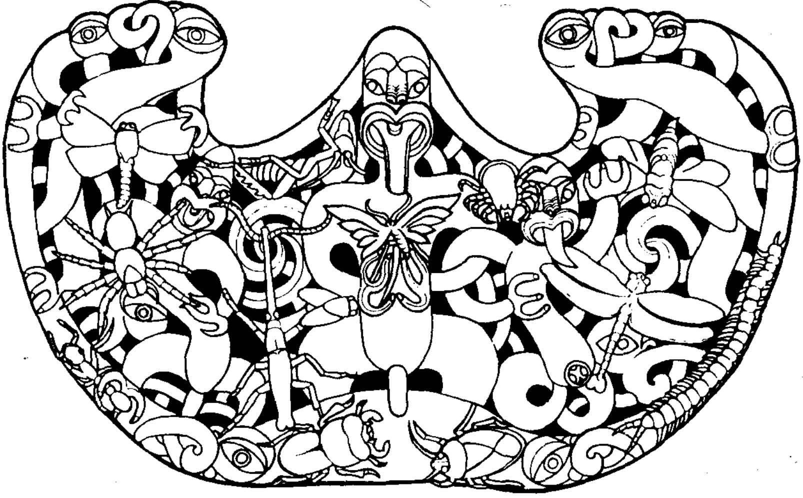

Fauna of New Zealand

Ko te Aitanga Pepeke o Aotearoa

INVERTEBRATE SYSTEMATICS ADVISORY GROUP

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Fauna of New Zealand
Ko te Aitanga Pepeke o Aotearoa

Number / Nama 41

Coccidae

(Insecta: Hemiptera: Coccoidea)

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POPULAR SUMMARY — HE WHAKARĀPOPOTOTANGA

Class **Insecta**

Order **Hemiptera**

Suborder **Stenorrhyncha**

Superfamily **Coccoidea**

Family **Coccidae**

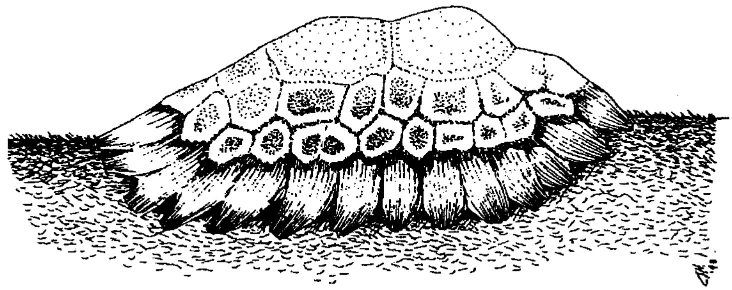

Illustration / Whakaahua: *Crystallotesta leptospermi* (Maskell) (Illustrator / Kaiwhakaahua: Chris Hodgson).

Soft scale insects

The soft scale family Coccidae is one of ten families of plant-sucking scale insects present in New Zealand. The 57 known species can be divided into two distinct groups: 43 indigenous species in 11 genera that are restricted to New Zealand, and 14 cosmopolitan (or adventive) species in six genera that are generally of world-wide distribution, and probably arrived here accidentally on imported plant material. Most of the indigenous species are quite closely related and are covered in a glassy wax cover characteristically divided into polygonally-shaped plates. No Maori names are known for any of these insects.

The native species of soft scales are associated with native trees and shrubs and there is only a single record of a native species found on any of the numerous introduced plant species. Many of these native scale species have quite wide host-ranges whilst others appear to be more host-specific. The closeness of the association between the indigenous species and the New Zealand flora, on which there are no definite records of serious damage, suggests that the association between the scale and its host plants has had a long evolutionary history. None of these native species are of economic importance, and none has been recorded outside New Zealand.

Most of the introduced or adventive species are of some economic importance, mainly on introduced crops and cultivated garden plants, both indoors and outdoors. Two species of wax scales require control on citrus, whilst other species are occasionally significant on plums, apricots, and cherries. Biological control agents were imported earlier to control two of the pest scales. One hymenopterous parasitoid species was introduced in 1921 to control brown soft scale (*Coccus hesperidum* Linnaeus), and four species have been imported against black scale (*Saissetia oleae* (Olivier)). Generally the

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Ko te whānau Coccidae, he whānau "unahi mohe". Ko ia tētahi o ngā whānau 10 o ngā ngārara unahi, he ngongo tipu tā rātou mahi, e noho ana i Aotearoa. Ka noho mai ngā momo e 57 e mōhiotia ana ki ētahi karangatanga whānui e rua. E 43 ngā momo kei te karangatanga tuatahi, nō ngā puninga 11, ā, ko Aotearoa anake te wāhi e kitea ai ēnei aitanga a Punga. Kei te huinga tuarua, ko ētahi momo 14, nō ngā puninga e 6, ka kitea i ōna whenua maha tonu o te ao, kua tae mānene mai rānei ki konei, noho ai. E whakapaetia ana i tau pokerehū mai ēnei ki Aotearoa mā runga i ētahi tipu i tukuna mai i tāwāhi. Ko te nuinga o ngā momo nō konei taketake ake, he pākanga kiritahi, ā, katoa, katoa, kua kapi i tētahi kiri mōhinuhinu. Hangaia ai te kiri nei ki ētahi wāhanga iti he taparau te āhua. Kāore e mōhiotia ana ngā ingoa Māori mō ēnei moroiti.

Ko ngā momo nō Aotearoa tūturu, kitea ai e piri tahi ana ki ngā rākau me ngā mauwha tūturu o Aotearoa. E ai ki ngā kōrero kua kohia mō ēnei unahi mohe, kotahi anake te kitenga o tētahi e piri ana ki tētahi rākau i takea mai i tāwāhi. Ko ētahi o ngā unahi mohe taketake ake, noho tahi ai ki te huhua o ngā momo rākau, ko ētahi anō, ka piri tahi ki te momo rākau kotahi nei. He torokaha tonu ngā hono i waenganui ngā unahi mohe taketake ake me ngā rākau taketake ake, engari kāore anō kia kitea ētahi pānga tino kino o te noho atu a ngā unahi mohe ki aua rākau. Nō reira e whakapaetia ana nō tua whakarere te noho tahi me te kukune tahi a ēnei o ngā tamariki a Tāne. Kāore he pānga kino, taha moni nei, o ngā momo o Aotearoa, ā, kāore anō kia kitea tētahi e noho ana i tētahi atu whenua o te ao.

Ko te nuinga o ngā momo kua kawea mai i tāwāhi, he pānga kino ō rātou ki ngā tipu i mauria mai i tāwāhi, ki ētahi tipu hoki o roto i ā tātou māra, tae atu ki ngā tipu whakapaipai ka noho ki rō whare. Arā ētahi momo unahi

(haere tonu)

cosmopolitan scales in New Zealand are each attacked by several species of parasitoids.

Like many other related sap-sucking insects, the soft scales eliminate honeydew from the anus. This is a sugary solution produced in the gut after feeding on the plant sap. A black sooty mould fungus often grows on the honeydew. In most parts of the world, this honeydew is attractive to ants, but in New Zealand only a single native species is known to be ant-attended — the reasons for this are unknown. However, soft scales are rarely as abundant as some other honeydew-producing scale insect families, such as the margarodids and eriococcids, and so are not the main cause of the sooty moulds so abundant on beech, manuka, and kanuka.

The life cycle and appearance of male and female soft scales are quite different. The stages that are most often seen are those of the female, which passes through two or three immature stages before becoming sexually mature, despite still looking immature. The males, on the other hand, pass through four stages before giving rise to the very small, fly-like, adult male. Quite unlike the adult female, the adult male has no functional mouthparts and only lives for a few days. Its sole function is to locate and fertilise the female. Some species, which live under the bark of trees, are thought to have dispensed with males and to reproduce asexually. Most of the native species seem to have only one or two generations a year.

The main stage used to identify and describe a species of scale insect is the adult female and this revision deals only with this stage. Mature females rarely reach 10 mm long and many are only 3–4 mm when fully grown and, although many New Zealand species can be identified by the form of the glassy cover or test, it is best to check the identification with a microscope by mounting the specimen on a glass slide. The characters that are most critical for identification are the numerous minute wax-secreting pores found over most of the body, and these require a high-power microscope for examination.

Contributor **Chris Hodgson** graduated from Kings College, London University, in 1960 and taught in a small public school for two years. In 1962 he emigrated to what was then Rhodesia where he was a Research Officer for the Research and Specialist Services, Ministry of Agriculture, until 1967. It was during this period that he became fascinated by scale insects and published some 16 papers

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harare e rua e noho tahi ana ki ngā rākau o te whānau rēmana, ka mātua patua e te tangata kia kore e raru aua rākau. Arā anō ētahi ka whakararu i ngā rākau paramu, āperekoti, tae atu ki te here. He mea tiki atu hoki ētahi ngārara i tāwāhi hei patu i ētahi o ngā unahi nei. Tērā tētahi momo ngārara nō te pūtoi Hymenoptera, ko te pirinoa tōna rite, i mauria mai ki Aotearoa i te tau 1921, ko tāna mahi, he patu i te unahi mohe parauri (*Coccus hesperidum* Linnaeus), ā, arā anō ētahi momo e whā kua mauria mai hei tātāmi i te unahi pango (*Saissetia oleae* (Olivier)). Mō te wāhi ki ngā ngārara unahi o Aotearoa ka kitea i ngā wāhi huhua o te ao, he maha anō ngā ngārara pirinoa ka tātāmi i tēnā momo, i tēnā momo.

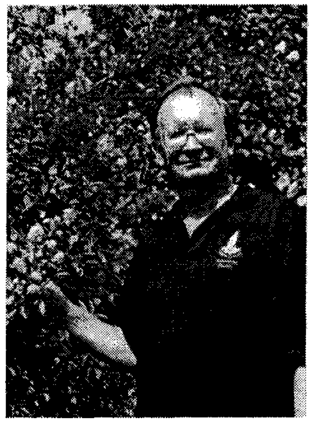
Pērā anō i ētahi atu ngārara ngongo pia, ka puta ake he honeydew i te tero o te ngārara unahi mohe. He wai reka te honeydew ka hangaia i roto i te puku ina kai te ngārara i te pia o tētahi rākau. Ka piri atu te wai reka ki te rākau, ā, ka tipuria e tētahi momo hōpurupuru pango. I te tino nuinga o ngā whenua e kitea ai te honeydew, kei reira anō tētahi momo pōpokorua, ā, ko te honeydew tētahi o āna tino kai. Engari i Aotearoa, kotahi anake te momo unahi whakaputa honeydew kua noho mai te pōpokorua hei hoa noho mōna. Kāore hoki e mōhiotia ana he aha i pēnei ai. Heoi anō, kāore e pērā rawa te mātinitini o ngā unahi mohe, pērā i ētahi atu o ngā ngārara unahi whakaputa honeydew (hei tauira, ngā margarodid me ngā eriococcid). Waihoki, ehara nā ngā unahi mohe te hōpurupuru pango ka kitea e tipu ana i te tawhai, te mānuka me te kānuka.

He rerekē te āhua me te pakari haere o ngā uha me ngā tāne. Ko te pakari haere o te uha te mea e kitea nuitia ana. E rua, e toru rānei ngā huringa o tōna āhua i te wā e kōhungahunga ana, kāahi anō ka huri hei pakeke, heoi anō, he rite tonu tōna hanga i tērā wā ki tō te kōhungahunga. Engari ko te mea tāne, e whā ngā huringa, kātahi ka huri hei pakeke, me te rite o tōna āhua pakeke ki tō tētahi ngaro iti. Heoi anō, kāore he waha o te tāne, ā, i roto i ngā rā torutoru nei, ka hemo. Kotahi anō te kaupapa a te tāne, ko te kimi i te uha, ka tuku tātea ki te kākano. Arā hoki ētahi momo ka noho ki raro i te peha o ētahi rākau, e whakapaetia ana kua kore kē he mea tāne; ka whakaputa uri i runga i te tōkai-kore. Ko te nuinga o ngā momo taketake ake o Aotearoa, kotahi noa iho, e rua rānei ngā wā e whakaputa uri ai i te tau.

Ko te āhua o te ngārara unahi ka tirohia hei tautuhi, hei whakaahua i tēnā, i tēnā momo, ko tō te uha pakeke, ā, kua whāia tēnei tikanga i konei. Me uaua ka roa ake i te 10 mm ngā uha, ā, ko te nuinga kei te āhua 3-4 mm kē. Ko te tokomaha o ngā momo o konei taketake ake, ka taea te tautuhi i rungā anō i te āhua o ō rātou kiri kōataata, engari ka whaihua tonu te āta tāpae atu hei tiro mā te karu

(haere tonu)

on them, mainly soft scales, many of these publications covering the whole of the Ethiopian Region. In 1967 he returned to England and became a Lecturer in Agricultural Entomology at Wye College, University of London, where he was until August 1999. For the first 20 years at Wye, Chris worked mainly on aphids, particularly on apterous dispersal and aphid-plant-virus interactions on which he did his doctoral research. Chris started working on scale insects again in 1990, since when he has published a further 14 papers, three of them on New Zealand scale insects. Chris has written or edited three books, and is the author or co-author of 6 book chapters and 59 scientific papers. Last year (1998) he organised the VIIIth International Symposium on Scale Insects Studies, held at Wye, and is currently editing the Proceedings.



Contributor **Rosa Henderson** graduated from the University of Canterbury, New Zealand, in 1965, and was a Research Fellow investigating chromosome abnormalities in leukaemia for 5 years at the Cytogenetics Unit, Christchurch Hospital. After a 15-year break from science bringing up her family, she began an entomological career in 1985, rearing insects for DSIR at Mt Albert Research Centre. From moths and crickets, this progressed to rearing predatory ladybird beetles and mites (both feeding on scale insects) in a biological control project for kiwifruit. When the DSIR was broken up into ten Crown Research Institutes in 1992, Rosa became a science technician for Landcare Research working on scale insects in the N.Z. Arthropod Collection. She is responsible for the curation of the specimens in that part of NZAC. Her interest in the

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whakarahi, kia tino tika ai te mahi. Ko ngā mea hei āta tirotiro māu i a koe ka mahi ki te tautuhi i tētahi unahi mohe, ko ngā koroputa harare moroiti e mau mai ana ki te tinana, heoi anō me mātua whakamahi tētahi karu whakarahi kaha tonu e pai ai te kite atu.

I puta mai a Chris Hodgson i te Kāreti o Kings, Whare Wānanga o Rānana, i te tau 1960, ā, ka rua tau e whakaako ana i tētahi kura tūmatanui paku nei. Nō te tau 1962 ka neke ki te whenua i karangatia ko Rhodesia i ērā wā. Ko tana tūranga i reira ā, tae rawa ki te tau 1967, ko te Āpiha Rangahau mō te Ratonga Rangahau, Kaupapa Whāiti, i te Manatū Ahuwhenua. I a ia i reira, ka warea ia ki ngā ngārara unahi. Tekau mā ono ngā tuhinga ka whakaputaina e ia mō ngā ngārara unahi, ko te nuinga e pā ana ki ngā unahi mohe. Ko te maha o aua tuhinga i titiro whānui ki ngā momo o te Takiwā o Ethiopia. Nō te tau 1967 ka hoki ki Ingarangi, ka tū hei Pūkenga mō te Mātai Pepeke i roto i ngā Mahi Ahuwhenua, i te Kāreti o Wye, Whare Wānanga o Rānana. I reira tonu a ia e mahi ana ā, taka rawa ki te Here-turi-kōkā, 1999. I ōna tau 20 tuatahi i Wye, ko ngā aphid tāna aronga nui, ā, ko ngā kaupapa whāiti, ko te whakawhitiwhiti rere-kore a ngā aphid me ngā hono i waenganui i te aphid, te tipu me te wheori - koirā anō hoki te kaupapa o tana mahi rangahau tākutatanga. Ka tae rawa ki te tau 1990, ka tahuri anō a Chris ki te āta tirotiro i ngā ngārara unahi. Mai i tērā wā, 14 ngā tuhinga kua puta i a ia, e 3 e pā ana ki ngā ngārara unahi o Aotearoa. E toru ngā pukapuka kua tuhia e ia, kua noho rānei ko ia te ētita. I tua atu i tērā, e 6 ngā wāhanga pukapuka, e 59 anō hoki ngā tuhinga pūtaiao poto kua tuhia e ia, ko ia rānei tētahi o ngā kaituhi. I te tau 1998 nāna i whakarite te Whakarauikatanga Tuawaru o te Ao mō ngā Mātai Ngārara Unahi, i tū ki Wye, ā, ko ia anō te ētita o ngā kōrero o te hui e whakapukapukangia ana.

Nō te tau 1965 i whiwhi ai a Rosa Henderson i tana tohu mātauranga mai i te Whare Wānanga o Waitaha, i Aotearoa. Ka rima tau ia e tū ana hei Paewai Rangahau i te Wāhanga Tirotiro Āhuatanga Tuku Iho o ngā Pūtau, i te Hōhipera o Ōtautahi, ko tāna, he tūhura i te wāhi ki ētahi pūira korokē i roto i te mate ruru toto. Tekau mā rima tau ia e whakapau kaha ana ki te whakatipu tamariki, ā, nō te tau 1985 ka hoki mai ki te ao pūtaiao, ka tīmata ki te whāwhā haere i ngā mahi mātai pepeke. Ko tana mahi tuatahi, he āta whakatipu i ētahi o ngā aitanga a Punga mā te DSIR, i te Pokapū Rangahau o Mt Albert. He pūrēhua, he pihareinga ngā mea tuatahi ka whakatipuria, ka whai mai ko ētahi

(haere tonu)

soft scales had its origins with the collection of many undescribed species during the Insect Survey of the East Cape Region, 1992–1994, organised by John Dugdale. John was leader of the Systematics team at that time, and strongly supported the revision of the N.Z. soft scales. In 1995, Rosa gained a Queen Elizabeth II Technicians Study Award and travelled to U.K. for a short period, to work with Chris Hodgson at Wye College on this revision. Rosa is author or co-author of 14 scientific papers.

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ngoikura me ētahi atu moroiti, e rua, e rua, kai ai i te ngārara unahi. Ko tēnei mahi whakamutunga, he kaupapa i whakatūria hei patu ā-koiora i ngārara whakararu i te huakiwi. Nō te wāwāhanga o te DSIR i te tau 1992 kia 10 rawa ngā Pūtahi Rangahau Karauna, ka noho a Rosa hei kaihangarau taha pūtaiao mā Manaaki Whenua. Ko tana kaupapa whāiti, ko te mātai i ngā ngārara unahi kei te Kohinga Angawaho o Aotearoa. Ko ia hoki kei te whakahaere i ngā mahi tiaki i tērā wāhanga o te Kohinga. Ko tana ngākaunui ki ngā unahi mohe, i takea mai i te kohikohinga o ētahi momo maha tonu kāore anō kia āta whakaahuatia, i te Tirohanga Ngārara ki te Raki o te Tairāwhiti, 1992–94, i whakahaeretia i raro i te maru o John Dugdale. Ko John te kaihautū o te kāhui Pūnaha Whakarōpū i tērā wā, ā, nāna i akiaki kia āta tirohia anō ngā whakapapa o ngā unahi mohe o Aotearoa. I te tau 1995, ka whakawhiwhia a Rosa ki tētahi Tohu Queen Elizabeth II mā te Kaihangarau, i āhei ai ia ki te haere ki Ingarangi mō tētahi wā, ki te mahi tahi ki a Chris Hodgson, i te Kāreti o Wye. Nā konei i tutuki ai tēnei titiro tuarua ki ngā unahi mohe nei. Tekau mā whā ngā tuhinga pūtaiao ko Rosa te kaituhi, tētahi rānei o ngā kaituhi.

He Kupu Āwhina — Glossary

āhuatanga tuku iho o ngā pūtau — cytogenetics
angawaho — arthropod
here — cherry
huakiwi — kiwifruit
kaihangarau — technician
korokē — abnormal
kukune — evolve
mohe — soft
harare — wax
karu whakarahi — microscope
kōataata — glassy
koroputa — pore
mātai — study, examine closely
mate ruru toto — leukaemia
mōhinuhinu — glossy, waxy
ngoikura — ladybird
ngongo pia — sap-sucking
pākanga kiritahi — close relative
Paewai — Fellow
pirinoa — parasite
pūira — chromosome
pūrēhua — moth
taparau — polygon
tautuhi — identify
tōkai-kore — asexual
unahi — scale (insect)
wheori — virus

Translation by **H. Jacob**
Huatau Consultants, Levin

The authors shared the work of this revision as follows: the 11 indigenous genera were divided between us, with the senior author (CJH) being responsible for about two-thirds. Draft generic diagnoses and species descriptions were written and then critically appraised by the other author. The introduction was a shared contribution. CJH was responsible for the section on adventive species, and for the sections popular summary and morphology. To all descriptions RCH added comments on biology, distribution, and host plants, collated the information in appendices A-D, and plotted the distribution maps. RCH also did most of the collecting and curation of the specimens, photographed the live insects, and was responsible for the scanning electron microscope studies. CJH drew all the figures, except for some of the adventive species as acknowledged.

ABSTRACT

The adult females of all Coccidae (Hemiptera: Coccoidea) known from New Zealand are described and illustrated. In addition to the four indigenous genera previously known (*Ctenochiton*, *Inglisia*, *Lecanochiton* and *Pounamococcus*), seven new genera are described (*Aphenochiton*, *Crystallotesta*, *Epelidochiton*, *Kalasiris*, *Plumichiton*, *Poropeza* and *Umbonichiton*), all of which are considered to be fairly closely related to *Ctenochiton* and all endemic to New Zealand. Within these eleven indigenous genera, 25 new species are described and 12 species are transferred to new genera, bringing the total to 43 species. *Ctenochiton elongatus* Maskell is designated a *nomen dubium*. None of the species currently included in the genera *Ctenochiton* and *Inglisia* described from outside New Zealand are here considered to be congeneric. In addition, all known adventive (exotic) species found in New Zealand are reviewed and briefly described. *Lecanium (Eulecanium) spinosum* Brittin is synonymised with *Parthenolecanium persicae* (Fabricius), and the synonymy of *Lecanium cassiniae* Maskell with *Saissetia oleae* (Olivier) is upheld. *Pulvinaria psidii* (Maskell) has not been recorded in New Zealand and its inclusion in previous checklists is erroneous. Keys to adult females are included for the separation of all genera and species, and also for preliminary instar separation. Earlier work done on the superfamily Coccoidea in New Zealand is briefly reviewed and the present classification of the Coccidae and closely related families is outlined. Their biology, distribution, host-plant interactions, parasites and predators, and economic importance are also described. The current methods for collecting and mounting specimens on slides for the New Zealand Arthropod Collection are outlined, followed by a description of the morphology of adult female Coccidae, introducing the terminology used. A list of plant hosts is included in an appendix.

Keywords. Hemiptera, Sternorrhyncha, Coccoidea, Coccidae, new genera, new species, adult females, taxonomy, keys, distribution, host plants, natural enemies, fauna.

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CHECKLIST OF TAXA

CONTENTS

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Chris Hodgson would especially like to thank his colleagues at Wye, particularly Mike Copland, for taking on many of the activities Chris should have been responsible for whilst this work was in progress and during his visits to New Zealand and Australia. In addition, Chris offers his sincere thanks to his wife Charlotte and his daughter Jessica for their patience, support, and understanding — with the hope that the visit to New Zealand was some small compensation!

INTRODUCTION

The earliest record of a soft scale insect from New Zealand is from Cook's First Voyage, 1768–71. During this voyage, the botanists Banks and Solander collected much herbarium material, and parts of that collection have been deposited in various museums, including the United States National Museum of Natural History (USNM). At some stage, a single adult female soft scale, along with the piece of leaf beneath it, was cut out from a herbarium specimen and preserved dry in the USNM (accession number 1276401); this is labelled *Ctenochiton* on *Coprosma acerosa*. There is some doubt about the accuracy of the plant host record, as *C. acerosa* has very narrow leaves, far narrower than the breadth of a fully mature female *Ctenochiton*! It is uncertain whether the specimen is *Ctenochiton paraviridis* n. sp. or *Ctenochiton viridis* Maskell; the latter has been recorded from *Coprosma* whereas *C. paraviridis* has not, but without slide mounting and therefore altering a unique sample, the benefit of the doubt concludes that it is possibly *C. viridis*.

New Zealand Coccoidea were first studied between 1879 and 1898 by W.M. Maskell, recognised then as one of the World's leading authorities on scale insects. He described about 300 species of Sternorrhyncha from around the world, including many scale insects from New Zealand. Maskell's interest in the then new science of microscopy meant that he was well ahead of his contemporaries in describing species from slide-mounted specimens. Although they were unstained and had other deficiencies, these slides can still be used today. Maskell also kept dried material both of the specimens he collected and of those he was sent. However, these cannot always be considered to be syntype material as he tended to put material collected on different days or from different localities in the same box if he thought they were the same species (see Deitz & Tocker, 1980). Maskell was before his time in recognising that stages other than the adult female might be important in the taxonomy of coccoids and his dry material collection can be useful as it often contains nymphs and males.

Since Maskell's time, there have been a number of other studies on New Zealand Coccoidea. The ten families of Coccoidea now known from New Zealand are as follows: **Asterolecaniidae**: Maskell's species were redescribed by Morrison & Morrison (1927) and the World fauna was revised by Russell (1941); **Cerococcidae**: 3 species; 2 redescribed by Lambdin & Kosztarab (1976, 1977) and 1 new species (Lambdin, 1998); **Coccidae**: Morrison & Morrison (1922) and Hodgson (1994a) redescribed the type species of Maskell's three New Zealand genera; Hodgson & Henderson (1998) described a new genus and 2 new species; **Diaspididae**: some species of the tribe Leucaspidinae by Britten (1937) and de Boer & Valentine (1977); an unpublished field study of the same taxon by Emms (1985); **Eriococcidae**: a complete revision by Hoy (1962) and more recently a revision of the genus *Eriochiton* by Hodgson (1994b) and Hodgson & Henderson (1996); **Halimococcidae**: a *Colobopyga* species described by Deitz (1979); **Margarodidae**: completely revised by Morales (1991); earlier papers covering aspects of this family are Brittin (1935), Dumbleton (1967), Morrison & Morrison's (1923) redescription of Maskell's species, and Morrison's (1928) world monograph; **Ortheziidae**: comments by Green (1929); **Phenacoleachiidae**: Beardsley (1964); and **Pseudococcidae**: completely revised by Cox (1987) with an earlier paper by Williams & de Boer (1973).

Thus, the soft scales or Coccidae have not received much attention this century since Maskell described 17 species of indigenous soft scales in three genera (*Ctenochiton, Inglisia,* and *Lecanochiton*) over a period of about 20 years, his last paper published in 1898. Exactly 100 years later Hodgson and Henderson (1998) described a fourth genus, *Pounamococcus*, containing two new species.

This volume provides a complete revision of the adult females currently known, adding descriptions of seven new genera — *Aphenochiton, Crystallotesta, Epelidochiton, Kalasiris, Plumichiton, Poropeza,* and *Umbonichiton* — and 25 new species, bringing the total to 11 indigenous genera and 43 species in New Zealand, although it is clear that there are still further species awaiting description. In addition, 14 adventive species are illustrated and briefly described.

None of the species currently included in *Ctenochiton* and *Inglisia* described from outside New Zealand are here considered to be congeneric. Thus *Inglisia* becomes monotypic (*I. patella* Maskell) with the four other New Zealand species originally placed in *Inglisia* transferred to either *Aphenochiton* n. gen. —*A. inconspicuus* (Maskell) — or *Crystallotesta* n. gen. — *C. fagi* (Maskell), *C. leptospermi* (Maskell), and *C. ornata* (Maskell). The genus *Ctenochiton* now includes only *C. viridis* Maskell and three new species — *C. chelyon, C. paraviridis,* and *C. toru*. *Ctenochiton depressus* Maskell and *C. perforatus* Maskell are transferred to *Kalasiris* n. gen.; *C. elaeocarpi* Maskell and *C. flavus* Maskell to *Plumichiton* n. gen.; *C. dacrydii* Maskell to *Poropeza* n. gen.; *C. fuscus* to *Crystallotesta* n. gen.; *C. hymenantherae* Maskell to *Umbonichiton* n. gen.; and *C. piperis* Maskell to *Epelidochiton* n. gen. *Ctenochiton elongatus* Maskell is designated a nomen dubium for reasons explained in full on page 184. The genus *Lecanochiton* retains its original two species *L. metrosideri* Maskell and *L. minor* Maskell. In addition, *Lecanium* (*Eulecanium*) *spinosum* Brittin is synonymised with *Parthenolecanium persicae* (Fabricius).

The known adult males and immature stages will be described in future volumes.

The Classification of the Lecanoid Coccoidea. The use of cladistic analyses to determine possible relationships within the Coccoidea have been relatively few: Miller, 1984 (many taxa of the Coccoidea, based on a range of characters); Miller and Miller, 1993a, 1993b (affiliations of *Puto* and *Eriokermes*); Foldi, 1995 (affiliations of *Limacoccus*); Miller and Williams, 1995 (affiliations of the Micrococcidae); Qin and Gullan, 1995 (relationships within the Ceroplastinae); Hodgson and Henderson, 1996 (affiliations of *Eriochiton*); Miller & Hodgson, 1997 (relationships within the lecanoid coccids), and Foldi, 1997 (many taxa, considered from the viewpoint of the evolution of their feeding sites and protective structures). In addition, several non-cladistic phylogenies have been suggested, i.e.. Borchsenius, 1958 (based mainly on adult female characters); Boratyński & Davies, 1971 (based on adult male characters); Koteja, 1974b (based on the structure of the adult female mouthparts); Miller & Kosztarab, 1979 (a version of Boratyński & Davies (1971) modified on the basis of more recent descriptions of males); Danzig, 1986 (using the morphology of the adult female, adult male, and crawler and also life history characters); and Koteja (reviewers' remarks in Kosztarab & Kozár, 1988).

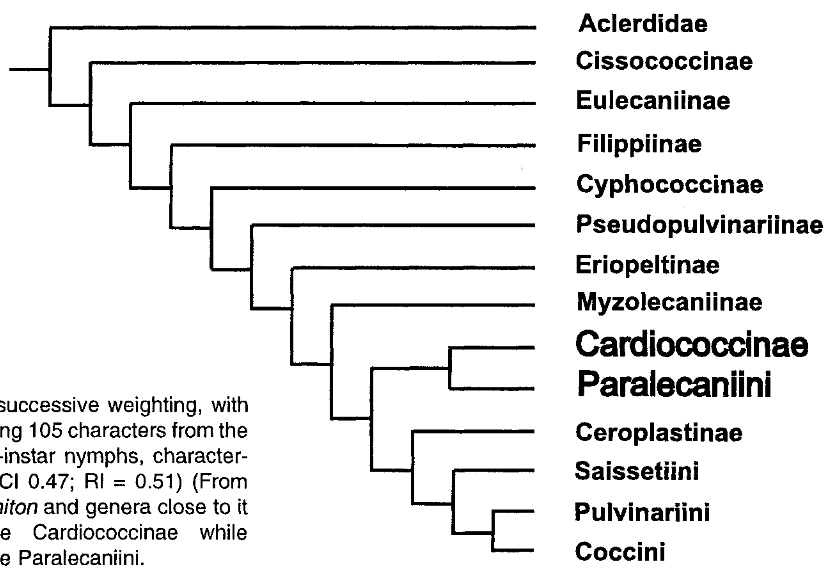


Fig. 1. Cladogram produced by successive weighting, with the Aclerdidae as the outgroup, using 105 characters from the adult female, adult male, and 1st-instar nymphs, character-states unordered (Length = 229; CI 0.47; RI = 0.51) (From Miller & Hodgson, 1997). *Ctenochiton* and genera close to it are thought to belong to the Cardiococcinae while *Pounamococcus* may belong to the Paralecaniini.

Few classifications have been suggested for the family Coccidae, the most recent being that of Tang *et al.* (1990), Tang (1991) and Hodgson (1994a). The two papers by Tang proposed a rather complex classification based entirely on female characters but most of the generic groupings were very different from those suggested by the studies of males (Giliomee, 1967). Hodgson (1994a) introduced a classification based on the relationships suggested by the morphology of both adult males and females. He divided the Coccidae into 10 subfamilies, with the Coccinae divided into four tribes, although he considered that the status of these groupings needed further study. This classification was the basis of a cladistic study done by Miller & Hodgson (1997), the results of which are shown in Fig. 1. The New Zealand coccid fauna with a glassy test (those related to *Ctenochiton*) are here believed to be close to the glassy scales (Cardiococcinae); the placement of genera such as *Pounamococcus* is uncertain but they appear to be close to the Paralecaniini. It is interesting to note that in all the cladograms of Miller & Hodgson (1997) the Cardiococcinae and Paralecaniini were sister taxa. A detailed phylogenetic analysis will be undertaken once the description of all stages, i.e., including the adult males and immatures, has been completed.

Biology and life cycle. Male and female coccoids go through very different post-embryonic development. The females are considered to be neotenic and reach the non-winged adult stage after two or three moults. The changes that take place at each moult are relatively small and the metamorphosis is of the heterometabolous-paurametabolous type (Fig. 2, p. 21). On the other hand, the development of the male resembles that of a holometabolous type, producing a fully-winged adult stage, quite different from that of the female. The 1st-instar stage or crawler of both males and females usually are indistinguishable. This is the main dispersal stage (Greathead, 1997) and is a feeding stage. The 2nd instar is also a feeding stage for both sexes but the nymphs are usually easily separable because they are sexually dimorphic, those of the male secreting a more elongate glassy test under which all further development takes place. In the male, the 2nd-instar nymph then moults three times giving rise to the non-feeding, sessile prepupal and pupal stages and finally the winged, non-feeding adult male. These moults take place beneath the protective glassy test secreted by the 2nd-instar male nymphs. The adult males of indigenous species emerge backwards from beneath their test, wingtips first, by means of the upwardly flexing plate on the posterior end of the test.

The crawler disperses to locate a suitable feeding site, which may be on the same plant as the natal mother or elsewhere. The test covering a neonate crawler is composed of soft wax that is less protective than that secreted once feeding has started. Crawler mortality is high as many do not find a suitable food source before succumbing to environmental factors, such as high rainfall, desiccation by wind or high temperatures, overcrowding on the natal leaf, and losses through wind dispersal. Surviving nymphs apparently often move away from the first settlement site and disperse further. Male nymphs can move to non-specific host plants once they have ceased feeding (or, perhaps, in the late feeding stages before becoming completely sessile), settle and secrete the wax which fixes the test firmly to the substrate, and then begin metamorphosis. This ability to settle on other plants makes determining the relationships of an adult male to a particular female difficult; thus, plant species on which only male stages are known are not here considered to be true host plants, as the female stages appear to have a more restricted host range.

In the female, subsequent nymphal instars change little other than in size, and the only safe way to be sure that you are looking at an adult is to locate the pregenital disc-pores or the vulva (more difficult). Usually on adult females, other pores such as the dorsal macropores are obvious and the ventral tubular ducts, when present, are more numerous than on younger instars. When most female stages are available, the difference in size of the anal plates and/or the clypeolabral shield makes instar identification reasonably easy (see key to stages, p. 21).

The female life cycle may have either two or three moults after the 1st-instar. Most indigenous species have three nymphal stages before the last moult; the third nymphal stage is sometimes very brief and so it is possible that a third instar is more widespread than records suggest.

With few exceptions, New Zealand native plants are predominantly evergreen (e.g., Wardle 1991, p. 39) and there are few records of coccids from the deciduous native trees. Amongst the evergreens recorded as hosts for scale insects in New Zealand are *Hedycarya arborea*, *Griselinia* spp., *Mida salicifolia*, *Myrsine australis*, *Pseudopanax* spp., and *Schefflera digitata*. The leaves of these lowland broadleaf trees may not senesce for several years, although individual leaves may be shed at any time of the year. Thus, a scale insect species with an annual life cycle can reliably overwinter on the previous summer's (old) leaves. In some univoltine species, e.g., *Ctenochiton paraviridis* and *C. viridis*, it is the 2nd-instar nymphs that overwinter; in this case, the female nymphs migrate in the spring from the old leaves and resettle on the new, fast growing shoots, where the rising sap supplies nutrients for rapid growth to maturity. Other univoltine species overwinter as the immature adult female on the leaves (e.g., *Aphenochiton subtilis*) or on the stems (e.g., *Plumichiton pollicinus*), whilst others, such as *Aphenochiton pubens*, are mature and reproduce on leaves from late winter. Sessile male nymphs remain on the old leaves and adult males emerge from there.

In the male, the crawler and the 2nd-instar nymphs are the only feeding stages. The test is usually glued to the plant surface, apparently by waxes secreted from a submarginal band of tubular ducts, the presence of which can separate most 2nd-instar males from 2nd-instar females. In all known male New Zealand 2nd-instar nymphs, there are also two groups of tubular ducts on the dorsum on about the 4th abdominal segment. These ducts secrete a type of wax that appears to act as the hinge for the posterior test plate, so that it can be raised during the emergence of the adult males. The 2nd-instar males moult into an elongate prepupal stage that shows the first signs of wing-buds, dorsal and ventral eyes, and a penial sheath; they lack functional mouthparts. The pupa is similar but the legs and wing-buds are better developed and the penial sheath is longer. The adult male remains beneath the male test for several days until fully developed and the long wax caudal filaments have been secreted (not present in all species), when it emerges backwards, and then actively flies looking for females. As it has no functional mouthparts, its life is rather short, usually only a few days. It is likely that some species of soft scale lack males completely and are therefore parthenogenetic; for example, those of *Poropeza*, where the adult females are hidden beneath the bark of the host trees.

The adult females of all soft scales have functional mouthparts and feed on sap from the phloem. Before the development of their ovaries, young adult females are only about the size of the last nymphal stage (Fig. 121 under *Lecanochiton*). They then undergo a very considerable increase in size, generally at least two to three times their post-moult size, although this may be as much as ten times for species of *Ctenochiton* and *Poropeza*. Once this swelling period is complete, the females are ready to reproduce. In many species (such as those in the genus *Lecanochiton*), the venter develops a distinct concavity to form a brood chamber. In species of *Lecanochiton*, the vulva is towards the middle of the abdomen, so that the eggs can be deposited directly into the chamber. In some of the other New Zealand species, such as those in the genera *Kalasiris* and *Pounamococcus*, the posterior half of the glassy test is used as the brood chamber, the adult female shrinking into the anterior half of the test as she oviposits; in these species the vulva is close to the anogenital fold at the posterior end of the abdomen. Quite a lot of species appear to contain fully developed nymphs and, therefore, are either viviparous or ovoviviparous (see Tremblay, 1997).

In the adventive *Pulvinaria* species, the ventral tubular ducts, of which there are three or four types, secrete a long white ovisac from beneath the venter (Figs C84, C85, C87). The eggs are then laid within this.

Distribution and host-plant associations. Fourteen cosmopolitan species of soft scale insects are established in New Zealand. Most of these adventive soft scales can be found in citrus orchards as well as on other host plants. The species found on citrus include the three *Ceroplastes* species in New Zealand—*C. ceriferus* (Fabricius), *C. destructor* Newstead, and *C. sinensis* Del Guercio—which are restricted to the warmer areas, generally from Northland to Gisborne, and two species of *Coccus*, two species of *Saissetia*, and one *Parasaissetia* species. The species not recorded from citrus are *Parthenolecanium corni* (Bouché) and the four *Pulvinaria* species recorded in New Zealand: *P. floccifera* (Westwood), *P. hydrangeae* Steinweden, *P. mesembryanthemi* (Vallot), and *P. vitis* (Linnaeus).

In New Zealand, the most common and widespread of the adventive soft scales is *Coccus hesperidum* Linnaeus; it has been found on the Kermadec Islands to the north and Chatham Islands to the south-east, as well as throughout most of the North and South Islands. *C. hesperidum* is mainly a pest of ornamentals, both outdoors and indoors, and it also occurs in nearly all types of fruit orchards—records are from a total of 35 exotic plant species and from 22 species of native plants. Both of the *Saissetia* species in New Zealand are also common and widespread; *S. oleae* (Olivier) is recorded from 21 exotic and 23 native plant species while *S. coffeae* (Walker) is recorded from 18 exotic and 14 native plant species.

Altogether 6 species of adventive soft scales have been found on indigenous native plants as well as exotic plants, although only two, *C. hesperidum* and *S. coffeae*, have been recorded from within native forests; the other four species, *Ceroplastes sinensis, Coccus longulus* (Douglas), *Saissetia oleae*, and *Parthenolecanium corni* were either recorded from garden natives, at forest margins that had been disturbed by human influence, or open natural ecosystems, e.g., on mangroves and bracken. A seventh species, *Pulvinaria mesembryanthemi*, is found on ice plants that may be considered native but not indigenous. The other 7 species have not been recorded from native plants and are generally of minor significance on exotic plants.

In regard to distribution, all endemic species currently known from New Zealand belong to genera that are here considered to be entirely endemic. Even the genera *Ctenochiton* and *Inglisia* (which contain species described from elsewhere) are considered here to be endemic, so that the non-New Zealand species will need to be reassigned to other genera. This applies even to the Australian species, which might have been expected to be closely related. This strong endemism is also emphasised by the host plants of the New Zealand soft scale fauna, as almost no endemic coccids have been recorded from the many introduced plant species (even in the case of the one exception, the collector noted that it was close to its normal host). As some of the endemic species appear to be fairly polyphagous, this is surprising.

There appears to be no distinct pattern of relationships among the endemic soft scale species and their associated host plant species. The degree of polyphagy ranges from the high of *Ctenochiton paraviridis* n.sp., *Epelidochiton piperis* (Maskell), and *Plumichiton flavus* (Maskell) with 15, 16, and 15 host plant species respectively (in 12–14 plant genera and 11–13 plant families) to lows of 2 or 3 host plant species (e.g., *Aphenochiton pronus* n.sp. and *Plumichiton diadema* n.sp.). Another polyphagous species is *Kalasiris perforata* (Maskell) with 18 host plant species including 6 *Coprosma* and 6 *Pittosporum* species. Of the 17 endemic coccid species that have between 4 and 18 associated species of plant hosts, (in 4 to 14 plant genera), *Poropeza dacrydii* (Maskell) is the only one restricted to a single plant family, the Podocarpaceae (see Appendix B).

The number of endemic soft scale species recorded from particular host-plant species is equally diverse, and in this case *Hedycarya arborea* is by far the most favoured of the host plants, with 11 endemic coccid species in 9 genera (and no adventive coccid species) recorded from it. *Coprosma* spp., *Pittosporum* spp., and *Podocarpus totara* have respectively 9, 7, and 6 coccid endemics recorded from them (see Appendix A).

Amongst some endemic soft scale genera that have become associated with closely related or single plant genera, the most obvious are *Lecanochiton*, restricted to the plant genus *Metrosideros*, and the adult females of *Poropeza*, restricted to closely related genera in Podocarpaceae. A group of three species *Crystallotesta leptospermi* (Maskell), *C. ornatella* n.sp., and *Plumichiton pollicinus* n.sp. are in effect monophagous on the closely related *Kunzea ericoides* and *Leptospermum scoparium*. Other monophage examples for which there are fairly extensive records are *Crystallotesta fagi* (Maskell) and *Crystallotesta neofagi* n.sp. recorded from *Nothofagus*; *Aphenochiton kamahi* n.sp. from *Weinmannia*; *Plumichiton nikau* n.sp. from *Rhopalostylis sapida*, and *Pounamococcus cuneatus* Henderson & Hodgson from ferns (*Blechnum fraseri* in particular).

Some distribution patterns for endemic soft scales can appear disjunct, e.g., *Aphenochiton subtilis* n.sp with localities recorded from the Three Kings Islands and the northern half of the North Island, then Fiordland and Southland (map 9), and *Kalasiris depressa* (Maskell) also with widely separated recorded localities from Northland to Fiordland (map 22). The seemingly haphazard nature of plant associations with insects in New Zealand was noted by Dugdale (1975), and may have evolved over the past millions of years in response to the sometimes violent reversals in both the climate and the shape and extent of the landmass since the Cretaceous. In reality, man has probably induced many of the relic populations of scale insects over the last approximate 150 years, with the huge loss in indigenous forest cover when much of New Zealand was cleared for farming by European settlers (see Miller, 1925, for maps showing total area of indigenous forest in 1840 and in 1924). Thus, the survival of remnant forest patches may have a greater bearing on the modern distribution of indigenous soft scales than past geologic or tectonic events.

Some of the plant-host genera on which the endemic soft scales are known have a much wider geographic distribution. For instance, *Dracophyllum* is also known from Australia and New Caledonia; *Leptospermum* is known from Australia, Malaya, and New Caledonia; *Nothofagus* is known from Australia, New Caledonia, New Guinea, and temperate South America, and yet the New Zealand coccid genera, as understood in this revision, have not been found in these countries. There are a few records in the literature of indigenous species elsewhere in the world but these are here considered to be misidentifications (see under *Ctenochiton elongatus, Kalasiris perforata,* and *Plumichiton flavus*).

Like many other New Zealand Sternorrhyncha (Morales, 1991), the adult females of both species of *Poropeza* are cryptozoic, living hidden beneath the bark of their host trees, and may have an unusual life cycle associated with this habit, with the immature stages feeding on other plants (see under *Poropeza*) and probably reproducing parthenogenetically. Other species, despite living on the leaf, are extremely well camouflaged. Thus, most *Aphenochiton* species are very flat and are either a very similar green to that of the leaf or are more or less transparent — the light reflected off the glassy test being the main clue to their presence (Figs C32–C36).

Most leaf-living species are found on the lower leaf surface, but *Lecanochiton scutellaris, Plumichiton diadema, P. pollicinus, P. punctatus,* and *Pounamococcus tubulus* all settle on the upper surface. With regard to *Pounamococcus tubulus*, we have postulated (Hodgson & Henderson, 1998) that this is a mechanism for remaining clean of sooty mould and debris in an area of very high rainfall. In these areas, the lower leaf surfaces of the host plants of *P. tubulus* acquire a thick burden of other invertebrates, lichens, fungi, and detritus that could smother this insect, while the upper surfaces are maintained clean and shiny by the almost daily washing, which also removes the honeydew. The former four species inhabit less extreme climates and are either heavily sclerotised (*L. scutellaris*), or have very thick tests (the *Plumichiton* species).

Parasites and predators. Birds have been observed feeding on soft scales in the native forest, e.g., the kokako (*Callaeas cinerea*) was recorded feeding on the large *Ctenochiton* species known as 'sixpenny scales' (Leathwick *et al.*, 1983). Hudson (1891) noted an instance of control of *Coccus hesperidum* (as *Lecanium hispidum*) by a species of *Rhizobius* (Coccinellidae) and Koebele (1893) mentioned the coccinellid beetle *Harmonia antipida* (White, 1846) as a predator of *Ctenochiton viridis*. Predatory mites and Cecidomyiidae have not been recorded feeding on indigenous soft scale species, however, the following have been recorded attacking the introduced *Ceroplastes destructor*: the mite *Tyrophagus perniciosus*, which is thought to prey on the eggs (Lo, 1995); the steel-blue ladybird (*Halmus (=Orcus) chalybeus*) which is considered to be a useful biocontrol agent in citrus orchards in Northland (Lo *et al.*, 1992; Lo & Blank, 1992) and a cecidomyiid belonging to the genus *Trisopsis* (Crosby, 1986). Indigenous species are commonly attacked by entomogenous fungi; indeed, Hosking & Kershaw (1985, p. 208) noted that "the collapse of the epidemic [of *Crystallotesta fagi*] appeared to be caused by an entomogenous fungus, probably *Hypocrella duplex*". Three species of parasitic fungi are currently known (see list below) but there are probably more species still to be identified that attack coccids in New Zealand. The list of hymenopterous parasites so far identified (see Appendix C; Valentine & Walker, 1991) is also probably very incomplete and again many more species remain to be discovered. Most instances of parasitism are observed by the round exit hole in tests, and thus parasitoids are seldom reared through for identification. The number of parasitoids emerging from a scale appears to be partly related to the size of the scale, with many larvae contained in large-bodied soft scales such as *Ctenochiton paraviridis* (Fig. C56) and with only 1–2 from small scales, such as male nymphs. As a defence against parasitism, coccids are often able to encapsulate the invading parasitoid eggs, thus preventing their development (see Blumberg, 1997); in mounted specimens, examples of encapsulation are frequently seen as brown, stalked oval bodies, usually near the margin.

Entomogenous fungi. 1. "Brown blobs": *Aegerita webberi* H.S. Fawc. (Fig. C69): particularly infesting *Ctenochiton paraviridis*, probably during the early nymphal stages; when completely infested, there is no remaining evidence of the scale insect (see Myers (1928)). 2. "Orange puffs": *Hypocrella duplex* (Berk.) Petch (Fig. C70): bright orange. Commonly infesting *Aphenochiton kamahi, Plumichiton flavus,* and *P. nikau*. In early infestations, the scale insect's shape and patterns are visible; in older infestations, the insects become puffed up, either at one end or all over, with a softer, yellow centre on top, sometimes exuding a ribbon-like part.

3. "White fungus": *Verticillium lecanii* (Zimm.) Viégas (Fig. C71): commonly seen on adult female coccids, particularly *C. paraviridis*, where body outlines remain visible. Note: *Verticillium* has a looser texture than the other two fungal species — the mycelium strands have whorls of small branches with spores on their tips, which shine under the light of a binocular microscope.

Parasitoids. All the adventive coccid species are parasitised by non-native hymenopterous parasitoids, and only one of these parasitoid species has also been recorded from an indigenous soft scale, namely *Euxanthellus philippiae* (Hymenoptera: Aphelinidae) from *Kalasiris perforata* (as *Ctenochiton perforatus*). Otherwise the parasitoids recorded from indigenous species are all endemic hymenopterous species. A full list is given in Appendix C.

See Hill (1989) and Morales (1989) for discussion of parasitoids introduced to New Zealand for biological control of *Coccus hesperidum* and *Saissetia oleae*.

ECONOMIC IMPORTANCE

It seems that none of the indigenous soft scales are economically important. They produce much less honeydew than the Margarodidae and are, therefore, less important both in terms of providing honeydew as a food source (that from Margarodidae supports not only native birds, geckos, and insects but also honey bees and the recently adventive European wasps) and as a substrate for sooty moulds. *Crystallotesta* [as *Inglisia*] *fagi* was blamed for the death of red beech trees (*Nothofagus fusca*) in an outbreak in the Maruia Valley, South Island, between 1976 and 1978 but there is little direct evidence, and Hosking & Kershaw (1985) considered that the trees had been stressed by several years of drought and that this could have accounted for the higher scale populations. Hoy (1958) studied the scale insects on rata (*Metrosideros*) and kamahi (*Weinmannia*) in an attempt to find the causes of reported large areas of die-back in these forest trees. As well as species belonging to other scale insect families, he found *Lecanochiton metrosideri* and *L. minor* on rata, and *Plumichiton* [as *Ctenochiton*] *flavus* on kamahi; he concluded that there was no indication that these coccids occurred in high enough numbers to have an adverse effect. It is relatively unlikely that any of the indigenous species will become an economic pest as they appear to be well adapted to their hosts, on which it is likely that they evolved. As they do not appear readily to accept any of the introduced plants, including all current commercial crops, it is also unlikely that they will move onto these plants. For the same reasons, it would appear that they do not have great potential as pests outside New Zealand, other than on closely related host species or genera.

However, a number of other coccids were known from New Zealand from about the time of Maskell. As these are all geographically widespread, cosmopolitan species, it is assumed that all are adventive (i.e., have been accidentally introduced from outside), and it is likely that most of them came with plants introduced by the early European settlers. Fourteen species have been definitely recorded plus two others that were apparently misidentified and, as there are no voucher specimens available, their possible earlier presence cannot be confirmed. The species that are currently of some importance are: *Ceroplastes destructor* and, to a lesser extent *C. sinensis*, both of which are serious pests of citrus in both of the major citrus orchard areas of Kerikeri (Northland) and Gisborne (D. Steven pers.comm.); *C. sinensis* also is a pest on feijoa (*Feijoa sellowiana*). *Coccus hesperidum* is a serious pest on ornamental plants, shrubs and ferns, both those grown indoors and outdoors, and can cause death when the infestations are heavy (D. Steven, pers. comm.); *C. hesperidum* also is found in low density populations on a wide range of introduced perennials, shrubs, and trees including *Pinus radiata* and *Prunus* spp., and has been recorded on about 20 indigenous plant species as well as on subtropical crops such as citrus, avocado (*Persea americana*), and tamarillo (*Cyphomandra betacea*). *Parthenolecanium corni* occurs at low levels in Central Otago stonefruit orchards, especially unsprayed orchards, and in particular on apricots (*Prunus armeniaca*) and plums (*Prunus* spp.) (G. McLaren, pers. comm.). *Pulvinaria floccifera* has been recorded on an experimental tea (*Camellia sinensis*) crop in Nelson, as well as on ornamental camellias. *Pulvinaria vitis* occurs in sporadic outbreaks on apricots in Central Otago orchards, records being clustered around 1951–52, 1984–85, and (at present) in 1998–1999. *Pulvinaria vitis* has also been recorded on grapevines (*Vitis vinifera*) and, although not a serious pest by itself, has been shown to transmit viruses associated with grapevine leafroll closterovirus disease (Belli *et al.*, 1994). Other coccids recorded in low numbers on grapevines are *Coccus hesperidum, Parthenolecanium corni, P. persicae, Saissetia coffeae,* and *S. oleae*. *Saissetia coffeae* is a minor pest of indoor plants and outdoor ornamental shrubs in the warmer north (e.g., Auckland) but has also been found in remnant native forest on indigenous plants including ferns; *S. oleae* is a pest of citrus in the Gisborne orchard area (D. Steven, pers. comm.); both *Saissetia* species have been found on indigenous trees in native bush margins near human habitation. Soft scales are seldom found on kiwifruit (*Actinidia deliciosa*), although *Ceroplastes destructor*, *Coccus hesperidum*, and *Saissetia oleae*, each a primary association, are recorded in the Plant Pest Information Network (PPIN) Database.

COLLECTING AND MOUNTING METHODS

While many species of soft scale insects cannot be identified by looking at either their general live appearance, their host plant, or their infestation site, this is not quite so true of most of the indigenous New Zealand coccids and it is hoped that the accompanying colour plates will help identify many of these species. However, the identity of even these and the majority of other species is best determined or checked by microscopic study of carefully processed, slide-mounted specimens.

Finding and collection. Soft scales may occur on any part of their host plants, from the roots to the fruit, but most often they are found on stems and the undersides of leaves. In other parts of the world, a collector may increase his chances of success by looking for intense ant activity, honeydew droplets, and/or sooty mould. In New Zealand, the only known association between an ant species and a coccid is that of the ant *Prolasius advena* with *Poropeza dacrydii* when the latter is under the bark of podocarp trees. While sooty mould can be an excellent indicator, again this is often less helpful than in other parts of the world due to the presence of large numbers of other honeydew producers, particularly margarodids and eriococcids.

Once found, the specimens need to be collected and stored either in 70–95% ethanol or as dried specimens. However, the latter method requires continuous dry storage thereafter, with careful protection from such 'museum pests' as dermestid beetles. All stages of the scale insect should be collected if possible, including the tests of 2nd-instar males and, if only a limited range of stages are available at first collection, it is worth revisiting the host plant at other times of the year to complete the range of stages, thus also gathering life-cycle data. It is important to identify the plant host and record the locality, date, and collector accurately.

Preservation and slide preparation. The following method has been used for the last few years for mounting the New Zealand coccids. If using dried specimens, first soak in 75% ethanol for 1–24 hours to soften. If mounting Ceroplastinae, it is advisable to first remove the thick wax test, by gently breaking it off and/or by soaking in the dewaxing solution (see 8 below).

1 Remove one or more specimens from the ethanol preservative and place in a small flat dish. Under the binocular microscope, make a small cut or slit in the side of the abdomen, avoiding damage to the legs. [Note: if separating the body into dorsum and venter for any reason, this is best done at this stage.]

2 Transfer the specimens to a heat resistant glass tube (small test tube) which has about 1cm depth of 95% ethanol; put a bung of cotton wool in the top and place the tube in a water bath (at about 90–95°C) and heat for 2 minutes.

3 Remove from heat and carefully tip the contents of the tube into a clean small dish; transfer the specimens to another small test tube with about 1cm depth of 10% KOH. Return to the water bath and heat for about 3–7 minutes, or until the specimens appear to be mostly cleared or until the body contents appear liquid (avoid boiling or overclearing at this stage).

4 Remove from heat, allow to cool slightly (to avoid the hot fumes of KOH affecting one's eyes when working at the microscope) and again tip contents into a small dish, such as a 5 cm petri-dish, to allow easy manipulation with bent pins or other flattened tools; gently pump and tease out the remaining body contents, including any eggs and/or unborn nymphs (sometimes it can be useful to have one specimen with unborn nymphs remaining inside, for confirmation of ovoviviparity or viviparity). [Note (i): the above maceration method is extremely difficult for very small specimens such as crawlers as they are easily lost after becoming transparent with heating in KOH. This method can still be used if there are many specimens as some will undoubtedly be retained but, alternatively, it may be best to macerate them in 10% KOH at room temperature for about 24 h instead. Note (ii): heavily sclerotised specimens may need extended maceration time; the limits for hot KOH may be <15 minutes, alternatively leave in KOH at room temperature for <several days. Note(iii): all the next stages of the method are in covered staining wells.]

4 Transfer to distilled water in a staining well for about 5–10 minutes. [Alternative staining method: if using acid fuchsin stain, add 1–2 drops of acetic-acid-alcohol, leave for a few minutes, then add 1–2 drops of stain (to the water etc.), leave for about 30 minutes or longer until the specimens are a good bright pink colour, then continue at point 6.]

5 Preferred staining method: transfer to McKenzie's stain in Essig's Solution (see below) from the distilled water (if NOT using acid fuchsin stain); leave for 30-60 minutes, either in a warming oven at 40°C or under a warm lamp (e.g., a 60 watt light bulb) on the lab bench. [Note: the

McKenzie's stain in Essig's Solution may be re-used many times (so long as you ensure that you remove all specimens each time!)]

6 Transfer specimens to a clean staining well with 75% ethanol, leave for about 5 minutes. If the specimen(s) are large and very full of stain, repeat this step to wash out excess stain.

7 Transfer as above to 95% ethanol, leave for about 5 minutes (= dehydration).

8 Transfer as above to a de-waxing mixture, made up fresh thus: mix (1:1) about 0.5ml xylene and 0.5ml absolute isopropanol (2-Propanol) (or, if isopropanol unavailable, 95–100% ethanol will do instead), leave for 2–10 minutes to clear any remaining wax; check under the microscope that all wax is gone and, if not, repeat this step, or gently knock off any waxy pieces adhering to the outer body with a pin.

9 Transfer as above to absolute isopropanol or absolute ethanol; leave for 10 minutes minimum (= washing and final dehydration). Repeat this step if specimens large.

10 Transfer as above to 1–3 drops of clove oil; leave for from 2 minutes up to 2 days (longer than this, the specimens may become brittle).

11 Slide mounting: take a clean glass slide and put a small drop of clove oil in the centre; transfer a specimen from the staining well of clove oil to the drop of oil on the slide; under the microscope arrange the specimen so that it is spread out straight; then, with a small piece of paper tissue, very carefully blot away the excess clove oil from the specimen, gently touching the sides only.

Add a very small drop of Canada balsam beside the specimen on the slide, just enough to cover the specimen with a thin film and then, with a pin, gently move the balsam over the specimen; this sticks it in place on the slide; it is very useful to do this when mounting a series of crawlers or nymphs in a row on one slide, as they should not move from their position after the coverslip is applied (see next step); write a code label or number on the slide and leave to set for a few minutes.

12 Add a large drop of Canada balsam by gently dropping on top of the specimen; with forceps, carefully place a clean cover slip on it, by lowering at one edge first; there should be enough Canada balsam to infill under the coverslip without unduly flattening the specimen, so that the dorsal and ventral surfaces are clearly separated; a generous amount of Canada balsam at this stage is particularly important for mounting adult males.

13 Store the slide flat in a drying oven at about 40°C for 2 weeks, or at room temperature for 6 weeks. The slide must be fully dried before storing on its side, but it may be taken out of the oven earlier if stored flat.

14 Add a printed label to each slide with full collection details. At NZAC, we use typed labels printed on a laser printer. The labels are cured on the sheet after printing, to anneal the flakes of ink, by heating in a small oven at 150–160°C for 1 minute.

Recipes:

1 Acetic-acid-alcohol:

ethanol, 95% —	50ml
distilled water —	45ml
glacial acetic acid —	20ml

2 McKenzie's Stain:
equal parts of acid fuchsin, erythrosin, and lignin pink, each made up into a 2% aqueous solution.

3 Essig's Solution (Essig's Aphid Fluid):

lactic acid (reagent grade 85%) —	20 parts
phenol (liquified) —	2 parts
glacial acetic acid —	4 parts
water, distilled —	1 part

Heat at 56–60°C for 30-60 minutes. Store in a brown bottle.

The suggested stock staining solution is made up of 30ml Essig's Solution with 60 drops of Mckenzie's stain added; this has a shelf life of several years under normal storage conditions.

Important. The slide-numbering system for Coccoidea operating in NZAC before 1992 used the Julian calendar to select the (accession) number, which represented the day on which the slide(s) were made, e.g.,10 April 1990 would be the 100th day of the year. If two or more unrelated samples were mounted that day, each sample was given a unique lower case letter, e.g., three slides of a mealybug sample might be all numbered #90-100a, and four slides of another sample from a different locality mounted the same day would be all #90-100b, and so on. A sample is defined as a unique collection of material in terms of species, host plant, locality, date, and collector. Thus, the number on the slide referred to the date on which the slides were made, and the lower case letter referred to the sample or collection data. A difficulty with this system compared with the system used now is highlighted by two slides of *Poropeza cologabata* n. sp. numbered #83-326c, but having no collection data, whereas a slide of *Poropeza dacrydii* (Maskell) is numbered #83-326f and has collection data from Fiordland. The assumption of shared collection data cannot be made about these slides, or other slides with the same accession number but with different lower case letters, if they were mounted at NZAC before 1992.

However, since 1992 the (accession) numbering system has been changed and slides with the same accession number, but with different lower case letters, are all from the same sample. The numbering now relates to the order in which samples are slide-mounted: the assigned number consists of a prefix with the year's last two digits (as before), followed by the sample number — simply in a running order starting with 001 at the beginning of any year, the next sample handled would be 002 and so on, regardless of the actual date collected. Thus, the first sample for 1998 was #98-001a–c (three slides were made) and a later sample was #98-021 (the twenty-first coccoid sample for 1998 and only one slide was made). The change was necessary to allow for databasing of records, with different instars or adult male/ females mounted on separate slides each requiring a unique code number, and also because much more material has been mounted since 1992.

CONVENTIONS

Depositories

BMNH The Natural History Museum, London, U.K.

CMNZ Canterbury Museum, Christchurch, N.Z.

FRNZ Forest Research, Rotorua, N.Z.

NZAC New Zealand Arthropod Collection, Auckland, N.Z.; [note: NZAC should be assumed where no depository is mentioned].

USNM United States National Museum of Natural History, Smithsonian Institution, Washington D.C., U.S.A.

Material studied. The data given under each species are those on the slide label, categorised under the area codes of Crosby *et al.* (1998), and arranged approximately from north to south in the New Zealand subregion. After the collection data, the depository is given if different from NZAC, followed by the number of slides and specimens studied, including their life stages, thus: "6/3 ♀♀ ad, 2 ♀ 3rd, 1 ♂ 2nd" indicates six slides with 3 adult females, two female 3rd-instars, and one male 2nd-instar.

Abbreviations used in collection data

asl — above sea level
cnr — corner
DSIR — Department of Scientific and Industrial Research
FP — Forest Park
FRI — Forest Research Institute
I — Island; Is — Islands
imm. — immature
km — kilometre(s)
L — Lake
lvs — leaves
m — metre(s)
Mt — Mount, Mountain
no./nos — number(s)
nr — near
NZFS — New Zealand Forest Service
Pt — Point
R — River
Ra — Range
Rd — Road
Res — Reserve
SF — State Forest
Stm — Stream
Stn — Station
Tk, tk — Track, track
V — Valley

Collectors. RCH = R.C. Henderson; W.M.M. = W.M. Maskell (all other collectors not abbreviated).

Illustrations. Text Fig. 1 is a cladogram from a cladistic study of coccid families. Fig. 2 shows the life stages of a typical indigenous coccid. Figs 3–7 are labelled for convenience, with Fig. 3 showing the structures most commonly noted on the indigenous species, whereas Fig. 4 also includes structures found only on some adventive species. Figs 5–7 show each of the main structures in more detail. The size of many structures are given in the text; details of how they were measured are shown in Fig. 7. Figs M8–M31 are Scanning Electron Micrographs showing detail of various structures. Figs C32–C95 are 64 colour photographs of females of most of the species described or discussed. Figs 96–155 are presented in the usual way for Coccoidea, with a central 'map' of the insect, the left half representing the dorsum and the right the venter, with the approximate number and position of most structures indicated by symbols in the body of the map. This central map is surrounded by vignettes showing some of the important features, enlarged as seen under phase-contrast. Phase-contrast emphasises differences in the degree of sclerotisation of a given structure and the appearance of the latter may be different using normal direct light (and even more so under the electron microscope!).

Geographic distribution maps for each indigenous species were prepared by plotting the latitude and longitude point for each collection site.

Key for preliminary separation of growth stage or instar in New Zealand species

1 Wings or wingbuds present; anal plates and mouthparts absent 2
—Wings or wingbuds absent; anal plates and mouthparts clearly present 4

2 Wings fully developed; body clearly divided into head, thorax, and abdomen; head with distinct eyes; antennae 10-segmented, bead-like and setose .... adult male
—Wings present as wingbuds; demarcation between head, thorax, and abdomen indistinct; eyes absent; antennae with indistinct segmentation and without setae 3

3 Wingbuds barely extending past metacoxae; length of leg segments subequal; prothoracic legs shorter than length of head; penial sheath lobe shorter than or about same length as lateral anal lobes .... prepupa
—Wingbuds clearly extending past metacoxae; coxae and trochanter significantly shorter than femur, tibia, and tarsus; prothoracic legs longer than length of head; penial sheath lobe clearly longer than lateral anal lobes .... pupa

4 Anal plates usually with one pair of apical setae longer than length of anal plates (all apical setae short in 1st-instar nymphs of *Lecanochiton actites* and some *Aphenochiton* spp.); claw and tarsal digitules all fine, with bases of tarsal digitules clearly offset .... 1st-instar nymph
—Apical setae on anal plates much less than half length of anal plates; one or more claw and/or tarsal digitules often broad; bases of tarsal digitules either not offset or only very slightly so 5

5 Ventral multilocular disc-pores present in anogenital area; dorsal macropores or preopercular pores present; claw digitules generally both broad .... adult female
—Ventral multilocular disc-pores almost never present posteriorly on abdomen; dorsal macropores or preopercular pores absent; claw digitules never both broad 6

6 Dorsal tubular ducts present in at least two groups medially on about 4th abdominal segment, and/or also in a reticulate pattern and/or marginally on venter, particularly on head and thorax. .... 2nd-instar male
—Dorsal tubular ducts absent; ventral tubular ducts, if present, in a different arrangement............................ ....2nd- or 3rd-instar females*

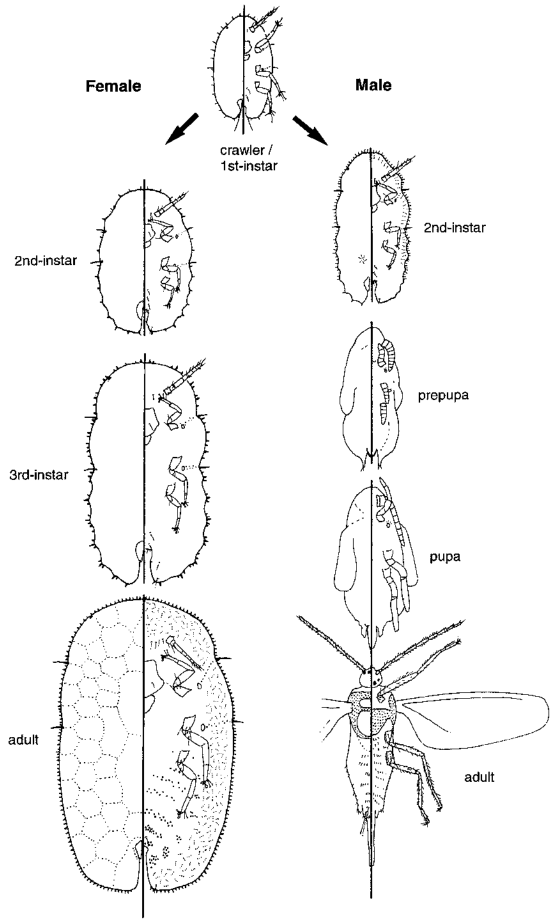


Fig. 2. Diagram showing the life stages of *Crystallotesta leptospermi* (Maskell). The left column shows the female stages and the right column the male stages. This species has three nymphal stages prior to the adult female.

[*Note: there appears to be no character for consistently separating the 2nd- and 3rd-instar female nymphs. One useful attribute is the proportional increase in size with growth. Thus, at least with indigenous species, if more than one stage is available (preferably including the 2nd-instar male and adult female), then the approximate proportional increase in the length of the anal plates of the different instars can be summarised as follows: 1st instar = 1; 2nd instar = 1.5; 3rd instar = 2 to 3, and adult female = 4 to 5. If the eyepiece graticule being used to measure the specimen is approximately calibrated to these ratios, then a quick measure is sufficient to identify the instar of the specimen in most cases, i.e. if the anal plates measure "2.5" then it is almost certainly a 3rd-instar female (as no males have anal plates that long). In addition, the 3rd-instar female tends to have more marginal spines and more abundant dorsal pores than the 2nd-instar female and the 3rd instar of a few species have multilocular disc-pores near the anal area].

SOFT SCALES OF NEW ZEALAND

Key to adult females

1 Adult females either without an apparent test or secreting a glassy wax test; dorsal setae never present; with either no stigmatic spines or only one in each stigmatic area (except several present on *Pounamococcus*); dorsal tubular ducts either absent (or in two diverging lines just anterior to anal plates on *P. cuneatus*); dorsal tubercles never present; tibio-tarsal articulatory sclerosis never present .... Group 1: Indigenous genera

—Adult females secreting a variety of tests: thick soft wax, woolly wax or just a thin colourless wax covering, but not a glassy test; dorsal setae present, usually fairly frequent; with three or more stigmatic spines per stigmatic area; tubular ducts occasionally present on dorsum; dorsal tubercles often present; tibio-tarsal articulatory scleroses usually present .... Group 2: Adventive (or exotic) genera

GROUP 1. INDIGENOUS GENERA

2 Marginal setae absent; true dorsum of mature adult significantly smaller than dorsal surface of insect, lateral margins composed of an expanded venter; legs absent; antennae much reduced .... (p. 130) ... ***Lecanochiton***

—Marginal setae present; dorsum always forming complete dorsal surface of insect (if dorsum slightly smaller than venter, then ventral surface lying in a leaf depression (*Ctenochiton* spp.)); legs present, usually well developed; antennae well developed 3

3 Each stigmatic cleft with more than one stigmatic spine; dorsal pores not forming a reticulate pattern; ventral tubular ducts restricted to medial and mediolateral areas of abdomen .... (p. 166) ... ***Pounamococcus***

—Each stigmatic area either lacking stigmatic spines, or with only one spine, or with stigmatic spines undifferentiated from margin spinose setae; dorsal pores forming a distinct reticulate pattern (except on *Inglisia patella* and *Poropeza cologabata*); ventral tubular ducts, when present, not restricted to medial and mediolateral areas of abdomen 4

4 Marginal setae spinose and of two distinctly different shapes, one type sharply spinose and other clubbed, the two types often alternating; posterior band of spiracular disc-pores absent; anal plates with about 6 spinose setae along each inner margin; ventral tubular ducts forming a distinct submarginal band one duct wide .... (p. 114) ... ***Inglisia***

—Characters not in this combination 5

5 Ventral tubular ducts absent (including *Ctenochiton viridis* in part) 6

—Ventral tubular ducts present (including *Ctenochiton viridis* in part) 8

Genera lacking ventral tubular ducts (5)

6 Body more or less pyriform, widest about 2nd or 3rd abdominal segment; mouthparts generally displaced to one side; ventral microducts most abundant medially on thorax and abdomen; pregenital disc-pores with mainly 8–10 loculi, distributed across all abdominal segments ....(p. 108) ... ***Ctenochiton viridis*** (in part - *ca*1/2 have 1–2 ventral tubular ducts)

—Body more or less oval, widest about metathorax; mouthparts rarely displaced to one side; other characters not in above combination 7

7 Each reticulation area on dorsum with a sclerotisation, small on young adults but complete on mature specimens; with a distinct anal sclerotisation on dorsum around anal plates; stigmatic spines, when present, only slightly larger than marginal spines .... (p. 111) ... ***Epelidochiton***

—Each reticulation area on dorsum without a sclerotisation; anal sclerotisation on dorsum around anal plates absent; stigmatic spines at least 1.5 × and generally 2–3 × length of marginal spines .... (p. 57) ... ***Aphenochiton***

Genera in which tubular ducts are present ventrally (5)

8 With a distinct band of ventral multilocular disc-pores around margin of body and along anal cleft margins; distinct anal sclerotisation present on dorsum around anal plates .... (p. 159) ... ***Poropeza***

—Multilocular disc-pores never forming a complete marginal band; anal sclerotisation absent 9

9 Pregenital disc-pores abundant and forming distinct bands medially across most or all abdominal segments 10

— Pregenital disc-pores not abundant, either restricted to groups on either side of ano-genital area or forming a line between anal cleft and posterior spiracles on medio-lateral lobes of abdominal segments 12

Genera in which the pregenital disc-pores are present medially across most abdominal segments (9)

10 Ventral tubular ducts, in addition to forming a broad submarginal band, also present medially on all thoracic segments, even if only near coxae .... (p. 79) ... ***Crystallotesta***

—Ventral tubular ducts present as a submarginal band or very sparsely scattered submarginally, never medially on all thoracic segments; sometimes with a group near mouthparts and procoxae 11

11 Ventral tubular ducts of two types, a distinctly different smaller type present on either side of anal plates and anterior end of anal cleft; normal ventral tubular ducts forming a dense band close to margin; anal plates without a broad sclerotised internal plate; mouthparts usually not displaced to one side (p. 119) ... ***Kalasiris***

—Ventral tubular ducts of one type (except a few degenerate ducts scattered on median abdomen on *C. chelyon*), not in above distribution; when present marginally or submarginally, not forming a dense band close to margin; anal plates each with an internal sclerotised plate; mouthparts often displaced to one side .... (p. 97) ... ***Ctenochiton***

Genera in which the pregenital disc-pores form distinct lines between the anal area and the posterior spiracles (9)

12 Dorsal macropores strongly conical, either 'cone-like' or 'bollard-like'; pregenital disc-pores with mainly 5–8 loculi; without a distinctly folded area along inner margins of anal plates; anal plate setae sharply spinose; with fewer than 15 marginal spinose setae laterally between stigmatic areas .... (p. 171) ... ***Umbonichiton***

—Dorsal macropores at most slightly convex; pregenital disc-pores with mainly 8–10 loculi (except *Plumichiton diadema*); each anal plate with a strongly folded area dorsally along their inner margins; anal plate setae rather spinose and often distinctly blunt; with more than 15 marginal spinose setae laterally between stigmatic clefts .... (p. 142) ... ***Plumichiton***

GROUP 2. ADVENTIVE GENERA IN NEW ZEALAND

1 Dorsum covered in a thick wax test; anal plates surrounded by and supported upon a heavily sclerotised caudal process or anal sclerotisation; stigmatic spines present in large groups in each stigmatic area, distinctly differentiated from marginal setae; dorsum with specialised uni-, bi-, and tri-locular pores of *Ceroplastes*-type, each with a long, inner, much divided, filamentous duct .... (p. 185)... ***Ceroplastes***

—Dorsum not covered in a thick wax test; if anal sclerotisation present, relatively small and usually poorly sclerotised; with only three stigmatic spines per stigmatic area; dorsal pores never of *Ceroplastes*-type, and only uni-locular 2

2 Pregenital disc-pores present medially on thorax and head as well as on abdomen; ventral tubular ducts more or less restricted to a submarginal ring, although a few may be present medially .... (p. 206) ... ***Parthenolecanium***

—Pregenital disc-pores restricted to abdominal segments and metathorax; ventral tubular ducts either absent, restricted to medial area of thorax, or almost as abundant medially on abdomen as submarginally .. 3

3 Mature adult female secreting a woolly or felted ovisac posteriorly from beneath abdomen; venter with 3 or 4 types of ventral tubular duct; ventral tubular ducts abundant medially on thorax and abdomen; dorsum with infrequent small tubular ducts .... (p. 212) ... ***Pulvinaria***

—Mature adult female not secreting a woolly or felted ovisac; venter with 0, 1, or 2 types of ventral tubular duct, never abundant both medially and submarginally on thorax and abdomen; tubular ducts usually absent from dorsum (but present submarginally on *Coccus hesperidum*) 4

4 Dorsum often convex at maturity and becoming heavily sclerotised, generally with dermal areolations; dorsal tubercles and pocket-like sclerotisations present; pregenital disc-pores often present on metathorax as well as abdomen .... (p. 205, 208)...***Parasaissetia & Saissetia***

—Dorsum usually not highly convex and generally not heavily sclerotised; without distinct dermal areolations; dorsal tubercles present but pocket-like sclerotisations absent; pregenital disc-pores almost restricted to abdominal segment VII .... (p. 195) ... ***Coccus***

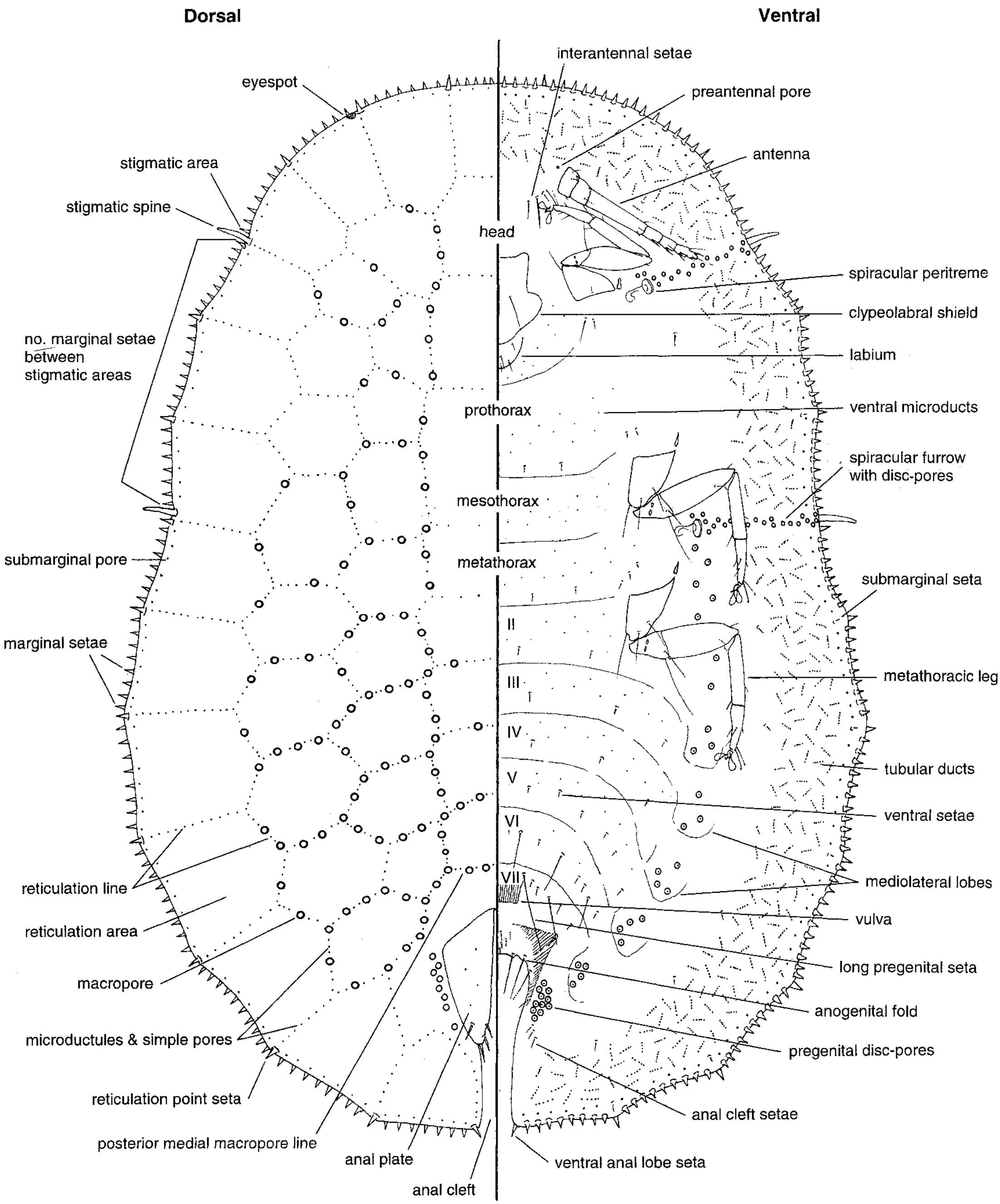


Fig. 3. Diagrammatic representation of an indigenous species, with left side showing dorsal structures and right side showing ventral structures.

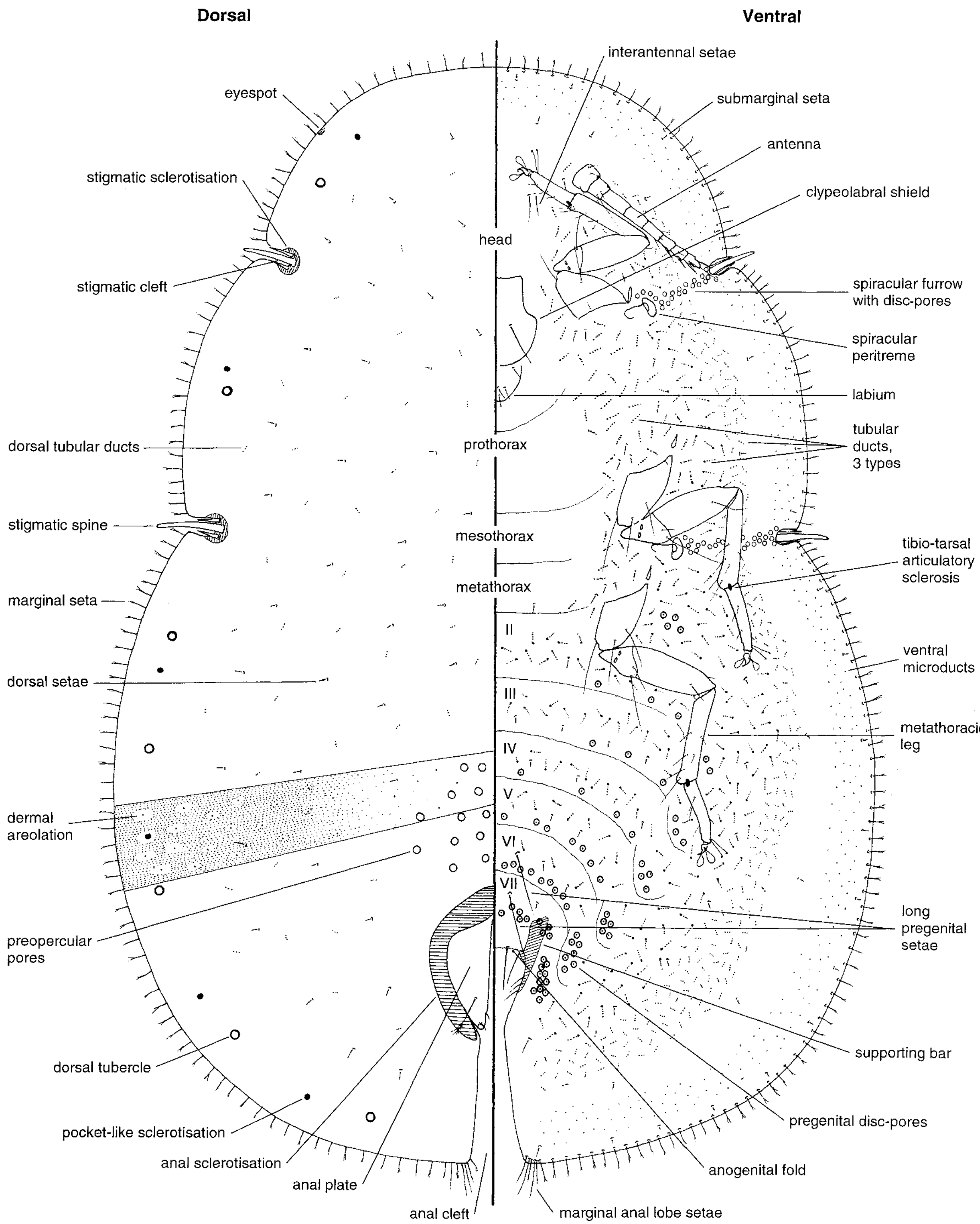


Fig. 4. Diagrammatic representation of an adventive species, with left side showing dorsal structures and right side showing ventral structures.

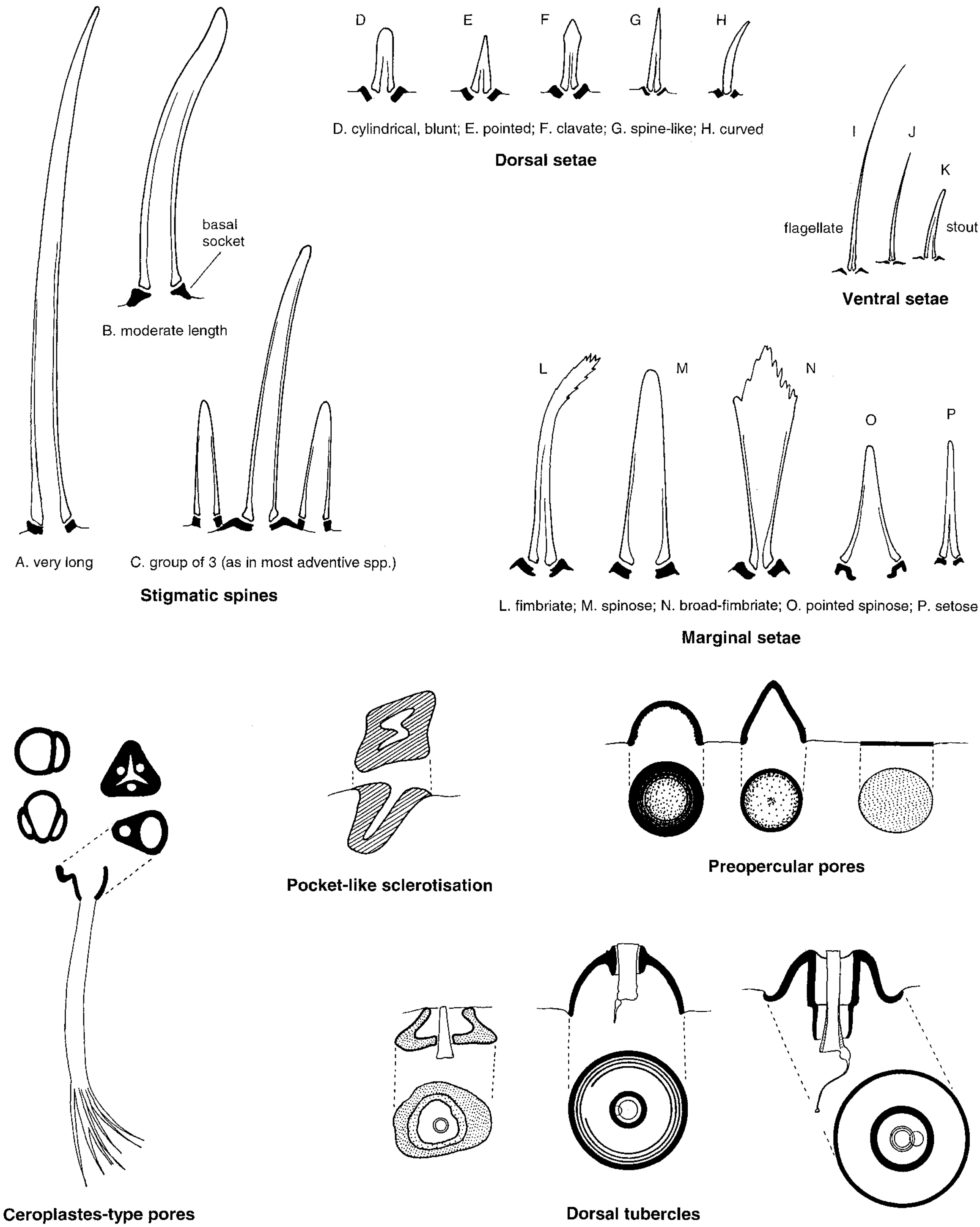


Fig. 5. Diagrammatic detail (vignettes) of setae and dorsal pores found on adventive species. Note: setal length was measured minus their basal sockets.

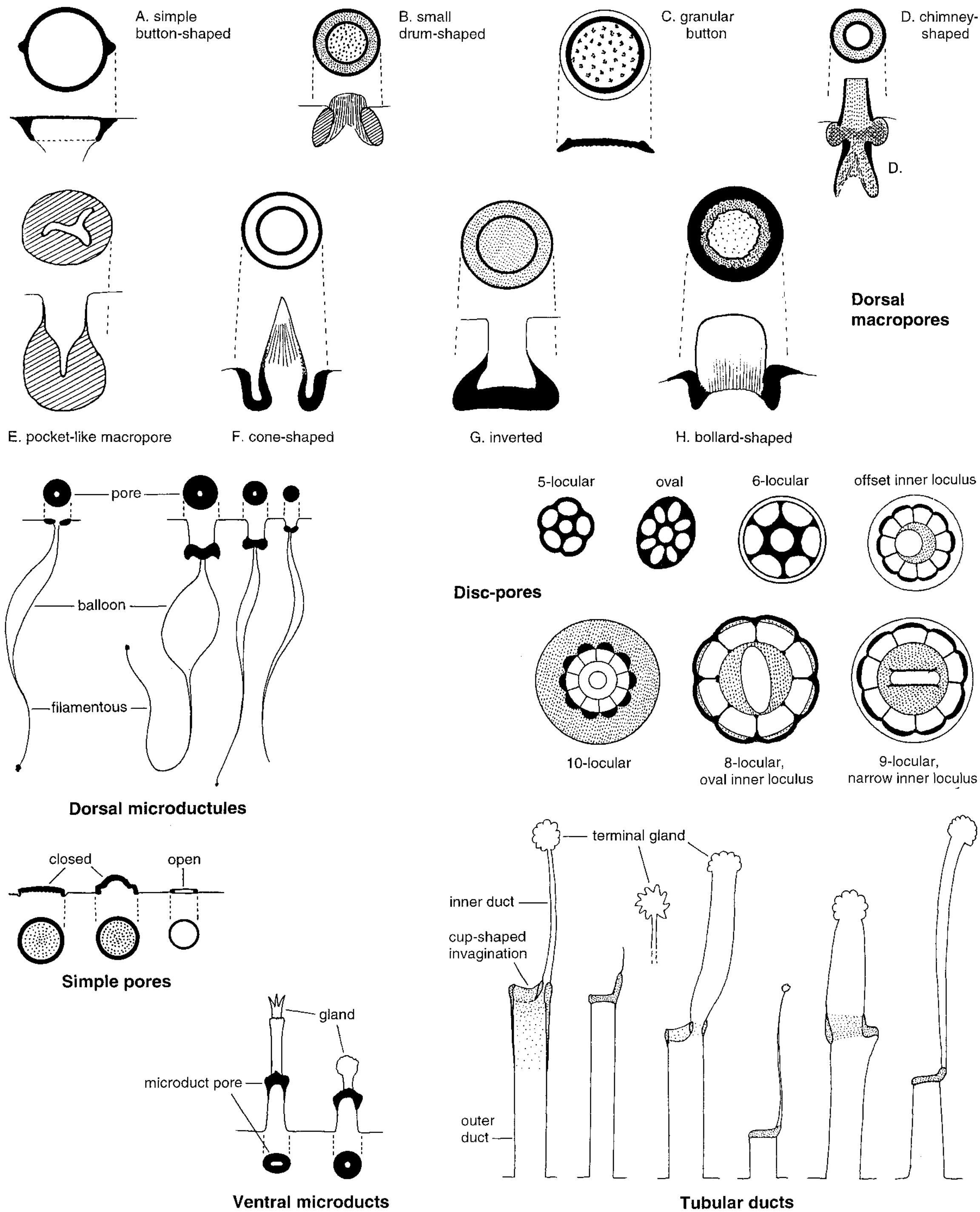


Fig. 6. Diagrammatic detail (vignettes) of dorsal macropores found on indigenous species, and of other dorsal and ventral pores and ducts. Note: ventral microducts have traditionally been drawn in an upright position; their orientation is reversed here to show that they open ventrally.

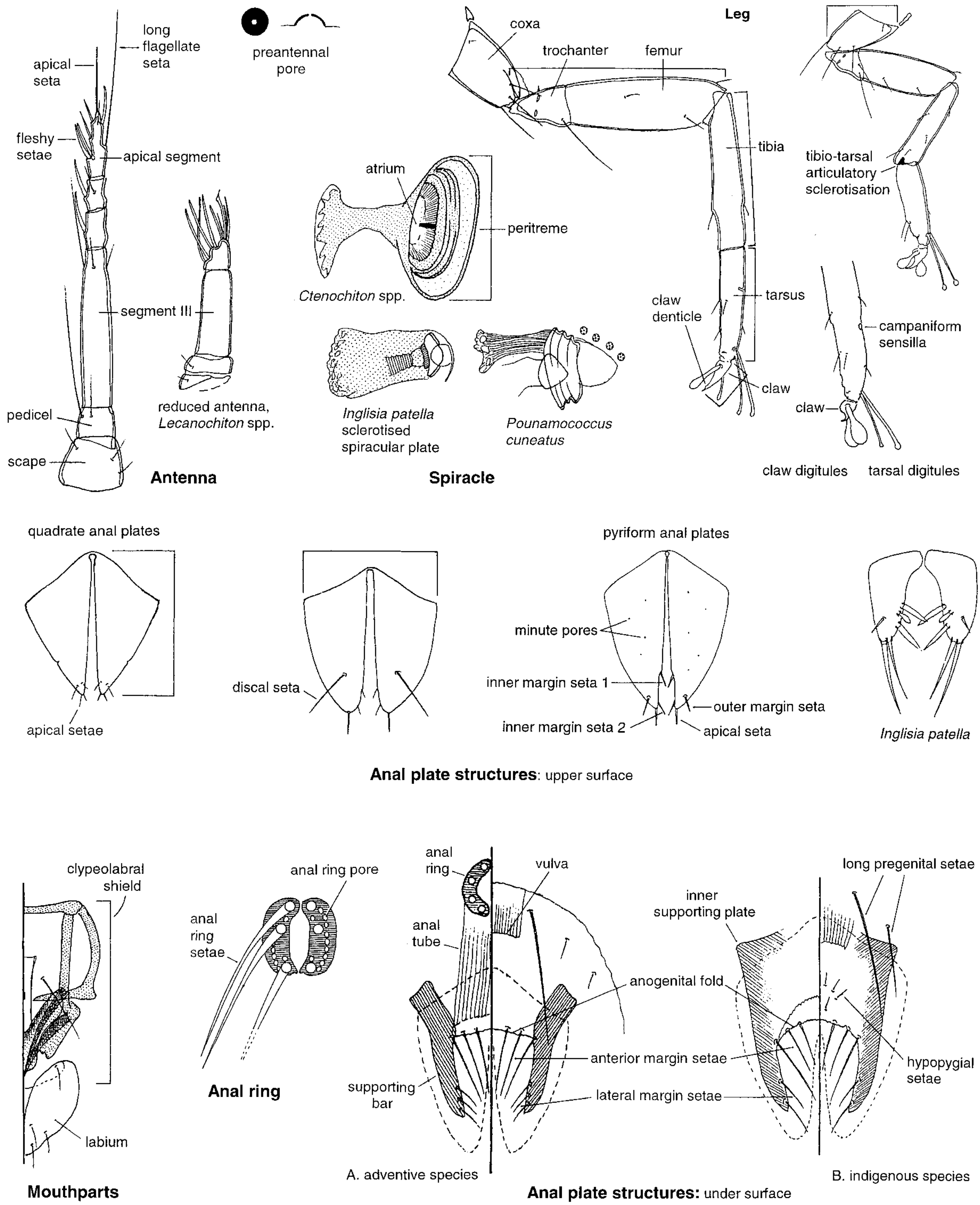
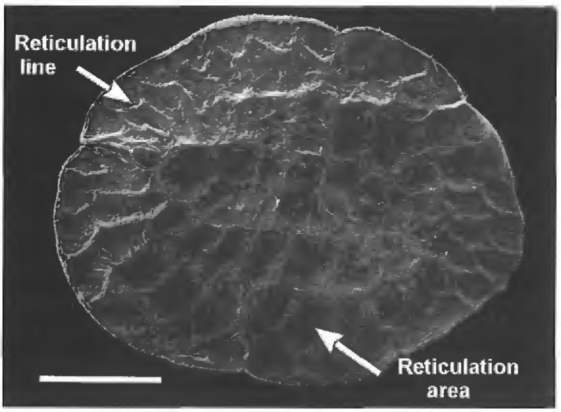
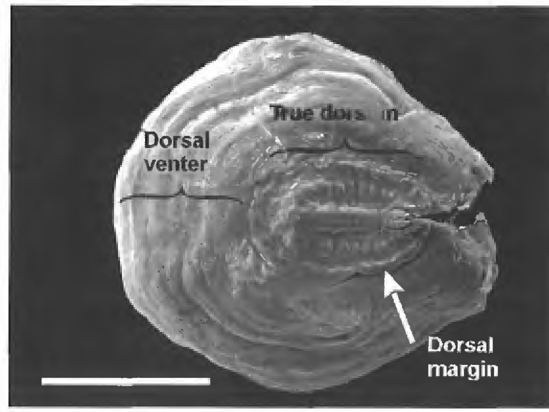


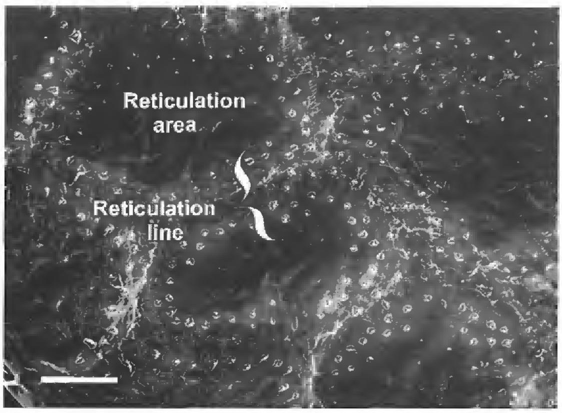
Fig.7. Diagrammatic detail (vignettes) of antenna, leg, spiracle, mouthparts, and anal plates. Bar lines indicate how length / breadth was measured for leg, spiracle, clypeolabral shield, and anal plates.



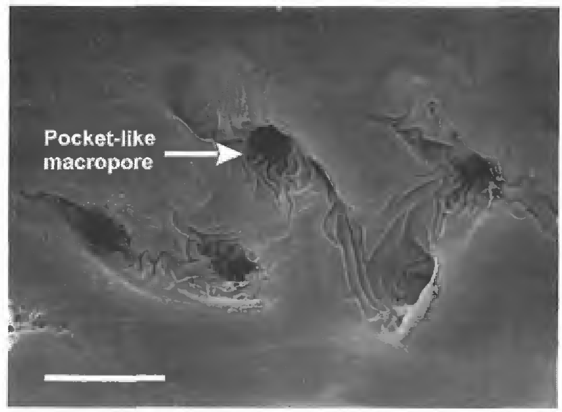
[M8] *Ctenochiton paraviridis*



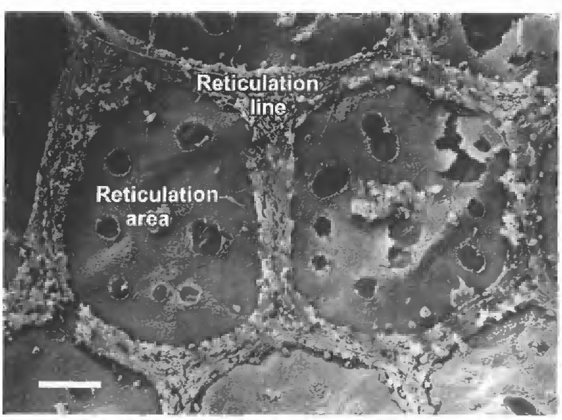
[M9] *Lecanochiton actites*



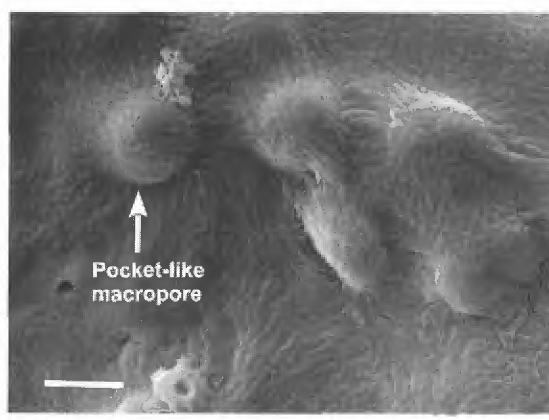
[M10] *Ctenochiton paraviridis*



[M11] *Lecanochiton actites*

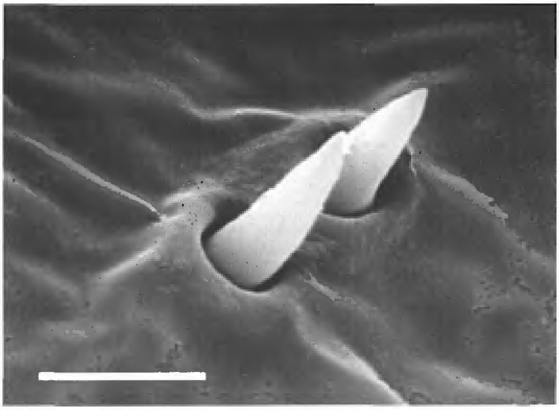


[M12] *Ctenochiton chelyon*

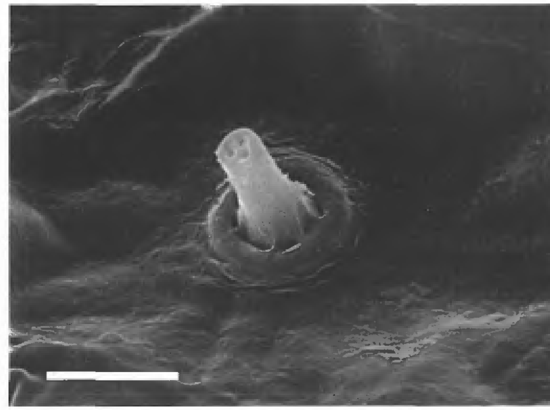


[M13] *Lecanochiton actites*

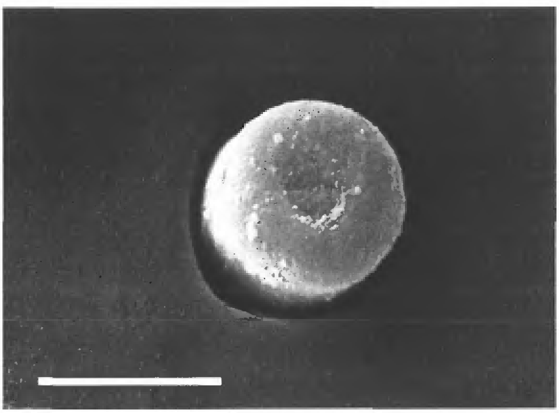
M8–31. Scanning electron micrographs (SEMs). **M8.** *Ctenochiton paraviridis*: dorsal view, reticulation pattern of lines of dorsal pores on ridges (scale bar = 1 mm). **M9.** *Lecanochiton actites*: dorsal view, true dorsum surrounded by part venter on dorsal surface (scale bar = 0.1 mm). **M10.** *Ctenochiton paraviridis*:dorsal view, several reticulation lines and areas (scale bar = 0.1 mm). **M11.** *Lecanochiton actites*: dorsal view, five "pocket-like macropores" (scale bar = 10 μm). **M12.** *Ctenochiton chelyon*: internal view of dorsum, glandular structures of dorsal pores in reticulation lines (scale bar = 0.1 mm). **M13.** *Lecanochiton actites*: internal view of dorsum, five "pocket-like macropores" (glandular structure not evident) (scale bar = 10 μm).



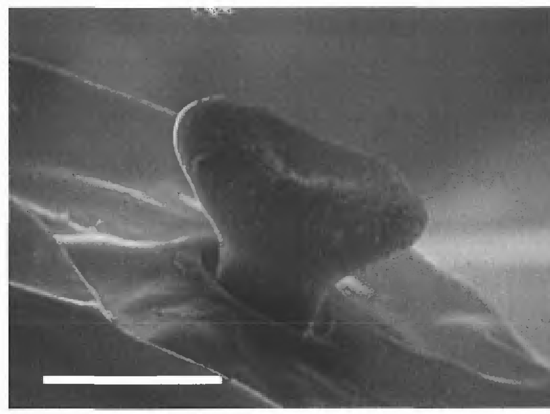
[M14] *Umbonichiton jubatus*



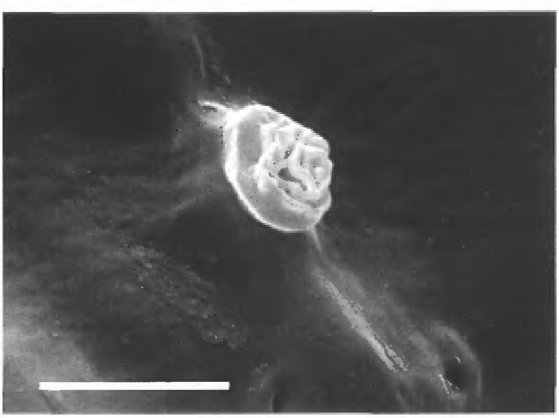
[M15] *Pounamococcus tubulus*



[M16] *Aphenochiton inconspicuus*



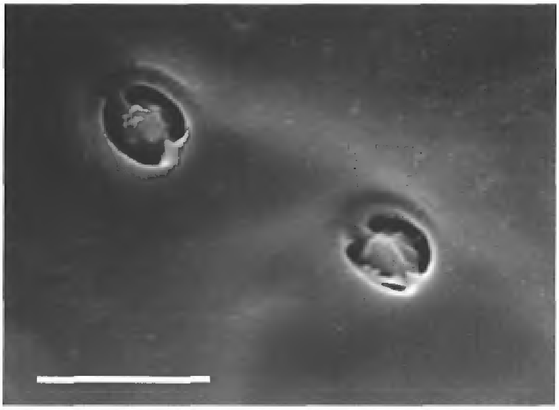
[M17] *Umbonichiton pellaspis*



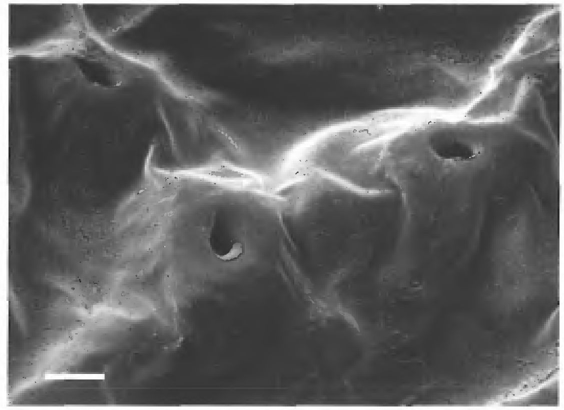
[M18] *Epelidochiton piperis*

[M19] *Crystallotesta ornata*

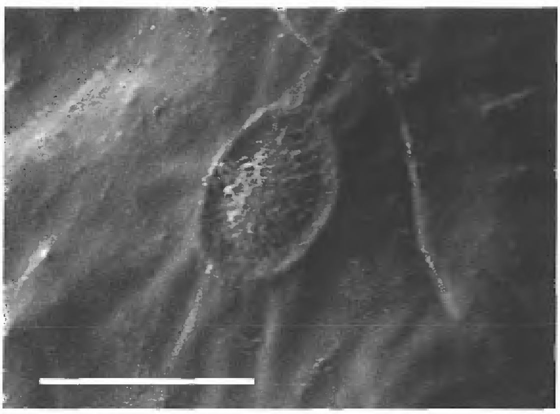
M14–M19. Dorsal views of macropores. **M14.** *Umbonichiton jubatus*: two cone-shaped macropores (scale bar = 5 μm). **M15.** *Pounamococcus tubulus*: chimney-shaped macropore (scale bar = 5 μm). **M16.** *Aphenochiton inconspicuus*: bollard-shaped macropore (scale bar = 5 μm). **M17.** *Umbonichiton pellaspis*: stalked, mushroom-shaped macropore (scale bar = 5 μm). **M18.** *Epelidochiton piperis*: outer part of flask-shaped macropore (scale bar = 5 μm). **M19.** *Crystallotesta ornata*: "pepper pot" macropore (scale bar = 5 μm).



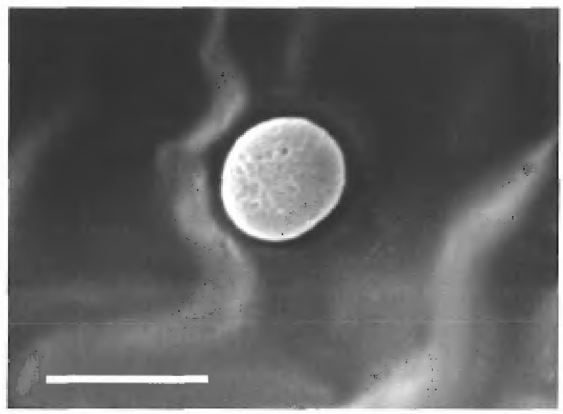
[M20] *Kalasiris perforata*



[M21] *Plumichiton pollicinus*

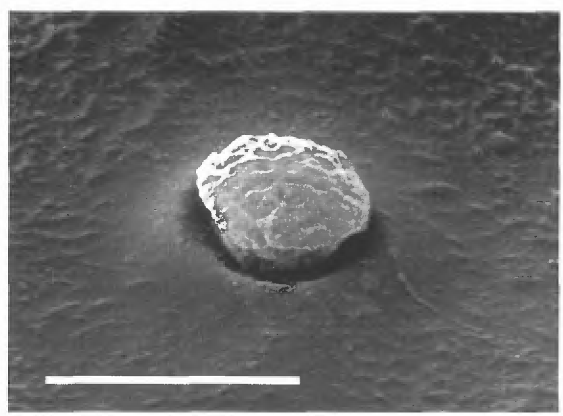


[M22] *Plumichiton diadema*



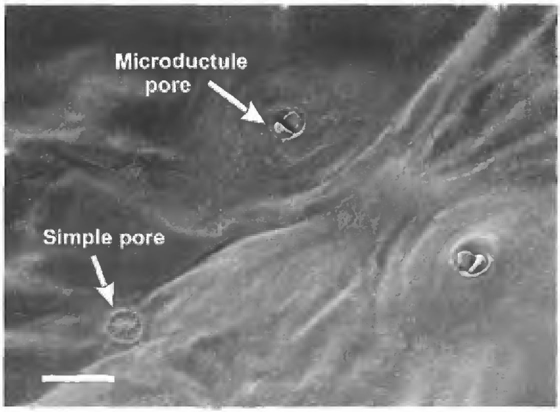
[M23] *Aphenochiton kamahi*

[M24] *Ctenochiton chelyon*

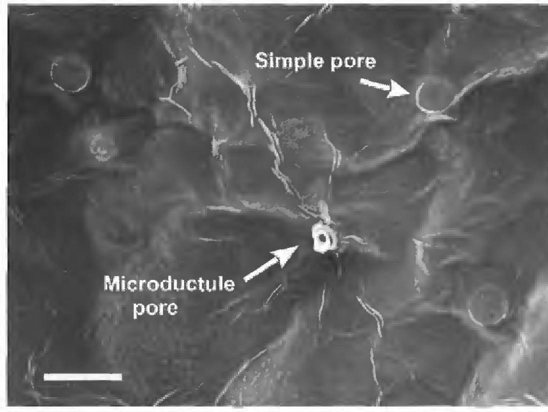


[M25] *Aphenochiton pubens*

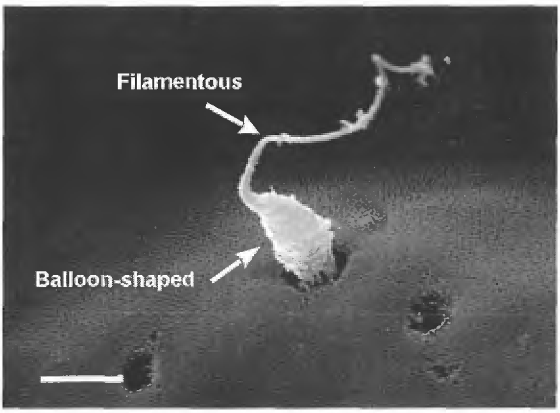
M20–M25. Dorsal views of macropores. **M20.** *Kalasiris perforata*: two bilocular macropores (scale bar = 5 μm). **M21.** *Plumichiton pollicinus*: the openings of three inverted, concave macropores (scale bar = 5 μm). **M22.** *Plumichiton diadema*: large, simple pore-type macropore (scale bar = 5 μm). **M23.** *Aphenochiton kamahi*: button-shaped macropore (scale bar = 5 μm). **M24.** *Ctenochiton chelyon*: granular, convex button-shaped macropore (scale bar = 5 μm). **M25.** *Aphenochiton pubens*: macropore, drum-shaped under light microscope (scale bar = 5 μm).



