

**Fauna of
New Zealand**
Ko te Aitanga Pepeke
o Aotearoa

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Ko te Aitanga Pepeke o Aotearoa

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Peloriidiidae
(Insecta: Hemiptera: Coleorrhyncha)

M.-C. Larivière¹, D. Burckhardt², A. Larochelle³

^{1,3} Landcare Research, Private Bag 92170, Auckland 1142, New Zealand

² Naturhistorisches Museum, Augustinergasse 2, CH-4054 Basel, Switzerland

¹ LariviereM@landcareresearch.co.nz, ² Daniel.Burckhardt@bs.ch,

³ LarochelleAndre@hotmail.com



**Manaaki
Whenua
P R E S S**

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2011

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HE WHAKARĀPOPOTOTANGA

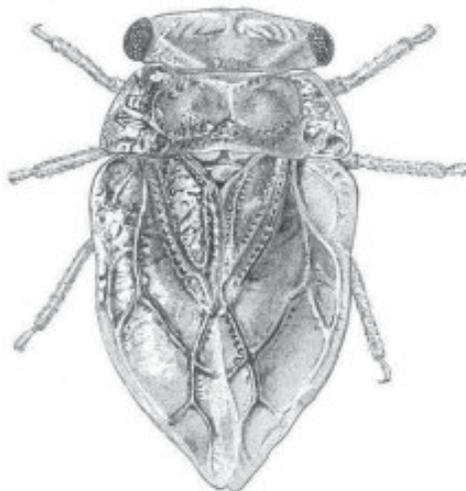
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Illustration / Whakaahua: *Xenophysella stewartensis* (Woodward) (Illustrator / Kaiwhakaahua: N. Lavoyer).

Moss bugs

The family Peloriidiidae or moss bugs are primitive members of the insect order Hemiptera. These “living fossils”, as they are often called, belong to the suborder Coleorrhyncha and live in the wet moss of temperate and subantarctic rainforests.

Peloriidiids occur in Chile, Argentina, New Zealand, New Caledonia, and eastern Australia, including Tasmania and Lord Howe Island, and are known from 17 genera and 36 species.

New Zealand can be regarded as a biodiversity ‘hotspot’ for these insects. The three genera and 13 New Zealand species are endemic, meaning they do not occur anywhere else. New Zealand has the most diversified fauna at the species level, with 36% of all world species in this group of special significance for the Southern Hemisphere, with evolutionary roots dating back to the break-up of Gondwana.

Moss bugs are strange-looking insects, generally ranging from 2 to 4 mm in length. Their body is flattened, broadly shaped, and cryptically coloured so that it blends with the surrounding environment. Their head is peculiar in that the eyes are widely separated, prominent at the sides, and petiolate (positioned on short stalks). The surface of their anterior or top wings is hardened and bears a network of veins and variously shaped areolae or closed cells.

All New Zealand species lack posterior wings and are flightless. They probably spend most of their life in the wet moss on which they feed, moving very little. It is thought that if environmental conditions become drier, peloriidiids move deeper into the moss layers in search of

Ngā ngārara pūkoho

Ko te whānau Peloriidiidae, he ngārara pūkoho, he huānga onamata nō te pūtoi pepeke Hemiptera. Nō te pūtoi iti Coleorrhyncha ēnei “mātātoka mataora”, ā, ko te pūkoho haukū o ngā ngahere ua tō rātou kāinga, i ētahi whenua āhua mahana, me ētahi kei Te Moana-Tāpokopoko-a-Tāwhaki.

He peloriidiid kei Hiri, kei Āketina, kei Aotearoa, kei Kanaki, kei te taha rāwhiti o Ahitereiria, tae atu ki Tahimania me te Moutere o Lord Howe. E 36 ngā momo e mōhiotia ana, nō roto i ngā puninga tekau mā whitu.

He tino puna mataora a Aotearoa mō ēnei ngārara. Ko ngā puninga e toru me ngā momo 13 kei Aotearoa, nō konei anake, kāore e kitea ana i wāhi kē o te ao. Huri i te ao, kāore he wāhi i tua atu i Aotearoa mō te huhua o ngā momo; ko tētahi 36% o ngā momo katoa o te ao whānui, kei tēnei rōpū. Waihoki, ko ngā momo katoa o te ao, kei te Tuakoi Tonga o te Ao, ā, ko ō rātou kāwai kunenga mai, nō te mawhetanga o Te Uri Māroa.

He hanga rerekē te ngārara pūkoho ki te titiro atu. E 2 ki te 4 mm te roa, he papatahi, he whānui te tinana. He matahunahuna anō, e kore ai ia e tere kitea i tōna taiao. He āhua rerekē te upoko, i te mea e noho tawhiti ana tētahi karu i tētahi, kei te noho mai anō ki ētahi kakau poto, ā, e āhua toro whakawaho ana. He mārō te mata o ngā parirau o runga, ā, he kapi katoa i te iaia, me ōna anō pūtau kati hanga rau.

(continued overleaf)

(haere tonu)

moisture and remain there until it is again suitably wet nearer to the surface.

Little is known about the biology and behaviour of New Zealand moss bugs. The life-cycle of these insects includes the egg stage, five nymphal stages, and the adult stage: once the egg has matured it develops into a nymph that feeds and grows through five stages before it finally becomes an adult.

The adult stage occurs mostly from December to March. Newly emerged adults – more soft-bodied and lightly coloured than mature adults – are active in January (North Island) or February (South Island). Nymphs of various stages are often found with adults, from November to December (North Island) or from January to February (South Island). Field surveys conducted during the New Zealand winter (June to September) have yielded only a few mature adults; no newly emerged adults or nymphs have been found in that season. This suggests moss bugs spend the winter in the adult and/or the egg stage.

The geographical distribution of most New Zealand peloriidiid species was poorly documented before this study. We now have a better understanding of distribution patterns, but more collecting is needed in under-surveyed areas such as Northland, the Coromandel Peninsula, eastern parts of the South Island, the Chatham Islands, and Stewart Island.

The genera *Xenophyes* and *Oiophysa* occur on the North and South Islands, while the genus *Xenophysella* is shared between the South Island and Stewart Island, where the genus *Oiophysa* also occurs. Of the two main islands of New Zealand, the South Island has the greatest number of genera (3) and species (10 or 77% of the fauna) although not all species are restricted to that island. Two moss bug species are shared between the North and South Islands, eight (8) species are restricted to the South Island, and two species to Stewart Island.

This handbook was written for a wide audience, with easy-to-follow identification keys and several illustrations and maps. It is hoped it will generate interest for this fascinating group of insects.

Kāore ngā momo o Aotearoa e whai parirau o muri, ka mutu he rerekore. E whakapaetia ana ka noho noa iho ki ngā pūkohu haukū, me uaua ka neke. Ko te whakaaro, ki te maroke ake tōna taiao, ka hōhonu kē atu te kuhu atu a te peloriidiid i ngā paparanga o te pūkohu ki te kimi haukū mōna, ā, ka noho tonu atu ki reira kia haukū haere anō ngā paparanga e tata ake ana ki te mata.

He iti te mōhio ki te koiroa me ngā whanonga a ngā ngārara pūkohu o Aotearoa. Heoi anō, tīmata mai ana i te hua, ā, e rima ngā tūātupu torongū me te kai haere tonu, te tupu haere tonu, kātahi anō ka huri hei kātua.

Kitea ai te tūātupu kātua mai i Hakiheia ki Poutūterangi. Ko ngā kātua hou — he ngohe ake, he teatea ake te tae o ēnei i ngā kātua pakari tonu — ka oreore i te Kohitātea (i Te Ika-a-Māui) i Huitanguru rānei (i Te Waka-a-Māui). He wā anō kitea ai ngā torongū (o ngā tūātupu maha) e noho tahi ana ki ngā kātua, mai i te Whiringa-ā-rangi ki te Hakiheia (i Te Ika-a-Māui) mai i te Kohitātea rānei ki Huitanguru (i Te Waka-a-Māui). I ngā mahi rangahau kua kawea i te takurua i Aotearoa (mai i te Pipiri ki te Mahuru), he torutoru noa ngā kātua pakari kua kitea; kāore he kātua hou, kāore rānei he torongū. E tohu ana tēnei ko ngā tūātupu takurua o te ngārara pūkohu, ko te kātua pakari, tae atu anō pea ki te hua.

I mua atu i tēnei rangahautanga, he iti noa ngā tuinga mō te tītaringa o te nuinga o ngā momo peloriidiid o Aotearoa ki te mata o te whenua. Kua mārama ake iāianā ngā tauira tītari o tā rātou noho tītari ki te whenua, engari me kaha ake ngā mahi kohikohi i ngā wāhi kāore anō kia tino rangahautia, pērā i Te Tai Tokerau, i Te Tara-o-Te-Ika, i te taha rāwhiti o Te Waipounamu, i Rēkohu, me Rakiura.

Ko ngā puninga *Xenophyes* me *Oiophysa*, kei Te Ika-a-Māui me Te Waka-a-Māui. Ko *Xenophysella*, kei Te Waka-a-Māui me Rakiura, ā, kei Rakiura anō a *Oiophysa*. He maha ake ngā puninga i Te Waka-a-Māui (inā hoki e 3 kei reira), tēnā i Te Ika-a-Māui, ā, he maha ake anō hoki ngā momo i reira (10 ngā momo, ko tētahi 77% tēnei o ngā momo katoa). Engari ehara i te mea katoa ngā momo i Te Waipounamu, kei reira anake. E rua ngā momo ngārara pūkohu kei Te Ika me Te Waka, e waru kei Te Waka-a-Māui anake, e rua kei Rakiura anake.

He mea tuhi tēnei pukapuka whakamōhio mā te iwi nui tonu. He ara tautohu māmā kei roto, he whakaahua huhua, he mahere whenua anō. Ko te wawata, kia kori ake ngā hinengaro o ngāi tātou, te tangata, ki te ketuketu, ki te whāwhā i tēnei karangatanga ngārara korokē.

Translation by **H. Jacob**
Ōtaki

Contributor **Marie-Claude Larivière** was born and educated in Québec, graduating with a PhD in systematic entomology from McGill University in 1990. For the following two years she did postdoctoral research at Agriculture Canada, Ottawa. In 1992, Marie-Claude moved to New Zealand to work as a full-time Hemiptera biosystematist with Landcare Research. From 1994 to 1997 she led the Biosystematics of New Zealand Land Invertebrates programme, from 1995 to 2005 the development of New Zealand Arthropod Collection's databasing and digital imaging systems, from 1999 to 2004, the Koiora-BioAssist™ project (Biodiversity Assessment using Information Technology and Taxonomy), and from 2007 to 2010, the Invertebrate Biosystematics research group (Landcare Research, Auckland). Marie-Claude has been an active member of the Fauna of New Zealand series committee (1994–2004, 2007–present). She is the author of over 100 papers and monographs on the taxonomy, distribution and natural history of Hemiptera and Carabidae (Coleoptera), including eight Fauna of New Zealand contributions (Hemiptera: Auchenorrhyncha catalogue, Heteroptera catalogue, Cixiidae, Peloridiidae and Pentatomoidea revisions; Carabidae: taxonomic catalogue; Harpalini revision; synopsis of supraspecific taxa). She has also published on Australian and South Pacific Hemiptera as well as on North and Central American Hemiptera, Orthoptera, and Carabidae. Many of her publications have been written in collaboration with her husband André Larochelle with whom she hopes to soon publish new works on New Zealand Hemiptera and Carabidae. In addition, she conducts international cooperative research and New Zealand-based commercial research for the Crown Research Institute Landcare Research. Marie-Claude has a keen interest in biological information technology, especially digital taxonomy, computer imaging, interactive identification, and web-publishing. She maintains electronic information on Hemiptera on The New Zealand Hemiptera website (<http://hemiptera.landcareresearch.co.nz/>). Since 1992 she has been actively involved in specialised field inventory, surveying Hemiptera in over 1000 localities, to gain a better understanding of the taxonomy, natural history, and biogeography of New Zealand species.

Contributor **Daniel Burckhardt** is from Basel, Switzerland, and was educated in Basel and Zürich where he graduated with a PhD in systematic entomology at the Federal Institute of Technology (ETH). From 1983–1985 he was a post-doctoral research fellow in Ian D. Hodkinson's lab at the Liverpool Polytechnic (now John Moores University). From 1985–1997 he was research scientist at the Muséum d'histoire naturelle, Geneva, working on beetles and psyllids, and in charge of the Lepidoptera, Hymenoptera,

Marie-Claude Larivière



and Diptera collections. In 1997 he moved to Basel as curator of the insect collection (excluding Coleoptera) and senior research scientist of the Naturhistorisches Museum. At the same time he started teaching entomology at the University Basel, since 2001 as 'Privatdozent' (equivalent to DSc). Daniel became interested in entomology, particularly Lepidoptera, as a teenager. For his MSc and PhD he studied faunistic and systematic aspects of Psylloidea under the supervision of Willi Sauter (ETH, Zürich), and developing a life-long passion for this fascinating group.

Daniel Burckhardt



Apart from psyllids he worked also on the systematics of Peloridiidae and some Coleoptera (Passandridae, Staphylinidae, Jacobsoniidae, and Pterogeniidae). Daniel enjoys fieldwork and has had the chance to visit many countries all over the globe: with sifter and Winkler-Moszarski he has made intensive collections of moss bugs in Southern Chile, Australia, and New Zealand. Daniel has published over 250 scientific publications describing over 380 new insect species (mostly psyllids). He is, or has been, editor of the *Fauna Helvetica*, *Mitteilungen der Schweizerischen Entomologischen Gesellschaft*, *Mitteilungen der Entomologischen Gesellschaft Basel*, *Revue suisse de Zoologie*, and others. He is president of the Entomologische Gesellschaft Basel and the scientific committee of GBIF.ch, as well as committee member of the Swiss Entomological Society. He has supervised eight PhD students and two post-doctoral fellows. As a pastime, Daniel plays guitar in the local blues and rock band ‘Fried Brains’.

Contributor **André Larochelle** was born and educated in Québec, graduating in 1974 with a Brevet d’Enseignement spécialisé from the Université du Québec à Montréal. He taught ecology at the Collège Bourget, Rigaud, Québec, until 1990. With the encouragement of the late carabid specialist Carl H. Lindroth, André very quickly became interested in the study of ground-beetles. From 1975 to 1979 he was the co-editor of two entomological journals, *Cordulia* and *Bulletin d’inventaire des insectes du Québec*. From 1986 to 1992, he was honorary curator to the Lyman Entomological Museum and Research Laboratory, McGill University, Québec. In 1992, André moved to New Zealand to work as a research scientist. Currently, he is a Research Associate with the New Zealand Arthropod Collection, Landcare Research, Auckland. André has written over 400 papers on the distribution, ecology, biology, and dispersal power of North American carabids and other insects (including two handbooks on the Heteroptera of Québec). In 1990 he published “The food of carabid beetles of the world”; in 1993, with Yves Bousquet, he co-authored a “Catalogue of Carabidae of America North of

Mexico”; and in 2001 and 2003, with his wife Marie-Claude, he published a “Natural History of the tiger beetles of North America North of Mexico” and “A Natural History of Carabidae” for the same region. His current main research interests are the faunistics and taxonomy of New Zealand ground-beetles on which he has co-authored three Fauna of New Zealand contributions (Catalogue of Carabidae, 2001; Revision of tribe Harpalini, 2005; Synopsis of supraspecific taxa, 2007). André is a keen provider of electronic information on ground-beetles on the internet via The New Zealand Carabidae website (<http://carabidae.landcareresearch.co.nz/>). Since 1992, he has been actively involved in specialised field inventory, surveying carabids in over 1000 localities, to gain a better understanding of the taxonomy, natural history, and biogeography of New Zealand species.



André Larochelle

ABSTRACT

The New Zealand Peloridiidae fauna (3 genera, 13 species) is reviewed. Results published by Burckhardt (2009: *Deutsche Entomologische Zeitschrift* 56) and by Burckhardt *et al.* (2011: *Zootaxa* 2923) are reconciled with a study of specimens contained in New Zealand and overseas entomological collections and museums (over 2,400 specimens from more than 175 localities).

A concise treatment of the taxonomy of all taxa is presented. New identification keys and descriptions are provided for genera and species, with illustrations emphasising the most important diagnostic features of the external morphology and male genitalia. Information is given on synonymy, type data, material examined, geographic distribution, and biology. Distribution maps, a descriptive biogeographical account, and detailed biological observations are provided for the first time. The composition of the New Zealand peloridiid fauna, with endemism levels of 100% for genera and species, is briefly outlined in relation to the faunas of Australia, Lord Howe Island, New Caledonia, and South America.

Keywords. Insecta, Hemiptera, Coleorrhyncha, Peloridiidae, New Zealand, taxonomy, keys, distribution, ecology, biology, fauna.

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We are indebted to the *Deutsche Entomologische Zeitschrift* for permission to use figures from Burckhardt's (2009) world paper and *Zootaxa* for figures from Burckhardt's *et al.* (2011) *Xenophyes* revision. Figures 23–36 and 39–40 are based on habitus drawings made by Nicolette Lavoyer.

Daniel Burckhardt is grateful to I. Löbl (Muséum d'histoire naturelle, Genève) for introducing him into the world of humicolous insects and the technique of Winkler/Moczarski electors, to J. S. Dugdale (Nelson) and P. J. Dale (Auckland) for support during fieldwork, and to M. Kotrba (Zoologische Staatssammlung, München) and M. Horak (Australian National Insect Collection, Canberra) for many stimulating discussions on fascinating insects, Gondwanan biota, and the meaning of life.

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INTRODUCTION

Peloriidae or moss bugs are the sole extant members of the hemipteran suborder Coleorrhyncha. Seventeen (17) genera and 36 species are known from Chile, Argentina, New Zealand, New Caledonia, and eastern Australia including Tasmania and Lord Howe Island.

These 'living fossils', as they are often called, live in the wet moss of temperate and subantarctic rainforests. They display a disjunct circumantarctic distribution and are considered relics of a richer more widely distributed fauna thought to have its evolutionary roots in the Late Permian to the Late Cretaceous (approx. 250 to 65–80 ma).

Moss bugs have hardened forewings and do not possess hindwings, except for the South American *Pelordium hammoniorum* Breddin, 1897, in which some individuals' hindwings are developed and functional. Consequently they are unable to fly, which makes them an ideal model group to test Gondwanan biogeographic hypotheses.

The New Zealand fauna (3 genera, 13 species) is endemic and accounts for 18% of world genera and 36% of world species. New Zealand has the most diversified fauna at the species level, followed by Australia, South America, and New Caledonia (see Table 1) although Australia has the greatest number of described genera.

The present work offers a concise faunal review of this 'iconic' Gondwanan group, reconciling results published by Burckhardt (2009: revision of world fauna) and by Burckhardt *et al.* (2011: revision of genus *Xenophyes*) with a study of specimens contained in New Zealand entomological collections and museums.

The goals of this faunal review are to provide an inventory of New Zealand taxa, a concise treatment of their taxonomy, identification keys to genera and species, and a summary of information available on species distribution and biology.

It is a further step in the authors' goal of attaining an overall understanding of the Hemiptera fauna of New Zealand within a reasonable timeframe, and making comprehensive information available to a wide range of end-users.

In addition to paper-based publications by the authors further information on the fauna is available on *The New Zealand Hemiptera Website* (<http://hemiptera.landcareresearch.co.nz/>), including updated checklists, digital images, identification tools, and recent literature, and general information on Moss Bug Base (<http://rameau.snv.jussieu.fr/cgi-bin/coleorrhyncha.pl/>).

Taxonomic history

The first member of the Peloridiidae described from New Zealand was *Xenophyes cascus* Bergroth, 1924. Subsequently Drake & Salmon (1948, 1950), Woodward (1952, 1956, 1958), and Evans (1982) described additional species.

Woodward (1958) provided a key to the New Zealand taxa. Evans (1982) supplied a comprehensive review of the world fauna, including a discussion on distribution, generic relationships, and dispersal as well as an account of anatomy and morphology. This author firmly established the taxonomy of New Zealand genera (*Oiophysa*, *Xenophyes*, *Xenophysella*), which is in use to this day, and recognised 10 species for the fauna. Evans produced very useful habitus illustrations of the New Zealand taxa but he did not provide identification keys in his world review. Furthermore, his study was based on very limited material from New Zealand and, although it is still regarded as a 'classic' in the field of Peloridiidae taxonomy, it failed to capture the extent of morphological variability between and within populations.

The most comprehensive revision of the world fauna to date is that of Burckhardt (2009), who provided descriptions and keys to all taxa (adult and nymphal stages), a cladistic analysis, and biogeographical discussion. Burckhardt maintained the generic classification of previous authors, synonymised *Oiophysa fuscata* Drake & Salmon, 1950 with *Oiophysa ablusca* Drake & Salmon, 1950, as well as *Xenophysella dugdalei* Evans, 1982 and *Xenophysella pegasusensis* Evans, 1982 with *Xenophysella stewartensis* (Woodward, 1952); and he described two new species for New Zealand (*Oiophysa paradoxa* and *Xenophysella greensladeae*). Burckhardt, in Burckhardt *et al.* (2011), described four new species of *Xenophyes*. Consequently, three genera and 13 species are now recognised from New Zealand. Burckhardt's revision included also a taxonomic treatment of the last instar of New Zealand species.

In the context of his world revision, Burckhardt (2009) included selected material from each region of the world. The New Zealand material comprised types, specimens from overseas museums, and specimens collected by him during two visits to the country (1992, 2000). Burckhardt's study included only some of the specimens deposited in New Zealand entomological collections and museums.

The current concise faunal review is based on all available specimens (over 2,400) from these museums and collections. This study material provided a solid basis on which to test taxonomic concepts and other information published by Burckhardt (2009) and Burckhardt *et al.* (2011), and to apply results comprehensively at the regional level.

Higher classification and phylogeny

The phylogenetic position of Peloridiidae within the order Hemiptera has been contentious for a long time. In the past, moss bugs have been variously assigned to Heteroptera or Homoptera. Today, they are generally considered to be the sole extant member of the hemipteran suborder Coleorrhyncha which is considered to be the sister group to the suborder Heteroptera.

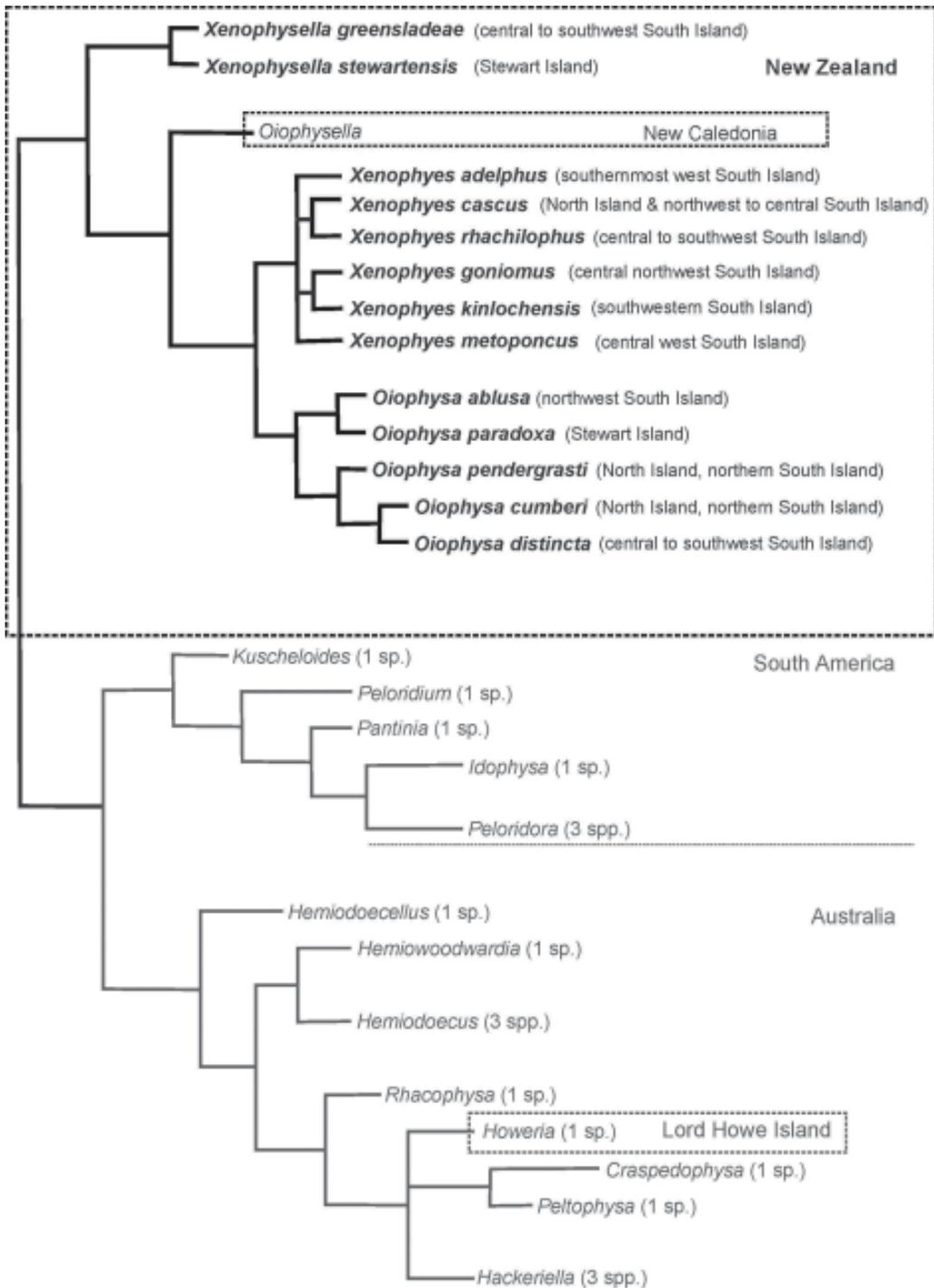
The phylogenetic analysis of Burckhardt (2009), summarised in a simplified version of his cladogram (p. 12), was the first attempt to apply a strict cladistic methodology to the morphological analysis of relationships among world Peloridiidae. A similar basic branching pattern as that of Burckhardt (2009) — (New Zealand/New Caledonia (South America + Australia)) — was uncovered in a previous, more narrative phylogenetic analysis by Popov & Shcherbakov (1996). The two studies uncovered a cladogram topology mostly consistent with the diversification of moss bugs as a consequence of the break-up of Gondwana. Earlier, Evans (1982) discussed intergeneric relationships but did not provide characters supporting his ideas.

Important differences from previous studies were revealed in Burckhardt (2009), e.g., a different phylogenetic position of the genera *Oiophysella* (New Caledonia), *Peloridium* (South America), and *Howeria* (Lord Howe Island) relative to other world genera, and a different sister group relationship between *Xenophysella* and *Oiophysella* (*Xenophyes* + *Oiophysa*). Previous hypotheses included, for example, the placement of *Xenophyes* as 'most ancestral taxon' (Evans 1982) or as sister-taxon to *Xenophysella*, and *Oiophysa* as most closely related to *Oiophysella* (New Caledonia) (Popov & Shcherbakov 1996).

Readers are referred to Burckhardt (2009) for a more detailed discussion of Peloridiidae higher classification and phylogeny, and Popov & Shcherbakov (1991, 1996) for a world overview of fossil Coleorrhyncha and phylogenetic considerations based on the fossil record.

Geographic distribution

Burckhardt (2009) provided a discussion of the historical developments of biogeographical concepts and analyses together with his own general perspective on the biogeography of the peloridiid world fauna. He concluded that "no detailed biogeographical conclusions can be drawn at the moment as neither the cladogram is sufficiently resolved nor the distribution is known in enough detail." A better-resolved phylogeny can be obtained through the discovery of new, phylogenetically informative morphological and/or molecular characters. Colleagues from Denmark and Germany are currently investigating molecular data. The



Simplified cladogram of world peloriids emphasising New Zealand taxa and their local distribution (based on Burckhardt 2009 and Burckhardt *et al.* 2011).

lack of detailed distributional data, deplored by Burckhardt (2009), which is probably more important in the present context than insufficient resolution of the cladogram, is remedied by the present study. In New Zealand species distributions are now well documented, and as a consequence, it is possible to give a brief biogeographical account for the fauna. In the following discussion any indication of putative relationships among species follows the cladogram on page 12.

The overall distribution of New Zealand Peloridiidae is summarised in Table 2 and in Maps 4–6 (pp. 70–72). Species distributions are largely allopatric within genera. The genera *Xenophyes* and *Oiophysa* occur on the North and South Islands. *Oiophysa* is also represented by one species endemic to Stewart Island (*O. paradoxa*). The genus *Xenophysella* has a more restricted distribution in mid- and southwestern areas of the South Island; it also has one species (*X. stewartensis*) endemic to Stewart Island.

The majority of Peloridiidae (10 species or 77% of the fauna) occur on the South Island; 8 species (*Oiophysa ablusus*, *O. distincta*, *Xenophyes adelphus*, *X. goniomus*, *X. kinlochensis*, *X. metoponcus*, *X. rhachilophus*, *Xenophysella greensladeae*) are restricted to this island. No species is restricted to the North Island although *Oiophysa cumberi* and *Xenophyes cascus* are widely distributed and mostly occur there, with a few populations also present in northernmost areas of the South Island. Only the genus *Xenophyes* has so far been recorded from the far north of New Zealand. The apparent absence of *Oiophysa* from the Northland area north of the Auckland isthmus is intriguing. The distribution range of *Oiophysa pendergrasti*, apparently a close relative of *O. cumberi*, appears to follow the same general pattern but material to hand suggests *O. pendergrasti* is locally less abundant. Further field collecting is required to investigate the occurrence of *O. pendergrasti* on the Coromandel Peninsula, to the apparent exclusion of *O. cumberi*, and the apparent absence of the genus *Oiophysa* from the Northland region (northernmost North Island). *Xenophyes cascus* and *X. rhachilophus* are the most widely distributed and locally most abundant of all New Zealand species. Among species occurring on the two main islands of New Zealand, *Oiophysa ablusus* and *Xenophyes metoponcus* have the most restricted distributions, in the northwest corner of the South Island and its central West Coast respectively. The fauna of Stewart Island is known only from two species, *Oiophysa paradoxa* and *Xenophysella stewartensis*. Peloridiidae have never been recorded from New Zealand's offshore islands, neither from the Three Kings Islands or Kermadec Islands in the North nor from the Chatham Islands or other Subantarctic islands (Antipodes Islands, Auckland Island, Bounty Islands, Campbell Island, The Snares).

Burckhardt (2009) and Burckhardt *et al.* (2011) identified species pairs (hypothesised sister-species) with allopatric or parapatric (in *Xenophyes*) distributions, that may have diversified as a result of vicariance: *Xenophysella greensladeae* – *stewartensis* (South Island – Stewart Island); *Oiophysa ablusus* – *paradoxa* (South Island – Stewart Island); *Oiophysa cumberi* – *distincta* (North Island and northern South Island – central to southwest South Island); *Xenophyes cascus* – *rhachilophus* (North Island and northwest to central South Island – central to southwest South Island); *Xenophyes goniomus* – *kinlochensis* (central northwest South Island – southwest South Island).

Biology and dispersal

Estévez & Remes Lenicov (1990) and Burckhardt (2009) showed that peloridiids have five morphologically distinct nymphal instars. Cassis & Gross (1995) noted that mating occurs in spring in Australia and overwintering is probably spent in the egg-stage. In New Zealand adults have been found from spring to autumn, mostly from December to March; teneral, newly emerged adults, have generally been collected in late spring, summer, and autumn, mostly in January (North Island) or February (South Island); nymphs have been captured mostly from November to December (North Island) or from January to February (South Island). Surveys conducted during the New Zealand winter (mainly June to September) have yielded a few adults only; no teneral or nymphs have been recovered in that season. This may be indicative of a life cycle with overwintering adults and/or eggs.

