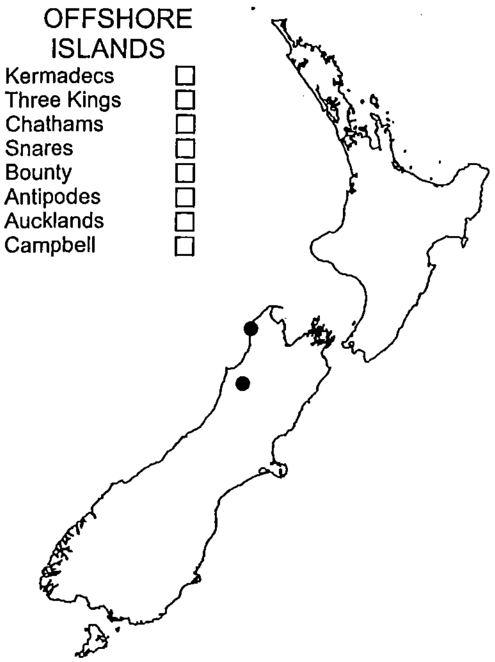
Map 8 Collection localities, *Anoteropsis cantuaria.*



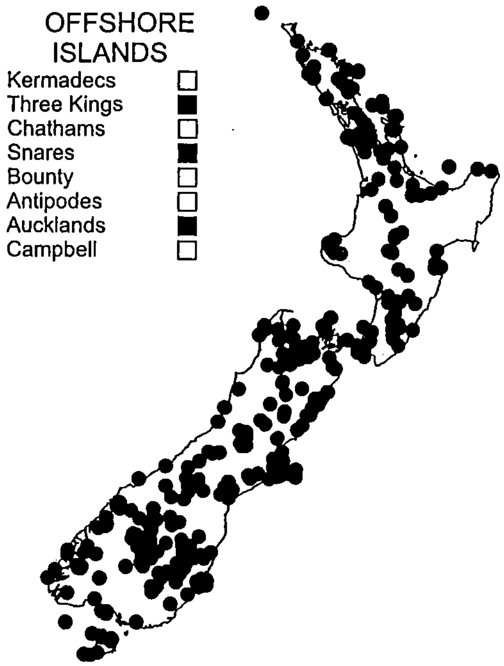
Map 9 Collection localities, *Anoteropsis flavescens.*



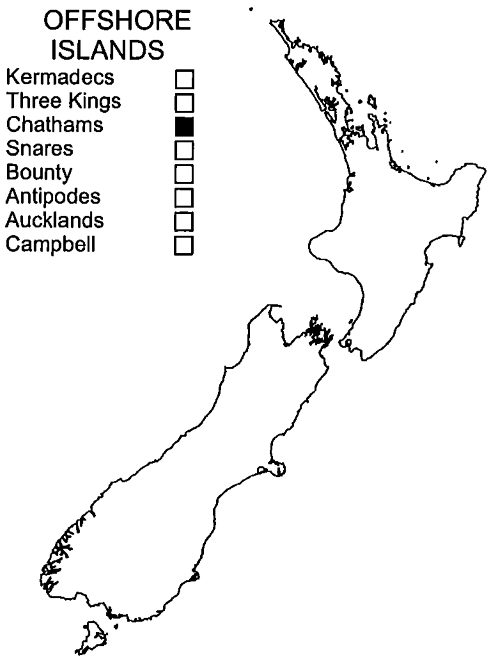
Map 10 Collection localities, *Anoteropsis forsteri.*



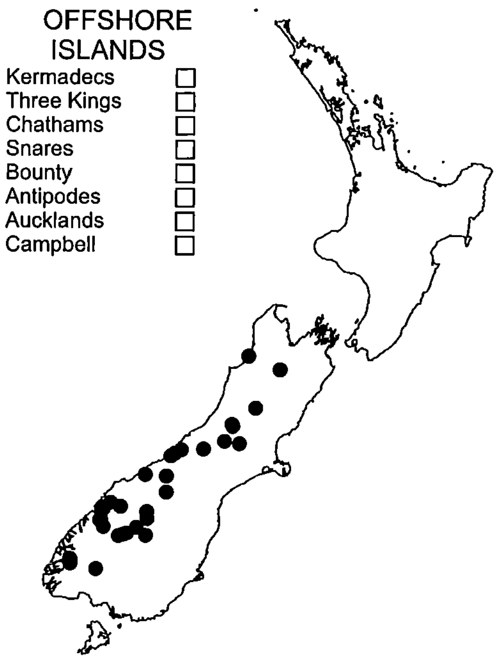
Map 11 Collection localities, *Anoteropsis hallae.*



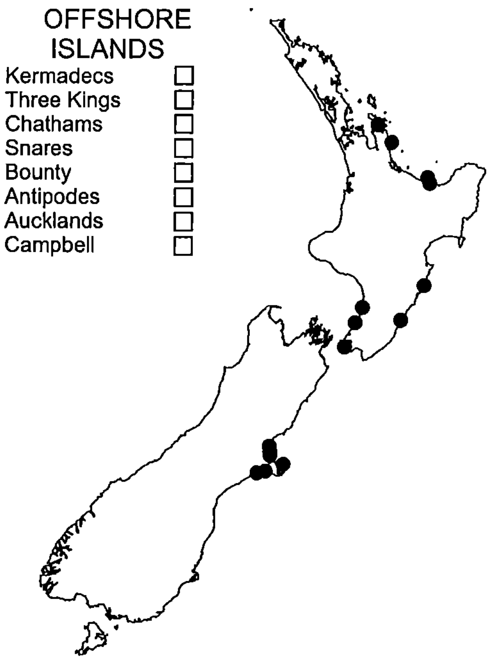
Map 12 Collection localities, *Anoteropsis hilaris.*



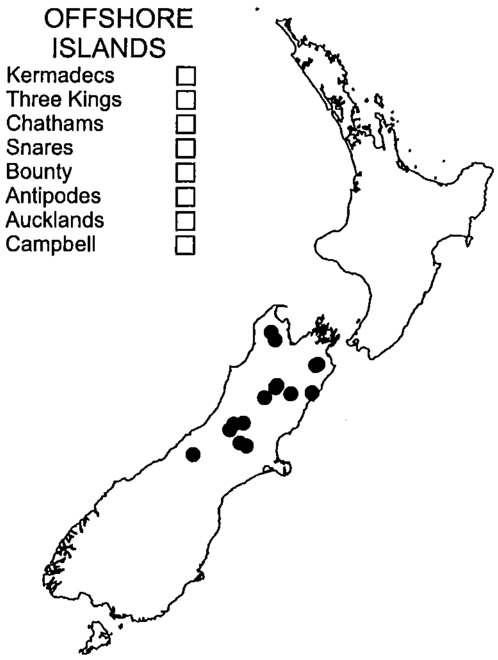
Map 13 Collection localities, *Anoteropsis insularis*.



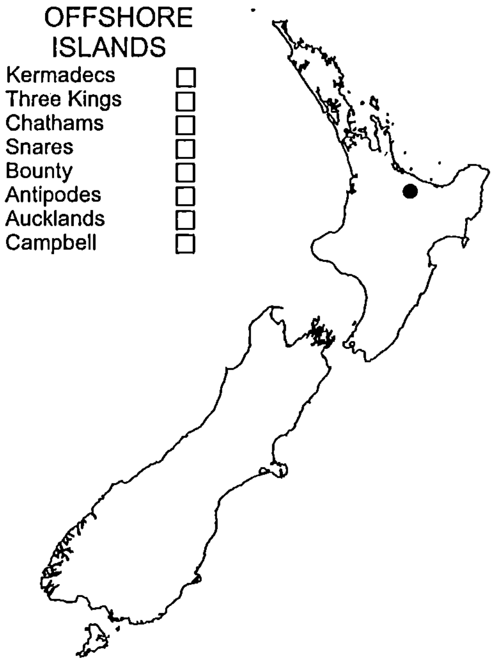
Map 14 Collection localities, *Anoteropsis lacustris*.



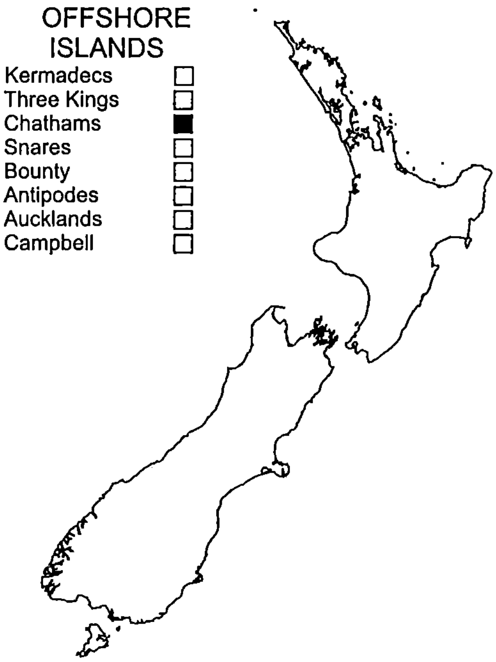
Map 15 Collection localities, *Anoteropsis litoralis*.



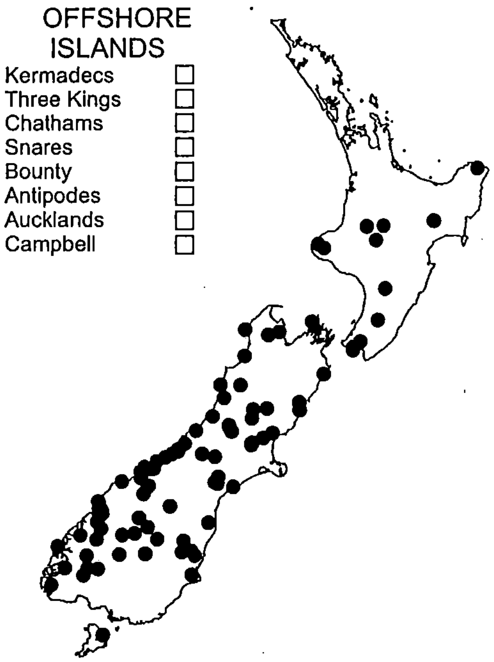
Map 16 Collection localities, *Anoteropsis montana*.



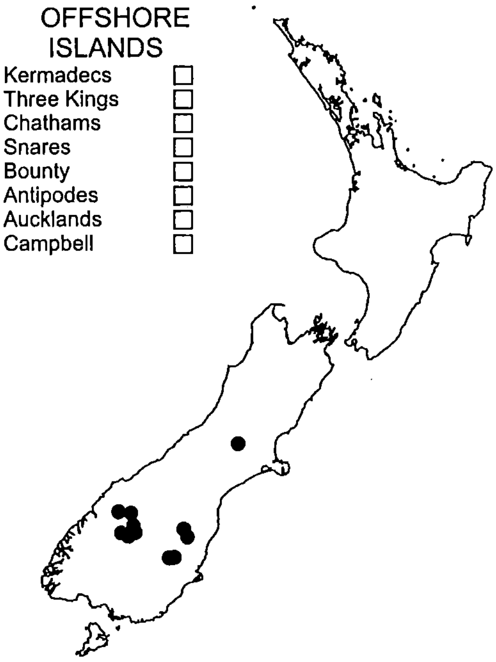
Map 17 Collection localities, *Anoteropsis okatainae.*



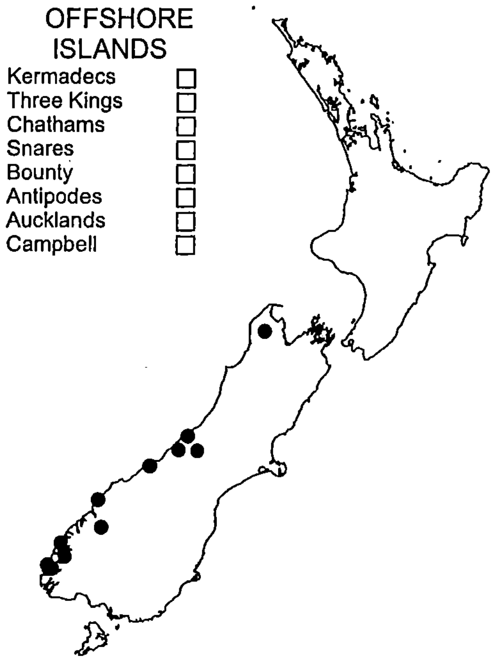
Map 18 Collection localities, *Anoteropsis ralphi.*



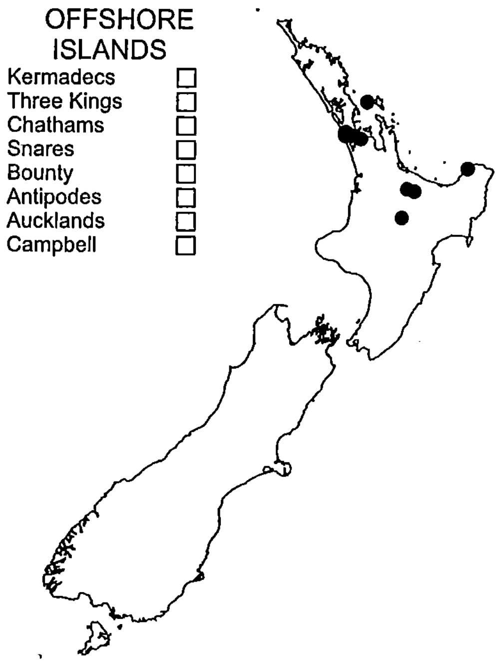
Map 19 Collection localities, *Anoteropsis senica.*