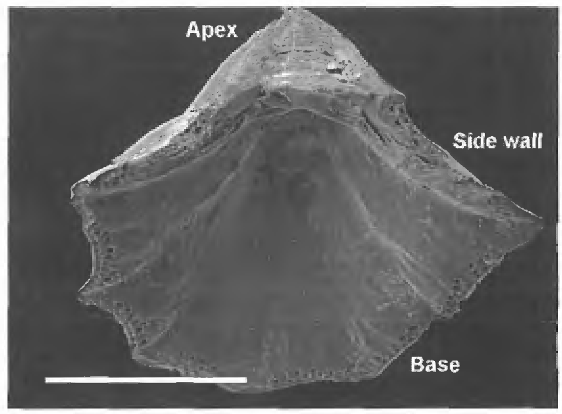
[M26] *Ctenochiton viridis*



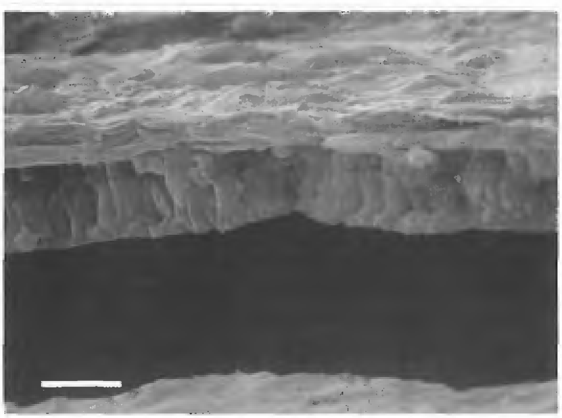
[M27] *Plumichiton flavus*



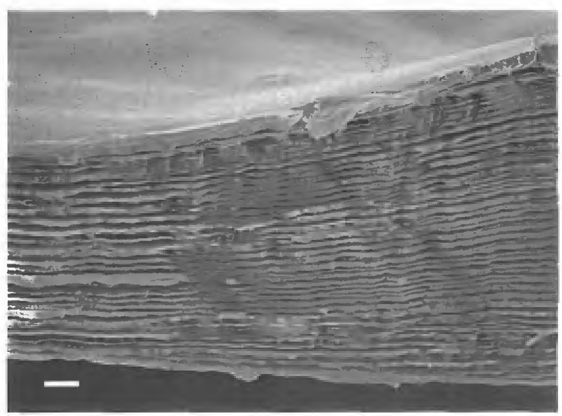
[M28] *Plumichiton flavus*



[M29] *Inglisia patella*



[M30] *Ctenochiton viridis*

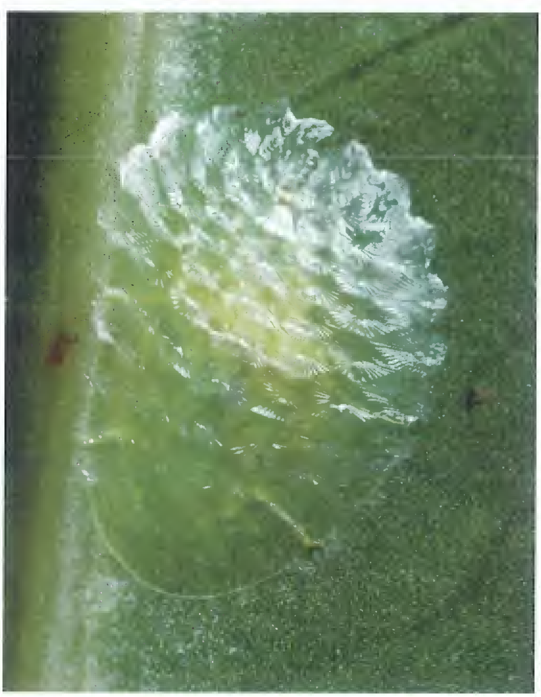


[M31] *Pounamococcus cuneatus*

M26. *Ctenochiton viridis*: dorsal view, one simple pore and two microductule pores (scale bar = 5 μm). **M27.** *Plumichiton flavus*: dorsal view, three simple pores and two microductule pores (scale bar = 5 μm). **M28.** *Plumichiton flavus*: dorsum internal view, microductule with balloon-shaped proximal tubule and filamentous distal tubule (scale bar = 5 μm). **M29.** *Inglisia patella*: cross section of wax test, internal view, half test cut away (scale bar = 0.5 mm). **M30.** *Ctenochiton viridis*: cross section of wax test, solid wax structure of a wax plate, uniform thickness (scale bar = 5 μm). **M31.** *Pounamococcus cuneatus*: cross section of test, layered structure of a small plate, thickest at one side (scale bar = 5 μm).

[C32] *Aphenochiton inconspicuus*, 2 ♀♀

[C33] *Aphenochiton kamahi*, ♀ with unborn nymphs visible



[C34] *Aphenochiton pubens*, ♀

[C35] *Aphenochiton subtilis*, ♀ [photo: M. Heffer]

[C36] *Aphenochiton pronus*, ♀♀ and empty ♂ test

[C37] *Ceroplastes destructor*, ♀♀ [photo: DSIR]

[C38] *Ceroplastes sinensis*, 2nd-instar numphs (white) & 3rd-instar nymphs (pink)

[C39] *Ceroplastes sinensis* adult, ♀♀

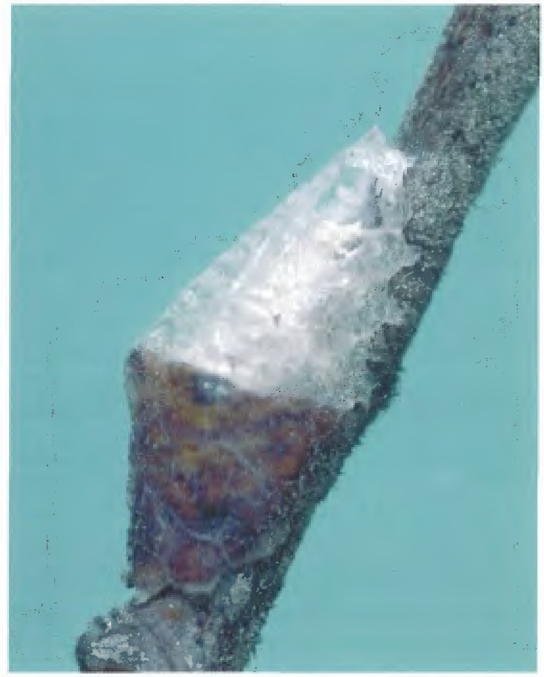
[C40] *Coccus hesperidum*, ♀♀ and nymphs, on leaf

[C41] *Coccus hesperidum*, ♀♀ and nymphs, on stem

[C42] *Coccus longulus*, ♀

[C43] *Crystallotesta fagi*, young ♀ [photo: DSIR]

[C44] *Crystallotesta fagi*, old ♀, shrunk to anterior of test (lower end) [photo: DSIR]



[C45] *Crystallotesta neofagi*, old ♀, folded into anterior half of test (lower end) [photo: DSIR]

[C46] *Crystallotesta leptospermi*, young ♀, (on left, mimics leaf scales on right)

[C47] *Crystallotesta leptospermi*, old ♀, shrunk to anterior of test [photo: M. Heffer]

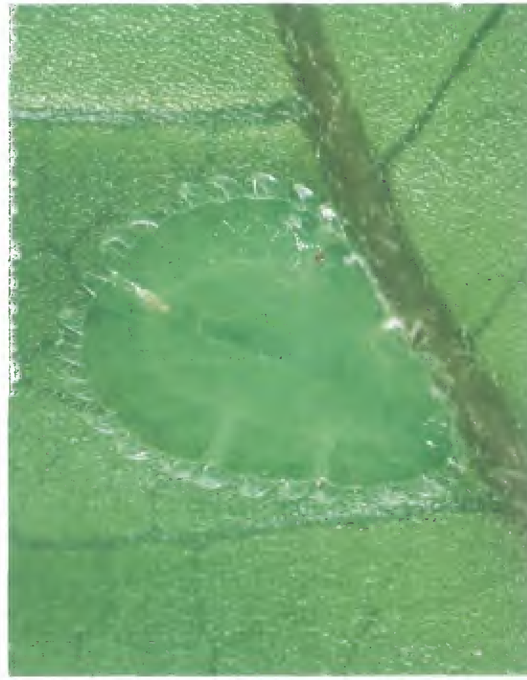
[C48] *Crystallotesta ornata*, young ♀

[C49] *Crystallotesta ornata*, mature ♀

[C50] *Crystallotesta ornatella*, young ♀

[C51] *Crystallotesta ornatella*, old ♀

[C52] *Ctenochiton chelyon,* 2 mature ♀♀ with crawlers



[C53] *Ctenochiton paraviridis,* young ♀ with wax fringe

[C54] *Ctenochiton paraviridis,* mature ♀

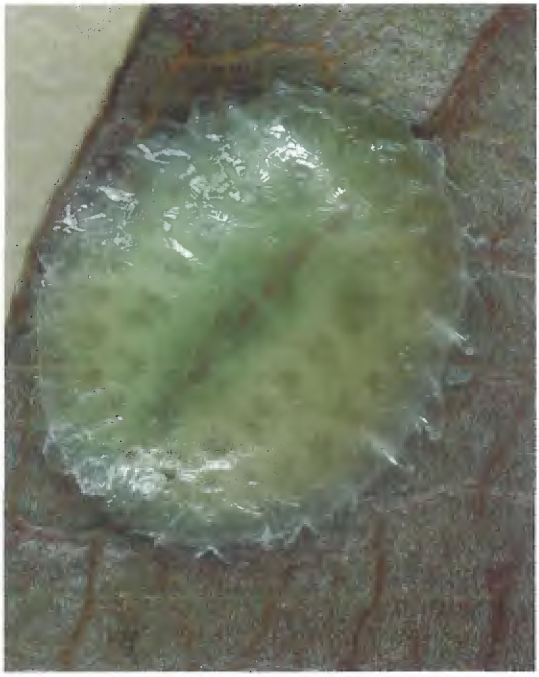
[C55] *Ctenochiton viridis,* ♀ and crawler

[C56] *Ctenochiton paraviridis,* ♀ parasitised by hymenopterous larvae

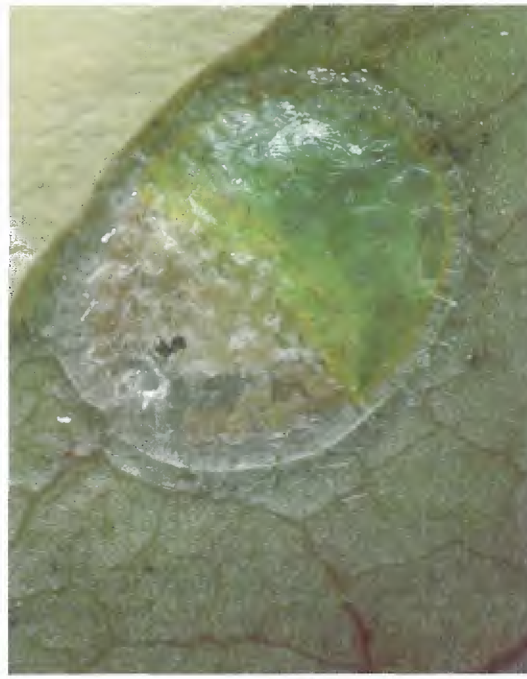
[C57] "Bumps" on upperside leaf associated with *Ctenochiton paraviridis,* ♀♀ on underside

[C58] *Epelidochiton piperis,* young ♀♀, mature ♀ (dark grey), and empty ♂ test (white)

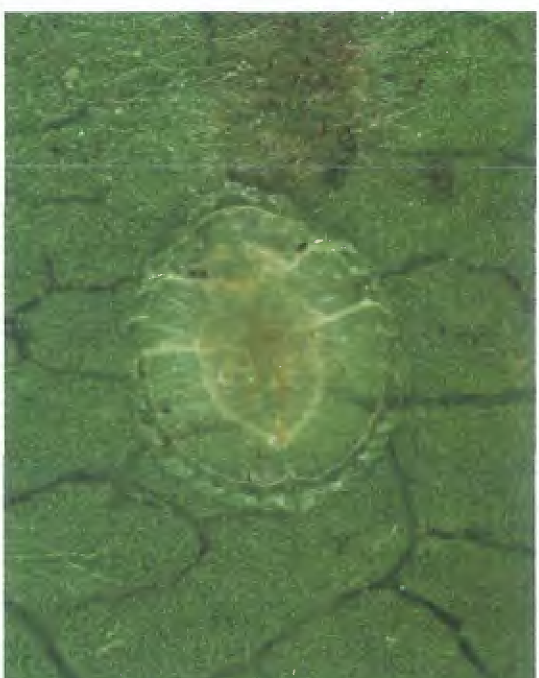
[C59] *Inglisia patella,* young ♀



[C60] *Kalasiris depressa,* young ♀



[C61] *Kalasiris depressa,* mature ♀, brood chamber under posterior half of test



[C62] *Kalasiris perforata,* young ♀

[C63] *Kalasiris perforata,* ♀ secreting wax on reticulation lines

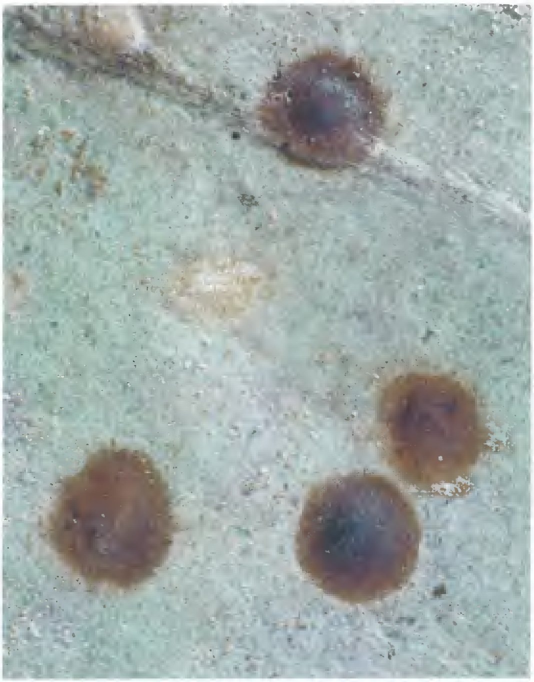
[C64] *Lecanochiton actites,* young ♀

[C65] *Lecanochiton metrosideri,* ♀, anterior spiracular furrows with white wax

[C66] *Lecanochiton scutellaris,* ♀ and crawler

[C67] *Parasaissetia nigra,* 2 ♀♀ and nymphs; note: colour varies with host, is often brown [photo: DSIR]

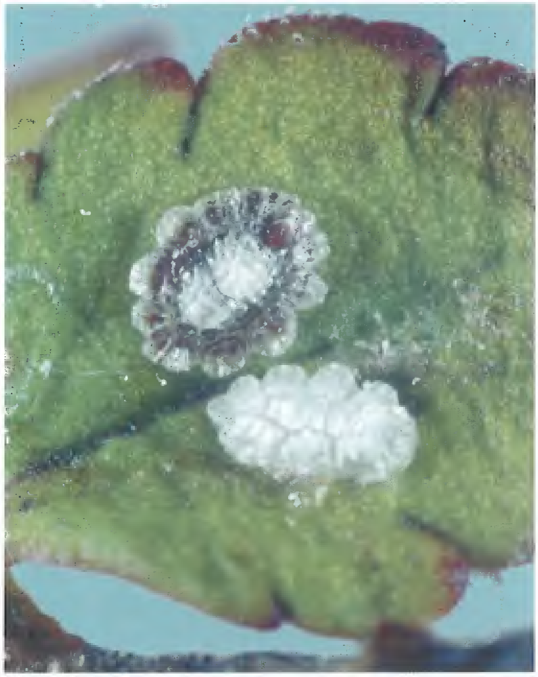
[C68] *Parthenolecanium corni,* ♀♀ on stem of cherry



[C69] Pathogen *Aegerita webberi,* infesting *Ctenochiton paraviridis* nymphs

[C70] Pathogen *Hypocrella duplex,* infesting *Ctenochiton paraviridis* nymphs

[C71] Pathogen *Verticillium lecanii,* infesting *Ctenochiton paraviridis* ♀♀ and nymphs



[C72] *Plumichiton diadema,* young ♀ and empty ♂ test

[C73] *Plumichiton flavus,* ♀

[C74] *Plumichiton elaeocarpi,* young ♀

[C75] *Plumichiton elaeocarpi,* mature ♀

[C76] *Plumichiton pollicinus,* young ♀

[C77] *Plumichiton pollicinus,* old ♀

[C78] *Plumichiton nikau,* ♀

[C79] *Poropeza dacrydii,* mature ♀ and crawler

[C80] *Pounamococcus cuneatus,* young ♀

[C81] *Pounamococcus cuneatus,* mature ♀ with neonate in brood chamber

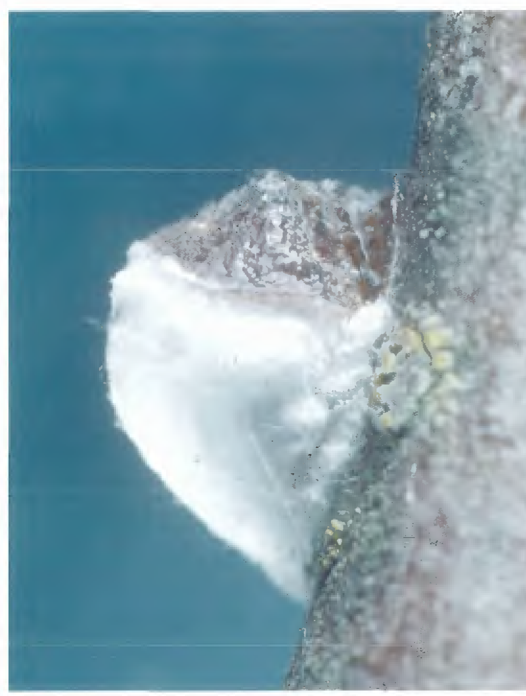
[C82] *Poropeza dacrydii,* young adult ♀ and 3rd-instar ♀ (yellow)

[C83] *Pulvinaria floccifera,* immature ♀

[C84] *Pulvinaria hydrangeae*, ♀ with ovisac [photo: DSIR]

[C85] *Pulvinaria mesembryanthemi*, ♀♀ with ovisacs, young ♀ (green), & nymphs

[C86] *Pulvinaria vitis*, young ♀



[C87] *Pulvinaria vitis*, mature ♀ with ovisac

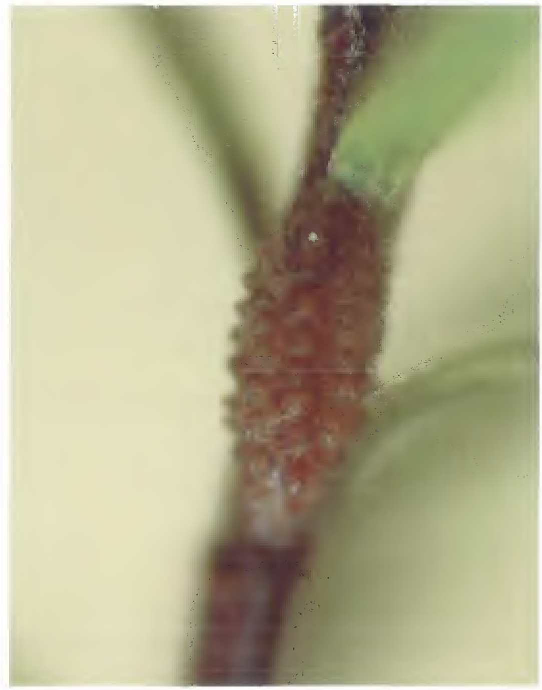
[C88] *Saissetia coffeae,* ♀♀ and nymphs

[C89] *Saissetia coffeae,* mature ♀

[C90] *Saissetia oleae,* immature ♀

[C91] *Saissetia oleae,* mature ♀

[C92] *Umbonichiton adelus,* young ♀



[C93] *Umbonichiton bullatus,* young ♀

[C94] *Umbonichiton hymenantherae,* young ♀

[C95] *Umbonichiton pellaspis,* young ♀

MORPHOLOGY

ADULT FEMALE (Figs 3–7)

The following applies to those species (both adventive and indigenous) currently known from New Zealand.

Basic shape: young teneral females of most Coccidae are broadly oval and flat but a few tend to be long and narrow (e.g., *Aphenochiton grammicus*). A few remain more or less flat as they age (e.g., *Coccus hesperidum*, *Ctenochiton viridis*, and all *Aphenochiton* species) but some expand laterally, becoming nearly round in outline (e.g., *Epelidochiton piperis*), while others often become highly convex (e.g., *Crystallotesta* species). The venter of species of *Lecanochiton* expands to form part of the dorsal surface.

Size: most adult female Coccidae are between about 2 and 6 mm long, but some species may grow to a large size (10 mm in length), as with *Poropeza* species.

Tests: the term 'test' (derived from Latin *testa* – a shell) is used to describe the protective waxy covering over the dorsum, whose function is to reduce both harmful environmental effects such as dehydration and also the chances of attack by parasites and predators. Although all coccids in New Zealand have some form of wax coating over their dorsum, not all these wax coats can be easily separated from the derm in mature adults and the term test is used only for those where the coat is more or less removable. Species without a test include all the adventive species (except the Ceroplastinae) and the indigenous four species of *Lecanochiton* and *Plumichiton elaeocarpi* (in part), although nymphs of all species generally have some form of waxy plates on the dorsum at some stage in their development. Most of the other indigenous taxa have a distinct, close fitting, glassy test over the dorsum which is secreted by dorsal pores, but these tests are not part of the dorsum and can be easily broken away, leaving the derm intact.

The tests on indigenous species fall into two groups: those with a distinctly reticulated, glassy wax cover, and those with some other form of test.

The first group have a test divided into numerous, more or less 5- to 6-sided glassy plates that are bounded by distinct sutures; these **reticulation plates** are usually in 5 or 7 longitudinal rows, counted across the middle of the test (Figs C34, C35, *Aphenochiton pubens* and *A. subtilis*). This group contains species in the following genera: *Aphenochiton*, *Ctenochiton*, *Crystallotesta*, *Epelidochiton*, *Kalasiris*, *Poropeza*, *Plumichiton*, and *Umbonichiton*. In these genera, it is likely that each reticulation plate grows as the insect expands. Studies of a section through a reticulation plate of *Ctenochiton viridis* (Fig. M30) showed that the wax was of uniform thickness and density across its width; this suggests that the wax was laid down at a uniform thickness at the edge of the expanding reticulation plate. When sufficiently thin and hyaline, the colour of the underlying female shows through and, as many species are green or brownish, they can harmonise with their backgrounds very closely; however, adult female *Ctenochiton chelyon* are relatively brightly coloured. The test may appear less hyaline and even whitish, due to striations and bubble-like inclusions (e.g., *Kalasiris perforata*) or brownish, as on *Crystallotesta ornata*. Some tests may be very flat, as on species of *Aphenochiton*, moderately convex, as on *Plumichiton* species, or highly conical, as on species of *Crystallotesta*. The tests of *Epelidochiton piperis* become dull and non-hyaline at maturity, while those of *Poropeza dacrydii* (the only species of *Poropeza* for which a test is known) have distinct rows of *Ctenochiton*-like plates but, at maturity, the plates become slightly separated, possibly due to a cessation of wax secretion as the female swells.

The second group contains species in the genera *Inglisia* and *Pounamococcus*; these have a glassy test but of a different structure to that of the first group. The test on *Inglisia patella* is of one piece, 10-sided and shaped like the shell of a limpet (Fig. C59); as the insect grows, the height of this test increases due to more wax being added to its base — and the growth-rings produced at each moult are often distinct. Studies of the test in cross section (Fig. M29) showed that the solid apex of the test is made up of transverse layers of wax, whereas the walls apparently have a honeycomb internal section between solid outer wax layers. The test of *Pounamococcus tubulus* is also of one piece, while that of *P. cuneatus* is formed from seven plates, four on the head and three long ones covering the rest of the body (Figs C80, C81). A study of one lateral plate of the test of *P. cuneatus* (Fig. M31) showed that it is made up of layers that are most numerous at the edge nearest the neighbouring median plate (where the lateral plate is thickest) and decrease to very few layers at the outer margin, thus the plate expands due to secretion of new broader layers of wax beneath it, and also asymetrically from one side. Each of these plates appears to be of one piece, without much external ornamentation.

The only group amongst the adventive species to have a true test is the Ceroplastinae. They have an extremely thick white soft wax test that not only protects them from harmful environmental effects, such as dehydration, but also prevents easy control of pest species by insecticidal sprays.

Ovisacs and egg protection: a true ovisac — a separate cover secreted to protect the eggs—is only produced by the Pulvinariini (as far as the New Zealand fauna is concerned) (Figs C84, C85, C87; *Pulvinaria floccifera, P. hydrangeae, P. mesembryanthemi,* and *P. vitis*), and is probably secreted mainly by the ventral tubular ducts. It takes the form of a white woolly 'sac', which protrudes from under the posterior end of the adult female and is often characteristically ridged, into which the eggs are laid. It can be quite long—up to several times the length of the female — and sticks to the substrate. It is likely that females of Pulvinariini withdraw their stylets once they start egg-laying and move forwards at the speed the ovisac is secreted; once egg laying is complete, the females die and may fall away, leaving the ovisac behind.

Protection for the eggs and/or nymphs in the other subfamilies is provided in other ways. In some taxa, the eggs and/or nymphs are protected beneath the venter, which becomes a concave brood chamber, as with species of *Saissetia* and *Ctenochiton*, the females of both genera producing large numbers of eggs beneath their abdomens. Although all species of *Lecanochiton* have relatively large brood chambers, these seem to contain few young. An alternative strategy is found with species of *Crystallotesta* (Figs C44, C45, C47), *Kalasiris* (fig. C61) and *Pounamococcus* (fig. C81) where the ovipositing females shrink beneath the glassy test so that the shrivelled body comes to lie in the anterior half and the neonate nymphs lie in the posterior half.

The following sections deal with the structures found on the dorsum, margin, and venter.

DORSAL STRUCTURES

Anal cleft (Figs 3, 4): is the cleft between the **anal lobes** at the posterior end of the body, and is usually about 1/7th to 1/10th of the total body length but may be very short in some species (e.g., *Inglisia patella*).

Anal plates (Fig. 7): are the paired, approximately triangular plates, that lie at the anterior end of the anal cleft, and are sometimes referred to as anal opercula; they are a major recognition character of Coccidae as similar plates are otherwise found only on a few species of Eriococcidae. These plates are 'hinged' along their anterior margin and open anterolaterally to allow the **anal tube** to evert, aiding the elimination of honeydew from the **anal ring**. On most adventive soft scales, they are approximately quadrate when combined, with the two **inner margins** lying more or less parallel. The outer margins are referred to as the **anterior margins** and the **posterior margins**, although the latter is here mainly referred to as the **outer margin** to clearly distinguish it from the posterior apex. On most indigenous species, the combined plates are not obviously quadrate but are more often pyriform (e.g., those of *Ctenochiton* species) or oval, with the anterior margin shorter than the posterior margin. On some genera, the inner margins diverge posteriorly and then most of their spinose setae are along the inner margins rather than apically or on the outer margin (e.g., on *Inglisia patella*). On most species, there are two setae along the inner margins (**inner margin setae**), one or more setae on the posterior apex (**apical setae**), and another either along the posterior outer margin (**outer margin setae**) or on the dorsal surface. On species in some genera (e.g., *Saissetia*), the dorsal setae are in the middle of the posterior half of each plate and, when they are distinctly enlarged, are referred to as the **discal setae**, in the **discal position**. Another feature that may be of taxonomic significance is the surface of the plates, which may be characteristically ridged or nodulated (e.g., on species of *Plumichiton*).

Anal ring (Fig. 7): is a sclerotised ring, composed of two lateral crescents, that surrounds the anal opening. Typically, it has numerous wax-exuding pores (which may be in one or more rows) and 3, 4, or more pairs of long setae, the **anal ring setae**. The anal ring is at the inner end of the **anal tube**; when withdrawn and inverted, this tube lies within the body cavity and usually extends well anterior to the anal plates; rarely the tube is short (e.g., as on *Poropeza* species).

Anal sclerotisation (Fig. 4): is a horseshoe-shaped sclerotisation around the anterior margin of the anal plates, e.g., on species of *Poropeza*. On members of the Ceroplastinae, the anal sclerotisations have become greatly enlarged to form the **caudal** or **anal process**, which carries the anal plates above the thick wax test.

Anogenital fold (Fig. 7): this fold lies across the anterior end of the anal cleft, more or less at right angles to the long axis of the body, beneath the anal plates. It separates the anus on the dorsum from the vulva on the venter. The anogenital fold usually has setae at either corner and along the anterior margin and these are here referred to as **anterior margin setae** (also called fringe setae by other authors). Setae are also generally present along the lateral margins and these are referred to as **lateral margin setae.** On either side of the anogenital fold, there is frequently a sclerotised supporting bar that appears to be part of the underside of each anal plate, and which is probably for the attachment of the muscles used in opening the anal plates;

these bars extend anteriorly beneath the derm, where they frequently expand and may even meet medially; they may be narrow, as on *Coccus hesperidum* or broad, as on most New Zealand species. In addition, there are sometimes groups of setae (called **hypopygial setae**) on the ventral derm just anterior to the anogenital fold and posterior to the pair of long pregenital setae on abdominal segment VII (present on several species of *Aphenochiton*).

Derm: that of teneral females tends to be thin and unsclerotised and this is the best stage for making slide preparations for identification. Species with dense **areolations** (Fig. 4) (small clear areas in the derm), such as *Saissetia coffeae*, may have quite a thick derm, even just after the final moult but, even then, the derm becomes much thicker with age (up to 10 times thicker than the venter), with the area within each areolation remaining quite thin, usually with a microduct. The size and distribution of the dorsal areolations may be useful in separating species. In the Ceroplastinae, the derm becomes heavily sclerotised quite soon after the final moult and only young females can be easily identified to species.

On indigenous species protected by a glassy test, the derm is thin and membranous, but may become slightly sclerotised with age; exceptions are *Epelidochiton piperis* (Fig. 115), on which sclerotised patches grow and coalesce in each reticulation area, and *Poropeza* species, which live beneath the bark of trees and become sclerotised throughout, possibly for added protection against pressure from the confined space.

The derm may also show other characteristic markings and structures. On most indigenous species, the derm has distinct polygonal reticulations throughout, these being partly thickened ridges along the lines of dorsal pores (Figs M8, M10). On fully-grown adults of species such as *Umbonichiton bullatus* and *U. jubatus*, each reticulation area on the dorsum becomes convex, forming a lobe, underlying each knob-like projection of the test.

Dorsal setae (Figs 4, 5): these are absent from all known indigenous species but present on all adventive species. They are short (4 µm to 10 µm long) and spinose, arising from a distinct basal socket and are randomly distributed throughout the dorsum.

Dorsal pores (Figs 3–6): most species have at least 3 or 4 different types of dorsal pores, whose function is probably to secrete different types of wax.

On most of the indigenous species, dorsal pores are distributed in a distinctly reticulate pattern (Figs 3, M8, M10), the reticulations in 5 or 7 longitudinal rows, most reticulations being approximately six-sided and underlying similarly-shaped **reticulation plates** in the test. In the descriptions below, the following terminology is used: the lines of pores are **reticulation lines**, the area of derm bounded by reticulation lines is the **reticulation area**, and the reticulation areas are in **reticulation rows** along the length of the insect; the junction of a reticulation line with the margin is a **reticulation point**, often associated with an enlarged marginal seta, the **reticulation point seta**. Most dorsal pores on the species with a reticulate pattern lie within the reticulation lines but their arrangement within each line is also species specific; for instance, each reticulation line in *Ctenochiton paraviridis* is composed of three parallel rows of pores (Fig. M10). On those species without reticulations, the dorsal pores are more or less randomly distributed.

There are three main types of dorsal pores on the indigenous New Zealand species (Fig. 6):

(a) **Dorsal microductules** (Figs M26–M28): each consists of a small sclerotised pore, round or slightly oval in shape, usually about 2-3µm in diameter, set at the base of a short ductule and with a minute pore or slit-like opening, when viewed from above. The true structure is best seen when viewed from the side (for a discussion of gland structure, see Foldi, 1997). Each microductule has a non-staining membranous **inner ductule** or **filament**, that is often balloon-shaped proximally and quite long distally. Because the inner filament is non-staining, it can be difficult to detect in many preparations. In adventive species, a microductule is usually present in each dermal areolation, when the latter are present.

(b) **Simple pores** (Figs M26, M27): small pores without an inner filament; represented by at least two types, although they may appear similar under the light microscope: (i) 'open' pores that have a distinct pore opening and are flat (and should not be confused with closed pores that have lost their structure through being overcleared during slide preparation), and (ii) 'closed' pores that have no apparent aperture under the light microscope but generally have a granulate surface (through which minute ducts emerge) and may be either flat or convex (see Foldi, 1997). Most are about 2–4µm wide but they can be quite a lot larger (<10µm), while some have slightly thicker margins and may then appear 'dark-rimmed'. They are usually round but may be oval. They have been referred to by previous workers as 'dark-rimmed', 'disc', or 'discoidal' pores.

(c) **Macropores** (Figs 6, M12, M14–M25): this term is introduced here to describe some large pores, with a glandular internal structure (Fig. M12), which appear to be highly characteristic of the indigenous Coccidae. They are usually at least twice the size of simple pores but are highly variable between species, both in size and shape, and are therefore very useful diagnostic characters. They may be flattish button-shaped (e.g., *Ctenochiton* species) or more convex and bollard- or cone-shaped (e.g., *Umbonichiton* species), or concave as on species of *Plumichiton*. When convex, they may extend above the derm surface through holes in the test (as in *Umbonichiton pellaspis*) and have heavily sclerotised margins and/or basal rings; when concave, they usually have membranous margins and a sclerotised base. Macropores are restricted to the reticulation lines when both these are present, and are most abundant medially on the abdomen. An indication of frequency may be the number of macropores in the most posterior medial transverse reticulation line with macropores, here referred to as the **posterior medial macropore line** (Fig. 3), which is anterior to the anal plates and to an intervening narrow medial line of small dorsal pores. Macropores are absent from all adventive species, but they may be homologous with the preopercular pores.

(d) **Multilocular disc-pores:** these are rare on the dorsum but are present on *Poropeza* species on the lateral margins of the anal cleft. Occasionally, the spiracular disc-pore bands extend onto the dorsum (as on *Crystallotesta fusca*). For further comment, see under ventral pores.

The following dorsal pore-types are not present on indigenous species but are found on one or more of the adventive species (Figs 4, 5):

(e) **Preopercular pores**: these pores are found in loose groups, typically just anterior to the anal plates, although they may be much more widespread in some genera and species. They are 'closed' pores (see under simple pores above) and are rather variable in shape. They may be small, flat, round to oval, relatively unsclerotised and may have a granular surface, as on *Coccus hesperidum*, when they look very similar to closed simple pores. In other genera, they are large, strongly convex, and heavily sclerotised (as on *Saissetia* species); these pores can have quite deep, vertical margins, which give them a strongly 'dark-rimmed' appearance when viewed from above, and have a rough granular surface; they have also been called 'discoidal pores' and 'paraopercular pores'. Typically, each pore is 3–5 µm wide. The number and shape may be of both specific and generic importance. Their function is unknown.

(f) ***Ceroplastes*-type pores:** these are possibly the only sclerotised pores present on the dorsum of the Ceroplastinae, to which they are restricted. They are heavily sclerotised, with a large central pore and 0–4 smaller (satellite) pores. *Ceroplastes*-type pores generally have a long inner filament arising from the base of the central pore, which is much branched distally and, because of the presence of these ductules, were termed 'dendritic pores' by De Lotto (1971a). *Ceroplastes*-type pores are abundant throughout the dorsum except on the lateral lobes or clear areas (areas on the dorsum without visible pores) and each opening is 2–5µm wide. They are almost certainly involved in the production of the thick, soft, waxy test typical of the Ceroplastinae.

Dorsal tubercles: also called sub-marginal tubercles. They are frequently present on adventive species but absent from all indigenous species. They are rather variable in structure but those on species currently known from New Zealand are convex, usually wider than tall and rather sclerotised, with a central duct which has a small swelling/thickening at its inner end, with an inner filamentous ductule on one side, rather similar in structure to the cup-shaped invagination and inner ductule of a tubular duct.

Pocket-like sclerotisations: sclerotisations which have a pocket-like invagination and mark the site of the dorsal tubercles on the previous instar. These are unknown on indigenous species although the large pores (here referred to as pocket-like macropores) in the two median lines on *Lecanochiton actites* and *L. metrosideri* have a very similar structure. However, pocket-like sclerotisations are found on some adventive species of *Saissetia* and *Parthenolecanium*. When present, pocket-like sclerotisations are generally found in association with a dorsal tubercle, either between it and the margin or close by, and only in a submarginal ring. Their function is unknown. Each sclerotisation is usually about 5µm wide.

Tubular ducts (Fig. 6): within the indigenous fauna, dorsal tubular ducts are known only from *Pounamococcus cuneatus* (as two diverging lines anterior to the anal plates) but dorsal tubular ducts are often common on some of the adventive species, on which they are apparently randomly distributed. Each duct consists of four parts: (a) an **outer ductule**, thin-walled, barely sclerotised, round in cross-section and generally at least 10 µm long, which opens through the dorsum by a small inconspicuous pore that may occasionally be mildly sclerotised; at its inner end is (b) a characteristic structure, here referred to as the **cup-shaped invagination** because the outer ductule terminates in a thick-walled structure that is bowl- or cup-shaped, and usually slightly asymmetrical; from one side of the cup arises (c) the **inner ductule** which is usually narrower and shorter than the outer ductule; this terminates in (d) a 'flower-head'-like structure, here referred to as the **terminal gland**. Tubular ducts can vary in the relative lengths and widths of the inner and outer ductules, in the form (particularly the depth) of the cup-shaped invagination, and in the size of the terminal gland. Including those types of tubular duct found on the venter, some *Pulvinaria* species have four or five types and the structure of each type and their distribution within a species are good diagnostic characters. Usually the dorsum has only one type of tubular duct.

MARGINAL STRUCTURES

Margin: on most Coccidae, the margin is distinct and marked by the presence of marginal setae. On *Lecanochiton*, where marginal setae are absent and where the lateral margins of the venter spread outwards to form part of the dorsal surface, the demarcation between dorsum and venter is indicated by differences in sclerotisation and ridges on the true dorsum (Fig. M9).

Marginal setae (Fig. 3): these form a marginal line one seta wide on almost all New Zealand species (but are in a band 1–3 setae wide on *Poropeza cologabata*). They are usually of one shape, are distinctly differentiated from other setae, and are frequently abundant; however, on *Inglisia patella* two types of setae are present and they usually alternate, while species of *Lecanochiton* lack marginal setae altogether. The shape and structure of these setae are highly variable but are usually constant for a given species. As a result, marginal setae are significant taxonomic features at all levels and the number of setae laterally between the anterior and posterior stigmatic clefts (or occasionally round the head between the anterior stigmatic clefts) is given in most descriptions as an indication of their frequency. On most genera, marginal setae are absent from the margins of the anal cleft, but occasionally they extend along the entire cleft margin (e.g., on species of *Poropeza*) or at least part (as on some species of *Kalasiris*). Also, as on *Saissetia coffeae*, one or more marginal setae on the anal lobes may be significantly longer than normal marginal setae (**marginal anal lobe setae**) (Fig. 4); these are in addition to the (often long) pair of **ventral anal lobe setae** (Fig. 3).

Each seta is set in a **basal socket** (Fig. 5) that is usually well developed and may be narrow or shallow. On those New Zealand species which have a reticulate pattern of dorsal pores on the dorsum, the marginal setae at the point where the reticulation lines reach the margin are often differentiated and are larger. These are here referred to as **reticulation point setae**; they are particularly obvious on *Crystallotesta neofagi*.

Stigmatic clefts (Figs 3, 4): may be distinct clefts, with parallel sides, as with *Aphenochiton pronus*, or only shallow indentations at the point where the spiracular disc-pore band meets the margin, or they may be absent (as on *Epelidochiton piperis* and species of *Poropeza*). On those species in which stigmatic clefts are absent, each of these points on the margin is here referred to as the **stigmatic area**.

Stigmatic spines (Figs 3–5): are one or more marginal setae that are usually differentiated from the other setae in each stigmatic cleft or stigmatic area. On almost all indigenous species except *Pounamococcus* species, there is only one stigmatic spine per stigmatic area, although rarely one or more of the lateral marginal spines may become differentiated, as on *Plumichiton pollicinus*. On most other Coccidae, including *Pounamococcus* species, there are usually three or more stigmatic spines and, when three, the middle (median) spine is generally longer than the laterals. Most stigmatic spines tend to be set slightly onto the dorsum but, on *Crystallotesta fusca*, they are displaced some distance onto the dorsum. On the Ceroplastinae, the stigmatic spines are in a large group in each stigmatic area, and may extend medially onto the dorsum. When stigmatic clefts are present, the stigmatic spines are located at their base. The number, shape, and relative lengths of stigmatic spines are of taxonomic importance.

Eyespots (Figs 3, 4): in the Coccidae, the eyespots are placed on the dorsum, very close to the margin, each consisting of a single lens. These can be hard to detect on slide-mounted specimens but are often clear on fresh specimens.

VENTRAL STRUCTURES

Antennae (Fig. 7): the basic structure of most normally developed antennae is as follows. The basal segment or **scape** (segment I) is well developed and has three setae; segment II (**pedicel**) has one long and one short seta on its ventral surface and a **campaniform sensillum** on the dorsal surface. Between the basal two segments and the terminal three segments there are normally one to four further segments, although usually it is only the segment nearest the apical three segments (or the distal end of segment III) which has setae and then there are three flagellate setae. On many indigenous species with only six segments on the antennae, the third can be as long as or longer than the other five combined. At the apex of each antenna are three segments which are remarkably constant in structure. The **apical segment** has about five normal setae and probably three or four **fleshy setae** (these can appear rather flagellate on some species), two or three on the ventral surface and one on the dorsal; on most species, the terminal seta (**apical seta**) is rather straight, non-flagellate, and its length appears to be of taxonomic significance; in addition, one of the flagellate setae on the dorsal side is usually very long, but is less useful taxonomically as it is often broken. The subapical segment has a single fleshy seta on the ventral surface and a flagellate seta laterally (two setae on *Pounamococcus* species), whilst the third segment from the apex has only a single fleshy seta ventrally (plus a flagellate seta on *Pounamococcus* species). The number of segments on the antennae can be very constant, as on *Coccus hesperidum,* where it is always seven, or it can be rather variable. Species of *Lecanochiton* have much reduced antennae and the segmentation is rather obscure. The structure of the antennae is of taxonomic importance.

Derm: thin and membranous on all indigenous New Zealand species, except on species of *Lecanochiton*, where the dorsum and the outer expanded margins of the venter that form the lateral margins of the dorsal surface become heavily sclerotised; the ventral surface also becomes sclerotised but less than the more dorsal parts.

The venter may have two or three pairs of shallow, radial grooves. In the species known from New Zealand, there is usually one groove from each peritreme to the margin, the **stigmatic groove** or **stigmatic furrow** (Fig. 3), in which most of the spiracular disc-pores lie. A third pair is sometimes present from the base of each antenna to the point on the margin where the eyespots are located, but this is indistinct or absent on indigenous species.

Labium and mouthparts (Fig 7.): the structure of the mouthparts is reasonably constant throughout the Coccidae, varying mainly in size—here usually indicated by the length of the **clypeolabral shield**. The labium is 1-segmented (occasionally indistinctly 2-segmented on some nymphs) and cone-shaped, usually with four pairs of setae (Koteja, 1974a), although these are difficult to see on some specimens. The position of the mouthparts is usually central between the anterior legs but on species that lie very flat on the leaf lamina and yet feed in the vascular bundles in the main leaf veins, the mouthparts can be displaced asymmetrically as the insects expand (as on *Pounamococcus* and most specimens of *Ctenochiton* species). This is an environmentally induced effect because, when a female settles by a flatter subsidiary leaf vein, she expands equally on either side of the stylet attachment point.

Legs (Fig. 7): when present (they are absent on *Lecanochiton*), the legs are normal insect legs, each with five segments, although they are generally slightly small in proportion to the rest of the body. The **coxae** are attached to the venter along their width and articulate with a sclerotisation at the lateral corner; this is often most obvious on legs that are much reduced. The structure of the coxae appears to be very similar throughout the Coccidae; nor is there much variation in the trochanter and femur. Each **trochanter** has a pair of large pores on each side (whose function is unknown) and one or two long setae on its ventral surface. The setae on the **femur** have not been found to vary much. The **tibia** is always longer than the single tarsus and usually the proportions are similar on all three pairs of legs. The tibia generally lacks the **campaniform sensillum** (here referred to as a campaniform pore) typically present at its base on most other coccoid families (Koteja, 1974b) but this pore-like structure is present on species of *Pounamococcus*; the absence of this pore is otherwise a major taxonomic character of the Coccidae. The tibia and tarsus are usually separate but without any articulation on most indigenous species, however they are fused on *Aphenochiton subtilis, Inglisia patella,* and *Poropeza cologabata.* On other coccids, there is clearly a true tibio-tarsal articulation with an **articulatory sclerosis** (as on *Pulvinaria* species); the presence or absence of this sclerosis is of taxonomic importance. The frequency, distribution, and length of the setae on the tibia and tarsus may also be of some significance. At the distal end of the tarsus is a pair of thin digitules, the **tarsal digitules**; these tend to be slightly dissimilar on most New Zealand species, one being slightly shorter and slimmer than the other; they tend to be shortest when the leg shows signs of reduction.

The structure of the **claw** and **claw digitules** show several features of taxonomic importance. The claw may be short and broad or long and thin and may or may not have a small **denticle** near the apex. The claw digitules may both be broad, both be narrow, or of distinctly dissimilar width. Fine claw digitules are generally associated with a reduction in the size of the legs.

Segmentation (Figs 3, 4): this is usually reasonably obvious medially on the abdomen and thorax. There are six visible segments between the vulva and the metathoracic coxa and these are here numbered segments II to VII, following the system of previous authors who considered that the first visible segment ventrally on the abdomen is the 2nd (segment II), the 1st being represented by an area laterad to the metathoracic legs; thus the **pregenital segment** is the 7th (segment VII). The segmentation on the thorax also usually can be seen, including the demarcation between the thorax and head, where the line runs posteriorly to the labium from near each procoxa. No segmentation is visible on the head. On many genera, each abdominal segment has a pair of lobes mediolaterally, so that there is a line of **mediolateral lobes** from the anal area to each metacoxa; this line of lobes often divides the segmental bands of pregenital disc-pores into a median group and/or two lateral groups and this is considered to be an important character of New Zealand Coccidae. These lobes are large and very distinct on species of *Ceroplastes* and *Lecanochiton.*

Spiracles (Fig. 7): each spiracle is composed of a sclerotised, funnel-shaped outer **peritreme**, which opens through the spiracular opening or **atrium** into the tracheae. The size of each peritreme is important and can be useful in placing a species at the generic level; for instance, the peritremes of *Ctenochiton* species are much wider than the length of the coxae, i.e., 100 µm or more wide, whereas most peritremes are between 40 and 80 µm wide (those of *Lecanochiton* are particularly small, less than 20 µm). On some species, there is a sclerotisation around each spiracle mesad to the peritreme and this is here referred to as the **sclerotised spiracular plate**, as on *Inglisia patella.*

Ventral pores

(i) **Disc-pores** (Fig. 6): each disc-pore has a central loculus which is usually round but may be oval, surrounded by a number of similarly-shaped loculi or pores, the complete disc-pore looking rather like a wheel with spokes. Each disc-pore usually has 5–10 loculi in the outer ring and the pores are therefore known as **multilocular disc-pores**.

Multilocular disc-pores can be divided into two groups: the **pregenital disc-pores** and the **spiracular disc-pores**.

(a) **Pregenital disc-pores:** are primarily located on the pregenital segment VII, thus the name. However, on most genera, they are also found across some of the more anterior abdominal segments and, less frequently, medially on the thorax and head (where they are referred to as multilocular disc-pores). Thus, on *Coccus hesperidum* for instance, pregenital disc-pores are almost entirely restricted to the pregenital segment, while on members of the Saissetiini and species of *Crystallotesta, Ctenochiton,* and *Kalasiris*, they are typically abundant across all the abdominal segments; on *Crystallotesta*, they are also often present laterad to the metacoxae. On species of *Plumichiton* and *Umbonichiton* the pregenital disc-pores are mainly on the mediolateral lobes and so form a line from near the anterior margins of the anal cleft to near each posterior spiracle. On some taxa (e.g., *Inglisia patella* and species of *Aphenochiton*), the pregenital disc-pores are restricted to either side of the genital opening or near the margins of the anal cleft and then each pore tends to have only five loculi; other taxa, such as some *Pulvinaria* species, tend to have seven or eight loculi, whereas the most frequent number of loculi per disc-pore is 10; they are usually 5–8 µm in diameter. Pregenital disc-pores have been shown to exude short, curved wax filaments which are hydrophobic and prevent the eggs from sticking together (Foldi, 1997; Hamon *et al.*, 1975); they are therefore least frequent on viviparous species, particularly in the Coccinae. The number of loculi and the number and distribution of these pores on the venter are important taxonomic characters.

(b) **Spiracular disc-pores:** are in bands in the stigmatic furrows between the stigmatic area on the margin and the spiracles. On most species, each pore has five loculi and most authors refer to them as **quinquelocular pores**. However, on species in a few genera, as in *Poropeza*, the pores have more than five loculi or have a variable number of loculi and so these pores are here referred to as **spiracular disc-pores**. Most spiracular disc-pores are about 4–6 µm wide. As with pregenital disc-pores, the distribution and frequency of spiracular disc-pores and the number of loculi/pore are important taxonomic characters. Spiracular disc-pores exude short, curved, wax filaments that are hydrophobic and help in gas diffusion along the stigmatic furrows (Foldi, 1997) and this wax can be seen even in the thick wax covering the Ceroplastinae (Tamaki *et al.*, 1975).

Each band of disc-pores is referred to as the **spiracular disc-pore band** and, on species with narrow bands, each band is often more or less of equal width throughout its length but, on other species, the pore bands widen near the peritremes and margins (as on several *Ctenochiton* species). On *Inglisia patella* and *Lecanochiton* species, the posterior band is reduced to a few pores near each peritreme, although the anterior bands are complete. On most species, the disc-pore bands end medially at or close to the peritremes of each spiracle but on *Poropeza cologabata*, they extend medially well past the anterior coxae.

(ii) **Ventral microducts** (Fig. 6): the oval, sclerotised pore of each ventral microduct is located at the base of a short, outer ductule (longer than that of the dorsal microductules). The pore opening is across the widest part of the pore and the non-staining **inner ductule** is usually broad and skirt-like, not filamentous. Each pore is usually about 2–3 µm wide. Generally, ventral microducts are present more or less throughout the venter, although they may be more frequent submarginally; occasionally they have distinctive distributions. On *Kalasiris depressa* and *Epelidochiton piperis*, those nearest the margins are distinctly larger. On the Ceroplastinae, the pore opening appears to be cruciform. The function of the ventral microducts is uncertain.

(iii) **Pre-antennal pores** (Fig. 7): these are small, convex pores that are present just anterior to each scape. Their function is unknown.

(iv) **Other ventral pores:** other types of pore are infrequent on the venter and are therefore good taxonomic characters. **Simple pores** (Fig. 6), similar to those on the dorsum, are occasionally present; they are most frequently associated with the margin (as on *Crystallotesta ornata* and *C. ornatella*) but may have a wider distribution, as on *Poropeza cologabata*, or be present with spiracular disc-pores, as in the anterior stigmatic furrows of *Lecanochiton minor* and *L. scutellaris.*

Ventral setae (Figs 3–5): most ventral setae are short and flagellate, but a few are longer and these (and their frequency) can be of some taxonomic significance. The most common distribution of the longer setae is: a pair medially on the pregenital segment (segment VII) (the **pregenital setae**) and often with additional pairs on the preceding two segments (segments VI and V); in addition, there may be long setae elsewhere, such as just mesad to each coxa and between the antennae (**inter-antennal setae**). On *Inglisia patella* and species of *Lecanochiton*, the pairs of long setae on the pregenital segments are replaced by groups or segmental rows of short, rather spinose, setae. Some other groupings of setae are now thought to be of significance and are here referred to as follows: the **submarginal setae** are a single row of setae just mesad to the margin and their frequency is given as the number laterally between the stigmatic clefts; the **anterior anal cleft setae** are a group of 1 to several setae that occur on either side towards the anterior end of the anal cleft; a pair of **ventral anal lobe setae** occur on the anal lobes near the margin and their length appears to be taxonomically significant; and the **abdominal setae** are those found medially on each abdominal segment and their frequency are also thought to be significant. Details of these setae (and others on the antennae and legs) are mentioned in most of the descriptions below.

Ventral tubular ducts (Fig. 6): the structure of the tubular ducts on the venter is similar to that of those on the dorsum and, like them, their structure and distribution are important taxonomic characters. When present, most species have only one type of dorsal and one type of ventral tubular duct and then they are usually identical but some species may have several types, as on members of the Pulvinariini, which have three or four different types of ventral tubular duct, each with its own distinctive distribution. These ducts are most frequently distributed in one of three patterns: (i) restricted to a more or less complete submarginal band, as on *Saissetia oleae*; (ii) more or less throughout, as on species of *Crystallotesta* and *Poropeza*; or (iii) in a group medially on the abdomen, as on *Pounamococcus.*

Vulva (Figs 3, 7): this is the female genital opening and is found on abdominal segment VII. Whilst the derm surrounding the opening of the **vulva** is thin and membranous and obscured by the anal tube, it can occasionally be found just anterior to the anogenital fold. On *Inglisia patella* and species of *Lecanochiton*, the anterior margin of segment VII and the vulva lie some distance anterior to the anal area, near the centre of the abdomen.

For a detailed description of the structure of the Coccidae, see Hodgson (1994a).

Genus *APHENOCHITON* Henderson & Hodgson new genus

Type species: *Inglisia inconspicua* Maskell (here designated).

Diagnosis. Adult female. Test: glassy, flat to slightly convex, hyaline, thin and brittle, showing a reticulate pattern, reticulation plates all subequal in size.

Shape: mature adults of moderate size, less than 7 mm in length, elongate oval to almost round, flat to slightly convex, with a shallow anal cleft; colourless to light green.

Dorsum: derm membranous. Dorsal setae absent. Dorsal pores distributed in a distinctly reticulate pattern, delineating a reticulation area underlying each wax plate of test; these reticulation areas in 7 longitudinal rows, with 7 to 10 areas in median row between anal plates and anterior margin and 27–29 areas around margin; each reticulation area with few discernable pores. Dorsal pores of 3 or 4 main types: (i) small to minute, dark microductules, with a long inner filament, consisting of a narrow balloon-like proximal end and a filamentous distal end: restricted to lines of reticulation; (ii) small simple pores, often of 2 sizes: mostly present just laterad to lines of reticulation but also occasionally present medially in reticulation areas, particularly in more lateral areas and sometimes forming a distinct band just dorsad to marginal spines; and (iii) macropores, of 3 basic shapes: either (a) 'button-shaped', quite large (at least twice width of pregenital disc-pores) and rather flat, with a distinctly granulate surface, smaller on *A. pronus*; or (b) 'drum-shaped' much smaller (subequal in size to pregenital disc-pores), distinctly convex with a heavily sclerotised border; or (c) very large and convex, 'bollard-like', heavily sclerotised, often with an inner duct (on *A. inconspicuus*); all 3 types restricted to reticulation lines. Preopercular pores, dorsal tubercles, and dorsal tubular ducts absent. Anal plates together broadest in anterior third, tapering to apex, each plate with 2 finely spinose setae along inner margin near apex, 1 longer seta ± apically and another on outer margin or upper surface near apex; with no anal sclerotisation on dorsum around anterior margins of anal plates. Anogenital fold with 2 large sclerotised plates arising internally and extending anteriorly from anterior margin; with 3–5 pairs of long setae along anterior margin and a single seta on each lateral margin. Anal tube moderately long; anal ring with 3 pairs of setae.

Margin: marginal setae in a single line extending around margin to anal cleft (but not along anal cleft margins); finely spinose (broadly spinose on *A. inconspicuus*), with a fairly sharp apex and a narrow basal socket; with 3–16 between lateral stigmatic areas; reticulation setae rarely differentiated from marginal setae; marginal setae on anal lobes not differentiated. Stigmatic clefts absent on *A. grammicus*, otherwise distinctly invaginated and narrow, without stigmatic sclerotisations; each cleft with a single stout, spinose stigmatic spine, never longer than about 4 × length of larger marginal setae. Eyespot present or absent.

Venter: pregenital disc-pores with 5–9 (mainly 5–6) outer loculi and a single round central loculus; distributed on either side of anterior end of anal cleft and occasionally with a few on mediolateral lobes of preceding segments (across most posterior segments on *A. inconspicuus*). Spiracular disc-pores with mainly 5 loculi, in narrow bands 1–4 pores wide between spiracles and margin, each band generally broadening near spiracle but with a few extending medially past peritreme on some species. Preantennal pores: 0–2 present. Ventral microducts present in a broad marginal band and medially on head, thorax, and abdominal segments II–VI. Ventral tubular ducts absent. Ventral setae: with 0–7 pairs of small anterior anal cleft setae, forming a distinct line along margins of anal cleft on some species; hypopygial setae present or absent; with 1 to several pairs of long pregenital setae on segment VII and usually also on segment VI and frequently with medium-sized setae on these and more anterior segments; other setae distributed as for family. Antennae well developed, 6- to 8-segmented, 3rd segment much longest; when 6-segmented, with 0–3 pseudosegments; setal distribution as for family. Mouthparts occasionally displaced to one side. Spiracles typical of family. Legs well developed, generally with a separate tibia and tarsus (fused on *A. subtilis*) but no tibio-tarsal articulatory sclerosis; distribution of leg setae as for family; claws small and short, without a denticle; claw digitules similar and broad; tarsal digitules dissimilar, one shorter and narrower than other; tarsal campaniform pores absent. Vulva opening on posterior of segment VII.

Remarks. This genus contains nine species: *Aphenochiton chionochloae* Henderson & Hodgson, n. sp., *A. dierama* Henderson & Hodgson, **n. sp.**, *A. grammicus* Henderson & Hodgson, **n. sp.**, *A. inconspicuus* (Maskell), **n. comb.**, *A. kamahi* Henderson & Hodgson, **n. sp.**, *A. matai* Henderson & Hodgson, **n. sp.**, *A. pronus* Henderson & Hodgson, **n. sp.**, *A. pubens* Henderson & Hodgson, **n. sp.**, and *A. subtilis* Henderson & Hodgson, **n. sp**. This group is characterised by:

(i) the complete absence of ventral tubular ducts;

(ii) pregenital disc-pores with 5–9 (generally 5–6) loculi;

(iii) rather few marginal setae, with 3–16 between the lateral stigmatic clefts, each usually finely spinose;

(iv) dorsal reticulations in 7 longitudinal rows;

(v) stigmatic clefts usually distinct;

(vi) dorsal macropores either bollard-like (*A. inconspicuus*), or flat-convex and quite large, or smaller and more convex.

Aphenochiton is one of the New Zealand genera in which the species have pregenital disc-pores which are mainly 5-locular. They differ from all similar species except *Epelidochiton piperis* in lacking ventral tubular ducts. Species in the genus *Aphenochiton* differ from *E. piperis* in:

(i) lacking sclerotisations in each reticulation area;

(ii) the absence of a horseshoe-shaped anal sclerotisation on dorsum anterior to the anal plates;

(iii) the position and length of the anal plate setae;

(iv) having 1 type of ventral microduct, and

(v) the absence of multilocular disc-pores near the mouthparts.

The species currently placed in *Aphenochiton* are all endemic to New Zealand.

Generic name derivation: the name refers to the inconspicuousness of these species: *aphenes* (Gr.) meaning unseen, invisible, secret, obscure, and *chiton* (Gr.) tunic or garment worn next to the skin.

Key to adult female *Aphenochiton*

1 Marginal setae strongly spinose, rather lanceolate in shape, tapering to a fine point; pregenital disc-pores tending to spread across most abdominal segments .. .. ***inconspicuus***

—Marginal setae finely spinose, narrow at base; pregenital disc-pores restricted to laterad to anogenital fold and to mediolateral folds of most abdominal segments 2

2 With more than 4 marginal setae on each side between stigmatic areas; hypopygial setae present 3

—With 3 marginal setae on each side between stigmatic areas; hypopygial setae absent 5

3 Pregenital disc-pores restricted to pregenital segment only .... ***pubens***

—Pregenital disc-pores extending onto mediolateral folds of most or all abdominal segments 4

4 Body of mature female large, at least 4 mm long; with more than 50 spiracular disc-pores in each disc-pore band; antennae more than 400 μm long .... ***chionochloae***

—Body of mature female small, less than 3 mm long; with less than 30 spiracular disc-pores in each disc-pore band; antennae less than 300 μm long .... ***matai***

5 Dorsal macropores abundant and widespread, extending laterally to near margin 6

—Dorsal macropores few and restricted to reticulation lines around median 3 rows of reticulation areas 7

6 Body distinctly elongate, length usually at least 2.5 × width; abdominal segment VI with only short pregenital setae; with only a single pair of anterior anal cleft setae; anterior margin of anogenital fold with 3 pairs of setae .... ***grammicus***

—Body oval, length usually less than 2.0 × width; abdominal segment VI with at least 1 pair of long pregenital setae; with 3+ pairs of anterior anal cleft setae; anterior margin of anogenital fold with 4 pairs of setae .... ***dierama***

7 Legs with a separate tibia and tarsus; apical segment on antenna short, length about 2.5 × width; anterior anal cleft setae not resembling a pair of inwardly pointed combs. 8

—Legs with tibia and tarsus fused; apical segment on antenna long, length at least 4 × width; anterior anal cleft setae rather long and stiff, resembling a pair of inwardly pointed combs .... ***subtilis***

8 Dorsal macropores quite large, at least 2 × width of pregenital disc-pores, mainly in reticulation lines along margins of median row of reticulation areas, except on abdomen; legs short, 150–185 μm .... ***kamahi***

—Dorsal macropores small, about size of pregenital disc-pores, and present around margins of median 3 rows of reticulation areas; legs long, 185–290 μm ..... ***pronus***

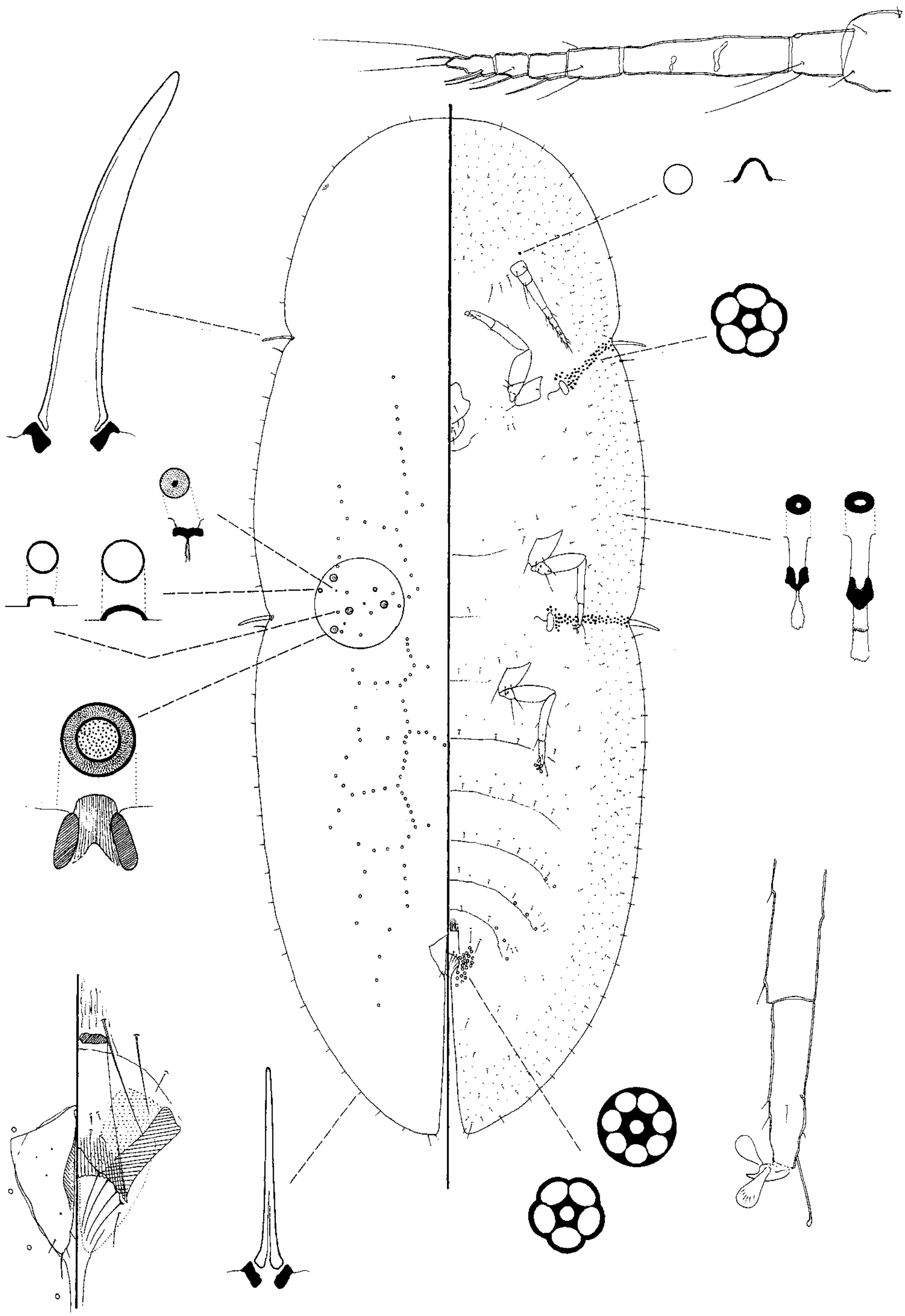


Fig. 96. *Aphenochiton chionochloae* Henderson & Hodgson, **n. sp.**, adult female; circle contains reticulation line of dorsal pores further enlarged.

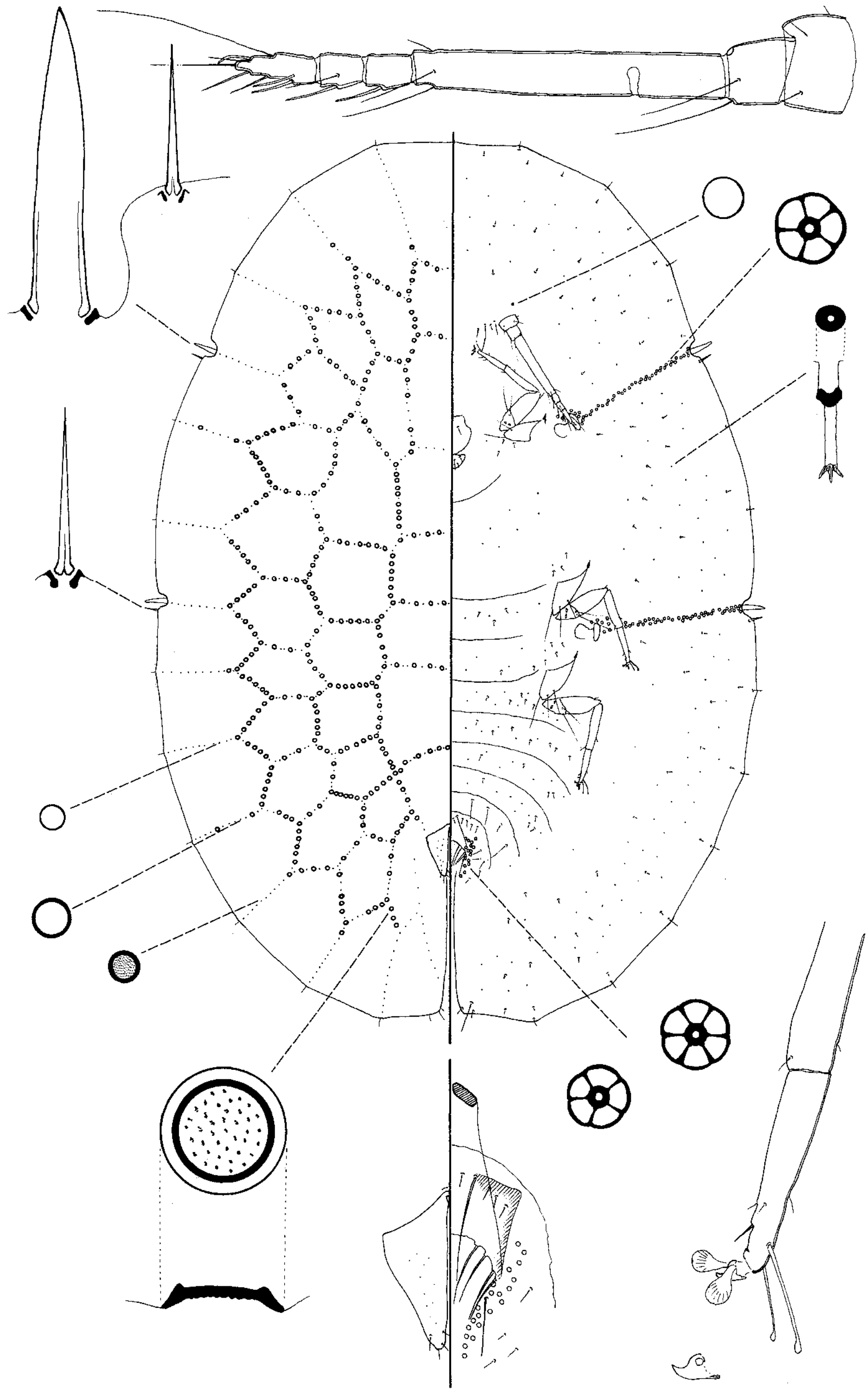


Fig. 97. *Aphenochiton dierama* Henderson & Hodgson, **n. sp.**, adult female.

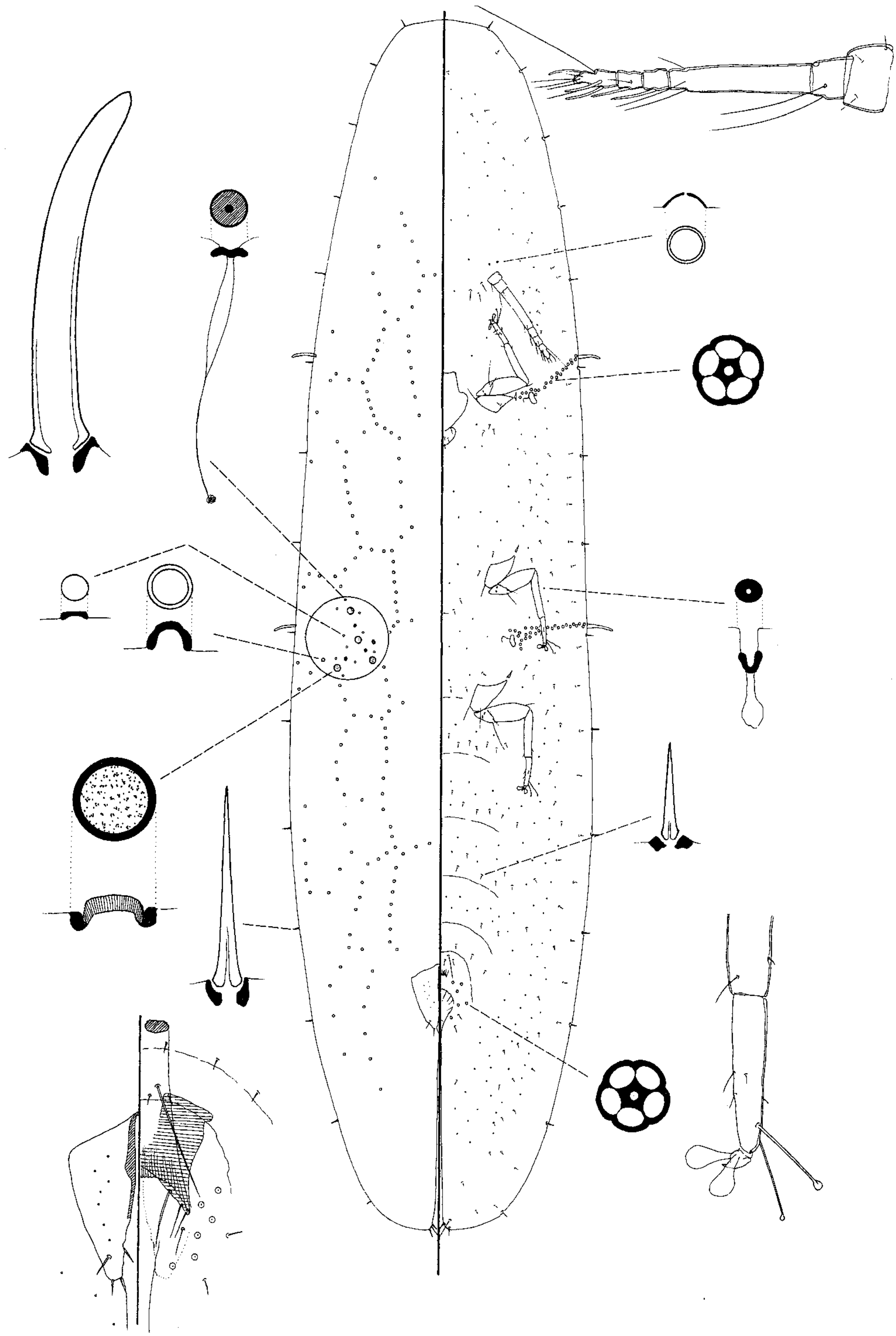


Fig. 98. *Aphenochiton grammicus* Henderson & Hodgson, **n. sp.**, adult female; circle contains reticulation line of dorsal pores further enlarged.

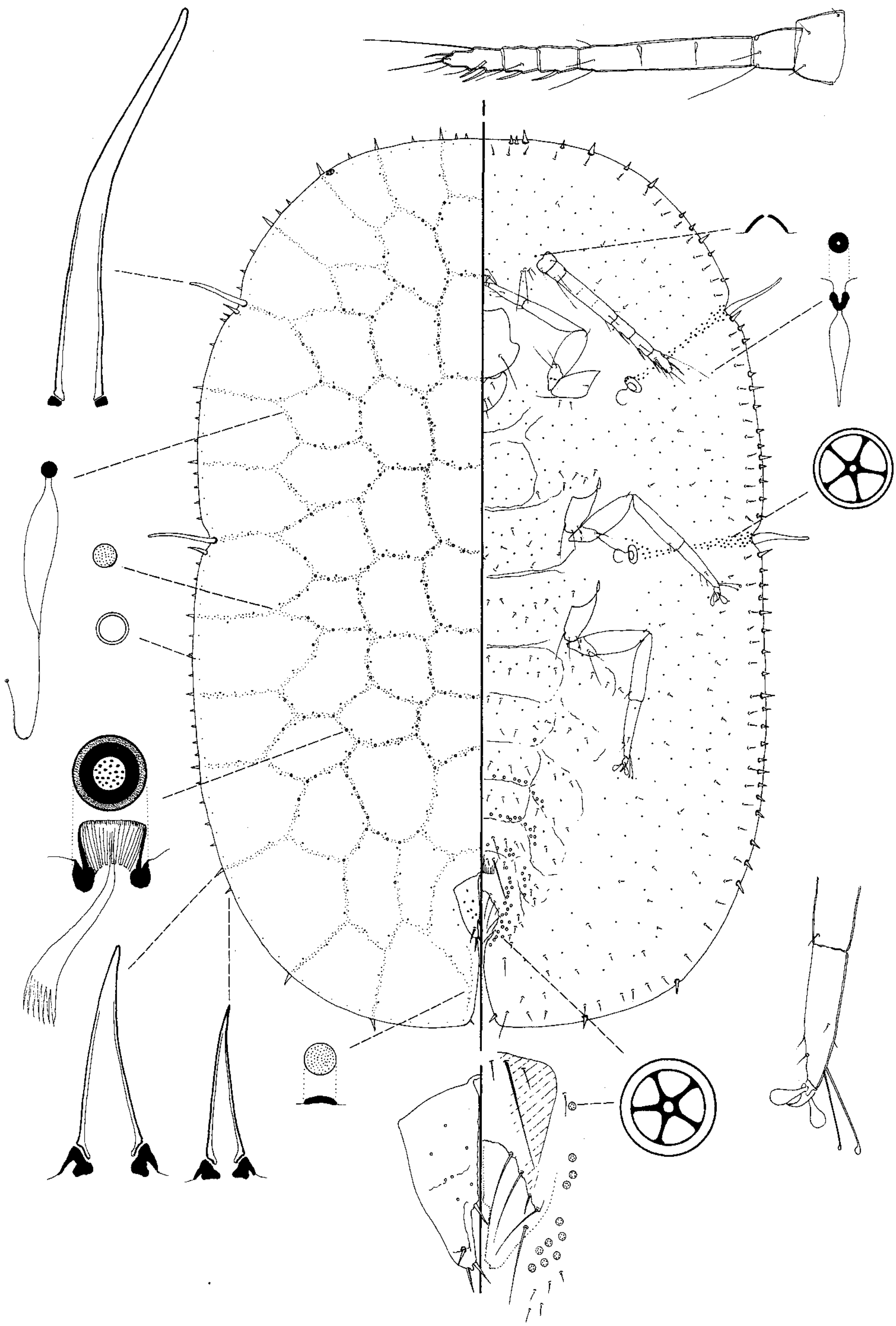


Fig. 99. *Aphenochiton inconspicuus* (Maskell), **n. comb.**, adult female.

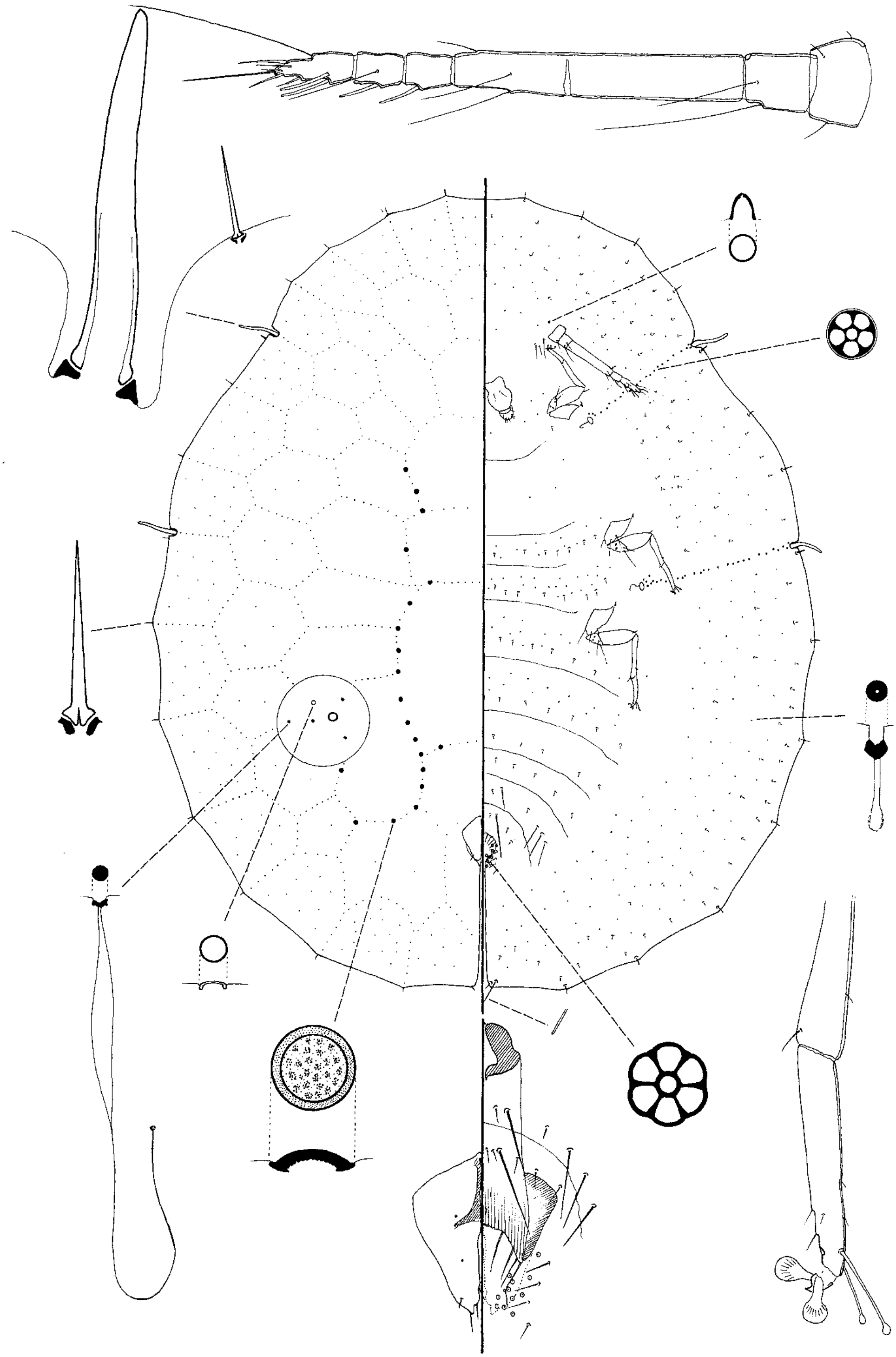


Fig. 100. *Aphenochiton kamahi* Henderson & Hodgson, **n. sp.**, adult female; circle contains reticulation line of dorsal pores further enlarged.

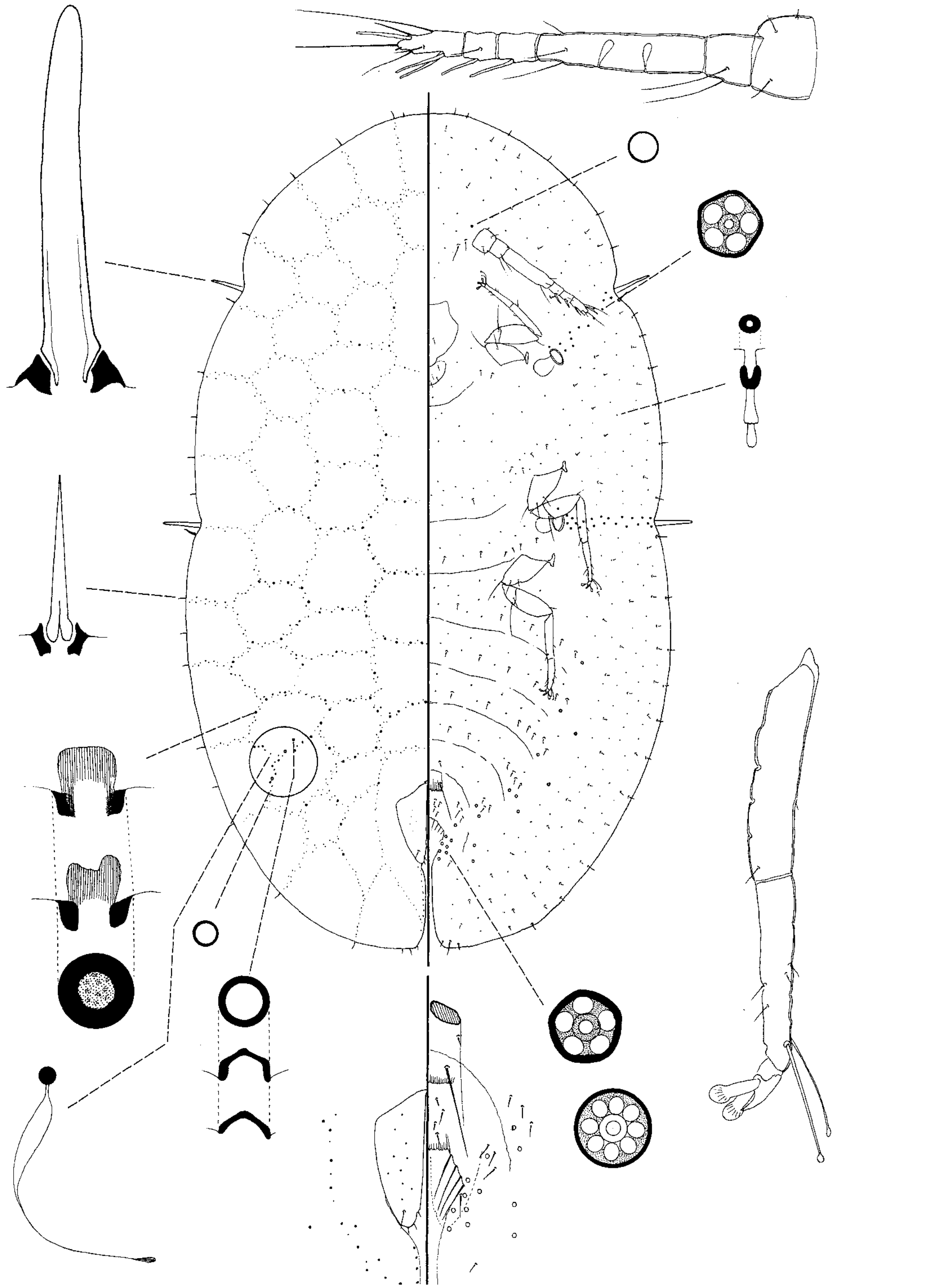


Fig. 101. *Aphenochiton matai* Henderson & Hodgson, **n. sp.**, adult female; circle contains reticulation line of dorsal pores further enlarged.

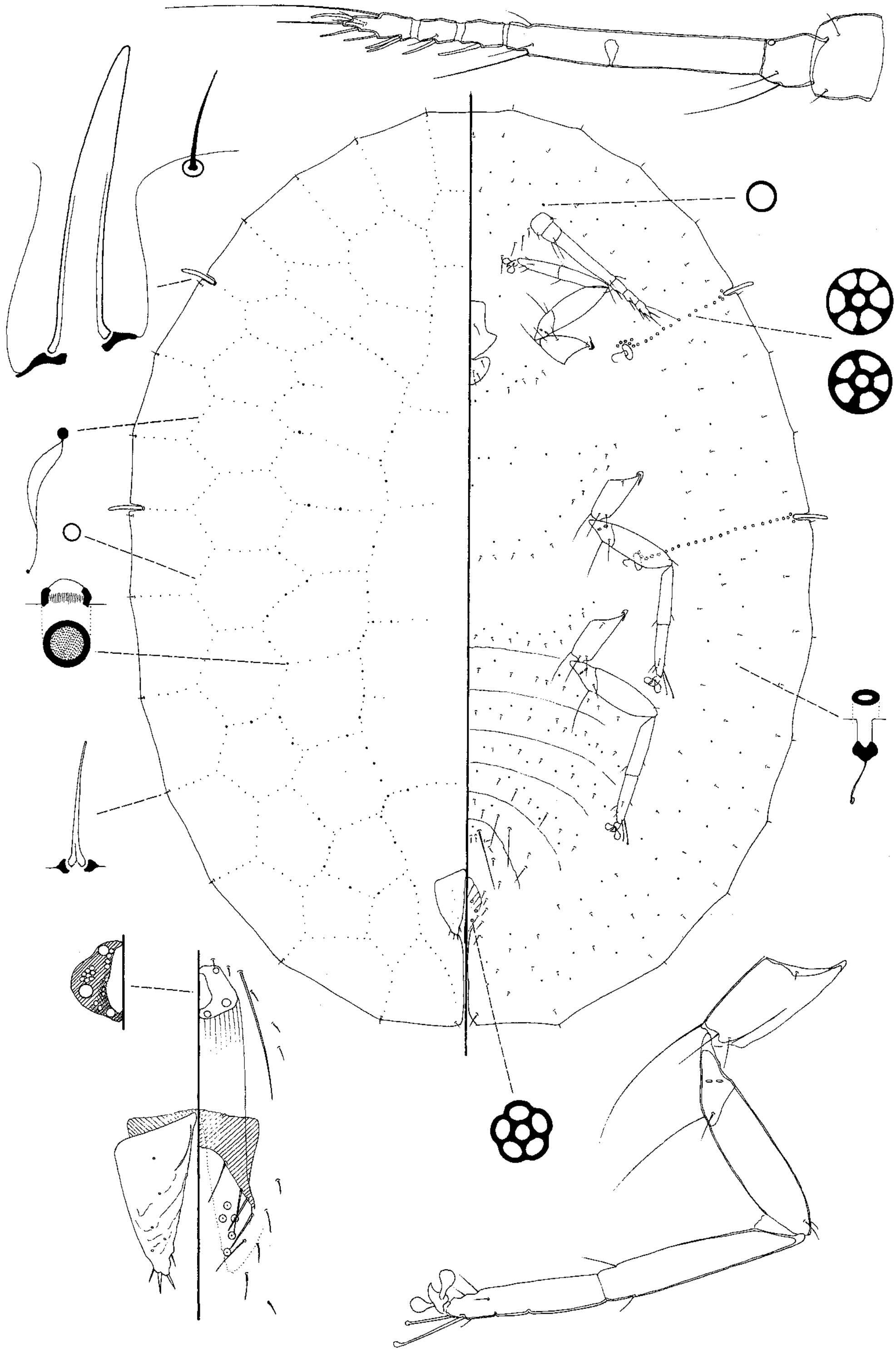


Fig. 102. *Aphenochiton pronus* Henderson & Hodgson, **n. sp.**, adult female.

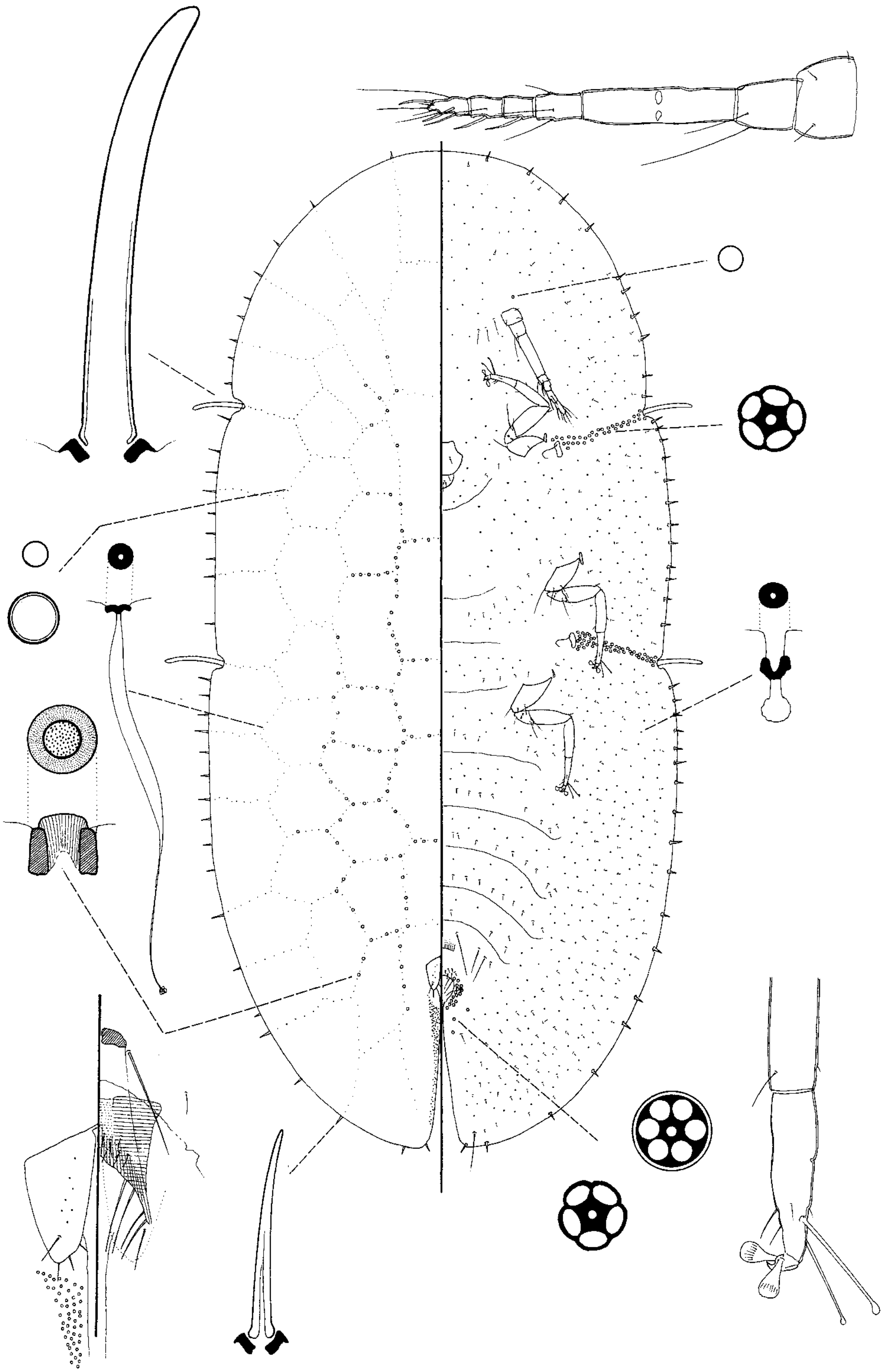


Fig. 103. *Aphenochiton pubens* Henderson & Hodgson, **n. sp.**, adult female.

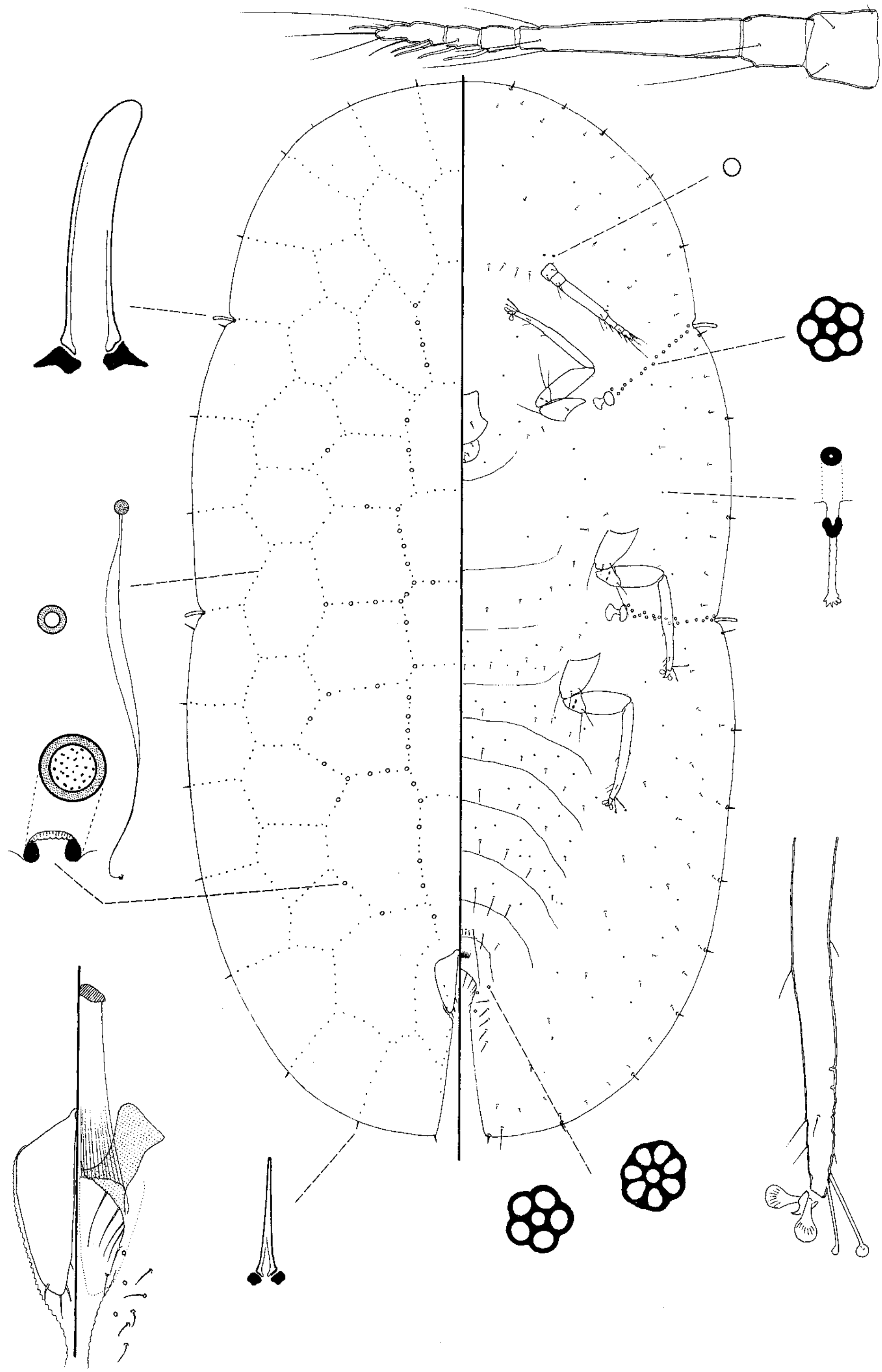


Fig. 104. *Aphenochiton subtilis* Henderson & Hodgson, **n. sp.**, adult female.

Aphenochiton chionochloae Henderson & Hodgson new species

Fig. 96

Unmounted material: only known material is of dry adult females removed from host plant; females elongate-oval and rather flat.

Mounted material: body elongate-oval, with shallow stigmatic clefts; anal cleft quite deep, about 1/6th body length; length 4.2–6.3 mm; breadth 2.0–2.7 mm.

Dorsum: dorsal pores in a reticulate pattern, probably with 7 rows of reticulation areas across dorsum, with about 8–9 reticulation areas between anal plates and anterior margin and perhaps 29 areas around margin. Dorsal pores of 3 or 4 types: (i) microductules: frequent within reticulation lines and along margins of anal cleft, where perhaps slightly larger; (ii) simple pores of 2 sizes: smaller pores subequal or slightly larger than pore of microductule, frequent in all reticulation lines and throughout more marginal reticulation areas; larger pores: perhaps more convex, scarce near reticulation lines and in a sparse submarginal band; and (iii) relatively small macropores (3–5 µm diameter — subequal in width to pregenital disc-pores), heavily sclerotised and highly convex: most abundant in median and submedian reticulation lines, absent near margin and anteriorly; with 2–4 macropores in the posterior medial macropore line. Anal plates: 158–176 µm long, combined widths 153–189 µm; each with 4–7 minute pores on dorsal surface; length of setae: inner margin 1, 7–9 µm; inner margin 2, 9–11 µm; apical, 8–22 µm; outer margin, 16–20 µm. Anogenital fold with 4 pairs of setae along anterior margin of anal fold and 1 pair laterally; longest 50–61 µm.

Margin: marginal setae finely spinose, with 8–13 on each side between stigmatic clefts; setae of 2 sizes: most setae small and fine, 12–22 µm long, but those just posterior to stigmatic clefts longer and more spinose, 23–31 µm long; reticulation setae not noticeably larger. Stigmatic spines of rather uniform thickness, generally bent, with a blunt apex; length 57–76 µm.

Venter: pregenital disc-pores with mainly 5–6 loculi (range 4–8): with (on each side of segment): VII, 15–35; VI, 2-5; V, 1–4; IV, 0–2; III, 0–2; and II, 0–1. Spiracular disc–pores: with 47–98 in each anterior band and 61–97 in each posterior band; each band becoming 5–6 pores wide near spiracle and margin; anterior bands with 0–3 pores present a short distance mesad to peritremes. Ventral microducts as for genus. Ventral setae: ventral anal lobe setae moderately long, each 37–51 µm; with 1–2 pairs of anterior anal cleft setae; with a group of 3–6 hypopygial setae; with pairs of long pregenital setae restricted to segment VII (one specimen had 1 long seta on VI); number of setae medially on abdomen: VII, 2 long, 0–3 medium + 1–5 short; VI, 0–1 long, 6–10 shorter; V, 7–14 short; IV, 10–17; III, 9–13; and II, 7–9; with 9–13 setae medially on metathorax; 6–9 medially on mesothorax and 1–2 setae near each procoxa, all rather short, length of setae associated with each procoxa 5–7 µm; with 3–4 pairs of inter–antennal setae; with 5–11 submarginal setae on each side between stigmatic areas. Antennae 6- to 8-segmented, with 0–2 pseudosegments in 3rd segment when 6- or 7-segmented; total length 471–587 µm; length of apical segment 34–53 µm; length of apical seta 45–60 µm. Mouthparts not apparently displaced to one side; length of clypeolabral shield 180–195 µm long. Width of spiracular peritremes: anterior 48–63 µm, posterior 55–81 µm. Legs: with a separate tibia and tarsus; lengths (metathoracic): coxa 187–230 µm, trochanter + femur 239–317 µm, tibia 194–252 µm, tarsus 126–164 µm, claw 14–20 µm.

Material examined: HOLOTYPE ♀: NEW ZEALAND: **NC**: Mt Oxford, [3,500 ft] 1060 m, 8 Feb 1955, W.R. Boyce, *Chionochloa flavescens*, #90-214d, NZAC: 1/ 1♀ad.
PARATYPES ♀♀: NEW ZEALAND: **NC**: as for holotype, #90-214a–c, e–i + 3 slides, W. Cottier Collection, as previous except [as *Danthonia flavescens*]: 11/11♀♀ ad.

Other material: none known.

Remarks. *A. chionochloae* is very similar to *A. pubens*. However, *A. chionochloae* has:

(i) more pregenital disc-pores (15–35 as compared with 5–21 in *A. pubens*), which are also present mediolaterally on some of the preceding abdominal segments;

(ii) fewer (3–6) hypopygial setae than *A. pubens* (which has 5–16);

(iii) shorter anal lobe setae (37–51 µm on *A. chionochloae* as against 72–108 µm on *A. pubens*);

(iv) legs, antennae, and spiracular peritremes all 20–25% larger than on *A. pubens*;

(v) twice as many disc-pores in each spiracular disc-pore band (usually more than 60 on *A. chionochloae* but less than 45 on *A. pubens*).

Biology. Unknown.

Distribution. Currently only known from the original collection off *Chionochloa* from Mt. Oxford in the South Island (Map 1).

Name derivation. This species has been named after the genus of its host plant, *Chionochloa* which in turn means 'snow grass'; *C. flavescens* is the broad-leaved snow tussock.

Aphenochiton dierama Henderson & Hodgson new species

Fig. 97

Unmounted material: unknown.

Mounted material: body broadly elongate-oval; with distinct, moderately deep stigmatic clefts; anal cleft about 1/6th–1/7th body length; length 3.0–6.6 mm; breadth 1.8–4.7 mm.

Dorsum: dorsal pores in a reticulated pattern, with 7 longitudinal rows of reticulation areas across dorsum, with 8 areas between anal plates and anterior margin and with 27 areas around margin. Dorsal pores of 3 types: (i) microductules: frequent within lines of reticulation, each often in an areolation; also in a line on either side of anal cleft; (ii) flat, simple pores, rather variable in size but mainly a little larger than microductules: frequent along margins of all reticulation areas; and (iii) large macropores (8–11 µm wide—at least 2 × width of pregenital disc-pores), heavily sclerotised, flat to slightly convex, with a granulate surface: abundant in all reticulation lines except near margin; with 7–12 macropores in posterior medial macropore line. Anal plates: 172–218 µm long, combined widths 124–202 µm; each with 4–10 minute pores on dorsal surface; length of setae: inner margin 1, 7–8 µm; inner margin 2, 9–13 µm; apical, 13–18 µm; outer margin, 14–18 µm; all near anal plate apex. Anogenital fold with 4 pairs of setae along anterior margins and a single pair laterally; longest 45–63 µm.

Margin: marginal setae finely spinose, with 3 on each side between stigmatic clefts; length 10–34 µm, those just posterior to stigmatic clefts usually much larger and distinctly spinose. Stigmatic spines of rather uniform thickness, often rather bent with a blunt apex; length 36–72 µm.

Venter: pregenital disc-pores: restricted to segment VII, in groups of 11–21 on either side of anterior end of anal cleft. Spiracular disc-pores: in bands 1–2 pores wide; with 38–62 in each anterior band and 37–64 in each posterior band; with 0–2 pores present mesad to each anterior peritreme. Ventral microducts as for genus. Ventral setae: ventral anal lobe setae 54–81 µm long; with 4–5 pairs of anterior anal cleft setae, not in a distinct line; with 2–3 long setae present medially on segment VII only but with medium length setae sometimes present on more anterior segments; number of short and medium length setae medially on abdomen: VII, 5–10; VI, 4–13; V, 5–10; IV, 14–16; III, 16–22; and II, 8–15; with 11–22 setae medially on metathorax, 8–11 medially on mesothorax and 3–5 near each procoxa; length of setae associated with procoxae 5–8 µm long; with 3–5 pairs of inter-antennal setae; with 3–6 submarginal setae on each side between stigmatic areas. Antennae: occasionally with a pseudo-segment on segment III; total length 440–510 µm; length of apical segment 53–57 µm; length of apical seta 52–81 µm. Length of clypeolabral shield 144–162 µm. Width of spiracular peritremes: anterior 32–45 µm, posterior 36–49 µm. Legs: with a separate tibia and tarsus; lengths (metathoracic): coxa 174–211 µm, trochanter + femur 211–249 µm, tibia 182–234 µm, tarsus 99–128 µm, claw 16–19 µm, hooked part of claw very short.

Material examined. HOLOTYPE ♀: NEW ZEALAND: **NC**: Arthur's Pass, 23 Jan 1983, J.M. Cox, under bark *Dracophyllum*, #161, NZAC: 1/3 ♀♀ (holotype is nearest the locality label and is clearly marked).
PARATYPES: as for holotype, the other 2 females on slide.

Other material: New Zealand: **NN**: Mount Lodestone, 1160 m [as 3800 ft], *Dracophyllum traversii*, 17 Nov 1969, J.A. de Boer, #604: 3/4 ♀♀ ad. Mt. Arthur, Flora Track, *Dracophyllum* sp., 8 Feb 1982, C.F. Butcher, #83–300g: 1/1 ♀ ad. **OL**: Makarora [as Makaroa], *Podocarpus hallii*, 1 Feb 1983, J.M. Cox, #227: 2/2 ♀♀ ad.

Remarks. *A. dierama* is one of the *Aphenochiton* species (along with *A. grammicus* and *A. kamahi*) which have large, rather flat, dorsal macropores. It can be separated from the other two species by the following combination of characters:
(i) dorsal macropores abundant in all reticulation lines except near margin;
(ii) with 2–3 long pregenital setae, restricted to segment VII;
(iii) with 27 reticulation areas around the margin;
(iv) marginal setae just posterior to each stigmatic cleft rather large and spinose;
(v) body much broader than *A. grammicus*.

Biology. Likely to have only one generation a year, as all collections are of adult females around midsummer.

Distribution. Only known from montane localities in the South Island (Map 2).

Name derivation. The name of this species is taken from the Greek *dierama*, meaning a sieve or strainer, referring to the large number of dorsal macropores, and is used as a noun in apposition.

Aphenochiton grammicus Henderson & Hodgson new species

Fig. 98

Unmounted material: adult female very thin and transparent and almost covering the width but not the full length of the host plant leaf.

Mounted material: body rather elongate-oval, anterior end acuminate and posterior end narrow; without stigmatic clefts; anal cleft quite deep, about 1/6th body length; length 3.3–4.2 mm; breadth 1.0–1.3 mm.

Dorsum: dorsal pores in a reticulate pattern, with 7 rows of reticulation areas across dorsum, with 8–9 reticulation areas between anal plates and anterior margin and with 29 areas around margin. Dorsal pores of 4 types: (i) microductules: within reticulation lines; (ii) simple pores, smaller than pore of microductule and flattish, scattered within reticulation lines and within marginal reticulation areas; (iii) slightly larger, rather convex, simple pores, occasionally within reticulation lines and near margin; and (iv) moderately large macropores, heavily sclerotised and flat to slightly convex, 5–7 µm wide: most abundant medially, becoming less frequent near margin and anteriorly; with about 4 macropores in posterior medial macropore line. Anal plates: 156–189 µm long, combined widths 133–171 µm; each with 5–8 minute pores on dorsal surface; length of setae: inner margin 1, 7–9 µm; inner margin 2, 10–13 µm; apical, 14–16 µm; outer margin, 16–18 µm. Anogenital fold with 3 pairs of setae along anterior margin and a single pair laterally, longest 27–47 µm.

Margin: marginal setae finely spinose, with 3 on each side between stigmatic clefts, length 10–13 µm, with those just posterior to stigmatic spines longest, up to 30 µm. Stigmatic spines of rather uniform thickness, often rather bent with a blunt apex; length 39–45 µm.

Venter: pregenital disc-pores with mainly 5 outer loculi; in groups of 5–7 on either side of anterior end of anal cleft only. Spiracular disc-pores: with 16–28 in each anterior band and 14–34 in each posterior band; anterior bands with 1–3 pores present just mesad to peritremes. Ventral microducts present throughout except in a narrow marginal band and medially on abdominal segments VI and VII. Ventral setae: ventral anal lobe setae 45–58 µm long; with 2–4 pairs of anterior anal cleft setae rather randomly distributed; hypopygial setae absent; with a pair of long pregenital setae restricted to segment VII; number of short setae medially on abdomen: VII, 4–6; VI, 3–7; V, 4; IV, 9–14; III, 9–11; and II, 9–13; with 6–7 setae medially on metathorax, 2 near each mesocoxa and 2–3 near each procoxa, length of setae associated with each procoxa 9–11 µm; with 3–4 pairs of inter-antennal setae plus 1 seta medially; with 7 submarginal setae on each side between stigmatic areas. Antennae: total length 279–340 µm; length of apical segment 34–46 µm; length of apical seta 37–47 µm. Length of clypeolabral shield 127–155 µm. Width of spiracular peritremes: anterior 23–33 µm, posterior 25–38 µm. Legs: with a separate tibia and tarsus; lengths (metathoracic): coxa 70–117 µm, trochanter + femur 131–194 µm, tibia 108–166 µm, tarsus 73–104 µm, claw 13–18 µm.

Material examined: HOLOTYPE ♀: NEW ZEALAND: **TO**: Pureora Forest Lodge, 10 Jan 1995, R.C. Henderson, *Dracophyllum subulatum* lvs, NZAC #95-012: 1/1 ♀ ad.

Other material: NEW ZEALAND: **GB**: Kakanui, 300 m, *Dracophyllum sinclairii*, 1 Feb 1993, RCH, #93-206a–b: 2/2 ♀♀ ad, 1 ♂ 2nd, 1 1st.

Remarks. *A. grammicus* is closest to *A. dierama* and *A. kamahi* in having moderately large, rather flat dorsal macropores, but is separated from the other two species by the following combination of characters:

(i) its very elongate shape (the other species tend to be more oval);
(ii) dorsal macropores frequent to abundant in all reticulation lines except near margin;
(iii) antennae without pseudosegments;
(iv) a single pair of long pregenital setae on segment VII, all other setae medially on abdomen short;
(v) 3 pairs of setae along anterior margin of anogenital fold.

Biology. Unknown.

Distribution. Restricted to narrow-leaved *Dracophyllum* spp. and collected in the East Cape region near Te Araroa and on the frost flats at Pureora in central North Island (Map 3).

Name derivation. This species is particularly long and narrow and the specific name is taken from the Greek *grammikos* meaning linear.

Aphenochiton inconspicuus (Maskell) new combination

Figs M16, C32, 99

Inglisia inconspicua Maskell, 1892: 19; –Maskell, 1895a: 14 [checklist]; –Cockerell, 1896: 330 [checklist]; –Fernald, 1903: 162 [world catalogue]; –Hutton, 1904: 227 [checklist]; –Myers, 1922: 199 [checklist]; –Wise, 1977: 105 [checklist]; –Deitz & Tocker, 1980: 29 [checklist]; –Ben-Dov, 1993: 148 [world catalogue]

Unmounted material: "Test of adult female white, elongated, narrow, convex, not conical, with [marginal] fringe [of wax plate filaments] either absent or very small; texture glassy, very thin and delicate and brittle; segments polygonal, marked with very delicate radiating striae of air cells and still finer concentric lines. Length of test averaging about 1/5 in. [5 mm]; height 1/30th in. [0.8 mm]. Although the test itself is white, the general appearance of the insect on the twig is brown, the colour of the insect showing through the translucent segments." "Adult female brown or reddish-brown, filling the test but shrivelling at gestation." (Maskell, 1892, p. 19).

Mounted material: body elongate oval; anal cleft about 1/9th body length; stigmatic clefts shallow but distinct; length 2.0–5.0 mm; breadth 1.35–2.45 mm.

Dorsum: dorsal pores in a reticulate pattern, with 7 rows of reticulation areas across dorsum, 9 reticulation areas between anal plates and anterior margin, and 29 areas around margin. Dorsal pores of 3 types: (i) microductules: sparse, restricted to lines of reticulation; (ii) simple pores of 2 types, both rather variable in size: (a) darkish pores: common but restricted to reticulation lines; and (b) slightly larger, paler pores: common along reticulation lines but also present sparsely within reticulation areas and with 9–11 submarginally on each side between stigmatic clefts; and (iii) large, very convex, bollard-like macropores, heavily sclerotised, basal portion slightly sunken, with an inner duct: distinctive in side view (Fig. M16) but appearing round in dorsal view: frequent in all reticulation lines except near margin; with 5–7 macropores in posterior medial macropore line. Anal plates: 144–189 µm long, combined widths 183–195 µm; with 1–6 minute pores on dorsal surface of each plate; length of setae: inner margin 1 (about 1/3rd from apex), 12–22 µm; inner margin 2 (just anterior to apex), 12–22 µm; apical (on apex), 13–31 µm, and outer margin (on dorsal surface of plates), 18–26 µm. Anogenital fold with 4 pairs of setae on anterior margin and 1 pair laterally; longest 54–81 µm.

Margin: marginal setae moderately strongly spinose, with 3–16 setae on each side between stigmatic clefts; setae usually curved and tapering to a fine point, of widely varying size, but with poorly developed basal sockets; those just posterior to each cleft sometimes set slightly onto dorsum and larger; those at reticulation points also larger; with 3 larger reticulation setae on each side between stigmatic clefts, each 32–38 µm long, and with 3–13 smaller setae between clefts, length 14–22 µm. Stigmatic spines tapering to a point, often slightly curved, with a narrow basal socket; set slightly onto dorsum; length 108–144 µm. Eyespot usually fairly distinct, 20 µm wide, just dorsad to marginal spines.

Venter: pregenital disc-pores with mainly 5 (range 3–6) loculi; distributed across most posterior abdominal segments; number on each segment (medially across each segment/in each lateral group): VII, 0–2/5–23; VI, 9–12/0–5; V, 11–16/0–4; IV, 7–12/0–3; III, 2–7/0; and II, 1/0; none laterad to metacoxae. Spiracular disc-pores with 3–6 (mainly 5) loculi in bands of variable width; with 30–53 in each anterior band and 23–62 in each posterior band; with 0–3 pores extending medially past peritreme. Ventral microducts of 1 type: present rather sparsely throughout except absent medially on posterior 4 abdominal segments. Ventral setae: ventral anal lobe setae 41–72 µm long; with 3–6 pairs of anterior anal cleft setae; hypopygial setae absent; with 1 pair of long pregenital setae present on segment VII only; longest about 50 µm; number of setae medially on each abdominal segment: VII, 2 long + 4–9 medium; VI, 2–8 medium (occasionally 2 slightly larger); V, 3–11 short (occasionally 1–2 medium); IV–II, 7–16 short; with 12–20 setae medially on metathorax and with a large group medially on mesothorax; with a group of 5–7 just anterior/mesad to mesocoxae and 2–5 near each procoxa; length of setae associated with procoxae, 10–16 µm; with 5–11 submarginal setae on each side between stigmatic areas, these longer than those more medially; with 3–4 pairs of inter-antennal setae. Antennae well developed, 6- (to 8-) segmented; 3rd segment with 2 pseudosegments (which sometimes appear to be distinct segments); total length 319–443 µm; length of apical segment 34–46 µm; length of apical seta 30–45 µm. Length of clypeolabral shield 176–207 µm. Width of spiracular peritremes: anterior 39–68 µm, posterior 48–78 µm. Legs: with a separate tibia and tarsus; lengths (metathoracic): coxa 110–146 µm, trochanter + femur 159–221 µm, tibia 135–168 µm, tarsus 102–127 µm, claw 18–22.5 µm.

Material examined: LECTOTYPE: NEW ZEALAND: ex W.M. Maskell's dry collection of *Inglisia inconspicua*, #149 (rectangular box), NZAC #95-018c: 1/1 ♀ ad. PARALECTOTYPES: (i) "*Inglisia inconspicua*, adult male, 1890, W.M.M."; NZAC: 1/1 ♂ ad.; (ii) "*Inglisia inconspicua*, larvae, 1891, W.M.M."; NZAC: 1/21 1sts.

Other material: NEW ZEALAND:, ex W.M. Maskell's dry collection of *Inglisia inconspicua*, (round pillbox) (i) [mounted by J.A. de Boer]: 1/1 ♀ ad; (ii) [mounted by RCH] on leaves of *Coprosma* sp., #95–018a–b, d–f: 6/1 ♀ ad (+1 ♀ ad *Kalasiris perforata* and 1 ♀ 3rd *Coccus ?hesperidum)*, 2♀ 2nd, 1♂ 2nd, 1 1st, immatures of uncertain species). Mask. coll. #149, USNM: 1/3 1st + 1 eriococcid 1st. **TO**: Mt. Ruapehu, *Aristotelia fruticosa* [as *fruiticosa*], 10 Mar 1958, J.I. Townsend: 3/3♀♀ ad. **NN**: Nelson, *Plagianthus divaricatus*, 22 Nov 1972, J.S. Dugdale, #960B: 1/1 ♀ ad, venter and dorsum split. **NC**: Waipara, *Muehlenbeckia australis*, 21 Nov 1915, G. Brittin Coll., Let. [sic!] T.D.A. Cockerell, Jan 1916, USNM: 1/1 ♀ ad [as *Eriochiton spinosus*]. **MC**: Chaney's Corner, [no host], Feb 1915, G. Brittin #76: 1/1 ♀ ad. New Brighton, *Corokia* sp., 25 May 1915, G. Brittin, #62: 1/1 ♀ ad. New Brighton, [no host], 26 May 1915, G. Brittin, #76: 1/1 ♀ ad. Birdlings Flat, on stems of *Coprosma propinqua*, 25 Aug 1996, G. Hall, #96-156a–i: 9/9♀♀ ad. Birdlings Flat, property G. Taylor, *Coprosma propinqua*, stems and leaves, 26 Sept 1997, RCH, #97-133a–j: 10/6♀♀ ad, 2♀ 3rd, 1♀ 2nd, 3♂ 2nd, 4 pupae. Banks Peninsula, Hinewai Reserve, *Pseudowintera colorata* stem, 6 Apr 1999, R. Macfarlane, #99-017a–b: 2/1 ♀ ad, 9 1sts. **SL**: Tiwai Point S22/35/78, *Olearia nummularifolia*, 16 Sept 1974, G. Collett, FRNZ: R(b)44: 4/4♀♀ ad.

