

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

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**Ko te Aitanga Pepeke o Aotearoa**

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# **Trechini**

**(Insecta: Coleoptera: Carabidae: Trechinae)**

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**Manaaki**  
**Whenua**  
**P R E S S**

**Lincoln, Canterbury, New Zealand**  
**2010**

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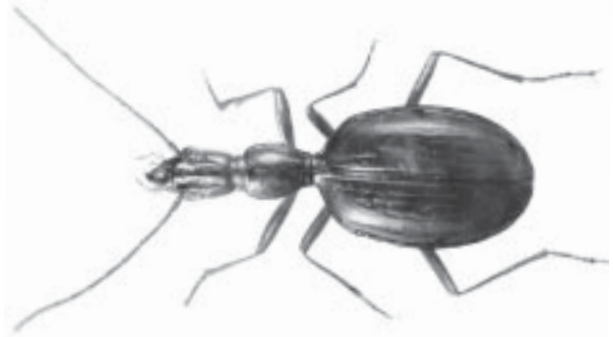
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## POPULAR SUMMARY

## HE WHAKARĀPOPOTOTANGA

Class **Insecta**Order **Coleoptera**Family **Carabidae**Subfamily **Trechinae**Tribe **Trechini**

**Illustration / Whakaahua:** *Kupetrechus larsonae* n.sp., Blue Cave Creek, Wangapeka (Photograph: Barry S. Eykel).

**Trechini beetles**

Trechini are small- to medium-sized ground beetles that live in habitats with high humidity. Many of the species that have become adapted for living in caves have reduced eyes, or have lost their eyes altogether. The true cave dwellers are pale brown in colour, having lost the characteristic dark pigmentation of most other ground beetles. Non-cave species live in damp habitats above ground such as beside forest streams, and others live buried in marine gravels below the high water mark. This latter group is best known from the Kaikoura Coast, although they have been collected more widely.

The most characteristic feature of trechines is that they have grooves on the head that curve around the eyes (or ocular area, if eyes are absent) and often meet grooves in the neck region, giving the head a broad inflated appearance. They also have a special arrangement of hairs around the edge of the elytra.

There are about 2500 species in the tribe Trechini worldwide (Ball & Bousquet 2001). Most trechines are found in the temperate regions of the world, or at higher altitudes in the tropics. They are widespread in the northern hemisphere, especially in Europe, North America, China, and Japan. Most of the southern continents and New Zealand have diverse trechine faunas, but amongst our relatively few species are some lineages that are apparently not present in Australia, Tasmania, or South America, posing some interesting biogeographic questions.

Currently there are 33 species of trechines known from New Zealand, all of which are endemic except 1 (a widespread species occurring around islands in the Southern Ocean). The largest genus, *Duvaliomimus*, contains 15

**Ngāi Trechini**

He pītara iti, āhua iti rānei tēnei, he noho papa, ko ngā wāhi haukū ngā wāhi pai hei kāinga mōna. O ngā momo kua urutau ki te noho ana, ko te maha atu kua kore haere, kua kore rawa atu rānei ngā karu. Ā, ko ngā mea noho pūmau ki te ana, kua teatea kē te kiri, kua kore i uriuri pērā i te nuinga o ngā pītara ka noho ki te mata o te whenua. Ko ngā momo kāore e noho ki rō ana, he haukū tonu ō rātou wāhi noho, tērā pea ko te taha o te kōawa i rō ngahere, ko roto tonu rānei o ngā kirikiri i te taihua. O ngā mea noho ki te taihua, ko ērā o te Takutai o Kaikōura ngā mea e āta mōhiotia ana, engari kua kohikohia ētahi i wāhi kē.

Ko te āhuatanga tino tāpua o ngā trechine, ko ngā kōwakawaka i te upoko, e amio haere ana i ngā karu (i te wāhi rānei e tika ana kia noho mai he karu ki reira) me te tūtaki anō pea ki ētahi atu kōwakawaka e rere ana i te kakī, i āhua paraha ai te upoko ki te titiro atu. Me kōrero anō ngā weu e tūtū mai ana i te taitapa o ngā kahu parirau.

E 2500 pea ngā momo o te iwi Trechini huri noa i te ao (Ball & Bousquet 2001). Ko te nuinga, kei ngā takiwā āhua mahana o te ao, kei ngā wāhi teitei rānei o ngā whenua pārūrū. Kua kaha te horapa ki te tuakoi raki, ā, e tino kitea ana i Ūropi, i Amerika ki te Raki, i Haina, i Hapanihi. He āhua raharaha ngā momo trechine i te nuinga o ngā whenua ki te tonga, tae atu ki Aotearoa. Engari o ngā momo āhua torutoru nei e kitea ana i konei, arā ētahi kāwai kāore e kitea ana i Ahitereiria, i Tahimānia, i Amerika ki te Tonga, i hua ake ai he urupounamu mō te koiora me te wāhi noho o te iwi nei kāore anō i kitea he whakautu.

E 33 ngā momo trechine o Aotearoa e mōhiotia ana, ā, ko Aotearoa anake te whenua noho o ēnei mea katoa, atu

(continued overleaf)

(haere tonu)

taxa, of which 9 are in the North Island and 7 in the south, but none of these species occur in both islands.

Trechine ground beetles are widespread throughout New Zealand, but have not been found on Chatham or Three Kings Islands. A single coastal species occurs around most of the islands to the south of New Zealand. They are very rare in Northland as only a single specimen of a very tiny species has been found in a cave there. The South Island has just over twice as many species as the North Island, and of these over 50% are restricted to northwest Nelson. This may to a degree reflect collecting activity, especially in caves, but there is no denying that there is a natural concentration of species in this region. Marlborough and most of Canterbury appear to lack trechines, except for those living in sub-littoral gravel, probably because the relatively dry climate and low humidities means there is a lack of suitable habitats.

All trechines require high humidity so caves, which provide an environment close to 100% humidity, are ideal. Almost 1/2 the known New Zealand trechine species are found in caves and these are highly modified for an underground life. They are pale, often lack eyes and usually have lengthened antennae and legs, which are probably used for sensory purposes. Troglobite (obligate underground dwelling) trechines are assumed to be dependant on live prey for food so need to survive for prolonged periods when prey is scarce. Surface-dwelling species also require high humidity and are usually found along streamsides or in beach gravel below the high water mark. As many of these habitats are difficult to collect in, it is not surprising that specimens are uncommon in collections.

Almost 40% of the troglobitic species are known from only a single population, making them highly vulnerable to extinction from catastrophic events. A single polluted stream could conceivably cause the loss of nearly 3% of our known trechine fauna. Although the number of New Zealand's trechine species is small on a world scale, they are a special part of our biota because they are one of our most diverse groups of cave insects, they occupy unusual habitats, and they show extreme adaptations to the hostile environments in which they live.

Contributor **James Ian Townsend** was born in the small town of Hawera, growing up in the rural atmosphere of Taranaki where his parents encouraged his interest in nature and the outdoors. He was educated at Hawera Technical High School and later completed courses in entomology at Massey University.

While working as a technician with Entomology Division, DSIR at Palmerston North, under the directorship of Dr Jim Hoy, Ian discovered a number of new species of eriococcid scale insect. His keen interest in the natural environment and taxonomy led in 1958 to his transferring to Nelson to assist in strengthening the combined

(continued overleaf)

i tētahi momo kotahi nei (he momo tērā kua horapa ki ētahi mouere maha o Te Moana-tāpokopoko-a-Tāwhaki). Ko *Duvalliomimus* te puninga rahi katoa, 15 ōna rōpū iti, e 9 o ērā kei Te Ika-a-Māui, e 7 kei Te Waipounamu, engari kāore kau he momo kotahi kua kitea e noho ana i ngā mouere e rua.

Kitea ai ngā pītara noho papa trechine puta noa i Aotearoa, engari kāore anō i kitea i Rēkohu, i Manawatāwhi rānei. Arā tētahi momo noho takutai kotahi kua kitea i te nuinga o ngā mouere ki te tonga o Aotearoa. Me uaua ka kitea i Te Tai Tokerau — kotahi noa te pītara mokemoke o tētahi momo moroiti kua kitea, i tētahi ana i reira. He paku neke atu i te rua whakareatanga te maha ake o ngā momo o Te Waipounamu, tēnā i ō Te Ika-a-Māui. Ka mutu, o ngā momo e noho ana ki Te Waipounamu, he nui ake i te 50% kei te rohe anake ki te rohe uru-mā-raki o Whakatū. Tērā pea nā te kaha o ngā mahi kohikohi i reira, me te kohikohi i rō ana, i pēnei rawa ai te tītaha, engari ahakoa tonu, me kī pēnei ake kei reira te huhua o ngā momo trechine. Kāore anō i kitea ēnei pītara i te taha rāwhiti o Te Taihū-o-Te-Waka, me te nuinga o Waitaha, hāunga ērā e noho ana ki ngā kirikiri i te pae whakararo o taihua. Arā pea te take i pērā ai, he maroke rawa nō te āhua o ngā rangi me te hau takiwā i aua wāhi, kāore i pai hei kāinga mō tēnei iwi.

Nā te rata o te pītara ki te haukū, ki te takawai, i noho ai te maha atu ki te pūwhenua (arā ki te ana), inā hoki, he tata ki te 100% te takawai o te ana. Ko tōna haurua o ngā momo trechine o Aotearoa he noho ana, me ōna anō urutaunga nui e pai ai te noho ki te pūwhenua. I tua atu i te hātea me te kore karu, he roa anō ngā pūhihi me ngā waewae — hei āwhina pea i a ia ki te whāwhā, ki te 'rongo' i ngā mea o tōna taiao. E whakaarotia ana ko te kai a ngā mea ka noho pūwhenua, he hanga ora tonu, ā, i ōna wā anō ka onge te kai, nō reira me manawanui tonu rātou. Ko ngā mea ka noho ki te mata o te whenua, me noho haukū tonu, koinā i kitea nuitia ai i ngā tahataha o te kōawa, i ngā kirikiri rānei ki taihua. He uaua te kohikohi pepeke iti i ēnei wāhi, nā konā i kore ai e nui ngā tauria o ngā trechini i ngā kohinga.

He tata ki te 40% o ngā momo noho ki te pūwhenua, nō te taupori kotahi, nō reira ka noho mōrearea tonu — kotahi noa pea te mate whawhati tata, kua korehāhā tonu atu. Me kī, ki te kino katoa te kōawa kotahi i te para, e 3% pea tērā o ngā trechine e mōhiotia ana ka ngaro. Ahakoa he wāhanga iti ngā trechine o Aotearoa nō te taupori trechine o te ao nui tonu, he puiki tonu, i te mea ko rātou tētahi o ngā rōpū pepeke noho ana tino matahuhua, he āhua rerekē tō rātou wāhi noho, ā, he nui ā rātou urutaunga e pai ai tā rātou noho ki aua wāhi uakaha.

(haere tonu)



Photograph: Peter Cleland

Cawthron/DSIR reference collection of terrestrial invertebrates (later to become NZAC). This was where he developed his special interest in Carabidae, sparked by seeing a number of striking broscines in Ted Gourlay's collection. A keen caver, Ian and other members of the Nelson Speleological Group collected a mass of carabid material during their underground explorations, which they sent for identification to Dr Everard Britton, the well-known specialist on Carabidae at the Natural History Museum. A highly productive correspondence ensued that led to a number of publications on the cave carabid fauna of New Zealand by Dr Britton. Ian was also greatly encouraged in his studies of Carabidae by meeting the internationally renowned carabidologist, Dr Carl Lindroth, in 1971. Later he escorted carabidologist Dr Shun-Ichi Uéno, Tokyo, during his visits to New Zealand to collect cave dwelling trechines, and maintained ongoing correspondence with Dr Uéno, who provided critical help and encouragement with this project over many years. In the mid-1970s Ian received geological training with the New Zealand Geological Survey that enabled him help map parts of the Nelson back country. In 1979 he moved back to Levin in the North Island, taking up a diagnostician position with the Ministry of Agriculture to identify insects intercepted by agricultural quarantine officers. He retired from MAF in 1988, but then conducted entomological surveys for various organisations, especially the Department of Conservation. He also maintained an active research interest, and provided much information about New Zealand Carabidae for Larochelle & Larivière's 2001 catalogue (*Fauna of New Zealand 43*).

Ian is currently a research associate with NZAC and has written a number of publications, primarily on Carabidae, but also on other natural history subjects. He lost his wife Heather to cancer in 2003, and has a daughter and two sons, and four grandchildren.

I whānau mai te kaituhi, a **James Ian Townsend**, i Hāwera, i te taiwhenua o Taranaki. He pai ki a ia te whāwhā i te taiao, me te tautoko anō a ōna mātua i tēnei āhua ōna. I kuraina ia ki Te Kura Tuarua Hangarau o Hāwera, nō muri ka oti i a ia he akoranga mātai pepeke i te Whare Wānanga o Massey.

Ka haere a Ian hei ringa hangarau i te Wāhanga Mātai Pepeke o te DSIR ki Te Papaiouea, i raro i a Tākuta Jim Hoy. Ka kitea e ia ētahi momo pepeke unahi eriococcid hou. Nā tana ngākaunui ki te taiao me ngā mahi whakarōpū ka neke ia ki Whakatū, ko tana kaupapa i reira, he āwhina ki te whakapai ake i te kohinga Cawthron/DSIR o ngā hanga tuarā-kore noho ki uta (ka riro koinei te NZAC i ētahi tau i muri mai). I reira ka kite ia i ētahi broscine i tino pai ki a ia, i te kohinga a Ted Gourlay, ā, ko te aranga ake tērā o tana manako nui ki a ngāi Carabidae. He tino mahi nā Ian te toro ana, ā, inā te huhua o ngā carabid i kohia e rātou ko ana hoa o te Rōpū Hōpara Ana o Whakatū, me te tuku atu kia tautohua e Tākuta Everard Britton, te kaimātai carabid rongonui i te Whare Ao Tūroa. Kāore i āriarika tā rāua whakawhitiwhiti kōrero, i tāia ai e Tākuta Britton ngā tuhinga maha mō ngā carabid noho ana o Aotearoa. He oranga hinengaro anō mō Ian i roto i āna mahi whāwhā i te carabid te tūtaki ki tērā o ngā kaimātai carabid rongonui, ki a Tākuta Carl Lindroth, i te tau 1971. Ko ia anō tērā i haere i te taha o Tākuta Shun-Ichi Uéno, o Tokyo, i a ia e kohikohi ana i ngā trechine noho ana o Aotearoa nei, me te rere tonu o ā rāua whakawhitiwhiti kōrero. Me kore ake a Dr Uéno, nāna i āwhina tēnei kaupapa i roto i ngā tau. I ngā tau waenga o ngā whitu tekau, i raro i te Rangahautanga Papawhenua o Aotearoa, ka whakaakona a Ian ki ngā āhuatanga papawhenua, i taetae ai e ia te tuhi mahere o ētahi wāhi kei uta rawa o Whakatū. Ka taka ki te tau 1979, ka hoki mai ia ki Te Ika-a-Māui, ki te Horowhenua, ki tētahi tūranga tautohu pepeke i Te Manatū Ahuwhenua, hei tautohu i ngā pepeke ka haukotia e ngā āpiha tauārai ahuhenua. Nō te tau 1988 ka mutu tana mahi tūturu mā te MAF, engari ka haere tonu āna mahi rangahau pepeke mā ētahi whakahaere, tae atu ki Te Papa Atawhai. Ā, i mau tonu ana mahi hāhau i ngā carabid o Aotearoa, mō te rārangi carabid a Larochelle & Larivière, i puta i te tau 2001 (*Fauna of New Zealand 43*).

He kawenga rangahau tonu tā Ian mā te NZAC, he maha anō ngā tuhinga kua tāia e ia, ko te nuinga mō ngāi Carabidae, engari kua toro anō hoki ki ētahi atu kaupapa o te ao tūroa. Nō te tau 2003 i riro ai tana hoa rangatira, a Heather, i te mate pukupuku. Kotahi tana tamāhine, e rua āna tama, ā e whā āna mokopuna.

Translation by **H. Jacob**

Ōtaki



**Frontispiece:** *Scototrechus orcinus* Britton, 1962 (Photograph: Peter McKenzie)

This work is dedicated to all victims of cancer, both those who have passed on and those battling on. The names of some of those with whom I have been personally associated are commemorated in the text.



## ABSTRACT

New Zealand Carabidae of the tribe Trechini are revised and relationships to the world fauna are discussed. Five lineages are recognised in the Trechini, 3 of which occur in New Zealand. The New Zealand fauna includes representatives of lineages that were previously regarded as the subtribes Aepina, Homaloderina, and Trechina. Newly described are 3 new genera (*Oarotrechus*, *Waiputrechus*, and *Kettlotrechus*), 1 new subgenus (*Mayotrechus*) in the genus *Duvaliomimus*, 18 new species, and 2 new subspecies. A total of 34 species plus 3 subspecies are recognised as follows: Aepine lineage *Kenodactylus audouini* (Guérin-Méneville), *Kiwitrechus karenscoottae* Laroche & Larivière, *Maoritrechus rangitotoensis* Brookes, *M. nunni* n. sp., *M. stewartensis* n. sp., *Neanops caecus* (Britton), *N. pritchardi* Valentine, *Oarotrechus gracilentus* n. gen., n. sp., *Waiputrechus cavernicola* n. gen., n. sp.; Homaloderine lineage *Erebotrechus infernus* Britton, *Kupetrechus lamberti* (Britton), *K. gracilis* n. sp., *K. larsonae* n. sp.; Trechine lineage *Duvaliomimus (D.) walkeri walkeri* (Broun), *D. (D.) walkeri brittoni* Jeannel (new status), *D. (D.) australis* n. sp., *D. (D.) chrystallae* n. sp., *D. (D.) crypticus* n. sp., *D. (D.) maori* (Jeannel) (re-instated), *D. (D.) megawattus* n. sp., *D. (D.) obscurus* n. sp., *D. (D.) orientalis* Giachino, *D. (D.) pseudostyx* n. sp., *D. (D.) styx* Britton, *D. (D.) taieriensis* n. sp., *D. (D.) watti* Britton, *Duvaliomimus (Mayotrechus) mayae mayae* Britton, *D. (M.) mayae mayorum* n. subsp., *Kettlotrechus orpheus* (Britton), *K. edridgeae* n. sp., *K. marchanti* n. sp., *K. millari* n. sp., *K. pluto* (Britton), *Scototrechus orcinus* Britton, *S. hardingi hardingi* n. sp., *S. hardingi worthyi* n. subsp., and *S. morti* n. sp. Their survival during changing geological episodes is discussed.

Keywords: Coleoptera, Carabidae, Trechinae, Trechini, systematics, keys, distribution, cave fauna.

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## INTRODUCTION

Speleologists in New Zealand are very fortunate. Not only are there 'sporting' caves that will test their endurance, and caves with beautiful mineral formations, but also there is a very rich cave fauna covering examples of almost all known arthropod groups of troglaphiles and troglobites.

Within the ground beetle family Carabidae there are troglobitic forms in the tribes Harpalini, Zolini, and Trechini. This last group is the subject of this volume, together with their epigeal relatives.

About half the known species of trechines in New Zealand are cave-dwellers. Collecting New Zealand trechines is often difficult. The cave-dwelling species are often very sparsely distributed in the caves in which they occur and the surface-dwelling species are not easy to find either. The reason for this is that trechines require habitats with very high humidity and are strictly confined to this environment. They live either in deep litter, or along stream-sides, or in caves as already mentioned, or sometimes sublittorally in beach gravel below the high water mark; habitats that usually escape the attention of general collectors.

The cuticle of adult trechines is often pale and thin, even when fully mature. Some cave species lack eyes, and instead have greatly lengthened antennae to assist in negotiation through three dimensional mazes in total darkness. They often have special tarsal structures to help adherence to moist surfaces. A less obvious problem that troglobites have had to overcome is that of water-balance. With almost 100% humidity, the relative humidity in a cave is above the osmotic equilibrium point of their body fluids and they have to secrete excess water (Howarth 1980). They have, of course, become partly pre-adapted to this situation by living in riparian environments.

Insects that are restricted to caves have had an interesting history as they have had to cope with major geological changes to the landscape over the last few million years. Although this subject must remain somewhat speculative, an attempt has been made to piece together the possible movements of some of the New Zealand species as they have avoided high sea levels and other changes to their environment.

New Zealand trechines range in size from only a few millimetres long to about 10 millimetres. They are rarely common; some species are known from only a single specimen, but this may reflect our inability to sample their true habitat, rather than their actual rarity. Like most Carabidae, they are considered to be predatory, and must rely on other small creatures for food. Because of their very specialised habitat, some species, those living in caves for instance, must be capable of existing for extended periods without food. Larvae of only a few species are known.

## CONSERVATION STATUS

The endemism of New Zealand Trechina is noteworthy. We have no genera shared with Australia and the only non-endemic species is *Kenodactylus audouini*, which is found in South America and islands in the Southern Ocean. All troglobitic species are of very restricted distribution and are totally reliant on the pristine nature of caves being maintained. It is particularly important that sink-holes, once in bush but now on farmland are not used as convenient rubbish disposal sites, and that forestry operations do not cause siltation or other changes to streams feeding karst areas. Epigeic species, with one exception, are all associated with riparian habitats, and although they have coped with massive floods in their time, pollution of waterways could be devastating. A species formerly found in a roadside rill at Belfast Creek on State Highway 6 south of Charleston (BR) has not been seen there since re-alignment of the road. It is fortunate that it is also known from cave systems at Bullock Creek near Punakaiki (BR) and the population there is viable. The apparent rarity of some species (one specimen in some cases) is more likely to reflect the difficulty of collecting and the fact that in caves there are many crevices suitable for fauna but impossible to examine.

## METHODS

Specimens have been borrowed from various museums and private collections. The following acronyms have been used in the text.

- AMNZ Auckland Institute and Museum, Auckland, New Zealand.  
 BMNH The Natural History Museum, London, United Kingdom.  
 BPBM Bernice P. Bishop Museum, Honolulu, Hawaii.  
 CMNZ Canterbury Museum, Christchurch, New Zealand.  
 ITNZ J. I. Townsend private collection, Levin, New Zealand.  
 JNNZ J. T. Nunn private collection, Dunedin, New Zealand.  
 LUNZ Entomology Research Museum, Lincoln University, Lincoln, New Zealand.  
 MONZ Museum of New Zealand Te Papa Tongarewa, Wellington, New Zealand.  
 NZAC New Zealand Arthropod Collection, Landcare Research, Auckland, New Zealand.  
 OMNZ Otago Museum, Dunedin, New Zealand.

The different lineages of New Zealand Trechini are dealt with alphabetically, and within each lineage the arrangement of genera and species follow the order of occurrence in the keys.

Additional relevant information, geological setting, associated biology, etc., is given after each species under "Remarks".

Measurements of length are taken from the tip of the mandibles to the apex of the elytra, or if elytra are abbreviated, to the tip of the last abdominal tergite. Lengths have been measured using a Leitz micrometer eye-piece and converting the scale to millimetres. The scale bar used in the illustrations is 1 mm unless stated otherwise.

Drawings have been made using a graticule eye-piece and squared paper, or a camera-lucida, or (more recently) using a Nikon digital camera attached to the microscope, copying from a print and adding details of setae, etc.

The two-letter area codes follow Crosby *et al.* (1976, 1998). Detailed coordinates of caves where these species occur have not been given in this publication because of conservation concerns.

## GLOSSARY

- abdominal ventrites** — segments of the underside of the abdomen  
**aedeagus** — tubular mid lobe of male genitalia  
**ambulatory setae** — pairs of setae situated ventrally on the abdomen  
**antennomere** — antennal segment  
**apophysis** — lamellate or hair-like structure beneath tarsal segment  
**basal pore** — see scutellar pore  
**cervical groove** — depression around neck as a continuation of ocular groove  
**clypeus** — portion of the head between the antennae immediately behind the labrum  
**cordate** — heart-shaped  
**coxal cavity** — area from which legs articulate  
**disc** — central region of pronotum  
**elytra** — chitinous wing-covers of abdomen  
**emarginate** — inwardly curved  
**epimeron** — small sclerite near coxal cavities  
**flagellum** — segments of antennae beyond scape  
**fovea** — a depression  
**frons** — portion of head forward of eyes  
**frontal furrows** or **ocular grooves** — longitudinal grooves on head between eyes  
**genae** — swollen portion of underside of head behind eyes

**glossa** or **ligule**— tongue-like process on underside of mouthparts

**labial palpomeres** — tactile segmented portions of the labium

**labium** — mouthparts seen from the underside of head

**labrum** — plate-like portion of head in front of clypeus

**lamellate hair** — a hair that is expanded laterally to form a thin sheet

**male genital segment** — 9th segment of abdomen that houses genitalia

**maxillary palpomere** — segment of maxillary palp

**mentum** — basal portion of mouthparts

**mesepimeron** — a small plate-like sclerite near the mesocoxal cavity

**microsculpture** — surface structure of chiton visible at 40× magnification

**papillae** — small protuberances on the underside of tarsi

**pedicel** — first antennomere beyond scape

**penultimate labial palpomere** — 2nd to last segment of labial palps

**premolar tooth** — an additional tooth at the base of mandibular teeth

**pubescent** — covered with fine hairs

**pronotum** — upper surface of prothorax

**prosternum** — lower surface of prothorax

**scape** — basal segment of antenna, antennomere 1

**scrobes** — hollow area on outer face of mandible

**scutellar pore** — tiny puncture bearing a seta, at the base of the elytra near the scutellum

**scutellar striole** — a small impressed line sometimes present near the scutellum

**stria** — an impressed longitudinal line (sometimes broken or consisting of punctures) on elytra, also known as interneur

**submentum** — area immediately below the mentum

**supraorbital setae**— prominent setae on the head behind the eyes

**tarsomere** — segment of tarsus

**tempora** — head area around the eye

**tibia (pro-, meso-, meta-)** — segment of fore, mid, and hind legs

**troglobite** — animal confined to caves and unable to exist above ground

**troglophile** — animal that can live in caves and also above ground

**trogloxene** — animal that is not usually found in caves and cannot complete life-cycle there

**umbilicate setae** — a series of setae arranged near the elytral margin

## GENERIC CONCEPT

When faced with a new taxon, there is a choice of either modifying an existing generic description to accommodate it (as has been done for *Scototrechus*), or of describing it as another genus. Although the number of monotypic genera in this revision may seem excessive, the principle that there have to be differences in a series of significant characters for separation of genera has been followed. There are many monotypic genera of trechini in other parts of the world. The isolated nature of troglobitic and other highly specialised species may account for this.

## TRECHINI

Trechini are small (less than 10 mm), pedunculate carabids in which the mesepimera do not reach the mesocoxal cavities. The most notable character used to define them at the tribal level is the shape of the head. It is relatively large and has very long and deep frontal furrows extending beyond the eyes (when present) and these furrows, in many species curve outwards behind the eyes, so that the eyes are on raised ocular hemispheres (Darlington 1962). They have a series of 8 setae around the margin of each elytron. The mouthparts are also distinctive: the glossa (“languette”) has 2 large median bristles and 2 or 3 smaller setae on the sides (Jeannel 1962), and they have a seta in the scrobes of the mandibles. The terminal and penultimate maxillary palpomeres are glabrous and of normal size, characters that clearly separate them from the Bembidiini, which have the terminal maxillary palpomeres strongly reduced, and the Zolini, in which the penultimate maxillary palpomeres are setose.

The 4th tarsomere usually has paired apophyses, which may protrude forward from the sole as far as the claw, thus underlying the 5th tarsomere. In the New Zealand Trechini these apophyses are always present on at least some tarsi (males and females alike). These structures may be hair-like or lamellate, and no doubt, provide good adhesion to wet surfaces. However, within a population there can be much variation in the length of these apophyses, presumably due to wearing with age. This makes this character of dubious value taxonomically although in broad terms it can certainly be useful. Across the genera, these modifications of the 4th tarsomere vary from nil (i.e., unmodified) on some tarsi, to 2 long setae projecting forward under the 5th tarsomere, to a series of lamellate hairs in the same position, or the structure of the tarsomere itself may be modified into an expanded process from which the specialised hairs arise. They may be present on the 4th tarsomeres of all legs, or the anterior and middle pairs alone and in most cases do not appear to show sexual dimor-

phism. These characters are most likely derived, reflecting the habitat of marine or cavernicolous species, where such changes would give maximum adhesion to seaweed or smooth wet rocks.

## HIGHER CLASSIFICATION — HISTORICAL BACKGROUND

In the 1970s and 1980s ideas on the world classification of Trechini appeared to be settling in favour of those proposed many years earlier by Jeannel. Provided his nomenclature was reduced in rank (his subfamilies became tribes and his tribes became subtribes) his overall plan remained largely intact.

For a time, the 5 “tribes” Jeannel (1926, 1927, 1928) established (Perileptini, Trechodini, Trechini, Aepini, Homaloderini) were rearranged, combined, or expanded as various characters were given emphasis in the belief that they were of greater or lesser phylogenetic significance. Laneyrie (1974) pointed out many of the shortcomings of previous attempts at an overall classification of the Trechini (or “Trechidae” — he considered them to be of even higher taxonomic rank than Jeannel), but did not provide a solution to the problems. He stated, and the New Zealand fauna seems to confirm, “that while regional faunae can be placed in what appears to be a reasonable taxonomic system, the combination of these systems on a world basis causes the greatest difficulty.” It would be presumptuous of me to attempt such an overview, and the following is intended only to give an indication of how the broader systematics can be seen from the viewpoint of a detailed study of the New Zealand fauna.

A world classification and checklist by Casale & Laneyrie (1982) divided the family into 2 subfamilies, the Trechodinae and the Trechinae, on the basis of the aedeagus being open dorsally and gutter-like in the former group. Within the Trechodini, the authors placed the Cnidini, Trechodini, and Plocamotrechini. In the Trechinae they placed the Perileptini, Aepini, and Trechini (within which they included the Homaloderini). The Perileptini were separated on account of their pubescent eyes and the penultimate labial palpomere having more than 4 setae. This placement of the Perileptini, however, is not supported by other internal structures, including those of the important male genitalia (Uéno 1989). The shape of the male genital segment also links the Perileptini and Trechodini, which cuts across their 2 subfamilies. The character of pubescent eyes is not clear-cut in some species.

Casale & Laneyrie (1982) separated the Aepini from the Trechini by their small size, being apterous and

depigmented with very small eyes, having a premolar tooth, and the anterior tibiae having a spur on their external face. All the rest they grouped in the Trechini, as not having the above characters. This does not work well for some of the New Zealand species.

Moore (1972) revised the trechine fauna of Australia and Tasmania, but did not divide the group below the Trechini, arguing that there was no clear-cut difference between the homaloderine and trechine lineages of the tribe.

Bousquet & Laroche (1993) in their catalogue of North American carabid fauna retained the 6 tribes of Casale & Laneyrie (1982), but reduced them all to subtribes, i.e., Cnidina, Trechodina, Plocamotrechina, Perileptina, Aepina, and Trechina, in which they included the Homaloderina (under the name Aemaloderina). The fauna of America north of Mexico all belonged to their expanded subtribe, Trechina. This followed Moore’s treatment of the Australian fauna, the argument as to whether they were Trechina or Homaloderina not arising.

Klimaszewski & Watt (1997) included the Bembidiini in the subfamily (as is generally recognised now) and included an illustration of *Zecillenusa alacris* (Broun) as an example of the Trechinae. Lawrence, in an appendix to this work, defined the Trechini and it is this group, as defined by Lawrence, that is the subject of this revision.

In their catalogue of the New Zealand Carabidae Laroche & Larivière (2001) followed the classification of Moore (1972). However, the Australian fauna, apart from the very distinctive Trechodini, consists entirely of the homaloderine lineage, whereas in New Zealand there are clear examples of homaloderine, aepine, and trechine lineages.

Laroche & Larivière (2007) published a synopsis of superaspecific taxa of New Zealand Carabidae, including the Trechini. They divided the New Zealand genera of the tribe into 2 subtribes, the Aepina and the Trechina. but did not recognise the Homaloderina as distinct. They also described 2 new genera of trechines in this work, which I consider unfortunate in that Laroche was aware of my ongoing work to revise the Trechini, including having specimens available with my interim names for them attached. Drs Uéno and Giachino had recognised these new genera some years ago, but generously refrained from describing them to leave them for characterising in this revision in context with all Trechini taxa.

## NEW ZEALAND PERSPECTIVE

This study has been ongoing for some years, during which time various world and regional revisions and new discoveries here in New Zealand have been made. For the most

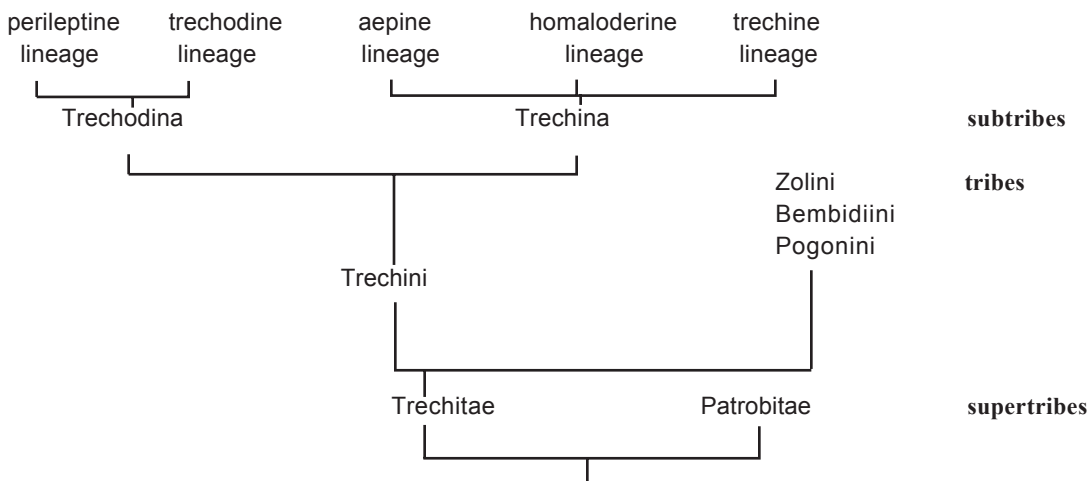
part, the New Zealand fauna seems to fall conveniently into the classical arrangement of tribes (or subtribes), except for a few problem species. Therefore, my initial thoughts followed the basic arrangement of Jeannel except for some minor modifications. For instance, in New Zealand there is a well-defined group of trechines that I regard as homaloderine, in spite of the fact that they are all blind, cavernicolous forms, a characteristic apparently not known for this subtribe in South America, where it forms a major part of the fauna. This same group of cavernicolous forms can be recognised in the Australian and Tasmanian faunas but has been classified there as Trechini by Moore (1972) as he considered the tribes Trechini and Homaloderini to be synonymous. Subsequently, Moore, in his catalogue of the Australian Carabidae (Moore *et al.* 1987) placed them all in the supertribe “Trechitae”, which also included genera usually placed in the tribes Zolini, Bembidiini, and Pogonini, and did not subdivide them further. However the New Zealand fauna contains **true** Trechini *sensu* Jeannel (apparently absent from Australia) and here at least, the old tribes or subtribes “Trechina” and the “Homaloderina” can be separated quite satisfactorily as distinct lineages by the shape of the female genitalia, and other characters including those of the mouthparts.

Examination of female genitalia shows major differences between the New Zealand examples of the Aepine lineage and the Homaloderine lineage, with the enigmatic genus *Neanops* (and others) falling into the former, although it is a cave dweller with greatly reduced eyes. Previously, aepines have been recognised by their association with the sub-littoral habitat. Within our Aepine lineage, the possession of a well-defined external tibial spur as in

*Kenodactylus*, is modified into a thicker spine among other bristles in *Maoritrechus*, and although *Oarotrechus* must be classed as belonging to the same lineage, based on its general morphology and the fact that it lives in marine gravels, it does not have an external spur but instead this is replaced by a series of dense bristles. *Neanops caecus* also has similar dense bristles and no spur, but *N. pritchardi* does have a small spur. So the presence of the tibial spur does not provide a clear-cut demarcation for the New Zealand fauna. However, the structure of the female genitalia puts *Neanops* clearly in the Aepine lineage in spite of it being a non-marine cave inhabitant. The arrangement of the female genital tract is of great importance when considering the higher classification of the Trechini and many other groups of Carabidae and its significance cannot be ignored.

In 1999 another cave-frequenting aepine was found in Northland (the first troglobitic carabid from the region) which has confirmed for me that the Aepine lineage *does* include cave-dwelling species. Unfortunately the only known specimen of this fascinating species is a slightly teneral male, so what the female genitalia look like remains unknown at this time. This Northland species *does* have the typical aepine spur on the outer side of the fore tibiae, but it also has elytra that are not truncate and has sharp pointed homaloderine mandibles. So almost all the external characters for separation have broken down. This could be an argument for abandoning the separate lineages; however, a female would be expected to have aepine type genitalia. It appears that a group of aepines in New Zealand have adapted from the sub-littoral to the subterranean environment.

The New Zealand fauna (all Trechina), is considered to contain examples of the right-hand 3 lineages. Figure redrawn from data by Grebennikov & Maddison (2005).



In this interpretation, the New Zealand fauna does not contain any examples of the Perileptini or Trechodini lineages that have been recognised in other parts of the world, but has representatives of what have been previously thought of as Aepina, Homaloderina, and Trechina, now perhaps better thought of as distinctive lineages within an expanded Trechina rather than formal subtribes. I have also been guided particularly by the shape of the male genital segment (9th sternite), a character that to my knowledge has not been used in trechine classification before. As this is an internal structure, unlikely to be modified by secondary environmental adaptations, its shape may well be of phylogenetic value. An examination of rather limited overseas material showed the shape of this structure supports Jeannel's earlier classifications (including 1941), but refutes his later (1960) idea of placing the Perileptina near the Trechina. It shows the Perileptina and the Trechodina to be closely related and quite distinct from the rest of the tribe (Figs 153–165).

A study of larval morphology has not been included in this revision because there are very few examples available. Among those that are available are *Kenodactylus* and *Maoritrechus* which have double claws (Johns 1974) and *Duvaliomimus (Mayotrechus) mayae* which has single claws (May 1963). The significance of this would require more study. However, Grebennikov & Maddison (2005) after a study of world-wide trechine larvae have come to the conclusion that the Perileptina are related to the Trechodina as suggested by Uéno (1989), and further supported by the shape of the male genital segment. Grebennikov & Maddison (2005) showed the Trechini as a whole to be of monophyletic origin, whereas the Bembidiini are probably polyphyletic.

## ORIGINS OF THE TRECHINI CAVE FAUNA

Some geologists take the extreme view that New Zealand or 'Zealandia' was totally inundated by sea about 23 million years ago. Campbell & Hutching (2007) discuss this scenario in some detail. From a biological viewpoint I doubt this could have happened. If it were so, then all our fauna, including trechines must have established and/or evolved since Oligocene time. This may well be so for perhaps the majority of our trechine fauna, but I think it is possible that there is also an archaic element in genera associated with older Ordovician marble, i.e., *Kupetrechus* and *Scototrechus*. This is not because the formation is so much older, but because the present day distribution of species of the Homaloderine lineage in particular indicates a radiation from this ancient marble. *Erebotrechus* too, although now also found in caves in Oligocene limestone, may well have survived from this older fauna. Homaloderines have

not been found in New Zealand outside the Nelson–Buller area, however they have close epigeal relatives in South America, and both epigeal and cave-dwelling species in Australia and Tasmania. This relationship is also shown by the subtribe Creobina (Broscini), which is well known in South America and Tasmania, and in New Zealand is at present known by a single species occurring on the remote Bounty Islands. Northwest Nelson is a faunal area of high diversity and endemism. It should be noted that the relict *Kiwitrechus* is also endemic to that region which has such a range of relict species (both plant and animal) that it must surely have escaped the Oligocene transgression. Gibbs (2007, p. 90) cites insects such as sandflies and mayflies being totally dependent on cool fresh water, sea water being poisonous to them, and provides a map (p. 193) showing how this fauna could have reached New Zealand 130–35 million years ago. Conran, Bannister & Lee (2009) suggest that "... the presence of a diverse and complex subtropical rainforest with epiphytic orchids surrounding a freshwater lake in Early Miocene Otago supports the assertion that there was land in the New Zealand region throughout the Cenozoic, with theories arguing for post-drowning re-colonization by New Zealand endemic taxa being much less plausible."

On the other hand, for those like Campbell & Hutching (2007), who believe Zealandia to have been totally submerged, it is possible that dispersal could have occurred after separation of Zealandia from Australia. Over time, there would be a high probability of massive floods whereby mini-islets of vegetation complete with decaying logs and fauna would be swept out to sea. Under today's milder conditions it is known that carabids can be flooded from pastures to be deposited later on nearby beaches (Walker 1904, Townsend 1994). If total submergence of New Zealand occurred in Oligocene Time, there would have been over 20 million years for such storms to provide transport for fauna. Climatically, conditions were probably severe at times, also warmer at other times and this may be why we now have populations of at least 25 species of carabids living in caves and nowhere else. This is a large fauna for a country the size of New Zealand, and to this could be added a host of other invertebrates such as harvestmen (Forster 1965), spiders, millipedes (Johns 1991), centipedes, symphylans, japygids, peripatus (Ruhberg 1985), hydrobiid snails (Haase 2008), and even Homoptera feeding on roots (Fennah 1975).

This does not mean that all these examples are necessarily of ancient stock, perhaps the majority have local surface-dwelling relatives, and it has been shown that cave species can evolve quite rapidly. In Hawaii trogllobites seem to have fast-tracked the evolutionary processes. On Maui, the trogllobitic carabid *Blackburnia howarthi* (Samuelson & Lieberr 1992) has evolved in the last 120,000



years (Liebherr & Samuelson 1992). This has been shown by dating the lava tube in which the cave has developed and also the flow below it, which would have ensured the elimination of any pre-existing fauna (Sherrod *et al.* 2003). There are many examples of lava cave species becoming differentiated in less than 10,000 years (Uéno, pers. comm.). This type of rapid evolution may also explain the presence of *Kettlotrechus* species in caves at Paturau and Oparara that were inundated by high sealevels during the last interglacial. Ancestors of *K. marchanti* could have survived in caves above the interglacial sea levels at the highest point of the limestone formation at Kaihoka and then invaded the lower areas as the sea receded, evolving into other species in the process. These and the many species of *Duvaliomimus* are clearly of the Trechine lineage with bidentate mandibles. Our cave-frequenting *Duvaliomimus* species and its subgenus *Mayotrechus* are probably recent invaders of caves, whereas the related genus, *Scototrechus*, as mentioned earlier, is perhaps much older. It is also feasible that the ancestral form may have been an epigian *Duvaliomimus*-like species that gave rise to the troglobitic genera.

The origin of the Trechine lineage in New Zealand is puzzling because this lineage appears to be absent in Australia today. Perhaps they were present there when Australia had a wetter climate, and then died out, being unable to survive in the drier conditions. However, parts of Tasmania should have provided suitable habitat, and after all, many trechines of Homaloderine lineage are found there. We have a strange and doubtful connection to China with the striking similarity of our *Erebotrechus infernus* to the Chinese *Sinaphaenops mirabilissimus* Uéno & Wang. Both species belong to the Homaloderine lineage, but there the similarity must surely end, the superficial resemblance being explained by convergent evolution. New Zealand has a relatively high number of species of both Trechine and Aepine lineages, yet these appear to be absent from Australia.

Panorama Cave, Sequoia National Park, California, at an altitude of 10,600 feet has freezing conditions, yet it has endemic diplurids and harvestmen. "This area was glaciated only 10,000 years ago, and it is hard to believe anything survived under a mile of ice and meltwater." (Krajick 2007). There are no troglobitic Carabidae reported from Panorama Cave, although it has been estimated that 250 troglobitic carabids occur in North America (Barr 1981). Krajick also suggests that troglobites in "young" cave systems may have been living previously in old caves, now eroded away. Shatter-zones in hard rocks give ample space for small creatures to migrate. Ian Millar has found that *Kupetrechus larsonae* can live within crevices, and it is generally recognised that the "mesocaverns" (fissures of 0.1–

20 cm) have a rich fauna (Howarth 1983). How else could troglobitic carabids establish in old disused Japanese mines (Uéno 1959)? As Uéno (1977b) points out, there is a whole fauna of troglobites living in micro-crevices, only to be discovered by us when we have access via mine shafts, etc. If the cavities are young, the fauna has to be already existing in the surrounding rocks.