Although Peloridiidae are commonly found in association with wet moss and sometimes hepatics, the specificity of these relationships remains unclear. Hacker (1932) was the first to establish the link between peloridiids and mosses. However, in their study of *Hackeriella veitchi* in Australia, Helmsing & China (1937) were the first to establish that peloridiids actually feed on mosses. In New Zealand the only published moss-association record is that of Carter (1950), who reported adults and nymphs of *Xenophyes* sp. to be found on *Psilopilum crispulum*. More than one peloridiid species can commonly be found together in the same locality and even microhabitat (see Appendix D, p. 40). Known associations between world peloridiids and mosses or hepatics are summarised in Table 3 (see also Burckhardt 2010).

Analysis of label data from specimens in New Zealand collections and personal field experience (D. Burckhardt and M.-C. Larivière, pers. observations) suggest that apart from requiring a year-round humid environment Peloridiidae are relatively eurytopic in terms of their macrohabitat requirements. This means that, in general, as long as there is

Table 1. Number of genera and species by Southern Hemisphere region. Note: Data based on Burckhardt (2009) and Burckhardt *et al.* (2011). * = shared with mainland Australia; taxa in bold = from New Zealand.

	New Zealand	E. Australia (mainland)	Tasmania	Lord Howe Island	New Caledonia	South America
<i>Craspedophysa</i>		1				
<i>Hackeriella</i>		3				
<i>Hemiodoecellus</i>		1	1*			
<i>Hemiodoecus</i>		3	1*			
<i>Hemiowoodwardia</i>		1				
<i>Howeria</i>				1		
<i>Idophysa</i>						1, Chile
<i>Kuscheloides</i>						1, Chile
Oiophysa	5					
<i>Oiophysella</i>					4	
<i>Pantinia</i>						1, Chile
<i>Peloridium</i>						1, Chile + Argentina
<i>Pelorida</i>						3, Chile
<i>Peltophysa</i>		1				
<i>Rhacophysa</i>		1				
Xenophyes	6					
Xenophysella	2					
Total genera (17)	3	7	2*	1	1	5
Total species (36)	13	11	2*	1	4	7

rain- or mistforest it does not matter whether southern beech (*Nothofagus*) or other tree species are present or absent. It also seems that peloridiids are more often found on wet (almost saturated) moss and hepatics growing in association with trees, e.g., on or close to trees, surface roots, fallen dead branches and trunks, than on similar vegetation growing under favourably wet conditions elsewhere, e.g., open moss carpets. This reiterates and expands observations made by Carter (1950). Figures 129–144 provide examples of New Zealand peloridiid habitats.

All New Zealand species lack hindwings. They probably spend most of their life in the wet moss on which they feed, probably moving very little, and consequently having low dispersal ability. It is presumed that if environmental conditions become drier Peloridiidae move deeper into the moss layers in search of humidity, and remain there until it is again suitably wet nearer to the surface.

As is the case with their biology, little is known about the ethology of moss bugs. Peloridiidae, like other plant-sap sucking Hemiptera, possess endosymbiotic microorganisms located in special mycetomes (Müller 1951;

Pendergrast 1962; Schlee 1969). Vibrational signaling and jumping, two features also known in other Hemiptera, have been observed by Hoch *et al.* (2006; *Hackeriella veitchi*, Australia) and Burrows *et al.* (2007) respectively.

MORPHOLOGY AND TERMINOLOGY

The main diagnostic features of adult Peloridiidae are detailed on page 19.

The reader may acquire the elementary knowledge of adult peloridiid morphology necessary to identify New Zealand taxa by reference to Figures 1–6, the glossary provided in Appendix A (p. 35), and other accounts of peloridiid morphology discussed by Burckhardt (2009), whose morphological terminology is generally adopted here. The term genitalia rather than terminalia (Burckhardt *et al.* 2011), is used to refer to the modified genital segments of the abdomen and associated structures involved in copulation, fertilisation, and oviposition.

Table 2. Summarised distributions for New Zealand Peloridiidae, from North to South and West to East. Two-letter area codes, explained on p. 19, follow Crosby *et al.* (1976, 1998).

Species	North Island												
	ND	AK	CL	WO	BP	TK	TO	HB	GB	RI	WI	WN	WA
<i>Oiophysa ablusa</i>													
<i>O. cumberi</i>		AK		WO	BP	TK	TO	HB	GB	RI		WN	
<i>O. distincta</i>													
<i>O. paradoxa</i>													
<i>O. pendergrasti</i>			CL							RI			
<i>Xenophyes adelphus</i>													
<i>X. cascus</i>	ND	AK	CL	WO	BP	TK	TO			RI		WN	WA
<i>X. goniomus</i>													
<i>X. kinlochensis</i>													
<i>X. metoponcus</i>													
<i>X. rhachilophus</i>													
<i>Xenophysella</i>													
<i>greensladeae</i>													
<i>X. stewartensis</i>													

Species	South Island															
	SD	NN	MB	KA	BR	WD	NC	MC	SC	MK	OL	CO	DN	FD	SL	SI
<i>Oiophysa ablusa</i>		NN														
<i>O. cumberi</i>	SD	NN														
<i>O. distincta</i>						WD		MC			OL	CO		FD	SL	
<i>O. paradoxa</i>																SI
<i>O. pendergrasti</i>		NN	MB													
<i>Xenophyes adelphus</i>														FD	SL	
<i>X. cascus</i>	SD	NN			BR	WD										
<i>X. goniomus</i>					BR	WD		MC								
<i>X. kinlochensis</i>						WD					OL			FD		
<i>X. metoponcus</i>						WD										
<i>X. rhachilophus</i>						WD					OL			FD	SL	
<i>Xenophysella</i>																
<i>greensladeae</i>					BR	WD					OL			FD		
<i>X. stewartensis</i>																SI

METHODS AND CONVENTIONS

Materials

The working methods and taxonomic concepts of Burckhardt (2009) and Burckhardt *et al.* (2011) are generally followed.

This study is based on over 2,400 Peloridiidae specimens from over 175 New Zealand localities, deposited in the following institutions:

AMNZ Auckland War and Memorial Museum, Auckland.

AMSA Australian Museum, Sydney, NSW, Australia.

ANIC Australian National Insect Collection, Canberra, ACT, Australia.

BMNH Natural History Museum, London, United Kingdom (previously British Museum (Natural History)).

Table 3. Known associations between peloridiids and mosses or hepatics (after Burckhardt 2009, 2010).

Peloridiid	Moss or hepatic	Association	Region	References
<i>Hackeriella veitchi</i>	<i>Papillaria kermadecensis</i> (pendulous epiphytic moss)	Found on (several adults and nymphs)	Australia	Helmsing & China 1937
<i>Xenophyes</i> sp.	<i>Psilopilum crispulum</i> (moss)	Found on (several adults and nymphs)	New Zealand	Carter 1950
<i>Peloridium hammoniorum</i>	<i>Pohlia cruda</i> (moss)	Found on	Chile	China 1962; Cekalovic 1986
<i>Howeria kingsmilli</i> (as <i>H. coggeri</i>)	<i>Spiridens vieillardii</i> (moss)	Found on	Lord Howe Island	Evans 1967
<i>Howeria kingsmilli</i> (as <i>H. kingsmilli</i> , <i>H. paytenii</i>)	<i>Porella elegantula</i> (hepatic; as <i>Madatheca stangeri</i>)	Found on	Lord Howe Island	Evans 1967
<i>Peloridium hammoniorum</i>	<i>Polytrichum strictum</i> (haircap moss)	Bred from	Argentina	Estévez & Remes Lenicov 1990
<i>Peloridium hammoniorum</i>	<i>Polytrichum strictum</i> (haircap moss)	Kept alive and observed feeding on (adults and nymphs)	Chile	Burckhardt 2009

CMNZ Canterbury Museum, Christchurch.

JWEC J. W. Evans collection, property of AMSA, deposited as long-term loan to ASCU (Agricultural Scientific Collection Unit, Orange Agricultural Institute, Orange, NSW, Australia).

LUNZ Entomology Research Museum, Lincoln University, Lincoln.

MHNG Muséum d'histoire naturelle, Genève, Switzerland.

MONZ Museum of New Zealand Te Papa Tongarewa, Wellington.

NHMB Naturhistorisches Museum, Basel, Switzerland.

NZAC New Zealand Arthropod Collection, Landcare Research, Auckland (previously DSIR collection).

QM Queensland Museum, Brisbane, QLD, Australia.

ZMHB Museum für Naturkunde Leibniz-Institut für Evolutions- und Biodiversitätsforschung an der Humboldt-Universität zu Berlin, Germany.

ZMUC Zoological Museum, University of Copenhagen, Denmark.

Specimen-based information from NZAC is being databased and will be made available online on the NZAC NZBUGS web pages of the Landcare Research website (<http://www.landcareresearch.co.nz/>).

A significant portion of the study material used by Burckhardt (2009) in his world revision came from his own fieldwork, types, and specimens in overseas institutions. Most specimens from New Zealand collections and museums were also examined by Burckhardt during his visit to NZAC in 2000, where this material had previously been assembled by Larivière. Burckhardt partially included results in his 2009 revision.

Specimens from New Zealand institutions have been double-checked or newly identified by Larivière for the present study, using the publications of Burckhardt (2009) and Burckhardt *et al.* (2011). Whenever identification was in doubt, specimens were sent to Burckhardt for final validation. The male genitalia of representatives of nearly 100 populations were dissected.

Collecting and preparation

Peloriidiidae are generally collected by sifting wet moss. This can be done using a sifter or litter reducer of the type used for humicolous beetles whereby moss is placed on the internal screen of the upper third of a pouch that is shaken with two handles, the smaller particles fall to the bottom of the sifter where they can be removed and processed easily. Extraction of specimens from the reduced moss samples can be done using Berlese funnels (closed funnel system with an electric light source at the top for drying the sample, a screen holding the sample in the middle, and an ethanol-containing jar at the bottom of the funnel) or Winkler/Moczarski ecollectors (also a funnel-like system but using the escape reflex of disturbed specimens rather than the humidity gradient and therefore not requiring an electric light source). It is also possible to use a sifting tray over a pan to sift material and visually locate and collect individual specimens in the field.

Specimens are then preserved in 70–75% ethanol or, if molecular sequencing is planned, in near absolute (e.g., 96%) ethanol and stored in a refrigerator or freezer.

For routine identification most features of the external morphology and the male and female genitalia can be viewed under an ordinary dissecting microscope. A magnification of 80× or more, although not necessary, can greatly enhance the examination of microsculpture, wing vein intersections, or male aedeagus.

Peloriidiids are generally stored in ethanol or air-dried and mounted on pins, usually using water-soluble glue and a card triangle or point. Adults and nymphs are usually covered with ‘waxy’ incrustations very similar in appearance to those of many humicolous beetles and flat bugs, and not soluble in water. These incrustations create a relatively opaque adhesive film on bodily surfaces, which may obscure diagnostic features, and can be removed manually by scratching with a very fine pin. Using a short-hair artist’s brush to carefully brush the surface of specimens collected in ethanol before pinning also gives excellent results.

When working with dry material it is necessary to soften and dissect male and female specimens to study their genitalia.

Male genitalia can be dissected as follows. Dry-mounted specimens are warmed for 5–10 minutes in soapy

water or alcohol (70–75% ethanol). If the abdomen alone is to be used, this can be separated from the rest of the body by inserting a pin between it and the thorax, or, in difficult cases, by first relaxing the whole specimen in hot soapy water or alcohol. Each specimen or abdomen is transferred to a watch glass or depression slide containing water (if soapy water was used) or ethanol, and the pygofer (genital capsule) is pulled away from the rest of the abdomen using fine forceps and a micro-scalpel, e.g., the needle tip from a 1.0 ml disposable hypodermic syringe. The pygofer is then warmed in very hot (almost boiling) ethanol for about 5 minutes, then transferred to another watch glass or depression slide containing ethanol. The anal tube, parameres, and aedeagus are detached and extracted from the pygofer in this solution, using fine forceps and a micro-scalpel. Dissected genitalia are transferred to glycerine (or glycerol) for examination and eventually stored in genitalia vials containing glycerine (or glycerol), and remounted on the pin below the relevant specimens.

Another method uses a 10% KOH solution to macerate the abdomen or, in some cases, the whole specimen. This is done by placing the abdomen or specimen in a test tube containing a little KOH solution and by placing the test tube on a hot plate in a beaker containing water to warm its contents for 10–15 minutes (alternatively the abdomen or specimen can be left in cold KOH overnight). The rest of the dissection can be carried out in water, but rinsing in 70–75% ethanol before transferring the genital to glycerine (or glycerol) is essential. The KOH technique may be quicker for routine identification because KOH is a clearing agent that allows the examination of genitalia by transparency. Great care should be applied when using KOH because it is corrosive to the skin or can cause an allergic reaction in some people.

For a more detailed study of morphology it is useful to prepare some permanent slides using Canada balsam for examination through a compound microscope.

Taxonomically relevant characters

The characters presented in the descriptions are subsets of the totality of characters studied by Burckhardt (2009), and represent the most important differences among, or variation within, closely related taxa. Character states not included in the species descriptions are as detailed in the generic descriptions.

The set of measures given here is also a subset of those provided by Burckhardt (2009), but sample size for each measurement was expanded to include, whenever possible, up to 10 males and 10 females randomly selected across the distribution range of each species.

Descriptive measures, given in mm as a range with mean between parentheses, were taken in the following manner:

body length measured from anterior margin of head to tip of tegmina (forewings);

head width taken across eyes;

head median length measured along the midline between anterior and posterior margins;

pronotum width measured as the maximal distance between the lateral margins of the paranota;

pronotum length taken along the midline between anterior and posterior margins;

combined width of tegmina (forewings) measured as the distance between the lateral margins of both tegmina at the tip of the clavus.

Characters with the highest diagnostic value have been illustrated. Most figures provided in this work have been extracted from Burckhardt (2009), with or without modifications. They represent the most commonly encountered state of a character. Readers must allow some degree of variation when working with individual specimens.

Characters chosen for identification are those generally easily observed, which do not require genitalic dissections.

Identification keys

Keys do not necessarily reflect phylogenetic relationships. They are intended as an aid to identification, not a statement of phylogenetic relations. Additional helpful characters (e.g., distribution) have often been included between key couplets to assist identification.

The identification keys in this work are different from and provide an alternative to those given by Burckhardt (2009: world fauna) and Burckhardt *et al.* (2011: *Xenophyes*).

Illustrations and digital photographs

Illustrations, except those extracted without modification from Burckhardt (2009), and maps were prepared using the software package CorelDRAW® graphics suite. All figures were laid out using this software package. Photographs were captured through a Leica MZ-12.5 stereomicroscope, a Leica DC500 digital camera, and the increased-depth-of-field software Helicon Focus. Further photo processing was done using the software packages Adobe® PhotoShop® and CorelDRAW® graphics suite.

Habitus photos were taken from air-dried pinned museum specimens that have suffered colour fading and yellowing over time. In the cases of *Oiophya ablusa*, *O. cumberi*, *O. distincta*, *Xenophyes cascus*, *Xenophysella*

greensladeae, and *X. stewartensis*, it has been possible to apply a certain level of colour correction through the availability of live material.

Taxonomic arrangement

Genera and species are treated alphabetically in this concise taxonomic review. Insights into the higher classification and phylogeny of Peloridiidae can be obtained from Burckhardt (2009). Further research on Peloridiidae in general and New Zealand taxa in particular is required, including more systematic field surveys and molecular work, before phylogenetic relationships can be resolved beyond the results published by Burckhardt (2009).

Type data

The status, repository, and collecting information of primary type specimens are given for each species. Not all primary types were seen for the current review, most types having already been seen by Burckhardt (2009) in the context of his world revision and by Burckhardt *et al.* (2011) in the *Xenophyes* revision.

Label data for primary types examined in the course of this study are listed as written on original labels, with a solidus (/) separating different labels.

Material examined

This indicates the number of specimens examined and the acronym of their repositories. Only nymphs determined by Burckhardt and found in association with adults from the same collecting event were considered to be authoritatively identified. Specimens from overseas collections were examined by Burckhardt.

The software used to record specimen data was Microsoft Excel. Label information accompanying each specimen was standardised, recorded, and georeferenced in a spreadsheet. For the purpose of the current review all analyses involving specimen data were performed in this environment. Once updated determination labels and NZAC accession numbers in the form of 2-D barcode labels are applied to individual specimens, data will be migrated to the Collection Information System (CIS) being developed for NZAC. Online access to this information will be provided on the Landcare Research website (<http://www.landcareresearch.co.nz/>).

Geographic distribution and biology

For New Zealand distribution records, the area codes of Crosby *et al.* (1976, 1998) are listed alphabetically by island. Each area is followed by collection localities listed alphabetically, with repository acronyms or other supporting references. A list of geographical coordinates for the main localities from which material was examined is given in Appendix B.

The two-letter abbreviation codes of Crosby *et al.* (1976, 1998) used in this publication are as follows (see Maps 1–3):

New Zealand. North Island: AK, Auckland; BP, Bay of Plenty; CL, Coromandel; GB, Gisborne; HB, Hawke's Bay; ND, Northland; RI, Rangitikei; TK, Taranaki; TO, Taupo; WA, Wairarapa; WI, Wanganui; WN, Wellington; WO, Waikato. **South Island:** BR, Buller; CO, Central Otago; DN, Dunedin; FD, Fiordland; KA, Kaikoura; MB, Marlborough; MC, Mid Canterbury; MK, Mackenzie; NC, North Canterbury; NN, Nelson; OL, Otago Lakes; SC, South Canterbury; SD, Marlborough Sounds; SL, Southland; WD, Westland. **Stewart Island, SI.**

Species distribution maps are provided on pp. 70–72 (Maps 4–6).

The biological information provided is based on specimen label data, field and laboratory observations by the authors, and data from the literature. To eliminate spurious records an effort was made to summarise available information by using the smallest common denominator among the greatest number of observations for each species. Appendix C (p. 39) provides a list of plants mentioned in the text. The terminology and style adopted here follow closely Larivière & Laroche (2004) and Larivière *et al.* (2010). Most technical terms are also defined in the glossary (Appendix A, p. 35).

TAXONOMIC TREATMENTS

FAMILY PELORIDIIDAE

Diagnosis. Body (Fig. 1) flattened, broadly shaped, cryptically colored, lacking macroscopic pilosity; 2–5 mm in length. **Head.** Flat and transverse; more or less produced anteriorly to form a laminate expansion often with two or more semi-transparent areolae. Eyes widely separated, prominent laterally, petiolate (positioned on short stalks). Ocelli absent. Antennae clavate, 3-segmented and short (concealed from above). Mouthparts hypognathous; labium long, prominent, 4-segmented; gula as discrete sclerite absent. **Thorax.** Pronotum laterally expanded into laminate paranota which may contain areolae. Legs relatively slender; tarsi 2-segmented. Tegmina coriaceous, semi-transparent, usually with well-developed raised venation and variously areolate; slightly overlapping in the middle and

lying flat over the abdomen. Posterior wings absent in all New Zealand taxa. **Abdomen.** Flattened. Spiracles positioned ventrally. Male genitalia symmetrical. Female ovipositor with 3 pairs of valvulae.

Remark. An alternative diagnosis of the adult was provided by Burckhardt (2009: 177), who also included a key to the nymphal instars (pp. 183–184) with habitus illustrations (pp. 186–187).

Key to genera of New Zealand Peloridiidae

Notes. New Zealand genera have been keyed against world genera by Burckhardt (2009: 179). A key adapted to the New Zealand context is included below. Additionally helpful but not necessarily exclusive characters are provided between square brackets.

- 1 Vein MP of tegmina ending on vein ScP (ScP apically fused with vein MP and the two together with C) (Fig. 9). Anterior margin of head (Fig. 13) distinctly concave medially (head often V-shaped), rarely nearly straight and narrowly notched medially (Fig. 14; *O. paradoxa*, Stewart Island). Inner posteroventral portion of paranota coarsely punctate (Fig. 12)
..... (p. 20) ... Genus *Oiophysa* Drake & Salmon
[Head about 0.5× as long as pronotum medially; conspicuously punctate dorsally. Tegmina generally punctate along veins.]
- Vein MP of tegmina ending on vein C (ScP not apically fused with vein MP, the two veins reaching vein C separately) (Fig. 10). Anterior margin of head (Fig. 15) variously convex (never strongly concave or V-shaped). Inner posteroventral portion of paranota impunctate (smooth; Fig. 19) or very finely punctate 2
[Head at least 0.7× as long as pronotum medially; not conspicuously punctate dorsally. Tegmina with punctures restricted to clavus and a few adjacent veins.]
- 2 Tegmina (Fig. 21) with veins C and ScP unfused in apical three-quarters, not producing a wide flattened margin; costal cells moderate to large; claval cell broad and moderately long, extending beyond scutellum by 1/2 its length or slightly more. Posterior margin of head (Fig. 23) strongly concave between 'neck' and eyes
..... (p. 24) ... Genus *Xenophyes* Bergroth
[Posterolateral margin of tergite 8 strongly produced. North and South Islands.]
- Tegmina (Fig. 22) with veins C and ScP fused in apical three-quarters, producing a wide flattened margin; costal cells small or ill-defined; claval cell narrower and longer, extending beyond scutellum by about 2/3 of its length or slightly less. Posterior margin of head (Fig. 24) weakly concave or sinuate between 'neck' and eyes
..... (p. 31) ... Genus *Xenophysella* Evans
[Posterolateral margin of tergite 8 weakly produced. South and Stewart Islands.]

Genus *Oiophysa* Drake & Salmon, 1950

Figures 7, 9, 12, 16, 25, 27–34, 55–74, 115–120; Map 4. *Oiophysa* Drake & Salmon, 1950: 3. Type species: *Oiophysa ablusa* Drake & Salmon, 1950: 4, by original designation.

Description. Adult (Fig. 115–120). Body shape broadly or narrowly oval, with head truncate and usually depressed anteriorly; length about 2–3 mm. Brachypterous. **Head** (Fig. 27–31) V-shaped or transversely oval; about 0.5× as long as pronotum medially (Fig. 25); conspicuously punctate dorsally. Eyes relatively small, petiolate, directed backward. Anterior margin distinctly concave medially or almost straight on either side of sometimes hardly visible notch (*O. paradoxa*). Posterior margin strongly concave between ‘neck’ and eyes (weakly concave or sinuate in *O. paradoxa*). Antennal segment 3 (Fig. 16) relatively short (about 1.3× length of segments 1 and 2 combined), broadly fusiform. **Thorax** (Fig. 27–31). Pronotum with anterior margin almost straight to weakly concave, distinct longitudinal ridge, and almost straight or weakly concave posterior margin. Paranota triangular, slightly rounded (*O. ablusa*) or subquadrate (*O. paradoxa*), with moderately convex to almost rectilinear (*O. paradoxa*) lateral margins and acutely rounded posterolateral angles; anterolateral angles very slightly if at all produced anteriorly, reaching hind margin of eyes (*O. paradoxa*) or removed from it; inner posteroventral portions coarsely punctate (Fig. 12). Scutellum medium-sized, flat, triangular, acute apically. Tegmina (Fig. 32–34, 115–120) structurally similar in both sexes. Veins distinctly raised, generally margined by punctures (Fig. 7). Costal vein (vein C) weakly or strongly rounded basally, hence humerus rounded or angular. Vein MP ending on vein ScP (ScP apically fused with vein MP and the two together with C) (Fig. 9). Veins C and ScP unfused in apical three-quarters, not producing a wide flattened margin as in *Xenophysella*. Costal cells moderate to large (smaller subapically in *O. paradoxa*). Subcostal cell long and narrow. Claval cell broad and short, extending beyond scutellum by no more than 1/2 its length. Apical radial cell separated from costal margin by costal cells. **Abdomen**. Ventral outline, except for genitalia, elongate, narrowly rounded. Posterolateral angles of tergite 8 strongly produced. Male genitalia: Anal tube (Fig. 71–74) irregularly oval; pygophore (Fig. 67–70), in ventral view, with unmodified lateral angles (not flattened as in *Xenophyes* and *Xenophysella*); parameres (Fig. 63–66) elongate, subacute or blunt apically, without a small dorsobasal lobe as in *Xenophysella*; aedeagus (Fig. 55–58), in lateral view, S-shaped with membranous apical dilatation. Female genitalia: Tergite 9 with inner margin rounded, in dorsal view; valvula 1 with many irregularly distributed teeth.

Other characters as in Burckhardt (2009: 204–205), who also keyed and illustrated the last instar (pp. 184, 186).

Key to species of *Oiophysa*

- 1 Paranota (Fig. 27, 30) rectangular, with lateral margins slightly rounded. Posterior margin of eyes almost touching or distant from anterior margin of paranota by less than the length of one eye (Fig. 27, 30) 2 [*South and Stewart Islands*.]
- Paranota (Fig. 28, 29, 31) triangular, with lateral margins acute to obtusely rounded. Posterior margin of eyes distant from anterior margin of paranota by the length of one eye or more (Fig. 28, 29, 31). 3 [*North and South Islands*.]
- 2 Anterior margin of head slightly convex on either side of wide, shallow, V-shaped concavity (Fig. 27) (p. 21) ... ***ablusa*** Drake & Salmon [*Northwestern South Island*.]
- Anterior margin of head almost straight on either side of sometimes hardly visible shallow notch (Fig. 30) (p. 23) ... ***paradoxa*** Burckhardt [*Stewart Island*.]
- 3 Pronotum less than 3.5× as wide as long medially (Fig. 31), moderately produced laterally. Tegmina (Fig. 32) with costal margins slightly sinuate in basal and apical halves; combined width across humeri less than or subequal to width across middle; additional veins in M and Cu area forming a close-knit mesh of rather small cells (p. 23) ... ***pendergrasti*** Woodward [*North Island and northernmost South Island*.]
- Pronotum at least 3.5× as wide as long medially (Fig. 28, 29), more strongly produced laterally. Tegmina (Fig. 33, 34) with costal margins strongly sinuate in basal and apical halves; combined width across humeri distinctly greater than width across middle; M and Cu area lacking close-knit mesh of small cells formed by additional veins 4
- 4 Anterolateral angles of paranota slightly produced anteriorly (Fig. 28). Aedeagus, in anterior view, with subparallel margins near middle (Fig. 60). Female tergite 9 with strongly curved dorsal margin and truncate apex (p. 21) ... ***cumberi*** Woodward [*North Island and northernmost South Island*.]
- Anterolateral angles of paranota not or less distinctly produced anteriorly (Fig. 29). Aedeagus, in anterior view, with convexly rounded margins near middle (Fig. 61). Female tergite 9 with weakly curved dorsal margin and narrowly rounded apex (p. 22) ... ***distincta*** Woodward [*Mid- to southwestern South Island*.]

***Oiophysa ablusa* Drake & Salmon, 1950**

Figures 16, 27, 55, 59, 63, 67, 71, 115, 145; Map 4.

Oiophysa ablusa Drake & Salmon, 1950: 4. Holotype male (MONZ), “[NN] Leslie Valley track, Nelson, N.Z., 24 Jan. 1948, J.T. Salmon. From moss and lichens; 3,000ft.” (Palma *et al.* 1989). Allotype (female) and paratypes (MONZ), same data as holotype.

Oiophysa fuscata Drake & Salmon, 1950: 6. Holotype female (MONZ), “[NN] Mt Arthur Tableland, Nelson, N.Z., 20 Feb. 1946, J.T. Salmon. From lichens inside cave.” (Palma *et al.* 1989). Synonymised by Burckhardt 2009: 205.

Description. *Adult* (Fig. 115). Yellowish. Eyes reddish to brown. Tegmina brown, often with dark costal cross-vein near whitish humerus; costal cells brown or white; apex white. Legs and abdomen pale yellow to brown. **Head** (Fig. 27, 115) transversely oval to slightly V-shaped. Anterior margin slightly convex on either side of wide, shallow, V-shaped concavity. Posterior margin of eyes distant from anterior margin of paranota by less than the length of one eye. **Thorax** (Fig. 27, 115). Pronotum on average $3.3\times$ as wide as long medially. Paranota rectangular, with lateral margins slightly rounded; anterolateral angles not distinctly produced anteriorly. Tegmina (Fig. 115) with vein C weakly curved basally, hence humeri appearing rounded; costal margins slightly sinuate (less so than in *O. cumberi* or *O. distincta*) in basal and apical halves; combined width across humeri less than or subequal to width across middle. **Abdomen.** Male genitalia: Anal tube (Fig. 71) ovate-elongate; sides almost straight in apical third, converging toward wide apex. Pygophore (Fig. 67) narrow, over $1.3\times$ as long as wide. Parameres (Fig. 63) long, about $4\times$ as long as wide, blunt apically. Aedeagus (Fig. 55, 59), in anterior view, rather wide; margins subparallel near middle. Female genitalia: Tergite 9 with nearly straight dorsal margin and acute apex. **Measurements** (4 males, 5 females). Body length: 2.19–2.59 (2.39) mm. Head: width 0.87–1.02 (0.93) mm; median length 0.18–0.23 (0.20) mm. Pronotum: width 1.05–1.37 (1.20) mm; median length 0.32–0.43 (0.36) mm. Tegmina: combined width 1.11–1.53 (1.29) mm.

Other characters and measurements as in Burckhardt (2009: 205).

Material examined. 55 specimens (34 males, 14 females, 7 nymphs) including holotypes of *O. ablusa* and *O. fuscata* (BMNH, JWEC, MHNG, MONZ, NHMB, NZAC).

Geographic distribution. **South Island.** NN – Cobb Ridge (MHNG, NHMB). Leslie Valley track (MONZ). Mount Arthur: Flora Saddle (MHNG, NHMB); Potholes (JWEC, NZAC); Tableland (MONZ); track (BMNH). Mount Domett (NZAC). The Maitai [=Upper Maitai River] (NZAC).

Biology. Montane. Found in *Nothofagus*-dominant for-

ests. Collected in wet moss or leaf litter; in wet moss on wet rock faces (Upper Maitai River, NN). Seasonality: December–March, mostly February (adults); December, February (nymphs).

***Oiophysa cumberi* Woodward, 1958**

Figures 25, 28, 33, 56, 60, 64, 68, 72, 116; Map 4.

Oiophysa cumberi Woodward, 1958: 687. Holotype female (NZAC), [TO] Pohokura, Taupo-Napier Road [between Rangitaiki and Tarawera], mixed beat[ings], R.A. Cumber, 15.2.1957. Allotype male (NZAC), [BP] Kaimai Range (Tauranga) [saddle Tauranga-Matamata Road], A. Cumber, 4.3.57. Paratype female (NZAC), same data as holotype.

Description. *Adult* (Fig. 116). Head and pronotum brown. Eyes reddish grey. Tegmina brown with white humerus, costal cells, and apex. Legs pale yellow. Abdomen brown. **Head** (Fig. 28, 116) V-shaped. Anterior margin slightly convex on either side of wide, shallow, V-shaped concavity. Posterior margin of eyes distant from anterior margin of paranota by more than the length of one eye. **Thorax** (Fig. 28, 116). Pronotum on average $3.9\times$ as wide as long medially. Paranota triangular; anterolateral angles slightly produced anteriorly. Tegmina with vein C moderately to strongly curved basally, hence humerus appearing rounded to angular; costal margins strongly sinuate in basal and apical halves (Fig. 33, 82); combined width across humeri distinctly greater than width across middle. **Abdomen.** Male genitalia: Anal tube (Fig. 72) ovate, neither particularly elongate nor short; sides slightly sinuate in apical third, converging toward narrow apex. Pygophore (Fig. 68) wide, under $1.3\times$ as long as wide. Parameres (Fig. 64) moderately long, about $3.5\times$ as long as wide, subacute apically. Aedeagus (Fig. 56, 60), in anterior view, narrower than in *O. ablusa*; margins subparallel near middle. Female genitalia: Tergite 9 with strongly curved dorsal margin and truncate apex. **Measurements** (5 males, 5 females). Body length: 2.41–2.79 (2.60) mm. Head: width 0.98–1.09 (1.05) mm; median length 0.22–0.26 (0.23) mm. Pronotum: width 1.19–1.52 (1.39) mm; median length 0.33–0.37 (0.35) mm. Tegmina: combined width 1.09–1.54 (1.37) mm.