Remarks. The available syntype series of 2 original slides contains an adult male and numerous crawlers, all in poor condition. It is here considered that none of these specimens is really suitable for primary type designation and so the lectotype has been selected from Maskell's dry collection of *Inglisia inconspicua*. This dry material is stored in two boxes: the first, a small rectangular box (labelled #149), contains twigs that each have a pin-hole through the stem, and several triangular pieces of card with "149" written on them, also each with a pin-hole. It is clear that at one time the specimens in this box were held on labelled pins, indicating that they were part of Maskell's original material. An adult female which was found glued to one of these twigs in the rectangular box and which appears to fit Maskell's description of *I. inconspicua*, has been slide-mounted (#95-018c) and designated as the lectotype. The above description is based on this specimen and on subsequent material from other collectors.

However, Maskell's remaining dry material in the second, round pillbox appears to be a mixture of collections, as at least two other coccid species have been identified within it and the identity of the immatures mounted from it is consequently doubtful. This material may not, therefore, be syntypic (see comments in Deitz & Tocker, 1980, p.17). Maskell (1892) indicated that the type series was off *Corokia cotoneaster* (Escalloniaceae) from the Reefton District of the South Island.

Adult female *A. inconspicuus*, along with *A. chionochloae*, *A. matai*, and *A. pubens*, have more than 3 spinose setae between the lateral stigmatic areas, but *A. inconspicuus* can easily be separated from the latter three species because:
(i) the marginal setae are broadly spinose (rather than finely spinose to setose);
(ii) there are no hypopygial setae (present in the other species);
(iii) the pregenital disc-pores are not restricted to the submedian folds on the abdomen but are also found medially.

Biology. Overwinters as the adult female. The male tests and nymphs are found on the leaves in the spring (September) and the adult females on twigs of the host plants.

Distribution. Currently known from the middle of the North Island to the south of the South Island (Map 4).

Aphenochiton kamahi Henderson & Hodgson new species

Figs M23, C33, 100

Unmounted material: Adult females almost round in shape, very thin and nearly transparent, often only noticed on undersurface of leaves because of more yellowish unborn nymphs clustered in abdomen; female test of thin glassy plates, marginal fringe plates rather pointed, but pair in each stigmatic cleft curve in towards each other.

Mounted material: body broadly elongate-oval; with distinct, moderately deep, stigmatic clefts; anal cleft about 1/6th body length; length 1.4–3.7 mm; breadth 1.2–3.1 mm.

Dorsum: dorsal pores in a reticulate pattern, with 7 rows of reticulation areas across dorsum, 7 or 8 reticulation areas between anal plates and anterior margin and 29 areas around margin. Dorsal pores of 3 types: (i) microductules: frequent within lines of reticulation; (ii) slightly larger simple pores: frequent along margins of all reticulation lines; and (iii) large macropores (Fig. M23), 8–11 µm wide (at least 2 × width of pregenital disc-pores), slightly convex, with a sclerotised rim and a granulate surface: infrequent in median reticulation lines and scarce or absent on head; with 2–3 in posterior medial macropore line. Anal plates: 136–171 µm long, combined widths 131–191 µm; each with 1–3 minute pores on dorsal surface; length of setae: inner margin 1, 5–7 µm; inner margin 2, 9–11 µm; apical, 11–17 µm; outer margin, 9–17 µm; all near apex of anal plates. Anogenital fold with 4 pairs of setae along anterior margin and with a single pair laterally; longest 36–54 µm.

Margin: marginal setae finely spinose, with 3 on each side between stigmatic clefts, length 9–20 µm, those just posterior to each cleft slightly larger than elsewhere. Stigmatic spines: of rather uniform thickness, often rather bent with a blunt apex; length 50–99 µm.

Venter: pregenital disc-pores restricted to a group of 6–16 on either side of anterior end of anal cleft on segment VII. Spiracular disc-pores: in bands mainly 1 pore wide; with 15–33 in each anterior band and 24–47 in each posterior band. Ventral microducts as for genus. Ventral setae: ventral anal lobe setae blunt and short, 25–41 µm long; with 4–6 pairs of anterior anal cleft setae pointing in several directions but more or less in a line; hypopygial setae absent; with 2–3 long setae present medially on segment VII and 5–10 distinctively long setae on segment VI, these all generally nearly as long as those on segment VII; other setae almost all short; number of short setae medially on each abdominal segment: VII, 5–10; VI, 1–4; V, 7–11; IV, 5–11; III, 8–12; and II, 8–12; with 9–20 setae across metathorax, 2–11 medially on mesothorax (none just anterior to coxae) and 0–2 near each procoxa, all short, length of setae associated with each procoxa 5–8 µm; with 2–4 pairs of inter-antennal setae; with 5–7 submarginal setae on each side between stigmatic areas. Antennae 6-segmented, with 0–2 pseudosegments in segment III; total length 264–376 µm; length of apical segment 34–46 µm; length of apical seta 43–56 µm. Mouthparts usually displaced towards 1 procoxa; length of clypeolabral shield 112–135 µm long. Width of spiracular peritremes: anterior 21–29 µm, posterior 25–34 µm. Legs: tibio-tarsal separation usually distinct but rarely reduced and appearing fused on an individual leg; lengths (metathoracic): coxa 111–153 µm, trochanter + femur 151–185 µm, tibia 104–134 µm, tarsus 91–121 µm, claw 11–15 µm, hooked part of claw very short.

Material examined: HOLOTYPE ♀: NEW ZEALAND: **GB**: Kakanui, 300 m, 30 Apr 1993, R.C. Henderson, *Weinmannia racemosa*, NZAC #93-284a: 1/1♀ ad.

PARATYPES: as for holotype ♀, NZAC #93-284b: 1/1♀ ad, 1♂ 2nd, pupa.

Other material: NEW ZEALAND: **ND**: Waipoua, *Weinmannia silvicola* [as *sylvicola*], 6 Nov 1961, J.M. Cox, FRNZ R(a) 73: 1/1♀ ad. **AK**: Hunua Ra, Mangatangi Reservoir, Workman Tk, *Weinmannia silvicola* leaf, 31 Jan 1998, C.J. Hodgson, #98-082: 1/1♀ ad. **BP**: Rereauira Swamp, Beech Ridge, *Weinmannia racemosa*, 17 Sep 1992, RCH, #92-310a–b: 2/5♀♀ ad. As previous except 29 Jan 1993, RCH, #93-063 & #93-278a–c: 4/5♀♀ ad, 3♀ 2nd. Te Koau, 200 m, Bushwalk Tk, *Weinmannia racemosa*, 31 Oct 1994, RCH, #94-106a–d: 4/2♀♀ ad, 4♀ 3rd (1 pharate), 1♀ 2nd, 7 1sts, 1 prepupa. Mamaku, Aquarius Rd, *Weinmannia racemosa*, 22 Sep 1981, R.M.J. McKenzie, FRNZ 73: 1/1♀ ad. Rotorua, 19 Jan 1998, *Weinmannia racemosa*, C.J. Hodgson, #98-042: 1/1♂ ad. **GB**: Paoneone, *Weinmannia racemosa* leaves, 2 Nov 1994, RCH, #94-107a–b: 2/2♀♀ ad, 1♂ ad, 1♂ 2nd, 1 prepupa. **TK**: Awakau Rd, *Weinmannia racemosa* leaves, 12 Dec 1993, RCH, #93-373a–i: 9/14♀♀ ad, 2♀ 3rd, 1♀ 2nd, 4♂ 2nd, pupa, 14 1st. Awakau Rd, *Weinmannia racemosa* underside leaves, 13 Nov 1994, RCH, #94-124a–c: 3/3♀♀ ad, 2♀ 3rd, 4♂ 2nd, 10 1st. As previous except *Melicytus ramiflorus* [tree beside *W. racemosa*], RCH & FL Henderson, #94-115c, 1/4♂ 2nd. **TO**: Ohakune, *Weinmannia racemosa*, 23 Sept 1958, G.B. Rawlings & R. Zondag, FRNZ R48: 1/3♀♀ ad. Pokaka, *Weinmannia racemosa*, 27 Jan 1982, C.F. Butcher, #83-325f: 3/3♀♀ ad. **FD**: Chalky Inlet, Edwardson Sound, L. Cadman Island, *Weinmannia racemosa*, 12 Feb 1996, RCH, #96-088: 1/2♀♀ ad. Dusky Sound, Resolution I, Facile Harbour, *Weinmannia racemosa*, 5 Feb 1996, RCH, #97-075a–c: 3/1♂ ad, 2♂ 2nd, pupa; moulted skin. **SI**: Stewart I, Halfmoon Bay, *Weinmannia racemosa* leaves, 18 Feb 1996, RCH, #96-089a–b: 2/5♀♀ ad.

Remarks. *A. kamahi* is one of the *Aphenochiton* species which have large, rather flat, dorsal macropores (along with *A. dierama* and *A. grammicus*). It differs from the other two species in the following combination of characters:

(i) dorsal macropores rather few, restricted to median reticulation lines;

(ii) very long pregenital setae present on both segment VI and VII;

(iii) 29 reticulation areas around the margin;

(iv) marginal setae just posterior to each stigmatic cleft only slightly longer and more spinose than those elsewhere.

Biology. It seems likely that this species has one generation per year overwintering as adult females. The adult female is probably the most thin and round coccid (as opposed to thin and long with *A. grammicus*) in New Zealand, appearing as nothing more than a film on the undersurface of the leaf and is nearly impossible to distinguish if wet with rain. Neonate nymphs have been observed emerging one at a time from beneath the posterior end of the test; there does not appear to be a brood chamber as on females of *Ctenochiton* or *Kalasiris* spp. Apparently restricted to *Weinmannia* spp.

Pathogens and parasitoids. Hymenopterous parasite recorded: Pteromalidae: *Aphobetus nana* (Bouček).

Distribution. Throughout, from the far north of the North Island to Stewart Island in the far south (Map 5).

Name derivation. As this species appears to be restricted to species of *Weinmannia*, it is named after the host plant's Maori name *kamahi*.

Aphenochiton matai Henderson & Hodgson new species

Fig. 101

Unmounted material: unknown.

Mounted material: body elongate-oval, with shallow stigmatic and anal clefts, latter about 1/9th body length; length 1.5–1.8 mm; breadth 0.85–0.93 mm.

Dorsum: dorsal pores in a reticulate pattern, with 7 rows of reticulation areas across dorsum, with probably 9 reticulation areas between anal plates and anterior margin and 29 areas around margin. Dorsal pores of 4 types: (i) microductules: frequent, associated with lines of reticulation and also in a band along margins of anal cleft, where slightly larger; (ii) flattish, simple pores, slightly larger than microductule: frequent in all reticulation lines only; (iii) larger, somewhat convex pores, rather scarce, located near reticulation lines but absent from submargin; and (iv) relatively small macropores (3–5 µm diam., subequal in width to pregenital disc-pores), heavily sclerotised and convex: most abundant in median and submedian reticulation lines, absent near margin and becoming less frequent on thorax and head; with 5–6 macropores in posterior medial macropore line. Anal plates rather narrow, 156–170 µm long, combined widths 126–153 µm; each with 4–10 minute pores on dorsal surface; length of setae: inner margin 1, 5–6 µm; inner margin 2, 7–9 µm; apical, 9–13 µm; outer margin, 10–15 µm. Anogenital fold usually with 4 pairs of setae along anterior margin and 1 pair laterally; longest 37–47 µm.

Margin: marginal setae finely spinose, with 3–7 on each side between stigmatic clefts; setae of 2 sizes: most setae small and fine, 7–10 µm long but those just posterior to stigmatic clefts longer and more spinose, 18–20 µm long; reticulation setae clearly enlarged when setae frequent but this less obvious when setae infrequent. Stigmatic spines of a rather uniform thickness, sometimes slightly bent, and with a blunt apex; length 61–74 µm.

Venter: pregenital disc-pores with mainly 5–6 loculi (range 3–8), all associated with mediolateral folds on abdomen; number on each side of segment: VII, 5–8; VI, 2–4; V, 1–3; IV, 1–3; III, 1–2; and II, 0–1; none laterad to metacoxae. Spiracular disc-pores: with 12–18 in each anterior band and 16–22 in each posterior band; bands narrow but broadening slightly near spiracle and margin and with 0–2 pores present a short distance mesad to peritremes. Ventral microducts: frequent, distributed as for genus. Ventral setae: anal lobe setae sometimes absent, when present, short, 27–34 µm long; with 0–2 pairs of anterior anal cleft setae; with a group of 8–10 hypopygial setae, often in 2 longitudinal lines and of rather variable length; with a pair of long pregenital setae restricted to segment VII; number of medium/short setae medially on each abdominal segment: VII, 0–4 medium + 2–8 short (total 6–10); VI, 6–10 short; V, 9–16; IV, 12–15; III, 8–11; and II, 10–12; with 3–4 setae associated with each meta- and mesocoxa plus 2–5 medially, and 1–3 near each procoxa, all rather short, length of setae associated with each procoxa 9–13 µm long; with 2–3 pairs of inter-antennal setae; with 3–7 submarginal setae on each side between stigmatic areas. Antennae 6- or 7-segmented, with 0–2 pseudosegments in 3rd segment; total length 275–310 µm; length of apical segment 36–40 µm; length of apical seta 63–70 µm. Mouthparts occasionally displaced to one side; length of clypeolabral shield 126–135 µm. Width of spiracular peritremes: anterior 28–36 µm, posterior 32–40 µm. Legs: with a separate tibia and tarsus; lengths (metathoracic): coxa 108–117 µm, trochanter + femur 131–144 µm, tibia 93–119 µm, tarsus 75–90 µm, claw 18–20 µm.

Material examined: HOLOTYPE ♀: NEW ZEALAND: **WO:** SF 97, Waimiha, (Te Kuiti), 1 Oct 1957, R.C. Howie, *Podocarpus spicatus* [=*Prumnopitys taxifolia*], FRNZ, R32: 1/4♀♀ ad, 2♂♂ ad, 2 pupae, holotype ♀ clearly marked.

PARATYPES: on same slide as holotype: 1/4♀♀ ad (holotype ♀ plus 3 ♀♀ paratypes), 2♂♂ ad, 2 pupae.

Other material: **WO**: as for holotype, except FRNZ R34: 1/2♀♀ ad (poor condition).

Remarks. *A. matai* belongs to the group of species in *Aphenochiton* which possess hypopygial setae and small, convex dorsal macropores (i.e.,*A. chionochloae*, *A. matai*, and *A. pubens*).

A. matai shares with *A. chionochloae* the presence of pregenital disc-pores mediolaterally on all/most abdominal segments, but differs from it in being much smaller.

A. matai differs from *A. pubens* in having more abundant pregenital disc-pores which extend onto the more anterior abdominal segments (restricted to laterad to anogenital fold on *A. pubens*).

Biology. Unknown.

Distribution. *A. matai* is only known from this one collection made from Te Kuiti in 1957 (Map 6).

Name derivation. This species has been named after the Maori name *matai* for the host plant *Prumnopitys taxifolia*, from which it was collected.

Aphenochiton pronus Henderson & Hodgson new species

Figs C36, 102

Unmounted material: fresh material of adult females seen from *Hebe pauciramosa* were yellow-green, flat above, more convex ventrally.

Mounted material: body oval, with shallow but distinct stigmatic clefts and shallow anal cleft, latter about 1/9th body length; length 1.8–4.9 mm; breadth 1.4–3.5 mm.

Dorsum: dorsal pores in a reticulate pattern, with 7 rows or reticulation areas across dorsum, 7 or 8 reticulation areas between anal plates and anterior margin and perhaps 29 areas around margin. Dorsal pores of 3 types: (i) microductules: most frequent associated with lines of reticulation; (ii) simple pores, slightly larger than microductules: frequent along margins of all reticulation lines; some dark and some paler; and (iii) larger, convex macropores, 2.7–4.2 µm diam. (subequal in size to pregenital disc-pores); sometimes with a long thin, dark inner gland system: within submedian and median reticulation lines; with 2–4 macropores in posterior medial macropore line. Anal plates 136–203 µm long, combined widths 128–212 µm; with 1–6 minute pores on dorsal surface of each plate; anal plate setae finely spinose and short; length of setae: inner margin 1, 5–14 µm; inner margin 2, 9–18 µm; subapical, 10–20 µm; outer margin setae, 12–20 µm. Anogenital fold with 4 (rarely 3) pairs of setae along anterior margin and another pair on lateral margins; longest 36–54 µm long.

Margin: marginal setae finely spinose, with 3 on each side between stigmatic clefts; most setae 7–9 µm long, those just posterior to each stigmatic cleft slightly larger, 12–20 µm long. Stigmatic clefts distinct and parallel–sided; stigmatic spines short, stout and blunt, sometimes slightly curved, with a well–developed, broad basal socket; length 55–99 µm.

Venter: pregenital disc-pores restricted to a group of 2–13 on either side of anogenital fold. Spiracular disc-pores: with 19–39 in each anterior band and 19–43 in each posterior band; anterior bands with 0–2 pores present just mesad to peritremes. Ventral microducts as for genus. Ventral setae: ventral anal lobe setae rather short, 18–32 µm long; with a line of 4–7 moderately long anterior anal cleft setae, these not appearing stiff and not all pointing inwardly towards anal cleft, but often lying close to anal cleft margin; hypopygial setae absent; with a pair of long pregenital setae present medially on segment VII, but with medium length setae on segments VI, V, and sometimes IV; number of setae medially on each abdominal segment: VII, 2 long + 6–12 short (total 8–15); VI, 1–13 medium length + 0–13 short (total 4–20); V, 1–7 medium + 1–12 short (total 5–15); IV, 0–2 medium + 3–14 short (total 4–14); III, 4–14 short; and II, 3–17 short; with 10–22 setae across metathoracic segment, 2–4 near mesocoxa and 1–3 (rather spinose) near procoxa; length of setae associated with each procoxa about 9 µm long; with mainly 3–4 (occasionally 2) pairs of inter–antennal setae; with 3–8 submarginal setae on each side between stigmatic areas; with a few small setae distributed rather randomly in a broad submarginal band. Width of each spiracular peritreme: anterior 27–43 µm, posterior 32–50 µm. Antennae 6-segmented, sometimes with a pseudosegment (one long antenna 7-segmented); third segment about subequal to other five segments together; total length 311–441 µm; length of apical segment 34–46 µm; length of apical seta 36–50 µm. Length of clypeolabral shield 120–175 µm long. Legs: with a separate tibia and tarsus; lengths (metathoracic): coxa 180–230 µm, trochanter + femur 184–290 µm, tibia 159–213 µm, tarsus 102–135 µm, claw 19–25 µm.

Material examined: HOLOTYPE ♀: NEW ZEALAND: **CO**: Rock and Pillar Range, Summit Stonehenge, 2 Dec

1993, B.H. Patrick, *Hebe pauciramosa* leaves, NZAC #93-375h: 1/1♀ ad.
PARATYPES: as for holotype ♀: NZAC #93-375a–g, i–k: 10/18♀♀ ad, 1♂ ad, 15 1sts.

Other material: NEW ZEALAND: **AK**: Huia, *Coprosma* sp. leaves, 13 Jan 1983, J.M. Cox, #138: 5/4♀♀ ad, 1♀ 3rd. **WD**: Otira, *Coprosma* sp., Christmas 1915, G. Brittin, #97: 1/1♀ ad. **SL**: Southland, Blue Mountains, 1020 m, pitfall trap in tussock, 5 Jan 1985, B.I.P. Barratt: 6/7♀♀ ad.

Remarks. This material is rather variable in size, that from Otira being large (particularly the leg measurements) and one specimen from the Blue Mountains appearing to be a runt. All of the Blue Mountain specimens are small compared with other specimens but, as they were caught in pitfall traps, perhaps they were dispersing pre-reproductive females.

A. pronus is similar to *A. subtilis* but the latter has:
(i) fused tibia and tarsus (separate on *A. pronus*);
(ii) anterior anal cleft setae long, in a line facing inwards and appearing rather stiff, like a comb (not as long or as formally placed in *A. pronus*);
(iii) an unusually long apical segment to the antenna (>50 µm on *A. subtilis*, <46 µm on *A. pronus*).

A. pronus also resembles *A. kamahi* in:
(i) having few dorsal macropores restricted to median and submedian reticulation lines;
(ii) absence of hypopygial setae;
(iii) pregenital disc-pores few and restricted to laterad to anogenital folds.

A. kamahi differs in having:
(i) much larger dorsal macropores (about twice the width of the pregenital disc-pores), which are more or less restricted to the median reticulation lines and absent from the head (more abundant and widespread on *A. pronus*);
(ii) much smaller legs (trochanter + femur 151–185 µm as compared with 184–290 µm on *A. pronus*).

Biology. The mature adult females collected off *Hebe pauciramosa* were not entirely sessile because they were able to walk away from the preferred host site in the natural depression in a leaf's upper surface when disturbed. It seems possible that the long legs of this species are an adaptation for moving to new host sites, perhaps after overwintering as adult females on older leaves. All known collections of *A. pronus* have been taken in midsummer, so it is probably univoltine; those off *H. pauciramosa* in December had begun to deposit nymphs.

Distribution. Four out of the five lots of material were collected in the South Island and the fifth near Auckland (Map 7).

Name derivation. The specific name is taken from the Latin *pronus* meaning lying flat or face downwards on the ground.

Aphenochiton pubens Henderson & Hodgson new species

Figs M25, C34, 103

Unmounted material: nearly indistinguishable from *A. subtilis*; both species nearly transparent, but adult female *A. pubens* more yellow-green than those of *A. subtilis*, which are rather blue-green. Test of *A. pubens* with 9 wax plates between anterior margin and anal plates. Body shape usually long and very flat; detected on plant by reflective shine of wax test.

Mounted material: body elongate-oval; with shallow but distinct stigmatic clefts; anal cleft quite deep, about 1/6th body length; length 2.0–5.7 mm; breadth 1.1–3.2 mm.

Dorsum: dorsal pores in a reticulate pattern, with 7 rows of reticulation areas across dorsum, 9 reticulation areas between anal plates and anterior margin, and 29 areas around margin. Dorsal pores of 3 types: (i) microductules: frequent, associated with lines of reticulation and also frequently abundant in a band along margins of anal cleft, particularly just posterior to anal plates, when slightly larger; (ii) flattish, simple pores of 2 sizes: small pores, subequal to that of microductule: frequent along margins of all reticulation lines; and much larger pores: rather scarce but also near reticulation lines; no submarginal band of dorsal pores present; and (iii) relatively small "drum-shaped" macropores (Fig. M25) (subequal in width to pregenital disc-pores), heavily sclerotised and highly convex: most abundant in median and submedian reticulation lines, becoming less frequent near margin and anteriorly; with 2–6 macropores in posterior medial macropore line. Anal plates: 135–205 µm long, combined widths 133–186 µm; each with 5–11 minute pores on dorsal surface; length of setae: inner margin 1, 7–11 µm; inner margin 2, 9–15 µm; apical, 18–22 µm; outer margin (actually in discal position), 18–27 µm. Anogenital fold with 3–5 pairs of setae along anterior margin and 1 pair laterally; longest 32–72 µm.

Margin: marginal setae finely spinose, with 7–13 on each side between stigmatic clefts, length 9–29 µm, largest just posterior to stigmatic spines; reticulation setae also sometimes slightly enlarged. Stigmatic spines of rather uniform thickness, often rather bent with a blunt apex; length 45–94 µm.

Venter: pregenital disc-pores with mainly 6 loculi: restricted to a group of 5–21 on either side of anterior end of anal cleft in segment VII; when frequent, group extending a short distance down margins of anal cleft. Spiracular disc-pores: with 22–47 in each anterior band and 29–58 in each posterior band; anterior bands with 0–3 pores just mesad to peritremes. Ventral microducts as for genus. Ventral setae: ventral anal lobe setae unusually long, 72–108 µm; with 1–2 pairs of anterior anal cleft setae; with a group of 5–16 hypopygial setae; with long pregenital setae restricted to segment VII; number of setae medially on abdominal segments: VII, 2–6 long + 0–6 short; VI, 7–14 short; V, 8–17; IV, 8–21; III 8–16; and II, 11–16; with 8–17 setae medially on metathorax, 9–16 medially on mesothorax and 2–5 near each procoxa, all rather short; length of setae associated with each procoxa 9–13 µm long; with 2–5 (usually 3–4) pairs of inter-antennal setae; with 4–8 submarginal setae on each side between stigmatic areas. Antennae 6- to 8-segmented, with 0–2 pseudosegments in 3rd segment when 6- or 7-segmented; total length 369–459 µm; length of apical segment 34–50 µm; length of apical seta 59–85 µm. Mouthparts often displaced to one side on larger specimens; length of clypeolabral shield 139–162 µm long. Width of spiracular peritremes: anterior 31–51 µm, posterior 39–56 µm. Legs: with a separate tibia and tarsus; lengths (metathoracic): coxa 145–198 µm, trochanter + femur 198–254 µm, tibia 129–189 µm, tarsus 99–128 µm, claw 14–20 µm.

Material examined: HOLOTYPE ♀: NEW ZEALAND: **AK**: Waitakere Range, Sharp Bush, 22 Mar 1998, R.C. Henderson, *Mida salicifolia* large-leaved sapling, NZAC #98-043d: 1/1♀ ad.
PARATYPES: as for holotype: #98-043a–c, e–f: 5/4♀♀ ad, 1♂ 2nd.

Other material: NEW ZEALAND: **ND**: Kamo, *Podocarpus totara*, 9 Oct 1968, R.A. Cumber, #1643: 1/2♀♀ ad. **ND/AK**: Kaiwaka, *Podocarpus totara*, 18 Sept 1968, R.A. Cumber, #1620/1643: 1/2♀♀ ad. **AK**: Waitakere Ra, Old Coach Road Tk, *Cordyline banksii* underside leaves, 18 Oct 1994, RCH, #94-092: 1/1♀ ad. Riverhead Forest, Barlow Road reserve, *Podocarpus totara* leaves, 16 Aug 1996, RCH, #96-152: 1/1♀ ad. Waitakere Ra, Sharp Bush, 6 Feb 1998, RCH, *Mida salicifolia* both sides lvs, #98-010a–b: 2/3♀ 3rd, 2♂ 2nd [+3♀ 3rd, 4♂ 2nd *Aphenochiton subtilis*]. Waitakere Ra, Sharp Bush, *Mida salicifolia* large-leaved sapling, 22 Feb 1998, RCH, #98-028i–k: 3/1♀ ad (pharate), 6♀ 3rd. As previous, except 7 July 1998, #98-080a–e: 5/3♀♀ ad, 11 crawlers (from brood chamber). As previous except 19 July 1998, #98-081: 1/1♀ ad. **CL**: Little Barrier I, Valley Tk ridge, *Mida salicifolia* new & old leaves, 17 Sept 1994, RCH, #94-071c: 1/1♀ ad. **BP**: Lottin Point, Otanga, *Litsea calicaris*, 27 Jan 1993, RCH, #93-272: 1/1♀ ad, 1♀ 2nd (pharate), 4 1st. Lottin Point, Otanga, *Hedycarya arborea* old leaves, 29 Sept 1993, RCH, #93-328b: 1/2♀♀ ad. Te Koau, 130 m, bushwalk to Twin Puriris, *Hedycarya arborea*, 2 Nov 1993, RCH, #93-347: 3/1♀ ad (+ ♀ ad *Aphenochiton subtilis*), 1♂ 2nd, pupa, 2 ♂♂ ad. **GB**: East Cape, Lighthouse Tk, *Pittosporum tenuifolium* leaves, 1 Nov 1994, RCH, #94-105: 3/1♀ ad, 1♂ 2nd (pharate), 10 1sts. As previous, except 3 Nov 1995, underside leaf, #95-107: 1/1♀ ad. **WO**: Mangapohue Bridge, *Beilschmiedia tawa*, 28 Dec 1993, RCH, #94-003: 1/1♀ ad, 10 1st. **TO**: Rangitoto Station, Mangatutu, *Beilschmiedia tawa* underside leaves, 9 Nov 1996, RCH, #96-209: 1/1♀ ad. As previous, #96-210: 2/1♂ 2nd, 1♀ 3rd. **TK**: Mt Egmont, 800 m, *Griselinia lucida* leaves, 24 Feb 1983, C.F. Butcher, #83-067a: 2/4♀♀ ad. **NN**: Riwaka, [no host], 2 Nov 1924, Brittin, #90-215: 4/5♀♀ ad.

Remarks. *A. pubens*, although rather variable, is a quite distinctive species. It shares with *A. chionochloae* and *A. matai:*
(i) the presence of hypopygial setae (absent on other species in *Aphenochiton*);
(ii) (usually) more than 4 marginal setae on each side between the stigmatic clefts (3 on other *Aphenochiton* species, except *A. inconspicuus*).

It differs from *A. chionochloae* and *A. matai* in having the pregenital disc-pores restricted to segment VII, whereas they extend onto the more anterior segments on the other two species.

A. pubens is very similar to *A. subtilis* in general appearance and the two species have been found together on the same *Mida salicifolia* leaf! (but the presence of hypopygial setae in *A. pubens* and the fused tibia+tarsus in *A. subtilis* quickly separates these two species).

One specimen off *Mida* from Little Barrier Island had a single tubular duct submarginally between the lateral stigmatic clefts.

Biology. Clearly rather polyphagous. It appears to have a similar life history to that of *A. subtilis*, overwintering as the adult female and probably with one generation a year.

Distribution. Throughout the North Island and to Nelson in the South Island (Map 8).

Name derivation. The name *pubens* (L. = pubic hair) refers to the presence of the hypopygial setae between the vulva and the anogenital fold.

Aphenochiton subtilis Henderson & Hodgson new species

Figs C35, 104

Unmounted material: nearly indistinguishable from *A. pubens*; both species nearly transparent, but adult female *A. subtilis* rather blue-green, those of *A. pubens* more yellow-green. Test of *A. subtilis* with 8 wax plates between anterior margin and anal plates; paired marginal wax plates in area of each stigmatic cleft tending to be unusually narrow, lying parallel with margin rather than curving outwards. Body usually long and very flat, detected on plant by reflective shine of wax test.

Mounted material: body broadly elongate-oval; with distinct, moderately deep stigmatic clefts; anal cleft about 1/7th–1/8th body length; length 1.90–4.35 mm; breadth 1.37–3.33 mm.

Dorsum: dorsal pores in a reticulate pattern, with 7 rows of reticulation areas across dorsum, 8 reticulation areas between anal plates and anterior margin and 27 or 29 areas around margin. Dorsal pores of 3 types: (i) very small, dark microductules: frequent within lines of reticulation; (ii) flat, simple pores, at least 2 × size of microductules, some at least 3 × larger: frequent along margins of all reticulation lines; and (iii) fairly small macropores (4–5 μm wide, subequal to size of pregenital disc-pores), sclerotised and convex: rather few, mainly in median reticulation lines; scarce or absent on head; macropores absent in posterior medial macropore line. Anal plates: 144–173 μm long, combined widths 140–162 μm; each with 4–7 minute pores on dorsal surface; length of setae: inner margin 1, 5–7 μm; inner margin 2, 9–12 μm; apical, 12–14 μm; outer margin, 12–13 μm; all near anal plate apex. Anogenital fold with 4 pairs of setae along anterior margin and a single pair laterally; longest 39–54 μm.

Margin: marginal setae finely spinose, with 3 on each side between stigmatic clefts, length 9–23 μm, those just posterior to each cleft slightly larger than elsewhere. Stigmatic spines of rather uniform thickness, often somewhat bent with a rather blunt apex; length 54–85 μm.

Venter: pregenital disc-pores generally slightly oval, with 5–9 loculi (generally 7–8); with 9–17 on each side of anterior end of anal cleft on segment VII (one specimen had a single disc–pore laterad on segment VI). Spiracular disc-pores in bands mainly 1 pore wide; with 15–47 in each anterior band and 21–57 in each posterior band; occasionally with 1–2 disc-pores mesad to peritremes. Ventral microducts as for genus. Ventral setae: ventral anal lobe setae setose, 36–47 μm long; with 5–9 pairs of anterior anal cleft setae, generally forming a distinct line, setae quite long and pointing inwards towards anal cleft; hypopygial setae absent; with 2–3 long pregenital setae present medially on segment VII and 4–10 moderately long setae on segment VI (about 1/2 length of those on segment VII); other setae mostly short; number of short setae medially on abdominal segments: VII, 6–13; VI, 1–3; V, 5–12; IV, 5–11; III, 7–11 and II, 11–20; with 12–21 setae medially on metathorax (one specimen had a single seta anterior to metacoxa), 11–23 medially on mesothorax (none just anterior to coxae) and 0–2 near each procoxa, all short, length of setae associated with each procoxa very short, 5–7 μm long; with 3–5 pairs of inter-antennal setae; with 3–9 submarginal setae on each side between stigmatic clefts. Antennae 6-segmented, with 0–2 pseudosegments in long segment III; total length 367–508 μm; apical segment particularly long (50–57 μm); length of each apical seta 65–77 μm. Mouthparts usually displaced to one side; length of clypeolabral shield 126–162 μm long. Width of spiracular peritremes: anterior 27–36 μm, posterior 29–38 μm. Legs: tibia and tarsus fused but separation rarely faintly indicated; lengths (metathoracic): coxa 121–162 μm, trochanter + femur 162–220 μm, tibia + tarsus 226–288 μm, claw 13–18 μm, hooked part very short.

Material examined: HOLOTYPE ♀: NEW ZEALAND: **AK**: Waitakere Range, Sharp Bush, 22 Mar 1998, R.C. Henderson, *Mida salicifolia* large-leaved sapling, NZAC #98-044a: 1/1♀ ad.
PARATYPES: collection data as for holotype: (i) NZAC #98-044b–h: 7/7♀♀ ad (one pharate); and (ii) NZAC #98-045a–b: 2/2♀♀ ad.

Other material: NEW ZEALAND: **TH**: Three Kings Is, West I, *Meryta sinclairii* leaves, 29 Nov 1983, C.F. Butcher, #83-347b: 1/1♀ ad. As previous, but on leaves of *Elingamita* sp. (or *Corynocarpus laevigatus*?), #83-347e: 4/3♀♀ ad, 1♀ 3rd. **AK**: Waitakere Ra, Walker Bush Tk, *Mida* sp. leaves, 5 Nov 1976, M.F. Tocker, #76-316a: 1/1♀ ad. Waitakere Ra, Sharp Bush, *Mida salicifolia* both sides leaves, 1 Dec 1994, RCH, #94-123a–c: 3/5♀ 2nd, 3♂ 2nd, 16 1st. As previous except 29 Apr 1995, #95-042a: 1/2♀♀ ad. As previous except 13 July 1997, #97-081a–b: 2/2♀♀ ad, 1♂ 2nd. As previous except 6 Feb 1998, #98-110a–b: 2/3♀ 3rd, 4♂ 2nd [+3♀ 3rd, 2♂ 2nd *A. pubens*]. As previous except 22 Feb 1998, #98-029a–b& 98-030a, c–d: 5/9♀ 3rd, 9♂ 2nd. As previous except 6 Mar 1998, #98-041a: 1/1♂ 2nd. As previous, except 22 Mar 1998, #98-046a–e: 5/5♀♀ ad, 2♀ 3rd, 5♂ 2nd. As previous, except 7 July 1998, #98-079a–b: 2/2♀♀ ad. **CL**: Little Barrier I, Valley Tk, ridge, *Mida salicifolia* new and old leaves, 17 Sept 1994, RCH, #94-071a–h: 8/6♀♀ ad, 2/5♀ 3rd, 2♀ 2nd, 2♂ 2nd. As previous except Hamilton Tk, #94-081a–i: 9/7♀♀ ad, 3♀ 3rd, 1♀ 2nd, 1♂ 2nd, ?5 1sts. **BP**: Te Koau, *Hedycarya arborea*, 23 Sept 1992, RCH, #92-278: 1/1♀ ad. Te Koau, 130 m, Bushwalk to Twin Puriris, *Hedycarya arborea*, 2 Nov 1993, RCH, #93-347a–b: 2/2♀♀ ad (+ ♀ ad *A. pubens*). **GB**: Paoneone, *Hedycarya arborea* both sides lvs, 2 Nov 1994, RCH, #94-127a–b: 3/3♀♀ ad, 12 1sts. **TO**: Rangitoto Stn, Mangatutu, *Mida salicifolia* leaves, 9 Nov 1996, RCH, #96-211a–f: 5/3♀♀ ad, 3♀ 3rd, 5♂ 2nd. **WN**: Rimutaka Ra, Mt Mathews, 300 m, *Hedycarya arborea*, 25 Dec 1932, D. Zotov: 1/1♀ ad. **FD**: Doubtful Sound, Bauza I, *Raukaua* [as *Pseudopanax*] *simplex* leaves, 28 Jan 1996, RCH, #96-043: 1/1♀ ad. Breaksea Sound, Breaksea I, *Hedycarya arborea* underside of leaves, 29 Jan 1996, RCH, #96-072: 1/1♀ ad, 2 1sts. **SL**: Invercargill, Thomsons [as Thompsons] Bush, *Pittosporum* sp. leaves, 27 Jan 1983, C.F. Butcher, #84-024e: 2/2♀♀ ad, 1♀ 2nd, 1♂ 2nd.

Remarks. *A. subtilis* can be separated from other species in this genus by the fused tibia and tarsus. It most closely resembles *A. pronus* and *A. kamahi*, the latter also being particularly thin and flat in life, but differs from them in the following combination of characters:

(i) pregenital disc-pores usually with 7 or 8 loculi and often rather oval in shape;

(ii) the presence of 5–9 pairs of quite long anterior anal cleft setae in a line facing inwards, often appearing stiff and comb-like;

(iii) the presence of 4–10 moderately long setae on abdominal segment VI, more or less 1/2 as long as long setae on segment VII (*A. kamahi* has 5–10 setae on segment VI almost as long as long setae on segment VII);

(iv) long antennae, with a long apical segment of more than 50 μm.

A. subtilis is also similar to *A. pubens* in general appearance and the two species have been found together on the same leaf of a plant of *Mida salicifolia*, but they can be easily separated by the presence of hypopygial setae in *A. pubens*.

Biology. Life cycle probably similar to that of *A. pubens*, with only one generation a year, overwintering as the adult female. Although it seems to be fairly polyphagous, the most favoured host plants are *Mida salicifolia* and *Hedycarya arborea*.

Distribution. Rather anomalous, with most records from the North Island but also from Fiordland and Invercargill (Map 9).

Name derivation. From the Latin *subtilis*, meaning thin, referring to the very thin and flat nature of this species, which resembles a film of water on the underside of a leaf.

Genus ***CRYSTALLOTESTA*** Henderson & Hodgson **new genus**

Type species: *Inglisia fagi* Maskell (here designated).

Diagnosis. Adult female. Test: conical, elongate-convex, open beneath, with a distinct fringe of small plates that are often sharply triangular; texture glassy.

Body: elongate oval to rather broad; anal cleft shallow; stigmatic clefts absent or distinct but shallow.

Dorsum: derm membranous. Dorsal setae absent. Dorsal pores distributed in a reticulate pattern, delineating reticulation areas in 5–7 longitudinal rows, 5–8 areas between anal plates and anterior margin (middle reticulation area sometimes particularly large), and with 26–28 areas around margin on most species but fewer on *Crystallotesta ornata* and *C. ornatella*. Dorsal pores of 3 or 4 types: (i) minute, dark microductules, with a long inner ductule: mainly associated with lines of reticulation; (ii) larger, flat, simple pores of variable size: smallest associated with reticulation lines, slightly larger pores often in a submarginal band; large simple pores sometimes present laterad to anal plates; (iii) quite large macropores, usually more or less round, slightly to distinctly convex, generally with a granulate surface: restricted to reticulation lines; and (iv) in *C. ornata* and *C. ornatella* only: inverted, tubular pores with a sclerotised inner base (small on *C. ornata*, large on *C. ornatella*): restricted to reticulation lines. Anal plates tapering to rather pointed apex, with anterior margins much shorter than posterior margins; with or without minute pores on dorsal surface of each plate; each plate with 4 spinose setae, 2 along inner margin, an apical seta and another on posterior margin. Anogenital fold with 2–3 pairs of setae along anterior margin and 1 pair on each lateral margin. Anal tube quite long, when inverted extending well anterior to anal plates; anal ring with 3 pairs setae (4 pairs on *C. ornatella*). Anal plate sclerotisation and supporting bars absent.

Margin: marginal setae broadly spinose with narrow basal sockets; abundant but absent from margins of anal cleft (except on *C. neofagi* where a few extend up anal cleft); reticulation setae may be significantly larger and then often displaced onto dorsum. Stigmatic spines stout, tapering, with a narrow basal socket, 1 per stigmatic cleft; quite short on some species, very long on others; set distinctly onto dorsum (significantly so on *C. fuscus*). Eyespot obscure and set slightly onto dorsum, or absent.

Venter: pregenital disc-pores with mainly 10 loculi; distributed across most or all abdominal segments and sometimes medially on metathorax and laterad to each metacoxa. Spiracular disc-pores with mainly 5 loculi, in bands 1–5 pores wide between each spiracle and margin (and extending onto dorsum on *C. fuscus*); with 0–2 pores extending medially past peritreme. Ventral microducts of 1 type, with a rather broad inner ductule; frequent in a broad submarginal band, otherwise rather sparse throughout but absent from posterior 4 abdominal segments. With 0–1 preantennal pores. Ventral simple pores present in a submarginal band on *C. ornata* and *C. ornatella*; absent on other species. Ventral tubular ducts of 2 types: (i) with a long outer ductule, long inner ductule and a well-developed terminal gland: frequent throughout except medially on more posterior abdominal segments where replaced with (ii) a slightly smaller duct with a broader cup-shaped invagination, with or without a glandular end to inner ductule: most frequent on either side of anal cleft, becoming less frequent on next few anterior abdominal segments. Ventral setae: ventral anal lobe setae rather spinose, tapering to a blunt or finely pointed apex; with 1–5 pairs of anterior anal cleft setae; with long pregenital setae present medially on abdominal segments VII, VI (and V on *C. ornata* and *C. ornatella*); with few setae medially on each abdominal segment; usually with 1–3 submarginal setae between stigmatic areas; with 3–4 pairs of interantennal setae; other setae rather few and small, 5–9 μm long. Antennae well developed and 6- to 8-segmented; when 6- or 7-segmented, 3rd segment much longest and generally with 1–2 pseudosegments. Spiracular peritremes moderate to quite large. Legs normal to rather small; tibia and tarsus sometimes without an articulation; with 2 long setae on each trochanter; tarsal digitules both slightly longer than claw digitules, generally subequal in length and with one narrower; claw digitules both broad and only slightly longer than claw; claw with or without a minute denticle. Vulva on segment VII, immediately posterior to long pregenital setae.

Generic name derivation: the name refers to the appearance of the test: *crystallum* (L.) meaning ice or rock crystal, and *testa* (L. f.) meaning shell. This name was suggested by the late C. Tymone Duval and we here dedicate it to his memory.

Remarks. This genus contains six species: *Crystallotesta fagi* (Maskell) **n. comb.**, *C. fusca* (Maskell) **n. comb.**, *C. leptospermi* (Maskell) **n. comb.**, *C. neofagi* Henderson & Hodgson **n. sp.**, *C. ornata* (Maskell) **n. comb.**, and *C. ornatella* Henderson & Hodgson **n. sp.** These species are characterised by the presence of:

(i) numerous pregenital disc-pores (with mainly 10 loculi) extending across all abdominal segments:
(ii) 2 types of ventral tubular duct, with the larger duct in a submarginal band and the slightly smaller duct medially on posterior abdominal segments and laterad to anterior end of anal cleft;
(iii) marginal setae abundant and spinose;
(iv) reticulation setae often clearly differentiated;
(v) generally with pairs of long setae on 2 pregenital segments (3 on *C. ornata* and *C. ornatella*);
(vi) generally with 2 or 3 pairs of anterior anogenital fold setae;
(vii) often with a group of simple pores laterad to anal plates;
(viii) test tending to be highly convex, stout and glassy.

Species in the genus *Crystallotesta* resemble species in the genera *Ctenochiton* and *Kalasiris* in having abundant pregenital disc-pores medially across the abdominal segments and numerous spinose marginal setae around the margin. *Crystallotesta* species also resemble *Kalasiris* species in having:

(i) 2 types of ventral tubular duct (but the distribution on the two genera differs);
(ii) large simple pores on the dorsum, generally associated with the anal plates.

Kalasiris differs in having ventral tubular ducts:

(i) in narrow submarginal bands, with the ducts tending to lie radially;
(ii) absent medially on the thorax.

Ctenochiton species differ from *Crystallotesta* species in:

(i) having a thin test;
(ii) having very large spiracles;
(iii) having spinose marginal setae rather unevenly spaced around margin;
(iv) having antennae generally without pseudosegments;
(v) lacking ventral tubular ducts medially on the thorax;
(vi) the displacement of the mouthparts to one side.

The species currently placed in *Crystallotesta* are all endemic to New Zealand. They are possibly univoltine apart from *C. ornata* and *C. ornatella*, which may have two generations a year.

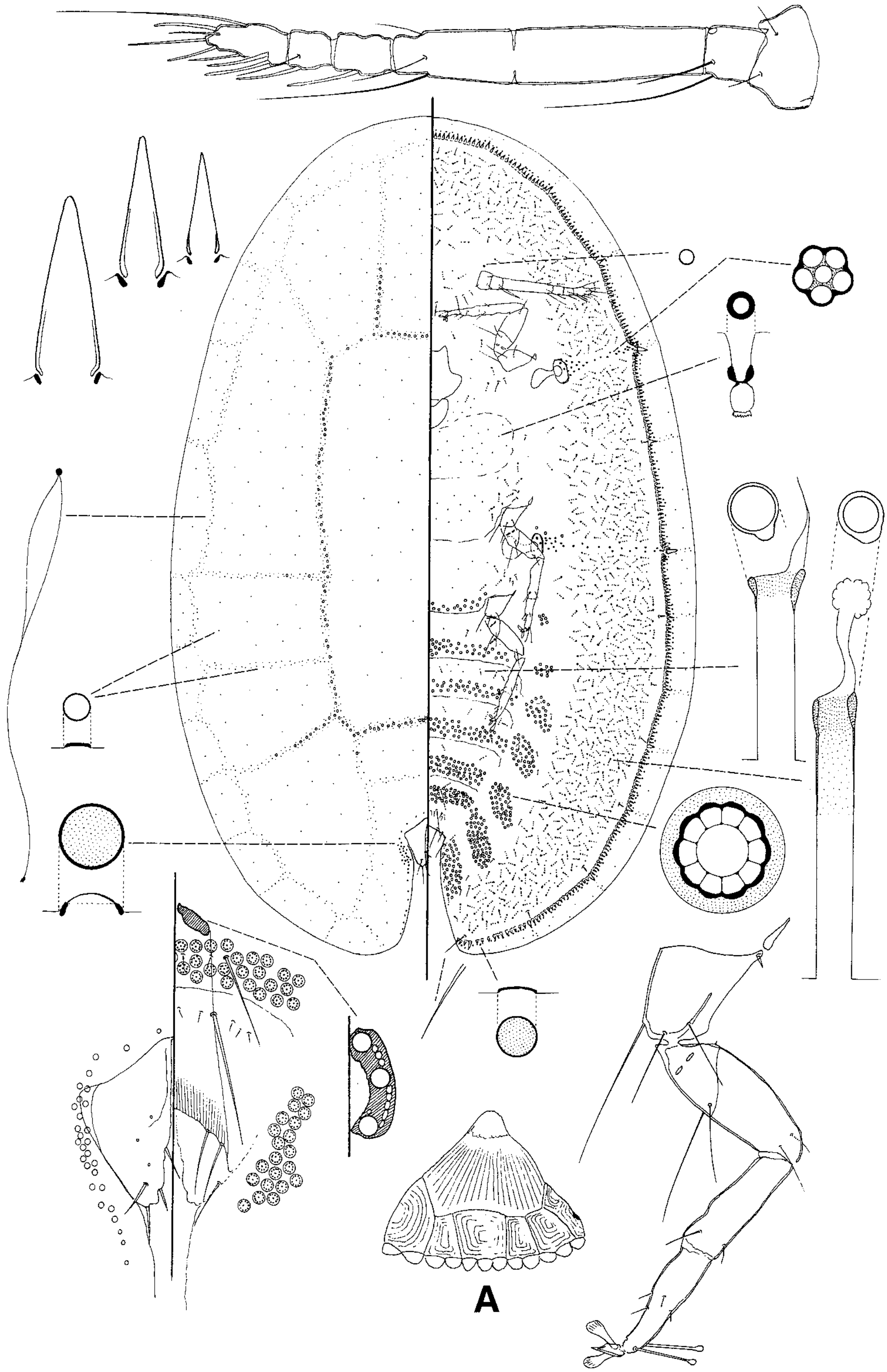


Fig. 105. *Crystallotesta fagi* (Maskell), **n. comb.**, adult female A = side view of test.

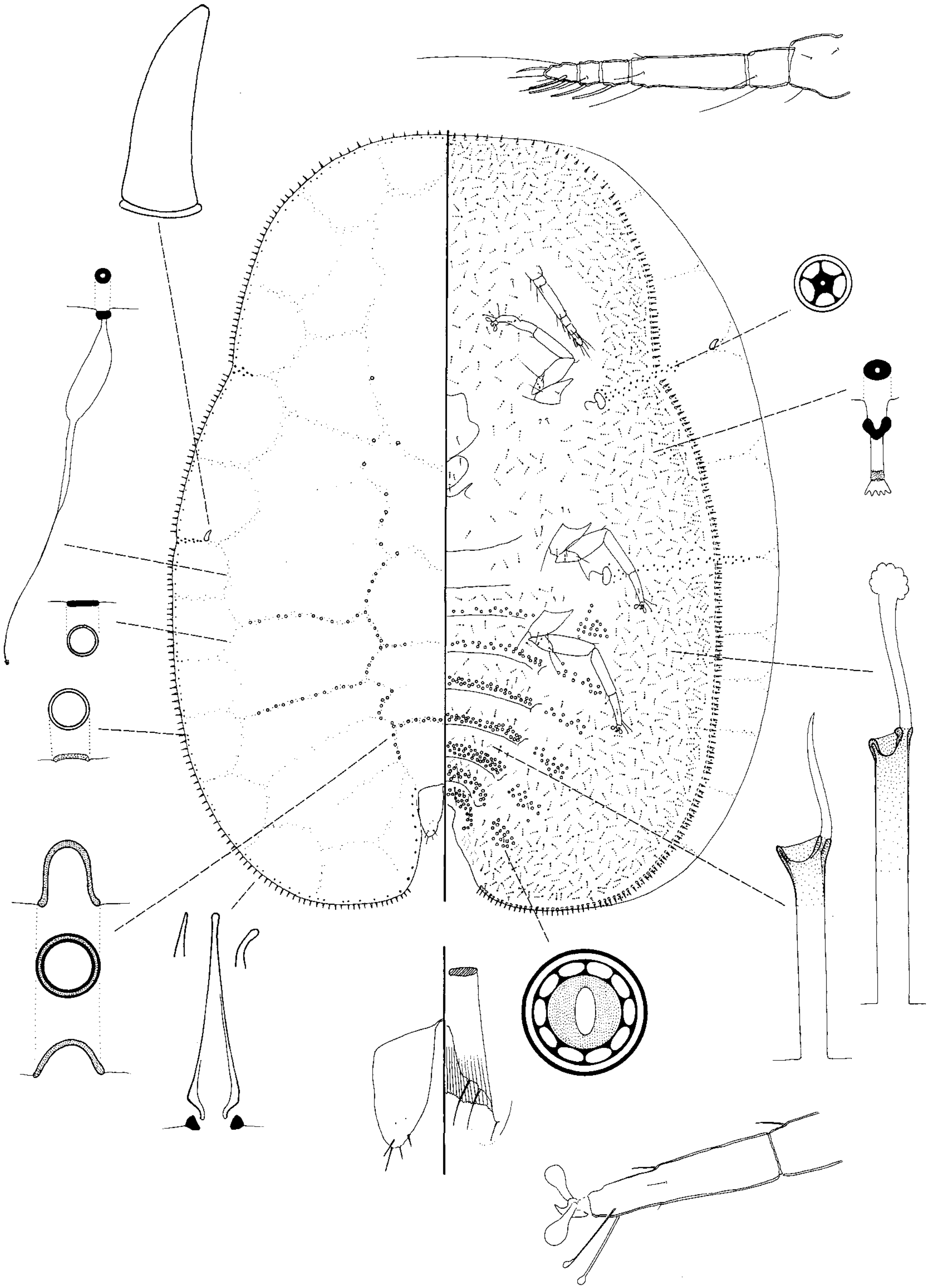


Fig. 106. *Crystallotesta fusca* (Maskell), **n. comb.**, adult female.

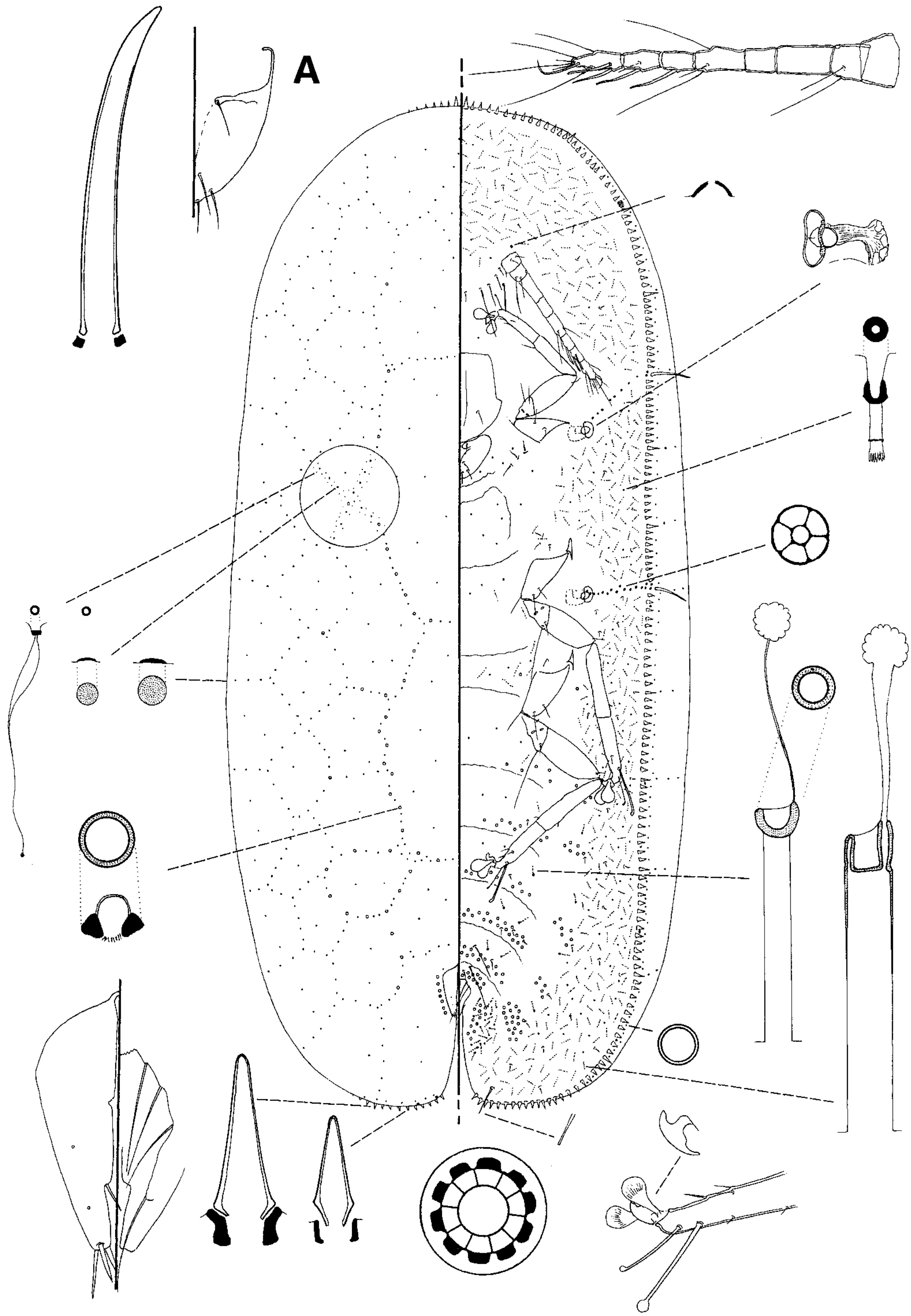


Fig. 107. *Crystallotesta leptospermi* (Maskell), **n. comb.**, adult female; circle contains reticulation line of dorsal pores further enlarged. A = right half of labium.

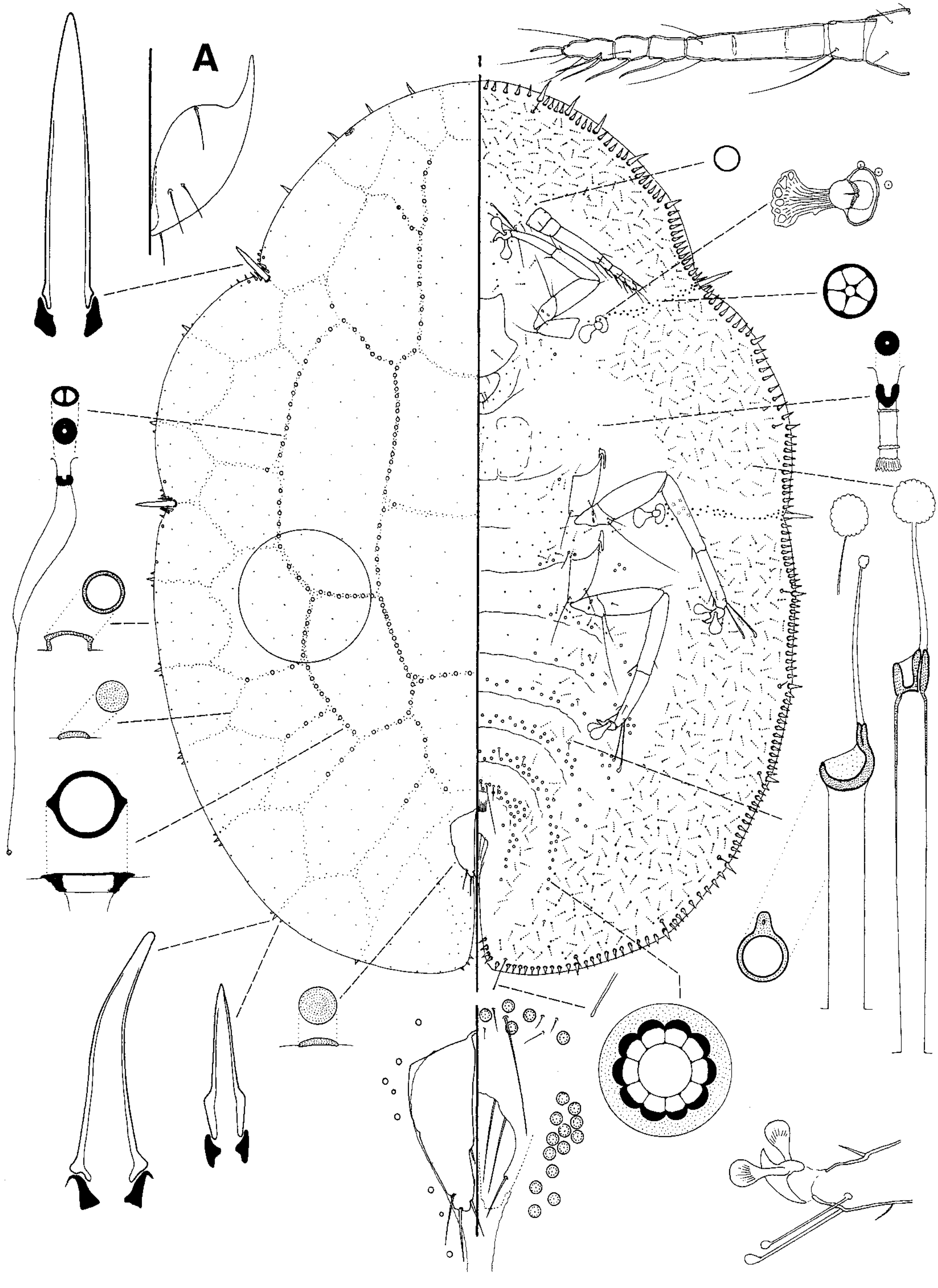


Fig. 108. *Crystallotesta neofagi* Henderson & Hodgson, **n. sp.**, adult female; circle contains reticulation line of dorsal pores further enlarged. A = right half of labium.

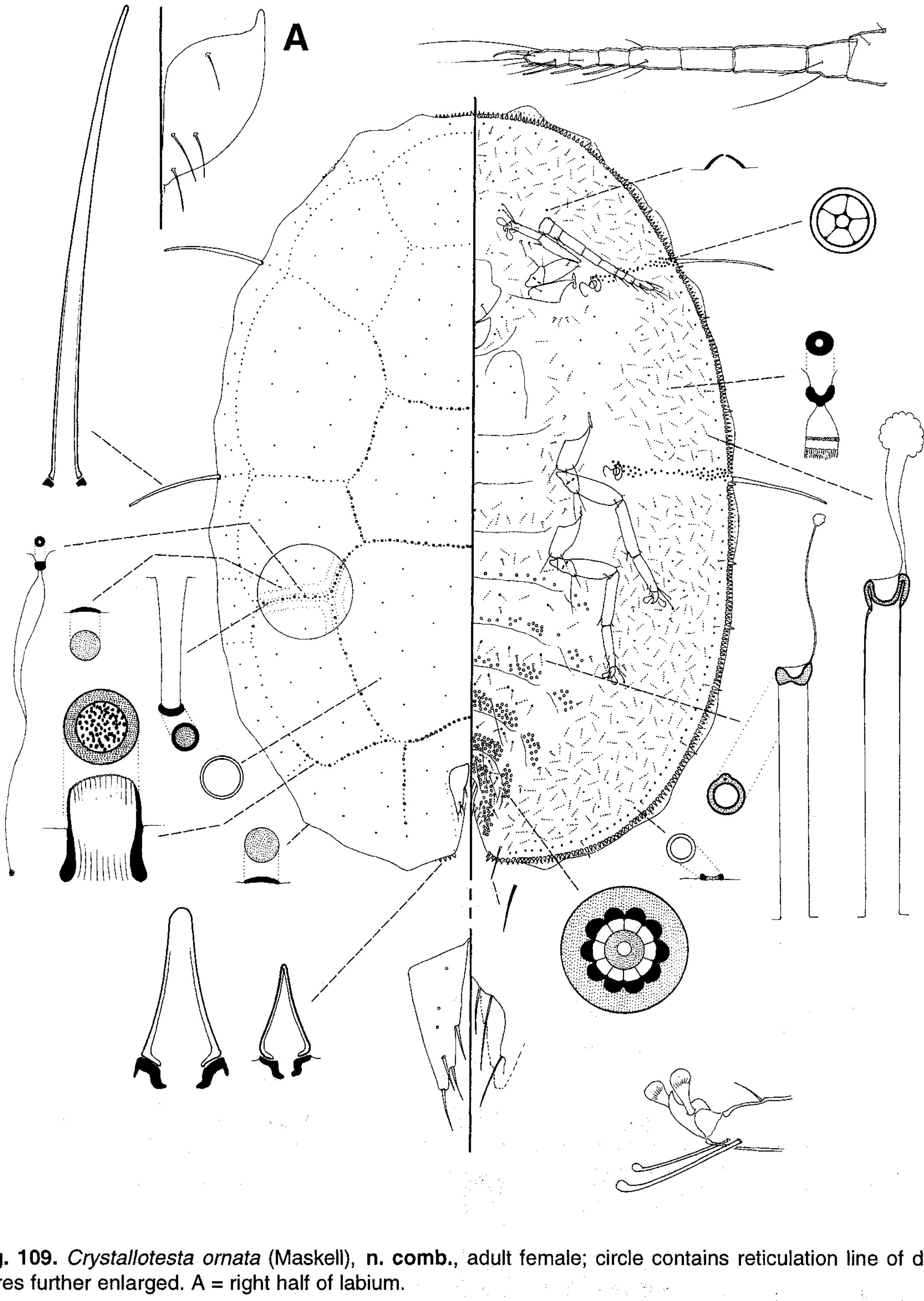


Fig. 109. *Crystallotesta ornata* (Maskell), **n. comb.**, adult female; circle contains reticulation line of dorsal pores further enlarged. A = right half of labium.

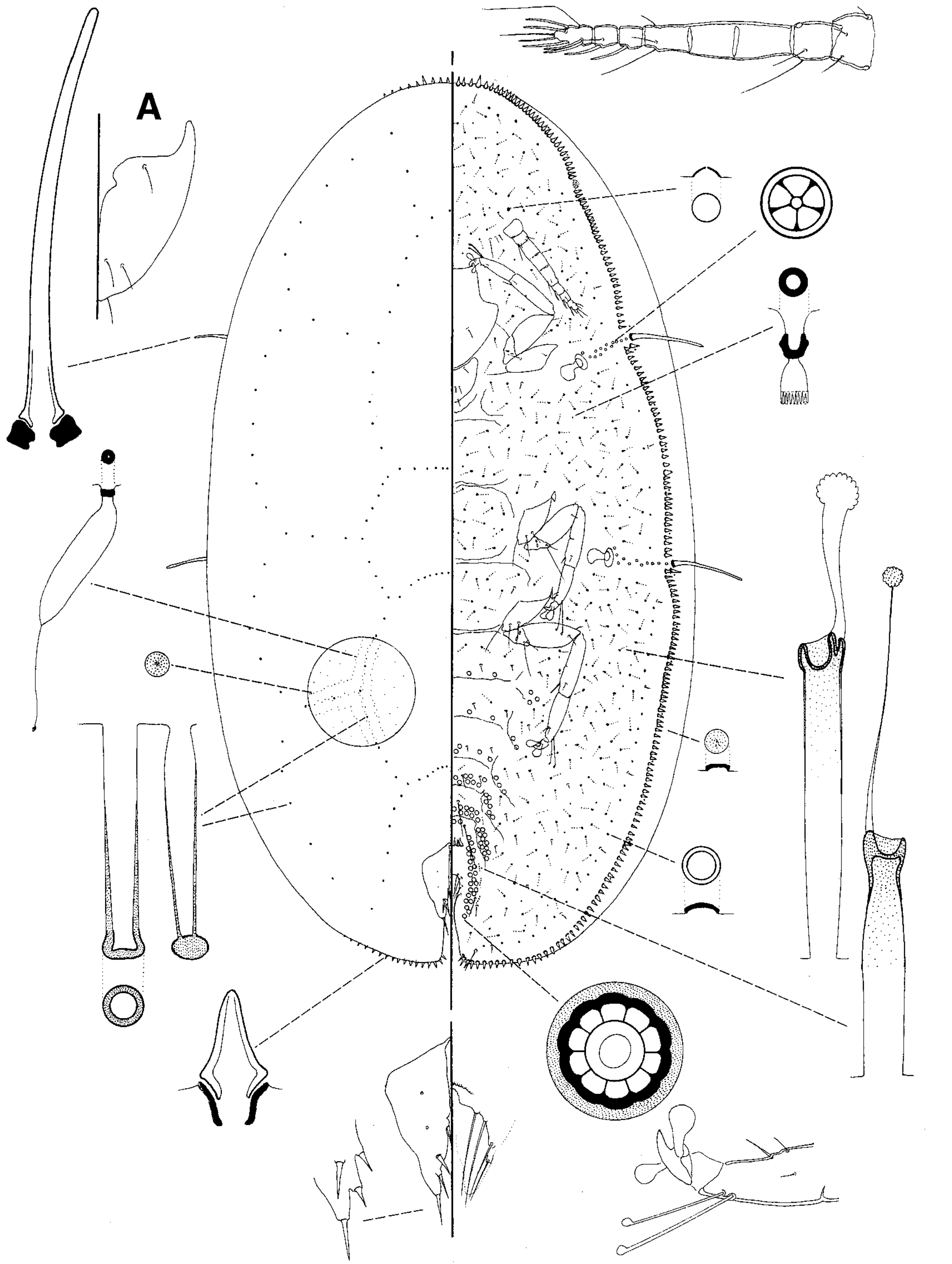


Fig. 110. *Crystallotesta ornatella* Henderson & Hodgson, **n. sp.**, adult female; circle contains reticulation line of dorsal pores further enlarged. A = right half of labium.

Key to adult female *Crystallotesta*

1 Spiracular disc-pore bands extending past marginal spinose setae onto dorsum; stigmatic spines either absent or set some distance onto dorsum at end of spiracular disc-pore band .... ***fusca***

—Spiracular disc-pores not extending past marginal spinose setae onto dorsum; stigmatic spines present on, or very close to, margin 2

2 Stigmatic spines very long, at least 10 × longer than marginal spinose setae 3

—Stigmatic spines shorter than 5 × length of marginal spinose setae 4

3 Dorsal macropores highly convex; with an invaginated pore (much smaller than dorsal macropore) also present in reticulation lines; ventral tubular ducts few or absent medially on pro- and mesothorax; with 2 pairs of setae along anterior margin of anogenital fold .... ***ornata***

—Dorsal macropores (or largest dorsal pore) tubular and invaginated, at least 4–5 × longer than broad, with a sclerotised distal end, present in reticulation lines; ventral tubular ducts frequent medially on pro- and mesothorax; with 3 pairs of setae along anterior margin of anogenital fold .... ***ornatella***

4 Reticulation point setae on margin noticeably long, ratio of length of ordinary marginal setae: reticulation setae: stigmatic setae = 1: 2: 4–5; large dorsal simple pores absent laterad to each anal plate; pairs of long pregenital setae only present on abdominal segment VII .... ***neofagi***

—Reticulation point setae on margin only slightly longer than ordinary marginal setae, ratio (as above) = 1 : 1.3 : <4; large dorsal simple pores present in a group on either side of anal plates; pairs of long pregenital setae present on abdominal segments VI and VII 5

5 With >20 large simple pores on either side of anal plates; pregenital disc-pores extremely abundant medially on all abdominal segments and with more than 20 across metathorax; pregenital disc-pores absent from segment VII; only on *Nothofagus* .... ***fagi***

—With about 10 large simple pores on either side of anal plates; pregenital disc-pores about 1/3 as numerous and with less than 6 across metathorax; pregenital disc-pores present on segment VII; only on *Kunzea* and *Leptospermum* .... ***leptospermi***

Crystallotesta fagi (Maskell) new combination

Figs C43, C44, 105

Inglisia fagi Maskell, 1890b: xv (nomen nudum).
Inglisia fagi Maskell, 1891: 13; –Maskell, 1895a: 13 [checklist]; –Cockerell, 1896: 330 [checklist]; –Fernald, 1903: 162 [world catalogue]; –Hutton, 1904: 226 [checklist]; –Myers, 1922: 199 [checklist]; –Miller, 1925: 33, 65 [host, illus.]; –Vayssière, 1927: 3 [host comment]; –Wise, 1977: 105 [checklist]; –Deitz & Tocker, 1980: 28 [checklist]; –Hosking & Kershaw, 1985: 201 [ecology]; –Ben-Dov, 1993: 149 [world catalogue].

Unmounted material: "Test of adult female usually conical, less frequently elongato-convex, open beneath, with a distinct fringe of small segments which are often sharply triangular; main segments large, patched with brownish-green or often altogether light-green, sometimes white, distinctly striated with air-cells, which are generally largest near the margins of the segments. Length of test often reaching 1/5th in. [5 mm], height from 1/10th–1/7th in [2.5–4 mm]. Texture glassy." (Maskell, 1891, p. 13). Specimens on thin twigs, although very conical, narrow laterally.

Mounted material: when off narrow twigs, body elongate-oval but rather more broadly oval when off thicker twigs, and pointed anteriorly; anal cleft about 1/12th body length. Length 2.2–3.4 mm; breadth 1.3–1.7 mm.

Dorsum: dorsal pores delineating reticulation areas in 5 longitudinal rows, with a very large reticulation area medially on dorsum, and with rather large reticulation areas mediolaterally; with 5 reticulation areas between anal plates and anterior margin and 26 smaller areas around margin. Dorsal pores of 3 types: (i) minute, dark microductules: restricted to lines of reticulation, rather sparse; (ii) larger, simple pores of variable size: smallest pores throughout each reticulation area and also associated with reticulation lines; slightly larger pores in a submarginal line, with 24–37 on each side between stigmatic clefts; largest pores in an elongate group on either side of anal plates, with 21–32 in each group; and (iii) moderately large macropores (5 μm diam.), slightly convex, with thickened margins and a granulate surface: restricted to lines of reticulation, most abundant around large median reticulation area but with a few more laterally; with 22–31 in posterior medial macropore line. Anal plates: 185–196 μm long, combined widths 144–195 μm; with 2–4 minute pores on dorsal surface of each plate; length of setae: inner margin 1 (about 1/3rd from apex), 27–40 µm; inner margin 2 (near apex), 18–27 µm; apical, 27–36 µm; and outer margin (on dorsal surface near apex), 27–34 µm. Anogenital fold with 2 pairs of setae on anterior margin and 1 pair laterally; longest 59–68 µm.

Margin: marginal setae strongly spinose: with 37–63 on each side between stigmatic clefts, those on either side of stigmatic spines extending slightly onto dorsum, forming a small group in each cleft; non-reticulation setae each 10–18 µm long; reticulation setae displaced slightly onto dorsum and larger, each 20–26 µm long, with 7 on either side of abdomen, 2 on each side between stigmatic clefts and 8 around head; spines absent from along margins of anal cleft. Stigmatic spines set distinctly onto dorsum; length 21–25 µm.

Venter: pregenital disc-pores distributed across all abdominal segments; number on each segment (medially across segment/in each lateral group): VII, 0 (very rarely 1)/32–43; VI, 86–88/63–75; V, 85–120/38–49; IV, 90–100/29–38; III, 61–94/20–28; and II, 27–43/7–14; with 26–33 across metathorax and 0–8 disc-pores laterad to each metacoxa; none on meso- or prothorax or near scape. Spiracular disc-pores: with 25–32 in each anterior band and 30–37 in each posterior band (latter band usually with some larger disc-pores closely associated); with 1–2 pores (rarely none) extending medially past peritreme. Ventral microducts and tubular ducts as for genus. Ventral setae: ventral anal lobe setae 49–54 µm long, rather spinose, tapering to a blunt or finely pointed apex; with 1–4 pairs of anterior anal cleft setae; with a pair of long pregenital setae medially on segments VII and VI, longest 77–86 µm long; number of setae medially on each segment: VII, 2 long + 8–9 short setae; VI, 2 long + 3–5 short setae; V–II, 1–4 short setae; with 2–3 setae just anterior to meta- and mesocoxa; 2 just posterior to procoxa, 1 longer than other, about 25–36 µm long; submarginal setae: those on thorax and abdomen near reticulation marginal spines particularly large, with large basal sockets, length 13–17 µm; with only 1 large submarginal seta laterally between stigmatic clefts; smaller setae also occasionally present between larger submarginal setae, each 9–11 µm long; with 7 interantennal setae. Antennae 6-segmented: total length 332 µm, 3rd segment much longest (168–201 µm long; ratio to total length 0.52:1); length of apical seta 36–41 µm. Length of clypeolabral shield 178–180 µm. Width of each spiracular peritreme: anterior 56–74 µm, posterior 72–81 µm. Legs: separation of tibia and tarsus indistinct; lengths (metathoracic): coxa 98–103 µm, trochanter + femur 115–127 µm, tibia + tarsus 160–176 µm, claw 18–20 µm; claw without a denticle.

Material examined: LECTOTYPE ♀: NEW ZEALAND: labelled "*Inglisia fagi*, adult female, 1889, W.M.M." NZAC: 1/1 pharate ♀ ad here designated. Maskell (1891) states off *Fagus* [=*Nothofagus*] var. sp., Reefton district (**BR**).

PARALECTOTYPES: NEW ZEALAND: (i) as for lectotype: NZAC: 3/1♂ ad, 2 1st, 1♀ 2nd (latter stained and remounted by RCH); (ii) mounted from Maskell's dry collection (blue pill box), by J.A. de Boer, NZAC: 2/6♀♀ ad; & by C.J. Hodgson: 10/11♀♀ ad, 4 1sts.

Other material: NEW ZEALAND: labelled *Inglisia fagi* Maskell, #118, USNM: 3/2♀♀ ad, 4 1st, (in quite good condition). **TO**: Ohakune, *Nothofagus* [as *Fagus*] *fusca*, 10 Jun 1924, G. Brittin, #133: [one each NZAC & USNM] 2/3♀♀ ad (poor). **NN**: Riwaka, *Fagus* sp., 8 Feb 1925, G. Brittin, #133: 1/1♀ ad (poor). As previous, except 25 Jul 1926: 1/1♀ ad (poor). Motueka, *Nothofagus fusca*, 3 Jan 1938, G. Brittin, #133: 1/3♀♀ ad (poor). Eve's Valley, *Nothofagus menziesii*, 29 Feb 1972, J.A. de Boer, #795: 1/2♀♀ ad (poor). Mt Arthur, Flora Hut, *Nothofagus fusca*, 4 Feb 1983, C.F. Butcher, #83-314b: 1/1♂ 2nd. **BR**: Slab Hut Creek, nr Reefton Saddle, *Nothofagus fusca*, 11 Feb 1970, A. Holloway, # 673: 1/1♀ ad. Capleston, nr Reefton, *Nothofagus menziesii*, 10 Nov 1972, J.A. de Boer, #926a: 1/2♀♀ ad (good; dorsum and venter split). Hochstetter Forest, nr Reefton, *Nothofagus menziesii*, 9 Nov 1972, J.A. de Boer, #945: 11♂ ad, 1♂ 2nd. Reefton, *Nothofagus menziesii* twig, 4 Feb 1987, J.M. Cox, #644: 1/2♀♀ ad (poor).

Remarks. Adult females of *C. fagi* are very similar to females of *C. neofagi* but differ in having:
(i) no pregenital disc-pores medially on segment VII (present on *C. neofagi*);
(ii) long pregenital setae on two posterior abdominal segments (in segment VII only on *C. neofagi*);
(iii) from 2 × to 5 × more pregenital disc-pores on each abdominal segment, both medially and mediolaterally;
(iv) a group of about 20–30 large dorsal simple pores laterad to each anal plate (only 2–6 small simple pores in *C. neofagi*);
(v) hind legs about 1/3 smaller (about 120 µm rather than about 200 µm on *C. neofagi*);
(vi) distinctive macropores;
(vii) only 5 longitudinal lines of reticulation areas (seven on *C. neofagi*).

C. fagi differs from other females of *Crystallotesta* in having a particularly large central reticulation area and rather short, conical stigmatic spines.

Biology. When mature and larvipositing, the body of the female bends as though hinged between the thorax and abdomen, so that the abdomen slowly turns up vertically beneath the test, in a concertina fashion as it does so. Old specimens are extremely difficult to slide mount due to this position. Possibly (as on *Kalasiris depressa*) the nymphs come to fill the resulting space beneath the test and disperse from under its slightly loosened posterior.

C. fagi (as *Inglisia fagi*) was implicated in the death of a large number of red beech trees (*Nothofagus fusca*) in an outbreak of the scale insect in the Maruia Valley, South Island, between 1976 and 1978. However, Hosking & Kershaw (1985) concluded that the scale insect population expansion was incidental and due to changes induced in the trees having been stressed by several years of drought. They noted that (Hosking & Kershaw, 1985, p.206) "the males and younger female instars occur on the underside of leaves, but the adult female occurs on the twigs as white conical protuberances". Unfortunately, specimens collected at that time have not been located for the present study.

Pathogens and parasitoids. Hosking & Kershaw (1985) also noted that "the collapse of the epidemic appeared to be caused by an entomogenous fungus, probably *Hypocrella duplex*".

Distribution. With a single site record from central North Island (Ohakune), otherwise in the northern third of the South Island (Map 10).

Crystallotesta fusca (Maskell) new combination

Fig. 106

Ctenochiton fuscus Maskell, 1884: 131; –Maskell, 1887: 70 [description]; –Maskell, 1895a: 13 [checklist]; –Cockerell, 1896: 330 [checklist]; –Fernald, 1903: 160 [world catalogue]; –Hutton, 1904: 226 [checklist]; –Myers, 1922: 199 [checklist]; –Wise, 1977, 104 [checklist]; –Deitz & Tocker, 1980: 29 [checklist]; –Ben-Dov, 1993: 102 [world catalogue]; –Henderson, 1995: 106 [lectotype designated].

Unmounted material: available dry material consisted of large, nearly round, moderately convex adult females with thick, white wax test plates. As pointed out by Henderson (1995), the description given by Maskell (1884: 131) seems to be more appropriate for *Plumichiton elaeocarpi* (Maskell) than for *C. fuscus*.

Mounted material: body oval to almost round and rather convex; anal cleft about 1/9th body length. Length 3.0–5.0 mm; breadth 2.1–3.6 mm.

Dorsum: dorsal pores delineating reticulation areas in 5 longitudinal rows across body; with 7 or 8 reticulation areas between anal plates and anterior margin and 26 areas around margin. Dorsal pores of 3 types: (i) small, dark microductules: present throughout, but most frequent within reticulation lines; (ii) simple pores all slightly larger than microductules, of 2 sizes: smaller pores, frequent along lines of all reticulations, and slightly larger pores, restricted to a submarginal band and laterad to anal plates; and (iii) heavily sclerotised, convex macropores: present medially and mediolaterally on thoracic and abdominal segments and occasionally on head. Anal plates with a rather blunt apex; 153–187 µm long, combined widths 162–243 µm; with 1–3 minute pores on dorsal surface of each plate; setae spinose; length of setae: inner margin 1, 14–18 µm; inner margin 2, 14–16 µm; apical, 21–38 µm and outer margin, 16–17 µm. Anogenital fold with 2 pairs of setae along anterior margin and a single pair laterally; longest 45 µm long.

Margin: marginal setae spinose with a blunt or slightly swollen apex and with a rather thin basal socket, length 9–22 µm; with 30–59 on each side between lateral stigmatic clefts; reticulation setae not differentiated. Stigmatic spines present or absent; when present, displaced some distance onto dorsum at outer end of spiracular disc-pore band; each spine short and stout, sometimes sharply pointed and then similar to marginal setae, otherwise blunt and rather bent; length 21–34 µm. Eyespot obscure or absent.

Venter: pregenital disc-pores with mainly 10–11 loculi (range 8–14); number on each abdominal segment (medially/laterally on one side): VII, 11–13/70–73; VI, 60–64/26–32; V, 36–54/15–27; IV, 54/15–23; III, 44–49/8–17; and II, 16–41/6–17; metathorax with 21–37 medially and 15–29 laterad to each coxa. Spiracular disc-pores with mainly 5 loculi (range 3–10), in a band 1–3 pores wide between each spiracle and margin and extending some distance onto dorsum through line of marginal setae; with 29–44 disc-pores in each anterior band and 27–46 in each posterior band (each band with 6–12 disc-pores on dorsum); anterior bands with 0–1 pores a short distance mesad to each peritreme. Preantennal pores apparently absent. Ventral microducts and tubular ducts as for genus. Ventral setae: ventral anal lobe setae 21–22 µm long; with 1 pair of anterior anal cleft setae; with 1 pair of long pregenital setae medially on segments VI and VII; number of setae medially on each abdominal segment: VII, 4–6; VI, 2–3; V–II, 0–2 (?) (all very short apart from pregenital pairs); with 1–4 setae near each metacoxa, 2–4 near each mesocoxa and 0–4 short setae near each procoxa; longest seta on thorax associated with mesocoxae, 30–35 µm long; with 1–3 pairs of interantennal setae laterally plus 0–1 seta medially; with 1–3 submarginal setae between each stigmatic area; with small setae distributed rather randomly submarginally. Antennae 6- to 8-segmented; 3rd (or 3–5) segment(s) about as long as other 5 segments together; total length 295–356 µm; length of apical seta 19–40 µm. Length of clypeolabral shield 183–207 µm. Width of spiracular peritremes: anterior 63–70 µm, posterior 70–83 µm. Legs well developed; separation of tibia and tarsus usually distinct; lengths (metathoracic): coxa 54–81 µm, trochanter + femur 135–146 µm, tibia 97–119 µm, tarsus 86–97 µm, claw 12 µm; claw with a distinct but very small denticle.

Material studied: LECTOTYPE ♀: NEW ZEALAND: labelled: "*Ctenochiton fuscus*, adult female, from *Brachyglottis* sp., Jan. 1883, W.M.M." CMNZ: 1/1♀ ad; designated by Henderson, 1995.
PARALECTOTYPES: NEW ZEALAND: (i) from *Panax* (=*Pseudopanax*) sp., Jan. 1883, W.M.M., CMNZ: 2/1♂ 2nd (although labelled female 2nd), 1♀ ad test. (ii) as previous, except NZAC: 1/1 "antenna of female".

Other material: NEW ZEALAND: from W.M. Maskell's dry material #37, mounted 2 Mar 1972 by J.A. de Boer: 1/1 pupa. **SD**: Trio Is, *Hymenanthera* sp., Aug 1965, D.J. Campbell, #61: 5/10♀♀ ad. **NN**: Motueka, *Melicytus ramiflorus*, 9 Jan 1937, 8 Jan 1938 & 12 Mar 1938, G. Brittin, #326: 3/6♀♀ ad. Motueka, *Myoporum laetum* [as ngaio], 4 Jul 1917, G. Brittin, No. 113, NZAC: 1/1♂ 2nd pharate prepupa. Golden Bay, Tarakohe, *Melicytus* sp., 14 Aug 1925, (G. Brittin dry collection), #90-213b: 1/1♀ ad. **MC**: Lyttelton, *Myoporum laetum*, no date, G. Brittin, #110, BMNH: 7/78, 2/2♀♀ ad + NZAC (mounted from dry material by C.J. Hodgson): 6/3♀♀ ad, 1♂ ad, 8 1sts (as 'Ctenochiton testudo', Brittin manuscript name). Lyttelton, *Myoporum laetum* [as ngaio], 1914, from Brittin dry collection, #110, #90-220a–d: 4/4♀♀ ad. As previous, except 13 Jan 1917, G. Brittin: 2/2♀♀ ad. Springfield, *Coprosma* sp., 26 Dec 1914, G. Brittin, #71: 1/1♀ ad [as *Inglisia ornata*]. Okuti Valley Scenic Reserve, *Melicytus ramiflorus* stems, 19 Jan 1983, L.M. Emms, #83-052d: 4/8♀♀ ad. **MK**: Lake Tekapo, *Hymenanthera* sp., 4 Feb 1968, J.A. de Boer, #352: 2/3♀♀ ad (1 split dorsoventrally).

Remarks. Maskell's material was collected at Canterbury, the *Brachyglottis* species was *B. repanda* and the *Panax* sp. was *P. arboreum* (=*Pseudopanax arboreus*) (Maskell, 1895a).

The adult females of *C. fusca* are easily recognisable by the extension of the spiracular disc-pore bands onto the dorsum and by either the absence of stigmatic spines or, when present, their displacement some distance onto the dorsum. Other important characters are the presence of:
(i) ventral tubular ducts throughout the venter;
(ii) a second type of ventral tubular duct around the anogenital area;
(iii) only 5 longitudinal rows of reticulation areas dorsally;
(iv) ventral microducts throughout the venter;
(v) pregenital disc-pores medially on metathorax and also laterad to each metacoxa;
(vi) the presence of a very small denticle on the claw;
(vii) the convex structure of the dorsal macropore;
(viii) the shape of the marginal spines, which are often slightly dilated at their apex.

Biology. Nothing known

Distribution. From Cook Strait (Trio Islands) to Lake Tekapo in the South Island (Map 11).

Crystallotesta leptospermi (Maskell) new combination

Figs C46, C47, 107

Inglisia leptospermi Maskell, 1882: 220; –Maskell 1885: 27 [male]; –Maskell, 1887: 75 [description]; –Maskell, 1895a: 14 [checklist]; –Cockerell, 1896: 330 [checklist]; –Fernald, 1903: 162 [world catalogue]; –Hutton, 1904: 227 [checklist]; –Myers, 1922: 199 [checklist]; –Green, 1929: 377 [record]; –Hoy, 1954: 601 [distribution]; –Hoy, 1961: 52, 57 [distribution]; –Wise, 1977: 105 [checklist]; –Deitz & Tocker, 1980: 29 [checklist]; –Ben-Dov, 1993: 148 [world catalogue]; –Henderson, 1995: 107 [lectotype designated].

Unmounted material: "Test of adult female white, glassy or waxy, elongated, convex above, flat and open beneath, formed of several agglutinated segments, each segment more or less convex or conical, median segments usually five in number; at the edge an irregular fringe, but the fringe is often absent. Average length of test, 1/10th in [2.5 mm]. The marginal segments sometimes assume the form of small cones, as if a number of secondary tests were attached to the principle one. All the segments are marked with striae radiating from the apex of each: the striae, which are composed of air-cells, widen from the apex to the base." (Maskell, 1887, p. 75). Young female chestnut brown; adult female shrivels to anterior end of test whilst ovipositing, causing near empty test to appear very white (this is stage most often collected).

Mounted material: body elongate oval, about equally rounded at both ends and parallel-sided; anal cleft about 1/11th body length; stigmatic clefts not indented. Length 1.9–2.4 mm; breadth 0.89–1.22 mm.

Dorsum: dorsal pores delineating reticulations in 7 longitudinal rows across dorsum, with 5+ reticulation areas between anal plates and anterior margin and about 28 areas around margin. Dorsal pores of 3 types: (i) minute, dark microductules: present throughout, but most frequent associated with lines of macropores; (ii) simple pores of various sizes: flat simple pores, slightly larger than microductule: present throughout but most frequent associated with lines of macropores, slightly larger near margin; larger simple pores: forming a distinct submarginal band; still larger simple pores are present in a line on either side of anal plates, with 6–11 in each group; and (iii) macropores, approximately similar in size to simple pores near anal plates: frequent within inner reticulation lines; with about 8 in posterior medial macropore line. Anal plates: 129–157 µm long, combined widths 113–141 µm; with 2–3 minute pores on dorsal surface of each plate; length of setae: inner margin 1, 10–18 µm (finely spinose); inner margin 2, 10–22 µm (more stoutly spinose and almost on apex); apical, 21–36 µm and outer margin, 16–18 µm (both almost on apex, latter set slightly onto dorsal surface of each plate). Anogenital fold with 2–3 pairs of setae on anterior margin and 1 seta on each lateral margin; longest 40–45 µm.

Margin: marginal setae conical and spinose, 10–15 µm long; with 29–34 laterally between stigmatic clefts; reticulation setae slightly larger, 15–20 µm long; with simple pores next to or between marginal setae, with 5–10 on each side between stigmatic areas. Stigmatic spines tending to be broad until very near apex, slightly curved; offset slightly onto dorsum; length 54–72 µm. Eyespot obscure on margin.

Venter: pregenital disc-pores with mainly 10 (range 6–13) loculi; number on each segment (medially across segment/laterally on one side): VII, 11–16/17–34; VI, 28–38/17–20; V, 26–32/6–14; IV, 23–28/7–12; III, 18–26/6–8; and II, 12–16/2–5; metathorax generally with at least 1 disc-pore laterad to each coxa and often with 1–2 medially. Spiracular disc-pores in bands 1–2 pores wide between each spiracle and margin; with 12–18 in each band, with none extending medially past peritreme. With preantennal pores single. Submarginal band of simple pores absent. Ventral microducts and tubular ducts as for genus. Ventral setae: ventral anal lobe setae quite long, 41–65 µm and generally with a blunt or even slightly swollen apex; with 0–1 pairs of anterior anal cleft setae; with a pair of long pregenital setae medially on segments VI and VII, longest 76–90 µm; number of short setae medially on each segment: VII–VI, 4–5; V, 0–1; IV, 2–4; and III–II, 2; with 1–3 setae just anterior to metacoxa; 2–4 near each mesocoxa, and 3 just posterior to each procoxa, latter much longer than those near other coxae, length 30–36 µm; with 1–3 submarginal setae on each side between stigmatic areas; with 3–4 pairs of interantennal setae laterally + 0–2 medially. Antennae 8-segmented, with no pseudosegments; total length 254–349 µm; length of apical seta 46–54 µm. Length of clypeolabral shield 158–171 µm. Width of spiracular peritremes: anterior 30–41 µm, posterior 37–45 µm. Legs with tibia and tarsus distinctly separate; lengths (metathoracic): coxa 133–140 µm, trochanter + femur 129–178 µm, tibia 120–144 µm, tarsus 91–110 µm, claw 18 µm; claw with or without a minute denticle.

Material examined: LECTOTYPE ♀: NEW ZEALAND: labelled "*Inglisia leptospermi* from manuka tree, two adult females, Oct. 1880, WWM"; CMNZ: 1/2♀ ad, lectotype arrowed; designated by Henderson, 1995.
PARALECTOTYPE: 1♀ ad on slide with lectotype. [Paralectotype: collection data as for lectotype except female - 2nd stage; CMNZ: 1/1♀ 3rd, a misidentification, now considered to be *Crystallotesta ornatella* described as new below. This specimen = Slide 2 under *Inglisia leptospermi*, p. 107, Henderson (1995)].

Other material: NEW ZEALAND: Maskell coll., no. 47, USNM: 4/2♀♀ ad, (one very poor), 1 1st, 4 ?eggs. New Zealand, *Kunzea ericoides* [as *Leptospermum*], 30 Apr 1922, Myers, BMNH: 1/1♀ ad. **TH**: Three Kings Is, Great I, Bald Hill, *Kunzea ericoides*, underside leaves, 14 Apr 1999, T.K. Crosby, #99-026a–d: 4/2♂ 2nd, 2♀ 3rd. **CL**: Little Barrier I, Te Maraeroa West, *Kunzea ericoides*, 17 Sept 1994, RCH, #94-077a–e: 5/1♀ ad, 2♀ 3rd (one pharate), 2♀ 2nd, 2♂ 2nd, 1 1st. Tairua SF, *Leptospermum scoparium*, 6 Jan 1961, A.E. Marsack, FRNZ no.R10: 1/1♀ ad. **GB**: Paoneone, *Kunzea ericoides*, leaves & twig, 15 Mar 1994, & 2 Nov 1994, RCH, #94-050b: 1/1♀ 2nd, 2♂ 2nd, & #94-101: 1/1♀ ad (good). **TO**: Kaingaroa SF Cpt 1164, *Leptospermum scoparium*, 10 Aug 1959, N.O. Secombe, FRNZ R99, 100: 2/7♂ 2nd. **SD**: d'Urville I, *Leptospermum* sp., 17 Feb 1971, J.A. de Boer, #700: 2/3♀♀ ad (one split dorsoventrally). **NN**: Riwaka, *Leptospermum* sp., Jan 1918, no coll., USNM #72: 1/2♀♀ ad. Nelson, Rockville, Arorere R, *Kunzea ericoides* [as *Leptospermum*], 4 Aug 1948, T.G. Sewell, #59 J.M. Hoy Collection: 5/1♀ 3rd, 4♀ 2nd, 4♂ 2nd. Onekaka, *Kunzea ericoides* [as *Leptospermum*], 4 Aug 1948, T.G. Sewell, #62 J.M. Hoy Collection: 2/2♂ 2nd. Pokoporo, Motueka Valley, *Kunzea ericoides* [as *Leptospermum*], 4 Dec 1959, J.G.R. McBurney, FRNZ R(a)23, 24: 2/6♀♀ ad. Nelson, *Kunzea ericoides* [as *Leptospermum*], 19 Dec 1968, J.A. de Boer, #471: 2/4♀♀ ad (one split dorsoventrally). **BR**: Buller R. Gowanbridge [as nr Gower Bridge], *Kunzea ericoides* [as *Leptospermum*], 3 Mar 1969, J.A. de Boer, #494: 1/2♀♀ ad. Maimai, *Kunzea ericoides* [as *Leptospermum*], 1 Aug 1948, T.G. Sewell, #67 J.M. Hoy Collection: 5/1♀ 2nd, 4♂ 2nd, 6 1sts. Reefton, 3 miles north, *Kunzea ericoides* [as *Leptospermum*], 2 Aug 1948, T.G. Sewell, #64 J.M. Hoy Collection: 4/3♀♀ ad (old), 1♂ 2nd, 8 1sts. Reefton, 4 miles south of Ahaura, *Kunzea ericoides* [as *Leptospermum*], 2 Aug 1948, T.G. Sewell, #68 J.M. Hoy Collection: 5/1♀ ad (pharate), 1♀ 3rd, 3♀ 2nd (one slide too poor). Inangahua Landing, *Leptospermum scoparium*, 2 Aug 1948, T.G. Sewell, J.M. Hoy Collection: 3/1♀ 3rd, 1♀ 2nd, 4♂ 2nd. Waipuna (Reefton District), *Kunzea ericoides* [as *Leptospermum*], 22 Oct 1960, R. Zondag, FRNZ R64, 65: 2/3♀ 2nd, 4 pupae. Tawhai S.F., *Kunzea ericoides* [as *Leptospermum*], 18 Jan 1960, J.G.R. McBurney, FRNZ R(a)36: 3/3♀♀ ad. **MC**: Springfield, *Leptospermum* sp., 25 Dec 1914, Brittin, #72: 1/1♀ ad.

Remarks. Also recorded from: **MC**: Governors Bay (Green, 1929: 377).

Crystallotesta leptospermi has been recorded only from *Leptospermum scoparium* —manuka— and *Kunzea ericoides* [also as *Leptospermum ericoides*]—kanuka. *C. leptospermi* can be identified by having the following combination of characters:

(i) a line of large dorsal simple pores on either side of anal plates;
(ii) dorsal reticulation areas in 7 longitudinal rows;
(iii) 8-segmented antennae;
(iv) pairs of long pregenital setae on abdominal segments VI and VII;
(v) the convex shape and unusual distribution of the dorsal macropores;
(vi) the narrow, moderately short, curved stigmatic spines.

In possessing a line of large simple pores laterad to the anal plates, it resembles *C. fagi* but these two species are otherwise easily separable by the characters listed above.

An attempt was made (Henderson, 1995) to sort out the Maskell coccid species recorded from *Leptospermum scoparium* and *Kunzea ericoides* (as *Leptospermum ericoides*). Further study has shown that it was only partly successful: the key characters and the discussion given in Henderson (1995) for *Inglisia ornata* Maskell are correct but with regard to *Inglisia leptospermi* Maskell, the type specimens are those illustrated by Maskell in 1887; the characters of the female lectotype given by Henderson were misdiagnosed and the key characters refer to a third species, *Crystallotesta ornatella*, described as new below.

Biology. Juvenile instars of both sexes are found on the leaves of the host plant, whereas the adult females settle on the twigs. The very young adult female is a cryptically coloured chestnut brown with spots and stripes and closely resembles the pattern of the leaf bud bracts of *Kunzea ericoides* (Colour plate I). From the collection records, there is apparently one generation per year, with the 1st- and 2nd-instar nymphs overwintering and the adult females reproducing over the summer and into autumn, depending on geographic location.

Pathogens and parasitoids. Hymenopterous parasitoids recorded are: Encyrtidae: *Adelencyrtoides variabilis* Noyes; Pteromalidae: *Aphobetus nana* (Bouček).

Distribution. Throughout areas with a drier climate in the North Island and the northern half of the South Island (Map 12)

Crystallotesta neofagi Henderson & Hodgson new species

Fig C45, 108

Unmounted material: unknown.

Mounted material: body broadly oval, rather more pointed anteriorly. Length 2.3–2.6 mm; breadth 1.5–1.7 mm.

Dorsum: dorsal pores delineating reticulation areas in 7 longitudinal rows across dorsum; with 5 reticulation areas between anal plates and anterior margin, middle 3 rows with rather fewer areas than on other species in this genus, and with 27–28 areas around margin. Dorsal pores of 3 types: (i) rather large, dark microductules (whose orifice often looks as though it is bilocular): common on either side of macropores in reticulation lines; (ii) similar sized, flat to slightly convex, simple pores: variable in size, associated with lines of reticulation but those nearest margin distinctly larger: with 12–17 in a submarginal line on each side between stigmatic clefts and with 2–6 in a line laterad to each anal plate; and (iii) quite large macropores (3–5 µm diam.), probably rather flat, either more or less round or roundly lemon-shaped, with lateral walls thickest: with 9–12 in posterior medial macropore line. Anal plates: 153–171 µm long, combined widths 100–116 µm; minute pores on dorsal surface apparently absent; length of setae: inner margin 1, 16 µm (possibly absent on some specimens but when present about middle of inner margin); inner margin 2 (near apex), 25–35 µm; apical, 45–48 µm, and outer margin, 36–45 µm (set on dorsal surface near apex). Anogenital fold with 2 pairs of setae on anterior margin and 1 pair on lateral margins; longest 50–63 µm.

Margin: marginal setae spinose: with 2–4 spines extending a short distance up anal cleft; with 32–39 on each side between stigmatic clefts, those on either side of stigmatic spines displaced slightly onto dorsum, forming a small group in each cleft; most setae 16–22 µm long but reticulation setae significantly larger, 22–36 µm, and displaced slightly onto dorsum; with 7 larger, reticulation setae on either side of abdomen, 2 on each side between stigmatic clefts and 8 around head. Stigmatic spines set slightly onto dorsum; each 76–99 µm long.

Venter: pregenital disc-pores with mainly 10 (7–11) loculi; distributed across abdominal segments; number on each segment (medially across segment/laterally on 1 side): VII, 5–9/14–21; VI, 40–61/7–14; V, 36–52/3–7; IV, 22–32/4–6; III, 11–17/4–6; and II, 8–10/1–5; with 5–9 medially across metathorax and with 1–3 laterad to each metacoxa; 0–1 mesad to each mesocoxa; 0–2 mesad to each procoxa and 0–1 mesad to each scape. Spiracular disc-pores with 3–7 (mainly 5) loculi in bands 1–5 pores wide between each spiracle and margin; with 36–43 in each anterior band and 41–47 in each posterior band; with 1–2 pores (rarely none) extending medially past peritreme. With 1–2 preantennal pores just anterior to each scape. Ventral simple pores absent. Ventral microducts and tubular ducts as for genus. Ventral setae: ventral anal lobe setae 66–76 µm long, rather spinose, with a blunt or even slightly capitate apex; with 0–1 pair of anterior anal cleft setae; with a pair of long pregenital setae medially on segment VII only, 63–94 µm long; number of shorter setae medially on each segment: VII, 7–9; VI–V, 2–4; IV–II, 0–4; with 1–3 setae just anterior to each meta- and mesocoxa and 1–3 just posterior to each procoxa; length of setae associated with each procoxa 13–18 µm; submarginal setae: those on thorax and abdomen near reticulation setae particularly large, with large basal sockets, length 27–33 µm; with 1 large seta on each side between stigmatic clefts but also with occasional smaller setae, 10–15 µm long, between larger submarginal setae; interantennal setae: with 1 pair of long setae + 1–3 pairs short setae. Antennae 6-segmented, with 2 pseudosegments in long third segment; total length 328–394 µm; third segment much longest (184–201 µm long; ratio to total length 0.54:1); length of apical seta 39–40 µm. Length of clypeolabral shield 165–170 µm long. Width of spiracular peritremes: anterior 55–70 µm, posterior 61–74 µm. Legs: separation of tibia and tarsus generally distinct; lengths (metathoracic): coxa 155–168 µm, trochanter + femur 192–201 µm, tibia 143–160 µm, tarsus 94–103 µm, claw 20–22 µm; claw without a denticle.

Material examined: HOLOTYPE ♀: NEW ZEALAND: **BR**: Granville Forest, 8 Aug 1957, E.E. Ensor, *Nothofagus fusca,* FRNZ R28-30: 1/1♀ ad. Holotype slide marked as such; [misidentified as *Inglisia fagi* Maskell by C.F. Butcher 1984] (remounted by C.J. Hodgson).
PARATYPES: as for holotype: NZAC: 11/2♀♀ ad, 7♀♀ pharate ad., 1♂ 2nd , 1♀ 3rd .

Other material: NEW ZEALAND: **GB**: L. Waikaremoana, 19 Jun 1991, C.F. Morales, *Nothofagus fusca*, #97-074a–c: 3/1♀ 3rd, 6♂ 2nd, 5 pupae. **TO**: SF 90, Taupo, *Nothofagus fusca*, 8 Dec 1975, M. Kay, FRNZ R(b)73–78: 6/10♀♀ ad (very poor). **BR**: Maimai [as Mai-Mai], *Nothofagus truncata*, Aug 1977, T. Johnson, #77-251a: 4/1♀ ad, 3 pharate♀♀ ad, 1♀ 2nd, 2♀ 3rd.

Remarks. The adult females of *Crystallotesta neofagi* are very similar to those of *C. fagi* but differ in having:
(i) long pregenital setae on only abdominal segment VII (segments VI and VII on *C. fagi*);
(ii) at least 5 pregenital disc-pores medially on segment VII (none or very rarely 1 on *C. fagi*);
(iii) one third as many pregenital disc-pores medially and mediolaterally on all abdominal segments;
(iv) few (2–6) dorsal simple pores laterad to each anal plate (about 30 on *C. fagi*);
(v) legs about 1/3rd longer than on *C. fagi* (about 200 µm rather than about 120 µm on *C. fagi*);
(vi) rather few (<15) macropores in the transverse median line anterior to the anal plates (*C. fagi* has more than 20);
(vii) many fewer pregenital disc-pores medially on the thorax (5–9 as compared with 23–26 on *C. fagi*) and these extending onto meso- and prothorax;
(viii) the test with seven lines of reticulation plates (only 5 on *C. fagi*).

Biology. *C. neofagi* has been collected in March, June, August, and December. Several life stages were collected in June and August and therefore *C. neofagi* may have just one generation a year. Found only on *Nothofagus* spp.

Distribution. The distribution is apparently disjunct, with two records from central North Island and two records from north-west South Island (Map 13).

Name derivation. A combination of *neo-*, new, with *fagi*, for the similarity to that species.

Crystallotesta ornata (Maskell) new combination

Figs M19, C48, C49, 109

Inglisia ornata Maskell, 1885: 27; –Maskell, 1887: 76 [description]; –Maskell, 1895a: 14 [checklist]; –Cockerell, 1896: 330 [checklist]; –Fernald, 1903: 162 [world catalogue]; –Hutton, 1904: 227 [checklist]; –Myers, 1922: 199 [checklist]; –Miller, 1925: 33, 63 [host]; –Hoy, 1954: 601 [distribution];–Hoy, 1961: 52, 57 [distribution]; –Wise, 1977: 105 [checklist]; –Deitz & Tocker, 1980: 30 [checklist]; –Ben-Dov, 1993: 149 [world catalogue]; –Henderson, 1995: 107 [lectotype designated].

Unmounted material: "Test of adult female reddish brown, the base more or less oval, the rest elevated in a cone and ending in a prominence standing up like a more or less sharp horn; sometimes there are two of these horns. The test is formed of a number of polygonal segments, each slightly elevated, and all marked with the striae peculiar to the genus. There is a fringe of sharply triangular segments, also striated. Average length of test about 1/6 inch [4 mm], but specimens attain a length of 1/4 inch [6 mm]; height about 1/10 inch [2.5 mm]" (Maskell, 1885, p. 27). The reddish-brown colour is the animal within showing through its nearly transparent test.

Mounted material: body oval, about equally rounded at both ends. Length 2.4–4.2 mm; breadth 1.7–2.5 mm.

Dorsum: dorsal pores delineating reticulation areas in 5 longitudinal rows; reticulation areas in middle 3 rows all large; with 5 or 6 areas between anal plates and anterior margin and about 19 areas around margin; each reticulation line broad, composed of 3 parallel lines of pores: a median line with macropores interspersed with tubular pores and microductules (microductules clustered around each tubular pore and each macropore in small groups) and 2 lateral lines with sub-groups of 3 or more pores, consisting of 1 or more simple pores with a microductule on either side. Dorsal pores of 4 types: (i) small, dark microductules: present within reticulation lines; (ii) slightly larger, flat, simple pores: present in both reticulation areas and in reticulation lines; of 2 sizes, those nearest margin largest; (iii) tubular pores, 7–10 μm deep, ductule about 1/4–1/3 length of a ventral tubular duct minus inner filament, and with a dark inner pore: present between macropores within median reticulation line; and (iv) large, highly convex macropores, bollard-shaped, with walls thickest at base (Fig. M19): present within inner reticulation lines and most abundant medially on thorax and abdomen; with 18–21 in posterior medial macropore line. Anal plates: 201–210 μm long, combined widths 146–173 μm; with 2–3 minute pores on dorsal surface of each plate; length of setae: inner margin 1, 45 μm; inner margin 2, 26 μm; apical, 65 μm, and outer margin, 38–42 μm (set on dorsal surface of each plate near apex). Anogenital fold with 1–3 pairs of setae on anterior margin and with 1 pair on lateral margins; longest 84–90 μm.

Margin: marginal setae spinose: with 50–67 laterally between stigmatic clefts, those just posterior to each cleft sometimes in a group 2–3 wide; length 9–22 μm; larger setae at intersegmental boundaries and not coinciding with reticulation junctions at margin. Simple pores present in a submarginal ring next to or between marginal setae, with 13–20 pores on each side between stigmatic areas. Stigmatic spines very long, slightly tapering and curved; length 340–382 μm. Eyespot obscure.

Venter: pregenital disc-pores with mainly 10 (6–11) loculi; number on each segment (medially across segment/ laterally on one side): VII, 40–62/26–30; VI, 17–27/49–63; V, 9–14/44–64; IV, 7–13/29–44; III, 4–11/26–41; and II, 5–12/12–19; one specimen also has a single disc-pore laterad to a metacoxa. Spiracular disc-pores with mainly 5 (range 3–7) loculi, in bands 1–5 pores wide; with 29–41 in each anterior band and 42–57 in each posterior band; with 0–2 pores (usually at least 1) extending medially past peritreme. With 0–1 preantennal pores. Also with a line of simple pores around submargin, approximately in line with submarginal setae; with 12–29 on each side between stigmatic clefts (when abundant, band more than 1 pore wide). Ventral microducts and tubular ducts as for genus. Ventral setae: ventral anal lobe setae 30–38 μm long, rather spinose; with 4–5 (generally 4) pairs of anterior anal cleft setae; with long pregenital setae medially on pregenital segments VII, VI, and V, longest 75–80 μm; number of setae medially on each segment: VII–VI, 4–8 long setae, no short setae; V, 2–3 long setae + 0–1 moderately long setae; IV–II, 2–4 short setae; with 1 seta just anterior to each meta- and mesocoxa; 0–2 setae just posterior to each procoxa; length of setae associated with each procoxa 12–16 μm; with 1 submarginal seta on each side between stigmatic areas; with 3–5 pairs of interantennal setae; other setae rather few and small. Antennae 8-segmented; total length 328–406 μm; scape with only 2 setae; length of apical seta 27–49 μm. Length of clypeolabral shield 185–207 μm. Width of spiracular peritremes: anterior 55–81 μm, posterior 66–92 μm. Legs with a distinct tibio-tarsal articulation; lengths (metathoracic): coxa 168–205 μm, trochanter + femur 172–226 μm, tibia 135–185 μm, tarsus 94–127 μm, claw 25–29 μm; claw without a denticle.

Material examined: LECTOTYPE ♀: NEW ZEALAND: [**WN**: Wellington], "*Inglisia ornata*, adult female, from *Elaeocarpus*, Mar.1884, W.M.M." NZAC / Maskell coll.: 1/1♀ ad.; designated by Henderson, 1995.
PARALECTOTYPES: NEW ZEALAND: (i) As for lectotype , but labelled "Female — 2nd stage / stained and remounted in Canada balsam, 16 Jan 1995, R.C. Henderson" [= 2nd-instar male] NZAC: 1/1♂ 2nd. (ii) "Young insect" [= 1st-instar], NZAC 1/1 1st. (iii) "Antenna, foot and spines of adult female, Oct 1884" NZAC: 1/bits. (iv) "Male, Aug 1884" NZAC 1/1♂ ad.

Other material: NEW ZEALAND: Maskell collection no. 45, USNM: 1/1♀ ad, 1/1♂ ad. **AK**: Riverhead Forest, Barlow Road reserve, *Podocarpus totara* leaves & stems, 4 May 1995, RCH, #95-040a+d: 2/2♂ 2nd. As previous, except 13 Oct 1995, #95-108a–f: 6/5♀♀ ad, 2♂ 2nd. As previous, except 17 Jul 1997, #97-085a–e, 5/2♀ 3rd, 3♂ 2nd. As previous, except 14 Aug 1997, reared to 10 Sep 1997, #97-121a–g: 7/6♂♂ ad, 7 moults, 3♂ 2nd, 3 prepupae, 1 pupa. As previous, except 6 Feb 1998, C.J. Hodgson, #98-070a–f: 6/3♀ 2nd, 14 1sts. As previous, except 25 Jul 1999, RCH, #99-093a–j: 10/1♀ ad, 3♀ 3rd, 6♂ 2nd, 2 prepupae, 1 pupa. **BP**: Te Koau, 360 m, *Hedycarya arborea*, 26 Oct 1992, J.S. Dugdale, #92-340: 1/1♀ ad. Waiaroho, *Hedycarya arborea*, 28 Jan 1993, RCH, #93-268: 1/1♂ 2nd. As previous, except 3 Nov 1993, #93-339: 1/1♀ ad (split dorso-ventrally). Rereauira Swamp, Beech Ridge, *Nothofagus truncata*, 26 Apr 1993, J.S. Dugdale, #93-032: 1/1♀ 2nd. Lottin Point, Otanga, *Vitex lucens* twigs, 5 Nov 1993, RCH, #93-051a–b: 1/1♀ ad, 5 1sts. **GB**: Taikawakawa, nr. Maungakaka, *Beilschmiedia tawaroa*, 18 Mar 1993, RCH, #93-084: 1/1♀ ad (poor). **WN**: Otaki Forks, *Podocarpus totara*, 4 Oct 1980, C.F. Butcher, #83-292: 1/1♀ ad.

Remarks. Adult females of *C. ornata* can be distinguished by the presence of the following characters:
(i) very long stigmatic spines;
(ii) large sclerotised, bollard-shaped macropores;
(iii) only 5 lines of reticulation plates;
(iv) 8-segmented antennae;
(v) 6 anal ring setae.

Crystallotesta ornatella (described below) is similar but differs in:
(i) being nearly half the size;
(ii) lacking the bollard-shaped dorsal macropores;
(iii) in having 8 anal ring setae;
(iv) 1 pair of long pregenital setae on segments VII and VI (rather than many on segments VII–V in *C. ornata*).

Maskell (1885a, 1887) states that *C. ornata* was also collected on *Leptospermum* sp. but it seems probable that these specimens refer to *Crystallotesta ornatella*, which is only known from species of *Leptospermum, Kunzea* (previously *Leptospermum*), and *Leucopogon*, and is very similar to *Crystallotesta ornata* in outward appearance. This is also probably true for the material collected off *Leptospermum* spp. by Hoy (1961), some of which is included in "Material examined" under *C. ornatella* below.

Biology. *C. ornata* probably has one generation a year as adults have most often been collected in October (Spring) while nymphs have been collected throughout the summer and winter at the Riverhead Forest site. Male nymphs are found on leaves, while the female nymphs move to the twigs where the 3rd instar and adult females are found.

Pathogens and parasitoids. Hymenopterous parasitoid recorded: Encyrtidae: *Adelencyrtoides variabilis* Noyes.

Distribution. *C. ornata* is only known from the North Island (Map 14).