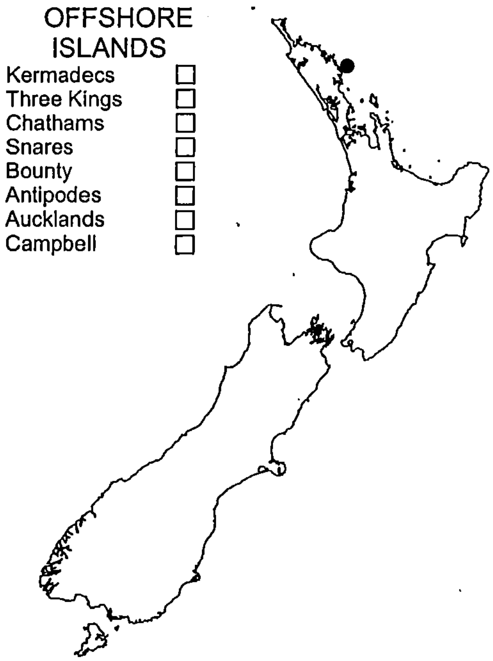
Map 20 Collection localities, *Anoteropsis urquharti.*



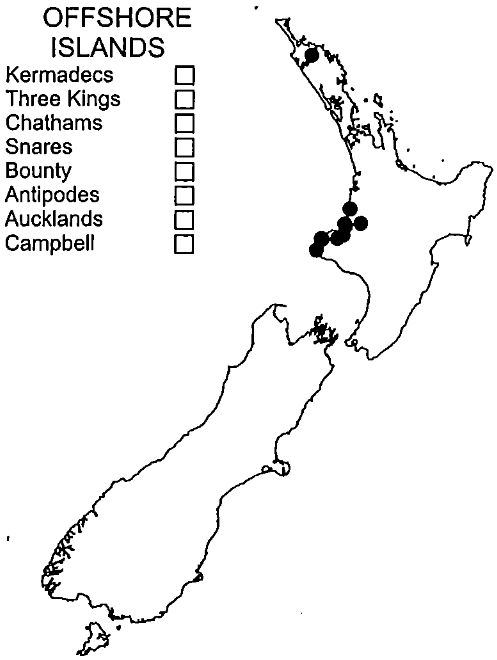
Map 21 Collection localities, *Anoteropsis westlandica*.



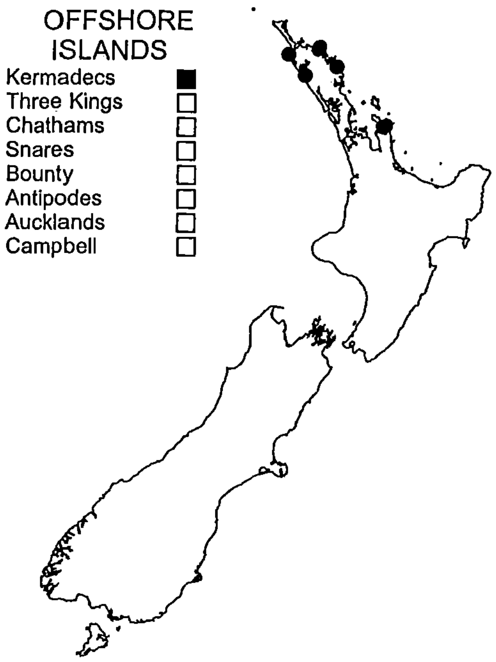
Map 22 Collection localities, *Artoria hospita*.



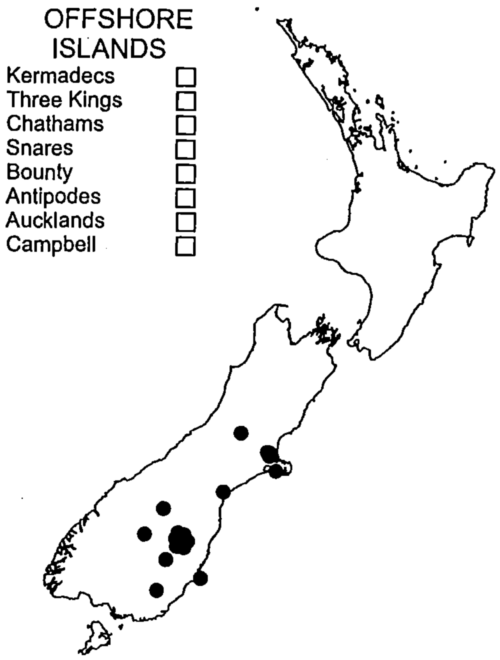
Map 23 Collection localities, *Artoria segrega*.



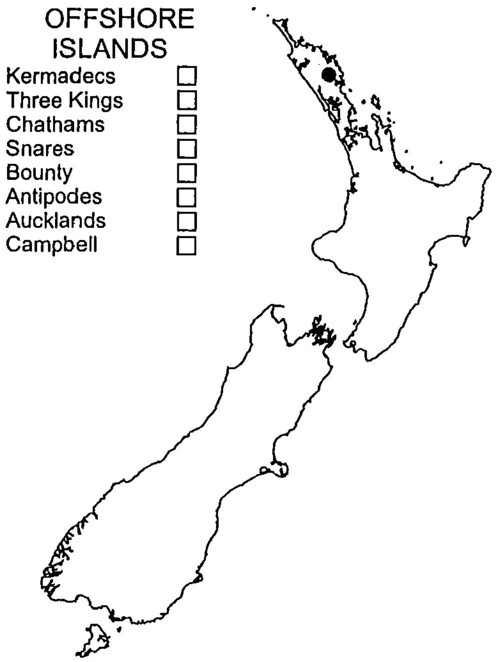
Map 24 Collection localities, *Artoria separata*.



Map 25 Collection localities, *Geolycosa tongatabuensis*.



Map 26 Collection localities, *Notocosa bellicosa*.



Map 27 Collection localities, *Venatrix goyderi*.

Chapter 4

A combined molecular and morphological phylogenetic analysis of the New Zealand wolf spider genus *Anoteropsis* (Araneae: Lycosidae)

Cor J. Vink and Adrian M. Paterson

Ecology and Entomology Group, PO Box 84, Lincoln University, Canterbury 8150, New Zealand

Abstract

Data sets from the mitochondrial gene regions NADH dehydrogenase subunit I (ND1) and cytochrome c oxidase I (COI) of the 20 species in the New Zealand lycosid genus *Anoteropsis* were generated. Two species of *Artoria* were also sequenced and used as an outgroup. Species with a large distribution within New Zealand were represented by two or more specimens to test for geographical variation. Sequence data were phylogenetically analysed using parsimony and maximum likelihood analyses. Sequence data were combined with a previously generated morphological data set and phylogenetically analysed using parsimony. The ND1 region sequenced included part of tRNA$^{\mathrm{Leu(CUN)}}$, which appears to have an unstable amino-acyl arm and no TψC arm in lycosids.

Analyses supported the existence of five main species groups within *Anoteropsis* and the monophyly of the species. Phylogenies generated from the COI data set show inconsistencies with the ND1 and morphological trees and caution is advised when using COI to estimate spider phylogenies. A radiation of *Anoteropsis* species within the last five million years is inferred from the ND1 likelihood phylogram, habitat and geological data.

Introduction

The paucity of phylogenetic studies on a family as diverse and widespread as the Lycosidae is testimony to the difficulties posed in obtaining meaningful morphological characters. Only four published works that used morphological characters have tackled aspects of lycosid phylogenetics. Dondale (1986) produced a phylogeny of lycosid subfamilies with 18 pedipalpal characters mapped onto it. Griswold (1993) used cladistic analysis to examine the relationships of the super family Lycosoidea based on somatic, behavioural, epigynal and male pedipalpal characters. At the species level, Casanueva (1980) performed a phenetic analysis of the Chilean lycosids based on somatic and sexual morphological characters, and Vink (in press) derived a phylogeny of the New Zealand genus *Anoteropsis* L. Koch, 1878 using parsimony analysis of characters from male and female genitalia, somatic morphology and ecology. (Fig. 1).

Status – prepared for submission to *Invertebrate Systematics*

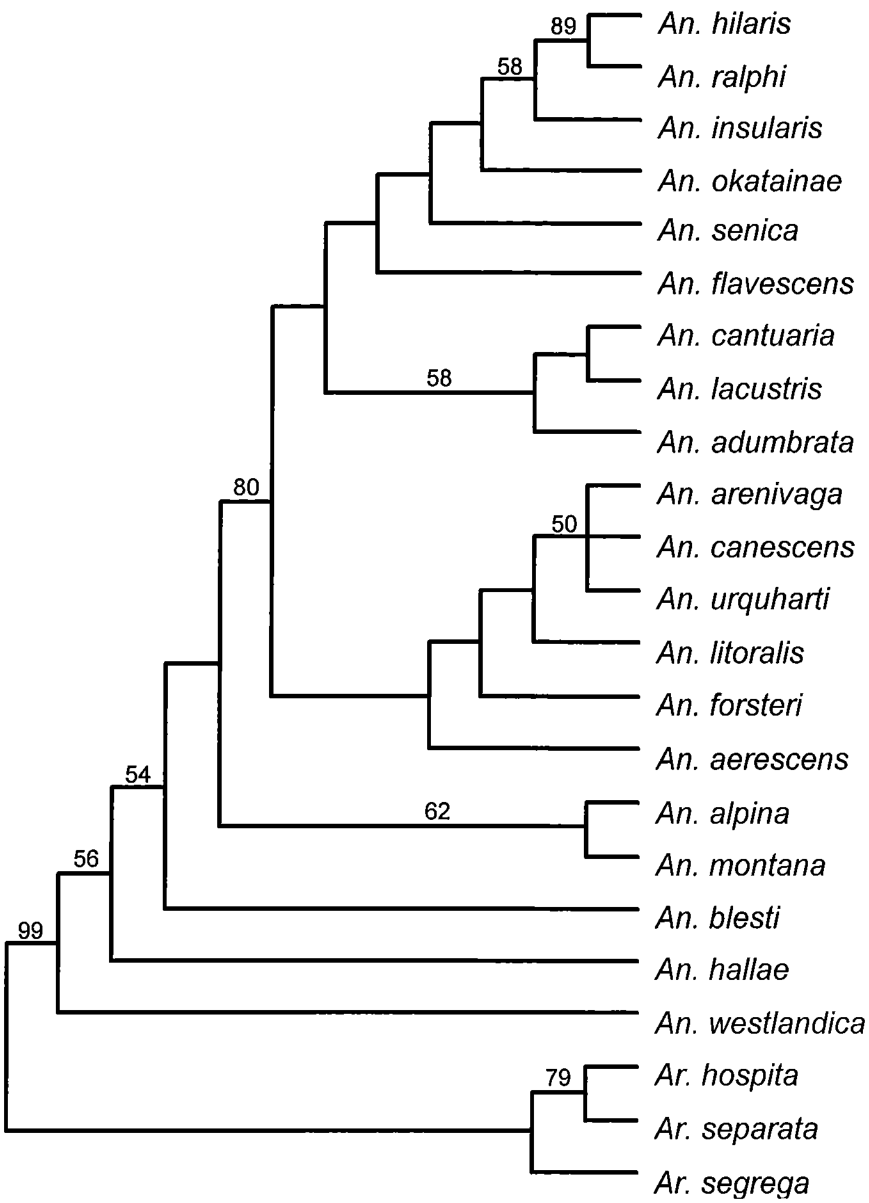


Fig. 1. A phylogenetic tree for *Anoteropsis* and the three New Zealand *Artoria* species based on morphological characters, from Vink (in press). Numbers above the branches indicate the bootstrap percentages of 1000 replicates.

Molecular sequencing generates large data sets for phylogenetic analyses and this has been done to good effect in other spider families (Tetragnathidae - Gillespie *et al.* 1994; Nesticidae - Hedin 1997a; Thomisidae - Garb 1999; Salticidae - Hedin and Maddison 2001; Ctenidae - Huber *et al.* 1993) and in the Lycosidae at the species and genus level (Zehethofer and Sturmbauer 1998; Vink and Mitchell in press; Vink *et al.* in press). The mitochondrial gene regions NADH dehydrogenase subunit I (ND1) and cytochrome c oxidase I (COI) have been used to infer species-level phylogenies in spiders (Hedin 1997a; Hedin 1997b; Hedin 2001; Garb 1999; Hedin and Maddison 2001) and primers are known for both regions (Simon *et al.* 1994; Hedin 1997a).

In an attempt to reconstruct the phylogeny of the lycosid genus *Anoteropsis* (*sensu* Vink in press) two gene regions, ND1 (including part of tRNA$^{\mathrm{Leu(CUN)}}$) and COI, were sequenced to obtain molecular characters for phylogenetic analyses. These phylogenies were tested for congruence to each other and to a morphological character based phylogeny (Vink in press).