Other characters and measurements as in Burckhardt (2009: 205–206), who also keyed and illustrated the last instar (pp. 184, 186).

Material examined. 95 specimens (47 males, 36 females, 12 nymphs) including holotype and allotype (AMSA, JWEC, MHNG, NHMB, NZAC).

Geographic distribution. **North Island.** AK – Waitakere Ranges, Fairy Falls (NZAC). BP – Kaimai Ranges: Mount Te Aroha (MHNG, NHMB); Tauranga-Matamata Road saddle (NZAC); Mamaku Forest [Conservation] Park,

Route 5, Woods Mill track (NZAC). **GB** – Urewera National Park, Huiarau Summit (NZAC). **HB** – Puketitiri, Balls Clearing Scenic Reserve (NZAC). **RI** – Paki-iti Farm (North East of Ohingaiti, Mangamako Road) (NZAC). Ruahine Range: Renfrew Road end, Rangiwahia Hut track (NZAC); Triplex [Hut] (NZAC). **TK** – Mount Egmont/Taranaki, Stratford Plateau Road (NZAC). **TO** – Pohokura (Taupo-Napier Road, between Rangitaiki and Tarawera) (NZAC). Raurimu (NZAC), Spiral Scenic Reserve (3 km North of National Park) (MHNG, NHMB). Tongariro National Park, Hauhungatahi, Erua track (NHMB). **WN** – Tararua Range, Otaki Forks (NHMB). **WO** – Mahoenui, Gribbon Road (NZAC). **South Island**. **NN** – Takaka Hill (NZAC), Canaan (AMSA, JWEC). **SD** – Waitohi Valley, Picton Reservoir (NHMB).

Biology. Lowland to montane. Found in broadleaf-podocarp, *Nothofagus*, or mixed broadleaf-podocarp-*Nothofagus* forests. Collected in wet moss; in moss in *Nothofagus menziesii* forest (Mount Te Aroha, BP); in moss and hepatics from tree branches and trunks in *Beilschmiedia tawa*-dominant forest (Kaimai Mamaku Conservation Park, BP); in moss and hepatics hanging from *Pseudowintera colorata* branches in *Nothofagus menziesii* cloud forest (Urewera National Park, GB); in moss and hepatics on branches and trunks of *Nothofagus fusca* and *Pseudowintera colorata* in *Fuchsia*-dominant forest (Ruahine Range, RI); also taken in sifted forest litter and rotten wood, mixed leaf litter-moss-ferns from rotten logs, in moss from dead fallen tree ferns, and in damp moss from streambank. Seasonality: September–November, February (mostly), April–June, August (adults); February, June (tenerals); February, April (nymphs).

Remarks. The Coromandel Ranges remain undersurveyed for Peloriidiidae, which may explain the apparent absence of *O. cumberi* there. The record of *O. cumberi* from the Nelson area on the northern South Island is based on specimens identified by Burckhardt from two collecting events: a single unsexed adult (with abdomen broken off) (det. Burckhardt, 2000; NZAC) collected in the same sample (Takaka Hill, 2500', 7.5.57, E. S. Gourlay) as 5 males and 6 females identified as *O. pendergrasti* (det. Burckhardt, 2000; NZAC); 2 males and 2 females (Burckhardt 2009; AMSA, JWEC) taken in the same moss sample (Takaka Hill, Canaan, 2800', 28.11.64, G. Kuschel, beech forest moss) as 3 males and 6 females identified as *O. pendergrasti* (det. Burckhardt, 2000; NZAC). These records provide two of three instances suggesting the co-occurrence of two *Oiophysa* species in the same microhabitat (see also Appendix D, Species co-occurrences).

Oiophysa distincta Woodward, 1952

Figures 29, 34, 57, 61, 65, 69, 73, 117; Map 4.

Oiophysa distincta Woodward, 1952: 184. Holotype female (CMNZ), [FD] Caswell Sound, S[outh] I[land], New Zealand, (moss), R.R. Forster, 14.IV.1949.

Description. **Adult** (Fig. 117). Head and pronotum brown. Eyes reddish grey. Tegmina brown with white humerus, costal cells and apex. Legs pale yellow. Abdomen brown. **Head** (Fig. 29, 117) V-shaped. Anterior margin distinctly convex (more so than in *O. cumberi*) on either side of narrow, deep, V-shaped concavity. Posterior margin of eyes distant from anterior margin of paronota by more than the length of one eye. **Thorax** (Fig. 29, 117). Pronotum on average 3.8× as wide as long medially. Paronota triangular; anterolateral angles not produced anteriorly (or less distinctly so than in *O. cumberi*). Tegmina with vein C strongly curved basally, hence humerus appearing angular; costal margins strongly sinuate in basal and apical halves (Fig. 34); combined width across humeri distinctly greater than width across middle. **Abdomen.** Male genitalia: Anal tube (Fig. 73) ovate-short; sides slightly convex in apical third, converging toward moderately wide apex. Pygophore (Fig. 69) narrow, over 1.3× as long as wide. Parameres (Fig. 65) short, about 3× as long as wide, subacute apically. Aedeagus (Fig. 57, 61), in anterior view, rather narrow; margins convexly rounded near middle. Female genitalia: Tergite 9 with weakly curved dorsal margin and narrowly rounded apex. **Measurements** (5 males, 5 females). Body length: 2.44–2.98 (2.68) mm. Head: width 1.01–1.22 (1.10) mm; median length 0.20–0.28 (0.23) mm. Pronotum: width 1.31–1.66 (1.43) mm; median length 0.31–0.42 (0.37) mm. Tegmina: combined width 1.22–1.77 (1.45) mm.

Other characters and measurements as in Burckhardt (2009: 207), who also keyed and illustrated the last instar (pp. 184, 186).

Material examined. 220 specimens (103 males, 92 females, 25 nymphs) including holotype, from ANIC, AMSA, BMNH, CMNZ, JWEC, LUNZ, MHNG, MONZ, NHMB, NZAC.

Geographic distribution. **South Island.** **CO/OL** – “Otago” (NHMB). **FD** – Breaksea Sound: Breaksea Island (NZAC); Gilbert Islands, Gilbert VI (NZAC). Caswell Sound (CMNZ). Dusky Sound, Passage Islands (NZAC). Head of Hollyford Valley (NZAC). Hollyford Valley, near air strip (MHNG, NHMB). Lake Te Au, South of Lake Te Anau (AMSA, BMNH, JWEC, MONZ). Milford track, near Lake Ada (ANIC). Murchison Mountains, East of McKenzie Burn (LUNZ). Resolution Island, Disappointment Cove (NZAC). Secretary Island, Gut Bay (NZAC). Turret Range: Mount Grey (NZAC); Wolfe Flat (NZAC). Wilmot Pass (BMNH, JWEC, LUNZ, NZAC). Bauza

Island (NZAC). **MC** – Back of Mount Hutt (NZAC). North bank of Pudding Hill Stream (NZAC). **OL** – Hollyford Valley, Hidden Falls (NZAC). **SL** – Longwood Range, Bald Hill (MHNG, NZAC). Takitimu Range, Princhester Creek (NHMB). **WD** – West Olivine Range, Simonin Pass (JWEC, NZAC). West Pyke River (NZAC). Cascade State Forest, Jackson River (LUNZ). Ferguson Scenic Reserve (Highway 6, 4 km South of Ross) (NHMB). Mount Hercules Scenic Reserve (LUNZ). Oтира (NZAC), Barretts [=Barrack] Creek (NZAC). Pyke [River] Valley, Head of Lake Alabaster (NZAC).

Biology. Lowland to montane. Found in podocarp, *Nothofagus*, or mixed podocarp–*Nothofagus* forests. All life stages collected in moss (e.g., ground moss, moss and lichens under trees, or from tree trunks and branches), in wet leaf litter under *Polystichum vestitum* and *Pseudowintera*, in leaf litter or moss in *Nothofagus* forest, or a mixture of leaf litter and moss. Also taken on the epiphytic pendulous moss *Weymouthia* (adults, teneral, nymphs, January, FD – Wilmot Pass); in ground litter under *Chionochoa* (adults and nymphs, December, FD – Murchison Mountains), in *Olearia–Pseudowintera–Polystichum* litter (adults and teneral, March, FD – Bauza Island), occasionally in *Nothofagus* leaf litter and rotten wood and more rarely on mat plants (adults). Seasonality: August–May, mostly December–March (adults); January–March (teneral); December–March (nymphs).

Remarks. The abdomen is missing from the holotype reported to be a female by Woodward (1952). The two records of this species east of the main alpine divide in Mid-Canterbury are of one female from Mount Hutt and one male from Pudding Hill Stream (det. Burckhardt, 2000; NZAC).

Oiophysa paradoxa Burckhardt, 2009

Figures 30, 118; Map 4.

Oiophysa paradoxa Burckhardt, 2009: 207. Holotype female (NZAC), Stewart Island, SI, Ocean Beach, 50m, 7.ii.1992, D. Burckhardt, podocarp-hardwood forest, #38. Paratypes 4 females and 8 nymphs (MHNG, NHMB), same data as holotype.

Description. Adult (Fig. 118). Almost entirely yellowish. Eyes reddish to brown. **Head** (Fig. 30, 118) transversely oval. Anterior margin almost straight on either side of sometimes hardly visible shallow notch. Posterior margin of eyes very close to or touching anterior margin of paranota. **Thorax** (Fig. 30, 118). Pronotum on average 3.3× as wide as long medially. Paranota rectangular, with lateral margins almost rectilinear; anterolateral angles not distinctly produced anteriorly. Tegmina with vein C weakly curved basally, hence humerus appearing rounded; costal margins

barely sinuate in basal and apical halves; combined width across humeri slightly greater than width across middle.

Abdomen. Male unknown. Female genitalia: Tergite 9 with weakly curved dorsal margin and narrowly rounded apex. **Measurements** (female holotype). Body length: 2.87 mm. Head: width 1.26 mm; median length 0.29 mm. Pronotum: width 1.48 mm; medial length 0.43 mm. Tegmina: combined width 1.55 mm.

Other characters and measurements as in Burckhardt (2009: 207–208), who also keyed and illustrated the last instar (pp. 184, 186).

Material examined. 14 specimens (6 females, 8 nymphs) including the type series (MHNG, NHMB, NZAC).

Geographic distribution. Stewart Island. SI – Mount Rakeahua (NZAC). Ocean Beach (NZAC, MHNG, NHMB).

Biology. Lowland. Found in podocarp–broadleaf forests. One adult collected from unsifted dead leaves of *Olearia colensoi* from the sheltered side of rocks on Mount Rakeahua. Seasonality: February (adults, teneral, and nymphs).

Remarks. The male of this species is unknown. The females and nymphs listed under material examined, were seen by Burckhardt (2009). The type series of *Oiophysa paradoxa* (5 females, 8 nymphs; MHNG, NZAC, NHMB) was sampled together with *Xenophysella stewartensis* (2 males, 3 females, 5 nymphs; MHNG) at Ocean Beach on Stewart Island (see also Appendix D, Species co-occurrences).

Oiophysa pendergrasti Woodward, 1956

Figures 31–32, 58, 62, 66, 70, 74, 119–120; Map 4.

Oiophysa fuscata pendergrasti Woodward, 1956: 49. Holotype male (AMNZ), “[CL] Coromandel Peninsula, N.I., New Zealand; on ridge leading to Little Moehau (ex moss, *Weinmannia* forest, 24.x.1954, J.G. Pendergrast”. Allotype female (MONZ, could not be located) and paratypes male and nymph (QM), with same data as holotype.

Oiophysa pendergrasti: Evans, 1982: 389.

Description. Adult (Fig. 119–120). Almost entirely yellowish. Eyes reddish to brown. Tegmina pale yellow or brown with paler humerus, whitish costal cells in apical half, and yellowish apex. **Head** (Fig. 31, 119–120) transversely oval to slightly V-shaped. Anterior margin slightly convex on either side of wide, shallow, U-shaped concavity. Posterior margin of eyes distant from anterior margin of paranota by the length of one eye or more. **Thorax** (Fig. 31, 119–120). Pronotum on average 3.3× as wide as long medially. Paranota triangular (not as strongly produced

laterally as in *O. cumberi* or *O. distincta*); anterolateral angles not distinctly produced anteriorly. Tegmina with vein C weakly curved basally, hence humerus appearing rounded; costal margins slightly sinuate in basal and apical halves (Fig. 32); combined width across humeri less than or subequal to width across middle; additional veins in M and Cu area forming a close-knit mesh of rather small cells (not so in other *Oiophysa* species). **Abdomen.** Male genitalia: Anal tube (Fig. 74) ovate, neither particularly elongate nor short; sides almost straight in apical third, converging toward moderately wide apex. Pygophore (Fig. 70) wide, under 1.3× as long as wide. Parameres (Fig. 66) moderately long, about 3.5× as long as wide, blunt apically. Aedeagus (Fig. 58, 62), in anterior view, wider than in *O. distincta*; margins convexly rounded near middle. Female genitalia: Tergite 9 with nearly straight dorsal margin and narrowly rounded apex. **Measurements** (5 males, 5 females). Body length: 2.40–2.80 (2.52) mm. Head: width 0.89–1.09 (1.03) mm; median length 0.19–0.23 (0.20) mm. Pronotum: width 1.09–1.34 (1.27) mm; median length 0.31–0.43 (0.38) mm. Tegmina: combined width 1.18–1.68 (1.41) mm.

Other characters and measurements as in Burckhardt (2009: 208), who also keyed and illustrated the last instar (pp. 184, 186).

Material examined. 75 specimens (36 males, 22 females, 17 nymphs) including holotype (AMNZ, AMSA, BMNH, JWEC, MHNG, NHMB, NZAC, QM).

Geographic distribution. **North Island.** **CL** – Maunaupaki/Camel's Back (NZAC). Little Moehau (AMNZ, QM). Mount Moehau (MHNG, NHMB, NZAC), Ward's Bush (NZAC). **RI** – Ruahine Range, Triplex [Hut] (NZAC). **South Island.** **MB** – Pelorus Bridge (NZAC). **NN** – Takaka Hill (AMSA, BMNH, JWEC, NHMB, NZAC); Canaan (AMSA, NZAC); Harwoods Hole (NZAC).

Biology. Montane. Found in *Nothofagus* or mixed broadleaf–podocarp–*Nothofagus* forests. Seasonality: September–November, February (mostly), May (adults); February (teneral, nymphs). Mostly collected in moss (including ground-moss or moss growing on logs), e.g. in *Nothofagus* forest (South Island; adults, teneral, nymphs) or in *Weinmannia*-dominant mixed forests (Coromandel region; adults); also in moss from exposed rock faces or damp moss from a streambank.

Remarks. The female allotype, reported to have been deposited in the “Dominion Museum, Wellington” (MONZ) by Woodward (1956), could not be located. The record of *O. pendergrasti* from the North Island Central Plateau is based on a single female specimen (det. Burckhardt, 2000; NZAC), that was collected in the same moss sample

(Ruahine Range, Triplex [Hut], 10 Feb 1980, C.F. Butcher, moss [sample] 80/15) as 2 males of *O. cumberi* (det. Burckhardt, 2000; NZAC). See also Appendix D (Species co-occurrences).

Genus *Xenophyes* Bergroth, 1924

Figures 1–6, 10–11a, 17, 19–21, 23, 26, 35–38, 41–54, 75–80, 83–88, 91–108, 121–126; Map 5.

Xenophyes Bergroth, 1924: 178. Type species: *Xenophyes cascus* Bergroth, 1924: 178, by monotypy.

Description. **Adult** (Fig. 121–126). Body shape narrowly to broadly oval, with head weakly to strongly convex anteriorly; length about 2–3 mm. Brachypterous. **Head** (Fig. 35–36, 49–54) transversely oval; at least 0.7× as long as or subequal to pronotum medially (Fig. 26); not conspicuously punctate dorsally. Eyes relatively small, petiolate, directed backward. Anterior margin weakly to strongly convex, sometimes slightly indented in middle (never distinctly concave medially or V-shaped as in *Oiophysa*). Posterior margin strongly concave between ‘neck’ and eyes (Fig. 23). Antennal segment 3 (Fig. 17) moderately long (about 1.6× length of segments 1 and 2 combined), narrowly fusiform. **Thorax** (Fig. 35–36, 49–54). Pronotum with anterior margin strongly concave, poorly to well-defined longitudinal ridge, and almost straight or weakly concave posterior margin. Paranota distinctly rounded, with weakly to strongly convex lateral margins and broadly to acutely rounded posterolateral angles; anterolateral angles moderately to strongly produced anteriorly, nearly reaching hind margin of eyes; inner posteroventral portions impunctate (smooth; Fig. 19) or irregularly punctate (Fig. 20). Scutellum medium-sized, flat, triangular, acute apically. Tegmina (Fig. 121–126) structurally similar in both sexes. Veins distinctly raised, with punctures restricted to clavus and sometimes a few adjacent veins. Costal vein (vein C) weakly or moderately rounded basally, hence humerus rounded. Vein MP ending on vein C (ScP not apically fused with vein MP, the two veins reaching vein C separately) (Fig. 10). Veins C and ScP unfused in apical three-quarters, rarely fused near apex (Fig. 21), not producing a wide flattened margin as in *Xenophysella*. Costal cells moderate to large. Subcostal cell long, narrow. Claval cell broad and moderately long, extending beyond scutellum by 1/2 its length or slightly more. Apical radial cell separated from costal margin by costal cells. **Abdomen.** Ventral outline, except for genitalia, elongate, narrowly rounded. Posterolateral margin of tergite 8 (Fig. 11a) strongly produced (as opposed to *Xenophysella*). Male genitalia: Anal tube (Fig. 103–108) irregularly oval or conical; pygophore (Fig. 97–102), in anterior view, bearing relatively flattened lateral angles; parameres (Fig. 91–95)

usually short or elongate, blunt, rounded or subacute apically, without a small dorsobasal lobe as in *Xenophysella*; aedeagus (Fig. 75–80, 83–88), in lateral view, S-shaped with membranous apical dilatation. Female genitalia: Tergite 9 with inner margin rounded, in dorsal view; valvula 1 (Fig. 5–6) with many irregularly distributed ventral teeth.

Other characters as in Burckhardt *et al.* (2011: 6), who also keyed and illustrated the last instar (p. 7).

Key to species of *Xenophyes*

1 Inner posteroventral portions of paranota punctate (Fig. 20). Pronotum irregularly punctate posteriorly near middle and towards sides (Fig. 36) 2

—Inner posteroventral portions of paranota smooth, not punctate (Fig. 19). Pronotum smooth or transversely wrinkled posteriorly near middle, at most finely punctate towards sides (Fig. 35) 3

2 Pronotum (Fig. 51) weakly punctate; paranota somewhat narrower anteriorly than posteriorly. Tegmina with vein M+CuA unbranched (Fig. 37). Eyes weakly directed backward (Fig. 51), their posterior margins forming an evenly rounded depression with posterolateral margins of head. Male aedeagus (Fig. 77), in lateral view, without spines on ‘neck’. Ventral margin of tergite 9 of female (Fig. 45) slightly sinuate in apical third (p. 28) ... **goniomus** Burckhardt [Body length 2.68–3.10 (2.90) mm. South Island: northern West Coast, south to Arthur’s Pass (MC).]

—Pronotum (Fig. 52) strongly punctate; paranota much narrower anteriorly than posteriorly. Tegmina with vein M+CuA branched (Fig. 38). Eyes strongly directed backward (Fig. 52), their posterior margins forming an almost right angle with posterolateral margins of head. Male aedeagus (Fig. 78), in lateral view, with a few short, coarse spines on ‘neck’. Ventral margin of tergite 9 of female (Fig. 46) strongly concave in apical third (p. 28) ... **kinlochensis** Evans [Body length 2.80–3.23 (3.02) mm. South Island: southern Westland (WD), western Otago Lakes (OL), and Fiordland (FD) regions.]

3 Median longitudinal ridge of pronotum poorly defined (Fig. 42, 50). Paranota much narrower anteriorly than posteriorly (Fig. 50). Posterior margins of eyes (Fig. 50) forming a right angle with posterolateral margins of head. Male aedeagus (Fig. 84), in anterior view, with broad ‘head’, regularly rounded apex and obtusely rounded antero-proximal lobes (p. 26) ... **cascus** Bergroth [Pronotum often transversely wrinkled posteriorly near middle (Fig. 50). Basal radial cell often with faint

additional veins in apical half of M+CuA (Fig. 122). Body length 2.48–3.10 (2.86) mm. North Island and northernmost South Island.]

—Median longitudinal ridge of pronotum well-defined (Fig. 41, 49, 53–54). Paranota about as wide anteriorly as posteriorly (Fig. 49) or only slightly narrower anteriorly than posteriorly (Fig. 53–54). Posterior margins of eyes forming an obtuse angle (Fig. 49) or evenly rounded depression (Fig. 53–54) with posterolateral margins of head. Male aedeagus (Fig. 83, 87–88) not as above 4

[Pronotum almost never transversely wrinkled posteriorly near middle. Basal radial cell lacking faint additional veins in apical half of M+CuA. Southern South Island.]

4 Paranota about as wide anteriorly as posteriorly (Fig. 49). Male aedeagus (Fig. 75), in lateral view, lacking visible spines on ‘neck’ or bearing at most a few short spines. Ventral margin of tergite 9 of female (Fig. 43) deeply indented in apical third (p. 26) ... **adelphus** Burckhardt

[Body length 2.35–2.63 (2.48) mm. South Island: western Southland (SL) region.]

—Paranota distinctly narrower anteriorly than posteriorly (Fig. 53–54). Male aedeagus (Fig. 79–80), in lateral view, with several long spines on ‘neck’. Ventral margin of tergite 9 of female (Fig. 47–48) not deeply indented as above 5

5 Head (Fig. 53) proportionally narrow (about 2.5–2.8× as wide as long); anterior margin very strongly convex; areolae well-defined, large. Male parameres (Fig. 95) short, blunt apically; aedeagus (Fig. 87) with irregularly rounded apex and subquadrate antero-proximal lobes. Ventral margin of tergite 9 of female (Fig. 47) slightly concave near middle; ventral teeth of valvula 1 small (Fig. 6) (p. 29) ... **metoponcus** Burckhardt [Pronotum always smooth posteriorly near middle. Colour brown to dark brown with distinctive paler areas on head, pronotum and tegmina. Body length 2.35–2.55 (2.44) mm. South Island: central West Coast.]

—Head (Fig. 54) proportionally broad (about 3.2–3.3× as wide as long); anterior margin weakly convex; areolae ill-defined, small. Male parameres (Fig. 96) longer, subacute apically; aedeagus (Fig. 88) with acutely rounded apex and obtusely rounded antero-proximal lobes. Ventral margin of tergite 9 of female (Fig. 48) slightly sinuate in apical third; ventral teeth of valvula 1 moderately large (Fig. 6) (p. 30) ... **rhachilophus** Burckhardt

[Pronotum rarely transversely wrinkled posteriorly near middle. Colour pale yellowish-brown, without distinctive pale areas as above. Body length 2.18–2.95 (2.68) mm. South Island: southwestern regions.]

***Xenophyes adelphus* Burckhardt, 2011**

Figures 43, 49, 75, 83, 91, 97, 103, 121; Map 5.

Xenophyes adelphus Burckhardt in Burckhardt *et al.* 2011: 7. Holotype male (NZAC), SL, Longwood Forest, Bald Hill, 700 m, 461150/1675000 [=46°11'50" S / 167°50'00" E], 26.I.1999, Laroche, Larivière, cloud forest (*N. menziesii*), sifting ground moss and lichens. Paratypes 1 male, 1 female, 1 nymph (MHNG, ZMUC) from same locality as holotype (see Burckhardt *et al.* 2011).

Description. Adult (Fig. 121). Yellowish to brown; clavus dark brown, contrasting with paler remigium. Body broadly oval. **Head** (Fig. 49, 121). Proportionally broad, about 2.9–3.2× as wide as long. Anterior margin weakly to moderately convex. Eyes moderately directed backward; posterior margins forming an obtuse angle with posterolateral margins of head. **Thorax** (Fig. 49, 121). Pronotum smooth posteriorly near middle; nearly smooth, at most finely punctate posteriorly towards sides; median longitudinal ridge well-defined. Paranota about as wide anteriorly as posteriorly; lateral margins strongly convex; inner posteroventral portions impunctate. Tegmina with vein M+CuA unbranched. **Abdomen**. Male genitalia – Anal tube (Fig. 103) narrowly oval, widest in basal third, with sinuate sides. Pygophore (Fig. 97) narrow, about 1.3× as long as wide; posterior median tooth long and narrow (more strongly developed than in other *Xenophyes* species); lateral angles strongly projecting outward. Parameres short, rounded apically (Fig. 91). Aedeagus, in anterior view (Fig. 83), with broad ‘head’, subtriangular apex and subquadrate antero-proximal lobes; in lateral view (Fig. 75), posterior edge of ‘head’ rectilinear, ‘neck’ without visible spines or with a few short, coarse spines. Female genitalia – Tergite 9 with ventral margin deeply indented in apical third (Fig. 43). Ventral teeth of valvula 1 moderately large (cf. Fig. 6). **Measurements** (2 males, 2 females; Burckhardt *et al.* 2011). Body length: 2.35–2.63 (2.48) mm. Head: width 0.98–1.23 (1.08) mm; median length 0.33–0.38 (0.34) mm. Pronotum: width 1.23–1.45 (1.38) mm; median length 0.38–0.40 (0.39) mm. Tegmina: combined width 1.38–1.55 (1.46) mm.

Other characters and measurements as in Burckhardt *et al.* (2011: 7–9), who also keyed and illustrated the last instar (pp. 7, 16).

Material examined. Six specimens (4 males, 1 female, 1 nymph), including types (MHNG, MONZ, NZAC, ZMUC).

Geographic distribution. **South Island.** **FD** – Lake Hauroko, West side (MONZ, NZAC). **SL** – Longwood Range, Bald Hill (MHNG, NZAC, ZMUC).

Biology. Montane to subalpine. Found in forests (e.g., *Nothofagus menziesii*), in moss (adults and nymphs).

Seasonality: October–February (adults); February (nymphs).

Remark. *Xenophyes adelphus* co-occurs with *X. rhachilophus* on the west side of Lake Hauroko (FD) where specimens of the two species have been found in the same NZAC sample (see also Appendix D, Species co-occurrences).

***Xenophyes cascus* Bergroth, 1924**

Figures 2–3, 19, 42, 44, 50, 76, 84, 92, 98, 104, 122; Map 5.

Xenophyes cascus Bergroth, 1924: 178. Holotype male (repositorio unknown); [TO] “New Zealand, Ohakune, North Island. Found on mould.”

Xenophyes forsteri Drake & Salmon, 1948: 65. Holotype male (MONZ), “[WN] Fort Hill Bush, Karori, Wellington, N.Z., 22 Jan. 1947, R. R. Forster. From moss on old log.” (Palma *et al.* 1989). Synonymised provisionally by China 1955: 82; synonymised formally by Woodward 1956: 45.

Description. Adult (Fig. 122). Yellowish to brown; clavus and remigium paler. Body moderately to broadly oval. **Head** (Fig. 50, 122). Proportionally narrow, about 2.9–3.0× as wide as long. Anterior margin weakly to strongly convex. Eyes strongly directed backward; posterior margins forming an almost right angle with posterolateral margins of head. **Thorax** (Fig. 50, 122). Pronotum often transversely wrinkled posteriorly near middle (otherwise smooth); nearly smooth, at most finely punctate posteriorly towards sides; median longitudinal ridge poorly defined. Paranota much narrower anteriorly than posteriorly; lateral margins moderately convex; inner posteroventral portions impunctate (smooth; Fig. 19). Tegmina with vein M+CuA unbranched; basal radial cell often with faint additional veins in apical half of M+CuA (Fig. 122; as opposed to other *Xenophyes* species). **Abdomen**. Male genitalia – Anal tube (Fig. 104) broadly oval, widest in basal quarter, with slightly convex sides. Pygophore (Fig. 98) broad, about 1.2× as long as wide; posterior median tooth short and wide; lateral angles barely projecting outward. Parameres (Fig. 92) moderately long, subacute apically. Aedeagus, in anterior view (Fig. 84), with broad ‘head’, regularly rounded apex and obtusely rounded antero-proximal lobes; in lateral view (Fig. 76), posterior edge of ‘head’ rectilinear, ‘neck’ with numerous long, coarse spines. Female genitalia – Tergite 9 with ventral margin slightly concave in apical third (Fig. 44). Ventral teeth of valvula 1 moderately large. **Measurements** (21 males, 23 females; Burckhardt *et al.* 2011). Body length: 2.48–3.10 (2.86) mm. Head: width 1.03–1.28 (1.18) mm; median length 0.35–0.43 (0.39) mm. Pronotum: width 1.43–1.93 (1.74)

mm; median length 0.40–0.48 (0.44) mm. Tegmina: combined width 1.58–2.05 (1.83) mm.

Other characters and measurements as in Burckhardt *et al.* (2011: 8–10), who also keyed and illustrated the last instar (pp. 7, 16).

Material examined. 533 (213 males, 191 females, 129 nymphs) non-type specimens (BMNH, LUNZ, MHNG, MONZ, NHMB, NZAC, QM, ZMHB, ZMUC).