Crystallotesta ornatella Henderson & Hodgson new species

Figs C50, C51, 110

Unmounted material: test of adult female similar to a small *C. ornata*, with a convex median horn and a series of pointed plates at its base, which easily break apart (unlike the fused test of *Plumichiton pollicinus*, which can appear similar and is about same size); young females reddish-brown; mature adult females shrink towards anterior end of test and become sclerotised.

Mounted material: body oval, slightly more pointed at anterior end; stigmatic clefts shallow or absent. Length 1.2–2.4 mm; breadth 0.85–1.2 mm.

Dorsum: dorsal pores delineating reticulation areas in 5 longitudinal rows across dorsum; with 5 or 6 areas between anal plates and anterior margin and an unknown number of areas around margin; each reticulation line broad, composed of 3 parallel lines of pores: median line of tubular macropores interspersed with microductules and an occasional simple pore (usually with several microductules clustered around each tubular macropore); lateral lines with microductules and occasional simple pores. Dorsal pores of 3 types: (i) small, dark microductules: present throughout, but most frequent associated with lines of macropores; (ii) slightly larger, flat simple pores: most abundant near margin; and (iii) long, inverted tubular macropores (or largest dorsal pores), about 1/2–2/3rds length of a ventral tubular duct minus inner filament, with a heavily sclerotised inner end, which tends to be slightly broader than duct, appearing round in dorsal view: present in all lines of reticulation; with 8–13 in posterior medial macropore line. Anal plates: 129–180 µm long, combined widths 115–126 µm; each plate tapering to a particularly narrow apex; with 2–3 minute pores on dorsal surface of each plate; length of setae: inner margin 1, 12–25 µm; inner margin 2, 14–18 µm; apical, 34–41 µm, and outer margin, 28–38 µm (set on dorsal surface of each plate near apex). Anogenital fold with 3 pairs of setae (one specimen with 2) on anterior margin and 1 pair laterally; longest 32–58 µm. Anal ring with 8 setae.

Margin: marginal setae spinose and conical; with 29–43 laterally between stigmatic clefts, those just posterior to each cleft sometimes set slightly onto dorsum; setae 9–13 µm long; with a submarginal band of simple pores on dorsum next to or between marginal spines, with 5–10 on each side between stigmatic areas. Stigmatic spines very long, slightly tapering and curved, with a well-developed basal socket; length 118–191 µm. Eyespot obscure.

Venter: pregenital disc-pores with mainly 10 (6–11) loculi; number on each segment (medially across segment/ in each lateral group): VII, 2–5/12–20; VI, 11–24/11–18; V, 9–21/5–9; IV, 7–15/0–5; III, 4–13/1–5; and II, 3–8/1–3; one specimen also had a single disc-pore laterad to a metacoxa. Spiracular disc-pores with mainly 5 (range 3–7) loculi, in bands 1–4 pores wide; with 8–18 in each band, but tending to have more in anterior than in posterior bands; pores not extending medially past peritremes. Preantennal pores single. Also with a submarginal line of simple pores, approximately in line with submarginal setae; with 7–10 on each side between stigmatic clefts. Ventral microducts and tubular ducts as for genus. Ventral setae: ventral anal lobe setae 18–23 µm long; with 1–4 (generally 2) pairs of anterior anal cleft setae; with a pair of long pregenital setae medially on pregenital segments VII, VI, and V, longest 28–45 µm long; number of setae medially on each segment: VII–VI, 2 long setae; V, 2 long setae and 1–2 short setae; IV–II, 4 short setae; with 1 seta just anterior to each meta– and mesocoxa; and 1–2 setae just posterior to each procoxa; length of setae associated with each procoxa 6–9 µm; with 1 submarginal seta on each side between stigmatic areas; with 2–4 pairs of inter-antennal setae. Antennae 6-segmented; 3rd segment only slightly shorter than other 5 segments together, with 2 pseudosegments; total length 184–234 µm; length of apical seta about 36 µm. Length of clypeolabral shield 138–153 µm. Width of spiracular peritremes: anterior 37–54 µm, posterior 36–58 µm. Legs: with tibia and tarsus distinctly separate; lengths (metathoracic): coxa 73–122 µm, trochanter + femur 102–144 µm, tibia 86–119 µm, tarsus 64–85 µm, claw 16–22 µm; claw without a denticle.

Material examined: HOLOTYPE ♀: "NEW ZEALAND: **AK**: Hunua Ra, Oct 1982, C.F. Butcher, #83-320d, NZAC: 1/1♀ ad.

PARATYPES: collection data as holotype: NZAC: 2/1♀ 3rd, 1♂ 2nd.

Other material: NEW ZEALAND: "*Inglisia leptospermi*" [misidentification], *Leptospermum scoparium* [as manuka tree], Oct 1880, W.M. Maskell: 1/1♀ 3rd [previously included as a paralectotype for *Crystallotesta leptospermi*]. **TH**: Three Kings Is, Great I, Bald Hill, *Kunzea ericoides*, stem, 14 Apr 1999, T.K. Crosby, #99-028: 1/1♀ ad. **ND:** 3 miles north of Dargaville, *Leptospermum scoparium*, 9 Aug 1954, J.M. Hoy, #160: 5/5♀♀ ad, 1 pupa, 1♂ ad. **CL**: Little Barrier I, Te Maraeroa west, *Kunzea ericoides*, 17 Sept 1994, RCH, #94-083a–b: 2/1♀ ad, 1 pharate ♀. **GB**: Kokakonui Stm headwater, Kaharoa Station, *Kunzea ericoides*, 20 Dec 1993, J.S. Dugdale, #93-376: 1/1♀ ad (parasitised, poor). Paoneone, *Kunzea ericoides* twigs, 4 Nov 1993, RCH, #93-340: 1/1♀ ad. As previous, 15 Mar 1994, #94-049a–c: 3/1♀ ad, 1♂ 2nd, 1 pupa, 1♂ ad. As previous, except *Kunzea ericoides*, both sides leaves, 4 Nov 1995, #95-102a–b: 2/1♀ 2nd, 3 1sts. Paoneone, *Leucopogon fasciculatus*, 2 May 1993, RCH: 2/1♀ ad, 1♂ 2nd. **WA**: Te Parae, *Metrosideros* sp. (rata), 29 May 1983, C.F. Butcher, #83-160a: 2/1 & 2 part ♀♀ ad, 2♂ 2nd. **NN**: Motueka, *Leptospermum scoparium*, 13 Apr 1925, G. Brittin Collection #71: 1/1♀ ad. Onekaka, *Kunzea ericoides* [as *Leptospermum*], 4 Aug 1948, T.G. Sewell, J.M. Hoy Collection #62: 6/2♀♀ ad (one pharate), 7♀ 3rd, 3♂ 2nd, [+?3/3 prepupae ??*ornatella* or *leptospermi*]. Collingwood, *Kunzea ericoides* [as *Leptospermum*], 4 Aug 1948, T.G. Sewell, J.M. Hoy Collection #60: 4/3♀ 3rd, 1♂ 2nd, 1 prepupa, 1 pupa. Garden Valley, nr Wairoa Gorge, *Kunzea ericoides* [as *Leptospermum*], 19 Dec 1968, J.A. de Boer, #470: 1/2♀♀ ad. Eves Bush, *Leucopogon fasciculatus* [as *Cyathodes fasciculata*], 10 May 1973, J.A. de Boer, #1019B: 1/2♂ 2nd. **MC**: New Brighton, *Leptospermum* sp., 24 May 1915, G. Brittin, #71: 1/1♀ ad.

Remarks. Adult females of *C. ornatella* and *C. ornata* are very similar and share:

(i) the same distribution of reticulation areas on the dorsum;

(ii) the same basic dorsal pore distribution in the reticulation lines;

(iii) the tubular pores on the dorsum (although of very different size in the 2 species);
(iv) the submarginal band of simple pores on the venter;
(v) the very long stigmatic spines.

C. ornatella can be separated from *C. ornata* by:
(i) its small size;
(ii) the long tubular macropores (or largest dorsal pores) (macropores convex and bollard-shaped on *C. ornata*);
(iii) 8 anal ring setae (6 setae on *C. ornata*);
(iv) only single pairs of long pregenital setae in segments V–VII (all setae long on segments VI and VII on *C. ornata*).

As indicated in the remarks under *C. ornata* above, the material off *Leptospermum* sp. mentioned by both Maskell (1885) and Hoy (1961) almost certainly refers to this species. The material from Dargaville (ND) collected by Hoy in 1954 and that collected from Onekaka and Collingwood (**NN**) by Sewell in 1948 are also probably of this species.

Biology. Adult female *C. ornatella* are generally found on the twigs of *Kunzea, Leptospermum,* and *Leucopogon* species. Adult females have been collected in the spring (August–December) and autumn (April–May) and adult males in August and March and so *C. ornatella* may be bivoltine; apparently overwinters as the 1st- and 2nd-instar nymphs. The empty glassy tests of the males persist on the twigs through the summer and autumn and can often be found when no other life stages are apparent on the host.

Distribution. Throughout areas with a drier climate from Northland to Mid-Canterbury (Map 15).

Name derivation. L *orno, -ornatus,* to decorate; *ornatella*, small ornate scale similar to *ornata.*

Genus *CTENOCHITON* Maskell

Ctenochiton Maskell, 1879: 208; –Atkinson, 1886: 277 [taxonomy]; –Maskell, 1887: 62, 65 [description]; –Maskell, 1895a: 12 [checklist]; –Cockerell, 1894b: 1053 [distribution]; –Cockerell, 1896: 330 [checklist]; –Cockerell, 1899a: 394 [checklist]; –Cockerell, 1899b: 16 [mention]; –Cockerell, 1899c: 332 [key]; –Farquhar, 1900: 247 [zoogeography]; –Fernald, 1903: 159 [world catalogue]; –Hutton, 1904: 126 [checklist]; –MacGillivray, 1921: 171, 178 [catalogue]; –Froggatt, 1921, 22 [distribution]; –Morrison & Morrison, 1922: 71 [redescription of type]; –Steinweden, 1929: 234 [classification]; –Bodenheimer, 1935: 243 [zoogeography]; –Balachowsky, 1936: 124 [French sp.]; –Archangelskaya, 1937: 35, 37 [mention]; –Lindinger, 1937: 182 [checklist]; –Brittin, 1940a: 412 [mention]; –Takahashi, 1942: 27, 29 [Asian sp.]; –Lindinger, 1943: 218 [mention]; –Balachowsky, 1948: 255 [key]; –Borchsenius, 1957: 48, 271 [mention]; –Wise, 1977: 104 [checklist]; –Ben-Dov, 1993: 99 [world catalogue].

Cnetochiton of Balachowsky, 1932: 36 [misspelling].

Type species: *Ctenochiton viridis* Maskell (designated by Fernald, 1903: 159)

Diagnosis. Adult female. Test: glassy, flat, thin, and brittle, hyaline; showing reticulate pattern (Figs M8, M10, internal wax structure of plate on *C. viridis*).

Shape: mature adults mostly large, up to 10 mm or more in length, pyriform, flat to slightly convex, with a shallow anal cleft. Colour green.

Dorsum: derm membranous. Dorsal setae absent. Dorsal pores in a reticulate pattern (Figs M8, M10 of *C. paraviridis*), delineating reticulation areas in 7 longitudinal rows across body, 9 reticulation areas between anal plates and anterior margin and with 26 or 28 areas around margin. Dorsal pores of 2 to 4 types: (i) minute, dark microductules, each with a long inner filament with a small balloon-like proximal end; (ii) simple pores of various sizes: mostly within lines of reticulation but also occasionally present medially on plates; (iii) larger convex, simple pores, apparently similar in structure to macropores: forming a distinct submarginal band (except on *C. viridis*); and (iv) macropores, quite large and rather flat ('button-shaped'): most abundant in median 3 reticulation lines, becoming less frequent laterally and absent near margins (absent on *C. viridis*). Preopercular pores, dorsal tubercles, and dorsal tubular ducts absent. Anal plates widest on anterior third, each plate with 4 setae: 2 stout setae along inner margin, one finer, longer seta ± apically and another spinose seta posteriorly on upper surface near apex; without a sclerotised collar around anterior margin of anal plates on dorsum. Anogenital fold with 2 large sclerotised plates arising internally and extending anteriorly from anterior margin; with 2–4 pairs of long setae along anterior margin and with a single seta on each lateral margin. Anal ring with 3 pairs of setae.

Margin: marginal setae abundant, broadly conical, strongly spinose (except finely spinose on *C. viridis*), rather blunt, shape of basal sockets rather variable within genus; in a single line not extending up margins of anal cleft; reticulation setae usually larger; setae on anal lobe not differentiated from other marginal setae. Stigmatic clefts shallow (particularly on *C. toru*) but distinct; without stigmatic sclerotisations; each cleft with a single spinose, rather short, stout stigmatic spine, never longer than 3 × length of marginal setae. Eyespot present.

Venter: pregenital disc-pores with mainly 10 (range 6–10) outer loculi and a single oval inner loculus, usually with distinctive parallel sides; distributed across most or all abdominal segments medially and in groups on mediolateral folds of most segments. Spiracular disc-pores with mainly 5 loculi (range 3–7), in fairly narrow to very broad bands between spiracles and margin, each band often broadening along margins of stigmatic cleft; with few or none extending medially past peritremes. One or 2 preantennal pores present near each scape. Ventral microducts: distal apex of inner ductule with 3–4 finger-like lobes: sparsely distributed in broad marginal band and abundant medially on head, thorax, and more anterior abdominal segments. Ventral tubular ducts of 1 type (2 types on *C. chelyon*), terminal glands on distal ends on inner ductules rather spiky: distribution highly variable between species and generally diagnostic (sometimes absent on *C. viridis*). Ventral setae: hypopygial setae absent; with a pair of long pregenital setae on abdominal segments VII and VI only; generally with groups of small setae present on either side of posterior spiracular disc-pore band (absent on *C. viridis*); other setae distributed as for family. Antennae well developed, 6-segmented, 3rd segment much longest, often subequal to other 5 segments, often showing some constriction between segments II and III; setal distribution as for family. Mouthparts generally distinctly displaced to one side. Spiracles large, width of peritremes usually longer than length of coxae. Legs well developed but rather small for size of mature female, each with a separate tibia and tarsus but no tibio-tarsal articulatory sclerosis; tarsal campaniform pores absent; distribution of leg setae as for family; claws small and short, without a denticle; claw digitules similar and broad; tarsal digitules dissimilar, one shorter and narrower than other. Vulva opening on segment VII.

Remarks. This genus contains four species: *Ctenochiton chelyon* Henderson & Hodgson **n. sp.**, *C. paraviridis* Henderson & Hodgson **n. sp.**, *C. toru* Henderson & Hodgson **n. sp.**, and *C. viridis* Maskell. The main diagnostic characters are:

(i) their large size and generally pyriform shape;

(ii) the distribution of the pregenital disc-pores across most abdominal segments, and the oval, parallel-sided shape of the inner loculus;

(iii) the large size of the spiracles, subequal to the size of the coxae;

(iv) the displacement of the mouthparts to nearer one procoxa;

(v) the distribution of the ventral tubular ducts, when present;

(vi) the rather irregular distribution of the marginal setae.

Species in the genus *Ctenochiton* are similar to those in *Crystallotesta* and *Kalasiris* in having abundant pregenital disc-pores medially across the abdominal segments, each with mainly 8–10 loculi. Species in both *Crystallotesta* and *Kalasiris* differ from those in *Ctenochiton* in having:

(i) 2 types of ventral tubular duct;

(ii) small spiracles;

(iii) abundant spinose marginal setae approximately evenly spaced around margin;

(iv) large simple pores on the dorsum, generally associated with the anal plates.

Crystallotesta species also differ in having ventral tubular ducts which are:

(i) present medially on the thorax;

(ii) in broad submarginal bands, with the ducts not tending to lie radially. *Kalasiris* species have ventral tubular ducts in complete, relatively narrow submarginal bands, with the ducts tending to lie radially.

Ben-Dov (1993) included thirteen non-New Zealand species in the genus *Ctenochiton* Maskell. The senior author has seen many of these and none appear to be congeneric with *C. viridis*. Indeed, most do not even belong to the same subfamily! As species in the genus *Ctenochiton* appear to be endemic to New Zealand, those from other parts of the world will have to be transferred either to new or to other existing coccid genera.

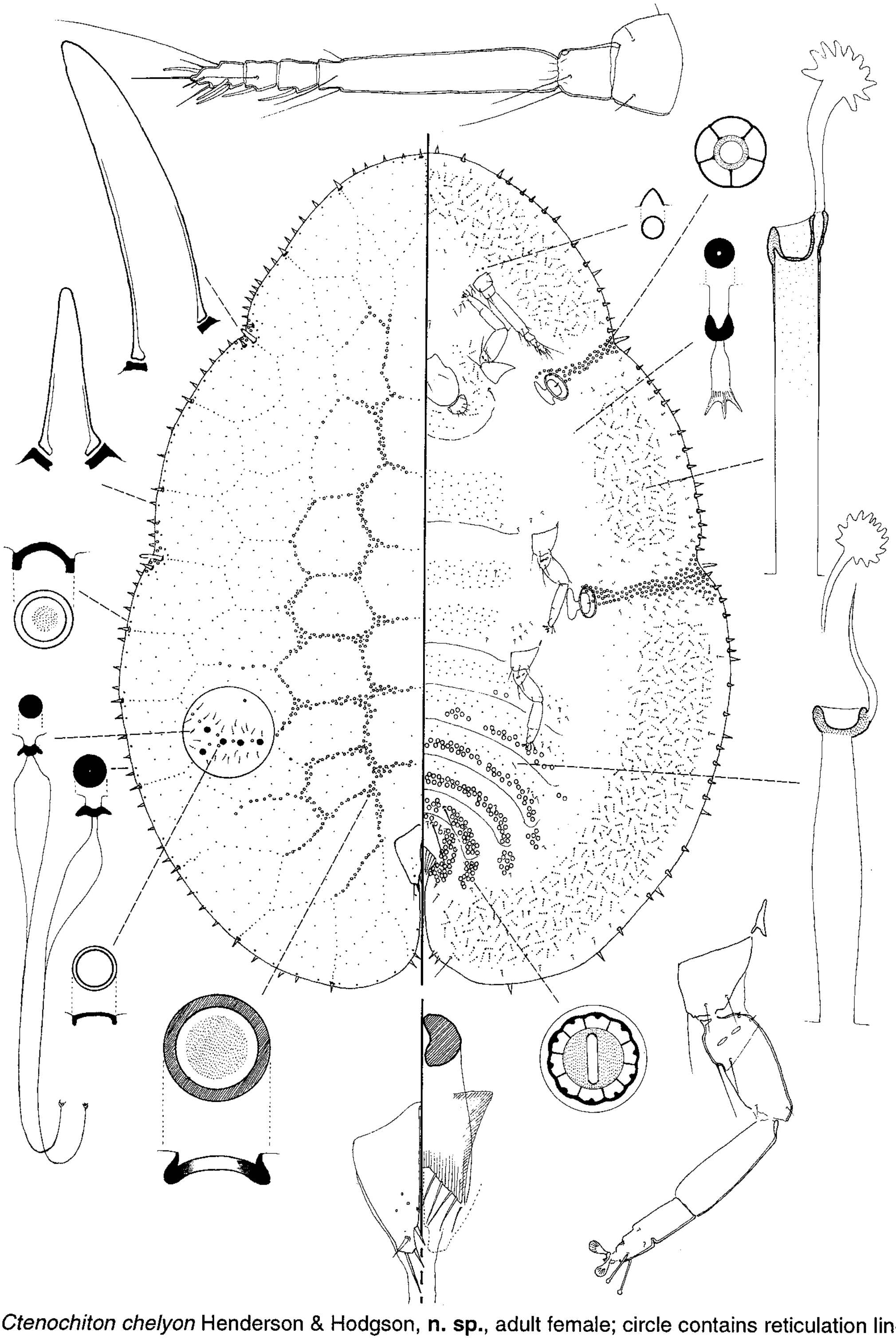


Fig. 111. *Ctenochiton chelyon* Henderson & Hodgson, **n. sp.**, adult female; circle contains reticulation line of dorsal pores further enlarged.

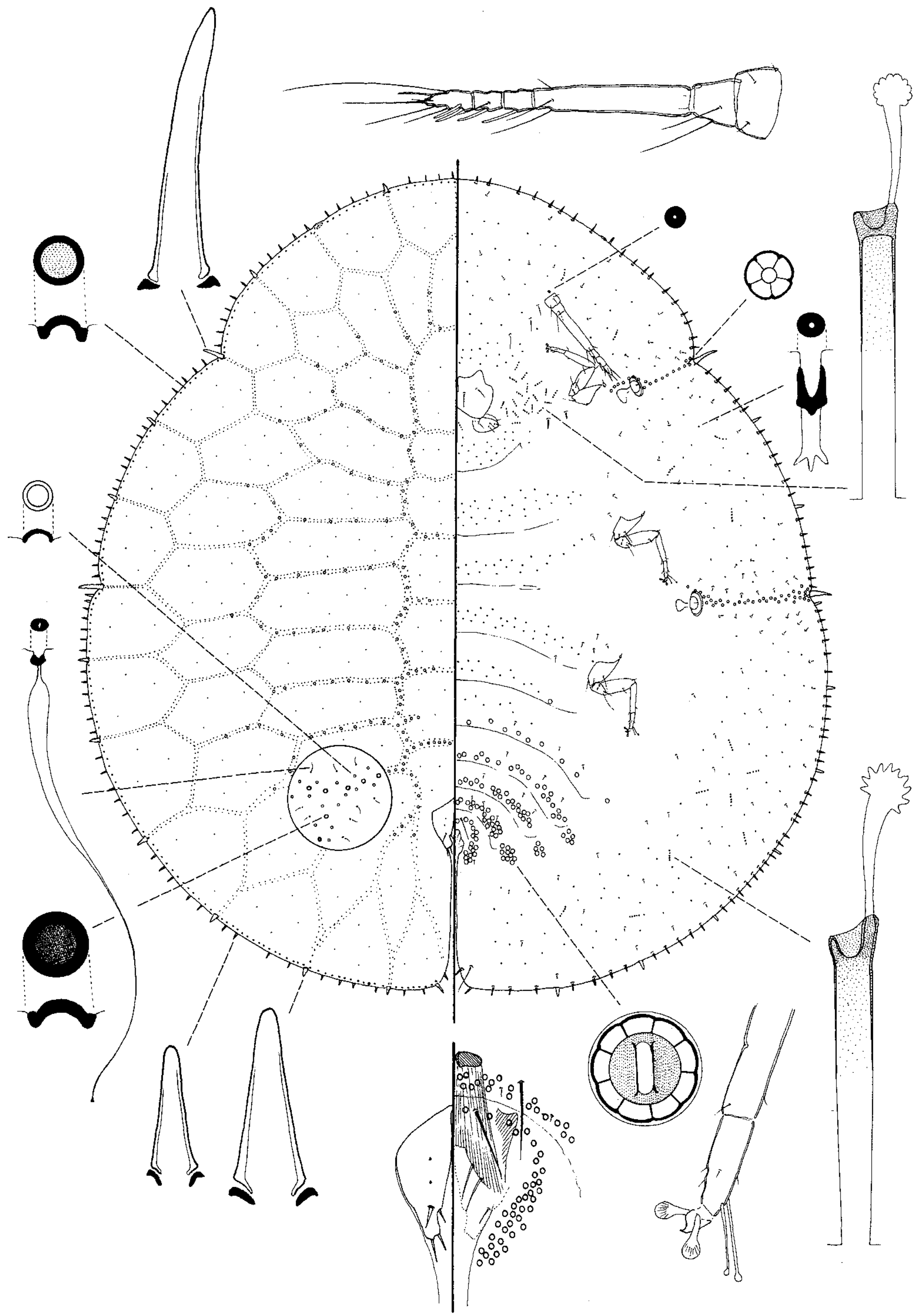


Fig. 112. *Ctenochiton paraviridis* Henderson & Hodgson, **n. sp.**, adult female; circle contains reticulation line of dorsal pores further enlarged.

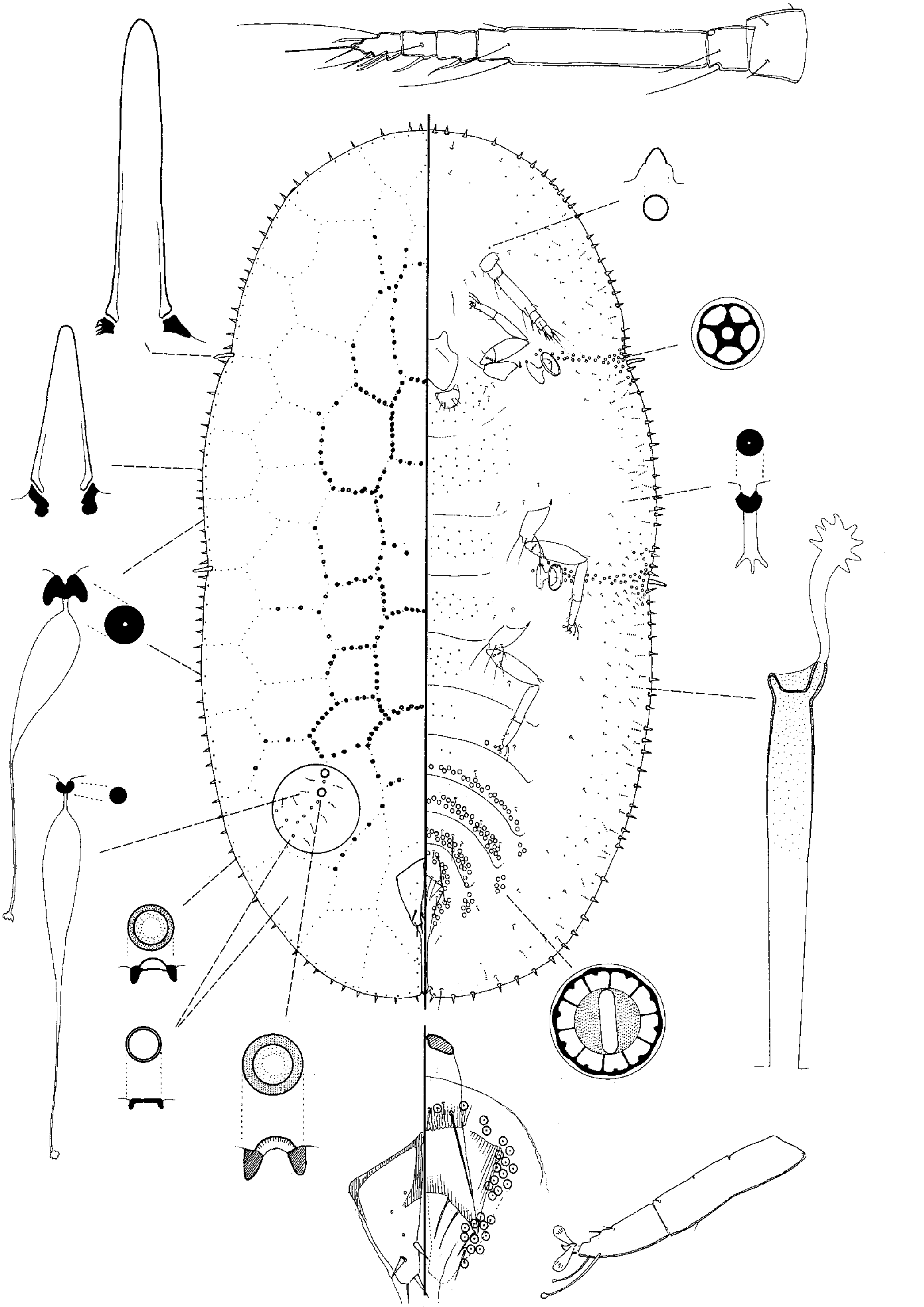


Fig. 113. *Ctenochiton toru* Henderson & Hodgson, **n. sp.**, adult female; circle contains reticulation line of dorsal pores further enlarged.

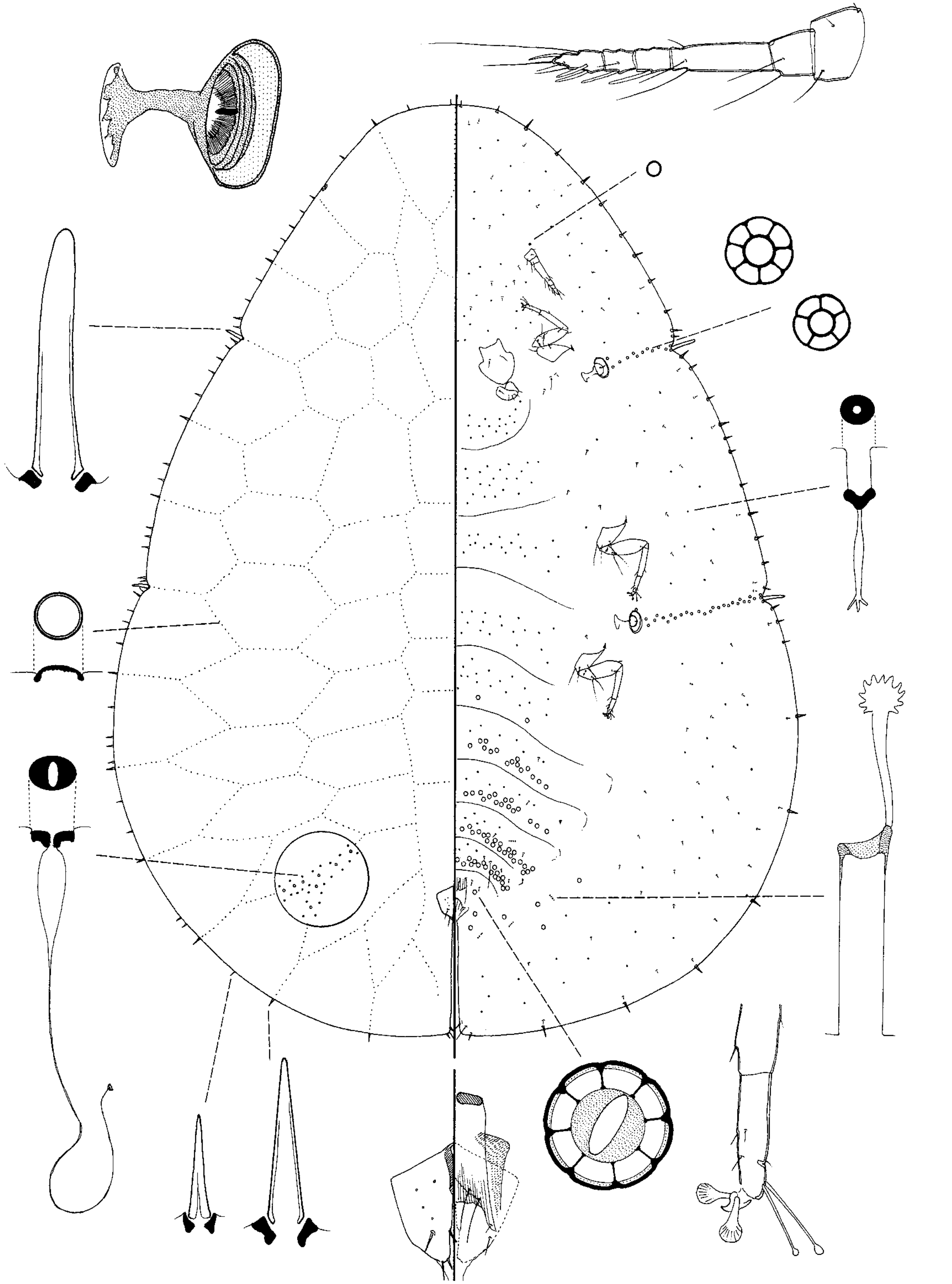


Fig. 114. *Ctenochiton viridis* Maskell, adult female; circle contains reticulation line of dorsal pores further enlarged. A = spiracle.

Key to adult female *Ctenochiton*

1 Ventral tubular ducts extremely scarce, 1–2 sometimes present mediolaterally on posterior abdominal segments; dorsal reticulation lines without macropores, replaced by simple pores subequal in size to associated microductule pores; marginal row of medium to large simple pores absent; spiracular disc-pore bands fairly narrow throughout. .... ***viridis***

—Ventral tubular ducts present in a submarginal band (although sometimes absent on *C. paraviridis*); dorsal reticulation lines with macropores, these much larger than associated microductule pores; with a complete row of medium to large simple pores close to marginal spines; posterior spiracular disc-pore bands generally broadening near margin 2

2 Ventral tubular ducts forming a sparse submarginal band mainly close to margin; ventral tubular ducts absent on either side of mouthparts .... ***toru***

—Ventral tubular ducts either forming a clear, dense submarginal band or with only a few ducts scattered away from margin; ventral tubular ducts usually present as a group between mouthparts and procoxae (rarely absent on *paraviridis*) 3

3 Ventral tubular ducts usually forming a clear, broad submarginal band (occasionally in a scattered band); dorsal macropores almost as large as pregenital disc-pores on venter; with 4 pairs of setae along anterior margin of anogenital fold .... ***chelyon***

—Ventral tubular ducts scattered or absent submarginally; dorsal macropores of medium size, smaller than pregenital disc-pores on venter; with 2 pairs of setae along anterior margin of anogenital fold ..***paraviridis***

Ctenochiton chelyon Henderson & Hodgson new species

Figs M12, M24, C52, 111

Unmounted material: large, up to 10 mm long, green, with a reticulate pattern in double lines of slightly paler green and blue green, and with an irregular-shaped patch in centre of each wax plate area bounded by same coloured double lines; body shape usually acuminate-oval and sometimes asymmetrical when adpressed to main leaf vein; usually convexly rounded on dorsum and ventrally nearly flat. Size increase to maturity can be at least 12-fold before oviposition begins, when median underside of abdomen gradually retracts to form a brood chamber. Test composed of thin glassy wax plates in a reticulate pattern of rows, with 7 rows of wax plates across abdomen and 9 plates between anal plates and anterior margin; teneral female with a narrow marginal fringe of pointed wax plates similar to that of *C. paraviridis*, which tend to disappear as insect grows.

Mounted material: body shape as above, round-oval to pyriform, slightly narrower at head end; length 2.62–6.30 mm, breadth 1.94–5.40 mm.

Dorsum: dorsal pores distributed in a reticulate pattern as for genus, but with 26 reticulation areas around margin; dorsal pores of 3 types: (i) microductules with dark oval pore, about half size of smaller disc-pores: present as 2 border rows along reticulation lines and in a submarginal row; (ii) simple pores, variable in size: small pores about twice size of microductule pore, occasionally with a few slightly larger simple pores: within reticulation lines between macropores, and with a few scattered within plate areas; medium-sized simple pores also present within plate areas and in a row on submargin, but not in a marginal row along anal cleft (those present part of reticulation lines); and (iii) large, button-shaped macropores with a sclerotised rim and granular centre (Fig. M24), often with a small clear dot in middle; subequal in size to pregenital disc-pores; with 10–14 in posterior medial macropore line, this line often with a gap medially where macropores absent. Anal plates: length 177–250 µm, combined widths 150–230 µm; each plate with 0–4 minute pores on upper surface; setae on inner and outer margins short and sharply spinose 14–24 µm long, apical setae up to nearly 3 × longer, 33–60 µm long, finely spinose-flagellate. Anogenital fold with 3–4 pairs of setae along anterior margin, longest about 46–60 µm.

Margin: marginal setae moderately spinose to near-conical with blunt tips, in staggered groups, with 10–26 on each side between stigmatic clefts; size rather variable, 15–34 µm long, larger spines more noticeable at reticulation points on abdomen. Stigmatic spines rather short, each 53–73 µm long.

Venter: pregenital disc-pores present medially across posterior 5–6 abdominal segments and in small groups on mediolateral lobes: number of disc-pores on each segment (medially/mediolaterally on one side): anal cleft+VII, 25–40/24–45; VI, 54–72/11–21; V, 62–106/7–15; IV, 48–95/0–12; III, 20–56/0–8; and II, 0–6/0. Spiracular disc-pores with 40–74 in anterior bands and 48–122 in posterior bands; each band 2–6 disc-pores wide near anterior stigmatic spines and 4–10 disc-pores wide submarginally near posterior stigmatic spines. Ventral microducts as for genus. Tubular ducts of 2 types, a larger type in a broad band on inner submargin, numbering 147-890 (mean 350) ducts, and on head by mouth, and with 0–5 smaller ducts mediolaterally on abdomen and on either side of anal cleft; absent medially on thorax. Ventral setae: ventral anal lobe setae 34–61 µm long; with a pair of long pregenital setae on abdominal segments VI and VII, longest 65–88 µm; with 1–6 pairs of anterior anal cleft setae; numbers of setae medially on abdominal segments: VII, 3–7; VI, 2–7; V, 1–7; IV, 0–7; III, 2–5; and II, 1–6; with 1–6 setae near each metacoxa, 1–5 near each mesocoxa and 2–4 near each procoxa; with 11–34 setae on either side and within each posterior spiracular disc-pore band; with 8–12 interantennal setae; with 3–5 submarginal setae on either side between stigmatic clefts. Antennae 6-segmented, total length 307–407 µm; apical seta 30–65 µm long. Clypeolabral shield 173–223 µm long. Spiracles: width of peritremes: anterior 73–123 µm wide, posterior 92–161 µm wide. Legs: length (metathoracic): coxa 119–184 µm; trochanter + femur 146–184 µm; tibia 100–184 µm; tarsus 53–73 µm; claw 10–20 µm long.

Material examined: HOLOTYPE ♀: NEW ZEALAND: **BP**: Waiaroho, 3 Nov 1993, R.C. Henderson, *Streblus heterophyllus* new young leaves, #93-342a, NZAC: 1/1♀ ad.

PARATYPES: collection data as for holotype, NZAC #93-342b–f: 5/3♀♀ ad, 3♂♂ ad, 2 pupae.

Other material: New Zealand (Hawkes Bay), labelled "*Ctenochiton depressus*, [misidentification] from *Plagianthus*, adult female, May 1883, W.M.M."; CMNZ: 1/1♀ ad. [previously included as a paralectotype for *Kalasiris depressa*]. **TH**: Three Kings Islands, Southwest I, *Corynocarpus laevigatus* leaves, 26 Nov 1983, J.C. Watt, #83-340a: 6/6♀♀ ad. As previous, but A. Wright, #83-346e, 3/3♀♀ ad. Three Kings Islands, West I, *Elingamita* sp., 28 Nov 1983 & 29 Nov 1983, J.C. Watt, #83-346c & 83-347f: 2/2♀♀ ad. **AK**: "*Ctenochiton viridis* Mask., Kotinsky Coll. #282, on *Ctichosperma viridis* [unknown plant name], Auckland, NZ, Koebele (1909) Nov. 23 1899" USNM: 1/1♀ ad. "*Ctenochiton viride*, Kot. Coll. #24, Auckland, NZ, Koebele (1914), Nov. 27 1899", USNM: 1/1♀ ad. "*Ctenochiton viridis* Mask., Auckland, New Zealand, Geo. Compere Coll. #713", USNM: 1/2♀♀ ad (incomplete). Owairaka, *Corynocarpus laevigatus* [as *laevigata*] leaf, Dec 1948, K.P. Lamb: 1/1♀ ad (poor). Auckland, St Heliers, *Corynocarpus laevigatus*, 23 Jan 1977, L.L. Deitz, #77-39a: 8/8♀♀ ad. Auckland University grounds, *Coprosma* sp. leaf, 10 Oct 1980, #80-291c: 3/3♀♀ ad. **BP**: Murupara, Motumoku Bush C1230, *Litsea calicaris*, 4 Nov 1959, N.O. Secombe, FRNZ R(a)4–10, 12–13: 13/11♀♀ ad, 3♂ 2nd, 10♂♂ ad. Lottin Point, Otanga, *Vitex lucens*, 27 Jan 1993, 29 Sept 1993 & 3 Nov 1993, RCH, #93-276a–d, #93-330a,c, #93-350a–f: 12/6♀♀ ad, 5♀ 3rd, 5♀ 2nd, 7♂ 2nd, 3 pupae, 3♂♂ ad. Waiaroho, *Streblus heterophyllus*, 26 Jan 1993, 29 Sept 1993 & 3 Nov 1993, RCH, #93-076a–f, #93-323a–b & #93-342a–f: 12/9♀♀ ad, 4♀ 3rd (2 pharate), 3♀ 2nd, 9 crawlers, 8♂ 2nd, 2 pupae, 3♂♂ ad. Te Araroa beach north end, *Corynocarpus laevigatus*, 31 Oct 1994, RCH, #94-132a–h: 8/3♀♀ ad (1 pharate), 7♀ 3rd, 10♂ 2nd, 4 pupae. **GB**: Karakatuwhero V Rd, Waipiata, *Melicope simplex* underside leaves, 28 Sept 1993 & 4 Nov 1993, RCH, #93-317b–e & #93-348b–d: 7/1♀ ad, 5♀ 3rd (2 pharate), 2♀ 2nd, 13♂ 2nd, 1 crawler, 1 prepupa, 2 pupae, 1♂ ad. Paoneone, *Clematis cunninghamii*, underside leaves, 2 Nov 1994, RCH, #94-103a–e: 5/6♀♀ad, 2♀ 3rd. Hexton, Grays Bush, *Streblus heterophyllus* young leaves, 25 Nov 1993, J.S. Dugdale, #94-001: 1/1♀ ad. **WN**: Wellington, *Vitex lucens* leaves, 16 Jan 1981, J. Campbell, #81-40a: 7/7 ♀♀ ad.

Remarks. *C. chelyon* is very similar to *C. paraviridis* in having:

(i) a marginal row of dorsal medium-sized simple pores;
(ii) nearly conical marginal spines;
(iii) ventral tubular ducts near the mouth;
(iv) in the shape of the dorsal macropores.

However, on *C. chelyon* the macropores are larger, the ventral tubular ducts are always present in a submarginal band, often in large numbers (they are rarely like this on *C. paraviridis*), and the posterior spiracular pore bands on *C. chelyon* widen substantially near the margin. *C. toru* also has spiracular bands which widen significantly near the margin but has no tubular ducts near the mouth and the ventral tubular ducts are nearer the margin. *C. viridis* can be separated from *C. chelyon* in:

(i) having slender marginal spines;
(ii) having narrow spiracular pore bands;
(iii) lacking dorsal macropores;
(iv) lacking a marginal row of simple pores;
(v) lacking ventral tubular ducts near the mouth and submarginally.

The three USNM slides listed above—originally identified as *C. viridis*—are here considered to be *C. chelyon*.

Biology. Similar to *C. paraviridis*.

Pathogens and parasitoids. Hymenopterous parasitoid recorded: Pteromalidae: *Aphobetus maskelli* Howard.

Distribution. Known from Three Kings Islands and the North Island (Map 16).

Name derivation. The specific name *chelyon* is taken from *chelyon* (Gr. n.): tortoise-shell: patterned and shaped like a turtle, referring to the pattern of colourful plates on the dorsum.

Ctenochiton paraviridis Henderson & Hodgson new species

Figs M8, M10, C53–54, C56–57, C69–71, 112

Unmounted material: large, up to 10 mm long, slightly convex on dorsum but more convex on venter, lying in a depression on underside of leaves, most often adpressed to main leaf vein and consequently asymmetrical, or near a subsidiary vein, when not so asymmetrical; generally green, sometimes with blue-green spots and sometimes with a dorsal reticulate pattern in a single different shade of green; test glassy, smooth, made up of a series of wax plates, with 7 longitudinal rows of plates across body, 9 plates between anal plates and anterior end and with a marginal fringe of rather pointed wax plates.

Mounted material: body becoming more oval at maturity; specimens taken from near a main leaf vein asymmetrical, with mouthparts twisted towards one side; specimens from other leaf sites usually more symmetrical; anal cleft about 1/5th body length; length 2.90–7.85 mm, breadth 2.35–6.50 mm.

Dorsum: derm membranous except at maturity when reticulation lines become sclerotised. Dorsal pores distributed in a reticulate pattern (Figs M8, M10) as for genus, but with 28 reticulation areas around margin; dorsal pores of 3 types: (i) microductules: in a row on either side of reticulation lines and along submargin; (ii) simple pores: flat, smallest scarce; slightly larger pores present within reticulation areas and reticulation lines; largest in a row between and beside marginal spines; and (iii) macropores, moderately large but smaller than pregenital disc-pores, button-shaped, with a heavily sclerotised outer ring and an inner, dark, granular surface: present in median and submedian reticulation lines, with 12–21 in complete posterior medial macropore line. Anal plates: widest at anterior third, tapering to apex, together oval; length 138–215 μm, combined widths 130–230 μm; each plate with 1–3 minute pores on upper surface; inner margin setae sharp and spinose, length 14–20 μm; apical setae slender spinose and usually about twice as long as inner pairs, length 36–47 μm; outer margin setae stout, sharp-pointed spines, length 21–36 μm. Anogenital fold with 3 pairs of setae, longest 46–57 μm.

Margin: marginal spines with blunt tips; with 7–24 on each side between stigmatic spines; size rather variable, 15–38 μm long, smaller spines fairly narrow, larger reticulation spines broad and almost conical, more obvious along margins of abdomen than on cephalothorax. Stigmatic spines 34–60 μm long.

Venter: pregenital disc-pores as for genus: number per segment (medially/mediolaterally on one side) laterally: anal cleft+VII 44–62; VI, 48–53/8–10; V, 27–60/4–13; IV, 29–53/2–5; III, 7–26/1–2; and II, 0–2/0. Spiracular disc-pores with mostly 5 (range 3–5) loculi; with 11–38 in each anterior band and 16–53 in each posterior band; anterior band only slightly broader near margin but posterior band broadening more obviously. Ventral microducts as for genus. Ventral tubular ducts sometimes scattered in a submarginal band (but with none close to margin), numbering 0–180 (proportion of specimens with 0–5 ducts: 80%; 6–50 ducts: 10%; 51–180 ducts: 10%), also in a group of 0–55 near mouthparts, usually with more ducts on compressed side when specimen asymmetrical. Ventral setae: ventral anal lobe setae 38–57 μm long; with a pair of long pregenital setae on abdominal segments VII and VI, longest 61–85 μm long; with 1–4 pairs of anterior anal cleft setae; frequency of setae medially on abdominal segments: VII, 1–4; VI, 2–6; V, 4–8; IV, 3–5; III, 1–3; and II, 0–4; with 1–5 setae near each metacoxa, 0–4 near each mesocoxa and 2–3 near each procoxa; with groups of 7–23 setae along margins of posterior spiracular disc-pore bands; with 4–7 interantennal setae; with 2–4 submarginal setae between stigmatic clefts on either side. Antennae 6-segmented, without pseudosegments; total length 326–376 μm; length of apical seta 38–73 μm. Clypeolabral shield 154–184 μm long. Spiracles: width of peritremes: anterior 50–100 μm; posterior 69–115 μm. Legs: length (metathoracic): coxa, 104–119 μm; trochanter + femur, 130–173 μm; tibia, 88–173 μm; tarsus, 61–96 μm; claw, 15–20 μm.

Material examined: HOLOTYPE ♀: NEW ZEALAND: **AK**: Waitakere Range, Ferndown Track, *Schefflera digitata* underside leaves, 12 Oct 1997, N.A. Martin, NZAC #97-144b: 1/1♀ ad.
PARATYPES: collection data as for holotype, NZAC #97-144a, c-l: 11/13♀♀ ad (1 pharate), 2♀ 3rd instars.

Other material: "*Ctenochiton viridis* Mask., New Zealand, ex coll. W.M. Maskell, Newstead Coll/1945-121, Cotype lot", USNM: 1/1♀ ad (split dorsoventrally). "*Ctenochiton viridis* Mask., New Zealand, Mask. Coll. #33", USNM: 1/1♀ ad. **AK**: Rangitoto I, Kidney Fern Glen, *Griselinia lucida*, 12 Sept 1976, G.Hall, 76-274a: 4/11♀♀ ad, 3♀ 2nd. Auckland, Titirangi, *Hedycarya arborea* leaves, 11 Jan 1983, J. Cox: 1/1♀ ad. Waitakere Ra, Fairy Falls Tk, *Hedycarya arborea* leaves, 4 Dec 1979, M.F. Tocker, #79-347c: 4/4♀♀ ad. Waitakere Ra, Rangemore Tk, east end, *Schefflera digitata* underside leaves, 26 Dec 1994, R.E. Beever, #95-005a–c, -006a–b, -007: 6/6♀♀ ad. Waitakere Ra, Sharp Bush, *Hedycarya arborea* underside leaves, 13

Jul 1997, RCH, #97-082a–b: 2/1♀ 2nd, 3♂ 2nd. As previous, except 6 Oct 1997, #97-140: 1/1♂ 2nd. Paparata Rd, neighbouring property to P.S. Dale, *Hedycarya arborea*, 26 Feb 1995, RCH, #95-025a–b: 2/2♀♀ ad. As previous, but on property of P.S. Dale, #95-026a–b: 2/3♀♀ ad. As previous except 1 Feb 1997, #97-032a–j, & #97-033a–j: 40/20♀♀ ad (split dorsoventrally). **BP**: Te Koau, 360 m, *Hedycarya arborea*, 26 Oct 1992, J.S. Dugdale, #92-339a–b: 2/4♀♀ ad. Te Koau, *Hedycarya arborea*, 31 Jan 1993, RCH, #93-077a–c & 4 Nov 1993, #93-355a–c: 5/6♀♀ ad, 1♀ 3rd, 1♀ 2nd, 10 crawlers. Te Koau, *Ripogonum scandens* leaves, 4 Nov 1993, RCH, #93-354a–e & Bushwalk tk, cnr to Lookout tk, 31 Oct 1994, #94-133a–h: 13/10♀♀ ad (1 pharate), 2♀ 3rd, 1♀ 2nd, 7♂ 2nd, 2 1st, 2 pupae, 2♂♂ ad. Lottin Point, Otanga, *Hedycarya arborea* new young leaves, 29 Sept 1993, RCH, #93-327a–c: 3/2 ♀♀(pharate), 4♀ 3rd, 2♂ 2nd, & #93-329: 1/2♂ 2nd, 2 prepupae, 2 pupae. As previous, except undersurfaces new leaves, 3 Nov 1993, #93-343a–f: 6/5♀♀ ad, 1♀ 3rd. Waiaroho, *Hedycarya arborea* new shoots & leaves, 3 Nov 1993, RCH, #93-341d–e: 2/2♀♀ ad. Orete Forest, Te Puia Hut, *Myrsine salicina*, 25 Jan 1993, RCH, #93-215a–b: 2/2♀♀ ad (split dorsoventrally). Rereauira Swamp, Beech Ridge, *Myrsine australis*, 29 Jan 1993, RCH, #93-079a–e & 29 Sept 1993, #93-324a–c: 6/6♀♀ ad, 13♀ 3rd, 1♂ 2nd. Whakarewarewa (F.R.I.), *Griselinia littoralis* leaves, 2 Nov 1960, R. Zondag, FRNZ R(a)55-57; R(a)68–69: 3/13♀♀ ad; 2/7♂♂ ad. **GB**: Kakanui, 250m, *Pseudowintera axillaris*, 1 Feb 1993, RCH, #93-275a–b: 2/1♀ ad (split dorsoventrally), 10 1st. Kakanui, 300m, *Myrsine australis*, 1 Feb 1993, RCH, #93-280a–e & 16 Mar 1993, #93-080: 6/6♀♀ ad, 1♀ 2nd, 1♂ 2nd, 8 1st. Paoneone, *Hedycarya arborea* leaves, 2 Nov 1994, RCH, #94-126: 1/3♀♀ ad, 1♀ 3rd. Pohutu, Awatere R bridge, *Hedycarya arborea* underside leaves, 4 Nov 1993, RCH, #93-357, 1 Nov 1994, #95-022a–j, 3 Nov 1995, #98-060a–b: 13/17♀♀ ad, 2♀ 3rd, 3♂ 2nd, 1 pupa. **TO**: Hauhungaroa Ra, 650m, Waihora, *Griselinia lucida* leaves, 11 Jan 1995, RCH, #95-015a–e: 5/5♀♀ ad. Rangitoto Station, Mangatutu, *Pseudowintera axillaris* new shoots, 9 Nov 1996, RCH, #96-236a–b: 2/9♀ 3rd. As previous, except *Hedycarya arborea* new shoots, #98-059: 1/1♀ ad. **HB**: Black Birch Ra, Kaweka Rd, *Griselinia littoralis* underside leaves, 14 Mar 1998, RCH, #98-054a–b: 2/1♀ ad, 3♂ 2nd, 1 1st. **TK**: Te Wera SF, N23/15/75, *Hoheria* sp., 10 Feb 1976, M.A. Stoodley, FRNZ R(b)81–83: 3/7♀♀ ad. **RI**: S. Ruahines, West Tamaki Valley, N/132/50/69, *Schefflera digitata* leaves, (no date or collector), FRNZ R(b)43: 1/4♀♀ ad (+ ♀ of another unknown ?coccid). S. Ruahine SF 3/04, West Tamaki Valley, *Schefflera digitata* foliage, 12 Dec 1974, M.A. Stoodley, FRNZ R(b)46–52: 7/10♀♀ ad. **WN**: "*Ctenochiton viridis* Mask., Wellington, N.Z., from *Hedycarya arborea*, Jan 1921, coll. J.G. Myers, BM.1940.180", BMNH; 1/2♀♀ ad. Wellington, *Pseudowintera axillaris*, 26 Feb 1980, S. Norton, #80-71b: 2/2♀♀ ad. Akatarawa Saddle, N21.61.67, *Schefflera digitata*, 2 Feb 1976, M.A. Stoodley: 1/1♀ ad. **SD**: Opouri Valley, Marlborough, *Pseudowintera axillaris*, 10 Jan 1969, J.S. Dugdale, No. 477: 2/2♀♀ ad (one split dorsoventrally). **NN**: Motueka, *Hedycarya arborea*, Dec 1937, G.Brittin, No.8, USNM: 1/1♀ ad, & 29 Dec 1937, NZAC: 2/2♀♀ ad. Eves Bush, *Pseudowintera axillaris*, 9 Dec 1970, J.A. de Boer, No. 671: 3/3♀♀ ad (split dorsoventrally). Upper Maitai R, Dad's Creek, 450m, *Griselinia littoralis* (broadleaf), 20 Oct 1963, E.S. Gourlay, #83-298b & #90-221a–f: 7/7♀♀ ad. Maitai R, *Dodonaea viscosa*, 17 Jan 1968, J.A. de Boer, No. 341: 1/2♀♀ ad (split dorsoventrally). Sherry Valley, 'from leaves', 4 Feb 1942, (no coll.), No. 687, #83-304c & #90-229a–e: 10/10♀♀ ad. Golden Downs, *Pseudowintera axillaris* [as *Drimys*], 9 Mar 1961, J.G.R. McBurney, FRNZ No. R11, 1/2♀♀ ad, & No. R19: 4 1st. Marsden Valley, *Hedycarya arborea*, 16 Apr 1969, E.W. Valentine, No. 508: 2/3♀♀ ad (split dorsoventrally). Motupiko, *Griselinia littoralis*, 19 Dec 1967, E.W. Valentine, No, 304: 2/2♀♀ ad (split dorsoventrally). **BR**: Maruia Springs, *Peraxilla colensoi*, 8 Jan 1976, B.P.J. Molloy, (submitted by Somerfield): 2/2♀♀ ad. Alfred R, L Daniells Tk, *Griselinia littoralis* underside leaves, 12 Jan 1994, RCH, #94-016a–b: 2/2♀♀ ad. Fletchers Creek, West Inangahua, Reefton, *Pseudowintera colorata*, 7 Mar 1972, J.A.K. Farrell, No. 816: 2/2♀♀ ad (split dorsoventrally). Springs Junction, Palmer Road, *Peraxilla colensoi* new shoots, 4 Nov 1993, J.S. Dugdale, #93-330Ba–e: 5/2♀♀ ad (one pharate), 4♀ 3rd, 1♂ 2nd, 2 pupae, 7♂♂ ad. Charleston – Addison Flat, *Myrsine salicina*, 7 Nov 1972, J.A. de Boer, No. 936: 1/3♀♀ ad (2 split dorsoventrally). **NC**: Wandle R, *Alepis* [as *Peraxilla*] *flavida*, 9 May 1973, B.P.J. Molloy, No. 1023: 1/2♀♀ ad (one split dorsoventrally). **MC**: Banks Peninsula, Akaroa, *Griselinia littoralis*, 16 Jan 1972, R.C. Close, No. 788: 2/2♀♀ ad (split dorsoventrally). Akaroa, *Pseudopanax arboreus* [as *Nothopanax*], 16 Jan 1972, R.C. Close, No. 787: 4/4♀♀ ad (split dorsoventrally). Banks Peninsula, Otanerito Reserve, *Pennantia corymbosa* leaf, 14 Jan 1994, RCH, #94-015: 1/1♀ ad. **DN**: "*Ctenochiton viridis* Mask., on *Griselinia littoralis*, Oamaru, N.Z., May 24, 1914, Brittin no.8", USNM; 1/1♀ ad. "*Ctenochiton viridis*, Oamaru, on *Griselinia littoralis*, G. Brittin, BM 1945 121, Newstead Coll., stained Oct 25th 1916, RN, No. 20", BMNH; 1/1♀ ad. Ardgowan, *Griselinia littoralis*, 12 Jan 1912, G. Brittin, No. 8: 1/1♀ ad. **FD**: Breaksea Sound, Gilbert I 6, *Hedycarya arborea*, 2 Feb 1996, RCH, #96-087: 1/1♀ ad.

Remarks. This species is highly variable and may be displaying unstable phenotypic characters or may be a complex of species. Amongst several collections on *Hedycarya arborea* an occasional specimen had large numbers of ventral submarginal tubular ducts and could thus be keyed out to the closely related new species *C. chelyon*, whereas other specimens with the same collection data were invariably *C. paraviridis*. In contrast, adult females of *C. chelyon* invariably exhibit a more stable phenotype and in addition, there are no known populations of *C. chelyon* on *H. arborea*. The live appearance of adult females, particularly the lack of multi-hued reticulate bands on the dorsum, can help distinguish *C. paraviridis* from *C. chelyon*. Individual *C. paraviridis* specimens without tubular ducts near the mouthparts may key out to *C. toru* (described as new below) but this latter species has very wide posterior spiracular disc-pore bands near the margin and has only been collected from *Toronia toru*, on which *C. paraviridis* has never been found.

C. paraviridis may be separated from C. *chelyon* and *C. toru* in lacking the very wide posterior spiracular disc-pore bands near the margin, and from *C. viridis* by:
(i) the broader marginal spines;
(ii) the presence of button-like macropores;
(iii) a dorsal submarginal row of simple pores.

The three USNM slides and two BMNH slides listed above that were originally identified as *Ctenochiton viridis* are here considered to be *C. paraviridis* n. sp. The collection of *C. paraviridis* off *Pseudopanax arboreus* from Akaroa is unusual, as this is the only record of a *Ctenochiton* species other than *C. viridis* (which is almost restricted to this genus) being recorded from it.

Biology. *C. paraviridis* is probably univoltine, with an extended generation during the summer although it may occasionally have 2 generations. It overwinters as the 2nd-instar nymph. At the spring flush, the juvenile females migrate to the outside of the young shoots of their host plant and quickly moult to the 3rd-instar. By the time the leaves have fully unfurled, females have completed their final moult to become adult. The 2nd-instar males remain on the old leaves and develop through prepupa and pupa to the adult male, emerging to mate with the adult females. The preferred settling site for the adult females is by the main leaf vein of new shoots, where they cause distinct depressions in the lamina. Once settled, they are sessile, continuing to grow in size and eventually producing about 500 eggs. The eggs hatch into crawlers in the brood chamber formed beneath the abdomen and emerge from under the posterior end, where the wax test is loosened from the leaf substrate, and then settle on nearby leaves. Post-oviposition females die and fall off the host, leaving permanent depressions in the lamina of the leaf.

Pathogens and parasitoids. Hymenopterous parasitoids recorded are: Encyrtidae: *Adelencyrtoides inconstans* Noyes; *Adelencyrtoides* sp. Pteromalidae: *Aphobetus maskelli* Howard; *Aphobetus nana* (Bouček). In addition, *C. paraviridis* is often attacked by several entomogenous fungal species, especially under damp conditions. The two most common are *Aegerita webberi* H.S. Fawc., the "brown blobs" fungus, which usually infests early instars, completely obliterating the shape of the insect, while *Verticillium lecanii* (Zimm.) Viégas is a white fungus generally killing adult females which retain their shape.

Distribution. Recorded from Auckland in the north to Fiordland in the south (Map 17).

Name derivation. From *para* (Gr.) meaning near and *viridis*, the species it resembles described by W.M. Maskell. Although the taxonomic characters of these two species differ widely, they share a remarkably similar outward appearance and are both so-called "sixpenny scales".

Ctenochiton toru Henderson & Hodgson new species

Fig. 113

Unmounted material: large, up to 8 mm long, elongate and green; restricted to lower leaf surface of host plant *Toronia toru*; usually sited with stylets inserted into main leaf vein; a depression is caused in leaf beneath body with a consequent bump in upper leaf surface; test of glassy wax plates covering dorsum.

Mounted material: body elongate-oval, slightly narrower at head end; length 2.6–7.3 mm, breadth 1.4–4.0 mm; anal cleft shallow, with margins meeting along their length; stigmatic areas not indented.

Dorsum: dorsal pores distributed in a reticulate pattern as for genus, but with 28 reticulation areas around margin; dorsal pores of 3 types: (i) microductules: present mainly as 2 border rows alongside reticulation lines, also with slightly larger pores in a submarginal row laterad to marginal row of simple pores; (ii) simple pores of various sizes: small pores very few, present within reticulation lines and reticulation areas; medium-sized pores present within middle row in reticulation lines between macropores; larger simple pores in a complete row near marginal spines, but not along margins of anal cleft; and

(iii) macropores dense and button-shaped, with a dark sclerotised ring and granular centre under light microscope, smaller than ventral pregenital disc-pores: restricted to centre of reticulation lines, around median and submedian reticulation areas from head to anal area, most abundant on abdomen; with 13–19 in complete posterior medial macropore line. Anal plates: length 154–184 µm, combined width 134–177 µm; each plate with 1–3 minute pores on upper surface; inner margin setae sharp and spinose, length 21–33 µm; apical setae longer and slender spinose, length 36–43 µm; outer margin seta stoutly spinose, length 16–33 µm. Anogenital fold with 3 pairs of setae along anterior margin, longest 33–47 µm.

Margin: marginal setae spinose to conical, with blunt tips; with 15–22 on each side between lateral stigmatic clefts; size rather variable, 19–34 µm long; usually distributed in groups of about 3 spines on abdomen at reticulation points. Stigmatic spines each 30–50 µm long.

Venter: pregenital disc-pores in rows across posterior 5 abdominal segments: numbers per abdominal segment (medially/mediolaterally on one side): anal cleft+VII, together 50–68; VI, 59–72/8–14; V, 53–83/5–10; IV, 50–59/3–12; III, 2–9/5–6; and II, none. Spiracular disc-pores: with 27–48 in each anterior band and 41–80 in each posterior band; posterior bands broadening to 3–12 pores wide near stigmatic spine. Ventral microducts as for genus but absent from a broad band submedially and also medially on posterior abdominal segments. Ventral tubular ducts usually in a row about 2 ducts wide close to margin; absent from elsewhere on venter and sometimes absent altogether (total 0–119 ducts). Ventral setae: ventral anal lobe seta 27–53 µm long; with a pair of long pregenital setae on both abdominal segments VI and VII, longest 80–92 µm; usually with 1 pair of anterior anal cleft setae; number of setae medially on abdominal segments: VII, 3–6; VI, 3–6; V, 3–6; IV, 3–7; III, 1–6; and II, 1–5; with 0–4 setae near each metacoxa, 0–3 near each mesocoxa and 3–6 near each procoxa; with 17–27 setae bordering and within posterior spiracular disc-pore bands, each 7–24 µm long; with 4–10 interantennal setae; with 3–4 submarginal setae between stigmatic clefts on either side. Antennae 6-segmented, 3rd segment by far longest, with no pseudosegments; total length 330–384 µm; apical seta 46–61 µm long. Clypeolabral shield 160–173 µm long. Width of spiracular peritremes: anterior 57–88 µm, posterior 73–104 µm. Legs: length (metathoracic): coxa 105–130 µm; trochanter + femur 135–160 µm; tibia 100–125 µm; tarsus 60–77 µm; claw 15–20 µm; claw digitules usually small, rather narrow and short.

Material examined: HOLOTYPE ♀: NEW ZEALAND: **TO**: Hauhungaroa Range, Waihaha R, 14 Jan 1995, RC Henderson, *Toronia toru* underside young lvs, NZAC, #95-014d: 1/1♀ ad.
PARATYPES: same collection data, NZAC #95-014a–c: 3/3♀♀ ad.

Other material: **BP**: Rereauira Swamp, Beech Ridge, *Toronia toru*, 19 Sept 1992, RCH, #92-292; 26 Jan 1993, #93-107a–c & -#93-267a–d, and 19 Apr 1993, #93-266a–b: 10/5♀♀ ad, 3♀ 3rd, 1♀ 2nd, 1♂ 2nd, 12 neonates/1st.

Remarks. *C. toru* is the least pyriform of the four species currently placed in the genus *Ctenochiton.* In lacking tubular ducts medially near the mouthparts, it resembles *C. viridis*, but differs from *C. viridis* in having:
(i) a distinct submarginal band of ventral tubular ducts;
(ii) distinct dorsal macropores (absent on *C. viridis*);
(iii) broad spiracular disc-pore bands, which become much wider near the margin (narrow on *C. viridis*);
(iv) posterior spiracular disc-pore bands with numerous small-medium size setae along margins (absent on *C. viridis*).

C. toru also resembles *C. chelyon* and *C. paraviridis* in having dorsal macropores and numerous small-medium setae along margins of posterior spiracular disc-pore bands, but *C. toru* differs from them in:
(i) more elongate body shape;
(ii) the absence of ventral tubular ducts near the mouth;
(iii) the distribution of the ventral tubular ducts in a band close to the margin.

Biology. Probably very similar to the other three species of *Ctenochiton.*

Distribution. Only collected from two localities, both in central North Island (Map 18).

Name derivation. From *toru*, the maori name for the host plant (*Toronia toru*).

Ctenochiton viridis Maskell

Figs M26, M30, C55, 114

Ctenochiton viridis Maskell 1879: 211; –Maskell, 1885: 24 [male description]; –Maskell, 1887: 74 [description]; –Maskell, 1890a: 278 [biology]; –Koebele, 1893: 12 [parasitoid]; –Maskell, 1895a: 13 [checklist]; –Cockerell, 1896: 330 [checklist]; –Fernald, 1903: 159, 161 [world catalogue]; –Hutton, 1904: 226 [checklist]; –Morrison & Morrison, 1922: 71 [redescription]; –Myers, 1922: 199 [checklist]; –Miller, 1925: 33, 64 [host]; –Green, 1929:

377 [record]; –Steinweden, 1929: 234 [classification]; –Green, 1930: 289 [mentions]; –Balachowsky, 1936: 124 [comparison French sp.]; –Lindinger, 1937: 183 [checklist]; –Wise, 1977: 104 [checklist]; –Deitz & Tocker, 1980: 32 [checklist]; –Ben-Dov, 1993: 104 [world catalogue]; –Hodgson, 1994a: 208 [redescription].

Unmounted material: very large, up to 10 mm long, green, sometimes with slightly paler green markings in a reticulate pattern, but never with blue-green spots as sometimes present on *C. paraviridis*; shape usually elongate acuminate-oval and often asymmetrical when adpressed to main leaf vein; usually flat on dorsum and convex ventrally, lying in a depression on leaf. Size increase to maturity can be at least 12-fold before oviposition begins, when median underside of abdomen gradually retracts to form a brood chamber. Test of thin glassy wax plates (Fig. M30, internal wax structure) in a reticulate pattern of rows, with 7 plates across abdomen and 9 plates between anal plates and anterior margin, and with a narrow, non-pointed, marginal fringe of wax plates which tends to disappear as insect grows.

Mounted material: body shape as above, oval, slightly narrower at head end; length 1.60–12.45 mm, breadth 1.13–4.70 mm.

Dorsum: dorsal pores distributed in a reticulate pattern as for genus, but with 28 reticulation areas around margin; dorsal pores of 2 types (Fig. M26): (i) microductules with dark oval pore with a slit-like opening across shorter side, sometimes appearing to be bilocular: in 2 border rows along reticulation lines only; and (ii) small simple pores about same size as microductule pore (occasionally a few slightly larger simple pores present): restricted to central band of pores in each reticulation line; with 13–20 simple pores in posterior medial macropore line; without a submarginal band of pores. Anal plates: length 138–219 µm, combined widths 138–184 µm; each plate with 0–4 minute pores on its upper surface; inner and outer margin setae all fine and sharply spinose, lengths 10–16 µm; apical setae longest, length 24–36 µm. Anogenital fold generally with 2 pairs of setae but sometimes with 3 setae along each side of anterior margin and 1–2 setae laterally, longest about 27–42 µm long.

Margin: marginal setae slender-spinose to moderately spinose with pointed tips; size variable, 7–23 µm long, larger spines at reticulation points but also with 2–3 on either side of stigmatic spines, 23–30 µm long; with 14–24 on each side between stigmatic clefts. Stigmatic spines short, each 19–50 µm.

Venter: pregenital disc-pores present medially across posterior 4–6 abdominal segments, seldom extending onto mediolateral lobes: number of disc-pores per segment (medially/mediolaterally on one side): anal cleft+VII, 0/4–12; VI, 25–72/0–2; V, 26–107/0; IV, 32–120/0–2; III, 21–54/0, and II, 0–41/0; and with 0–16 medially on metathorax and 0 laterad to metacoxae. Spiracular disc-pores with mainly 5 (range 3–5) loculi, with 9–44 in each anterior band and 22–48 in each posterior band; bands narrow, only 1–5 pores wide near stigmatic clefts. Ventral microducts as for genus but abundant in broad bands across median thorax and abdominal segments II–III, with fewer on IV–V and none medially on VI–VII. Tubular ducts: with 1–2 ducts present laterad to anal area on about half specimens examined. Ventral setae: ventral anal lobe setae each 23–46 µm long; with a pair of long pregenital setae on both abdominal segments VI and VII, longest 77–92 µm; with 0–3 pairs anterior anal lobe setae; numbers of setae medially on abdominal segments: VII, 3–8; VI, 3–9; V, 3–10; IV, 2–10; III, 1–6; and II, 0–8; with 0–3 setae near each metacoxa, 0–2 near each mesocoxa and 0–4 near each procoxa; with few or no small setae associated with posterior spiracular disc-pore bands; with 4–13 interantennal setae; with 3–8 rather small submarginal setae between stigmatic clefts on either side. Antennae 6-segmented, total length 330–450 µm; apical seta 38–73 µm long. Clypeolabral shield 154–192 µm long. Width of spiracular peritremes: anterior 46–127 µm, posterior 57–150 µm. Legs: length (metathoracic): coxa 107–150 µm; trochanter + femur 154–180 µm; tibia 88–134 µm; tarsus 50–65 µm; claw well developed, 13–19 µm long; claw digitules narrowly expanded, subequal.

Material examined: LECTOTYPE ♀: NEW ZEALAND: here designated, *Ctenochiton viridis,* from '*Panax*', adult female, June 1878, W.M.M. / stained and remounted in Canada balsam, Feb 1998, RCH, CMNZ: 1/1♀ ad.
PARALECTOTYPES: (i) "from *Coprosma*, skin of adult female, June 1878, W.M.M." / stained and remounted in Canada balsam, 2 Feb 1995, RCH, CMNZ: 1/1♀ ad. (ii) "from *Coprosma* - five females - 2nd stage, June 1978, W.M.M" / stained and remounted in Canada balsam, 16 Feb 1995, RCH, CMNZ: 1/1♀ 2nd, 2♂ 2nd, 2 1st (i.e. not all females!). (iii) "from *Rubus*, old females, June 1977, W.M.M.", NZAC: 1/2♀♀ ad mounted dry, whole (both parasitised and infested with fungus). (iv) from '*Panax*' as above, CMNZ: 2/3♀♀ ad mounted dry, whole (all heavily infested with fungus).

Other material: Maskell subsequent slide, *Ctenochiton viridis*, adult male, 1890, W.M.M., CMNZ: 1/1♂ ad. **TH**: Three Kings Is, Great I, *Pseudopanax lessonii*, 1–3 Jan

1963, E.S. Gourlay, #83-304a: 3/3♀♀ ad. Great I, *Meryta sinclairii*, 27 Nov 1983, C.F. Butcher, #83-349e, 2/2♀♀ ad. West I, [no host], 29 Nov 1983, C.F. Butcher, #83-346h: 1/1♀♀ ad (and 2 parasitoids). **ND**: Te Arai Sanctuary, Houhora, *Pseudopanax lessonii* hybrid, 27 Jan 1995, R.E. Beever, #95-021 a–c: 3/3♀♀ ad. **AK**: Waitakere Range, Sharp Bush, *Pseudopanax arboreus* leaf, 1 Dec 1994, RCH, #94-122: 1/1♀ ad. As previous, but 30 Dec 1994, #95-002 a–b, #95-003, #95-004: 4/4♀♀ ad. As previous, but 29 Apr 1995, #95-043: 1/3♀ 2nd (2 pharate), 6 1st. As previous, but 11 Sept 1995, G. Hall & L.H. Clunie, #95-100a–d: 4/6♀ 3rd (3 pharate), 6♀ 2nd, 2♂ 2nd. As previous, but 23 Oct 1995, RCH, #95-110a–f: 6/4♀♀ ad (2 pharate), 12♀ 3rd. As previous, but 13 Jul 1997, #97-079a–b: 2/7♀ 2nd, 2♂ 2nd. As previous, but 6 Oct 1997, #97-139a–c: 3/1♀ 2nd, 1♂ 2nd, 1 pupa, 1♂ ad. **CL**: Little Barrier I, Summit Tk, 243 m, *Pseudopanax arboreus*, 10 Mar 1974, J.C. Watt, #83-300f & #90-243: 3/3♀♀ ad. Little Barrier I, Hamilton Tk, *Pseudopanax arboreus* underside leaves, 17 Sept 1994, RCH, #94-080a–d: 4/3♀ 3rd, 16♀ 2nd, 6 1st. **BP**: Te Koau, 130 m, *Pseudopanax arboreus* new young shoots, 2 Nov 1993, RCH, #93-356a–c: 3/6♀♀ ad, 2♀ 2nd. Te Koau, 175 m, side track from Bush Walk track, *Pseudopanax arboreus* new leaves, (one slide, from old leaves), 31 Oct 1994, RCH, #94-131 a–h: 8/9♀♀ ad (1 pharate), 3♀ 3rd, 9♂ 2nd. Te Koau, *Pseudopanax arboreus* underside new leaves, 2 Nov 1995, RCH, #95-111 a–d: 4/3♀♀ ad. 3♀ 3rd. Rereauira Swamp, *Pseudopanax arboreus*, 29 Jan 1993, RCH, #93-285 a–e: 5/5♀♀ ad. **GB**: East Cape, *Pseudopanax crassifolius*, 3 Feb 1993, RCH, #93-202 a–d: 4/4♀♀ ad (3 split dorsoventrally). As previous, but 17 Mar 1993, #93-081 a–d: 4/3♀♀ ad (1 split dorsoventrally), 11 1st. As previous, but 30 Oct 1994, old leaves, #94-130a–d: 4/6♀ 3rd (1 pharate), 9♀ 2nd, 4♂ 2nd, 3 prepupae, 1 pupa. As previous, but *Pseudopanax ferox* old leaves & new shoots, #94-129a–e: 5/2♀♀ ad (1 pharate), 12♀ 3rd, 6♀ 2nd, 5♂ 2nd, 1 prepupa, 1 pupa. Paoneone, *Pseudopanax arboreus* underside leaves, 2 Nov 1994, RCH, #94-128a–c: 3/5♀♀ ad, 1♀ 2nd. Pohutu, *Pseudopanax arboreus*, 30 Jan 1993, RCH, #93-078a–d: 4/3♀♀ ad, 13 1st. As previous, but off new shoots & leaves, 4 Nov 1993, #93-349a–c: 3/6♀♀ ad, 2♀ 3rd. **WO**: Pangaki Stm, Paemako Reserve, *Pseudopanax arboreus*, 11 Dec 1993, RCH, #93-374,a–d: 4/4♀♀ ad. **TO**: Arataki SF 98, *Pseudopanax arboreus* [as *Neopanax arboreum*] leaves, 7 Jan 1974, R.J.M. McKenzie, FRNZ R(b)56–58: 3/7♀♀ ad. Hauhungaroa Range, Piropiro Road, *Pseudopanax crassifolius,* 13 Jan 1995, RCH, #95-017a–c: 3/4♀♀ ad, 5♀ 3rd. Hauhungaroa Range, Waihaha R, *Pseudopanax arboreus* underside leaves, 14 Jan 1995, RCH, #95-013: 1/1♀ ad. Pureora Forest Park, Waipapa Lodge Tk, *Pseudopanax arboreus* underside leaves, 15 Jan 1995, RCH, #95-016a–d: 4/4♀♀ ad. **NN**: Rai Valley, Cpt. 2, 300 ft, Marlboro' Prov., S68:90:38, *Pseudopanax arboreus* [as *Neopanax arboreum*] 23 Jan 1964, W.A. Holloway, FRNZ R(b)9–11: 3/10♀♀ ad. Maitai R, *Pseudopanax arboreus* [as *Neopanax arboreum*], 19 Dec 1967, J.A. de Boer, No, 308: 2/3♀♀ ad. Eves Valley, *Pseudopanax arboreus* [as *Neopanax arboreum*], 29 Feb 1972, J.A. de Boer, No. 804: 2/3♀♀ ad (2 split dorsoventrally). As previous, but *Pseudopanax crassifolium*, No. 805: 1/1♀ ad (split dorsoventrally). Golden Bay, nr Bainham, Mt Stevens Tk, *Pseudopanax crassifolius* juvenile leaf, 12 Mar 1998, N.A. Martin, #98-056: 1/1♀ ad. **MB**: Pelorus Bridge, *Pseudopanax arboreus* [as 'Five Finger'], May 1952, W. Cottier: 4/4♀♀ ad. **NC**: Lees Valley Rd, near Oxford, *Pseudopanax ?linearis* [as *?lineare*], 4 Mar 1963, R.M.J. McKenzie: 2/4♀♀ ad.

In addition, the identity of the following material from Maskell's syntype series remains unconfirmed: (i)"from *Rubus*, old females, June 1877, W.M.M., 1/1♀ ad mounted dry, whole (NZAC)", because no other material is available from this host; (ii) the Maskell subsequent slide labelled "*Ctenochiton viridis*, [no host], female early 3rd stage, Jan 1890, W.M.M. / stained and remounted in Canada balsam, 16 Feb 1995, RCH" (NZAC) is a misidentification as it is probably *Aphenochiton kamahi* Henderson & Hodgson n. sp.

Remarks. *C. viridis* and *C. paraviridis* are referred to as the "sixpenny scales" because of their size and generally flat shape. Although the outward appearance of these two scales is very similar, mounted females of *C. viridis* can be separated immediately by the lack of:

(i) dorsal macropores;
(ii) a submarginal band of simple pores;
(iii) ventral tubular ducts on the submargin and by the mouth;
(iv) the presence of fine marginal spines.

Apart from one unconfirmed record (Maskell's whole mount female "from *Rubus*"), Maskell's paralectotype from *Coprosma* sp. and the collection off *Meryta sinclairii* from Three Kings Is, *C. viridis* has been found exclusively on species of *Pseudopanax,* whereas there is only one other instance of any of the other three species of *Ctenochiton* having been collected off this host plant.

Green (1929) recorded this species off '*Hedycarpa*' *arborea* (clearly a misspelling of *Hedycarya*), from Korokoro, Wellington, Jan. 1921. As *C. viridis* has not been collected off this host, this record almost certainly refers to *C. paraviridis*. In addition, Miller (1925) recorded *C. viridis* off pukatea (*Laurelia novae-zelandiae*) and porokaiwhiri (*Hedycarya arborea*) and these records are also presumed to refer to *C. paraviridis*, while the record off karaka (*Corynocarpus laevigatus*) is considered to refer to *C. chelyon*, also described as new above. Of the records included under *C. viridis* by W.M. Maskell (1895), those off *Panax (=Pseudopanax)* and *Coprosma* can be confirmed from his original slides but those off the other hosts, namely *Hedycarya*, *Atherosperma (=Laurelia)*, and *Rubus* are unconfirmed. The present records for *C. viridis* are almost restricted to *Pseudopanax* spp. and so it seems likely that these last three host genera refer to *C. paraviridis*.

Morrison and Morrison (1922) wrote a description based on slides mounted from dry material from the W.M. Maskell Collection, of which they stated: "There is no positive evidence that the unmounted specimens were from the original type lot of material". Based on their description and the slides we have studied from the USNM, including the Cotype slide of Morrison & Morrison (which is here identified as *Ctenochiton paraviridis* Henderson & Hodgson n. sp.) we conclude that it was unlikely that they studied *C. viridis*, but that the slides were most probably a mixture of specimens of *C. paraviridis* (which their description fits) and *C. chelyon*, unrecognised as separate species at that time. In addition, Hodgson (1994a), whilst redescribing what he thought was *C. viridis* using USNM material, also commented on the great range of variability in the available material and considered that the material represented more than one species. The illustration of *C. viridis* in Hodgson (1994a) is nearest to *C. paraviridis*.

Biology. Normally univoltine, but two generations may occur in a favourable summer or in a favourable site. *C. viridis* overwinters as 1st- or 2nd-instar nymphs. At the spring flush, female nymphs move to the new leaves on young shoots (where they settle in preference by a main vein on the undersurface of leaves) and undergo rapid growth and development. The male nymphs remain on the old leaves and develop over the same period into adult males and emerge from their tests to mate with young adult females. The adult females can increase in size at least 12-fold between their last moult and becoming fully grown. Once oviposition begins, the median underside of the abdomen gradually retracts to form a brood chamber where the eggs are laid and the nymphs shelter after hatching. Often about 500 eggs and neonates can be found in a female's brood chamber. First-instar nymphs emerge from under the posterior end of the test and settle on nearby leaves. Old, post-oviposition females finally drop off the host plant, with their telltale depressions remaining for the life of the leaves.

Pathogens and parasitoids. Hymenopterous parasitoids recorded: Encyrtidae: *Adelencyrtoides inconstans* Noyes; *A. variabilis* Noyes. Entomogenous fungal parasites as for *C. paraviridis* except *Aegerita webberi*. Myers (1928) noted that he never found *C. viridis* attacked by *A. webberi* when on *Pseudopanax arboreus* [as *Nothopanax*] whereas the scale he thought to be *C. viridis* (now *C. paraviridis*) on *Hedycarya arborea* was always heavily attacked by this fungus.

Distribution. From Three Kings Islands, the North Island except south of Lake Taupo, to North Canterbury (Map 19).

Genus *EPELIDOCHITON* Henderson & Hodgson new genus

Type species: *Ctenochiton piperis* Maskell (here designated).

Diagnosis. Adult female. Test: glassy wax plates on young adults, becoming duller due to dark grey sclerotised derm of mature adult beneath.

Shape: mature female convex. Body of adult female round, with a shallow anal cleft and no stigmatic clefts.

Dorsum: each reticulation area with a small sclerotised patch, formed initially in centre but growing to fill whole reticulation area on mature insects; anal sclerotisation present anterior to anal plates, horseshoe-shaped at first but expanding to join nearby dermal sclerotisations on old individuals. Dorsal setae absent. Dorsal pores distributed in a reticulate pattern of lines delineating areas underlying wax plates of test; with reticulation areas in 7 longitudinal rows, 9 areas between anal plates and anterior margin and with 27 areas around margin. Dorsal pores of 4 types: (i) small, dark microductules: present as most abundant pore in all reticulation lines; (ii) minute simple pores: a few scattered beside lines of microductules; also 2–3 pores between reticulation points on submargin; (iii) larger simple pores: present occasionally near reticulation lines and at reticulation points on margin and along anal cleft; (iv) large, sclerotised, flask-shaped macropores, with a strongly sclerotised base imbedded in derm and with a ridged top (see SEM 11) — in side view under light microscope appearing like a fine brush; interspersed with microductules, mainly within lines around median 3 rows of reticulation areas. Preopercular pores, dorsal tubercles and dorsal tubular ducts absent. Anal plates oval-shaped, with minute pores present on upper surface; with 4 pairs of long flagellate setae in a row on upper face of posterior half of each plate, usually pointing outwards. Anogenital fold with 3 or 4 pairs of setae arising from fleshy basal extensions along anterior margin and 1 pair laterally. Anal tube short; anal ring with 6 setae. Eyespots present on margin.

Margin: marginal setae small and finely spinose, sparse, with 1 seta at each reticulation point on margin, plus an additional seta by each eyespot and 3 setae between stigmatic areas on each side. Stigmatic clefts absent; each stigmatic area with or without a small stigmatic spine; when present, obviously differentiated but only slightly larger and broader than marginal setae.

Venter: pregenital disc-pores with mainly 5 loculi (range 3–5), present in a group on either side of anterior end of anal cleft. Spiracular disc-pores with 3–7 (mainly 5) loculi in bands between each spiracle and margin. Multilocular disc-pores with mainly 5 loculi, present in a small group on either side of clypeolabral shield. Ventral microducts of 2 types: (i) a small microduct abundant throughout; and (ii) a much larger microduct in a submarginal row several pores wide. Ventral tubular ducts absent. Ventral setae: anal lobe setae short; anterior anal cleft setae few; hypopygial setae absent; with 1 pair of long pregenital setae on segment VII; setae frequent medially on abdomen, scarce on thorax and head; other setae as for family. Antennae 6-segmented; third segment long; setal distribution as for family. Mouthparts usually displaced to 1 side. Spiracles typical of family. Legs well developed, with a separate tibia and tarsus but no articulation; setal distribution as for family; tarsal digitules subequal or with 1 distinctly shorter than other; claw digitules both broad; claw short, without a denticle. Vulva in segment VII.

Remarks. This genus contains one endemic species, *Epelidochiton piperis* (Maskell). Whilst clearly related to the other 'Ctenochiton-like' species described here, it is quite distinct. It can be immediately recognised by:
(i) the sclerotisation of the reticulation areas on the dorsum;
(ii) the stigmatic spines which are mostly absent or, if present, only slightly larger than the marginal setae;
(iii) the presence of quinquelocular disc-pores on either side of the clypeolabral shield;
(iv) the 2 types of ventral microduct, the larger with a long inner ductule;
(v) the distribution of the long, flagellate setae on the anal plates;
(vi) the flask-shaped dorsal macropores.

Generic name derivation. The name refers to the sclerotisations on each of the reticulation areas: from *epelis*, *epelidos* (Gr.= freckle) and *chiton* (Gr.= tunic or garment worn close to the skin).

Epelidochiton piperis (Maskell) new combination

Figs M18, C58, 115

Ctenochiton piperis Maskell 1882: 218; –Maskell 1885: 25 [male description]; –Maskell 1887: 73 [description]; –Maskell, 1895a: 13 [checklist]; –Cockerell, 1896: 330 [checklist]; –Fernald, 1903: 161 [world catalogue]; –Hutton, 1904: 226 [checklist]; –Myers, 1922: 199 [checklist]; –Green, 1929: 376 [record]; –Wise, 1977: 104 [checklist]; –Deitz & Tocker, 1980: 31 [checklist]; –Ben-Dov, 1993: 103 [world catalogue].

Unmounted material: young adults rather flat and round, becoming more convex when mature. Test of young female glassy, each wax plate convex, composed of layers of wax, uppermost layers at centre of each plate smallest and narrowest (secreted when insect was small); most basal layers of each plate broadest, filling plate area (and secreted most recently). Teneral female at first light green, then developing a red-brown horseshoe-shaped pattern on each submedian reticulation area; this expands to form a brownish circular area medially with a light green margin, dorsum finally becoming overall dark grey with a dull appearance when all sclerotised patches have coalesced and thickened.

Mounted material: as for genus. Length 1.5-2.4 mm, breadth 1.6-2.2 mm.

Dorsum: derm of teneral female membranous but becoming sclerotised as described above for genus. Dorsal pores as for genus; with 0–1 macropores (Fig. M18) in posterior medial macropore line. Anal plates: 110–123 µm long, combined widths 96–120 µm; sometimes with surface near inner margin of plates striated; with 4–8 minute pores on upper surface of each plate; setae flagellate, as for genus, in a row on upper surface, sometimes near outer margin and sometimes apparently positioned more medially; anteriormost seta generally pointing outwards and very long (50–53 µm), 2 × longer than more posterior 3 (latter all about 23–27 µm). Anogenital fold as for genus; length of longest setae 30–46 µm.

Margin: marginal setae as for genus, each marginal seta 7–10 µm long. Stigmatic spines: when present 10-20 µm long.

Venter: pregenital disc-pores restricted to a group of 9–13 on either side of anterior end of anal cleft. Spiracular disc-pores: with 10–35 in each anterior band and 20–45 in each posterior band. Multilocular disc-pores also in a group of usually 1–4 (range 0–9) pores on either side of clypeolabral shield. Ventral microducts of 2 types: (i) small microducts with a short, tubular inner ductule: those present medially on thorax and abdomen sometimes larger and more sclerotised than those on submedian areas, and (ii) a microduct about 2 × larger than small microducts, with a sunken sclerotised, dark pore and a long inner ductule narrowly expanded at the proximal end and distally filamentous (not always discernable): present in 1 to 2 submarginal rows. Ventral setae: ventral anal lobe setae short, 5–20 µm long; with 0–3 anterior anal cleft setae; with a pair of long setae on segment VII only, longest 50-130 µm; number of setae medially on each abdominal segment: VII, 3–9; VI, 3–7; V, 4–9; IV, 3–12; III, 9–15; and II, 4–14; with 4–8 setae medially and 4-9 near each coxa on metathorax; with 5–12 medially and 3–9 near each coxa on mesothorax; and with 0–1 medially and 2–4 near each coxa on prothorax; with 2–4 pairs of interantennal setae. Antennae 6-segmented, occasionally with slight signs of pseudo-segmentation, total length 234–296 µm; length of apical seta 38–52 µm. Clypeolabral shield 115–135 µm long. Width of spiracular peritremes: anterior 25–30 µm, posterior 30–36 µm. Legs: lengths (metathoracic): coxa 146-177 µm, trochanter + femur 167–200 µm, tibia 115–155 µm, tarsus 77–94 µm, claw 15–22 µm.

Material examined: LECTOTYPE ♀ (here designated): NEW ZEALAND: *Ctenochiton piperis*, from *Piper* [=*Macropiper*] *excelsum*, female in test, Jan 1881, W.M.M. "Entomology Div., DSIR, W.M. Maskell Collection"; NZAC: 1/1♀ ad. The slide contains a young female in good condition, with small amount of wax remaining.
PARALECTOTYPES: (i) as for lectotype, except "two females in tests", a hollow mount slide, the specimens uncleared, in poor condition, CMNZ: 1/2♀♀ ad. (ii) as for lectotype, "young insect" (a crawler), CMNZ: 1/1 1st. (iii) as for lectotype, "female - 2nd stage", an uncleared specimen with most of the pattern of wax plates visible CMNZ: 1/1 2nd ♀.

Other material: NEW ZEALAND: Maskell subsequent slide: "male, from *Piper excelsum*, Oct 1882, W.M.M.", NZAC: 1/1♂ ad — in reasonable condition, uncleared. From *Macropiper excelsum*, J.G. Myers, New Zealand, #10, BMNH: 1/3♀♀ ad . **ND**: Kohukohu, N. Auckland, *Coprosma robusta*, J.G. Myers, No. 17, BMNH: 1/4♀♀ ad. Rawene, *Vitex lucens*, 31 Dec 1982, J.M. Cox: 1/1♀ ad. Whangaroa, *Corynocarpus laevigatus*, 12 Oct 1968, R.A. Cumber, No. 1607, E.W. Valentine's Collection: 1/4♀♀ ad. Poor Knights Is, Tawhiti Rahi, *Dysoxylum spectabile*, 2 Dec 1980, C.F. Butcher, #81-50b: 2/4♀♀ ad. As previous, except *Macropiper excelsum*, #81-58f: 4/7♀♀ ad. **AK**: Noises Is, Otata I, track E of summit, *Macropiper excelsum* leaves, 1 Nov 1977, L.L. Deitz, #77-329g & #80-289c: 6/11♀♀ ad (with wax plates). As previous, except near cottage, #78-152b: 1/2♀♀ ad. Noises Is, Otata I, *Coprosma macrocarpa* leaves, 1 Nov 1977, L.L. Deitz, #77-343b & #80-289d: 4/9♀♀ ad. Noises Is, Motuharopapa I, SW face, *Dysoxylum spectabile* leaves, 2 Nov 1977, L.L. Deitz, #78-111b: 1/1♀ ad. Noises Is, Motuharopapa I, summit, trig point 55 m, *Coprosma macrocarpa* leaves, 4 Nov 1977, L.L. Deitz, #77-329f: 2/4♀♀ ad. Auckland, Titirangi, *Vitex lucens*, 13 Oct 1973, P.S. Dale, No. 1085, J.A. de Boer Collection: 1/5♀♀ ad (2 split dorsoventrally). As previous, except 'shrub', 12 Jan 1983, J.M. Cox, No. 126 and 11 Jan 1983, No. 122: 2/2♀♀ ad. Huia, *Vitex lucens* leaves, 20 Jul 1975, J. Johanneson: 4/9♀♀ ad. Huia Dam, *Aristotelia serrata*, 26 Sept 1980, G. Hall, #80-282w: 3/6♀♀ ad. As previous, except *Corynocarpus laevigatus*, #80-282x & #90-241: 2/3♀♀ ad. As previous, except *Coprosma robusta*, C.F. Butcher & G. Hall, #80-282s: 2/4♀♀ ad. As previous, except *Macropiper excelsum*, C.F. Butcher, #80-282e: 2/1♀ ad, 1♀ 3rd. Huia Dam, *Hedycarya* leaf, 28 Mar 1981, B.G. Bennett, #81-100f–g: 3/3♀♀ ad, 1♀ 3rd. Huia Dam, *Hedycarya arborea* leaves, 9 Apr 1981, C.F. Butcher, #81-105a: 1/1♀ ad. Auckland, Wattle Bay, *Corynocarpus laevigatus* leaf, 5 Jul 1982, P.A. Maddison, #82-187h: 1/1♀ ad. Laingholm, *Macropiper excelsum* leaf, 14 Jan 1979, W. Park & P.A. Maddison, #79-022a: 2/8♀♀ ad. As previous, *Dysoxylum spectabile* leaf, except W. Park, #79-022d: 1/1♀ ad. Bethells, Te Henga Reserve, *Corynocarpus laevigatus* leaf, 19 Oct 1980, P.A. Maddison, #80-296b: 3/3♀♀ ad. Waitakere Ra, Walker Bush track, *Dysoxylum spectabile* leaves, 5 Nov 1976, M.F. Tocker, #76-316c: 2/4♀♀ ad. Waitakere Ra, *Dysoxylum spectabile*, Dec 1979, P.A. Maddison, #79-347b: 1/2♀♀ ad. South Piha nr beach, *Macropiper excelsum* leaves, 29 Oct 1979, C.F. Butcher, #79-305e: 4/11♀♀ ad, 1♂ 2nd, 1 prepupa (pharate). Auckland, Mt Albert Rd, *Corynocarpus laevigatus*[as karaka] leaves, 11 Jun 1992, RCH, #92-188b: 1♀ 3rd (pharate), 2♀ 2nd. Auckland, Glen Eden, *Vitex lucens*, 17 Oct 1993, RCH, #93-302a–d: 4/1♀ ad, 1♀ 3rd, 3♂♂ ad, 2 pupae, 2 prepupae (pharate), 1♂ 2nd. As previous, except 11 Sept 1994, #94-069a–i: 9/3♀♀ ad (1 pharate), 6♀ 3rd (1 pharate), 13♀ 2nd, 8♂ 2nd, 1 prepupa, 1 pupa. As previous, except 12 Dec 1995, #95-151a–b: 2/11 1sts. **WO**: Raglan, Bridal Veil Falls, *Laurelia novae-zelandiae*, 19 Sept 1981, C.F. Butcher, #81-282a: 1/1♀ ad. As previous, except *Schefflera digitata*, #81-282j: 1/1 teneral ♀ ad. Raglan, *Dysoxylum spectabile*, 19 Sept 1981, C.F. Butcher, #81-282e: 2/2♀♀ ad, 1♂ 2nd. As previous, except *Pittosporum* sp., #84-013e: 2/2♀♀ ad. Raglan, *Metrosideros* sp. (rata), 19 Oct 1981, C.F. Butcher, #81-282g: 1/1 teneral ♀ ad. **CL**: Kopu–Hikuai Rd, *Alectryon excelsus*, 1 Aug 1968, R.A. Cumber, No. 1583 E.W Valentine Collection: 1/1♀ ad. **BP**: Te Puke, 6 Sept 1977, P. Malcolm, No. E.303: 1/6♀♀ ad. Mt Te Aroha, Tui Mine roadside, *Vitex lucens*, 29 Nov 1991, RCH, #91-346a–b: 2/6♀♀ ad. Papatea, *Macropiper excelsum*, 25 Jan 1993, RCH, #93-110: 1/1♀ ad (split dorsoventrally). Hicks Bay, Wharekahika R, *Dysoxylum spectabile*, 20 Sept 1992, RCH, #92-277b–c: 3/4♀♀ ad (1 pharate), 4♀ 3rd, 3♂ 2nd. As previous, except *Macropiper excelsum*, #92-335: 1/3♀♀ ad. Te Koau, *Macropiper excelsum*, 23 Sept 1992, RCH, #92-336: 1/2♀♀ ad. As previous, except *Dysoxylum spectabile*, #92-341: 1/1♀ ad. Lottin Point, Otanga, *Vitex lucens*, 29 Sept 1993, RCH, #93-330b: 1/1♂ 2nd. **HB**: White Pine Bush reserve, *Pittosporum eugenioides*, 20 Jun 1991, C.F. Morales, #91-212a–b: 2/1♀ ad (pharate), 2♀ 3rd, 1♂ 2nd. **GB**: Gisborne, *Chamaecyparis lawsoniana* [as *Lawsonia*] hedge (close to native trees), 19 Feb 1981, C.F. Butcher, #81-121d: 2/3♀♀ ad. **SD**: d'Urville I, *Dysoxylum spectabile*, 16 Feb 1971, J.A. de Boer, No. 694: 1/1♀ ad (split dorsoventrally). **NN**: Marsden Valley, *Hedycarya arborea*, 16 Apr 1969, E.W. Valentine, No. 509 J.A de Boer Collection: 2/7♀♀ ad (2 split dorsoventrally). Motueka, *Melicytus* sp., 1 Jul 1917, G.Brittin, No. 131: 2/2♀♀ ad.

Remarks. This species is easily separable from all other New Zealand species by the following combination of characters:

(i) the round shape, convex at maturity;
(ii) presence of sclerotised patches on the dorsal derm;
(iii) a sclerotised collar on dorsum anterior to anal plates;
(iv) presence of 5-locular disc-pores laterad to the mouthparts;
(v) long, outward-pointing discal seta on each anal plate;
(vi) flask-shaped dorsal macropores;
(vii) complete absence of ventral tubular ducts, but with numerous microducts throughout the venter.

Although *E. piperis* is a widespread and common species, it has been recorded only once from an introduced host plant, namely from a hedge of *Chamaecyparis lawsoniana* (Lawson's cypress); however, it was noted at the time that the hedge was "close to native trees". This isolated record is considered to be a chance occurrence as there are no other records of an endemic New Zealand soft scale becoming established on a non-native plant.

Biology. *E. piperis* is multivoltine, at least in the warmer northern areas near Auckland. It is also oligophagous and able to withstand urban environments (in Auckland at least). Unlike most other adult female New Zealand coccids, adult females of *E. piperis* are not entirely sessile and can walk off the underside of the leaves (their preferred feeding site) when disturbed. It seems possible that this is an adaptation for moving to new feeding sites, particularly after overwintering on older leaves.

Pathogens and parasitoids. Hymenopterous parasitoids recorded: Pteromalidae: *Aphobetus nana* Bouček. The entomogenous fungi *Aegerita webberi* H.S. Fawc. and *Verticillium lecanii* (Zimm.)Viégas occasionally attack *E. piperis*.

Distribution. The distribution of *E. piperis* in the North Island lies within the lowland forest from Northland to Waikato in the west and to northern Hawkes Bay on the east coast, and then from Marlborough Sounds to the Nelson area in the South Island. *E. piperis* has not been collected between southern Waikato and Wellington (North Island), nor south of Nelson (South Island) (Map 20).

Genus *INGLISIA* Maskell

Inglisia Maskell, 1879: 213; –Signoret, 1882a: clviii [synonymy]; –Signoret, 1882b: clxxxiii [synonymy]; –Maskell, 1887: 75 [description]; –Cockerell, 1894b: 1054 [distribution]; –Cockerell, 1895: 100 [sp. description]; –Cockerell, 1896: 330 [checklist]; –Cockerell, 1899a: 394 [checklist]; –Cockerell, 1899c: 332 [key]; –Fernald, 1903: 162 [world catalogue]; –Hutton, 1904: 226 [checklist]; –Green, 1909: 282 [Ceylon sp.]; –Froggatt, 1915: 513 [Australian spp.]; –Brain, 1920: 36 [South Africa spp]; –Froggatt, 1921: 25 [taxonomy]; –MacGillivray, 1921: 171, 178 [catalogue]; –Morrison & Morrison, 1922: 75 [redescription type]; –Mahdihassan, 1923: 97 [relationships]; –Steinweden, 1929: 201, 202, 206, 207, 237 [classification]; –Ramakrishna Ayyar, 1929: 35, 41 [Indian sp.]; –Goux, 1933: 123 [mention]; –Lindinger, 1937: 187, 191 [checklist]; –Hempel, 1937: 10 [Brazilian sp.]; –Lepage, 1938: 357 [Brazilian sp.]; –Hodgson, 1967b: 1 [African spp.]; –Hodgson, 1969: 17 [African spp.]; –Wise, 1977: 105 [checklist]; –Tao, 1978: 82 [Taiwan checklist]; –Tao *et al.*, 1983: 91 [Taiwanese sp.]; –Hamon & Williams, 1984: 56 [Florida sp.]; –Tang, 1991: 321 [Chinese sp.]; –Ben-Dov, 1993: 146 [world catalogue]; –Hodgson, 1994a: 289 [redescription type].

Type species: *Inglisia patella* Maskell (designated by Fernald, 1903: 162)

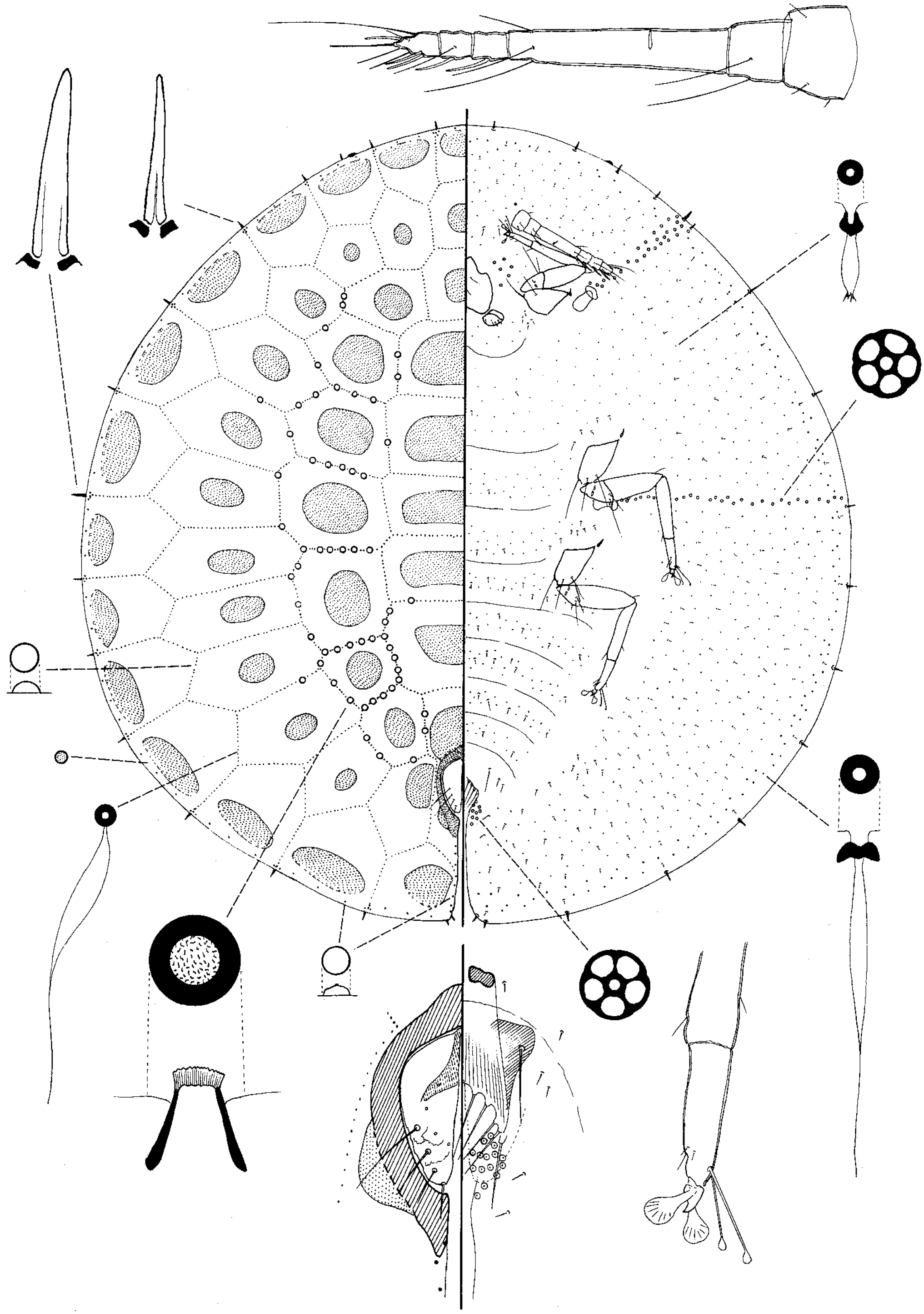


Fig. 115. *Epelidochiton piperis* (Maskell), **n. comb.**, adult female.

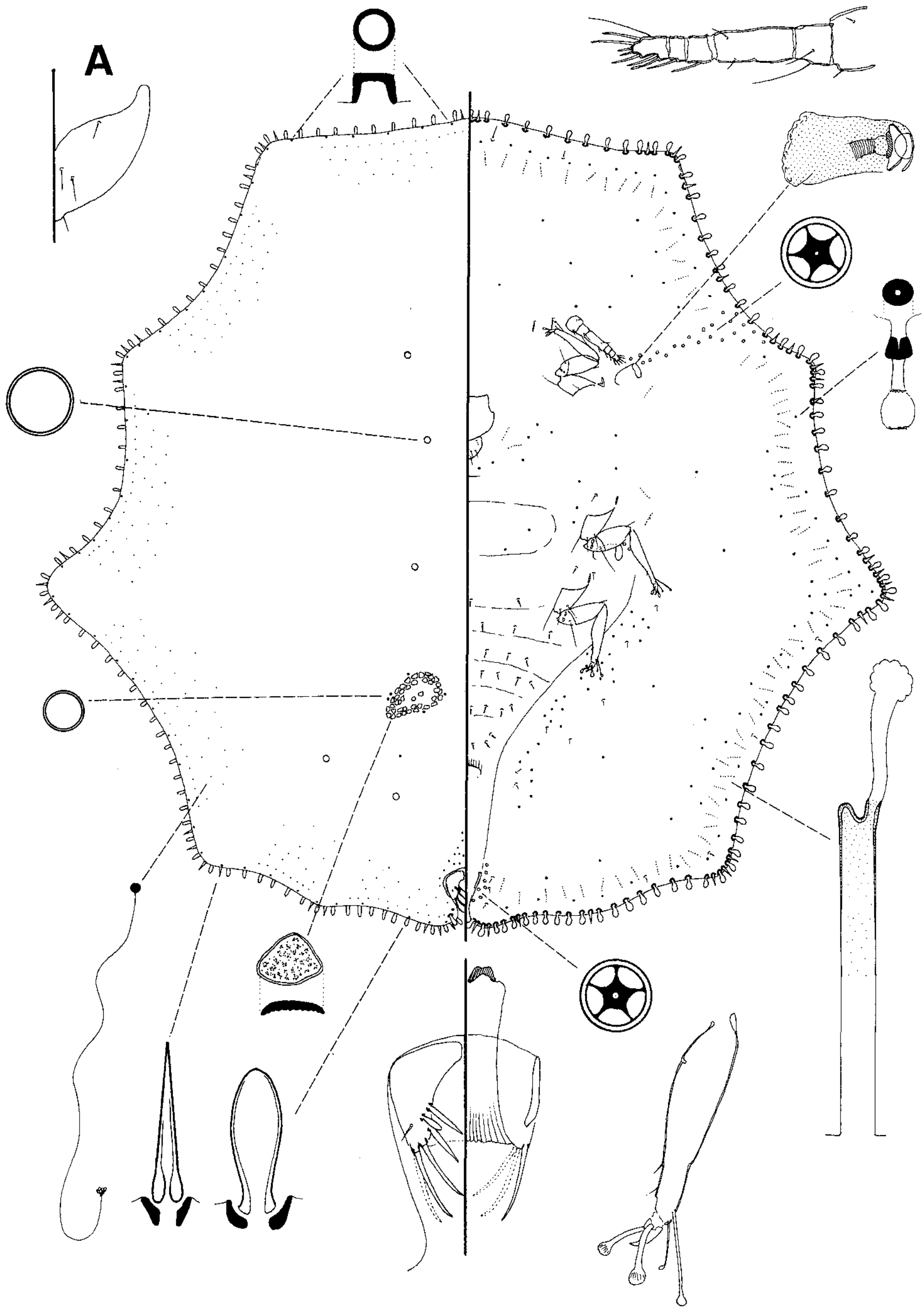


Fig. 116. *Inglisia patella* Maskell, adult female. A = right half of labium.

Diagnosis: adult female. Test: glassy, conical and limpet-like, with 2 concentric lines around it marking change in growth between instars; margin approximately 10-sided, each side rather fluted at each indentation and with median apex roundly pointed.

Shape: body rather 10-sided (decagonal), lacking stigmatic clefts and with a very shallow anal cleft.

Dorsum: derm membranous, without reticulation lines. Dorsal setae absent. Dorsal pores of 3 or 4 types present: (i) minute microductules, with a long, filamentous inner ductule; (ii) small, heavily sclerotised, convex simple pores; (iii) much larger simple pores or macropores; and (iv) round, simple pores, similar to (iii) but smaller: present sparsely throughout. Two rather large membranous areas present approximately dorsad to metathoracic legs, each with numerous unevenly round pores with a granulate surface. Preopercular pores, dorsal tubular ducts, and submarginal tubercles absent. Anal plates each with anterior margin almost at right angles to body axis and with outer angle almost a right angle; each plate with 5 long spinose spines on inner margin and on apex, plus 1 shorter spine set slightly onto dorsum; plates lacking minute pores on dorsal surface. Anogenital fold without setae. Anal ring with 6 setae; anal tube much longer than length of anal plates.

Margin: marginal setae spinose, of 2 types: (i) a club-shaped spine, blunt apically and narrowing abruptly at base, with a large basal socket; and (ii) a sharply spinose seta, with a quite large basal socket; marginal setae on anal lobe not differentiated from other marginal setae. Stigmatic clefts absent; stigmatic spines not differentiated from marginal spines. Eyespots small, very indistinct on anterior outer corners of decagon.

Venter: derm membranous. Pregenital disc-pores with 5 or 6 loculi: present in a line on either side of anal area and extending down margins of anal cleft. Spiracular disc-pores with mainly 5 loculi; present in bands extending to margin from anterior spiracles only; posterior bands only represented by a group of 2 or 3 pores just anterior to peritreme. Preantennal pore possibly absent. Ventral microducts present, scattered sparsely throughout much of venter. Ventral tubular ducts of 1 type, with a rather long outer ductule and a long inner ductule with a large terminal gland; present in a narrow submarginal band and with a few elsewhere. Ventral setae spinose, distributed as follows: ventral anal lobe setae absent; anterior anal cleft setae present laterad to pregenital disc-pores; hypopygial setae absent; long pregenital setae absent, each abdominal segment with short bands of stout setae present medially across each segment; with very few setae on thorax and head; with interantennal setae; submarginal setae sparse. Antennae 6- or 7-segmented, 3rd segment longest; setal distribution: 2 setae on scape; a long flagellate seta and a short seta on pedicel; 2 short setae on 3rd segment; 1 fleshy seta on both 4th and 5th segments; total of 8 setae on apical segment, 1 very short seta, 1 rather short flagellate seta and 6 fleshy seta including longest, latter usually clubbed terminally. Spiracles quite small, each with a distinct, sclerotised spiracular plate. Legs typical of family but rather small and with tibia and tarsus fused; setal distribution: coxa with 4 setae, trochanter with 1 long flagellate seta, femur with 1 seta, tarsus usually with 1 seta (occasionally 2 setae on metatarsus); tarsal digitules variable; claw digitules alike with broad apices; claws with or without a small denticle. Anterior margin of segment VII near centre of abdomen, far anterior to anal plates, with a distinct vulva immediately posterior to its anterior margin.

Remarks. Although many species have been placed in this genus in the past, it is here considered that it is currently a monotypic genus, as was also concluded by Morrison & Morrison (1922), and endemic to New Zealand. For distinctive characters, see under the species description below.

Inglisia patella Maskell

Figs M29, C59, 116

Inglisia patella Maskell, 1879: 213; –Maskell, 1882: 219 [male description]; –Maskell, 1887: 78 [description]; –Maskell, 1895a: 14 [checklist]; –Cockerell, 1896: 330 [checklist]; –Fernald, 1903: 162 [world catalogue]; –Hutton, 1904: 227 [checklist]; –Myers, 1922: 199 [checklist]; –Morrison & Morrison, 1922: 75 [redescription]; –Miller, 1925: 33, 64 [host]; –Green, 1929: 377 [record]; –Steinweden, 1929: 212 [classification]; –Lindinger, 1937: 187 [checklist]; –Wise, 1977: 105 [checklist]; –Deitz & Tocker, 1980: 28, 29, 30, 31, 32 [checklist]; –Ben-Dov, 1993: 149 [world catalogue]; –Hodgson, 1994a: 289 [redescription].

Unmounted material: test glassy, shaped like a limpet (*Patella*), as for genus; internal wax structure a combination of horizontal layers near apex, appearing more as honeycomb areas in the outer side walls, and solid wax in the inner side walls (Fig. M29).

Mounted material: shape of body rather 10-sided (decagonal), lacking stigmatic clefts and with a very shallow anal cleft, about 1/30th body length. Length 0.9–2.4 mm, width 0.9–2.8 mm.

Dorsum: dorsal pores of 4 types: (i) minute microductules: in an broken submarginal band up to 4 or more pores wide but tending to be absent at each corner of decagon; largest microductules in a triangular area just anterior to anal plates; (ii) small, heavily sclerotised, convex simple pores: present in a line just dorsad to marginal spines, with about 1 pore per 3 or 4 spines; with 31–47 around head between anterior stigmatic areas; (iii) large simple pores/macropores, much larger than simple pores: present sparsely throughout median part of dorsum; and (iv) round, simple pores, similar to (iii) but smaller: present sparsely throughout. Two large, membranous, cribriform-like areas present approximately dorsad to metathoracic legs; size of each area 90–123 x 53–82 µm, each with about 60 unevenly round pores with a granulate surface, distributed mainly around edge. Anal plates as for genus; length of plates 48-56 µm, combined width 73–88 µm; each plate with 5 long spinose setae on inner margin and on apex, plus 1 shorter spinose seta set slightly onto dorsum near inner margin about 1/3rd from posterior apex; length of setae: anterior 2 spines: 27–31 µm; next 2 spines on inner margin, 39–43 µm; apical spine, 36–51 µm, and spine on dorsum, 14–21 µm; latter spine or 1 of marginal spines can be club-shaped (similar to club-shaped marginal setae), all others strongly spinose with parallel sides and a sharp point.