So it seems that evolution proceeds at very different rates and at different times for different locations and different creatures. As far as our fauna is concerned, many of the troglobitic Carabidae (and some other groups) may well have origins pre-dating the break-up of Gondwana, while others have evolved more rapidly and recently. Perhaps it is partly due to New Zealand's turbulent geological history (being on a plate boundary) that caves have become such important refugia. Their future preservation is paramount. It is likely that New Zealand speleologists will find there are many more biological discoveries to be made in the future, as there are still extensive areas of calcareous, potentially caverniferous rock from which no cave inhabiting trechines have been recorded.

If I was asked to speculate **where** to search, I would suggest Fiordland, near the south coast – maybe caves in Oligocene deposits west of the lower Waiau River where the effects of the glaciations would have been less severe. Entomologists have searched unsuccessfully for trechines in caves like Aurora, Te Anau where the fauna seems to be relatively impoverished, perhaps because of the glaciations (Emberson, pers. comm.).

The roots of our trechine beetles may have been influenced by movements of the alpine fault and the 'other half' of the northwest Nelson cave fauna should be looked for further south. There are other examples of flightless carabid beetles that reflect this. Britton (1949) [incorrectly, in my opinion] synonymised *Mecodema aeneoniger* (Broun) from Wangapeka, Nelson with *M. punctatum* (Laporte de Castelnau) from Otago because of their close similarity, and the Otago-centred *Taenarthrus* has more than one undescribed species in northwest Nelson. Movement on the fault may also explain the somewhat anomalous northern distribution of *Duvaliomimus (D.) walkeri*.

## FUTURE STUDIES IN NEW ZEALAND

This publication reflects part of almost a lifetime's study of New Zealand Carabidae. It reveals there are still gaps in our knowledge of the Trechini because of the apparent rarity of some species. Until now I have waited for more specimens of some of the cave species to become available before describing them, but there has to be a time when a study must be finished, and as a result this has left some of the information in this publication less complete than I

would have wished. For example, there is some uncertainty about *Neanops pritchardi*; it would have been nice to have a good male specimen of *Scototrechus morti* instead of having to rely on dismembered parts of long-dead specimens found on cave ledges; it would have been nice to check the shores of D'Urville Island to see if *Maoritrechus rangitotoensis* does occur there or rediscover it in the Hauraki Gulf; a fully chitinised specimen of *Waiputrechus* from Northland and an example of the opposite sex would have been great; and as for the large and difficult genus *Duvaliomimus* there will be new species to describe, and DNA studies may be required to unravel the complex of populations living in the Tararua south to within the city limits of Wellington. Similar problems exist near Auckland and Dunedin, so there is more work to be done by future researchers.

Finally, a word of caution should be sounded about collecting specimens in caves. Beetles can cope with the underground habitat better than humans and collecting them is not without its exciting moments. Deuve (1993) while collecting the unique specimen of *Dongodytes fowleri* Deuve from a cave in China reported "A lone individual of a blind carabid beetle was discovered running over a steep mud slope at the edge of an unexplored pitch. The acrobatics necessary to capture the fleeing beetle nearly resulted in the rapid exploration of the pitch!"

## TRECHINA — CHARACTERS TO DEFINE THE NEW ZEALAND SPECIES

Moderate to small Carabidae often with proportionally large-sized heads; head with deep ocular grooves that may be straight and sometimes incomplete or curved outwards behind the eyes to meet the cervical groove; eyes (or if blind, the ocular area) on inflated ocular hemispheres; usually with 2 or occasionally more ocular setae; maxillary palps with the penultimate palpomere glabrous and of similar size to the terminal palpomere; labial palpi with penultimate palpomere bearing up to 4 or rarely 7–8 setae; mentum with or without a tooth, which may be simple or bifid, submentum with 6 or rarely 8 setae; glossa with 2 median bristles and 2 or 3 smaller setae on the sides; mandibles bi- or tridentate, with a seta in the scrobes; elytra without an inner longitudinal ridge beneath the apical edge, each usually with 8 marginal umbilicate setae, although in one genus (*Kenodactylus*) this number can vary from 6 to 10. The New Zealand species always have an apophysis present on the 4th tarsomere of at least some tarsi (males and females alike). Males usually have some tarsomeres of the protarsi asymmetrically expanded, and/or with sen-

sory papillae beneath them. The male genital segment is usually V-shaped, or rarely U-shaped, but never Y-shaped.

Where possible, the following key has been constructed on external features. However internal structures are important for classification and have to be resorted to at times. The male genital segment is of great significance, so in spite of its restriction to maybe only half of the population, its shape is to be considered a major factor in separating the subtribes and also (later) the unique genus *Kiwitrechus*.

## KEY TO THE SUBTRIBES AND MAIN GENERIC LINEAGES OF TRECHINI

- 1 Terminal palpomeres of labial and maxillary palpi subulate, i.e., rudimentary, much shorter and narrower than penultimate segment, similar to *Bembidion*; eyes pubescent ..... TRECHODINA –Perileptine lineage (not in N.Z.)
- Terminal palpomeres of palpi not subulate; eyes not pubescent ..... 2
- 2 Male genital segment Y-shaped; aedeagus gutter-like, lacking a closed basal bulb, ejaculatory duct entering between 2 subequal lobes (Fig. 163, 164) ..... TRECHODINA –Trechodine lineage (not in N.Z.)
- Male genital segment U-shaped or V-shaped; aedeagus usually tube-like, with a closed basal bulb and complete basal orifice for ventral entry of ejaculatory duct, rarely partially open dorsally (N.Z. species) ..... TRECHINA 3
- 3 Mandibles bidentate, without a premolar tooth (Fig. 111–120); setae on 3rd elytral interval displaced towards striae so that a line through them is oblique to suture, i.e., apical setae attached to 2nd stria and therefore closer to suture and humeral setae attached to 3rd stria and more distant .....(p. 35)... **Trechine lineage**
- Mandibles tridentate, with a premolar tooth, at least on one side (Fig. 103–110); discal setae on elytra forming a line approximately parallel to suture, i.e., apical setae equally as far from suture as humeral setae ..... 4
- 4 Very small, rarely more than 4 mm, or if larger with truncate elytra; basal mandibular teeth very sharp, but main structure short and thick with blunt tip (Fig. 103–105); anterior tibiae often with an external spur; elytra usually completely or partly free at suture, apices often truncate; male genitalia of attenuated form, basal bulb with blade (for N.Z. species), internal sac often with only vestigial copulatory piece (Fig. 122–124); female genitalia with a well developed spermatheca (Fig. 167–171) .....(p. 19)... **Aepine lineage**
- Larger, usually more than 6 mm long; elytra entire; basal

mandibular teeth blunt, but main structure thin and sharp pointed (Fig. 108–110); anterior tibiae without an external spur; elytra fused along suture, apices not truncate; male genitalia stouter, truncate at tip, basal bulb without blade (for N.Z. species), internal sac with a well developed copulatory piece (Fig. 130–132); female genitalia consisting of a simple bursa, without discrete spermatheca (Fig. 172, 181) .....  
.....(p. 30)... **Homaloderine lineage**

## AEPINE LINEAGE

In this revision, 6 genera of the aepine lineage are recognised in New Zealand: *Kenodactylus* Broun, *Kiwitrechus* Laroche & Larivière, *Maoritrechus* Brookes, *Neanops* Britton, *Oarotrechus* n. g., and *Waiputrechus* n. g. The lineage can be distinguished by the mandibles being tridentate, with the premolar tooth sharp pointed. Eyes, when present, small and convex, not pubescent. Males may have the 2 basal protarsomeres expanded (*Kenodactylus*, *Maoritrechus*, *Oarotrechus*, and *Waiputrechus*) or only the 1st tarsomere expanded (*Kiwitrechus*) or no tarsomeres expanded but with special sensory hairs beneath (*Neanops*). Anterior tibiae smooth, with or without an external groove, often with an external spur near the apices, although this is sometimes replaced by a series of equal-sized bristles. Pronotum with 2 setae on each side, 1 a little posterior of the anterior angle and 1 in front of the posterior angle. The elytra are often truncated apically so that the last abdominal tergites may be visible dorsally (*Kenodactylus* and *Maoritrechus*) or completely covered (*Oarotrechus*, *Kiwitrechus*, and *Waiputrechus*) or with full elytra but a portion of the last tergite protruding (*Neanops*). The marginal series of elytral umbilicate setae are arranged with 4 in the humeral area, 2 lateral and 2 in the apical region before the lateral fold, although *Kenodactylus* may be somewhat variable in both number and position. The base of the aedeagus has a well defined blade (the “aileron sagittal” of Jeannel), although this structure varies in size within the species *Kenodactylus audouini* (Guérin-Méneville) (Fig. 122a–f). Some female genitalia have a large spermathecal gland attached to the bursa copulatrix (Fig. 168, 170).

### KEY TO GENERA OF THE AEPINE LINEAGE

- 1 Disc of elytra with setiferous punctures on 3rd and 5th intervals only .....(p. 19)... ***Kenodactylus*** Broun  
—Disc of elytra with punctures on either 3rd or 4th intervals only ..... 2
- 2 Eyes present; anterior tibia with a groove between 2 setae-bearing ridges in distal 1/2; without setae on prosternum ..... 3

- Eyes absent; anterior tibia with distal 1/2 more-or-less smooth, without groove, although sometimes a longitudinal series of fine spines present; with setae on mid part of prosternum ..... 5
- 3 Elytral setae on 3rd interval only, non-foveate; 2 basal protarsomeres of male only moderately expanded (Fig. 76, 77), elytra truncate .....  
.....(p. 21)... ***Maoritrechus*** Brookes
- Elytral setae on 4th interval only, 1st and 2nd foveate; 1st and/or 2nd basal protarsomeres of male greatly expanded on their inner side (Fig. 80, 81, 85–87), elytra full ..... 4
- 4 Pronotum with sides evenly rounded to basal margin which is less than 1/2 length of apical margin .....  
.....(p. 24)... ***Kiwitrechus*** Laroche & Larivière
- Pronotum with sides sharply sinuate before basal margin which is more than 2/3rds length of apical margin .....(p. 25)... ***Oarotrechus*** n. g.
- 5 Elytra with shoulders entirely effaced; male with 2 basal protarsomeres greatly expanded; ocular area with 2 setae on each side .....(p. 27)... ***Waiputrechus*** n. g.
- Elytra with clearly defined shoulders; male without expanded protarsomeres; ocular area with 3 or 4 setae on each side .....(p. 28)... ***Neanops*** Britton

### Genus *Kenodactylus* Broun, 1909

*Kenodactylus* Broun, 1909: 91. Type species: *Kenodactylus capito* Broun, 1909 (= *Trechus audouini* Guérin-Méneville, 1830), by monotypy

*Aepomorphus* Jeannel, 1926: 447 Type species: *Trechus audouini* Guérin-Méneville, 1830, by monotypy. Synonymised by Jeannel, 1938: 255.

**Diagnosis.** Tridentate mandibles with very sharp premolar tooth, apical portion of left mandible thicker than right (Fig. 103); without accessory setae on frons; frontal furrows almost straight; genae without fine setae; pronotum with 2 setae each side; prosternum without setae; elytra with discal punctures on 3rd and 5th intervals, those of 3rd almost equidistant from suture; elytra truncate apically, shoulders evenly rounded; anterior tibia without groove, but with a short spur on outer distal area; 2 basal protarsomeres expanded in male; male genitalia with aedeagus in form of a closed tube, basal blade present (Fig. 122); female genitalia with spermatheca forming a bulbous gland off vagina below oviduct (Fig. 167).

**Description.** Distinguished from other New Zealand aepines by its larger size (4.5–6 mm), presence of setae on 5th elytral interval and dense microsculpture on elytra giving a dull appearance compared to head and pronotum which are shiny. **Head:** wide, almost as large as pronotum,

tempora strongly inflated; 2 supraorbital setae, 1 immediately above eye and other behind, in frontal furrow; antennae with scape and 1/2 of the 2nd antennomere glabrous, remaining antennomeres pilose; 2 small setae near base of each antenna; frons without accessory setae; clypeus with 4 setae; labrum with 6 setae; mandibles tridentate with sharp premolar tooth; penultimate labial palpomere with 4 setae placed distally (Fig. 90); mentum with simple tooth and suture present; genae with 2 normal prominent tactile setae but no fine accessory setae. **Thorax:** Pronotum cordate with broadly reflexed lateral margins, each bearing 2 setae, base narrower than apex. **Ventral surface:** Prosternum without setae; without accessory setae on abdominal ventrites. **Elytra:** Basal margin absent; apex with pronounced apical shelf, but extension truncate so that abdomen is visible dorsally; elytral intervals flat, 3 setae associated with 3rd stria, and a single seta on 5th stria; marginal channel with umbilicate series of 6–10 setae. **Legs:** Protibiae without a groove on their external face but with a small spur near apex; 4th tarsomere of all tarsi with a process beneath, terminating in a thin lamina produced forward under 5th tarsomere, protarsi have this lamina as a broad sheet, on the meso- and metatarsi it is divided into 2 unequal sheets, outer one longest.

A monotypic genus widely distributed in intertidal and supralittoral habitats on islands and landmasses in the Southern Ocean, with occasional records in southern New Zealand.

**Remarks:** *Kenodactylus* is unusual in having a variable number of marginal umbilicate setae, sometimes only 6 and occasionally up to 10. The number of marginal umbilicate setae may also vary between the left and right elytra of an individual.

### *Kenodactylus audouini* (Guérin-Méneville, 1830)

Fig. 1, 23, 27, 90, 103, 122, 153, 167, Map p. 88

*Trechus audouini* Guérin-Méneville, 1830: 60, plate I, figure 16.

*Trechus testaceus* Blanchard, 1843: Coléoptères, plate 3, Figure 15 (redescribed in 1853: 45). Type locality: Port Famine, Falkland Islands. Synonymised by Putzeys, 1870: 22.

*Kenodactylus capito* Broun, 1909: 91. Type locality: Campbell Island. Synonymised by Johns, 1974: 293.

*Aepomorphus audouini*: Jeannel 1926: 451, 1937, 1940; Darlington 1964; Pilgrim 1963.

*Kenodactylus audouini*: Jeannel 1937, 1940, 1962; Darlington 1970; Johns 1974; Casale & Laneyrie 1982.

**Redescription.** **Length:** 4.5–6 mm. **Colour:** brown; elytra with strong microsculpture consisting of short impressions aligned with suture, very weakly isodiametric on head and thorax. **Head:** Large, frontal furrows almost

straight, weakening before cervical groove; eyes round, protruding, facets clearly visible; mandibles stout, left thicker towards the tip than right. **Thorax:** Pronotum cordate, with basal margin angled obliquely towards lateral angles. **Elytra:** Intervals very flat, 2nd and 3rd a little broader, 3 setae of 3rd stria sometimes displaced towards 4th interval; usually only 1 seta on 5th stria in apical 1/2. **Legs:** Protarsi in male with 2 basal segments strongly expanded on their inner sides. **Genitalia:** with median lobe of aedeagus cylindrical, arcuate, basal bulb slightly swollen; basal blade varies in size and shape depending on location of the populations (Fig. 122a–f). Female with well developed spermatheca (Fig. 167).

**Type locality.** Soledad Bay, Falkland Islands.

**Distribution** (N.Z. records Map p. 88). Wide ranging — Patagonia, Falkland Islands, South Georgia, Straits of Magellan, Tierra del Fuego. New Zealand records: Antipodes Island, Bollons Island (Antipodes), Auckland Islands, Campbell Island, Snares Islands, commonly; and has been rarely found at Stewart Island and on a Dunedin beach.

— / DN, SI / SN, AN, AU, CA

**Material examined.** 106 non-type specimens from New Zealand subantarctic islands, Stewart Island, and Dunedin; also Patagonia (CMNZ, NZAC, ITNZ, JNNZ).

**Remarks.** Darlington (1964) drew attention to the close relationship of *K. audouini* and *K. capito* but, in spite of Jeannel's (1938) statement about their similarity and his own listed comparisons of head / prothorax, width / length prothorax, base / apex prothorax, base thorax / head width, and width of elytra / prothorax, and examination of male genitalia which he stated to be "not significantly different", he refrained from synonymising these species on the grounds of geographical separation of 6500 km.

Johns (1974) redescribed this species and added descriptions of larvae and pupae. He showed a relationship between body size and habitat, and suggested that increasing body size may be related to increasing numbers of available prey such as Collembola, Isopoda, and various arthropod eggs in terrestrial as opposed to inter-tidal habitats. He also drew attention to some anomalous features, such as the adult having 3 sclerotised rectal rings instead of the usual 6, and the larvae having 2 subequal claws and the combination of 3 maxillary articles and 3 or perhaps 4 labial articles.

I have examined over 100 specimens of *capito* from New Zealand and the subantarctic islands but only a few specimens of *audouini* from Patagonia. The drawings of male genitalia (Fig. 122a–f) show that there is considerable variation in the size of the basal blade. The development of this structure follows a parallel pattern to that of body

size shown by Johns (1974). It also emphasises the trend of the intertidal population on Stewart Island to appear to be closest to the Patagonian population and least like specimens from the strictly supralittoral habitat on the Snares, in spite of this being the nearest point geographically. The size and shape of the male basal blade appears to be a variable character for this species. In view of the limited overseas material at my disposal I accept the synonymy of *capito* as established by Johns (1974), although a future examination of the Snares Island population may show it to be taxonomically distinct, at least at subspecies level.

Grebennikov (2008) published photographs of adult and larvae and the nature of the double claws, which are fused at their base preventing independent movement of each claw. His analysis supports a previously proposed hypothesis (Grebennikov & Maddison 2005) that the reduction in the number of tarsal claws in larvae of Trechitae took place at least twice.

### Genus *Maoritrechus* Brookes, 1932

*Maoritrechus* Brookes, 1932: 27. Type species *Maoritrechus rangitotoensis* Brookes, by original designation. Reinstated by Laroche & Larivière, 2007

**Diagnosis.** Tridentate mandibles, left mandible thicker towards tip than right; without accessory hairs on frons, genae, or prosternum; frontal furrows curved and meeting cervical groove; pronotum with 2 setae on each side; elytra truncate apically, with discal punctures of 3rd stria approximately equidistant from suture; anterior tibiae with weak groove and small subapical external spur; 2 basal protarsomeres weakly expanded in male; male aedeagus of slender, tubular, arcuate form with basal blade (Fig. 123); female genitalia with well developed spermatheca (Fig. 168).

**Description.** Small aepines (<5 mm). **Colour:** brown to reddish-brown. Wingless. **Head** large relative to body, ocular furrows completely surrounding small but prominent and clearly faceted eyes; frons without accessory setae; antennae submoniliform with 1st antennomere longest, pubescent from antennomeres 2–11; 4th antennomere shortest but subequal to following antennomeres, terminal one slightly longer; labrum deeply emarginate; terminal segments of maxillary and labial palpi tapered towards their tips, their base not markedly thinner than termination of penultimate palpomeres; penultimate labial palpomere with 4 setae in apical 1/2 (Fig. 91); tooth on mentum simple to shallowly bifid; with a suture between mentum and submentum; mentum with 2 setae, submentum with 6; genae with or without accessory setae. **Thorax:** Pronotum with pronounced marginal channels, 2 setae on each side, 1 within apical 1/4 and other in front of posterior angles. Apterous. **Elytra** with shoulders rounded; basal margin

absent; scutellar pore and striole present; striae weakly defined, becoming obliterated towards truncate apices as intervals become flatter; with a series of 2–3 setiferous pores on or near 3rd stria; with 1 or 2 apical setiferous punctures; marginal series of umbilicate setae arranged as a group of 4 humeral (2 subgroups of 2) almost equally spaced, 2 middle and 2 apical, all similarly spaced. **Legs:** Anterior tibiae with a groove on external face and a small subapical spur; 4th tarsomeres of anterior and mid tarsi with lamellate hairs which project forward beneath 5th tarsomere; 4th metatarsomere has long hairs, but they are not lamellate; 2 basal protarsomeres expanded in male. **Genitalia:** Male aedeagus slender, tubular, with or without basal blade (Fig. 123, 124). Female genitalia with well developed spermatheca broadly attached to bursa copulatrix (Fig. 168).

**Remarks.** Jeannel hinted at the close resemblance of *Temnostega* and *Maoritrechus* in his earlier papers, but it was not until 1965 that he made the mistake of synonymising *Maoritrechus rangitotoensis* with *Temnostega antarctica* Enderlein 1905, stating that they could not be distinguished, even at the subspecies level. This was surprising, because *rangitotoensis* is clearly distinct generically from *T. antarctica* on many points.

Although Laroche & Larivière (2001, 2007) record *Maoritrechus* as reinstated, they did not give the reasons for this. On comparing all New Zealand species of *Maoritrechus* with a topotype of *T. antarctica* from the Baie du Navire, Possession Island, Crozet Islands, the difference is immediately apparent. *Temnostega* is more slender, with only a narrow margin to the pronotum which has a narrower base. The outline of the elytra is elongate-oval ( $W : L = 1 : 1.50$ ) with shoulders effaced. The shoulders are rounded in both genera, but much stronger and with margin more reflexed in *Maoritrechus*, where the elytra would be better described as broadly oval with truncate apices ( $W : L = 1 : 1.47$ ). In *Temnostega* the elytral intervals are flat, striae weakly impressed with the 1st and 2nd not reaching the base of the elytra. In *Maoritrechus* the elytral intervals are more convex and the 1st and 2nd striae reach the base of the elytra. *Maoritrechus* has coarsely faceted eyes (25–30 facets are clearly defined), whereas in *T. antarctica* the surface of the eye is smooth, so an accurate count of facets cannot be made. In *Temnostega* antennomeres 3–11 are more globular than those of *Maoritrechus* and the 4th antennomere is clearly shorter than the 5th, whereas in *Maoritrechus* these antennomeres are subequal. In *Temnostega* the head has a series of fine secondary setae on the vertex and an extra pair near the ocular grooves. *Maoritrechus* lacks these. *Temnostega* has a series of 5 or 6 setae on the genae, some up to eye level, whereas *Maoritrechus* usually lacks these setae en-

tirely, but if any are present, there are no more than 2, and these are placed well below the level of the eye. The mentum (with tooth very weak) has 4 setae in *Temnostega* and only 2 in *Maoritrechus* (with tooth more prominent). [Enderlein's (1905) illustration, Fig 4 p. 721 is accurate. However, Jeannel's (1940:79, Fig 12; 1965, Fig 59b) illustrations of the whole animal fail to record the 2nd lateral setae of the pronotum, which are present in front of the posterior angles.] In *Temnostega* the terminal labial palpomere is especially thin compared with the very thick penultimate palpomere. In *Maoritrechus* the terminal palpomere is more tapered, its base not markedly narrower than the termination of the penultimate palpomere. *Temnostega* has 2 setae in the mid region of the prosternum; *Maoritrechus* does not. Also there are differences in the shape of the male genitalia — the aedeagus is more slender and angled in *Temnostega* (Fig. 125) and the internal sac has numerous fine spines (Jeannel 1940, p. 82). There is also biogeographical evidence. *T. antarctica* occurs on the Crozet Islands, in the southern Indian Ocean, some 8000 kilometres from New Zealand and it has been reported (Jeannel 1940) to be living “under debris and stones at the base of tussocks approximately 100 m from the sea”. Numerous adults and also larvae have been found in this habitat. Brookes discovered his specimens of *M. rangitotoensis* “under decaying *Zostera*, well below high water mark, as the tide fell”, a strikingly different environment. All known New Zealand *Maoritrechus* are from a strictly littoral to sub-littoral habitat.

#### KEY TO SPECIES OF MAORITRECHUS

- 1 Shape of elytra oval in outline with sides evenly rounded  
L : W = 1.42 to 1.52 : 1; sides of pronotum with a distinct sinuation before posterior angles .....  
.....(p. 22)... *rangitotoensis* Brookes
- Shape of elytra more elongate L : W = 1.57 : 1, with sides almost straight in middle; sides of pronotum straight before posterior angles, without, or with a very slight sinuation ..... 2
- 2 Sides of pronotum curved outwards in anterior 1/2, widest part of pronotum being sinuation behind anterior seta (Fig. 77) .....(p. 23)... *nunni* n. sp.
- Pronotum more trapezoidal in shape; sides straight almost to anterior setae, widest part being closer to them (Fig. 78) .....(p. 23)... *stewartensis* n. sp.

#### *Maoritrechus rangitotoensis* Brookes, 1932

Fig. 2, 25, 29, 71, 76, 104, 123, 154, 168, Map p. 89  
Brookes, 1932: 27. Jeannel 1937, 1940, 1964, 1965 as *Temnostega*.

**Diagnosis.** Mandibles tridentate with sharp pointed premolar. 2 setae on each side of pronotum, set about equidistant from anterior and posterior margins. [Kaikoura population has anterior seta set further from apex, but this character is variable.] Pronotum with a sharp sinuation before posterior angles. Elytra ovoid in outline with sides evenly rounded. L : W = 1.49 : 1. Anterior tibiae with external groove and small sub-apical spur.

**Redescription.** **Length:** 2.7–3.0 mm. **Colour:** Fuscous brown. **Head** large, ocular groove complete, meeting cervical groove at 2nd ocular seta; with 2 small setae between eye and base of antenna; eyes small, convex, with clearly defined facets; mandibles with left broader than right, with a sharp pointed premolar tooth on each side; tooth on mentum blunt; genae without accessory setae. **Thorax:** Pronotum cordate, slightly wider than long, mid length : maximum width = 1 : 1.21; sides gently sinuate anteriorly, sharply sinuate before posterior angles; marginal groove well developed with 2 setae set almost equidistant from anterior and posterior margins respectively; median line weakly impressed, not reaching base or apex where it divides towards anterior angles forming a Y-shaped impression. **Elytra** with shoulders evenly rounded, apices only slightly truncate; marginal channel narrow; intervals moderately convex, 3rd with 3 setiferous punctures; apical fold weak. **Legs:** Male with 2 basal protarsomeres expanded to form a tooth on their inner sides, 1st protarsomere more expanded than 2nd. **Genitalia:** Male with well developed blade (Fig. 123). Female with well developed spermatheca broadly opening from bursa copulatrix (Fig. 168).

**Type locality.** Rangitoto Island, Hauraki Gulf, AK.

**Distribution** (Map p. 89). Known originally from Rangitoto Island, Hauraki Gulf, but in the 1970s discovered on Kaikoura Peninsula, see “Remarks”.

AK / KA

**Material examined.** Holotype, 2 paratypes, 70+ non-type specimens. **Holotype** male, **AK**, glued on card, right tibia and tarsi missing, labelled: Under decaying *Zostera* Below H.W. mark / Rangitoto Island Hauraki Gulf / Coll. A. E. Brookes 4–7–1920 / Red Holotype / A. E. Brookes Collection / (Green) Body illustrated D. W. Helmore 18.4.05. Glass vial attached with genitalia (NZAC). Recent examination (2008) of the type shows that it has been “cleaned” and many setae have been dislodged. **Allotype** female and 1 **paratype** (NZAC), same data as holotype. A paratype female is in BMNH (Uéno, pers. comm.), not seen. Non-type specimens: **KA**, Kaikoura, First Bay, November 1973, D. S. Horning.

**Remarks.** Dr D. S. Horning discovered a population of *Maoritrechus* living in detritus and small stones at a depth

of 60–70 cm at high to mid eulittoral in November 1973 at First Bay, Kaikoura. Because of the geographical separation, it was at first thought that this population would at least be separable at subspecific level, however the differences are so slight (mainly in the position of the lateral pronotal setae) that this is not tenable. Examination of over 70 specimens from Kaikoura has shown that variation within this population includes most differences shown by the Rangitoto Island specimens, although the Kaikoura population has particularly robust setae on the labial palpi. Until fresh specimens from the Hauraki Gulf are discovered, the true status of the southern population must remain in doubt. The Kaikoura population is at NZMS 260 031: 687645

Also recorded by Jeannel (1940, p.80) as “de l’ile Rangitoto, sur la cote nord de Middle Island, dans le detroit de Cook (Nouvelle-Zelande)” and again in 1965 as from “le Canal de Cook”. This is probably a mistake by Jeannel, as Brookes was very precise about the type locality being in the Hauraki Gulf. Curiously, however, the Maori name for D’Urville Island is Rangitoto and islands nearby are known as the Rangitoto Islands. Various entomologists, myself included, have searched for fresh specimens from Rangitoto Island, Hauraki Gulf without success. The habitat is very different from other known populations of *Maoritrechus* being fine mud instead of shingle. Also this volcanic island is very recent in origin, appearing a mere 600 years ago, and remaining active for a number of years after that, discharging ash and lava (Wilcox 2007). This would surely make it a highly unsuitable environment for *Maoritrechus* in spite of its ability to live below high water mark. *Maoritrechus* must have existed on other islands in the vicinity prior to this (perhaps Motutapu). It would require more searching around other islands in the Hauraki Gulf and also perhaps around D’Urville Island before any conclusions can be drawn.

This species can at once be distinguished from other *Maoritrechus* by the sharp sinuation before the posterior angles of the pronotum, and the position of the anterior pronotal setae which are set farther back from the anterior angles than other species.

### *Maoritrechus nunni* new species

Fig. 77, 91, 105, 124, Map p. 88

**Description.** **Length:** ca. 4 mm. (holotype 4.1 mm). **Colour:** Pale fulvous brown. **Head** swollen, ocular furrows complete, meeting cervical groove; eyes highly convex with clearly defined facets, typical for genus; left mandible with a tooth near mid point connected to near tip by a prominent flange, making it considerably wider than right mandible in distal part; usually with 1 or 2 fine setae on gena

below and behind eyes. **Thorax:** Pronotum with lateral margins reflexed, flexure extending the apical margin as a sharp point; sides curved outwards in anterior 1/2; anterior and posterior setae almost equidistant from anterior and posterior margins respectively. **Elytra** a little truncate with widely reflexed margins; shoulders evenly rounded; sides straight in mid part; striae represented by very weakly impressed lines or fine punctures which become obsolete apically; with 3 setiferous punctures attached to 3rd stria and a 4th at its extremity at distal margin. **Legs:** Male with 2 basal protarsomeres equally expanded so that they are wider than long. **Genitalia:** Male aedeagus with depression on dorsal profile; without basal blade (Fig. 124).

**Type locality.** Deborah Bay, Port Chalmers, Dunedin.

**Distribution** (Map p. 88).

— / DN

**Material examined.** Holotype and 8 paratypes. **Holotype** male labelled: New Zealand DN, Deborah Bay, Port Chalmers 26.12.04 / In gritty/muddy gravel, edge of stream entering beach / J. T. Nunn Collection / [Red holotype label] Holotype [male symbol] *Maoritrechus nunni* n.sp. Det. J. I. Townsend 2007 (NZAC). **Paratypes:** 7, Deborah Bay 12.11.2000, 19.v.2001, 26.12.2004 J. T. Nunn. 1 male Black Head Beach, S. of Dunedin (NZMS 260 144: 101724) under rock at HWM. sandy beach 13.12.2008 J. T. Nunn (OMNZ, JNNZ, ITNZ).

**Etymology.** Named for my friend, John Nunn who has discovered several new carabids, including this one, and many other minute Coleoptera.

**Remarks.** This species and the following one can be distinguished from *M. rangitotoensis* by their elytra being longer and parallel sided.

### *Maoritrechus stewartensis* new species

Fig. 78, Map p. 89

**Description.** **Length** 3.0 mm. **Colour** uniformly orange-brown, eyes dark. **Head:** Ocular furrows complete, somewhat broader behind posterior seta; eyes round, composed of approximately 18 dark facets; 2 ocular setae on each side and 2 setae between eye and base of antenna; frontal margin of clypeus with 2 setae on each side of mid point, outer ones largest; labrum evenly emarginate in front, bearing 6 setae; mandibles sharp pointed, with a premolar tooth which is sharp pointed; tooth on mentum shallow and poorly defined; mentum with 2 setae, submentum with 6. **Thorax:** Pronotum trapezoidal in shape with anterior margin considerably broader than posterior margin; sides only slightly arcuate anteriorly, straight before obtusely rounded posterior angles; marginal groove broad with prominent setae at anterior 1/6th and posterior 1/7th; median im-

pressed line very weak. **Elytra** elongate L : W = 1 : 0.64, parallel sided, abruptly truncate apically, shoulders evenly rounded; marginal channel broad, widest at shoulders; striae very feebly impressed, only just discernible on disc, 3rd with 3 setae; intervals flat; apical fold almost obsolete. **Legs:** Male with 2 basal protarsomeres only weakly expanded on their inner sides. Reticulate **microsculpture** present on head but weak elsewhere. Minute asperities on elytra similar to *M. rangitotoensis* but apical area, which is devoid of them, extends laterally along sides below lateral fold. **Ventral surface:** with weak reticulate microsculpture.

**Type locality.** Stewart Island, Paterson Inlet, Tommy Island (only known locality).

**Distribution** (Map p. 89).

— / SI

**Material examined.** Holotype only. **Holotype** male, 3 × 1.2 mm, labelled: Tommy Island, Paterson Inlet, Stewart Island 30.xi.81 L. C. Cadenhead & N. A. Deans / under large rock in supralittoral zone (CMNZ).

**Remarks.** This species can be most readily distinguished from other species *Maoritrechus* by the straight sides of the pronotum which give it a trapezoidal appearance (Fig. 78).

### *Kiwitrechus* Laroche & Larivière, 2007

Type species *Kiwitrechus karenscoottae* Laroche & Larivière, 2007: 42, by monotypy.

**Diagnosis.** Mandibles of approximately equal thickness, with a premolar tooth on the left but not on the right; with fine accessory hairs on frons, genae, and prosternum, but not pronotum; submentum with 8 setae; clypeus with 6 setae; frontal furrows curved towards, but not meeting cervical groove; hind angles of pronotum completely effaced; elytra with apical setae (on 3rd interval) closer to suture than humeral and central setae (on 4th interval); with usual 8 marginal setae + 2 small setae beyond fold near apex; anterior tibiae without groove; male with 1st segment of protarsus expanded, but not 2nd; male genital segment U-shaped, aedeagus bifurcate at tip; female genitalia with well defined spermatheca.

**Description.** Body small, ovoid; surface shining, without microsculpture; hindwings absent. **Colour** pale fuscous to dark reddish brown. **Head** broad, triangular, vertex bulging outwards behind prominent eyes, with many accessory setae, with deep ocular grooves which do not completely unite with cervical grooves behind eyes; eyes small, highly convex, 2 supraorbital setae on each side and 2 small setae between eye and base of antenna; all antennomeres pilose to base excepting scape which is only sparsely pilose; frons with sparse fine setae; clypeus with 6 setae, 2nd

from lateral margins large; labrum with 6 setae, outer large; genae convex, with fine setae; mandibles with a premolar tooth on the left but not on the right; penultimate labial palpomere bearing up to 7 setae (Fig. 92); mentum with weak tooth and 2 setae; submentum distinct, with 8 setae; gula sutures forming deep pits near submentum; paraglossae shorter than ligula. **Thorax:** Pronotum transverse, sides evenly rounded to base, anterior margin more than twice as wide as basal margin, hind angles very obscure; median groove well impressed but not reaching apex or base where it is deflected laterally. **Ventral surface:** Prosternum with 2 minute setae situated centrally. **Elytra** fused along suture, ovoid in outline, shoulders absent, with border complete to base; scutellar striae absent; 1st stria recurrent towards 5th, forming an apical fold; 8 marginal setae arranged in a group of 4 near shoulder, sub-equally spaced, 2 approximately posterior 1/3rd, almost combining with apical pair; also 2 small apical setae beyond fold near apex, apical is minute; 2 discal foveate punctures associated with 4th interval, in humeral and central areas very prominent, disrupting interval and making it bullate, a 3rd smaller foveate setiferous puncture is placed well down hind slope on 3rd interval. **Legs:** Anterior tibiae without groove, but a fine subapical spine may be present, lamellate hairs present under 4th tarsomere of pro- and mesotarsi, and 3rd tarsomere of metatarsi. Male with greatly expanded 1st protarsal segment, although 2nd segment is normal. **Genitalia:** Male genital segment U-shaped (Fig. 155); aedeagus sharply angled, bifurcate at tip (Fig. 129c). Female genitalia with spermatheca (Fig. 171). Some females with only 2 setae on last ventrite (same as males), however there is an additional pore present.

**Remarks.** The placement of the setae on the elytra should not be interpreted as a link with the trechine lineage because this state is brought about here by the 1st and 2nd setae being displaced laterally to the 4th interval (as also occurs with the following new genus *Oarotrechus* and *Kenodactylus*) whereas with the trechine lineage it is the 3rd seta that is displaced inwards to the 2nd stria.

### *Kiwitrechus karenscoottae* Laroche & Larivière, 2007

Fig. 5, 24, 28, 85–88, 92, 106, 129, 155, 171, Map p. 88 *Kiwitrechus karenscoottae* Laroche & Larivière, 2007: 42.

**Redescription.** **Length:** 2.8–3.5 mm. (40 specimens). **Colour:** Head reddish brown, antennae and mouthparts slightly paler; legs, sides of thorax and margin of elytra pale fuscous, mid portion of pronotum and disc of elytra darker, suffused towards margins. **Head:** Ocular groove ends at posterior ocular seta; 1st ocular seta is more prominent and nearer eye; eyes round, consisting of about 15 well spaced facets set within a sharply defined border;



anterior edge of labrum only shallowly emarginate, bearing 6 setae; clypeus with 6 setae, extra pair very small and situated exterior to large 2nd pair; mentum with tooth simple to very weakly bifid. **Thorax**: Pronotum broader than long, maximum width 1.30–1.52 times middle length, sides evenly rounded from expanded anterior margin to greatly reduced posterior margin which is width of peduncle; hind angles very obtuse; marginal channel well developed laterally, continuing on to anterior but not posterior margin, with lateral setae at approximately anterior 1/3rd and posterior 1/3rd; median line well impressed, crossing an arcuate depression near base but not quite reaching hind margin, bifurcate near anterior margin, whole forming an open Y-shaped impression. **Elytra** with shoulders evenly rounded; basal margin absent, a fold meeting margin posteriorly; scutellar striole and scutellar setiferous pore present near base of 2nd stria; stria feebly and irregularly punctured; intervals weakly to moderately convex, 3rd with a prominent setiferous puncture at its apex and 4th with 2 punctures on disc, 1 in humeral region and other slightly beyond midpoint, dorsal punctures tending to be foveate. Striae 3 and 4 coalesce at these punctures giving 4th interval a bullate appearance. **Legs** with femora much expanded, particularly anterior pair; male with 1st basal protarsomere asymmetrically expanded internally (Fig. 85, 86) and furnished with specialised setae (Fig. 87), 2nd protarsomere not expanded, 4th tarsomere of fore and mid tarsi of both sexes with a lamina on underside which extends below claw segment (Fig. 88), protibiae sometimes with a weak line on external face, but not a well defined groove as in *Duvaliomimus*, an external spur, thicker than other setae can be recognised on some specimens. **Genitalia**: Male genitalia with aedeagus sharply bent at right-angles, tip bifid; internal sac lined with minute granules and containing a copulatory piece consisting of a twisted, semi-tubular lamina (Fig. 129b); genital segment broadly U-shaped, with bottom of U having a partly sclerotised area (Fig. 155). Female genitalia with vagina as long as bursa copulatrix, spermatheca discrete (Fig. 171).

**Type locality**. NN, Nelson, Golden Bay, Mt. Domett, 1463 m.

**Distribution** (Map p. 88). Northwest Nelson and northern West Coast.

— / NN, BR

**Material examined**. 54 specimens (NZAC except when stated otherwise). NN, 1, 9 miles north of Karamea, 1200 ft, 31.5.1963, litter, F. Alack; 1, Karamea Bluff, 1000 ft, 31.5.1963, mixed forest litter, G. Kuschel; 1, Mt Dewar, Paparoa Range, 3500 ft, 5.12.1969, J. McBurney; 12, Pupua Valley, 21.5.1967, 11.11.1971, litter, F. Alack & J. I. Townsend; 2, Oparara, 13–19.11.1957, M. J. Esson & J. I.

Townsend; 2, Oparara, 20.1.50, R. R. Forster (MONZ); 12, Mt Domett, NW Nelson, 30.11.1971, 1.12.1971, litter & mat plants, G. Kuschel, G. Ramsay & J. S. Dugdale; 4, Mt Augustus, Granity, 850 m, 21.3.1970, J. S. Dugdale; BR, 1, Fletchers Creek, J. S. Dugdale; 6, Punakaiki Scenic Reserve, Porarari River, 20 m, 9.vi.1985, J. Early (LUNZ); 3, Croesus track, 730 m, 21.1.1982, J. Early (LUNZ); 4, Bullock Creek, *Nothofagus* litter, 7.5.1970, P. M. Johns (CMNZ). Other specimens: BR, 1, Stony Creek, W. Inangahua; 1, Mt Glasgow, 1957, C. E. Clarke (BMNH not seen). NN, 1, Denniston Saddle; 1, MacKay Hut, Heaphy Track; 1, Granity (MONZ, NZAC).

**Remarks**. These trechines are unusual for not being primarily associated with streams, but instead are found deep in litter. Their expanded fore femora would suggest they have a fossorial life.

*Kiwitrechus*, along with *Erebotrechus*, are morphologically unique among New Zealand trechines in having 6 setae on the clypeus, all others have 4.

To my knowledge, the first specimen was collected by Dr R. R. Forster in January 1950, and this little beetle has been rather an enigma to entomologists ever since. Until recently I was under the impression that it had such unique characters that it required a separate lineage. Uéno (pers. comm.) in a letter to me dated 12.6.1975 "*Edaphinus humicola* (my manuscript name by which it was then known) is a homaloderine beyond all doubt. It is something intermediate between certain Australian genera and Chilean *Trechinotus*, though much isolated. In some facies, it is similar to *Trechinotus*, and in several points, it resembles *Mimanillus* from Tasmania." With the greatest of respect, I must differ from this view, on account of the shape of the female genital tract (Fig. 171). I now regard it as an aberrant aepine. This conclusion is further backed up by the following genus, *Oarotrechus*, being the only other New Zealand trechine to have foveate setae on the elytra.

Is there a connection between this species possessing foveate setae on the elytra and it living in a humicolous habitat? There is another example. Uéno (1996) refers to a humicolous species (*Deuveotrechus yinae*, from Western Yunnan, Southwest China) with pores on the elytra "all remarkably foveolate at the roots". This character is relatively uncommon in Trechinae.

### ***Oarotrechus* new genus**

Type species: *Oarotrechus gracilentus* n. sp. by monotypy.

**Diagnosis**. Mandibles tridentate with sharp premolars, left only slightly thicker towards tip than right; ocular grooves sinuate and meeting cervical grooves; without accessory setae on frons or prosternum; without fine setae on genae; elytra with weakly foveate setae on 4th interval

arranged so that middle pair are farthest from suture; anterior tibiae with weak groove and external spur among other setae; 2 basal protarsomeres greatly expanded in male; aedeagus curved, tubular, without discernible internal structures; female genitalia with cylindrical tapering spermatheca (Fig. 169).

**Description.** A typical small (<5 mm) wingless halophile aepine, living interstitially in gravel at and below high water mark. **Head:** Antennae long, basal joints elongated, 3rd antennomere longer than last; eyes small and highly convex with clearly defined facets; temples not pubescent; mandibles tridentate, sharply pointed; mentum with 2 setae; submentum with 6 setae; penultimate labial palpomere bearing 4 setae in distal 1/2 (Fig. 93). **Thorax** cordiform. **Elytra** with basal margin absent; with 4 setae on 4th interval, 3 discal and 1 near apex, setae placed so that middle pair are farthest from the suture; discal setae tend to be in foveate punctures; marginal series of umbilicate setae arranged in 2 groups of 4, humeral and apical, humeral equally spaced, apical more widely. **Legs:** 2 basal protarsomeres greatly expanded in male; exterior face of anterior tibiae weakly grooved, with a sub-apical spur difficult to detect amongst other setae; 4th tarsomeres of pro- and mesotarsi with lamellate setae which project forward beneath 5th tarsomere; in metatarsi these setae are long and curved at tip, but not lamellate. **Genitalia:** Male genital segment V-shaped; male with aedeagus curved, tubular, apparently without internal armature; female with spermatheca.

**Etymology:** The name *Oarotrechus* is derived from the Maori name Oaro, the locality from where the type series was collected.