Geographic distribution. **North Island.** **AK** – Hunua Ranges, Kohukohunui (NZAC). Waitakere Ranges, Fairy Falls (NZAC), track (30 m above falls) (NZAC). **BP** – Kaimai Ranges: Kaimai Road summit (Tauranga) (NZAC); Mount Te Aroha (NZAC). **CL** – Great Barrier Island, Mount Hobson (NZAC). Mount Moehau (NHMB). **ND** – Raetea Forest, Mangamuka Gorge track (East side) (NZAC). Waipoua Forest, Waikohatu Stream (NZAC). **RI** – Ruahine Range: Rangitane Road end, Colenso Trig track (NZAC); Renfrew Road end, Rangiwahia Hut track (NZAC); Triplex [Hut] (NZAC). **TK** – Mount Egmont/Taranaki (NZAC): Curtis Falls track (NZAC); Dawson Falls (BMNH, MONZ, NZAC) (Millrace track (NZAC); Wilkies Pools (NZAC)); Egmont-Pembroke Road (NHMB); North Egmont (MONZ, NZAC); North side (NZAC); Northern slopes (MONZ); Source of Waingongoro River (NZAC); Stratford Mountain House, The Plateau (NZAC); Stratford Plateau Road (NZAC); The Plateau (NZAC); track near Dawson Falls (MONZ). Ohura, 23 miles [= 37 km] West (NZAC). Pouakai Range: near summit (NZAC); Pouakai Hut (NZAC); Saddle (NZAC); The Hump (NZAC). **TO** – Makatote Gorge (MONZ). Pureora Forest Park, Bog Inn Hut track (NZAC). Tongariro National Park: Hauhungatahi, Erua track (NHMB, ZMHB, ZMUC); Mahuia Camp (NZAC); Mangawhero Forest Walk (ZMHB). Ohakune (Bergroth 1924). **WA** – Waewaepa Range (NZAC). Mount Ross (BMNH, MONZ). **WN** – Akatarawa [River] (MONZ). Rimutaka Range: Five Mile Loop track (NHMB, ZMHB, ZMUC); main ridge top (NHMB); Mount Matthews (NHMB); Whakanui summit/track (NZAC, ZMUC). Tararua Range: above Field's Hut [= Field Peak Hut] (MONZ); Dundas Hut/Ridge (NZAC) (Rain Gauge Knob (NZAC); River Forks (NZAC); East side (NZAC); Logan (NZAC); Logan East Basin (NZAC); West slope (NZAC); East Pukemoremore Stream (NZAC); Mount Dundas (NZAC); Mount Field [= Field Peak] Hut (NZAC); Mount Holdsworth (NZAC); Mount Pukemoremore (NZAC); near Field [Peak] Hut (NZAC); North of (below) Field's Hut [= Field Peak Hut] (QM); Otaki Forks (NHMB, ZMHB, ZMUC), Hector track (NZAC). Otaki Gorge [=Forks], Waiotauru track (NZAC). Wellington, Karori, Fort Hill Bush (MONZ). **WO** – Pirongia Mountain,

Wharauroa (NZAC). **South Island.** **BR** – Bullock Creek (ZMUC). Flagstaff Bio. Res. [= Flagstaff Ecological Area] (NZAC). Fletcher Creek: 1.5 km West of Coll Creek, 6 km Southwest of Rotokohu (NZAC). Fletcher Creek Bio. Res. [= Fletcher Creek Ecological Area] (NZAC). Kangaroo Creek, East of Ngahere (NZAC). Maruia Saddle (NZAC). Mawhera State Forest (NZAC). McMahan Creek, Fletcher Creek [Ecological Area] (2 km Southwest of Rotokohu) (NZAC). Mount Harata (NHMB). Nile/Waitakere River Valley (LUNZ, ZMUC). Paparoa Range: Buckland Peaks track (NZAC); Mount Dewar (NZAC). Rahu Saddle (LUNZ, NZAC). Rahu Scenic Reserve: Inangahua [River] Valley near Otto River (MHNG); Rahu Creek (MHNG). Tawhai Forest, [Soldiers-] Big River Road (3 km South of Reefton) (NZAC). **NN** – Kaituna Valley (NZAC). Kaituna [River], Aorere Valley (NZAC). Mount Arthur: Flora Camp (BMNH, MONZ); Flora Saddle (MHNG, MONZ); Flora track (MONZ); Salisbury Opening (MONZ); track (MONZ). Mount Augustus, Granity (NZAC). **SD** – Waitohi Valley, Picton Reservoir (NHMB). **WD** – Canavans Knob (adjacent to) (LUNZ). Dunlop Creek (Highway 6, 2 km South of Pukekura) (NHMB). Fox River (MONZ). Mount Hercules Scenic Reserve (LUNZ). Okuku Forest (10 km East of Kumara) (LUNZ). Punakaiki Scenic Reserve (Porarari River) (LUNZ).

Biology. Lowland to subalpine. Found in broadleaf-podocarp, podocarp, *Nothofagus*, or mixed forests as well as in open subalpine habitats such as grasslands, scrub, fellfields. Collected in moss (adults, nymphs) or moss-hepatics associations from surface roots, live tree trunks and branches or fallen dead rotten branches. For example, found in moss on roots, sedges, and leaf litter on steep slope in broadleaf-podocarp forest (AK, Waitakere Ranges), in moss and hepatics growing on live tree trunks and branches in *Beilschmiedia tarairi*-dominant cloud forest (ND, Mangamuka Gorge), *Nothofagus-Pseudowintera-Fuchsia* dominant forest (RI, Ruahine Range) or *Weinmannia racemosa*-podocarp forest (TK, Mount Egmont/Taranaki), and in moss from fallen dead rotten branches of podocarp (*Elaeocarpus-Podocarpus-Phyllocladus*) swamp forest (TO, Pureora Forest). Also collected in leaf litter, mixed moss (including ground moss) and lichens, mixed moss and mat plants, mixed moss and grass (including *Poa colensoi*), and rotten wood. All life stages have been found in moss or leaf litter. Seasonality: Adults – Throughout the year, mostly December to March; teneral – January (BR), February (RI, WN), March (BR, WA), April (TK), June (BR, WO), mostly January (South Island) and February (North Island); nymphs – October (BR, WN), November (BP, BR, TK), December (BR, TK, WD), January (BR, NN, WD, WN), February (BR, NN),

March (BR, NN, TO, WD), April (NC, TK), May (NN), June (BR, TK), and August (WN), mostly November and April (North Island) and January–March (South Island).

Remarks. Burckhardt *et al.* (2011) could not locate the holotype of *Xenophyes cascus* in New Zealand or overseas institutions.

There is evidence of the co-occurrence of *Xenophyes cascus* and *X. goniomus* in two South Island localities of the Buller region: Mount Dewar (NZAC) in the Paparoa Range and Rahu Creek at Rahu Scenic Reserve (MHNG). Specimens of the two species have been found together in the same sample at Mount Dewar. See also Appendix D (Species co-occurrences).

Burckhardt *et al.* (2011) established that *X. cascus* does not occur on Stewart Island, contrary to previous information (see Burckhardt 2009).

Specimens collected from Milford track near Lake Ada and Tutoko Valley (FD), deposited in ANIC, and reported under *X. cascus* by Burckhardt (2009), probably belong to *X. rhachilophus*.

Xenophyes goniomus Burckhardt, 2011

Figures 37, 45, 51, 77, 85, 93, 99, 105, 123; Map 5.

Xenophyes goniomus Burckhardt in Burckhardt *et al.* 2011: 16. Holotype male (NZAC), [BR] Mt. [=Mount] Dewar, 945 m, Paparoa Ra [=Range], Westland, 10 Dec 1969, J.I. Townsend, moss. Paratypes 30 males, 28 females, 12 nymphs (LUNZ, NHMB, MHNG) from four localities in the Buller (BR) and Mid-Canterbury (MC) areas (see Burckhardt *et al.* 2011).

Description. Adult (Fig. 123). Yellowish; clavus brown contrasting with paler remigium. Body narrowly to moderately oval. **Head** (Fig. 51, 123). Proportionally broad, about 3.2–3.3× as wide as long. Anterior margin weakly convex, slightly indented in middle. Eyes weakly directed backward; posterior margins forming an evenly rounded depression with posterolateral margins of head. **Thorax** (Fig. 51, 123). Pronotum irregularly punctate posteriorly, both near middle and towards sides (less strongly punctate than in *X. kinlochensis*); median longitudinal ridge poorly defined. Paranota somewhat narrower anteriorly than posteriorly; lateral margins weakly convex; inner posteroventral portions punctate. Tegmina with vein M+CuA unbranched (Fig. 37). **Abdomen.** Male genitalia – Anal tube (Fig. 105) broadly oval, widest in basal third, with strongly convex sides. Pygophore (Fig. 99) broad, about 1.2× as long as wide; posterior median tooth long and narrow; lateral angles moderately projecting outward. Parameres long, subacute apically. Aedeagus, in anterior view (Fig. 85), with narrow ‘head’, acutely rounded apex and acutely angled antero-proximal lobes; in lateral view

(Fig. 77) posterior edge of ‘head’ strongly sinuate, ‘neck’ without spines. Female genitalia – Tergite 9 with ventral margin slightly sinuate in apical third (Fig. 45). Ventral teeth of valvula 1 very large (cf. Fig. 6). **Measurements** (20 males, 18 females; Burckhardt *et al.* 2011). Body length: 2.68–3.10 (2.90) mm. Head: width 1.08–1.33 (1.19) mm; median length 0.33–0.40 (0.37) mm. Pronotum: width 1.45–1.88 (1.69) mm; median length 0.35–0.53 (0.45) mm. Tegmina: combined width 1.53–1.95 (1.76) mm.

Other characters and measurements as in Burckhardt *et al.* (2011: 8–9, 16–17), who also keyed and illustrated the last instar (pp. 7, 16).

Material examined. 115 specimens (52 males, 49 females, 14 nymphs), including types (LUNZ, MONZ, MHNG, NHMB, NZAC).

Geographic distribution. South Island. BR – Lewis Pass (NHMB). Paparoa Range: Lochnagar Ridge (NZAC); Mount Dewar (LUNZ, MONZ, NZAC). Rahu Scenic Reserve, Rahu Creek (MHNG). **MC** – Arthur’s Pass (LUNZ, NZAC), Bealey Valley (MHNG). **WD** – Haast Pass (NZAC). Mount Tuhua, East side of Lake Kaniere (NZAC).

Biology. Montane to subalpine. Found in forests (e.g., *Nothofagus solandri*). Collected in moss (all life stages); also in moss-lichen associations or mat plants. Seasonality: November–April (adults); December, April (nymphs).

Remark. See under *X. cascus*.

Xenophyes kinlochensis Evans, 1982

Figures 20, 36, 38, 46, 52, 78, 86, 94, 100, 106, 124; Map 5.

Xenophyes kinlochensis Evans, 1982: 386. Holotype male (NZAC), [OL] Routeburn Valley, Kinloch, S[outh] Is[land], J.W. Evans, 1-57. Allotype female (NZAC), same data as holotype.

Description. Adult (Fig. 124). Yellowish to pale brown; clavus dark brown to almost black, contrasting with paler remigium. Body narrowly to moderately oval. **Head** (Fig. 36, 52, 124). Proportionally broad, about 3.0–3.3× as wide as long. Anterior margin weakly convex, slightly indented in middle. Eyes strongly directed backward; posterior margins forming an almost right angle with posterolateral margins of head. **Thorax** (Fig. 36, 52, 124). Pronotum irregularly punctate posteriorly, both near middle and towards sides (more strongly punctate than in *X. goniomus*); median longitudinal ridge poorly defined. Paranota much narrower anteriorly than posteriorly; lateral margins moderately convex; inner posteroventral portions punctate (Fig. 20). Tegmina with vein M+CuA branched (as opposed to

other *Xenophyes* species; Fig. 38). **Abdomen.** Male genitalia – Anal tube (Fig. 106) irregularly conical, widest in basal third, with edges evenly converging apically. Pygophore (Fig. 100) broad, about 1.2× as long as wide; posterior median tooth long and narrow; lateral angles moderately projecting outward. Parameres (Fig. 94) long, subacute apically. Aedeagus, in anterior view (Fig. 86), with moderately broad ‘head’, blunt subtriangular apex and obtusely rounded antero-proximal lobes; in lateral view (Fig. 78), posterior edge of ‘head’ slightly sinuate, ‘neck’ with a few short, coarse spines. Female genitalia: Tergite 9 with ventral margin strongly concave in apical third (Fig. 46). Ventral teeth of valvula 1 very large (cf Fig. 6). **Measurements** (23 males, 19 females; Burckhardt *et al.* 2011). Body length: 2.80–3.23 (3.02) mm. Head: width 1.18–1.36 (1.26) mm; median length 0.36–0.45 (0.40) mm. Pronotum: width 1.64–1.98 (1.78) mm; median length 0.38–0.52 (0.46) mm. Tegmina: combined width 1.66–2.04 (1.82) mm.

Other characters and measurements as in Burckhardt *et al.* (2011: 8–9, 17), who also keyed and illustrated the last instar (pp. 7, 16).

Material examined. 244 specimens (74 males, 80 females, 90 nymphs), including holotype and allotype (MHNG, MONZ, NHMB, NZAC, ZMHB).

Geographic distribution. **South Island.** **FD** – Hollyford Valley: Lake Marian track (MHNG); near air strip (MHNG). Lake Hauroko (NZAC). Lake Manapouri, West Arm (NZAC). Lake Poteriteri (MONZ). Manapouri (NZAC). Secretary Island (NZAC): Mount Grono (NZAC); ridge towards Mount Grono (NZAC). Te Anau, 56 miles [= 90 km] Northwest (NZAC). Turret Range, Wolfe Flat (NZAC). Upper Hollyford Valley, Lyttles Flat (NZAC). Wilmot Pass (NZAC). **OL** – [Lower] Hollyford Valley: Hidden Falls (NZAC); Lake Howden (NZAC). Key Summit (MHNG, MONZ, NHMB, NZAC, ZMHB). Routeburn Valley, Kinloch (NZAC). **WD** – West Olivine Range: Simonin Pass (NZAC); Tempest Spur (NZAC). Pyke [River] Valley, Head of Lake Alabaster (NZAC).

Biology. Lowland to subalpine. Found in forests (e.g., *Nothofagus* or mixed podocarp–broadleaf) and open subalpine habitats such as grasslands or scrub. Collected in moss (all life stages) from the ground as well as live tree trunks and branches. Adults also taken from moss–lichen associations; leaf litter; mixed leaf litter, moss and ferns; mixed moss and mat plants; mixed moss, mat plants and tussock; mixed moss and ferns. Seasonality: November–March (adults); January–February (teneral); November, December, February, March (nymphs).

Remarks. There is evidence of the co-occurrence of *X. kinlochensis* and *X. rhachilophus* in three Fiordland locali-

ties of the Hollyford Valley — Air strip (MHNG), Lake Marian Track (MHNG, NZAC), and Lyttles Flat (NZAC) — where specimens of the two species have been found in the same samples. See also Appendix D (Species co-occurrences).

Xenophyes metoponcus Burckhardt, 2011

Figures 47, 53, 79, 87, 95, 101, 107, 125; Map 5.

Xenophyes metoponcus Burckhardt in Burckhardt *et al.* 2011: 19. Holotype male (NZAC), WD, Lake Matheson, 105 m, 43°26.622'S, 169°58.111'E, 14.ii.2010, G. Gibbs. Paratypes 14 males, 21 females, 26 nymphs (LUNZ, MHNG, NHMB, NZAC, ZMUC) from same locality as holotype and two other localities in the Westland (WD) area (see Burckhardt *et al.* 2011).

Description. **Adult** (Fig. 125). Brown to dark brown with paler areas on anterior margin of head and humeri, sometimes also along veins basally and in apical two-thirds; clavus and remigium black. Body very broadly oval. **Head** (Fig. 53, 125). Proportionally narrow, about 2.5–2.8× as wide as long (narrower than in other *Xenophyes* species). Anterior margin very strongly convex (more so than in other *Xenophyes* species). Areolae well defined, large (compared to *X. rhachilophus*). Eyes strongly directed backward; posterior margins forming an obtuse angle or evenly rounded depression with posterolateral margins of head. **Thorax** (Fig. 53, 125). Pronotum smooth posteriorly near middle; nearly smooth posteriorly towards sides; median longitudinal ridge well-defined. Paranota somewhat narrower anteriorly than posteriorly; lateral margins moderately convex; inner posteroventral portions impunctate. Tegmina with vein M+CuA unbranched. **Abdomen.** Male genitalia – Anal tube (Fig. 107) irregularly conical, widest in basal quarter, with edges evenly converging apically. Pygophore (Fig. 101) narrow, about 1.3× as long as wide; posterior median tooth short and rather narrow; lateral angles slightly projecting outward. Parameres short, blunt apically (Fig. 95). Aedeagus, in anterior view (Fig. 87), with moderately broad ‘head’, irregularly rounded apex and subquadrate antero-proximal lobes; in lateral view (Fig. 79), posterior edge of ‘head’ subrectilinear, ‘neck’ with numerous long, coarse spines. Female genitalia: Tergite 9 with ventral margin slightly concave near middle (Fig. 47). Ventral teeth of valvula 1 small (cf Fig. 6). **Measurements** (6 males, 6 females; Burckhardt *et al.* 2011). Body length: 2.35–2.55 (2.44) mm. Head: width 0.98–1.03 (1.01) mm; median length 0.35–0.40 (0.38) mm. Pronotum: width 1.45–1.58 (1.50) mm; median length 0.35–0.40 (0.38) mm. Tegmina: combined width 1.55–1.68 (1.61) mm.

Other characters and measurements as in Burckhardt *et al.* (2011: 8–9, 19), who also keyed and illustrated the last instar (pp. 7, 16).

Material examined. 63 specimens (15 males, 22 females, 26 nymphs), including types (LUNZ, MHNG, NHMB, NZAC, ZMUC).

Geographic distribution. South Island. WD – Canavans Knob (LUNZ, NZAC). Fritz Range, Franz Josef (NZAC). Gillespies [Beach] - Cook River Road (LUNZ, NZAC). Lake Matheson (MHNG, NHMB, NZAC, ZMUC).

Biology. Lowland to Montane. Found in forests (e.g., *Nothofagus* or mixed podocarp–broadleaf), in moss; also in *Weinmannia*–tree fern leaf litter. Seasonality: October–February (adults); February (nymphs).

Xenophyes rhachilophus Burckhardt, 2011

Figures 11a, 17, 23, 26, 35, 48, 54, 80, 88, 96, 102, 108, 126, 145; Map 5.

Xenophyes rhachilophus Burckhardt in Burckhardt *et al.* 2011: 19. Holotype male (NZAC), S Is [=South Island], FD, Fiordland N[ational] P[ark], Lake Marian Track, Hollyford Valley, 300 m, 12.II.1992, D. Burckhardt, #46. Paratypes 259 males, 218 females, 1 unsexed adult, 202 nymphs, 3 nymphal skins (BMNH, MHNG, NHMB, NZAC, ZMHB, ZMUC) from same locality as holotype and several other localities in the Fiordland (FD), Otago Lakes (OL), Southland (SL) and Westland (WD) areas (see Burckhardt *et al.* 2011).

Description. Adult (Fig. 126). Pale yellowish to brown; clavus dark brown to almost black, contrasting with paler remigium. Body narrowly to broadly oval. **Head** (Fig. 23, 26, 35, 54, 126). Proportionally broad, about 3.2–3.3× as wide as long. Anterior margin weakly convex. Areolae ill-defined, small (compared to *X. metoponcus*). Eyes strongly directed backward (although slightly less so than in *X. metoponcus*); posterior margins forming an obtuse angle or evenly rounded depression with posterolateral margins of head. **Thorax** (Fig. 35, 54, 126). Pronotum usually smooth, rarely transversely wrinkled, posteriorly near middle; nearly smooth, at most finely punctate posteriorly towards sides; median longitudinal ridge well-defined. Paranota somewhat narrower anteriorly than posteriorly; lateral margins strongly convex; inner posteroventral portions impunctate. Tegmina with vein M+CuA unbranched. **Abdomen.** Male genitalia – Anal tube (Fig. 108) broadly conical, widest in basal quarter, with lateral margins evenly converging apically. Pygophore (Fig. 102) narrow, about 1.3× as long as wide; posterior median tooth short and wide; lateral angles barely projecting outward. Parameres moderately long, subacute apically (Fig. 96). Aedeagus, in anterior view (Fig. 88), with moderately broad ‘head’, acutely rounded apex and obtusely rounded antero-proximal lobes; in lateral view (Fig. 80), posterior edge of ‘head’ strongly sinuate, ‘neck’ with numerous long, coarse spines.

Female genitalia: Tergite 9 with ventral margin slightly sinuate in apical third (Fig. 48). Ventral teeth of valvula 1 moderately large (cf Fig. 6). **Measurements** (21 males, 15 females; Burckhardt *et al.* 2011). Body length: 2.18–2.95 (2.68) mm. Head: width 0.93–1.23 (1.14) mm; median length 0.28–0.38 (0.34) mm. Pronotum: width 1.18–1.75 (1.58) mm; median length 0.33–0.45 (0.41) mm. Tegmina: combined width 1.33–1.83 (1.64) mm.

Other characters and measurements as in Burckhardt *et al.* (2011: 8–9, 19–20), who also keyed and illustrated the last instar (pp. 7, 16).

Material examined. 889 specimens (335 males, 305 females, 249 nymphs), including types (BMNH, LUNZ, MHNG, MONZ, NHMB, NZAC, ZMHB, ZMUC).

Geographic distribution. South Island. FD – Doubtful Sound, Deep Cove (NZAC). Eglinton Valley: Cascade Creek (BMNH); divide (NZAC); South of Cascade Creek (NZAC). Hollyford Valley: Head (BMNH, NZAC); near air strip (MHNG, ZMHB, ZMUC); Deadman’s track 1 (ZMHB); Deadman’s track 2 (ZMHB); Lake Marian track (MHNG, NHMB, NZAC); 7 miles [=11.3 km] into [valley] (NZAC). Lake Hauroko, West side (LUNZ, NZAC). Manapouri (NZAC). Milford Sound (NHMB): Hotel (4 miles [=6.4 km] East (MONZ, NZAC); 9 miles [=14.5 km] East (NZAC); 16 miles [=25.7 km] East (NZAC); 25 km East (NZAC)); Tutoko River/Valley (MHNG, NHMB, ZMHB, ZMUC). Percy Valley (ZMUC). Secretary Island: Grono Bay track (NZAC); Gut Bay (NZAC). Upper Hollyford Valley, Lyttles Flat (NZAC). **OL** – Cameron’s Creek (NHMB). Key Summit track (ZMUC). Kowhai Creek (6 km North of Kinloch) (MHNG). Lake Wakatipu, Paradise (ZMUC). Routeburn Valley (Mount Aspiring National Park) (MHNG). **SL** – Bluff (MONZ). Takitimu Range, Princhester Creek (NHMB, ZMUC). **WD** – Canavans Knob (adjacent to) (LUNZ). Cascade State Forest, Jackson River (LUNZ). Haast Pass (NZAC, ZMUC). Lake Paringa, South end (NZAC). Random Creek (MHNG). Waiho Gorge (BMNH).

Biology. Lowland to montane. Found in forests (e.g., *Nothofagus menziesii*, *N. solandri*, mixed *Nothofagus*–podocarp–broadleaf forests). Collected primarily in ground moss (all life stages). Adults and nymphs also taken from leaf litter, moss–lichen associations, mixed moss and leaf litter, moss–hepatic associations, mixed *Astelia*–litter and decayed wood. Seasonality: October–April (mostly January–February), August (adults); January (teneral); October–December, mostly January–March (nymphs).

Remark. See under *X. adelphus* and *X. kinlochensis*.

Genus *Xenophysella* Evans, 1982

Figures 8, 11b, 18, 22, 24, 39–40, 81–82, 89–90, 109–114, 127–128; Map 6.

Xenophysella Evans, 1982: 386. Type species: *Xenophyes stewartensis* Woodward, 1952: 182, by original designation.

Description. Adult (Fig. 127–128). Body shape narrowly to moderately oval, with head slightly to moderately convex anteriorly; length about 2–3 mm. Brachypterous. **Head** (Fig. 39–40, 127–128) transversely oval; at least 0.8–0.9× as long as pronotum medially; not conspicuously punctate dorsally. Eyes relatively large, petiolate, directed laterally. Anterior margin weakly convex (never distinctly concave or V-shaped as in *Oiophysa*). Posterior margin weakly concave or sinuate between ‘neck’ and eyes (Fig. 24). Antennal segment 3 (Fig. 18) longer than in *Oiophysa* and *Xenophyes* (about 1.7× the length of segments 1 and 2 combined), narrowly fusiform. **Thorax** (Fig. 39–40, 127–128). Pronotum with anterior margin almost straight or weakly concave, more or less distinct longitudinal ridge, and almost straight posterior margin. Paranota slightly rounded or subquadrate, with barely convex lateral margins and acutely rounded to almost quadrate posterolateral angles; anterolateral angles very slightly if at all produced anteriorly, reaching hind margin of eyes; inner posteroventral portions impunctate (smooth). Scutellum medium-sized, flat, triangular with lateral processes, blunt apically. Tegmina (Fig. 8, 127–128) structurally similar in both sexes. Veins distinctly raised, with punctures restricted to clavus and a few adjacent veins (Fig. 8). Costal vein (vein C) moderately rounded basally, hence humerus rounded. Vein MP ending on vein C (ScP not apically fused with vein MP, the two veins reaching vein C separately) (as in *Xenophyes*, cf. Fig. 10). Veins C and ScP fused (Fig. 22) in apical three-quarters, forming a wide flattened margin. Costal cells small or ill-defined. Subcostal cell long, wide. Claval cell narrow and long, extending beyond scutellum by about two-thirds of its length or slightly less. Apical radial cell touching costal margin (not separated from it by costal cells). **Abdomen**. Ventral outline, except for genitalia, convex, almost circular. Posterolateral angles of tergite 8 (Fig. 11b) weakly produced (as opposed to *Xenophyes*). Male genitalia: anal tube (Fig. 111, 114) irregularly quadrate or oval; pygophore (Fig. 110, 113), in ventral view, bearing relatively flattened lateral angles; parameres (Fig. 109, 112) elongate, rounded or truncate apically, with small dorsobasal lobe; aedeagus (Fig. 81–82, 89–90), in lateral view, fusiform, with two simple lateral membranous wing-like processes near middle. Female genitalia: Tergite 9 with inner margin rounded, in dorsal view; valvula 1 with subrectilinear row of teeth.

Other characters as in Burckhardt (2009: 224–225), who also keyed and illustrated the last instar (pp. 184, 187).

Key to species of *Xenophysella*

- 1 Pronotum (Fig. 39) almost smooth posteriorly (not distinctly punctate); anterolateral angles of paranota broadly rounded. Tegmina with costal cells normally developed (Fig. 127). Parameres (Fig. 109) distinctly curved, broadly rounded apically. Aedeagus (Fig. 81, 89) with broad, irregularly rounded dorsolateral wing-like processes in apical half. Female tergite 9 blunt apically (p. 31) ... ***greensladeae*** Burckhardt [Body length larger on average (2.67 mm), ranging from 2.48 to 3.00 mm. Pronotum width larger on average (1.44 mm), ranging from 1.30 to 1.63 mm. South Island.]
 - Pronotum (Fig. 40) distinctly punctate posteriorly; anterolateral angles of paranota more narrowly rounded than above. Tegmina with costal cells smaller or ill-defined in apical two-thirds (Fig. 22, 128). Parameres (Fig. 112) nearly straight, obliquely truncate apically. Aedeagus (Fig. 82, 90) with narrow, acuminate dorsolateral wing-like processes in apical half. Female tergite 9 acute apically ... (p. 32) ... ***stewartensis*** (Woodward) [Body length smaller on average (2.51 mm), ranging from 2.34 to 2.63 mm. Pronotum width smaller on average (1.39 mm), ranging from 1.27 to 1.46 mm. Stewart Island.]

Xenophysella greensladeae Burckhardt, 2009

Figures 8, 39, 81, 89, 109–111, 127; Map 6.

Xenophysella greensladeae Burckhardt, 2009: 225. Holotype male (NZAC), [FD], New Zealand: S[outh] Is. [=Island], Fjordland [Fiordland] N[ational] P[ark], Tutoko [=Tutoko] Valley, 1 km fr. [= from], 15 Feb 1987, P. Greenslade, moss/rainforest. Paratypes 1 male and 4 females (ANIC), same data as holotype.

Description. Adult (Fig. 127). Pale greyish yellow. Eyes reddish to brown. Body more broadly oval. **Thorax** (Fig. 39, 127). Pronotum almost smooth posteriorly (not distinctly punctate as in *Xenophysella stewartensis*). Anterolateral angles of paranota broadly rounded. Tegmina with costal cells normally developed. **Abdomen**. Male genitalia: Anal tube (Fig. 111) broadly oval, widest near middle. Pygophore (Fig. 110) with broad triangular apical process. Parameres (Fig. 109) distinctly curved, broadly rounded apically; dorsobasal lobe prominent. Aedeagus (Fig. 81, 89) with broad, irregularly rounded dorsolateral wing-like processes in apical half. Female genitalia: Tergite 9 blunt apically. **Measurements** (4 males, 4 females). Body length: 2.48–3.00 (2.67) mm. Head: width 1.07–1.26 (1.15) mm; median length 0.26–0.38 (0.31) mm. Pronotum: width 1.30–1.63 (1.44) mm; median length 0.36–0.43 (0.39) mm. Tegmina: combined width 1.41–1.78 (1.58) mm.

Other characters and measurements as in Burckhardt (2009: 225), who also keyed and illustrated the last instar (pp. 184, 187).

Material examined. 24 specimens (13 males, 9 females, 2 nymphs) including type series (ANIC, LUNZ, MHNG, NHMB, NZAC).

Geographic distribution. South Island. BR – Paparua Range: East of Mount Dewar (NZAC); Mount Dewar (NZAC). **FD** – Milford Sound, Tutoko River (MHNG, NHMB). Secretary Island, Grono Spur (NHMB); Gut Bay (NZAC). Tutoko Valley (1 km from road) (ANIC, NZAC). **OL** – Key Summit (MHNG). **WD** – Lake Mapourika (NZAC). Mount Hercules Scenic Reserve (LUNZ).

Biology. Lowland to subalpine. Found in podocarp, *Nothofagus*, mixed forests, subalpine scrub. Collected in moss (all life stages); also in leaf litter and moss (adults). Seasonality: November–December, February (adults); February (nymphs).

Remarks. The specimens from ANIC, MHNG, and NHMB were examined by Burckhardt (2009). *Xenophysella greensladeae* is here recorded from Buller (BR) and Westland (WD) for the first time. See also Appendix D (Species co-occurrences).

Xenophysella stewartensis (Woodward, 1952)

Figures 18, 22, 24, 40, 82, 90, 112–114, 128, 145; Map 6.

Xenophyes stewartensis Woodward, 1952: 182. Holotype male (CMNZ), [SI] Ulva [Island], Stewart I[sland], New Zealand, (leafmould), G. Knox, 12.I.1951.

Xenophysella stewartensis: Evans, 1982: 388.

Xenophysella dugdalei Evans, 1982: 389. Holotype male (NZAC), New Zealand, SI, N[orth] Peak, 182 m, 19 Nov 1968, J.S. Dugdale, *Astelia* Litter 68/187. Paratype female (NZAC), same data as holotype. Synonymised by Burckhardt 2009: 225.

Xenophysella pegasusensis Evans, 1982: 389. Holotype female (NZAC, could not be located), “New Zealand, [SI] Stewart Island, Twilight Bay, Port Pegasus, II-45 [sic], G. Kuschel” (Evans 1982). Paratype female (NZAC), [SI], Twilight Bay, Port Pegasus, 22.ii.68, G. Kuschel., Stewart I[sland] Exp.[= Expedition] Feb. 1968. Synonymised by Burckhardt 2009: 225.

Description. Adult (Fig. 128). Pale greyish brown. Eyes reddish or brownish. Body more narrowly oval than in *X. greensladeae*. **Thorax** (Fig. 40, 128). Pronotum distinctly punctate posteriorly. Anterolateral angles of paranota more narrowly rounded than in *X. greensladeae*. Tegmina with costal cells small or ill-defined in apical two-thirds (Fig. 8, 22). **Abdomen.** Male genitalia: Anal tube (Fig. 114) narrowly oval, widest in basal third. Pygophore (Fig. 113) with narrow triangular apical process. Parameres (Fig. 112) nearly straight, obliquely truncate apically; dorsobasal lobe

less prominent than in *X. greensladeae*. Aedeagus (Fig. 82, 90) with narrow, acuminate dorsolateral wing-like processes in apical half. Female genitalia: Tergite 9 acute apically. **Measurements** (5 males, 4 females). Body length: 2.34–2.63 (2.51) mm. Head: width 1.06–1.16 (1.12) mm; median length 0.28–0.33 (0.31) mm. Pronotum: width 1.27–1.46 (1.39) mm; median length 0.36–0.39 (0.38) mm. Tegmina: combined width 1.29–1.54 (1.46) mm.

Other characters and measurements as in Burckhardt (2009: 225), who also keyed and illustrated the last instar (pp. 184, 187).

Material examined. 107 specimens (44 males, 20 females, 43 nymphs), including holotype of *Xenophysella stewartensis*, paratype of *Xenophysella pegasusensis*, and holotype of *Xenophysella dugdalei* (BMNH, CMNZ, MHNG, NHMB, NZAC).

Geographic distribution. Stewart Island. SI – Big South Cape Island: North East (NZAC); North Peak (NZAC). Codfish Island, Summit track (NZAC). Stewart Island: Fern Gully (MHNG); Horseshoe Bay (MHNG); Oban, Raroa track (MHNG, NHMB); Ocean Beach (MHNG); Port Pegasus (Smiths Lookout (NZAC); Twilight Bay (NZAC)); Ulva Island (BMNH, CMNZ), near Sydney Cove (MHNG, NHMB).