Margin: marginal setae spinose, of 2 types: (i) club-shaped spines: length 10-22 µm; blunt apically and narrowing abruptly at base, with a large basal socket: approximately evenly spaced, with 46–56 around head between anterior stigmatic areas; and (ii) sharply spinose spines: length 10–14 µm, with a quite large basal socket: usually present all around margin, alternating with club-shaped setae but sometimes most frequent at corners of decagon; with 25–59 around head between anterior stigmatic areas; with a few sometimes on margins of anal cleft; a club-shaped spine also occasionally present on dorsal surface of each anal lobe.

Venter: pregenital disc-pores as for genus. Spiracular disc-pores in complete bands of 16–33 pores between margin and each anterior spiracle only; posterior bands only represented by a group of 2 or 3 pores just anterior to peritreme. Ventral microducts quite distinctive, with a long inner ductule swollen distally; scattered among submarginal band of tubular ducts, in a band on mediolateral folds of abdominal segments and with a few medially on thorax and head. Ventral tubular ducts as for genus: in a narrow submarginal band, and with a few sometimes present more medially near antennae, mouthparts and spiracles. Ventral setae as for genus, but with 3 pairs of anterior anal cleft setae laterad to pregenital disc-pore groups; with bands of short, stout setae present medially across each segment as follows: VII, 4–8; VI, 5–10; V, 5–9; IV, 5–9; III, 3–6; and II, 3–5; with 2–3 setae just anterior to each metacoxa, 1 anterior to each mesocoxa, and 0–1 near each procoxa; longest about 16 µm; with 1–3 pairs of interantennal setae; submarginal setae sparse, with 4–5 pairs posteriorly on abdomen, 2–3 anteriorly on head, and none on thorax. Antennae 6- or 7-segmented (segmentation of long 3rd segment indistinct), 3rd segment longest; total length 111–139 µm; length of terminal seta 7–17 µm, much shorter than stout fleshy setae on apical segment; length of lateral flagellate setae very short, 14–18 µm. Clypeolabral shield 117–126 µm long. Spiracles quite small, each with a distinct, sclerotised spiracular plate; width of peritremes: 23–30 µm. Legs rather small; with tibia and tarsus fused, although on some specimens a slight indication of pseudosegmentation present; lengths (metathoracic): coxa 65–77 µm, trochanter + femur 81–98 µm, tibia + tarsus 104–131 µm; claw 10–15 µm; trochanter with only 1 long seta.

Material examined: LECTOTYPE ♀ (here designated): NEW ZEALAND: *Inglisia patella*, from *Drimys* [=*Pseudowintera* sp.], two adult females, July 1878, W.M.M.; CMNZ: 1/2♀♀ ad. The lectotype female has an everted anal tube, is nearest the original Maskell label, and is clearly marked.
PARALECTOTYPES: (i) the second ♀ ad on the lectotype slide (above). (ii) same data as lectotype, except "tests on leaf", = whole mount slide, NZAC: 1/1♀ ad, 9♂ 2nd.

Other material: NEW ZEALAND: Ex Maskell's dried material, mounted by C.F. Butcher: 1/1♀ ad. Maskell coll., #46 USDA: 1/1♀ ad. DSIR #331, no coll. data, remounted by C.J. Hodgson: 4/4♀♀ ad. **BP**: Lottin Point, Otanga, *Hedycarya arborea*, 27 Apr 1993, RCH, #93-171: 1/1♂ 2nd. As previous, except 29 Sept 1993, #93-314a–c: 3/3♀♀ ad. As previous, except 3 Nov 1993, #93-351a: 1/1♀ ad, 1♀ 2nd, 1 1st + 4 neonates. Onepoto Bay, *Hedycarya arborea*, 15 Mar 1994, RCH, #94-048: 1/1♂ ad. **GB**: Taikawakawa, *Hedycarya arborea*, 2 Feb 1993, RCH, #93-048: 1/1♀ ad. As previous, except 18 Mar 1993, #93-089: 1/1♂ 2nd, 1/1♀ 2nd (+ bit). As previous, except 1 May 1993, #97-067: 1/1♂ 2nd. **TO**: Rangitoto Station, Mangatutu, *Pseudowintera colorata*, 9 Nov 1996, RCH: 1/1♂ 2nd. Ohakune, *Pseudowintera colorata* [as *Drimys*], 6 June 1924, G. Brittin, #107: 2/2♂ 2nd. **NN**: Motueka, *Pseudowintera colorata* [as *Drimys*], G. Brittin coll. 1924, Brittin #107: 1/1[prob]♂ 2nd [without coverslip], USDA. Motueka, *Hedycarya arborea*, 9 Jan 1938, G. Brittin, #107: 2/2♀♀ ad. Motueka, *Elaeocarpus* sp., 2 Feb 1938, G. Brittin, #107, USDA, #107: 2/1♀ ad, 2 pupae. Whangamoa

Saddle, *Pseudowintera axillaris*, 18 Sept 1968, J.A. de Boer, #438: 1/2♂ 2nd, [+3♀ 2nd, prob. *Ctenochiton* sp.]. **BR**: Buller Gorge, *Pseudowintera colorata*, 17 Mar 1971, J.A. de Boer, #724: 1/1♀ ad (split dorsoventrally) + 1/1♀ ad *Plumichiton flavus* (split dorsoventrally). Fletcher's Creek, nr Inangahua, *Pseudowintera colorata*, 7 Mar 1972, J.A.K. Farrell: 1/1♀ ad (v. poor). Redman's Creek, nr. Reefton, *Pseudowintera colorata*, 6 Nov 1972, J.A. de Boer, #952: 1/1♀ ad. Murchison, nr upper Matakitaki, *Pseudowintera colorata*, 5 Jan 1998, C.J. Hodgson, #98-074: 1/1♀ ad. **MC**: [On hill above Lyttelton], on *Pseudowintera* [as *Drimys*] sp., June 1881, W.M.M., NZAC: 2/1 1st, 1/rostrum, antenna, foot and spines (poor). Riccarton Bush, *Pseudowintera colorata* [as *Drimys*], 31 Dec 1916, G. Brittin, #107: 1/1♀ ad. Christchurch, *Pittosporum* sp., 13 Aug 1921, J.G. Myers, BMNH: 1/3♀♀ ad. Christchurch, *Pseudowintera colorata* [as *Drimys*], no date, G. Brittin #107, BMNH: 1/1♀ ad. **FD**: Thompson Sound, Bauza I, *Pseudowintera colorata*, Mar 1984, C.F. Butcher, #98-072: 1/2♀♀ ad. Charles Sound, Elaenor I, *Pittosporum colensoi* underside leaves, 26 Jan 1996, RCH: 11/9♀♀ ad, 9 (settled) 1st, 5 crawlers.

Remarks. The main characters of adult female *Inglisia patella* are:

(i) the decagonal, conical shape of the test;
(ii) the decagonal shape of the body margin;
(iii) the shape of the anal plates and the shape and distribution of the anal plate setae;
(iv) the presence of 2 types of marginal spines;
(v) the presence of 2 'cribriform'-like areas medially on the abdomen;
(vi) the absence of a posterior spiracular disc-pore band;
(vii) the position of the vulva, towards the middle of the abdomen;
(viii) the presence of a spiracular plate around each spiracle.

Ben-Dov (1993) included 17 species in the genus *Inglisia*. The senior author has seen most of these species and he agrees with Morrison & Morrison (1922) that none are congeneric with *I. patella*. Indeed, a morphological study of all the life stages of *I. patella*, including the adult male, suggests that *Inglisia* is a plesiomorphic genus and shares few characters with other known soft scales. *Inglisia*, therefore, appears to be a monotypic genus endemic to New Zealand.

Inglisia patella is an unusual and distinctive species and is quite unlike any other known from New Zealand. Note: the measurements of the limbs, etc. given above are about 10% smaller than those given by Hodgson (1994a); the reasons for this are unclear.

Biology. Normally located on the underside of leaves of its favoured host plants: species of *Hedycarya, Pittosporum,* and *Pseudowintera.* The number of generations per year is uncertain but, as the immature stages have been recorded in September and March, it is likely that there are at least two generations, one in the spring and the other in the autumn.

Pathogens and parasitoids. Hymenopterous parasitoids recorded are: Aphelinidae: *Bardylis* sp.; Platygastridae: *Errolium* sp. (undescribed); Pteromalidae: *Aphobetus nana* (Bouček).

Distribution. In lowland forest throughout New Zealand (Map 21).

Genus *KALASIRIS* Henderson & Hodgson, new genus

Type species: *Ctenochiton perforatus* Maskell (here designated)

Diagnosis. Adult female. Test: glassy, roundish, thin at first, thickening with maturity.

Shape: mature adults fairly small (less than 4.5 mm long), oval to almost round, moderately convex when mature, shrinking towards anterior end during larviposition so that posterior end of test forms a brood chamber; anal cleft shallow; colour either translucent or light greenish, sometimes with a reddish stripe when immature.

Dorsum: derm membranous. Dorsal setae absent. Dorsal pores forming a distinct reticulate pattern delineating reticulation areas (which underlie wax plates of test), in 5 or 7 longitudinal rows, with 5–8 reticulation areas between anal plates and anterior margin and 26–29 areas around margin. Dorsal pores of 3 or 4 types: (i) small, dark microductules, each with a long inner filament with a small balloon-like proximal end: throughout but mainly in lines of reticulation; (ii) simple pores, flat: of 2 sizes: (a) largish pores laterad to anal plates and/or in a submarginal band, and (b) smaller pores within reticulation lines; and (iii) macropores, rather flat, round to oval, smaller than pregenital disc-pores (absent on *K. paradepressa*); when present, restricted to reticulation lines and most abundant medially. Preopercular pores, dorsal tubercles and dorsal tubular ducts absent. Anal plates together widest at anterior 1/5th to 1/4th, tapering to a narrow apex, often with a small pointed protrusion apically; each plate with 4 finely spinose setae, 2 along inner margin, 1 apically and another posteriorly on upper surface near apex. Anal plates without supporting bars or plates. Anogenital fold with 2 pairs of long setae along anterior margin and a single seta on each lateral margin. Anal tube quite long; anal ring with 6 setae.

Margin: marginal setae abundant, strongly spinose with narrow basal sockets, in a single marginal line which also extends at least part-way up anal cleft (few at distal end only on *K. perforata*); reticulation setae usually larger; marginal setae on anal lobe undifferentiated. Stigmatic clefts shallow but distinct, without stigmatic sclerotisations; each cleft with a single spinose, stigmatic spine; rather short, never longer than about 2 × length of longest marginal setae. Eyespots present.

Venter: pregenital disc-pores with mainly 8–10 outer loculi and a single oval inner loculus; distributed across most or all abdominal segments medially and with groups on most mediolateral folds. Spiracular disc-pores with mainly 5 loculi, in narrow bands between spiracles and margin; with 0–5 extending medially past peritreme. Preantennal pores present or absent. Ventral microducts in species-specific distributions. Ventral tubular ducts of 2 types: (i) a larger duct, forming a distinct submarginal band, some ducts opening very close to margin; most ducts near margin lying radially; and (ii) a smaller duct, either without a terminal gland or with only a small gland, present medially on posterior abdominal segments and laterad to anal cleft. Ventral setae: with 1–2 pairs of anterior anal cleft setae; hypopygial setae absent; with pairs of long setae restricted to either segment VII or segments VI and VII; other setae distributed as for family. Antennae well developed, 6- or 7-segmented (3rd segment (or 3rd+4th in 7-segmented antennae) subequal to or longer than other 5 segments); setal distribution as for family. Mouthparts normal and not displaced. Spiracles typical of family. Legs well developed, each with a separate tibia and tarsus but no tibio-tarsal articulatory sclerosis; distribution of leg setae as for family; claws without a denticle; claw digitules similar and broad; tarsal digitules dissimilar, 1 shorter and narrower than other; tarsal campaniform pores absent. Vulva opening posteriorly on segment VII.

Remarks. This genus contains three species: *Kalasiris depressa* (Maskell), **n. comb.**, *K. paradepressa* Henderson & Hodgson **n. sp.** and *K. perforata* (Maskell) **n. comb.**

The main diagnostic characters of the species in this genus are:
(i) marginal setae particularly abundant, with some extending up margins of anal cleft (few there on *K. perforata*);
(ii) at least a few larger simple pores dorsally on either side of anal plates, usually common and forming a group;
(iii) 2 types of ventral tubular ducts, a larger type submarginally and a smaller type medially and mediolaterally on posterior abdominal segments and laterad to anal cleft, where common;
(iv) ventral tubular ducts present in a submarginal band near or on margin, the ducts often lying radially;
(v) groups of ventral tubular ducts never present near mouthparts.

Two types of ventral tubular duct also occur on *Ctenochiton chelyon,* but they are very few and do not have this distribution.

Species in the genus *Kalasiris* are similar to those in *Ctenochiton* and *Crystallotesta* in having abundant pregenital disc-pores medially across the abdominal segments, each pore with mainly 8–10 loculi. In addition, species in the genus *Crystallotesta* also resemble those in *Kalasiris* in having:
(i) 2 types of ventral tubular duct;
(ii) small spiracles;
(iii) abundant spinose marginal setae approximately evenly spaced around margin;
(iv) large simple pores on the dorsum, generally associated with the anal plates.

However, *Crystallotesta* species differ in having ventral tubular ducts present medially on the thorax and in broad submarginal bands, with the ducts not tending to lie radially.

Ctenochiton species differ from those of *Kalasiris* in:
(i) having very large spiracles;
(ii) having spinose marginal setae rather unevenly spaced around the margin;
(iii) the distribution of the ventral tubular ducts.

The species currently placed in *Kalasiris* are all endemic to New Zealand.

Name derivation. From *kalasiris* (Gr., f.) meaning "garment fringed at the base", referring to the beautiful marginal wax fringe in *K. perforata* (Maskell).

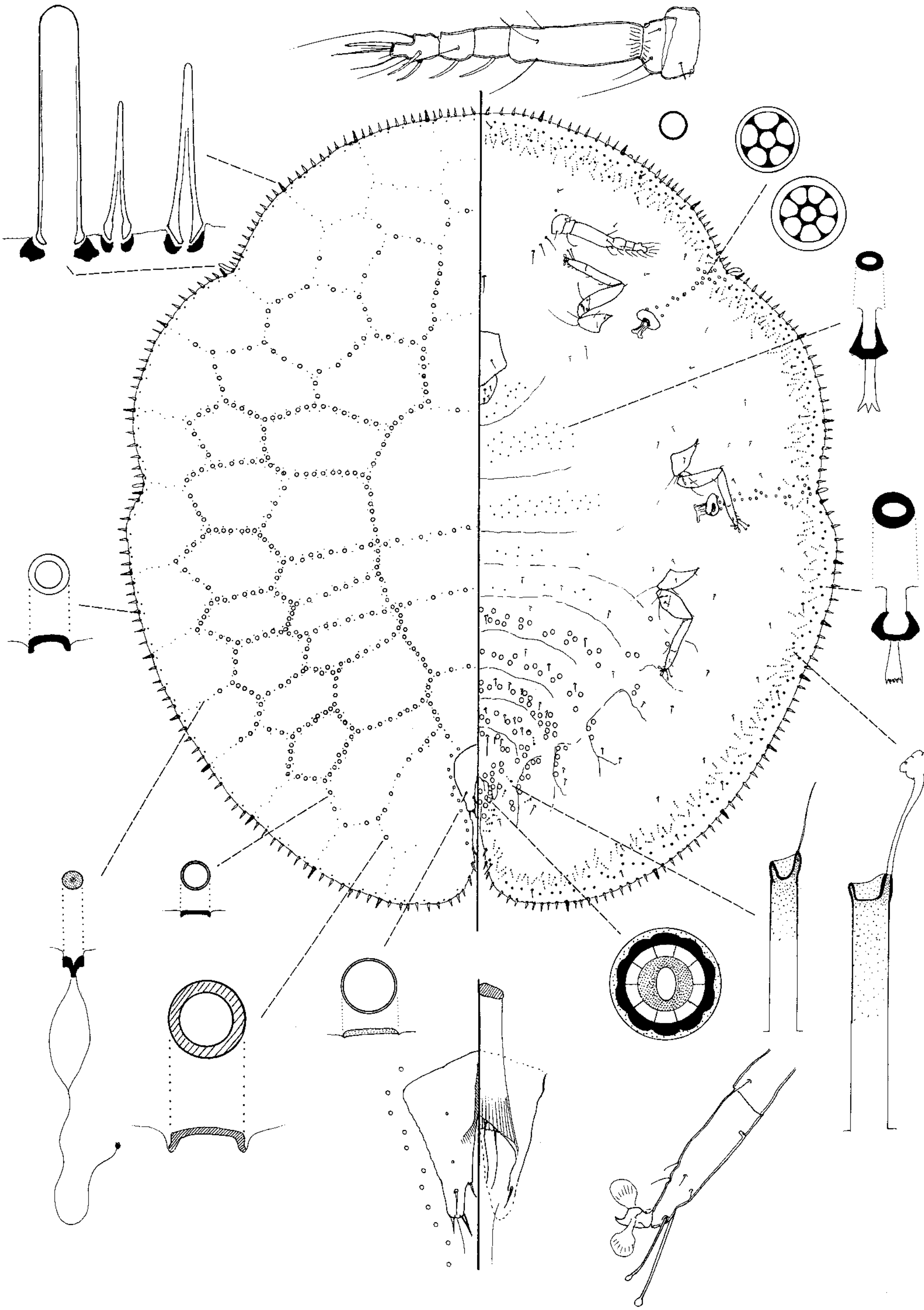


Fig. 117. *Kalasiris depressa* (Maskell), **n. comb.**, adult female.

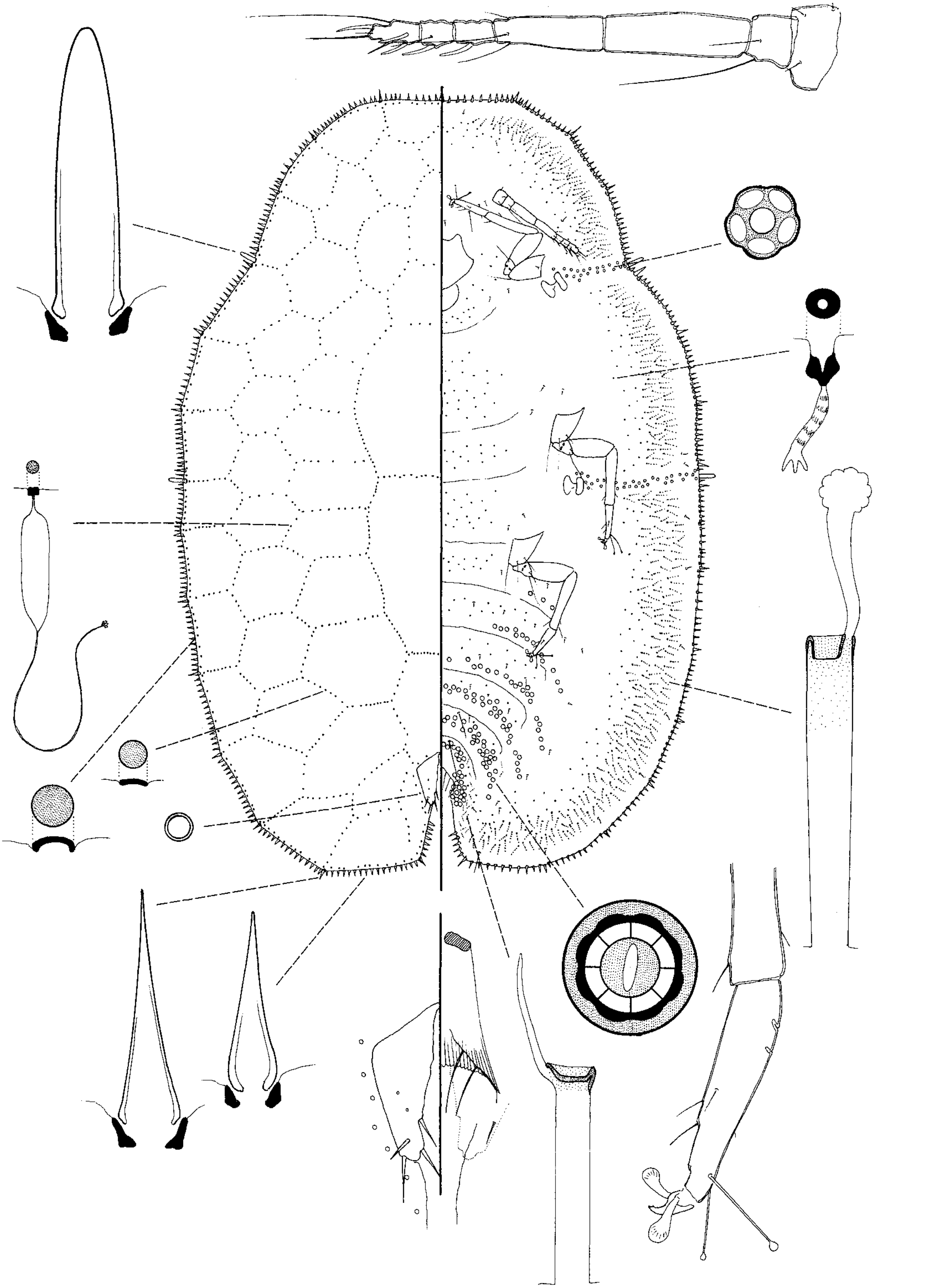


Fig. 118. *Kalasiris paradepressa* Henderson & Hodgson, **n. sp.**, adult female.

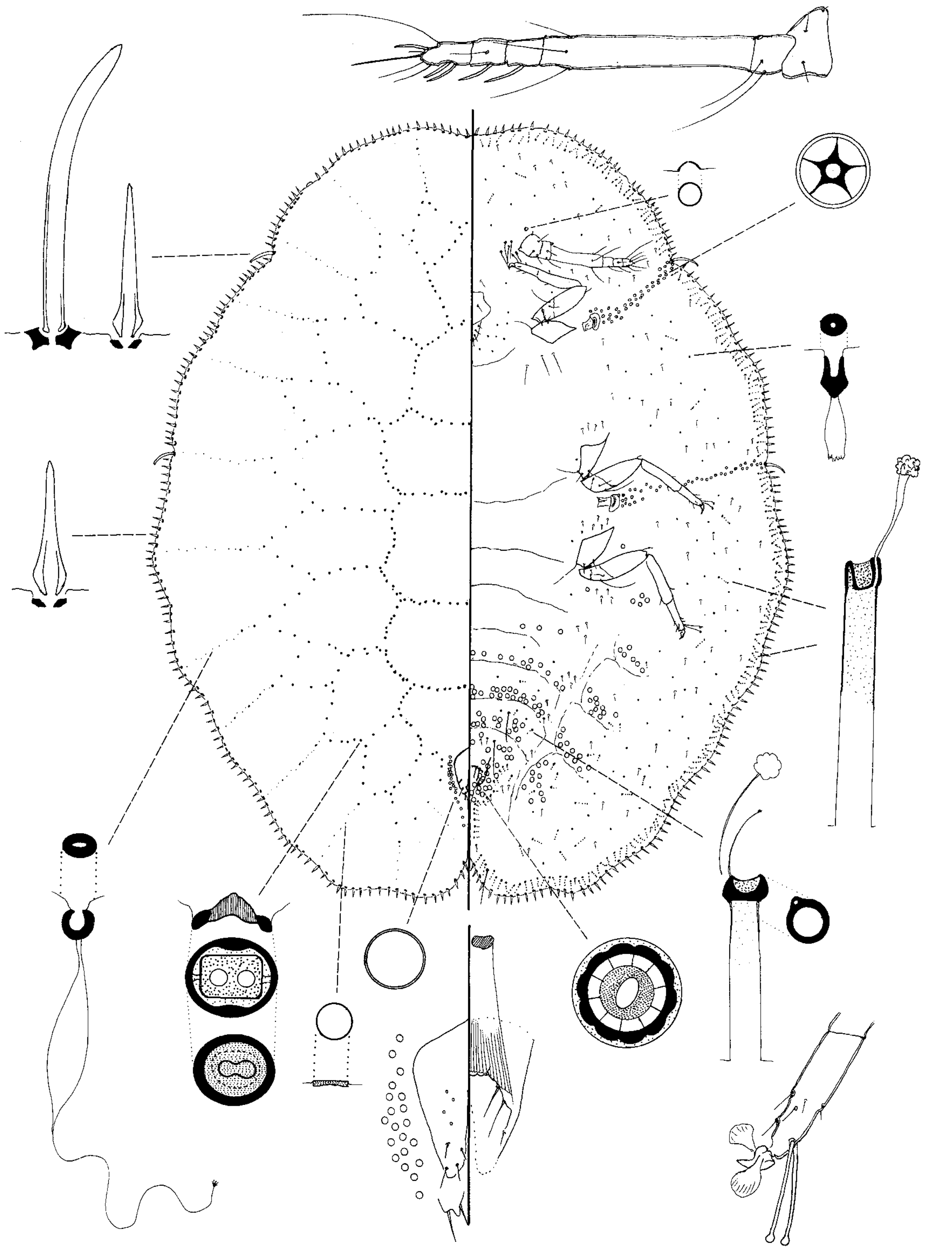


Fig. 119. *Kalasiris perforata* (Maskell), **n. comb.**, adult female.

Key to adult female *Kalasiris*

1 Pairs of long pregenital setae only present on abdominal segment VII; ventral microducts of 2 sizes, largest forming a marginal band between margin and submarginal band of ventral tubular ducts, smaller microducts abundant medially on thorax .... ***depressa***

—Pairs of long pregenital setae present on 2 abdominal segments (VII and VI); ventral microducts of 1 size, with none present between margin and submarginal band of ventral tubular ducts 2

2 Ventral tubular ducts in a distinct narrow marginal band about 1 duct wide, most ducts lying radially but often with a few also scattered submarginally away from marginal band; with, at most, 2–3 marginal setae extending up anal cleft; ventral microducts absent medially on thorax .... ***perforata***

—Ventral tubular ducts in a submarginal band distinctly several ducts wide, with a clear marginal area free from ducts but sometimes with a few ducts scattered more medially on submargin; marginal setae extending part way up anal cleft; ventral microducts frequent medially on thorax ....***paradepressa***

Kalasiris depressa (Maskell) new combination

Figs C60, C61, 117

Ctenochiton depressus Maskell, 1884: 132; –Maskell, 1887: 66 [description]; –Maskell, 1892: 19 [taxonomy]; – Maskell, 1895a: 12 [checklist]; –Cockerell, 1896, 330 [checklist]; –Fernald, 1903: 159 [world catalogue]; – Hutton, 1904: 226 [checklist]; –Myers, 1922: 199 [checklist]; –Wise, 1977: 104 [checklist]; –Deitz and Tocker, 1980: 28 [checklist]; –Ben-Dov, 1993: 100 [world catalogue].
Ctenochiton depressus (small form) Maskell, 1892: 19.
Ctenochiton depressus forma *minor* Maskell, 1895a: 12 [checklist]; –Cockerell, 1896: 330 [checklist].
Ctenochiton depressus minor Maskell; –Fernald, 1903: 160 (synonymy); –Wise, 1977: 104 [checklist]; –Deitz & Tocker, 1980: 30 [checklist].
Ctenochiton depressum minor; –Ben-Dov, 1993: 100 [mis-spelling of *depressus*].

Unmounted material: mature female moderately convex and rounded like a shell; when larvipositing, test appearing bicoloured, greenish in anterior half due to colour of underlying female and fawn in posterior half due to colour of nymphs (Fig. C61). The following description by Maskell (1887, p. 66) is here believed to refer to old females attacked by fungus: "Test of adult female flat, nearly circular, thin, waxy, greyish coloured; fringe inconspicuous or sometimes absent. No perforations or air-cells. Diameter about 1/7 in." "Adult female filling the test, but shrivelling to the anterior end of the test at gestation. Colour brownish to grey."

Mounted material: body oval to almost round; length 2.0–4.5 mm; breadth 1.9–4.1 mm; anal cleft about 1/8th body length; stigmatic clefts shallow.

Dorsum: dorsal pores in a reticulate pattern, with reticulation areas in 7 longitudinal rows, with 8 reticulation areas between anal plates and anterior margin and with 29 areas around margin. Dorsal pores of 3 types: (i) microductules: present throughout, but most frequent associated with lines of reticulation; (ii) simple pores: rather variable in size: (a) small, flat pores, slightly larger than microductule pore: frequent associated with lines of reticulation; and (b) rather larger simple pores: in a sparse band near margin; and (iii) large, heavily sclerotised macropores, slightly sunken and convex: about equally abundant throughout except near margin; with 7–10 in posterior medial macropore line. Anal plates 137–180 µm long, combined widths 135–173 µm; with 0–4 minute pores on dorsal surface of each plate; length of setae: inner margin 1, 12–20 µm; inner margin 2, 14–20 µm (sometimes larger and stouter than apical seta); apical, 9–24 µm and outer margin, 18 µm. Anogenital fold with 2–3 pairs of setae along anterior margin and 1 seta on each lateral margin; longest 32–60 µm.

Margin: marginal setae spinose, 9–20 µm long, with 18–27 laterally between stigmatic clefts; reticulation setae only slightly larger; marginal setae extending about a third to a half-way up anal cleft margin. Stigmatic spines rather stout and blunt, sometimes slightly curved, with quite well developed basal sockets; length 18–27 µm. Eyespot present.

Venter: pregenital disc-pores with mainly 10 loculi (range 7–11); number per segment (medially/mediolaterally on each side): VII, 10–24/24–32; VI, 26–50/6–11; V, 26–42/3–7; IV, 22–43/2–7; III, 2–16/1–4; and II, 0/0–1; with none laterad to metacoxae. Spiracular disc-pores in bands 1–4 pores wide; with 13–26 in each band; each anterior band with 0–5 pores present a short distance mesad to peritremes. Ventral microducts of 2 sizes: (i) larger microducts: present in a distinct submarginal band, lying mainly between ventral tubular ducts and margin or within band of tubular ducts; and (ii) smaller microducts: present medially from labium to abdominal segment II. With 1–2 preantennal pores/antenna. Ventral tubular ducts of 2 types, as for genus: smaller duct rather short, with a fine inner ductule, lacking a terminal gland; frequent on either side of anal cleft and extending around anogenital area but rarely extending onto more anterior abdominal segments except a single duct usually present laterally on segment VI; very occasionally, a few also present in submarginal band of larger ducts. Ventral setae: ventral anal lobe setae 18–23 µm long; with 1 pair of anterior anal cleft setae; with long pregenital setae restricted to a pair medially on abdominal segment VII; number of short setae medially on each abdominal segment: VII, 4–8; VI, 6–8; V, 4–10; IV, 2–8; III and II, 0–4; with 0–2 setae near each metacoxa, 0–2 near each mesocoxa, and with 1–3 near each procoxa (often rather spinose); length of setae associated with each procoxa quite long, 14–20 µm, sometimes very spinose; with 3–4 pairs of interantennal setae laterally plus 1–2 setae medially; with 5–6 submarginal setae on each side between each stigmatic area. Antennae 6-segmented, with a constriction between 2nd and 3rd segment; total length 270–323 µm; length of apical setae 32–56 µm; fleshy seta near apex of each antenna particularly stout. Length of clypeolabral shield 131–146 µm. Width of spiracular peritremes: anterior 45–65 µm, posterior 45–74 µm. Legs: lengths (metathoracic): coxa 45–67 µm, trochanter + femur 118–151 µm, tibia 81–119 µm, tarsus 63–98 µm, claw 12–18 µm.

Material examined: LECTOTYPE ♀ (here designated): NEW ZEALAND: labelled "*Ctenochiton depressus* Mask., ex Mask. dry material #36, mounted 2.III.72". NZAC; mounted (2 March 1972) by J.A. de Boer: 1/1♀ ad.

PARALECTOTYPES: NEW ZEALAND: (i) labelled "*Ctenochiton depressus*, from *Plagianthus*, adult male and female 2nd stage, May 1883, W.M.M."; gold label: Entomology Div., DSIR, NZ, W.M. Maskell Collection, NZAC: 1/1♂ ad, 1♂ 2nd; the "female 2nd stage" is actually a 2nd-instar male. (ii) as above, except "antenna and foot of female" (actually those of a 2nd-instar male with part of the body margin attached); CMNZ: 1/1♂ 2nd. (iii) mounted from W.M. Maskell's dried material of *Ctenochiton depressus* by RCH, no date or host, NZAC #95-019a–b: 2/(part of)1♀ ad, 1♂ 2nd. (iv) *Ctenochiton depressus* Mask., New Zealand, no data, Mask. Coll. no. 36, USNM: 1/1♀ ad. [Paralectotype: collection data as for paralectotype (ii) except "adult female", CMNZ: 1/1♀ ad, a misidentification, now considered to be *Ctenochiton chelyon* described as new above].

***Ctenochiton depressus minor* Maskell (small form)**: LECTOTYPE ♀ (here designated): NEW ZEALAND: labelled "*Ctenochiton depressus* small form, adult female. 1891, W.M.M."; NZAC: 1/1♀ ad.

PARALECTOTYPES: ex Maskell's dry material #201, mounted 2 Mar 1972 by J.A. de Boer: 2/4♀♀ ad. Mounted from W.M. Maskell's dry material *Ctenochiton depressus* small form, by RCH, NZAC #95-020a–f: 6/3♀♀ ad, 2♀ 3rd, 1♂ 2nd. *Ctenochiton depressus minor* Mask., no data, New Zealand, Mask. coll. no.201, USNM: 1/1♀ ad.

Other material: NEW ZEALAND: **ND**: Omahuta SF, Kauri Sanctuary, *Coprosma* sp., 6 Oct 1980, J.S. Noyes, #81-40c: 1/♂ 2nd. **AK**: Huia Dam, *Coprosma* sp., 31 Oct 1980, C.F. Butcher, #80-311e: 1/1♀ ad. Waitakere Ra, Karamatura V, *Coprosma arborea* underside leaves, 21 Oct 1994, RCH, #94-093a–f: 6/6♀♀ ad. As previous, except 1 Dec.1994, #94-125a–b: 2/1♀ ad, 11 1st. As previous, except 31 July 1995, 1/1♂ 2nd. As previous, except 8 Oct 1995, #95-098a–e: 5/2♀ 3rd, 2♂ 2nd, 2 pupae. As previous, except 11 Sept 1995, G. Hall & L.H. Clunie, #95-099: 1/1♂ 2nd. Waitakere Ra, 179 Laingholm Drive, *Coprosma arborea* leaves, 13 Sept 1997, N.A. Martin, #97-129a–c: 3/4♀ 3rd, 1♂ 2nd. **BP**: Hicks Bay, Wharekahika River, *Coprosma rhamnoides*, 20 Sept 1992, RCH, #92-304a–b: 2/4♀♀ ad, 1♂ 2nd. **TK**: Mt Egmont, *Coprosma* sp. leaves, 24 Feb 1983, C.F. Butcher, #83-067g: 1/2♀♀ ad. **NN**: Golden Downs, Gordons Creek, *Coprosma* sp., 4 Dec 1963, W.A. Holloway, FRNZ no. R(a)66: 2/2♀♀ ad. Wairoa Gorge, *Coprosma ?colensoi*, 13 Dec 1967, J.A. de Boer, no. 290: 1/1♀ ad (split dorsoventrally). **FD**: Breaksea I, (no host), 26 May 1982, C.F. Butcher, #82-175h: 2/1♀ ad (old), 1♂ 2nd. Dusky Sound, Seal I, *Coprosma foetidissima*, 8 Mar 1983, C.F. Butcher, #83-332g: 3/4♀♀ ad. Resolution I, Disappointment Cove, *Coprosma colensoi*, 10 Mar 1983, C.F. Butcher, #83-293i, & 83-320g: 4/4♀♀ ad.

Remarks. Maskell's original material was collected off *Plagianthus* sp. and *Cyathea* sp. and was sent to him from Hawke's Bay by Rev. Colenso (Maskell, 1884, p. 133). Two of the original slides of *Ctenochiton depressus* Maskell in the syntype series available for study include a 2nd-instar male, a piece of a 2nd-instar male and an adult male. None of these specimens is ideal for designation as lectotype. In addition, a third slide listed by Deitz & Tocker (1980) is clearly a misidentification by Maskell, as it is actually an adult female of *Ctenochiton chelyon* (described as new above). However, we are confident that all the dry material in Maskell's collection #36 represents some of the original material and that it agrees with his concept of *C. depressus*. We therefore consider it to be syntypic and have designated one of the two adult females mounted from the dry material collection #36 as lectotype of *Ctenochiton depressus*. The only remaining unmounted Maskell dry material of *C. depressus* are nymphs.

The adult female lectotype of *Ctenochiton depressus minor* Maskell (what Maskell originally described as the "small form") agrees both with further adult females mounted from Maskell's dry material collection #201 relating to his "small form" description and with the above females of *C. depressus* (#36). We therefore uphold their synonymy by Fernald (1903).

Adult females of *K. depressa* are characterised by the following combination of characters:

(i) a submarginal band of tubular ducts, separated from the margin by a marginal band of larger ventral microducts;
(ii) smaller ventral microducts restricted to medially on thorax, posterior to labium and abdominal segment II;
(iii) a pair of long pregenital setae on abdominal segment VII only;
(iv) dorsal macropores flat and simple, present throughout except on radial reticulation lines near margin;
(v) a distinct constriction present between the 2nd- and 3rd-antennal segments (also present on *K. paradepressa*);
(vii) rather short antennae (270–323 µm).

K. depressa is close to *K. paradepressa,* but the latter has no large dorsal macropores, and to *K. perforata,* but the latter species has 7 longitudinal rows of reticulation areas on the dorsum rather than 5. For further differences, see under these species.

Maskell (1884) states that the original material was collected off *Plagianthus* sp., although all subsequent collections have been from *Coprosma* sp. As the type series appears to consist of adult and 2nd-instar males, *Plagianthus* may not be a true host of *K. depressa* as male stages are known to settle on many plant genera apparently unsuitable for the females.

Biology. *K. depressa* favours *Coprosma* spp. with smallish leaves as host plants. It apparently overwinters as nymphs, becoming adult and larvipositing in the spring to early summer. Post-ovipositional females have a distinctively contracted abdomen, which is folded into a wide-mouthed pocket; the innermost fold is formed at about abdominal segment II, which comes to lie beneath the anterior end of the thorax, about level with the prothoracic legs. Another sharp fold is formed across the body approximately between the posterior stigmatic clefts, forming the outer margin of the pocket; and the anal cleft and abdominal body margin are also retracted anteriorly, pulling part of the abdominal dorsum round to the ventral surface; the derm between the pocket margins remains unfolded (unlike the folds on *K. perforata* post-ovipositional females).

Pathogens and parasitoids. Hymenopterous parasitoids recorded are: Encyrtidae: *Adelencyrtoides inconstans* Noyes and *A. variabilis* Noyes; Pteromalidae: *Aphobetus nana* (Bouček).

Distribution. Throughout, from Northland to Fiordland, but not recorded from eastern South Island (Map 22).

Kalasiris paradepressa Henderson & Hodgson new species

Fig. 118

Unmounted material: unknown.

Mounted material: body oval, with very shallow stigmatic clefts and a shallow anal cleft, about 1/9th body length; length 3.0–5.0 mm; breadth 2.1–3.6 mm.

Dorsum: dorsal pores in a reticulate pattern, with reticulation areas in 7 longitudinal lines, with 5–6 reticulation areas between anal plates and anterior margin and with 28 areas around margin. Dorsal pores of 4 types: (i) small, dark microductules: present throughout but most frequent within lines of reticulation; (ii) slightly larger, dark, granular, flattish simple pores: frequent in all reticulation lines; (iii) similar-sized simple pores which appear pale (possibly a paler type (ii)): scarce, mainly laterad to anal plates; and (iv) rather larger simple pores, similar to (ii) but restricted to around the margin and laterad to anal plates; macropores absent. Anal plates rather elongate, 189–194 µm long, combined widths 183–218 µm; with 0–2 minute pores on dorsal surface of each plate; setae finely spinose, lengths: inner margin both 22–26 µm; apical seta, 32–43 µm; outer margin setae all missing. Anogenital fold with 2 pairs of setae along anterior margin (longest about 50 µm) and a shorter pair on lateral margins.

Margin: marginal setae spinose, 10–25 µm long; with 36–48 on each side between stigmatic clefts; reticulation setae distinctly larger and usually set slightly onto dorsum; marginal setae extending about a third to a half-way up margin of anal cleft. Stigmatic spines rather short, stout and blunt, with a quite well developed basal socket; length 21–32 µm. Eyespot usually obscure or possibly absent.

Venter: pregenital disc-pores with mainly 8 loculi (range 7–9); number of pores per segment (medially/mediolaterally on either side): VII, 22–30/19–30; VI, 42–

56/5–9; V, 46–64/4–8; IV, 28–42/3–4; III, 16–22/2–4; and II, 2–10/0–2; with none laterad to metacoxae. Spiracular disc-pore bands widest near peritreme and margin; with 18–26 in each anterior band and 16–38 in each posterior band; each anterior band with 1 pore present a short distance mesad to peritremes. Ventral microducts of 1 type, present in a distinct submarginal band just mesad to submarginal band of ventral tubular ducts and also frequent medially on all thoracic segments, rather less frequent medially on abdominal segments; also present posterior to mouthparts. Preantennal pores apparently absent. Ventral tubular ducts as for genus: with a distinct marginal area free from ducts; submarginal band of ducts fairly narrow but also extending medially along margins of each spiracular disc-pore band; absent elsewhere; smaller ducts, rather short, with a fine inner ductule appearing to arise from side of each cup-shaped invagination and lacking a terminal gland; frequent on either side of anal cleft and extending around anogenital area on segments VII and VI. Ventral setae: ventral anal lobe setae about 25 µm long; with only a single pair of anterior anal cleft setae; with a pair of long pregenital setae medially on abdominal segments VII and VI; number of short setae medially on each abdominal segment: VII, 1–4; VI, 4–6; V–III, 4–9; and II, 2–6; with 2 setae near each metacoxa, 2–3 near each mesocoxa, and 2–4 (rather spinose) setae near each procoxa, length of setae associated with coxae all short, those near procoxae, 7–9 µm; with 3–4 pairs of interantennal setae laterally plus 1 seta medially; with 1–3 submarginal setae on each side between stigmatic areas. Antennae 7-segmented, occasionally 6-segmented with an indistinct pseudosegment; with a constriction between 2nd and 3rd segment; total length 394–432 µm; length of apical setae 25–41 µm; fleshy seta near apex particularly large. Length of clypeolabral shield 180–189 µm. Width of spiracular peritremes: anterior 52–68 µm, posterior 61–76 µm. Legs: lengths (metathoracic): coxa 70–83 µm, trochanter + femur 189–198 µm, tibia 151–175 µm, tarsus 72–108 µm, claw 18–22 µm.

Material examined: HOLOTYPE ♀: NEW ZEALAND: **MC**: Lincoln, *Hebe odora*, 16 Nov 1967, B.P.J. Molloy, DSIR #283, NZAC: 1/1♀ ad.
PARATYPES: (i) as for holotype, DSIR #283 NZAC: 1/1♀ ad. (ii) as previous, but off *Hebe brachysyphon*, #281, NZAC: 2/2♀♀ ad.

Remarks. Adult female *K. paradepressa* have the following combination of characters:

(i) no large macropores on dorsum (present on the other two species);
(ii) ventral tubular ducts in a submarginal band 4–5 ducts wide (narrower on the other two species);
(iii) pairs of long pregenital setae on abdominal segments VI and VII (as on *K. perforata*);
(iv) presence of ventral microducts medially on the thorax (as on *K. depressa*);
(v) extension of the marginal spinose setae up the anal cleft (as on *K. depressa*);
(vi) reticulate pattern in seven longitudinal rows (as on *K. depressa*);
(vii) with a fairly distinct constriction between the pedicel and segment III on the antennae (as on *K. depressa*);
(viii) the presence of distinct segmentation or pseudo-segmentation in the long '3rd' segment, giving 7-segmented antennae (absent on the other two species).

Biology. Unknown.

Distribution. This species has only been collected off two species of *Hebe* on the one occasion (at Lincoln, South Island) (Map 23).

Name derivation. This species was initially mistaken for *K. depressa* and so the name refers to the similarity: *para* (Gr.) meaning near and *depressa*, the species it resembles.

Kalasiris perforata (Maskell) new combination

Figs M20, C62, C63, 119

Ctenochiton perforatus Maskell, 1879: 208; –Maskell 1884: 130 [taxonomy]; –Maskell 1887: 72 [description]; –Riley & Howard, 1893: 282 [poss. Californian record]; –Cockerell, 1894a: 32, 34 [checklist]; –Maskell, 1895a: 13 [checklist]; –Cockerell, 1896, 330 [checklist]; –Howard, 1897: 81 [record correction]; –Fernald, 1903: 161 [world catalogue]; –Hutton, 1904: 226 [checklist]; –Myers, 1922: 199 [checklist]; –Green, 1929: 377 [record]; –Gourley, 1930: 7, 10 [parasitoid]; –Fulmek, 1943: 30 [parasitoid]; –Wise, 1977: 104 [checklist]; –Deitz & Tocker, 1980: 31 [checklist]; –Ben-Dov, 1993: 102 [world catalogue]; –Henderson, 1995: 105 [lectotype designated].

Unmounted material: young adult female thin, nearly flat; mature female more convex; test glassy, each plate with lines of air cells radiating from centre; fringe of long curved wax plates rather like the wing feathers of a bird. Colour transparent to greenish. "Adult female filling the test, shrivelling to the anterior end of the test at gestation." (Maskell, 1887, p. 72).

Mounted material: body oval; anal cleft about 1/8th body length. Old females shrivelled (as above), with margin characteristically rather sclerotised and scalloped (folded); length 2.0–4.0 mm; breadth 1.75–4.0 mm;

Dorsum: dorsal pores in a reticulate pattern, with reticulation areas in mainly 5 longitudinal rows (but with two additional reticulation areas split from submedian row on each side, 1 on thorax and 1 on abdomen) and with probably 7 areas between anal plates and anterior margin and with 26 areas around margin. Dorsal pores of 4 types: (i) microductules: present throughout, but most frequent within reticulation lines; (ii) simple pores, slightly larger than microductule pore and flat: frequent, within reticulation lines and near margin; (iii) larger, slightly convex, simple pores: present in an elongate group around anal plates but most abundant on either side, with from 8–25 laterad to posterior margin of each anal plate; and (iv) heavily sclerotised macropores, convex and slightly sunken; rather distinctive, sometimes rather square and often appearing to have a dumbbell-shaped area medially when viewed from above under light microscope, but bilocular when viewed with the scanning electron microscope (Fig. M20): most abundant in median and submedian lines of reticulation, becoming less common laterally; with 11–35 in posterior medial macropore line. Anal plates 117–159 µm long, combined widths 100–166 µm; with 0–4 minute pores on dorsal surface of each plate; length of setae: inner margin 1, 12–14 µm; inner margin 2, 11–16 µm; apical, 19–25 µm, and outer margin, 12–16 µm. Anogenital fold with 2 pairs of setae along anterior margin, longest 34–54 µm, and 1 shorter pair on lateral margins.

Margin: marginal setae spinose, 11–25 µm long; with 17–40 on each side between stigmatic clefts; marginal setae absent along margins of anal cleft or, if present, with only 2–3 along outermost margin. Stigmatic spines tapering slightly, rather blunt and slightly curved, with a quite well-developed basal socket; length 21–50 µm.

Venter: pregenital disc-pores with mainly 10 loculi; number per abdominal segment (medially/mediolaterally on each side): VII, 14–70/9–51; VI, 38–98/8–24; V, 44–112/3–21; IV, 22–8613–14/; III, 2–22/2–11; and II, 0–18/0–5; with 0–4 laterad to each metacoxa. Spiracular disc-pores in bands 1–4 pores wide; with 17–73 in each band; each anterior band with 0–3 pores present a short distance mesad to peritremes. Ventral microducts of 1 type: scattered in a broad submarginal band, near mouthparts and occasionally near each meso- and metacoxa and medially on more posterior abdominal segments; absent medially on thorax. With a single preantennal pore/antenna. Ventral tubular ducts as for genus but with marginal ducts abundant as a narrow marginal band, mostly lying very close to margin; also occasionally present on submargin and then more numerous on posterior abdomen; smaller tubular ducts usually lacking a terminal gland but more anterior ducts sometimes with a gland present: abundant on either side of anal cleft and extending around anogenital area and with a few anteriorly, particularly mediolaterally on segments IV to VI. Ventral setae: ventral anal lobe setae 31–90 µm long; with 1–2 pairs of anterior anal cleft setae; with pairs of long pregenital setae restricted to medially on abdominal segments VII and VI; number of short setae medially on each abdominal segment: VII, 4–12; VI–III, 4–8; and II, 0–4; with 2–6 setae near each metacoxa, 4–5 near each mesocoxa, and 1–4 near each procoxa; length of setae associated with each procoxa particularly long, 45–60 µm; with 2–4 pairs of interantennal setae laterally plus 0–1 seta medially; with 1–4 submarginal setae on each side between stigmatic areas. Antennae 6-segmented; total length 300–506 µm; length of apical setae 68–86 µm. Length of clypeolabral shield 135–162 µm. Width of spiracular peritremes: anterior 25–47 µm, posterior 32–54 µm. Legs quite broad; tibio-tarsal segmentation often indistinct; lengths (metathoracic): coxa 72–118 µm, trochanter + femur 176–306 µm, tibia 115–207 µm, tarsus 70–135 µm, claw 18–25 µm.

Material examined: LECTOTYPE ♀: NEW ZEALAND [Hawke's Bay]: "*Ctenochiton perforatus*, from *Parsonsia*, female—2nd stage without fringe, Sept. 1877, W.M.M.", CMNZ: 1/1♀ 3rd moulting into ♀ ad; designated by Henderson, 1995.
PARALECTOTYPES: NEW ZEALAND: (i) ex *Parsonsia*, five females—2nd stage without fringe June 1877, W.M.M., NZAC: 1/5♂ 2nd. (ii) ex *Panax* [=*Pseudopanax*], female—2nd stage with fringe, June 1877, W.M.M., CMNZ: 1/1♀ 2nd. (iii) ex *Coprosma*, head & antenna of male, Nov. 1877 & Dec 1877, W.M.M.: 3/3♂♂ (2 CMNZ, 1 NZAC). (iv) ex *Pittosporum*, adult female, Feb. 1878, W.M.M., NZAC: 1/1 ♀ ad. (v) ex *Coprosma*, two tests with old shrivelled females, May 1878, W.M.M., CMNZ: 1/2♀♀ ad.

Other material: NEW ZEALAND, no host or date, W.M.M., #35 USNM: 1/1♀ ad. Mounted from W.M. Maskell's dry material, Box 27, by C.J. Hodgson (1996), no host or data: 2/2 1st. Mounted from W.M. Maskell's dry collection #34 & #35 by J.A. de Boer (2 Nov 1972): 3/4♀♀ ad, 4♂ 2nd, 1 1st. **ND**: Poor Knights Is, Tawhiti Rahi, *Coprosma* sp., 10 Dec 1980, C.F. Butcher, #81-42g: 3/9♀♀ ad. **AK**: Southern Waitakere Ra, Twin Peaks Tk, 440 m, *Pittosporum kirkii* leaf, 21 Nov 1976, A.R.

Ferguson, #76-334: 1/1♀ ad. **CL**: Little Barrier I, Hamilton track, *Pittosporum umbellatum*, 17 Sept 1994, RCH, #94-078: 1/2♀♀ ad. **BP**: Rotorua, FRI Nursery, *Pittosporum eugenioides*, 30 Oct 1961, R.Zondag, FRNZ R(a)71,72: 9/9♀♀ ad. Rotoehu S.F., *Coprosma lucida*, 8 Feb 1959, R. Zondag: 4/4♀♀ ad. **GB**: Karakatuwhero V. Rd, Waipiata, *Passiflora tetrandra*, 28 Sept 1993, RCH, #93-316a–b: 2/1♀ ad, 1♀ 3rd (+1♂ 2nd unknown sp.). As previous, except *Melicope simplex*, #93-317a: 1/1♀ ad. As previous, 1 May 1993, #93-322b, 1/1♀ (pharate). As previous, 4 Nov 1993, #93-348: 1/1♀ ad. **TO**: Pureora SF, *Pittosporum turneri* (associated hymenoptera card-mounted), Nov 1984, C.F. Butcher, #85-024f: 2/2♀♀ ad. **WN**: Wellington, *Pittosporum* sp., Oct. 1920, J.G. Myers, BMNH: 1/3♀♀ ad, 1♀ 3rd. **NN**: Motueka, Fearons Bush, *Pittosporum* sp., 6 Dec 1931, [no collector], #90-214a–c: 3/3♀♀ ad (poor), 1 pupa. Motueka, *Pittosporum* sp., 21 Feb 1932, G. Brittin, #26: 1/1♀ ad. As previous, 28 Jan 1935, 1/1♀ ad. As previous, 24 Dec 1937: 1/2♀♀ ad. Whakapuaka, *Coprosma* sp. leaves, 3 Dec 1941, no coll., No.540, #83-304d: 3/3♀♀ ad. Port Motueka, *Pittosporum tenuifolium* leaves, 10 Oct 1963, W.A. Holloway, FRNZ #R(a)100: 1/1♀ ad. As previous, 6 Dec 1963, FRNZ #R(a)64,65: 11/11♀♀ ad. Nelson, *Pittosporum eugenioides*, 1 Dec 1967, E. Valentine, #288: 1/3♀♀ ad. Wairoa Gorge, *Coprosma spathulata*, 13 Dec 1967, J.A. de Boer, #291: 1/1♀ ad. Maitai R, *Coprosma* sp., 19 Dec 1967, J.A. de Boer, #314: 1/1♀ ad (split dorso-ventrally). Maitai R, *Coprosma* sp., 17 Jan 1968, J.A. de Boer, #342: 1/1♀ ad. Nelson, *Coprosma* sp., 29 Sept 1968, E.W. Valentine, #441: 1/2♀ 3rd. **BR**: Reefton, *Griselinia littoralis*, 1914, G. Brittin, #8: 1/1♀ ad. **MC**: Christchurch, *Pittosporum* sp., R.G. Hamilton, 17 May 1939: 2/1♀ 3rd, 4♂ 2nd. Christchurch, Orchard belonging to Hamilton, *Pittosporum* sp. leaves, 17 May 1939, G. Brittin dry collection, #94-057a–d: 4/8♂ 2nd, 5♀♀ 2nd, 1♀ 3rd. Christchurch, Riccarton Bush, *Pittosporum eugenioides* underside leaves, 26 Sept 1997, RCH, #97-135a–j: 10/1♀ ad, 2♀ 3rd, 6♂ 2nd, 11 pupae, 3♂♂ ad. Lyttelton, Corsair Bay, 48 Park Tce., *Coprosma repens*, 10 Oct 1976, T. Hay: 1/1♀ ad (good). As previous, 14 Mar 1977, #77-89a: 2/8♀♀ ad (poor). **DN**: Totara, *Discaria toumatou*, 11 Nov 1926, G. Brittin, #26: 1/1♀ ad. Oamaru, *Discaria toumatou.*, 12 Aug 1913, G. Brittin, #26: 1/1♂ ad. **FD**: Manapouri, *Pittosporum* sp., 17 Mar 1984, no coll., #94-054: 1/2♀♀ ad.

Remarks. In addition to the above hosts, Maskell (1887) also recorded *K. perforata* off *Rubus* sp. (Rubiaceae) and *Drimys* [=*Pseudowintera*] sp. (Winteraceae) and from the following localities: **WN**: Wellington; **NN**: Nelson; **MC**: Riccarton Bush; **DN**: Dunedin.

The main features of adult females of *K. perforata* are:

(i) the well-defined, narrow, marginal band of ventral tubular ducts, these ducts mainly lying very close to the margin, but with a few also generally present on the submargin (other two species with a clear marginal area free from ducts);

(ii) the absence of ventral microducts from medially on the thorax (present there on both other species);

(iii) the rather complex form of the dorsal macropores (absent on *K. paradepressa*, simple on *K. depressa*);

(iv) the rather abundant larger simple pores on either side of the anal plates dorsally (fewer on *K. depressa*, smaller on *K. paradepressa*);

(v) pairs of long pregenital setae on the posterior two pregenital segments (as on *K. paradepressa*);

(vi) the very long 3rd-antennal segment (shorter on *K. depressa*, with a pseudosegment on *K. paradepressa*);

(vii) long setae medially near procoxae (short on other two species).

It is close to *K. depressa* but the latter has:

(i) 2 types of ventral microduct, the larger forming a marginal band between the ventral tubular ducts and the margin (but absent submarginally);

(ii) an abundant group of smaller ventral microducts medially on the thorax

(iii) marginal setae extending some way up the margins of the anal cleft;

(iv) the dorsal macropores appearing rather simple and lacking the dumbbell-shaped markings;

(v) with a distinct clear submarginal area between the band of ventral tubular ducts and the margin, with no ventral tubular ducts on the marginal areas;

(vi) with a pair of long pregenital setae on abdominal segment VII only;

(vii) small ventral tubular ducts on either side of anal cleft and anal plates much less frequent than on *K. perforata*.

For a comparison with *K. paradepressa* see under that species.

K. perforata (as *Ctenochiton perforatus*) was recorded as having been introduced into California by Riley & Howard (1893) but this record was later corrected by Maskell who indicated in a letter to Howard (1897) that it was probably a dactylopiid!

Variability. This material is very variable in size and this also affects the frequency of the pores. Some specimens off *Coprosma* are easily the smallest (e.g., #81/42), whilst the largest are off *Pittosporum* (e.g., Brittin, #26); however, some specimens off *Coprosma* are only slightly smaller than those off *Pittosporum* sp. Nonetheless, the basic characters of the species given above remained constant. It is clear that there is considerable intra-specific variation in some of the numerical values, probably due to host-induced or climatic effects.

Pathogens and parasitoids. Hymenopterous parasitoids recorded are: Aphelinidae: *Euxanthellus philippiae* Silvestri; Encyrtidae: *Adelencyrtoides blastothrichus* Noyes; *A. variabilis* Noyes; Pteromalidae: *Aphobetus nana* (Bouček).

Biology. *K. perforata* is rather polyphagous, although *Pittosporum* species appear to be favoured hosts. Probably with one generation a year, overwintering as nymphs. Post-ovipositional females have a distinctively contracted abdomen, which is folded in a concertina fashion towards the anterior thorax, while the body margins become differentially sclerotised and characteristically folded in scallops.

Distribution. In lowland forest throughout (Map 24).

Genus *LECANOCHITON* Maskell

Lecanochiton Maskell, 1882: 221; –Atkinson, 1886: 278 [taxonomy]; –Maskell, 1887:62, 64 [description] – Cockerell, 1894b: 1053 [distribution]; –Cockerell, 1896: 330 [checklist]; –Cockerell, 1899c: 332 [key]; – Cockerell, 1900: 368 [mention]; –Fernald, 1903: 147 [world catalogue]; –Hutton, 1904: 226 [checklist]; – MacGillivray, 1921: 172, 178 [catalogue]; –Morrison & Morrison, 1922: 69, 71 [redescription]; –Lindinger, 1932: 197 [mention]; –Borchsenius, 1957: 48 [mention]; –Wise, 1977: 105 [checklist]; –Ben-Dov, 1993: 155 [world catalogue]; –Hodgson, 1994a: 306 [redescription type].

Type species: *Lecanochiton metrosideri* Maskell, 1882, by monotypy.

Diagnosis. Adult female. Note: this genus contains two groups of species, (i) the *L. actites* spp.-group: *L. actites* n. sp. and *L. metrosideri* Maskell , and (ii) the *L.minor* spp.-group: *L. minor* Maskell and *L. scutellaris* n. sp. These two groups differ in a number of significant ways (see under Remarks below) but combined, they form a taxon (a single genus) that is very different from all other New Zealand genera. In the following generic diagnosis, the *L. actites* spp.-group and the *L.minor* spp.-group refer to the species pairs above.

Test: either absent or represented by a thin glassy wax covering.

Shape: convex but flat on top, "having the general appearance of an overturned basket" (Maskell, 1882); fully mature female rather round but with a distinct anal cleft; dorsal surface sclerotised, with a central, flat, oval area which represents true dorsum, surrounded by a wide margin formed from venter (the *L. actites* spp.-group: lateral margin <2.5 × wider than true dorsum; the *L.minor* spp.-group: lateral margin <1/8 total width of true dorsum). Mounted material of young, pre-reproductive adult oval, with no stigmatic clefts and a fairly shallow anal cleft; length 0.5–1.0 mm, width 0.4–0.8 mm. As adult female matures, size of true dorsum remains constant and lies medially, whereas venter expands laterally so that its submargin lies dorsally and becomes the *de facto* margin of dorsal surface; mature specimens up to 2.0 mm long and 2.2 mm wide, with a deep anal cleft (Fig. 33).

Dorsum: derm of true dorsum in central area of young adult sclerotised, lateral dorsal surface at first membranous, becoming uniformly sclerotised on older specimens, with an anal sclerotisation. Dorsal setae entirely absent. Dorsal pores of 2 (the *L.minor* spp.-group) or 3 (the *L. actites* spp.-group) types: (i) small simple pores: present or absent; (ii) rather larger microductules (possibly absent in the *L.minor* spp.-group); and (iii) large, sunken, macropores, referred to as 'pocket-like macropores': present in 2 distinct lines extending anteriorly from anal plates towards a point either halfway between the anal plates and the head or nearly dorsad to the clypeolabral shield (the *L. actites* spp.-group) and also in 8–10 radial lines (the *L.minor* spp.-group). Anal plates elongate, narrow, with outer margin more or less rounded; each plate with 1–2 small apical setae, a longer seta on outer margin and another near middle of inner margin; also generally 0–3 minute pores medially on posterior third of each plate. Anogenital fold with a pair of supporting bars and 3–4 pairs of setae along anterolateral margins. Anal tube of moderate length; anal ring with 6 setae.

Margin: marginal setae entirely absent, although ventral submarginal setae may briefly appear to be marginal during rapid expansion phase (the *L. actites* spp.-

group). The *L.minor* spp.-group with a distinct marginal row of quinquelocular disc-pores or simple pores; these absent in the *L. actites* spp.-group; however, both the *L. actites* spp.-group and the *L.minor* spp.-group with a marginal row of microductules. Stigmatic clefts and stigmatic spines absent (except a single spine on one specimen of *L. scutellaris*). Eyespots possibly present in *L. scutellaris*, otherwise absent.

Venter: derm of young adult lightly sclerotised and expanding very considerably outwards and therefore with some ventral structures coming to lie dorsally; that part of derm that lies dorsally becoming moderately sclerotised at maturity. On young adults, venter finely folded along band of ventral tubular ducts, so as to allow for expansion — shown by arrow in Fig. 122. A cavity is formed medially beneath abdomen and thorax, enclosed laterally by a large pair of distinct mediolateral abdominal folds, which extend from anogenital fold to each posterior spiracle (the *L. actites* spp.-group) or to each anterior spiracle (the *L.minor* spp.-group). Pregenital disc-pores with 5 loculi: present in a mediolateral line extending from lateral margins of anogenital area to each posterior spiracle, with 1 pair (the *L.minor* spp.-group) or 2 pairs (the *L. actites* spp.-group) of disc-pores per abdominal segment and with a small group laterad to anogenital area (the *L. actites* spp.-group). Spiracular disc-pores with 5 loculi: in broad bands (in young adults) extending laterad from anterior spiracles towards true margin on dorsum, thus lying on ventral surface and partially on dorsal surface on older adults when band becomes stretched and narrow; posterior bands of spiracular disc-pores absent, but with a small group of 1–3 near peritreme of each posterior spiracle: in the *L.minor* spp.-group, anterior bands of spiracular disc-pores also with a few simple pores. Simple pores present in the *L.minor* spp.-group, both submarginally and within anterior spiracular pore band; absent in the *L. actites* spp.-group. Ventral microducts of 2 sizes in the *L. actites* spp.-group, small microducts medially and large microducts submarginally; in the *L.minor* spp.-group only small ventral microducts present, possibly throughout venter. Ventral tubular ducts of 1 type, each with an elongate outer ductule and a thin inner ductule with a large terminal gland; present in a wide submarginal band which spreads laterally onto dorsal surface on older females; more medial ducts slightly broader than those nearer margin. Ventral setae small, with 4–5 on each posterior lobe and 1–2 submarginal rows in the *L. actites* spp.-group but not thus in the *L.minor* spp.-group; present medially in rows across abdominal segments, and very few elsewhere; usually with 1–2 pairs between antennae. Antennae reduced, segmentation obscure but probably 3- or 4-segmented; all setae on apical segment apparently fleshy, some even slightly swollen apically and distorted. Mouthparts typical of family. Spiracles very small, posterior pair pointing posterolaterally on young adults and posteromedially on mature adults and opening into abdominal concavity formed by medial invagination of abdomen. Legs entirely absent. Vulva clearly visible on some young adults, apparently lying between 6th and 7th visible abdominal segments.

Remarks. This genus contains four species: *Lecanochiton actites* Henderson & Hodgson, **n. sp.**, *L. metrosideri* Maskell, *L. minor* Maskell, and *L. scutellaris* Henderson & Hodgson **n. sp.** Species in this genus are characterised by:

(i) the way that the venter swells during development, so that the lateral margins come to lie on the dorsal surface, laterad to the true dorsum which does not itself change in size;
(ii) the complete absence of legs;
(iii) the reduction in the size of the antennae;
(iv) the restriction of the spiracular disc-pore bands to the anterior spiracles only, and this band extending onto dorsal surface on mature females;
(v) the distribution of the pregenital disc-pores in a line between the anogenital fold and the posterior spiracle;
(vi) the formation of a large brood chamber ventrally beneath the thorax and abdomen, with the development of large mediolateral folds;
(vii) the absence of marginal and stigmatic setae;
(viii) the presence of dorsal pocket-like macropores.

As indicated in the generic diagnosis above, species in the genus *Lecanochiton* can be divided into two species groups based on structure. The *L. actites* spp.-group contains *L. actites* and *L. metrosideri*, while the *L.minor* spp.-group contains *L. minor* and *L. scutellaris.* These two groups differ in the following:

(i) the proportion of the dorsal surface composed of the expanded venter — broad in the *L. actites* spp.-group, narrow in the *L.minor* spp.-group;
(ii) the structure of the dorsal macropores: large, heavily sclerotised pocket-like macropores, with sclerotised margins in the *L. actites* spp.-group, rather more shallow, with a sclerotised margin and with a granular inner surface in the *L.minor* spp.-group;
(iii) the distribution of the dorsal macropores: restricted to the two median longitudinal lines of pores in the *L. actites* spp.-group, quite widespread throughout much of dorsum in the *L.minor* spp.-group;
(iv) presence of a pair of eyespot-like areas (occasionally 1 or none) on dorsum near anterior margin in the *L.minor* spp.-group, absent in the *L. actites* spp.-group;

(v) the number of pairs of pregenital disc-pores on the mediolateral folds of the abdomen: 2 pairs on the *L. actites* spp.-group, a single pair on the *L.minor* spp.-group;

(vi) the pregenital disc-pores forming a group on either side of anogenital fold in the *L. actites* spp.-group, absent there in the *L.minor* spp.-group;

(vii) without a distinct marginal row of pores in the *L. actites* spp.-group, but with either 5-locular disc-pores or simple pores forming a distinct marginal row in the *L.minor* spp.-group;

(viii) with only 5-locular spiracular disc-pores in the anterior band in the *L. actites* spp.-group, but with both 5-locular disc-pores and simple pores in the anterior spiracular pore band in the *L.minor* spp.-group;

(ix) ventral microducts of 2 sizes in the *L. actites* spp.-group but 1 size in the *L.minor* spp.-group.

Fig. 33 shows the comparative sizes of some of the stages in the life cycle of *L. actites*. This shows that the 1st-instar crawler expands to 4–5 times its original size before moulting, and that the 2nd-instar female only grows a relatively small amount, so that the teneral adult female is only marginally bigger than the largest 1st-instar crawler. However, by the time the expansion of the venter is complete, the final size of the insect is several times larger. Thus the size of the mature adult female is about 'normal' for a coccid. The reason for this behaviour is unclear. That the female 2nd stadium may be quite short is suggested by the very few specimens available compared with 2nd-instar males.

In addition to the above lateral expansion, the mid-ventral part of the abdomen and thorax withdraws upwards to form a large concavity which acts as a brood chamber. This chamber opens, often by means of a distinct tunnel-like opening, beneath the anal plates and between the anal lobes. The posterior spiracles and the vulva, which appears to be rather further forward than on most other Coccidae, open into this space.

The species currently placed in *Lecanochiton* are all endemic to New Zealand and are all host-specific to the genus *Metrosideros*.

Key to adult female *Lecanochiton*

1 In mature adult, venter expands to several times width of true dorsum; dorsal pocket-like macropores restricted to 2 lines extending anteriorly from anal plates; each macropore with a heavily sclerotised margin; pregenital disc-pores forming a double line between anogenital fold and each posterior spiracle; without simple pores or quinquelocular disc-pores forming a distinct marginal row 2

—In mature adult, venter expands to <2 × width of true dorsum; dorsal pocket-like macropores present in radiating lines from median area of dorsum; each dorsal macropore not heavily sclerotised; pregenital disc-pores in a single line between anogenital fold and each posterior spiracle; with either simple pores or quinquelocular disc-pores forming a distinct marginal row 3

2 Median bands of dorsal pocket-like macropores extending from anal plates anteriorly to near dorsad of clypeolabral shield; antennae about 3 or 4 times as long as broad, 3rd segment about half total length; spiracular disc-pores in anterior band abundant and clearly extending to true margin .... ***metrosideri***

—Median bands of dorsal pocket-like macropores extending anteriorly from anal plates, but only reaching to about half-way point dorsad to clypeolabral shield; antennae short, about twice as long as broad, 3rd segment as long as broad; spiracular disc-pores rather few, band sometimes not reaching true margin on dorsal surface .... ***actites***

3 With a single row of 5-locular disc-pores all round true margin between true dorsum and expanded venter; antennae >70 µm long .... ***minor***

—With a single row of simple pores all round true margin between true dorsum and expanded venter; antennae short <65 µm long ....***scutellaris***

Lecanochiton actites Henderson & Hodgson new species

Figs M9, M11, M13, C64, 120–121

Unmounted material: young female light brown and covered in thin wax plates which make insect look hairy; old female dark brown, shiny, largest known *Lecanochiton* species. Body almost round but with a distinct anal cleft posteriorly, with an opening into brood chamber beneath abdomen. Dorsal surface rather flat; central true dorsum with indistinct radial ridges, only about 1/5th total width and about 1/3 total length. Lateral areas of dorsal surface formed from venter apparently without other markings.

Mounted material: as for generic diagnosis. Width of true dorsum 0.34–0.48 mm; final size of mature, fully expanded female up to 2.30 mm wide.

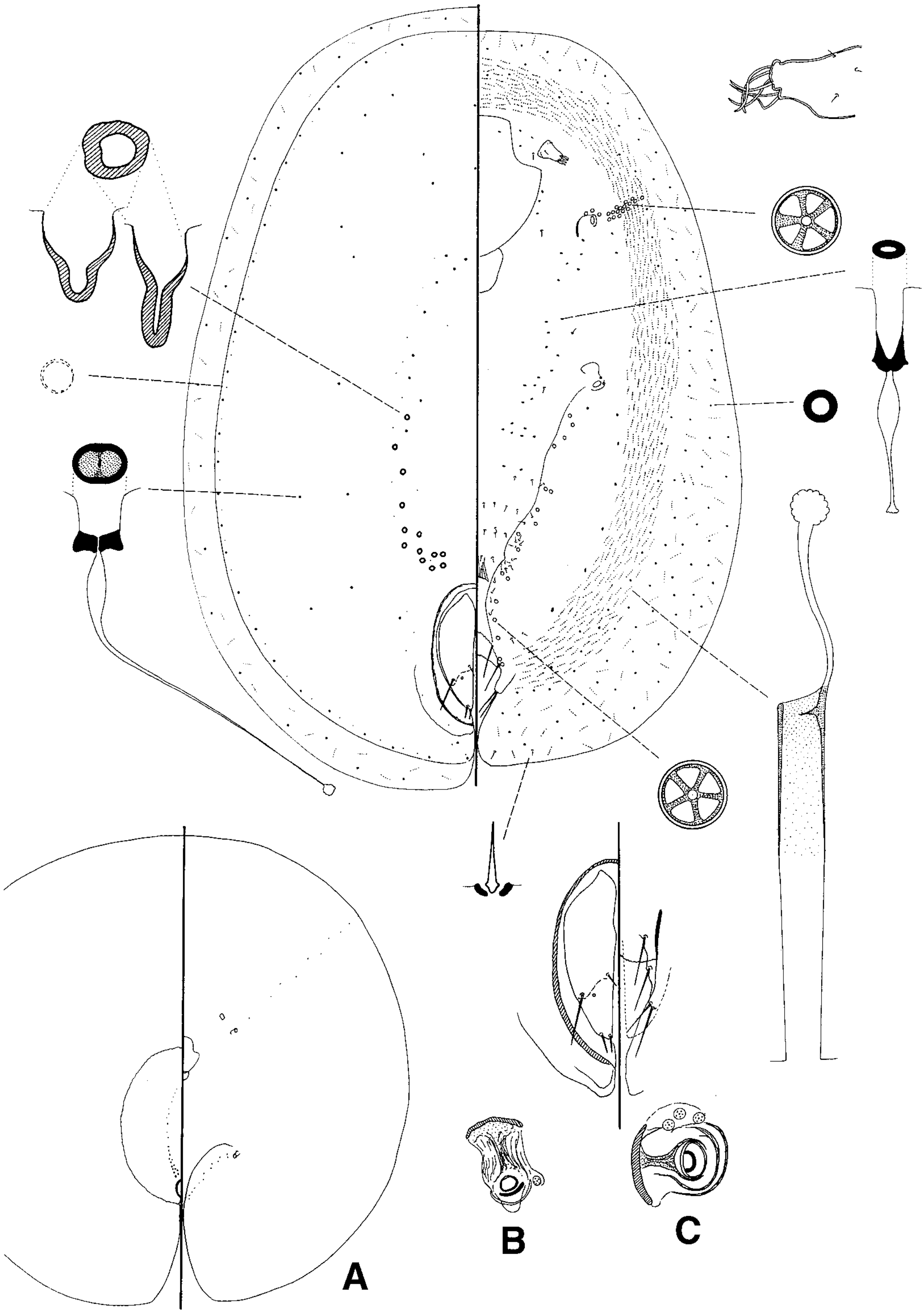


Fig. 120. *Lecanochiton actites* Henderson & Hodgson, **n. sp.**, adult female. Main drawing = young female; A = dorsal view of mature mounted adult female showing the relative sizes of dorsum and lateral margins of expanded venter; B = posterior spiracle and C = anterior spiracle.

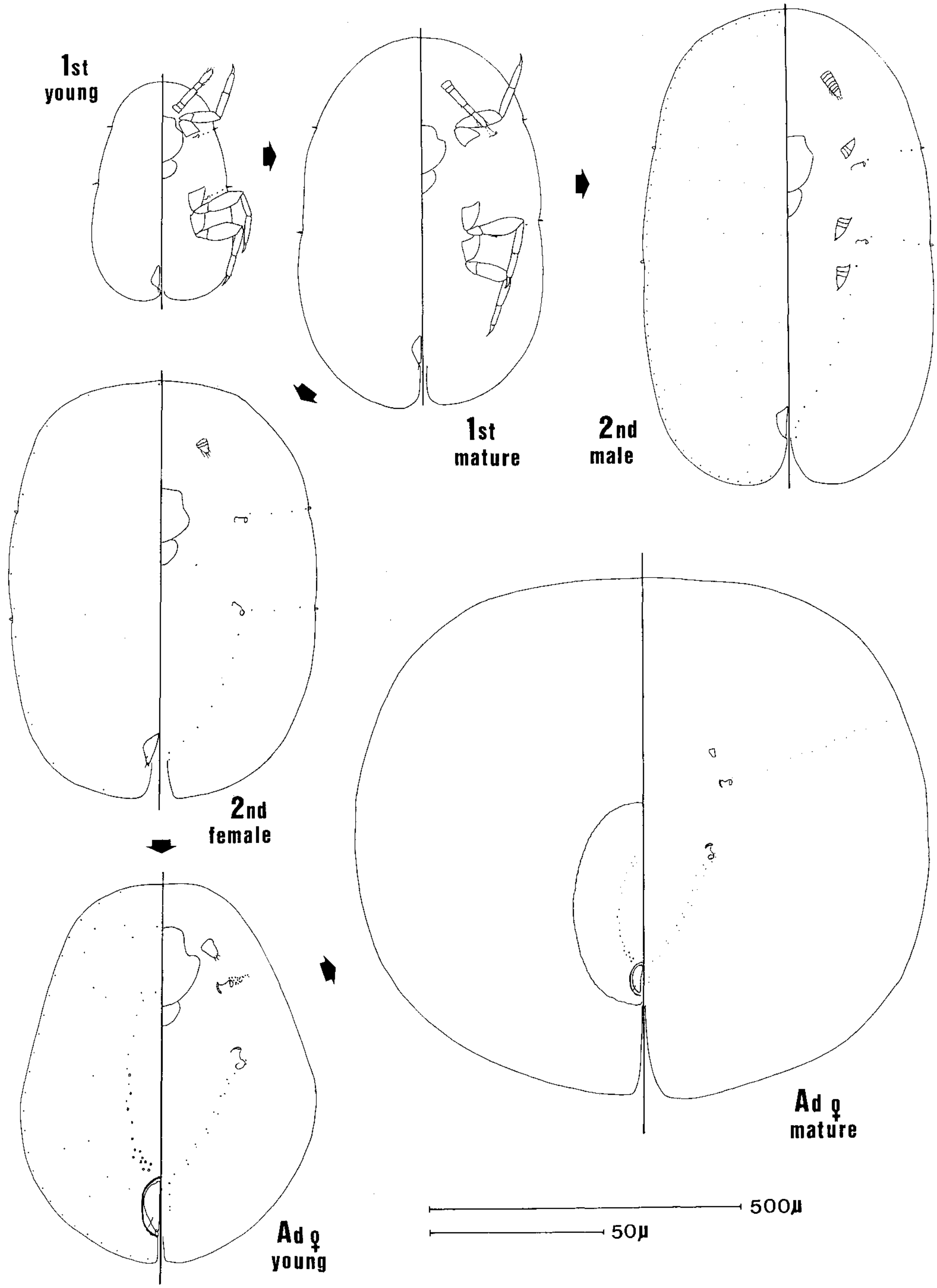


Fig. 121. Diagram to show the amount of growth between each instar of *Lecanochiton actites* Henderson & Hodgson. Long line = 500 μm (for adult female), short line = 50 μm (all other stages).

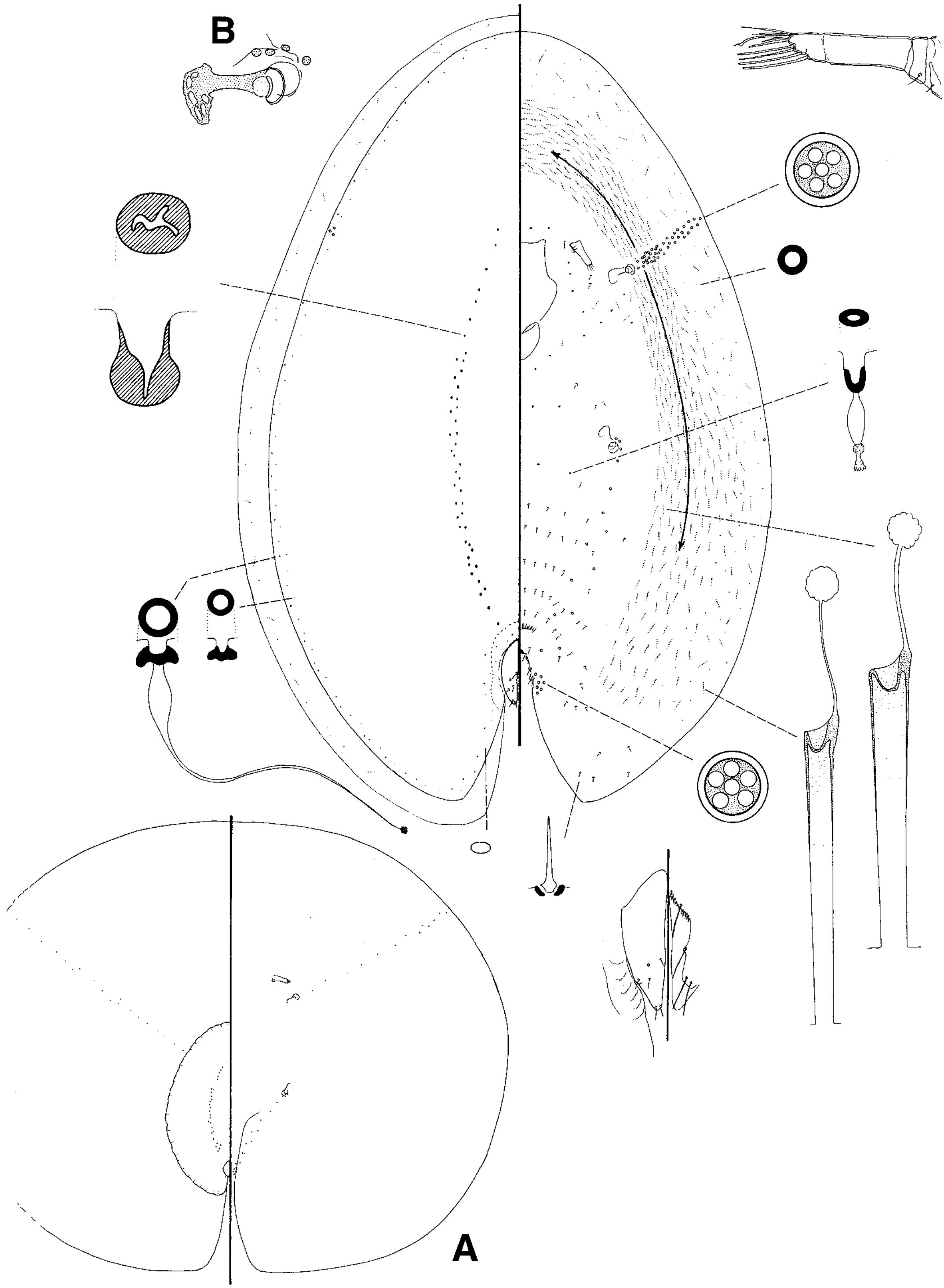


Fig. 122. *Lecanochiton metrosideri* Maskell, adult female. Main drawing = young female; A = dorsal view of mature mounted adult female showing the relative sizes of dorsum and lateral margins of expanded venter; B = anterior spiracle.

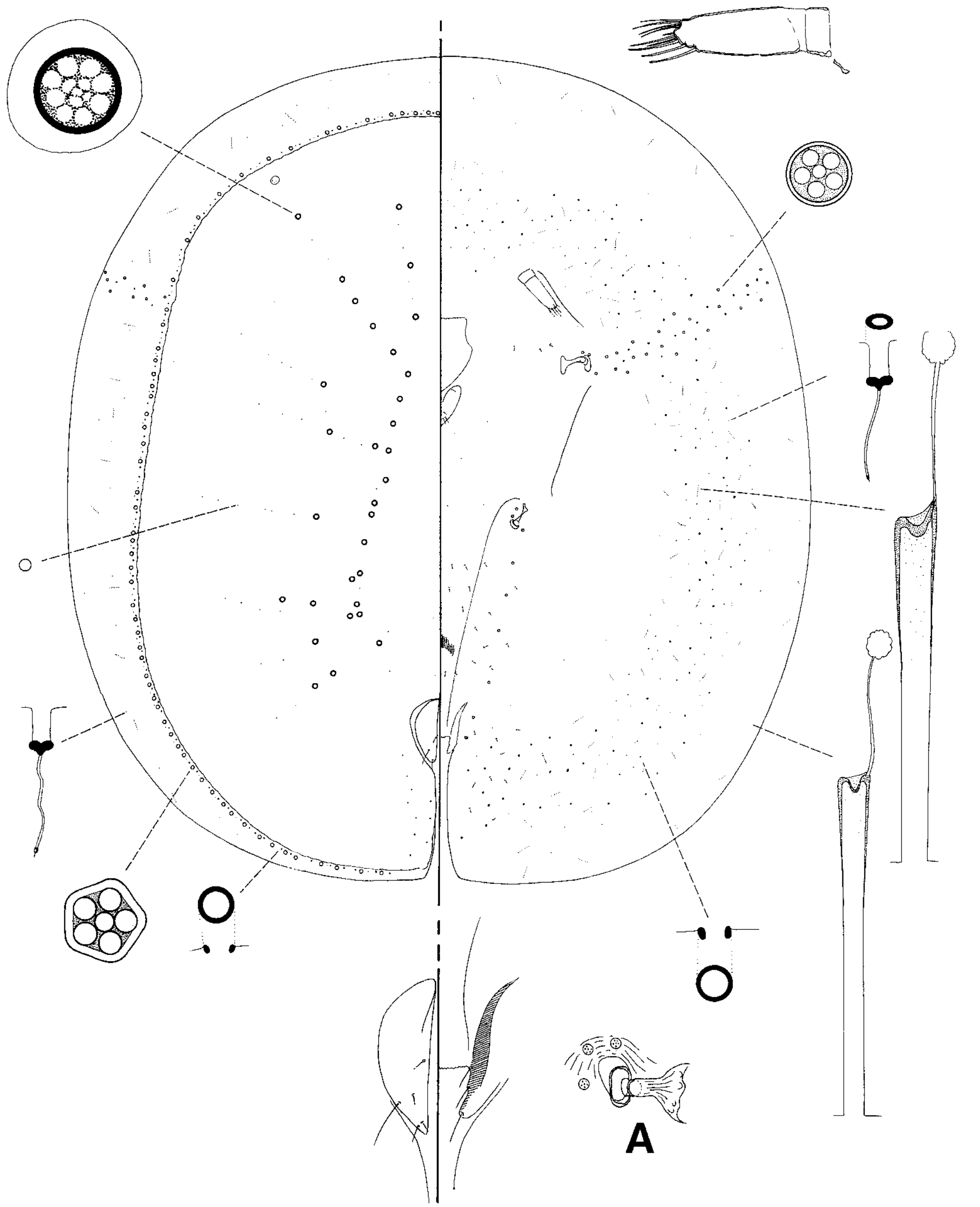


Fig. 123. *Lecanochiton minor* Maskell, adult female. A = posterior spiracle.

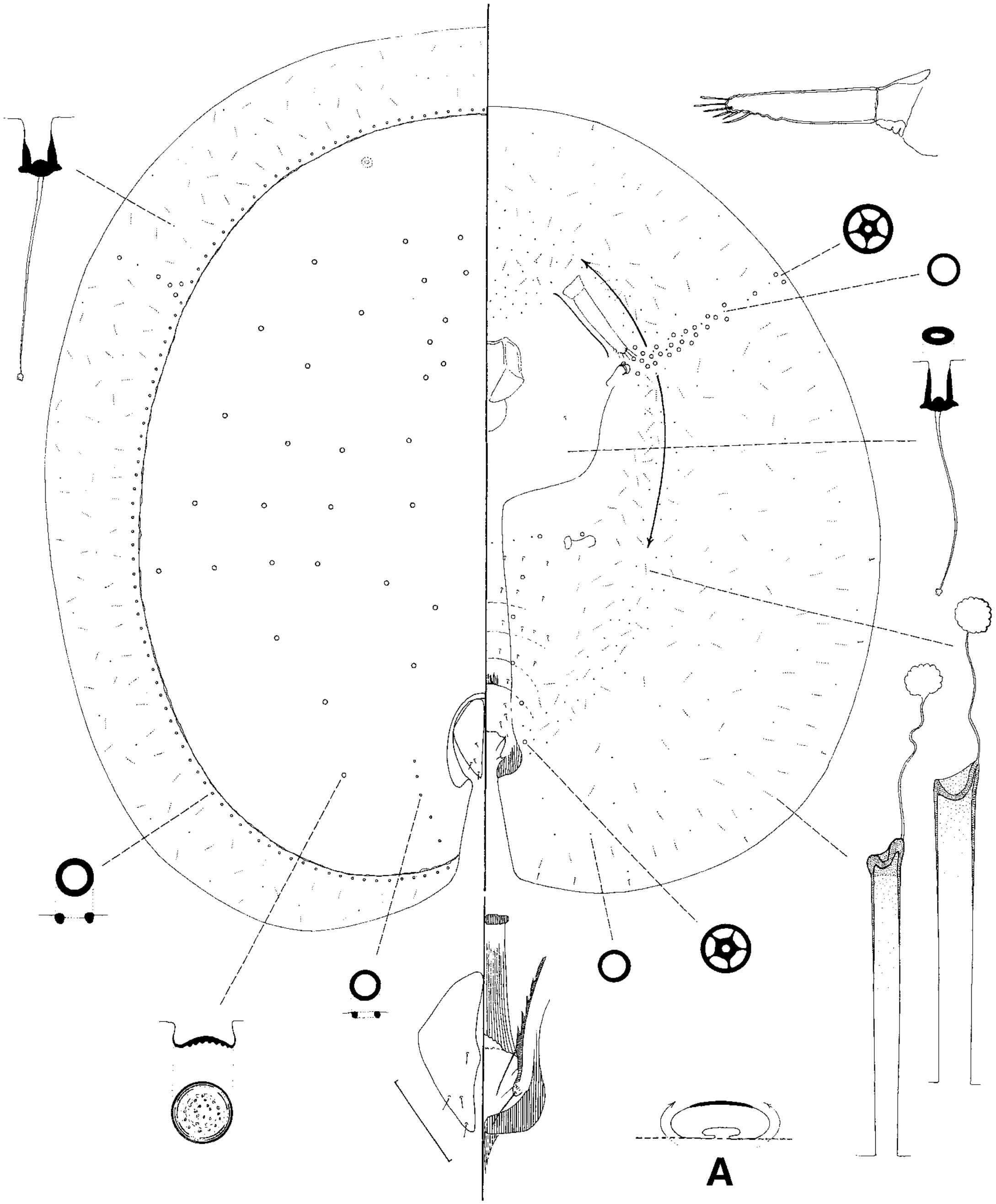


Fig. 124. *Lecanochiton scutellaris* Henderson & Hodgson, **n. sp.**, adult female. A = cross-section through adult female to show how the lateral margins of the venter expand to become part of the dorsal surface, where thickened dark line represents the true dorsum. Also note brood chamber beneath venter.

Dorsum: as for genus, with an anal sclerotisation around anal plates: dorsal pocket-like macropores large, sunken and heavily sclerotised (Figs M9, M11, M13), only present on posterior half of each median longitudinal pore band; with 9–30 (usually less than 25) in each band; these pores replaced anteriorly by moderate-sized microductules, which also occur rather sparsely elsewhere on dorsum, probably in radial lines; simple pores also present in association with medial lines of dorsal macropores; simple pores and microductules forming a distinct marginal band (most obvious on young specimens). Anal plate: length 91–106 µm, breadth of single plate 32-36 µm; each plate with a single minute pore; seta on outer margin pointing outwards and quite long, 21–28 µm; and with 2 pairs setae near apex, 9–12 µm long. Anogenital fold with 4 pairs of setae along lateral margins, posterior pair of setae more stout than other pairs, 24–33 µm long.

Margin: as for genus.

Venter: as for genus, but pregenital disc-pores in a small group of only 1–4 on either side of anogenital fold and with 2 mediolaterally on each abdominal segment. Spiracular disc-pores in broad bands, extending from each anterior spiracle often only part way to true margin, with 18–35 in each band; posterior disc-pore bands absent but with a small group of 1-3 disc-pores near each peritreme. Ventral microducts present medially on head, thorax, and anterior abdominal segments, and also with 1 mediolaterally on most abdominal segments. Ventral tubular ducts: present in a wide submarginal band which extends laterally onto dorsal surface on mature specimens. Antennae reduced to a short stump, only about twice as long as width of scape, segmentation obscure; total length 29–43 µm. Clypeolabral shield broader than long, length 43–58 µm, width 54–63 µm. Spiracles: width of each peritreme 11-18 µm. Legs absent.

Material examined. HOLOTYPE ♀: NEW ZEALAND: **AK**: Okura R, 25 Oct 1993, R.C. Henderson, *Metrosideros excelsa* midrib undersurface leaves & stems, #93-336b, NZAC: 1/3♀♀ ad, 1 1st; the youngest ♀ ad next to the 1st-instar nymph is designated holotype and clearly marked. PARATYPES: (i) remaining 3 specimens on holotype slide. (ii) as for holotype: NZAC, #93-336a, c–q: 17/12♀♀ ad, 4♂ 2nd, 3 pupae, 8♂♂ ad, 2 1st.

Other material: *Lecanochiton metrosideri*, New Zealand, Maskell coll. #31, USNM: 4/3♀♀ ad, 1 1st. **ND**: Poor Knights Is, Tawhiti Rahi I, *Metrosideros excelsa* stem, 6 Dec 1980, C.F. Butcher, #81-134a: 1/1♀ ad. Poor Knights Is, *Metrosideros excelsa*, 11 Dec 1980, #83-327e: 1/1♀ ad. **AK**: Auckland, no host, - Feb 1921, G. Brittin #9, NZAC: 6/6♀♀ ad; BMNH: 1/3♀♀ ad; USNM: 2/2♀♀ ad [Brittin manuscript name *L. aucklandicus*]. Kawau I, *Metrosideros excelsa* [as pohutukawa], 25 Aug 1955, R.H. Harrison: 2/24♀♀ ad. Rangitoto I, *Metrosideros excelsa* [as pohutukawa], 12 Sept 1976, J. Cox: 2/9♀♀ ad. Rangitoto I, *Metrosideros excelsa* [as pohutukawa] & *Metrosideros* sp. [as rata] leaves, 19 Dec 1990, C.F. Morales, #90-357a–c, -358a–d: 7/5♀♀ ad, 8♂ 2nd, 13 1st. Wattle Bay, *Metrosideros excelsa* [as pohutukawa] stems, 22 Aug 1981, C.F. Butcher, #81-245: 7/21♀♀ ad. Cornwallis, Spraggs Monument, *Metrosideros excelsa* leaf, 28 May 1983, P. Dale, #83-168b: 2/4♀♀ ad. **CL**: Colville Hill, *Metrosideros robusta* stem, 6 Aug 1957, J.M. Hoy: 2/14♀♀ ad (1 parasitised). **BP**: Ohope, *Metrosideros excelsa*, 22 Feb 1979, R.J.M. Mckenzie, FRNZ 15 & 16: 2/9♀♀ ad. Otanga, Lottin Point, *Metrosideros excelsa* twigs, 3 Nov 1993, RCH, #93-366a: 1/1♀ ad. **GB**: Kakanui, base of coastal cliff, *Metrosideros excelsa*, 22 Sept 1992, RCH, #93-292: 1/1♀ ad. **RI**:, [Pohangina V],Totara Reserve, *Metrosideros* sp. [as rata], 17 Apr 1966, no collector: 3/8♀♀ ad.

Remarks. With *L. metrosideri*, this species belongs to the *L. actites* spp.-group. Adult females of *L. actites*, therefore, are similar to, although generally larger than, those of *L. metrosideri*. *L. actites* differs in having:
(i) much smaller antennae;
(ii) fewer large, dorsal pocket-like macropores in the 2 median longitudinal lines;
(iii) dorsal microductules present within the dorsal lines of sclerotised pores and elsewhere on the dorsum;
(iv) ventral tubular ducts rarely present medially on prothorax;
(v) fewer spiracular disc-pores in each pore band.
These characters are best seen on young unexpanded females.

Biology. Nymphs are found on the undersides of leaves positioned alongside the midribs, but young females move to, and are nearly always found on, the young green stems. Sometimes very old dead females from a previous generation persist on old brown stems further from the host plant's growing tips. There may be more than one generation per year, with the main generation in early summer. Most favoured host plant is *Metrosideros excelsa*, a coastal tree often found growing on seaside cliffs and beaches and, in fact, *L. actites* is rarely found on trees away from the coast, suggesting an ability to tolerate salt spray drift. *L. actites* is often found in association with *L. scutellaris* which inhabits the upper leaf surfaces — for example, the Poor Knights Is record of 6 Dec 1980.

Distribution. Generally found on North Island eastern coasts from Northland to the East Cape region but has also been collected inland, from Pohangina Valley (Map 25).

Name derivation. From the noun *actites* (Gr., m): a dweller near the shore or coast; this species of *Lecanochiton* appears to favour coastal areas.

Lecanochiton metrosideri Maskell

Figs C65, 122

Lecanochiton metrosideri Maskell, 1882: 222; –Maskell, 1884: 129 [male description, distribution]; –Maskell, 1887: 64 [description]; –Maskell, 1895a: 11 [checklist]; –Cockerell, 1896: 330 [checklist]; –Fernald, 1903: 147 [world catalogue]; –Hutton, 1904: 226 [checklist]; –Myers, 1922: 199 [checklist]; –Morrison & Morrison, 1922: 69 [redescription]; –Miller, 1925: 32, 64 [host]; –Hoy, 1958: 185, 187, 199 [hosts; distribution]; –Wise, 1977: 105 [checklist]; –Deitz & Tocker, 1980: 30 [checklist]; –Ben-Dov, 1993: 155 [world catalogue]; –Hodgson, 1994a:306 [redescription].

Unmounted material: shiny medium-brown to dark brown, with two lateral white wax stripes associated with anterior spiracular pore bands and sometimes with a pair of white wax ribbons on anal plates; apparently lacking any distinct waxy test. Shape rather round but more pointed at anterior end and widest medially, with a distinct anal cleft; at anterior end of anal cleft beneath anal plates is a distinct vertical opening through which 1st-instar crawlers emerge from brood chamber beneath concave abdomen. True dorsum centrally placed, plate-like and flat, about ½ total length and ⅓ total width. With concentric ridges on lateral areas of dorsally located venter; outermost 'pseudomargin' marked by a darker line. Mainly found on lower leaf surface.

Mounted material: as for genus. Width of true dorsum 0.48 – 0.75 mm; final size of mature, fully expanded female up to 1.96 mm wide.

Dorsum: as for genus but with a darker, heavily sclerotised anal sclerotisation around anal plates. In addition, dorsal macropores highly sclerotised and pocket-like, in 2 longitudinal lines extending anteriorly to a point dorsad to bases of antennae, each line 1–3 pores wide and with 20-48 (generally more than 30) pores in each line. Dorsal microductules and simple pores restricted to a submarginal band near margin and around anterior margin of anal plates; absent elsewhere. Anal plates elongate and narrow, outer margin rounded, length of plates 86-107 µm, breadth of single plate 32-45 µm; some specimens with an additional, fifth, seta on dorsal surface near apex; outer margin setae quite short, 7–14 µm; with 2 apical setae, 9–12 µm long. Anogenital fold: lateral pair of setae each 14–16 µm long.

Margin: as for genus.

Venter: as for genus but pregenital disc-pores in a small group of 5–9 on either side of anogenital fold and in groups of 2 mediolaterally on each abdominal segment. Spiracular disc-pores on young, unexpanded adults in broad bands extending from each anterior spiracle to true margin but becoming narrow as venter expands laterally; with 51–75 in each band; posterior spiracles each with 1-3 disc-pores near peritreme; on 1 young adult, a single pore is present on 1 side near margin in posterior stigmatic area. Ventral microducts restricted to medially on head and thoracic segments. Ventral tubular ducts: in a wide submarginal band, extending laterally onto dorsal surface on older females; also with a sparse band extending medially just posteriorly to anterior spiracles. Ventral setae: as for genus. Antennae reduced, probably 4-segmented, 3rd segment rather long, 3–4 times as long as broad; total length 61–72 µm. Labium broader than long, length 37–47 µm, width 57–63 µm. Spiracles: width of peritremes: 13-18 µm. Legs absent.

Material examined. LECTOTYPE ♀ (here designated): NEW ZEALAND: "*Lecano-chiton metrosideri*, from Rata, tests of adult, Jan. 1881, W.M.M.". Maskell coll, NZAC: 1/2♀♀ ad (old); one specimen is split into dorsum and venter and this is here designated lectotype and is clearly marked.

PARALECTOTYPES: (i) remaining specimen on lectotype slide. (ii) as for lectotype, "adult female", NZAC: 1/1♀ 2nd; "four females" [remounted by C.J. Hodgson], NZAC: 4/2♀♀ ad (pharate), 1♀ 2nd, 1 1st.

Other material: NEW ZEALAND: **AK**: Hunua Ra, *Metrosideros* sp., Nov 1982, C.F. Butcher, #83-293e: 3/4♀♀ ad. **NN**: near Karamea, Kohaihai Bluff, *Metrosideros* sp. (rata), 19 Jan 1983, C.F. Butcher, #84-024d & #90-215b–c: 4/7♀♀ ad, 1♂ 2nd, 1 1st. Denniston, *Metrosideros* sp. leaves, 19 Jan 1983, C.F. Butcher, #84-024k: 2/4♀♀ ad. **BR**: Garveys Creek Rd, *Metrosideros* sp. leaves, 21 Jan 1983. C.F. Butcher, #83-285b: 2/2♀♀ ad. Maruia, *Metrosideros* sp., Dec 1915 [as Xmas], G. Brittin #93: 2/2♀♀ ad. Sewell Peak, = 2500 m (TV Repeater Mast), ex *Metrosideros* sp. [as rata], 22 Nov 1984, C.F. Butcher: 19/9♀♀ ad, 5♂ 2nd, 1♀ 2nd, 3 1st. **WD**: Otira, *Metrosideros umbellata* [as *lucida*], Jan 1914, G. Brittin #93, USNM:

1/2♀♀ ad. Otira, *Metrosideros* sp., 28 Dec 1915, G. Brittin #93, USNM: 1/1♀ ad. Otira, *Metrosideros* sp., Dec 1915 [as Xmas], G. Brittin #93: 2/2♀♀ ad. As previous, mounted by C.J. Hodgson from Brittin dry collection: 3/3♀♀ ad (1 split) [+ 3/11 1st = uncertain species, population mixed with *L. minor*]. Franz Josef Glacier, *Metrosideros umbellata,* 20 Sep 1981, R. Allan, FRNZ 70– 72: 3/4♀♀ ad, 3♂ 2nd. Franz Josef Glacier, Roberts Point Track, *Metrosideros* sp. [as rata], 6 Feb 1983, J.M. Cox, #235: 2/2♀♀ ad. Cook Saddle, *Metrosideros* sp. [as rata], no date, J.M. Hoy: 1/3♀♀ ad. Picnic Pt., *Metrosideros* sp. [as rata], 6 Oct 1955, J.M. Hoy: 1/6♀♀ ad. **FD**: Breaksea I, *Metrosideros umbellata* leaves, 29 Jan 1996, RCH, #96-077: 1/1♂ 2nd. **SI**: Stewart I, Oban, Thule, *Metrosideros umbellata*, 20 Nov 1969, Kershaw, FRNZ nos 2–3: 2/12♀♀ ad.

Remarks. *L. metrosideri* belongs to the *L. actites* spp.-group. Adult females of *L. metrosideri* appear similar to those of *L. actites* but *L. metrosideri* has:
(i) much larger antennae;
(ii) many more dorsal macropores in the two medial longitudinal lines;
(iii) dorsal microductules absent within the dorsal lines of sclerotised pores;
(iv) many more spiracular disc-pores in each anterior pore band.
These characters are best seen on the young, unexpanded teneral females.

In addition to the above localities, Hoy (1958) recorded it from **AK**: Auckland; Kawau Is; **CL**: Colville; **RI**: Pohangina Valley; **BR**: Maruia; **WD**: Wilberg Range; Franz Josef; Cook Saddle; Kokatahi Gorge; **OL/CO**: Devils Staircase, Lake Wakatipu; **SL**: Waimea Forest; Tautuku Bay; **FD**: Alton Valley and Milford Sound. Also from *Metrosideros excelsa* and *M. robusta*, in addition to *M. umbellata*. However, some of these records could refer to *L. actites*, particularly the record from Auckland off *M. excelsa*.

Biology. According to Hoy (1958), this species is more likely to be found on the smaller stems when there are large populations of the diaspidid *Anoplaspis metrosideri* Maskell, and on the leaves when these diaspidids are less abundant.

Distribution. *L. metrosideri* is common, especially on southern rata (*Metrosideros umbellata*), in lowland forest throughout the West Coast of the South Island, including Fiordland and on Stewart Island. There is only the one collection in NZAC from the North Island (the Hunua Range) (Map 26).

Lecanochiton minor Maskell

Fig. 123

Lecanochiton minor Maskell, 1891: 12; –Maskell, 1895a: 11 [checklist]; –Cockerell, 1896, 330 [checklist]; –Fernald, 1903: 147 [world catalogue]; –Hutton, 1904: 226 [checklist]; –Myers, 1922: 199 [checklist]; –Morrison & Morrison, 1922: 71 [redescription]; –Miller, 1925: 32, 64 [host]; –Hoy, 1958: 185, 188 [hosts; distribution]; –Wise, 1977: 106 [checklist]; –Deitz & Tocker, 1980: 30 [checklist]; –Ben-Dov, 1993: 155 [world catalogue].

Unmounted material: dried material light brown, very flat; central true dorsum larger than in other known *Lecanochiton* species, with faint radial lines; with a narrow lateral margin formed from venter. Apparently restricted to lower leaf surface.

Mounted material: as for genus but young, pre-reproductive adult roundly oval; length of dorsum 0.77–0.90 mm, width of dorsum 0.84–0.92 mm; final size of mature, fully expanded adult up to 1.30 mm long and 1.22 mm wide.

Dorsum: as for genus but with 2 median longitudinal lines of dorsal pocket-like macropores fairly distinct and with radial lines sometimes rather short and not always extending to near true margin. Simple pores present on dorsum within radial lines of macropores. With a pair of pale areas near anterior margin anterior to antennal bases on most specimens. Anal plates as for genus, length 86–91 μm, width of single plate 34–38 μm; some with an additional fifth seta on dorsal surface near apex; setae on outer margin short, 12–14 μm long; setae near apex very short, 5–9 μm long. Anogenital fold: lateral pair of setae fine, 7–12 μm long.

Margin: as for genus. With a complete row of numerous 5-locular disc-pores around margin of true dorsum, these pores generally about 1.5 × size of 5-locular spiracular disc-pores. Simple pores and small microductules also present, scattered within this row; on sclerotised specimens, ductules of microductules appearing as clear areas in a dorsal submarginal row.

Venter: as for genus, except brood chamber clearly extends into thorax and head as there are distinct dermal folds laterad to spiracles and antennae. Spiracular disc-pores: with 26–35 disc-pores in each anterior band. Simple pores present within anterior bands of spiracular disc-pores and also scattered throughout. Ventral microducts as for genus. With a submarginal row of minute setae, 2 pairs of anal lobe setae, other ventral setae as for genus. Antennae reduced and segmentation very indistinct; total length 73–97 µm. Labium rather broad, width 59–67 µm. Spiracles: width of each peritreme 14–16 µm. Legs absent.

Material examined: LECTOTYPE ♀ (here designated): NEW ZEALAND: "*Lecanochiton minor*, adult female, 1889, W.M.M.". NZAC: 1/1♀ ad.
PARALECTOTYPES: as for lectotype, NZAC: 3/1♂ ad, 2 1st, (1 labelled "female 2nd stage") all uncleared.

Other material: NEW ZEALAND: labelled "*Lecanochiton minor*, New Zealand, Maskell collection No. 117, USNM": 2/1♀ ad, 1♂ 2nd. **WD**: labelled "*Lecanochiton metrosideri* Mask.", Otira, *Metrosideros* sp., 28 Dec 1915, G. Brittin #93, USNM: 1/4♀♀ ad. Otira Gorge, *Metrosideros* sp., no date, G. Brittin #93, BMNH: 1/6♀♀ ad. Otira, *Metrosideros umbellata* [as *lucida*], 28 Dec 1915, G. Brittin, #320: 1/1♂ 2nd. Otira, *Metrosideros* sp. [as rata], - Dec 1915, G. Brittin, #93: 2/2♀♀ ad. Otira, *Metrosideros* sp., 21 Dec 1915, from G. Brittin dry coll. #93, #90-221: 8/10♀♀ ad. Maruia, *Metrosideros* sp., [as rata], 28 Nov 1935, G. Brittin #93: 1/1♂ 2nd.

Remarks. *L. minor* and *L. scutellaris* (described below), the two species which make up the *L.minor* spp.-group within *Lecanochiton*, appear to be rather uncommon, *L. minor* having only been collected on about four occasions (and none recently) and *L. scutellaris* from only four localities but on several occasions. *L. minor* differs from *L. scutellaris* in having:
(i) a complete band of quinquelocular disc-pores around the margin (rather than simple pores as on *L. scutellaris*);
(ii) the dorsal pocket-like macropores forming two fairly distinct median longitudinal lines, from which the radial lines of pores usually extend only about half-way to margin (median lines less distinct, but radial lines usually nearly reaching the margin on *L. scutellaris*);
(iii) in the relatively larger antennae.

In addition to the above records, Hoy (1958) also recorded this species from **CL**: Amodeo Bay; Colville; **RI**: Pohangina Valley; **BR**: Reefton; **WD**: Wilberg Range; Franz Josef; Cook Saddle and Kokatahi Gorge. Also from off *Metrosideros excelsa*, *M. robusta* and *M. umbellata*. However, some of these records could refer to *L. scutellaris*, described below.

Biology. Nothing known.

Distribution. All the collections represented in NZAC by verified slides are from localities within a small area of the West Coast, South Island. Maskell's type collection site is uncertain, although amongst Hoy's (1958) locality records he mentions Reefton, 1890, W. Maskell, on *Metrosideros robusta*, and Reefton is close to the localities recorded by Brittin (Map 27).

Lecanochiton scutellaris Henderson & Hodgson new species

Figs C66, 124

Unmounted material: without a wax test. Colour brown. Dorsum represented by a flat, central plate with faint radial ridges; width of dorsal plate about 1/2 total width and length about 3/4 total length. Outer margin roundish but more pointed at anterior end and with slight indentations where spiracular disc-pore bands extend onto dorsal surface. Found only on upper leaf surface.

Mounted material: as for genus but young, pre-reproductive adult rather round; length of dorsum 0.90–1.00 mm, width of dorsum 0.59–0.74 mm; final size of mature adult up to 1.04 mm long and 0.91 mm wide.

Dorsum: as for genus; median longitudinal lines of dorsal pocket-like macropores indistinct but with reasonably distinct radial lines which extend to near margin. Simple pores absent from dorsum apart from a few in a line on either side of anal cleft. With a pair of pale areas near anterior margin on most specimens, perhaps representing eyespots. Anal plates: length 79–86 µm, width of single plate 28–34 µm; outer margin setae, 12–16 µm long; setae near apex generally not discernable, about 5 µm long. Anogenital fold: lateral pair of setae generally not discernable because anal plates stain dark, 14–16 µm long.

Margin: as for genus, but with a complete marginal row of simple pores and small microductules; on sclerotised specimens, ductules of microductules appear as clear areas in a dorsal submarginal row. One specimen has a small, curved, distinctly spinose, stigmatic spine in 1 anterior stigmatic area.

Venter: as for genus, except brood chamber clearly extends into thorax and head as there are distinct dermal folds which appear to be mesad to spiracles and antennae; also anterior margin of anal cleft heavily sclerotised. Spiracular disc-pores: with 27–49 pores in each anterior band. Simple pores few, in a wide submarginal band; otherwise present in (i) a submedian band, (ii) within anterior spiracular pore band and (iii) commonly between groups of ventral setae laterad to anogenital area; apparently absent medially. Ventral microducts as for genus. With 1 pair of ventral anal lobe setae. Antennae reduced with very indistinct segmentation; total length 55–61 µm. Labium rather broad, width 46–54 µm. Spiracles: width of each peritreme 10–13 µm. Legs absent.

Material examined: HOLOTYPE ♀: NEW ZEALAND: **BP**: Lottin Point, Otanga, 27 Apr 1993, R.C. Henderson, *Metrosideros excelsa*, #93-277b, NZAC: 1/3♀♀ ad (middle specimen designated holotype and clearly marked).
PARATYPES: as for holotype: (i) other 2 females on holotype slide, and (ii) NZAC, #93-277a, c–h: 7/5♀♀ ad, 3♂ 2nd, 2 pupae.

Other material: NEW ZEALAND: **ND**: Poor Knights Is, Tawhiti Rahi, *Metrosideros excelsa* leaf, 6 Dec 1980, C.F. Butcher, #81-134a: 1/1♀ ad (teneral). **CL**: Amodeo Bay, *Metrosideros excelsa*, 6 Aug 1957, J.M. Hoy: 2/11♀♀ ad, 2 1st [as *L. minor*]. **BP**: Lottin Point, Otanga, upper surface of leaves of *Metrosideros excelsa*, 3 Nov 1993, RCH, #93-366b–l & #95-149: 11/3♀♀ ad, 3♂ 2nd, 5 1st, 2 pupae, 1♂ ad. As previous, but dated 15 Mar 1994, #94-045a–d: 4/2♀♀ ad, 4♂ 2nd, 13 1st.

Remarks. *L. scutellaris* is in the *L.minor* spp.-group and is closely related to *L. minor*. For a comparison of the two species, see under *L. minor*.

Biology. Found only on the upper surfaces of leaves of *Metrosideros excelsa* growing close to sheltered sea shores. Apparently has more than one generation per year.

Pathogens and parasitoids. Hymenopterous parasitoid recorded: Pteromalidae: *Aphobetus nana* (Bouček).

Distribution. Has been collected from eastern coasts of the North Island, from Northland to the East Cape region (Map 28).

Name derivation. From *scutellum* (Latin, n. dim.) meaning a small shield, combined with the Latin adjectival suffix *-aris* meaning relating to. The unmounted material looks as though it is covered by a round shield.

Genus *PLUMICHITON* Henderson & Hodgson new genus

Type species: *Plumichiton pollicinus* Henderson & Hodgson, **new species** (here designated).

Diagnosis. Adult female. Test: of thick, glassy plates with a broad fringe of thick white wax plates and with very thick blocks of wax covering median dorsum. Colour varying from green-, red-, or gold-browns to black.

Shape: oval to almost round, convex when mature; stigmatic clefts shallow, with long or medium-short stigmatic spines; anal cleft rather wide; venter of female becoming rather concave between mediolateral lobes of abdomen at maturity, to form a brood chamber for neonate larvae.

Dorsum: derm membranous. Dorsal setae absent. Dorsal pores usually delineating a distinct pattern of reticulation areas, with 5 rows of reticulation areas across thorax and abdomen (discernible only on submargin on *P. elaeocarpi*), median and submarginal rows broad and between these submedian row narrower, and with 2, 4, or 7 plates between anal plates and anterior margin. Dorsal pores of at least 3 types: (i) microductules, with a dark pore and long inner filament with a small balloon-like proximal end: most common in reticulation lines; sometimes larger near margin; (ii) small, flat, simple pores: within reticulation lines and often enlarged near margin, forming a distinct submarginal band (but few on submargin between reticulation points in *P. elaeocarpi*); also present in a line laterad to anal plates; (iii) large simple pores, equal in size to a macropore; and (iv) large, concave macropores, inner base heavily sclerotised, with a broad membranous tube opening to derm surface (absent on *P. flavus*). Preopercular pores, dorsal tubercles, and dorsal tubular ducts absent. Anal plates rather elongate, dorsal surface always folded or wrinkled, at least along inner margins of plates (wrinkled over most of dorsal surface of plates on *P. elaeocarpi*); each plate with 3 long, thick, usually blunt-tipped, spinose setae near apex, and with a short, sharp spinose seta on outer margin. Anogenital fold with 2 large internal supporting plates and with 4–6 pairs of setae along anterior margin and a single pair laterally. Anal ring with 3 pairs of setae.