### *Oarotrechus gracilentus* new species

Fig. 32, 80, 93, 126, 169, Map p. 89

**Description.** **Length:** 3.8–4.2 mm. (10 specimens). **Colour:** elytra reddish brown, head, thorax, and appendages yellowish brown, eyes dark. **Head:** elongate with inflated ocular area; ocular groove complete, meeting cervical groove at 2nd ocular seta, 1st ocular seta situated just behind eye, both of about equal size; 2 small curved setae between eye and base of antenna less than 1/2 length of ocular setae; vertex smooth between deeply impressed ocular grooves which are straight and then diverging towards cervical groove; no secondary setae present; eyes very small but highly convex, with 12–14 facets, slightly elongate-oval, longer axis lateral; antennae with basal antennomeres more elongate, 3rd longest, distal 3 subcylindrical; clypeus with prominent setae at anterior lateral angles and 2 smaller setae between them, set back from margin, gap between them approximately equal to distance between ocular grooves at their closest point; labrum clearly emarginate,

bearing 6 setae on frontal edge; mandibles large, tridentate with sharp tips; mentum elongate but with tooth broad, truncate, and ill-defined, its 2 setae set well forward, deeply hollowed at each side near base; submentum with 6 setae; gular sutures deeply impressed. **Thorax:** Pronotum subcordate, considerably narrowed to base, sides sinuately expanded anteriorly so that frontal margin is almost 1.5 times as wide as basal margin; anterior margin approximately equal to mid-length, i.e., mid length : anterior width : basal width : maximum width = 1 : 1 : 0.73 : 1.17, lateral marginal channels broad with 2 setae on each side, 1 about halfway between widest part of pronotum and anterior angles, other at posterior situation, almost as far from base as anterior seta is from apical margin; median line well impressed, usually reaching base but not apex, where it bifurcates towards anterior angles. **Elytra** elongate but slightly truncate at apex so that part of last tergite is visible dorsally; shoulders rounded, marginal groove complete to apical fold which is directed towards almost invisible 5th stria; 8 setae of marginal series arranged as a group of 4 humeral, 2 lateral almost linked to apical group of 2, last of which is adjacent to elytral fold; 2 additional apical setae beyond 3rd stria and set within marginal rim, 1 nearest suture is a strong bristle of similar size to discal series, and could be classed as a 4th discal seta; additional to these are 3 discal setae on 4th interval, 1st adjacent to 3rd stria, 2nd near 4th stria and disrupting it, and 3rd where 3rd and 4th striae unite; intervals 2–4 wider than 1st; striae more or less impunctate, somewhat irregularly but well impressed on disc, becoming obsolete towards margins, 1st beginning at scutellar seta on shoulder and becoming evanescent near apex, 2nd stria also disappearing before apex, 3rd weak on shoulder area, becoming more deeply impressed between 1st and 3rd discal setae; 4th absent from shoulder and weakly impressed towards 2nd discal seta to which it is deflected, and ending at 3rd seta where it unites with stria 3 producing a shallow bullate appearance; outer stria obsolete; discal setae weakly foveate. **Legs:** Anterior tibiae with a spur on outer face which is scarcely differentiated from lines of other fine bristles; 4th tarsomere with lamina below; 2 basal protarsomeres greatly enlarged in male, inner expansion produced forward as a prominent tooth which protrudes beyond 3rd tarsomere, with specialised setae beneath. **Microsculpture** very weak, reticulate on head, a little more pronounced on elytra; underside shining. **Genitalia:** Male genitalia with elongate aedeagus which is bulbous at base and has a small basal blade (Fig. 126). Female genitalia with a simple, tubular tapering spermatheca (Fig. 169).

**Type locality.** KA, Oaro Beach, south of Kaikoura (42° 31'S, 173° 30'E).

**Distribution** (Map p. 89).

— / KA, SL

Type series restricted to the population at Oaro Beach. However, a single specimen has been found at Frasers Beach, Southland, illustrating how widely spread a halophilic species can be.

**Material examined.** **Holotype** male, 3.8 × 1.3 mm, **KA**, Oaro, Kaikoura 8.9.1979 R. M. Emberson & R. R. Scott under logs supralittoral coarse sand (LUNZ). **Allotype** female + 5 **paratypes**, Oaro, Kaikoura, 30.3.1980 J. B. Waller & R. B. Chapman, under fresh seaweed on beach; 3 paratypes, Oaro, Kaikoura, 8.9.1979 R. M. Emberson & R. R. Scott, under logs supralittoral coarse sand. (LUNZ); **SL**, 1 female, Frasers Beach, SL, in mid-tidal pea gravel 8.12.2005, A.Solodovnikov (ITNZ), not included in the type series because of its distant location. However, it is certainly conspecific.

**Remarks.** This species can at once be separated from all others of aepine lineage by the unique setal arrangement of the elytra and the greatly produced basal protarsomeres in the male.

### *Waiputrechus* new genus

Type species *Waiputrechus cavernicola* n.sp. by monotypy

**Diagnosis.** Mandibles fine pointed and approximately equal width. 2 minute setae on vertex; frontal furrows curved to meet cervical groove; genae with a few fine setae; prosternum with setae; elytral discal punctures all approximately equidistant from suture; anterior tibiae without a groove but with an external spur in outer distal area; 2 basal segments of anterior tarsi expanded asymmetrically (particularly 2nd) in male.

**Description.** A small anophthalmic trechine with pale integument. **Head** with ocular groove complete, curved to meet cervical groove; eyes absent; with 2 ocular setae and 2 minute setae on frons; antennae pubescent from near midpoint of 2nd antennomere; clypeus with 4 setae, labrum with 6; genae with fine setae on sides and underside additional to 2 tactile setae near junction with pronotum; mentum with 2 long tactile setae at base; penultimate labial palpomere with 4 setae set distally. **Thorax:** Pronotum with 2 setae on each side but without fine discal setae; sides straight before obtuse and rounded posterior angles; median line not meeting base or apex; lateral basal depressions almost obsolete. **Elytra** with 3 hypertrophied setae on disc, associated with 3rd stria, approximately equidistant from suture; an additional seta at apex; striae very weak and indistinct, only perceptible on disc; basal pore set far from scutellum; marginal setae grouped as 4 humeral, 2 lateral, and 2 near elytral fold, 2nd, 6th, and 8th greatly lengthened. **Legs:** Protibiae without groove but with subapical spur; male with 1st and 2nd protarsomeres asymmetrically expanded. [The single specimen is teneral and not suitable for examination of genitalia.]

**Etymology.** The name derived from the name for the district, Waipu, from where it was found.

**Remarks.** This set of characters places the genus between the aepine and homaloderine lineages but clearly closer to the former. It may be related to the Tasmanian *Goedtrechus* but in that genus the posterior lateral pronotal seta is placed much closer to the basal angle of the pronotum, the apical elytral setae are not present, and there are no setae on the prosternum. Until the genitalia of *Waiputrechus* can be examined it is not possible to comment further about this relationship, but the above points are sufficient to give it generic distinction. Its possible connection with *Goedtrechus* may provide an intriguing link of Northland fauna with that of Tasmania.

### *Waiputrechus cavernicola* new species

Fig. 33, 81, Map p. 89

**Description.** **Length:** 3.1 mm. **Colour:** Body and appendages pale yellowish brown. **Head:** Ocular groove complete, meeting cervical groove at posterior ocular seta; 1st ocular seta situated near area of rudimentary eye (visible only as a small clear window in integument, with a weak fold above and below it); 2 dark pores in ocular grooves level with 1st ocular setae, between and well in front of these is a minute seta; 2 small setae at base of each antenna; clypeus with 2 large lateral setae set in from edge and 2 smaller ones between them; labrum transverse, frontal margin weakly emarginate and bearing 6 setae; mandibles with sharp pointed apices of homaloderine type; mentum with a minute tooth between basal segments of labial palpi; mentum with 2 setae; submentum with 6; genae with a few fine setae. **Thorax:** Pronotum slightly wider than long L : W = 1 : 1.08; anterior edge about twice length of posterior edge, sides gently curved anteriorly but from mid point they are almost straight to rounded posterior angles; 2 prominent setae on each side; lateral channel is wide anteriorly but narrows towards posterior; mid dorsal line distinct but stops 1/6th short of both anterior and posterior margins, basal impressions barely discernible as very weak crescentic impressions far from border. Scutellum prominent on pedunculate body. Prosternum with numerous fine setae. **Elytra** elongate, without trace of shoulders or basal margin, apices rounded, marginal channel even from shoulders to recurrent stria near apex; 3 prominent discal setae associated with 3rd stria, a tiny, but prominent setiferous pore near base of 2nd or 3rd stria, but striae so weak that they cannot be discerned apart from on disc; 8 marginal setae (which are somewhat distant from edge) arranged in a group of 4 level with 1st discal puncture, 2 level with 2nd and 2 near very weak elytral fold. **Legs:** Anterior tibiae without an external groove but with a

subapical spur amongst other fine setae; male with 2 basal protarsomeres expanded, 1st tarsomere has a small tooth on inner edge, 2nd tarsomere is greatly expanded on inner side, such that its width is greater than its length.

**Type locality.** ND, Northland, Waipu, Mert's Muddle Cave (only known locality).

**Distribution** (Map p. 89).  
ND / —

**Material examined.** ND, **Holotype** male 3.1 × 1.05 mm, labelled: Merts Muddle, Waipu, Northland ND, 21.x.99, M. Hunt, NZMS 260 Q07 309833. / Great Lakes Chamber, on rocky wall. / [Red holotype label] Holotype *Waiputrechus cavernicola* n. sp. & g. Det. J. I. Townsend (NZAC).

**Remarks.** I would like to thank Maree Hunt for discovering this tiny beetle under very difficult conditions and her persistence in trying to find further specimens.

### *Neanops* Britton, 1962

Type species *Duvaliomimus caecus* Britton, 1960: 121.

**Diagnosis.** Tridentate mandibles with tips of about equal thickness, with sharp premolar teeth; with accessory setae on frons; frontal furrows almost straight but joining cervical groove; genae with fine setae; pronotum with 2 setae on each side and sometimes with additional fine setae on disc; prosternum with a few fine setae; elytra with distinct shoulders, with discal punctures approximately equidistant from suture; anterior tibiae without external groove but sometimes with a spur, or finely pubescent; male with protarsi not expanded but with glandular pads beneath; male genitalia small and truncated, opening distally, and with a large copulatory piece; female genitalia with large spermatheca.

**Description.** (Modified from Uéno 1977a) An anophthalmic trechine; forebody narrow, with elongate head and small prothorax; hind body ample; surface glabrous and smooth, microsculpture obliterated on pronotum and elytra. **Colour** reddish brown, depigmented. **Head** with frontal furrows entire, not angulate at middle but distinctly sinuate near level of anterior pair of normal supraorbital setae; supraorbital area with 4 pairs of setae, normal 2 pairs placed on lines convergent posteriad, additional 2 pairs being much shorter than normal ones and either adjoining or almost adjoining frontal furrows, anterior 1 of these additional pairs being near level of anterior pair of normal supraorbital setae and posterior one a little before level of posterior normal setae; eyes absent; genae sparsely covered with erect pubescence; neck very wide; labrum widely emarginate at apex and with 6 setae; mentum free, not fused with submentum, former bearing a simple tooth which is sometimes truncated at tip, latter with 6 setae;

ligula porrect, subtriangular and with 8 setae; paraglossae thin and moderately curved, extending well beyond ligula; palpi rather short; penultimate labial palpomere longer than apical palpomere and with 4 setae in distal 1/2 (Fig. 94); maxillary palpomeres glabrous, last 2 of about equal length; apical palpomeres thin; antennae submoniliform, rather stout, slightly dilated towards apices and covered with long pubescence except for scape. **Thorax:** Pronotum small and narrow not much wider than head, about as wide as long and more strongly contracted towards base than towards apex; sides narrowly but sharply bordered throughout, gently arcuate in front and sinuate before hind angles, which are very obtuse; base truncated at middle but distinctly oblique on each side; with 2 pairs of marginal setae, posterior pair being distant from hind angles; disc usually with 2 short setae on each side of median line, which is distinct on disc and widens near base; apical transverse impression vague or obsolete, basal 1 continuous, merging on each side into basal foveae which are very small; postangular carinae absent; inner wings absent. **Elytra** large and ample, with shoulders distinct though rounded; prehumeral borders oblique, extending inwards and reaching basal peduncle without forming a defined innermost point; basal margin absent; sides narrowly but sharply reflexed, well rounded behind and slightly emarginate before apices; striae superficial, distinctly impressed on disc but obsolete at sides, stria 2 not forming apical anastomosis with stria 3; scutellar striole either absent or rudimentary; apical striole fairly deep but very short and almost straight, being free at anterior end though seemingly directed to site of stria 5; stria 3 with 2 setiferous dorsal setae and a preapical seta situated at its apical end, close to terminus of apical striole and widely distant from suture; no dorsal seta on outer striae; 2 apical setae normal, adjoining apical striole; marginal umbilicate setae almost aggregated and regular, though 4 setae of humeral series are rather widely spaced. **Ventral surface** glabrous and smooth, though prosternum bears a few hairs at its median part. **Legs** slender though not particularly long; protibiae slightly bowed in apical 1/2, entirely pubescent and not externally grooved; tarsi not long, tarsomere 4 with a long ventral apophysis in pro- and mesotarsi; in male, protarsus is almost simple, 2 proximal tarsomeres being very slightly dilated and somewhat angulate inwards near each apex and furnished beneath with several rudimentary appendages. **Genitalia:** Male genital organ unusually small and of peculiar structure; aedeagus short and thick, with basal part hardly bent towards ventral side; basal orifice large and round; apical orifice open at distal end, not dorsal; apical lobe not defined; ventral surface widely concave behind middle, concavity being oval and surrounded by an obtuse ridge except for apical portion (i.e., "blade"); inner sac

armed with a large anisotropic copulatory piece; parameres short and very broad; left paramere without ventral projection near base; each style normally provided with 3 apical setae. Male genital segment V-shaped. Female genitalia with a large spermathecal gland opening broadly from neck of bursa copulatrix.

**Remarks.** The genus *Neanops* has been difficult to place phylogenetically and has been generally regarded as an aberrant homaloderine (Uéno 1977), but is probably better placed in the Aepine lineage, making it unusual as a cave-frequenting member of this group. Particularly fundamental characters are the shape of both the male and female genitalia which align it with the aepines. Males have a blade at the base of the aedeagus, as do most other New Zealand aepines (our homaloderines do not) and females have a large spermatheca-like gland which is absent from New Zealand homaloderines. There are several other characters supporting this view. Among the external features are the tridentate mandibles with the premolar tooth very sharp pointed as in the aepine lineage, whereas this tooth is blunt in homaloderine lineage; the pronotum has setae in front of the posterior angles as do all aepines (but also *Erebotrechus* of the Homaloderine lineage); the male anterior tarsi are virtually unexpanded, but they have specialised setae beneath, and although the anterior tibiae sometimes lack the stronger external spine of most aepines, they have instead an area of dense setae similar to *Oarotrechus* which is undoubtedly an aepine if this separation is to be maintained.

### KEY TO SPECIES OF NEANOPS

- 1 With additional fine setae on the frons and disc of pronotum; pronotal hind angles obtuse; elytra broad, W : L = 1 : 1.35 ..... (p. 29)... *caecus* (Britton)  
—Without fine setae on frons and disc of pronotum; pronotal hind angles square or acute; elytra elongate, W : L = 1 : 1.60 ..... (p. 30)... *pritchardi* Valentine

#### *Neanops caecus* (Britton, 1960)

Fig. 7, 26, 31, 68, 94, 107, 127, 170, Map p. 89

*Duvaliomimus caecus* Britton, 1960: 121.

*Neanops caecus* (Britton). Uéno 1977a; Casale & Laneyrie 1982.

**Redescription.** **Length:** 3.3–3.5 mm. **Colour:** Reddish brown, appendages a little paler. **Head:** Frontal furrows almost straight, diverging slightly to meet cervical groove near posterior ocular seta; with 2 additional short setae on each side; eyes absent; genae with sparse erect hairs; labrum emarginate with 6 setae; clypeus with 4 setae; mandibles slender with sharp premolar tooth; microsculpture of coarse polygonal meshes; antennae with 3rd antennomere

longest. **Thorax:** Pronotum subcordate; sides gently sinuate apically, more narrowed posteriorly; hind angles obtuse; base almost straight but obliquely angled at sides; 2 marginal setae on each side, posterior pair a little distant from hind angles; disc with 2 short setae on each side of median line; basal foveae small. **Elytra** with shoulders distinct; sides narrowly reflexed; apices separately rounded, with a very small re-entrant angle at suture exposing abdomen, although not at all truncate; striae very weak and almost impunctate, often evanescent near base and margins; intervals slightly convex near suture but flat elsewhere; 3rd stria with 2 discal setae and 2 near apex. **Legs** not greatly lengthened; protibiae without external groove; male protarsi with 1st 2 tarsomeres without expansion but with specialised setae beneath (Fig. 68). **Genitalia:** Male with aedeagus very small, slightly expanded in apical part; ostium opens at apex and is surrounded by irregular lamellae; copulatory piece large, spathulate; basal orifice round but not emarginate; basal blade small to rudimentary; viewed laterally, ventral side is triangularly produced near centre of ventral concavity; parameres broad and short, bearing 2–3 setae (Fig. 127). Female genitalia (Fig. 170) are typically aepine lineage, with a separate spermatheca-like gland widely attached to bursa copulatrix.

**Type locality.** WO, Te Kuiti, Fred Cave, 400 yards from entrance, 170 feet below surface.

**Distribution** (Map p. 89).

WO / —

Limestone caves in the Te Kuiti area, specifically Fred Cave and Broken Hill Cave.

**Material examined.** **Holotype** (17.ii.1960, D. V. May & P. J. Barrett) (NZAC) + paratype male (labelled female), same data; **Paratype:** Fred Cave, 26.3.1960 B. M. May. **Other specimens.** 1 female, Broken Hill Cave, Mangakowhai, Piopio, 17.4.1971, on mud bank, M. R. Wing; 3 males, 1 female, Broken Hill Cave, 11.1.77, S.-I. Uéno (viewed briefly after capture, National Museum of Nature and Science, Tokyo).

**Remarks:** A single teneral male taken 100 yards in Komrad Cave, Marakopa, on shingle by stream, 20.vii.1968, D. V. May, probably represents another species, and may in fact be *N. pritchardi*. It is smaller than *N. caecus* and quite similar to *N. pritchardi* — the only problem is Komrad Cave is 35 km from Wairere Cave, but not impossible for there to be underground connections. The male genitalia (as best retrieved from a teneral specimen) is different from Uéno's drawing of *N. caecus* and lacks a basal blade (Fig. 127). It is not remotely like Valentine's published drawing of *N. pritchardi* genitalia, which must be treated as dubious.

Uéno notes that his specimens of *N. caecus* were found

on a wet muddy talus several hundred metres from the entrance, just below a fissure leading to the surface, where rotten logs and other organic material had accumulated. They were always found clinging to the underside of large stones and were not as active as *Duvaliomimus (Mayotrechus) mayae* which were also present. This and its morphology indicates that this species may not be primarily associated with caves, but a cave system is simply a means of our finding them. The characteristics of the habitat may not be very different from the interstitial marine gravel of conventional aepines.

### *Neanops pritchardi* Valentine, 1987

Fig. 75, 79, 128, Map p. 89

*Neanops pritchardi* Valentine, 1987: 79.

**Redescription** (modified from Valentine 1987): **Length:** 3.6–3.75 mm. **Colour:** Depigmented, pale reddish brown, appendages a little paler. **Head:** Frontal grooves long and deep, meeting cervical grooves; 3 ocular setae on each side, additional 1 near cervical groove; with 2 small setae at base of each antenna; genae setose; frons glabrous; eyes absent; mandibles elongate, with a small but distinct premolar tooth; maxillary palpi long and slender. **Thorax:** Pronotum with sides rather arcuate; hind margin slightly sinuate, obliquely angled to posterior angles, making them appear almost acute; with 2 setae on each side, 1 at basal situation, other a little in front of widest part; disc glabrous. **Elytra:** Striae rather well impressed, vaguely punctate, becoming obsolete before apex and towards margins; 1st and 2nd striae reaching scutellar seta, others fading in humeral area; with 3 strong setae on or near 3rd stria; recurved apical stria joins 3rd discal stria; marginal internal fold visible from above; a series of 8 umbilicate setae in marginal groove, 2nd, 6th, and 8th more than twice length of others. **Legs:** Protibiae without a groove externally; male with 1st 2 protarsomeres only very slightly enlarged, but with specialised setae beneath. **Genitalia:** Male teneral specimen (Fig. 128). Female genital tract of similar type to *N. caecus*, with prominent spermatheca-like gland broadly attached to bursa copulatrix.

**Type locality.** Cave at WO, Te Kuiti, Wairere Falls (only known locality).

**Distribution** (Map p. 89).

WO / —

**Specimens examined.** **Holotype**, ‘**Allotype**’ and 1 **paratype**. 1 male? + 3 females taken in the upper gallery of a small wet cave at Wairere Falls, south of Te Kuiti, 26.12.37, J. M. Valentine & E. D. Pritchard. Holotype “male” (BPBM), is in fact a female.

**Remarks.** E. D. Pritchard (pers. comm. 1994) said the specimen he found was a considerable distance from the

entrance and associated with a well rotted branch and where other organic material had accumulated. Valentine collected the other 3 further along the cave.

The purported holotype male being in fact a female raises doubts about the authenticity of Valentine’s drawing of the male genitalia, and the possibility that it is of some other unrelated carabid. If his drawing is true of the species, then it could not remain in the genus *Neanops*. Until fresh material is found, I leave it in this genus as all other characters are of *Neanops*.

## HOMALODERINE LINEAGE

In New Zealand this lineage contains 2 genera, *Erebotrechus* Britton and *Kupetrechus* Laroche & Larivière. The lineage is distinguished by species having tridentate mandibles with a blunt premolar tooth; the anterior tibia is without an external spur, and elytra are not truncate. Male genitalia are stout, with a truncate tip and the internal sac always has a well developed copulatory piece. The aedeagus may be open or closed dorsally and lacks a basal blade. The female genitalia have a simple sac-like bursa, without discrete spermatheca or gland, similar to the surface-dwelling *Homalodera* sp. of South America (two species from Chile have been examined).

### KEY TO GENERA OF HOMALODERINE LINEAGE

- 1 Pronotum long and narrow, length 1.5× width, with 2 pairs of setae on sides, 1 at apical 1/5th, the other at basal 1/4th, marginal channel obsolete; male without expanded segments of fore tarsi; penultimate labial palpomere with setae in basal 1/2 ..... (p. 30)... *Erebotrechus* Britton  
—Pronotum of normal proportions, width 0.83–0.92× length, with a marginal channel, with only 1 seta situated at apical 1/9th; 2 basal segments of anterior tarsi expanded in male; penultimate labial palpomere has setae confined to distal 1/2 ..... (p. 32)... *Kupetrechus* Laroche & Larivière

### Genus *Erebotrechus* Britton, 1964

Type species *Erebotrechus infernus* Britton, 1964: 625.

**Diagnosis.** Mandibles of approximately equal thickness, tridentate, each with premolar tooth; accessory setae on frons; frontal furrows almost straight; pronotum with 2 setae on each side; prosternum with setae; genae with fine setae; elytra without shoulders, discal punctures all approximately equidistant from suture; anterior tibiae with a weak groove, without spur in outer distal area; basal segments of protarsi not expanded in male; aedeagus open

dorsally, gutter-like; female genitalia, a simple bursa copulatrix without discrete spermatheca or spermathecal gland.

**Description.** Overall appearance ant-like. **Head** and mouthparts elongate, head with frontal grooves almost straight, not curved outwards posteriorly; tempora not inflated; neck strongly constricted; frons with a number of setae-bearing punctures in addition to normal 2 supraorbital setae on each side; clypeus with 6 setae; mandibles tridentate, with premolar tooth (Fig. 108); genae with a few short, erect setae additional to 2 prominent tactile setae near neck, present on most trechines; tooth on mentum obscurely bifid; 2 setae on mentum and 8 on submentum (Fig. 83), with a very poorly defined suture between mentum and submentum; penultimate labial palpomere with setae in proximal 1/2 (Fig. 95); eyes virtually absent, reduced to a single rudimentary facet; antennae pubescent from base of 2nd antennomere, 3rd antennomere a little longer than 4th. **Thorax:** Pronotum subcylindrical, lateral margins obsolete, with 2 setiferous punctures on each side. **Elytra** fused along suture; elongate-ovoid, shoulders completely effaced; 3 discal punctures all approximately equidistant from suture; hind wings absent; marginal umbilicate setae with humeral group equidistant and set well below shoulder, middle set closer to apical pair so that they almost form 1 widely spaced group. **Ventral surface:** Prosternum with a few fine setae; metasternum greatly reduced; ventrites with additional fine setae; **Legs:** anterior tibiae with minute setae on inner (anterior) face between comb organ and apex, exterior face without sub-apical spine, with a weak groove in distal 1/2; male without expanded basal protarsomeres but both sexes have specialised winged setae beneath (Fig. 70). **Genitalia:** Male aedeagus with dorsal part open, gutter-like to apex with a large copulatory piece (Fig. 130); female bursa copulatrix a simple sac, without detectable spermatheca (Fig. 172).

### *Erebotrechus infernus* Britton, 1964

Fig. 4, 22, 34, 70, 83, 95, 108, 130, 157, 172, Map p. 88, 90

Britton, 1964: 625, by monotypy. Casale & Laneyrie 1982: 66.

**Redescription.** **Length:** ca. 7 mm. **Colour:** reddish brown, shining. **Head** elongate, with additional fine setae to normal ocular pair; clypeus with 6 setae; ratio of middle length from fronto-clypeal suture to neck constriction : maximum width = 1.23 : 1; eyes reduced to a single atrophied facet on each side. **Thorax:** Pronotum without explanate lateral margins; with 2 setae on each side; ratio of middle length : greatest width 1.50 : 1. **Elytra** shining, rather strongly convex, with narrow lateral margins; ratio of length : greatest width = 1.72 : 1, sutural stria strongly impressed ex-

cept close to apex, but then continuing marginally and returning towards 8th stria; other striae visible only by transmitted light through semitransparent elytra as sparse rows of dots which are thickenings of cuticle visible as small tubercles on underside of elytra; setae on disc very long; **Legs:** Male without expanded segments on fore tarsi, but both sexes have pairs of specialised winged setae beneath (Fig. 70); laminate setae emanate from 4th tarsomere of pro- and mesotarsi.

**Type locality.** Fox River Cave near Charleston, BR.

**Distribution** (Map p. 88, 90). Confined to caves in the south Nelson, Buller, and West Coast areas (NN, BR).

— / NN, BR

Specifically known from NN, Blue Creek Cave, Wangapeka, Nelson; Biddie's Cave, N side of Buller River at Inangahua; Coal Flat Cave (Eggers Cave), Lower Buller River. **BR,** Profanity Cave, Inangahua; Buller Constrictor Cave, South side of Buller River near Newton Flat; Fox River Cave (TYPE); Te Ana Titi Cave, Fox River; Te Tahi Cave, Four-Mile Rd; Hollywood Cave, Four-Mile; Metro, Nile River Cave, Charleston; Xanadu Cave and Cairns Catacombs, Bullock Creek.

**Material examined.** Holotype, 2 paratypes, and 46 non-type specimens. **Holotype + 2 paratypes:** **BR,** Fox River Cave, Punakaiki, 21.4.1962, P. Main (NZAC). Other specimens: **BR,** 1, Buller Constrictor Cave, Newton Flat, S. side of Buller River, 25.10.1963 J. I. Townsend; 1, nr "Dragon's teeth", Metro Cave, Charleston, 16.8.1970, P. M. Johns; 1, Metro Cave, Charleston, on wet muddy walls, stream passage nr Main Entrance, 2.9.1971, P. M. Johns; 1, Cairns Catacombs, Bullock Creek, Punakaiki, 15.8.1970, P. M. Johns; 5, Xanadu Cave, Punakaiki (300–1500 yards inside, on mud walls), 10.7.1969, P. M. Johns; 7, Xanadu Cave, Punakaiki, 22.8.1969, P. M. Johns; 10, Xanadu Cave, Punakaiki (on mud floors and limestone walls), 6–7.5.1970, P. M. Johns; 1, Xanadu Cave, Punakaiki, 11.4.1971, A. Cody; 8, Profanity Cave, Inangahua, 24.4.1971, P. M. Johns; 2, Stream passage, Metro Cave, 1.9.1971, P. M. Johns & J. I. Townsend. 3 (remains), 2, Te Tahi Cave, Four-mile Rd, 19.10.1999, I. Millar & R. Bromley; **NN,** 1, Beedy's [Biddie's] Cave, N side Buller River, Inangahua, 2.4.1972, S. Wilkinson; Coal Flat Cave, W of New Creek, Buller, 1.11.1975, J. I. Townsend. 1, Blue Creek Cave, Mt Owen, Wangapeka, 21.6.1964, H. R. Larson (NZAC, LUNZ, CMNZ, ITNZ).

**Remarks:** Deuve (1993) described *Dongogytes fowleri* from Jiabao Dong cave in Guangxi, China and drew attention to its superficial resemblance to *Erebotrechus infernus*. However genitalia and mandibular characters are very different and in fact our *Erebotrechus* is closer to *Sinaphaenops mirabilissimus* (Uéno & Wang, 1991), another cave beetle from Guizhou, about 160 km northeast of Guangxi. This is best explained as an example of convergent evolution.

**Genus *Kupetrechus* Laroche & Larivière, 2007**

Type species: *Duvaliomimus lamberti* Britton 1960: 34.

**Diagnosis.** Tridentate mandibles with premolar tooth, tips of equal thickness (Fig. 108); no accessory setae on frons, pronotum, or prosternum; pronotum with only 1 lateral seta on each side; genae without fine hairs but with several tactile setae; elytral discal setiferous punctures all approximately equidistant from suture; anterior tibiae with weak groove, without external spur; 2 basal tarsomeres of protarsi expanded in male; aedeagus a short, truncated tube, without basal blade; female genitalia, a simple bursa copulatrix without discrete spermatheca.

**Description:** Typical homaloderine of cavernicolous form. **Head** elongate, posterior ocular seta displaced posteriorly to be adjacent to cervical groove; eyes vestigial; 3rd antennomere a little longer than 4th; mandibles tridentate with a blunt premolar tooth; tooth on mentum simple; mentum with 2 setae, submentum with 8; genae often with a few sparse setae; labrum with 6 setae, outer largest; penultimate labial palpomere with 3 or more setae, always on distal 1/2 of segment (Fig. 96). **Thorax:** Pronotum with a single seta on each side in anterior position. **Elytra:** 3 discal (including subapical) setae on 3rd elytral interval, all approximately equidistant from suture, distance between apical pair never less than distance between basal pair; marginal series of umbilicate setae as follows -humeral setae with 1st 3 equidistant. 4th a little more widely separated, middle pair closer to apical pair. **Legs:** Anterior tibiae with a well defined groove on external face. 4th tarsomere of anterior and mid tarsi with a pair of long curved lamellae on underside. Male with 2 basal protarsomeres expanded and produced to form an apical prolongation on their inner sides, with specialised 'mushroom' setae beneath. **Ventral surface:** Ventrites with or without accessory setae. **Genitalia:** Male genital segment V-shaped. Male genitalia stocky, truncate apically, without basal blade, internal sac with a well developed copulatory piece (Fig. 131, 132). Female genitalia consisting of a simple bursa without discrete spermatheca (Fig. 172, 181).

**KEY TO SPECIES OF *KUPETRECHUS***

- 1 Elytra with weak shoulders, striae clearly impressed although a little irregular, particularly 1st and 2nd striae; may have a series of 4 or more fine setae on each ventrite ..... (p. 32)... *larsonae* n.sp.  
—Elytra without trace of shoulder, humeral margin evenly rounded; striae weak to obsolete with fine punctures more apparent; ventrites with only the usual pair of setae ..... 2

2 Elytra swollen and globose; only the sutural stria pronounced, others obsolete; penultimate labial palpomere with 3 setae ..... (p. 33)... *lamberti* (Britton)

—Elytra elongate with shoulders completely effaced; 1st and 2nd striae discernible to base, others obsolete; penultimate labial palpomere with 5 setae ..... (p. 34)... *gracilis* n.sp.

***Kupetrechus larsonae* new species**

Fig. 19, 37, 110, 132, 159, 181, Map p. 90

**Description.** Cavernicolous form, appendages lengthened. **Length:** 7.2–7.7mm. **Colour** deep amber-brown, palpi and antennae slightly paler. **Head:** Elongate, with constricted neck; frontal grooves deep, subparallel, space between them wide in front, narrowing behind antennae and then expanding and remaining approximately parallel to their termination on upper surface of head in front of constriction of neck, not continuing around eyes; surface glabrous, eyes minute, reduced to 2 or 3 remnants of facets only, which are scarcely paler than integument; antennae moderately long, reaching well beyond shoulders of elytra, 1st joint (scape) shortest, 3rd antennomere longest, others sub-equal; mandibles long and sharply pointed, with a premolar tooth (Fig. 110); penultimate labial palpomere bearing 4 setae, 2 on inner surface at approximately 2/3rds from base, and 2 externally at approximately mid point, all sub-equal in size; setae at extremity of ligula long, reaching beyond penultimate labial palpomere; tooth on mentum simple with rounded apex. **Thorax:** Pronotum longer than broad, maximum width 0.86× middle length; anterior margin longer than posterior margin; lateral margins with well developed marginal groove complete from base to apex, a slight sinuation in front of obtuse posterior angles, evenly curved to seta which is at anterior 1/6th, more sharply narrowed to well-rounded anterior angles; median line reaching base but not apical margin; base with a shallow lateral impression on each side; apex with a few obscure punctures and wrinkles near margin (visible with incident light from a low angle). **Elytra** globose with obvious shoulder angles from which margin is slightly incurved behind; intervals slightly convex with irregular wavy striae which are obscurely punctured; fine punctures on expanded 5th and 6th intervals; 3 discal setae on 3rd elytral interval arranged in a row that is parallel to suture, i.e., distances between suture and apical pair, middle pair, and basal pair respectively are all approximately equal. **Ventral surface:** Ventrites with a series of up to 4 or more additional fine setae (holotype). **Legs** only moderately elongate, with a groove on external face of anterior tibia; male tarsi with 2 basal protarsomeres expanded, with an apical prolongation on their inner edges. **Genitalia:** Male genitalia with



aedeagus truncated, a large copulatory piece within inter-nal sac (Fig. 132); genital segment V-shaped (Fig. 159). Female genitalia reduced to a simple bursa copulatrix (Fig. 181).

**Type locality.** NN, Nelson, Mt Owen, Cave in Poverty Basin.

**Distribution** (Map p. 90). Caves and deeply within scree, Mt Owen, Nelson, and Blue Creek Cave, an abandoned resurgence cave for the Mt Owen drainage.

— / NN

**Material examined.** Holotype, allotype, and 5 paratypes.

**Holotype** male  $7.3 \times 2.75$  mm, labelled: New Zealand NN, Cave, Poverty Basin, Mt. Owen, 9.i.1987, I. Millar. / M28 708618 In rockfall c. 25 m from entrance / [Red holotype label] Holotype [male symbol] *Kupetrechus larsonae* Townsend (NZAC). **Allotype** female  $7.6 \times 2.75$  mm, Blue Creek Cave, Wangapeka, Nelson, 5.3.1967, J. A. Coates. **Paratypes** (4 males, 1 female), NN, 1, Curtis Ghyll, 1520 m, Mt. Owen (just within dark zone of cave), 29.12.1963, W. A. Holloway; 1, Blue Creek Cave, 21.2.1971, J. I. Townsend; 1, Blue Creek Cave, 12.9.1965, G. Hardman; 1, Bulmer Basin, Mt Owen (baited pitfall trap 0.5 m deep at base of talus slope), 8.1.1987, I. Millar; 1, Panorama Passage, Bulmer Chasm [Caverns], Mt. Owen 4.1.1990 P. Entwistle (NZAC, ITNZ). Other specimens, 1, Bohemia Cave, Mt Owen, I. Millar; dead remains, Blue Creek Cave, 21.6.1964 H. Larson & J. I. Townsend; Blue Creek Cave, west side of River 16.2.1975 on silty sand, J. I. Townsend.

**Variation.** Most of the specimens from Mt Owen (including the holotype) have a greater number (4 or more) of fine setae on each ventrite, but those from Blue Creek Cave, west side of river have only the usual 2. *Kupetrechus lamberti* is also present in this cave and the population contains intermediate forms, but this is the only site where this has been observed.

**Etymology.** Named for my late wife, Heather who was lost to cancer in 2003. She helped collect material of this species and several others.

**Remarks.** This is the first truly troglitic species that has been found outside caves in New Zealand. The specimen from within the talus slope on Mt Owen is morphologically identical to those from within caves although it is a little darker — deep red-brown, rather than amber (the specimen from Curtis Ghyll is also a little darker and was taken just within the entrance). The discovery of a cave beetle in this scree environment (the “milieu souterrain superficial” of Juberthie (1982)) is an important clue to understanding the distribution of these beetles, and how they may disperse through shatter zones and faults in non-calcareous rocks.

### *Kupetrechus lamberti* (Britton, 1960)

Fig. 6, 18, 21, 36, 69, 96, 109, 131, 158, Map p. 88, 90  
*Duvaliomimus lamberti* Britton, 1960: 34.

**Redescription.** **Length:** 5.5–7.8 mm. **Colour:** pale amber brown. **Head:** elongate, frontal furrows subparallel, not uniting with cervical groove; 2 ocular setae set well back on head; eyes minute, reduced to a small circular window ca 0.05 mm in diameter comprising 6 facets only; 2 small curved setae behind antenna; mandibles sharp pointed with blunt premolar tooth; labrum expanded apically, emarginate, with 6 setae near margin, outer pair largest, inner pair smallest; clypeal margin straight with 4 setae; frontoclypeal suture straight in middle, level with antennae; penultimate labial palpomere bearing 3 setae, 2 just beyond mid-point and 1 external apical (Fig. 96). **Thorax:** Pronotum slightly longer than wide, ratio greatest width / middle length ca 0.92; posterior angles obtuse and rounded; marginal channels wider towards apex with a single seta within apical 1/4. **Elytra:** elliptical with globose profile; shoulders rounded; chitin translucent with striae obscure except for basal 1/2 of sutural stria. **Legs:** anterior tibiae grooved on external face; male with 2 basal tarsomeres expanded on their inner sides with minute papillae beneath (Fig. 69). **Genitalia:** Male aedeagus truncate with large copulatory piece; without basal blade (Fig. 131). Female without discrete spermatheca, bursa copulatrix a simple sac.

**Type locality.** Nelson, Takaka Hill, Canaan, Dog-leg Cave.

**Distribution** (Map p. 88, 90).

— / NN

From caves and pot-holes in Ordovician limestone from Golden Bay, Takaka Hill, and south to Wangapeka, Nelson. Occasionally from caves in Tertiary limestone adjacent to the marble. To the west, it also occurs in caves (Ruatanuiwha) in dolomitic limestone at Mt Burnett. There are 2 major rivers cutting between this area and the other locations which completely isolate this limestone outcrop from the calcareous rocks to the east. Specifically known from the following caves:—Marble Creek (or Ruatanuiwha), Anatoki, Council (or Motupipi), Manson’s (or Rawhiti), Irvine’s, Simms, Gorge Creek, Starlight, Harwood Hole, Ed’s Cellar, Dog-leg, Olympia, Summit Tomo, Marble Pot, Greenlink, Hawke’s, Kairuru, Commentary, Blue Creek, west of the river.

**Material examined.** Holotype, 2 paratypes, and 58 other specimens. **Holotype:** Dogleg Hole, 300’ down, Canaan, Takaka Hill, Nelson, Jan. 1959, P.Lambert (NZAC). **Paratypes:** 1, Dogleg Hole 200’ [60 m] down, Feb. 1959, D. Kershaw; 1, Harwood Hole, 900’ [275 m] down, Jan. 1959, P.Lambert. **Other specimens:** NN, 15, Ed’s Cellar, 200–600’ [60–185 m] down, 25.4.1961–20.9.1964 D. V. May, P. J. Barrett, D. Coates, J. Marchant, P. R. Kettle, W.

A. Holloway & C. Don; 1, Starlight end of Harwood System, 19.11.1960, J. I. Townsend; 1, Olympia Cave, 500' [150 m] down, Takaka Hill, 21.6.1970, C. M. Smith; 5, Manson's Cave, 11.10.1970, 19.8.1972, pit-trap, C. M. Smith & J. I. Townsend; 3, Irvine's Cave, 11.2.1973, 1.7.1973 & 11.8.1974, C. Coates, S. Hunter, J. I. Townsend; 3, Gorge Creek Cave, 3.3.1973, C. M. Smith & P. Smith; 1, Marble Pot, Canaan, -2.1978, A. Cody; 1, Summit Tomo, near sump, Takaka Hill, 20.9.1981, I. R. Millar; 3, Commentary Cave, Upper Takaka, 14.8.1983, [with entomophagous fungi], I. R. Millar; 1, Kairuru Cave, Takaka Hill, -2.79, J. Bateup; 3, in cave, -30 m on silt floor, Takaka Hill, 1.6.1986 I. R. Millar; 1, Greenlink Cave, Bypass passage, Weta Inlet area, 6.5.1988, G. Pickford; 2, Marble Creek Cave (Ruatanuiwha), Mt Burnett, Golden Bay, 10.3.1973 & 8.1.1975, J. I. Townsend; 9, Sim[m]s Cave, Takaka Valley, 2.11.1973, 7.12.1973 & 9.4.2000, pit-trap, J. Mc.Burney, J. W. Harding & J. I. Townsend; 2, Blue Creek Cave, Wangapeka, 16.2.1975, J. I. Townsend. Also remains from: 1, Council Cave, Motupipi, 16.5.1962 J. I. Townsend; 2, Hawkes Cave, Takaka Hill, 13.8.1989, I.R.Millar; 2, Anatoki Cave, T. Worthy & I. R. Millar (AMNZ, CMNZ, ITNZ, NZAC).

**Etymology.** Dr Britton named this species after Peter Lambert, who not only collected it, but also tragically lost his life while further exploring Harwood Hole in January 1960.

**Remarks.** A globose form of *K. lamberti* (Fig. 21) is morphologically distinct enough to be considered as a separate race, however there is some evidence to indicate that *K. lamberti* may exhibit dimorphism under certain conditions. Until this possibility can be further investigated, it would be better noted as a rare variant. The distribution of this form would pose problems of continuity of gene pool if it was considered as a separate race. Caves in which it has been found are on the periphery of *K. lamberti* distribution. Ruatanuiwha Cave is farthest north-west, Council Cave north-east, and Blue Creek Cave farthest south. In these caves the typical form has not been seen, although in Blue Creek Cave *K. larsonae* n.sp. also occurs, a species that has a distribution centred on Mt. Owen to the south. The globose form has been taken in Manson's Cave as dead remnants only, and the normal form as live specimens. In Simms Cave, Gorge Creek Cave and Starlight Cave both forms and intermediates occur. Ruatanuiwha, Council, Simms, and Blue Creek (the Western series, where the beetles were found) all contain much mud and silt. This may indicate a richer environment for larval development, leading to larger, more robust adults (Fig. 18, 21). A more bizarre explanation may be related to a discussion by Vandel (1965). In Europe it is known that Bathysciinae (Leiodidae; various *Leptodirus* species) display a feature of greatly expanded abdomens, known as "false physogastry" because there is no real increase in the vol-

ume of the abdomen. Instead the elytra become fused together and form a high dome containing a pocket of air over the abdomen. If this were the explanation, the globose forms of *K. lamberti* would have a 'built-in life-jacket' which could be advantageous in caves prone to flooding.

### *Kupetrechus gracilis* new species

Fig. 20, 35, Map p. 90

**Description.** Cavernicolous form, body attenuated, appendages lengthened. **Length:** 6.7 mm. **Colour** pale golden brown to warm reddish brown. **Head** very elongated, with posterior setae some distance in front of cervical groove; frontal furrows of even depth, converging behind antennae and then remaining approximately parallel to their termination in front of neck, not completely surrounding ocular area; surface glabrous; eyes reduced to a small clear circular area, scarcely protruding from surface of head; antennae long, reaching to approximately mid-point of elytra; mandibles long and sharply pointed, their inner edges more deeply pigmented; penultimate labial palpomere bearing 5 setae, 2 on inner face and 3 on outer; tooth on mentum simple, acutely angled with tip rounded. **Thorax:** Pronotum longer than broad, maximum width 0.83×middle length; anterior margin a little longer than posterior margin; lateral margins with narrow marginal groove extending evenly from base to apex; posterior angles obtuse, in front of which sides are quite straight for a short distance before a weak sinuation, and then evenly rounded to anterior margin; with a single marginal seta at anterior 1/6th; median line reaching base and apex where there are a few obscure punctures and weak wrinkles. **Elytra** with basal margin swept back at an oblique angle to scarcely perceptible shoulders where it is rounded to become lateral margin; marginal channel narrow throughout; intervals quite flat, 1st stria more clearly defined near base, other striae fading to mere wavy lines of tiny round punctures; 3 elytral setae prominent. **Legs** elongate, with a groove on external face of anterior tibia; male tarsi with 2 basal protarsomeres prolonged on their inner apices. **Genitalia:** Male genitalia truncated, with a large copulatory piece and fine asperities within internal sac. Female unknown.