Materials and methods

Generic placement of species is based on the recent taxonomic revision of New Zealand Lycosidae (Vink in press). Species sequenced, sex, and collection details (locality, date and collectors) are shown in Table 1. All specimens are stored in 95% ethanol at 4°C and held at the Ecology and Entomology Group, Lincoln University, except *Anoteropsis hallae* and *A. westlandica*, which are held at the Museum of New Zealand Te Papa Tongarewa, Wellington, and the New Zealand Arthropod Collection, Auckland respectively. Species with wide distributions (*A. adumbrata*, *A. aerescens*, *A. hilaris*, *A. litoralis*, and *A. senica*) were sampled from at least two distant localities within their geographic ranges. *A. aerescens* and *A. urquharti* were represented by three specimens and *A. arenivaga* by two specimens as these three species are all morphologically similar and molecular analyses could be used to confirm the division of species (Vink in press) or reveal possible cryptic species.

DNA extraction, amplification and sequencing

Specimens were washed in sterile deionised, distilled water before DNA extraction. Total genomic DNA was extracted by homogenising 1-2 legs from single individuals (Table 1) using a proteinase-K digestion and, in all but four specimens, a high salt precipitation method (White *et al.* 1990). For the specimens of *A. canescens*, *A. hallae*, *A. urquharti* OL and *A. westlandica*, Dneasy™ tissue kits (QIAGEN) were used as the specimens had been stored since collection for more than a month in 70% ethanol and the high salt precipitation method had been unsuccessful. ND1 gene fragments (~420 bp) were amplified using the following primer combination: TL-1-N-12718 plus N1-J-12261 (Hedin 1997a) (Fig. 2a). COI gene fragments (~400 bp) were amplified using the following primer combination: C1-J-1751 (alias Ron) plus C1-N-2191 (alias Nancy) (Simon *et al.* 1994) (Fig. 2b).

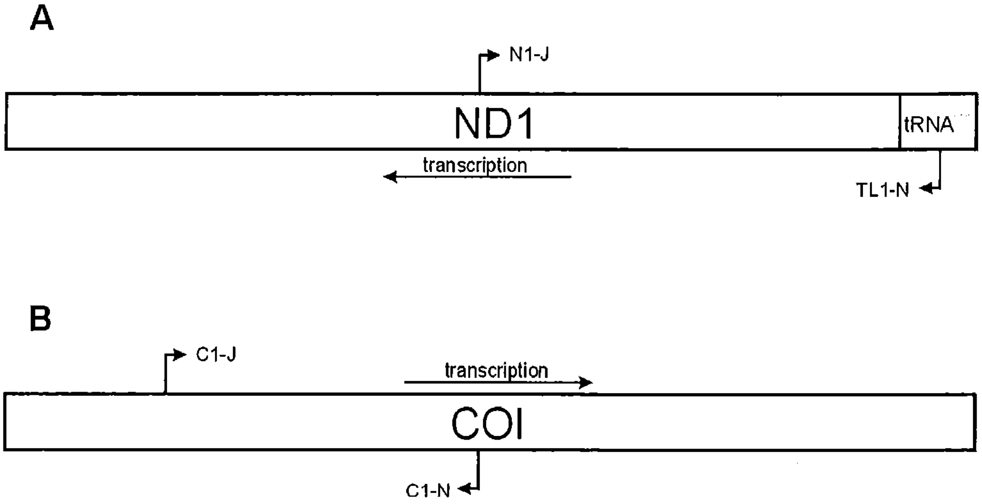


Fig. 2. Schematic of gene regions showing areas sequenced by primers and direction of transcription. *A*, ND1 (NADH dehydrogenase subunit I, including part of tRNA$^{\mathrm{Leu(CUN)}}$): *B*, COI (cytochrome c oxidase I).

The 25 μl reactions comprised 2.5 μl of 10× *Taq* buffer (Roche), 2.5 μl of dNTPs (2.5 mM), 2 μl of $MgCl_2$ (25 mM), 1 μl 10 μmol of each primer, and 0.25 μl *Taq* DNA Polymerase (Roche). A GeneAmp® PCR System 2400 (Perkin–Elmer) thermocycler was used with a cycling profile of 94°C for 2 minute pre-PCR followed by 94°C for 40 s, 47°C (45°C for the primers C1-J-1751 plus C1-N-2191) for 40 s, 72°C for

40 s for 40 cycles with a 5 minute extension at 72°C after the final cycle. PCR product was purified using the CONCERT™ Rapid PCR Purification System (Life Technologies). Purified PCR fragments were sequenced using ABI PRISM® BigDye™ termination mix (Perkin-Elmer) and an ABI PRISM® 310 automatic sequencer. Sequence data were deposited in GenBank (Benson *et al.* 2000) (see Table 1 for accession numbers).

Data analysis

Artoria appears to be the sister genus to *Anoteropsis* (Vink *et al.* in press) and two species (one New Zealand and one Australian) were, therefore, selected as an outgroup (see Watrous and Wheeler 1981 and Maddison *et al.* 1984 for a discussion of outgroups). *Notocosa bellicosa* (Goyen, 1888) was also considered for the outgroup. However, its ND1 and COI sequences (GenBank accession numbers AY059995 and AY059960 respectively) were too different from *Anoteropsis* spp. and *Artoria* spp. and may have resulted in "long-branch attraction" (see Kennedy *et al.* 1999 and Swofford *et al.* 2001).

Sequences were aligned using CLUSTAL X (Thompson *et al.* 1997). For the ND1 sequence data, insertion/deletion events were inferred where necessary based on the secondary structure of $\text{tRNA}^{\text{Leu(CUN)}}$ inferred by Masta (2000). Phylogenetic analyses were conducted using PAUP* 4.0b8 (Swofford 2001). Nucleotide sequences were translated to amino acid sequences using MacClade (Maddison and Maddison 1992) and also analysed using PAUP*.

Data were analysed as unordered characters using parsimony and the heuristic search (1000 replicates) option in PAUP*. All characters were equally weighted, and zero length branches were collapsed to polytomies. Variability in the number of informative characters was observed at different sites with 72% occurring at third positions in ND1 and 92% in COI, 22% at first positions in ND1 and 8% in COI, 6% at second positions in ND1 and none in COI. The probability of a change in a nucleotide within a codon resulting in a change to the amino acid coded for was calculated using the invertebrate mitochondrial genetic code table. A change in the second position always results in a change in the amino acid (probability of 1.0). A change in the first position resulting in a change to the amino acid has a probability of 0.979167 $[1-4\div(64\times3)]$. For the third position the probability of an amino acid change was 0.291667 $[(2\times28)\div(64\times3)]$. Analyses were performed with weighting based on these probabilities (first positions weighted at 0.979167, second positions at 1.0 and third positions 0.291667). Bootstrap values (Felsenstein 1985) for monophyletic groups were calculated from 1000 replicate parsimony analyses using the closest addition sequence of the taxa and the heuristic search option in PAUP*.

MODELTEST version 3.06 (Posada and Crandall 1998) was used to select the maximum likelihood parameters. The hierarchical likelihood ratio tests in MODELTEST (see Posada and Crandall 2001) recommended TIM+Γ+I for ND1 and GTR+Γ for COI. Both are general time reversible models (Yang 1994) and were used to estimate the maximum likelihood tree and branches were collapsed (creating polytomies) if the branch length were less than or equal to 1e-08. Bootstrap values for the maximum likelihood tree were calculated from 100 replicates.

ND1, COI and morphology (Vink in press) trees were compared to test for congruence using a tree comparison metric (Nelson and Platnick 1981; Page 1989). The tests were performed using the "tree-to-tree distances" option in PAUP*. This method compares components (monophyletic groups) between two trees. Tree similarity is measured by symmetric-difference values. This distance metric sums the components of the two trees and subtracts the components that are shared by both trees. The COI and morphology phylogenies were compared with 1000 random trees. Random trees were generated under a Markovian model using the "generate trees" option in PAUP*.

A data set combining the ND1 and COI sequences and morphological characters (Vink in press) was analysed using parsimony analysis (a heuristic search with 1000 replicates). There were approximately four times more informative characters in each molecular data set than the morphology data set. Therefore, there was a danger that the morphological signal might be swamped by the molecular signal so the morphological characters were weighted four times. Three of the morphological characters were ordered as per Vink (in press).

The two-letter codes following some species refer to the New Zealand area codes as defined by (Crosby *et al.* 1976; 1998).

Results

Alignment of the ND1 sequence data with the secondary structure of tRNA$^{\mathrm{Leu(CUN)}}$ of Masta (2000) inferred that, as in the Salticidae (Masta 2000; Hedin and Maddison 2001), there is an unstable amino-acyl arm and the TψC arm is lacking in Lycosidae.

Parsimony analysis of unweighted ND1 data produced nine equally parsimonious trees (Fig. 3), with a length of 354 steps (consistency index - excluding uninformative characters (CI) of 0.406, retention index (RI) of 0.645. Of the 423 characters included in the analysis, 135 were variable with 102 parsimony informative. When weighting was applied (see materials and methods) the analysis produced 27 equally parsimonious trees (Fig. 4), with a length of 172.25 steps (CI = 0.397, RI = 0.678). Nucleotides in the tRNA section (25 bp) were each assigned a weight of 1.0 as it was not possible to infer a weighting scheme for that part of the sequence. The tree topologies differed in their placement of *A. alpina* and *A. montana* (which are sister taxa in the unweighted tree), *A. insularis* (which is more basal in the unweighted tree), and the clade containing *A. adumbrata*, *A. cantuaria* and *A. lacustris*, which was more basal in the weighted tree. Bootstrap values for the unweighted and weighted trees were similar. All trees had strong bootstrap support of the monophyly of *Anoteropsis*.

Parsimony analysis of unweighted COI data produced 1284 equally parsimonious trees with four islands with 735, 388, 158 and three trees. The islands differed mainly in the basal branches as can be seen in the consensus tree (Fig. 5). The trees had a length of 236 steps (CI = 0.442, RI = 0.621). Of the 409 characters included in the analysis, 101 were variable with 74 parsimony informative. When weighting was applied the analysis produced six equally parsimonious trees (Fig. 6), with a length of 79.63 steps (CI = 0.457, RI = 0.657). Weighting improved the resolution of the lower branches but grouped *A. alpina* and *A. arenivaga* with the outgroup species. Again the bootstrap values were similar between the unweighted and weighted trees.

The nucleotide composition of the ND1 sequence was A + T rich (36.7% A, 11.6% C, 7.5% G, 44.2% T), which is typical for arthropods (Simon *et al.* 1994). The nucleotide composition of COI sequence was more homogenous (26.1% A, 13.5% C, 15.9% G, 44.5% T)

Phylogenies based on amino acid sequences (not shown) were almost inconclusive. The 92 equally parsimonious trees generated from the COI data had no consensus, which was not surprising, since there were only four parsimony informative characters. The ND1 amino acid data generated two equally parsimonious trees (11 parsimony informative characters) and there was good bootstrap support (84%) for the clade containing *A. blesti*, *A. hallae* and *A. westlandica*. There was also some bootstrap support for *A. alpina* and *A. montana* as sister species (52%). The amino acid data for both regions were combined and the analysis produced 153 equally parsimonious trees. The clade containing *A. blesti*, *A. hallae* and *A. westlandica* was well supported (76%) and there was some support (51%) for that clade being sister to the remaining *Anoteropsis* species. *A. okatainae* and *A. senica* had some support (62%) as sister species as did *A. aerescens* and *A. forsteri* (63%).

Maximum likelihood analysis of the ND1 data resulted in five trees with scores of 2137.16 (Fig. 7). They differed from the parsimony analyses by placing the clades containing *A. blesti*, *A. hallae* and *A. westlandica*, *A. alpina* and *A. montana*, and *A. adumbrata*, *A. cantuaria* and *A. lacustris* more basally. The position of *A. insularis* also changed.

Maximum likelihood analysis of the COI data resulted in one tree with a score of 1697.7304 (Fig. 8). It differed from the parsimony analysis by placing the clade containing *A. adumbrata*, *A. cantuaria* and *A. lacustris* more basally. *A. alpina* and *A. montana* were placed by the likelihood analysis in a more derived clade.

The topology of the maximum likelihood trees (Figs 7, 8) and the parsimony trees (Figs 3-6) differed mainly in the lower branches, which had less than 50% bootstrap support in all trees.

Symmetric-difference distance values between the COI and ND1 maximum likelihood trees and the morphological tree were significantly lower than would be expected by chance. The COI tree was more similar to the ND1 trees (symmetric-difference distances of 22-24) than to 1000 random trees (symmetric-difference distances of 51-55). The morphology tree was more similar to the ND1 trees (symmetric-difference distances of 21-22) and the COI tree (symmetric-difference distance of 25) than to 1000 random trees (symmetric-difference distances of 31-35). A consensus tree (not shown) of the ND1, COI and morphology trees indicated five species groups within *Anoteropsis*.

Simultaneous analysis of combined data sets can better maximise cladistic parsimony than separate analyses (Huelsenbeck *et al.* 1996; Nixon and Carpenter 1996; Whiting *et al.* 1997). Parsimony analysis of the combined data set (ND1, COI and morphology) produced four equally parsimonious trees (Fig. 9), with a length of 850 steps (CI = 0.406, RI = 0.546). Of the 854 characters included in the analysis, 245 were variable with 161 parsimony informative.