Margin: marginal setae abundant and strongly spinose, rather elongate, short and straight, with narrow basal sockets; reticulation setae usually enlarged, with more pronounced basal sockets; often with a pair of broader and blunter setae laterad to each stigmatic spine; marginal setae absent from margins of anal cleft, except on *P. flavus* where 1–2 are present at distal end of cleft; marginal anal lobe setae not differentiated. Stigmatic clefts shallow but distinct, without stigmatic sclerotisations; stigmatic spines from 2 to 5+ times as long as marginal spines. Eyespot present just dorsad to margin.

Venter: pregenital disc-pores with mainly 7–10 outer loculi (mainly 7 on *P. diadema*), shape of central loculus variable between species; present mainly in groups on mediolateral folds of each abdominal segment, thus forming a line between anogenital area and metathoracic spiracles but with a few medially on abdomen on some species but never as frequent there as laterally (also present medially on thoracic segments on *P. diadema*). Spiracular disc-pores mainly with 5 loculi, in narrow bands between spiracles and stigmatic clefts, not extending medially past peritremes, except on *P. diadema*. Preantennal pores present or absent. Ventral microducts of 1 type, usually scattered throughout and with some always present near mouthparts but distribution often distinctive for each species. Ventral tubular ducts of 1 type; abundant in submarginal band and generally present just posterior to mouthparts and medially on thorax associated with coxae (except *P. punctatus*); with some ducts opening very close to margin on some species. Ventral setae: with a distinct group of anterior anal cleft setae on either side of anal cleft; hypopygial setae absent; usually with several pairs of long pregenital setae present on segment VII, and often on VI and sometimes also V; with only 1 submarginal seta on each side between stigmatic clefts; other setae as for subfamily. Antennae well developed, 6-segmented, third segment particularly long, with 0–2 pseudosegments; setal distribution as for subfamily. Mouthparts normal and not displaced. Spiracles normal. Legs well developed, with a separate tibia and tarsus but no articulatory sclerosis; setal distribution as for subfamily; tarsal digitules unequal, 1 broader and longer than other; tarsal campaniform pores absent; claws without a denticle; claw digitules equal and broad. Vulva opening on abdominal segment VII.

Remarks. This genus contains six species: *Plumichiton diadema* Henderson & Hodgson **n. sp.**, *P. elaeocarpi* (Maskell), *P. flavus* (Maskell), *P. nikau* Henderson & Hodgson **n. sp.**, *P. pollicinus* Henderson & Hodgson **n. sp.**, and *P. punctatus* Henderson & Hodgson **n. sp.** Species in the genus *Plumichiton* have the following combination of characters:
(i) anal plates with characteristic folds on their dorsal surface;
(ii) anal plate setae spinose, stout and bluntly tipped, resembling a 3-fingered comb on the apex;
(iii) pregenital disc-pores with 7 or more outer loculi, mainly present in a line on the mediolateral folds on the abdomen;
(iv) presence of large, wide, concave dorsal macropores (absent from *P. flavus*);
(v) dorsal reticulation areas in 5 longitudinal rows;
(vi) with 1 type of ventral tubular duct;
(vii) abundant marginal spinose setae.

Species in the genus *Plumichiton* resemble those in *Umbonichiton* in having pregenital disc-pores more or less restricted to a mediolateral-lateral line on the abdomen between the posterior spiracles and the anogenital area. However, *Umbonichiton* species differ from those of *Plumichiton* in having:
(i) convex (non-sunken) dorsal macropores;
(ii) pointed spinose setae on the anal plates;
(iii) dorsal surface of the anal plates without folds or wrinkles;
(iv) few setae ventrally on abdomen and these mainly short;
(v) fewer marginal spinose setae.

The species currently placed in *Plumichiton* are all endemic to New Zealand.

Generic name derivation. From *pluma* (Latin, f.) meaning soft and feathery, referring to the waxy extrusions from the middle of the dorsum, and *chiton* (Gr. m.) a tunic or garment worn close to the skin.

Key to adult female *Plumichiton*

1 With very long stigmatic spines, about 10 × longer than marginal spines 2
—Stigmatic spines relatively short, < about 3 × longer than marginal spines 3

2 Wide, concave dorsal macropores present; on *Rhopalostylis* .... ***nikau***
—Wide, concave dorsal macropores absent; on various hosts other than *Rhopalostylis* .... ***flavus***

3 Dorsal macropores about as numerous as dorsal simple pores; dorsal macropores in reticulation lines throughout dorsum, reaching to near margin .... ***punctatus***
—Dorsal simple pores far more numerous than dorsal macropores; dorsal macropores never near margin, mainly present submedially on abdomen. 4

4 Each anal plate nearly rectangular; anal plates with most of upper surface obviously deeply folded, including laterally on anterior third of each plate; with pairs of long pregenital setae present on abdominal segments VI and VII; reticulation lines not distinguishable medially because dorsal pores apparently placed randomly; pregenital disc-pores absent medially from abdominal segments .... ***elaeocarpi***

—Anal plates broadest anteriorly and tapering towards apex; anal plates with deep folding on upper surfaces restricted to near inner margins and posteriorly, never laterally on anterior third; pairs of long pregenital setae present only on abdominal segment VII, but with some other setae at least half their length present on segment VI; reticulation lines clearly present medially on dorsum, although less clear laterally; pregenital disc-pores present medially on at least some abdominal segments 5

5 Pregenital disc-pores present on all abdominal segments, medially on all thoracic segments and with a large group laterad to each metacoxa; with several pairs of long pregenital setae on abdominal segment VII; ventral microducts forming a distinct line near margin .... ***diadema***

—Pregenital disc-pores only present medially on posterior-most abdominal segments, absent medially from thorax and with few laterad to each metacoxa; with only a single pair of long pregenital setae on abdominal segment VII; ventral microducts not in a distinct line but sparsely distributed in a broad band marginally .... ***pollicinus***

Plumichiton diadema Henderson & Hodgson new species

Figs M22, C72, 125

Unmounted material: test circular or slightly elliptical in outline, convex, of thick glassy wax plates, with a fringe of broadly triangular segments around edge, extending beyond body rather like petals on a daisy; submarginal ring of small, thinner plates allowing reddish colour of insect to show through; median plates very wide, appearing as regular transverse bands on young specimens but coalescing and becoming very thick in old specimens. Colour white and dark red.

Mounted material: body round-oval. Length 1.48–1.86 mm, breadth 1.03–1.55 mm.

Dorsum: dorsal pores distributed in a reticulate pattern, as for genus but with 7 reticulation areas between anal plates and anterior margin; number of reticulation areas around margin uncertain; median and submarginal reticulation areas much wider than intervening submedian areas. Dorsal pores of 4 types: (i) microductules: most numerous pore within reticulation lines; a few much larger microductules present submarginally; (ii) small simple pores, about size of microductule pores: present within reticulation lines; (iii) much larger simple pores (Fig. M22): present within reticulation lines, in a submarginal band close to marginal spines and in a row along margins of anal cleft; and (iv) concave macropores, each with a deep, heavily sclerotised, base and a wide, non-sclerotised tube: restricted to reticulation lines submedially on abdomen; none in posterior medial macropore line. Anal plates: broad, often indented along posterior margin, tapering to apex; length 165–196 μm, combined widths 165–210 μm; with 2–9 minute pores on each upper surface; dorsal surface along inner margins often folded; inner margin and apical setae long, spinose, with rounded tips; lengths: inner margin 1, 26–36 μm, inner margin 2, 24–31 μm, apical setae, longest 31–55 μm; outer setae short and sharply spinose, 19–24 μm long. With 4 pairs of anogenital setae along anterior margin and 1 pair laterally, longest 50–61 μm.

Margin: marginal setae spinose, 11–23 μm long; with 18–26 spines between stigmatic clefts; reticulation setae slightly longer and displaced slightly onto dorsum; marginal setae on margins of stigmatic clefts sometimes slightly broader than other marginal setae. Stigmatic spines slightly offset on to dorsum; short, 27–50 μm long.

Venter: pregenital disc-pores with mainly 5–9 loculi; distributed as for genus; number of disc-pores on each segment (medially/mediolaterally): anal cleft: VII, 0–6/12–18; VI, 1–5/6–9; V, 2–8/6–10; IV, 5–10/5–11; III, 7–20/7–12; and II, 9–15/6–12; metathorax with 7–16 disc-pores medially and 4–19 laterad to each coxa; mesothorax with 1–8 medially and 2–7 laterad to each coxa; prothorax with 0–4 medially and 0–2 near each coxa. Spiracular disc-pores: with 21–31 in each anterior band and 25–36 in each posterior band, each band extending well past peritremes. Ventral microducts in a submarginal row but absent from within submarginal band of tubular ducts; also scattered throughout rest of venter. Tubular ducts as for genus but with a few on head between antennae and near mouth, and usually with a few near each coxa and sometimes with 1 or 2 medially on abdomen. Ventral setae: ventral anal lobe setae 23–34 μm long; with 6–8 pairs of flagellate anterior anal cleft setae; with 1–2 pairs of longer setae amongst rows of moderately long setae on all abdominal segments, longest 53–85 μm; total number

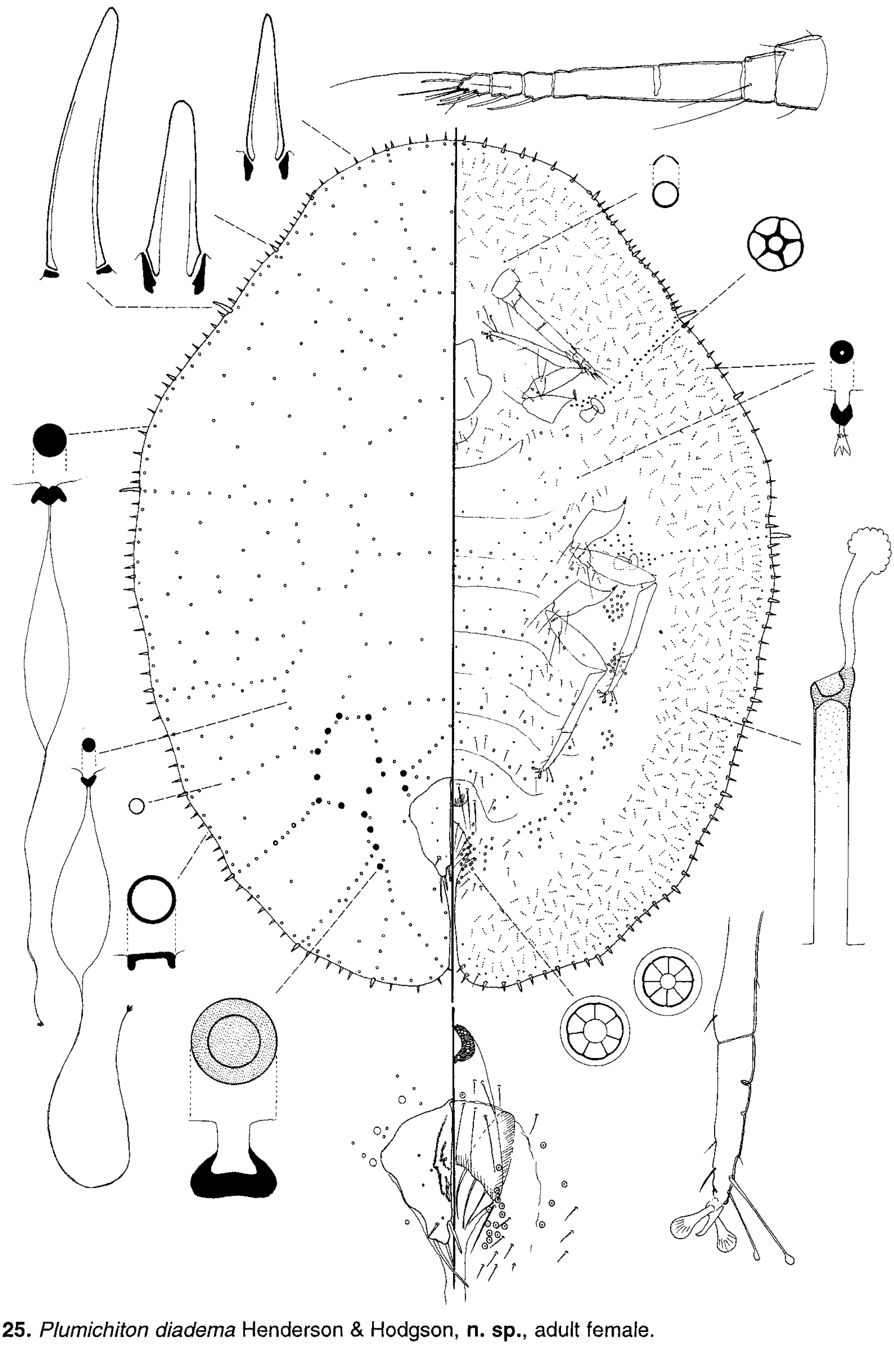


Fig. 125. *Plumichiton diadema* Henderson & Hodgson, **n. sp.**, adult female.

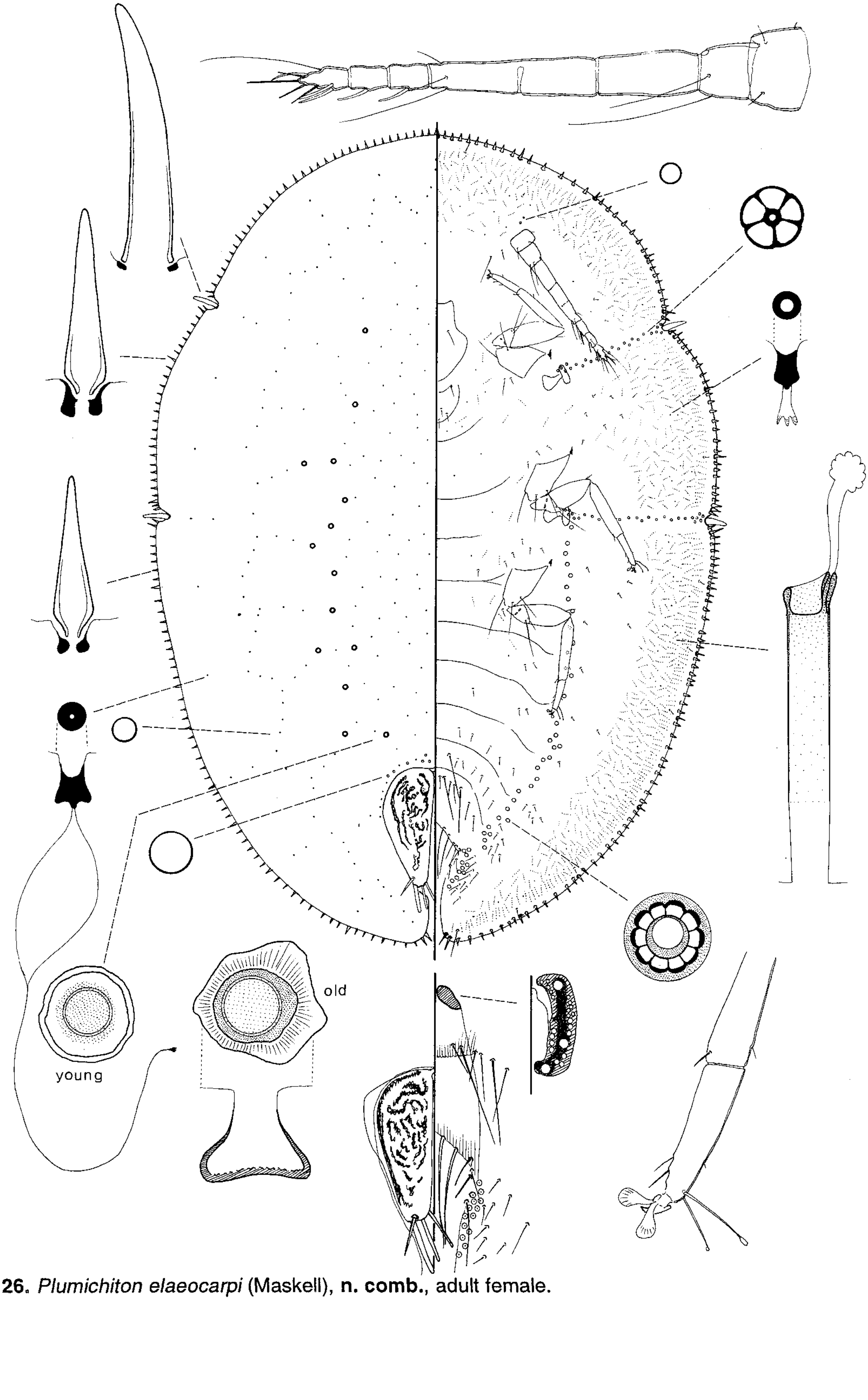


Fig. 126. *Plumichiton elaeocarpi* (Maskell), **n. comb.**, adult female.

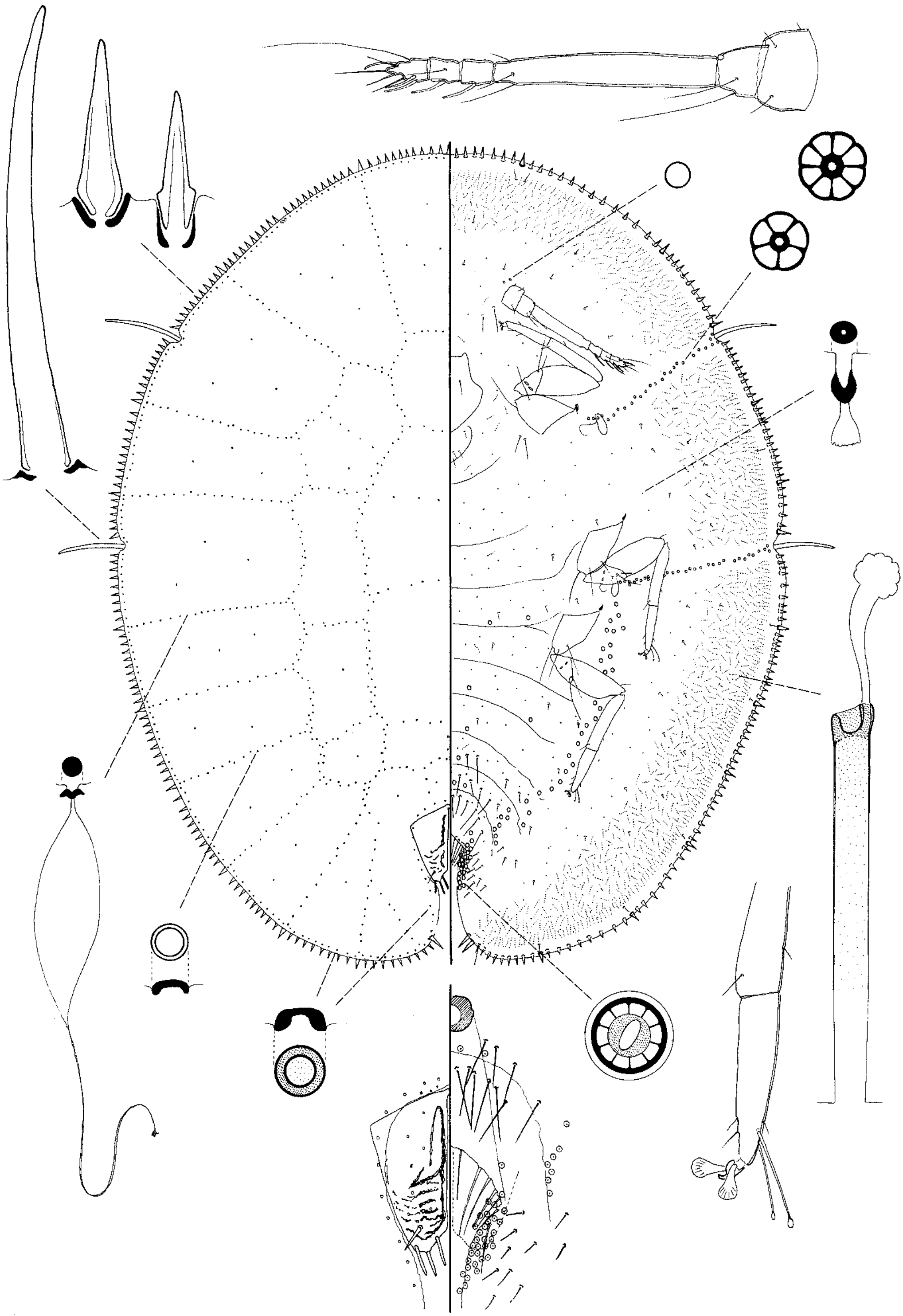


Fig. 127. *Plumichiton flavus* (Maskell), **n. comb.**, adult female.

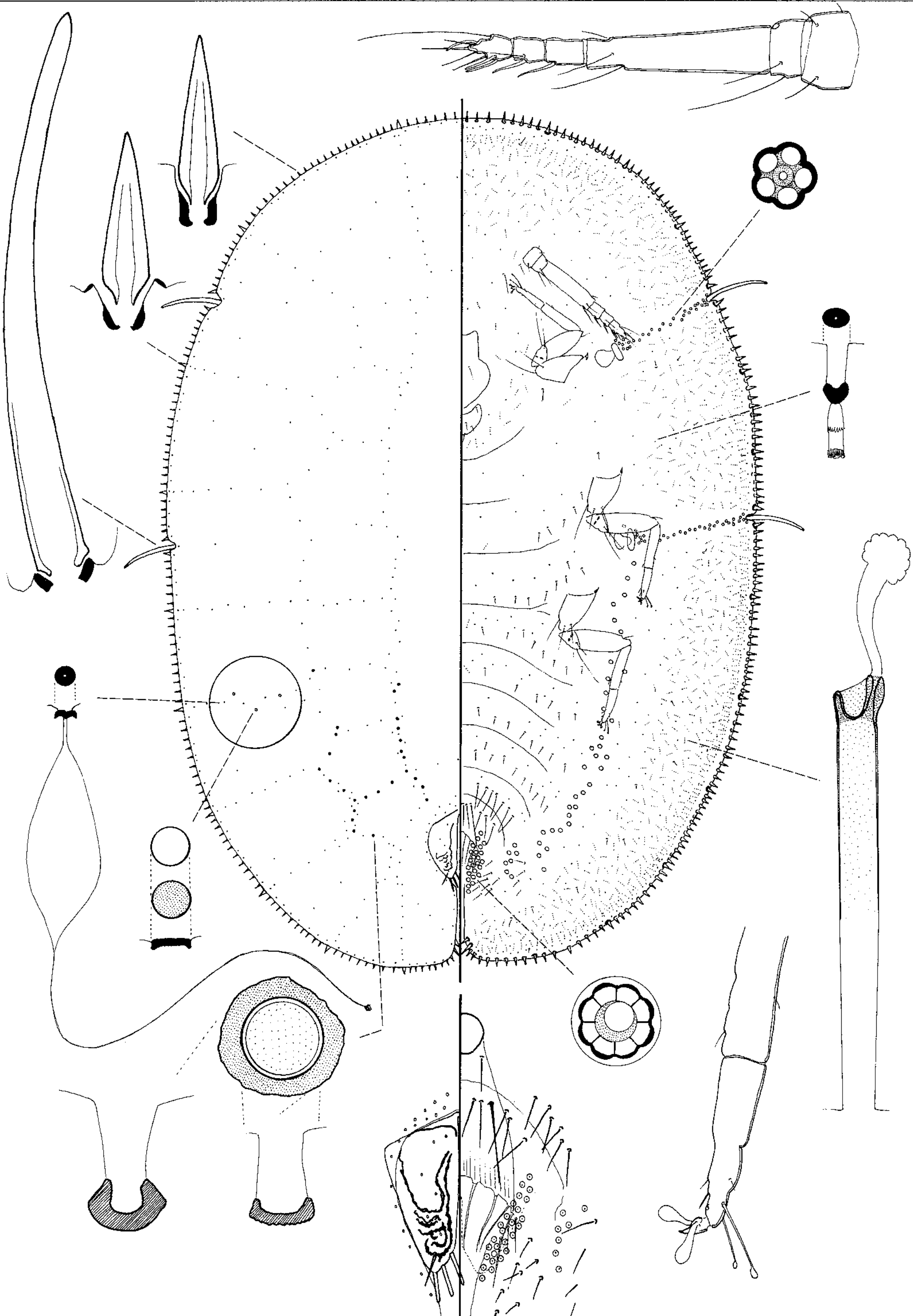


Fig. 128. *Plumichiton nikau* Henderson & Hodgson, **n. sp.**, adult female; circle contains reticulation line of dorsal pores further enlarged.

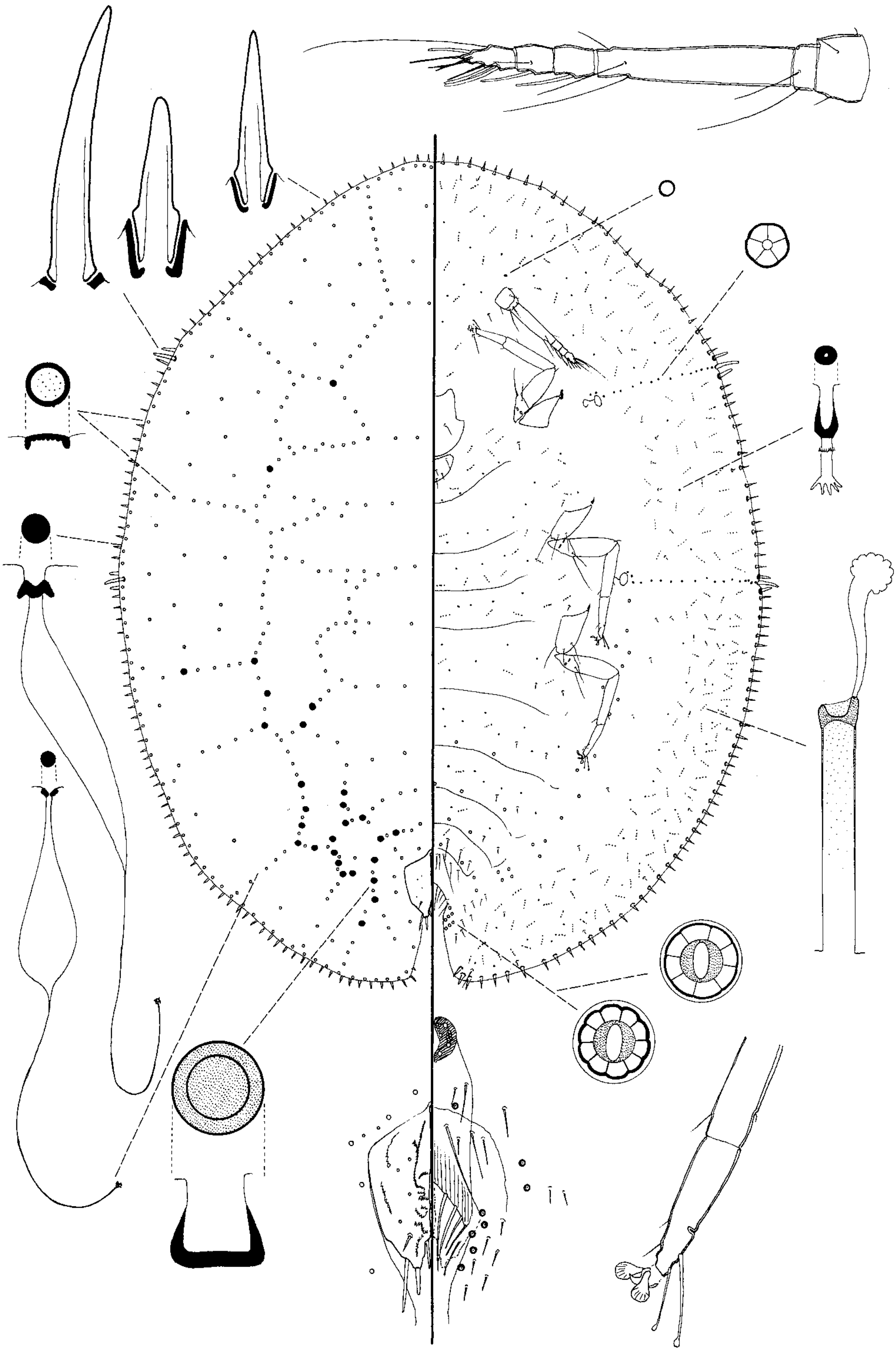


Fig. 129. *Plumichiton pollicinus* Henderson & Hodgson, **n. sp.**, adult female.

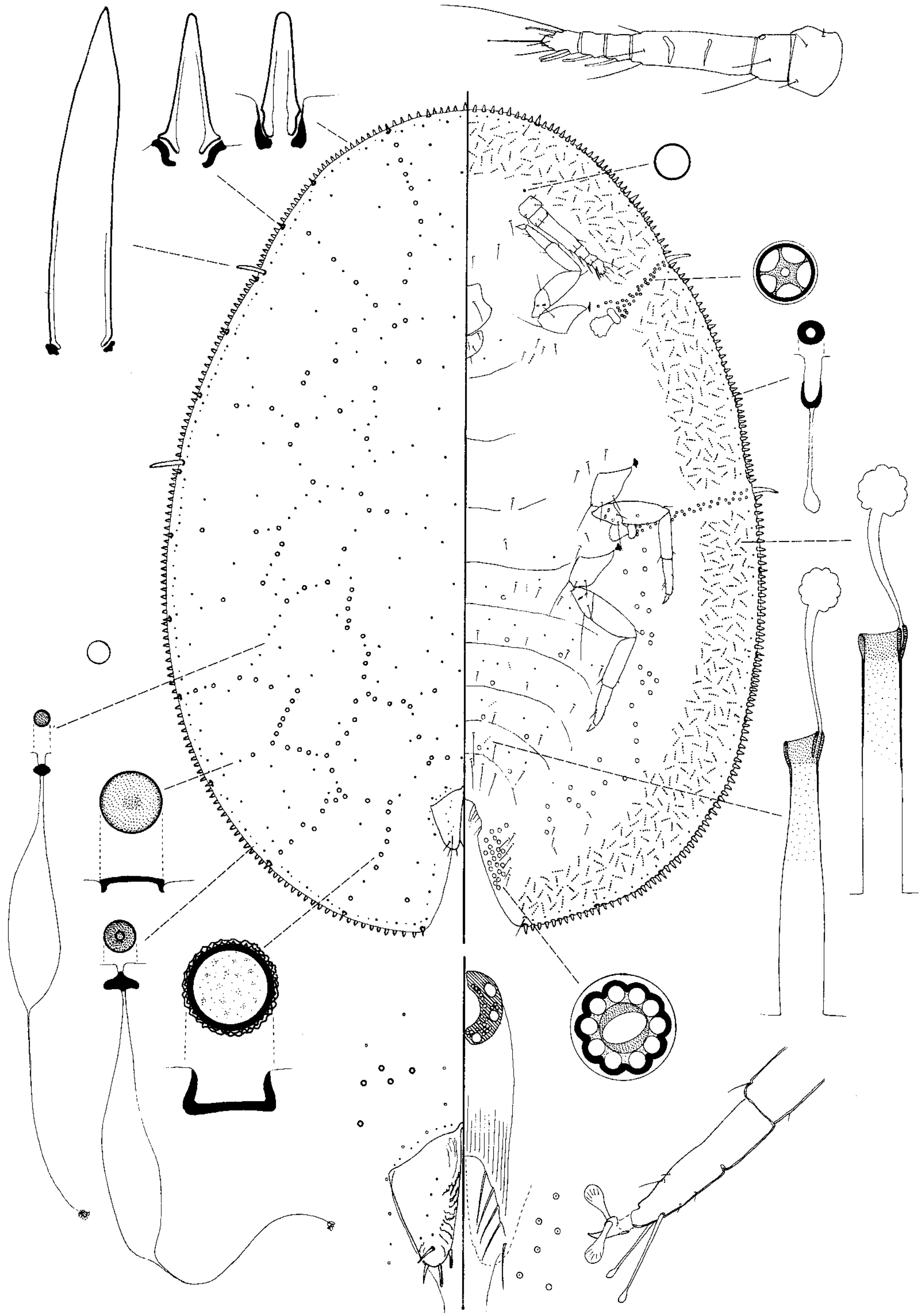


Fig. 130. *Plumichiton punctatus* Henderson & Hodgson, **n. sp.**, adult female.

of setae medially on each abdominal segment: VII, 5–7; VI, 8–10; V, 7–10; IV, 9–13; III, 5–14; and II, 1–8; with 3–10 setae near each metacoxa, 1–6 near each mesocoxa and 3–4 near each procoxa; with 4–6 (total) interantennal setae. Antennae 6-segmented, 223–257 µm long; apical seta 23–38 µm long. Clypeolabral shield 130–165 µm long. Width of spiracular peritremes: anterior 30–34 µm; posterior 30–38 µm. Legs: lengths (metathoracic): coxa, 142–157 µm; trochanter + femur, 177–203 µm; tibia, 138–154 µm; tarsus, 96–115 µm; claw rather long, 19–25 µm.

Material examined: HOLOTYPE ♀: NEW ZEALAND: **HB**: Kaweka Range, Makahu Spur track, *Parahebe olseni*, upperside leaves, 25 Jan 1998, R.E. Beever, #98-003h, NZAC: 1/1♀ ad.
PARATYPES: collection data as for holotype: NZAC #98-003a–g, i & j: 9/9♀♀ ad.

Other material: NEW ZEALAND: **HB**: Kaweka Range, Makahu Spur track, 1250m, *Parahebe olseni* upperside leaf, 14 Mar 1998, T.J.B. Herman, #98-051: 1/1♀ ad. **TO**: Tongariro National Park, Whakapapanui Stm, Tawhai Falls, *Ozothamnus leptophyllus* [as *Cassinia leptophylla*], 25 Jan 1982, C.F. Butcher, #98-004: 1/1♀ ad. Desert Road, near Waiouru, *Olearia nummularifolia*, 22 Sept 1958, G.B. Rawlings & R. Zondag, FRNZ no.R(a)67: 1/2♀♀ ad, 1♂ 2nd. As previous, except 23 Sept 1958, FRNZ nos 54–56: 10/4♀♀ ad, 1♀ 3rd, 1♀ 2nd, 1♂ 2nd, 3 1sts. **NN**: Lake Sylvester, *Ozothamnus leptophyllus* [as *Cassinia vauvilliersii*], 29 Apr 1969, J.A. de Boer, no. 514: 1/2♀♀ ad (one split dorsoventrally). **MC**: Porters Pass, *Gaultheria* sp., 7 Feb 1982, C.F. Butcher, #83-320c & #90-254a–b: 3/2♀♀ ad, 4 1sts.

Remarks. *P. diadema* can be differentiated from all other *Plumichiton* species by:
(i) the numerous pregenital disc-pores present medially on the thorax and on all the abdominal segments, as well as in the 2 mediolateral bands on abdomen;
(ii) the extension of the spiracular disc-pore bands past the peritremes onto the median thorax.

P. diadema is similar to *P. nikau* and *P. pollicinus* in having the dorsal macropores mainly restricted to the abdomen.

P. diadema is closest to *P. pollicinus*, with which it shares:
(i) 7 reticulation areas between the anal plates and the anterior margin;
(ii) the medium length of the ventral anal lobe setae;
(iii) the large dorsal simple pores in the reticulation lines and in a submarginal row.

P. diadema differs from *P. elaeocarpi* and *P. nikau* in having medium length stigmatic spines (the latter two species have long stigmatic spines), while *P. flavus* differs from *P. diadema* in having no dorsal macropores. *P. diadema* shares the presence of long claws with *P. punctatus*.

Biology. *P. diadema* appears to favour montane habitats. All the host plants have small leaves that remain on the plant during the winter and all collection sites have periods of snow coverage. The type series was found above the tree line between about 1200 and 1350 metres asl, on a prostrate plant of *Parahebe* growing amongst rock scree. Young adult females and empty male tests were present in midsummer (January) and there was little change by late summer (March), although the females' wax tests had grown thicker. The only known collection with juvenile stages is from Desert Road in late September. From this, it is concluded that the adult female overwinters and reproduces in the spring.

Distribution. The seven lots of material available were collected in the southern half of the North Island and northern half of the South Island (Map 29).

Name derivation. The name is from *diadema* (Greek, n.) meaning royal circlet or crown, reflecting the shape and jewel-like ornamentation of the wax test.

Plumichiton elaeocarpi (Maskell) new combination

Figs C74, C75, 126

Ctenochiton elaeocarpi Maskell 1885: 26; –Maskell, 1887: 42 [description]; –Maskell, 1892: 17 [adult male]; –Maskell, 1895a: 12 [checklist]; –Cockerell, 1896: 330 [checklist]; –Fernald, 1903: 160 [world catalogue]; –Hutton, 1904: 226 [checklist]; –Myers, 1922: 199 [checklist]; –Miller, 1925: 33, 63 [host]; –Wise, 1977: 104 [checklist]; –Deitz & Tocker, 1980: 28 [checklist]; –Ben-Dov, 1993: 101 [world catalogue]; –Henderson 1995: 106 [lectotype designation].

Unmounted material: "Test of adult female oval, nearly circular, black in colour, divided into hexagonal and pentagonal segments which are not conspicuous, and of which the median series forms a very slightly elevated ridge somewhat lighter in colour. Test is only slightly convex. Fringe is very long and conspicuous, segments toothlike" (Maskell, 1887, p. 67). Young adult female almost round, although often fitting over curve of branch; colour speckled grey-brown, apart from a fringe of quite long white wax plates and blocks of dirty-white wax medially on dorsum; at first with curls or cones of wax on top but these soon wear off. Mature female convex, black, with only marginal fringe plates and small amounts of median dorsal wax blocks remaining, otherwise mature females devoid of wax plates on elevated sides but with a thin wax coating over sclerotised derm. On twig or small branch of host plant.

Mounted material: body shape oval. Length 1.63–2.47 mm, breadth 1.02–2.0 mm.

Dorsum: derm becoming sclerotised at maturity. Dorsal pores distributed in a reticulate pattern laterally but reticulation lines obscure medially; possibly with 25–26 areas around margin. Dorsal pores of 3 types: (i) microductules: with a large sclerotised pore and very long inner filament often appearing looped and twisted within body of slide-mounted young females; present in reticulation lines and scattered over dorsum but not on submargin; (ii) very small simple pores, about half size of microductule pores: seemingly randomly distributed; with a row of slightly larger pores of both (i) and (ii) in an arc just anterior to anal plates; and (iii) large concave macropores, with a heavily sclerotised base with a granular surface and a lightly sclerotised tube wall: present in a broad, loose band submedially on abdomen and thorax, sometimes extending in a single row onto head; with none in posterior medial macropore line. Anal plates: each plate almost rectangular, with very deep folds over almost entire upper surface including laterally over anterior third; length of each plate 173–211 µm, combined widths 150–200 µm; with minute pores present but barely visible within folds on each plate; with 3 pairs of anal plate setae near apex, all stoutly spinose with rounded tips; lengths: inner margin 1, 46–65 µm, inner margin 2, 48–53 µm and apical seta, 53–63 µm; outer margin setae shorter, tapering, sharply spinose, 38–42 µm long. Anogenital fold usually with 5 (range 4–6) pairs of setae along anterior margin and 1 pair laterally; longest 77–125 µm.

Margin: marginal setae spinose, slim and sharply pointed, each 15–30 µm long; reticulation setae slightly longer; with 26–43 spines on each side between stigmatic clefts; those near stigmatic spines sometimes slightly larger. Stigmatic spines of medium length, 50–73 µm long.

Venter: pregenital disc-pores with mainly 10 loculi (range 8–12), each with a distinctively offset inner loculus associated with a crescent-shaped dark area; restricted to a line on mediolateral folds on abdomen, extending to posterior spiracles: number of disc-pores on each side of segment: anal cleft/VII, 15–30; VI, 2–11; V, 4–8; IV, 5–10; III, 6–11; and II, 6–13; also with 6–15 in a line laterad to metacoxae. Spiracular disc-pores: with 19–40 in each anterior band and 21–42 in each posterior band; bands 1 pore wide, except near peritremes and at margin. Preantennal pores sometimes present. Ventral microducts as for genus. Tubular ducts as for genus but with a few medially on head, thorax (mostly near coxae) and occasionally on abdomen. Ventral setae: ventral anal lobe setae long, 37–52 µm; with 7–10 pairs of flagellate anterior anal cleft setae; with pairs of long pregenital setae on abdominal segments VI and VII, and sometimes also V; longest 85–142 µm; other pregenital setae on segments VI and VII moderately long; total number of setae medially on each abdominal segment: VII, 6–13; VI, 7–10; V, 3–11; IV, 2–5; III, 1–6; and II, 1–6; with 3–6 setae near each metacoxa, 2–5 near each mesocoxa and 2–3 near each procoxa; with 2–4 (total) interantennal setae. Antennae with 2 pseudosegments, total length 300–423 µm; apical seta 38–50 µm long. Clypeolabral shield 173–207 µm long. Width of spiracular peritremes: anterior 46–65 µm, posterior 55–80 µm. Legs: lengths (metathoracic): coxa, 127–157 µm; trochanter + femur, 165–215 µm; tibia, 130–169 µm; tarsus, 85–104 µm; claw, 15–20 µm.

Material examined: LECTOTYPE ♀: NEW ZEALAND: labelled: "*Ctenochiton elaeocarpi*, antenna and foot of adult female, from *Elaeocarpus,* Oct 1884, W.M.M." NZAC: 1/1♀ ad.; "Entomology Div., DSIR, NZ, W.M. Maskell Collection"; designated by Henderson, 1995.
PARALECTOTYPES: (i) as lectotype, except labelled "Female-2nd stage" (actually an early 2nd-instar male; NZAC: 1/1♂ 2nd). (ii) "Ctenochiton elaeocarpi, test of female 2nd-stage, ... *Elaeocarpus*, W.M.M."; gold label as above (actually a whole mount of a 2nd-instar male on a piece of leaf, in good condition and distinctive of the species); NZAC: 1/1♂ 2nd.

Other material: NEW ZEALAND: ex Maskell's dry material (round box) labelled *Ctenochiton elaeocarpi*, mounted by J.A. de Boer: 2/3♀♀ ad. **ND**: Tangihua Range, Horokaka, *Beilschmiedia tawa* underside leaf, 6 Apr 1993, RCH, #98-090a–c: 3/1♀ 3rd, 1♀ 2nd, 1 1st. **AK**: Waitakere Range, Fairy Falls Tk, *Beilschmiedia tawa* underside leaf, 18 Oct 1994, RCH, #98-087: 1/1♀ 2nd. Hunua Range, Mangatangi Reservoir, Workman Tk, *Weinmannia silvicola* leaves, 31 Jan 1998, C.J. Hodgson, #98-088: 1♀ 3rd, 1/1♀ 2nd. **BP**: Mamaku, Aquarius Rd, *Weinmannia racemosa*, 21 Sept 1981, R.M.J. McKenzie, FRNZ 74: 1/1♂ 2nd. Lottin Point, Otanga, *Litsea calicaris*, 27 Jan 1993, RCH, #93-265: 1/1♀ 3rd. As previous, except *Hedycarya arborea*, 27 Apr 1993, #93-0175a–b: 2/1♀ ad (pharate), 2♂ 2nd. As previous, except 3 Nov 1993, #93-

365: 1/1♀ ad (old). Te Koau, Bush Walk, twig of *Beilschmiedia tawaroa*, 15 Mar 1993, RCH, #93-087a–b: 2/1♀ ad (old), 4 1sts. As previous, except 30 Sept 1993, #93-320: 1/1♂ 2nd. As previous, except underside leaves, 14 Mar 1994, #97-054: 1/1♂ 2nd (split dorsoventrally). As previous, except Hovell's Watching Dog, #97-053: 1/9 1sts. Hicks Bay, Onepoto Bay creek, *Hedycarya arborea*, stem and underside leaves, 31 Oct 1994, RCH, #94-108a (stem): 1/3♀♀ ad, & b–c (leaves), 3/1♀ ad (pharate), 1♀ 3rd (pharate), 1♀ 2nd, 5♂ 2nd. As previous, except #97-055a–b: 2♀ 3rd (dorsoventrally split), 2/2♂ 2nd (dorsoventrally split). Orete Forest, Te Puia Hut, *Beilschmiedia tawaroa* leaves, 26 Apr 1993, RCH, #97-052: 1/5 1sts. Rereauira Swamp, Beech Ridge, *Weinmannia racemosa*, 29 Jan 1993, RCH, #93-064a–b: 2/2♂ 2nd (parasitised). Waiaroho, *Beilschmiedia tawaroa*, 29 Apr 1993, RCH, #93-121: 1/1♂ 2nd. As previous, except *Hedycarya arborea*, 29 Sept 1993, #93-315a–c: 3/2♀♀ ad, 1♂ 2nd, (+1 *Poropeza dacrydii* ♀ 3rd, pharate); #93-338: 1/1♂ ad. As previous, except 3 Nov 1993, underside leaf, #93-359: 1/1♂ ad. As previous, except twig at node, #93-364a–b: 2/2♀♀ ad. **GB**: Karakatuwhero V Rd, Waipiata, *Beilschmiedia tawaroa* twig, 28 Sept 1993, RCH, #93-319a–c: 3/2♀♀ ad (old), 1♀ 2nd, 1♂ 2nd. Pohutu, *Hedycarya arborea*, 17 Mar 1993, RCH, #93-305: 1/1♀ 2nd (parasitised). As previous, except 28 Sept 1993, #93-318: 1/3♂ 2nd. **TO**: Rangitoto Station, Mangatutu, *Beilschmiedia tawa* underside leaf, 9 Nov 1996, RCH, #98-091: 1/2♂ 2nd. **WI**: Bruce Park, 5km south Hunterville, *Hedycarya arborea*, 18 Jan 1994, RCH, #98-089: 1/1♀ 3rd. **NN**: Motueka, (no host), 27 Jul 1924, G Brittin, no. 110: 2/1♀ ad, 1♂ 2nd. Nelson, *Elaeocarpus hookerianus*, 8 Aug 1968, J.A. de Boer, no. 403: 2/1♀ 3rd, 2♂ 2nd (split dorsoventrally). As previous, except 19 Dec 1968, no. 465: 1/1♀ ad. Nelson, Ruby Bay, *Ileostylis* [as *Loranthus*] sp., 20 Nov 1969, J.S. Dugdale, no. 608: 2/2♀♀ ad (old). Nelson, Garden's Valley, *Elaeocarpus hookerianus*, 6 Apr 1973, J.A. de Boer: 2/2♀♀ ad (old). **MC**: Lyttelton, *Coprosma* sp., 13 Jan 1917, G Brittin, no. 113 (Brittin original slide) & ex dry material Brittin Collection, #94-060a–e: 6/6♀♀ ad. Lyttelton, *Coprosma* sp., (no date), G. Brittin, #113, [Brittin manuscript name 'Ctenochiton bicornutum']: 4/3♀♀ ad, 1♂ ad.

Remarks. *P. elaeocarpi* can be differentiated from all other *Plumichiton* species by:

(i) the large, deep folds on the anterior dorsal surface of the anal plates (whilst other *Plumichiton* species have folds on their anal plates, these are never present on the anterior third);

(ii) the lack of a submarginal band of simple pores dorsally;

(iii) the absence of a clear dorsal reticulation pattern;

(iv) the sclerotisation of the dorsum at maturity.

P. elaeocarpi differs from *P. flavus* in possessing concave dorsal macropores. It also differs from *P. flavus* and *P. nikau* in having medium-short stigmatic spines (long on the latter two species) and from *P. diadema*, *P. pollicinus*, and *P. punctatus* in the absence of pregenital disc-pores medially on the abdomen.

Biology. Young females were collected in spring, larvipositing females in summer through autumn, and very old, sclerotised females in autumn through winter, the latter remaining on the host even when dead. The nymphs were most often collected from autumn through winter to late spring, but sometimes also in midsummer. Adult females appear to have been collected in nearly all months of the year but, when the wide span of their ages is taken into consideration, it possibly signifies a long period of adulthood and an extended larval production period, perhaps resulting in non-synchronous single generations per year rather than being multivoltine. At any one time, a few neonate larvae shelter in the brood chamber beneath the female's abdomen before emerging from beneath her posterior end.

Distribution. From Northland to Christchurch (Map 30).

Plumichiton flavus (Maskell) new combination

Figs M27, M28, C73, 127

Ctenochiton flavus Maskell 1884: 130; –Maskell 1885: 26 [host]; –Maskell, 1887: 68 [description]; –Maskell, 1895a: 13 [checklist]; –Cockerell, 1896: 330 [checklist]; –Fernald, 1903: 160 [world catalogue]; –Hutton, 1904: 226 [checklist]; –Froggatt, 1921: 23 [taxonomic remark]; –MacGillivray, 1921: 178 [catalogue]; –Myers, 1922: 199 [checklist]; –Miller, 1925: 33, 63 [host]; –Costa Lima, 1936: 167 [doubtful Brazilian record]; –Lepage, 1938: 351 [doubtful Brazilian record]; –Lindinger, 1954: 619 [Brazilian record incorrect]; –Hoy, 1954: 601 [distribution]; –Hoy, 1958: 197 [host; distribution]; –Hoy, 1961: 58 [distribution]; –Wise, 1977: 104 [checklist]; –Deitz & Tocker, 1980: 28 [checklist]; –Ben-Dov, 1993: 101 [world catalogue].

Unmounted material: "Female test golden, waxy, flat beneath, convex above; outline circular or slightly elliptical, with a fringe of broadly triangular segments around the edge. Apex of test an irregular elongated mass of wax, remainder divided into two concentric series of plates, inner series pentagonal with sharp angles, outer pentagonal with rounded angles and with outer sides forming base of segments of the fringe. The inner series often forms irregular lumps of wax" (Maskell, 1884, p. 130). Colour varies from dark and light brown to yellow-brown. The thick fringe of wax plates resemble petals on a daisy.

Mounted material: body round-oval. Length 1.48–2.76 mm, breadth 1.0–2.05 mm.

Dorsum: dorsal pores distributed in a reticulate pattern, delineating 4 reticulation areas between anal plates and anterior margin and probably with 21 areas around margin. Dorsal pores of 2 types (Fig. M27): (i) microductules (Fig. M28), about half size of smallest simple pores: present within reticulation lines and with a few on submarginal reticulation areas, and (ii) small simple pores of 2 sizes, smallest about twice size of microductule pore: present within reticulation lines; slightly larger simple pores: in a submarginal row close to marginal spines and along margins of anal cleft; reticulation lines with many pores of both types, often 2 pores wide, but narrowing to 1 pore wide near margins. Anal plates: length 184–219 µm, combined widths 154–242 µm; with 2–10 minute pores on each upper surface; upper surface of each plate with deeply wrinkled or folded along inner third (and occasionally on posterior half), but never laterally on anterior third; inner and outer margin setae short and sharply spinose, apical setae spinose, longer and thicker, usually with a rounded tip; length of setae: inner margin 1, 16–31 µm, inner margin 2, 21–33 µm, apical setae, 33–43 µm, and outer setae, 12–21 µm. With 5–6 pairs of setae along anterior margin of anogenital fold and 1 pair laterally; longest 57–100 µm.

Margin: marginal setae spinose, narrow, straight and sharply pointed, each 11–23 µm long; reticulation setae slightly longer; with 1–2 pairs of noticeably stout spines extending up outermost margins of anal cleft; with 19–35 spines between stigmatic clefts; those on either side of stigmatic spines larger, with a blunt tip, 23–30 µm long. Stigmatic spines long, 134–192 µm, displaced slightly onto dorsum.

Venter: pregenital disc-pores with mainly 10 loculi (range 8–10), most abundant on mediolateral folds on abdomen in a line between genital area and posterior spiracle but with a few also present medially on abdomen: number of disc-pores (medially/mediolaterally on each side) on each segment: anal cleft/VII, 0/13–40; VI, 0–5/3–9; V, 0–3/5–10; IV, 1–2/6–9; III, 1–3/3–9; and II, 0–2/3–9; metathorax with 0–2 disc-pores medially and 3–9 laterad to each coxa. Spiracular disc-pores with mainly 5–7 loculi; with 19–39 in each anterior band and 21–42 in each posterior band; bands 1 pore wide except near peritremes and margin. Preantennal pores present. Ventral microducts and ventral tubular ducts as for genus. Ventral setae: ventral anal lobe setae 34–53 µm long; with 5–11 pairs of flagellate anterior anal cleft setae; with 2–3+ pairs of long pregenital setae in addition to setae of medium length on segments V–VII, longest 50–96 µm; number of setae medially on each abdominal segment: VII, 4–11; VI, 5–11; V, 4–7; IV, 3–7; III, 0–5; and II, 1–4; with 1–8 setae near each metacoxa, 1–4 near each mesocoxa, and 1–2 near each procoxa; with 2–6 (total) interantennal setae. Antennae 260–342 µm long; apical seta 17–35 µm long. Clypeolabral shield 160–173 µm long. Width of spiracular peritremes: anterior 36–52 µm, posterior 40–52 µm. Legs: lengths (metathoracic): coxa, 110–146 µm; trochanter + femur, 150–178 µm; tibia, 119–134 µm; tarsus, 80–94 µm; claw, 15–20 µm.

Material examined: LECTOTYPE ♀ (here designated): NEW ZEALAND: labelled "*Ctenochiton flavus*, from *Brachyglottis*, June 1882, W.M.M."; gold label, "Entomology Div., DSIR, NZ, W.M. Maskell Collection", NZAC: 1/4♀♀ ad — lectotype female clearly marked. PARALECTOTYPES: (i) on lectotype slide above, NZAC: 1/3♀♀ ad. (ii) as for lectotype slide, NZAC: 3/3♀♀ ad "in puparia", 1♂ "puparia", "female 2nd stage" = ♀ 3rd, stained and remounted by RCH.

Other material: NEW ZEALAND: from *Leptospermum*, Oct 1884, W.M.M.: 1/1♂ ad. **AK**: Waitakere Ra, Sharp Bush, *Elaeocarpus dentatus* leaf, 29 Apr 1995, RCH, #95-044: 1/1♀ ad. Riverhead Forest, Barlow Rd reserve, *Myrsine australis* leaf, 22 July 1998, RCH, #98-085: 1/pupa. **BP**: Waenga Bush, Otanga, (Lottin Pt Road), *Prumnopitys ferruginea* stems, 3 Nov 1994, RCH, #94-104a–c: 3/1♀ ad, 2♀ 3rd, 1♀ 2nd, 2♂ 2nd. Waiaroho, *Beilschmiedia tawaroa*, 26 Apr 1993, RCH, #93-185: 1/♀ 2nd. Ruatahuna, Whakatane R, (N 44.35.42 [NZFS no.]), *Pseudowintera axillaris* leaves, 9 Apr 1961, J.S. Dugdale, FRNZ R12,R13: 2/12♀♀ ad. **GB**: Pohutu, Awatere R bridge, *Hedycarya arborea* stem, 1 Nov 1994, RCH, #94-102: 1/1♀ ad. Kakanui E-W saddle, head of Waipohatuhatu Stm, *Ripogonum scandens*, 22 Sept 1992, RCH, #92-312a–b: 2/1♀ ad (infested with fungus *Hypocrella duplex*), 4♂ 2nd. Kakanui, 300 m, *Myrsine salicina*, 16 Mar 1993, J.W. Marris, #93-083: 1/1♀ ad. As previous, except 30 Apr 1993, RCH, #93-083b: 1/1♂ ad. **TK**: Awakau Road, *Weinmannia racemosa* leaf, 12 Dec 1993, RCH, #93-372: 1/1♀ ad. **TO**: Pureora Forest, *Weinmannia racemosa*, 22 Mar 1960, J.M. Hoy: 1/1♀ ad. **NN**: Tarakohe, *Melicytus ramiflorus*, 14 Aug 1925, G. Brittin, no. 215: 4/4♀♀ ad, 4♀ 3rd, 2♂ 2nd. As previous, except *Pittosporum* sp., ex dry material Brittin collection, #94-058a–c: 3/2♀♀ ad (pharate), 3♀ 3rd, 1♂ 2nd. Buller, near Millerton, *Weinmannia* sp., 19 Jan 1983, C.F. Butcher: 1/1♀ ad. **KA**: Kaikoura, Half Moon Bay, *Hedycarya arborea* stems, 15 Jan 1998, C.J. Hodgson, #98-092: 1/1♀ ad. **BR**: Buller Gorge, *Pseudowintera colorata*, 17 Mar 1971, J.A. de Boer, no. 724: 1/1♀ ad (+*Inglisia patella* ♀ ad). Punakaiki, *Hebe (elliptica?)*, 25 Oct 1970, J.A. de Boer, no.650: 1/2♀♀ ad (split dorsoventrally). **MC**: Riccarton Bush, *Pseudowintera colorata* [as *Drymus*], 30 Dec 1916, G. Brittin, no. 108: 1/1♀ ad. As previous, except 17 Mar 1917: 1/1♀ ad. **FD**, Bligh Sound, Wild Natives R, *Weinmannia racemosa*, stems and leaves, 21 Jan 1996, RCH, #96-048a–n: 14/11♀♀ ad (2 pharate), 3♀ 3rd, 1♀ 2nd, 2♂♂ ad, 4 pupae, 3 prepupae, 6♂ 2nd, 5 1sts. Bradshaw Sound, Precipice Cove, *Weinmannia racemosa*, 28 Jan 1996, RCH, #96-085a–d: 4/1♀ ad, 4♀ 3rd, 2♀ 2nd, 1♂ 2nd.

Remarks. *P. flavus* can be differentiated from other *Plumichiton* species in:
(i) the absence of concave dorsal macropores;
(ii) in having only 3–4 reticulation areas between the anal plates and the anterior margin;
(iii) the presence of long stigmatic spines (shared with *P. nikau*).

P. flavus shares with *P. elaeocarpi* the character of long ventral anal lobe setae, and with *P. diadema*, *P. pollicinus*, and *P. punctatus* the presence of pregenital disc-pores medially on the abdomen.

This species was also recorded off *Weinmannia racemosa* from Pohangina Valley (**RI**), Tamaki River (**RI**), and Waituhi Saddle (**TO**) by Hoy (1958). As no other species of *Plumichiton* has been recorded off *Weinmannia*, these records seem likely to be *P. flavus*, although no material is available to confirm them. Hoy (1958) also mentions another species ("near *flavus*") off *W. racemosa* which had an "unusually small number of pores in the spiracular canallae". It was possibly a 3rd-instar female *C. flavus*, although again no material is available.

P. flavus (as *Ctenochiton flavus*) has also been recorded from São Paulo, Brazil (MacGillivray, 1921; Costa Lima, 1936; Lepage, 1938). As pointed out by Lindinger (1954), the hosts quoted by these authors are those from New Zealand NOT Brazil and so nothing more is known about this record. It seems highly improbable that it was *P. flavus*.

Biology. It is not known whether *P. flavus* is uni- or multivoltine, but early-instar nymphs are present mainly in the warmer months of the year and *P. flavus* probably overwinters as the adult female. Much honeydew is produced by colonies of this insect; this was particularly notable in Fiordland, where the host trees were blackened with sooty mould living on the honeydew.

Pathogens and parasitoids. *P. flavus* is susceptible to attack by the orange-coloured parasitic fungus *Hypocrella duplex* (Berk.) Petch.

Distribution. Throughout, from Auckland in the north to Fiordland in the south (Map 31).

Plumichiton nikau Henderson & Hodgson new species

Figs C78, 128

Unmounted material: glassy wax test convex and oval, with thick plates, fused into 3 longitudinal rows dorsomedially; raised sides formed from submarginal row of plates with fringe plates apparently fused together; base of test broad with a marginal footplate of gum-like wax which sticks test to leaf substrate; colour variable, from light green and light brown. Positioned along length of leaf on either leaf surface.

Mounted material: body shape oval. Length 2.13–2.90 mm, breadth 1.84–2.49 mm.

Dorsum: dorsal pores distributed in a reticulate pattern, delineating 2 reticulation areas between anal plates and anterior margin (one very large) and with perhaps 21 areas around margin. Dorsal pores of 3 types: (i) microductules: present in reticulation lines and submarginally; (ii) small simple pores, slightly larger than microductule pore: also present in reticulation lines and submarginally; reticulation lines with many pores of both types, often 2 pores wide, but narrowing to 1 pore wide towards margin; and (iii) large concave macropores, with a heavily sclerotised base which appears granular with thin walled tube; this pore appears to become more heavily sclerotised with age; restricted to median and submedian reticulation lines on abdomen; with none in posterior medial macropore line. Anal plates: length 192–223 µm, combined widths 192–260 µm; with 1–9 minute pores on each upper surface; dorsal surfaces of each plate distinctively folded or wrinkled but never laterally on anterior third; each plate with 3 spinose setae near apex, of rather uniform width and usually with rounded tips, length: inner margin 1, 16–28 µm, inner margin 2, 24–33 µm, apical setae, 28–40 µm; outer margin setae set on dorsal surface of plates, short and sharply spinose, length 12–33 µm. Anogenital fold with usually 5 pairs of setae along anterior margin and 1 pair laterally; longest seta 88–115 µm.

Margin: marginal setae spinose, straight, sharply pointed, 11–15 µm long; reticulation setae slightly longer and with a pair of larger, blunt tipped spines on either side of stigmatic spine, length 10–23 µm; with 25–38 spines on each side between stigmatic clefts. With a submarginal row of simple pores close to marginal spines and almost as numerous, and with a row of more numerous microductules close to, and just dorsad to, simple pores. Stigmatic spines long, 107–150 µm long, offset slightly onto dorsum.

Venter: pregenital disc-pores with mainly 10 loculi (range 6–10), restricted to mediolateral folds on abdomen between posterior spiracle and genital area; absent medially; number of disc-pores on each side of segment: anal cleft/VII, 25–32; VI, 0–5; V, 3–7; IV, 3–9; III, 3–6; and II, 3–9; with 2–12 pores in a line laterad to each metacoxa. Spiracular disc-pores: with 21–38 in each anterior band and 22–42 in each posterior band; each band 1 pore wide except near peritremes and margin. Preantennal pores present. Ventral microducts and tubular ducts as for genus. Ventral setae: ventral anal lobe setae very short, 7–15 µm long; with 4–7 flagellate anterior anal cleft setae; with numerous long setae on segments VI–VII, longest 60–92 µm, and with some moderately long setae on segment V; total number of setae medially on each abdominal segment: VII, 8–12; VI, 10–16; V, 8–14; IV, 6–12; III, 4–16; and II, 2–16; with 2–7 setae medially on each metathorax; 1–6 setae medially on each mesothorax, and 1–2 near each procoxa; with 2–5 (total) interantennal setae. Antennae: 215–263 µm long; apical seta 19–30 µm long. Clypeolabral shield 134–154 µm long. Width of spiracular peritremes: anterior 42–50 µm, posterior 50–57 µm. Legs: lengths (metathoracic): coxa, 96–115 µm; trochanter + femur, 88–146 µm; tibia, 80–107 µm; tarsus, 50–73 µm; claw, 12–15 µm.

Material examined: HOLOTYPE ♀: NEW ZEALAND: **BP**: Te Koau, 243m, *Rhopalostylis sapida*, 4 Nov 1993, R.C. Henderson, #93-363a, NZAC: 1/1♀ ad.
PARATYPES: as for holotype: NZAC #93-363b–e: 4/♀ ad, 1♀ 3rd, 1♂ 2nd, 1♂ ad.

Other material: NEW ZEALAND: **AK**: Auckland, Titirangi, (Bruce Taylor's property), *Rhopalostylis sapida* leaf, 22 Nov 1977, A.R. Ferguson, #79-198b: 2/2 ♀♀ ad. **CL**, Kauaeranga State Forest, *Rhopalostylis sapida* [as 'nikau palm'] leaves, 20 Jan 1960, R. Zondag, FRNZ R(a)26 & 27: 2/3♀♀ ad, 6 1sts. **BP**: Te Koau, *Rhopalostylis sapida* leaves, 31 Jan 1993, RCH, #93-060a–j: 10/8♀♀ ad, 7 1sts. As previous, except 15 Mar 1993, #95-154a–c: 3/1♀ ad, 4♂ 2nd. As previous, except 30 Sept 1993, #95-155, 1/1♀ ad. Waenga Bush, Lottin Point Road, *Rhopalostylis sapida*, 27 Jan 1993, RCH, #95-152a–b: 2/1♀ ad, 6 1sts.

Remarks. *P. nikau* is similar to all other *Plumichiton* species other than *P. flavus* in having dorsal concave macropores but it differs from all other *Plumichiton* species in:
(i) having very short ventral anal lobe setae;
(ii) the near absence of pores medially on the dorsum;
(iii) only about two reticulation areas between the anal plates and anterior margin.

It is similar to *P. flavus* in having very long stigmatic spines, to *P. elaeocarpi* in lacking pregenital disc-pores medially on the abdomen, and to *P. pollicinus* in having submarginal rows of dorsal microductules and simple pores.

Biology. Collected only from *Rhopalostylis sapida*, a native palm. The mature female is highly convex, her abdomen retracting ventrally to form a brood chamber, where a few neonate nymphs are generally found sheltering during larviposition, before emerging from beneath the posterior end.

Pathogens and parasitoids. *P. nikau* is commonly attacked by the orange-coloured parasitic fungus *Hypocrella duplex* (Berk.) Petch.

Distribution. As this species is uncommon compared with its host plant and then often not found alive (it is impossible to identify when parasitised with fungus), it is likely that the distribution is wider than records show, but it may be absent from the wetter areas of *R. sapida*'s distribution (Map 32).

Name derivation: after the Maori name for the host plant, *nikau*.

Plumichiton pollicinus Henderson & Hodgson new species

Figs M21, C76, C77, 129

Unmounted material: test of young female slightly elliptical in outline, convex, composed of thick glassy wax plates, with a fringe of broadly triangular segments around margin; mature female highly convex and hornlike, wax plates coalescing from margin to form a median rounded point, with rough edges where marginal and submarginal plates join. When on leaf of host plant, inhabits upper surface.

Mounted material: body oval. Length 1.04–1.64 mm, breadth 0.75–1.30 mm.

Dorsum: dorsal pores distributed in a reticulate pattern, delineating 7 reticulation areas between anal plates and anterior margin and with about 17 areas around margin. Dorsal pores of 4 types: (i) microductules of 2 sizes: smaller pores abundant in reticulation lines; larger pores present as a submarginal row; (ii) small simple pores (subequal in size to larger microductule pore): present in reticulation lines; (iii) large simple pores (about size of a spiracular disc-pores): present in reticulation lines, in a submarginal row close to marginal spines, and in a row on either side of anal cleft and extending around anterior margin of anal plates; and (iv) concave macropores (Fig. M21), each with a deep heavily-sclerotised base and a non-sclerotised, wide outer tube: present in reticulation lines submedially on abdomen, often in a distinctive zigzag pattern; with occasionally 1 or 2 in posterior medial macropore line. Anal plates: often indented just posterior to widest part; length 146–177 µm, combined widths 123–157 µm; with 1–5 minute pores on upper surface of each plate; upper surface of each plate slightly folded or wrinkled, particularly along inner margins, never laterally on anterior third; inner margin setae long and spinose, with rounded tips, length 19–26 µm; apical setae longest, 31–43 µm long, spinose and blunt; outer margin setae set onto dorsum, short and sharply spinose, length 14–21 µm. Anogenital fold with 4 pairs of setae along anterior margin and 1 pair laterally; longest 46–69 µm long.

Margin: marginal setae spinose, narrow, straight, apex mostly rounded to blunt, but some pointed, each 11–23 µm long; reticulation setae only slightly longer but usually displaced slightly onto dorsum; with 15–33 spines between stigmatic clefts; with a pair of slightly wider and noticeably blunt setae on either side of stigmatic spines, each 10–23 µm long. Stigmatic spines short, narrow, often slightly curved, with pointed tip and shallow basal socket, displaced slightly onto dorsum; each 10–30 µm long.

Venter: pregenital disc-pores with a highly variable number of loculi ranging from 5–10; mostly on mediolateral folds of abdominal segments extending from pregenital area to posterior spiracles but also with a few medially on abdominal segments; number of disc-pores on each segment (medially/mediolaterally on each side): anal cleft/VII, 0–1/4–9; VI, 2–4/2–6; V, 0–3/3–5; IV, 2–4/2–4; III, 0–4/2–4; and II, 0–4/3–5; metathorax with none medially but with 2–4 laterad of each coxa. Spiracular disc-pores: with 8–23 in each anterior band and 8–29 in each posterior band, pore lines not extending past peritremes. Preantennal pores present. Ventral microducts and tubular ducts as for genus. Ventral setae: ventral anal lobe setae 19–32 µm long; with 4–8 pairs of flagellate anterior anal cleft setae; with a pair of long pregenital setae on segment VII and sometimes on segment VI, but with some medium length setae on both VII and VI, longest 61–96 µm; number of setae medially on abdominal segments: VII, 7–10; VI, 5–9; V, 3–8; IV, 2–11; III, 5–8; and II, 1–7; with 1–2 setae near each metacoxa; 1–3 near each mesocoxa and 1–2 near each procoxa; with usually 2 pairs of interantennal setae. Antennae 160–226 µm long: apical seta 23–30 µm long. Clypeolabral shield 110–142 µm long. Width of spiracular peritremes: anterior 23–34 µm, posterior 27–38 µm. Legs: lengths (metathoracic): coxa, 96–123 µm; trochanter + femur, 127–154 µm; tibia, 80–123 µm; tarsus, 65–92 µm; claw short, 13–17 µm.

Material examined: HOLOTYPE ♀: New Zealand: **CL**: Little Barrier I, (upper) Valley Tk, *Leptospermum scoparium*, upperside leaves, 6 June 1994, R.C. Henderson, NZAC #94-065b: 1/1♀ ad.
PARATYPES: collection data as for holotype: NZAC: #94-065a: 1/1♀ ad; 94-065c, 1/1 pupa, 3♂ 2nd; 94-065d, 1/1♀ 3rd, 2 1st instars.

Other material: NEW ZEALAND: **CL**: Little Barrier I, Valley Tk ridge, *Leptospermum scoparium* upperside leaves, 17 Sept 1994, RCH, #94-084a–b: 1/1♀ ad, 1♂ ad. **AK**: Waitakere Ra, Huia Dam, [no host], 23 Aug 1980, C.F. Butcher, #80-242d: 1/1♀ ad. Huia, *Leptospermum scoparium*, 19 Sept 1980, C.F. Butcher, #80-269h: 1/1♀ ad. Waitakere Ra, Matuku Reserve, Taranga Tk, *Kunzea ericoides* leaf, 27 May 1995, RCH, #95-045: 1/1♀ ad. Waitakere Ra, Sharp Bush roadside, *Kunzea ericoides* upperside leaves, 22 Mar 1998, RCH, #98-052a–b: 2/2♂ 2nd, 2 prepupae, 2 pupae, 1 1st. As previous, except Mountain Rd, lvs & twigs, 7 July 1998, #98-078a–d: 4/2♀♀ ad, 1♂ ad (pre-emergent), 1♂ 2nd, 2 pupae. **GB**: Paoneone, *Kunzea ericoides* upper surface leaves, 15 Mar 1994, RCH, #94-141a–b: 1/1♀ ad (pharate), 1♀ 3rd, 2♂ 2nd. **BP**: Rotorua, Atiamuri Rd, *Leptospermum scoparium*, 12 July 1959, R. Zondag, FRNZ R94: 2/2♀ 3rd. **WI**: Flock House, *Leptospermum scoparium*, 30 Apr 1959, M.A. Stoodley, FRNZ R83–86: 4/22♀♀ ad. **SD:** Okiwi Bay, *Leptospermum scoparium*, 17 Oct 1955, J.M. Hoy, #201: 1/1♀ ad. Para Swamp, near Picton, *Leptospermum scoparium*, 9 Aug 1948, T.G. Sewell, #78: 3/2♀♀ ad (one pharate), 3♀ 3rd (one pharate), pupa. Rocky

Creek Bridge, *Leptospermum scoparium*, 9 Aug 1948, T.G. Sewell, #74: 2/3♀♀ ad (one pharate), 3♀ 3rd, 2♂ 2nd. **MB**: Waihopai [as Waihopeu] Valley, *Leptospermum scoparium*, 5 Aug 1948, T.G. Sewell: 4/3♀♀ ad (pharate), 3♀ 3rd, 2♂ 2nd, pupa. **NN**: Nelson, *Leptospermum* sp., upperside leaves, 10 Apr 1925, Brittin dry collection #71, #98-068a–n: 14/3♀ 3rd (one pharate), 9♀ 2nd, 11♂ 2nd, 2 1st. Collingwood, *Kunzea ericoides*, [as *Leptospermum*] 3 Aug 1948, T.G. Sewell: 5/4♀♀ ad (3 pharate), 4♀ 3rd, 1♂ 2nd. 5 miles north of Westport, *Leptospermum scoparium*, 23 Mar 1960, J.G.R. McBurney, FRNZ R(a)44–46: 3/5♀♀ ad, 2♀ 2nd, 4♂ 2nd (+some bits), 1 1st. **BR**: Inangahua Landing, *Leptospermum scoparium*, 9 Nov 1959, J.G.R. McBurney, FRNZ no. R(a)3: 1/1♂ ad.

Remarks. *P. pollicinus* can be differentiated from all other *Plumichiton* species by:

(i) the short stigmatic spines, with a very blunt marginal spine either side;

(ii) the characteristic zigzag pattern formed by the concave macropores dorsally on the abdomen.

P. pollicinus is similar to all other *Plumichiton* species other than *P. flavus* in having concave macropores dorsally on the abdomen. It is closest to *P. diadema*, with which it shares:

(i) 7 dorsal reticulation areas between the anal plates and anterior margin;

(ii) medium length ventral anal lobe setae;

(iii) some large dorsal simple pores medially within the reticulation areas and in a submarginal row.

It resembles *P. nikau* in having a submarginal row of dorsal microductules, and a short claw on the legs; and is similar to *P. flavus* and *P. punctatus* in having a few pregenital disc-pores medially on the abdomen.

Biology. Apparently restricted to New Zealand's two most common shrubland plants, *Kunzea ericoides* (previously *Leptospermum*) and *Leptospermum scoparium*. The main overlapping generation(s) seems to be from autumn through winter to spring, with both nymphs and adults collected then. All males, nymphs, and some young adult females are found on the upper leaf surfaces but the mature females are on the stems.

Distribution. Lowland shrubland throughout (Map 33).

Name derivation. The name is taken from: *pollex, pollicis* (L.) meaning thumb, *pollicinus* meaning thumb-like (the mature adult female test resembles a small, horny thumbnail).

Plumichiton punctatus Henderson & Hodgson new species

Fig. 130

Unmounted material: inhabits upperside of leaf (waxy base pad remaining on leaf in dry collection); nothing else known.

Mounted material: body round-oval. Length about 2.57 mm, breadth about 2.1 mm.

Dorsum: dorsal pores distributed in a reticulate pattern, delineating 7 reticulation areas between anterior margin and anal plates and with perhaps 19 areas around margin. Dorsal pores of 4 types: (i) microductules of 2 sizes: very small pores: in reticulation lines; much larger pores: in a submarginal row along with large simple pores; (ii) small simple pores, slightly larger than small microductules: associated with reticulation lines and occasionally elsewhere; (iii) large button-shaped simple pores, about size of spiracular disc-pores: present in reticulation lines, in a submarginal row alternating with large microductules (about 1 opposite every 2.5 marginal spines), in a sparse row along anal cleft margin and around anterior margin of anal plates and rather randomly within reticulation areas, particularly medially on dorsum; and (iv) large concave macropores, each with a heavily sclerotised base and a short, wide, non-sclerotised tube; rather common, present in all reticulation lines, and with 0–4 in posterior medial macropore line. Anal plates: length about 200 μm, combined widths about 215 μm; with 2–5 minute pores on each upper surface; upper surface of each plate slightly folded or wrinkled, particularly along inner margins but never laterally on anterior third; inner margin setae spinose with blunt tips, length 26–31 μm; apical setae similar but more sharply pointed, length about 28 μm, and outer margin setae set on dorsal surface, short and sharply spinose, length about 24 μm. Anogenital fold with 4 pairs of setae along anterior margin and 1–2 pairs laterally; longest about 80 μm.

Margin: marginal setae spinose and stout, with rounded tips, 11–19 μm long; reticulation setae slightly displaced onto dorsum and with distinctly different basal sockets; with about 27 spines on each side between stigmatic clefts; with a pair of larger setae on either side of stigmatic spines, differentiated from other marginal setae only in being blunter. Stigmatic spines short and sharply pointed, with very shallow setal sockets; each 42–46 μm long, displaced onto dorsum.

Venter: pregenital disc-pores with mainly 10 (range 7–10) loculi; mainly present on mediolateral folds on abdominal segments from anogenital area to posterior spiracles; also present sparsely medially on abdomen; number of disc-pores on each segment (medially/mediolaterally on each side): anal cleft/VII, 0/15–20; VI, 3/2–4; V, 4/2–3; IV, 1/4–5; III, 1/2–6; and II, 1/2–5; metathorax with none medially but with 2–5 laterad to each metacoxa. Spiracular disc-pores: with 25–37 in each anterior band and 27–40 in each posterior band, pore bands not extending past peritremes. Preantennal pores present. Ventral microducts in a submarginal row and very sparse medially. Tubular ducts as for genus except possibly of 2 types, a broader type forming the submarginal band and with a slightly narrower duct sparse medially on abdomen; with a single duct near procoxae. Ventral setae: ventral anal lobe setae about 27 µm long; with about 7 pairs of flagellate anterior anal cleft setae; with a pair of long pregenital setae on each of segments VI and VII, longest about 77 µm long, with other setae of moderate length; approximate number of setae medially on each abdominal segment: VII, 8; VI, 6; V, 5; IV, 7; III, 4; and II, 4; with perhaps 2 setae near each metacoxa, 3–4 near each mesocoxa, and 3–4 near each procoxa; with 2 pairs of interantennal setae. Antennae noticeably broad, with 2 pseudosegments in the long third segment, total length 285–305 µm; apical seta 34–38 µm long. Clypeolabral shield about 155 µm long. Width of spiracular peritremes: anterior 34–38 µm, posterior 42–46 µm. Legs: lengths (metathoracic): coxa, 154–160 µm; trochanter + femur, 188–200 µm; tibia, 150–154 µm; tarsus, 110–120 µm; claw long, 23 µm.

Material examined: HOLOTYPE ♀: NEW ZEALAND: **MC**: Waipara, *Olearia macrodonta*, 12 Dec 1915, G. Brittin, no. 76, NZAC: 1/1♀ ad.
PARATYPE: as for holotype, (i) on holotype slide: crawler; (ii) mounted from dry material, upperside leaf, NZAC: #90-214, 1/1♀ ad.

Remarks. *P. punctatus* can be differentiated from all other *Plumichiton* species by the numerous large concave dorsal macropores found throughout the dorsum in all dorsal reticulation lines. *P. punctatus* is closest to *P. diadema* and *P. pollicinus* in having:
(i) medium length ventral anal lobe setae;
(ii) dorsal simple pores as large as spiracular disc-pores, present in the reticulation lines and in a submarginal row.

P. diadema differs (in addition to the distribution of the dorsal macropores) in having pregenital disc-pores medially on all thoracic segments, while *P. pollicinus* differs in having frequent ventral tubular ducts medially on the thorax.

Although only two adult females are known, it is felt that they are sufficiently different from other *Plumichiton* species to warrant description.

Distribution. This species is only known from the one collection in central South Island (Map 34).

Name derivation. The specific name *punctatus* is a Latin adjective meaning dotted or marked with spots, referring to the many dorsal macropores.

POROPEZA Henderson & Hodgson, new genus

Type species: *Ctenochiton dacrydii* Maskell (here designated)

Diagnosis. Adult female. Test: (known for *P. dacrydii* only), composed of moderately thick glassy wax plates, which separate from each other rather easily, marginal wax fringe short on mature females, more noticeable on young adults.

Shape: oval to round, sometimes wider than long, with nearly vertical sides and a flattish top; mature females very large, up to 10 mm long, with a concave brood chamber beneath abdomen.

Dorsum: derm membranous, apart from a distinct anal sclerotisation. Dorsal setae absent. Dorsal pores either apparently randomly distributed (*P. cologabata*) or arranged in a reticulate pattern (*P. dacrydii*); dorsal pores of at least 3 types: (i) small, dark microductules: present throughout and/or forming reticulation lines; (ii) simple pores of various sizes: present throughout or in reticulation lines and also in a submarginal band; and (iii) large, heavily sclerotised macropores, either bollard-like, or cone-shaped with base set in a derm pocket: most abundant medially on abdomen near anal plates, tending to become less frequent anteriorly and marginally; present in reticulation lines when bollard-like or randomly when cone-shaped. Preopercular pores, dorsal tubercles, and dorsal tubular ducts absent. Anal plates broad, widest at about 3/5 from anterior margin, inner margins diverging slightly posteriorly; apex rather blunt; each plate with either a few small pores (*P. dacrydii*) or many, very large convex pores (*P. cologabata*); each plate with 4–5 long setae posteriorly. Anogenital fold with about 5 pairs of setae along anterolateral margin, lying in unusually posterior position on *P. cologabata*; probably without supporting bars or plates. Anal tube short, barely reaching anterior margin of anal plates; anal ring with 6 setae.

Margin: marginal setae stoutly spinose, with well developed, deep basal sockets; in a band 1–3 setae wide around margin, on margins of anal cleft and extending onto posterior margins of anal sclerotisation on dorsum. Stigmatic clefts absent; stigmatic spines present or not differentiated from marginal setae. Multilocular disc-pores forming a complete marginal band 2–5 pores wide ventrally, apparently becoming dorsal along part or all of margins of anal cleft anteriorly and extending onto anal sclerotisation on dorsum. Eyespot present or absent.

Venter: pregenital disc-pores similar to those around margin: present medially on posterior abdominal segments (and more anteriorly on *P. cologabata*). Spiracular disc-pores similar to disc-pores around margin: in short, broad bands between spiracles and margin and also extending medially past peritreme to near or even past associated coxae. Preantennal pores possibly absent. Ventral microducts of 1 size: more or less present throughout. With a large type of simple pore forming a complete submarginal band. Ventral tubular ducts of 1 type: abundant throughout but absent from near-marginal band and medially on abdominal segments VI (on *P. cologabata*) or VI and VII (on *P. dacrydii*). Ventral setae: with 4–10 anterior anal cleft setae; setae present medially on head, thorax, and abdomen rather long and flagellate; interantennal setae long, length <123 µm, and very finely flagellate for the distal half (often broken); other setae as for subfamily. Antennae 6- to 8-segmented, somewhat reduced on *P. cologabata*; setal distribution probably as for family. Mouthparts typical of family. Spiracular peritremes particularly large, width up to 190 µm, set rather close to margin. Legs rather small for size of mature females, particularly on *P. cologabata*; structure and setal distribution varying depending on degree of size reduction; lacking a tarsal campaniform sensilla; claw without a denticle. Vulva opening on segment VII.

Remarks. This genus contains two species: *Poropeza cologabata* Henderson & Hodgson, **n. sp.** and *P. dacrydii* (Maskell) **n. comb.** These two species share a number of important characters:
(i) large size, when mature;
(ii) a marginal band of multilocular disc-pores, which also extends up anal cleft onto anal sclerotisation on dorsum;
(iii) presence of abundant tubular ducts throughout venter;
(iv) large spiracles, set rather close to margin;
(v) broad bands of spiracular disc-pores;
(vi) rather distinctively shaped anal plates;
(vii) short anal tube;
(viii) presence of marginal setae along margins of anal cleft;
(viii) presence of ventral microducts throughout most of venter.

The two species currently included in *Poropeza* are both endemic to New Zealand.

Name derivation. *Poropeza* is a combination from *poros* (Gr.) meaning hole and *peza* (Gr.) meaning edge or border, for the many disc-pores around the margin.

Key to adult female *Poropeza*

1 Dorsal pores not forming a distinct reticulate pattern, but abundant and apparently evenly distributed; large simple pores abundant throughout dorsum, particularly near margin; each anal plate with a group of very large simple pores; similar large simple pores also frequent ventrally, particularly posteriorly on abdomen; marginal spines abundant, with more than 100 on either side between lateral stigmatic areas; stigmatic spines undifferentiated from spinose marginal setae .... ***cologabata***

—Dorsal pores forming a distinctly reticulate pattern; dorsum and venter lacking large simple pores similar in size to macropores; each anal plate with a few minute pores only; with less than 35 marginal spinose setae on either side between lateral stigmatic areas; stigmatic spines differentiated from marginal spines; legs reasonably well developed .... ***dacrydii***

Poropeza cologabata Henderson & Hodgson new species

Fig. 131

Unmounted material: unknown.

Mounted material: body oval to round, almost as wide as long, with a shallow anal cleft about 1/9th body length. Length 9.7–9.9 mm; breadth 8.3–8.6 mm.

Dorsum: dorsal pores apparently randomly distributed; pores of 4 types: (i) unusually large microductules, with a long, rather characteristically shaped, inner ductule: present throughout but most abundant posteriorly; (ii) slightly larger, convex simple pores: infrequent throughout; (iii) large, slightly convex pores with a granular appearance: abundant throughout but also in groups forming a broad disjointed band near margin; and (iv)

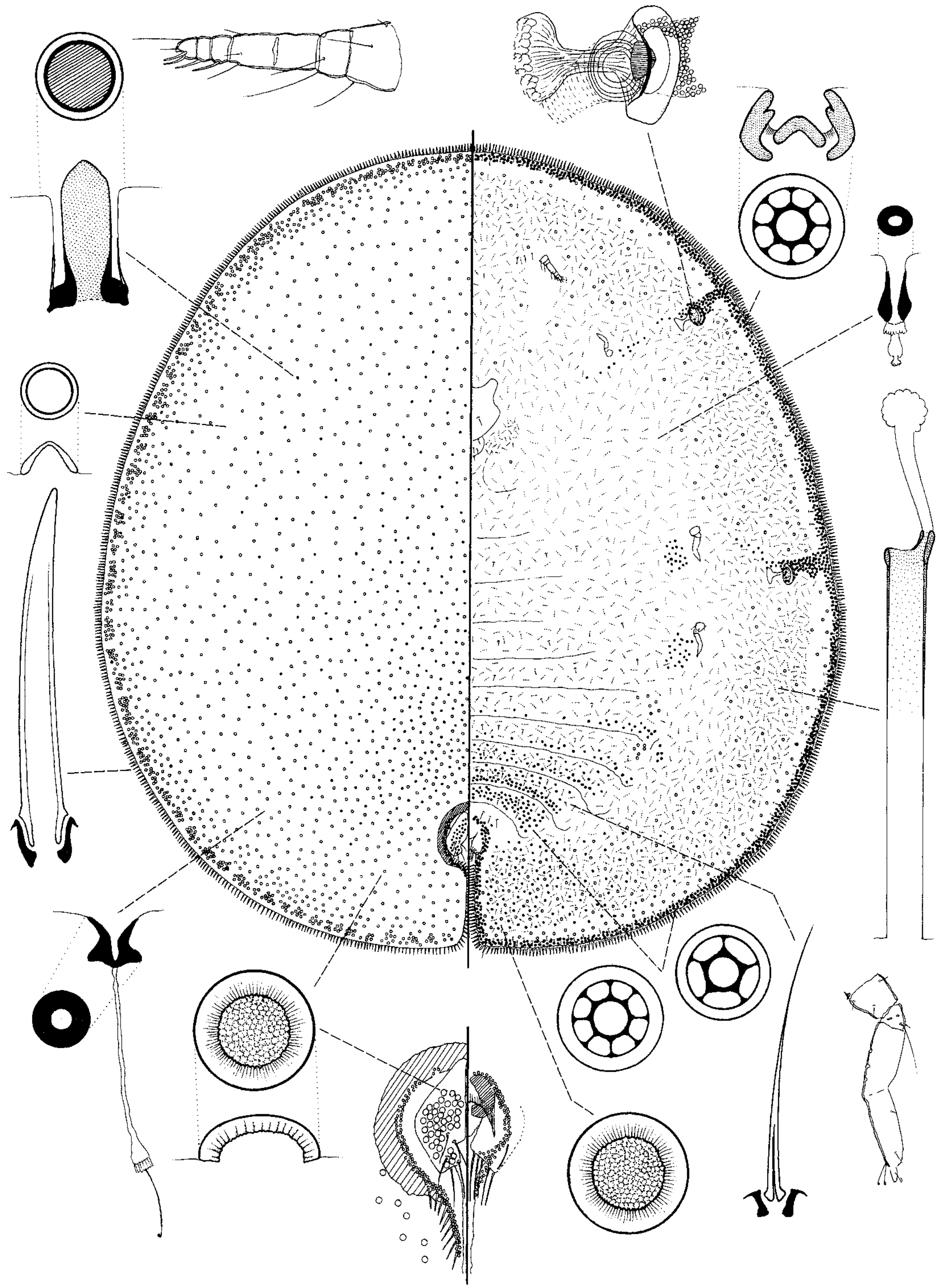


Fig. 131. *Poropeza cologabata* Henderson & Hodgson, **n. sp.**, adult female.

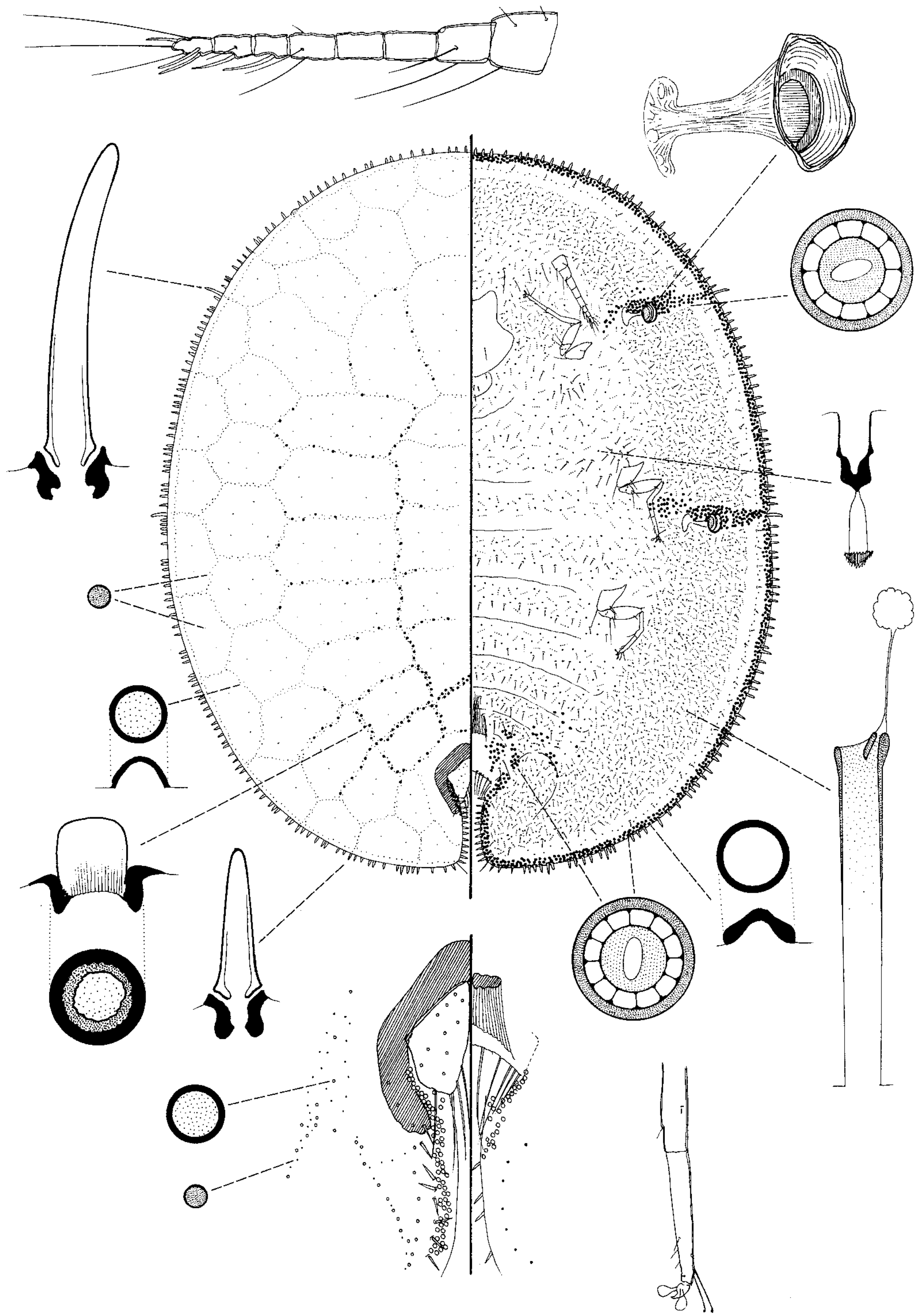


Fig. 132. *Poropeza dacrydii* (Maskell), **n. comb.**, adult female.

large macropores, with a very blunt apex and with base sunken in derm: abundant near anal plates but becoming less frequent anteriorly and marginally; absent in a wide submarginal band. Anal plates: length 287–303 µm, combined width 291–328 µm; with 32–53 large pores on dorsal surface of each plate, similar to pore type (iii) on dorsum; with 5 setae on posterior half of each plate, 2 posteriorly on dorsal surface, 1 on inner margin and 2 subapically; each 72–108 µm long. Anogenital fold lying beneath posterior end of anal plates; with 5–7 pairs of setae along margin, longest 150+ µm long.

Margin: marginal setae each stoutly spinose, straight or slightly bent, in a narrow basal socket; with 110–132 in a band 1–3 setae wide on each side between stigmatic clefts; length 45–65 µm; with 40–45 along each margin of anal cleft and extending onto posterior end of anal sclerotisation on dorsum. Stigmatic spines not differentiated from marginal setae. Marginal band of multilocular disc-pores as for genus. Eyespot poorly defined or absent.

Venter: pregenital disc-pores with mainly 7 outer loculi (range 5–8) and a round central loculus; present medially on all abdominal segments, throughout segments VI, V, and IV but only along posterior margins of segments III and II; also present in groups of 22–29 mesad to each meso- and metacoxa. Marginal band of multilocular disc-pores as for genus but also extending onto segment VII ventrally, where they form a distinct band anterior to anal tube opening. Spiracular disc-pores with mainly 8 loculi: with more than 150 disc-pores in each band; each band extending medially to near each associated coxa, also onto median venter near each procoxa. Ventral microducts: throughout, most abundant in a fairly broad submarginal band but also very common elsewhere; least frequent medially. With large, slightly convex pores (similar to type (iii) on dorsum): present sparsely in a complete, broad, submarginal band, becoming very abundant posteriorly on either side of anal cleft; also present in small groups of 3–4 and 4–5 mediolaterally on abdominal segments II and III respectively and with a few medially on head. Ventral tubular ducts: abundant throughout except in a marginal band; least frequent medially and absent medially on abdominal segments VI and VII. Ventral setae: ventral anal lobe setae poorly demarcated from other submarginal setae, each about 21–29 µm long; with 4–8 pairs of anterior anal cleft setae; with fairly long setae present medially on all abdominal segments and mesad to each coxa; number medially on each abdominal segment: VII, 8–10; VI, 6–8; V, 12–14; IV, 8–12; III, 8–10; and II, 10–12; with 8–12 setae near each metacoxa, 11–15 near each mesocoxa and 2–4 near each procoxa; longest on thorax about 55 µm long; with 5–6 pairs of interantennal setae, longest about 55 µm; with 7–11 submarginal setae between each stigmatic area; with small setae distributed rather randomly mediolaterally. Antennae somewhat reduced, 6-segmented; length 288–293 µm; with 2 long setae on scape; length of apical seta perhaps 100 µm. Clypeolabral shield 500–648 µm long. Width of each spiracular peritreme large, 153–187 µm. Legs poorly developed and sometimes segmentation obscure or absent; lengths (metathoracic): coxa 55–81 µm, trochanter + femur 99 µm, tibia 45 µm, tarsus 40 µm, and claw 9 µm; tarsal digitules about as long as claw, 1 slightly stouter than other, both with small knobbed apices; claw digitules very short, perhaps both slightly dilated apically.

Material examined. HOLOTYPE ♀: NEW ZEALAND: **[WN]**: No. 553, *Dacrydium cupressinum*, Orongorongo Valley, 25 Sept 1969, D. Campbell, J.A. de Boer Collection, NZAC: 1/1♀ ad (split dorsoventrally and mounted under 2 coverslips).

Other material: NEW ZEALAND: **AK**: Waitakere Ra, Sharp Bush, *Blechnum fraseri* underside leaves, 23 Oct 1995, RCH, #95-105a–c: 3/2♀ 3rd, 2♀ 2nd. As previous, except 18 Aug 1996, #96-154: 1/3♀ 2nd, 1 1st (+1♀ 2nd unknown sp.). **WO**: Raglan, Bridal Veil Falls, *Schefflera digitata*, 19 Sept 1981, C.F. Butcher, #81-282j: 1/1 ♀ 3rd. **BP**: Wairoho, *Hedycarya arborea*, 29 Sept 1993, RCH, #93-315b: 1/1♀ 3rd (pharate). As previous, except underside of leaf midrib, 3 Nov 1993, #93-346: 1/1♀ 3rd (pharate). **GB**: Taikawakawa, litter 92/71, 18 Oct 1992, J.S. Dugdale, #96-001: 1/1♀ 3rd. *No collection data except, New Zealand, NZAC, #83-326c: 2/2♀♀ ad.

Remarks. This is a very distinctive species. It is close to *P. dacrydii* but is immediately recognisable by the presence of large simple pores on the anal plates and in the more abundant marginal spinose setae.

Biology. Immature specimens of *P. cologabata*, despite being found on leaves of *Blechnum fraseri, Hedycarya arborea,* and *Schefflera* sp., and in litter rather than on Podocarpaceae, seem to belong to this species. Although none of the records of adult females indicate the site of collection on the host plant, it is assumed to be under the bark as with *P. dacrydii*, in which case the life cycle is probably also unusual. No male stages are known.

Distribution. Possibly widespread but rarely collected; adult known from the southern tip of North Island; immatures known from Auckland, Waikato, and the East Cape region (Map 35).

Name derivation. The specific name refers to the abundant pores found apparently randomly over the dorsum: *colo-* from the Latin *colum* (n.) meaning a sieve, and *gabata* the Latin for a dish or platter.

Poropeza dacrydii (Maskell) new combination

Figs C79, C82, 132

Ctenochiton dacrydii Maskell, 1892: 18; –Maskell, 1895a: 12 [checklist]; –Cockerell, 1896: 330 [checklist]; –Coleman, 1903: 81 [host comment]; –Fernald, 1903: 159 [world catalogue]; –Hutton, 1904: 226 [checklist]; –Myers, 1922: 199 [checklist]; –Miller, 1925: 33, 63 [host]; –Hall, 1926: 18 [mention]; –Deitz & Tocker, 1980: 28 [checklist]; –Ben-Dov, 1993: 100 [world catalogue].

Unmounted material: "Test of adult female white, or with a slight yellowish tinge, moderately thick, formed of a number of subcircular segments, which seem to be very brittle and apt to break off; the edge of each segment is irregular, and the surface marked with irregular lines, and also radiating lines, so that it has somewhat the appearance of a fish-scale; the circular lines are rather deeply indented. Fringe [of wax plates] in the specimens seen fragmentary. The segments of the test are sometimes convex, sometimes flattish" (Maskell, 1892, p. 18). Live colour pinkish-brown but dark brown when preserved. Young adults broadly oval with anal plates clearly noticeable posteriorly on dorsum; mature female more convex, with a raised flattish top and nearly vertical sides, and with anal plates and anal cleft actually on posterior vertical margin.

Mounted material: body oval to round, sometimes wider than long, with a shallow anal cleft, about 1/10th body length. Length 3.5–8.5 mm; breadth 2.7–9.5 mm.

Dorsum: dorsal pores distributed in a reticulate pattern, delineating reticulation areas each with a few small microductules only; these reticulation areas in 7 longitudinal rows, probably with 9–10 areas between anal plates and anterior margin and with 30 areas around margin; dorsal pores of 3 types: (i) microductules, probably with long inner ductules, although these could not be seen: distributed throughout but most abundant in reticulation lines; (ii) slightly larger, convex simple pores: common in lines of reticulations and also forming a band submarginally; and (iii) macropores bollard-like; most abundant towards posterior end, medially and mediolaterally; absent submarginally; with 26–39 in posterior medial macropore line. Anal plates: length of plates 237–254 µm, combined widths 254–303 µm; with 3–15 minute pores on dorsal surface of each plate; with 2 long setae along inner margin, a long apical seta and a long seta on outer margin, all setae 100+ µm. With 5–6 setae on anterolateral margins of anogenital fold; longest 108–150 µm.

Margin: marginal setae stoutly spinose, with a heavily sclerotised, deep basal socket; length 14–23 µm; with 17–29 laterally between stigmatic clefts; with 6–10 on either margin of anal cleft and extending onto posterior margins of anal sclerotisation on dorsum. With 0 or 1 stigmatic spine per stigmatic area, each apically blunt and slightly curved, length 18–49 µm. Marginal band of multilocular disc-pores with mainly 10 loculi. Eyespots each 14–20 µm wide.

Venter: pregenital disc-pores with mainly 10 outer loculi and an oval central loculus; mainly found in groups on each side of posterior abdominal segments; number of pores on each side: VII none, VI, 15–20; V, 7–20; IV, 1–10; III and II, 0. Similar multilocular disc-pores also present in a band 2–5 pores wide round entire margin. Spiracular disc-pores each with 8–10 (mainly 10) outer loculi; with more than 100 disc-pores in each band; each band extending medially almost to associated coxa. Ventral microducts as for genus. With a slightly convex simple pore forming a complete, narrow, submarginal band; with 20–40 between stigmatic areas. Ventral tubular ducts as for genus: less frequent medially and absent from abdominal segment VII. Ventral setae: ventral anal lobe setae each about 60–120 µm long; with 4–10 pairs of anterior anal cleft setae; with long setae present medially on all abdominal segments and mesad to each coxa, rather abundant, many with an extremely long, fine, flagellate apex; number medially on each abdominal segment: VII, 7–14; VI, 18–26; V, 20–30; IV, 18–28; III, 15–26; and II, 10–28; with 18–38 on metathorax, 30–50 near each mesocoxa, and 4–24 near each procoxa, longest 135+ µm; with 3–6 pairs of inter-antennal setae; with 4–13 submarginal setae laterally between each stigmatic area; small setae also present rather randomly mediolaterally. Antennae well developed, 6- to 8-segmented; total length 324–511 µm; with a long seta on scape; length of apical seta 135+ µm. Length of clypeolabral shield 423–500 µm. Width of each spiracular peritreme 169–189 µm. Legs well developed but rather narrow and frequently misshapen; lengths (metathoracic): coxa 91–100 µm, trochanter + femur 200–216 µm, tibia 138–171 µm, tarsus 91–135 µm, claw 13–20 µm; tarsal digitules both longer than claw, 1 slightly stouter than other; claw digitules both broad; claw without a denticle.

Material studied: LECTOTYPE (here designated): NEW ZEALAND: labelled "*Ctenochiton dacrydii* Mask., New Zealand, Mask. Coll. No. 202", USNM: 1/1♀ ad (dorsum and venter split).
PARALECTOTYPES: "*Ctenochiton dacrydii* Mask., New Zealand, Mask. Coll. No. 202", NZAC: 1/1♀ ad (unmounted, dry). "*Ctenochiton dacrydii*, early 2nd stage female, 1891, W.M.M.", NZAC: 1/1 1st (i.e., a crawler rather than a ♀ 2nd). *Ctenochiton dacrydii* larvae, 1891, W.M.M.: 1/9 1st. Mask. coll., #202, USNM: 1/21 1st.

Other material: NEW ZEALAND: **KE**: Kermedec Is., Raoul Is. crater, litter 72/188, 11 Oct 1972, C.R. Veitch, #17, 18: 3/2♀ 3rd, 1♀ 2nd. **AK**: Riverhead SF, under bark of *Podocarpus totara*, associated with ants, 7 Nov 1981, C. Mercer, #81-317d: 1/1♀ ad. Riverhead Forest, Barlow Road reserve, *Podocarpus totara* under bark, 6 Feb 1998, C.J. Hodgson & RCH, #96-007a–e: 5/4♀♀ ad, 1♀ 3rd. **TO**: Whirinaki, *Podocarpus totara* bark, 18 May 1965, J.S. Dugdale, FRNZ R(b)26/27: 2/2♀♀ ad (poor condition). TeWhaite area, *Podocarpus totara*, Jan 1970, R.J. McKenzie, FRNZ R(b)28–31: 4/4♀♀ ad (dorsums and venters split). Mimiha Strm, Ruatahuna, *Podocarpus totara*, 17 Mar 1970, R.J. McKenzie, FRNZ R(b)32–36: 5/5♀♀ ad (dorsums and venters split). Mangawiri Basin 125', S.F. 58, Whirinaki, ex *Podocarpus totara*, April 1972, R.J. McKenzie, #844: 1/1♀ ad (dorsum and venter split). **WN**: Orongorongo Valley, *Dacrydium cupressinum*, 25 Sept 1969, D. Campbell, #553: 1/1♀ ad (venter and dorsum split). **NN**: Riwaka Valley, Motueka, Nelson, *Dacrycarpus dacrydioides* [as *Podocarpus dacrydioides*], 17 Nov 1918, G. Brittin: 1/1♀ 3rd. **BR**: Buller Gorge, *Dacrydium cupressinum*, 17 Mar 1971, J.A. de Boer, #713: 4/3♀ ad (all split, 2♀♀ on single slides, 1♀ dorsum and venter on separate slides). Mawhera S.F., nr Reefton, *Dacrydium cupressinum*, 19 Apr 1972, J.S. Dugdale, #846: 1/1♀ ad (split). **FD**: Secretary I, Bauza I, *Podocarpus* sp., 26 Nov 1981, C.F. Butcher #82-148c: 4/3♀♀ ad, 1♀ 3rd. Breaksea Sound, Gilbert 6, *Prumnopitys ferruginea* [as *Podocarpus ferrugineus*] bark, 12 Mar 1983, C.F. Butcher, #83-321a, -326f: 2/2♀♀ ad. As previous, except [as miro], Gilbert Is. 6, #90-242a–c: 12/6♀♀ ad, 1 ♀ 3rd, 31 1st. Bauza I, *Podocarpus totara* under bark & moss, 28 Jan 1996, RCH, #96-080: 1/1♀ ad (anal plates dissected). Breaksea Sound, Gilbert 6, *Podocarpus totara* under thin bark, 2 Feb 1996, RCH, #96-046a–b: 2/4♀ 3rd. Dusky Sound, Anchor I, by lake, *Dacrydium cupressinum* under bark, 10 Feb 1996, RCH, #96-047: 1/1♀ ad. Chalky Inlet, Little I, *Podocarpus totara* under thin bark, 11 Feb 1996, RCH, #96-045a–d: 4/2♀♀ ad, 2♀ 3rd, 7 1st. Preservation Inlet, Cuttle Cove, *Podocarpus totara* under thin bark, 13 Feb 1996, RCH, #96-044a–o: 15/ 10♀♀ ad, 7♀ 3rd, 7 1st. **SL**: Bluff Hill, Glory Track, bark of *Dacrydium cupressinum*, 16 Feb 1982, C.F. Butcher, #83-335e: 1/1♀ ad.

Remarks. The original material was collected in the Reefton district (**BR**) (Maskell, 1892). This species and *P. cologabata* (described as new above) appear to be closely related, but *P. dacrydii* is immediately separable in:
(i) possessing a reticulate pattern of pores on the dorsum;
(ii) lacking the large simple pores on the anal plates which are so distinctive on *P. cologabata.*

Biology. Maskell (1892, p. 19) commented that "Mr Raithby first found the specimens under thick moss on the roots just above the ground; later finds were under the bark on the trunk; and he thinks that the species may sometimes be subterranean." All specimens in the NZAC from under bark of various Podocarpaceae are either large mature females, much smaller young adult females or still smaller 3rd-instar females, all of which have large mouthparts, with stout, long stylets, presumably adapted to feeding through the outer tissues of the tree; 2nd-instar females have never been found under bark with adults. The crawlers that emerge from beneath the mature females do not have particularly strong mouthparts and it is supposed that they may leave the maternal site and migrate elsewhere, perhaps feeding on the fine roots? Miller (1925) indicated that he had found *P. dacrydii* infesting not only the bark but also the roots of rimu (*Dacrydium cupressinum*). If the early instars do feed elsewhere, it is likely that they grow to the 3rd instar before migrating back beneath the bark. This suggestion is supported to some extent by the fact that three nymphs of *P. dacrydii,* including the only known 2nd-instar female, were collected from litter (on the Kermedec Islands). It is also possible that the young and mature adults found together under the bark may be from different generations as it is unusual in New Zealand Coccidae to find such a huge size difference in a given population — mature adults 3–4 × length of young adult females — in one cohort; alternatively the life cycle may be very long. No male stages are known and so this species is probably parthenogenetic.

P. dacrydii is invariably attended by the native ant *Prolasius advena* (Fr. Smith) when under the bark of trees. This is the only New Zealand coccid known to have a relationship with ants.

Distribution. In lowland podocarp forest throughout (Map 36).

POUNAMOCOCCUS Henderson & Hodgson

Pounamococcus Henderson & Hodgson: Hodgson & Henderson, 1998: 606

Type species: *Pounamococcus tubulus* Henderson & Hodgson.

Diagnosis. Adult female. Test: of medium thick glassy wax, with or without sutures.

Body: pyriform, narrower at head end, usually clearly asymmetrical, with distinct stigmatic and anal clefts. Asymmetry shown most obviously by mouthparts which are generally nearer 1 procoxa and with labium usually twisted through 90°.

Dorsum: derm membranous, even on old specimens; with or without sclerotisations in the stigmatic clefts but with no sclerotisations anterior to anal plates. Dorsal setae absent. Dorsal pores not in a reticulate pattern; dorsal pores of 3 or 4 types: (i) microductules, with a long inner filament: fairly frequent throughout but not forming a distinct pattern; (ii) simple pores, varying in size, those in *P. cuneatus* medium size, while those in *P. tubulus* very small; (iii) macropores very large and slightly convex (present on *P. cuneatus*); and (iv) chimney-shaped macropores (present on *P. tubulus*). Preopercular pores and dorsal tubercles absent. Dorsal tubular ducts present or absent, when present in 2 diverging lines anterior to anal plates. Anal plates together approximately quadrate; each with 2 setae along inner margin near apex, an apical seta and 1 small seta either on posterior margin or almost in discal position. Anogenital fold apparently without supporting bars; with 2 pairs of setae along anterior margin and with 1 or 2 setae along lateral margins. Anal tube moderately long; anal ring with 3 pairs of setae.

Margin: marginal setae all finely spinose, with a blunt apex and a small basal socket: in a single row along margin, with 5–18 on each side between stigmatic clefts, usually with fewer on side nearest mouthparts; not extending up margins of anal cleft; anal lobe setae not differentiated from other marginal setae. Stigmatic clefts distinct and quite deep (shallower on older swollen specimens), with or without stigmatic sclerotisations. Each cleft with 2–8 stigmatic spines of distinctive shape. Eyespot probably absent.

Venter: derm membranous. Pregenital disc-pores generally with more than 5 loculi; restricted to posterior 3 pregenital segments. Spiracular disc-pores with mainly 5 loculi: in broad bands between spiracles and margin. Preantennal pores present or absent. Ventral microducts frequent throughout. Ventral tubular ducts of 1 type, with a long outer ductule, an almost equally long inner ductule and a well-developed terminal gland: present rather sparsely medially and mediolaterally on more posterior abdominal segments. Ventral setae: long pregenital setae on segment VII present or absent, otherwise distribution of ventral setae typical of family. Antennae well developed, 6- to 8-segmented, 3rd segment generally with 1–2 pseudosegments; 3rd segment from apex with a flagellate seta and penultimate segment with 2 flagellate setae in addition to the usual single fleshy seta. Mouthparts usually displaced to one side and labium twisted through about 90°. Spiracles as for family. Legs quite well developed; each with a separate tibia and tarsus but no articulatory sclerosis; tibia with 2 setae on distal end; claws with or without a small denticle; tarsal digitules both fine and not extending past end of claw in length; claw digitules dissimilar, one broader than other; tarsal campaniform pore present on all 3 pairs of legs. Vulva opening on segment VII.

Remarks. This genus is endemic to New Zealand and contains two species: *Pounamococcus cuneatus* Henderson & Hodgson and *P. tubulus* Henderson & Hodgson. Species in the genus *Pounamococcus* differ from all other known soft scale genera in possessing tarsal campaniform pores (see Hodgson & Henderson, 1998). Other significant characters are :

(i) the asymmetry of the labium, which is approximately at right angles to the long axis of the body;
(ii) the presence of 2 setae on the distal end of each tibia;
(iii) the restriction of the ventral tubular ducts to medially and mediolaterally on the abdomen;
(iv) more than 1 stigmatic spine per stigmatic cleft, forming a distinct group at the base of the stigmatic clefts;
(v) presence of finely spinose marginal setae;
(vi) presence of 2 flagellate setae on the penultimate antennal segment.

On the basis of these characters, *Pounamococcus* is quite unlike any other New Zealand genus. All known stages of the two species currently included in *Pounamococcus* were described by Hodgson & Henderson (1998).

Key to adult female *Pounamococcus*

1 Stigmatic spines long and tubular, expanded apically, with 6–8 spines per cleft; tubular ducts absent from the dorsum; dorsal macropores heavily sclerotised, chimney-like, and rather scarce .... ***tubulus***

—Stigmatic spines wedge-shaped, with 2–3 spines per cleft; tubular ducts present dorsally in 2 diverging lines anterior to anal plates; dorsal macropores large, convex and frequent throughout .... ***cuneatus***

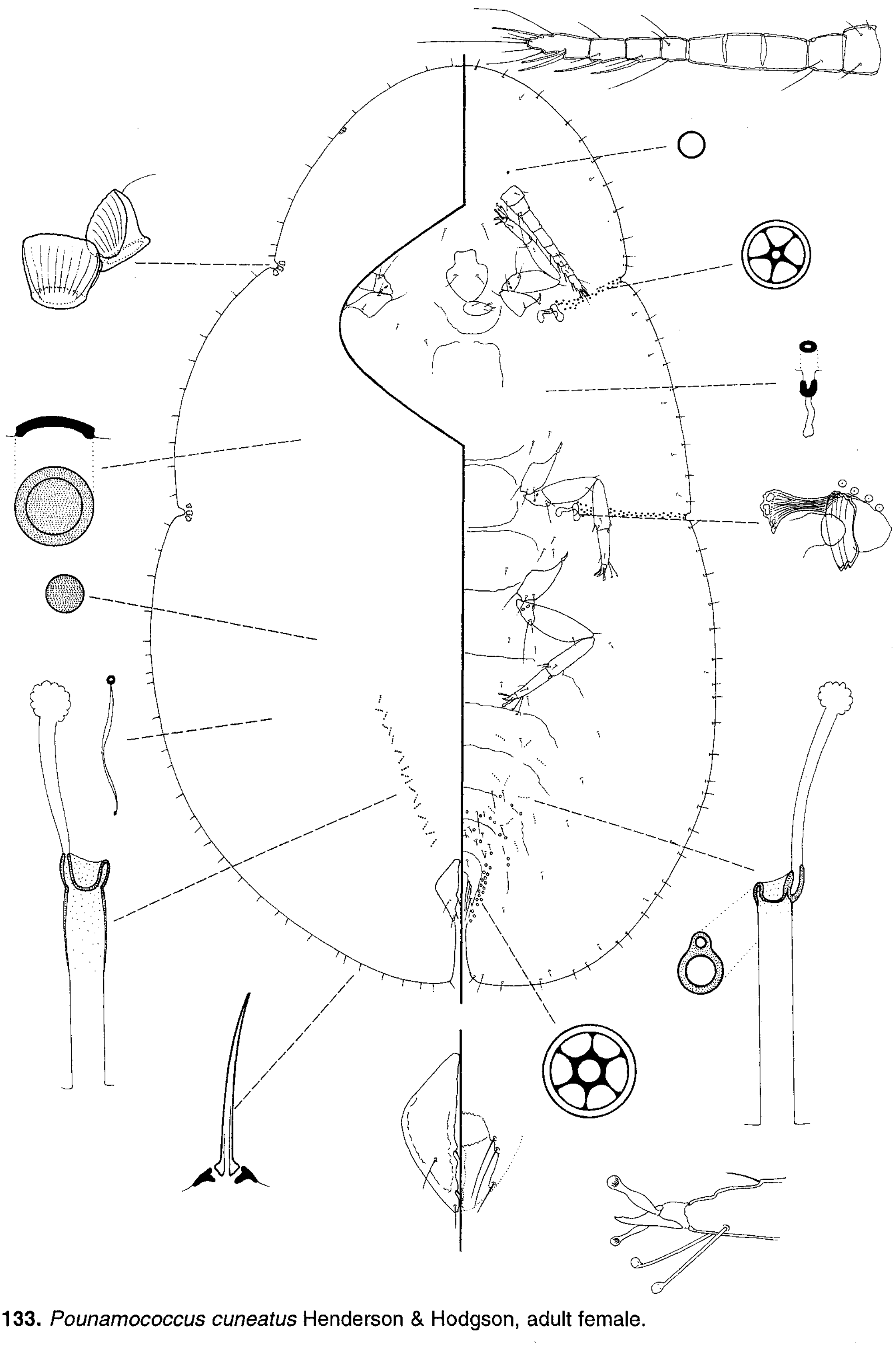


Fig. 133. *Pounamococcus cuneatus* Henderson & Hodgson, adult female.