**Type locality.** Nelson, Golden Bay, Aorere Valley, Hidden Creek Cave.

**Distribution** (Map p. 90).

— / NN

Hidden Creek Cave, Aorere Valley; also Burnt Bush Cave, Quartz Range Block, Aorere Valley (based on elytral remains only).

**Material examined.** **Holotype** male, 6.7 × 2.8 mm, Hidden Creek Cave, Aorere, Nelson, 6.v.1972, C. M. Smith (NZAC). Elytral remains, Hidden Creek Cave and Burnt Bush Cave, 2.4.1988, I. R. Millar; cave on Hidden Creek, Aorere Valley, Golden Bay, Nelson, -8.89, P. Entwistle.

## TRECHINE LINEAGE

In this group the distance between the apical pair of discal elytral setae is always less than the distance between the basal pair, this displacement being within the 3rd interval. This is a good external character for their separation. Also in the trechine lineage the mandibles are bidentate, without a premolar tooth, and the tooth on the mentum is bifid or truncate. Male genital segment for all New Zealand genera is V-shaped. The New Zealand representatives are placed in the following genera and subgenera: *Duvaliomimus* (*Duvaliomimus*) Jeannel, *Duvaliomimus* (*Mayotrechus*) n. subg. *Kettlotrechus* n. g., and *Scototrechus* Britton. These include both cave and riparian species.

### KEY TO GENERA AND SUBGENERA OF TRECHINE LINEAGE

- 1 Troglotic, with eyes reduced to a tiny window; frontal grooves straight, not meeting cervical groove; penultimate labial palpomere long with 2 large setae near mid-point of leading edge, without a small seta at apex (Fig. 101, 102) ..... 2
  - Eyes present, showing many facets; frontal grooves curved, meeting cervical groove; penultimate labial palpomere with setae placed distally, an additional small seta near base of terminal palpomere (Fig. 97, 100) ..  
..... *Duvaliomimus*... 3
- 2 Larger (8.5–10 mm); elytra depressed basally near pronotum; striae largely replaced by deep round punctures; 2 setae on penultimate labial palpomere placed at about mid-point; ventrites with a series of fine supernumerary setae .....  
.....(p. 35)... *Scototrechus* Britton
  - Smaller (6–8 mm); elytra not depressed basally; striae usually evenly impressed, never replaced by deep punctures; 2 setae on penultimate labial palpomere at mid-point and basal; ventrites without additional setae ...  
.....(p. 38)... *Kettlotrechus* n. g.
- 3 Eyes normal; body usually dark, although sometimes paler; pronotum markedly wider than long; head broad, with only 1 small seta between eye and base of antenna; not of troglotic form, legs normal; ventrites without additional setae .....  
.....(p. 42)... *Duvaliomimus* (*Duvaliomimus*) Jeannel
  - Eyes somewhat reduced; pronotum usually a little longer than wide; head elongate, including mouthparts and antennae; with usually 2 small setae between base of antenna and eye; legs lengthened as in troglotic forms; ventrites with additional setae .....  
.....(p. 51)... *Duvaliomimus* (*Mayotrechus*) n. subg.

## Genus *Scototrechus* Britton, 1962

Type species *Scototrechus orcinus* Britton, 1962: 670 by original designation.

**Diagnosis.** Large (9–10 mm) troglotic trechines with or without an external groove on anterior tibia; surface of elytra depressed near base, with margins widely reflexed; mouthparts attenuated with tooth on mentum obscurely to clearly bifid; eyes vestigial; striae represented by deep punctures.

**Description.** Large (ca 9 mm) anophthalmic trechines with lengthened appendages. **Head:** Frontal grooves incomplete (i.e., not continued around sides of head); clypeus with 2 setiferous punctures on each side; labrum with 6 setae; eye reduced to a tiny round window behind antenna, bearing 3–5 remnants of ocelli; frons with 2 setiferous punctures on each side above and behind eye; with 1 or rarely 2 small curved setae at base of antenna; 3rd antennomere slightly longer than 4th; median tooth on mentum clearly or obscurely bifid; mentum separated from submentum by a very faint transverse suture; submentum with 6–8 setiferous punctures, mentum with 2; glossa bearing 8 long setae at apex; mandibles, maxillae, palpi, and paraglossa all very long and slender; penultimate labial palpomere with 2 or 3 setae at mid-point; antennae as long as body, pubescent from middle of 2nd antennomere to apex. **Thorax:** Pronotum cordiform, with 1 seta on each lateral margin, at widest part and sometimes an additional 1 at basal angle; hind wings absent. **Elytra** elliptical to sub-elongate, shoulders rounded or weakly angled, striae represented by deep punctures, without setae on 5th interval but with 2–4 setiferous punctures on 3rd interval, anterior and discal punctures in contact with 3rd stria and apical puncture near end of 2nd stria; end of recurrent 1st stria directed towards 5th stria; basal 1/4 of surface obviously depressed, slightly concave; lateral reflexed margins wider towards base; all striae visible, punctured, 8th stria fainter than others; a minute setiferous pore present at base of 2nd stria; marginal umbilicate series of punctures grouped as follows, 4 near shoulder in basal 1/2 almost equally spaced, 2 just behind middle separated by about 2× distance of those of humeral group, and apical pair closer together; hind wings absent. **Legs:** Anterior tibia with trace of pubescence on inner side at apex, with or without an external longitudinal groove in distal 1/2; anterior tarsus in male with 2 basal tarsomeres slightly enlarged, a small forward-pointing tooth on their distal inner edges; 4th tarsomere of pro- and mesotarsi produced apically on their undersides into an elliptical chitinous lamina on free edge of which are set some long colourless lamellate setae. **Underside:** Abdominal ventrites with a series of fine supernumerary setae. **Genitalia:** Male aedeagus long, tubular,

expanded laterally at apex; internal armature of small sharp-pointed copulatory piece. Female with bursa copulatrix and spermatheca.

### KEY TO SPECIES AND SUBSPECIES OF *SCOTOTRECHUS*

- 1 Anterior tibiae without a groove on their external face; pronotum with 2 pairs of pronotal lateral setae .....  
.....(p. 36)... *orcinus* Britton  
—Anterior tibiae with a groove on their external face; pronotum with 1 pair of pronotal lateral setae, hind setae absent ..... 2
- 2 3rd elytral interval with 3 setae, or rarely 4 .....  
.....(p. 36)... *morti* n. sp.  
—3rd elytral interval with only 2 setae, middle seta absent .....  
..... *hardingi* n. sp.....3
- 3 Elytra with edge in humeral area deflected in a more-or-less straight line from scutellar area to 1st seta in marginal series, where a weak shoulder angle is present .  
.....(p. 37)... *hardingi hardingi* n. sp.  
—Elytra with humeral edge evenly rounded, without shoulder .....(p. 37)... *hardingi worthyi* n. subsp.

#### *Scototrechus orcinus* Britton, 1962

Fig. 8, 62, 101, 120, 151, 162, 166, Map p. 91  
*Scototrechus orcinus* Britton, 1962: 670.

**Redescription.** **Length:** ca 9 mm. **Colour:** uniform yellowish-brown. **Head:** Antennae 1.8× as long as elytra; eye remnants very small (ca 0.3 × 0.2 mm.); with 1 small curved seta at base of antenna between it and eye. **Thorax:** Pronotum ratio of maximum width : middle length = 1.0 : 1; posterior angles acute, projecting laterally, hind margin of pronotum almost straight; median line impressed; ratio of maximum width : width across basal angles ca 1.35 : 1; with 2 setae on each side, 1 near widest part, other at posterior angle; a series of fine curved impressions in basal 1/3rd. **Elytra** with shoulders evenly rounded; 3 setae on 3rd interval; intervals slightly to moderately convex, becoming weaker towards sides. **Legs** elongate, length of posterior tibia 0.77× length of elytra; without a groove on external face of protibia. **Genitalia:** Male aedeagus long, constricted beyond basal bulb and expanded at tip, internal sac with reticulate walls, no spines seen (Fig. 151). Female with a well defined spermatheca attached to bursa copulatrix (Fig. 166).

**Type locality.** Nelson NN, Takaka Hill, Canaan area, a sink-hole known as “Ed’s Cellar” because it is almost beneath the house where Edgar Sixtus once lived.

**Distribution** (Map p. 91).

— / NN

**Material examined.** Holotype, 2 paratypes, and 2 other specimens. **Holotype** female: Nelson, Takaka Hill, Canaan, 300 ft. [90 m] down sinkhole [= “Ed’s Cellar”] 25.iv.1961 J. I. Townsend (NZAC). **Paratypes:** 1 male, Ed’s Cellar, 1961, J. Marchant (NZAC); 1 male, Ed’s Cellar, 700’ [213 m] down, D. Coates (ITNZ). Other specimens: 1, Ed’s Cellar, Canaan, grotto below 100’ pitch, crawling on wet stones, J. W. Harding; 1 female: Marble Pot, Canaan, —.2.1978, A. Cody (ITNZ). (1 Paratype female, Ed’s Cellar, 25.4.1961, P. R. Kettle, specimen in BMNH, not seen).

**Remarks.** Only known from sinkholes in the marble north of the Canaan Saddle, on Takaka Hill, specifically Ed’s Cellar and Marble Pot.

#### *Scototrechus morti* new species

Fig. 61, 152, Map p. 91

**Description.** **Length:** 8.9 mm. **Colour:** uniform brown. **Head:** broader than *Scototrechus orcinus*, not attenuated, antennae long, reaching to apex of elytra, with 1 small seta at their base; eyes reduced to a slanting oval window; tooth on mentum, blunt, obscurely bifid; penultimate labial palpomere with 2 large setae placed centrally. **Thorax:** Pronotum as long as wide; posterior angles acute, slightly projecting; hind margin straight, lateral margins evenly rounded to a sharp situation before posterior angles, not strongly reflexed; median line well impressed, not reaching base or apex; a few punctures near anterior and posterior margins. **Elytra** depressed near base, with shoulders evenly rounded, 3 setae on 3rd interval, intervals strongly convex, striae punctures deep, round and even; usually only striae 1 and 5 reaching apex. **Legs:** anterior tibiae grooved externally. **Genitalia:** Male with aedeagus similar to *S. orcinus*, but with tip produced to a thickened lip (Fig. 152). Genital segment with lateral arms united centrally, similar to *Duvaliomimus obscurus*, but with a slightly longer combined section.

**Type locality.** Nelson NN, Mt Arthur, Expelair Cave.

**Distribution** (Map. p.91)

— / NN

Caves in Mt Arthur limestone, Expelair and Ellis Basin, Tomo Thyme.

**Material examined.** Holotype and 5 remains. **Holotype** female labelled: Mt. Arthur, Nelson, NZ, Expelair Cave, 8.1.1992, on moist silt, S. Erberhard / [Red card] Holotype [female symbol], *Scototrechus morti* n. sp. Townsend, 2007 (NZAC). Also dismembered remains of 4 other specimens from Mt Arthur, Ellis Basin, Tomo Thyme pot-hole, 30.12.1989, P. Entwistle; 1 male (as remains), Mt Arthur,

Pearse Resurgence, Nettlebed Cave, 13.3.1971, A. Cody.

**Etymology.** Named after my father, George Mortimer Townsend, affectionately known as Morty to his friends. Sadly lost to cancer at age 59.

**Remarks.** This species occurs furthest south, in the karst of the Ellis Basin, Mt Arthur, and also at the highest altitude, 1500 m.

### *Scototrechus hardingi* new species

**Description.** **Length:** 8.5–10 mm. (holotype = 8.7). **Colour:** uniform dark reddish-brown. **Head** and mouthparts attenuated as in *S. orcinus*, antennae long, reaching to apex of elytra; eyes atrophied, very small, round and flat; usually with 1 seta at base of antenna. **Thorax:** Pronotum ratio of maximum width : middle length = 1.0 : 1; posterior angles acute and projecting, without a seta; lateral seta in front of widest point, hind margin straight; lateral margins reflexed. **Elytra** with shoulders evenly rounded, or weak with margin sloping away obliquely from scutellar region in an almost straight line; ratio length : width = 1.6 : 1; with 2 or 3 setae on 3rd interval. **Legs:** Anterior tibiae shallowly grooved externally, male with 2 basal protarsomeres weakly expanded on their inner sides with minute papillae beneath (Fig. 66, 67). **Genitalia:** Male aedeagus with ostium opening before tip and deflected to right when viewed dorsally, apex with slightly thickened tip, parameres with 3 setae (Fig. 151). Female genitalia similar to *S. orcinus*.

On the character of elytral shape, 2 subspecies can be recognised as defined in the key.

### *Scototrechus hardingi hardingi* new subspecies

Fig. 59, 66, 67, 102, 165, Map p. 91

Form with weak shoulders, margin of elytra almost straight before a slight angle near 1st series of umbilicate setae. Usually with 3 setae on 3rd interval.

**Type locality.** Takaka Hill NN, Canaan Rd, Greenlink Cave (only known locality).

**Distribution** (Map p. 91).

— / NN

**Material examined.** Holotype and 10 paratypes from Greenlink cave: **Holotype** male: Takaka Hill NN, Canaan, Greenlink Cave, 200 feet [60 m] down, 13.i.1974 J. W. Harding & R. Thompson (NZAC). **Paratypes:** 1 male, 100 feet [30 m] down, flowstone & stalagmitic wall above 'The Watergate', 13.1.1974, J. I. Townsend; 1 male, flowstone above 'The Watergate', 2.2.1974, J. I. Townsend; 1 male, 250 feet [75 m] down, 2.2.1974, R. Thompson; 2 males, flowstone above 'The Watergate', 3.3.1974, J. I. Townsend; 1 female, at 'The Watergate', 3.3.1974, C. Thomas & J. W. Harding; 1 male, flow above 'Watergate',

13.iv.1974, J. I. Townsend; 2 females, bypass passage, weta inlet area, 6.5.1988, T. H. Worthy & G. Pickford; 1, female, rock in streambed, start of dry bypass above 3rd pitch entrance passage, 6.5.1988, T. H. Worthy (NZAC, ITNZ).

**Remarks.** Known only from sink-holes and caves south of the Canaan Saddle, in the vicinity of Greenlink pot-hole but southwards from there to the Mt. Arthur Tableland, the subspecies *worthyi* occurs.

Granite intrusions cut the older Ordovician limestone at the Canaan Saddle and this appears to be the boundary between *Scototrechus orcinus* and *S. hardingi*. However, for the more widespread and variable *Kupetrechus lamberti* this does not appear to have been a barrier. Probably they bypassed these intrusions via limestone and marble in the Takaka Valley. If for some reason the genus *Scototrechus* is confined to the higher altitude, as collecting data seem to show, then this option would not have been available for them.

### *Scototrechus hardingi worthyi* new subspecies

Fig. 60, Map p. 91

**Description.** **Length:** 9.5 mm. **Colour:** uniform reddish brown. **Head:** Frontal furrows deep, almost straight, not meeting cervical groove; antennae long; eyes small, flat, scarcely distinguishable from integument; mouthparts attenuated; penultimate labial palpomere with 2 or occasionally 3 large setae near mid-point. **Thorax:** Pronotum width equal to length; posterior angles acute, projecting laterally; lateral seta slightly in front of widest part. **Elytra:** depressed near base; shoulders evenly rounded and not obliquely angled as in subspecies *hardingi*, with only 2 setae on 3rd interval. The ample and evenly rounded shoulders are the main distinguishing feature for this subspecies.

**Type locality.** Nelson NN, Takaka Hill, Perseverance Cave.

**Distribution** (Map p. 91).

— / NN

Known from the following caves on Takaka Hill, Nelson: Perseverance, Sting, and Hawkes; also from Cheops Cave, Mt Arthur Tableland.

**Material examined.** Holotype, 3 paratypes, and 3 remains of specimens. **Holotype** female: length 9.5 mm, elytral width 3.6 mm, elytral length 5.5 mm, labelled: New Zealand NN, Perseverance Cave, Takaka Hill, 20.i.1990, T. Worthy / N26 994228, damp silt floor in upper level above third rockfall (NZAC); **Paratypes:** 1 female, same data as holotype; 1 female, Sting Cave, Takaka Hill, -70m, on wall, 21.1.1996, T. H. Worthy (NZAC); 1 female, Cheops Cave, Tableland area, 22.2.1994, T. H. Worthy (ITNZ). Records as remains: 1 Pot-hole in Canaan W of Greenlink, M. Doty; 2, Hawkes Cave, Takaka Hill, 3.viii.1989, I. Millar.

### Genus *Kettlotrechus* new genus

Type species: *Duvaliomimus orpheus* Britton, 1962: 668.

**Diagnosis.** Anterior tibiae with external groove; pronotum without a seta at posterior angles; head elongated, frontal furrows not meeting cervical groove, with 2 small setae at base of antenna; eyes flat, reduced to a small window; setae on penultimate labial palpomere placed from about mid-point and basal; pronotum with length equal to or longer than maximum width.

**Description.** Troglobitic trechines with eyes reduced to a few remnant facets, and lengthened appendages. **Head:** elongate, with frontal furrows incomplete, not reaching cervical groove; tooth on mentum simple; submentum with 6–8 setae; setae on penultimate segment of labial palpi situated in basal 1/2; eyes very small, not projecting, reduced to a small window in integument; 2 small curved setae between base of antenna and eye. **Thorax:** Pronotum elongate, middle length equal to or longer than maximum width; with a single seta in marginal groove; median line impressed. **Elytra** with 3 setae in 3rd interval, 1st 2 against 3rd stria and 3rd attached to 2nd stria so that it is closer to suture than others; marginal umbilicate setae with humeral group set close together, middle pair a little more widely spaced and apical pair with approximately 2× space between them. **Legs:** Anterior tibia with a weak groove on external face with fine pubescence on their inner sides; 2 basal protarsomeres expanded in male and furnished beneath with minute papillate setae near their inner edge and a winged seta near outer edge of 2nd protarsomere; laminate hairs of 4th tarsomeres (of both sexes) arranged as follows — protarsi with lamina extending forward under 5th segment, mesotarsi with 4th segment produced below to form a small projection from which lamellate hairs arise (Fig. 63–65), metatarsi with normal hairs. **Ventral surface:** Ventrites without additional setae.

**Etymology.** It is with great pleasure that I use the name of my close friend, Dr P. R. Kettle, who collected some of the specimens of this genus. He spent many years caving with the Nelson Speleological Group and has always had a keen interest in the fauna.

**Remarks.** This genus is related to *Scototrechus*, but all species are much smaller in size and with different proportions of the body, the elytra being shorter and more elliptical in outline, and not depressed near the base. They also lack the deep punctures in the elytral striae characteristic of *Scototrechus* and they do not have accessory setae on the ventrites.

*Scototrechus* is found in caves in Ordovician marble at altitudes above 700 m, whereas *Kettlotrechus* is found in caves on Oligocene limestone from almost sealevel to about 150 m except for *K. millari* which is known from near sea level in Water Supply Cave to the higher altitude of Ed's Cellar and Summit Cave on Takaka Hill.

### KEY TO SPECIES OF KETTLLOTRECHUS

- 1 Basal angles of pronotum not acute or projecting laterally ..... (p. 38)... *orpheus* (Britton)
  - Basal angles of pronotum acute and projecting laterally ..... 2
- 2 Anterior edge of elytra straight from scutellar area to shoulders where it is sharply angled; elytral intervals strongly convex ..... (p. 39)... *pluto* (Britton)
  - Elytra with weak shoulders or evenly rounded in humeral area; intervals moderately convex or entirely flat ..... 3
- 3 Elytral intervals entirely flat; striae broken and reduced to a faint trace ..... (p. 39)... *edridgeae* n. sp.
  - Elytral intervals weakly or moderately convex; striae weak, but at least continuous on disc ..... 4
- 4 Elytral intervals moderately convex; hind margin of pronotum straight ..... (p. 40)... *marchanti* n. sp.
  - Elytral intervals weakly convex; hind margin of pronotum emarginate ..... (p. 41)... *millari* n. sp.

### *Kettlotrechus orpheus* (Britton, 1962), n. comb.

Fig. 14, 56, 57, 63, 64, 99, 115, 149, 173, Map p. 91  
*Duvaliomimus orpheus* Britton, 1962: 668.

**Redescription.** **Length:** 6–8 mm. **Colour:** body uniform reddish brown, appendages a little paler. **Head,** including mouthparts elongate; antennae 1.5× as long as elytra; rudimentary eyes very small, not projecting, semicircular in outline (diameter ca 0.1 mm); with 2 ocular setae on each side. **Thorax:** Pronotum elongate, ratio of greatest width : middle length ca 1.0 : 1; ratio of greatest width : width across basal angles varies from 1.60 : 1 to 1.70 : 1, posterior angles of pronotum square or slightly acute, median line impressed; lateral margin with a single seta in apical quarter. **Elytra** elliptical in outline, shoulders completely effaced; striae weakly impressed with elongate punctures, except at apex where they become evanescent; intervals distinctly convex; some setae on elytra up to 1 mm long. **Legs:** Hind tibiae slightly bowed; male with 2 basal protarsomeres expanded on their inner sides and furnished with minute papillate setae beneath (Fig. 63); 3rd protarsomere with 2 minute pores beneath (Fig. 64). **Genitalia:** Male: Aedeagus with a basal blade; internal sac with copulatory piece (Fig. 149). Female: without setae on inner edge of hemisternites; bursa copulatrix not greatly lengthened, with a small sac-like spermatheca opening directly from it (Fig. 173).

**Type locality.** Northwest Nelson, NN, Paturau, Twin Forks Cave.

**Distribution** (Map p. 91).

— / NN

Caves in the Paturau region, both north and south of Paturau River, and as far south as the Turimawivi River.

**Material examined.** Holotype, 14 specimens. **Holotype** male, labelled: Type (circular red bordered label, typed) / Twin Forks Cave, Paturau, Nelson, 28.i.1961, J. I. Townsend (NZAC). [There are 5 paratypes: 4 in NZAC and 1 in BMNH]. 5, Twin Forks Cave, 28.1.1961, 8.9.1971, 3.10.1972, 28.9.1977, J. I. Townsend; 1, Marchant's Mistake Cave, Paturau, 5.8.1961, P. R. Kettle; 3, Wet Neck Cave, Paturau, 4.1.1961, 24.4.1966, P. R. Kettle, J. I. Townsend, L. Kermod; 2, Little Cave, Paturau, 24.6.1961, 3.6.1962, P. R. Kettle, D. S. Allison; 3, Ionkay Bluff Cave, S Paturau, 25.10.1970, 24.10.1971, 28.1.1975, J. I. Townsend; 1, Phil's Pot, Paturau, 29.1.1978, J. I. Townsend; 1, Turimawivi Cave, S Paturau, 15.4.1990, T. Worthy. Elytra, Oedipus Cave, Paturau, 4.7.1977, S. Hunter (NZAC, ITNZ).

**Remarks.** Specimens from Turimawivi Cave and Ionkay Bluff (Fig. 57) have posterior angles of the pronotum which are slightly acute and protruding laterally, but not to the extent of *K. pluto*.

#### ***Kettlotrechus pluto* (Britton, 1964), n. comb.**

Fig. 15, 58, 116, 150, 174, Map p. 91

*Duvaliomimus pluto* Britton, 1964: 627.

**Redescription.** **Length:** 6.25 mm. **Colour:** Reddish brown; legs, antennae and palpi yellowish brown. **Head:** with elongate mouthparts, antennae very long, almost reaching to apices of elytra; rudimentary eyes very small, lenticular in shape, surface transparent and slightly tuberculate, length (horizontal) 0.4× length of terminal segment of maxillary palps. **Thorax:** Pronotum elongate, ratio of greatest width : middle length ca 0.90 : 1, posterior angles very acute, directed outwards; median line impressed. **Elytra:** elliptical, with prominent shoulder angles; striae strongly impressed but a little fainter towards outer edges and apices; intervals distinctly convex. Almost all setae very long and fine, 2nd, 6th, and 8th of marginal series exceptionally long (ca 1 mm). **Legs:** long, posterior tibiae arcuate; anterior tibiae with a few short setae on inner apical face; male with 2 basal protarsomeres only slightly expanded. **Genitalia:** Male aedeagus similar to *orpheus* but a little longer and very slightly deflected upwards at tip (Fig. 150); female with 2 spines on inner side of hemisternites, and end of bursa copulatrix is greatly lengthened to form a fine tip, spermatheca appears to be reduced to a small nodule near neck of bursa copulatrix (Fig. 174).

**Type locality.** Karamea NN, Oparara, Fenian Creek Cave.

**Distribution** (Map p. 91).

— / NN

Caves in limestone from the Heaphy River, south to Oparara, Karamea.

**Material examined.** Holotype, 5 specimens. **Holotype** male, Fenian Creek, Oparara, 27.iv.1963, J. I. Townsend (NZAC). **Paratypes** 1, Ida Cave, Oparara, 10.3.1971, J. I. Townsend (NZAC); 1, Honeycomb Hill Caves, Oparara, 19.9.1984, T. Worthy (LUNZ); 2, Honeycomb Hill Cave, Oparara, 26.3.1985, I. R. Millar & C. Moore (ITNZ); 1, Copper's Cave, Ryan Creek, Heaphy River, 31.10.1984, T. Worthy (LUNZ).

**Remarks.** It is of interest to note that female genitalia of *Kettlotrechus orpheus* and *K. pluto* are strikingly different (Fig. 173, 174), whereas the male genitalia show little differentiation (Fig. 149, 150). According to Liebherr & Marris (2009) this is a very unusual set of characters. They record it for the first time in New Zealand Carabidae with a pair of *Mecyclothorax* (*M. oopteroides* and *M. otagoensis*).

The greatly lengthened bursa copulatrix is very distinctive for this species and also *K. marchanti* and *K. millari*, which form a subgroup (Fig. 174).

#### ***Kettlotrechus edridgeae* new species**

Fig. 17, 53, 65, 98, 118, 147, 178, Map p. 91

**Description.** **Length:** 7.0–7.5 mm. [holotype 7.1 mm]. **Colour:** uniform pale yellowish-brown to reddish brown depending on maturity. **Head:** elongate with prominent sharp-pointed mandibles; palpi attenuated; antennae long, reaching to end of elytra; frontal furrows almost straight, coalescing rather than meeting weak cervical groove; with 2 ocular setae. **Thorax:** Pronotum cordate with well developed marginal channel; sides gently sinuate, then sharply curved before prominent, acute hind angles; a single seta at anterior 1/5th; base clearly emarginate. **Elytra** almost smooth with intervals quite flat and striae almost obliterated, visible only as a series of round impressions from underside; shoulders rounded. **Legs** long, meso- and metatibiae arcuate, but middle pair less so; male with 2 basal protarsomeres expanded with minute papillae beneath (Fig. 65), 3rd protarsomere with a minute pore and a pair of winged setae beneath (Fig. 65). **Genitalia:** Male with basal blade bifurcate where it joins base of aedeagus, ostium opens dorsally before pointed tip; female with a small spermathecal chamber near neck of the bursa copulatrix.

**Type locality.** Nelson, NN, Takaka Valley, Simms Cave.

**Distribution** (Map p. 91).

— / NN

**Material examined** Holotype and 23 paratypes. **Holotype** male, labelled: Sim[m]s Cave, Takaka Valley, 22.2.70, J. I. Townsend / [Red Holotype label] Holotype [male symbol] *Kettlotrechus edridgeae* n. sp. Det. J. I. Townsend 2007 (NZAC). **Paratypes:** Simms Cave, Takaka

Valley, 11.3.1973, 16.12.1973, 17.10.1977, J. I. Townsend; 2.9.1973, pit-trap, J. McBurney; 22.2.1970, S. Edridge & J. I. Townsend; 17.9.1967, Mrs A. Larson (NZAC); 2, Simms Cave 9.4.2000 J. Harding & J. I. Townsend (ITNZ). Other specimen: Water Supply Cave, Pohara Valley, Takaka, 22.8.2000, I. R. Millar.

**Etymology.** Named for Sue Hunter (nee Edridge) who was another of those people lost to cancer at an early age. She was not only a keen speleologist but also a highly regarded member of the entomologists working in Nelson during the 1960s and 70s. It is most appropriate that her name is linked to one of the cave beetles she helped to discover.

**Remarks.** This species is different from other species of *Kettlotrechus*. It has fewer setae on the penultimate labial palpomere (sometimes only the 2 large centrals), it is larger and the elytra are almost devoid of striae but instead have very weak punctures. In general form and size this species is somewhat like a smooth form of *Duvaliomimus* (*Mayotrechus*) *mayae* but it lacks the supernumerary setae on the ventrites, and has all the *Kettlotrechus* characters.

### *Kettlotrechus marchanti* new species

Fig. 54, 82, Map p. 91

**Description.** Length: 6 mm. **Colour:** reddish-brown, appendages slightly paler. **Head:** elongate; frontal furrows deep, subparallel, becoming obsolete near postocular seta, not meeting weak cervical groove; antennae 1.5× length of elytra; remnant of eyes small, very elliptical. **Thorax:** Pronotum as wide as long; marginal channel widening towards basal angles which project laterally, but not backward; hind margin straight; sides gently curved to a little before posterior angles; median impressed line reaching base but dividing Y-shaped towards anterior. **Elytra:** elliptical in outline with shoulder angle weak to obsolete. **Legs:** Mid and hind tibiae lightly bowed; male with basal 2 protarsomeres only slightly enlarged. **Genitalia:** Male genitalia not examined but probably similar to *K. orpheus*. [The only available male specimen was used for SEM photos.] Female with lengthened bursa copulatrix, similar to *K. pluto*.

**Type locality.** NW Nelson, NN, Kaihoka, Pluto's Retreat Cave.

**Distribution** (Map p. 91).

— / NN

Known only from caves in the limestone north of West Haven Inlet, where it is at its highest level.

**Material examined.** Holotype, 3 paratypes, and 5 other specimens. **Holotype** female, labelled: "Pluto's Retreat, Nelson N.Z., Kaihoka, 22.10.72, J. I. Townsend", [Red holotype label]"Holotype *Kettlotrechus marchanti* n. sp.

Det. J. I. Townsend 2007" (NZAC). **Paratypes:** 1 (female), Pluto's Retreat Cave, Kaihoka, 22.10.1972, J. I. Townsend; 2 (male & female), Wylie's Cave, Kaihoka, 2.6.1974, J. I. Townsend (NZAC, ITNZ). Other specimens (only seen in the field): 1 male, Wylie's Cave 16.1.1975, S.-I. Uéno; 2 males, Pluto's Retreat, 16.1.1975, S.-I. Uéno; 2 females, Pluto's Retreat, 16.1.1975, J.I. Townsend (National Museum of Nature and Science, Tokyo).

**Etymology.** Lee Marchant was a member of the entomological team working in Nelson during the 1960's and 70's. He was also an ambitious caver until an accident during an expedition to Mt Owen in 1963 prevented him from continuing that sport. It is fitting that his name is linked with a beetle from the area he enjoyed exploring speleologically.

**Remarks.** These caves are at the highest level of the gently south-dipping coastal Oligocene limestone beds. Being at a height of over 150 m they would have been above the interglacial sea levels of the Pleistocene that left lag deposits of quartzite boulders in the Paturau area up to 120 m on the hillsides and in some of the caves, including Twin Forks, where *K. orpheus* could not have existed at that time, certainly not in the lower levels. There is also good evidence of these high sea levels by a series of raised beaches at 35–45m and 100m. The area at present occupied by *K. pluto* would also have been inundated. These species must have either evolved since these high sea-levels, or else would have had to escape into crevices in non calcareous rocks. Perhaps if they evolved relatively recently, their short evolutionary period may account for the variability of some populations and the fact that there is some evidence of a cline existing between *K. orpheus* in the Paturau area and *K. pluto* in the Oparara to Heaphy area. Specimens of *K. orpheus* from Ionkay Bluff and Turimawivi caves immediately south of Paturau are larger, with deeper impressed elytral striae and slightly protruding posterior angles of the pronotum (although not to the extent of *K. pluto*). Perhaps *K. marchanti* represents the "ancestral" form, and once the seas retreated from the lower caves this, and a changing river pattern, would have allowed it to migrate into a vast new area. This expansion might have triggered the rapid evolutionary changes hypothesised to have occurred in these beetles. The geomorphology of old river terraces indicates that the Paturau River once flowed out to sea at West Haven Inlet, and before that it probably swung east and emptied into the sea at Pakawau. Thus at that time there would have been a route south for cave beetles via the coastal limestone. As *K. orpheus* is present today in caves both north and south of the Paturau River, it must have evolved prior to this break, but after the development of West Haven Entrance.

A precisely similar pattern of distribution is found with cave harpaline beetles: *Pholeodytes palmae* Laroche



& Larivière in Pluto's Retreat Cave and *P. townsendi* Britton in caves on both sides of the Paturau River (equivalent to *K. orpheus*), and *P. cerberus* Britton at Oparara. What is intriguing is the fact that these beetles follow exactly the same morphological changes to their pronota, with species to the south having acute hind angles.

### ***Kettlotrechus millari* new species**

Fig. 55, 148, Map p. 91

**Description.** **Length:** 6–7 mm (holotype 6.8 mm). **Colour:** deep reddish-brown, appendages slightly paler. **Head:** with dense microsculpture; frontal furrows parallel, not meeting weak cervical groove; clypeus with 4 setae; labrum with 6, 2 exterior more than 3× length of others; rudimentary eyes small, flat, unevenly rounded in outline, showing a little variation between cave populations; **Thorax:** Pronotum with narrow marginal channel; hind margin emarginate so that posterior angles project laterally and backward. **Elytra:** with shoulders rounded; intervals flat; striae weak and broken, disappearing apically; setae of 3rd interval placed so that 1st and 2nd are against 3rd stria and 3rd closer to 2nd so that apical pair are closer together than others. **Legs:** Hind tibiae bowed, but mesotibiae straight; anterior tibiae straight, with a groove on external face; all tarsi with lamellae following generic pattern; male protarsi with 2 basal protarsomeres slightly expanded, with a small tooth at inner apex. **Genitalia:** Male of similar structure to *K. orpheus* but a little slimmer; aedeagus (Fig. 148) evenly tapered from basal orifice to slightly recurved tip; opening dorsal, near apex; internal sac with copulatory piece; basal blade present. Female bursa copulatrix with an extremely long prolongation at tip similar to *K. pluto*.

**Type locality.** Nelson, NN, Takaka, Motupipi, Council Cave.

**Distribution** (Map p. 91).

— / NN

Known from caves in the Tertiary limestone bordering the older marble near Motupipi, Takaka, and 2 examples from Mansons Cave and Ed's Cellar in the Ordovician marble immediately to the east. Also in Summit Cave, Takaka Hill.

**Material examined.** Holotype, 4 paratypes, and 2 other specimens. **Holotype** female, labelled: "New Zealand NN, Council Cave, Motupipi, 7 Feb 85, J. I. Townsend & J. Nunn", [Red holotype label] "Holotype [female symbol] *Kettlotrechus millari* n. sp. J. I. Townsend 2007" (right front tibia missing) (NZAC). **Paratypes:** 1 male, Water Supply Cave, Pohara Valley, Golden Bay, NZ, 9.10.1996, I. R. Millar; 1 male, Council Cave, Motupipi, Takaka, Nelson, 16.7.1972, S. Hunter; 2 females, Manson's Cave, Ex pit-trap, 11.9.1970, C. M. Smith (NZAC, ITNZ).

Other specimens: Ed's Cellar, -30 m on rock, Canaan, 27.11.1985, R. M. Emberson (LUNZ); 1, Summit Cave, Takaka Hill, 12.4.1992, T. H. Worthy. Elytra, Water Supply Cave, Pohara Valley, Takaka, 26.4.1994, J. I. Townsend.

**Etymology:** I am very pleased to name this species after Ian Millar of Department of Conservation, Nelson, a keen speleologist who has made a special study of cave fauna and has been extremely helpful in obtaining specimens for this study.

### **Genus *Duvaliomimus* Jeannel, 1928**

*Duvaliomimus* Jeannel 1928: 82. Type species *Trechus maori* Jeannel, 1920, by original designation and monotypy.

**Diagnosis.** Head with eyes well developed but sometimes flat; mandibles without a premolar tooth; frontal furrows complete, meeting cervical groove; penultimate labial palpomere with setae in distal 1/2; with 1 or 2 small setae between eye and base of antenna; pronotum wider than long, with a single seta on each side; elytra with 3 setae on 3rd interval, arranged with apical seta closer to suture than others.

**Description:** Typical epigeal, or rarely troglobitic trechines, usually mid to dark brown or almost black in colour, or of paler troglobitic form (subgenus *Mayotrechus*). **Head:** large, eyes prominent to somewhat reduced but always with many facets; antennae pilose from tip to almost base of pedicel; usually with only 1 small seta between eye and base of antenna, rarely with 2 (subgenus *Mayotrechus*); ocular furrow meeting cervical groove; with 2 ocular setae; mandibles stout; maxillary palpi elongate, penultimate segment subequal to terminal segment which is fusiform; penultimate labial palpomere with setae in distal 1/2; mentum with 2 setae, submentum with 6; anterior margin of clypeus straight; clypeal suture almost straight between ocular grooves; clypeus with 4 setae on anterior margin placed towards sides; labrum with anterior margin emarginate, with 6 setiferous punctures placed equidistant from each other. **Pronotum:** cordate, usually wider than long, rarely longer than wide (subgenus *Mayotrechus*); with a single seta on each side; anterior angles obtuse, rounded; sides evenly rounded in anterior 2/3rds, strongly sinuate in basal 1/3rd; scutellum triangular, flat. **Elytra:** Scutellar striole present; 3rd interval with 3 setae, 2 discal and 1 preapical which is closer to suture than others; 6th interval convex apically; sutural stria recurrent with 5th; marginal groove with a series of 8 umbilicate setae: 4 humeral (closely aggregated and almost equidistant), middle and apical pairs spaced a little further apart. **Legs:** Usually with all tibiae straight, rarely with hind tibia curved (subgenus *Mayotrechus*); anterior tibiae with an external

groove with a variable amount, but at least a trace, of fine pubescence near extremity on inner side; male protarsi with 2 basal tarsomeres expanded to varying degrees. **Ventral surface:** Abdominal ventrites usually with only 2 setae, rarely with supplementary fine setae (subgenus *Mayotrechus*); female with an additional pair on last segment.

**Remarks.** Species within the genus *Duvaliomimus* are often difficult to separate, especially on external characters. The only certain method for some is to examine the male genitalia.

The genus contains 2 subgenera, *Duvaliomimus* and *Mayotrechus*.

### *Duvaliomimus (Duvaliomimus) Jeannel, 1928*

**Description.** Body not of troglobitic form, usually dark, although sometimes pale brown, or paler apically; head with eyes well developed, broad, with only 1 small seta between eye and base of antenna; pronotum markedly wider than long; legs normal, all tibiae straight.

#### KEY TO *DUVALIOMIMUS (DUVALIOMIMUS)* SPECIES AND SUBSPECIES:

- 1 Head, pronotum, and elytra reddish brown, appendages only a little paler ..... 2  
—Head, pronotum, and elytra dark brown or black, appendages noticeably paler ..... 3
- 2 Elytral intervals moderately convex, tip of aedeagus not dilated laterally (Fig. 121) (Buller) ..... (p. 43)... *maori* Jeannel  
—Elytral intervals only weakly convex, tip of aedeagus dilated laterally (Fig. 144) (Otago) ..... (p. 45)... *taieriensis* n. sp.
- 3 Hind margin of pronotum clearly emarginate (Fig. 89a) ..... 4  
—Hind margin of pronotum almost straight (Fig. 89b)... ..... 6
- 4 Thorax with narrow marginal channels; aedeagus with elongated twisted tip ..... (p. 49)... *crypticus* n. sp.  
—Thorax often with broad marginal channels; tip of aedeagus truncate or somewhat produced but not twisted ..... 5
- 5 Tip of aedeagus obliquely angled ..... (p. 47)... *styx* Britton  
—Tip of aedeagus truncate ... (p. 48)... *pseudostyx* n. sp.
- 6 Elytra more convex, intervals weakly convex; striae usually continuous ..... 7  
—Elytra flat, intervals almost flat, striae irregularly broken ..... 9
- 7 Eyes less prominent, flatter; head often wider behind the eyes; aedeagus greatly lengthened (Fig. 136) ..... (p. 48)... *obscurus* n. sp.  
—Eyes prominent; head widest across the eyes; aedeagus not greatly lengthened (Fig. 133–135, 137–143) .... 8
- 8 Head dull with microsculpture of transverse mesh; aedeagus truncate at ostium, basal blade absent or greatly reduced (Fig. 139) ..... (p. 49)... *orientalis* Giachino  
—Head usually shining, without microsculpture; aedeagus evenly narrowed to blunt tip, basal blade prominent, semicircular (Fig. 134) ..... (p. 50)... *watti* Broun
- 9 Lateral margins of pronotum broadly reflexed (Fig. 42); North I. .... (p. 50)... *megawattus* n. sp.  
—Marginal channels narrower; South I. .... 10
- 10 Shaft of aedeagus lengthened and narrow, not expanded laterally at tip (Fig. 145)... (p. 46)... *chrySTALLae* n.sp.  
—Shaft of aedeagus shorter, less constricted ..... 11
- 11 Elytra broad, intervals almost flat, striae 3 and 4 uniting at discal puncture and again apically ..... (p. 46)... *australis* n. sp.  
—Not of above combination ..... 12
- 12 Intervals weakly convex; hind angles of pronotum square, scarcely protruding laterally ..... (p. 43)... *walkeri walkeri* (Broun)  
—Intervals flat, especially towards lateral margins, hind angles of pronotum usually acute and protruding laterally ..... (p. 45)... *walkeri brittoni* Jeannel

***Duvaliomimus (Duvaliomimus) maori* (Jeannel, 1928),  
re-instated**

Fig. 9, 41, 73, 114, 121, 160, 176, Map p. 91

*Trechus maori* Jeannel, 1920: 111. Type locality: Greymouth, BR. Incorrectly synonymised with *Duvaliomimus walkeri* by Jeannel 1928: 83.

**Redescription.** **Length:** 5.0–6.25 mm. **Colour:** Pale amber brown, appendages only slightly paler. **Head:** Large, shining with very weak microsculpture; frontal furrows deep, subparallel, meeting cervical groove at 2nd ocular seta; eyes large, round, many faceted. **Thorax:** Pronotum with weak microsculpture; hind margin straight with hind angles acute and slightly protruding laterally; marginal channels well developed; lateral seta just anterior to widest point. **Elytra** with shoulders evenly rounded or rarely with a very slight humeral angle; striae with weak elongate punctures; intervals convex; striae 3 and 4 uniting before apex. **Legs:** 4th protarsomeres have a small lamellate pad arising from sole and projecting forward, smaller lamellae extend from 4th tarsomere of meso- and metatarsi; male with protarsomeres 1 and 2 prolonged on their inner side to form a small tooth, in some specimens tarsomeres 3 and 4 also have a minute dark tooth in a similar position (visible at 30× magnification). **Genitalia:** Male with median lobe of aedeagus sharply angled and a little constricted beyond basal bulb, then gradually expanded towards tip, internal sac with a well developed copulatory piece (Fig. 121); Female with curled spermatheca which has a narrow entry to bursa copulatrix (Fig. 176).

**Type locality.** Greymouth, BR.

**Distribution** (Map p. 91).

— / BR

Buller, from Belfast Creek, south of Charleston to Fox River and Bullock Creek, Punakaiki, where it has also been found in caves; specifically Fox River Cave, Xanadu, and Cairns Catacombs, and also south to Greymouth, where it was first discovered by Helms.