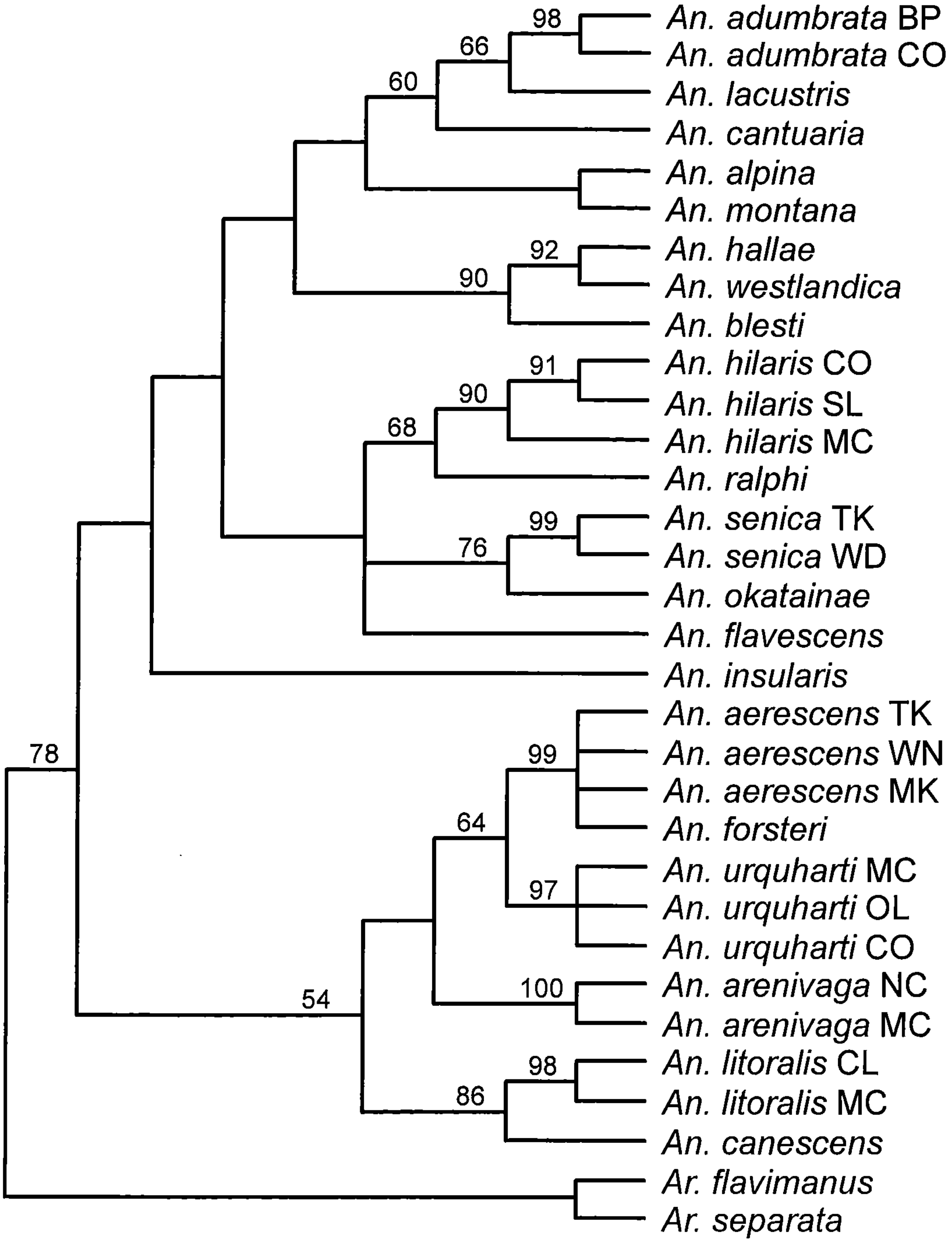


Fig. 3. Strict consensus of nine equally parsimonious trees derived from the unweighted ND1 data set. Numbers above the branches indicate the bootstrap percentages of 1000 replicates.

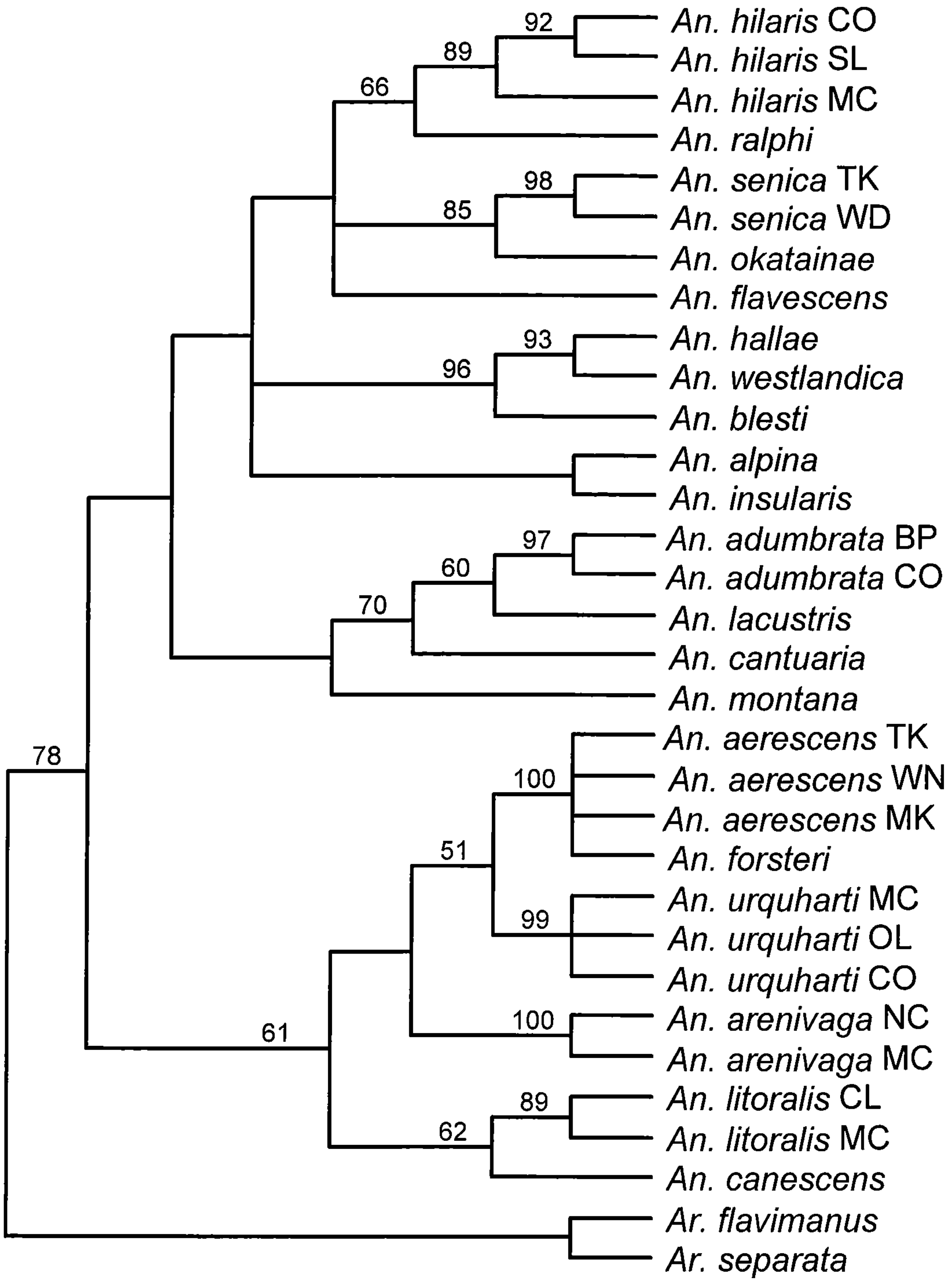


Fig. 4. Strict consensus of 27 equally parsimonious trees derived from the weighted ND1 data set. Numbers above the branches indicate the bootstrap percentages of 1000 replicates.

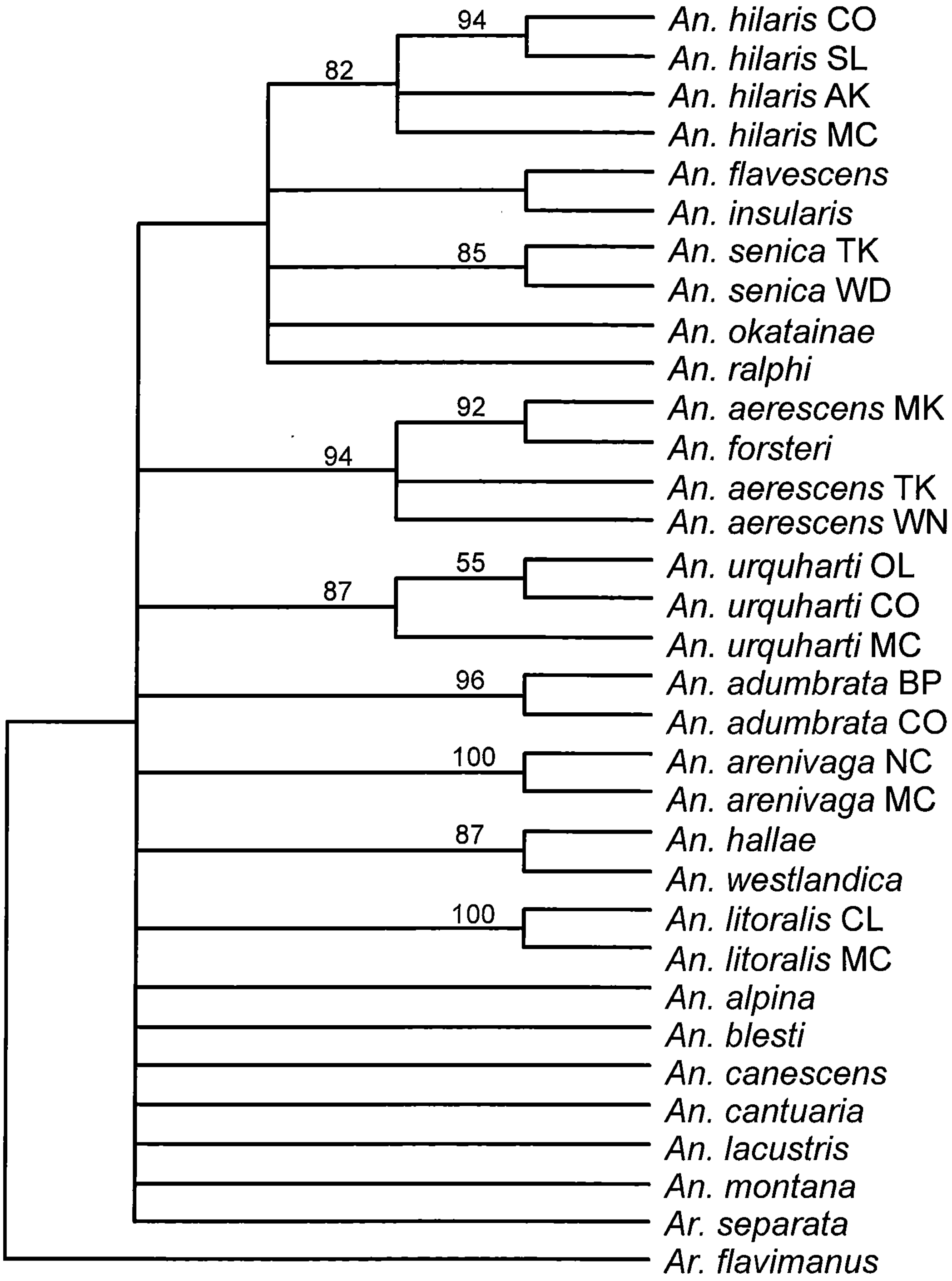


Fig. 5. Strict consensus of 1284 equally parsimonious trees derived from the unweighted COI data set. Numbers above the branches indicate the bootstrap percentages of 1000 replicates.