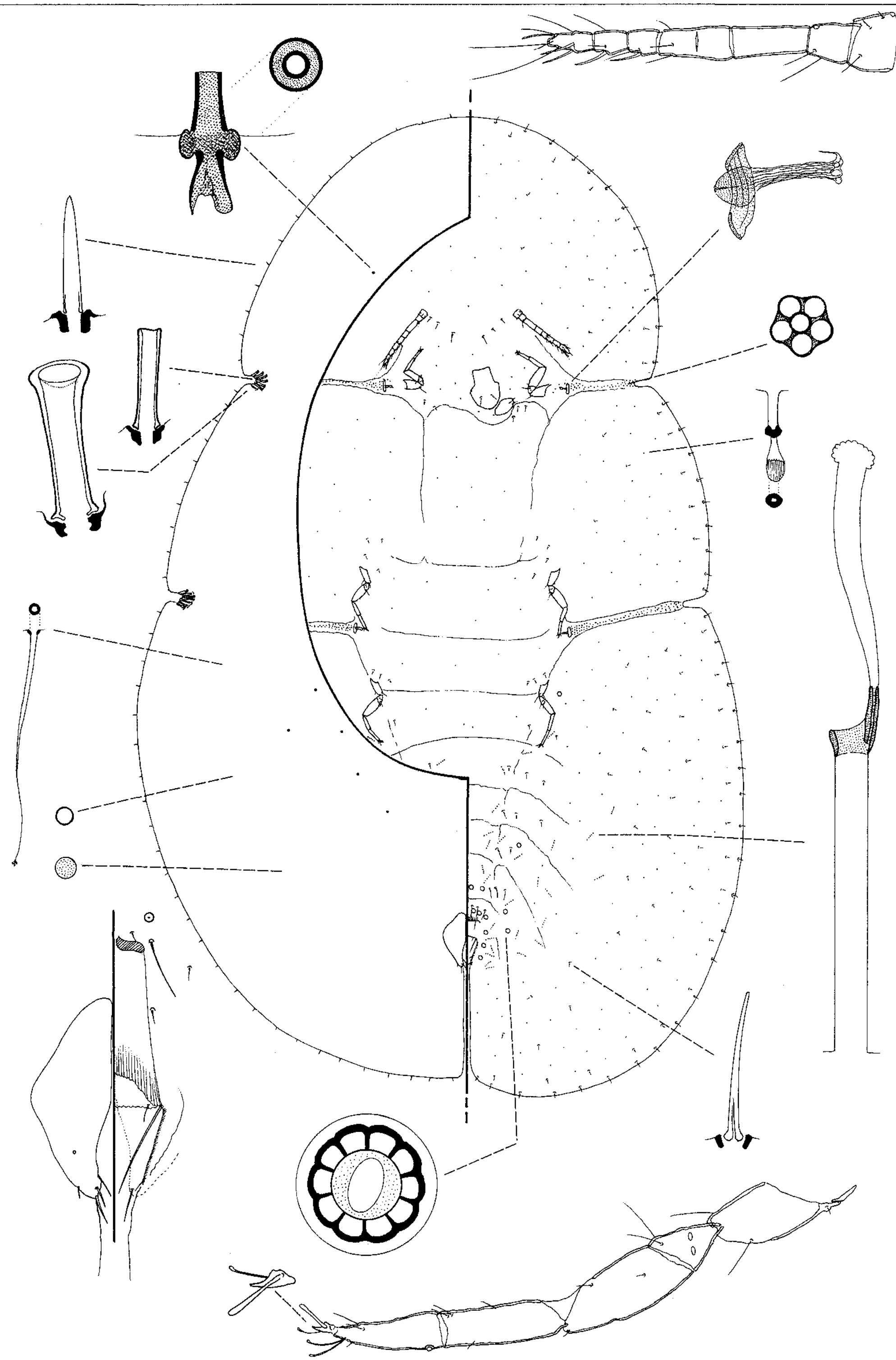


Fig. 134. *Pounamococcus tubulus* Henderson & Hodgson, adult female.

Pounamococcus cuneatus **Henderson and Hodgson**

Figs M31, C80, C81, 133

Pounamococcus cuneatus Henderson & Hodgson; – Hodgson & Henderson, 1998: 623

Unmounted material: live specimens mottled green, often with a darker green submedian oval ring, extending from head to anal plates. Wax test formed of 7 median-thick plates, 4 smallish plates on cephalothorax (1 anteriorly, 2 laterally, and 1 mediodorsally) and 3 long plates posteriorly; internal structure of test composed of layered wax (Fig. M31); median plates separated from lateral plates by submedian suture which corresponds to green stripe (when that is present) on underlying insect; surface of test slightly dimpled. All sutures between plates are true sutures. Post-ovipositional females tend to shrink towards anterior end of test.

Mounted material: length 2.5–4.4 mm, width 1.5–3.8 mm.

Dorsum: dorsal pores of 3 types: (i) microductules: probably throughout but most frequent submarginally; (ii) medium-size simple pores present submarginally; and (iii) large, slightly convex macropores: frequent throughout except submarginally. Dorsal tubular ducts present in 2 diverging lines just anterior to anal plates, each duct with a fairly broad outer ductule, deep cup-shaped invagination and narrow inner ductule with a distinct glandular end; with 13–20 ducts in each line. Anal plates with apices not diverging; length of plates 133–167 µm, width of single plate 59–76 µm; plates without minute pores; lengths: inner margin 1, 10–14 µm; inner margin 2, 16–20 µm; apical, 18–22 µm; setae on each posterior margin almost in discal position, 14–20 µm. Anogenital fold with 2 pairs of setae, subequal in length (37–50 µm) and with 1 seta on each lateral margin, length 14–22 µm.

Margin: marginal setae finely spinose: length 12–36 µm, with 10–18 on each side between stigmatic clefts. Stigmatic clefts lacking stigmatic sclerotisations; each cleft with 2–3 stigmatic spines (occasionally with a smaller spine on or near outer margin, which is usually peg-like but can resemble typical stigmatic spines), each spine distinctively wedge shaped, although round to oval at base, and with poorly-developed basal socket; length 11–14 µm.

Venter: pregenital disc-pores with 5–8 (mainly 6–7) loculi; total number per segment: anal cleft/VII, 36–49; VI, 7–16; V, 1–13; IV, 0–2; III, 0–1; and II, 0; none laterad to metacoxae. Spiracular disc-pores: with 28–58 in each anterior band and 39–85 in each posterior band; with 0–4 extending medially past each peritreme. Preantennal pores present. Ventral tubular ducts similar to those on dorsum but slightly narrower: very sparse medially and mediolaterally on abdominal segments IV–VI. Ventral setae: with a pair of moderately long setae medially on all abdominal segments, particularly V and VI, but these absent from VII, and with a pair of shorter setae on segments VII–III; also generally with 1 long and 1 short seta near each meso- and metacoxa, and 1–2 short setae near each procoxa; with 2–3 pairs of interantennal setae, longest 54–65 µm; with about 4–6 submarginal setae on each side between stigmatic clefts. Antennae well developed, 6- or 7-segmented, 3rd segment generally with 1–2 pseudosegments; total length 324–434 µm; length of each apical seta 41–65 µm. Length of clypeolabral shield 127–167 µm. Width of spiracular peritremes: anterior 29–45 µm; posterior 36–54 µm. Legs: lengths (metathoracic): coxa 70–95 µm; trochanter + femur 175–238 µm; tibia 90–144 µm; tarsus 101–139 µm; claw 23–25 µm; claws with a small denticle.

Material examined: HOLOTYPE ♀: NEW ZEALAND: **WD**: Otira, 30 Dec 1915, on fern, ex dry material G. Brittin collection, NZAC #90-213g: 1/1♀ ad (designated by Hodgson & Henderson, 1998).
PARATYPES: as for holotype, NZAC #90-213a–f :6/6♀♀ ad; Brittin original slides labelled "on fern, Otira, Dec 1915, Ctenochiton, no 96": 2/2♀♀ ad.

Other material: NEW ZEALAND: **AK**: Waitakere Ra, Fairy Falls, *Blechnum fraseri*, 21 Sept 1982, C.F. Butcher, #84-014h: 3/1♀ ad, 2♀ 2nd. Fairy Falls, Dec. 1982, ex fern, C.F. Butcher, #83-321d: 1/1♀ ad and #95-148: 1/♀ 2nd. Waitakere Ra, Sharp Bush, *Blechnum fraseri* underside leaves, 23 Oct 1995, RCH, #95-103a–c, f: 4/3♀♀ ad, 1 1st. As previous except 18 Aug 1996, #97-155: 1/1♀ ad. As previous except, underside of fronds, 5 Feb 1997, #97-031a–g: 7/7♂ 2nd. As previous except, 14 Mar 1997, RCH, #97-058a–d: 4/4 pupae, 1♂ ad + cast pupal skin, 1♀ 2nd, 1♂ 2nd + pharate ♂ 2nd. As previous except 6 Feb 1998, RCH & C.J. Hodgson, #98-a–i: 9/1♀ ad (pharate), 1 ♀ 2nd, 7♂ 2nd (3 split dorsoventrally).

Remarks. Adult female *P. cuneatus* differ from those of *P. tubulus* in the following:
(i) shape of the stigmatic spines, which are wedge-shaped and short (trumpet-shaped in *P. tubulus*);
(ii) presence of dorsal tubular ducts in 2 diverging lines just anterior to the anal plates;
(iii) a denticle on the claw;
(iv) pregenital disc-pores with mainly 5–8 loculi;

(v) moderate-sized, granulate pores throughout the dorsum;
(vi) absence of a pair of long setae on abdominal segment VII;
(vii) absence of highly-sclerotised, tubular macropores on the dorsum.

For a further discussion, see Hodgson & Henderson (1998).

Biology. Presumed to be univoltine, with adult males and females emerging in late summer, the adult females overwintering and the young stages appearing in late spring to early summer. Test not persisting on host plant after death.

Pathogens and parasitoids. Hymenopterous parasitoid recorded: Encyrtidae: *Adelencyrtoides variabilis* Noyes.

Distribution: Originally collected from the middle of the South Island just west of the Main Alpine Divide at Otira more than eighty years ago, although the more recent collections have been from the forested hills west of Auckland City, North Island. It appears to be restricted to ferns and possibly Blechnaceae (Map 37).

Pounamococcus tubulus Henderson & Hodgson

Figs M15, 134

Pounamococcus tubulus Henderson & Hodgson; – Hodgson & Henderson 1998: 612

Unmounted material: live females medium-dark green, with 4 spiracular pore bands showing as white stripes. Test composed of a medium-thick wax plate without sutures but with a faintly dimpled surface; older, post-ovipositional females tending to shrink towards anterior end of test by concertina-like folds of abdomen.

Mounted material: length 1.8–4.7 mm, width 1.0–2.7 mm.

Dorsum: dorsal pores of 3 types: (i) microductules: frequent throughout; (ii) simple (closed) pores, very small, which may be of 2 types: 1 type with a granulate surface, the other possibly without; both fairly frequent throughout; and (iii) heavily sclerotised macropores, composed of a short chimney-like tube protruding above derm, a broad sclerotised ring on derm surface and an inner sclerotisation about equal in length to that above derm surface (Fig. M15): rather sparse. Dorsal tubular ducts absent. Anal plates with apices slightly divergent; length of plates 158–198 µm, width of single plate 70–103 µm; each plate with 0 or 1 minute pore; lengths of setae: inner margin 1, 25–36 µm; inner margin 2, 21–27 µm; apical, 14–18 µm and outer margin setae (on outer margin near apex), 7–9 µm. Anogenital fold with 2 pairs of setae along anterior margin (1 pair rather long (63–76 µm) and other very short) and with 2 pairs of setae on lateral margins, longest 27–33 µm.

Margin: marginal setae narrowly spinose: length 9–17 µm; with 5–15 on each side between stigmatic clefts. Stigmatic clefts with a slight stigmatic sclerotisation; each cleft with 6–8 stigmatic spines, each spine broadening at apex (rather like a trumpet) and possibly with an apical pore; with well-developed basal sockets; length 12–35 µm.

Venter: pregenital disc-pores with mainly 10 loculi; with 14–28 disc-pores on segment VII, 4–7 on VI, and 0–2 on segments II–V; also with 0–3 pores laterad to each metacoxa. Spiracular disc-pores: with 45–75 in each anterior band and 50–130 in each posterior band; with only 2–5 extending medially past peritreme. Preantennal pores absent. Ventral microducts with a characteristically shaped inner ductule. Ventral tubular ducts: present medially and mediolaterally on all abdominal segments but most abundant posteriorly; also frequently with a single tubular duct just posterior to an antenna. Ventral setae: with a pair of moderately long setae on all abdominal segments but those on pregenital segment much the longest; total number per segment: VIII, 2; VII, 4–8; VI–II, 4; with 2–4 setae near each metacoxa, 3–5 near each mesocoxa, and 3 near each procoxa; with 2–4 pairs of interantennal setae, often asymmetrically distributed, longest 20–45 µm; with 4–7 submarginal setae on each side between stigmatic clefts. Antennae well developed, 7- or 8-segmented, 3rd segment sometimes with a pseudo-segmentation when 7-segmented; total length 315–416 µm; length of each apical seta 32–40 µm. Mouthparts generally displaced to one side; labium almost invariably twisted through about 90°; length of clypeolabral shield 162–195 µm. Spiracles: width of peritreme: anterior 38–56 µm; posterior 50–68 µm. Legs: length (metathoracic): coxa 38–50 µm; trochanter + femur 121–142 µm; tibia 65–81 µm; tarsus 61–72 µm; claw (without a denticle); 14–20 µm.

Material examined: HOLOTYPE ♀: NEW ZEALAND: **FD**: Doubtful Sound, Bauza I, 28 Jan 1996, RC Henderson, *Pseudopanax simplex* [= *Raukaua simplex*] upperside leaves, NZAC #96-042k: 1/1♀ ad (designated by Hodgson & Henderson, 1998).

PARATYPES: as for holotype, NZAC #96-042a–j, l–o: 14/10♀♀ ad, 2♂ 2nd, 1 pharate pupa, 17 1st (paratypes of

nymphs omitted in Hodgson & Henderson (1998)).
Other material: NEW ZEALAND: **FD**: Fiordland, [no locality], *Pseudopanax* sp., Mar 1983, C.F. Butcher,#90-207 (#83-339): 1/1♀ ad. Charles Sound, Elaenor I, *Hedycarya arborea*, 26 Jan 1996, RCH, #96-041a–b: 2/2♀♀ ad, and #96-082a–c: 3/3♂ 2nd. Secretary I, *Pseudowintera* sp., May 1982, C.F. Butcher, #84-012c: 3/3♀♀ ad. Secretary I, Grono Bay Track, *Pseudowintera colorata* 24 Nov 1981, C.F. Butcher, #97-002: 1/1♀ ad. As previous except, *Pseudopanax* sp., March 1983, #83-332d: 3/4♀♀ ad. Bauza I, *Pseudopanax lessoni*, Jan. 1984, C.F. Butcher, 1/1♀ ad. Dagg Sound, Anchorage Arm, *Pseudowintera colorata*, 1 Feb 1996, RCH, #96-083: 1/1♀ ad. Breaksea Sound, Breaksea I, *Pseudopanax arboreus*, 26 Jan 1996, RCH, #96-074a–e: 5/3♀♀ ad, 1 pharate prepupa, 4 1sts. Dusky Sound, Cooper I, Sportsman Cove, *Pseudopanax arboreus* both sides of leaves, 7 Feb 1996, RCH, #96-040a–n: 14/12♀♀ ad, 1 pharate ♀ ad, 1♂ 2nd, 1 pupa, 1♂ pharate, 3♂♂ ad. Dusky Sound, Girlies I, *Raukaua simplex* [as *Pseudopanax simplex*] leaves, 9 Feb 1996, RCH, #96-084: 1/1♀ ad (pharate ♀ 2nd-♀ ad).

Remarks. Adult female *P. tubulus* differ from those of *P. cuneatus* in the following:
(i) stigmatic spines trumpet-shaped;
(ii) dorsal tubular ducts absent;
(iii) pregenital disc-pores with mainly 10-loculi;
(iv) presence of a pair of long setae on the pregenital segment VII;
(v) presence of highly sclerotised macropores on the dorsum;
(vi) absence of a denticle on the claw.

For further discussion see Hodgson & Henderson (1998).

Biology. Apparently oviparous and univoltine, with young produced in summer. Old tests not persisting on host plant after death.

Distribution. Known only from Fiordland in the south-west of the South Island. This mountainous region has a mean rainfall of about 5–6 metres per year (Map 38).

Genus *UMBONICHITON* Henderson & Hodgson **new genus**

Type species: ***Ctenochiton hymenantherae*** **Maskell** (here designated).

Diagnosis: adult female. Test: glassy wax, convex, with 7 rows of plates, median row with six plates, each plate convex like a knob (except on *U. pellaspis* where test is of leathery wax with fibrous strands); insect beneath often showing bicoloured through test.

Shape: elongate oval with rounded ends. Small, length <3.5 mm; breadth <2.1 mm.

Dorsum: derm membranous. Dorsal setae absent. Dorsal pores distributed in a reticulate pattern, delineating reticulation areas in 7 longitudinal rows across abdomen, with 9 areas between anal plates and anterior margin and 29 areas around margin; dorsal pores of 3 or 4 types (i) small, dark microductules, with or without discernible inner ductules; (ii) small simple pores, about same size as microductule pore; both pore types most frequent in reticulation lines, occasionally with 1 or 2 between reticulation junctions on margin and along margins of anal cleft; (iii) large, heavily sclerotised macropores, shape probably diagnostic of species, either cone-shaped, bollard-like or mushroom-shaped and apparently extending above dorsal derm surface between wax plates of test, each with a round, heavily sclerotised, inner base; most abundant in median and submedian reticulation lines. Preopercular pores, dorsal tubercles, and dorsal tubular ducts absent. Anal plates widest in anterior quarter, tapering to apex; with minute pores on upper surface of each plate; surface relatively smooth; each plate with 2 inner margin setae, each short, sharp, and fine, 1 apical seta, spinose or setose and generally slightly longer than inner margin setae, and a posterior margin seta on upper anal plate surface, usually rather setose; without an anal sclerotisation. Anogenital fold with 2 large sclerotised plates arising internally and extending anteriorly from anterior margin; with 2–4 pairs of setae along anterior margin and with 1 pair laterally. Anal tube moderately long; anal ring with 6 setae.

Margin: marginal setae small and finely spinose; with 3–12 setae on each side between stigmatic clefts; in a single line not extending up margins of anal cleft; reticulation setae sometimes differentiated; marginal setae on anal lobes not differentiated. Stigmatic clefts shallow, without a stigmatic sclerotisation, each with 1 stigmatic spine of moderate length, about 6–10 × length of marginal spines. Eyespot present (but hard to discern on most specimens).

Venter: pregenital disc-pores with 3–8 (mainly 5) outer loculi, on mediolateral folds of abdominal segments in a line from anal cleft extending towards each posterior spiracle; occasionally 1–2 present medially on segments V–VI on *U. adelus*; a few sometimes present laterad to metacoxae. Spiracular disc-pores with mainly 5 loculi, in narrow bands 1–5 pores wide between spiracles and margin and with a few extending medially. Ventral microducts of 1 type, present in a submarginal band (throughout submargin on *U. adelus*) and in segmental bands medially, except on posterior 1–2 abdominal segments. Preantennal pores: generally with 1–2 pairs present. Ventral tubular ducts of 1 type, present in a broad submarginal band and usually also present medially on head, thorax, and abdomen (absent medially on *U. hymenantherae*). Ventral setae: with 1–4 pairs of anterior anal cleft setae; with a single pair of long pregenital setae on segment VII only; hypopygial setae absent; with 4–9 (total) (mainly 8) interantennal setae; other setae distributed as for family. Antennae 6- to 8-segmented, with 0–2 pseudosegments on segment III when 6-segmented; setal distribution as for family, but longest seta on apical segment shortest on *U. jubatus* (30–80 µm) and longest on *U. hymenantherae* (80–110 µm). Mouthparts occasionally displaced to one side. Spiracles typical of family. Legs well developed, generally with a separate tibia and tarsus but no articulatory sclerosis; tarsal campaniform pore absent; claws small and short without a denticle; tarsal digitules knobbed, unequal in length and thickness; claw digitules expanded and equal, much longer than claw. Vulva present in segment VII.

Remarks. This genus contains five species: *U. adelus* Henderson & Hodgson, **n. sp.**, *U. bullatus* Henderson & Hodgson **n. sp.**, *U. hymenantherae* (Maskell) **n. comb.**, *U. jubatus* Henderson & Hodgson **n. sp.**, and *U. pellaspis* Henderson & Hodgson **n. sp.**

Species in the genus *Umbonichiton* are characterised by the following combination of characters:

(i) few spinose marginal setae, and moderately long stigmatic spines;

(ii) presence of very large sclerotised dorsal macropores of either cone -, bollard-, or mushroom-shape;

(iii) very small simple pores and apparently ductless microductules in dorsal reticulation lines;

(iv) a broad submarginal band of ventral tubular ducts;

(v) pregenital disc-pores restricted to either side of the anal cleft and on the abdominal mediolateral folds, forming a line between the anal cleft and posterior spiracles.

In addition, the genus is characterised by a knobbly glassy test (except for *U. pellaspis*, which has a unique test made up of strands of fibre incorporated with wax).

Aphenochiton inconspicuus, with large bollard-shaped macropores, can be distinguished from all *Umbonichiton* species by its lack of ventral tubular ducts. *Poropeza dacrydii* also has bollard-shaped macropores and can be distinguished by its marginal rows of disc-pores.

Species in the genus *Umbonichiton* resemble those in *Plumichiton* in having pregenital disc-pores more or less restricted to the mediolateral lobes of the abdomen in a line between the anal cleft and the posterior spiracles. *Plumichiton* species differ from those in *Umbonichiton* in having:

(i) concave dorsal macropores;

(ii) spinose setae on the anal plates, with those nearest the apex tending to be very blunt and parallel-sided;

(iii) the dorsal surface of the anal plates folded or wrinkled, particularly along the inner margins;

(iv) many long setae ventrally, especially around the anogenital fold;

(v) rather more abundant marginal spinose setae.

Generic name derivation. Name refers to the knobbly test and the convex dorsal macropores, thus: *umbo-*, *umbonis* (L., masculine) meaning a boss, knob, or shield and *chiton* (Gr.) meaning tunic or garment worn next to the skin.

Key to adult female *Umbonichiton*

1 Dorsal macropores approximately mushroom-shaped when seen from the side, apex expanding to several times the width of the basal 'stalk' .... ***pellaspis***

—Top of dorsal macropores approximately similar in width to or narrower than their inner base 2

2 Dorsal macropores 'bollard-like', with a broadened, very blunt, apex; marginal reticulation setae larger than other marginal setae .... ***bullatus***

—Dorsal macropores 'cone-shaped', with more or less pointed apices; marginal reticulation setae similar in size or only slightly larger than other marginal setae 3

3 Ventral tubular ducts absent medially from head, thorax and abdomen (although 1–3 ducts occasionally present between coxae) .... ***hymenantherae***

—Ventral tubular ducts present medially on head, thorax and abdomen 4

4 Marginal setae finely spinose and with 3–5 setae between stigmatic clefts; dorsal macropores few, with none in transverse median reticulation line anterior to anal plates; ventral tubular ducts sometimes present medially on abdominal segments II–III or absent medially on all abdominal segments .... ***adelus***

—Marginal setae clearly spinose and with 5–10 setae between stigmatic clefts; dorsal macropores more numerous, with several on transverse median reticulation line anterior to anal plates; ventral tubular ducts scattered throughout abdominal segments II–V at least .... *jubatus*

Umbonichiton adelus Henderson & Hodgson new species

Figs C92, 135

Unmounted material: test as for genus.

Mounted material: body elongate oval with rounded ends. Length 1.27–2.24 mm; breadth 0.76–1.40 mm.

Dorsum: dorsal pores distributed in a reticulate pattern as for genus; dorsal pores of 3 types as for genus except that dorsal macropores are heavily sclerotised and cone-shaped, sometimes becoming detached from their sunken base during slide-mounting; most abundant in median and submedian reticulation lines, but with none in median transverse lines. Anal plates: length 123–134 µm, combined widths 96–110 µm; with 3–8 minute pores on upper surface of each plate; length of setae: inner margin 1, 17–12 µm, inner margin 2, 7–14 µm, apical setae, 7–12 µm, outer margin setae, 12–14 µm. Anogenital fold with 3–4 pairs of setae along anterior margin and a single pair laterally, longest seta 23–34 µm.

Margin: marginal setae small and finely spinose, occurring near to, or at, each reticulation point around margin; with 3–5 setae between stigmatic clefts, each about 10 µm long but with seta just posterior to each cleft rather larger, 15–23 µm long. Stigmatic spines of rather uniform thickness: 92–134 µm long.

Venter: pregenital disc-pores as for genus: number present medially/mediolaterally on each segment: anal cleft/VII, 0/4–8; VI, 1–2/1–2; V, 1–2/1–2; IV, 0/1–2; III, 0/1–2; and II, 0/1–3; with 0–3 laterad to each metacoxa. Spiracular disc-pores: with 15–28 in each anterior band and 21–36 in each posterior band. Ventral microducts present in a wide submarginal band and medially throughout except on posterior abdominal segments. Ventral tubular ducts as for genus, except absent from abdominal segments IV–VII and only occasionally present on abdominal segments II–III. Ventral setae: ventral anal lobe setae 19–30 µm long; with a pair of larger, stouter, marginal setae at base of anal cleft, 10–20 µm long; with 3–4 pairs of anterior anal cleft setae; length of longest pregenital setae 34–50 µm; number of setae present medially on each abdominal segment: VII, 4–7; VI, 4–7; V, 8–11; IV, 8–13; III, 6–10; and II, 3–12; with (laterally near each coxa/medially between coxae), 1–4/3–6 on metathorax; 3–6/1–2 on mesothorax, and 3–4/0 on prothorax; with 6–7 (total) interantennal setae; with 2–7 small submarginal setae on each side between stigmatic clefts. Preantennal pores present. Antennae 6- or 7-segmented, segment 3 with 1–2 pseudosegments when 6-segmented; total length 225–277 µm, length apical seta 38–46 µm. Clypeolabral shield 115–134 µm long. Width of spiracular peritremes: anterior 27–30 µm, posterior 30–34 µm. Legs: lengths (metathoracic): coxa 85–100 µm; trochanter + femur 110–119 µm; tibia 80–92 µm; tarsus 65–80 µm; claw 10–15 µm.

Material examined: HOLOTYPE ♀: NEW ZEALAND: **AK**: Riverhead Forest, Barlow Road reserve, 14 August 1997, L.H. Clunie, *Podocarpus totara* leaves, NZAC #97-125a: 1/1♀ ad.
PARATYPES: same collection data as holotype: NZAC #97-125b–l: 11/11♀♀ ad.

Other material: NEW ZEALAND: **AK**: Riverhead Forest, Barlow Road reserve, *Podocarpus totara* leaf by petiole, 31 July 1997, RCH, #97-113: 1/1♀ ad. As previous, except 14 Aug 1997, #97-126a–j: 10/1♀ ad, 5♀ 3rd, 2♀ 2nd, 4♂ 2nd, 11 1st; #97-142, 1/1♀ ad. As previous, except stem and leaf, 22 July 1998, #98-084: 1/1♂ 2nd. Waitakere Ranges, Scenic Drive, under bark of *Podocarpus totara*, 15 Jan 1983, J.M. Cox, 134: 1/1♀ ad [note, this collection 'under bark' seems at variance with most other collections (from leaves) and this detail may be incorrect]. Warkworth, *Podocarpus totara*, 5 Sept 1982, [no collector], #82-267i: 1/1♀ ad.

Remarks. *Umbonichiton adelus* shares with *U. hymenantherae* and *U. jubatus* large cone-shaped macropores. *U. adelus* differs from *U. hymenantherae* in having:
(i) ventral tubular ducts medially;
(ii) ventral anal lobe setae short (10–20 µm on *U. adelus* and 45–60 µm on *U. hymenantherae*);
(iii) pregenital disc-pores usually present on all mediolateral folds of the abdomen (in *U. hymenantherae*, the pores are rarely present on segments II & III).

U. adelus differs from *U. jubatus* in having:
(i) few finely spinose marginal setae (those of *U. jubatus* are both more spinose and more numerous);
(ii) few (0–3) tubular ducts on the median abdominal venter (*U. jubatus* has numerous tubular ducts there).

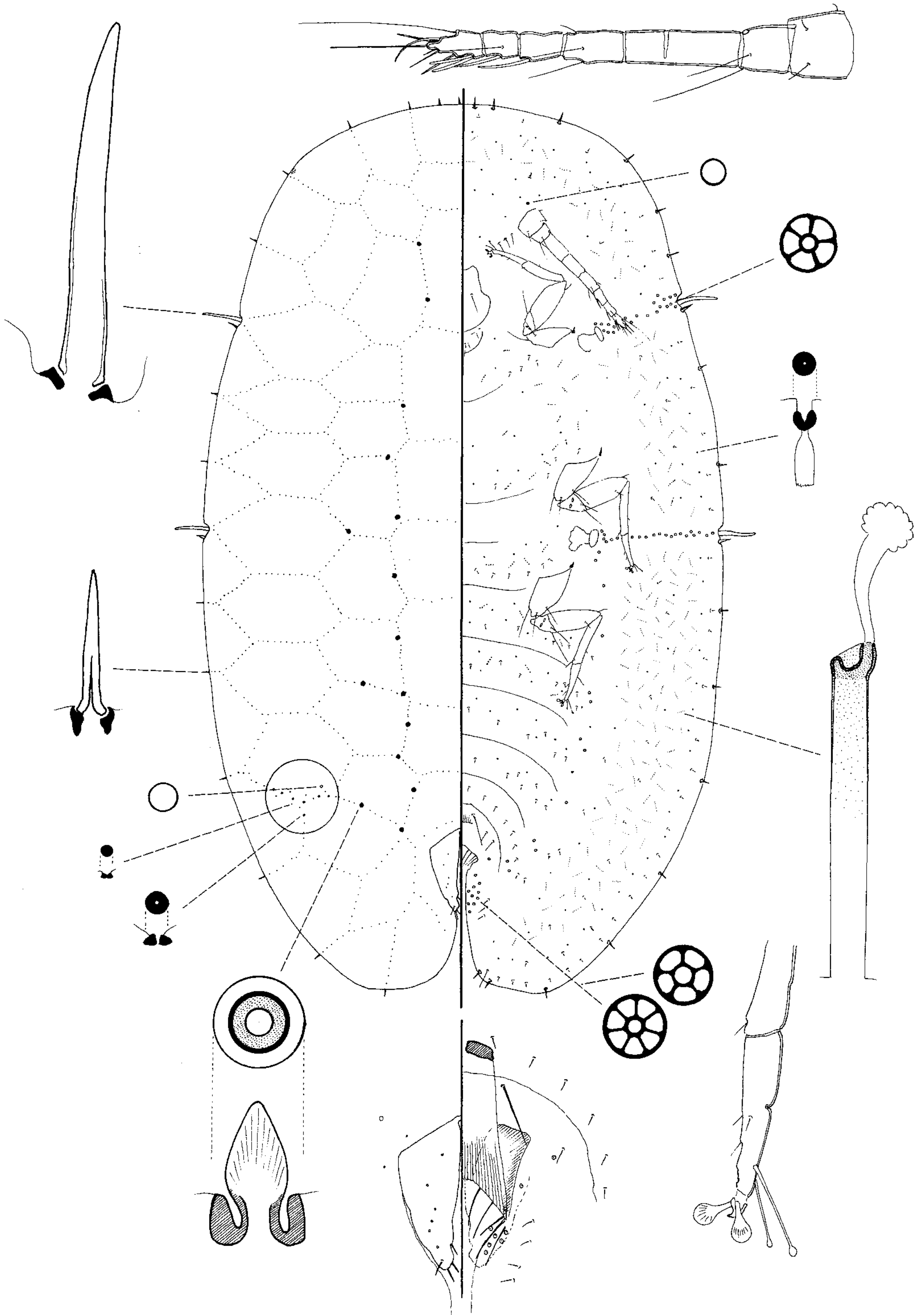


Fig. 135. *Umbonichiton adelus* Henderson & Hodgson, **n. sp.**, adult female; circle contains reticulation line of dorsal pores further enlarged.

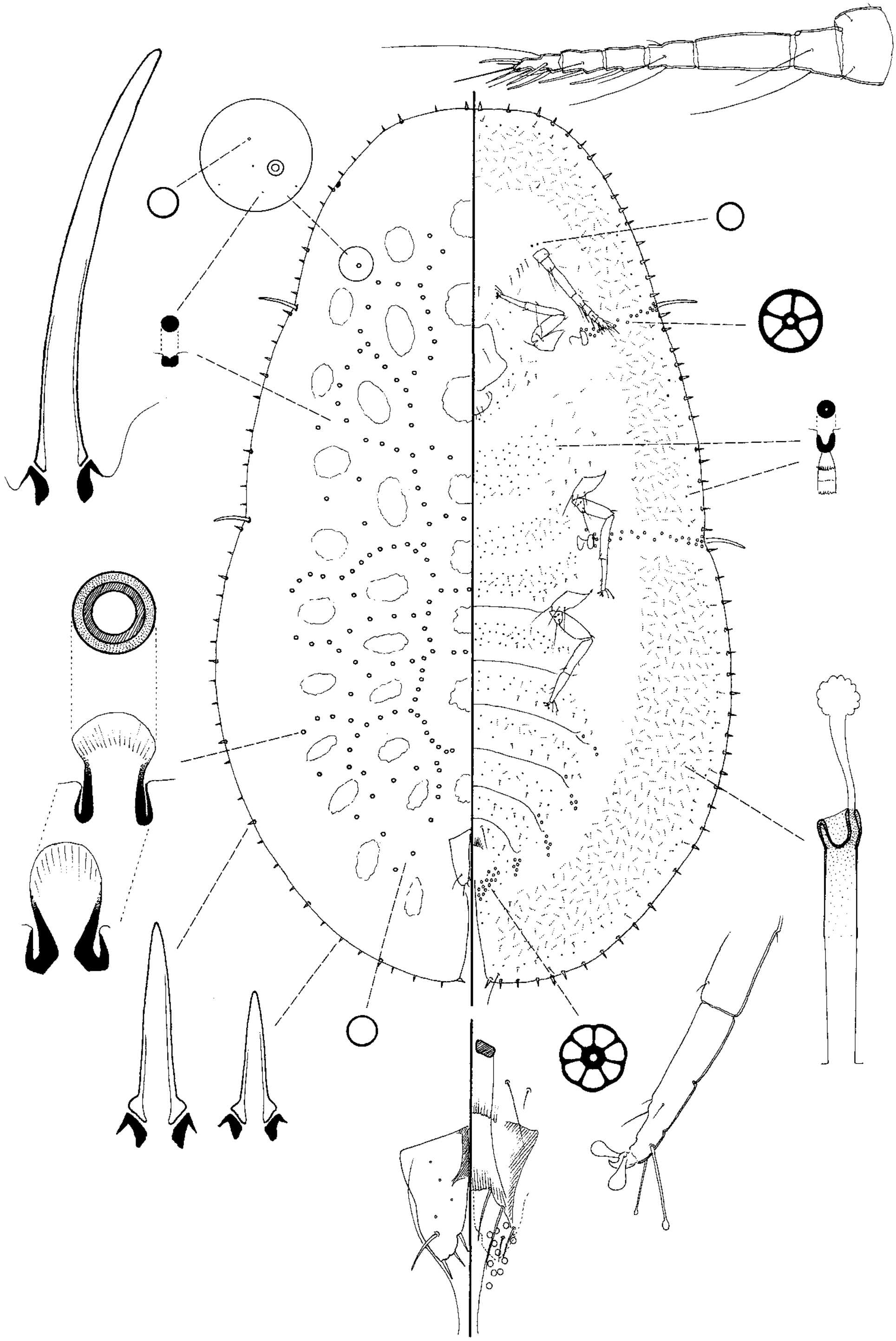


Fig. 136. *Umbonichiton bullatus* Henderson & Hodgson, **n. sp.**, adult female; circle contains reticulation line of dorsal pores further enlarged.

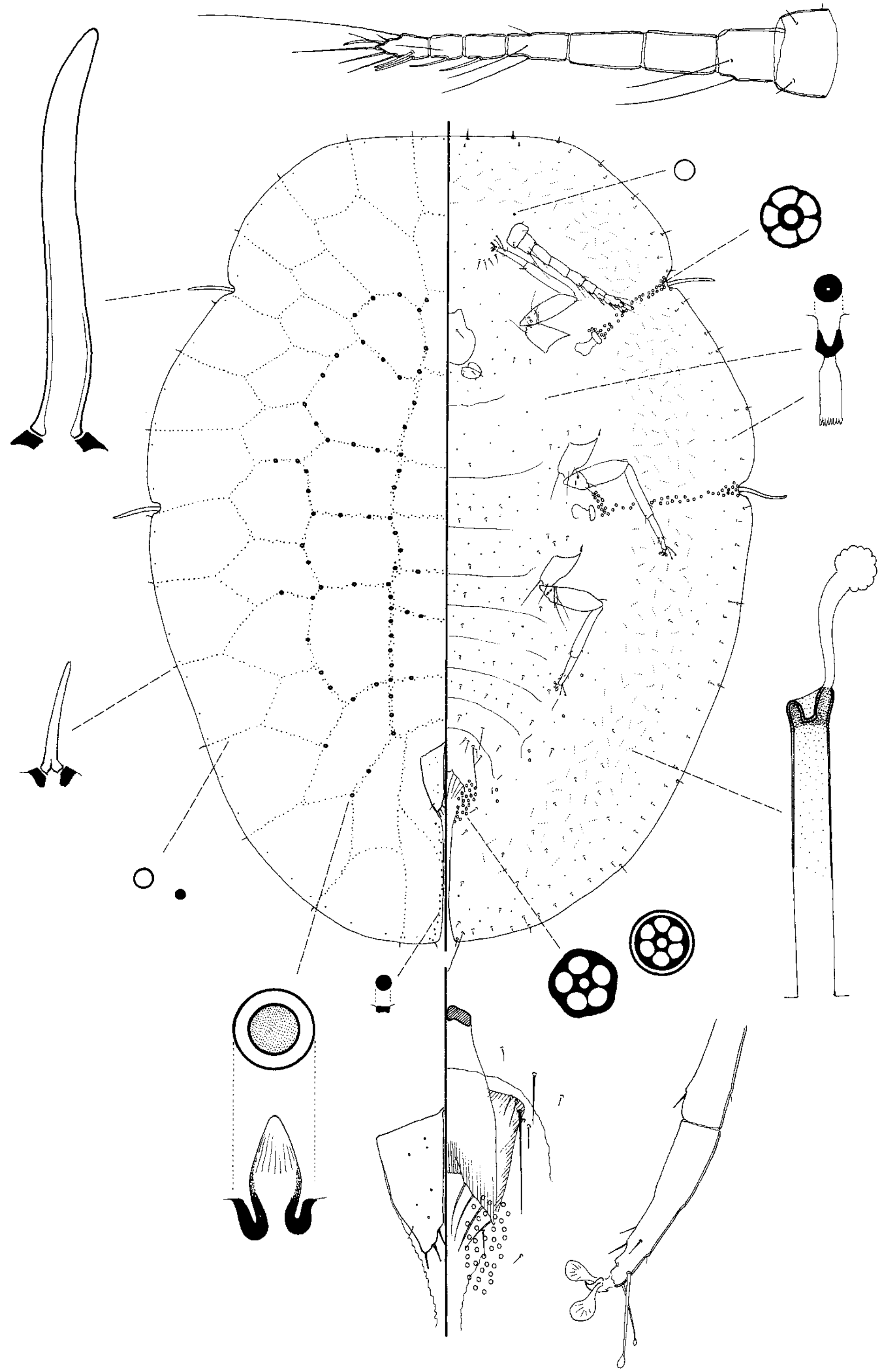


Fig. 137. *Umbonichiton hymenantherae* (Maskell), **n. comb.**, adult female.

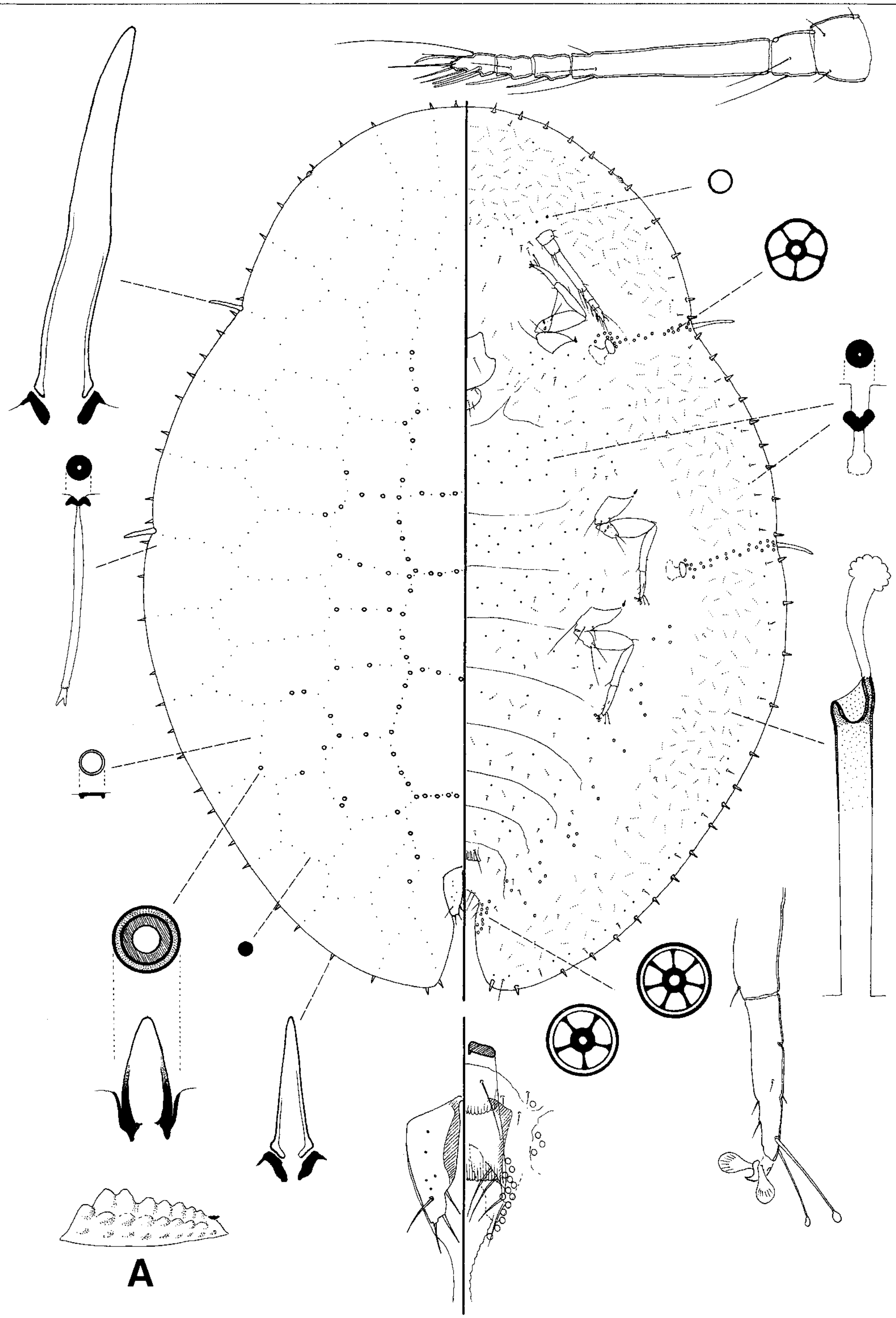


Fig. 138. *Umbonichiton jubatus* Henderson & Hodgson, **n. sp.**, adult female. A = side view of adult female minus test, showing dermal folds.

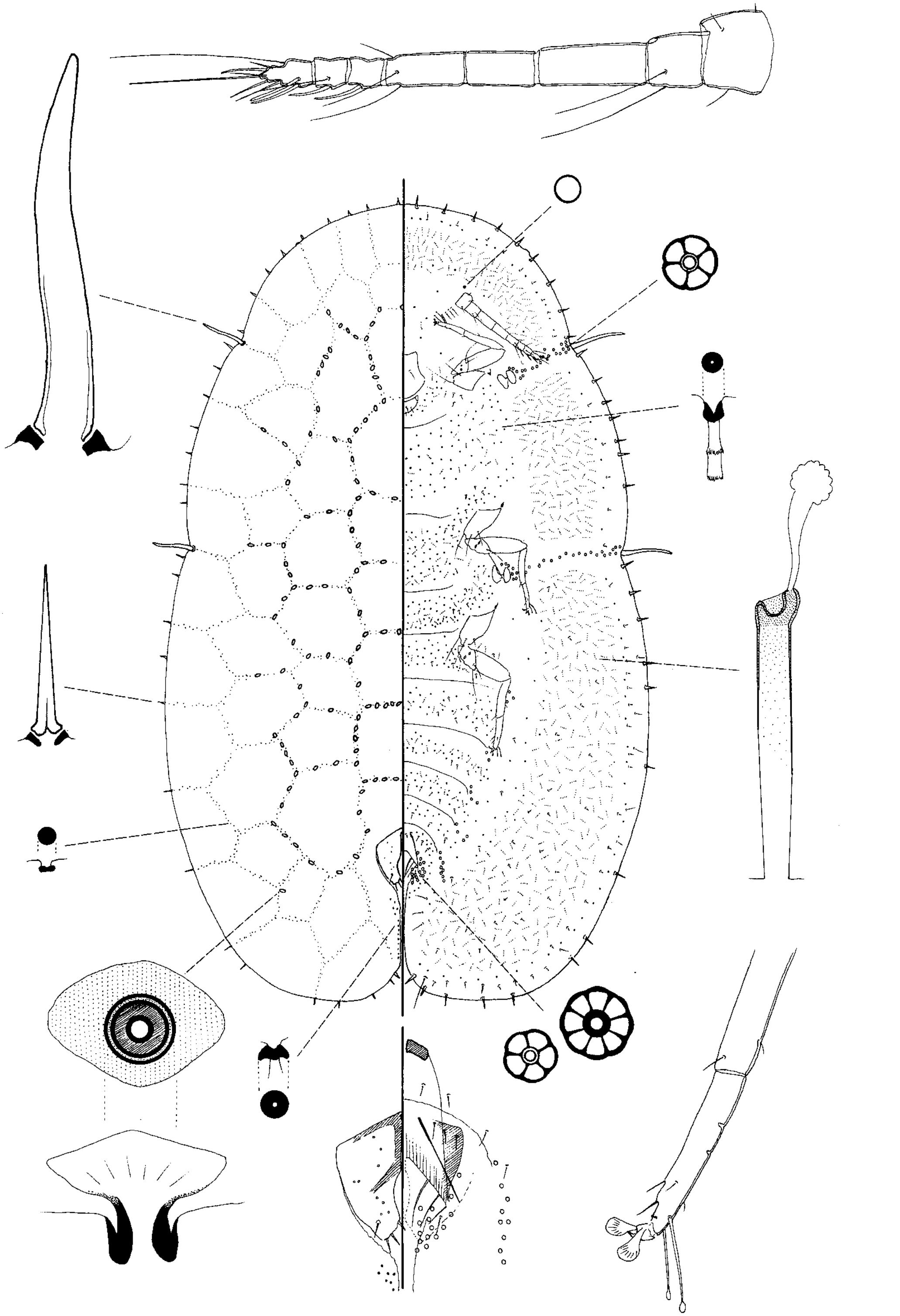


Fig. 139. *Umbonichiton pellaspis* Henderson & Hodgson, **n. sp.**, adult female.

Biology. *U. adelus* has been collected only from *Podocarpus totara*. The adult females have been found in winter through to spring (July–September) and also in the summer (January), perhaps suggesting two generations per year.

Distribution. Only known from the Auckland region (Map 39).

Name derivation. The name *adelus* is based on *adelos* (Gr. = unseen, unknown, obscure), the scales are well hidden at the base of the leaves of *Podocarpus totara*, where the petiole twists a 1/4 turn from the stem.

Umbonichiton bullatus Henderson & Hodgson new species

Figs C93, 136

Unmounted material: one teneral female known, positioned lengthwise on twig of host plant; colour when alive chestnut brown; test composed of knobbly wax plates as for genus; dorsal derm with 5 rows of knobbly protuberances; shape of adult female elongate.

Mounted material: body elongate-oval to oval, slightly narrower at head end; convex, with a lengthwise row of rounded derm folds medially and 2 submedian rows each side, which relate to dorsal knobs of live female; submarginal row of folds absent. Body length 2.06–2.51 mm, breadth 1.22–1.94 mm.

Dorsum: dorsal pores distributed in a reticulate pattern as for genus; dorsal pore types as for genus except dorsal macropores very large, sclerotised and bollard-shaped: present in median and submedian reticulation lines; with 1–5 macropores in posterior medial macropore line. Anal plates: length 119–157 µm, combined widths 104–157 µm; with 2–8 minute pores on each upper surface; length of setae: inner margin 1, 10–14 µm, inner margin 2, 12–14 µm, apical setae, 16–19 µm, outer margin setae long with a wide, sclerotised socket, 24–31 µm. Anogenital fold with 3 pairs of setae along anterior margin and 0–1 pair laterally, longest about 40 µm long.

Margin: marginal setae variable in shape and size, from lanceolate to spinose, with pointed tips; with 9–12 setae on each side between stigmatic clefts, length 9–23 µm; reticulation setae noticeable longer than elsewhere. Stigmatic spines gradually narrowing, 85–154 µm long.

Venter: pregenital disc-pores with 5–7 loculi, restricted to mediolateral folds of abdominal segments III–VII; number on each side: anal cleft/VII, 9–23; VI, 5–10; V, 2–9; IV, 1–6; III, 1–2; and II, 0; absent from medial abdomen and thorax, and from laterad to metacoxae. Spiracular disc-pores: with 14–51 in each anterior band and 22–55 in each posterior band; each band 1–5 pores wide near margin. Ventral microducts in a sparse submarginal row and abundant medially. Preantennal pores: with 1–2 near each scape. Tubular ducts as for genus. Ventral setae: ventral anal lobe setae 50–60 µm long; with 1–2 pairs of anterior anal cleft setae; length of long pregenital setae 57–77 µm; number of setae medially on abdominal segments: VII, 5–10; VI, 6–9; V, 10–18; IV, 11–20; III, 7–15; and II, 3–12; with 5–8 setae near each meso- and metacoxa and 2–5 near each procoxa; with 8–9 (total) interantennal setae. Antennae 6- or 7-segmented, with 1 pseudosegment when 6-segmented; total length 215–350 µm; length of apical seta 46–69 µm. Clypeolabral shield 154–180 µm long. Width of spiracular peritremes: anterior 25–46 µm, posterior 30–53 µm. Legs: lengths (metathoracic): coxa, 88–134 µm; trochanter + femur, 110–160 µm; tibia, 96–123 µm; tarsus, 77–107 µm; claw, well developed, 15 µm long.

Material examined: HOLOTYPE ♀: NEW ZEALAND: **TO**: labelled in pencil: "*Ctenochiton*, x *Weinmannia racemosa*, Waithui [=Waitui] Saddle, J.M. Hoy, 8 Aug 1957", NZAC: 1/2♀♀ ad (of two ♀♀ ad on slide, the holotype has complete anal plates, is nearest to the locality label, and is clearly marked.
PARATYPE: as for holotype, the other adult female on the holotype slide.

Other material: NEW ZEALAND: **BP**: Matakana I, *Leptospermum scoparium*, 20 Apr 1961, A.E. Marsack, FRNZ R14: 1/1♀ ad. **GB**: Paoneone, *Kunzea ericoides*, 2 Nov 1994, RCH, #94-098: 1/1♀ ad. **TO**: Te Whaiti area, *Podocarpus totara*, 19 Jan 1970, R.J. McKenzie: 1/1♀ ad.

Remarks. Adult female *U. bullatus* are characterised by:
(i) 5 rows of dorsal protuberances beneath the test in the position of the reticulation areas, which appear as 5 rows of regular folds on slide-mounted specimens, whereas only a median row of such folds can be seen on the slide-mounted material of other *Umbonichiton* species;
(ii) bollard-shaped dorsal macropores (*U. adelus*, *U. hymenantherae*, and *U. jubatus* all have cone-shaped macropores — *U. pellaspis* has larger, stalked, and mushroom-shaped macropores — *Aphenochiton*

inconspicuus also has bollard-like dorsal macropores but lacks ventral tubular ducts).

U. bullatus is close to *U. jubatus,* both having:

(i) distinctly spinose marginal setae;

(ii) numerous ventral tubular ducts medially;

(iii) prominent dorsal derm folds (although they differ in form as described above).

U. jubatus differs, in addition to the shape of the dorsal macropores, in having:

(i) pregenital disc-pores mediolaterally on abdominal segment II and laterad to the metacoxae (absent on *U. bullatus*);

(ii) the dorsal macropores very infrequent on the head and almost restricted to around the median three reticulation areas (more widespread on *U. bullatus*).

Biology. Nothing known.

Distribution. Currently only known from the eastern central North Island (Map 40).

Name derivation. The name *bullatus* is a Latin adjective from *bulla* meaning knobbed, describing the knobbly appearance of the live female.

Umbonichiton hymenantherae (Maskell) new combination

Figs C94, 137

Ctenochiton hymenantherae Maskell, 1885: 25; –Maskell, 1887: 71 [description]; –Maskell, 1895a: 13 [checklist]; –Cockerell, 1896: 330 [checklist]; –Fernald: 1903: 160 [world catalogue]; –Hutton, 1904: 226 [checklist]; –Myers, 1922: 199 [checklist]; –Deitz & Tocker, 1980: 29 [checklist]; –Ben-Dov, 1993: 102 [world catalogue].

Unmounted material: "Test of adult female waxy, circular, convex, dirty-white, yellow or brownish, formed of a number of hexagonal or octagonal segments, which are also convex, giving it a rough appearance. Fringe [of wax plates] not very conspicuous. Diameter of test, about 1/12 in. [2 mm]" (Maskell, 1887, p. 71). No fully mature females seen; young adult females as above but not particularly convex. Colour due to adult female showing through thick, glassy wax test; often young female is bicoloured yellow/brown.

Mounted material: body broadly oval, often with anterior margin nearly straight transversely, rather than rounded; anal cleft about 1/5 body length. Length 1.96–2.96 mm; breadth 1.50–2.10 mm.

Dorsum: dorsal pores distributed in a reticulate pattern as for genus; dorsal pores of 4 types: (i) small, dark microductules, with a fine, rather short, inner ductule, only slightly swollen near pore; (ii) minute simple pores, smaller than microductule pore; both pore types most frequent in reticulation lines; (iii) slightly larger, convex simple pores: present in a row along anal cleft margins, and (iv) heavily sclerotised, cone-shaped macropores: most abundant in reticulation lines around median three rows of reticulation plates; with 0–2 in posterior medial macropore line. Anal plates: widest in anterior fifth, tapering to apex; length 107–127 µm, combined widths 100–123 µm; with 3–9 minute pores on upper surface of each plate; length of setae: inner margin 1, 14–16 µm, inner margin 2, 12–16 µm, apical setae, 12–16 µm, and outer setae, 12–14 µm. Anogenital fold with 4 pairs of setae along anterior margin and 1 pair laterally, longest 42– 53 µm. Eyespot only noted on one specimen.

Margin: marginal setae small and finely spinose, mainly present approximately where dorsal reticulation lines meet margin but with a few occasionally present elsewhere, each 7–10 µm long; with 3–8 (average 4) setae on each side between stigmatic clefts; with a rather larger marginal seta at posterior edge of each stigmatic cleft, about 15 µm long. Stigmatic spines of rather uniform thickness, 82–104 µm long.

Venter: pregenital disc-pores with 4–6 loculi, as for genus but usually present only on segments IV–VII (occasionally on III); number mediolaterally on each side of abdominal segments: anal cleft/VII, 11–33; VI, 1–2; V, 1–2; IV, 0–2; III, 0–1; and II, 0; none medially or laterad to metacoxae. Spiracular disc-pores: 20–43 in each anterior band, 26–53 in each posterior band. Preantennal pores generally present. Ventral microducts of 1 type, present throughout including submargin but not on margin. Ventral tubular ducts present in a broad submarginal band; absent medially except 1–3 ducts occasionally present near coxae, or mesad to spiracles. Ventral setae: ventral anal lobe setae long, 46–61 µm; with 2–4 pairs of anterior anal cleft setae; longest pregenital setae 61–104 µm; number of setae medially on abdominal segments: VII, 6–9; VI, 4–7; V, 5–8; IV, 5–7; III, 4–7; and II, 2–10; with 1–4 setae near each meso- and metacoxa, and 1–3 near each procoxa; with 5–8 (total) interantennal setae; with 4–9 small submarginal setae on each side between stigmatic clefts. Antennae 6-segmented, with 2 pseudosegments on segment 3; total length 296–325 µm; length of apical seta 55–73 µm. Clypeolabral shield 155–175 µm long. Width of spiracular peritremes: anterior 28–

32 μm, posterior 30–36 μm. Legs: lengths (metathoracic): coxa 104–134 μm; trochanter + femur 134–155 μm; tibia 107–125 μm; tarsus 73–94 μm; claw 12–17 μm.

Material examined: LECTOTYPE ♀ (here designated): NEW ZEALAND: "*Ctenochiton hymenantherae*, adult female, from *Hymenanthera*, Aug 1884, W.M.M."; "[gold label] "Entomology Div., DSIR, NZ / W.M. Maskell Collection"; "stained & remounted in Canada Balsam, 2 Feb 1995, R.C. Henderson": NZAC: 1/1 ♀ ad.
PARALECTOTYPE: "antenna and foot of female", Aug 1884, W.M.M., NZAC: 1/1 bits.

Other material: NEW ZEALAND: Mask. Coll. No. 38, USNM: 1/1 ♀ ad. "Ex Maskell's dry material, labelled *Ctenochiton hymenantherae*: s and ♂♂s", 2/4 ♀♀ ad and pieces of wax test", (all in J.A de Boer's handwriting). **AK**: Waitakere Ra, Sharps Bush, *Hedycarya arborea* underside leaf, 13 Jul 1997, RCH, #97-080: 1/1 ♂ 2nd. **GB**: Pohutu, *Hedycarya arborea*, underside leaf, 4 Nov 1993, RCH, #93-353: 1/1 ♀ ad. Pohutu, *Hedycarya arborea*, undersurface leaves, RCH, 15 Mar 1994, #94-046a–d:4/ 1 ♀ ad, 1 ♀ 3rd, 1 ♂ 2nd, 1 ♂ ad. As previous, 1 Nov 1994, #95-150a: 1/1 ♀ ad. As previous, 3 Nov 1995, #95-106: 1/1 ♀ ad. **RI**: Pohangina Valley, Totara Reserve, *Hedycarya arborea*, underside leaf, 10 Nov 1994, RC & FL Henderson, #94-097: 1/1 ♀ ad. **NN**: Wairoa Gorge, *Melicytus ramiflorus*, 13 Dec 1967, J.A. de Boer, No.292: 1/2 ♀♀ ad. **MC**: Port Hills, Sign of Bellbird, *Myrsine divaricata*, 17 Feb 1982, #83-321c: 1/♀ ad. **FD**: Secretary I, ?*Myrtus* sp, Mar 1983, C.F. Butcher, #83-293h: 1/ 1 ♀ (pharate).

Remarks. *U. hymenantherae* shares the character of large cone-shaped macropores with *U. adelus* and *U. jubatus*, but differs from both in:
(i) having longer ventral anal lobe setae (46–61 μm as compared with 19–46 μm in the others);
(ii) the absence of pregenital disc-pores mediolaterally on abdominal segments II and III (present in the other two species).

It is also similar to *U. adelus* in having few, finely spinose marginal setae, but differs in having:
(i) many fewer dorsal macropores;
(ii) many more pregenital disc-pores on segment VII (11–33 as compared with 4–8 on *U. adelus*);
(iii) much longer legs (trochanter + femur 134–155 μm compared with 85–100 μm on *U. adelus*).

U. jubatus differs from *U. hymenantherae* in having:
(i) more numerous, broadly spinose marginal setae;
(ii) fewer pregenital disc-pores on segment VII (3–10 as compared with 11–33 on *U. hymenantherae*);
(iii) shorter antennae (257–269 μm as compared with 296–325 μm on *U. hymenantherae*).

U. hymenantherae has been recorded from several broad-leaved host plants but not from any Podocarpaceae. However, other material studied off *Astelia* species (a monocotyledenous genus) has a greater number of pregenital pores on the mediolateral lobes between the anal cleft and posterior spiracles: number mediolaterally on each side of abdominal segments: anal cleft/VII, 20; VI, 2–6; V, 7; IV, 6; III, 2; II, 1; none medially but 2 near metacoxae. (**AK**: Waitakere Ra, Huia, Twin Peaks Ridge, *Astelia banksii*, 8 Dec 1972, B.M.May, No. 965 (J.A. de Boer) + #97-145a,b: 3/4 ♀♀ ad). In all other characters measured, this material off *Astelia* appears to agree with *U. hymenantherae*. It is uncertain whether this variation is due to host plant influences or whether this material is of another species.

Biology. Unknown.

Distribution. The relatively few specimens available appear to be widely spread from central North Island to the southern end of the South Island (Map 41).

Umbonichiton jubatus Henderson & Hodgson new species

Figs M14, 138

Unmounted material: test of adult female glassy, white, convex with a crest-like median ridge, highest at anterior end and tapering in a series of undulations towards anal plates. Derm of dorsum of adult female similarly ridged beneath test in a median row of convex folds.

Mounted material: body of mature female pear-shaped, narrow at head and widest behind posterior stigmatic clefts, with shallow anal cleft about 1/8th body; with derm folds in a median line, largest on head, becoming smaller towards anal plates. Length 1.0–2.0 mm; breadth 0.7–2.0 mm.

Dorsum: dorsal pores distributed in a reticulate pattern as for genus; dorsal pores of 3 types: (i) microductules, with a narrow straight inner ductule, with a bi- or trifurcate distal end: most obvious near margin but also present medially and submedially in reticulation lines; (ii) slightly larger, flat simple pores; and (iii) large, heavily sclerotised, cone-shaped macropores (Fig. M14):

most abundant in median reticulation lines but with a few in lines extending to abdominal submargin; with 8–9 in posterior medial macropore line. Anal plates: widest at anterior third, tapering to apex; length 115–120 µm, combined widths 85–107 µm; with 1–5 minute pores on upper surface of each plate; length of setae: inner margin 1, 14–16 µm, inner margin 2, 16–21 µm, apical setae slender spinose and 16–24 µm long and outer margin setae setose and 19–24 µm. Anogenital fold with 3–4 pairs of setae along anterior margin and with 1 pair laterally; length of longest 33–36 µm.

Margin: marginal setae sharply spinose, mostly 10–15 µm long, rather variable in size, reticulation setae not differentiated; with 5–10 on each side between stigmatic clefts; with a rather larger, more conical, spinose seta posterior to each stigmatic spine, 20–25 µm long. Stigmatic spines quite long, 110–146 µm.

Venter: pregenital disc-pores with 5–8 loculi, distributed as for genus; with none medially; number mediolaterally on each side of abdominal segments: anal cleft/VII, 3–10; VI, 3–4; V, 2–4; IV, 2–3; III, 4–5; and II, 1–2; with none laterad to each metacoxa. Spiracular disc-pores: with 20–26 in each anterior band and 22–30 in each posterior band. Preantennal pore: with 0–2 near each scape. Ventral microducts present in a single row near margin, and medially on head, thorax, and most abdominal segments. Ventral tubular ducts as for genus. Ventral setae: ventral anal lobe setae 23–46 µm long; with 1–2 pairs of anterior anal cleft setae; with 1 pair of long setae discernable on segment VII on young females but not easily discernible on old females; with 4–8 (total) interantennal setae; with 3–5 small submarginal setae on each side between stigmatic clefts; number of setae medially on each abdominal segment: VII, 5; VI, 5–6; V, 7; IV, 10; III, 10; and II, 8; with 2–3 setae near each meso- and metacoxa, and 1 near each procoxa; submarginal setae long, 7–15 µm in length, about equal to length marginal spines, but latter much more broad. Antennae 6-segmented, 3rd segment subequal in length to rest of antenna and without pseudosegments; total length 257–269 µm; length of apical seta 38–44 µm. Clypeolabral shield 123–157 µm long. Width of spiracular peritremes: anterior 23–27 µm, posterior 27–30 µm. Legs: lengths (metathoracic): coxa 96–100 µm, trochanter + femur 130–134 µm, tibia 104–106 µm, tarsus 73–83 µm, claw 10–15 µm.

Material examined: HOLOTYPE ♀: NEW ZEALAND: **TO**: Hauhungaroa Ra., *Pittosporum turneri*, 7 Nov 1982, C.F. Butcher, NZAC #94-110c: 1/1♀ ad.
PARATYPES: as for holotype: NZAC: #94-110a,b: 2/2♀♀ ad; #94-110d–m: 10/6♀♀ ad (5 pharate), 2♀ 3rd, 3♂ 2nd, 1 pupa, 2♂♂ ad, 1 neonate.

Remarks. *U. jubatus* shares with *U. adelus* and *U. hymenantherae* large cone-shaped macropores but differs in having more numerous and more broadly spinose marginal setae (those of *U. adelus* and *U. hymenantherae* are fewer and only finely spinose). *U. jubatus* is similar to *U. bullatus* in:
(i) the shape and number of marginal spines;
(ii) in having dorsal derm folds, but these are restricted to a median longitudinal line on *U. jubatus*, whereas *U. bullatus* has 5 longitudinal rows of rounded derm folds; *U. bullatus* also differs in having bollard-like dorsal macropores.

Biology. Nothing known.

Distribution. Only collected once from central North Island (Map 42).

Name derivation. From *jubatus* (L. = maned, crested) describing the long median crest of the adult female and her test.

Umbonichiton pellaspis Henderson & Hodgson new species

Figs M17, C95, 139

Unmounted material: young adults positioned lengthwise on twig of host plant and lateral margins also curved partly around twig; patterned chestnut and dark brown in life; shape elongate; test composed of wax plates reinforced with some sort of fibrous material.

Mounted material: body elongate-oval, slightly narrower at head end. Body length 3.20–3.36 mm, breadth 1.37–1.84 mm.

Dorsum: dorsal pores distributed in a reticulate pattern as for genus; dorsal pores of 3 types: (i) small dark pores which appear to lack a ductule: present in a scattered row between macropores within reticulation lines, with groups at junctions of lines and near margin; also with an occasional pore on submargin between reticulation junctions on margin; (ii) slightly larger pores, which may be microductules although inner ductules unclear: in a single or double row along anal cleft, and (iii) very large, sclerotised, stalked, bulbous or mushroom-shaped macropores (Fig. M17)—outer bulbous part appears fibrous like a shaving-brush under light microscope—

protruding above derm surface, and with a basal sclerotised tube-like stem; present in median and submedian reticulations rows and also in some lines extending to inner submargin; with 2–6 in posterior medial macropore line. Dorsal simple pores apparently absent. Anal plates: widest in anterior third; length 134–146 µm, combined widths 119–138 µm; with 5–10 minute pores on each upper surface; length of setae: inner margin 1, 10–14 µm, inner margin 2, 10–16 µm, apical setae, 10–14 µm and outer margin setae slim, 12–21 µm. Anogenital fold with 3 pairs of rather thickened setae along anterior margin and a single pair laterally, longest 34–50 µm.

Margin: marginal setae short, finely spinose, 15–19 µm long, with 6–8 between stigmatic clefts, and with a larger, stouter seta just posterior to each stigmatic cleft, each about 23 µm long. Stigmatic spines tapering and quite long, length 96–115 µm.

Venter: pregenital disc-pores with 7–8 loculi, distributed as for genus but absent medially and laterad to metacoxae; number mediolaterally on each side of abdominal segments: anal cleft/VII, 15–18; VI, 6–10; V, 5–7; IV, 2–6; III, 0–2; and II, 0–1. Spiracular disc-pores: with 20–24 in each anterior band and 23–37 in each posterior band, each band 2–4 pores wide near margin. Ventral microducts very small, numerous in broad bands across median thorax and abdomen, in a submarginal line and also present sparsely within submarginal band of tubular ducts. Tubular ducts as for genus. Ventral setae: ventral anal lobe setae 53–57 µm long; with 2–3 pairs of anterior anal cleft setae; longest pregenital setae about 77 µm; numbers of setae medially on each abdominal segment: VII, 9–10; VI, 76–10; V, 13–14; IV, 7–9; III, 4–10; and II, 0–10; with 4–5 setae near each metacoxa, 5–7 near each mesocoxa, and 3 near each procoxa; with 5–8 (total) interantennal setae. Antennae 6-segmented, with 2 pseudosegments in long 3rd segment; total length 292–304 µm; apical seta about 61 µm long. Clypeolabral shield 146–170 µm long. Width of spiracular peritremes: anterior 34–38 µm, posterior 42–46 µm. Legs: lengths (metathoracic): coxa 107 µm; trochanter + femur 142–146 µm; tibia 96–107 µm; tarsus 80–85 µm; claw 15 µm long.

Material examined: HOLOTYPE ♀: NEW ZEALAND: **AK:** Riverhead Forest, Barlow Road reserve, *Podocarpus totara* stem, 31 July 1997, RC Henderson, #97-114c, NZAC: 1/1♀ ad.
PARATYPES: as for holotype, NZAC #97-114a–b, d–f: 5/2♀♀ ad, 1♂ 2nd, 2 ♀♀ tests.

Other material: NEW ZEALAND: **AK**: Riverhead Forest, Barlow Road reserve, *Podocarpus totara* leaves and stems, 4 May 1995, RCH, #95-040a,c: 2/1♀ 2nd, 3♂ 2nd. As previous, underside leaves, 31 July 1995, #97-143a–d: 4/1♀ 2nd, 3♂ 2nd. As previous, leaves, 16 Aug 1996, #96-153a–b: 2/1♀ 2nd, 2♂ 2nd. As previous, leaves, 17 July 1997, #97-084a–d: 2♀ 2nd, 1♂ 2nd, 1 pharate 1st-2nd, 4/4 1sts. As previous, leaves, 14 Aug 1997, #97-122, -123, -124a–d: 6/5♂ 2nd, 1 1st. As previous, except on stems, 22 July 1998, #98-083: 2/1♀ ad (infested with fungus), 4 1sts (from female brood chamber).

Remarks. This species can be immediately separated from other species in the genus by the dorsal macropores, which are by far the largest macropores of the genus and of an unique mushroom shape.

The test contains some fibrous material, which enables it to be partially stained and provides sufficient strength to allow it to be mounted on a microscope slide, so that the structure of the wax plates can be studied. These mounted tests show occasional holes along the reticulation lines, presumably where the macropores extend through the test.

Biology. Apparently host specific to *Podocarpus totara*. Immature specimens were collected through the autumn and winter, with adult females only being collected in late winter (July). As the adult is very cryptic and difficult to find, it is not known whether this signifies a univoltine life-cycle. The preadult and adult females were found on the stems of the host plant whereas the more immature stages were on the leaves.

Distribution. Only known from the one site in Auckland area (Map 43).

Name derivation. The specific name *pellaspis* from *pellis* (L. = skin) and *aspis* (f. = a snake), describing the snakeskin appearance of the live female, her cryptic pattern of browns resembling the twig on which she lies.

OTHER SPECIES

Ctenochiton elongatus Maskell nomen dubium

Ctenochiton elongatus Maskell, 1879: 212; –Maskell, 1887: 68; –Cockerell, 1893: 548; –Cockerell, 1896: 330; –Fernald, 1903: 160; –Hutton, 1904: 226; –Myers, 1922: 199; –Wilke, 1927: 207; –Pape, 1939: 346; –Lindinger, 1943: 218; –Wise, 1977: 104.

Maskell described *C. elongatus* in 1879. A single slide exists, labelled "*Ctenochiton elongatus*, from *Geniostoma*, two females, April 1878, W.W.M.". (stained and remounted in Canada Balsam, 2nd Feb. 1995, R.C. Henderson). This slide is the only material which can definitely be assigned to the original collection data and has two specimens on it, both 2nd-instar males! (NOT females). Unfortunately, they belong to different species! No adult females can be located, although the colour plate in Maskell's paper of 1887 (Plate VII, Fig. 4) clearly shows a female test rather than a male test. The original material was collected off *Geniostoma* sp. There are no records of any female specimens of any species being collected off *Geniostoma* in New Zealand, although undetermined males have from time to time been collected from this plant. Second-instar males often apparently settle on plants which are not the host plant of the adult females and so the host plant of this stage may be no indicator of the corresponding female. At the present time, neither of the 2nd-instar males on the slide can be definitely placed with any known female but, even if both specimens could be, it would leave open the question as to which is actually *C. elongatus*. We therefore consider that the best action is to designate *C. elongatus* a *nomen dubium*.

In the later papers, Maskell also lists *Dendrobium* sp. and *Earina* sp. (both Orchidaceae) as hosts. None of this material exists. Presumably based on these latter hosts, various authors (Wilke, 1927; Pape, 1939; Lindinger, 1943) have reported this species as a pest of orchids (*Dendrobium* sp. and *Epidendrum* sp.) in Europe. It is not known on what basis these identifications were made but it is considered here unlikely that they refer to *C. elongatus* — or indeed any of the New Zealand species.

ADVENTIVE SPECIES

The key to the genera found in New Zealand is on page 23.

All the adventive or exotic species in New Zealand are cosmopolitan. They have been redescribed many times and good descriptions are available in a number of recent publications. Because of this, the following descriptions are intended to ensure proper identification within the framework of the New Zealand fauna and are not intended to be exhaustive or to separate these species from other similar species elsewhere in the world — nor are the references exhaustive. For a fuller bibliography see Ben-Dov (1993).

The fourteen species recorded for New Zealand and three additional species erroneously recorded are treated here as belonging to six genera. Some of these species have been placed in other genera at some time and, where this is the case, this is discussed in the Remarks section under each description. These seventeen non-indigenous species belong to two subfamilies (as defined by Hodgson, 1994a), namely the Ceroplastinae (5 species) and the Coccinae (Tribes: Coccini, 2 species; Pulvinariini, 5 species and Saissetiini 5 species).

Subfamily CEROPLASTINAE

Diagnosis: Test: adult females covered in thick coating of wax at maturity; anal plates carried on a sclerotised caudal process in order to reach above surface of wax; form and colour of wax often distinctive for a given species.

Shape: adult female— denuded of wax— usually highly convex, with a distinct dorsal extension to form caudal process, which may be short or longer than rest of body and which is at least partly heavily sclerotised. Stigmatic clefts usually distinct; anal cleft extends up underside of caudal process to anogenital area. Eggs and 1st-instar nymphs held beneath concave venter.

Dorsum: usually highly sclerotised at maturity, and may have a mid-dorsal, an anterior, and 2 or 3 pairs of lateral lobes or clear areas, each lacking dorsal pores or setae. Dorsal setae usually sparse, short (often not much longer than width of basal socket), and blunt. Dorsal pores highly characteristic and heavily sclerotised *Ceroplastes*-type pores, usually with 1–3 satellite loculi and with a long inner filament which branches terminally into numerous fine filaments; these pores may be found throughout or may be absent from some or all dorsal lobes. Preopercular pores generally present in a group imbedded in a sclerotised caudal process anterior to anal plates. Dorsal tubular ducts, dorsal tubercles, and pocket-like sclerotisations absent. Anal plates together quadrate, anterior margins usually almost at right angles to long axis of body; posterior margins convex; inner margins parallel; each plate with a group of fine apical and subapical setae. Anogenital fold with setae present along anterior and lateral margins.

Margin: marginal setae setose and rather sparse. Stigmatic spines usually abundant, variable in shape, sometimes of more than one type, *either* extending along margin *or* radially onto dorsum. Eyespots present just dorsad to margin.

Venter: membranous, usually thrown into large mediolateral folds on either side of genital opening. Pregenital disc-pores usually with 10 loculi. Spiracular disc-pores usually with 5 loculi, present in broad bands between margin and each spiracle. Ventral microducts distinctive, with a sclerotised, cruciform pore and generally most abundant submarginally. Ventral tubular ducts usually present. Ventral setae sparse. Spiracles rather large. Legs usually well developed but may be reduced; each with or without a tibio-tarsal articulation and articulatory sclerosis; each claw with or without a denticle; claw digitules usually similar, with broadly expanded apices, but both may be fine when legs reduced. Antennae normally well developed, with 6 to 8 segments. Labium normal.

Remarks. Three species of *Ceroplastes* are known from New Zealand: *C. ceriferus* (Fabricius), *C. destructor* Newstead, and *C. sinensis* Del Guercio. Two other species (*C. rubens* Maskell and *C. rusci* (Linnaeus)) are mentioned in the literature but, as there are no voucher specimens and subsequent authors treated them as misidentifications, these records are here treated as doubtful. *Ceroplastes* species are all immediately identifiable by the thick, soft, waxy test which covers the dorsum.

Genus *CEROPLASTES* Gray

Type species: *Coccus (Ceroplastes) janeirensis* Gray, 1828: 7.

Coccus (Ceroplastes) Gray, 1828: 7.
Ceroplastes Gray; –Signoret, 1872: 35; –Wise, 1977: 103 [checklist].

The genus *Ceroplastes* is very large and the boundaries are controversial so that some members have also been placed in the genera *Gascardia* Targioni Tozzetti and *Waxiella* De Lotto in the past. However, a phylogenetic study of their relationships by Qin & Gullan (1995) suggested that the genus *Ceroplastes* could only be considered monophyletic if all species were included. This is followed here.

Key to adult female *Ceroplastes* species in New Zealand

1 Antennae 7-segmented; tibio-tarsal articulatory sclerosis present; claw digitules similar; dorsal pores mainly trilocular .... ***sinensis***

—Antennae 6-segmented; tibio-tarsal articulatory sclerosis present or absent; claw digitules similar or dissimilar; dorsal pores bi- or trilocular 2

2 Stigmatic spines in a compact, oval group, extending up onto dorsum; caudal process very broad, particularly at its base, where it is more than ½ width of body on mature adults; ventral tubular ducts only present posteriorly on abdomen .... ***destructor***

—Stigmatic spines more or less restricted to along margins of stigmatic clefts, extending some way laterad to mid-point in each cleft but not extending as an oval group on to dorsum; caudal process short on young specimens but, when long, never very broad at base; ventral tubular ducts present anteriorly between antennae as well as posteriorly on abdomen .... ***ceriferus***

Ceroplastes ceriferus (Fabricius) Indian wax scale

Fig. 140

Coccus ceriferus Fabricius, 1798: 546.
Ceroplastes ceriferus (Fabricius); –Walker, 1852: 1087.

Unmounted material: body covered in thick white or pinkish-white wax, often irregular in outline, normally with an anteriorly projecting horn, particularly on young specimens. Length 3.0–12.0 mm, width 3.0–10.0 mm.

Mounted material: more or less oval, derm becoming heavily sclerotised on old females. Caudal process short on young specimens but becoming more elongate with maturity, up to 1/3rd length of body.

Dorsum: usually with 11 clear areas devoid of pores and setae in submedian band around body, but none medially on dorsum. Dorsal setae rather variable but cylindrical, each about 6 µm long. *Ceroplastes*-type pores mainly triangular and trilocular, evenly distributed, with fewer oval trilocular, quadrilocular, and bilocular pores. Filamentous ducts present around margin.

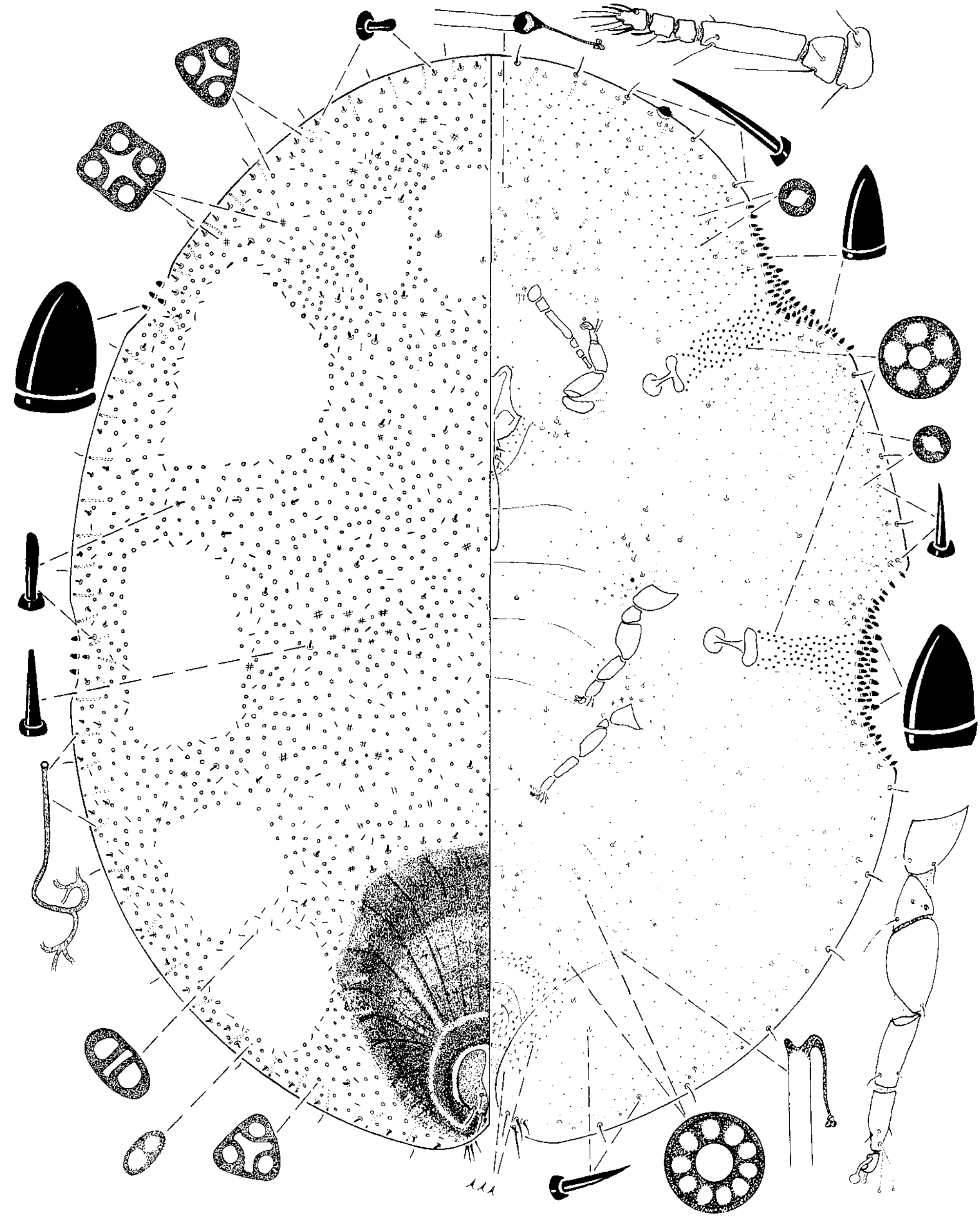


Fig. 140. *Ceroplastes ceriferus* (Fabricius), adult female — (From Gimpel *et al.*, 1974).

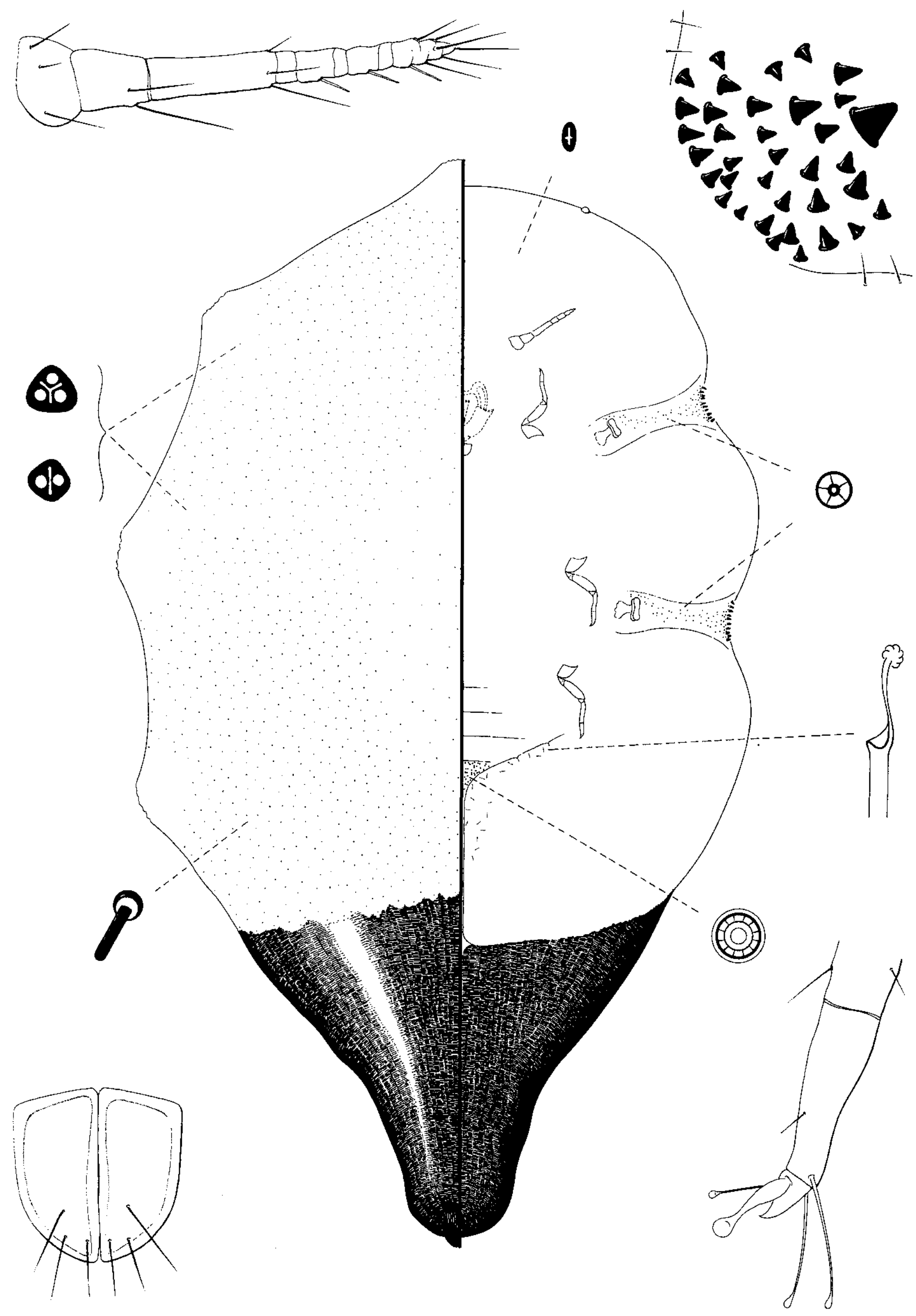


Fig. 141. *Ceroplastes destructor* Newstead, adult female — (From De Lotto, 1965).

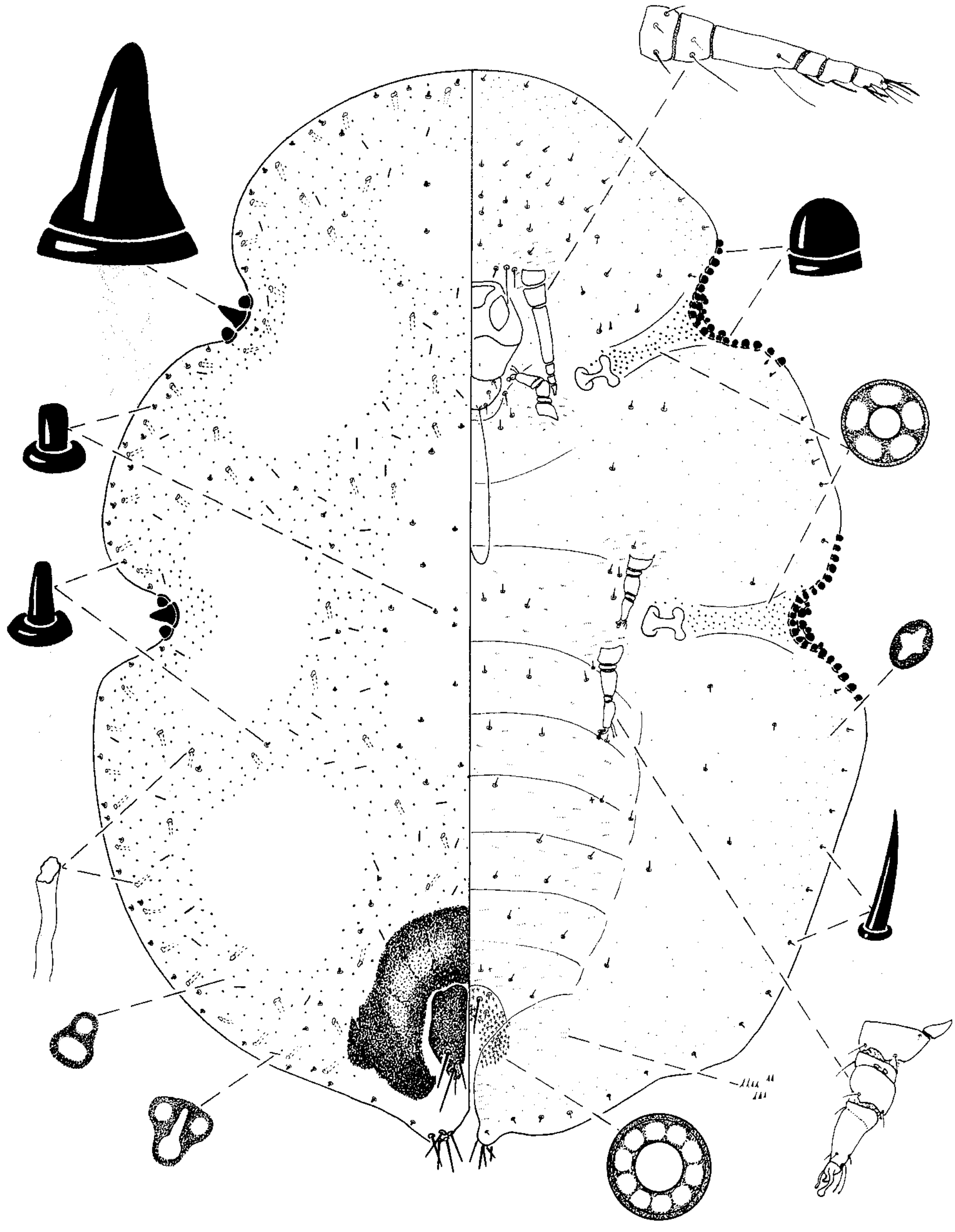


Fig. 142. *Ceroplastes rubens* Maskell, adult female — (From Gimpel *et al.*, 1974).

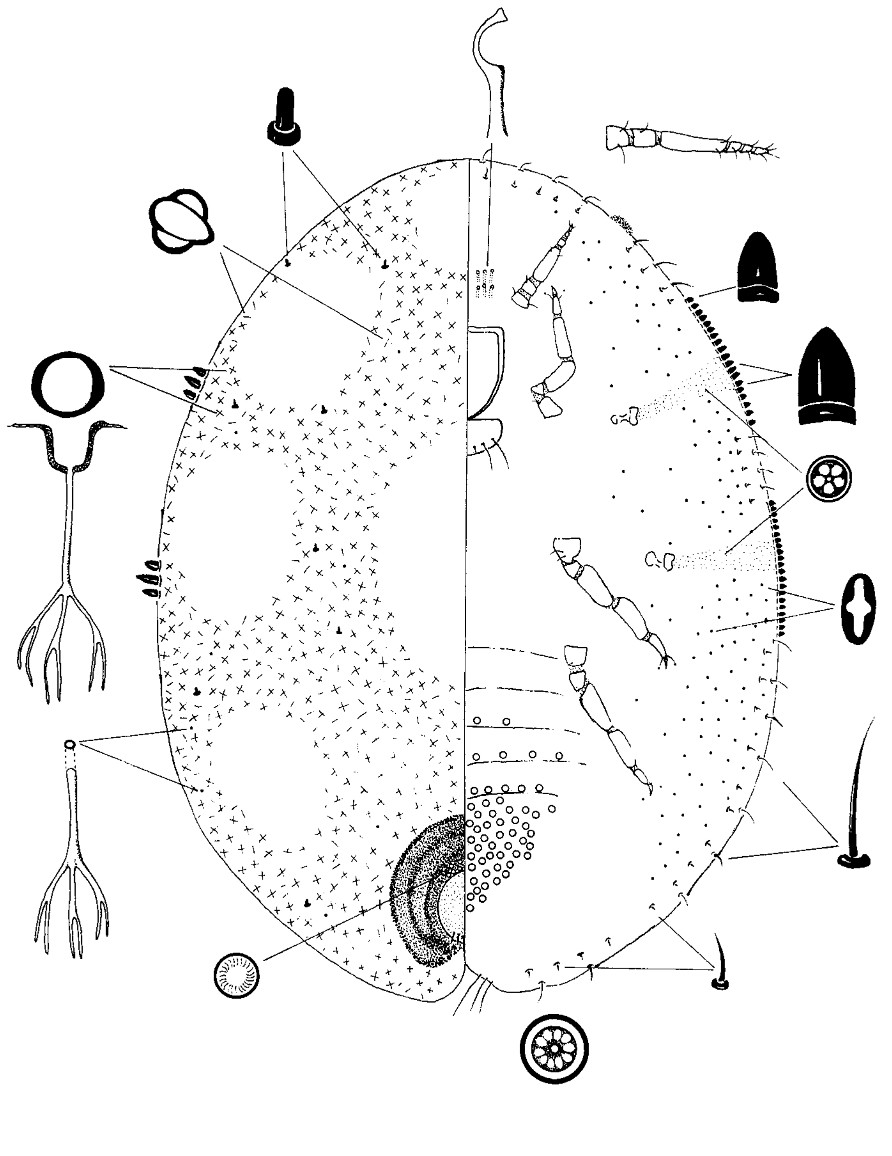


Fig. 143. *Ceroplastes rusci* (Linnaeus), adult female — (From Pellizzari & Camporese, 1994).

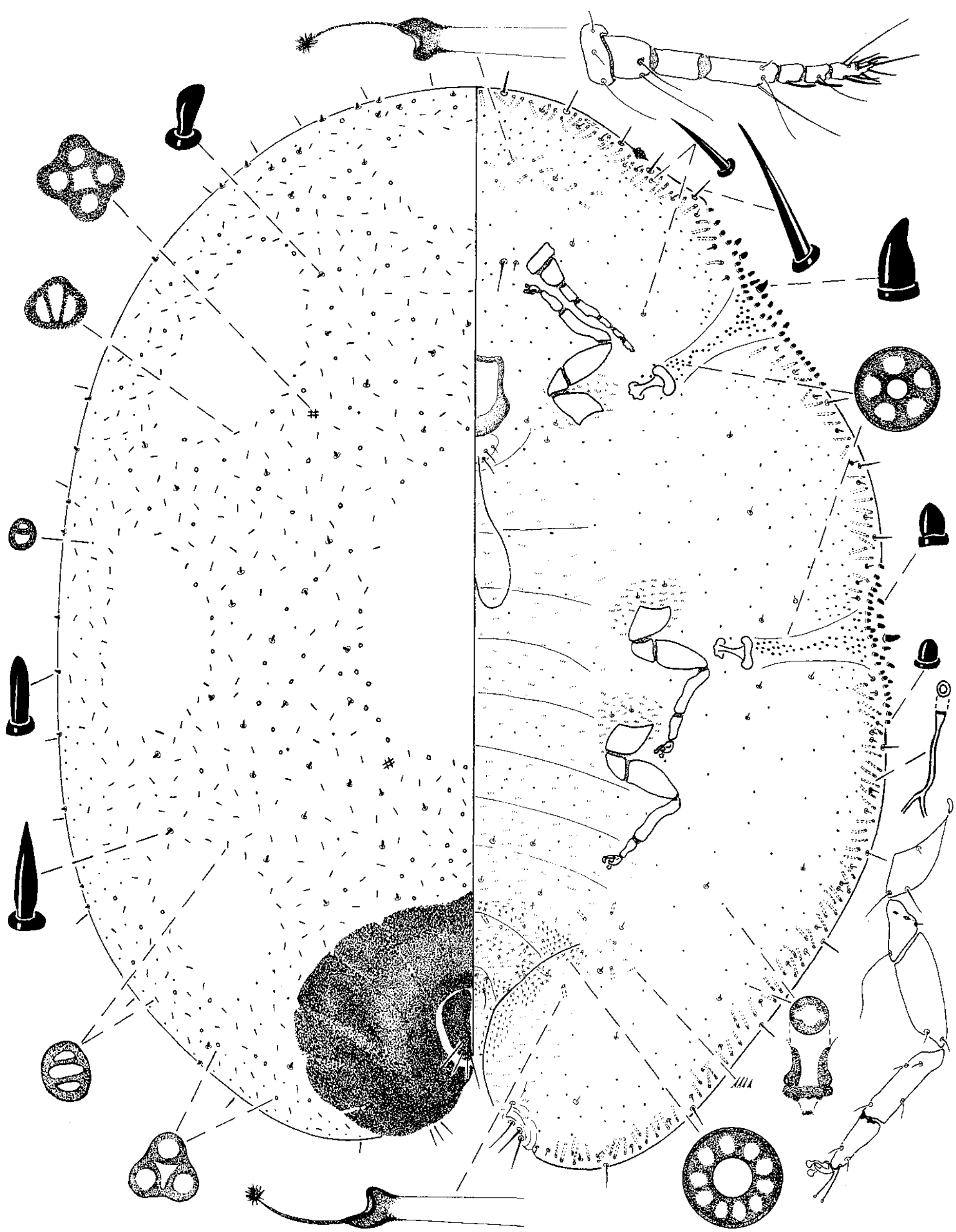


Fig. 144. *Ceroplastes sinensis* Del Guercio, adult female — (From Gimpel *et al.*, 1974).

Margin: marginal setae rather few and setose, with about 2–4 laterally between stigmatic areas, each about 20 µm long. Stigmatic clefts shallow, each with 28–88 bullet-shaped stigmatic spines extending along margin of cleft in 6 irregular rows.

Venter: pregenital disc-pores with mainly 10 loculi: abundant around genital area and on preceding segment, becoming infrequent on more anterior segments but also present mesad to each coxa. Ventral tubular ducts with a narrow inner ductule: restricted to medially on posterior four abdominal segments and between antennae. Antennae 6-segmented. Legs well developed, with a separate tibia and tarsus but no articulation; claw digitules unequal and claw with a denticle.

Material examined. I. Not recorded on indigenous native plants.
II. On exotic plants: *Citrus reticulata, Citrus sinensis* ,and *Citrus* x 'tangelo'.

GB (all records of primary association, from PPIN database).

Remarks. Recent descriptions include: De Lotto (1971a), Williams & Kosztarab (1972), Gimpel *et al.* (1974), Hamon & Williams (1984), Avasthi & Shafee (1986), and Williams & Watson (1990). Useful identification characters are the 6-segmented antennae, well developed legs lacking an articulatory sclerosis, and presence of ventral tubular ducts between the antennae.

First reported from New Zealand in March 1992 (source, PPIN database).

This species has a wide distribution throughout southern Asia (China, Japan, India, Sri Lanka, Thailand, Vietnam, Indonesia, Malaysia, Papua New Guinea, and the Philippines (Ben-Dov, 1993)). It has been known in Australia since the last century (as *Ceroplastes australiae* Walker, 1852) but it has not yet become a pest (Qin & Gullan, 1994). It has also been recorded from the Cook Is, Fiji, New Caledonia, Tonga, and Vanuatu by Williams & Watson (1990). It was introduced into the USA in 1936 (Gimpel *et al.*, 1974) where it is now widespread and causes significant damage to ornamentals. It has a large host range—Ben-Dov (1993) lists 39 plant families.

Biology. In cool areas, *C. ceriferus* overwinters as the adult female. In the spring, it lays a thousand or more eggs which hatch in 2–3 weeks (Williams & Kosztarab, 1972). The nymphs settle on the twigs or stems, with the female going through 4 and the male 5 instars. Males are generally considered to be rare (Gimpel *et al.*, 1974).

Distribution and status in New Zealand. Known only from Gisborne at present; of low economic importance.

Ceroplastes destructor Newstead soft wax scale

Figs C37, 141

Ceroplastes destructor Newstead, 1917: 26; –Cottier, 1956: 273, 329 [key; status; host range]; –Ben-Dov, 1993:30 [world catalogue].
Gascardia destructor (Newstead); –De Lotto, 1965: 200; –Wise, 1977: 105 [checklist].

Unmounted material: test of thick, white, soft wax, 'wet' to touch, strongly convex and irregular in shape. Length about 3.0–5.5 mm, breadth 1.5–3.0 mm.

Mounted material: broadly oval with a caudal process about 1/3rd body length, very broad at base. Length up to 6 mm.

Dorsum: with 7 clear areas devoid of pores and setae in a submedian band around body; mid-dorsal area with few pores and setae. Dorsal setae short and cylindrical to slightly clavate. *Ceroplastes*-type pores fairly evenly distributed, oval and triangular trilocular pores most common but with a few bilocular pores.

Margin: marginal setae possibly restricted to a few short, flagellate setae on either side of stigmatic clefts. Stigmatic clefts broad and shallow, each with about 10 short, conical spines along margin and further spines extending onto dorsum as a conspicuous round to oval group of short, broadly conical spines, each group with 1–2 much larger spines furthest from margin; total number of stigmatic spines per cleft 37–77.

Venter: pregenital disc-pores with mainly 10–12 loculi: restricted to immediately around the genital area. Ventral tubular ducts restricted to the mediolateral folds laterad to vulva region. Antennae 6-segmented and quite long. Legs well developed but comparatively rather small for body size; lacking a tibio-tarsal articulatory sclerosis; claw digitules dissimilar; claw without a denticle.

Material examined. I. Not recorded on indigenous native plants.
II. On exotic plants: *Actinidia deliciosa, Citrus* spp.

ND, AK, WO, BP, GB.

Remarks. This species has been included in the genus *Gascardia* by many authors. Recent descriptions include: De Lotto (1965), Williams & Watson (1990), Qin & Gullan (1994), and, describing all stages, Wakgari & Giliomee (1998). It is best identified by the very large, broad caudal process, the well developed legs lacking a tibio-tarsal articulatory sclerosis, and the absence of ventral tubular ducts between the antennae.

C. destructor was first reported from New Zealand by Greig (1940). It is currently an important pest on citrus in Northland (Smith *et al.*, 1980; Lo & Blank, 1992; Lo *et al.*, 1992; Olsen *et al*, 1993; Lo, 1995; Lo *et al.*, 1996; Blank *et al.*, 1997), and Gisborne (D. Steven, pers.comm.).

This species was first described from tropical Africa where it is widespread; its biology was studied in South Africa by Cilliers (1967). Away from the Ethiopian region, it is known from Australia and from parts of the Pacific Region — Norfolk Island, Solomon Is., and Papua New Guinea (Williams & Watson, 1990; Ben-Dov, 1993). The distribution records for India, Florida, Mexico, and Colombia are believed now to be doubtful (T.-K. Qin, pers. comm. 1999).

C. destructor has a wide host range. Ben-Dov lists 21 plant families, while Brimblecombe (1956) lists 79 plant species from Australia, and Snowball (1969) 106 plant species from New South Wales alone. However, Cottier (1956) stated that it was only known on citrus in New Zealand.

Biology. In Queensland, where it was a major pest of citrus before the 1970's (probably due to overuse of certain pesticides (Smith, 1970)), it has two generations a year (Smith & Ironside, 1974) but only one in the south (Qin & Gullan, 1994). In New Zealand, the biology has been studied by Lo *et al.* (1992), Olsen *et al.* (1993), and Lo (1995). In Northland, New Zealand, it has been shown to have only one generation (Lo *et al.*, 1996). Males are unknown. The crawlers tend to settle on the leaves but then migrate to the twigs (late 2nd or early 3rd instar) for the rest of their lives. Overwintering is by the 3rd-instar nymphs and adults.

The possibility of introducing biological control agents into Australia from South Africa was first studied by Snowball (1969); since then several parasitoids and predators have been introduced and it is currently under good biological control (Sands *et al.*, 1986; Qin & Gullan, 1994).

Distribution and status in New Zealand. *C. destructor* is an important pest of citrus in Northland and Gisborne.

Ceroplastes rubens Maskell — red wax scale

Fig. 142

Ceroplastes rubens Maskell, 1893a: 214; –Muggeridge, 1933: 226 [doubtful record]; –Cottier, 1939b: 422 [identification correction]; –Wise, 1977: 103 [checklist, as misidentification]; –Ben-Dov, 1993: 49 [world catalogue].

C. rubens was reported from New Zealand (Muggeridge, 1933) but there are no voucher specimens, and the record was considered to be a misidentification by Cottier (1939) and Wise (1977). It is treated here as doubtful. It is a rather common and widespread species in the Pacific (Williams & Watson, 1990). It is highly polyphagous and Ben-Dov (1993) lists 72 plant families as hosts. It is considered to be a major pest of citrus in Australia (Sabine, 1969; Qin & Gullan, 1994), Hawaii and Japan (Ebeling, 1959), and the Solomon Is (Williams & Watson, 1990). The test is easily identified by the reddish-pink colour of its wax, while mounted specimens have poorly developed legs—shorter than the antennae—and no ventral tubular ducts.

Recent descriptions include: Gimpel *et al.* (1974), Kawai (1980), Hamon & Williams (1984), Williams & Watson (1990), and Qin & Gullan (1994).

Ceroplastes rusci (Linnaeus) — fig wax scale

Fig. 143

Coccus rusci Linnaeus, 1758: 456.
Ceroplastes rusci (Linnaeus); –Signoret, 1872: 35; –Muggeridge, 1933: 226 [doubtful record]; –Cottier, 1939b: 422 [identification correction]; –Wise, 1977: 103 [checklist, as misidentification]; –Ben-Dov, 1993: 51 [world catalogue].

This is another *Ceroplastes* species which was reported from New Zealand by Muggeridge (1933) but there are no voucher specimens and the record was considered to be a misidentification by Cottier (1939b) and Wise (1977). Although it has been recorded in some tropical areas (Ben-Dov, 1993), *C. rusci* is typical of areas with a Mediterranean climate where it is a pest of figs; it is also a minor pest of citrus in Israel.

It is highly polyphagous and Ben-Dov (1993) lists 30 plant families. It infests the stems, branches, and leaves of its host. Its biology in Italy is described briefly by Pellizzari & Camporese (1994). Its colour and the arrangement of the white stigmatic wax bands in the red wax test make this species fairly easy to identify.

Recent descriptions include: Hodgson (1969) and Pellizzari & Camporese (1994). Mounted material is best separated from the other *Ceroplastes* species considered here by the presence of 6-segmented antennae, well developed legs with a tibio-tarsal articulatory sclerosis, and ventral tubular ducts restricted to area between the antennae.

Ceroplastes sinensis Del Guercio hard wax scale or Chinese wax scale

Figs C38, C39, 144

Ceroplastes sinensis Del Guercio, 1900: 232; –Cottier, 1939b: 422 [description; status; hosts]; –Cottier, 1956: 273, 327 [key; status; hosts]; –Hoy, 1961: 58 [mention; distribution]; –Wise, 1977: 104 [checklist]; –Penman, 1984: 64 [biology; distribution; hosts]; –Scott, 1984: 28 [hosts]; –Ben-Dov, 1993: 54 [world catalogue].

Unmounted material: young nymphs have small white wax plates in a star-like rosette and are normally found on leaves; mature females with thick, off-white wax test, coloured pinkish brown in patches, and with white 'dry' wax in the lateral and dorsal depressions; usually on leaves or stems; oval in dorsal view, hemispherical when viewed laterally, without a horn; old females lose pinkish-brown colours, becoming grey-white with sooty mould fungus. Females often clumped together on stems, when shape of individual specimens becomes distorted.

Mounted material: broadly oval, dorsum only lightly sclerotised; caudal process short. Length 3.5 mm, width 3.0 mm.

Dorsum: with 7 clear areas devoid of pores and setae around submargin and with a distinct clear area mid-dorsally. Dorsal setae short and cylindrical to clavate. Oval, trilocular, *Ceroplastes*-type pores most numerous, but also with triangular trilocular and bilocular pores.

Margin: marginal setose setae, rather few, with 2–4 between lateral stigmatic clefts, each up to about 20 μm long. Stigmatic clefts shallow, each with about 30 hemispherical, bullet-shaped spines in 2–4 elongate rows along margin.

Venter: pregenital disc-pores with mainly 10 loculi: abundant around vulva region and in two preceding segments. Ventral tubular ducts sparse posteriorly on abdomen and between antennae on head. Long filamentous ducts present in a band around margin. Antennae 7-segmented. Legs well developed, with a distinct tibio-tarsal articulatory sclerosis; claw digitules both broad; claw with a small denticle.

Material examined. I. On indigenous native plants: *Avicennia marina* subsp. *australasica, Coprosma rhamnoides, Coprosma robusta, Coprosma* sp., *Hebe stricta, Hoheria populnea, Melicope simplex, Pteridium esculentum, Solanum aviculare, Vitex lucens.*

II. On exotic plants: *Citrus* spp., *Feijoa sellowiana, Gardenia* sp., *Ilex aquifolium, Lonicera* sp., *Thunbergia* sp.

TH / ND, AK, CL, WO, BP, GB, HB.

Remarks. Recent descriptions include: De Lotto (1971a), Williams & Kosztarab (1972), Gimpel *et al.* (1974), Hamon & Williams (1984), Tremblay (1988), Gill (1988), Williams & Watson (1990), Pellizzari & Camporese (1994), and Qin & Gullan (1994). This species has 7-segmented antennae and well-developed legs with a tibio-tarsal articulatory sclerosis.

It was first reported in New Zealand in 1932 (Cottier, 1939b) but then declined (Snowball, 1970), although Hoy (1961) described it as widespread and recorded it off both *Leptospermum scoparium* and *Kunzea* [as *Leptospermum*] *ericoides*. It is currently a widespread species on citrus in Northland but considered to be less destructive than *C. destructor* (Lo *et al.*, 1996).

C. sinensis is widespread in the Palaearctic Region, where it is a sporadic pest in Italy and Spain, and is also found in some southern and eastern states in the USA and in Mexico, Brazil, and Chile (Ben-Dov, 1993). In the Pacific, it has been found on Norfolk Is (Williams & Watson, 1990) and has been causing some concern in Australia, where it was first reported in 1966 (Snowball, 1970) and where it is now quite widespread. Qin *et al.* (1994), in an effort to determine a suitable geographic area from which to import biocontrol agents for its control in Australia, looked at the relationships of all the Ceroplastinae and concluded that *C. sinensis* was probably native to Central or South America.

C. sinensis has a very large host range. Ben-Dov (1993) and Qin & Gullan (1994) list about 50 plant families. Cottier (1939b, 1956) lists the following hosts from New Zealand: citrus, clematis, *Escallonia* sp., *Fatsia* sp., *Feijoa sellowiana, Hebe* sp., matipo (*Pittosporum* sp.), *Olearia* sp., puriri (*Vitex lucens*), tree tomato (= tamarillo, *Cyphomandra betacea*), and *Veronica* sp.; and he noted that it had been sufficiently serious on species of *Olearia* and *Hebe* to kill them. Since then, the incidence of damage to indigenous plants has become minor.

Biology. One generation a year in Italy (Frediani, 1960; Pellizzari & Camporese, 1994), Virginia (Williams & Kosztarab, 1972), and New South Wales, Australia (Snowball, 1970). Young nymphs feed on the leaves and then, in the 3rd instar, migrate to the stems to complete development (Hamon & Williams, 1984; Snowball, 1970). The biology in New South Wales is described by Snowball (1970) who found that there were 4 female instars and six male (with an extra 3rd-nymphal instar). Qin & Gullan (1994) illustrate a 3rd-instar male with anal plates and mouthparts (appearing more like the 2nd-instar male than a normal prepupa) and also with small ventral wingbuds. Qin & Gullan (1994) did not illustrate a prepupa or pupa and have indicated (pers.comm.) that they did not find any prepupae or pupae in the population that they studied. Confirmation of the number of male instars is required. In New Zealand, the eggs hatch in early March; development is slow during the winter, with the females becoming mature in December (Cottier, 1939b; Penman, 1984). The young stages are mainly found on the upper leaf surface while the adults are on the stems and small branches (Cottier, 1956; Penman, 1984). Its biology in New Zealand has recently been studied by Lo (1995) and Lo *et al.* (1996) and found to be univoltine, with the development of the early nymphal stages much delayed in the spring and early summer in comparison to *C. destructor*.

Distribution and status in New Zealand. *C. sinensis* is an important pest of citrus in Northland and Gisborne, and of *Feijoa* in Auckland. It has been recorded from Great Island (Three Kings Islands) and from most regions of the northern half of the North Island.

Subfamily COCCINAE

Type genus: *Coccus* Linnaeus, 1758: 455.

Diagnosis. New Zealand species in 3 tribes. Test covering dorsum either absent, extremely sparse or of thin wax; woolly ovisac produced ventrally on Pulvinariini, in which eggs and 1st-instar nymphs are protected; in other tribes eggs and/or 1st-instar nymphs are held under concave venter. Body oval and usually rather flat, less commonly highly convex when mature (e.g., many Saissetiini); stigmatic clefts rather shallow or absent; anal cleft normal; occasionally with an anal sclerotisation around anterior margin of anal cleft.

Dorsum: derm quite thin (thick with dermal areolations on Saissetiini), sclerotised at maturity. Dorsal setae typically spinose. Dorsal pores variable, but generally including a dorsal microductule. Preopercular pores generally present: on Pulvinariini usually in a single band extending anteriorly from anal plates; spreading around sides of anal plates on Saissetiini; each pore usually small, but large, convex and heavily sclerotised on Saissetiini. Dorsal tubercles present or absent; when present, convex and submarginal. Pocket-like sclerotisations only present on Saissetiini. Dorsal tubular ducts present or absent; when present, usually small. Anal plates together quadrate, each plate usually with outer margins subequal in length or with posterior margin slightly longer; typically with 3 or 4 setae near apex, occasionally with setae or spinose setae along inner margins; discal setae rarely present except on Saissetiini. Anogenital fold with pairs of setae present along both anterior and lateral margins. Supporting bars to anal plates usually present. Anal ring with 6–10 setae.

Margin: marginal setae either spinose or setose, the latter frequently fimbriate on Coccini and Saissetiini; usually present in a single marginal line and not extending up margins of anal cleft. Stigmatic spines: 3 in each cleft, clearly differentiated from marginal setae. Eyespots situated near margin.