Biology. Lowland. Found in podocarp–broadleaf forests. Collected in moss, also in moss mixed with lichens (all live stages), and sometimes in leaf litter (adults), e.g., at base of *Astelia*. Seasonality: November, January–February (adults); November, February (nymphs).

Remarks. The female holotype of *Xenophysella pegasusensis* could not be located either in NZAC (previously DSIR, Auckland) or in the collection of the Agricultural Scientific Collection Unit (Orange Agricultural Institute, NSW, Australia) where most of J. W. Evans’s collection has been deposited. Original primary types designated by Evans, however, were also sent to public collections, e.g. Australian Museum, South Australian Museum, and possibly other collections (M. J. Fletcher, personal communication). Furthermore, the published collecting date of II-45 for the holotype is incorrect. The collector, G. Kuschel, was still living in South America in 1945 and did not arrive in New Zealand before 1961. The Stewart Island expedition of the DSIR occurred in February 1968. It is obvious from paratypical data that this is the correct collecting event for the holotype.

The specimens from BMNH, MHNG, and NHMB were examined by Burckhardt (2009). This species is recorded for the first time from Big South Cape Island and the Codfish Island neighbouring Stewart Island (Rakiura).

The Ocean Beach specimens (MHNG) were sampled together with the type series of *Oiophysa paradoxa* (see also “Remarks” under that species and Appendix D, Species co-occurrences).

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Appendix A. Glossary.

acute — sharp or pointed apically, with margins forming an angle of less than 90 degrees.

aedeagus — the slender intromittent structure of the male genitalia used for sperm transfer, analogous to the mammalian penis.

anal tube — the tenth abdominal segment forming a tubular projection distal to the pygophore.

angular — forming an angle.

anterolateral — situated anteriorly and to the side.

anterolateral angles (of paranota) — the angles situated at the front of and on the side of each paranotum.

apex — the end or extremity of a structure or organ.

apical — related to the apex.

apical radial cell — the cell located apically on the wing and anteriorly margined by the Radius (R or radial vein) or its first branch.

areola (plural areolae) — a small cell or closed area, e.g. on the forewing (tegmen).

areolate — with a network of closed cells or areolae.

basal — related to the base.

basal radial cell — the cell located basally on the wing and anteriorly margined by M+CuA (the fused Media and anterior cubital vein).

base — the beginning or point of attachment of a structure or organ.

blunt — having a dull edge, neither sharp nor acute apically.

C, see Costa.

cell (of wing) — open or closed area of wing between or bounded by veins.

claval cell — the cell located basally on the forewing (tegmen), immediately anterior to the clavus.

clavate — clubbed, thickened gradually toward the tip, e.g. the antennae of Peloridiidae.

clavus — the long pointed anal area of the forewing (tegmen), that part next to the scutellum when the wing is folded.

concavity — a hollowed or depressed surface or structure.

coriaceous — thick and tough, leather-like.

Costa, costal vein (C) — the first longitudinal vein of the wing, extending along its anterior

margin (costal margin) and ending before the apex; it is unbranched.

costal cells — any wing cells anteriorly margined by the Costa (vein C).

costal margin — the anterior, often thickened, margin of the wing; in Peloridiidae, the outer margin of the forewing (tegmen).

Cu, see cubital vein.

Cubitus or cubital vein (Cu) — the fifth longitudinal vein of the wing immediately posterior to the Media (M); it may be branched, e.g., into an anterior cubital vein (CuA) and a posterior cubital vein (CuP).

dilatation — widening, enlargement.

dorsobasal — situated dorsally towards the base of a structure.

dorsolateral — situated dorsally towards the side of a structure.

fellfield — open rocky environment above the tree-line or in the freeze-thaw zone, with scattered dwarf plants or grass.

fusiform — shaped like a spindle.

genitalia — the modified genital segments of the abdomen and associated structures involved in copulation, fertilisation and oviposition.

gula — the 'throat' or sclerite laterally bounded by the genae ('cheeks') and forming the median part of the head beneath (fusion of the maxillary plates); absent in Peloridiidae.

humerus (plural humeri) — the basal exterior angle of the forewing (tegmen).

hypognathous (mouthparts) — directed downward from the vertically oriented head of the insect.

impunctate — not marked with punctures or points, not punctate; smooth.

inner — situated on the inside or close to the centre.

laminar — compressed into a thin plate or sheet.

lobe — rounded process or outgrowth on the surface or along the margin of a structure.

M, see Media.

Media or medial vein (M) — the fourth longitudinal vein of the wing, usually divided into two major branches the anterior medial vein or Media Anterior (MA) and the posterior medial vein or Media Posterior (MP), themselves often subdivided.

medially — situated toward the middle or midline of a structure.

MP, see Media.

'neck' (of head) — the narrowed part situated behind the eyes and connecting the head to the thorax.

notch — a shallow and narrow V-shaped indentation.

obtuse — blunt or not pointed apically or with margins forming an angle of more than 90 degrees.

ocellus (plural ocelli) — the 'simple' eye positioned on the top of the head between the compound eyes; absent in Peloriidae.

outer — situated on the outside or far from the centre.

ovate — shaped like an egg.

ovipositor — egg-laying apparatus of the female.

parameres — paired lateral processes attached to the base of the aedeagus.

paranotum (plural paranota) — lateral expansion of the pronotum.

petiolate — stalked; placed upon a stalk.

posterolateral — situated posteriorly and to the side.

posteroventral — situated posteriorly on the ventral surface (or underside).

process — a projection from a surface, margin, or structure.

produced — prolonged.

pronotum — dorsal surface of the prothorax.

punctate — marked with punctures or points.

puncture — microscopic pit similar to that made by a needle.

pygophore — the strongly sclerotised ninth abdominal segment, appearing as a double-sided box more or less open dorsally and posteriorly, containing the male genitalia.

quadrate — square or nearly so.

Radial sector or Radius sector (RS) — the most posterior of the two primary divisions of the Radius or radial vein.

Radial vein 1 or Radius 1 (R1) — the most anterior of the two primary divisions of the Radius or radial vein.

Radius or radial vein (R) — the third longitudinal vein of the wing, behind the Costa (C) and Subcosta (Sc), with branches usually covering a large area of wing apex.

rectilinear — shaped like a straight line.

remigium (of tegmen) — the anterior or basal part of the tegmen that includes most of the large wing veins (e.g., Costa, Subcosta, Radius, Media, Cubitus).

ScA, see Subcosta Anterior.

ScP, see Subcosta Posterior.

scutellum — dorsal, more or less triangular part of the mesothorax, usually visible between the bases of the forewings (tegmina).

serrulate — armed with small teeth.

sinuate — wavy.

spiracle(s) — external opening of the respiratory system in the body wall; paired lateral 'holes' located ventrally in Peloriidae.

sub- (as a prefix) — rather, almost.

Subcosta Anterior or anterior subcostal vein (ScA) — the anterior branch of the second longitudinal vein of the wing (Sc or Subcosta), immediately behind the Costa (C).

Subcosta Posterior or posterior subcostal vein (ScP) — the posterior branch of the second longitudinal vein of the wing (Sc or Subcosta), immediately behind the Costa (C).

subcostal cell — cell located in the basal half of the wing, anteriorly margined by the Subcosta (Sc) or its posterior branch (ScP or Subcosta Posterior).

tarsus (plural tarsi) — the insect 'foot'; an appendage attached to the end of each tibia, divided into two segments in Peloriidae.

tegmen (plural tegmina) — the thickened leathery forewing of Peloriidae.

tergite 8 — the upper or dorsal surface of the eighth abdominal segment, consisting of a single sclerite or sclerotised (hardened) plate.

tergite 9 (of female) — the upper or dorsal surface of the ninth abdominal segment, consisting of a single sclerite or sclerotised (hardened) plate extending ventrally so that its lateral margins almost touch and partially covering the ovipositor.

transversely — in a crosswise direction.

truncate — cut off rather squarely or obliquely at the tip.

valvula 1 (plural valvulae 1) — one of a pair of sclerotised appendages (gonapophyses) of the eighth abdominal segment of the female, forming the anterior or ventral blades of the ovipositor.

Appendix B. Geographical coordinates of main localities. Coordinates should read as 00°00'S / 000°00'E. The two-letter area codes follow Crosby *et al.* (1976, 1998).

Akatarawa River, WN	4106/17506	Gertrude Cirque, FD	4445/16801
Arthur's Pass, MC	4255/17134	Gilbert Islands, Breaksea Sound, FD	4535/16640
Bald Hill, Longwood Range, SL	4610/16750	Gillespies Beach-Cook River Road, WD	4315/16953
Balls Clearing Scenic Reserve, Puketitiri, HB	3916/17629	Granity, Mount Augustus, NN	4140/17151
Bauza Island, FD	4517/16654	Grono Bay, Secretary Island, FD	4517/16656
Big South Cape Island, North Peak/North		Grono Spur, Secretary Island, FD	4515/16657
East, SI	4713/16725	Gut Bay, Secretary Island, FD	4517/16657
Bluff, SL	4636/16820	Haast Pass, WD	4406/16920
Bog Inn Hut track, Pureora Forest Park, TO	3835/17538	Harwoods Hole, NN	4056/17252
Breaksea Island, Breaksea Sound, FD	4534/16638	Hauhungatahi, Erua track, TO	3913/17525
Buckland Peaks, Paparoa Range, BR	4153/17138	Hidden Falls, Hollyford Valley, OL	4437/16807
Bullock Creek, BR	4206/17120	Hollyford Valley, FD	4432/16806
Cameron's Creek, OL	4409/16918	Hollyford Valley, East Side, OL	4446/16810
Canaan, NN	4058/17251	Hollyford Valley, near air strip, FD	4444/16808
Canavans Knob, WD	4323/17010	Horseshoe Bay, SI	4652/16807
Cascade Creek, Eglinton Valley, FD	4453/16805	Huiarau Summit, GB	3837/17701
Cascade State Forest, Jackson River, WD	4407/16833	Hunua Ranges, Kohukohunui, AK	3731/17513
Caswell Sound, FD	4502/16718	Inangahua River Valley, BR	4214/17157
Cobb Ridge, NN	4103/17230	Kaimai Range (Tauranga), BP	3748/17559
Codfish Island, Summit track, SI	4646/16737	Kaimai Range Road summit, BP	3752/17556
Colenso Trig, Ruahine Range, RI	3945/17602	Kaituna River, Aorere Valley, NN	4042/17234
Coll Creek, BR	4200/17149	Kangaroo Creek, BR	4225/17130
Curtis Falls, Mount Egmont/Taranaki, TK	3917/17406	Karori, WN	4117/17445
Dawson Falls, Mount Egmont/Taranaki, TK	3919/17406	Key Summit, OL	4448/16807
Deadman's Track, FD	4444/16808	Kinloch, OL	4451/16821
Deep Cove, Doubtful Sound, FD	4527/16709	Kowhai Creek, OL	4447/16819
Disappointment Cove, Resolution Island, FD	4536/16640	Lake Ada, FD	4442/16751
Dundas Hut/Ridge, Tararua Range, WN	4042/17527	Lake Hauroko, FD	4556/16716
Dunlop Creek, WD	4301/17039	Lake Howden, OL	4449/16808
Eglinton Valley divide, FD	4503/16800	Lake Manapouri, West Arm, FD	4531/16736
Erua, TO	3913/17523	Lake Mapourika, WD	4319/17012
Fairy Falls, Waitakere Ranges, AK	3654/17433	Lake Marian, FD	4448/16804
Ferguson Scenic Reserve, WD	4257/17044	Lake Matheson, WD	4326/16958
Fern Gully, SI	4653/16805	Lake Paringa, WD	4343/16924
Field Peak, Tararua Range, WN	4057/17517	Lake Poteriteri, FD	4606/16705
Five Mile Loop track, Rimutaka Range, WN	4120/17455	Lake Te Au, FD	4515/16723
Flagstaff Ecological Area, BR	4228/17144	Leslie Valley track, NN	4113/17232
Fletcher Creek, BR	4158/17151	Lewis Pass, BR	4223/17224
Fletcher Creek Ecological Area, BR	4159/17147	Little Moehau, CL	3632/17522
Flora Camp, Mount Arthur, NN	4110/17243	Lochnagar Ridge, Paparoa Range, BR	4206/17133
Flora Saddle, Mount Arthur, NN	4111/17244	Logan East Basin, Tararua Range, WN	4043/17527
Flora track, Mount Arthur, NN	4111/17244	Lyttles Flat, Upper Hollyford Valley, FD	4448/16801
Fox River, WD	4328/17000	Mahoenui, Gribbon Road, WO	3834/17450
Franz Josef, WD	4323/17010	Mahuia Camp, Tongariro National Park, TO	3910/17527
		Maitai River (Upper), NN	4116/17319
		Makatote Gorge, TO	3916/17521
		Manapouri, FD	4533/16736
		Mangamuka Gorge, Raetia Forest, ND	3510/17327
		Mangawhero Forest Walk, TO	3924/17525
		Maruia Saddle, BR	4202/17217

Maumaupaki/Camel's Back, CL	3658/17534	Potholes, Mount Arthur, NN	4113/17240
Mawhera State Forest, BR	4229/17130	Pouakai Hut, Pouakai Range, TK	3914/17402
McKenzie Burn, Murchison Mountains, FD ..	4516/16725	Pouakai Range, TK	3914/17400
McMahon Creek, BR	4200/17147	Princhester Creek, Takitimu Range, SL	4533/16756
Milford Sound, FD	4440/16755	Pudding Hill Stream, MC	4333/17130
Mount Arthur, NN	4113/17240	Pukemoremore (Mount/Stream), Tararua	
Mount Arthur, Salisbury Opening, NN	4111/17239	Range, WN	4042/17528
Mount Arthur, Tableland, NN	4110/17237	Punakaiki Scenic Reserve (Porarari River),	
Mount Dewar, Paparoa Range, BR	4204/17132	WD	4206/17121
Mount Dewar, Paparoa Range, BR	4204/17133	Pyke River Valley (Head of Lake Alabaster),	
Mount Domett, NN	4103/17218	WD	4429/16810
Mount Dundas, Tararua Range, WN	4043/17526		
Mount Egmont/Taranaki, TK	3917/17403	Rahu Creek, Rahu Scenic Reserve, BR	4217/17203
Mount Egmont/Taranaki, Egmont-Pembroke		Rahu Saddle, BR	4218/17206
Road, TK	3919/17408	Random Creek, WD	4343/16924
Mount Egmont/Taranaki, North Egmont/		Rangiwahia Hut, Ruahine Range, RI	3953/17559
North Side, TK	3914/17406	Raurimu, TO	3907/17523
Mount Egmont/Taranaki, Stratford Plateau		Rimutaka Range, WN	4123/17457
Road, TK	3918/17407	Rotokohu, BR	4158/17154
Mount Egmont/Taranaki, The Plateau, TK	3918/17405	Routeburn Valley (Kinloch), OL	4443/16818
Mount Grey, Turret Range, FD	4533/16714		
Mount Grono, Secretary Island, FD	4515/16657	Secretary Island, FD	4513/16655
Mount Harata, BR	4222/17155	Simonin Pass, West Olivine Range, WD	4420/16822
Mount Hercules Scenic Reserve, WD	4310/17027	Smiths Lookout, Port Pegasus, SI	4714/16731
Mount Hobson, Great Barrier Island, CL	3611/17524	Soldiers-Big River Road, Tawhai Forest, BR	4209/17152
Mount Holdsworth, Tararua Range, WN	4052/17525	Spiral Scenic Reserve, TO	3907/17524
Mount Hutt, MC	4328/17131		
Mount Matthews, Rimutaka Range, WN	4121/17500	Takaka Hill, NN	4102/17251
Mount Moehau, CL	3633/17524	Tauranga-Matamata Road saddle, Kaimai	
Mount Rakeahua, SI	4656/16752	Range, BP	3751/17556
Mount Ross, WA	4127/17520	Te Anau, FD	4531/16739
Mount Te Aroha, Kaimai Range, BP	3732/17544	Tempest Spur, West Olivine Range, WD	4422/16824
Mount Tuhua, WD	4249/17111	The Hump, Pouakai Range, TK	3914/17402
		Triplex Hut, Ruahine Range, RI	3947/17611
Ngahere, BR	4224/17127	Tutoko River/Valley, FD	4439/16758
Nile/Waitakere River Valley, BR	4200/17130	Twilight Bay, Port Pegasus, SI	4709/16741
Oban, SI	4654/16807	Ulva Island, SI	4654/16808
Ocean Beach, SI	4658/16810		
Ohakune, TO	3924/17524	Waewaepa Range, WA	4026/17604
Ohura, TK	3850/17459	Waiho Gorge, WD	4324/17006
Okuku Forest (East of Kumara), WD	4242/17113	Waikohatu Stream, Waipoua Forest, ND	3539/17333
"Otago", CO/OL	4530/17000	Waingongoro River, Mount Egmont/Taranaki,	
Otaki Forks/Gorge, Tararua Range,		TK	3918/17405
WN	4052/17513	West Pyke River, WD	4419/16811
Otira, WD	4249/17133	Whakanui summit/track, Rimutaka Range,	
Otira, Barrack Creek, WD	4251/17133	WN	4116/17458
		Wilkie Pools, Mount Egmont/Taranaki, TK ...	3919/17406
Paki-iti Farm (North East Ohingaiti), RI	3952/17549	Wilmot Pass, FD	4530/16711
Paradise, Lake Whakatipu, OL	4444/16822	Wolfe Flat, Turret Range, FD	4531/16719
Passage Islands, Dusky Sound, FD	4546/16635	Woods Mill track, Kaimai-Mamaku	
Pelorus Bridge, MB	4117/17334	Conservation Park, BP	3800/17553
Picton Reservoir, Waitohi Valley, SD	4118/17400		
Pirongia Mountain, Wharaurua, WO	3759/17507		
Pohokura, TO	3858/17632		

Appendix C. Native plants mentioned in this publication.

Scientific name	Common name	Family name
<i>Astelia</i>	astelia	Liliaceae
<i>Beilschmiedia tarairi</i>	taraire	Lauraceae
<i>Beilschmiedia tawa</i>	tawa	Lauraceae
<i>Chionochloa</i>	snow grass, snow tussock	Poaceae
<i>Elaeocarpus</i>	–	Elaeocarpaceae
<i>Fuchsia</i>	fuchsia	Onagraceae
<i>Nothofagus</i>	beech	Nothofagaceae
<i>Nothofagus fusca</i>	hutu, red beech	Nothofagaceae
<i>Nothofagus menziesii</i>	tawai, silver beech	Nothofagaceae
<i>Nothofagus solandri</i>	tawai rauriki, mountain beech or black beech	Nothofagaceae
<i>Olearia</i>	akeake, tree daisy	Asteraceae
<i>Olearia colensoi</i>	tupare	Asteraceae
<i>Phyllocladus [trichomanoides]</i>	tanekaha, celery pine	Phyllocladaceae
<i>Poa colensoi</i>	blue tussock	Poaceae
<i>Podocarpus</i>	–	Podocarpaceae
<i>Polystichum vestitum</i>	puniu, prickly shield fern	Dryopteridaceae
<i>Pseudowintera</i>	–	Winteraceae
<i>Pseudowintera colorata</i>	horopito	Winteraceae
<i>Weinmannia</i>	–	Cunoniaceae
<i>Weinmannia racemosa</i>	kamahi	Cunoniaceae
<i>Weymouthia</i>	'hanging moss'	Meteoriaceae

Appendix D. Species co-occurrences at locality or microhabitat levels as suggested by specimen labels.

Locality level co-occurrences

Species	Label data	Repository
<i>Oiophysa ablusa</i> , <i>O. pendergrasti</i>	NN, Upper Maitai River	NZAC
<i>O. ablusa</i> , <i>Xenophyes cascus</i>	NN, Mt Arthur	BMNH, MONZ
<i>O. cumberi</i> , <i>O. pendergrasti</i> , <i>X. cascus</i>	RI, Ruahine Ra, Triplex Hut	NZAC
<i>O. cumberi</i> , <i>X. cascus</i>	AK, Waitakere Ranges, Fairy Falls	NZAC
	BP, Kaimai Ranges, Mount Te Aroha	NZAC
	TK, Mount Egmont/Taranaki, Stratford Plateau Road	NZAC
	TO, Tongariro National Park, Hauhungatahi, Erua track	NHMB
	SD, Waitohi Valley, Picton Reservoir WN, Tararua Range, Otaki Forks	NHMB NHMB
<i>O. distincta</i> , <i>X. adelphus</i>	SL, Longwood Range, Bald Hill	NZAC
<i>O. distincta</i> , <i>X. cascus</i> , <i>Xenophysella greensladeae</i>	WD, Mount Hercules Scenic Reserve	LUNZ
<i>O. distincta</i> , <i>X. kinlochensis</i>	FD, Turret Range, Wolfe Flat	NZAC
<i>O. distincta</i> , <i>X. kinlochensis</i>	FD, Wilmot Pass	NZAC
	OL, Hollyford Valley, Hidden Falls	NZAC
	WD, Pyke River Valley, Head of Lake Alabaster	NZAC
<i>X. rhachilophus</i> , <i>X. kinlochensis</i>	FD, Manapouri	NZAC
	OL, Key Summit	NZAC, ZMHB
<i>X. rhachilophus</i> , <i>Xenophysella greensladeae</i>	FD, Tutoko Valley	NZAC, ZMHB

Microhabitat-level co-occurrences

Species

Label data and repository

<i>Oiophysa cumberi</i> , <i>O. pendergrasti</i>	RI, Ruahine Ra, Triplex Hut, 10 Feb 1980, C.F. Butcher, moss 80/15, NZAC NN, Takaka Hill, 2500', 7.5.57, E.S. Gourlay, NZAC NN, Takaka Hill, Canaan, 2800', 28.xi.1964, G. Kuschel, beech forest, moss, AMSA & NZAC
<i>O. cumberi</i> , <i>Xenophyes cascus</i>	RI, Ruahine Range, Renfrew Road end, Rangiwahia Hut track, 1000 m, 28.ii.1994, Larivière, Larochelle, moss and hepatics from branches and trunks, horopito-fuchsia-red beech forest, NZAC
<i>O. distincta</i> , <i>X. cascus</i>	WD, Mount Hercules Scenic Reserve, 150m, 6.xii.1982, J.W. Early, moss by stream in forest LCNZ [=LUNZ] 82/25, LUNZ
<i>O. distincta</i> , <i>X. rhachilophus</i>	FD, Head of Hollyford Valley, 24.x.66, F.D. Alack, moss & lichens, NZAC WD, Cascade State Forest, Jackson, River, 30m, 12.iv.1982, J.W. Early, Litter from forest floor LCNZ [=LUNZ] 82/13, LUNZ
<i>O. distincta</i> , <i>X. rhachilophus</i> , <i>Xenophysella greensladeae</i>	FD, Secretary Island, Gut Bay, 25 Nov 1981, C.F. Butcher, sifted litter and mosses 81/181, NZAC
<i>O. distincta</i> , <i>X. kinlochensis</i> , <i>X. rhachilophus</i>	FD, Hollyford Valley, near air strip, 100m, 12.ii.1992, D. Burckhardt, #47a, MHNG
<i>O. paradoxa</i> , <i>Xenophysella stewartensis</i>	SI, Stewart Island, Ocean Beach, 50 m, 7.ii.1992, D. Burckhardt, #38, podocarp-hardwood forest, MHNG
<i>X. adelphus</i> , <i>X. rhachilophus</i>	FD, West Side, Lake Hauroko, 12.xi.66, F.D. Alack, moss from wet bank, NZAC
<i>X. cascus</i> , <i>X. goniomus</i>	BR, Rahu Scenic Reserve, Rahu Creek, 700m, 18.ii.1992, D. Burckhardt, #55, MHNG
<i>X. cascus</i> , <i>X. goniomus</i> , <i>Xenophysella greensladeae</i>	BR, Paparoa Range, Mount Dewar, 945m, Dec 1969, J.I. Townsend, moss, NZAC
<i>X. kinlochensis</i> , <i>X. rhachilophus</i>	FD, Air strip, Hollyford Valley, 100m, 12.ii.1992, D. Burckhardt, #47a, MHNG FD, Lake Marian Track, Hollyford Valley, 300m, 12.ii.1992, D. Burckhardt, #46, MHNG FD, Lyttles Flat, Upper Hollyford Valley, 13 Feb 1982, C.F. Butcher, sifted litter 82/28, NZAC
<i>X. kinlochensis</i> , <i>Xenophysella greensladeae</i>	OL, Key Summit, 950m, 11.ii.1992, D. Burckhardt, subalpine scrub #44a, MHNG
<i>X. rhachilophus</i> , <i>Xenophysella greensladeae</i>	FD, Milford Sound, Tutoko River, 50 m, 11.ii.1992, D. Burckhardt, #45, MHNG

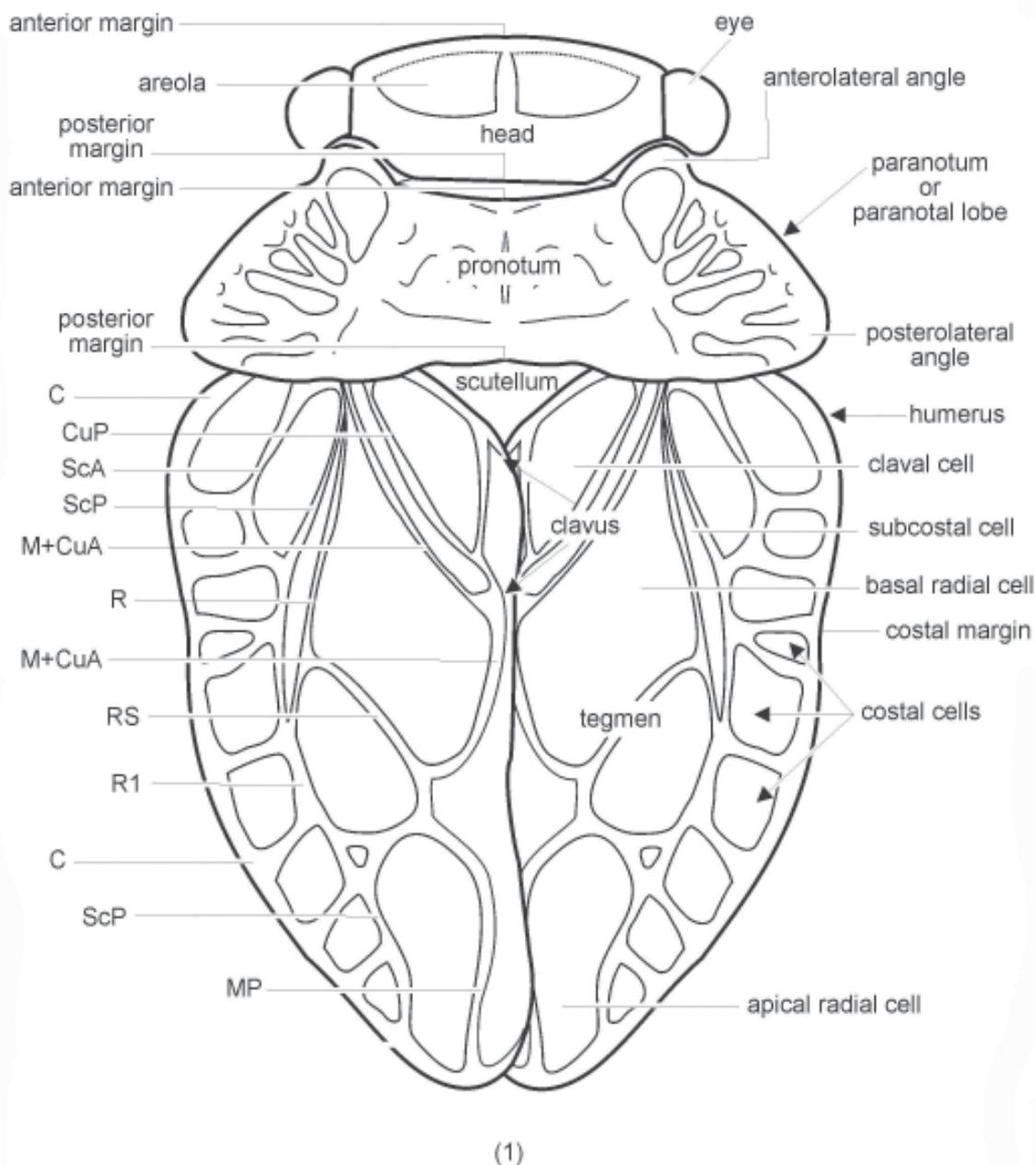


Fig. 1 Schematic dorsal view of *Xenophyes* sp. (C – costal vein or Costa; CuA – anterior cubital vein or Cubitus anterior; CuP – posterior cubital vein or Cubitus posterior; M – medial vein or Media; MP – Media Posterior; R – radial vein or Radius; R1 – radial vein 1 or Radius 1; RS – radial sector or Radius sector; ScA – anterior subcostal vein or Subcosta Anterior; ScP – posterior subcostal vein or Subcosta Posterior).

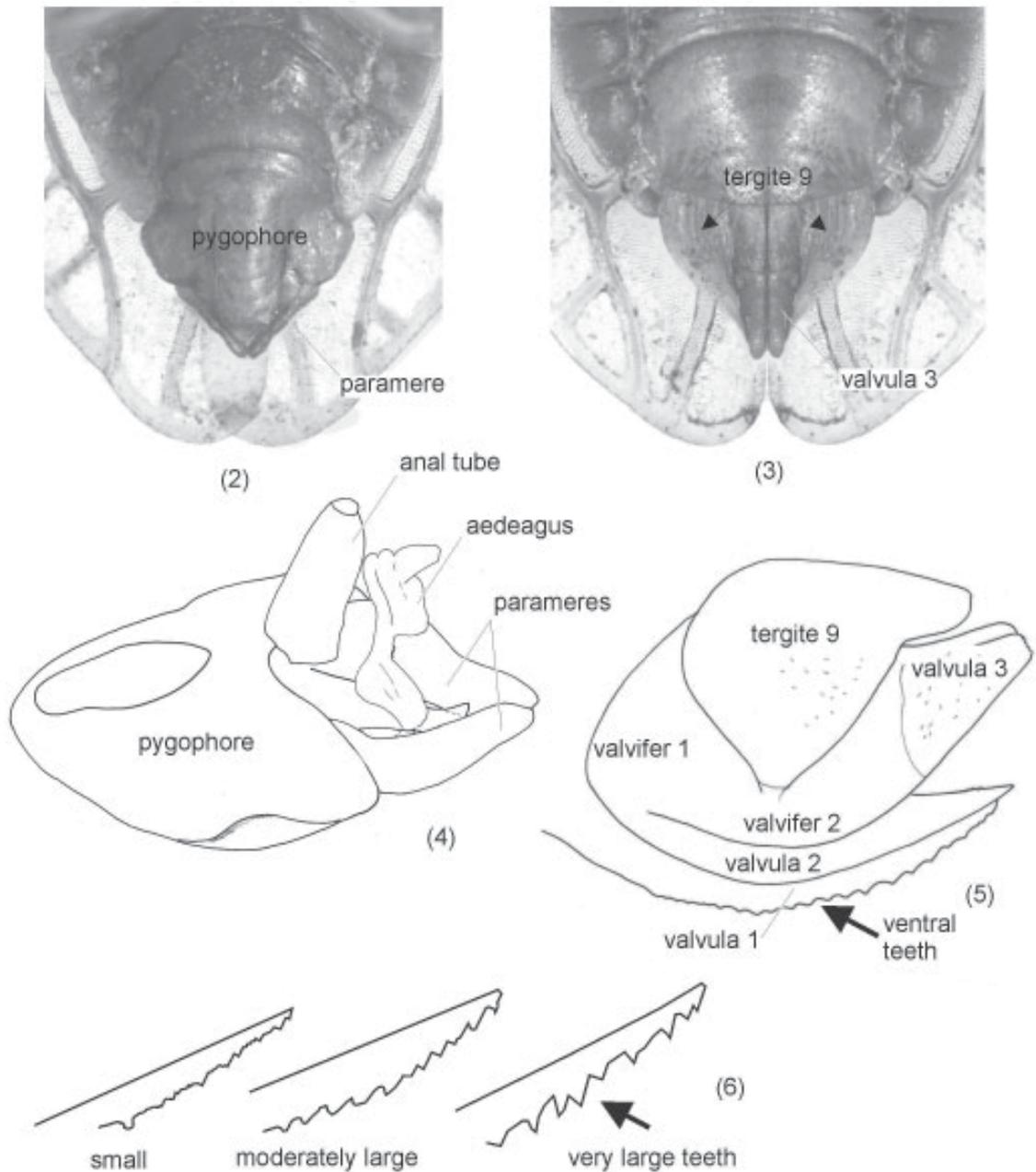


Fig. 2-6 (2, 3) Ventral view of apex of abdomen: (2) *Xenophyes cascus*, male; (3) female. (4, 5) Generalised dorsolateral view of (4) male and (5) female genitalia in *Xenophyes* (modified from Burckhardt 2009). (6) Valvula 1 in *Xenophyes*, with small, moderately large or very large ventral teeth (modified from Burckhardt *et al.* 2011).