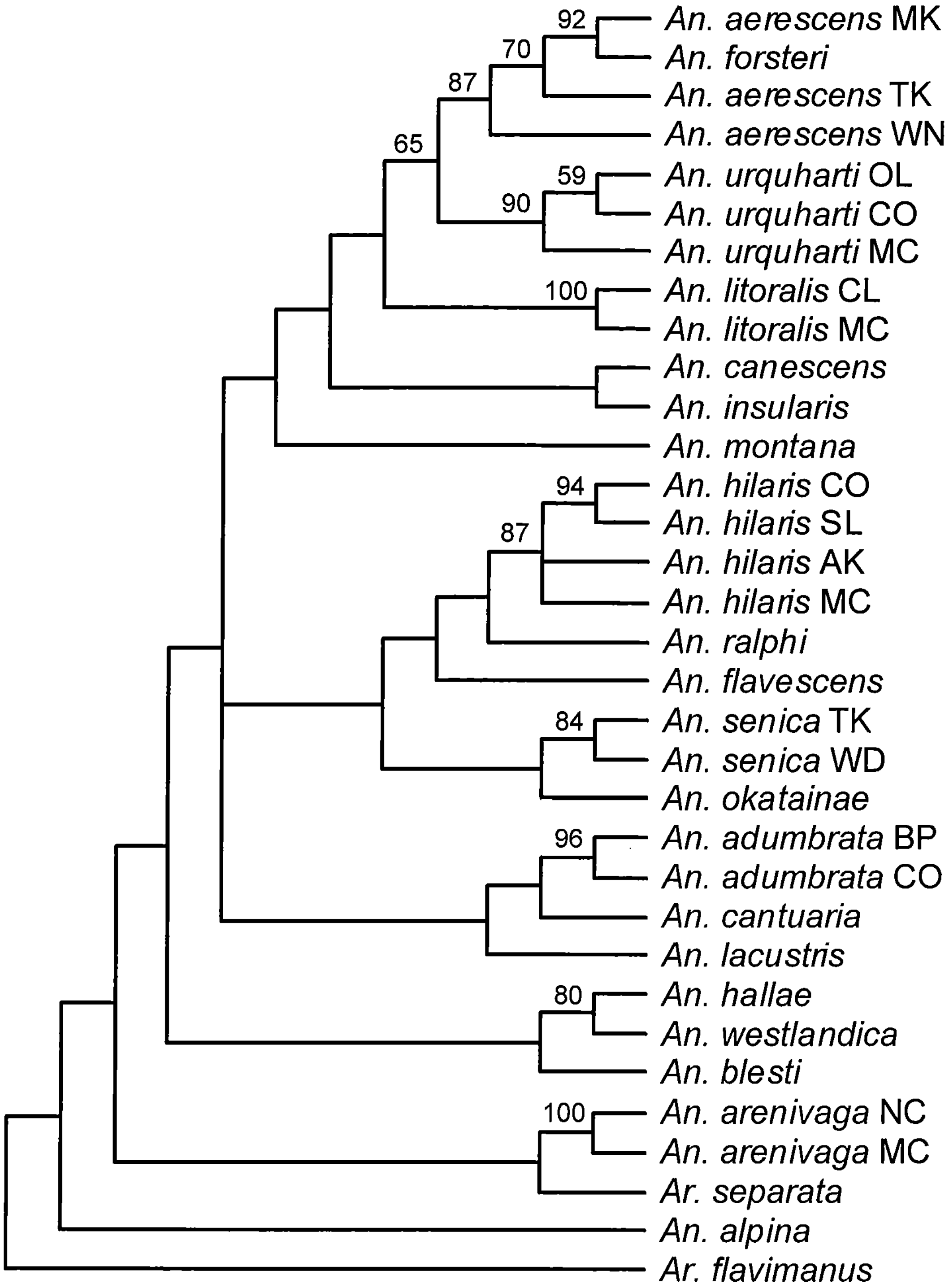


Fig. 6. Strict consensus of six equally parsimonious trees derived from the weighted COI data set. Numbers above the branches indicate the bootstrap percentages of 1000 replicates.

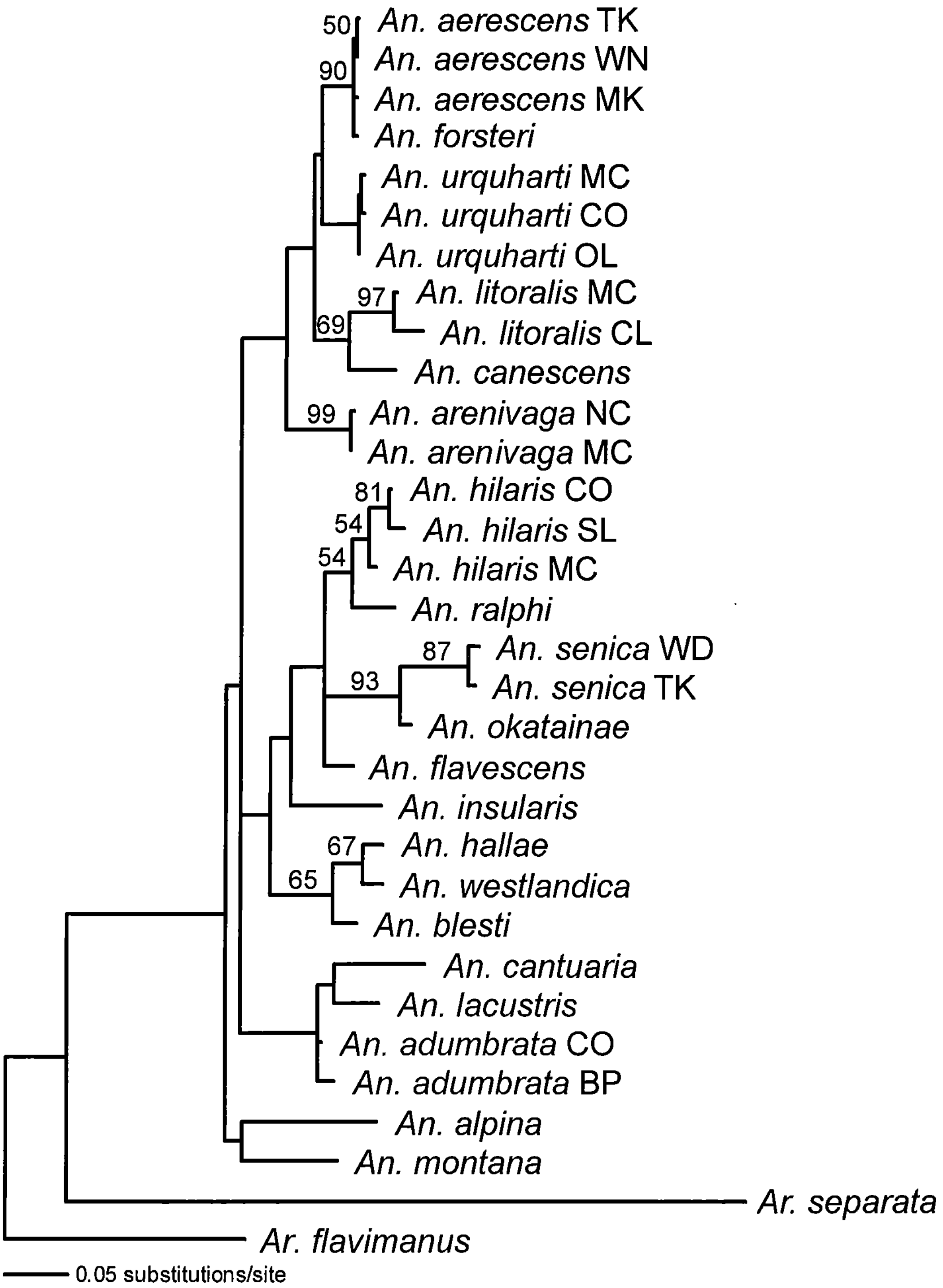


Fig. 7. Strict consensus of the five maximum likelihood trees derived from the ND1 data set. Numbers above the branches indicate the bootstrap percentages of 100 replicates. Branch lengths are proportional to nucleotide substitutions.

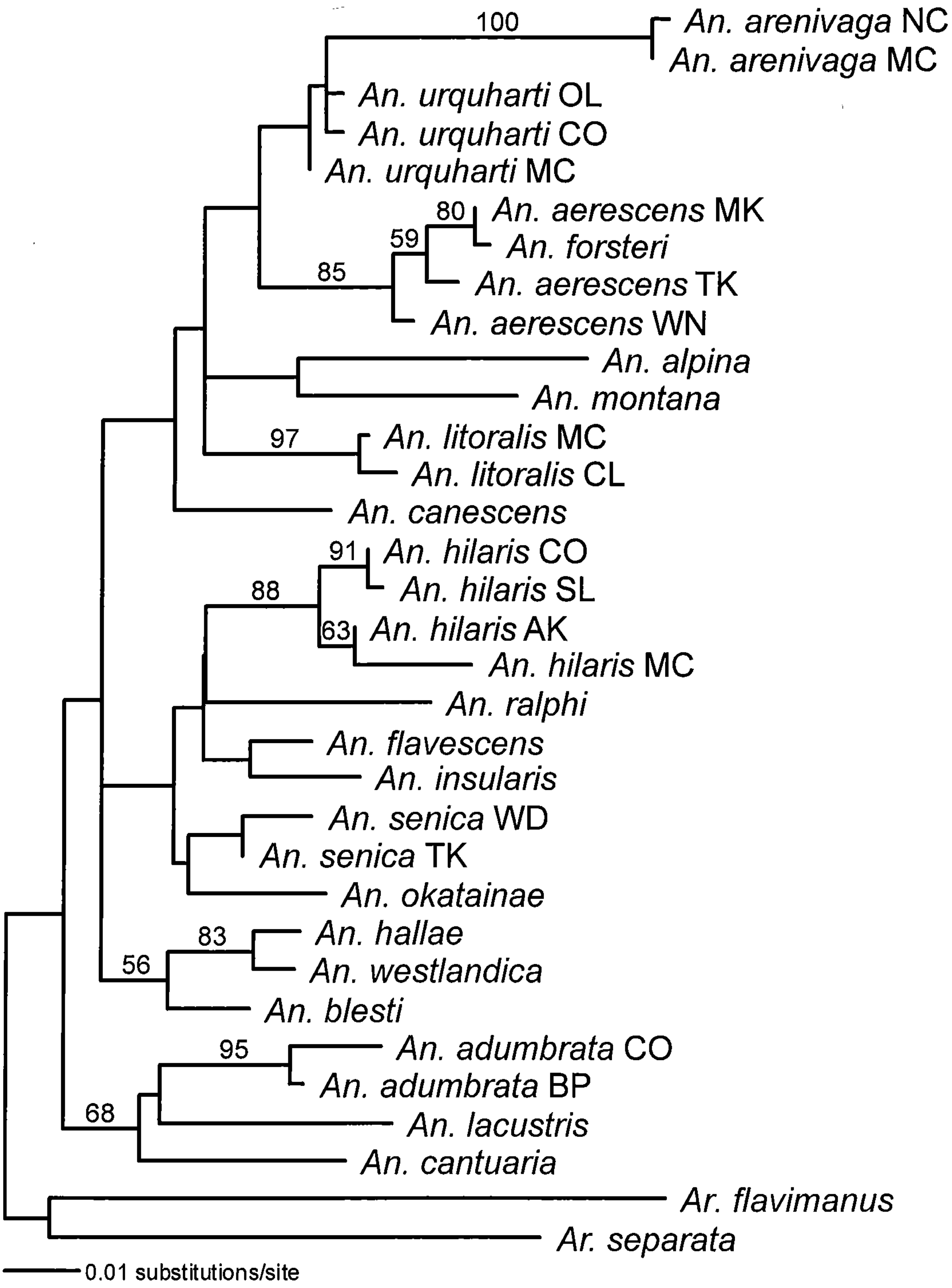


Fig. 8. The maximum likelihood tree derived from the COI data set. Numbers above the branches indicate the bootstrap percentages of 100 replicates. Branch lengths are proportional to nucleotide substitutions.

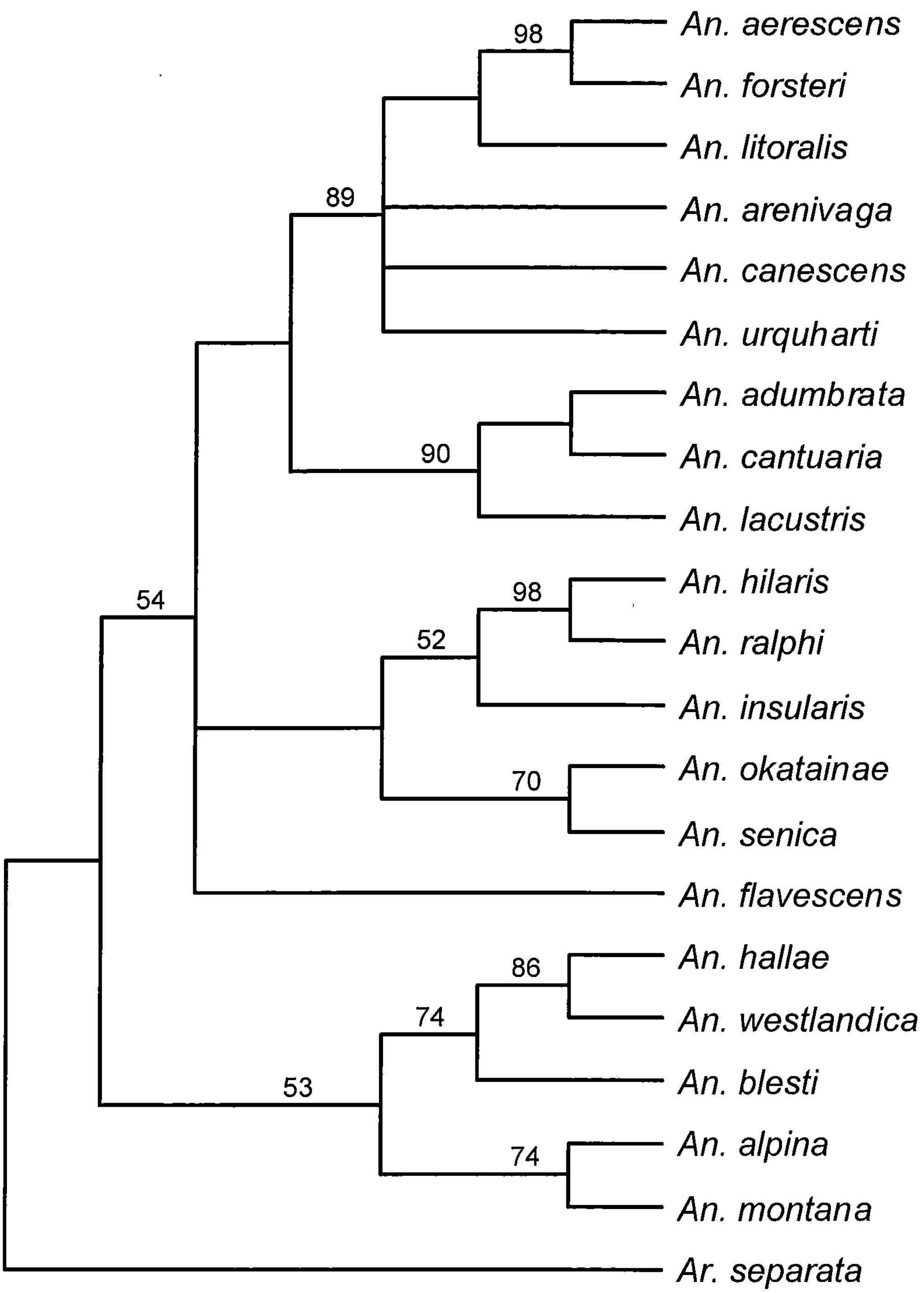


Fig. 9. Strict consensus of four equally parsimonious trees derived from the simultaneous analysis of combined data sets. Numbers above the branches indicate the bootstrap percentages of 1000 replicates.