**Material examined.** Lectotype, 43 other specimens. **Lectotype** female, labelled: *Trechus maori* n. sp. R. JEANNEL det. / Type HT. [red circle] / New Zealand Helms Reitter / Greymouth, New Zealand. Helms. / Sharp Coll. 1905–313 (BMNH), specimen missing distal half of left antenna, legs twisted and glued underneath. [3 Paralectotypes, Greymouth (2 BMNH, 1 Paris Museum (not seen)]. Other specimens: 3, Belfast Creek, 8 miles S Charleston 12.10.1970, J. I. Townsend; 7, Bullock Creek, Punakaiki, 6.5.1970, at night on damp rocks and soil, P. M. Johns; 18, Xanadu Cave, Punakaiki, 10.7.1969, 21.8.1969, 6–7.5.1970 (2 outside cave), P. M. Johns; 1, Cairns Catacombs, Punakaiki, 15.8.1970, mud passages, P. M. Johns; 1, Xanadu Cave, Punakaiki, 26.6.1990, T. H. Worthy; 1,

Xanadu Cave, 26.4.1989, S. Winskill; 2, Xanadu Cave, Bullock Creek, 5.1.1974, R. M. Emberson; 1, Bullock Creek Track, Xanadu, 20.11.1977, J. K. Barnes; 1, Bullock Creek Caves, Kubla Khan Series below passage in Cairns Catacombs, 1.10.1972, R. M. Emberson; 2, Xanadu Cave, 20.1.1999, S. Pawson; 1, Cairns Catacombs, Bullock Creek, 9.7.1971, R. M. Emberson; 1, bottom of Slot, Fox River Main Cave, 20.1.1975, R.M.Emberson (NZAC, CMNZ, LUNZ, ITNZ).

***Duvaliomimus (Duvaliomimus) walkeri walkeri* (Broun,  
1903)**

Fig. 10, 49, 72, 82, 97, 111, 133, 175, Map p. 88, 91

*Anchomenus walkeri* Broun, 1903: 456

*Agonum (Anchomenus) walkeri*: Csiki, 1931: 865.

*Duvaliomimus walkeri*: Jeannel, 1938: 256.

**Diagnosis:** Body dark brown, contrasting with paler appendages; elytra with very weak shoulders, intervals weakly convex; hind angles of pronotum square.

**Redescription.** **Length:** 5.0–7.0 mm. **Colour:** Body dark brown to black, appendages paler. **Head:** with ocular grooves prominent, uniting with cervical groove at 2nd ocular seta; eyes prominent, hemispherical. **Thorax:** Pronotum with straight hind margin and hind angles not protruding laterally; marginal channel narrow, bearing lateral seta slightly anterior of widest point; isodiametric microsculpture in wrinkles at base. **Elytra** with a very slight angle in humeral margin; striae weakly punctured; intervals weakly convex to almost flat; 2nd elytral stria usually ends just beyond union of striae 3 and 4, but sometimes continues almost to apex; 1st stria recurrent towards 5th stria; depth of striae show considerable variation, especially apically and towards lateral margins; **Legs:** Male with 2 basal protarsomeres prolonged on their inner sides, but they are without dark tooth seen in some *D. (D.) maori*, nor have additional teeth been seen on 3rd and 4th protarsomeres. **Genitalia:** Male with a prominent basal blade (Fig. 133). Female spermatheca has a broad union with bursa copulatrix (Fig. 175).

**Type locality.** Westport, NN/BR.

**Distribution** (Map p. 88, 91).

— / NN, BR, WD, FD, OL, CO/SL

Epigeal riparian habitats from Westport down the west coast to Jackson Bay and northern Fiordland, also east of the Southern Alps in Otago. Known also from Profanity Cave, Inangahua (the possible source of the “Westport” specimen), but apparently only an infrequent cave dweller.

**Material examined.** Holotype and 58 specimens. **Holotype**, labelled: *Anchomenus walkeri* [female symbol] / Westport 1902 / 2663 / New Zeal. Broun Collection 1922–

482 / [red circular Type label]. Specimen glued to card rectangle, antennae and palps complete, right foreleg and left hind leg missing; brown colour hinting of a slightly teneral specimen, or of cave origin (BMNH). **BR**: 1, Profanity Cave, Inangahua; **WD**: 3, Mt Greenland, Ross, 2000', 9.1.1943, E. S. Gourlay. 2, Franz Josef, 1000', 9.1.1977, J. I. Townsend; 1, Louisa Peak, Alex Knob, Franz Josef, 20.2.1984, C. W. & R. W. Hornabrook; 1, Fox Glacier, 24.2.1966, J. I. Townsend; 1, Fox Glacier (at side of terminal moraine), 12.11.1968, J. I. Townsend; 1, Lake Moerakei, J. I. Townsend; 1, Found Creek, Haast Pass, 315m, 25.8.1994, B. H. Patrick; 2, Jackson Bay (seepage in splash zone of tide), 6.10.1995, B. H. Patrick; 1, Jackson Head; 1, Gates of Haast Bridge, 11.11.1968, J. I. Townsend; 11, Arawata Biv, 840 m, 31.1.1989, 3.2.1989, at night, sandy seepage under river bank, R. M. Emberson; 2, Arawata Valley, 1050 m. under rocks in small stream, Mt. Aspiring National Park, 31.1.1989, R. M. Emberson. **OL**: 1, small creek on S side of Haast Pass, 18.4.1994, J. I. Townsend; 4, Wharf Creek, foot of Mt. White, Lake Wanaka, 11.11.1968, J. I. Townsend; 6, Bob's Cove, Queenstown, 6.11.1968, J. I. Townsend; 1, under drift debris, Queenstown, Lake Wakatipu, 12.12.1978, R. M. Emberson; 1, Mossvale Stream, Diamond Lake, Lake Wakatipu, 2.3.1996, J. I. Townsend; 1, moss by waterfall near Roaring Meg, Kawarau Gorge Rd, 29.3.1984, R. C. Craw; **CO/SL**: 15, Beaumont State Forest, 15.11.1985, under rock by stream, C. A. Muir. **FD**: 1, Mt Annette, Little Red Hill, Barrier Range, 1200 m (BMNH, NZAC, LUNZ, CMNZ, OMNZ, ITNZ).

**Remarks.** It is difficult to understand why Larochelle & Larivière (2001) stated that *Duvaliomimus walkeri* required a new genus, when they had accepted the synonymy "*Anchomenus*" *walkeri* with "*Trechus*" *maori*.

The distribution of this species is rather strange. The type locality of Westport may be somewhat misleading. It has never been seen again in Westport since the initial collection by J. J. Walker in 1901, and it may have been deposited there by a flood in the Buller River from further inland. I once found *Duvaliomimus* (*D.*) *pseudostyx* apparently deposited by flood waters in the Rangitikei riverbed at Bulls which is not its normal habitat, and noted numerous species of Carabidae deposited alive on beaches after floods in the Manawatu (Townsend 1994). I believe my assumption of a flood in the Buller River to be correct. During final editing Dr Crosby remembered reading of such a flood, and a search of the Landcare Research library found Walker (1904: 149–150) in which he described his collecting at Westport: "On the 19<sup>th</sup> [November 1901] the Buller River was in high flood after the rain, running down at the

rate of more than ten miles an hour, and carrying great quantities of drift timber, large and small, out to sea. The next day was fine, and when I went down to the beach I found it literally teeming with beetle life, under the driftwood and other *débris* thrown up by the tide on the clean sand. As many as ten or a dozen species of *Coleoptera* were sometimes found under a single small piece of wood, and three hours' work gave me no fewer than 105 species, a number unprecedented, I should say, in a day's collecting in New Zealand. These, when sorted out, were distributed as follows: *Carabidae* 20, *Dytiscidae* 1, *Hydrophilidae* 4, *Staphylinidae* 11, *Pselaphidae* 2, Clavicorns 13, *Lucanidae* 2, Lamellicorns 10, *Elateridae* 10, *Malacodermata* 6, *Heteromera* 12, *Rhynchophora* 10, and *Phytophaga* 4 species. A large proportion of these had probably been brought down for a distance of many miles by the flooded Buller River and its tributaries, and small river-bank and shingle-frequenting *Staphylinidae* and *Carabidae* (*Anchomenus*, *Actenonyx*, *Oöpterus*, *Bembidium*, &c.) with three or four *Elateridae*, were individually the most numerous. But larger forms were by no means absent, and I took, for the first time, *Amarotypus edwardsi*, Sharp, the very elegant *Demetriida lineella*, White, three species of *Mecodema*, including a single example of the rare *M. ducale*, Sharp, and apparently new *Zolus*, *Saphobius setosus*, Sharp, and two very nice Heteromeric forms, *Mesopatrum granulosum*, Br., and *Cerodolus chrysoloides*, Sharp. Two hours' work next morning on the same ground gave me 80 species of beetles, and these figures will, I think, go far to show that New Zealand is not as poor a region for the Coleopterist as has sometimes been stated."

*D.* (*D.*) *walkeri* is known from well upstream from Westport, in the Buller Gorge at Inangahua where it occurs in Profanity Cave, the only record of this species living as a troglophile. It is normally an epigeic species living near water, commonly occurring along the foothills of the Southern Alps at least as far south as Jackson Bay. There appears to be a strange gap in its distribution from Mt Greenland to Inangahua, but this may be accounted for by much of this country being relatively inaccessible. Its eastward distribution includes the headwaters of the Makarora and Clutha Rivers and via them almost to the coast of Otago. It is an extremely variable species. In the Otago region it tends to become smoother and approaches the form from the high mountain areas of the South Island previously known as *D.* (*D.*) *brittoni*. In the northern region it tends to have more convex elytral intervals and in this respect it approaches *D.* (*D.*) *maori* but not to the extent of that species.

***Duvaliomimus (Duvaliomimus) walkeri brittoni* Jeannel, 1938 n. comb.**

Fig. 48, 142, Map p. 88

*Duvaliomimus brittoni* Jeannel, 1938: 256.

**Diagnosis:** Elytral intervals flatter than *walkeri*; striae weaker, especially towards sides.

**Redescription.** **Length:** 5.0–6.5 mm. **Colour:** Head, thorax, and elytra black, appendages reddish brown. **Head:** Frontal furrows deep, curved outwards behind eyes to meet cervical groove. **Thorax:** Pronotum broader than long; marginal channel narrow with a seta at widest point; hind margin almost straight with lateral angles acute and projecting laterally. **Elytra:** with a weak shoulder angle; intervals flat; sutural stria well impressed, recurrent towards 5th stria, other striae weakly and rather irregularly punctured, often evanescent towards margins and sometimes also towards apex, and in humeral area; 3 setae in 3rd interval, 1st and 2nd near 3rd stria, 3rd adjacent to 2nd stria and closer to suture than others. **Legs:** Male with 2 basal protarsomeres bearing only a small tooth on their inner apical extremity. **Genitalia:** Male genital segment narrowly V-shaped; aedeagus curved sharply from basal bulb and gradually expanded towards a truncate tip (Fig. 142).

**Type locality.** [Mt] Earnslaw, OL

**Distribution** (Map p. 88).

— / OL, WD?

Known from mountains around Lake Wakatipu, above 1000 metres.

**Material examined.** **OL:** 1, Ben Lomond, Lake Wakatipu, A. Philpott, Ex Chas. E. Clarke Collection (NZAC); 16, Coronet Peak Road, Queenstown, *Nothofagus*, 25.1.1971, P. M. Johns (CMNZ, ITNZ). **WD:** 3, Chancellor Hut, Fox Glacier, under schist slabs in stream 28.1.2005, J. T. Nunn (JNNZ, ITNZ). These 3 specimens are female, so their precise identity cannot be determined. They are tentatively placed with the subspecies *brittoni* because they appear identical to specimens from Coronet Peak.

**Remarks:** In view of the variability of *D. (D.) walkeri*, it is difficult to maintain *D. (D.) brittoni* as a full species. There is a population of *Duvaliomimus* living around the shores of Lake Wakatipu that has been included with *D. (D.) walkeri*, however it may have had its origin in the local mountains and possibly be closer to the subspecies *brittoni* although the elytral striae are a little more defined than the typical form. It is not unusual for high altitude populations of carabids to be smoother than the lowland forms. An example is the *Mecodema* complex of *politanum* Broun (high level), *lucidum* Laporte de Castelnau and *impressum* Laporte de Castelnau (low level). The lakeside population

of *Duvaliomimus* has probably made its way downstream via the Kawarau and Clutha Rivers to establish satellite colonies like those around Beaumont Forest.

The riparian species of *Duvaliomimus* in general have a precarious existence. At times massive floods wash them downstream and their natural tendency is to go upstream, as shown by their presence in small trickles and seepages at the headwaters of streams. Over time this must account for the spread of species, and the isolation of the colonies tends to produce minor variations. It seems logical that the Otago lakes have been a reservoir for displaced alpine species, and these eventually being swept further downstream may have been the origin of lowland species, or forms that are difficult to classify such as those around Beaumont Forest. The Haast Pass, Makarora River, and Lake Wanaka has similarly allowed *D. walkeri* to join the Otago mix. In fact some specimens from Mt Cargill, Dunedin are so like typical *D. walkeri* that had they been found on the West Coast there would have been little doubt of their identity.

4 female specimens from Mt Cook National Park (JNNZ, LUNZ, ITNZ) are paler in colour and have acute, laterally protruding hind angles on the pronotum. Elytral striae are well developed so are not allied to *D. (D.) walkeri brittoni*. Neither are they typical *D. (D.) walkeri walkeri* and may represent an undescribed species but until males are found they are better left unclassified.

***Duvaliomimus (Duvaliomimus) taiariensis* new species**

Fig. 47, 144, Map p. 87

**Diagnosis.** Reddish brown body, and appendages of almost similar colour; male aedeagus expanded laterally at tip.

**Description.** **Length:** 5.5–6.0 mm (holotype = 6.0 mm). **Colour:** Deep reddish brown, appendages only a little paler. **Head:** Frontal furrows even, a little arcuate, meeting cervical groove; eyes round, only a little raised above surface of head. **Thorax:** Pronotum with well developed marginal channel with a seta at widest point of pronotum; base only slightly emarginate; median line weak, reaching base but dividing before apex; posterior angles almost square and not protruding laterally. **Elytra:** with shoulders rounded; intervals strongly convex; striae 3 and 4 uniting at 1st discal puncture but dividing again and continuing to base. **Legs:** 4th protarsomere extended below into a process from which lamellae protrude forward under 5th tarsomere; male with 2 basal protarsomeres expanded on their inner sides. **Genitalia:** Male with aedeagus expanded laterally near tip (Fig. 144). Female with bursa copulatrix and spermatheca similar to *D. (D.) walkeri*.

**Type locality.** Taieri Mouth, DN

**Distribution** (Map p. 87).

— / CO, DN

Taieri Mouth Picnic Reserve, DN; Allison Reserve, Akatore; CO, Waikaia Forest.

**Material examined.** Holotype, 7 paratypes, and 2 other specimens. **Holotype** male, labelled: New Zealand DN, Taieri Mouth, 11.3.89, J. T. Nunn / [Red holotype label] Holotype [male symbol] *Duvaliomimus taieriensis* n. sp. Det. J.I. Townsend (NZAC). **Paratypes:** **DN:** 1, Allison Reserve, Akatore, 14.4.1998, J. T. Nunn; 3, Taieri Mouth, 11.3.1989, J. T. Nunn; 3, Picnic Reserve, Taieri Mouth, 14.4.1998, J. I. Townsend. Other specimens: **CO:** 2, Piano Flat, Waikaia Forest, 22.9.2001, under stone, forest stream at water edge, J. T. Nunn (NZAC, JNNZ. ITNZ).

***Duvaliomimus (Duvaliomimus) australis* new species**

Fig. 38, 143, Map p. 87

**Diagnosis.** Body much darker than appendages; head with strong isodiametric microsculpture, more transverse in occipital region, aedeagus a little expanded laterally towards tip.

**Description.** **Length:** 5.0–5.8 mm. **Colour:** Head, thorax, and elytra dark brownish black, antennae and mandibles reddish brown, legs and palpi amber brown. **Head:** with strong isodiametric microsculpture, becoming more transverse in occipital region, also on margins of pronotum and shoulders of elytra; frontal furrows subparallel, meeting cervical groove near posterior ocular seta; eyes clearly faceted, only a little raised above surface of head. **Thorax:** Pronotum with a seta on each side at broadest part; hind margin straight; hind angles acute and slightly protruding; marginal channel widest near lateral seta; median line reaching base but not apex; basal part of pronotum and near margins with dense isodiametric microsculpture. **Elytra:** without trace of shoulder angle; intervals almost flat; striae with irregular punctures, becoming evanescent towards sides, near shoulders and in apical area; 1st stria recurrent as a strong fold to 5th stria; striae 3 and 4 uniting at 1st discal puncture and again apically. **Legs:** 1st and 2nd male protarsomeres with a small apical tooth on inner side. **Genitalia:** Male with aedeagus gradually tapered apically and a small fold at extremity in front of ostium; basal blade prominent, circular. (Fig. 143). Female genitalia similar to *D. (D.) walkeri*.

**Type locality.** Gore, SL, Croydon Bush (only known locality).

**Distribution** (Map p. 87).

— / SL

**Material examined.** Holotype and 50 paratypes. **Holotype** male, labelled: “New Zealand SL, Croydon Bush,

Dolamore Loop walk, 200 m, 20.1.1999, Larochelle, Larivière, Paquin”, “stream banks; half shaded, bare moist clay. Under stones. Gregarious”, Larivière Larochelle Collection”, [Red holotype label] “Holotype [male symbol] *Duvaliomimus australis* n. sp. Det. J. I. Townsend 2007” (NZAC). **Paratypes:** 4, Croydon Bush, Gore, 9.3.1989, J. T. Nunn; 46, Croydon Bush Loop Walk, 200 m, SL, 19 & 20.1.1999, P. Paquin, Larochelle & Larivière, stream banks half shaded, bare moist clay under stones, gregarious (NZAC, JTNZ, ITNZ).

**Remarks.** A gravid female contained 4 eggs in the oviduct.

***Duvaliomimus (Duvaliomimus) chrySTALLAE* new species**

Fig. 39, 145, Map p. 87

**Diagnosis.** Body much darker than appendages; head shining but with transverse microsculpture in occipital region; otherwise very like *D. (D.) australis* but male has aedeagus without lateral expansion at tip, and a narrower shaft.

**Description:** **Length:** 5.0–6.0 mm (holotype = 5mm). **Colour:** Head dark reddish brown, pronotum and elytra brownish black, appendages pale yellowish brown. **Head** shining, with weak microsculpture (transverse on occiput, otherwise isodiametric); frontal furrows long, sub-parallel, meeting cervical groove; eyes flat, scarcely raised above surface of head. **Thorax:** Pronotum with sides evenly rounded, and then sharply sinuate before posterior angles which are acute and slightly protruding laterally; hind margin not at all emarginate; marginal channel narrow; median line sharply impressed from near base but not reaching apex. **Elytra:** without shoulder angle; intervals weakly convex, flatter towards margins; striae with irregular weak punctures; 1st stria recurrent to 5th; striae 3 and 4 often uniting at 1st discal puncture; most striae becoming evanescent apically. **Legs:** 4th tarsomere of all tarsi with lamellate hairs extending forward from sole to under 5th tarsomere. Male with 2 basal protarsomeres produced to a tooth on their inner sides. **Genitalia:** Male with aedeagus a little expanded towards tip but not dilated laterally (Fig. 145).

**Type locality.** Longwood State Forest, SL, Bald Hill (only known locality).

**Distribution** (Map p. 87).

— / SL

**Material examined.** Holotype and 4 paratypes. **Holotype**, labelled: “New Zealand SL, Longwood SF, Bald Hill, 700 m, 24.1.1999, P. Paquin”, Wet sub-alpine cloud forest (beech); mossy floor. Wet, organic soil. Under stones”, [Red holotype label] “Holotype *Duvaliomimus chrySTALLAE* n.sp. Det. J.I. Townsend”, [Green label] “Larivière Larochelle Collection” (NZAC). **Paratypes:** same collecting data as holotype.

**Etymology:** It is with real pleasure that I name this species after Leita Chrystall who has scrambled up slippery streams with me in pursuit of trechine beetles, and has also been of great encouragement during my final writing of this work.

***Duvaliomimus (Duvaliomimus) styx* Britton, 1959**

Fig. 3, 11, 46, 89a, 112, 137, 138, 180, Map p. 87  
*Duvaliomimus styx* Britton, 1959: 104.

**Diagnosis.** Base of pronotum usually emarginate, posterior angles acute, usually not protruding laterally, but with some populations, they do; elytral intervals slightly convex; male protarsomeres 1 and 2 with prominent tooth; aedeagus gradually narrowed from ostium to tip.

**Redescription.** **Length:** 4.5–5.0 mm. **Colour:** Head dark brown, pronotum and elytra shining black on disc, margins dark brown, elytra often paler apically; antennae and mandibles reddish-brown, palpi yellowish-brown; legs yellowish-brown, with femora and tibiae infusate. **Head:** Frontal furrows deep, curved outwards to meet cervical groove; eyes prominent. **Thorax:** Pronotum elongate, ratio greatest width : middle length = 1.12 : 1; marginal groove well developed with a seta at widest point; hind angles acute, usually scarcely projecting laterally, occasionally more protruding, base usually strongly emarginate, posterior extension of hind angles 7–10% of mid length. **Elytra:** ovoid in outline, without trace of shoulder angle; striae evenly impressed but 4th stria usually fading before base; intervals slightly convex, striae 3 and 4, 6 and 7 combining apically. **Legs:** 4th tarsomere of all tarsi with sole extended forward as a small lamella; male with 2 basal protarsomeres with a small tooth at inner distal extremity. **Genitalia:** Male with median lobe sharply angled beyond basal bulb, gradually expanded towards ostium and evenly and obliquely narrowed to a protruding tip, basal blade always present (Fig. 137, 138). Female genitalia with a narrow entry of spermatheca to bursa copulatrix (Fig. 180).

**Type locality.** Port Waikato, WO, Puriri Cave.

**Distribution** (Map p. 87).

WO, TK, GB, WA, WN / —

Found in caves and riparian habitats from Waikato to northern Taranaki, also Manawatu Gorge, Mahia Peninsula, Possum Cave (Wairoa GB), and Nitty Gritty Cave (Wairarapa WA).

**Material examined.** Holotype and 57 specimens. **Holotype** male, Puriri Cave, Port Waikato, WO, 200–300 yards from entrance, on mud near stream, 15.6.1958, B. M. May (NZAC). Other specimens: **WO:** 7, Puriri Cave, Port Waikato, 15.6.1958, 31.7.1960, 17.9.1966, B. M. May & D. I. Gardiner; 2, Papparaha Cave, Awakino, 26.1.1964, I. Stringer & L. Wilkins; 1, Skyline Cave, Awakino, in trap

300 yards in, on stream passage, 20.6.1966, B. M. May; 1, in cave, Mangaorongo, Mahoenui, 17.8.1963, in shingle, B. M. May; 1, 50 yards in cave, Bothwell Station, Waikaretu, 2.1.1967, D. I. Gardiner; 1, small stream near Puriri, Port Waikato, 4.11.1977, J. I. Townsend; 1, Gribbons Rd., 8 km N. of Mahoenui, 25.4.1986, in stream, D. B. Townsend. **TK:** 2, Ecch Cave, Aria, 27.1.1963, D. I. Gardiner; 3, small stream, East end of Tangarakau Gorge, 19.4.1987, D. B. & J. I. Townsend. **GB:** 13, Mahia Scenic Reserve, 400', 17.1.1989 & 22.1.1995, J. I. Townsend; 1, Graveyard Passage, Possum Cave, Wairoa, 26.1.1985, T. H. Worthy. **WA:** 1, Aohanga River, SW of Akitio, 7.10.1993, siltstone in streamlet, J. I. Townsend; 6, Mud stream bank, Nitty-Gritty Cave, Coonor, Wairarapa, 14.7.1973, 18.8.1973, R. H. Newman. **WN:** 17, Ballance Bridge Reserve, Manawatu Gorge, 25.12.1982 & 25.3.1984, J. T. Nunn & J. I. Townsend (NZAC, LUNZ, ITNZ, JNNZ).

**Remarks:** The patchy distribution of *D. (D.) styx* across the North Island suggests that it may be more closely related to the ancestral species and with restricted gene flow others may have evolved. The East Cape / Hawkes Bay area seems to have been a centre of evolution for *Duvaliomimus*, with at least 4 or possibly 5 species occurring there.

A single specimen from Tawapata Stream 900' Mahia Peninsula, Hawkes Bay (20.1.89 D.B.Townsend (ITNZ)) has male genitalia similar to *D. (D.) pseudostyx* but the elytra are broader, the striae are deeper and the head has transverse microsculpture. It may be more closely related to *D. styx* but its true identity must remain in doubt until more specimens can be examined

The population from Ballance Bridge Reserve, Manawatu Gorge, are a little atypical, with the striae more disrupted with fine punctures.

A form from Nitty Gritty Cave in the Wairarapa has slight differences in male genitalia from the typical species (Fig. 138), however I consider this to be within the bounds of variation and the population there also has variation in the posterior margin of the pronotum, some being almost straight, but others more deeply emarginate. It seems that on rare occasions *D. (D.) styx* can have an almost straight hind margin to the pronotum and also occasionally have hind angles that protrude laterally. This exemplifies the problems of relying on external features. The male genitalia have the most reliable characters for identifying species of *Duvaliomimus*. The following species shows the need to examine male genitalia.

***Duvaliomimus (Duvaliomimus) pseudostyx* new species**

Fig. 45, 89a, 135, Map p. 87

**Diagnosis.** Intervals moderately convex; externally like

*D. (D.) styx*, but male genitalia has aedeagus truncated at ostium like *D. (D.) orientalis*, but with a normal basal blade.

**Description.** **Length:** 4.5–5.5 mm (holotype = 5.0 mm). **Colour:** Head reddish black, pronotum and elytra shining black with apex fuscous; femora, tarsi, palpi, and scape golden brown; flagellum and tibiae reddish brown. **Head:** with reticulate microsculpture; frontal furrow curved on vertex, meeting cervical groove. **Thorax:** Pronotum a little wider than long, maximum width : mid length = 1.26 : 1; hind angles acute and slightly protruding laterally; hind margin a little emarginate. **Elytra:** with apices paler; without trace of shoulder angle; striae evenly impressed, almost impunctate; striae 3 and 4 uniting apically, striae 6 and 7 not reaching apex; intervals moderately convex. **Legs:** 2 basal protarsomeres of male with a small tooth on their inner sides, some specimens have this feature repeated on segment 3 as a minute dark tooth. **Genitalia:** Male with aedeagus abruptly narrowed at ostium to a protruding tip, base with a clearly defined blade (Fig. 135). Female genitalia similar to *styx*, but spermatheca with wider entry to bursa copulatrix.

**Type locality:** Makuhou Scenic Reserve, WI, northwest of Marton.

**Distribution** (Map p. 87).

TK, TO, WI, RI / —

Riparian habitats from Taranaki, inland Wanganui, and Rangitikei.

**Material examined.** Holotype and 14 paratypes. **Holotype** male labelled: “Makuhou Rd., NW Marton, WI, 15.9.1985, J. I. Townsend” (NZAC). **Paratypes:** **WI:** 14, Makuhou Rd, NW of Marton, 15.9.1985, D. B. & J. I. Townsend. **Other specimens:** **TK:** 1, Lake Mangawhio, W of Waitotara River, 12.2.1995, J. I. Townsend; 7, S side of Mt Messenger, 400' [120 m], 20.3 1994, J. I. Townsend; 11, Ahukawakawa Track, Pouakai Range, 1200 m, 11.1.1978, J. C. Watt & J. S. Dugdale; 1, Holly Hut, 950m, North Egmont, 30.11.1975, J. S. Dugdale. **TO:** 1, Pukekaha Rd, near Orautoha, N of Raetihi, 8.1.1989, J. I. Townsend. **WI:** 2, Rangitikei River at Bulls, 31.3.1990, in flood debris J. I. Townsend; 3, Mangakaretu Scenic Reserve, Turakina Valley, 5.4.1988, J. I. Townsend; 1, Laird's Bush, W of Hunterville, 15.9.1990, J. I. Townsend. **RI:** 4, Mt Richards, Pohangina Valley, under small log in silty stream-bed, 31.12.1997, A. C. Eyles & J. I. Townsend; 10, Otoko, Parapara Rd, 9.1.1989, J. I. Townsend; 5, Paengaroa Scenic Reserve, Mataroa, 19–20.12.1995 & 18.1.1996, J. I. Townsend; 1, Kaiwaka, Wanganui River, 17.12.1974, R. Emberson & P. Syrett (NZAC, CMNZ, LUNZ, ITNZ, JNNZ).

**Remarks:** The type series is limited to the Marton locality because it has a good population in a reserve and

examples from other places show some minor variation in external morphology.

There are very distinct habitat preferences for *D. (D.) styx* and *D. (D.) pseudostyx*. The former may be restricted to limestone areas (although the Manawatu Gorge population does not comply with this) and the latter appears to be commonest in riparian areas of softer tertiary siltstones which are widespread across the North Island. It is tempting to think of differences in the shape of the pronotum to be a response to the silty nature of the streams. Perhaps, sharper hind angles and an emarginate hind margin may be advantageous in these conditions?

*Duvaliomimus (D.) pseudostyx* has been found displaced by floods on 2 occasions. 4 specimens were found under a small log in the silty streambed of the Pohangina River after a flood. These were associated with *Bembidion anchonoderum* Bates, and was not a normal trechine habitat. Also 2 specimens were found in flood debris in the lower reaches of the Rangitikei River at Bulls.

#### *Duvaliomimus (Duvaliomimus) obscurus* new species

Fig. 13, 43, 89b, 113, 136, 161, 177, Map p. 87

**Diagnosis.** Externally very like *D. watti* but male has genitalia with a greatly lengthened aedeagus (Fig. 136).

**Description.** **Length:** 5–6 mm (holotype = 6 mm). **Colour:** Head, thorax, and elytra dark brownish black, marginal groove of both pronotum and elytra often a little paler, antennae reddish brown, legs and palpi golden brown. **Head:** Frontal furrows deep, subparallel, meeting cervical groove near 2nd ocular seta; eyes round, flat, scarcely raised above surface of head, width of head behind them often greater. **Thorax:** Pronotum with a seta in marginal groove at or just in front of widest part; basal angles acute and slightly protruding laterally; hind margin only slightly emarginate; median line weakly impressed, almost reaching base but becoming evanescent before apex without showing bifurcation. **Elytra:** with shoulders evenly rounded; disc slightly depressed; striae evenly impressed from base to apex, impunctate, 1st and 2nd often uniting at scutellar pore, striae 3 and 4 uniting near apical puncture, striae 5 and 6 uniting at posterior 3rd; 1st recurrent stria joining 5th near apex; intervals moderately convex with 3 setiferous punctures on 3rd. **Legs:** Male with 2 basal protarsomeres expanded to form a well developed tooth on their inner apical margin. **Genitalia:** Male with a greatly extended mid lobe of aedeagus and well developed basal blade (Fig. 136). Female with spermatheca as a small lobe off upper part of bursa copulatrix (Fig. 137).

**Type locality.** East Cape, BP, SW of Waihou Bay, Papatea Stream.

**Distribution** (Map p. 87).

BP, GB / —



Streamsidings from East Cape — southwest to Opotiki, Motu, BP and east to Tikitiki, GB.

**Material examined.** Holotype and 45 paratypes. **Holotype** male, labelled: "Papatea Stream, SW of Waihou Bay, East Cape, 28.1.1993, J. I. Townsend", [Red holotype label] "Holotype [male symbol] *Duvaliomimus obscurus* n. sp. Det. J.I.Townsend 2007" (NZAC). **Paratypes:** **BP:** 8, 2 miles from Pass between Lower Waiou & Toatoa, Opotiki, 6.9.1969, stones in wet gully, R. S. Cranfield; 1, Mt Hikurangi, 5000', under stones, 18.1.1964, P. M. Johns (CMNZ); 2, Waiou River, 1000', Toatoa Rd Motu, 12 miles in, 6.11.1977, J. I. Townsend; 2, small stream S of Ohau Stream, Waiouka Gorge, 2.7.1988, J. I. Townsend; 1, Small rocky creek by Whanaroa River, East Cape, 5.2.1993, J. I. Townsend; 1, Papatea Stream, SW of Waihou Bay, East Cape, 25.1.1993, J. I. Townsend; 1, Oroi Scenic Reserve, Torere, 15.4.1987, J. T. Nunn; 11, Waiouka Gorge, 14.4.1987 & 22.4.1987, J. T. Nunn; 18, Tutaetoko Valley, 15 km S of Opotiki, 13.4.1987, J. T. Nunn. **GB:** 4, Stream W of Mangatutaekuri, Tikitiki, East Cape, 19.3.2004, J. Griffiths, L. P. Chrystall & J. I. Townsend (NZAC, JNNZ, ITNZ).

**Remarks:** The 18 specimens from Tutaetoko Valley consisted of 15 males (14 fully hardened) and 3 teneral females which may well have been the attractant for the males.

#### *Duvaliomimus (Duvaliomimus) crypticus* new species

Fig. 40, 89a, 140, Map p. 87

**Diagnosis.** Convex elytral intervals, basal angles of pronotum rectangular and not protruding laterally; tooth on male protarsomeres 1 and 2 very small; genitalia with aedeagus a little longer and narrower than *D. (D.) orientalis* and with twisted tip and a clearly visible basal blade.

**Description.** **Length:** 4.5–5.0 mm (holotype = 4.5 mm). **Colour:** Head and pronotum dark reddish brown, elytra brownish-black, reddish at suture, paler at apical edge; appendages pale golden brown. **Head:** with reticulate microsculpture; frontal furrow evenly curved, meeting cervical groove at 2nd ocular seta; eyes well developed, widest part of head. **Thorax:** Pronotum with posterior angles rectangular or slightly acute, not protruding at sides; hind margin a little emarginate. **Elytra:** without trace of shoulder angle; striae strongly impressed; intervals convex. **Legs:** Male with 2 basal protarsomeres expanded but tooth on their inner sides very small. **Genitalia:** Male aedeagus narrow with twisted tip.

**Type locality.** East Cape, GB, Hicks Bay, Nukutaharoa Stream.

**Distribution** (Map p. 87).

GB / —

In the immediate surrounds of Hicks Bay.

**Material examined.** Holotype and 4 paratypes. **Holotype** male, labelled: "Nukutaharoa St[rea]m, Hicks Bay [GB], 31.1.1993, J. I. Townsend" (NZAC). **Paratypes:** 1, same data as holotype; 3, small rocky creek, Te Koau, Hicks Bay, 4.2.1993, J. I. Townsend (NZAC, ITNZ).

#### *Duvaliomimus (Duvaliomimus) orientalis* Giachino, 2005

Fig. 44, 89b, 139, Map p. 87

*Duvaliomimus orientalis* Giachino, 2005: 82.

**Diagnosis.** Elytral striae evenly impressed; intervals moderately convex; base of pronotum emarginate and posterior angles acute and protruding laterally; male genitalia with aedeagus abruptly narrowed at ostium, basal blade rudimentary.

**Redescription.** **Length:** 5.0–5.5 mm. **Colour:** Body and elytra black, marginal groove reddish brown, head and pronotum dark reddish brown, appendages yellowish brown. **Head:** with frontal furrows deep, meeting cervical groove; eyes prominent, forming widest part of head. **Thorax:** Pronotum cordate, with well developed marginal channel; sides evenly curved in apical 2/3rds, then sharply sinuate before posterior angles which are acute and slightly protruding; hind margin scarcely emarginate; base with weak microsculpture between wrinkles. **Elytra:** with striae evenly impressed; apical seta of 3rd elytral interval in line with 2nd stria, displacing it towards elytral suture; striae 3 and 4 uniting before apical seta; 1st and 2nd striae sometimes uniting before base. **Legs:** Male with 2 basal protarsomeres toothed on their inner side. **Genitalia:** Male with aedeagus swollen in apical 1/2 and abruptly narrowed at ostium, profile with weak dorsal depression; basal blade of minimal size or absent (Fig. 139). Female genitalia with 2 spines on inner side of hemisternites; with spermatheca partly curled around bursa copulatrix which has a small opening to it, similar to *D. (D.) maori*.

**Type locality.** Te Kanapa Stream, GB, Rangitukia Rd.

**Distribution** (Map p. 87).

GB / —

Restricted to the East Cape area.

**Material examined.** Holotype and 9 paratypes. **Holotype:** Te Kanapa Stream, Rangitukia Rd, GB, 24.11.1993, J. S. Dugdale (NZAC). **Paratypes:** 6, same data as holotype; 3, Te Awha Stream, Rangitukia Rd, GB, 12.1.1994 & 2.11.1994, J. S. Dugdale & G. Hall. Other specimens of original series: **GB:** 2, Mangatutaekuri Mountain, 11.11.1996; 13, Te Awha Stream, 12.1.1994, J. S. Dugdale & G. Hall; 20, Te Kanapa Stream, 24.11.1993, J. S. Dugdale; 4, stream in Tertiary mudstone, Paoneone, Te Araroa, 1.2.1993, J. I. Townsend; 5, a mudstone creek flowing from Kakanui Headland, Te Araroa, 31.1.1993, J. I. Townsend (NZAC, ITNZ).

***Duvaliomimus (Duvaliomimus) watti* Britton, 1958**

Fig. 50, 74, 89b, 117, 134, Map p. 88

*Duvaliomimus watti* Britton, 1958: 188

**Diagnosis.** Head usually glossy without microsculpture; hind margin of pronotum almost straight; striae evenly impressed; male genitalia with aedeagus gradually expanded to ostium and then evenly narrowed to tip.

**Redescription.** **Length:** 5.1 mm. **Colour:** Head, pronotum, elytra, and abdomen reddish-black, piceous; antennae and palpi dark reddish; legs dark brown. Head and pronotum glossy, usually without microsculpture. **Head:** Eyes flat, barely forming widest part of head; frontal furrows subparallel on frons, sometimes deep, meeting cervical groove. **Thorax:** Pronotum wider than long, maximum width : middle length = 1.20 : 1; maximum width : minimum width (just before posterior angles) = 1.70 : 1; posterior angles acute and sharp; hind margin almost straight (Fig. 89b). **Elytra:** without trace of shoulder angle; striae strong and evenly impressed, although sometimes with a few irregular punctures; marginal groove well developed. **Legs:** Male with 2 basal protarsomeres weakly expanded. **Genitalia:** Male with aedeagus only slightly expanded towards ostium and evenly narrowed to a slightly prolonged tip (Fig. 134). Female genitalia similar to *D. walkeri*. **Type locality.** Hunua Ranges AK, Moumoukai Valley.

**Distribution** (Map p. 88).

AK, CL, BP / —

Known from Little Barrier Island and immediately south of Auckland, to the Coromandel and eastern Bay of Plenty.

**Material examined.** Holotype and 19 specimens.

**Holotype:** AK, Moumoukai Valley, 24.iv.1954, J. C. Watt (AMNZ Specimen in poor condition — some legs and antennomeres missing, genitalia have been removed and missing). Other specimens: **CL:** 10, West side of Tapu-Coroglen Hill, 1000' [300 m], Coromandel, 31.8.1987, D. B. Townsend, D. Coates & J. I. Townsend; 1, Waipawa Stream, 55 m, Little Barrier Island, 16.x.1983, K. A. J. Wise & V. M. Doyle (AMNZ). **BP:** 1, Mt Te Aroha, 3000' [900 m], under stones, 21.10.1967, J. C. Watt; 7, Waimana Valley, Urewera National Park, Te Wai-iti Stream track, 26.xi.1995 & 28–30.xi.1995, Larivière & Laroche, shaded edges of swift rill, stony-rocky, under half-submerged stones and fallen nikau fronds (NZAC).

**Remarks:** Distribution of this species appears to be confined to streams running through hard rocks which break down to form chippy material in clean water. Very similar specimens have been seen in greywacke streams of the Tararua Ranges as far south as Wellington, but they proved, in fact, to be another species which is described next.

***Duvaliomimus (Duvaliomimus) megawattus* new species**

Fig. 42, 89b, 141, Map p. 87

**Diagnosis.** Head with reticulate microsculpture; hind margin of pronotum almost straight; elytral striae often with fine punctures; male with expanded segments of protarsi having a prominent tooth; male genitalia similar to *D. styx* but with a shorter tip and smaller basal blade.

**Description.** **Length:** 5.0–5.8 mm (holotype = 5.5 mm). **Colour:** Head, pronotum, and elytra dark reddish-black, appendages pale reddish-brown. **Head:** dull with microsculpture; frontal furrows shallow where they meet cervical groove; eyes prominent, forming widest part of head. **Thorax:** Pronotum with a well developed marginal channel; hind angles acute but scarcely protruding laterally; hind margin scarcely emarginate. **Elytra:** with shoulders evenly rounded; intervals weakly convex; striae may be broken into fine punctures in some parts; 3rd stria interrupted by discal punctures, 2nd stria by apical puncture. **Legs:** Male with 2 basal protarsomeres expanded and with a prominent tooth. **Genitalia:** Male aedeagus very similar to *D. styx* but with a shorter tip and smaller basal blade (Fig. 141).

**Type locality.** Shannon, WN, Mangahao Hydro road to Arapeti Dam, Stream near “Sunshine Corner”.

**Distribution** (Map p. 87).

WN / —

Associated with streams in greywacke as is *D. watti*. Centred on the Tararua Ranges from Mangahao to Wellington, although there is some variation in southern specimens.

**Material examined.** Holotype, 7 paratypes, and 18 other specimens. **Holotype,** labelled: “Third stream beyond “Sunshine Corner”, Mangahao Hydro Rd, Shannon, 31.8.1985, A. J. Townsend” (NZAC). **Paratypes:** **WN:** 1, Third stream beyond “Sunshine Corner”, Mangahao Hydro Rd, Shannon, 31.8.1985, D. B. Townsend; 3, Twin streams before “Sunshine Corner”, Mangahao Hydro Rd, Shannon, 31.8.1985, I. Cooksley, J. I. Townsend & J. Nunn; 2, E tributary of Arapeti Stream, Mangahao Rd, Tararua Forest Park, 1.1.1988, J. I. Townsend; 1, upper Mangahao, 450 m, 11.3.1984, among stones and silt in stream bed, J. I. Townsend. Other specimens: **WN:** 2, Tararua Forest Park, facing Gladstone Rd, 7.4.1985, in moist leaf litter & stones near stream, I. Cooksley & J. I. Townsend; 1, Stewarts Creek, Gladstone Rd, Levin, 26.11.1989, J. I. Townsend; 3, Tararua Forest Park, 500', Florida Rd, Levin, 29.1.1994, J. I. Townsend; 2, Makorokio Stream, Tangimoana Rd, Levin, 14.3.1987 & 14.9.1993, J. I. Townsend; 3, Rahui Rd, Otaki, 13.12.1993, flood debris in stream, J. I. Townsend; 1, Waitaruru Stream, Otaki Forks, 19.1.1986,

wet boulder slope, J. Nunn; 2, Headwaters of Bull Stream, Akatarawa Saddle, 14.11.1987, D. B. & J. I. Townsend; 1, W side of Akatarawa Saddle, 27.1.1979, J. I. Townsend; 2, Wilton's Bush, Wellington, 28.7.1985 & 2.12.1990, under wet stones by stream, J. Nunn & J. I. Townsend; 1, Keith George Reserve, Silverstream, 25.5.1994, forest stream, flood debris, J. Nunn (NZAC, JNNZ, ITNZ).

**Remarks:** This species appears to show considerable variation over the full range of the Tararua Mountains and in view of this the type series is restricted to the northern area.

### Subgenus *Duvaliomimus* (*Mayotrechus*) new subgenus

Type Species: *Duvaliomimus mayae* Britton, 1958: 184

**Description.** Troglobitic trechines with lengthened appendages, head elongate with lengthened mouthparts and antennae, eyes somewhat reduced, with 1 or 2 small setae between eye and base of antenna; pronotum usually a little longer than wide; legs lengthened as in troglobitic forms, sometimes with metatibiae curved; inner extremity of protibiae with sparse, fine setae.

### *Duvaliomimus* (*Mayotrechus*) *mayae* Britton, 1958

Fig. 16, 51, 52, 84, 100, 119, 146, 179, Map p. 92

**Diagnosis.** Head with frontal grooves complete, meeting cervical grooves; eyes reduced, compared with *Duvaliomimus* (*Duvaliomimus*), but round, many-faceted and slightly convex; setae on penultimate labial palpomere placed in distal 1/2; tooth on mentum bifid; anterior tibiae with external groove; ventrites with additional fine setae.