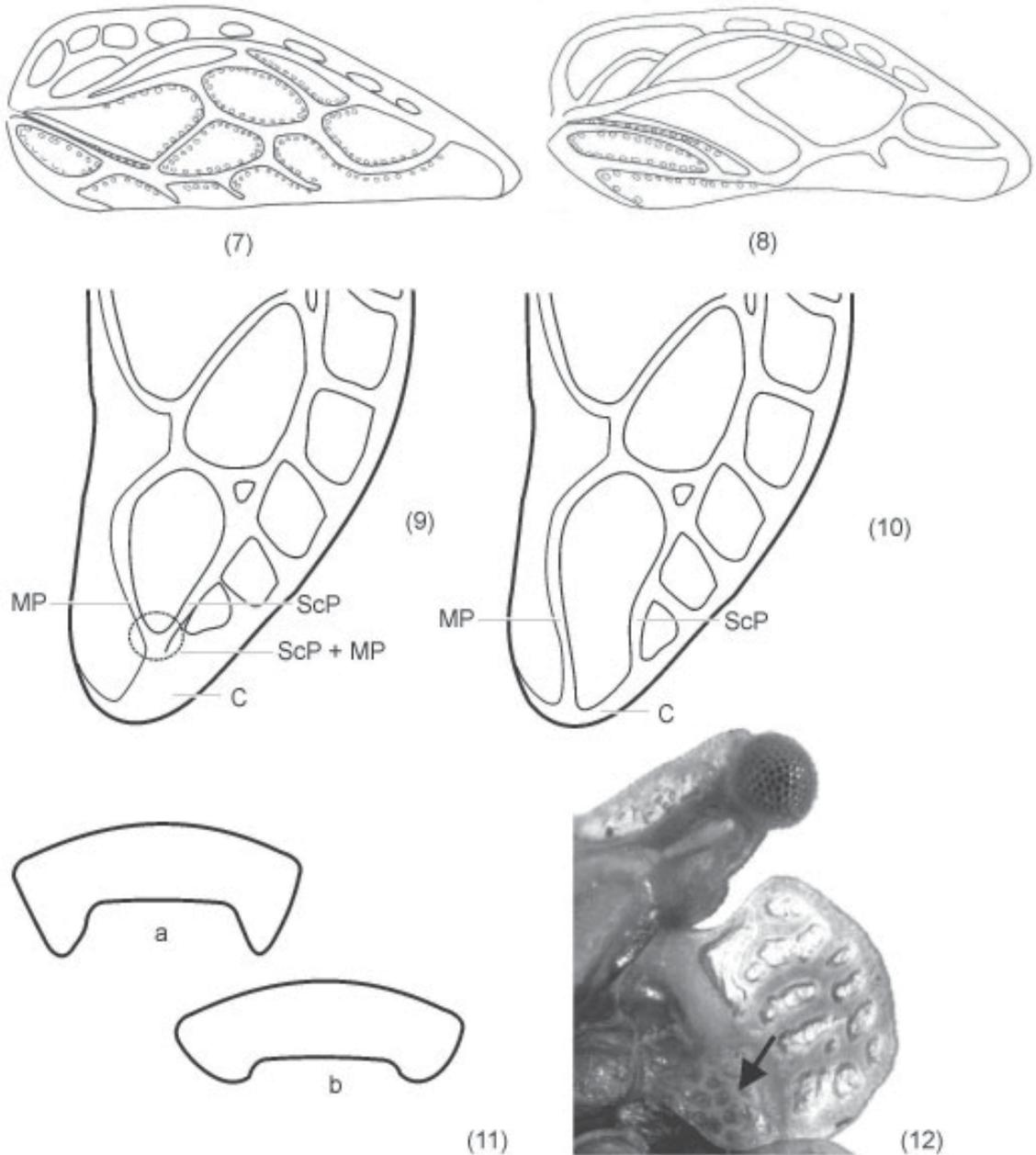


Fig. 7–12 (7–10) Right tegmen: veins (7) generally margined with punctures, *Oiophysa ablusa* (from Burckhardt 2009); (8) only margined with punctures near clavus, *Xenophysella greensladeae* (from Burckhardt 2009); (9) schematic view of apical half, showing fusion of veins ScP and MP; (10) same, showing unfused veins. (11) Male abdominal tergite 8: (11a) *Xenophyes rhachilophus* (modified from Burckhardt 2009); (11b) *Xenophysella stewartensis*. (12) Inner posteroventral portion of paranotum: coarsely punctate, *Oiophysa cumberi*.

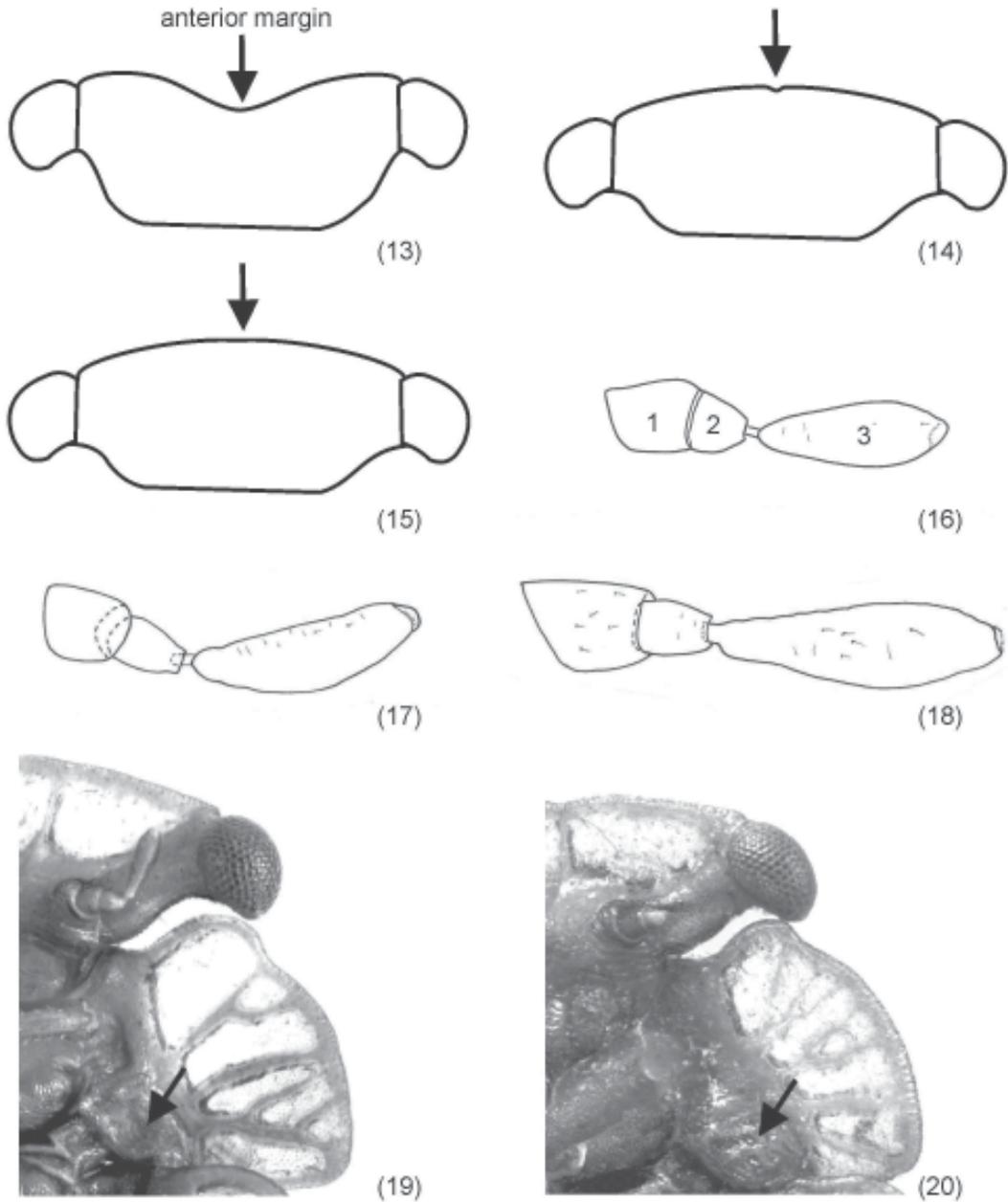


Fig. 13–20 (13–15) Schematic dorsal view of head: anterior margin (13) strongly concave medially (head V-shaped); (14) narrowly, shallowly concave or notched medially; (15) slightly convex. (16–18) Antenna: (16) *Oiophysa ablusa*; (17) *Xenophyes rhachilophus*; (18) *Xenophysella stewartensis* (from Burckhardt 2009). (19, 20) Inner posteroventral portion of paranotum: (19) impunctate, *Xenophyes cascus*; (20) punctate, *X. kinlochensis*.

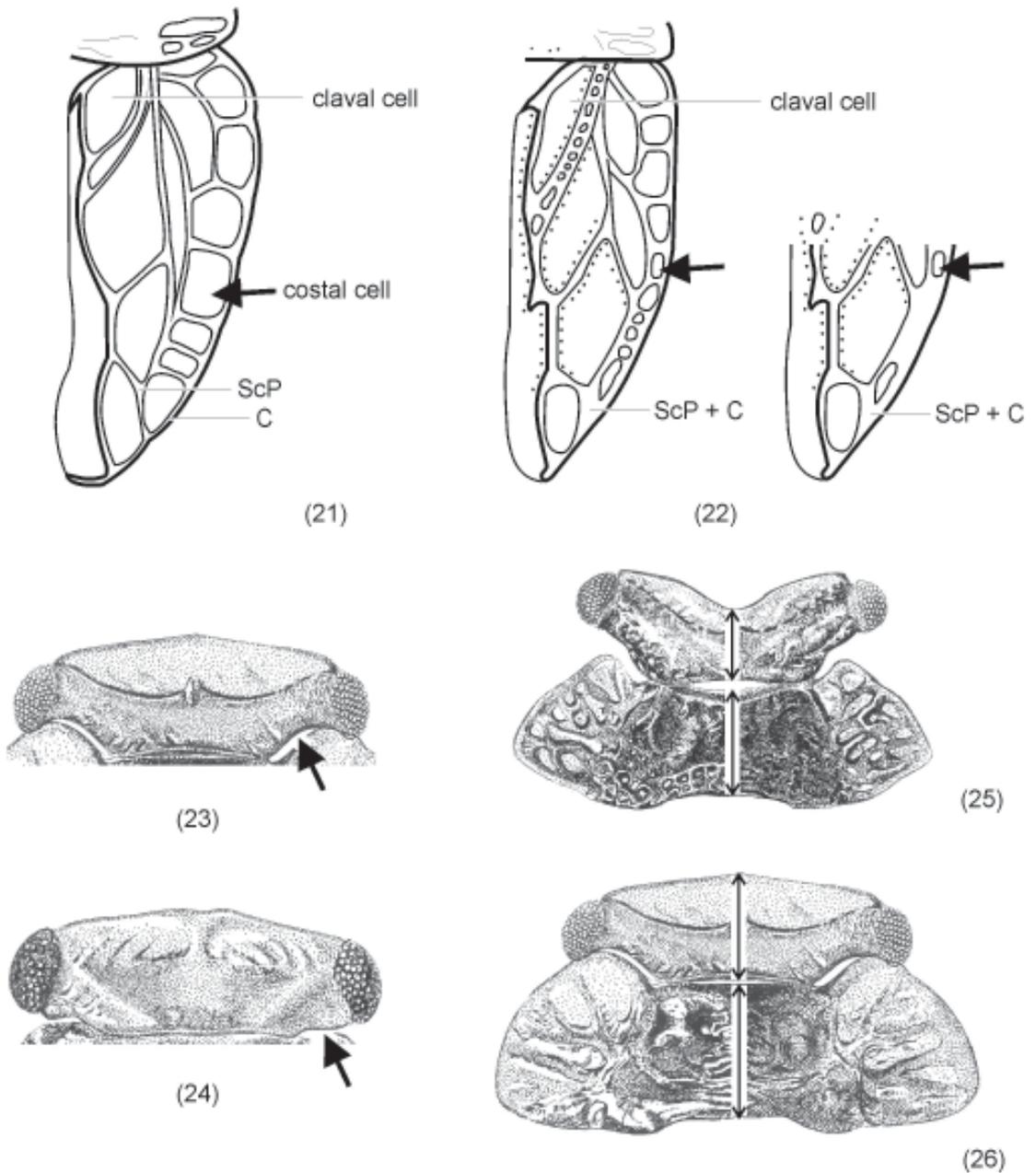


Fig. 21–26 (21, 22) Schematic view of right tegmen: (21) short and broad claval cell, normally developed costal cells and unfused ScP and C veins, *Xenophyes*; (22) long and narrow claval cell, costal cells small or ill-defined and fused ScP and C veins (forming a flattened margin), *Xenophysella*. (23, 24) Dorsal view of head: posterior margin (23) strongly concave between ‘neck’ and eyes, *Xenophyes rhachilophus*; (24) weakly concave or sinuate, *Xenophysella stewartensis* (modified from Burckhardt 2009). (25, 26) Relative length of head compared to pronotum along middle, in dorsal view: (25) *Oiophysa cumberi*; (26) *Xenophyes rhachilophus* (modified from Burckhardt 2009).

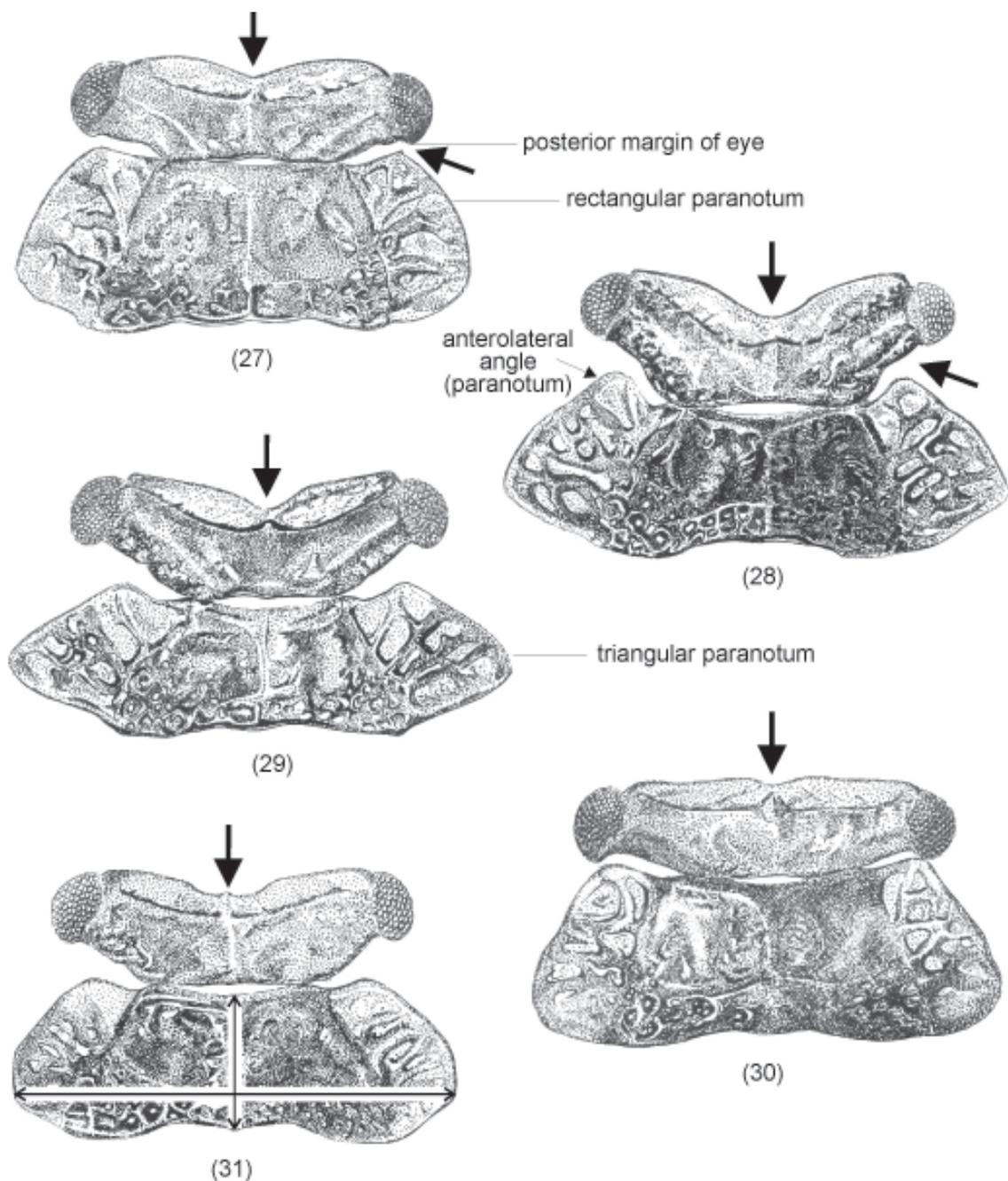


Fig. 27–31 Dorsal view of head and pronotum (modified from Burckhardt 2009): (27) *Oiophysa ablusa*; (28) *O. cumberi*; (29) *O. distincta*; (30) *O. paradoxa*; (31) *O. pendergrasti*, with arrows showing width to length ratio on pronotum.

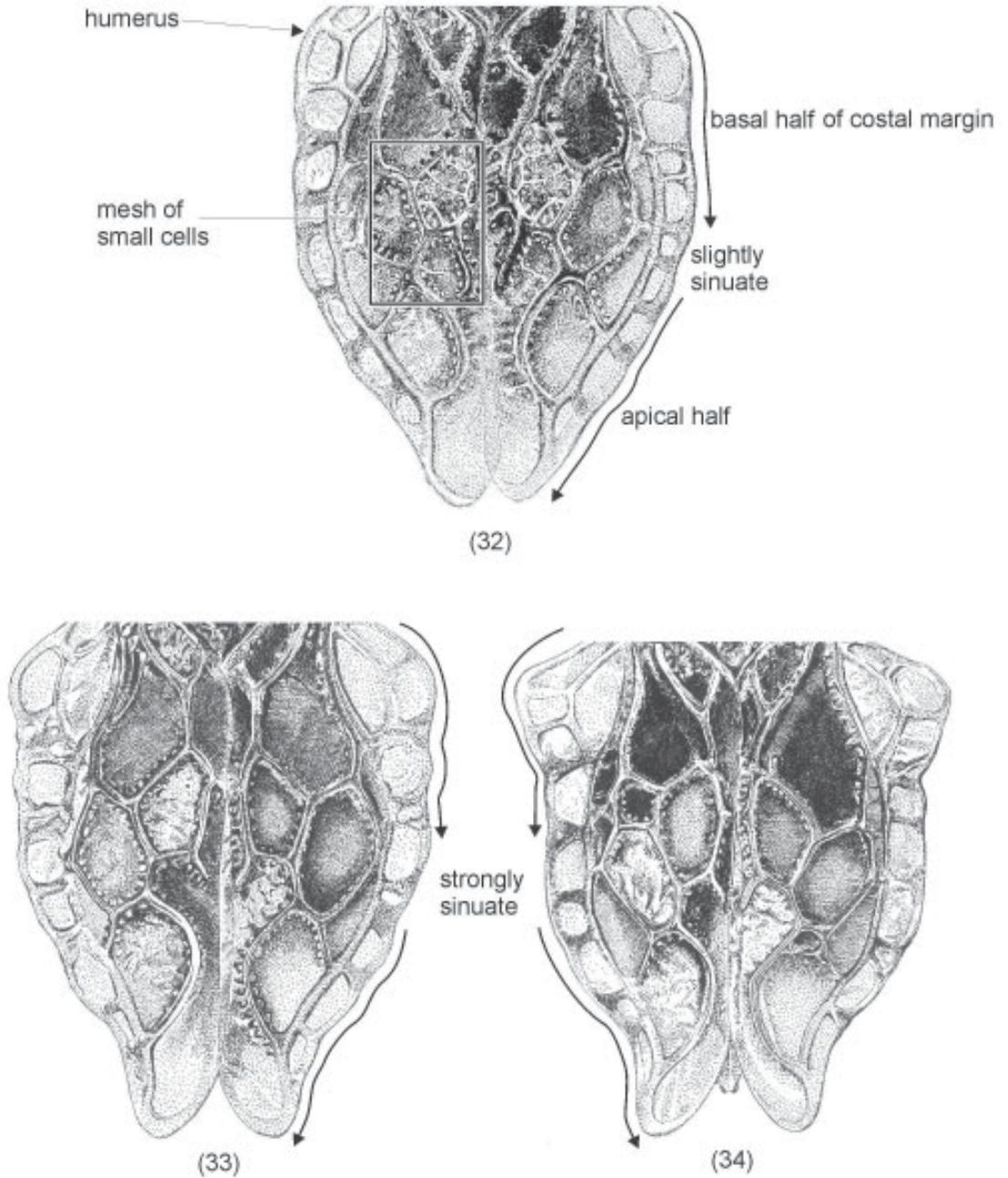


Fig. 32–34 Dorsal view of tegmina (modified from Burckhardt 2009): (32) *Oiophysa pendergrasti*; (33) *O. cumberi*; (34) *O. distincta*.

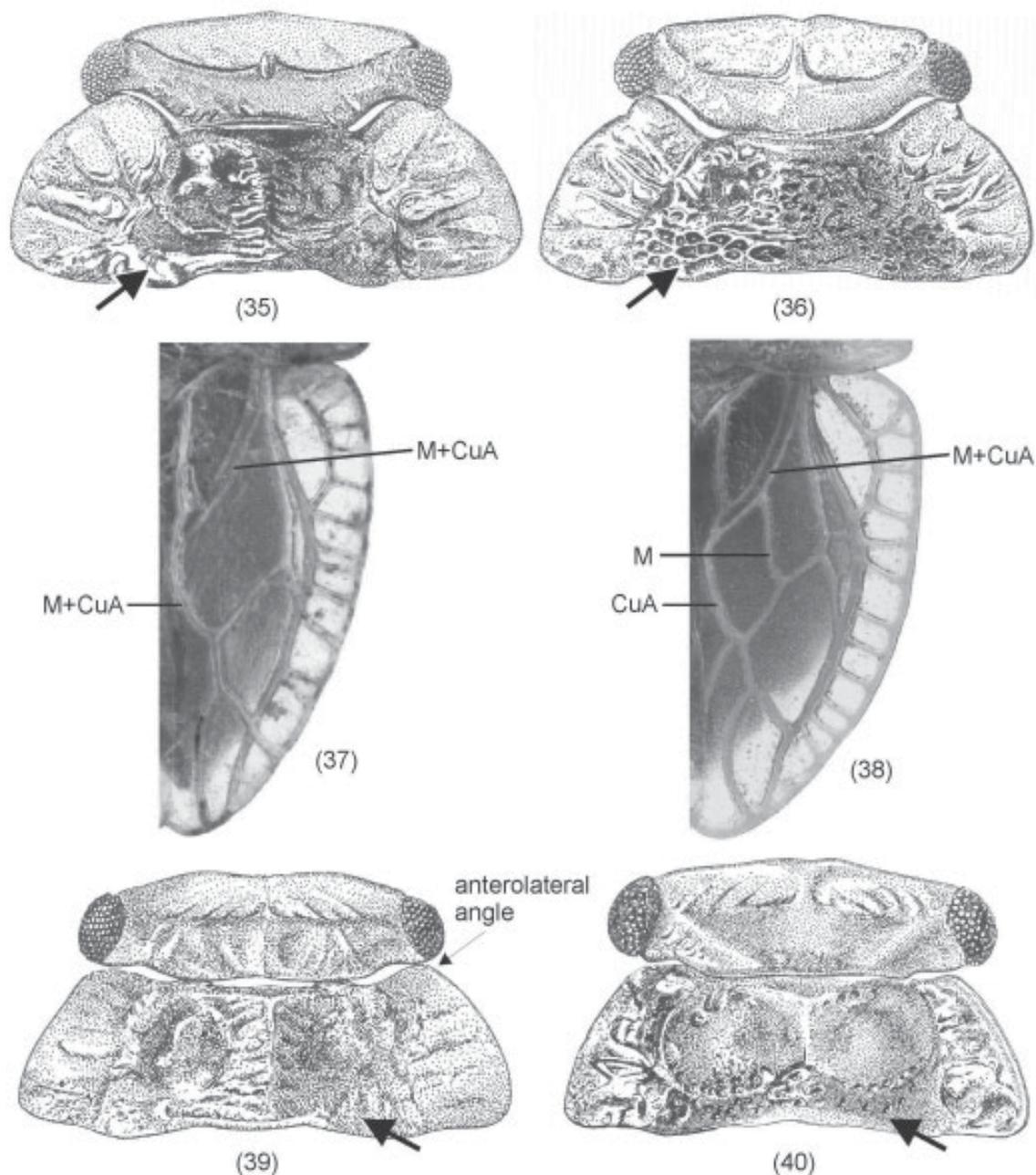


Fig. 35–40 (35, 36) Dorsal view of head and pronotum (modified from Burckhardt 2009): (35) *Xenophyes rhachilophus*; (36) *X. kinlochensis*. (37, 38) Right tegmen: vein M+CuA (37) unbranched, *X. goniomus*; (38) branched, *X. kinlochensis*. (39–40) Dorsal view of head and pronotum (modified from Burckhardt 2009): (39) *Xenophysella greensladeae*; (40) *X. stewartensis*.

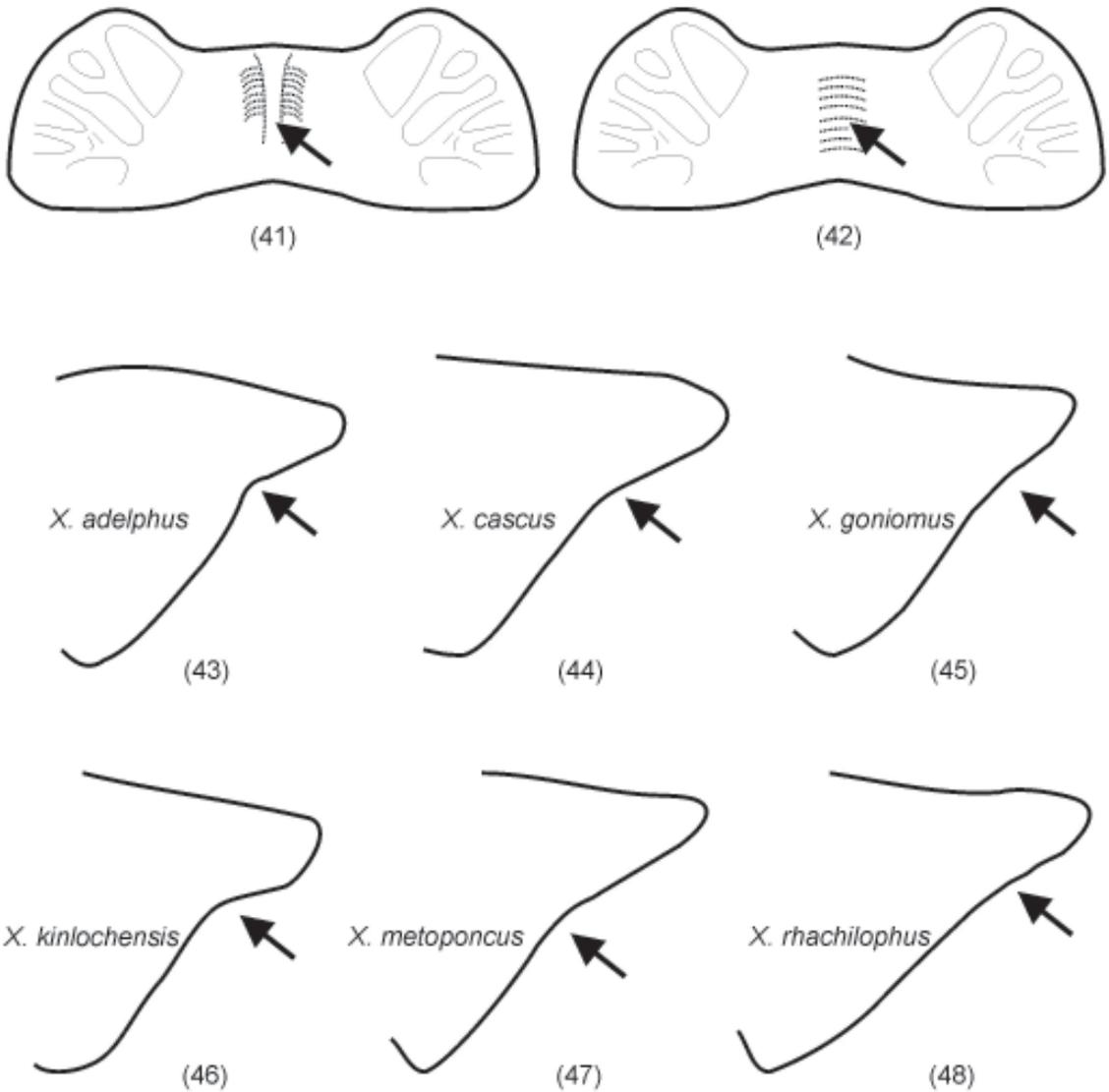


Fig. 41–48 (41–42) Schematic view of pronotum: median longitudinal ridge (41) well-defined; (42) poorly defined. (43–48) Schematic view of ventral margin of tergite 9 of female: (43) *Xenophyes adelphus*; (44) *X. cascus*; (45) *X. goniomus*; (46) *X. kinlochensis*; (47) *X. metoponcus*; (48) *X. rhachilophus*.



(49)

Xenophyes adelphus



(50)

X. cascus



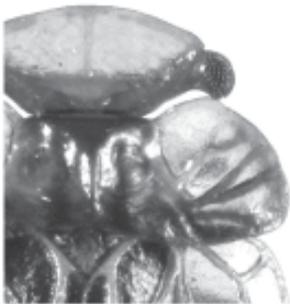
(51)

X. goniomus



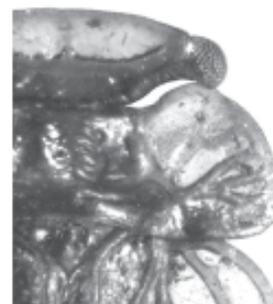
(52)

X. kinlochensis



(53)

X. metoponcus



(54)

X. rhachilophus

Fig. 49–54 Dorsal view of head and pronotum (modified from Burckhardt *et al.* 2011): (49) *Xenophyes adelphus*; (50) *X. cascus*; (51) *X. goniomus*; (52) *X. kinlochensis*; (53) *X. metoponcus*; (54) *X. rhachilophus*.