Discussion

In this study, we used two different methods of analysis, parsimony and maximum likelihood. Parsimony methods are widely used for estimating evolutionary relationships, are intuitively appealing (Swofford *et al.* 1996) and use a simple model of evolution (Brower *et al.* 1996). Parsimony methods, however, do not account for differences in branch length, variation in substitution rate across sites, or differing patterns of nucleotide substitution and may become inconsistent if there are substantial differences among taxa in any of the above (Kennedy *et al.* 1999; Swofford *et al.* 2001). Relatively long branches were observed for the clades containing *A. alpina* and *A. montana*, and the two specimens of *A. arenivaga*.

Maximum likelihood methods compensate for changes along long branches that, in parsimony analyses, can result in incorrect placement due to "long-branch attraction". Maximum likelihood methods also compensate for rate heterogeneity across sites and may allow for differences in nucleotide frequencies and substitution types. Although both parsimony and maximum likelihood trees recovered the same relationships with strong bootstrap support in the upper branches of the phylogenetic trees (e.g., *A. hilaris* and *A. ralphi* were sister taxa in all analyses), the maximum likelihood method was much better at resolving the lower branches (e.g., the placement of *A. alpina* and *A. montana*). Bootstrap support, however, was below 50% in the lower branches of both parsimony and maximum likelihood trees.

Almost all trees presented here agree on the existence of five main species groups: Group 1) *A. aerescens*, *A. arenivaga*, *A. canescens*, *A. forsteri*, *A. litoralis* and *A. urquharti*; Group 2) *A. flavescens*, *A. hilaris*, *A. insularis*, *A. okatainae*, *A. ralphi* and *A. senica*; Group 3) *A. adumbrata*, *A. cantuaria* and *A. lacustris*; Group 4) *A. blesti*, *A. hallae* and *A. westlandica*; and Group 5) *A. alpina* and *A. montana*. These groups are also often related by their habitat types. Group 5 spiders are both found in alpine and montane habitats. All species in Group 1 inhabit rocky, stony or sandy habitats. Speciation in *Anoteropsis*, like many other lycosid species (e.g., McKay 1974), appears to be closely tied to their habitat.

Almost all species represented in the data set by two or more specimens from across their range were found to be monophyletic with strong bootstrap support. Almost all nucleotide differences within species were in third positions and resulted in the change of ND1 amino acids only in the widespread species *A. adumbrata* (one change), *A. litoralis* (two changes) and *A. senica* (two changes). The amino acids coded for in COI and ND1 in *A. hilaris* and *A. urquharti* were the same for all specimens. All but the COI likelihood tree had *A. urquharti* as monophyletic. The paraphyly of *A. urquharti* is likely to be due to anomalies in the COI tree, which are discussed below. The other species found to be paraphyletic in some of the trees was *A. aerescens*. Based on the phylogenies generated from the molecular data, *A. aerescens* and *A. forsteri* are either very closely related or possibly the same species. Vink (in press), however, found them to be distinct species with definite morphological differences, especially in the diagnostic male pedipalp. The three specimens of *A. aerescens* and the one specimen of *A. forsteri* differ in the region of ND1 sequenced by only two third position nucleotides (both transition changes) and the corresponding amino acids coded for are identical. The region of COI sequenced revealed nine nucleotide differences within the clade with one amino acid change (leucine to methionine) shared by the southern specimen of *A. aerescens* (see Table 1) and *A. forsteri*. There was no consensus of the relationships within this clade between the molecular analyses. Based on our molecular evidence, we do not suggest synonymising or splitting of any *Anoteropsis* species. Morphological and genetic distinctiveness are not strictly correlated in lycosid species (Vink and Mitchell in press) and there are often discrepancies between gene trees and species trees (Maddison 1997; Nichols 2001). More detailed molecular studies of *Anoteropsis* spp. in the future may reveal cryptic species but our findings do not refute the species as defined by Vink (in press), who used a character-based phylogenetic species concept (Baum and Donoghue 1995).

Although the phylogenies generated from the ND1 and COI sequence data and morphological data were more similar than could be expected by chance ($p<0.001$), there were inconsistencies in the COI tree (Fig. 8) shown by the symmetric-difference distance values. Between the morphological tree (Fig. 1) and the ND1 likelihood trees (Fig. 7) the values were 21-22 and between the morphological tree and the COI likelihood tree the value was 25. Although these values were not significantly different, there is an indication of inconsistencies in the phylogeny derived from the COI data. The inclusion of the two *A. arenivaga* specimens within the *A. urquharti* clade implied paraphyly. The relationships within the five main clades differed from the ND1 and morphological trees, and the clade containing *A. alpina* and *A. montana* was more derived in the COI tree than in the other trees. Assuming that a tree with similar branch lengths indicates a gradual change over time in nucleotide substitutions per site, the ND1 likelihood trees were more clock-like than those of the COI tree. This result, however, is not altogether surprising as Hedin and Maddison (2001) found in their phylogenetic analysis of the jumping spider subfamily Dendryphantinae that the phylogenetic results from COI conflicted conspicuously with phylogenetic results from other genes (ND1, 16S, 28S) and morphological data. Hedin and Madison (2001) proposed that complexities in the evolutionary dynamics of COI evolution contributed to misleading phylogenetic signal. We believe that COI should be used with caution when inferring spider phylogenies.

Most *Anoteropsis* species are found in habitats in the Southern Alps of the South Island or habitats derived from those mountains (e.g., scree, alluvial riverbeds). The Southern Alps are a result of the 600 km long Alpine Fault, the continental boundary between the Australasian and Pacific plates, which has experienced as much as 20 km of uplift in approximately the last five million years (Batt *et al.* 2000; Chamberlain and Poage 2000). By combining what we know of the habitats of *Anoteropsis* species, the age of that habitat and the topology of the ND1 maximum likelihood trees (Fig. 7) we can infer that *Anoteropsis* probably underwent a radiation sometime after the uplift of the Southern Alps, approximately five million years ago. There are two possible scenarios about how the ancestors of modern *Anoteropsis* spp. arrived in New Zealand. Either the ancestor(s) of *Anoteropsis* were present on New Zealand when it broke away from Gondwanaland 60-80 million years ago (Hayes and Ringis 1973) or, they arrived by ballooning (Greenstone 1982; Richter 1970) across the Tasman Sea at some later date. By comparing the branch lengths in the ND1 maximum likelihood tree of *Anoteropsis* to those of representatives of the sister genus *Artoria*, it seems more likely that *Anoteropsis* arrived sometime after the isolation of New Zealand but before the uplift of the Southern Alps. Future investigations into the comparatively poorly known Australian lycosid fauna are likely to shed light on the biogeographical history of *Anoteropsis*.

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Table 1.–Specimens sequenced showing species, sex, collection localities (two-letter codes follow Crosby *et al.* 1998), collectors and dates collected, partial gene regions sequenced and GenBank accession numbers.

Species	Sex	Collection details	Partial gene regions sequenced	GeneBank accession numbers
Anoteropsis adumbrata (Urquhart, 1887)	♂	BP, Lake Okataina (38°07'S, 176°25'E), 18.ii.1999, C.J. Vink	ND1 & tRNA^{Leu}, COI	AY059998, AY059961
Anoteropsis adumbrata (Urquhart, 1887)	♀	CO, Titan Rocks Track (45°31'S, 169°00'E),9.xii.1998, G. Hall, B. Brown & E. Edwards	ND1 & tRNA^{Leu}, COI	AY059999, AY059962
Anoteropsis aerescens (Goyen, 1887)	♂	TK, Mt Egmont, (39°18'S, 174°05'E), 2.xii.2000, C.J. Vink	ND1 & tRNA^{Leu}, COI	AY060000, AY059963
Anoteropsis aerescens (Goyen, 1887)	♂	WN, Orongorongo River (41°25'S, 174°54'E), 3.xii.2000, C.J. Vink & P.J. Sirvid	ND1 & tRNA^{Leu}, COI	AY060001, AY059964
Anoteropsis aerescens (Goyen, 1887)	♀	MK, near Hooker Glacier (43°41'S, 176°06'E), 6.i.2001, M.A. Hudson & C.J. Vink	ND1 & tRNA^{Leu}, COI	AY060002, AY059965
Anoteropsis alpina Vink, 2002	♂	MC, Mount Cloudsley (43°12'S, 171°39'E), 27.xii.2000, M.H. Bowie	ND1 & tRNA^{Leu}, COI	AY060003, AY059966
Anoteropsis arenivaga (Dalmas, 1917)	♀	NC, Rough Creek, (42°57'S, 171°33'E), 19.i.2000, M.P. Anstey	ND1 & tRNA^{Leu}, COI	AY060004, AY059967
Anoteropsis arenivaga (Dalmas, 1917)	♀	MC, Kaitorete Spit, (43°49'S, 172°36'E), 11.vi.1999, C.J. Vink & J.W. Griffiths	ND1 & tRNA^{Leu}, COI	AY060005, AY059968
Anoteropsis blesti Vink, 2002	♂ paratype	CL, Waitekuri River (36°46'S, 175°34'E), 26.i.2000, C.J. Vink & A.D. Blest	ND1 & tRNA^{Leu}, COI	AY060006, AY059969
Anoteropsis canescens (Goyen, 1887)	♀	MC, McLeans Island (43°28'S, 172°28'E), 21-31.i.1997, R.P. Macfarlane	ND1 & tRNA^{Leu}, COI	AY060007, AY059970
Anoteropsis cantuaria Vink, 2002	♂	MC, Prices Valley (43°46'S, 172°42'E), 20.x.1999, C.J. Vink	ND1 & tRNA^{Leu}, COI	AY060008, AY059971
Anoteropsis flavescens L. Koch, 1878	♀	DN, Swampy Summit (45°47'S, 170°28'E), 24.ix.2000, S.M. Pawson	ND1 & tRNA^{Leu}, COI	AY060009, AY059972
Anoteropsis forsteri Vink, 2002	♂ paratype	SL, Oreti Beach (46°26'S, 168°14'E), 2.ii.2000, C.J. Vink	ND1 & tRNA^{Leu}, COI	AY060010, AY059973
Anoteropsis hallae Vink, 2002	♂ holotype	NN, between Heaphy and Lewis Huts (40°58'S, 172°08'E), 7.xi.1999, G. Hall	ND1 & tRNA^{Leu}, COI	AY060011, AY059974
Anoteropsis hilaris (L. Koch, 1877)	♀	AK, Oakley Creek Reserve (36°53'S, 174°42'E), 16.ii.1999, C.J. Vink & G. Hall	COI	AY059975
Anoteropsis hilaris (L. Koch, 1877)	♂	MC, Lincoln University (46°39'S, 172°27'E), 6.viii.1999, C.J. Vink	ND1 & tRNA^{Leu}, COI	AY060012, AY059976
Anoteropsis hilaris (L. Koch, 1877)	♀	CO, near Obelisk (45°19'S, 169°12'E), 13.i.1999, C.J. Vink	ND1 & tRNA^{Leu}, COI	AY060013, AY059977
Anoteropsis hilaris (L. Koch, 1877)	♀	SL, Riverton (46°22'S, 168°01'E), 2.ii.2000, C.J. Vink	ND1 & tRNA^{Leu}, COI	AY060014, AY059978
Anoteropsis insularis Vink, 2002	♂	CH, Waitangi Bay (43°12'S, 176°32'W), 6.xii.1999, C.J. Vink	ND1 & tRNA^{Leu}, COI	AY060015, AY059979
Anoteropsis lacustris Vink, 2002	♂ paratype	NC, Bealey River (42°56'S, 171°34'E), 9.iv.1999, C.J. Vink & M.A. Hudson	ND1 & tRNA^{Leu}, COI	AY060016, AY059980
Anoteropsis litoralis Vink, 2002	♂	CL, Whangapoua (36°43'S, 175°37'E), 25.i.2000, C.J. Vink	ND1 & tRNA^{Leu}, COI	AY060017, AY059981
Anoteropsis litoralis Vink, 2002	♂	MC, Taumutu (43°51'S, 172°22'E), 21.x.1999, S.J. Crampton & C.J. Vink	ND1 & tRNA^{Leu}, COI	AY060018, AY059982
Anoteropsis montana Vink, 2002	♀	MC, Foggy Peak (43°17'S, 171°45E), 14.xi.1999, H. Ranson	ND1 & tRNA^{Leu}, COI	AY060019, AY059983
Anoteropsis okatainae Vink, 2002	♂	BP, Lake Okataina (38°07'S, 176°25'E), 18.ii.1999, C.J. Vink	ND1 & tRNA^{Leu}, COI	AY060020, AY059984
Anoteropsis ralphi (Simon, 1905)	♂	CH, Waitangi Bay (43°55'S, 176°32'W), 6.xii.1999, C.J. Vink	ND1 & tRNA^{Leu}, COI	AY060021, AY059985
Anoteropsis senica (L. Koch, 1877)	♀	TK, Dawson Falls (39°20'S, 174°06'E), 2.xii.2000, C.J. Vink	ND1 & tRNA^{Leu}, COI	AY060022, AY059986
Anoteropsis senica (L. Koch, 1877)	♂	WD, Franz Josef Glacier (43°25'S, 170°10'E), iv.1999, C.J. Vink & M.A. Hudson	ND1 & tRNA^{Leu}, COI	AY060023, AY059987
Anoteropsis urquharti (Simon, 1898)	♀	MC, Porters Pass (43°18'S, 171°44'E), 25.vi.2000, C.J. Vink & M.A. Hudson	ND1 & tRNA^{Leu}, COI	AY060024, AY059988
Anoteropsis urquharti (Simon, 1898)	♂	OL, Cardrona Ski Field (44°52'S, 168°56'E), 10.i.1999, C.J. Vink	ND1 & tRNA^{Leu}, COI	AY060025, AY059989
Anoteropsis urquharti (Simon, 1898)	♂	CO, top of Cardrona Valley (45°00'S, 156°57'E), 2.ii.1999, C.J. Vink	ND1 & tRNA^{Leu}, COI	AY060026, AY059990
Anoteropsis westlandica Vink, 2002	♂	NN, Upper Cobb Valley (41°03'S, 172°31'E), 6.i.1998, A. Tennyson	ND1 & tRNA^{Leu}, COI	AY060027, AY059991
Artoria flavimanus Simon, 1909	♂	Australia, WA, Crowea (34°28'S, 116°10'E), 6.v.1999, C.J. Vink	ND1 & tRNA^{Leu}, COI	AY060028, AY059992
Artoria separata Vink, 2002	♀	TK, Lucys Gully (39°09'S, 173°56'E), 1.xii.2000, C.J. Vink	ND1 & tRNA^{Leu}, COI	AY060029, AY059993