**Redescription.** A troglobitic species with lengthened appendages. **Head:** elongate with lengthened antennae, eyes somewhat reduced compared with *Duvaliomimus* (*Duvaliomimus*), round, less than 0.2 mm in diameter and slightly convex, many faceted; antennae 1.32–1.37× length of elytra; often with only 1 seta between their base and eye; ocular groove meeting cervical groove; mentum with bifid tooth and 2 setae, submentum with 6 setae (Fig. 84); penultimate labial palpomere with setae confined to distal 1/2 (Fig. 100). **Thorax:** Pronotum elongate, ratio of maximum width : middle length = 0.95 : 1; posterior angles very acute; hind margin emarginate; median line impressed; ratio of greatest width : width across posterior angles 1.4 : 1; with a single seta on lateral margin. **Elytra** elliptical, shoulders completely effaced, with 3 setae on 3rd interval; striae well impressed, almost impunctate; 1st recurrent stria joins 5th stria; marginal umbilicate setae with humeral group more widely spaced than *Duvaliomimus*, middle pair similarly spaced, apical pair with more than 2× space between them. **Legs:** elongate, length of hind tibia 0.6× length of

elytra (ca 0.5× in *Duvaliomimus* (*Duvaliomimus*)); 2 basal protarsomeres of male expanded on their inner side to form a small tooth. **Ventral surface:** Ventrites with additional setae. **Genitalia:** Male aedeagus gently curved and evenly narrowed to a fine tip beyond ostium; internal sac with fine spines and a copulatory piece (Fig. 146). Female genitalia with a curved spermathecal gland opening off bursa copulatrix (Fig. 179).

**Etymology.** The name is in recognition of the late Mrs Brenda May who carried out much pioneering research on the cave fauna of the North Island of New Zealand. The subgenus contains 2 geographic subspecies.

**Remarks:** May & Kermode (1972) showed that there are 2 forms of *Mayotrechus mayae* which are isolated in 2 series of caves north and south of an impervious volcanic deposit of ignimbrite from Taupo eruptions. They showed that these forms can be separated statistically by the thorax being a little narrower in specimens from northern caves, but that this variation tended to be clinal. Recent examination has shown that the elytra, too, tend to be slightly wider in the southern race. The shape of the metatibiae is perhaps the best means of separation, in the northern race they are more strongly curved. I recognise these forms as subspecies.

### Key to subspecies of *Duvaliomimus* (*Mayotrechus*) *mayae*

- 1 Pronotum longer than wide (1 : 0.95); elytra longer and narrower; hind tibiae strongly curved (Northern caves) .....(p. 51)... *mayae mayae* (Britton)
- Pronotum broader (ca 1 : 1); elytra broader; hind tibiae very weakly curved (Southern caves) .....(p. 52)... *mayae mayorum* n. subsp.

### *Duvaliomimus* (*Mayotrechus*) *mayae mayae* (Britton, 1958), n. comb.

Fig. 16, 51, 84, 100, 119, 146, 179, Map p. 92

*Duvaliomimus mayae* Britton, 1958: 184.

**Redescription.** **Length:** 6.5–8.5 mm. **Colour:** uniform testaceous. **Head:** elongate, including mouthparts and antennae; antennae 1.32–1.37× as long as elytra; eyes very small, less than 0.2 mm diameter; mentum with bifid tooth; frontal furrows meeting cervical groove; clypeus with 2 setae on each side, outer 1 largest; labrum with 6 setae near front margin, inner less than 1/3rd as long as outer. **Thorax:** Pronotum a little longer than wide, ratio of greatest width : middle length = 0.95 : 1; median line well impressed; marginal channel narrow, narrowing apically so that anterior edge is almost straight; sides with a single seta

just before widest part; posterior angles very acute, hind margin emarginate. **Elytra**: elliptical, shoulders completely effaced, length : maximum width = 1.56 : 1; striae fairly uniformly impressed; intervals slightly convex; 3 setae on 3rd interval with apical 1 nearest to suture, i.e., against 2nd stria, and 1st 1 against 4th stria. **Legs**: long with hind tibiae curved. **Genitalia**: Male with aedeagus narrow, very slightly expanding towards ostium and then gradually tapering to a blunt tip (Fig. 146). Female genitalia with spermatheca curled and broadly attached to bursa copulatrix (Fig. 179).

**Type locality**. Te Kuiti, WO, 500 yards in Waipuna Cave.

**Distribution** (Map p. 92)

WO / —

Caves in the Waitomo region north of Te Kuiti, as specified below.

**Material examined**. Holotype and 77 specimens.

**Holotype** female: Type [circular red bordered label, typed] / Waipuna Cave, 500 yards from entrance, in baited trap, No. 2, holotype female 2.xi.57 V. A. L. May (NZAC). Other specimens: **WO**: 5, Waipuna Cave, trapped, 23.2.1957, 2.9.1957, 28.9.1957, B. M. May, V. A. L. May, D. V. May & F. Walton; 51, traps, Luckie Strike Cave, Te Kuiti, 2.9.1957 & 6.4.1958, B. M. May, D. V. May & P. Walton (NZAC, AMNZ, ITNZ); 1, Rumbling Gut, Te Kuiti, 28.9.1959, B. M. May; 3, Komrad Cave, trap 100 yards in, Kairimu, -4.69, D. V. May; 3, Whites Cave, Te Kuiti, 30.8.1959, 24.4.1962 & 17.6.1963, B. M. May, D. V. May & D. L. Smith; 1, Fred Cave, on mud, 500 yards in, 170 feet down, 27.3.1960, D. V. May; 3, Small Cave, Waitomo Gorge, 2.12.1962, B. M. May; 1, Fossil Cave, Waitomo, 12.2.1967, D. I. Gardiner; 6, De Udder Cave, Waitomo Valley, 3.1.1966, D. I. Gardiner & D. Scanlen; 3, Gardiner's Gut, 600 yards in, Waitomo, 25.2.1960, 2.6.1962 & 18.5.1968, P. J. Barrett, D. V. May & D. J. Kershaw; 1, Blind Man's Bluff Cave, 23.3.62, J. Hobson (NZAC); 1, Mason's Dry Cave, Waitomo, -8.99, D. Smith (ITNZ).

**Remarks**: The larva of this subspecies was described by May (1963a), and a photograph provided (May 1963b).

### *Duvaliomimus (Mayotrechus) mayae mayorum* new subspecies

Fig. 52, Map p. 92

**Description**. **Length**: 6.0–7.0 mm (holotype = 6.1 mm). **Colour**: uniform reddish-brown. **Head**: elongate, frontal furrows meeting cervical grooves; antennae long; eyes small, convex; mentum with tooth weakly bifid. **Thorax**: Pronotum a little wider than long, greatest width : mid length = 1.05 : 1, posterior angles acute and slightly protruding laterally, hind margin emarginate. **Elytra**: a little

wider than nominate species, otherwise similar. **Legs**: Metatibiae almost straight.

**Type locality**. Paemako, WO, Sid's Surmise Cave.

**Distribution** (Map p. 92).

WO / —

Caves in the Piopio region, south of Te Kuiti.

**Material examined**. Holotype, 20 paratypes, and 21 other specimens. **Holotype**, labelled: "On mud beside stream, Sid's Surmise Cave, 100–200 yds in, Paemako, Piopio Dist., 18 Nov 1962, B. M. May", [Red holotype label] "Holotype *Duvaliomimus (Mayotrechus) mayae mayorum* Det. J. I. Townsend 2007" (NZAC). **Paratypes**: **WO**: 1, Echo Cave, Aria, 26.1.1963, D. I. Gardiner; 2, Echo Cave, 17.3.1963, B. M. May & S. R. Davis; 2, small Cave, Mangaorongo, 17.8.1963, B. M. May; 6, King George Cavern, side passage, 26.1.1963, ex trap, B. M. May; 9, Porthole Cave, Mahoenui, 30.8.1981, J. I. Townsend (NZAC, LUNZ, ITNZ). Other specimens: **WO**: 1, Echo Cave, Aria, 26.1.1963, D. I. Gardiner; 9, Echo Cave, Aria, 17.3.1963, D. I. Gardiner, S. R. Davis, & B. M. May; 3, small cave, Mangaorongo, Mahoenui, 17.8.1963, D. I. Gardiner & B. M. May; 1, 500 yards in cave, Mangaorongo, 17.8.1963, D. I. Gardiner; 1, Selenite Cave, Piopio, 16.3.1963, D. I. Gardiner; 1, 50 yards in small cave, Davis's farm, Piopio, 9.7.61, K. A. J. Wise; 7, Sid's Surmise Cave, Paemako, near Piopio, 18.9.1962 & 26.1.1963, B. M. May & D. I. Gardiner; 1, King George Cavern, trap in side passage, 26.1.1963, B. M. May; 2, Broken Hill Cave, Mangakowhai, Piopio, 17.4.1971, B. M. May & L. Fow (NZAC).

**Etymology**: Brenda's husband Vic and her son David were involved in collecting material of *D. mayae* and other cave beetles. It is my pleasure to name this subspecies after them.

**Remarks**: In Porthole Cave, *D. (M.) mayae mayorum* was noted from wet habitats to dry clay areas and cave walls.

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**Appendix 1. Troglobitic and troglophilic Carabidae recorded from caves** (\* = Not seen, recorded by I.R.Millar)

<i>Duvaliomimus (D.) maori</i> (Jeannel) .....	TRECHINI [Troglophile]
BR: Cairns Catacombs; Xanadu	
<i>Duvaliomimus (D.) styx</i> Britton .....	TRECHINI [Troglophile]
WO: Paparahia; Puriri; Skyline	
TK: Ecch	
GB: Possum	
WA: Nitty-Gritty, Coonoor	
<i>Duvaliomimus (D.) walkeri walkeri</i> (Broun) .....	TRECHINI [rarely Troglophile]
BR: Profanity	
<i>Duvaliomimus (Mayotrechus) mayae mayae</i> Britton .....	TRECHINI [Troglobite]
WO: Blind Man's Bluff; Cut Throat; De Udder; Fossil; Fred; Gardiner's Gut; Komrad; Luckie Strike; Mason's; Matthew's; Ruakuri*; Rumbling Gut; Small; St. Benedicts Caverns*; Waipuna; White's	
<i>Duvaliomimus (Mayotrechus) mayae mayorum</i> Townsend .....	TRECHINI [Troglobite]
WO: Broken Hill; Echo; King George Cavern; Porthole; Selenite; Sid's Surmise; small (unnamed), Davis's farm	
<i>Erebotrechus infernus</i> Britton .....	TRECHINI [Troglobite]
NN: Blue Creek, Wangapeka; Biddie's, Buller; Egger's (Coal Flat)	
BR: Profanity; Buller Constrictor; Babylon*; Cairns Catacombs; Fox River; Hollywood; Metro (Ananui); Name Later*; Te Ana Titi; Te Tah; Winchhead*; Xanadu	
<i>Kettlotrechus edridgeae</i> Townsend .....	TRECHINI [Troglobite]
NN: Simms, Takaka Valley; Water Supply. Pohara	
<i>Kettlotrechus marchanti</i> Townsend .....	TRECHINI [Troglobite]
NN: Pluto's Retreat, Kaihoka	
<i>Kettlotrechus millari</i> Townsend .....	TRECHINI [Troglobite]
NN: Council; Ed's Cellar; Manson's (Rawhiti); Summit Cave; Water Supply, Pohara	
<i>Kettlotrechus orpheus</i> (Britton) .....	TRECHINI [Troglobite]
NN: Ionkay Bluff; Little; Marchant's Mistake; Oedipus; Phil's Pot; Turimawiwi; Twin Forks; Wet Neck, all Paturau district	
<i>Kettlotrechus pluto</i> (Britton) .....	TRECHINI [Troglobite]
NN: Fenian Creek; Honeycomb Hill; Ida; Copper's, Gunner River	
<i>Kupetrechus gracilis</i> Townsend .....	TRECHINI [Troglobite]
NN: Burnt Bush; Hidden Creek, Golden Bay	
<i>Kupetrechus lamberti</i> (Britton) .....	TRECHINI [Troglobite]
NN: Anatoki; Blue Creek; Commentary; Council; Cullifords*; Dogleg; Ed's Cellar; Gorge Creek; Greenlink; Hawkes; Irvine's; Kairuru; Manson's (Rawhiti); Marble Creek (Ruataniwha); Marble Pot; Olympia; Simms; Starlight; Summit Tomo	
<i>Kupetrechus larsonae</i> Townsend .....	TRECHINI [Troglobite]
NN: Blue Creek, Wangapeka; Bohemia; Bulmer System; Curtis Ghyll; cave in Poverty Basin -all Mt. Owen	
<i>Neanops caecus</i> (Britton) .....	TRECHINI [Troglobite]
WO: Broken Hill; Fred	
<i>Neanops pritchardi</i> Valentine .....	TRECHINI [Troglobite]
WO: Wairere Falls; ?Komrad, Marakopa	
<i>Oopterus</i> sp. ....	ZOLINI [Troglophile]
NN: Hodge Creek; Richards; -both Tablelands - Flora area	
<i>Pholeodytes cerberus</i> Britton .....	HARPALINI [Troglobite]
NN: Fenian Creek; Honeycomb Hill; Ida	



<i>Pholeodytes helmorei</i> Larochelle & Larivière .....	HARPALINI [Troglobite]
NN: Coal Flat (Egger's)	
<i>Pholeodytes palmae</i> Larochelle & Larivière .....	HARPALINI [Troglobite]
NN: Pluto's Retreat, Kaihoka	
<i>Pholeodytes nunni</i> Larochelle & Larivière .....	HARPALINI [Troglobite]
NN: Council; Gorge Creek; Greenlink; Irvine's; Kerry-John; Simms; Water Supply; Weka; Worm's Surprise	
<i>Pholeodytes townsendi</i> Britton .....	HARPALINI [Troglobite]
NN: Bus Shelter; Cafe-au-lait; Cascade; Dome; Ionkay Bluff; Little; Mangarakau Bluff; Potter's; Prouse's; Robin's Return; Rush; Saddle; Tunnel; Twin Forks; Upper Mile; Wet Neck; What; Cave of the headless Chook; Turimawiwi -all Paturau area; Megamania, Gunner River; Cave Creek, Heaphy River	
<i>Scototrechus hardingi hardingi</i> Townsend .....	TRECHINI [Troglobite]
NN: Greenlink	
<i>Scototrechus hardingi worthyi</i> Townsend .....	TRECHINI [Troglobite]
NN: Cheops; Hawkes; Perseverance; Sting	
<i>Scototrechus morti</i> Townsend .....	TRECHINI [Troglobite]
NN: Expelair; Nettlebed; TomoThyme	
<i>Scototrechus orcinus</i> Britton .....	TRECHINI [Troglobite]
NN: Ed's Cellar	
<i>Syllectus gouleti</i> Larochelle & Larivière .....	HARPALINI [Troglobite]
BR: Abyssinia; Bamboo; Fox River; Metro (Ananui); Te Tahī*; Xanadu	
<i>Syllectus magnus</i> Britton .....	HARPALINI [Troglophile]
NN: Blue Creek; Cascade; Coal Flat; Hidden Creek; Ionkay Bluff; Nettlebed; small cave, Te Hapu	
BR: McWha's; Metro (Ananui); The Drain, Profanity	
<i>Waiputrechus cavernicola</i> Townsend .....	TRECHINI [Troglobite] very small
ND: Waipu -muddy area	

## Appendix 2. Caves and recorded troglobitic and troglophilic Carabidae (\* = Not seen, recorded by I.R.Millar)

ND: Waipu Cave <i>Waiputrechus cavernicola</i> [Troglobite] one unique specimen!	WO: Broken Hill, <i>Duvaliomimus (Mayotrechus) mayorum</i> [large] + <i>Neanops caecus</i> [small] [both Troglobites]
WO: Blind Man's Bluff; Cut Throat; De Udder; Fossil; Gardiner's Gut; Luckie Strike; Mason's; Matthew's; Ruakuri*; Rumbling Gut; small, Waitomo Gorge; St. Benedicts Caverns*; Waipuna; White's -all <i>Duvaliomimus (Mayotrechus) mayae mayae</i> . [Troglobite]	WO: Komard, <i>Duvaliomimus (Mayotrechus) mayae mayae</i> [large] + <i>Neanops ?pritchardi</i> [small] [Troglobites]
WO: Echo; King George Cavern; Porthole; Selenite; Sid's Surmise; small (un-named) Davis's farm-all <i>Duvaliomimus (Mayotrechus) mayae mayorum</i> . [Troglobite]	WO: Paparahia; Puriri; Skyline, -all <i>Duvaliomimus (D.) styx</i> [Troglophile]
WO: Fred, <i>Duvaliomimus (Mayotrechus) mayae mayae</i> [large] + <i>Neanops caecus</i> [small] [both Troglobites]	WO: Wairere Falls, <i>Neanops pritchardi</i> [original site] [Troglobite]
	TK: Ecch, <i>Duvaliomimus (D.) styx</i> [Troglophile]
	GB: Possum, <i>Duvaliomimus (D.) styx</i> [Troglophile]
	WA: Nitty-Gritty, <i>Duvaliomimus (D.) styx</i> [Troglophile]

*Paturau area*

- NN: Pluto's Retreat, *Kettlotrechus marchanti* + *Pholeodytes palmae* [both Troglobites]  
 NN: Wylie's, *Kettlotrechus marchanti* [Troglobite]  
 NN: Ionkay Bluff; Little; Turimawiwi; Twin Forks; Wet Neck -all *Kettlotrechus orpheus* + *Pholeodytes townsendi* [both Troglobites]  
 NN: Ionkay Bluff, *Syllectus magnus* [Troglophile]  
 NN: Marchant's Mistake; Oedipus; Phil's Pot -all *Kettlotrechus orpheus* [Troglobite]  
 NN: Bus Shelter; Cafe-au-lait; Cascade; Dome; Mangarakau Bluff; Potter's; Prouse's; Robin's Return; Rush; Saddle; Tunnel; Cave of the headless Chook; Megamania (Gunner River); Cave Creek (Heaphy) -all *Pholeodytes townsendi* [Troglobite]  
 NN: Cascade, *Syllectus magnus* [Troglophile]  
 NN: small cave, Te Hapu *Syllectus magnus* [Troglophile]

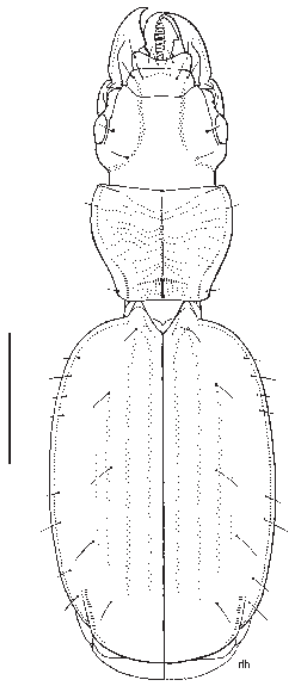
*Golden Bay - Takaka Valley*

- NN: Burnt Bush; Hidden Creek, both Golden Bay - both *Kupetrechus gracilis* [Troglobite]  
 NN: Hidden Creek, *Syllectus magnus* [Troglophile]  
 NN: Water Supply, Pohara *Kettlotrechus millari* + *Kettlotrechus edridgeae* + *Pholeodytes nunni* [all Troglobites]  
 NN: Council *Kettlotrechus millari* + *Kupetrechus lamberti* + *Pholeodytes nunni* [all Troglobites]  
 NN: Manson's (Rawhiti) *Kettlotrechus millari* + *Kupetrechus lamberti* [both Troglobites]  
 NN: Gorge Creek, Irvine's -both *Kupetrechus lamberti* + *Pholeodytes nunni* [both Troglobites]  
 NN: Simms, *Kupetrechus lamberti* + *Kettlotrechus edridgeae* + *Pholeodytes nunni* [all Troglobites]  
 NN: Anatoki; Marble Creek (Ruataniwha); Starlight -all *Kupetrechus lamberti* [Troglobite]  
 NN: Kerry-John; Weka; Worm's Surprise (Barron's Flat) -all *Pholeodytes nunni* [Troglobite]

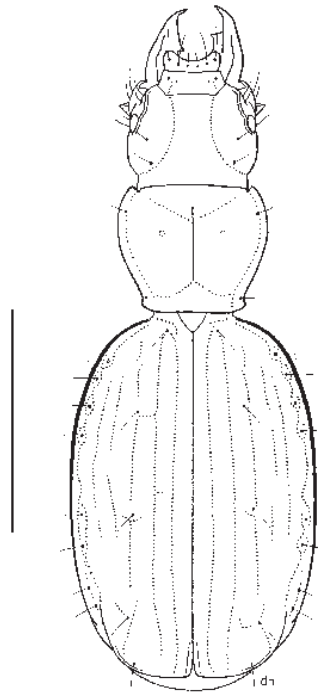
*Canaan - Takaka Hill*

- NN: Ed's Cellar. *Kettlotrechus millari* + *Kupetrechus lamberti* + *Scototrechus orcinus* [all Troglobites]  
 NN: Greenlink, *Kupetrechus lamberti* + *Scototrechus hardingi hardingi* + *Pholeodytes nunni* [all Troglobites]

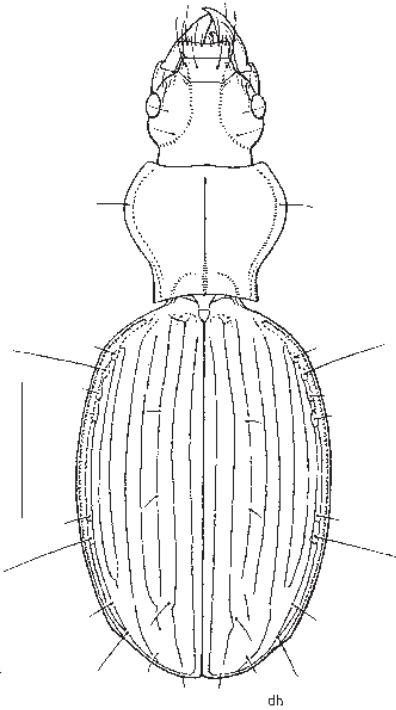
- NN: Dogleg; Kairuru; Marble Pot; Olympia; Summit Tomo -all *Kupetrechus lamberti* [Troglobite]  
 NN: Summit Cave *Kettlotrechus millari* [Troglobite]  
 NN: Hawkes *Kupetrechus lamberti* + *Scototrechus hardingi worthyi* -both as remains only  
 NN: Perseverance; Sting -both *Scototrechus hardingi worthyi* [Troglobite]  
*Mt. Arthur - Mt. Owen*  
 NN: Nettlebed, *Syllectus magnus* + *Scototrechus morti* (as remains only)  
 NN: Blue Creek (Western Series), Wangapeka *Kupetrechus lamberti* + *Kupetrechus larsonae* + *Erebotrechus infernus* [all Troglobites] + *Syllectus magnus* [Troglophile]  
 NN: Cheops, Richard, Mt. Arthur Tableland *Scototrechus hardingi worthyi* [Troglobite] + *Oopterus* sp. [Troglophile]  
 NN: Hodge Creek, Flora track *Oopterus* sp. [Troglophile]  
 NN: Bohemia; Bulmer Caverns; Culliford's; Curtis Ghyll; all Mt. Owen -all *Kupetrechus larsonae* [Troglobite]  
*Buller - West Coast*  
 NN: Biddie's; Buller Constrictor -both *Erebotrechus infernus* [Troglobite]  
 NN: Egger's (Coal Flat), *Erebotrechus infernus* + *Pholeodytes helmerei* [both Troglobites] + *Syllectus magnus* [Troglophile]  
 BR: small cave on McWha's property, south of Murchison, *Syllectus magnus* [Troglophile]  
 BR: Profanity, *Duvaliomimus (D.) walkeri walkeri* [usually Troglaxene] + *Erebotrechus infernus* [Troglobite]  
 BR: Metro (Ananui), *Erebotrechus infernus* + *Syllectus gouleti* [both Troglobites] + *Syllectus magnus* [Troglophile]  
 BR: Fox River; Metro (Ananui); Te Tahī -all *Erebotrechus infernus* + *Syllectus gouleti* [both Troglobites]  
 BR: Bullock Creek caves; Cairns Catacombs; Kubla Khan; Xanadu -all *Duvaliomimus (D.) maori* [Troglophile]  
 BR: Abyssinia, Bamboo (Tiropahi Valley); Xanadu -all *Syllectus gouleti* [Troglobite]  
 BR: Babylon\*; Cairns Catacombs; Hollywood; Name Later\*; Te Ana Titi -all *Erebotrechus infernus* [Troglobite]



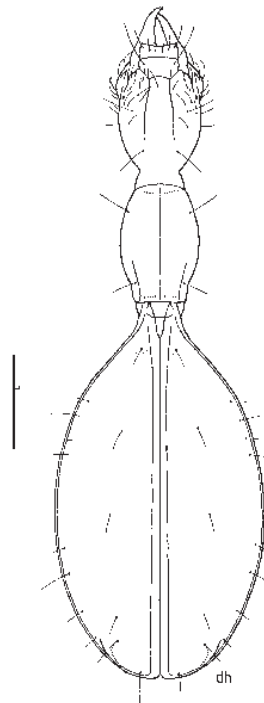
(1) *Kenodactylus audouini*



(2) *Maoritrechus rangitotoensis*

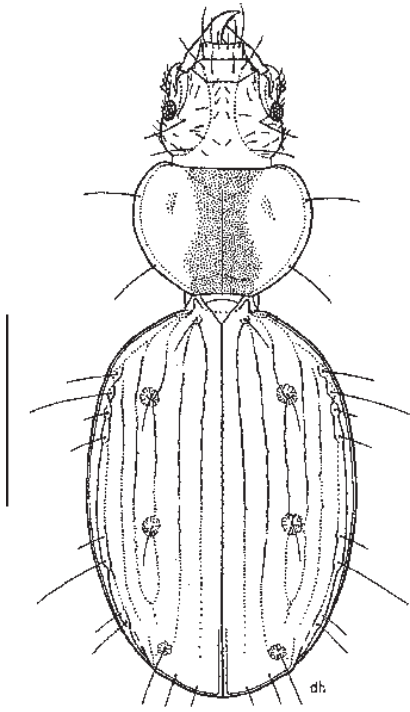
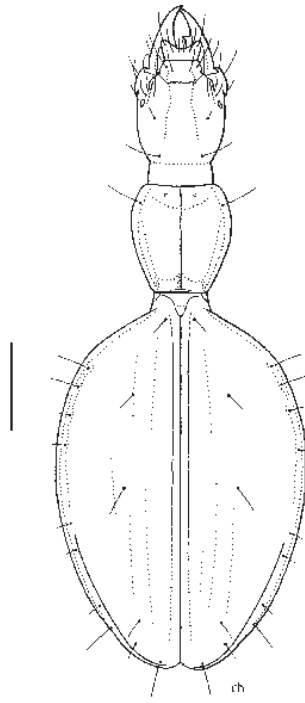
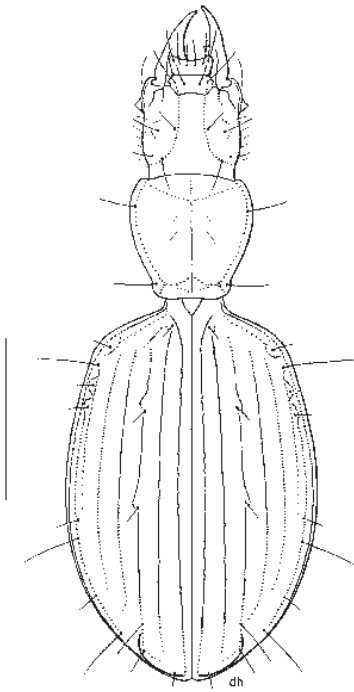
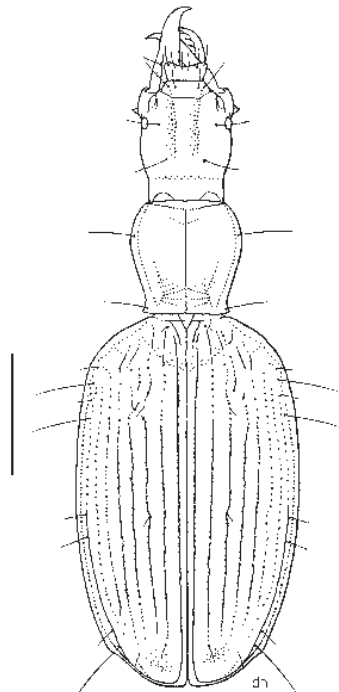


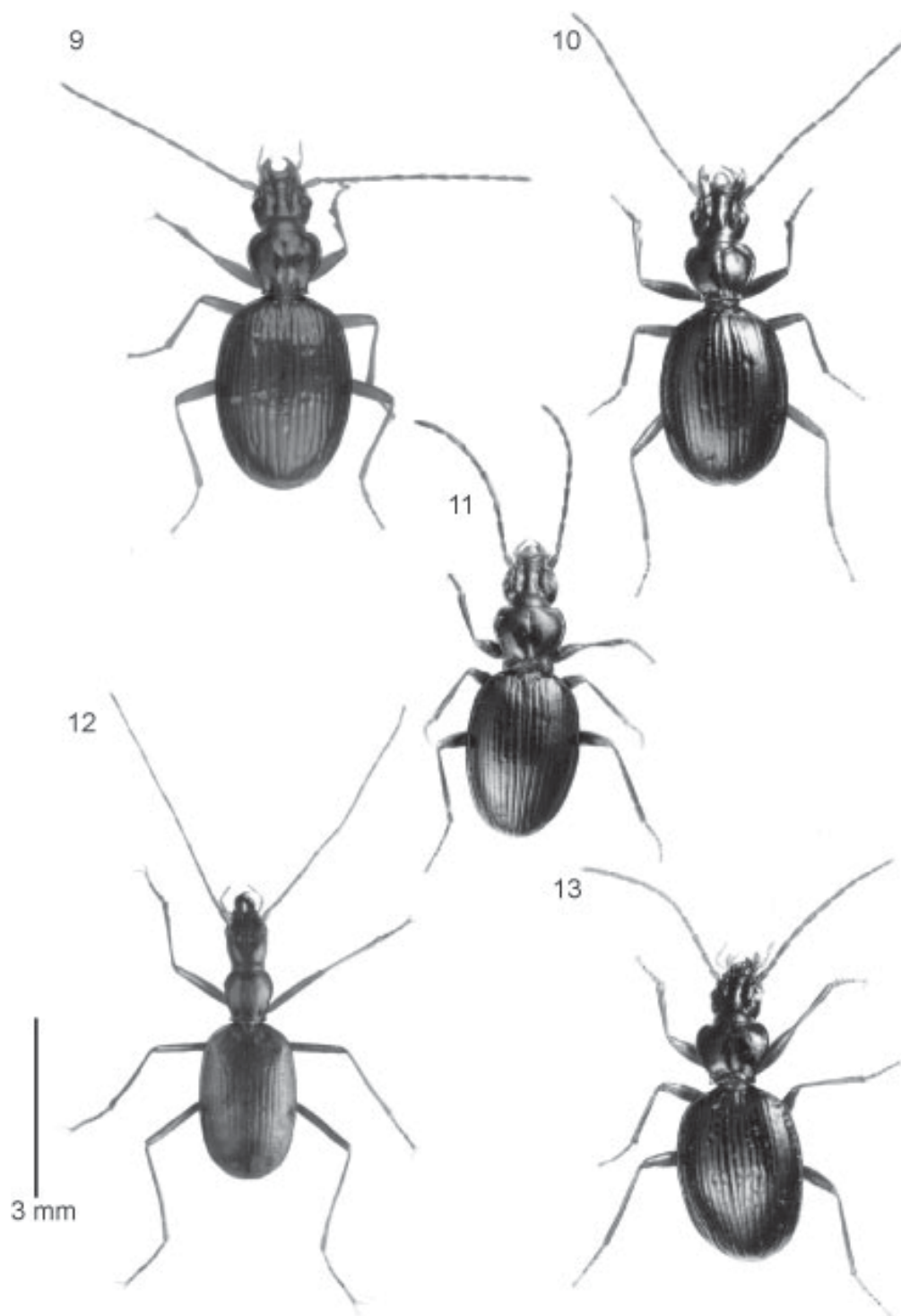
(3) *Duvaliomimus (D.) styx*



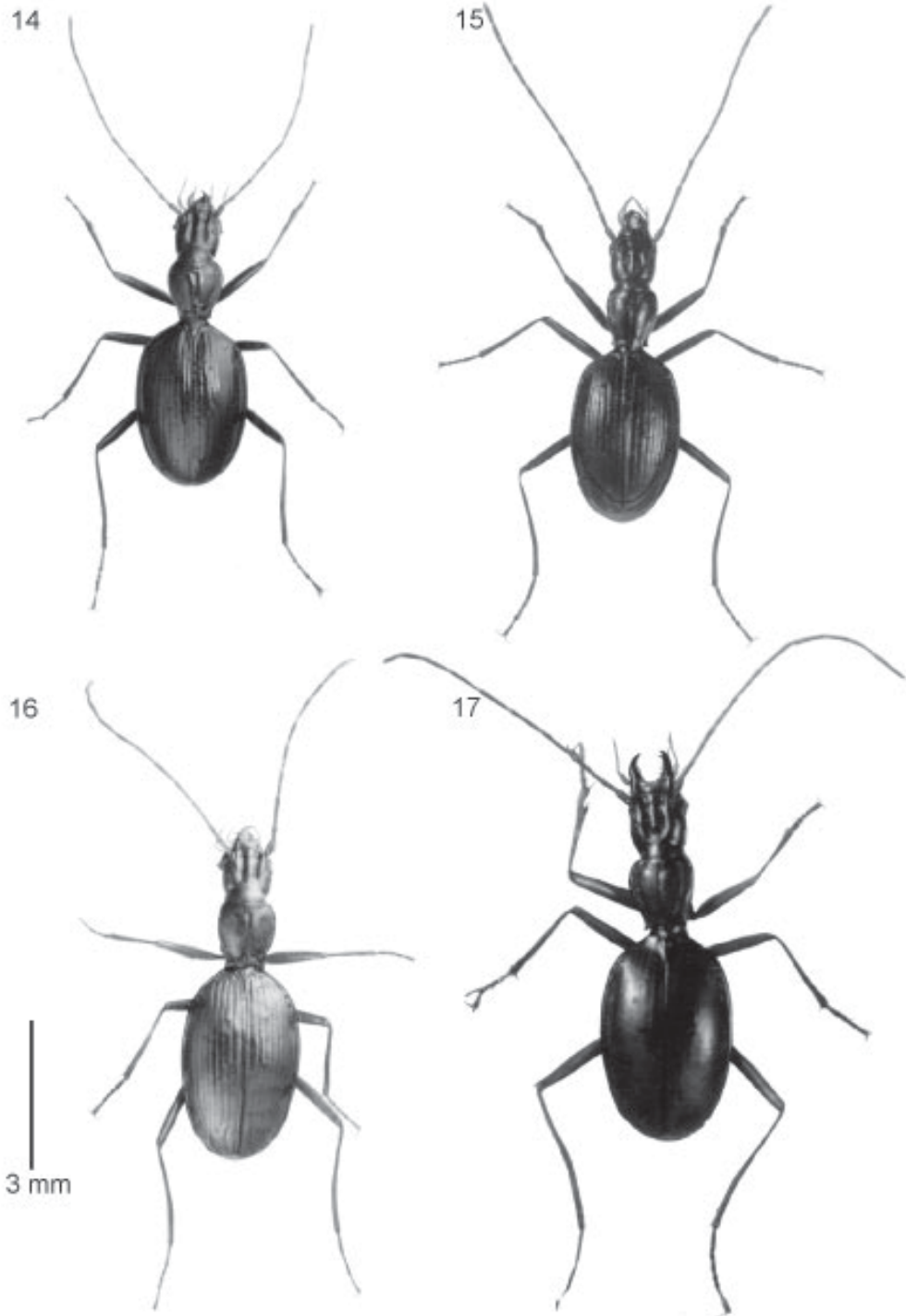
(4) *Erebotrechus infernus*

**Fig. 1–8** Body outline and details of genera of Trechini (Illustrated by D.W. Helmore with modifications by Laroche & Larivière, 2007, *Fauna of New Zealand* 60).

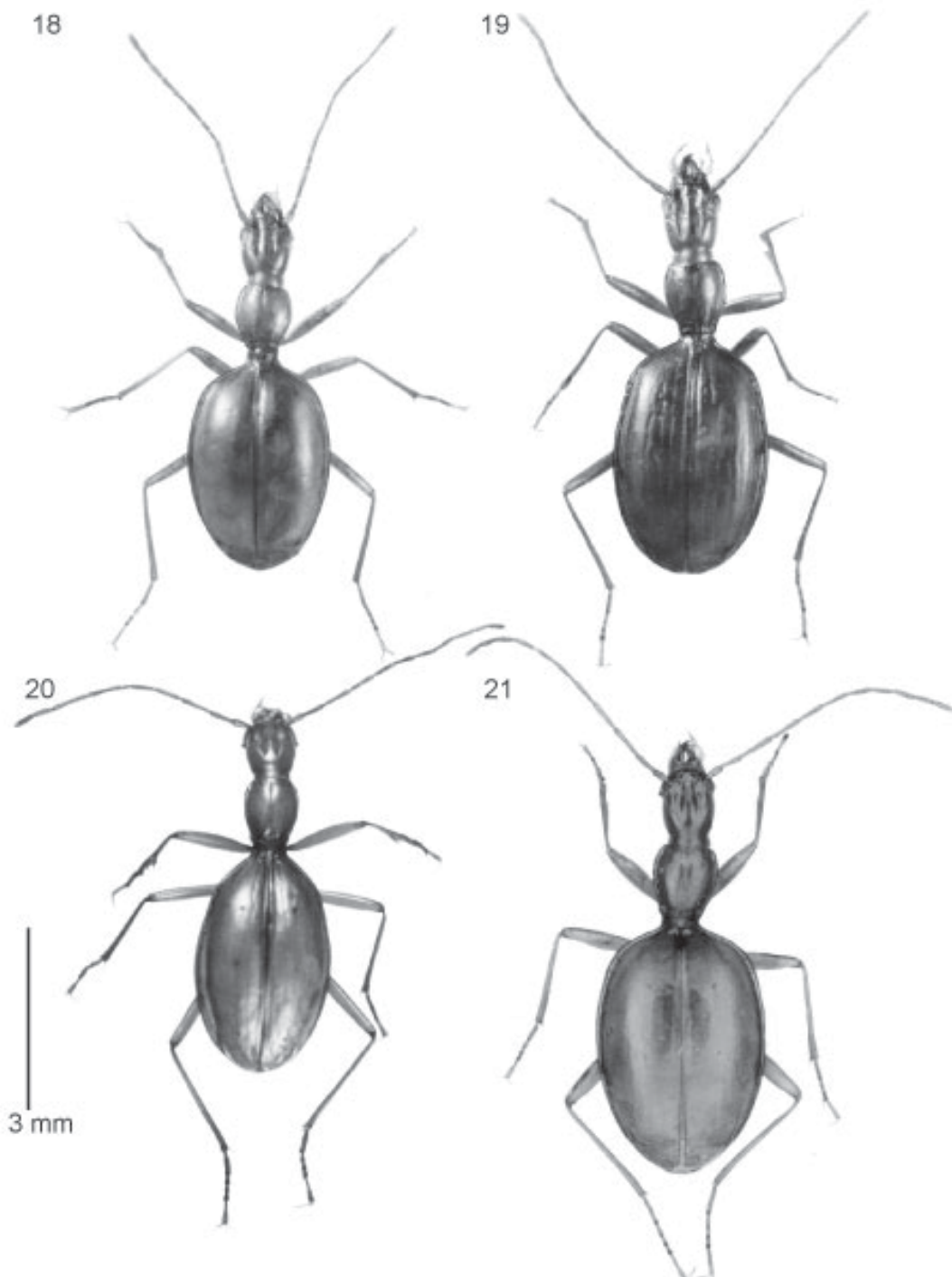
(5) *Kiwitrechus karenscottae*(6) *Kupetrechus lamberti*(7) *Neanops caecus*(8) *Scototrechus orcinus*



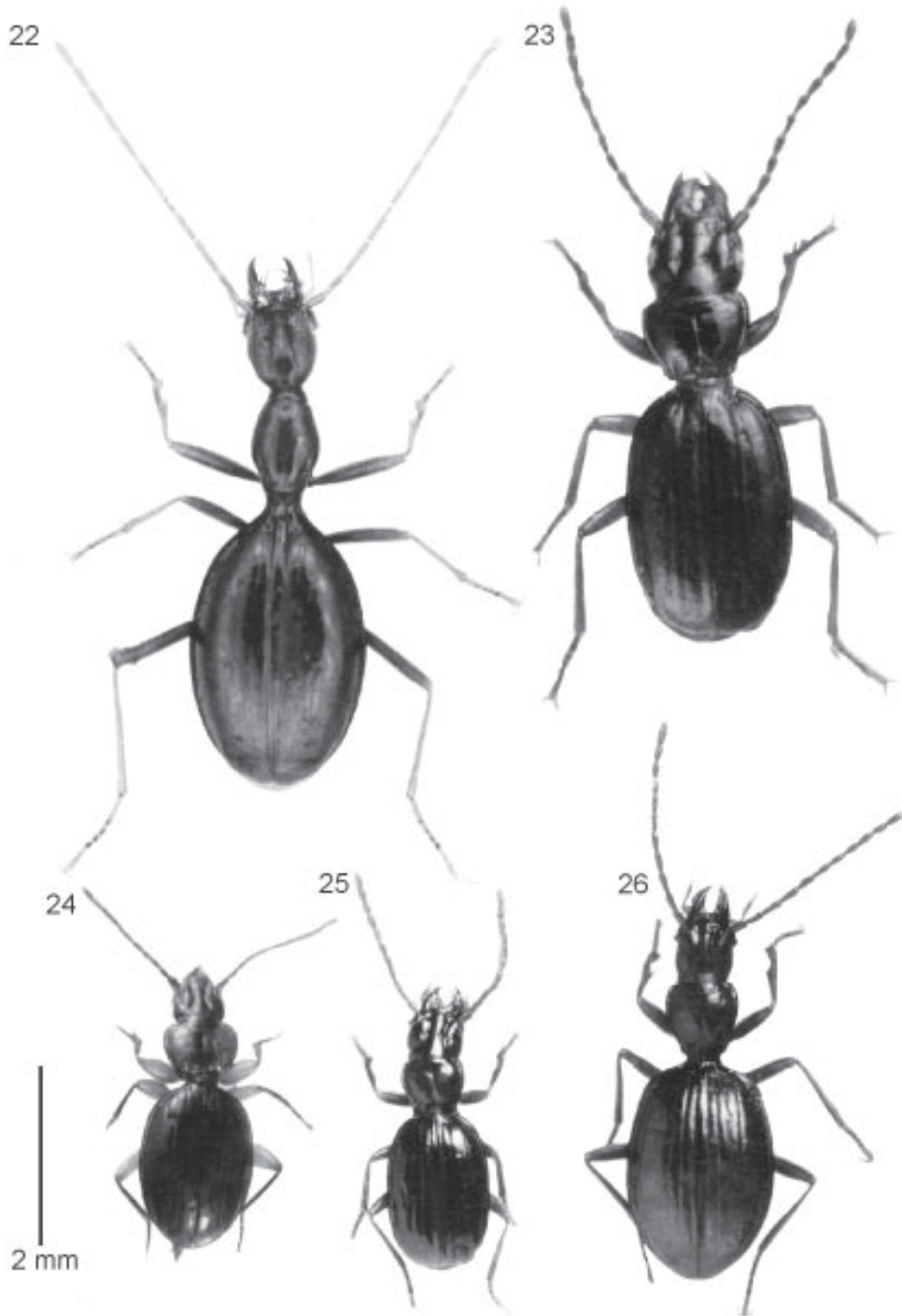
**Fig. 9–26** Photographs of Trechini species (photographed by B. S. Eykel): 9, *Duvaliomimus maori* (live specimen), Belfast Creek; 10, *Duvaliomimus walkeri walkeri*, Mt Greenland, Ross; 11, *Duvaliomimus styx*, Puriri Cave; 12, *Scototrechus orcinus*, Ed's Cellar; 13, *Duvaliomimus obscurus*, Motu River.



14, *Kettlotrechus orpheus*, paratype, Little Cave; 15, *Kettlotrechus pluto*, holotype, Fenian Creek Cave, Oparara; 16, *Duvaliomimus (Mayotrechus) mayae mayae*, Luckie Strike Cave; 17, *Kettlotrechus edridgeae*, Simms Cave.



18, *Kupetrechus lamberti*, Pot-hole, Takaka Hill; 19, *Kupetrechus larsonae*, Blue Cave Creek, Wangapeka; 20, *Kupetrechus gracilis*, holotype, Hidden Creek Cave, Golden Bay; 21, *Kupetrechus lamberti*, globose form, Marble Creek Cave, Golden Bay.