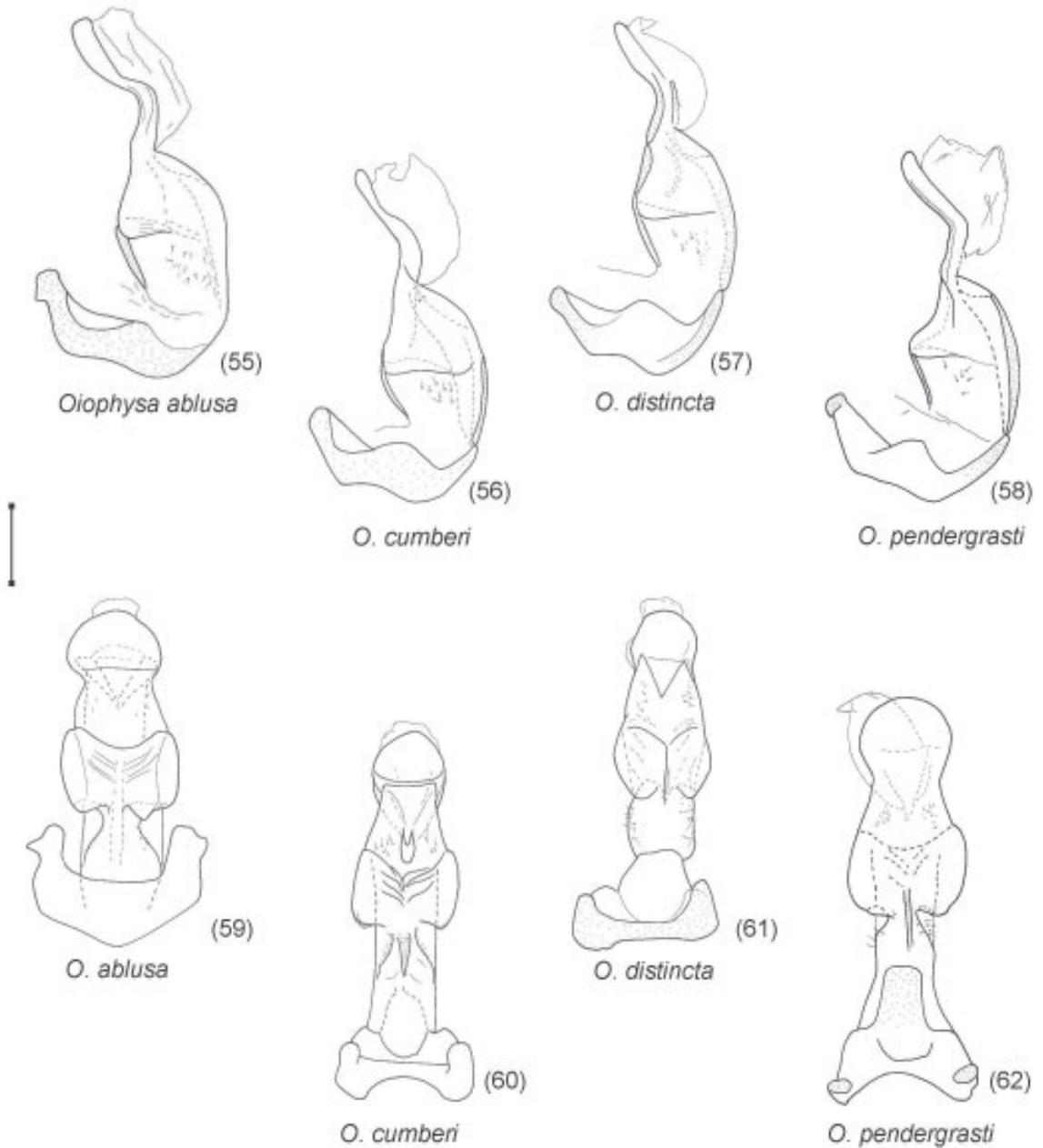


Fig. 55–62 Male genitalia of *Oiophysa* species (from Burckhardt 2009). (55–58) Aedeagus, lateral view: (55) *O. ablusa*; (56) *O. cumberi*; (57) *O. distincta*; (58) *O. pendergrasti*. (59–62) Aedeagus, anterior view: (59) *O. ablusa*; (60) *O. cumberi*; (61) *O. distincta*; (62) *O. pendergrasti*. Scale bar = 0.1 mm.

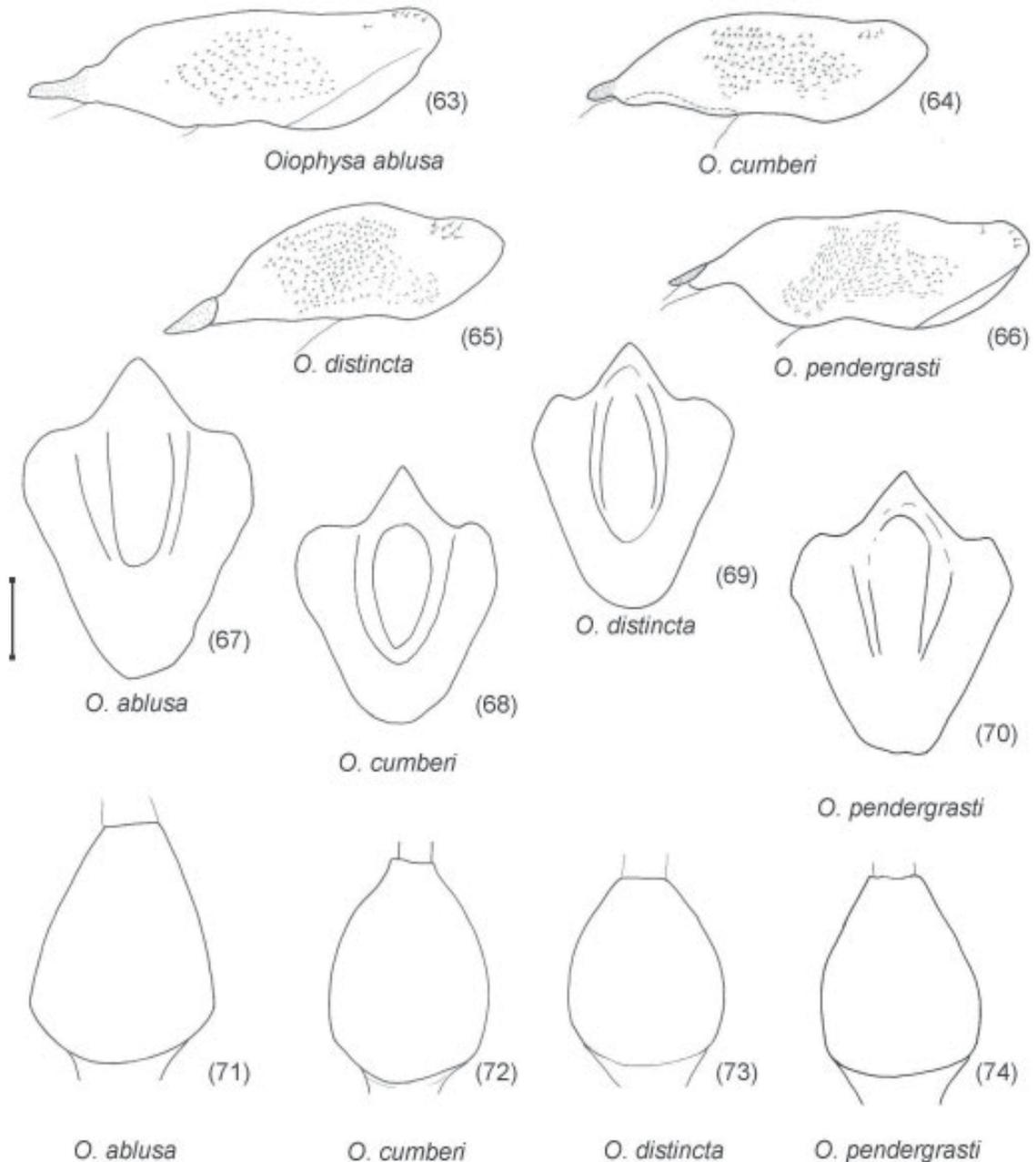


Fig. 63–74 Male genitalia of *Oiophysa* species (modified from Burckhardt 2009). (63–66) Paramere, outer lateral view: (63) *O. ablusa*; (64) *O. cumberi*; (65) *O. distincta*; (66) *O. pendergrasti*. (67–70) Pygophore, posterior view: (67) *O. ablusa*; (68) *O. cumberi*; (69) *O. distincta*; (70) *O. pendergrasti*. (71–74) Anal tube, dorsal view: (71) *O. ablusa*; (72) *O. cumberi*; (73) *O. distincta*; (74) *O. pendergrasti*. Scale bar = 0.1 mm (paramere, anal tube), 0.2 mm (pygophore).

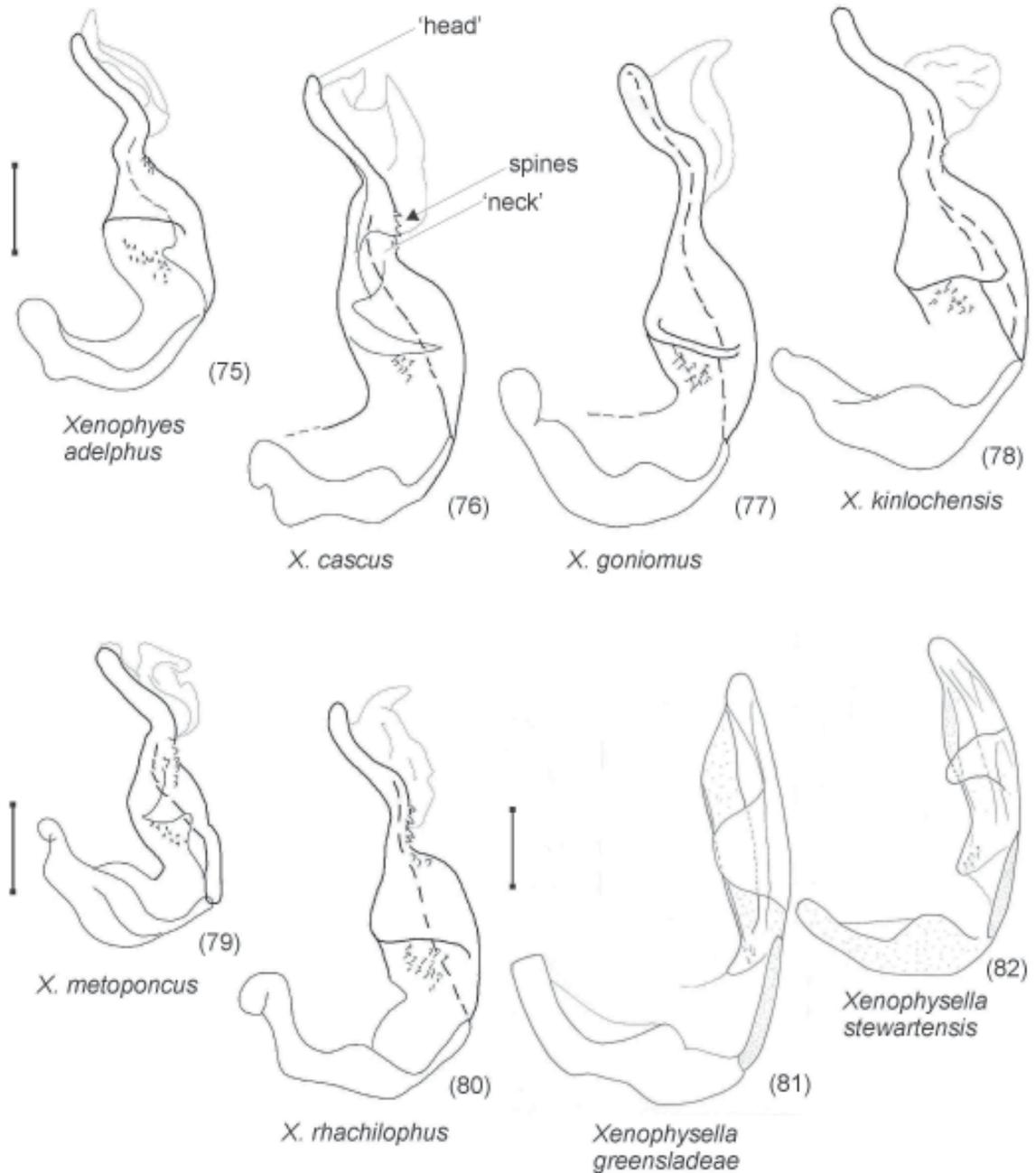


Fig. 75–82 Male genitalia of *Xenophyes* and *Xenophysella* species. Aedeagus, lateral view: (75) *Xenophyes adelphus*; (76) *X. cascus*; (77) *X. goniomus*; (78) *X. kinlochensis*; (79) *X. metoponcus*; (80) *X. rhachilophus* (modified from Burckhardt *et al.* 2011); (81) *Xenophysella greensladeae*; (82) *Xenophysella stewartensis* (from Burckhardt 2009). Scale bars = 0.1 mm.

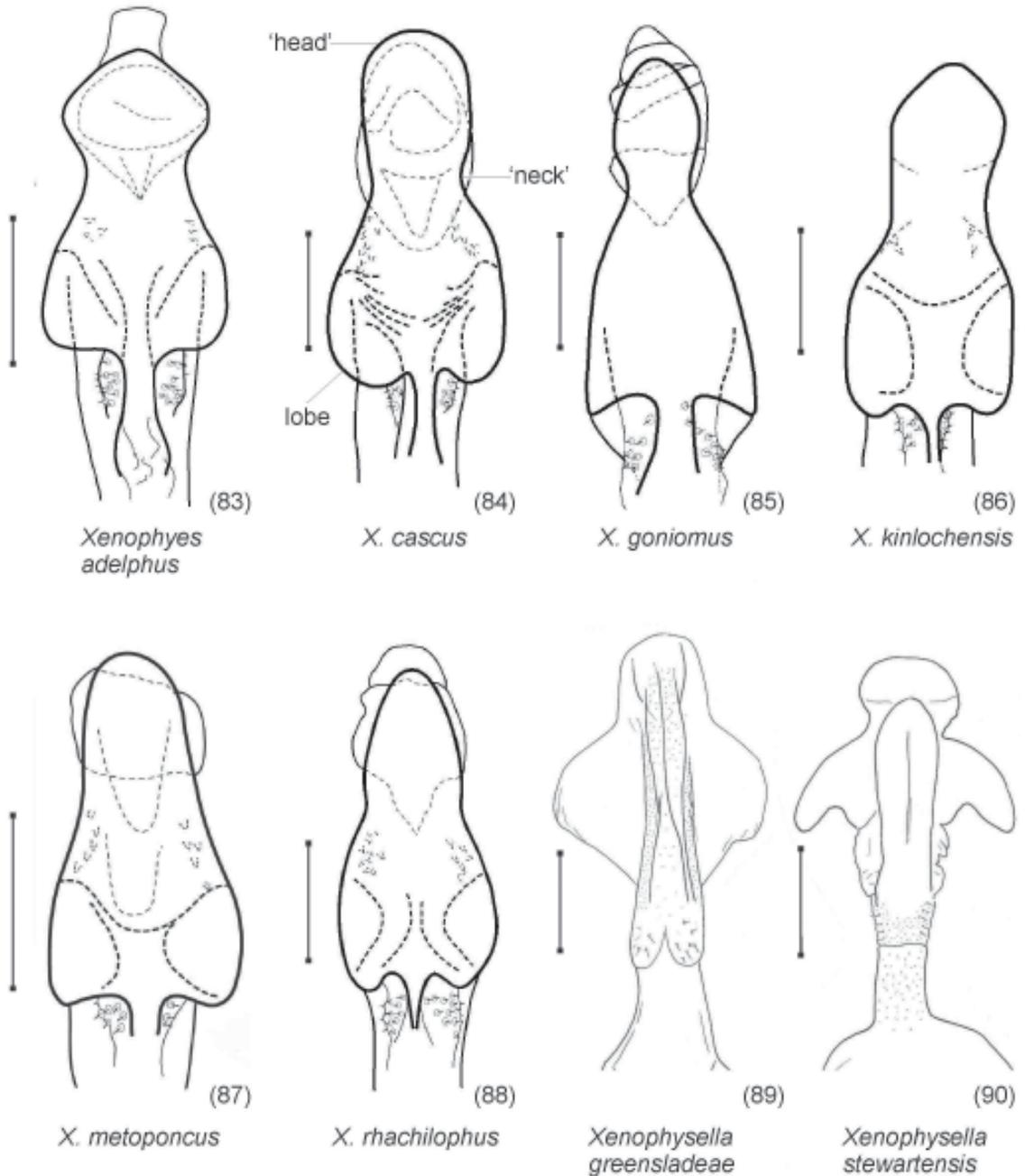


Fig. 83–90 Male genitalia of *Xenophyes* and *Xenophysella* species. Aedeagus, anterior view: (83) *Xenophyes adelphus*; (84) *X. cascus*; (85) *X. goniomus*; (86) *X. kinlochensis*; (87) *X. metoponcus*; (88) *X. rhachilophus* (from Burckhardt *et al.* 2011); (89) *Xenophysella greensladeae*; (90) *Xenophysella stewartensis* (modified from Burckhardt 2009). Scale bars = 0.1 mm.

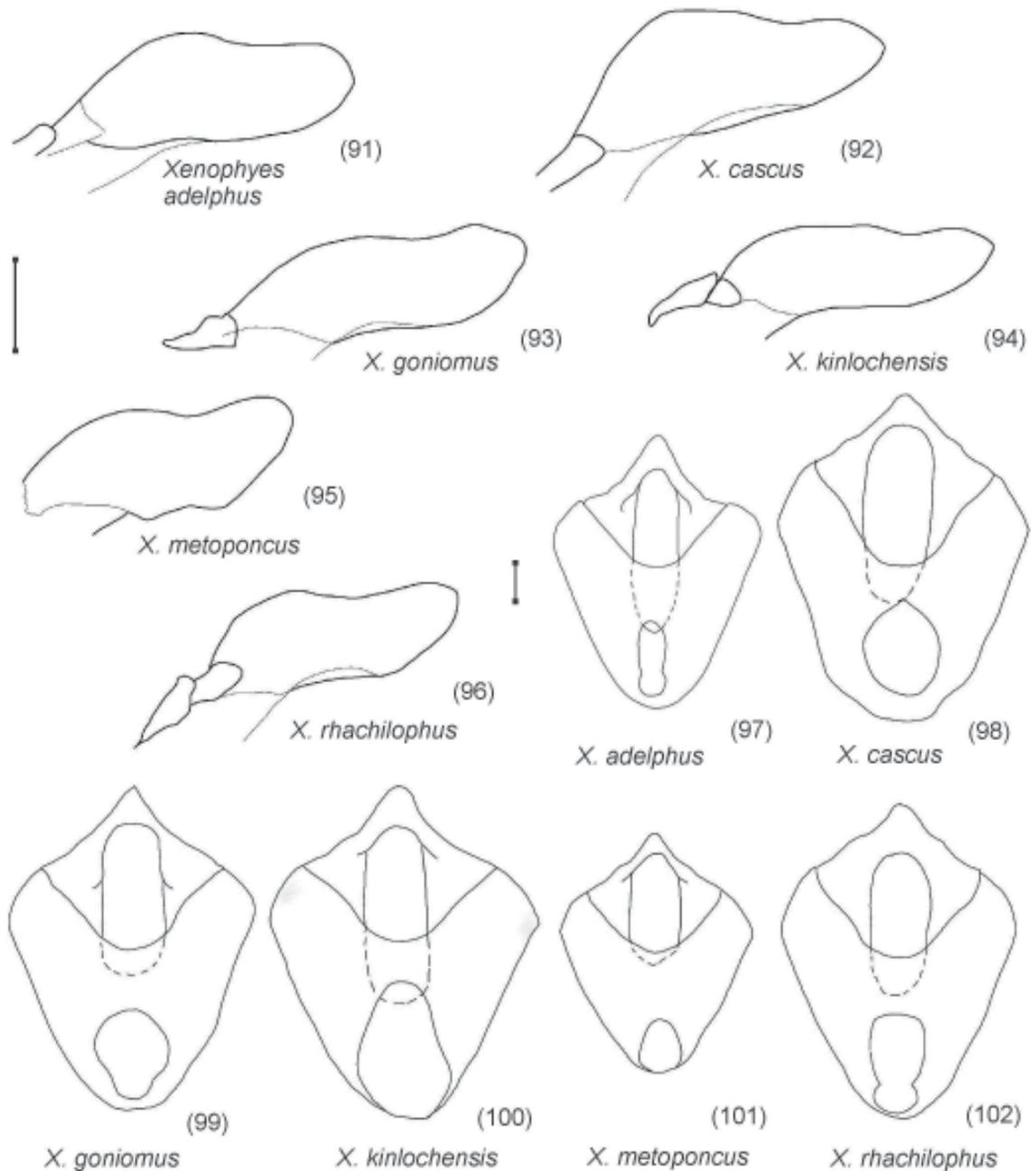


Fig. 91–102 Male genitalia of *Xenophyes*. (91–96) Paramere, outer lateral view (from Burckhardt *et al.* 2011): (91) *Xenophyes adelphus*; (92) *X. cascus*; (93) *X. goniomus*; (94) *X. kinlochensis*; (95) *X. metoponcus*; (96) *X. rhachilophus*. (97–102) Pygophore, posterior view (modified from Burckhardt *et al.* 2011): (97) *Xenophyes adelphus*; (98) *X. cascus*; (99) *X. goniomus*; (100) *X. kinlochensis*; (101) *X. metoponcus*; (102) *X. rhachilophus*. Scale bars = 0.1 mm.

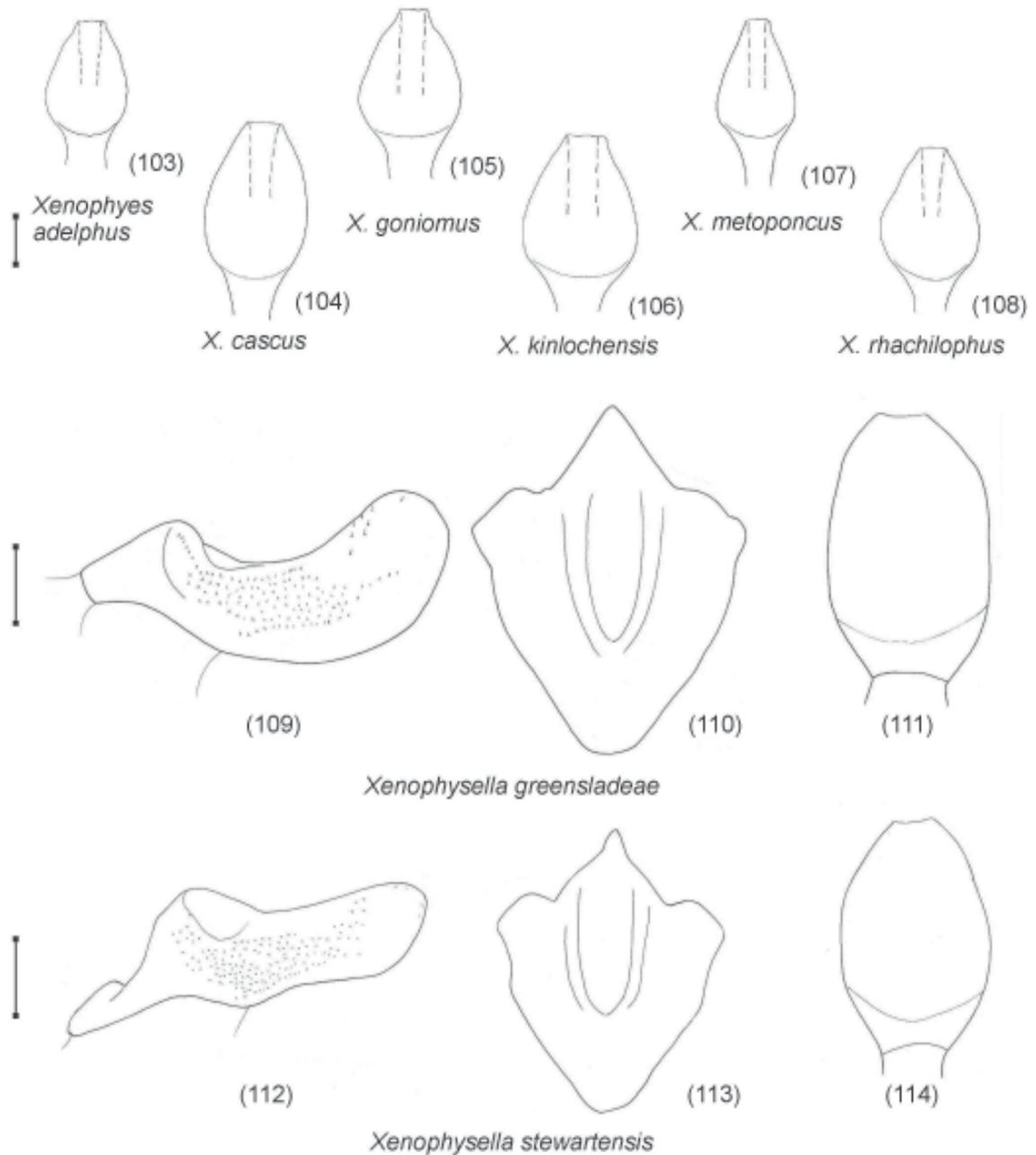


Fig. 103–114 Male genitalia of *Xenophyes* and *Xenophysella* species (from Burckhardt *et al.* 2011). (103–108) Anal tube, dorsal view: (103) *Xenophyes adelphus*; (104) *X. cascus*; (105) *X. goniomus*; (106) *X. kinlochensis*; (107) *X. metoponcus*; (108) *X. rhachilophus*. (109–111) *Xenophysella greensladeae* (from Burckhardt 2009): (109) paramere, outer lateral view; (110) pygophore, posterior view; (111) anal tube, dorsal view. (112–114) *Xenophysella stewartensis* (from Burckhardt 2009): (112) paramere, outer lateral view; (113) pygophore, posterior view; (114) anal tube, dorsal view. Scale bars = 0.1 mm (anal tube, paramere), 0.2 mm (pygophore).

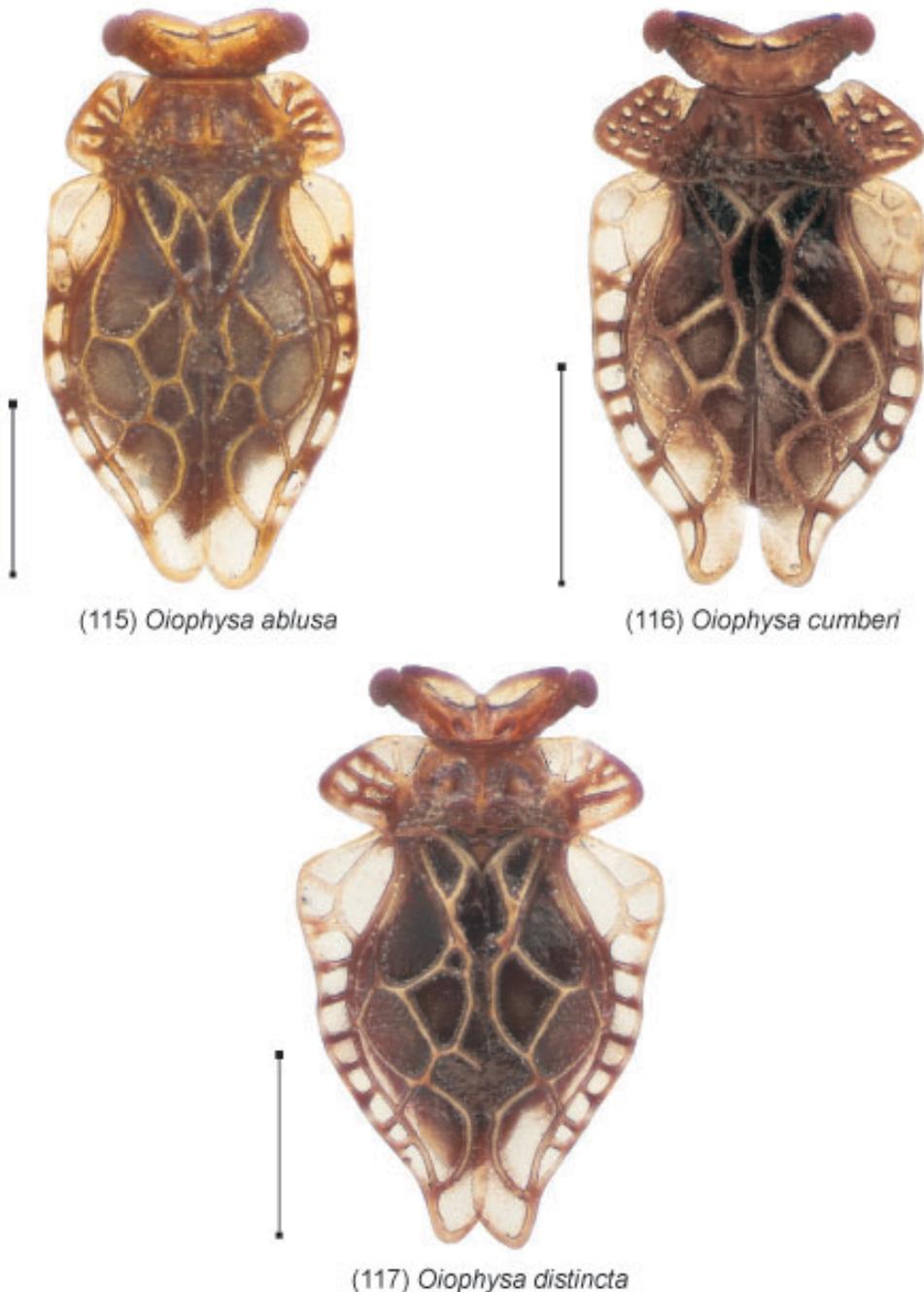


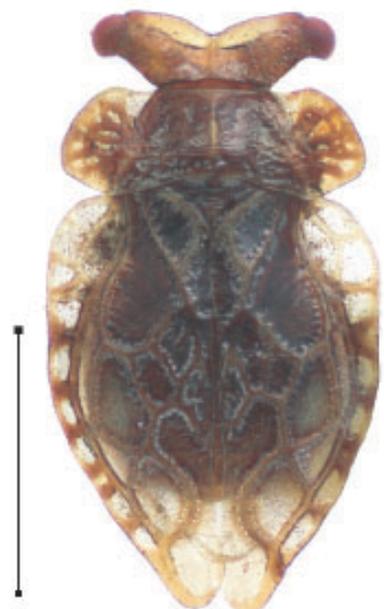
Fig. 115–128 Colour photographs of Peloridiidae. (115) *Oiophysa ablusa*, NN. (116) *O. cumberi*, TO. (117) *O. distincta*, FD. (118) *O. paradoxa*, holotype, SI. (119–120) *O. pendergrasti*, NN and CL. (121) *Xenophyes adelphus*, FD. (122) *X. cascus*, TO. (123) *X. goniomus*, MC. (124) *X. kinlochensis*, OL. (125) *X. metoponcus*, WD. (126) *X. rhachilophus*, FD. (127) *Xenophysella greensladeae*, FD. (128) *Xenophysella stewartensis*, SI. Scale bar = 1 mm. (Photographer B. E. Rhode, except Fig. 120 by M.-C. Larivière). Note: Colour of figures 115–117, 122, 124, 127 corrected against live individuals.