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Chapter 5

General conclusions

The dearth of scientific studies on New Zealand wolf spiders in areas such as ecology can be attributed to the lack of basic taxonomic and systematic knowledge of this family in New Zealand. It is hoped that this study, which has ended the lycosids of New Zealand's long stay in the taxonomic and systematic wilderness, will allow New Zealand wolf spider species to now receive the scientific attention they deserve.

As has been shown in many other taxonomic and systematic works on New Zealand spiders, our fauna is closely linked to the fauna of Australia. Before any meaningful taxonomic placements of species in genera or subfamilies can be made, the Australian lycosid fauna has to be considered. This was done by examining a large number of Australian specimens and investigating the phylogenetic relationship of New Zealand's lycosid fauna to the Australian fauna. In chapter 2, a data set from the mitochondrial 12S gene was used to infer the relationship of New Zealand genera to Australian, Asian, North American, European, Holarctic and Palaearctic genera. It confirmed that New Zealand species do not belong in the Northern Hemisphere genera into which they had been placed. Analyses revealed that Australasian species form clades distinct from Palaearctic and Holarctic species. The monophyletic New Zealand genus *Anoteropsis* was found to be sister to *Artoria*, a large, mainly Australian genus with three New Zealand species. Both *Anoteropsis* and *Artoria* are sister to *Notocosa*, a monotypic New Zealand genus. These three genera, along with the Australasian genus *Allotrochosina* (see appendix 1) were found to be basal in the Lycosidae. More derived in the Lycosidae were the Australasian genus *Venatrix* (see appendix 3) and the worldwide genus *Geolycosa*, which belong in the subfamily Lycosinae, found throughout Asia and the Holarctic. Analyses imply that Australasia had an ancestral fauna and was subsequently invaded by lycosine species, possibly via Asia into northern Australia. Results suggest 12S DNA sequence data are useful for inferring phylogenies of closely related genera. However, these data appear to be too conservative for adequate resolution at the species level (appendix 2) and too fast for deeper relationships, inferred from low (less than 50%) bootstrap support in the lower branches of the trees.

Twenty-seven lycosid species were found in New Zealand. Chapter 3, a revision of the New Zealand Lycosidae, placed these species in six genera (*Allotrochosina*, *Anoteropsis*, *Artoria*, *Geolycosa*, *Notocosa* and *Venatrix*). Twenty of the New Zealand species, of which 11 are new, belong in the monophyletic, New Zealand genus *Anoteropsis*. Three new species have been included in the genus *Artoria*, which has a large Australian fauna. It is thought that the New Zealand species of *Artoria* arrived comparatively recently from Australia. The monotypic genus *Notocosa* is known only from the South Island of New Zealand and the Australasian genus *Allotrochosina* (appendix 1) has only one, widespread New Zealand species. Only one species of *Venatrix* is found in the far north of New Zealand and is thought to be a recent arrival from Australia, where this and 21 other species are found (appendix 3). Also found in the north of New Zealand is a Pacific species of *Geolycosa*. *Venatrix* and *Geolycosa* fit the subfamilial definition of Lycosinae and *Allotrochosina* fits the subfamilial definition of the Venoniinae. *Anoteropsis*, *Artoria* and *Notocosa*, however, do not fit any of the current lycosid subfamilies. It is possible that they may be placed in Venoniinae using an extended subfamilial definition.

As part of the revision in chapter 3, an attempt to reconstruct the phylogeny of *Anoteropsis* based on morphological characters was made and contained significant phylogenetic structure. The phylogeny of *Anoteropsis* was further investigated in chapter 4 using molecular data from two mitochondrial gene regions, ND1 and COI. The ND1 region sequenced included part of $tRNA^{Leu(CUN)}$and it appears that lycosids have an unstable amino-acyl arm and no TψC arm, which is also absent in the Salticidae (jumping spiders). Species with a widespread distribution within New Zealand were represented by two or more specimens to test for geographic variation. Analyses, parsimony and maximum likelihood, had strong bootstrap support for clades at the tips of the phylogenetic trees and concurred with the species as defined in the taxonomic revision in chapter 3, although some analyses found paraphyly within *Anoteropsis aerescens*. Phylogenies generated from the molecular data were compared with each other and with the phylogeny generated from the morphological characters. Maximum likelihood analyses appeared to provide better resolution of the deeper phylogenetic structure with *Anoteropsis*. However, neither maximum likelihood nor parsimony analyses had strong bootstrap support for the lower branches. Although the phylogenies generated from the ND1 and COI sequence data and morphological data were more similar than could be expected by chance ($p<0.001$), there were inconsistencies in the COI tree, which were shown by symmetric-difference distance values. In a previous study, phylogenies generated by COI data in Salticidae have also shown marked differences from phylogenies generated from other molecular and morphological data. Caution is advised when using COI to estimate spider phylogenies. A combined analysis of ND1, COI and morphological data produced a phylogeny that further confirmed the existence of five main species groups in *Anoteropsis*. A radiation of *Anoteropsis* species within the last five million years was inferred from the phylogenies, habitat and geological data.

The major aspects of New Zealand spider taxonomy and systematics have been covered by this thesis. While it is hoped that a major revision of the family Lycosidae in New Zealand need not be undertaken again for many years, it would be folly to suggest that this is the last word on the taxonomy and systematics of New Zealand Lycosidae. There is a possibility that I and other collectors, like Ray Forster, may not have collected every single lycosid species in New Zealand. Although no evidence was found in this study, more detailed molecular phylogenetic analyses may yet reveal cryptic species within widespread species such as *Anoteropsis hilaris*. Future work on the taxonomy and systematics of the large Australian lycosid fauna, which I intend to be a part of, may result in necessary changes to the generic placements of New Zealand species and will certainly require the redefinition of subfamilies and possible introduction of new ones. Having said all this, however, it is my intention that this thesis will provide a stable platform for future studies on the family Lycosidae in New Zealand.

This work has highlighted problems with current generic and subfamilial concepts in Lycosidae. The major problems stem from their basis on the Northern Hemisphere fauna. In this study I have placed species in established genera and subfamilies only if they fit the definitions. I have ignored the generic definitions of Roewer (1959, 1960) as they are based on somatic characters and I consider them imprecise. Below I list and discuss the genera and subfamilies that New Zealand species may belong in.

Allotrochosina

Allotrochosina schauinslandi and *A. karri* are clearly congeneric (see Vink 2001), however, the genus may need to be redefined later if more congeneric species are found in Australia during a revision of that fauna. It is still unclear which genus it is most closely related to but both parsimony and likelihood analyses in chapter 2 have it close to *Pirata,* with which it shares a simple pedipalpal and epigynal structure.

Anoteropsis

There is strong support from the morphological and molecular data for the monophyly of the species included in *Anoteropsis.* All species share the synapomorphy of an enlarged and longitudinally oriented median apophysis with a laterally directed bend. No species that possess this structure have been found in Australia to date. A similar structure is found in *Artoria,* which also have an enlarged and longitudinally orientated median apophysis. In all known species of *Artoria,* however, the median apophysis is spoon shaped or bifurcate with mesially directed teeth. *Anoteropsis* has a ventrally bent basoembolic apophysis, which is also found in *Artoria* and *Notocosa.* Based on the structure of the pedipalp, *Anoteropsis* and *Artoria* appear to be sister genera, with *Notocosa* sister to them both. This relationship is also shown in the 12S molecular phylogeny. Further investigations into the Australia fauna may discover further *Anoteropsis* species or perhaps a 'link' between *Anoteropsis* and *Artoria.* At present there are no species that refute the monophyly of *Anoteropsis.*

Artoria

Framenau (2002) recently provided a redefinition of *Artoria* and the New Zealand species *A. hospita*, *A. segrega* and *A. separata* clearly fit within the genus. Australia appears to be the centre of origin for *Artoria* and there are at least another 50 undescribed Australian species. There are at least two forms of the median apophysis (spoon shaped and bifurcate) and *Artoria* may be further divided once the Australian fauna is revised.

Geolycosa

Dondale and Redner (1990) limited this genus to North America. Zyuzin and Logunov (2000) extended the range of the genus by including two Palaearctic species. The pedipalp and epigyne of *Geolycosa tongatabuensis* conform to the genus but other somatic features do not. There are several other Pacific lycosids that are clearly congeners of *G. tongatabuensis* and many Australian species (e.g., "*Lycosa*" *godeffroyi*) have morphological similarities. 12S molecular data suggests that *L. godeffroyi* may belong in *Geolycosa.* Two scenarios for the correct placement of Southern Hemisphere *Geolycosa*-like species seem possible: 1) *Geolycosa* is redefined and restricted to the Palaearctic and one or more genera are created to accommodate the Pacific and Australian species; 2) *Geolycosa* is redefined and expanded to include Australian and Pacific species. Pedipalpal structure favours the second scenario.

Notocosa

Notocosa bellicosa does not possess the synapomorphies that define *Anoteropsis* or *Artoria.* It also does not fit any other generic definitions. It posses a ventrally bent basoembolic apophysis, which is also found in *Anoteropsis* and *Artoria* and molecular data place it as sister to those two genera, but has a shorter embolus. Congeners might be found in Australia, which may necessitate a redefinition of the genus.

Venatrix

This genus was revised by Framenau and Vink (2001) and species usually have the combination of a tubercle on the male fang and claw-like macrosetae on the cymbium tip. There are also overall similarities in the male pedipalp. 12S molecular data also supports the monophyly of this genus. The centre of origin for this genus appears to be Australia, with one species likely to have established in Northland comparatively recently.

Venoniinae

Dondale (1986) expanded the redefinition of Venoniinae (Lehtinen & Hippa 1979), which does include some Australian *Venonia* species. *Allotrochosina* conforms to Dondale's (1986) definition except it does not have an enlarged median apophysis and the terminal apophysis does not act as a conductor. These two characters may have been lost or may not be relevant to the subfamily classification. *Notocosa* also fits the definition of Venoniinae although the terminal apophysis does not function as a conductor. Both *Allotrochosina* and *Notocosa* can be accommodated in the current definition of Venoniinae.