22, *Erebotrechus infernus*, paratype, Buller Constrictor Cave; 23, *Kenodactylus audouini*, Ranui Cove, Auckland Islands; 24, *Kiwitrechus karenscottae*, Pupu Valley, Golden Bay; 25, *Maoritrechus rangitotoensis*, holotype, Rangitoto Island; 26, *Neanops caecus*, holotype, Fred Cave.





*Kenodactylus audouini*



*Kiwitrechus karenscoottae*



*Maoritrechus rangitotoensis* (Kaikoura form)



*Maoritrechus nunni*

**Fig. 27–62** Colour photographs of Trechini species (photographed by P. McKenzie, except 28, 31, 33, 35, and 61 by B. E. Rhode). 27, *Kenodactylus audouini*, Ranui Cove, Auckland I.; 28, *Kiwitrechus karenscoottae*, Mt Domett; 29, *Maoritrechus rangitotoensis*, Kaikoura; 30, *Maoritrechus nunni*, Deborah Bay, Port Chalmers.

31

*Neanops caecus*

32

*Oarotrechus gracilentus*

33

*Waiputrechus cavernicola*

34

*Erebotrechus infernus*

31, *Neanops caecus*, Fred Cave; 32, *Oarotrechus gracilentus*, Fraser's Beach, Southland; 33, *Waiputrechus cavernicola*, Mert's Middle Cave; 34, *Erebotrechus infernus*, Xanadu Cave.

35



*Kupetrechus gracilis*

36



*Kupetrechus lamberti*

37



*Kupetrechus larsonae*

38



*Duvaliomimus (D.) australis*

35, *Kupetrechus gracilis*, Hidden Creek Cave; 36, *Kupetrechus lamberti*, Blue Creek Cave; 37, *Kupetrechus larsonae*, Blue Creek Cave; 38, *Duvaliomimus (D.) australis*, Croydon Bush.



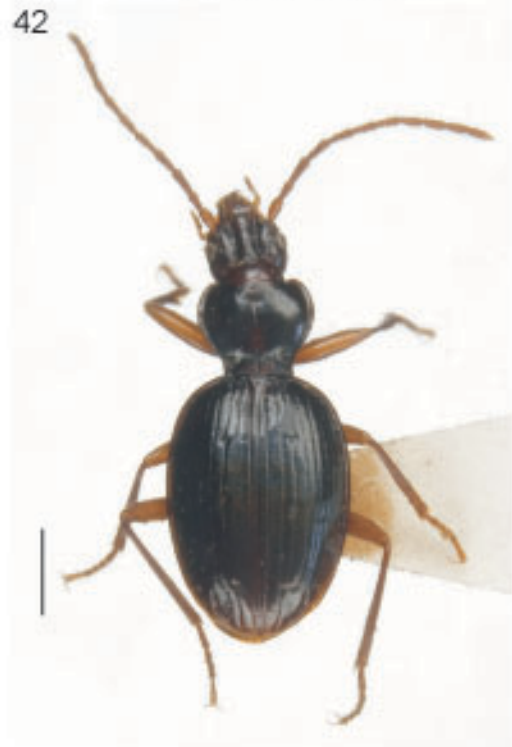
*Duvaliomimus (D.) chrystallae*



*Duvaliomimus (D.) crypticus*



*Duvaliomimus (D.) maori*



*Duvaliomimus (D.) megawattus*

39, *Duvaliomimus (D.) chrystallae*, Longwood SR; 40, *D. (D.) crypticus*, Hicks Bay; 41, *D. (D.) maori*, Xanadu Cave; 42, *D. (D.) megawattus*, Mangahao Rd.



*Duvaliomimus (D.) obscurus*



*Duvaliomimus (D.) orientalis*



*Duvaliomimus (D.) pseudostyx*



*Duvaliomimus (D.) styx*

43, *Duvaliomimus (D.) obscurus*, Waioeka Gorge; 44, *D. (D.) orientalis*, Te Araroa; 45, *D. (D.) pseudostyx*, Makuhou Stream; 46, *D. (D.) styx*, Nitty Gritty Cave.



*Duvaliomimus (D.) taieriensis*



*Duvaliomimus (D.) walkeri brittoni*



*Duvaliomimus (D.) walkeri walkeri*  
Bob's Cove population



*Duvaliomimus (D.) watti*

47, *Duvaliomimus (D.) taieriensis*, Taieri Mouth; 48, *D. (D.) walkeri brittoni*, Chancellor Hut; 49, *D. (D.) walkeri walkeri*, Bob's Cpve; 50, *D. (D.) watti*, Tapu Hill.



*Duvaliomimus (Mayotrechus) mayae mayae*



*Duvaliomimus (Mayotrechus) mayae mayorum*



*Kettlotrechus edridgeae*



*Kettlotrechus marchanti*

51, *Duvaliomimus (M.) mayae mayae*, Luckie Strike Cave; 52, *D. (M.) mayae mayorum*, Porthole Cave; 53, *Kettlotrechus edridgeae*, Simms Cave; 54, *K. marchanti*, Wylies Cave.



*Kettlotrechus millari*



*Kettlotrechus orpheus*



*Kettlotrechus orpheus* (variety)



*Kettlotrechus pluto*

55, *Kettlotrechus millari*, Water Supply Cave; 56, *K. orpheus*, Twin Forks Cave; 57, *K. orpheus* (variety), Ionkay Bluff Cave; 58, *K. pluto*, Honeycomb Hill Cave.

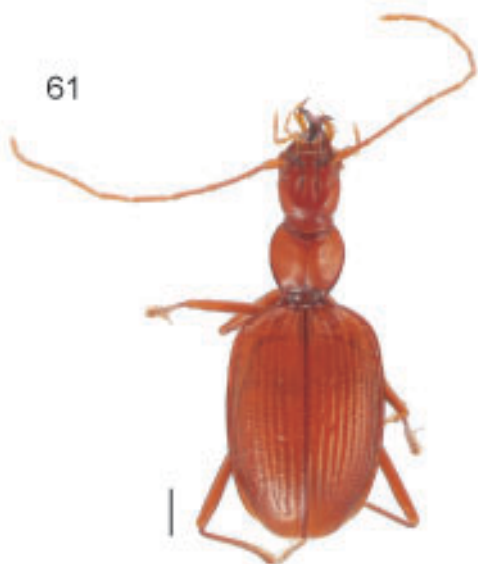




*Scototrechus hardingi hardingi*



*Scototrechus hardingi worthyi*

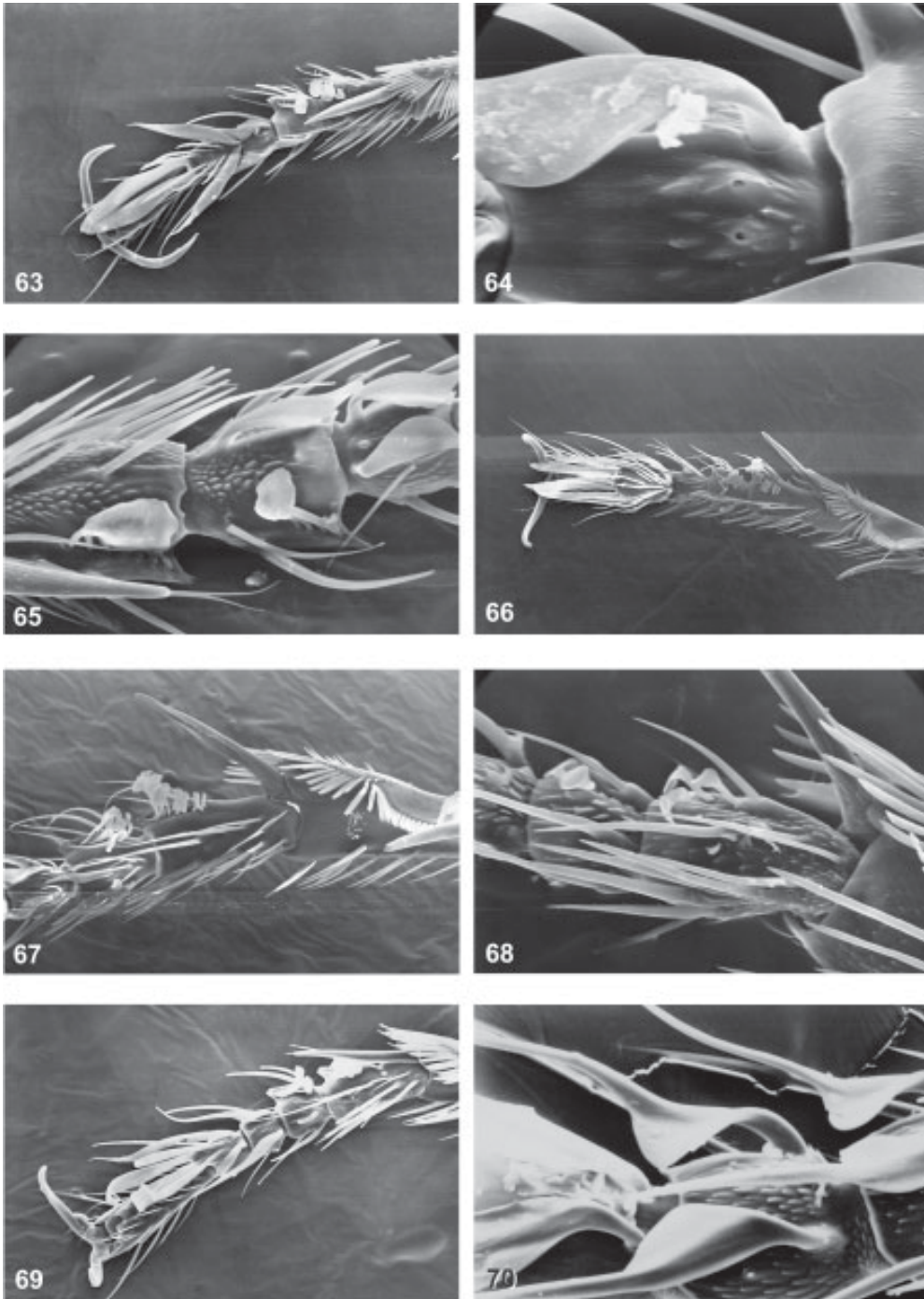


*Scototrechus mortii*

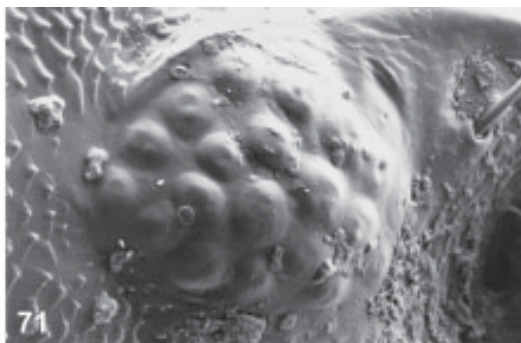


*Scototrechus orcinus*

59, *Scototrechus hardingi hardingi*, Greenlink Cave; 60, *S. hardingi worthyi*, Cheops Cave, Mt Arthur Tableland; 61, *S. mortii*, Expelair Cave; 62, *S. orcinus*, Ed's Cellar, Canaan.



**Fig. 63–70** SEM micrographs of protarsomere region: 63–64, *Kettlotrechus orpheus*, 63, papillae under weakly expanded 1st and 2nd male protarsomeres, and lamellate setae arising from under 3rd and 4th, 64, enlarged 3rd protarsomere showing twin pores; 65, *Kettlotrechus edridgeae*, expanded 1st and 2nd protarsomeres and lamellate setae of 3rd with single pore; 66–67, *Scototrechus hardingi*, 66, male protarsomeres, 67, papillae on 1st and 2nd protarsomeres; 68, *Neanops caecus*, 2 basal non-expanded protarsomeres of male showing papillae below; 69, *Kupetrechus lamberti*, male protarsomeres, expanded 1st and 2nd with papillae, 3rd and 4th with lamellate setae; 70, *Erebotrechus infernus*, protarsomeres with winged setae (both sexes).



71 *Maoritrechus rangitotoensis* (Kaikoura form), eye facets



72 *Duvalomimus (D.) walkeri walkeri*



73 *Duvalomimus (D.) maori*

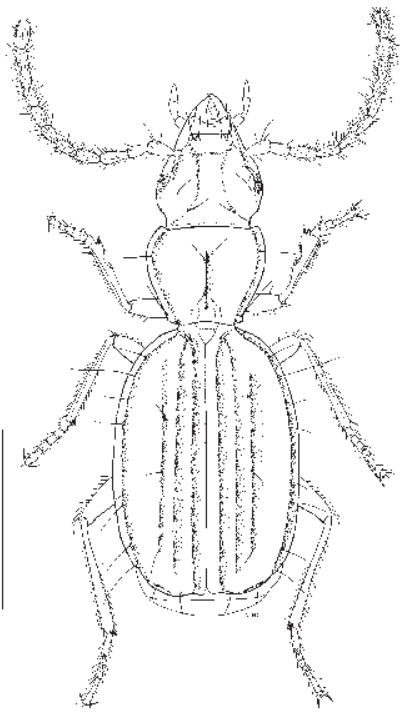


74 *Duvalomimus (D.) watti*

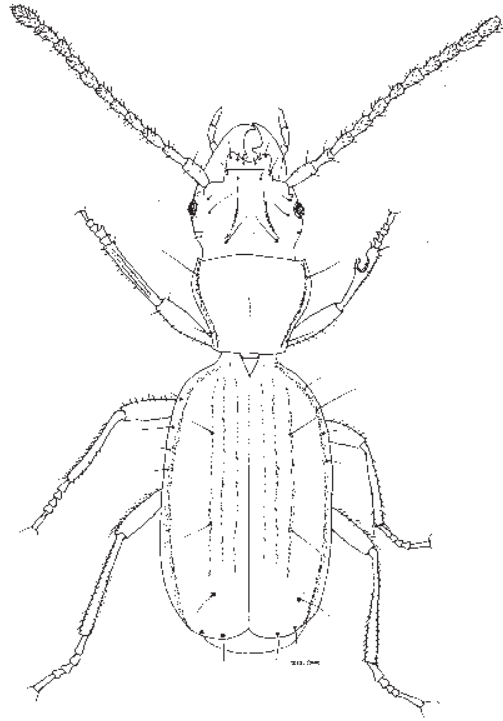


75 *Neanops pritchardi*

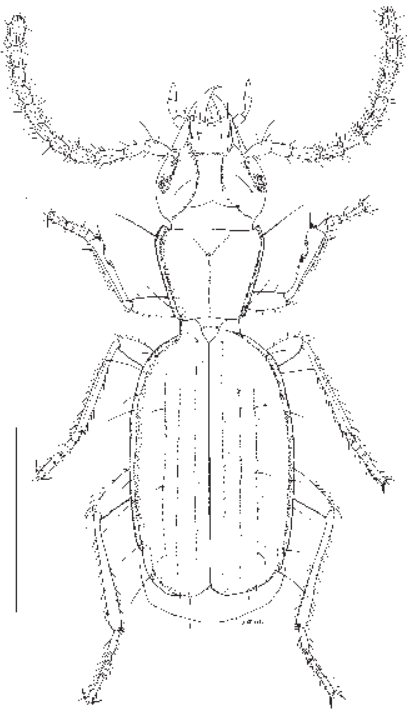
**Fig. 71–75** 71, SEM micrograph, *Maoritrechus rangitotoensis*, Kaikoura form, eye structure. 72–75 Photographs of primary types of 4 species (72, 74, 75 holotypes; 73 lectotype).



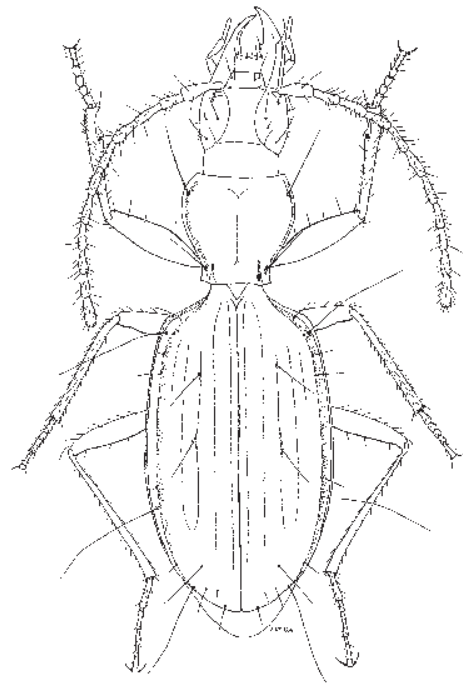
(76) *Maoritrechus rangitotoensis*  
(Kaikoura form)



(77) *Maoritrechus nunni*

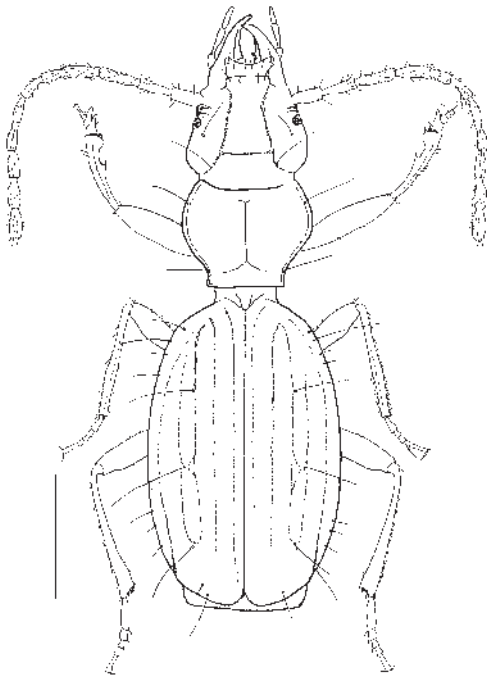


(78) *Maoritrechus stewartensis*

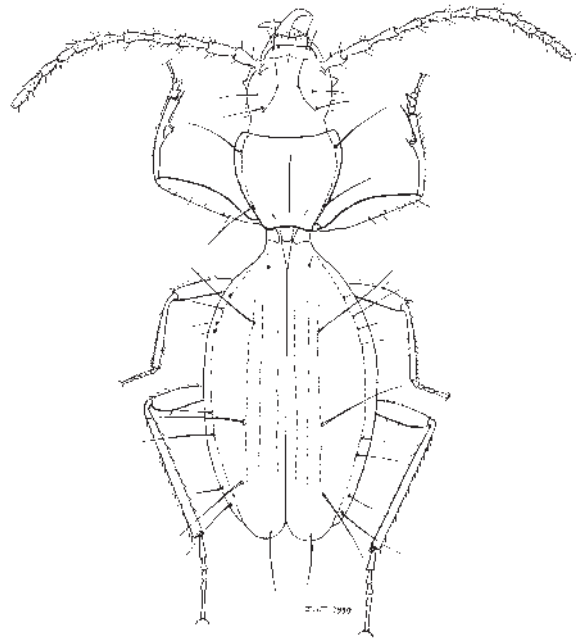


(79) *Neanops pritchardi*

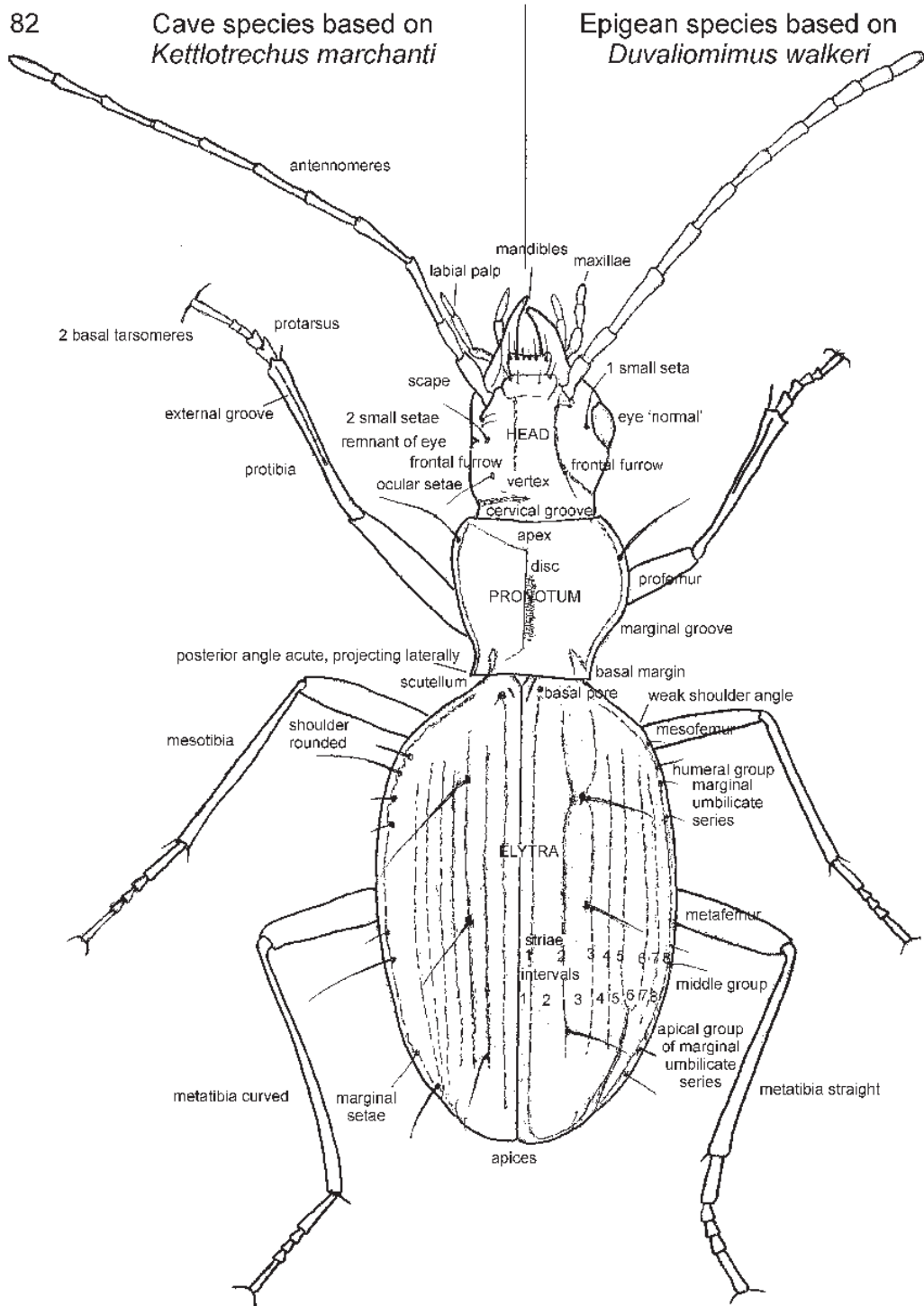
Fig. 76–81 Outline habitus drawings of Trechini species.



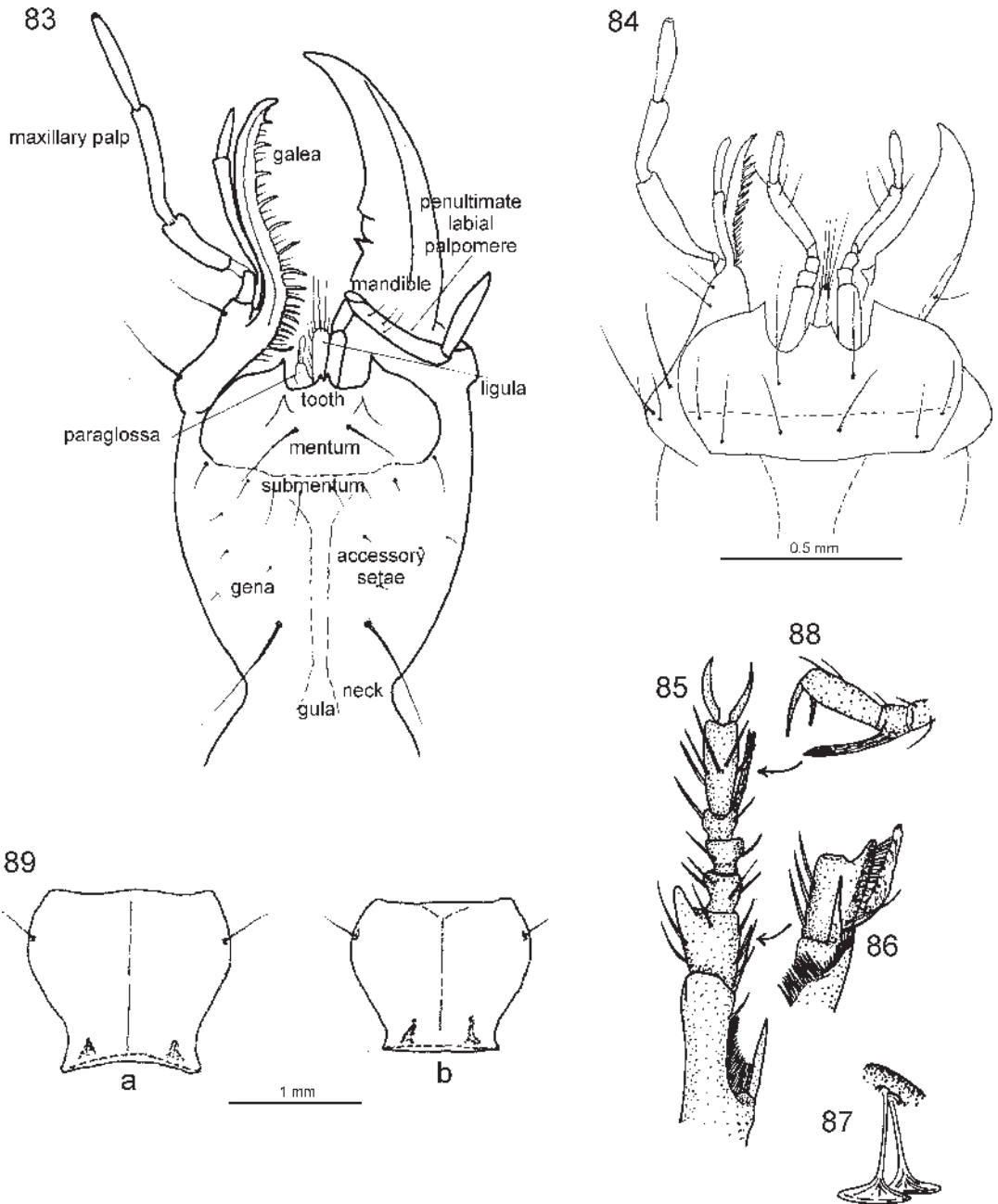
(80) *Oarotrechus gracilis*



(81) *Waiputrechus cavernicola*



**Fig. 82** Comparison of troglobitic (left side) and epigean (right side) trechines, based on *Kettlotrechus marchanti* and *Duvaliomimus walkeri* respectively.



**Fig. 83–89** Detailed structures of Trechini. 83, head and mouthparts (ventral), *Erebotrechus inferus*; 84, mouthparts, *Duvaliomimius (Mayotrechus) mayae mayae*; 85–88, *Kiwitrechus karenscoottae*, 85, male protarsomeres, 86, 1st protarsomere showing papillae (ventral), 87, details of papillae or specialised setae, 88, terminal segments of protarsus showing lamellate setae from 4th protarsomere underlying claw segment; 89, comparison of pronota of *D. styx* and *watti*, type a: *styx*, *pseudostyx*, and *crypticus*; type b: *watti*, *megawattus*, *obscurus*, and *orientalis*.

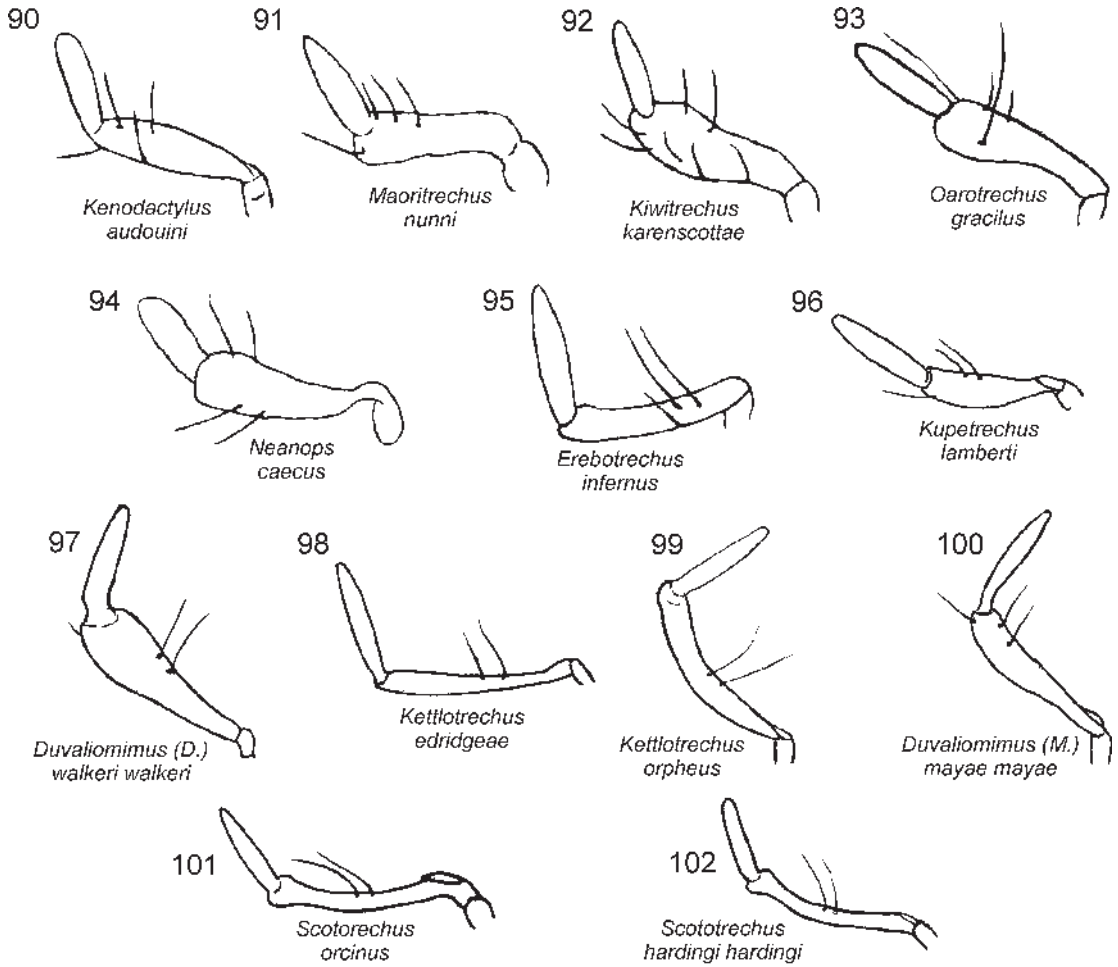


Fig. 90–102 Labial palpomeres (not to scale).



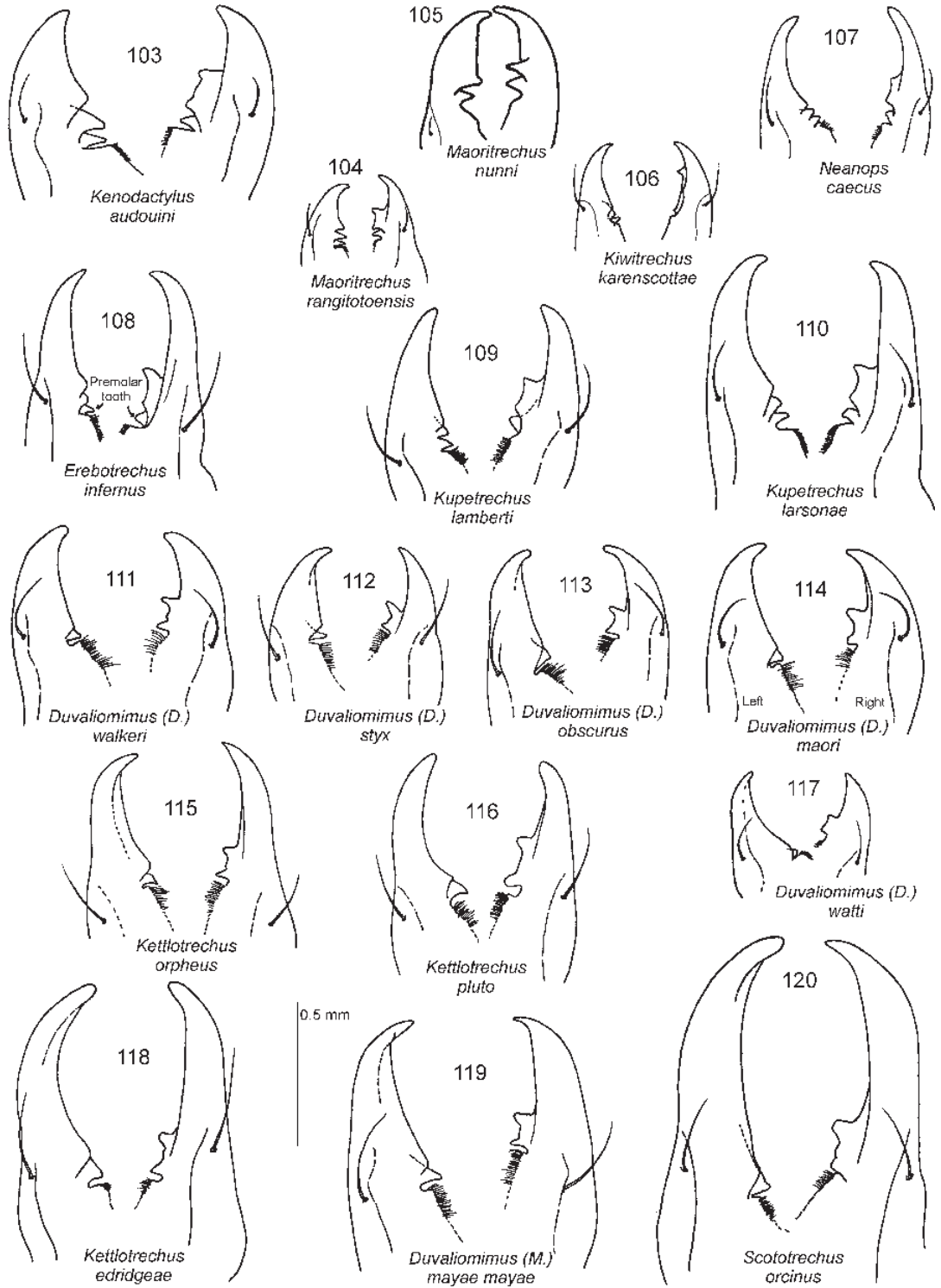


Fig. 103–120 Mandibles (dorsal)

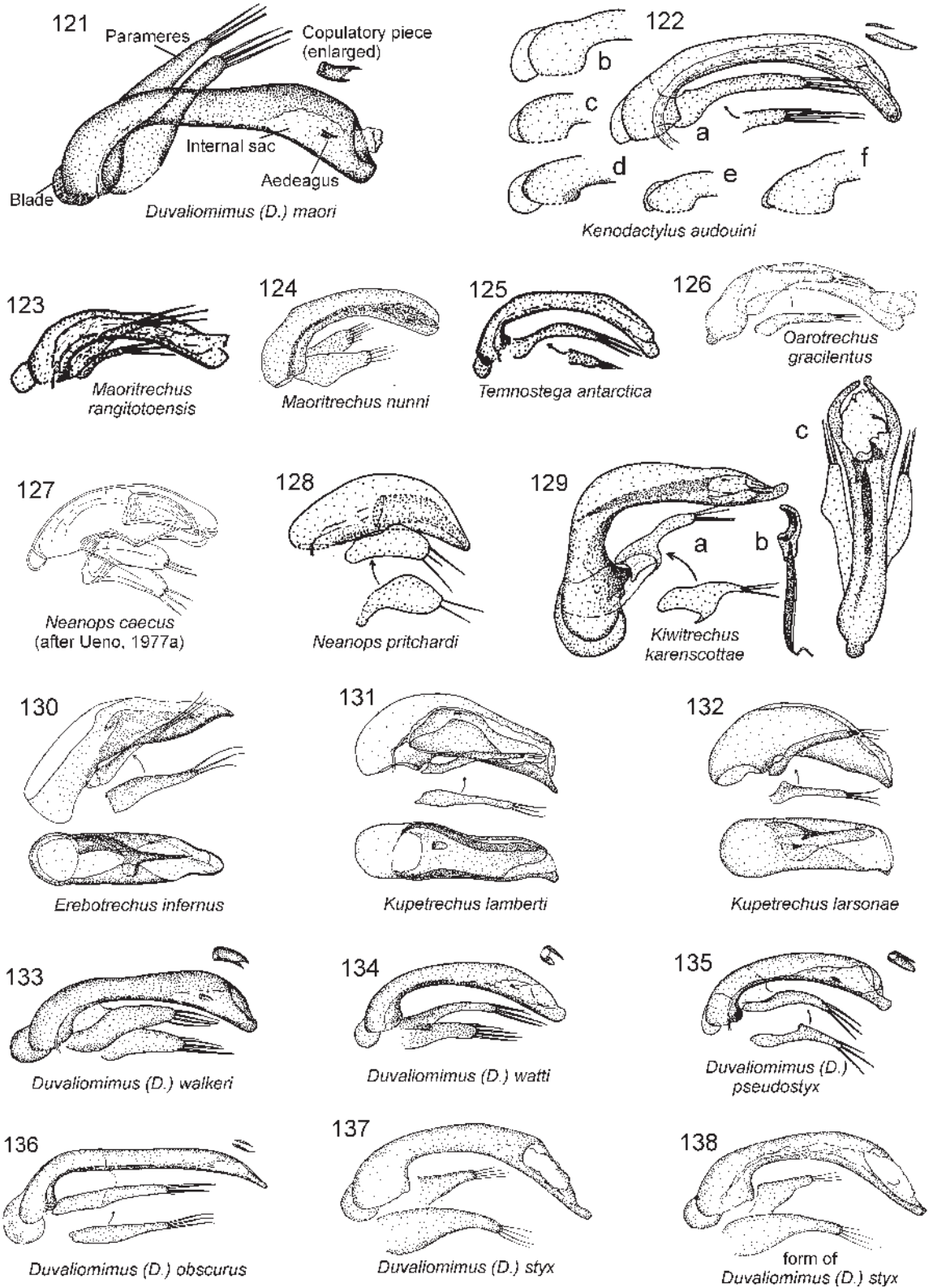
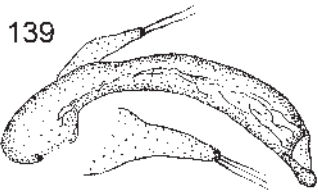
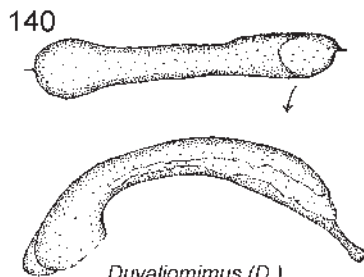


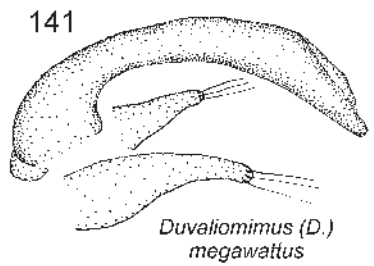
Fig. 121–152 Male genitalia.



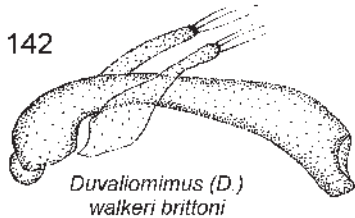
*Duvaliomimus (D.) orientalis*



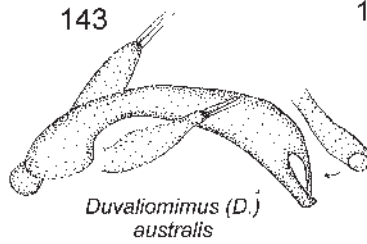
*Duvaliomimus (D.) crypticus*



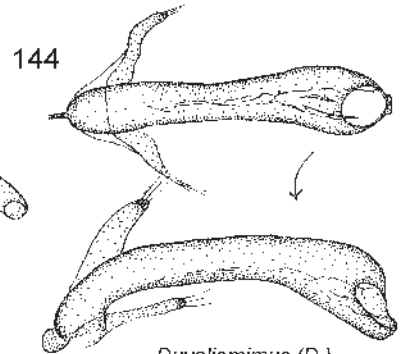
*Duvaliomimus (D.) megawattus*



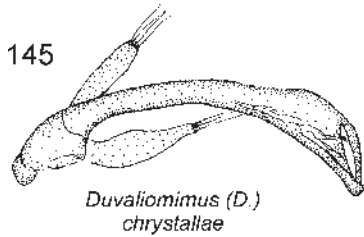
*Duvaliomimus (D.) walkeri brittoni*



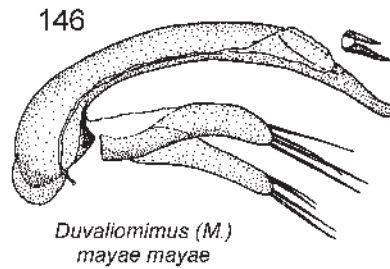
*Duvaliomimus (D.) australis*



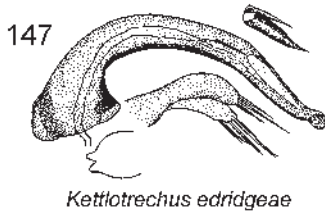
*Duvaliomimus (D.) taieriensis*



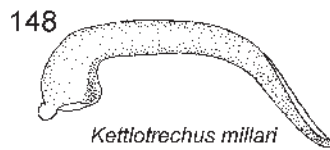
*Duvaliomimus (D.) chrystallae*



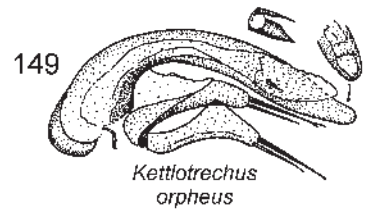
*Duvaliomimus (M.) mayae mayae*



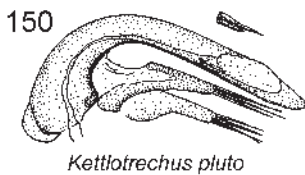
*Kettlotrechus edridgeae*



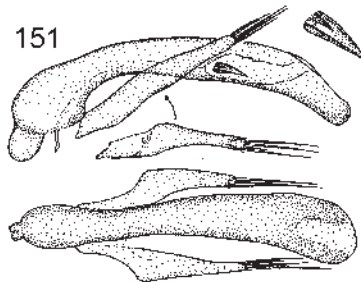
*Kettlotrechus millari*



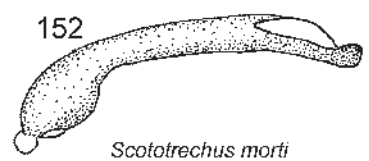
*Kettlotrechus orpheus*



*Kettlotrechus pluto*



*Scototrechus orcinus*



*Scototrechus morti*

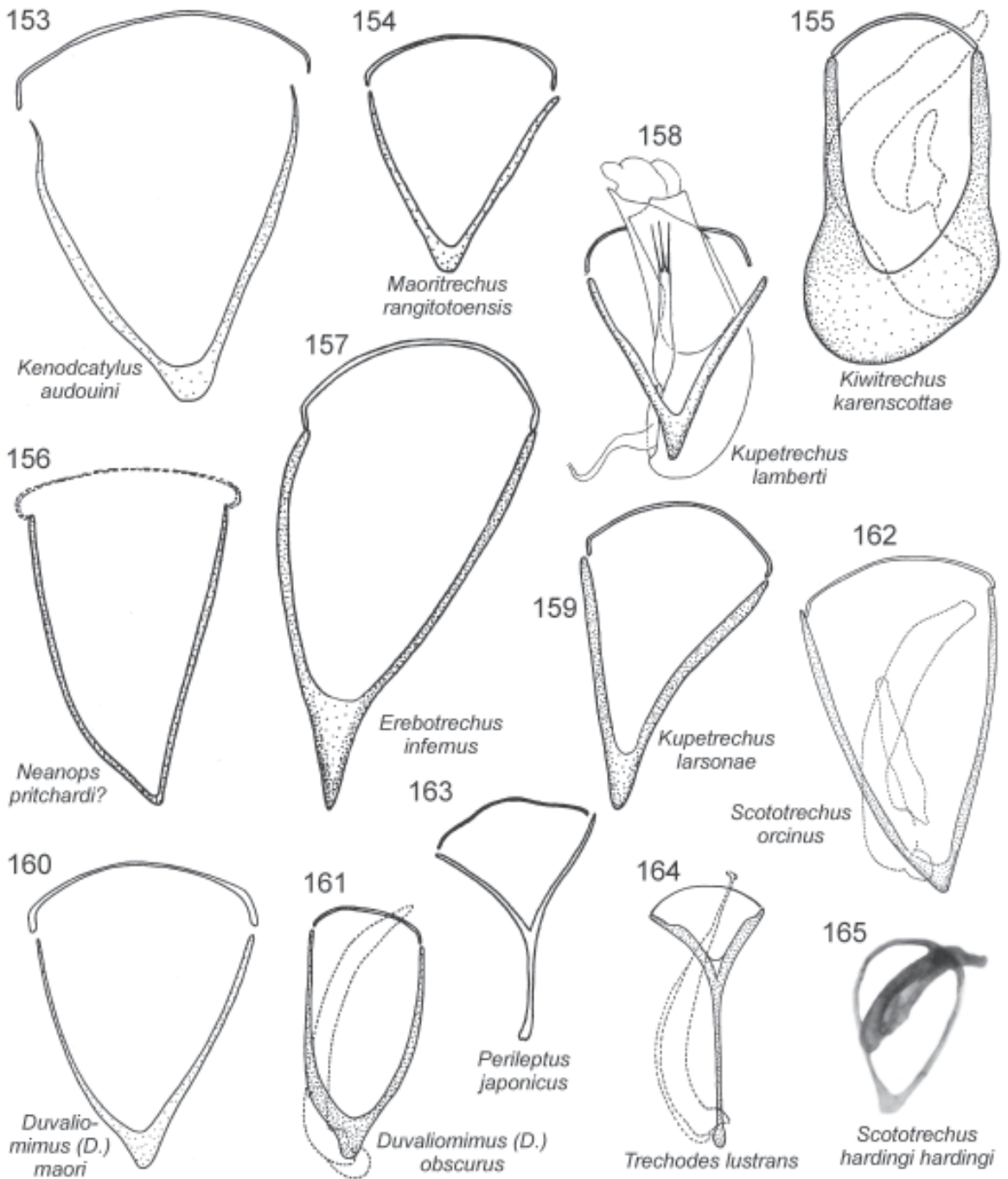


Fig. 153–165 Male genitalia segments (Fig. 158 shown from reverse side)..