(118) *Oiophysa paradoxa*



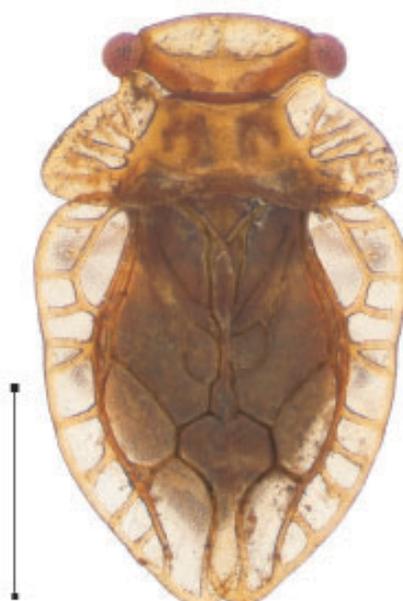
(119) *Oiophysa pendergrasti*



(120) *Oiophysa pendergrasti*



(121) *Xenophyes adelphus*



(122) *Xenophyes cascus*



(123) *Xenophyes goniomus*



(124) *Xenophyes kinlochensis*



(125) *Xenophyes metoponcus*



(126) *Xenophyes rhachilophus*



(127) *Xenophysella greensladeae*



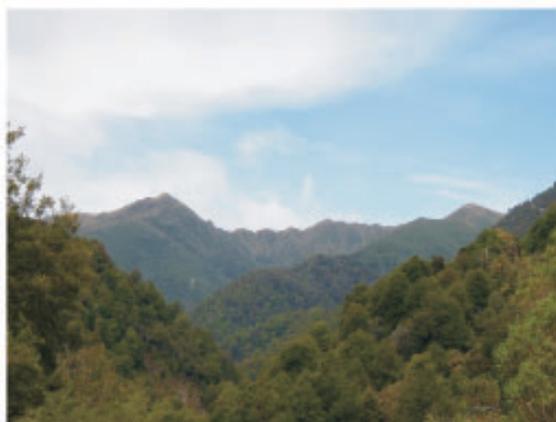
(128) *Xenophysella stewartensis*



(129)



(130)



(131)



(132)

Fig. 129–144 Colour photographs of peloriid habitats. (Photographers M.-C. Larivière, except Fig. 140, 141, 143 D. Burckhardt, Fig. 133, 134, 144 V. Hartung).

(129–130) Broadleaf–podocarp forest, northern North Island. (131–132) Mixed *Nothofagus*–broadleaf–podocarp forest (131) and *Nothofagus* forest (132), central North Island.



(133)



(134)



(135)



(136)

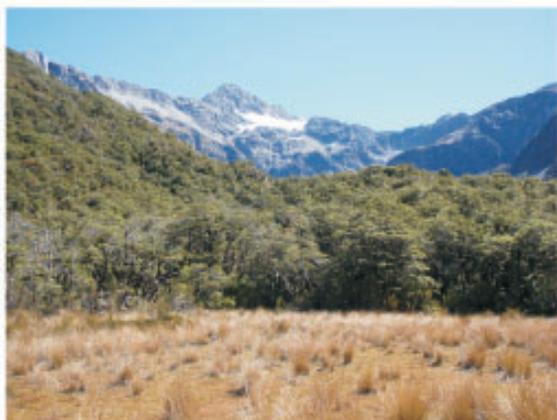
(133–134) Broadleaf–podocarp forest (133) and *Nothofagus*-dominant forest (134), southern North Island.
(135–136) Rimu-dominant forest (135) and *Nothofagus* forest (136), northwest South Island.



(137)



(138)



(139)



(140)

(137–138) Podocarp forest, central west South Island. (139–140) *Nothofagus* forest, central South Island near Arthur's Pass.



(141)



(142)



(143)



(144)

(141–143) *Nothofagus* forest, southwest South Island. (144) Podocarp–broadleaf forest, Stewart Island.

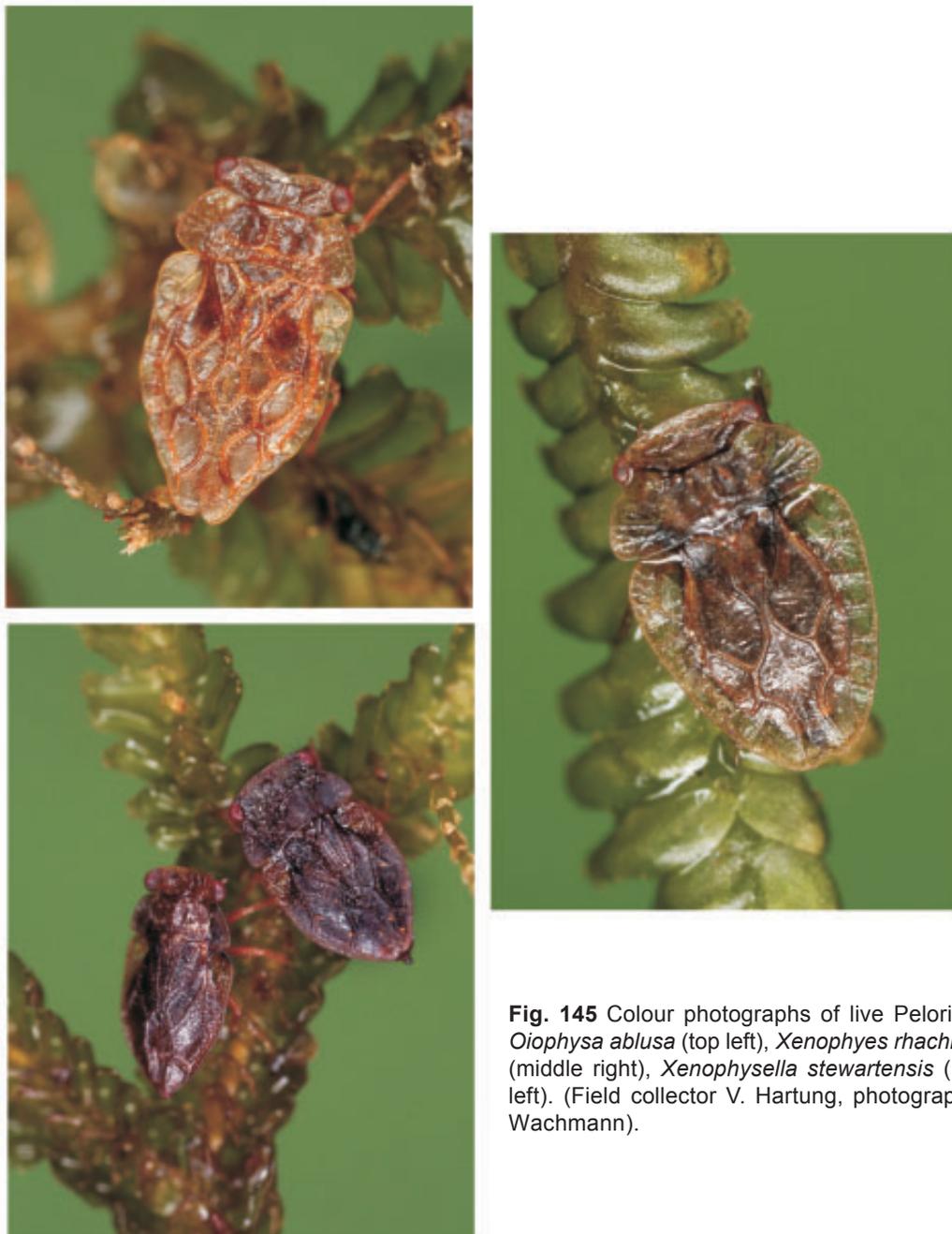
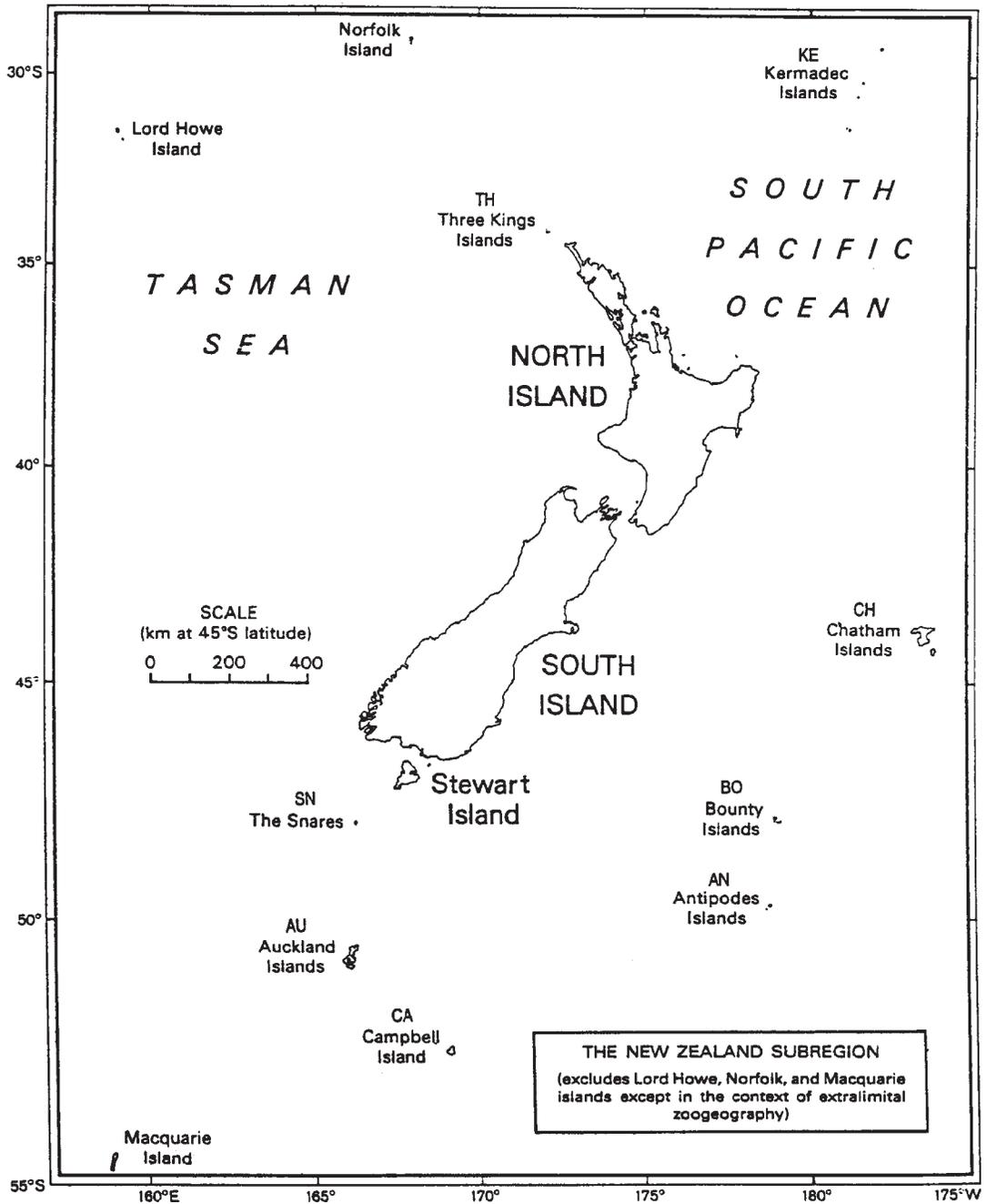
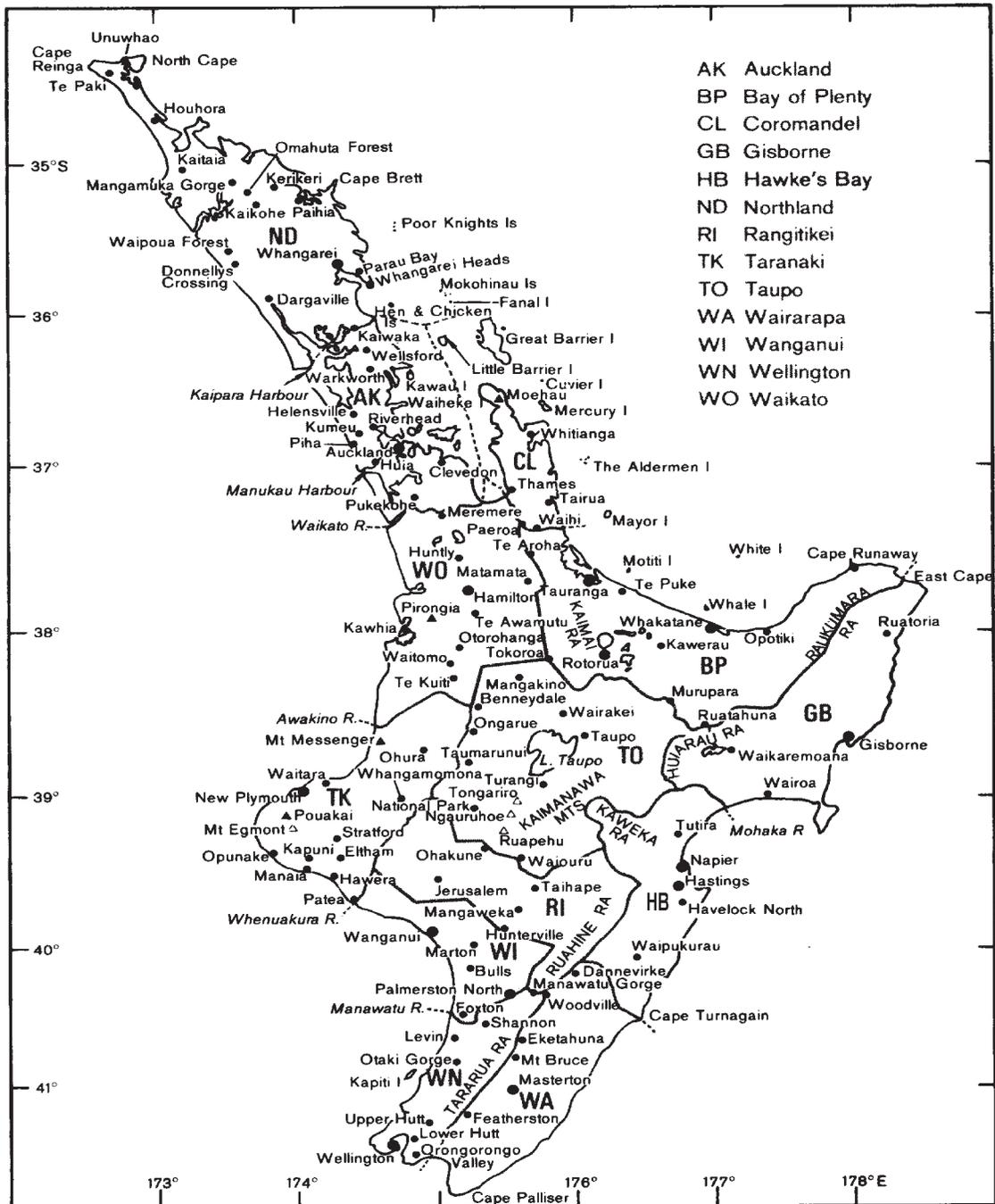


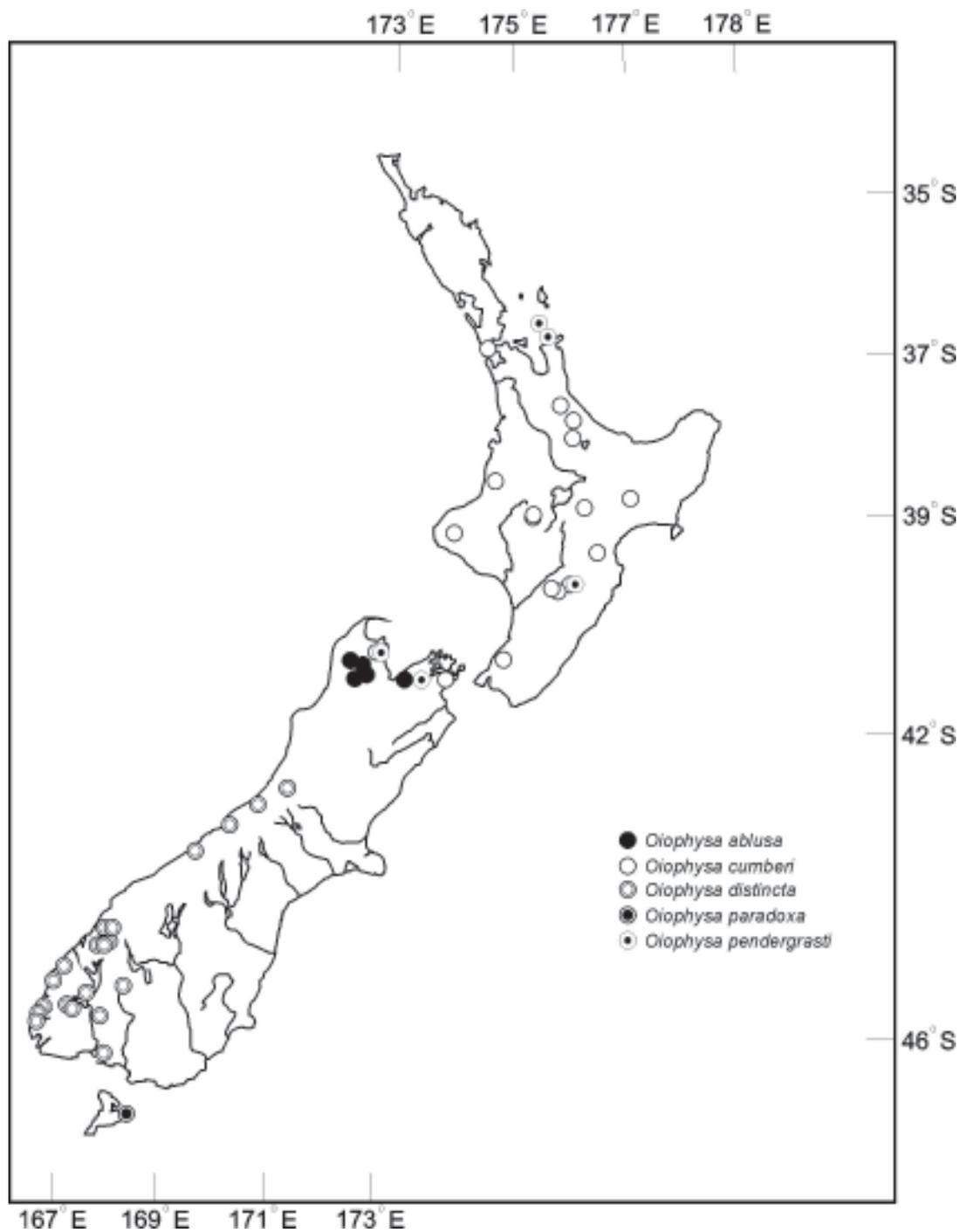
Fig. 145 Colour photographs of live Peloridiidae. *Oiophya ablusa* (top left), *Xenophyes rhachilophus* (middle right), *Xenophysella stewartensis* (bottom left). (Field collector V. Hartung, photographer E. Wachmann).



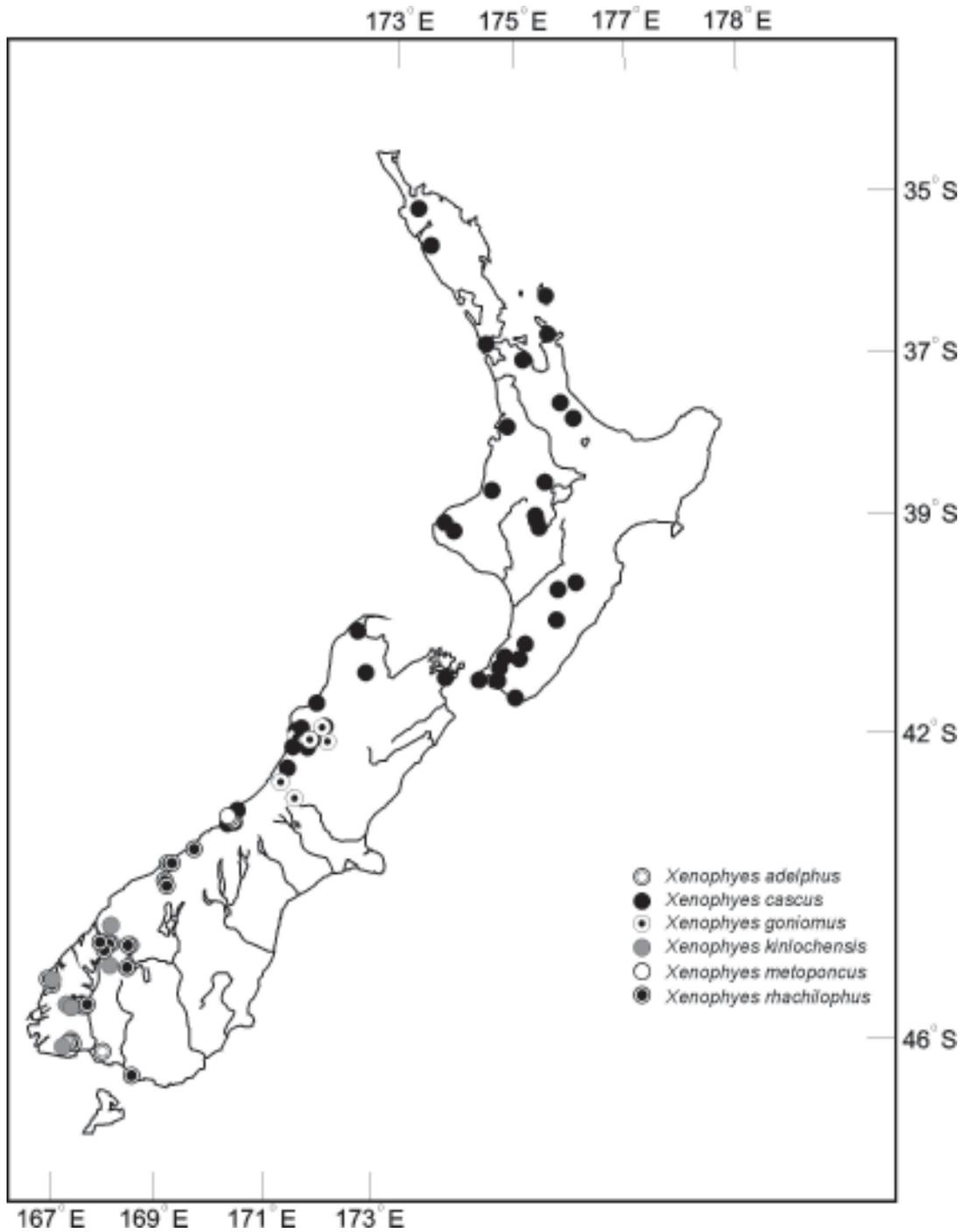
Map 1 The New Zealand subregion with area codes.



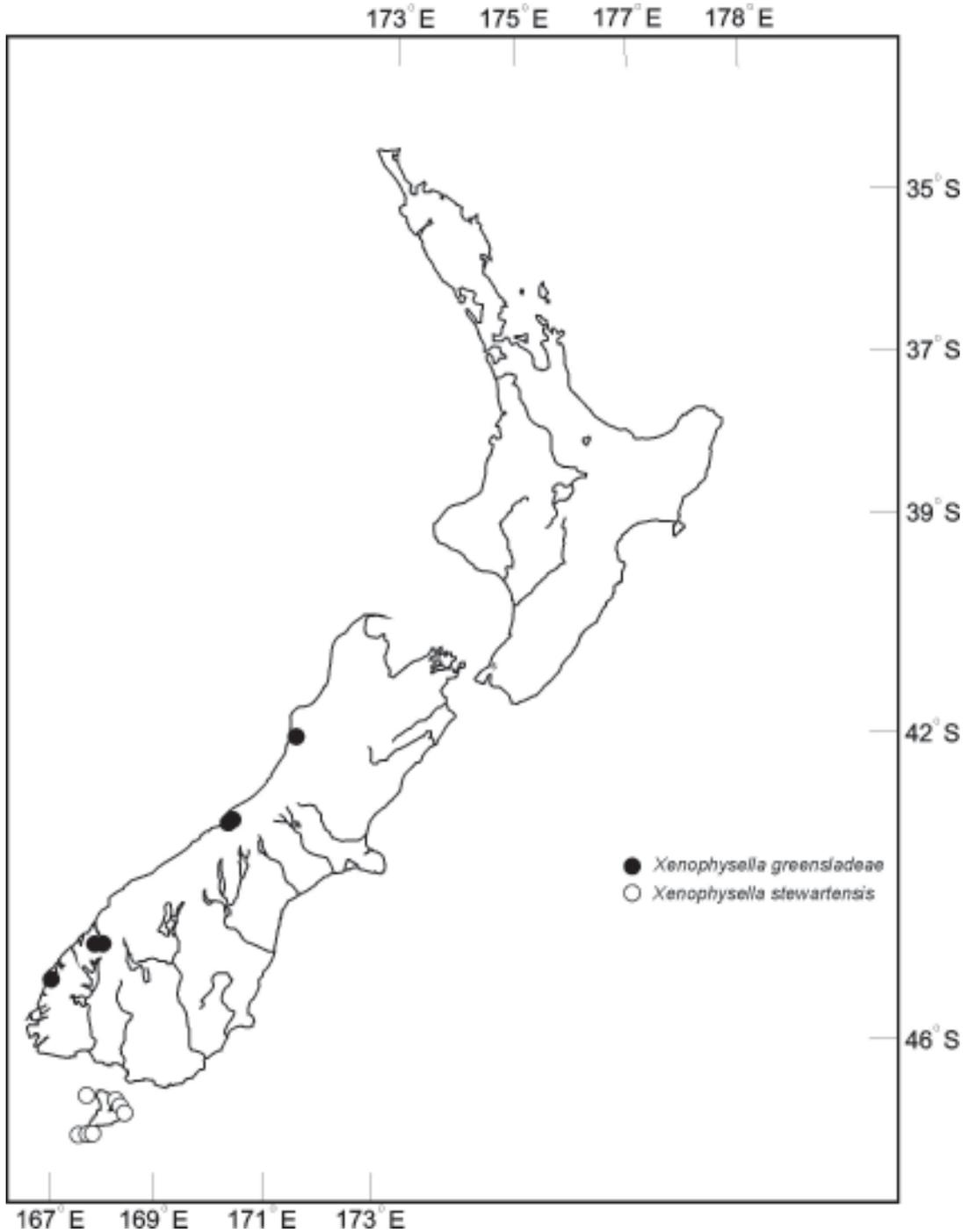
Map 2 Area codes of collecting localities from mainland New Zealand, North Island.



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Map 5 Collecting localities of *Xenophyes* species, New Zealand.



Map 6 Collecting localities of *Xenophysella* species, New Zealand.

TAXONOMIC INDEX

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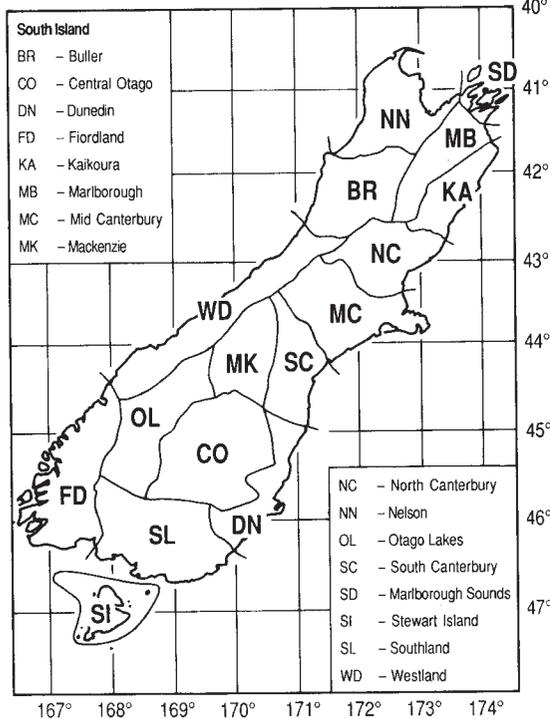
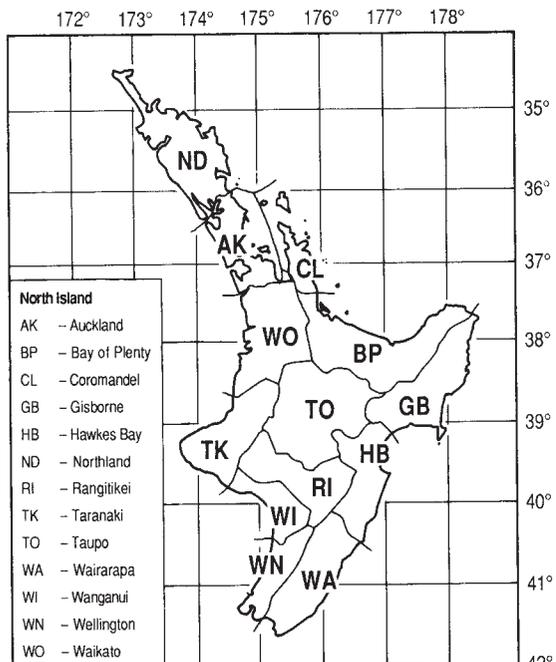
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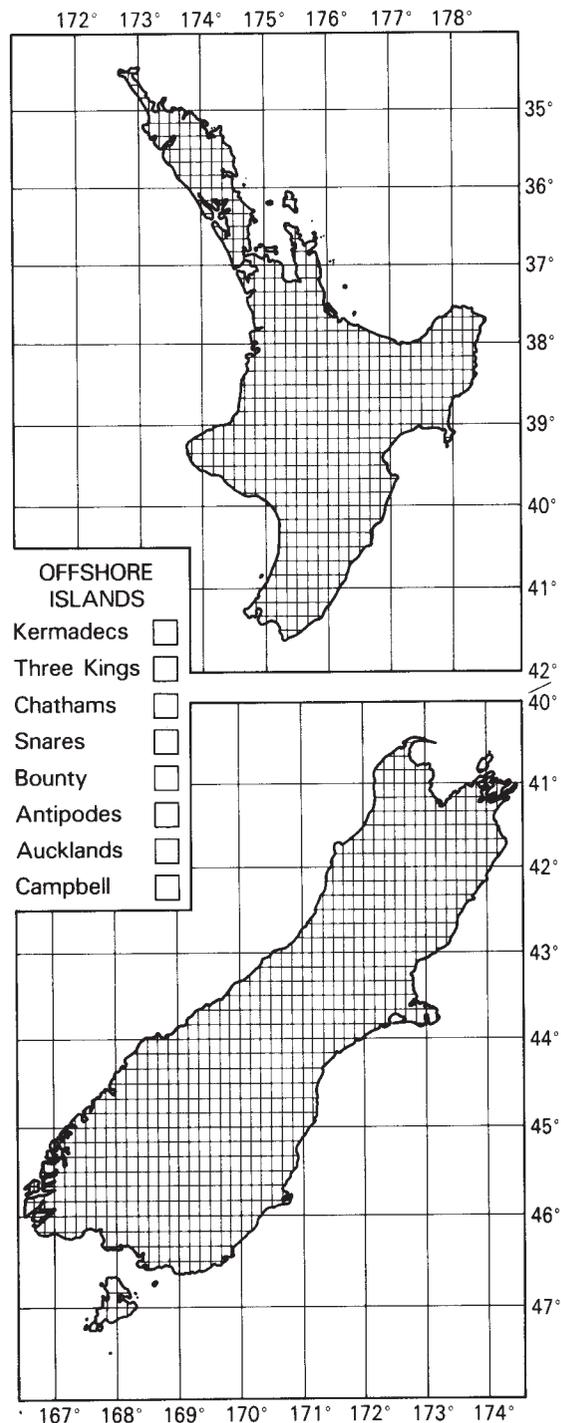
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Area codes and boundaries used to categorise specimen locality data (after Crosby *et al.* 1976)



Base-map for plotting collection localities; this may be photocopied without copyright release

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