Lycosinae

This subfamily was redefined by Dondale (1986) and *Geolycosa* and *Venatrix* both fit the definitions. 12S data support the genera that Dondale (1986) placed in Lycosinae except for *Arctosa*, which did not fall in with the other lycosines. Dondale (1986) and Zyuzin (1990) have attempted to further divide the subfamily based on Northern Hemisphere species although *Venatrix* does not completely fit any of their schemes and 12S data does not support their hypotheses. If Lycosinae is to be further divided (which, to me, is pointless when there are far more pressing issues in lycosid systematics), then the Australasian fauna must be considered.

No suitable subfamily

There is currently no suitable subfamily for *Anoteropsis* and *Artoria*. Their closest relatives are found in the Venoniinae. *Anoteropsis* and *Artoria* have an enlarged, longitudinally oriented median apophysis, which is a characteristic of venoniines although they lack the other characters (e.g., a small embolus situated distally on the bulb). *Anoteropsis* and *Artoria* are sister to the venoniine *Notocosa* and are basal in the Lycosidae in the 12S molecular phylogenies. Either, 1) Venoniinae should be expanded to include *Anoteropsis* and *Artoria*, or 2) a new subfamily should be erected to include *Anoteropsis*, *Artoria* and *Notocosa*, which all share the common character of a ventrally bent basoembolic apophysis. A revision of the Australian fauna needs to be completed in order to choose between the two options.

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Appendices – articles removed.

Appendix 1 :

Vink, C. J. (2001). A revision of the genus Allotrochosina Roewer (Araneae: Lycosidae). Invertebrate taxonomy, 15 , 461-466.

Appendix 2 : not published

Appendix 3:

Framenau, V. W., & Vink, C. J. (2001). Revision of the wolf spider genus *Venatrix* Roewer (Araneae: Lycosidae). Invertebrate taxonomy, 15, 927-970.

Appendix 4:

Hodge, S. , & Vink, C. J. (2000). An evaluation of Lycosa Hilaris as a bioindicator of organophosphate insecticide contamination. New Zealand Plant Protection, 53, 226-229.

Appendix 2

12S DNA sequence data confirms the separation of *Alopecosa barbipes* and *Alopecosa accentuata* (Araneae: Lycosidae)

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Summary

Phylogenetic analyses of DNA sequence data from the 12S ribosomal subunit supported the relationship of *Alopecosa accentuata* as sister species to *A. barbipes*. Other *Alopecosa* species, although more morphologically distinct, were found to have far less variation in their sequence data.

Introduction

The Lycosidae is a morphologically conservative family. In some cases species are separated by slight morphological differences, which have become apparent only after behavioural and/or ecological observations. This has been the case with species in genera such as *Alopecosa* Simon, 1885 (Kronestedt, 1990), *Schizocosa* Chamberlin, 1904 (Stratton, 1991) and *Pardosa* C. L. Koch, 1847 (Kronestedt, 1992, 1999).

Dahlem *et al.* (1987) studied the courtship behaviour of *Alopecosa* spp. and found differences between *Alopecosa barbipes* (Sundevall, 1833) and *A. accentuata* (Latreille, 1817). Subsequently, Cordes & von Helversen (1990) noted morphological, behavioural, and ecological differences between the species and removed *A. barbipes* from synonymy with *A. accentuata*. *Alopecosa barbipes* is found in regions with an oceanic climate, adults mate in autumn and often in the following spring, and males have an exaggerated courtship posture and have a black tibial hair-brush on the front legs (Cordes & von Helversen, 1990). *Alopecosa accentuata* is found in parts of Central Europe with a warm, continental climate, adults mate in spring, the courtship posture of males is less distinctive and they have no black tibial hair-brush on the front legs (Cordes & von Helversen, 1990). The validity of *A. barbipes* as a species distinct from *A. accentuata* is now generally accepted (e.g., Merrett & Millidge, 1992; Roberts 1993).

12S DNA sequences have recently been used to infer European lycosid phylogenetic relationships (Zehethofer & Sturmbauer, 1998), which included sequences from *Alopecosa accentuata*, *A. cuneata* (Clerck, 1757), *A. pulverulenta* (Clerck, 1757), *A. taeniata* (C. L. Koch, 1835), *A. trabalis* (Clerck, 1757) and *A. inquilina* (Clerck, 1757). Zehethofer & Sturmbauer (1998) found that 12S was especially suitable for resolving relationships between more distantly related taxa. In this study, a section of 12S mitochodrial DNA from *A. barbipes* was sequenced and compared with sequences from other species of *Alopecosa*, including *A. accentuata*. Our objectives were to see whether sequence data supported the separation of *A. barbipes* and *A. accentuata* and how these species were related to other species of *Alopecosa*.

Materials and methods

A male specimen of *A. barbipes* was collected by CJV and M.A. Hudson on 6 October 1999 in grass at Redgrave and Lopham Fen, Suffolk (Grid ref. TM 0479, 52°23'N 01°00'E). The specimen was stored in 95% ethanol and washed in sterile, deionised, distilled water before DNA extraction. DNA was extracted by homogenising one each of legs III and IV using a proteinase-K digestion and high salt precipitation method (White *et al.*, 1990). A 263 base pair segment from the 12S rDNA was amplified and sequenced from *A. barbipes* following the methods in Zehethofer & Sturmbauer (1998). The sequence data have been submitted to GenBank (Benson *et al.*, 2000) (accession number AY028420).

Sequence data of the six *Alopecosa* species studied by Zehethofer & Sturmbauer (1998), and *Trochosa terricola* Thorell, 1856, were obtained from GenBank (accession numbers AJ008022, AJ008024, AJ008025, AJ008026, AJ008027, AJ008030, AJ008017 respectively).

Phylogenetic analyses were performed on the six *Alopecosa* sequences generated by Zehethofer & Sturmbauer (1998) plus *A. barbipes*. It should be pointed out that for this analysis we did not attempt to test the monophyly of *Alopecosa*, but simply rooted the resulting trees on *T. terricola*, since Zehethofer & Sturmbauer (1998) found this species to be distinct, but closely related to *Alopecosa*. The data were analysed with PAUP* (Swofford, 2001) using parsimony (an exhaustive search) and maximum likelihood (a heuristic search with TBR branch swapping and 10 random sequence additions). The general time reversible model (Yang, 1994) was used to estimate the maximum likelihood tree. The rate and among-site heterogeneity parameters were estimated in the search. Support for the parsimony tree was assessed by bootstrap analysis (Felsenstein, 1985).

Results

Maximum likelihood analysis resulted in two trees, one of which is shown here (Fig. 1). The second tree differed only in the placement of *A. inquilina*, which came out in a trichotomy with a second clade of *A.*

accentuata and *A. barbipes* and the remaining *Alopecosa* species in a third clade. The parsimony analysis resulted in one most parsimonious tree that had an identical topology to the maximum likelihood tree shown in Fig. 1. Bootstrap analysis (1000 replicates) showed good support (89%) for the clade containing *A. cuneata*, *A. pulverulenta*, *A. taeniata* and *A. trabalis*, and some support (44%) for the clade containing *A. barbipes*, *A. accentuata* and *A. inquilina*. *Alopecosa barbipes* and *A. accentuata* were found to be sister species (bootstrap value of 44%). The sequences of *A. barbipes* (4 unique nucleotide sites) and *A. accentuata* (six unique nucleotide sites) differed by nine transitions and one transversion. Within the seven *Alopecosa* species examined there were 29 variable sites and these are shown in Fig. 1.

Discussion

The ten base pair difference between the same 12S mitochondrial subunit sequence from *A. barbipes* and *A. accentuata* supports the morphological, behavioural and ecological differences found by Cordes & von Helversen (1990). In contrast, *A. pulverulenta* and A. trabalis, which are morphologically distinct from each other (in both male and female genitalia) (Heimer & Nentwig, 1991), have identical 12S sequences (Zehethofer & Sturmbauer, 1998). The clade containing *A. cuneata*, *A. pulverulenta*, *A. taeniata* and *A. trabalis* is part of the "*pulverulenta* group" (Lugetti & Tongiorgi, 1969). There are only seven variable sites within this clade, so it would appear that *A. barbipes* and *A. accentuata* have been separate species for at least as long as the divergence of the species in the "*pulverulenta* group". The section of mtDNA sequenced has been found to be highly conserved among many taxa (Kocher *et al.*, 1989), so sequencing of other gene regions (e.g. COI (see Garb, 1999), ND1 (see Hedin, 1997)) may more fully distinguish between closely related species such as *A. pulverulenta* and *A. trabalis*.

The topology of the clade containing four species of the "*pulverulenta* group" in the parsimony analysis and the maximum likelihood analysis agrees with the tree produced by Zehethofer & Sturmbauer (1998). The relationship of *A. accentuata* and *A. inquilina* to the other *Alopecosa* species was unresolved in Zehethofer & Sturmbauer (1998), but the addition of *A. barbipes* in this study provides some resolution. *Alopecosa barbipes* is also shown to be sister to *A. accentuata*.

Alopecosa contains more than 130 species (Platnick, 2000) and a very small proportion of this genus has been sequenced. However, this study demonstrates that morphological and genetic distinctiveness are not strictly correlated.

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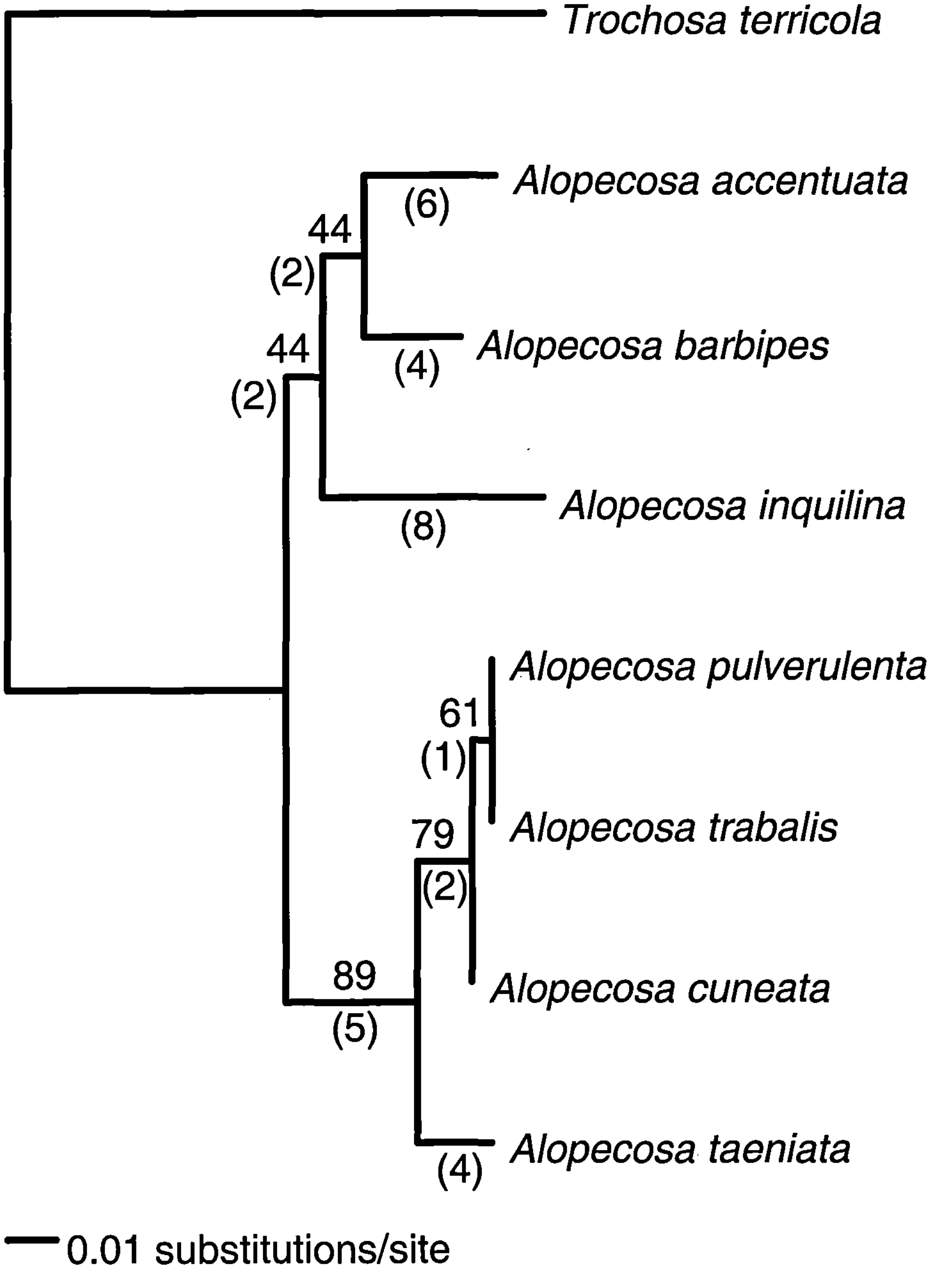

Fig. 1: Maximum likelihood tree of *Alopecosa* spp. Numbers without brackets are bootstrap values (1000 replicates) from the parsimony tree with the same topology. Numbers in brackets show numbers of apomorphies (nucleotide changes).