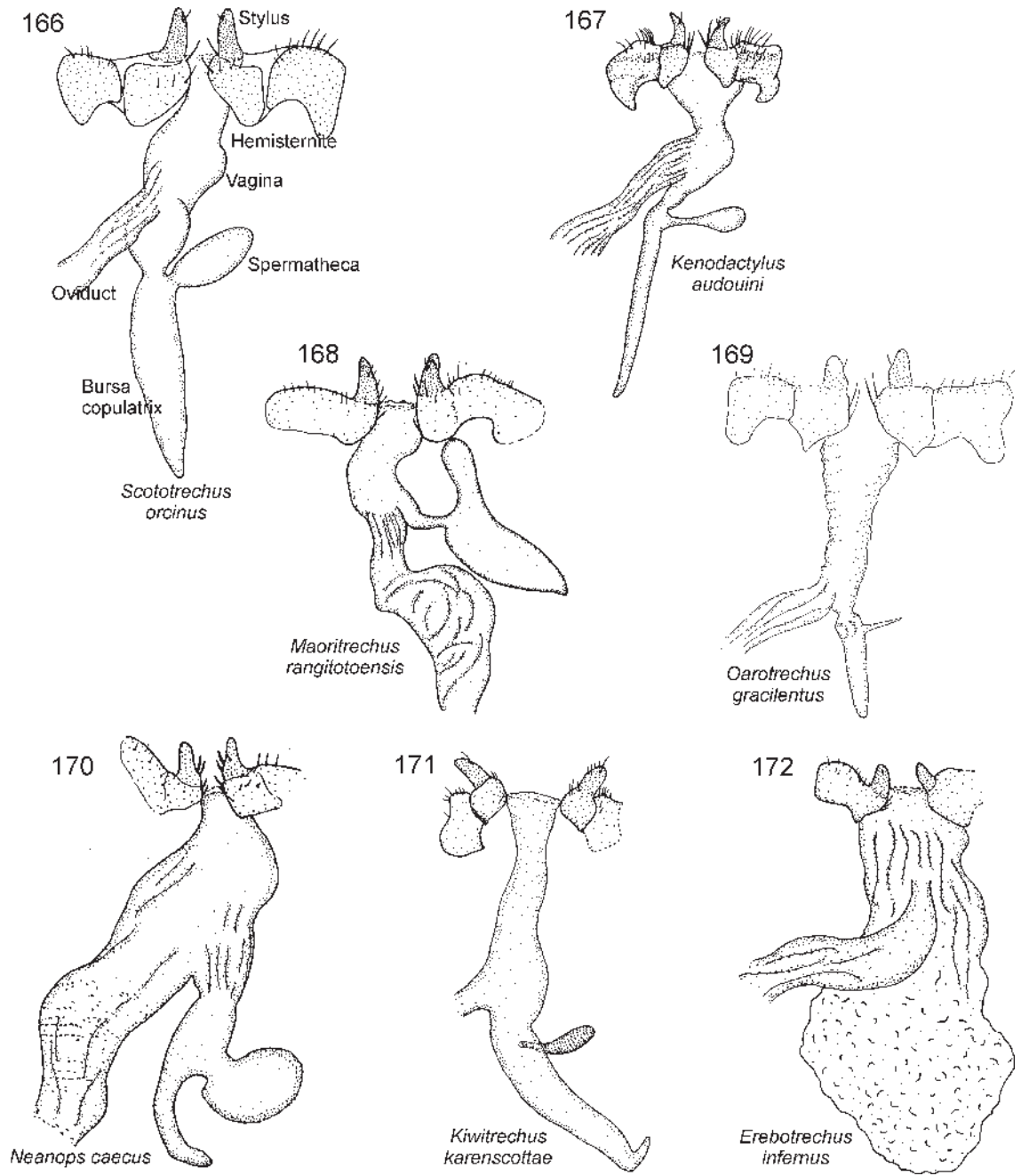
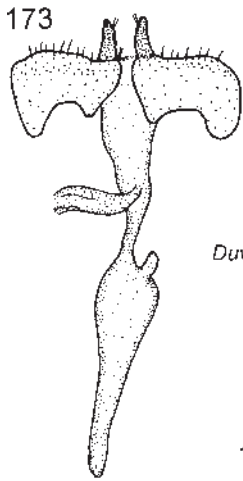
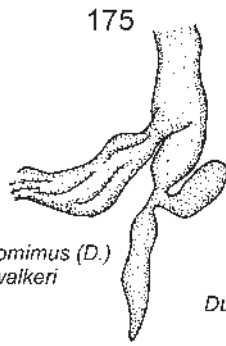


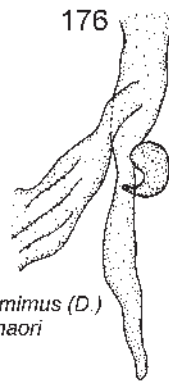
Fig. 166–181 Female genitalia.



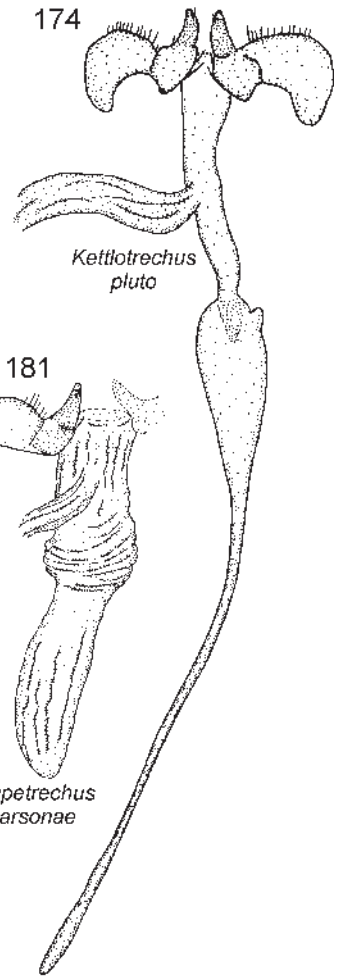
*Kettlotrechus orpheus*



*Duvaliomimus (D.) walkeri*



*Duvaliomimus (D.) maori*



*Kettlotrechus pluto*



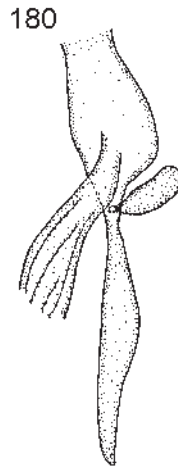
*Duvaliomimus (D.) obscurus*



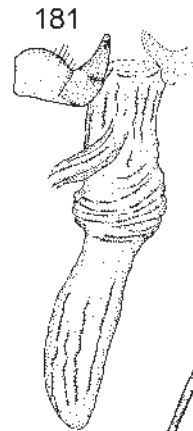
*Kettlotrechus edridgeae*



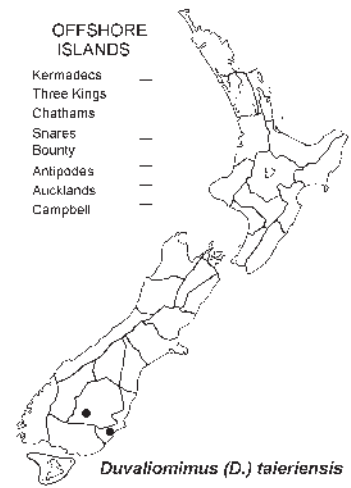
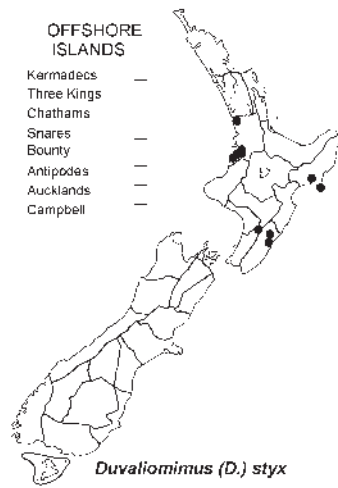
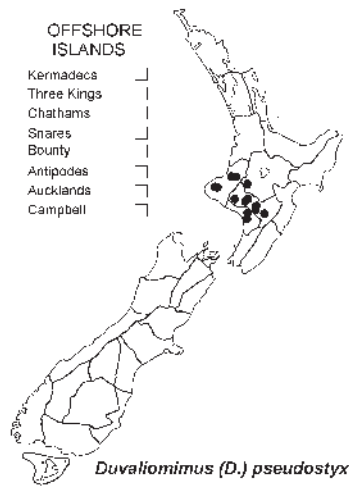
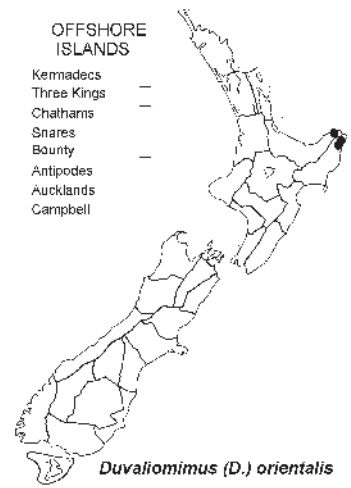
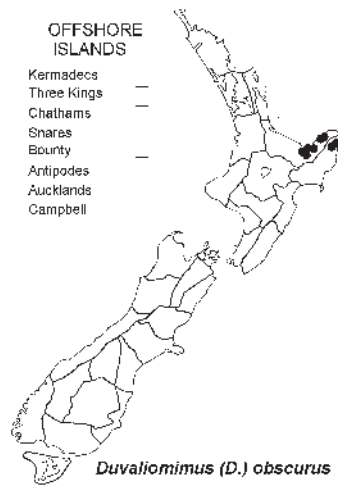
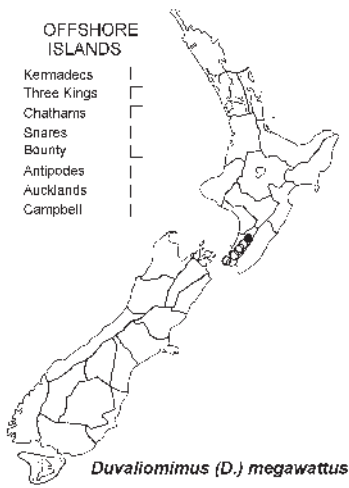
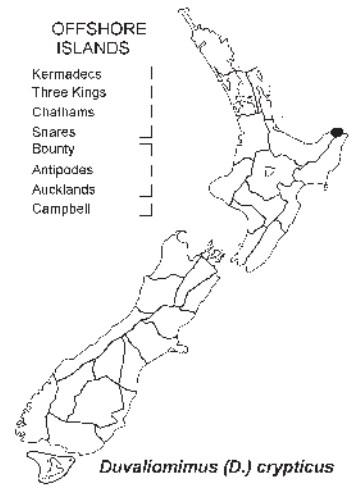
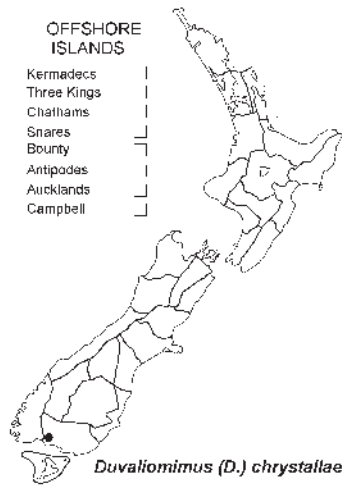
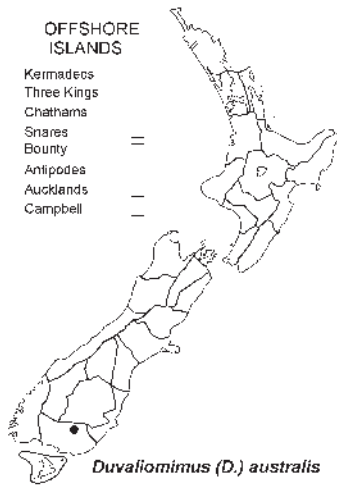
*Duvaliomimus (M.) mayae mayae*

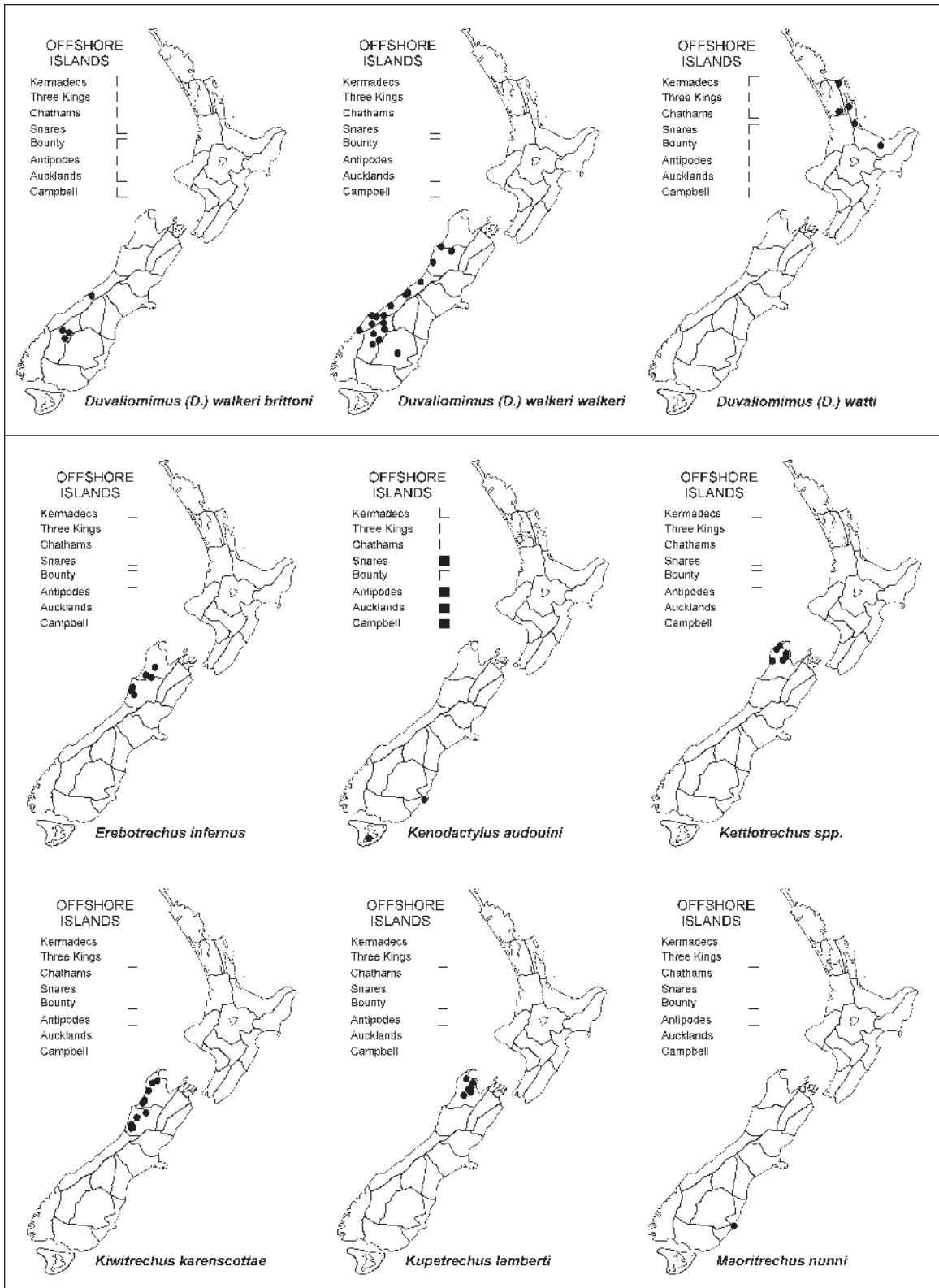


*Duvaliomimus (D.) styx*

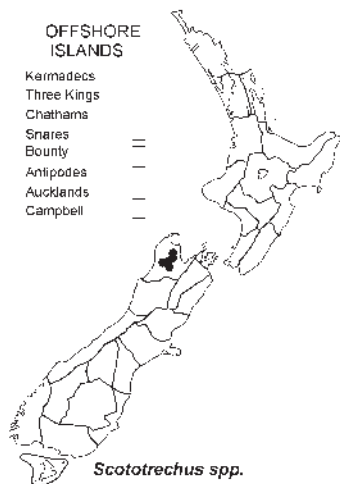
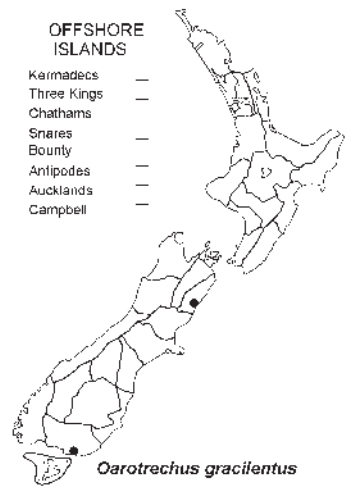
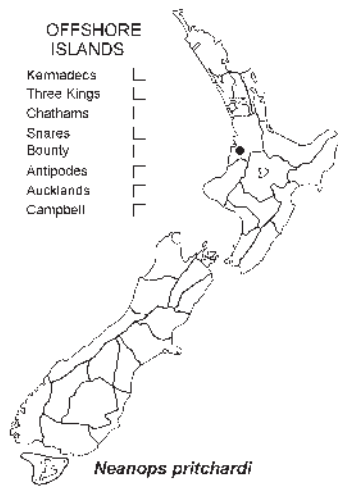
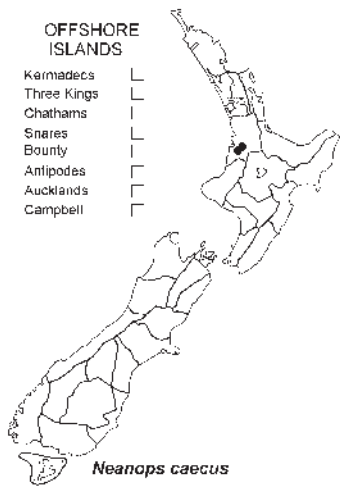
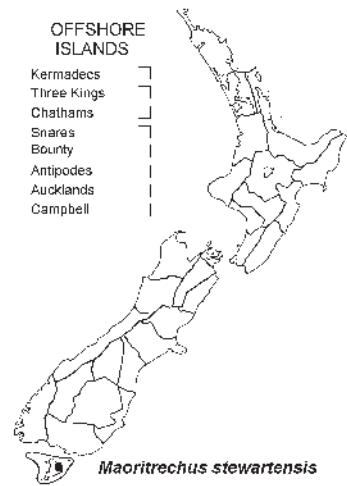
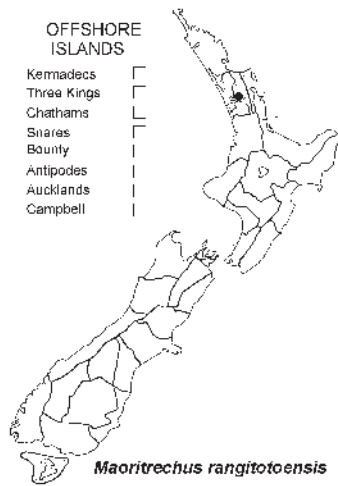
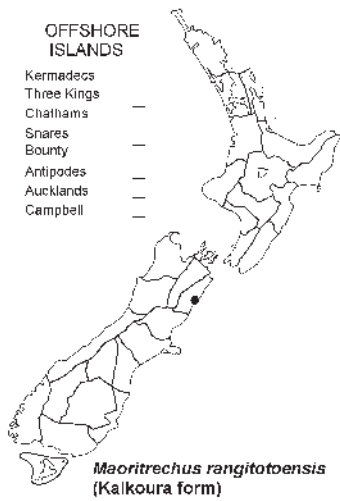


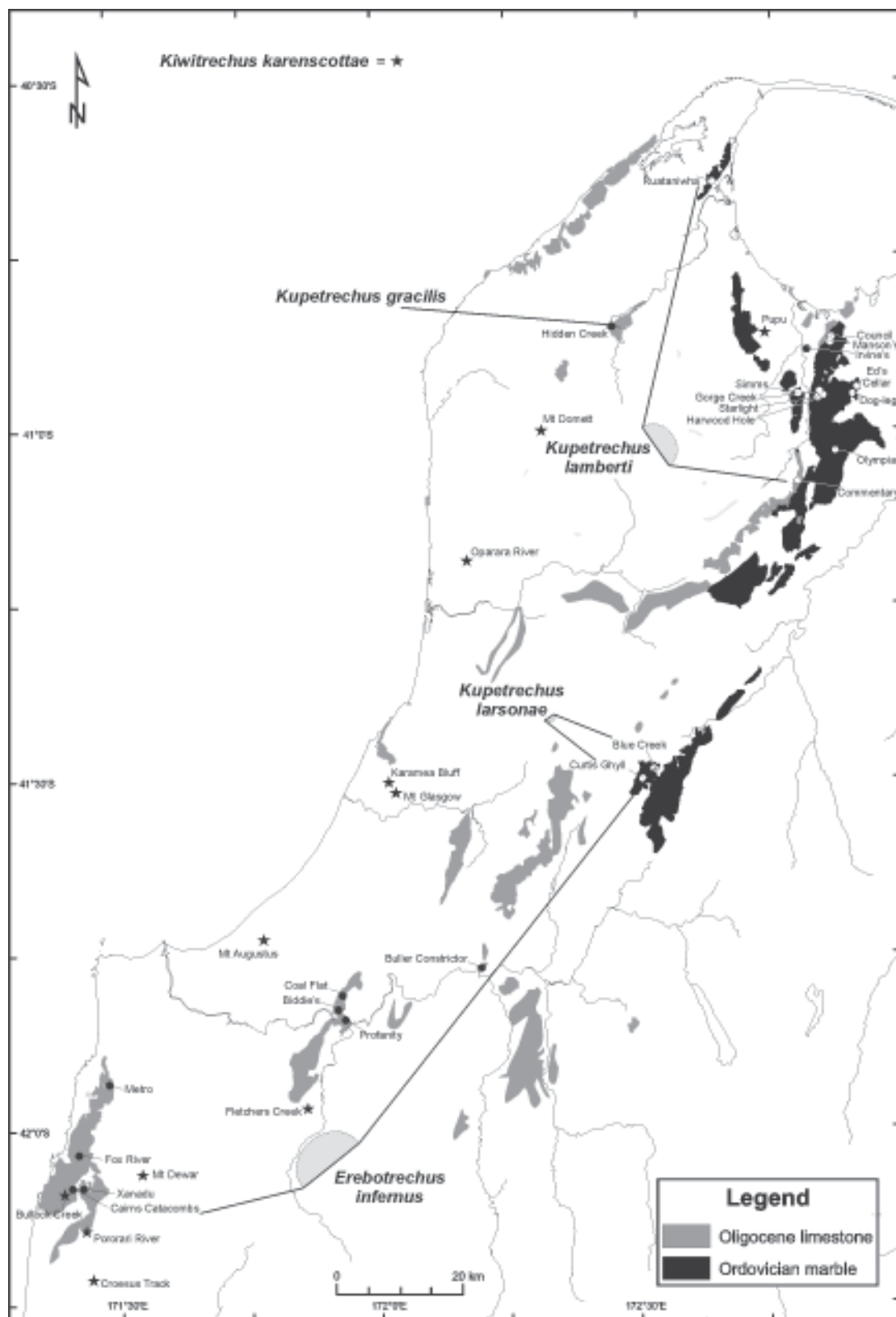
*Kupetrechus larsonae*



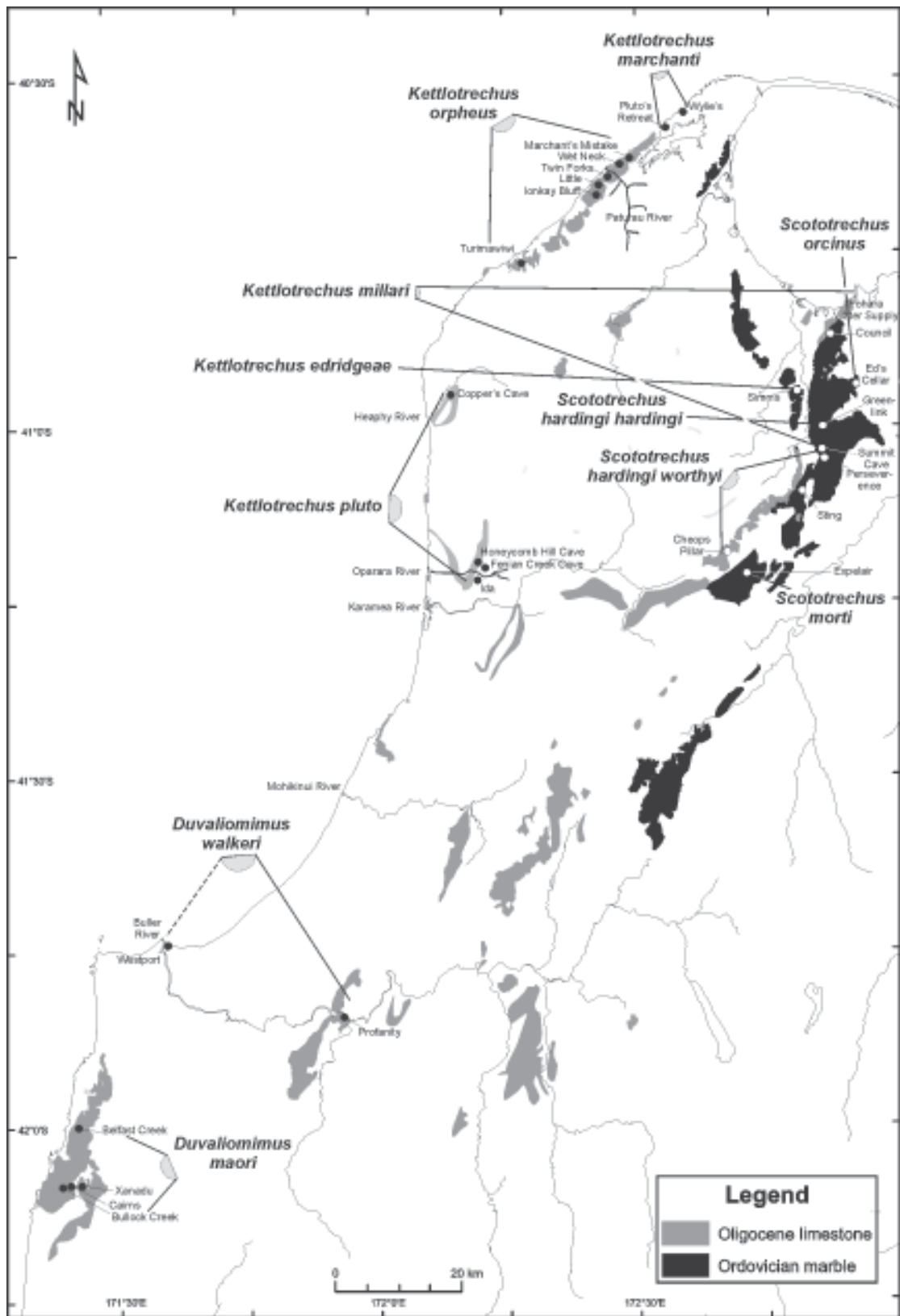




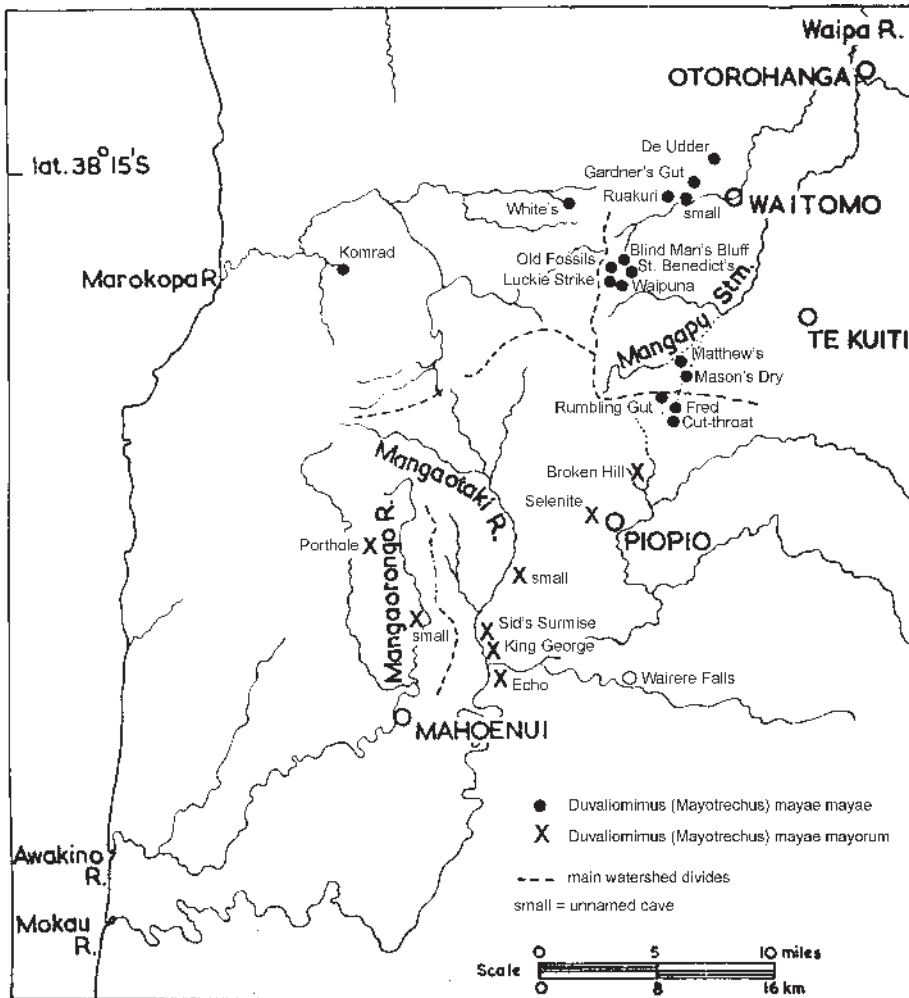




Known distribution of cave beetles of Homaloderine lineage in northwest Nelson, and epigeal beetles of Aepine lineage (see also appendix 1 for full list of cave recordings)



Known distribution of cave inhabiting beetles of Trechine lineage in northwest Nelson (see also Appendix 1 for full list of cave recordings)



Caves in which *D. (M.) mayae mayae* and *D. (M.) mayae mayorum* have been recorded (modified after May & Kermodé 1972).

## Taxonomic index

This index covers the nominal taxa mentioned in the text, regardless of their current status in taxonomy. In the case of synonyms, the combinations of generic and specific names are those originally published by authors, and may differ from combinations implicit in current usage. Taxa in **bold** are those included in the checklist. Page numbers in **bold** indicate main entries. Page numbers in *italics* indicate **figures**. The letter “p” after a page indicates **photographs**, the letter “k” indicates a **key**, and the letter “m” indicates a **distribution map**.

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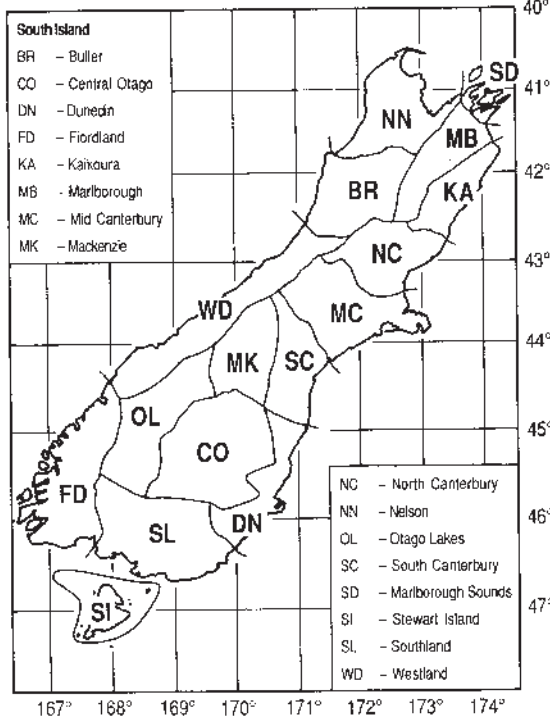
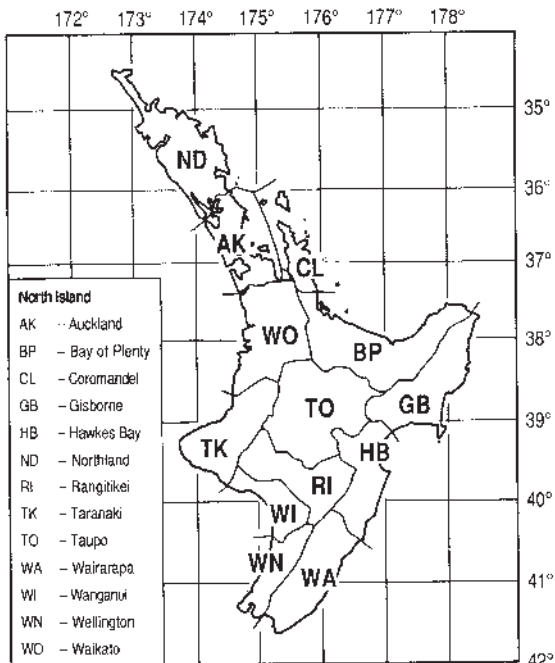
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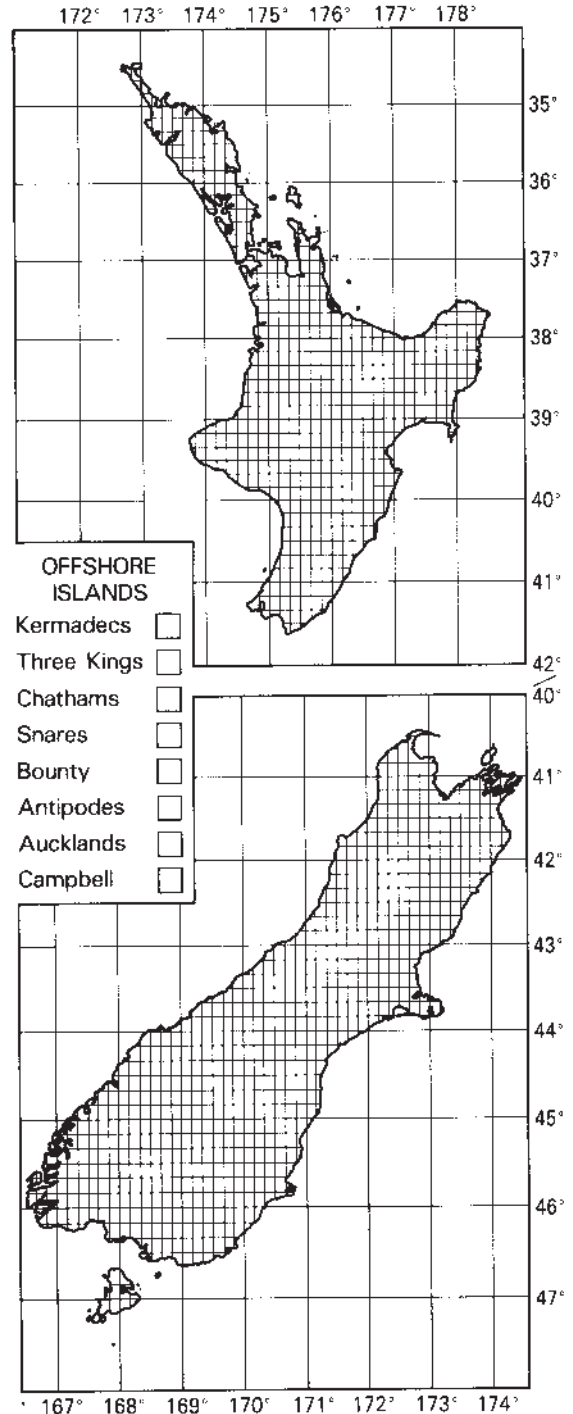
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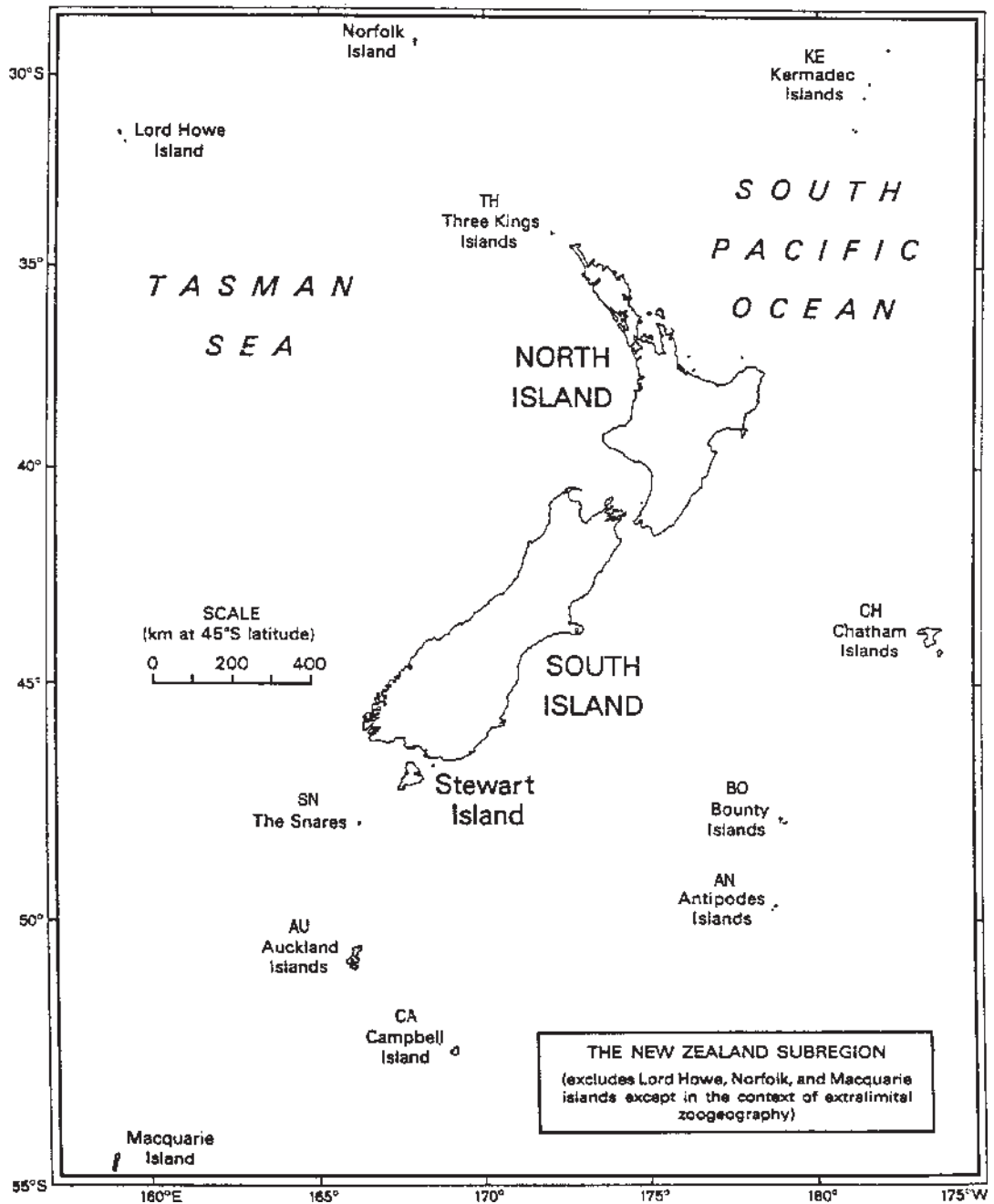


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#### Nematoda

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Kua whakatūria tēnei huinga pukapuka hei whakahauhau i ngā tohunga whai mātauranga kia whakaputa i ngā kōrero poto, engari he whaikiko tonu, e pā ana ki ngā aitanga pepeke o Aotearoa. He tōtika tonu te āhua o ngā tuhituhi, engari ko te tino whāinga, kia mārama te marea ki ngā tohu tautuhi o ia ngārara, o ia ngārara, me te roanga atu o ngā kōrero mō tēnā, mō tēnā.

He titiro whāiti tā tēnei pukapuka ki ngā mea noho whenua, kāore he tuarā; i pēnei ai i te mea kei te mōhio whānuitia ngā mea whai tuarā, ā, ko ngā mea noho moana, koirā te tino kaupapa o te huinga pukapuka *Marine Fauna of N.Z.*

Ka āhei te tangata ki te **whakauru tuhituhinga** mehemea kei a ia ngā tohungatanga me ngā rauemi e tutuki pai ai tana mahi. Heoi anō, e wātea ana te Kohinga Angawaho o Aotearoa hei āta tiroiro mā te tangata mehemea he āwhina kei reira.

Me whāki te kaituhi i ōna whakaaro ki tētahi o te Kāhui Ārahi Whakarōpūtanga Tuarā-Kore, ki te ġ tita rānei i mua i te tīmatanga, ā, mā rātou a ia e ārahi mō te wāhi ki tana tuhinga.

Ko te hunga pīrangī **hoko pukapuka**, me tuhi ki *Fauna of N.Z.*, Manaaki Whenua Press, Manaaki Whenua, Pouaka Poutāpeta 40, Lincoln 8152, Aotearoa.

E rua ngā tūmomo kaihoko: “A” – kaihoko tūmau, ka tukua ia pukapuka, ia pukapuka, me te nama, i muri tonu i te tānga; “B” – ka tukua ngā pānui whakatairanga me ngā puka tonu i ōna wā anō.

Te utu (tirohia “Titles in print”, whārangi 98). Ko te kōpaki me te pane kuini kei roto i te utu. Me utu te hunga e noho ana i Aotearoa me Ahitereiria ki ngā tāra o Aotearoa. Ko ētahi atu me utu te moni kua tohua, ki ngā tāra Merikana, ki te nui o te moni rānei e rite ana.

E toe ana he pukapuka o ngā putanga katoa o mua. Mehemea e hiahia ana koe ki te katoa o ngā pukapuka, ki ētahi rānei, toonoa mai kia whakaheke te utu. Tekau ōrau te heke iho o te utu ki ngā toa hoko pukapuka.