Venter: derm membranous. Pregenital disc-pores each with 5–10 loculi; on Saissetiini, usually present medially across most abdominal and thoracic segments; on Pulvinariini, typically restricted to abdominal segments and metathorax; on Coccini, typically on only 1 or 2 pregenital segments. Spiracular disc-pores each with 5 loculi; present in bands between margin and spiracles. Ventral microducts present, usually throughout. Ventral tubular ducts highly variable; typically absent on Coccini or, if present, restricted to medially on thorax (e.g., on *Coccus*); on the Saissetiini, present in a broad submarginal band of generally 1 or 2 types (3 on some Saissetiini); on the Pulvinariini throughout and generally of 3 or 4 types. Ventral setae normally sparse; with long pregenital setae present on 3 pregenital segments. Antennae each with 5–9 segments. Labium and mouthparts normal. Spiracular peritremes normal in size. Legs usually well developed; each leg with separate tibia and tarsus, with or without an articulatory sclerosis (typically present on Pulvinariini); claw digitules usually both broad; each claw with or without a denticle.

Tribe **Coccini** Fallén

Type genus: *Coccus* Linnaeus, 1758: 455.

Members of this tribe in New Zealand are characterised by: (i) absence of ventral tubular ducts or their restriction to medially on thorax; (ii) lack of pocket-like sclerotisations; (iii) preopercular pores in an elongate band anterior to anal plates; (iv) pregenital disc-pores on 1–3 pregenital segments only.

Genus *COCCUS* Linnaeus

Coccus Linnaeus, 1758: 455.

Type species: *Coccus hesperidum* Linnaeus, 1758, designated in Opinion 1303 under the plenary powers of the International Commission on Zoological Nomenclature (name number 2244) (1985).

Remarks. Two species currently placed in the genus *Coccus* are known from New Zealand, namely *Coccus hesperidum* L. and *Coccus longulus* (Douglas). The former is of some importance on horticultural crops.

Key to adult female *Coccus* species in New Zealand

1 Antennae 8-segmented; ventral tubular ducts absent; dorsal setae short, curved, and sharply pointed .... ***longulus***

—Antennae 7-segmented; ventral tubular ducts present medially on pro- and mesothorax; dorsal setae blunt and cylindrical .... ***hesperidum***

Coccus hesperidum Linnaeus soft brown scale

Figs C40, C41, 145

Coccus hesperidum Linnaeus, 1758: 455; –Fernald, 1903: 168 [world catalogue]; –Thomson, 1922: 334 [pest status; hosts]; –Myers, 1922: 199 [checklist]; –Miller, 1935 [status; biology]; –Cottier, 1956: 272, 331 [key; status; hosts]; –Wise, 1977: 104 [checklist]; –Penman, 1984: 61 [biology]; –Somerfield, 1984: 87 [hosts]; –Ben-Dov, 1993: 73 [world catalogue].
Lecanium hesperidum (Linnaeus); –Maskell, 1879: 205 [description; biology; pest status]; –Maskell, 1887: 80 [description; records]; –Maskell, 1893a: 218 [synonymy discussion]; –Maskell, 1893b: 103 [synonymy; status]; –Maskell, 1895a: 15 [checklist]; –Hutton, 1904: 353 [checklist].
Lecanium maculatum Signoret, 1873b: 400; –Maskell, 1879: 207 [brief description]; –Maskell, 1887: 81 [description; records]; –Maskell, 1895a: 16 [checklist]; –Hutton, 1904: 353 [checklist].
Coccus maculatus (L.); –Fernald, 1903: 172 [world catalogue]; –Thomson, 1922: 334 [mention]; –Myers, 1922: 199 [checklist]; –Wise, 1977: 104 [checklist].

Unmounted material: body elongate-oval to nearly round, sometimes asymmetrical if against leaf vein; rather flat, with a series of faint lateral ridges; markings highly variable, young adults generally pale green, developing series of brown spots which take on a distinct pattern; mature adults finally turning dark brown, slightly convex.

Mounted material: elongate-oval, up to 6.0 mm long and 4.0 mm wide.

Dorsum: derm membranous, becoming mildly sclerotised with small pale areolations on older specimens. Dorsal setae small, cylindrical with blunt apices. Dorsal pores frequent throughout, with a minute microductule in each areolation. Preopercular pores flat, in a diffuse group in front of anal plates. Dorsal tubular ducts present or absent; when present, scarce submarginally, sometimes singly but with up to 6 or more per side. Dorsal tubercles almost invariably present submarginally; each tubercle small, simple, and convex; with 0–6 on each side. Anal plates rather pointed; posterior margins usually with a small indentation about 1/2–1/3rd way along length. Anogenital fold with 2 pairs of long setae along anterior margin and 2 pairs laterally.

Margin: marginal setae finely spinose with flattened fimbriate apices but setae can appear pointed; with 8–14 setae on each side between stigmatic clefts. Stigmatic clefts usually slightly indented, with 3 stigmatic spines; median spine generally slightly curved, with a blunt apex and 2–3 × length of lateral spines, which are usually straight with a blunt apex.

Venter: pregenital disc-pores with mainly 10 loculi: sparse immediately around genital opening and with a few mediolaterally on preceding 1 or 2 segments. Spiracular disc-pores in a narrow band. Ventral microducts small and rather sparse throughout. Ventral tubular ducts present in a rather distinct pattern, with a small group of 0–3 just mesad to each procoxa, a larger group near each mesocoxa and usually extending thinly across median area of mesothorax, and with 0-2 also present lateral to anogenital fold. Antennae 7-segmented. Legs well developed; each with a distinct tibio-tarsal articulation and a small articulatory sclerosis (occasionally absent on some legs); claw digitules both broad though one occasionally slightly thinner than other; claws without a denticle.

Material examined. I. On indigenous native plants: *Beilschmiedia tawa, Blechnum fraseri, Brachyglottis bellidioides, Brachyglottis repanda, Carmichaelia* sp., *Chordospartium stevensonii, Coprosma acutifolia, Coprosma* sp., *Corokia* sp., *Cyathea* sp., *Myoporum laetum, Olearia nummularifolia, Olearia traversii, Pimelea* sp., *Pittosporum* sp., *Pratia physaloides, Pseudopanax crassifolius, Pseudopanax lessonii, Pseudopanax* sp., *Senecio* sp., *Solanum aviculare, Tecomanthe speciosa, Vitex lucens.*

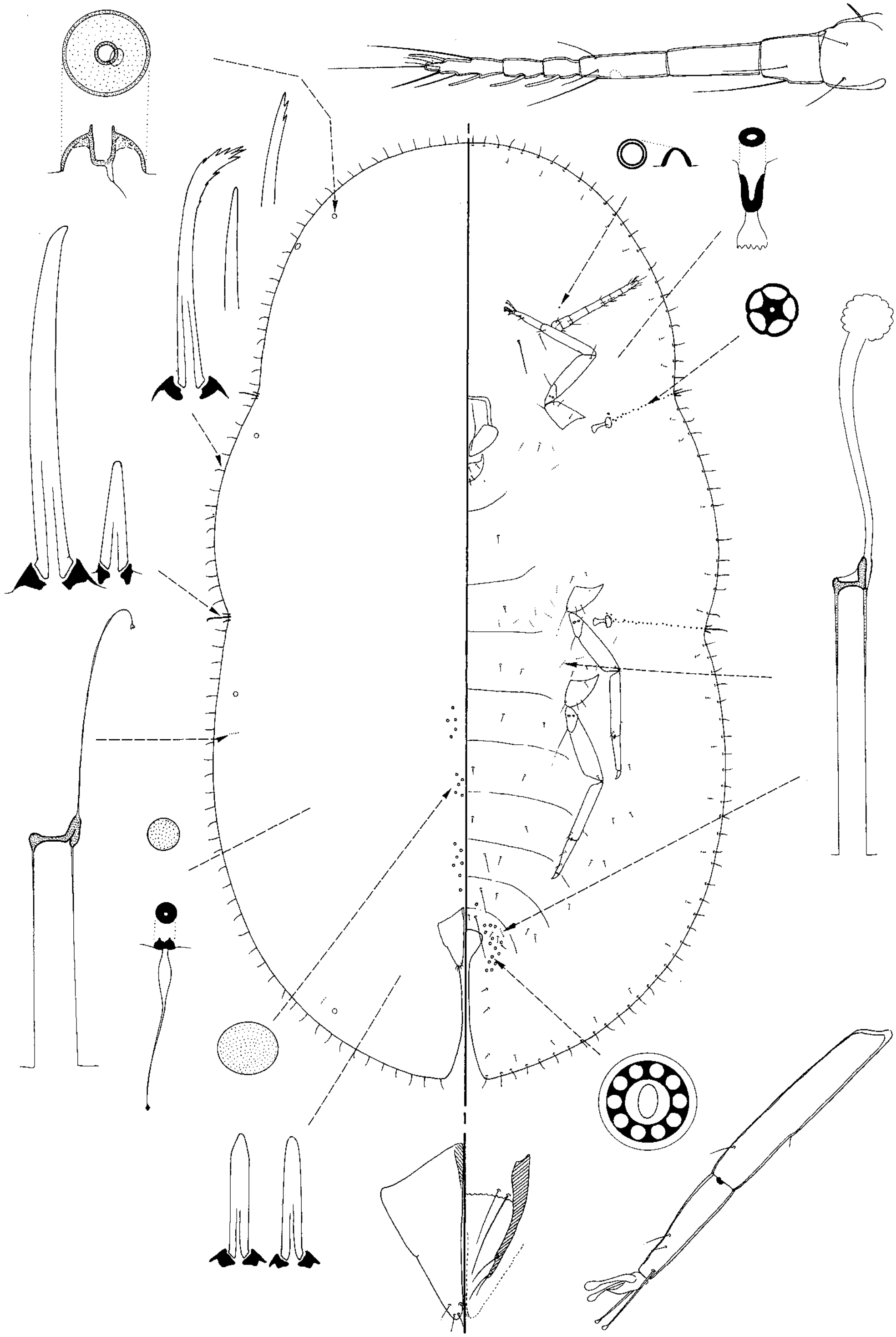


Fig. 145. *Coccus hesperidum* Linnaeus, adult female — (Adapted from Hodgson, 1994a).

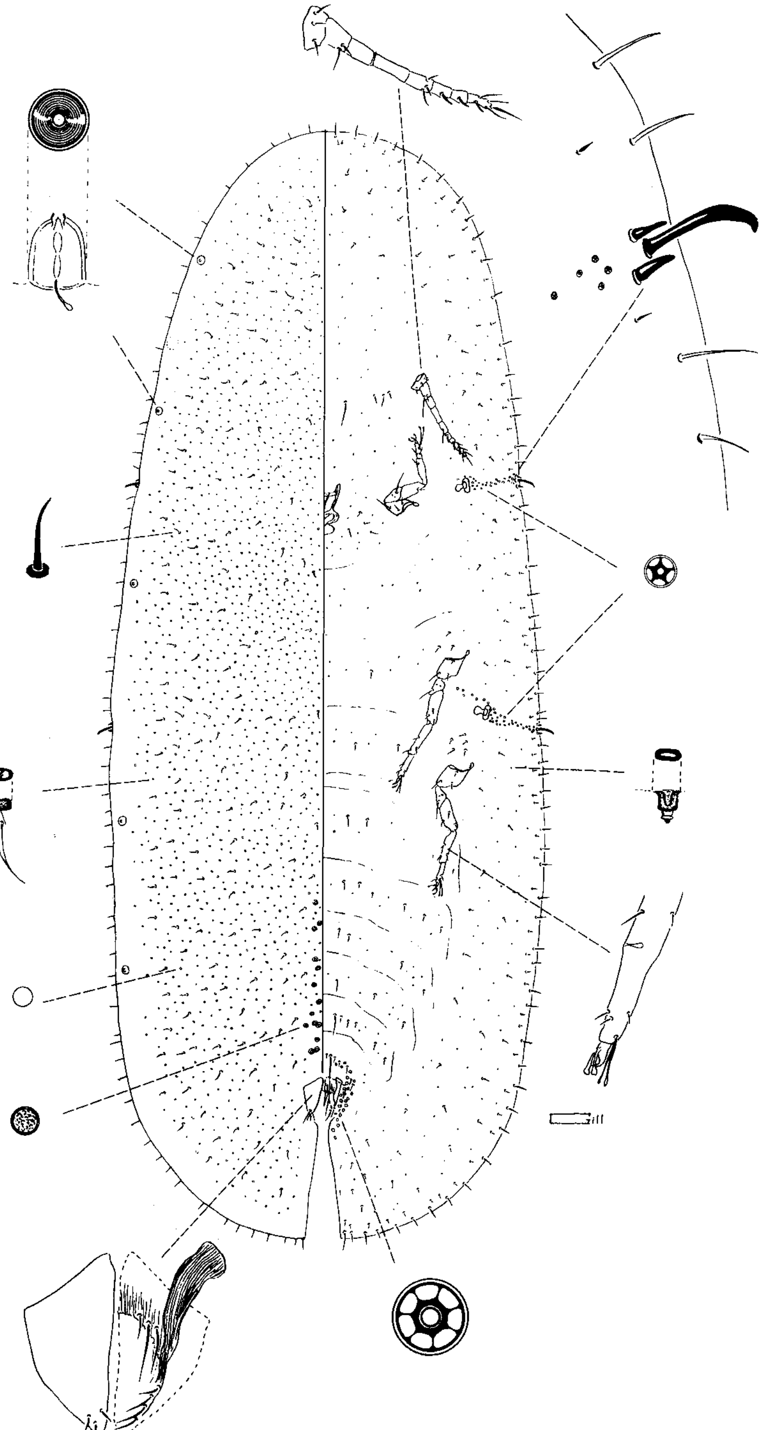


Fig. 146. *Coccus longulus* (Douglas), adult female — (From Gill, 1988).

II. On exotic plants: *Abutilon* sp., *Actinidia deliciosa, Alternanthera philoxeroides, Bouvardia* sp., "broom", *Citrus* spp., *Cucurbita maxima, Cymbidium* sp., *Dendrobium* sp., *Dianthus* sp., *Fatsia* sp., *Ficus* sp., *Gardenia* sp., *Hedera* sp., *Hibiscus tiliaceus, Ilex* sp., Laurel, *Luculia* sp., *Malus* x *domestica, Medicago sativa, Persea americana, Phalaenopsis* sp., *Phlox* sp., *Pinus radiata, Poncirus trifoliata, Prostanthera cuneata, Prunus armeniaca, Prunus avium, Prunus laurocerasus, Prunus persica* var *nucipersica, Prunus salicina, Ribes nigrum, Rosmarinus* sp., *Rubus* x [as loganberry], *Sollya heterophylla, Vitis vinifera.*

KE / ND, AK, WO, BP, GB, HB, TK, WA, WI, WN / SD, NN, MB, BR, WD, MC, SC, OL, CO, DN, SL / CH.

Remarks. Recent descriptions of *C. hesperidum* can be found in: Williams & Kosztarab (1972), Gill *et al.* (1977), Kawai (1980), Hamon & Williams (1984), Gill (1988), Williams & Watson (1990), and Hodgson (1994a). The 7-segmented antennae and the distribution of the ventral tubular ducts are particularly good identification characters, along with such anal plate characters as lateral margin indentation, 4 pairs of small setae near apex, and noticeably sclerotised supporting bars.

C. hesperidum is one of the most cosmopolitan and polyphagous insects (Ben-Dov (1993) lists 91 plant families), but Gill (1988) states that it has been found on almost every kind of plant except grasses. It is an important pest on citrus and ornamentals, including those under glass. *C. hesperidum* was first reported in New Zealand by Maskell in 1879, when he considered that it was becoming a veritable pest on introduced garden trees. Cottier (1956) considered that it had a wide host range but was of minor importance, while Penman (1984) stated that it was often a problem on citrus in the northern North Island. An encyrtid parasitoid, *Microterys flavus* (Howard), was introduced to N.Z. for its control in 1921 (Hill, 1989).

Biology. *C. hesperidum* has 3–5 generations a year outdoors in California and more under protective cultivation (Gill, 1988); it is mainly parthenogenetic and ovoviviparous. It attacks leaves and twigs, and usually is associated with large amounts of honeydew, resulting in a thick covering of sooty mould, which is often more important than any physical damage done by the insect. Where toxic chemicals are infrequently used, it is usually kept under control by natural enemies. Penman (1984) notes that generally within an orchard of subtropical fruit trees, large numbers of *C. hesperidum* may be found in very small areas on a single tree or only on isolated trees. There are 3–4 (Miller 1935) or possibly up to 5 (Penman 1984) generations per year in New Zealand.

Distribution and status in New Zealand. *C. hesperidum* has been recorded from the Kermadec Islands and Chatham Islands as well as throughout the North and South Islands where it is a serious pest of ornamentals, both indoors and outdoors. It has also been recorded from at least 22 indigenous plant species.

Coccus longulus (Douglas) long brown scale

Figs C42, 146

Lecanium longulum Douglas, 1887: 97; –Maskell, 1891: 16 [synonymy]; –Maskell, 1893a: 221 [Sandwich Is]; –Maskell, 1897: 310 [first record].
Lecanium chirimolae Maskell, 1890c: 137; –Maskell, 1891: 16 [synonymy]; –Fernald, 1903: 171 [world catalogue].
Coccus elongatus (Signoret); –Fernald, 1903: 168 [world catalogue]; –Wise, 1977: 104 [checklist].
Coccus longulus (Douglas); –Fernald, 1903: 171 [world catalogue]; –Thomson, 1922: 334 [status]; –Myers, 1922: 199 [checklist]; –Wise, 1977: 104 [checklist]; –Ben-Dov, 1993: 80 [world catalogue].

Unmounted material: elongate oval, moderately convex and smooth; yellowish to greyish-brown.

Mounted material: elongate, up to 6 mm long and 3 mm wide.

Dorsum: derm membranous to slightly sclerotised, with conspicuous areolations. Dorsal setae often curved, sharply pointed. Dorsal microductules present in each areolation. Dorsal tubular ducts absent. Dorsal tubercles present, totalling up to about 19. Preopercular pores in an elongate group in front of anal plates. Anogenital fold with 4 pairs of setae along anterior margin and 4 pairs laterally.

Margin: marginal setae setose, rarely with frayed apices, with about 12 between lateral stigmatic clefts. Stigmatic clefts shallow, with three stigmatic spines, median spine 2 to 3 times longer than lateral spines. Eyespot set slightly onto dorsum in a clear area of derm.

Venter: pregenital disc-pores with mainly 7 loculi: abundant around vulva and occasionally on 1 or 2 preceding segments. Ventral microducts sparse throughout, most common near labium. Ventral tubular ducts absent. Antennae 8-segmented. Legs well developed, with a tibio-tarsal articulatory sclerosis.

Material examined. I. On indigenous native plants: *Carmichaelia australis, Carmichaelia* sp., *Chordospartium stevensonii, Melicope ternata.*

II. On exotic plants: *Citrus* sp., *Hypericum* sp., *Magnolia stellata, Vitis vinifera.*

AK, BP / MB.

Remarks. Recent descriptions—often as *C. elongatus* (Signoret)—include: Ben-Dov (1977), Gill *et al.* (1977), Kawai (1980), Hamon & Williams (1984), Gill (1988), and Williams & Watson (1990). The presence of 8-segmented antennae, slender, pointed, often curved dorsal setae, and absence of dorsal and ventral tubular ducts quickly separate this species from *C. hesperidum.*

A cosmopolitan species found in most countries with a warm climate or under protected cultivation. It has a large host range — Ben-Dov (1993) lists 45 families. It was first reported in New Zealand by Maskell in 1897 when he thought it likely that it would become established in the warmer regions; the record by Dale *et al.* (1976) was not therefore the first.

Biology. This species is parthenogenetic (Ben-Dov, 1977, 1993). It is generally found on the leaves, branches and twigs. It is rarely of economic importance.

Distribution and status in New Zealand. *C. longulus* is seldom collected in New Zealand; most records are from the Auckland area.

Tribe **Saissetiini** Hodgson

Type genus: *Saissetia* Déplanche, 1859.

Members of this tribe in New Zealand differ from others in the Coccinae in having: (i) a broad submarginal band of ventral tubular ducts of 1 or 2 types; (ii) dorsal tubercles and often pocket-like sclerotisations; (iii) pregenital disc-pores, usually each with 10 loculi, present medially on thorax as well as abdomen; (iv) preopercular pores in a group around or anterior to anal plates; and (v) dorsal tubular ducts generally absent (present on *Parthenolecanium corni*).

Remarks. In New Zealand this tribe contains three genera and five species: *Parasaissetia nigra* (Nietner), *Parthenolecanium corni* (Bouché), *Parthenolecanium persicae* (Fabricius), *Saissetia coffeae* (Bernard), and *Saissetia oleae* (Olivier).

Key to adult female Saissetiini in New Zealand

1 Pregenital disc-pores present medially on thorax and head as well as on abdomen; dorsal setae of distinctly two sizes, largest setae forming a mid-dorsal band anterior to anal plates; ventral tubular ducts of two types, with a smaller type completing the submarginal band between antennae . *Parthenolecanium* spp. ... 2

—Pregenital disc-pores not present anteriorly to metathorax; dorsal setae of one size, evenly distributed over dorsum; larger ventral tubular ducts forming a complete submarginal band between antennae 3

2 Submarginal band of ventral tubular ducts with three types of duct, one of which has inner ductule as wide as or wider than outer ductule; ventral microducts abundant between band of ventral tubular ducts and margin; legs with a tibio-tarsal articulatory sclerosis .... ***Parthenolecanium persicae***

—Submarginal band of ventral tubular ducts with only two types of duct, neither of which has inner ductule as broad as outer ductule; ventral microducts very scarce or absent between submarginal band of tubular ducts and margin; legs without a tibio-tarsal articulatory sclerosis .... ***Parthenolecanium corni***

3 Anal plates without setae in discal position; dorsal setae spinose with clavate apices; legs without a tibio-tarsal articulatory sclerosis; dorsum with numerous polygonal cell-like areas .... ***Parasaissetia nigra***

—Anal plates each with a discal seta; dorsal setae spinose with pointed apices; legs each with a tibio-tarsal articulatory sclerosis; dorsum never with polygonal cell-like areas but with distinct dermal areolations ... . *Saissetia* spp. ... 4

4 Submarginal band of ventral tubular ducts of one type only, none with inner ductule as wide as outer ductule .... ***Saissetia oleae***

—Submarginal band of ventral tubular ducts with three types of duct, one of which has inner ductule as wide as outer ductule .... ***Saissetia coffeae***

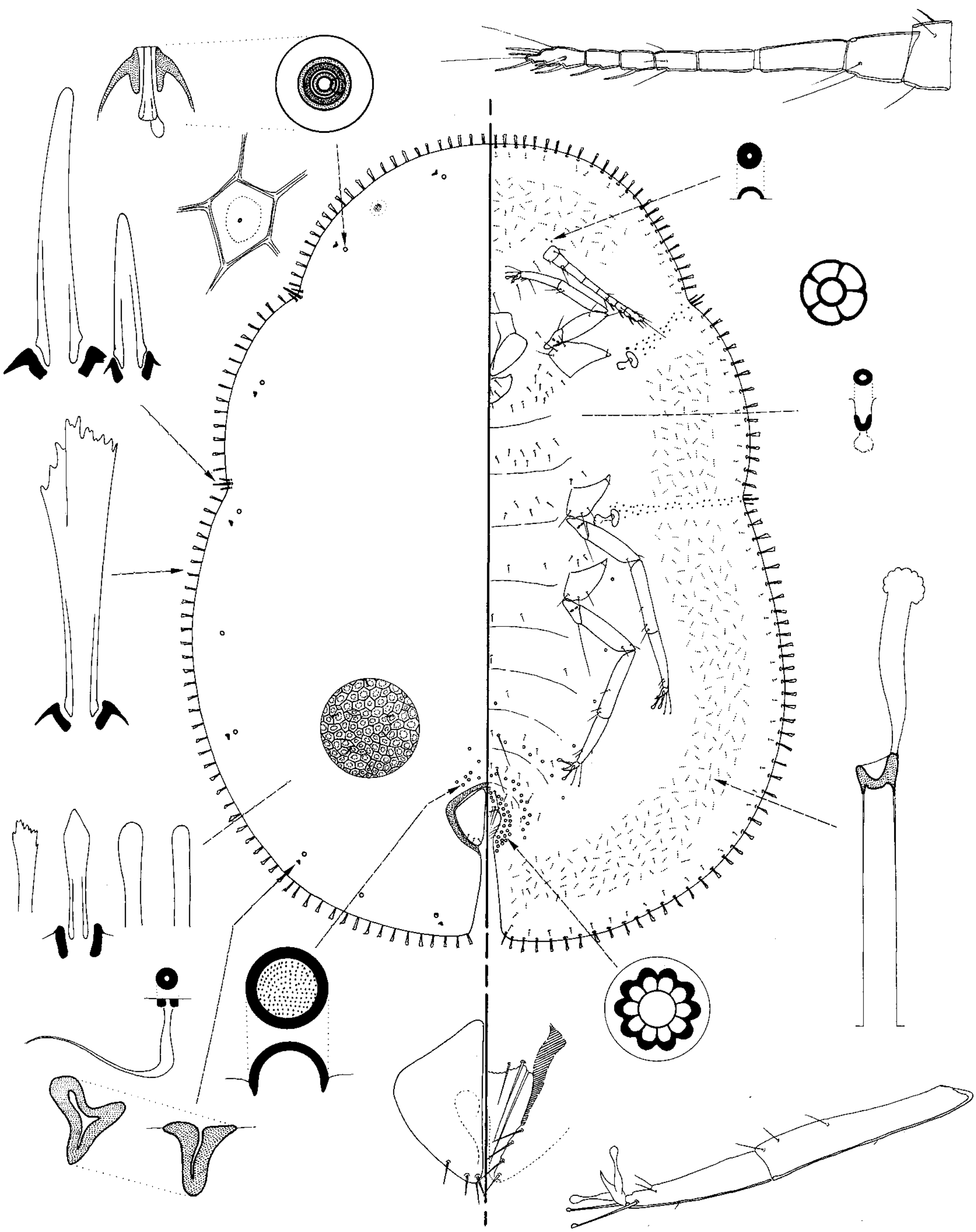


Fig. 147. *Parasaissetia nigra* (Nietner), adult female — (Adapted from Hodgson, 1994a).

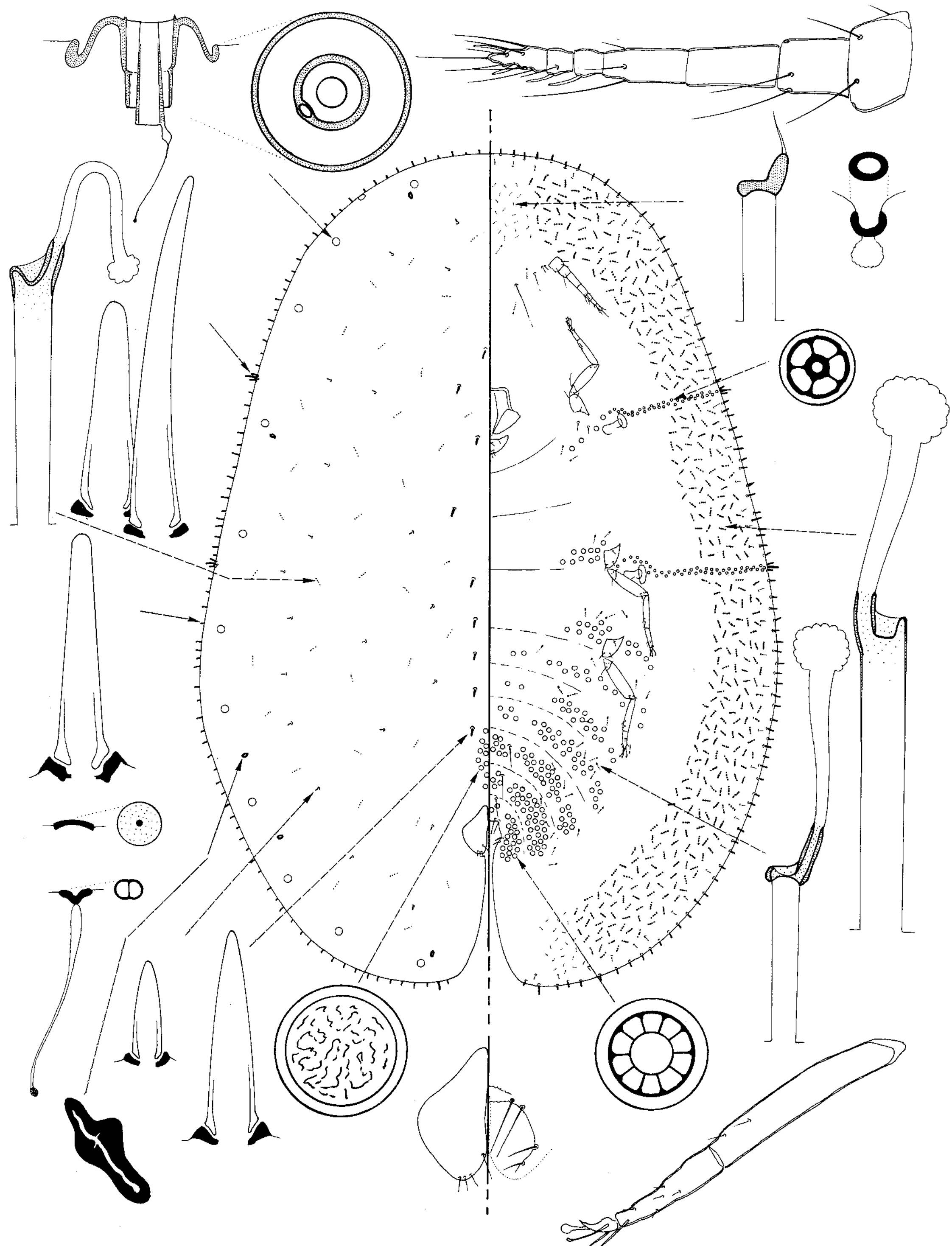


Fig. 148. *Parthenolecanium corni* (Bouché), adult female — (Adapted from Hodgson, 1994a).

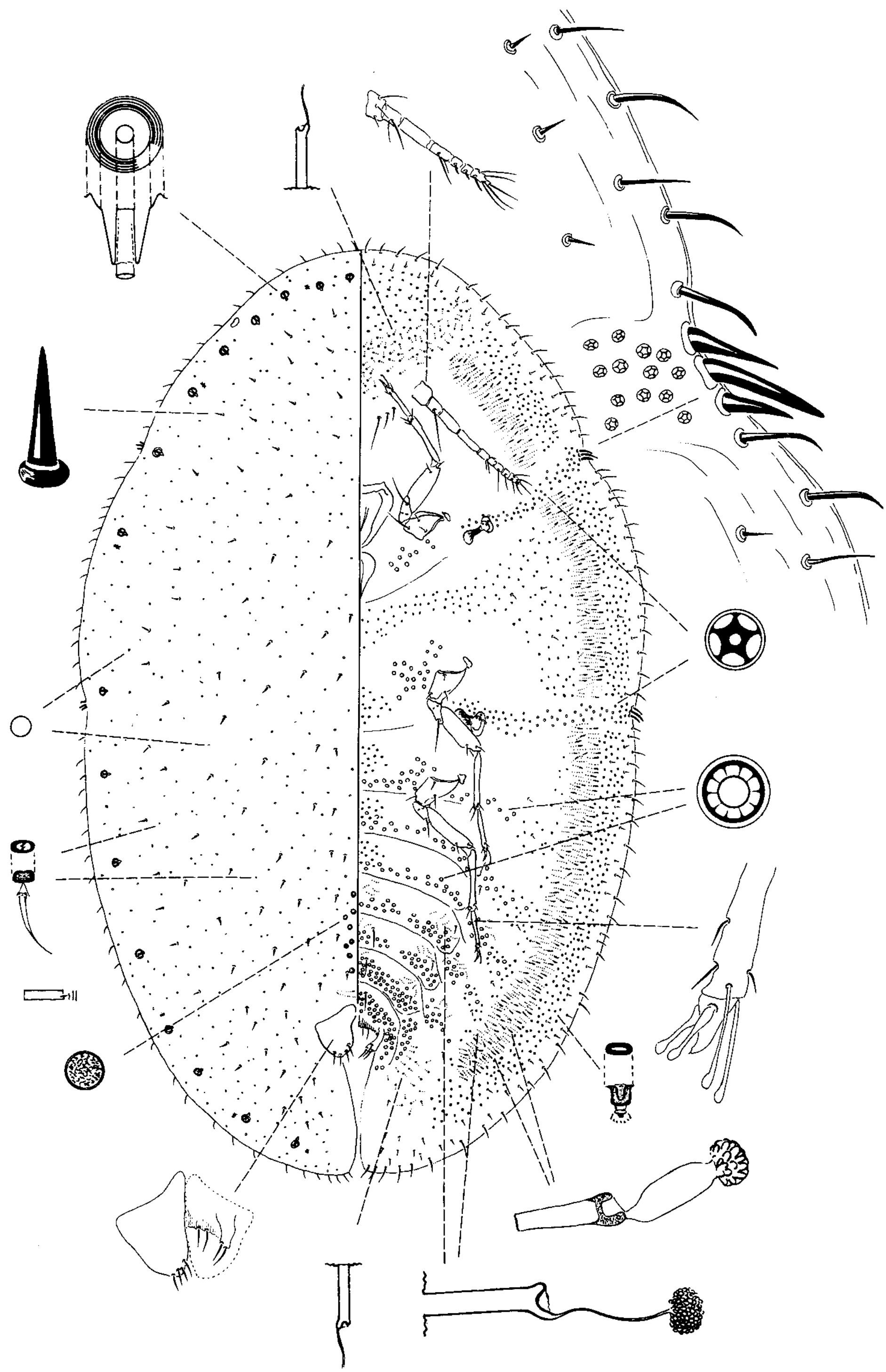


Fig. 149. *Parthenolecanium persicae* (Fabricius), adult female — (From Gill, 1988).

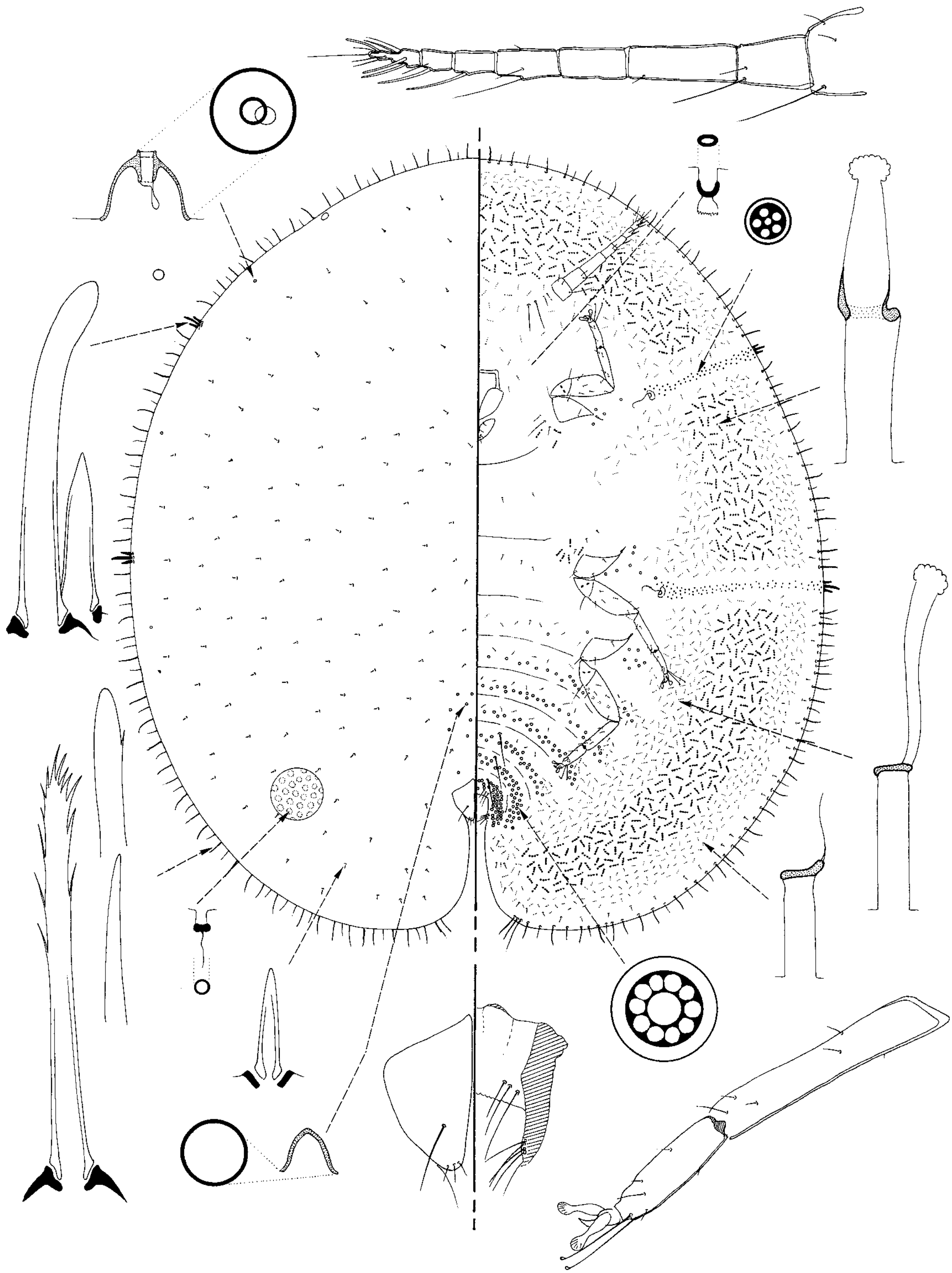


Fig. 150. *Saissetia coffeae* (Walker), adult female — (Adapted from Hodgson, 1994a).

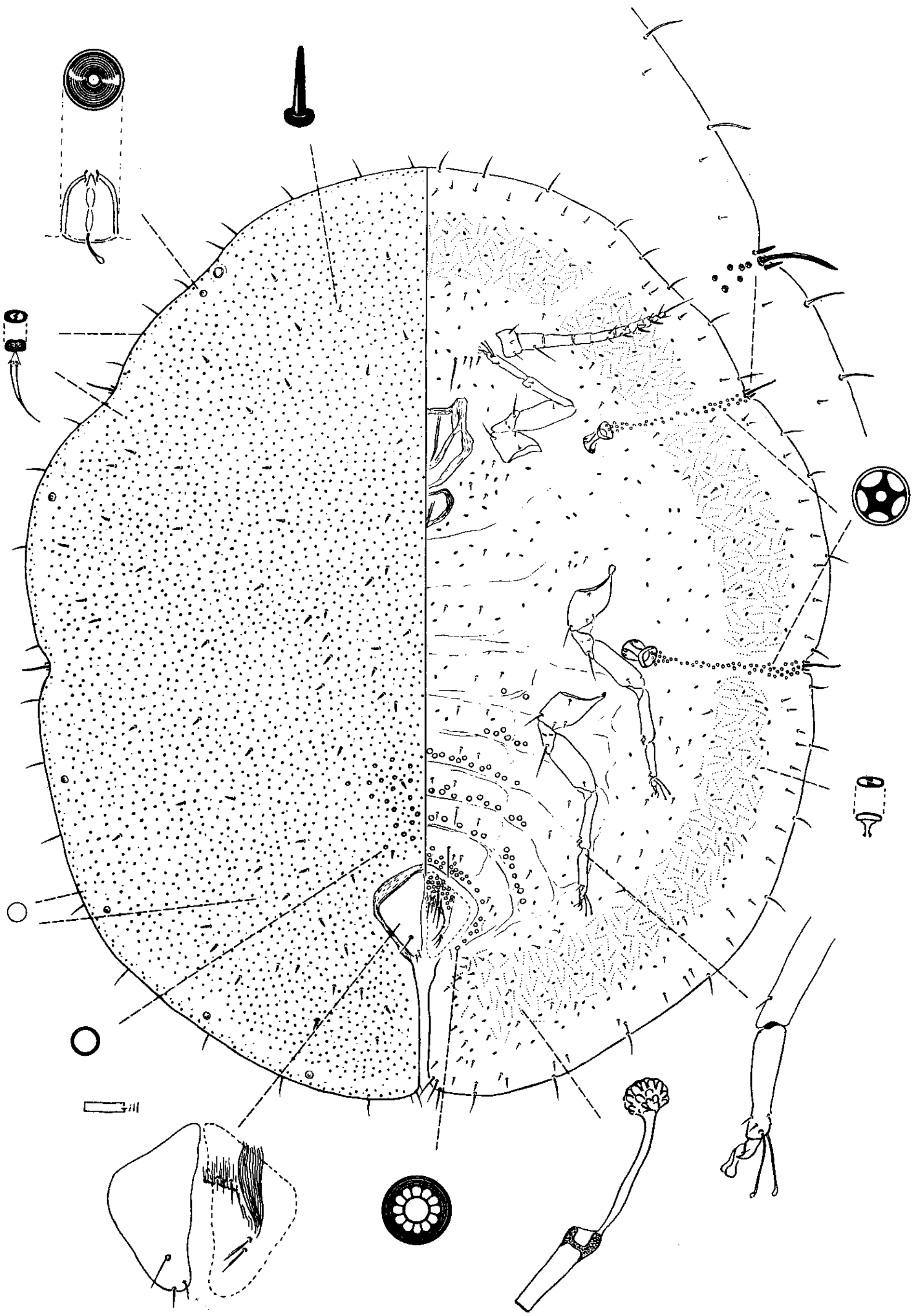


Fig. 151. *Saissetia oleae* (Olivier), adult female — (From Gill, 1988).

Genus *PARASAISSETIA* Takahashi

Parasaissetia Takahashi, 1955: 26.

Type species: *Lecanium nigrum* Nietner, 1861.

Parasaissetia nigra (Nietner) nigra scale

Figs C67, 147

Lecanium nigrum Nietner, 1861: 9; –Maskell, 1894a: 166 [synonymy]; –Maskell, 1894b: 73 [mention]; –Hutton, 1904: 353 [checklist]; –Green, 1929: 376 [record].
Lecanium depressum Targioni Tozzetti, 1867: 29; – Maskell, 1879: 206 [description]; –Maskell, 1887: 79 [description; records]; –Maskell, 1893a: 220 [description; status]; –Maskell, 1894a: 166 [synonymy]; –Maskell, 1894b: 73 [mention].
Lecanium nigrum var. *depressum* Targioni Tozzetti; – Maskell, 1895a: 16 [checklist].
Lecanium (Saissetia) nigrum Nietner; –Cockerell & Parrott, 1899: 163; –Green, 1929: 376 [record].
Saissetia nigra (Nietner); –King, 1902: 296; –Fernald, 1903: 204 [world catalogue]; –Thomson, 1922: 335 [mention].
Saissetia depressa (Targioni Tozzetti); –Fernald, 1903: 201 [world catalogue]; –Myers, 1922: 200 [checklist]; – Wise, 1977: 106 [checklist].
Parasaissetia nigra (Nietner); –Takahashi, 1955: 26; – Wise, 1977: 106 [checklist]; –Ben-Dov, 1993: 209 [world catalogue].

Unmounted material: young females usually elongate oval and flat to rounded and convex, with elongate individuals usually on twigs and rounded ones on leaves. Dorsum of older, darkened females smooth, without "H" pattern, polygonally reticulated and often with a single series of staggered, squarish white wax plates around margin and with 5 longitudinal dorsal rows of smaller wax plates. Shape and colour varies with type of host and location on host. Young adult females translucent yellow, occasionally with brown or red mottling, becoming shiny and dark brown to purple-black with age. Young females about 2.0 mm long but growing to about 5.5 mm long and 4.0 mm wide.

Mounted material: body almost round to elongate oval, with shallow stigmatic indentations: about 2.0–3.5 mm long and 1.5–3.2 mm wide.

Dorsum: on all but newly moulted adults, derm with numerous polygonal areas except at extreme margins; each polygon with a central areolation. Dorsal setae typically cylindrical, with a clavate apex; frequent throughout. Dorsal microductules each in a polygonal areolation. Preopercular pores highly convex, round, sclerotised, with a granular surface: present in a small group of 6–23 pores immediately anterior to anal plates. Dorsal tubular ducts absent. Dorsal tubercles fairly small and convex, with 1–26 in a submarginal ring. Pocket-like sclerotisations generally present, total 0–17. Anogenital fold with 6–8 setae along anterior margin and 3 or 4 pairs setae laterally. Anal ring with 8 setae.

Margin: marginal setae each often apically flattened, broadened, and frayed; with 11–23 setae on each side between stigmatic clefts. Stigmatic clefts shallow, each with 3 stigmatic spines; median spines 2 × to 4 × length of lateral spines, all rather blunt.

Venter: preopercular pores with mainly 10 loculi; abundant around genital opening, becoming progressively less frequent on preceding abdominal segments. Ventral tubular ducts of one type: in a submarginal band. Antennae 8-segmented but occasionally with only 7 segments. Legs well developed; each with a separate tibia and tarsus but no articulatory sclerosis; claw digitules both broad and marginally shorter than tarsal digitules; claws without a denticle.

Material examined. I. Not recorded on indigenous native plants.

II. On exotic plants: 'broom', *Citrus* spp., *Daphne* sp., *Feijoa sellowiana*, *Ilex* sp., *Iris germanica*, *Prunus armeniaca*.

AK, BP, TO, WI, WN / NN, MB, MC, OL.

Remarks. Recent descriptions include: De Lotto (1967), Ezzat & Hussain (1969), Ben-Dov (1978), Kawai (1980), Hamon & Williams (1984), Gill (1988), Williams & Watson (1990), and Hodgson (1994a). The reticulated pattern on the dorsum separates this species from all others considered here.

P. nigra is a cosmopolitan species but is mainly restricted to the warmer countries, unless under glass. It has a huge host range, Ben-Dov (1993) listing 81 host families. It is mainly a pest on ornamentals.

It was first reported from New Zealand by Maskell (1879) — as *Lecanium depressum* Targioni Tozzetti— occurring in greenhouses.

Biology. *P. nigra* has 1 generation outdoors in California but up to about 6 in greenhouses in Israel (Ben-Dov, 1978). Reproduction is parthenogenetic. It is found on the leaves, twigs, branches, and fruits. In California, this species overwinters as the 2nd- or 3rd-instar nymphs (Gill, 1988). See Smith (1944) for a study of its biology, etc., in California.

Distribution and status in New Zealand. Sporadic throughout North and South Island — not a serious pest.

Genus *PARTHENOLECANIUM* Šulc

Parthenolecanium Šulc, 1908: 36.

Type species: *Lecanium corni* Bouché, 1844, designated by Opinion 1303 under the plenary powers of the International Commission on Zoological Nomenclature (1985).

Parthenolecanium corni (Bouché) brown scale or European fruit lecanium

Figs C68, 148

Lecanium corni Bouché, 1844: 298; –Wise 1977: 105 [checklist].
Lecanium ribis Fitch, 1857: 427; –Maskell, 1891: 16 [description; status]; –Maskell, 1892: 22 [pest status]; –Maskell, 1895a: 16 [checklist]; –Maskell, 1898: 237 [record]; –Hutton, 1904: 353 [checklist]; –Thomson, 1922: 335 [mention].
Lecanium rosarum Snellen von Vollenhoven, *in* De Graaf *et al.*, 1862: 94; –Maskell, 1892: 22 [pest status]; –Maskell, 1895a: 17 [checklist]; –Thomson, 1922: 335 [mention].
Eulecanium corni (Bouché); –Fernald, 1903: 185 [world catalogue]; –Myers, 1922: 199 [checklist]; –Miller, 1935 [status; biology].
Lecanium (*Eulecanium*) *corni* (Bouché); –Brittin, 1940a: 411 [mentions].
Parthenolecanium corni (Bouché); –Borchsenius, 1957: 356; –Ben-Dov, 1993: 214 [world catalogue].

Unmounted material: shape and colouration extremely variable. Mature females chestnut-brown and leathery, varying from slightly convex to pyramidal or hemispherical in profile. Stages on leaves semi-transparent yellow-green; stages on twigs mottled yellow and brown, often with darker bands on abdomen. Eggs white. Young adult females and 2nd- and 3rd-instar nymphs on twigs well camouflaged and difficult to detect.

Mounted material: elongate oval, widest in abdomen; length up to 4.3 mm and width up to 3.0 mm.

Dorsum: derm becoming evenly and heavily sclerotised at maturity; lacking cell-like areolations. Dorsal setae of 2 sizes: rather large, stout, blunt spines, each 12–34 µm long, present in a more or less double line medially anterior to anal plates extending as far forward as mouthparts; much smaller, rather blunt, spines, each about 5–12 µm long: rather sparse throughout rest of dorsum. Dorsal pores of 2 types: present throughout. Preopercular pores circular, moderately large, with a rough surface: present in a small loose group of 6–26 pores just anterior to anal plates. Dorsal tubular ducts present though frequency highly variable, ranging from abundant to sparse or even absent. Dorsal tubercles normal, large, and convex; total 0–18 in a submarginal band. Pocket-like sclerotisations varying from 0–7 pairs; when present, more or less within submarginal band of dorsal tubercles. Anogenital fold with 2 pairs of long setae along anterior margin and 2 pairs of shorter setae laterally. Anal ring with 8 setae.

Margin: marginal setae each bluntly spinose; present more or less in 2 lines, rather unevenly spaced, with 11–20 setae on each side between stigmatic areas. Stigmatic clefts absent. Stigmatic spines all bluntly spinose, in groups of 3 in each stigmatic area, each median spine about 1.5 × longer than laterals and generally slightly curved.

Venter: pregenital disc-pores with mainly 10 loculi; fairly abundant around genital opening, becoming progressively less frequent across preceding abdominal segments; with small groups also mesad to each coxa and laterad to each metacoxa. Ventral microducts abundant in a submarginal band and much less frequent medially, particularly on abdomen. Ventral tubular ducts of 3 types present: (i) small duct: present in small submarginal groups between antennae and on either side of anal cleft; abundance highly variable between specimens; (ii) slightly larger duct, with outer ductule rather longer than type-(i), with a large terminal gland: rather sparse mediolaterally on head, thorax and abdomen; and (iii) fairly large duct: in a broad submarginal band extending from anterior to each antenna to near anal cleft. Antennae 7-segmented (rarely 6 or 8). Legs normally developed; each with a separate tibia and tarsus but no articulatory sclerosis; claws rather long and narrow with a minute denticle; claw digitules dissimilar, one broader than the other.

Material examined. I. On indigenous native plants: *Aristotelia* sp.

II. On exotic plants: *Prunus* sp., *Prunus armeniaca*, *Prunus avium*, *Quercus palustris*, *Ribes nigrum*, *Vitis vinifera*.

BP, WO, HB, WN / MB, CO.

Remarks. Recent descriptions include: Williams & Kosztarab (1972), Kawai (1980), Hamon & Williams (1984), Danzig (1986), Kosztarab & Kozár (1988), Gill (1988), and Hodgson (1994a). The presence of multilocular disc-pores medially on all thoracic segments and two sizes of dorsal setae identifies this genus, while the absence of a type of ventral tubular duct with a very broad inner ductule separates *P. corni* from *P. persicae*.

Distributed mainly in the Palaearctic, Nearctic, and Holarctic; within the Australasian and Pacific regions, only known from New Zealand and Australia. Polyphagous — Ben-Dov (1993) lists 40 plant families. Highly polymorphic, appearance varying depending on the host plant, the part of the plant attacked, and the age of the scale (see Ebeling, 1938). Often an important pest of deciduous fruit, vines, and ornamentals.

First reported in New Zealand by Maskell in 1891 (as *Lecanium ribis* Fitch). Wise (1977) included *L. mori* as a synonym of *Eulecanium (Parthenolecanium) corni* but *L. mori* is actually a synonym of *P. persicae*; in addition, Wise (1977) included *P. rosarum* under *P. persicae* but *P. rosarum* is a synonym of *P. corni* (Ben-Dov 1993). It is possible that some of the early records (such as those of Hutton (1904), Thomson (1922), and Myers (1922)) could refer to either species.

Biology. Usually has only a single generation in the USA, where it overwinters as a 2nd-instar nymph on the twigs and branches, remaining there to mature in the spring. The resultant crawlers disperse to the leaves but return to the twigs and branches in the autumn. On evergreen hosts, the entire life cycle can occur on the leaves (Gill, 1988). The life cycle in southern England is described by Birjandi (1981) and Habib (1955a, 1955b).

Distribution and status in New Zealand. *P. corni* is a minor pest of plums, apricots and grapevines in both the North and South Islands.

Parthenolecanium persicae (Fabricius) peach scale

Fig. 149

Chermes persicae Fabricius, 1776: 304.
Coccus berberis Schrank, 1801: 146.
Lecanium mori Signoret, 1874: 407; –Maskell, 1885: 29 [description; status]; –Maskell, 1887: 82 [description; records]; –Maskell, 1894b: 75 [description]; –Maskell, 1895a: 16 [checklist]; –Maskell, 1896: 392 [status]; –Hutton, 1904: 353 [checklist]; –Thomson, 1922:334 [checklist].
Lecanium persicae (Fabricius); –Comstock, 1883: 134; –Green, 1929: 376 [record]; –Wise, 1977: 105 [checklist].
Eulecanium berberis (Schrank); –Fernald, 1903: 182 [world catalogue]; –Miller, 1935: 37 [description; status].
Lecanium (Eulecanium) persicae (Fabricius); –Brittin, 1940: 411 [mention]; –1940b: 413 [life history; description immatures].
Lecanium (Eulecanium) persicae spinosum Brittin, 1940b: 420; –Wise, 1977: 105 [checklist]; **syn. nov.**
Eulecanium persicae (Fabricius); –Cottier, 1956: 272, 333 [key; description; status; biology].
Parthenolecanium persicae spinosum (Brittin); –Ben-Dov, 1993: 224 [world catalogue].
Parthenolecanium persicae (Fabricius); –Borchsenius, 1957: 350; –Ben-Dov, 1993: 221 [world catalogue].

Unmounted material: highly variable; not strongly convex, elongate oval with a medial longitudinal ridge. Young adult females usually yellowish with brown markings or mottling, becoming uniformly brown with age. Colour of eggs unkown.

Mounted material: elongate oval, with distinct stigmatic clefts; length up to 5.0 mm and width to 3.0 mm.

Dorsum: derm membranous when young, becoming mildly sclerotised when old. Dorsal setae of 2 sizes: rather large, stout, blunt spines: present in a more or less double line medially anterior to anal plates extending as far forward as mouthparts; much smaller, rather blunt, spines: rather sparse throughout rest of dorsum. Dorsal pores of 2 types, present throughout. Preopercular pores circular, moderately large, with a rough surface: present in a small loose group of about 20–26 pores just anterior to anal plates. Dorsal tubular ducts absent. Dorsal tubercles normal, large, and convex; total of 24–42 around submargin. Pocket-like sclerotisations probably present (included in illustration by Gill, 1988). Anogenital fold with 2 pairs of long setae along anterior margin and 2 pairs of shorter setae laterally. Anal ring with 8 setae present.

Margin: marginal setae long, slender, curved, and pointed, in a single band; with about 8–12 setae on each side between stigmatic areas. Stigmatic clefts distinct, each with 3 stigmatic spines, all sharply spinose and about as long as marginal setae; each median spine slightly longer than laterals and generally slightly curved.

Venter: pregenital disc-pores with mainly 10 loculi; fairly abundant around genital opening, becoming progressively less frequent across preceding abdominal segments; with large groups also present mesad to each coxa. Ventral microducts abundant in a submarginal band

and near labium, much less frequent medially, particularly on abdomen. Ventral tubular ducts of 3 types: (i) small duct: present in small submarginal groups between antennae; (ii) a slightly larger duct, with outer ductule rather longer than type-(i), with a large terminal gland: rather sparse, intermixed with type-(iii); and (iii) large duct, with an inner ductule as wide as or wider than outer ductule: present in a broad submarginal band extending from anterior to each antenna to near anal cleft. Ventral setae: submarginal setae in a double row. Antennae 8- or 9-segmented (rarely 6- or 7-segmented). Legs normally developed; each with a tibio-tarsal articulatory sclerosis; claws rather long and narrow with a distinct denticle; claw digitules broad and similar.

Material examined. I. Not recorded on indigenous native plants.

II. On exotic plants: "*Lecanium berberidis,* [no host or locality], 1896, W.M.M.": 1/1'head & antenna'; *Lec. persicae* Fab., det. J.G. Saunders, Nov. 20 1909, Washington, D.C.; 1/1'2nd-stage female'; 1/1 'larvae'; NZAC.
Lecanium (Eulecanium) persicae (Fab.) *spinosum* Brittin: LECTOTYPE ♀ here designated: "*Eulecanium persicae* Fabr. variety, No. 248, on *Wisteria*, Ngongotaha, 4 Jan 1934, R.P.B.". G. Brittin Collection; NZAC: 1/1 young ♀ ad.
PARALECTOTYPES: 2/2 old ♀♀ ad.; collection data as above except locality data: 1/ "Ngongotahi Waihi"; 1/ "Waihi".

III. From PPIN database (all primary associations): *Citrus* spp., **GB, WN, MB, SC**. *Vitis vinifera*, **HB**.

Remarks. Recent descriptions include: Williams & Kosztarab (1972), Kawai (1980), Hamon & Williams (1984), Danzig (1986) (as *P. thymi*), Gill (1988), and Kosztarab & Kozár (1988). The presence of multilocular disc-pores medially on all thoracic segments and the two sizes of dorsal setae identify this genus, while the presence of ventral tubular ducts with a very broad inner ductule separates it from *P. corni*.

Cosmopolitan, widespread in the Palaearctic and Nearctic, but also known from the Neotropics, Oriental, Australasian regions, and New Zealand. It has a fairly wide host range (Ben-Dov (1993) lists 21 plant families). It is a minor pest in deciduous orchards.

P. persicae was first reported from New Zealand by Maskell (1892) — as *Lecanium rosarum* Snellen von Vollenhoven — but see comments under *P. corni* above regarding the identity of early records.

A study of the available material of *Lecanium (Eulecanium) persicae spinosum* Brittin (1940b) indicates that this is a synonym of *P. persicae* (Fabricius) (**syn. nov.**) It was collected off *Wisteria* [published as '*Wistaria*'] sp. There is some doubt about the published collection locality of Ngatea (WO) that differs from the localities given on the slides—variously Ngongotaha (BP) and Waihi (BP)—but these three sites are all within a relatively small area of the North Island, and the chosen lectotype specimen agrees closely with Brittin's description.

Biology. Probably almost entirely parthenogenetic, although males are known. Has 1 or 2 generations a year, overwintering as the 2nd-instar nymph on the twigs or stems. The subsequent crawlers disperse to the leaves and the next generation can be on the leaves.

Distribution and status in New Zealand. It is occasionally a minor pest of citrus and grapevines; currently known from the southern half of North Island to the northern half of South Island.

Genus *SAISSETIA* Déplanche

Saissetia Déplanche, 1859: 6.

Type species: *Lecanium coffeae* Walker, 1852, proposed by Ben-Dov, 1989: 116, approved by the International Commission on Zoological Nomenclature (Opinion 1627, 1991).

Saissetia coffeae (Walker) hemispherical scale

Figs C88, C89, 150

Lecanium coffeae Walker, 1852: 1079.
Lecanium hemisphaericum Targioni Tozzetti, 1867: 26; –Maskell, 1885: 29 [description; pest status]; –Maskell, 1887: 80 [description; records]; –Maskell, 1895a: 15 [checklist]; –Maskell, 1895b: 59 [Australian records]; –Cockerell & Parrott, 1899: 164 [synonymy]; –Hutton, 1904: 353 [checklist; synonymies]; –Thomson, 1922: 335 [record; host].
Chermes filicum Boisduval, 1867: 328.
Saissetia filicum (Boisduval); –Fernald, 1903: 201 [world catalogue]; –Wise, 1977: 106 [checklist].
Chermes hibernaculorum Boisduval, 1867: 328; –Maskell, 1879: 207 [brief comment]; –Hutton, 1904: 353 [checklist].

Lecanium hibernaculorum (Boisduval); –Maskell, 1887: 81 [description; records]; –Maskell, 1895a: 15 [checklist].
Saissetia hemisphaerica (Targioni Tozzetti); –Kuwana, 1902: 63; –Fernald, 1903: 202 [world catalogue]; –Thomson, 1922: 335 [record, host]; –Myers, 1922: 200 [checklist]; –Miller, 1935: 36 [status; biology].
Lecanium (*Saissetia*) *hemisphaericum* (Targioni Tozzetti); –Green, 1929: 376 [record].
Saissetia coffeae (Walker); –Kirkaldy, 1902: 105; –Cottier, 1939a: 146 [description; status; hosts]; –Cottier, 1956: 272, 325 [key; description, status, biology]; –Wise, 1977: 106 [checklist]; –Penman, 1984: 63 [biology]; –Scott, 1984: 28 [pest status].

Unmounted material: older adults convex and rounded; colour shiny tan to light brown with many evenly spaced light dots over most of dorsal surface. Nymphs and young adult females much flatter and light yellow to pink with some darker mottling. Characteristic 'H' pattern noticeable on nymphs and young adults, but disappears as adults become convex, so the dorsal surface is completely smooth on mature individuals. Adult females 2–4 mm long. Eggs pink.

Mounted material: body oval, lacking obvious stigmatic clefts; length 1.4–2.0 mm, width 1.2–1.8 mm.

Dorsum: derm membranous when young, becoming heavily and uniformly sclerotised when mature, with small oval areolations, each with a microductule. Dorsal setae spinose and quite short, 3–7 µm long: frequent throughout dorsum. Dorsal pores of 2 types, including a minute microductule: present in each areolation. Preopercular pores rather small, variable in size, each convex, with a bluntly pointed apex: in a well-spaced group of 6–20 pores anterior to anal plates. Dorsal tubular ducts absent. Dorsal tubercles each simple and convex: with 1–6 pairs in a sparse submarginal band. Anogenital fold with 3 or 4 setae present along anterior margin and 3 or 4 pairs laterally. Anal ring with 8 setae.

Margin: marginal setae of 2 sizes, both with slightly expanded and more or less fimbriate apices although this may be hard to see in some views; with 12–18 setae on each side between stigmatic areas, of which 5–8 are short; length of each seta 18–70 µm; with more than 30 setae around the head between the anterior stigmatic clefts. Stigmatic clefts each with 3 spines; median spine slightly bent, with a blunt apex, each about 1.5 × longer than lateral spines.

Venter: pregenital disc-pores with mainly 10 loculi: abundant around genital opening and across all preceding abdominal segments; a few occasionally present medially on metathorax and with small groups laterad to each coxa. Spiracular disc-pores in quite broad bands between margin and each spiracle, with 40–86 disc-pores in each band. Ventral microducts present throughout venter. Ventral tubular ducts of 3 types present: (i) large ducts with wide outer and inner ductules and a large terminal gland: present in a distinct submarginal band but absent from wide gaps at each band of spiracular disc-pores; also with 1–5 present just mesad to each pro- and mesocoxa; (ii) small ducts with a short outer ductule and a short filamentous inner ductule: present between submarginal band of type (i) ducts and margin; and (iii) ducts with a fairly narrow outer ductule, a much thinner inner ductule and a large terminal gland: present medially and mediolaterally on all segments, though sparse on thorax; particularly abundant just laterad to band of type-(i) ducts. Antennae generally 8-segmented. Legs well developed, with a tibio-tarsal articulation and generally with a small articulatory sclerosis; claws without a denticle; claw digitules both broad and slightly shorter than tarsal digitules.

Material examined. I. On indigenous native plants: *Asplenium bulbiferum*, *Asplenium pauperequitum*, *Asplenium* sp., *Avicennia marina* subsp. *australasica*, *Blechnum fraseri*, *Coprosma ?propinqua*, *Cordyline australis*, *Geniostoma* sp., *Hebe macrocarpa*, *Myoporum laetum*, *Parahebe lyalli*, *Pouteria costata*, *Pratia physaloides*, *Pteridium esculentum*.

II. On exotic plants: *Alternanthera philoxeroides*, 'Asparagus fern', *Citrus* spp., *Cornus alternifolia*, *Cydonia oblonga*, *Dendrobium noble*, *Fatsia japonica*, 'Ferns', *Gardenia* sp., *Homalocladium*, *Luculia* sp., *Picea pungens* cv. Glauca, *Prunus persica* var *nucipersica*, *Prunus salicina*, *Saintpaulia* sp., *Thunbergia* sp., *Vitis vinifera*, *Washingtonia robusta*.

ND, AK, WO, BP, GB, HB, TK, WI / NN, MB, NC, OL.

Remarks. Recent descriptions include: Kawai (1980), Hamon & Williams (1984), Gill (1988), Tremblay (1988), Williams & Watson (1990), and Hodgson (1994a). The presence of a discal seta on each anal plate, pregenital disc-pores medially across all abdominal segments and on the metathorax, and a submarginal band of tubular ducts identify this as belonging to the genus *Saissetia*, whilst *S. coffeae* can be separated from *S. oleae* by the presence of ventral tubular ducts with a broad inner ductule and by having more than 30 marginal setae around the head between the anterior stigmatic clefts.

S. coffeae is tropicopolitan and is also an important pest under glass. It is highly polyphagous — Ben-Dov (1993) lists 82 plant families. It is an important pest of ornamentals. Penman (1984) states that, unlike black scale (*Saissetia oleae*), honeydew and the accompanyng black sooty mould are not characteristic. Cottier (1939a, 1956) lists the following as hosts in New Zealand: asparagus, camellia, citrus, cucumber (*Cucumis sativus*), currant (*Ribes* sp.), eggplant (*Solanum melongena*), japonica (*Chaenomeles* sp.), oleander (*Nerium oleander*), orchids, and palms. Scott (1984) mentions passionfruit (*Passiflora edulis*) and blackcurrant (*Ribes nigrum*) as being commonly attacked.

S. coffeae was first reported from New Zealand by Maskell in 1879—as *L. hibernaculorum*— and then as *L. hemisphaericum* in 1885.

Biology. Probably entirely parthenogenetic as no males are known. It has up to 8 overlapping generations a year in the tropics but fewer under cooler conditions. There is more than 1 generation a year in New Zealand (Cottier, 1956). Often effectively controlled by parasitoids. It occurs along the main veins of the leaves and on the stems (Miller, 1935). Overwinters as immature stages but is mature by the spring when it migrates to the leaves or young twigs to reproduce (Cottier, 1939a; Penman, 1984).

Distribution and status in New Zealand. Cottier (1956) stated that *S. coffeae* could be a major pest of citrus and passionfruit; currently it is a pest on ornamentals especially ferns and potted plants, and is occasionally found in native forest margins. Recorded from the north of the North Island to the Otago Lakes in the South Island.

Saissetia oleae (Olivier) black scale or olive scale

Figs C90, C91, 151

Coccus oleae Olivier, 1791: 95.
Lecanium oleae (Bernard); –Walker, 1852: 1070; –Maskell, 1885: 28 [pest status]; –Maskell, 1887: 82 [description; records]; –Maskell, 1895a: 16 [checklist]; –Hutton, 1904: 353 [checklist].
Lecanium cassiniae Maskell, 1891: 15 [description; status]; –Maskell, 1895a: 15 [checklist]; –Hutton, 1904: 227 [checklist]; –Borschenius, 1957: 336 [synonymy].
Saissetia cassiniae (Maskell); –Fernald, 1903: 200 [world catalogue]; –Myers, 1922: 200 [checklist]; –Wise, 1977: 106 [checklist]; –Ben-Dov, 1993: 303 [synonymy uncertain].
Lecanium (*Saissetia*) *cassiniae* (Maskell); –Cockerell & Parrott, 1899: 163.
Lecanium (*Saissetia*) *oleae* (Bernard); –Green, 1929: 376 [record].
Saissetia oleae (Bernard); –Cockerell, 1901: 31; –Fernald, 1903: 205 [world catalogue]; –Myers, 1922: 200 [checklist]; –Thomson, 1922: 335 [mention]; –Miller, 1935: 35 [description; status; biology]; –Cottier, 1939a: 145 [description; status; hosts]; –Cottier, 1956: 272, 324 [key; description; status; biology]; –Wise, 1977: 106 [checklist].
Saissetia oleae (Olivier); –De Lotto, 1971b: 149 [authorship correction];–Penman, 1984: 61 [biology; pest status]; –Ben-Dov, 1993: 313 [world catalogue].

Unmounted material: adults hemispherical, young adults round and fairly flat, immatures oval. Young adults and nymphs yellow or grey, rough or granular in appearance, older females dark brown or black; all stages with "H" pattern on dorsum. Adult females 2–5 mm long.

Mounted material: body round to oval, widest in abdomen, with shallow stigmatic indentations; up to 4.5 mm long and 4.0 mm wide.

Dorsum: derm fairly thick, with numerous pale areolations present throughout; unsclerotised on young individuals apart from a dense anal sclerotisation anterior to anal cleft; derm becomes much thicker and heavily sclerotised throughout on old individuals. Dorsal setae strongly spinose; length of each seta 8–13 µm; rather sparse throughout. Dorsal pores of 2 types including heavily sclerotised microductules in each areolation. Preopercular pores quite large and heavily sclerotised, probably roundly convex: in a broad group of 3–46 anterior to anal plates. Dorsal tubular ducts absent. Dorsal tubercles each rather small and convex, total 4–16 in a submarginal ring. Pocket-like sclerotisations absent. Anal plates with a large discal seta about 17–18 µm long. Anogenital fold with 3 or 4 pairs of fairly long setae present along anterior margin and 2 or 3 pairs laterally. Anal ring with 8 setae.

Margin: marginal setae quite large, spinose, with rather parallel sides and either tapering, blunt, or with a slightly frayed apex; tending to be of 2 sizes, smaller setae about 14–20 µm long; longer setae more numerous and 35–40 µm long; with 5–12 setae on either side between the anterior and posterior stigmatic clefts, of which 0–3 may be short; with 15–30 setae around the head between the anterior stigmatic clefts. Median stigmatic spine about 4 × length of lateral spines, slightly curved, tapering to a blunt point; lateral spines each tapering to a fairly sharp point.

Venter: pregenital disc-pores with mainly 10 loculi: present in a dense group around genital opening and less frequently across preceding abdominal segments and metathorax. Ventral microducts present throughout. Ventral tubular ducts of 2 types: (i) larger duct with a fairly broad outer ductule, thin inner ductule and moderate-sized terminal gland: present in a fairly broad submarginal band; and (ii) a slightly smaller duct with a filamentous inner ductule and no terminal gland: only present mediolaterally on last 2 or 3 abdominal segments. Antennae each 7- or 8-segmented. Legs well developed; each with separate tibia and tarsus but articulatory sclerosis usually absent; claws without a denticle; claw digitules both broad and slightly shorter than fine tarsal digitules.

Material examined.
I. *Lecanium cassiniae* Maskell. LECTOTYPE ♀: here designated; labelled "*Lecanium cassiniae*, adult female, Mar 1890, W.M.M."; NZAC: 1/1♀ ad. Host given by Maskell (1890) as "*Cassinia leptophylla*" [= *Ozothamnus leptophyllus*], and localities as "Wellington, Waiararapa, [and] Hawke's Bay."
PARALECTOTYPE: "*Lecanium cassiniae*, female 2nd-stage, Mar 1890, W.M.M."; NZAC: 1/1 ♀ nymph (uncleared, unstained).
Other material: "*Lecanium cassinae*, adult female, 1891, W.M.M."; NZAC: 1/1♀ ad.

II. On indigenous native plants: *Avicennia marina* subsp. *australasica, Brachyglottis repanda, Coprosma repens, Coprosma* sp., *Dichondra repens, Entelea arborescens, Hebe elliptica, Hibiscus* sp., *Myoporum laetum, Myrsine australis, Nestegis lanceolata, Olearia paniculata, Olearia* sp., *Ozothamnus leptophyllus, Ozothamnus* sp., *Pittosporum* sp., *Plagianthus divaricatus, Plagianthus* sp., *Pouteria costata, Pseudopanax* sp., *Pteridium esculentum, Solanum aviculare, Vitex lucens.*

III. On exotic plants: *Abutilon* sp., *Actinidia deliciosa, Aralia* sp., *Asparagus, Choisya ternata, Citrus* spp., *Cucurbita pepo, Cycas* sp., *Cymbiduim* sp., *Eugenia uniflora, Hibiscus* sp., *Hydrangea* sp., *Lagunaria patersonii, Lavatera* sp., *Litchi chinensis, Olea europaea, Pyrus communis, Pyrus pyrifolia, Rosa* sp., *Rosmarinus* sp., *Vitis vinifera.*

KE, TH / ND, AK, CL, WO, BP, GB, HB, TK, RI, WI, WN / NN, MB, BR, MC, SC, OL, DN.

Remarks. Recent descriptions include: De Lotto (1965, 1971c), Kawai (1980), Hamon & Williams (1984), Tremblay (1988), Gill (1988), Williams & Watson (1990), and Hodgson (1994a — as *Bernardia oleae*). The presence of a discal seta on each anal plate, pregenital discpores medially across all abdominal segments and on the metathorax, and a submarginal band of tubular ducts identify this as belonging to the genus *Saissetia*, whilst it can be separated from *S. coffeae* by the absence of ventral tubular ducts with a broad inner ductule, and by having less than 30 marginal setae around the head between the anterior stigmatic clefts.

A study of Maskell's material of *Lecanium cassiniae* Maskell shows that it is identical with *S. oleae* and a lectotype is here designated; we therefore uphold the earlier synonymy by Borschenius (1957). *S. oleae* was first reported from New Zealand by Maskell in 1885 — as *Lecanium oleae.*

In the past, other species of *Saissetia*, such as *S. miranda* (Cockerell & Parrott) and *S. neglecta* De Lotto, have been misidentified as *S. oleae* and thus its true distribution is hard to determine. Nonetheless, it appears to be cosmopolitan and has a wide host range—50 plant families are listed in Ben-Dov (1993). It is a major pest on some crops such as citrus and olives under subtropical and temperate conditions. Cottier (1939a; 1956) lists the following as hosts in New Zealand: apple (*Malus* x *domestica*), apricot (*Prunus armeniaca*), camellia, citrus, daphne, grapevine (*Vitis vinifera*), guava (*Psidium* sp.), holly (*Ilex* sp.), laurel, oleander (*Nerium oleander*), pear (*Pyrus communis*), pepper tree (*Schinus* sp.), palms, plums (*Prunus* spp.), rose, *Tecomaria capensis,* and wisteria; he also states that "it is said to infect various native trees".

Several predators and parasitoids have been introduced into New Zealand as potential biological control agents against *S. oleae* (Morales, 1989). The coccinellid predators *Halmus* [as *Orcus*] *chalybeus* (Boisduval) and *Rhizobius forestieri* (Mulsant) are now well established although they appear to be relatively ineffective. Of the several species of hymenopterous parasitoids that have been introduced, the encyrtid *Metaphycus lounsburyi* (Howard) has become established, although a later introduction of three other species (in parasitised *S. oleae* and *S. coffeae*) was unsuccessful. Other parasitoid species recorded from *S. oleae* in New Zealand are *Coccophagus ochraceus* Howard (Aphelinidae), which was introduced for the control of mealybugs, and *Euxanthellus philippiae* Silvestri (Aphelinidae) and *Moranila californica* (Howard) (Pteromalidae).

Biology. Probably almost entirely parthenogenetic as males very rarely reported (however, empty male tests seen in Auckland on one occasion in 1998). Usually has 1 or 2 generations a year. Crawlers can settle almost anywhere but, on deciduous trees, late-instar nymphs emigrate back onto the twigs to become adult.

In New Zealand, *S. oleae* overwinters as eggs and nymphs (Miller 1935); the adults take about 3 months to develop and there is only one generation a year. According to Penman (1984) the females lay large numbers of eggs in November – December; these hatch mainly from December – January and the crawlers settle on leaves. After feeding for 4–6 weeks, the young scales generally migrate to woody parts of the host plant and become permanently attached. When common, *S. oleae* is associated with much sooty mould (Cottier, 1939a) and this can cause major damage (Penman, 1984).

Distribution and status in New Zealand. Cottier (1956) stated that *S. oleae* was found wherever citrus was grown; it is currently one of the more important pests of citrus, particularly in the Gisborne area. Its range extends from the Kermadec Islands and Three Kings Islands, throughout the North Island and most of the South Island.

Tribe **Pulvinariini** Targioni Tozzetti

Pulvinati Targioni Tozzetti, 1868: 727.
Pulvinariini Targioni Tozzetti; Ashmead, 1891: 98.

Type genus: *Pulvinaria* Targioni Tozzetti, 1867: 13.

Diagnosis: in New Zealand, members of the Pulvinariini are typically characterised by: (i) production of a woolly ovisac by the reproducing female, which protrudes from beneath the posterior end of abdomen, often lifting the insect so that it appears to be standing on its head; and the presence of: (ii) small dorsal tubular ducts; (iii) a tibio-tarsal articulatory sclerosis; and (iv) ventral tubular ducts of 3 or 4 types, including (a) a large duct with inner ductule of similar length and width, with a large terminal gland, (b) a similar duct (intermediate duct) but with a narrow inner ductule and large terminal gland, and (c) a short duct with a filamentous inner ductule and no glandular end; and (v) the absence of pocket-like sclerotisations.

Remarks. Four species of *Pulvinaria* have been recorded from New Zealand and are minor pests: *P. floccifera* (Westwood), *P. hydrangeae* Steinweden, *P. mesembryanthemi* (Vallot), and *P. vitis* (L.). The record of *P. psidii* in Fernald (1903) is erroneous; this species has never been recorded from New Zealand.

Key to adult female *Pulvinaria* species in New Zealand

1 Dorsal tubercles absent 2
—Dorsal tubercles present 3

2 Marginal setae spinose, with a rather blunt apex; anal plates without setae in discal position; pregenital disc-pores with mainly 10 outer loculi .... ***mesembryanthemi***
—Marginal setae finely spinose with a sharp apex; anal plates each with a seta in discal position; pregenital disc-pores with mainly 7 or 8 outer loculi. .... ***hydrangeae***

3 Marginal setae slightly fimbriate; pregenital disc-pores with mainly 7 outer loculi ....***floccifera***
—Marginal setae finely pointed; pregenital disc-pores with mainly 10 loculi .... ***vitis***

Genus ***PULVINARIA*** Targioni Tozzetti

Pulvinaria Targioni Tozzetti, 1866: 146; Targioni Tozzetti, 1867: 13.

Type species: *Coccus vitis* Linnaeus, 1758.

Pulvinaria floccifera (Westwood) cottony camellia scale

Figs C83, 152

Coccus flocciferus Westwood, 1870: 308.
Pulvinaria camelicola Signoret, 1873a: 32; –Maskell, 1879: 207 [description]; –Maskell, 1887: 83 [description; records]; –Maskell, 1895a: 17 [checklist]; –Myers, 1922: 199 [checklist]; –Wise, 1977: 106 [checklist].
Chloropulvinaria floccifera (Westwood); –Borchsenius, 1952: 300.
Pulvinaria floccifera (Westwood); –Green, 1897: 72; –Thomson. 1922: 335 [mention]; –Ben-Dov, 1993:261 [world catalogue].

Unmounted material: body elongate oval, slightly convex, usually widest near centre; cream to tan-coloured, mottled with brown and usually with a brown border around body. Adult females on stems and leaves of host, secreting an elongate, very white, and fluffy ovisac; at maturity; spent female falls off, leaving only the ovisac attached to plant.

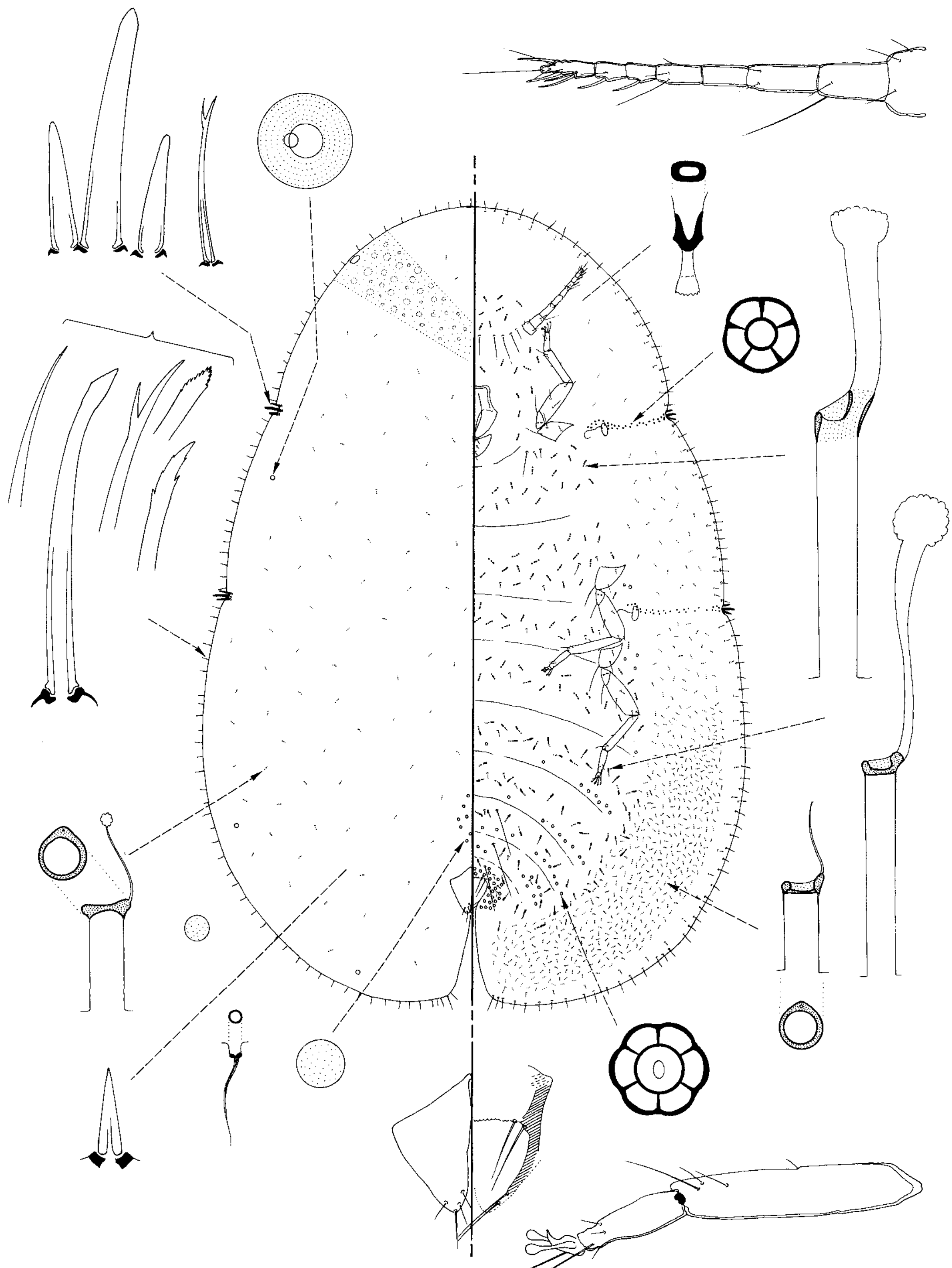


Fig. 152. *Pulvinaria floccifera* (Westwood), adult female — (Adapted from Hodgson, 1994a).

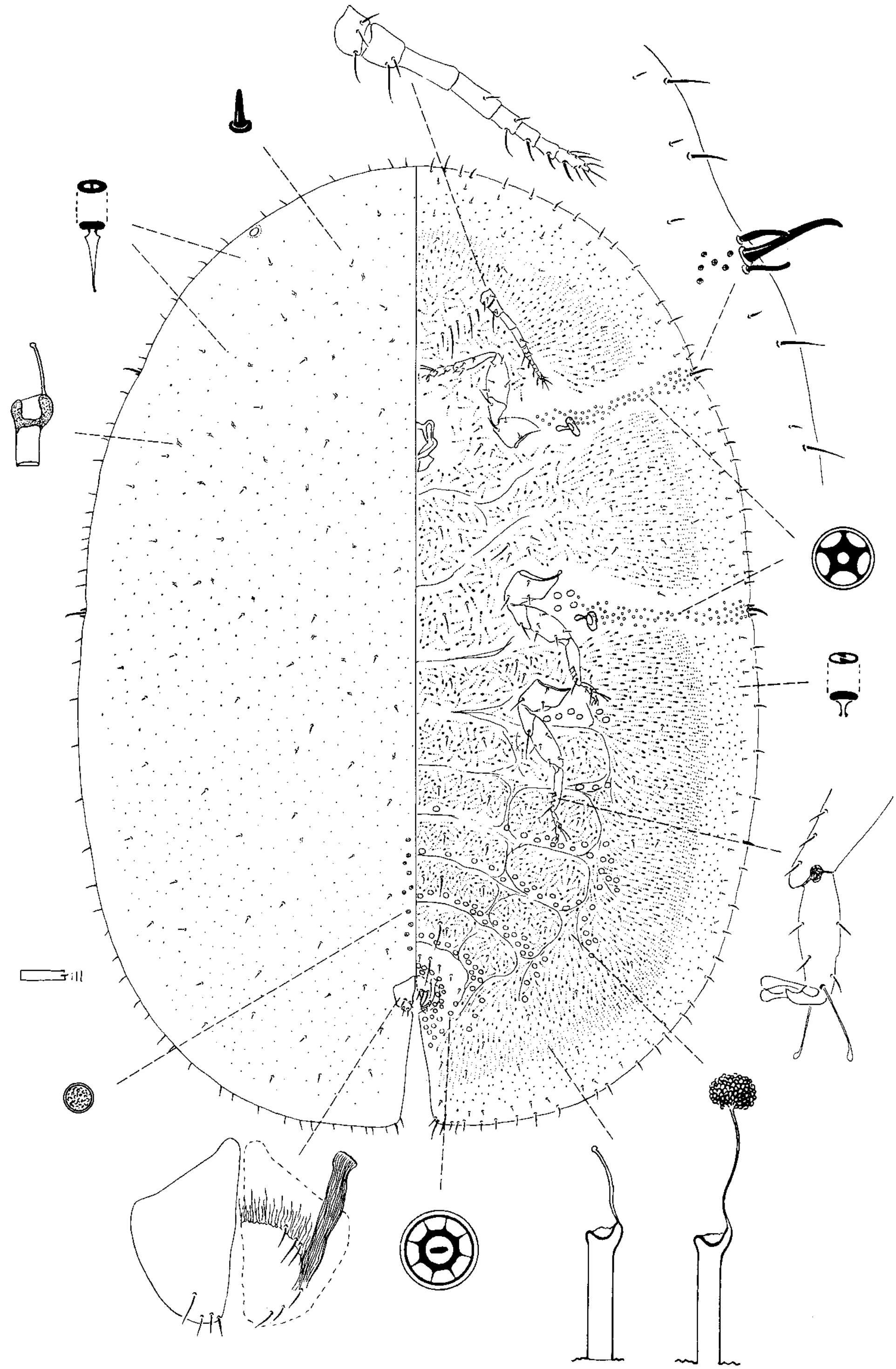


Fig. 153. *Pulvinaria hydrangeae* Steinweden, adult female — (From Gill, 1988).

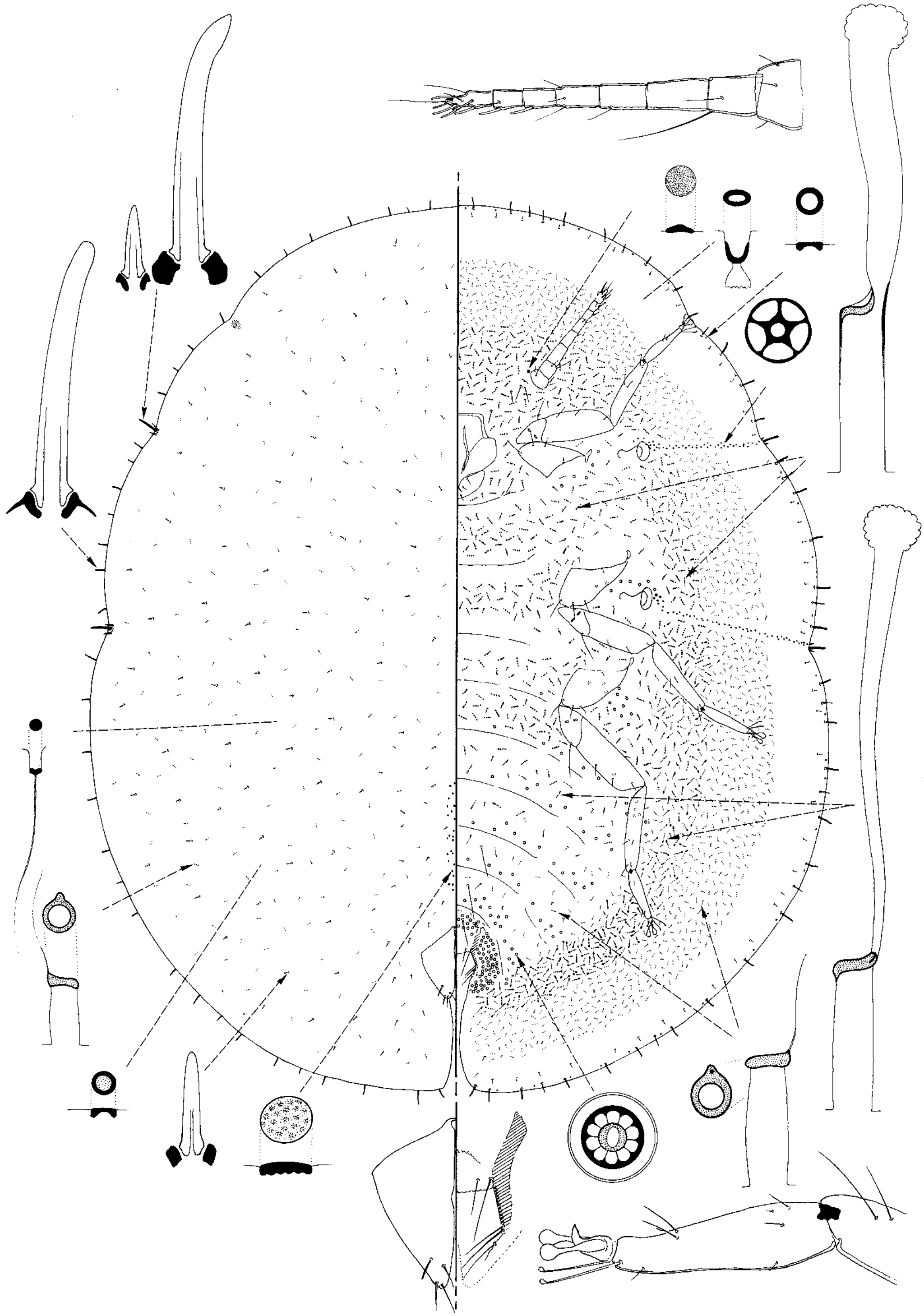


Fig. 154. *Pulvinaria mesembryanthemi* (Vallot), adult female — (Adapted from Hodgson, 1994a).

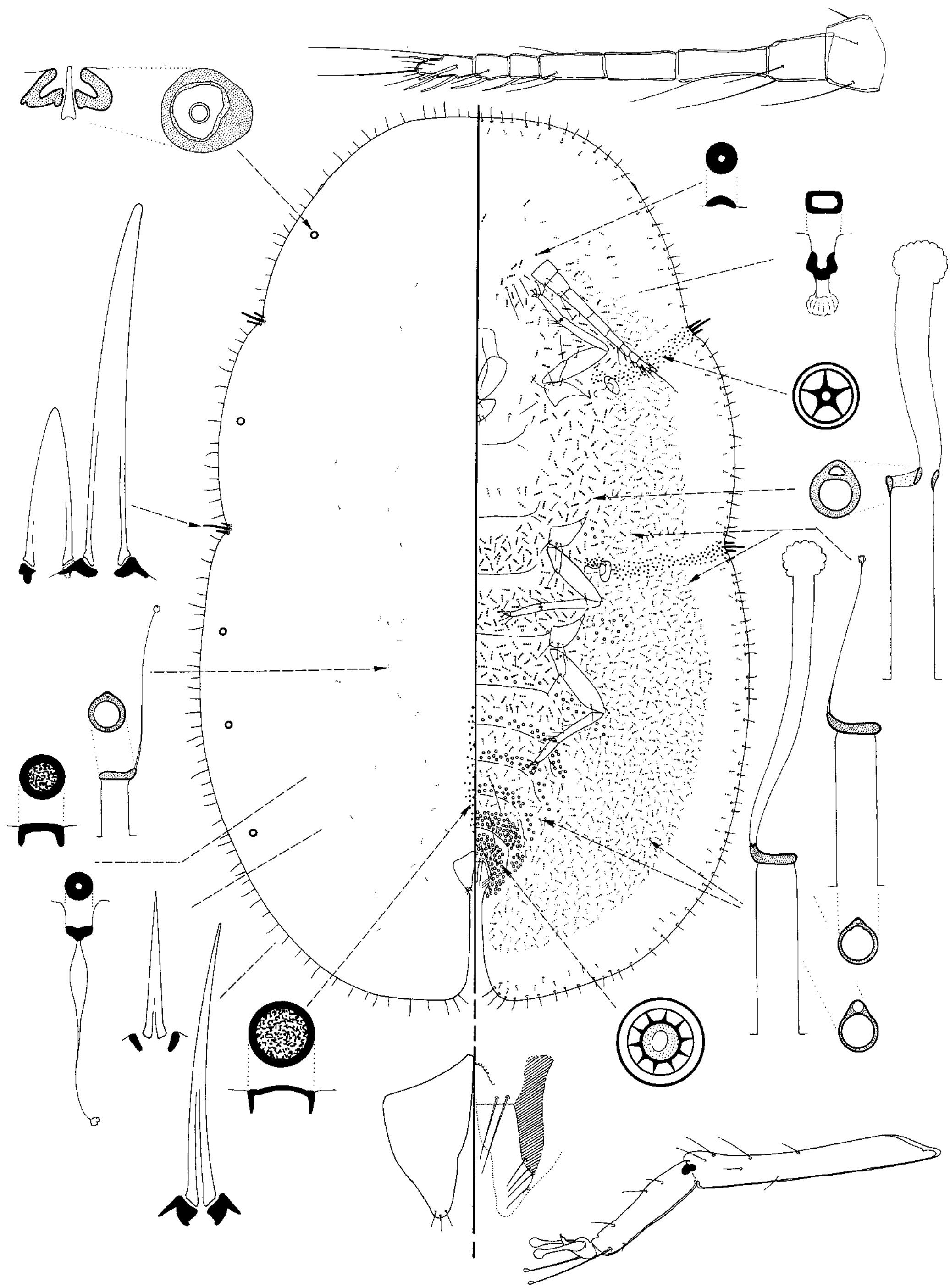


Fig. 155. *Pulvinaria vitis* (Linnaeus), adult female — (Adapted from Hodgson, 1994a).

Mounted material: body elongate oval, widest in abdomen. Length 1.5–4.0 mm, width 1.0–2.5 mm.

Dorsum: derm membranous, with pale areolations on older females. Dorsal setae rather short and spiniform, 4–6 µm long: frequent over entire dorsum. Dorsal pores of 2 types, including a small microductule located mainly in areolations. Preopercular pores rather small, flat, and barely sclerotised: in a small group of 7–25 in front of anal plates. Dorsal tubular ducts frequent throughout. Dorsal tubercles rather small, with total of 4–14 submarginally (rarely absent). Anal plates together quadrate. Anogenital fold with 1 or 2 pairs of setae on anterior margin and 1 or 2 pairs laterally. Anal ring with 3 pairs of large setae and 0–2 pairs of smaller setae.

Margin: marginal setae rather long, slightly shorter than median stigmatic spine, typically with a slightly spatulate apex, but may be pointed, frayed, or divided; each seta generally slightly curved, with well-developed basal sockets; with 15–27 setae on either side between stigmatic clefts; length 23–93 µm (usually about 50 µm). Stigmatic clefts with 3 rather stout stigmatic spines, each tapering to a blunt apex; median spine 2 × to 3 × length of lateral spines; each median spine 55–70 µm, laterals 17–40 µm.

Venter: pregenital disc-pores each with mainly 7 loculi: present around genital opening and on mediolateral areas of preceding 3 to 4 segments; small groups also present laterad to each meta- and (occasionally) mesocoxa. Spiracular disc-pore bands narrow, with 30–71 pores in each band. Ventral microducts present in a broad submarginal band and sparsely throughout elsewhere. Ventral tubular ducts: (i) large ducts: present medially on head, thorax, and first 1 or 2 abdominal segments, extending laterally to spiracles; (ii) intermediate ducts: present medially on posterior abdominal segments; and (iii) short ducts: present in a broad submarginal band, abundant posteriorly on abdomen, becoming rather thinly distributed between bands of spiracular disc-pore, very scarce anterior to prothorax and absent anterior to antennae. Antennae each with 8 segments, 2nd and 3rd segments subequal. Legs well developed; each with a tibio-tarsal articulation and an articulatory sclerosis; claws without a denticle; both claw digitules broad and slightly shorter than thin tarsal digitules.

Material examined. I. Not recorded on indigenous native plants.

II. On exotic plants: *Camellia* spp.

BP, TK / NN.

Remarks. Recent descriptions (often as *Chloropulvinaria floccifera* (Westwood)) include: Williams & Kosztarab (1972), Kawai (1980), Hamon & Williams (1984), Gill (1988), Kosztarab & Kozár (1988), Qin & Gullan (1992), and Hodgson (1994a). This species has dorsal tubercles, mildly fimbriate marginal setae, pregenital disc-pores with mainly seven loculi, and no ventral tubular ducts submarginally anterior to the antennae.

P. floccifera has an almost world-wide distribution and is particularly widespread in the Holarctic Region. In the Australasian and Pacific regions, it is only known from Australia (Qin & Gullan, 1992) and New Zealand, and only from Vietnam in the Orient (Ben-Dov, 1993). Ben-Dov (1993) lists 27 plant families as hosts.

P. floccifera was first reported from New Zealand by Maskell (1879) — as *Pulvinaria camellicola*, a misspelling of *P. camelicola* Signoret.

Often placed in the genus *Chloropulvinaria* Borchsenius, 1952.

Biology. Has a single generation in USA (Williams & Kosztarab, 1972) and Japan, although 2 generations are known off *Eurya* in Tokyo (Takahashi, 1955). See El-Minshawy & Moursi (1976) for some details of its biology.

Distribution and status in New Zealand. Currently only known from tea (*Camellia sinensis*) and camellias in New Zealand.

Pulvinaria hydrangeae Steinweden — cottony hydrangea scale

Figs C84, 153

Pulvinaria hydrangeae Steinweden, 1946: 7; –Ben-Dov, 1993: 265 [world catalogue].

Unmounted material: yellowish, mottled with brown, rather flat, developing transverse ridges with age; ovisac up to about 10 mm long, broad, white, and ribbed. Length 2.00–5.00 mm, width 1.5–2.0 mm.

Mounted material: ovoid. Up to 4.00 mm long and 3.5 mm wide.

Dorsum: derm membranous. Dorsal setae short and tapering to a sharp point; present throughout. Dorsal pores: perhaps only minute microductules: frequent throughout. Preopercular pores small, with a granulate surface: in an elongate group anterior to anal plates. Dorsal tubular ducts small; frequent throughout. Dorsal tubercles absent. Anal plates together quadrate, with 3 fine setae near apex and another in the discal position. Anogenital fold with 2–3 pairs of setae along anterior margin and 3 pairs on lateral margin. Anal ring with 4 pairs of setae, 1 pair rather short.

Margin: marginal setae slender, mostly with an acute apex but some fimbriate, slightly curved; rather sparse, with about 10–20 setae on each side between stigmatic clefts. Stigmatic clefts shallow, with 3 stigmatic setae; each median spine 1.5–3.0 × longer than lateral spines, curved.

Venter: pregenital disc-pores each with mainly 7 loculi, central loculus slit-like: present in a dense group around genital opening, becoming much less frequent across anterior abdominal segments, with a group laterad to each metacoxa and sometimes each mesocoxa. Spiracular disc-pores in a band extending medially and merging with groups of pregenital disc-pores laterad to each coxa; with 55–70 disc-pores in each band. Ventral microducts, abundant in a broad submarginal band; apparently absent elsewhere. Ventral tubular ducts: (i) large ducts: abundant medially and submedially on head and thorax (sometimes abdominal segments II & III); (ii) intermediate ducts: present medially and mediolaterally on abdomen and laterad to type (i) on head and thorax; and (iii) short ducts: present in a complete, broad, submarginal band. Antennae 8-segmented. Legs well developed; each with a tibio-tarsal articulation and an articulatory sclerosis; claws without a denticle; both claw digitules broad and slightly shorter than thin tarsal digitules.

Material examined. I. Not recorded on indigenous native plants.

II. On exotic plants: *Hydrangea* sp., *Prunus avium*, *Prunus serrulata*.

WO, GB, HB, WN / NN, MC.

Remarks. Recent descriptions (sometimes as *Eupulvinaria hydrangeae* (Steinweden)) include: Canard (1965), Williams & Kosztarab (1972), Pellizzari Scaltriti (1976), Kawai (1980), Hamon & Williams (1984), Gill (1988), and Qin & Gullan (1992). As mounted specimens, it can easily be identified by the discal seta on each anal plate and the absence of dorsal tubercles.

First recorded in New Zealand in 1977 (Archibald *et al.* 1979). Within the last 20 years there have been a few records of this species in New Zealand— it remains scarce and of no economic importance. The only other records from the Southern Hemisphere are from New South Wales (Qin & Gullan, 1992), otherwise it is only known from the Nearctic and Palaearctic regions. Ben-Dov (1993) only lists 7 plant families; of these, the Hydrangeaceae are the main hosts (Gill, 1988). As it appears to be able to survive quite cold winters, it could occur almost anywhere in New Zealand.

Biology. Has 1 generation a year in California (Gill, 1988), where it overwinters as the 3rd-instar female on the twigs, matures in the spring, and lays eggs. The crawlers then return to the leaves for initial development. In Europe it is parthenogenetic (Canard, 1965) and the female migrates back to the leaves to produce its ovisac.

Distribution and status in New Zealand. Of no economic importance. Records from between central North Island and the northern end of the South Island.

Pulvinaria mesembryanthemi (Vallot) ice plant scale

Figs C85, 154

Coccus mesembryanthemi Vallot, 1829: 30.
Pulvinariella mesembryanthemi (Vallot); –Borchsenius, 1953: 287.
Pulvinaria mesembryanthemi (Vallot); –Ben-Dov, 1993: 270 [world catalogue].

Unmounted material: adult females oval to circular, moderately convex; bright green in colour; ovisac convex and white, almost as long as body; females also secrete a sparse dorsal covering of white mealy wax.

Mounted material: body oval to almost round, widest in abdomen, rather flat; stigmatic clefts shallow; a shallow cleft often present near each eyespot. Length 1.6–2.3 mm, width 0.9–1.6 mm.

Dorsum: derm membranous. Dorsal setae small (5–8 μm long), spinose with a blunt apex: frequent throughout. Dorsal pores of 2 types: a minute microductule and a larger simple pore: fairly frequent throughout. Preopercular pores rather small, round to slightly oval, flat to slightly convex, with a granular surface: in a small narrow group of 11–51 pores anterior to anal plates. Dorsal tubular ducts small; frequent throughout. Dorsal tubercles absent. Anal plates together quadrate. Anogenital fold with 2 pairs of setae present along anterior margin and 2 or 3 pairs laterally. Anal ring with 3 pairs of large and 0–1 pair of smaller setae present.

Margin: marginal setae stoutly spinose, slightly curved, blunt apically, and with rather parallel sides; rather sparse, in more or less 2 lines, more ventral line with smaller setae; larger setae 20–30 µm long, shorter setae as short as 12 µm; with 5–10 larger and 1–3 smaller setae on each side between stigmatic clefts. Stigmatic clefts with 3 stigmatic setae; each median spine 37–45 µm long, slightly curved, occasionally slightly swollen apically; lateral spines generally short, each 10–24 µm long.

Venter: pregenital disc-pores with mainly 10 loculi: present in a dense group around genital opening, becoming much less frequent across anterior abdominal segments and metathorax; a group also present laterad to each coxa. Spiracular disc-pores in a band extending medially and merging with groups of pregenital disc-pores laterad to each coxa; with 32–65 disc-pores in each band. Ventral microducts, abundant near margin and labium but less frequent elsewhere. Simple pores in a marginal band among marginal setae, with 3–5 pores on each side between stigmatic clefts. Ventral tubular ducts: (i) large ducts: abundant medially and submedially on head, thorax, and 2nd abdominal segment; (ii) intermediate ducts: abundant submedially throughout abdomen, merging with type-(i) anteriorly; occasionally present medially on abdominal segments III–VI; and (iii) short ducts: present in a complete, broad, submarginal band, and also submedially on abdomen and medially on posterior abdominal segments. Antennae 8-segmented. Legs rather large; each with a distinct tibio-tarsal articulation and articulatory sclerosis; each claw possibly with a minute denticle; claw digitules both broad and subequal in length with tarsal digitules.

Material examined. I. On native (non-indigenous) plants: *Disphyma australe*.

II. On exotic plants: *Carpobrotus* sp., *Lampranthus* sp., *Mesembryanthemum crystallinum*, *Mesembryanthemum* sp.

TH / AK, CL, HB / MC.

Remarks. Recent descriptions (often as *Pulvinariella mesembryanthemum* (Vallot)) include: De Lotto (1967), Hodgson (1967a, 1968, 1994a), Gill (1988), and Qin & Gullan (1992). Can be identified by lack of dorsal tubercles, bluntly spinose marginal setae, pregenital disc-pores with mainly 10 loculi and ventral tubular ducts present anterior to antennae.

P. mesembryanthemi is a potential pest of Aizoaceae wherever they are grown. Considered to have originated from South Africa. It has been known in New Zealand since 1987.

Biology. *P. mesembryanthemi* has a very restricted host-range, being known only from Aizoaceae (and occasionally Chenopodiaceae (Ben-Dov, 1993)). Its life cycle has been studied by Washburn & Frankie (1981, 1985) and Washburn *et al.* (1985); it usually has 2 generations a year in northern California but multiple generations in the south (Gill, 1988).

Distribution and status in New Zealand. Recorded from Great Island (Three Kings Islands), the Auckland region and from Thames, Napier, and Christchurch.

Pulvinaria psidii Maskell — green shield scale

Pulvinaria psidii Maskell, 1893a: 223; –Fernald, 1903: 137 [world catalogue]; –Wise, 1977: 106 [checklist]; – Ben-Dov, 1993: 278 [world catalogue].

P. psidii has never been recorded from New Zealand. Maskell described it in 1893 in the *Transactions and Proceedings of the New Zealand Institute* from Hawaii (the Sandwich Is). Without apparently sighting the paper, Fernald (1903) included this reference in her World Catalogue as being recorded in New Zealand and this error was repeated by Wise (1977); Ben-Dov (1993) gives the correct distribution status for *P. psidii* in his World Catalogue.

Pulvinaria vitis (Linnaeus) — cottony vine scale

Figs C86, C87, 155

Coccus vitis Linnaeus, 1758: 456.
Pulvinaria vitis (L.); –Signoret, 1873a: 45; –Ben-Dov, 1993: 288 [world catalogue].

Unmounted material: live adult female highly variable, depending on age, host-plant species, and position on host; teneral female pale beige, reddish-brown, dark-brown or blotched dark-grey, occasionally with raised pale-yellow longitudinal mid-dorsal band; body becoming greatly convex, heavily sclerotised, uniform dark-brown and wrinkled at maturity; ovisac large, white, strongly convex, up to 10.0 mm long. Eggs pink.

Mounted material: body elongate oval, widest in abdomen, with shallow stigmatic areas. Length 1.5–8.5 mm and width 0.9–6.9 mm.

Dorsum: derm membranous on young specimens, becoming heavily sclerotised when mature, with sparse pale areolations. Dorsal setae finely spinose with a sharp point, sometimes slightly curved, each 4–15 µm long;

frequency variable. Dorsal pores of 2 types: a minute microductule in areolations and a slightly larger simple pore. Preopercular pores round, flat to slightly convex, with a granulate surface, rather variable in size: in an elongate group of 7–170 pores. Dorsal tubular ducts small and sparsely distributed on some specimens, rather frequent on others. Dorsal tubercles in a submarginal ring totalling 0–14. Anogenital fold with 2 pairs of long setae present along anterior margin and 3 or 4 pairs laterally. Anal ring with 6 large and 2 shorter setae.

Margin: marginal setae spinose, fine, often curved, each 16–42 μm long: distributed in more or less 2 rows, with 8–19 setae on each side between stigmatic clefts. Stigmatic clefts shallow, each with 3 stigmatic spines; median spine longest, often slightly curved, bluntly pointed; length of median spine about twice length of lateral spines.

Venter: pregenital disc-pores with mainly 10 loculi: abundant around genital opening, becoming progressively less frequent across preceding abdominal segments and metathorax; also present laterad to each meso- and metacoxa. Spiracular disc-pores in broad bands, with about 60–110 disc-pores in each band. Ventral microducts abundant near margin, less frequent elsewhere. Ventral tubular ducts abundant throughout except medially on head and anterior to antennae; 3 types present: (i) large ducts: only duct present medially on head, thorax, and more anterior abdominal segments; extending laterally to band of type (ii) and (iii) ducts, where they become infrequent or absent; (ii) intermediate ducts: frequent medially on more posterior abdominal segments and laterally interspersed with type (i) ducts; and (iii) short ducts: frequent in a broad submarginal band extending from anal cleft to near antennae. Antennae 8-segmented. Spiracles quite large. Legs well developed; each with a distinct tibio-tarsal articulation and articulatory sclerosis; claws with a small denticle; claw digitules both broad and marginally shorter than tarsal digitules.

Material examined. I. Not recorded on indigenous native plants.

II. On exotic plants: *Populus ?nigra* hybrid, *Prunus armeniaca*, *Prunus persica*, *Prunus* sp., *Pyrus communis*, *Ribes nigrum*, *Vitis vinifera*.

NN, MC, SC, OL, CO, DN, SL.

Remarks. Recent descriptions include: Danzig (1986), Kosztarab & Kozár (1988), Gill (1988), Hodgson (1994a), and Łagowska (1996). This species can be identified by the following combination of characters: presence of dorsal tubercles, pregenital disc-pores with 10 loculi, ventral tubular ducts absent from anteriorly on head between antennae, marginal setae finely spinose, and a denticle on the claw.

P. vitis is a highly polymorphic species and the many forms of it have been studied in Europe by Malumphy (1991) and Łagowska (1996), who considered that many of the *Pulvinaria* species from Europe were synonyms of *P. vitis*. Based on their interpretation of *P. vitis*, this species has a fairly narrow host range of only about 14 plant families (Ben-Dov, 1993).

It appears to have arrived in New Zealand only fairly recently. Elsewhere, it is mainly found in the Palaearctic Region, where it is an important pest of grapevine (in Europe); also present in the Nearctic Region, where it is important on peaches (in Canada). In the Southern Hemisphere, only known from Brazil and New Zealand (Ben-Dov, 1993). In New Zealand, sporadic outbreaks have occured on apricots in Central Otago orchards, with records clustered around 1951–52, 1984–85, and (at present) in 1998–1999. Occasionally also on grapevines, to which it can transmit grapevine leafroll closterovirus disease (Belli *et al.*, 1994).

Biology. A univoltine species throughout most of its range. Many details regarding the biology of this species (in Poland) can be found in Łagowska (1996).

Distribution and status in New Zealand. Of little importance economically; verified records from the South Island only — range possibly more extensive.

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Appendix A. Alphabetical listing of host plants including family, with their associated soft scale species in New Zealand. Plant names and authors as in Griffiths (1994) and Parsons *et al.* (1999) (references included up to December 1995), with Breitwieser & Ward (1997) and Mitchell *et al.* (1997). **A**, adventive, cultivated and/or naturalised; **E**, endemic; **N**, native, but not endemic; **[P]**, published record, not verified.

***Abutilon* sp.**, Malvaceae, A
Coccus hesperidum, A
Saissetia oleae, A
Actinidia deliciosa (A. Chev.) C.F. Laing & A.R. Ferguson, Actinidiaceae, A
Ceroplastes destructor, A
Coccus hesperidum, A
Saissetia oleae, A
Alectryon excelsus Gaertn., Sapindaceae, E
Epelidochiton piperis, E
Alepis flavida (Hook. f.) Tieghem, Loranthaceae, E
Ctenochiton paraviridis, E
Alternanthera philoxeroides (Mart.) Griseb., Amaranthaceae, A
Coccus hesperidum, A
Saissetia coffeae, A
Astelia banksii A. Cunn., Asteliaceae, E
Umbonichiton hymenantherae?, E
***Aralia* sp.,** Araliaceae, A
Saissetia oleae, A
Aristotelia fruticosa Hook. f., Elaeocarpaceae, E
Aphenochiton inconspicuus, E
Aristotelia serrata (J.R. Forst. & G. Forst.) W.R.B. Oliver, Elaeocarpaceae, E
Epelidochiton piperis, E
***Aristotelia* sp.**, Elaeocarpaceae, E
Parthenolecanium corni, A
***Asparagus* sp.**, Asparagaceae, A
Saissetia coffeae, A
Saissetia oleae, A
'asparagus fern' [*Asparagus setaceus*], Asparagaceae, A
Saissetia coffeae, A
Asplenium bulbiferum G. Forst., Aspleniaceae, E
Saissetia coffeae, A
Asplenium pauperequitum Brownsey & P. Jackson, Aspleniaceae, E
Saissetia coffeae, A
***Asplenium* sp.**, Aspleniaceae, E
Saissetia coffeae, A
Astelia banksii A. Cunn., Asteliaceae, E
Umbonichiton hymenantherae ?, E
Avicennia marina* subsp. *australasica (Walp.) J. Everett [syn. *Avicennia resinifera* G. Forst.], Avicenniaceae, N
Ceroplastes sinensis, A
Saissetia coffeae, A
Saissetia oleae, A
***Avicennia* sp.**, Avicenniaceae, N
Ceroplastes sinensis, A

Beilschmiedia tawa (A. Cunn.) Benth. & Hook f. ex Kirk, Lauraceae, E
Aphenochiton pubens, E
Coccus hesperidum, A
Plumichiton elaeocarpi, E
Beilschmiedia tawaroa A.E. Wright, Lauraceae, E
Crystallotesta ornata, E
Plumichiton elaeocarpi, E
Plumichiton flavus, E
Saissetia coffeae, A
Blechnum fraseri (A. Cunn.) Luerss., Lauraceae, E
Coccus hesperidum, A
Poropeza cologabata, E
Pounamococcus cuneatus, E
Saissetia coffeae, A
***Bouvardia* sp.**, Rubiaceae, A
Coccus hesperidum, A
Brachyglottis bellidioides (Hook. f.) B. Nord., Asteraceae, E
Coccus hesperidum, A
Brachyglottis repanda J.R. Forst & G. Forst., Asteraceae, E
Coccus hesperidum, A
Crystallotesta fusca, E
Saissetia oleae, A
***Brachyglottis* sp.**, Asteraceae, E
Plumichiton flavus, E
' broom', Fabaceae, A
Coccus hesperidum, A
Parasaissetia nigra, A

***Camellia* sp.**, Theaceae, A
Pulvinaria floccifera, A
Saissetia coffeae, [P], A
Saissetia oleae, [P], A
Carmichaelia australis R. Br. in Lindl. [syn. *C. aligera* G. Simpson & *C. cunninghamii* Raoul; syn. *Chordospartium stevensonii* Cheeseman], Fabaceae, E
Coccus hesperidum, A
Coccus longulus, A
***Carmichaelia* sp.**, Fabaceae, E
Coccus longulus, A

Carpobrotus sp., Aizoaceae, A
Pulvinaria mesembryanthemi, A
Cassinia leptophylla [including *Cassinia vauvilliersii*] see *Ozothamnus leptophyllus*, E
Chaenomeles sp., Rosaceae, A
Saissetia coffeae, [P], A
Chamaecyparis lawsoniana (Murray) Parl., Cupressaceae, A
Epelidochiton piperis, E
Chionochloa flavescens Zotov, Gramineae, E
Aphenochiton chionochloae, E
Choisya ternata HBK., Rutaceae, A
Saissetia oleae, A
Chordospartium stevensonii see *Carmichaelia australis*
Citrus spp., Rutaceae, A
Ceroplastes ceriferus, A
Ceroplastes destructor, A
Ceroplastes sinensis, A
Coccus hesperidum, A
Coccus longulus, A
Parasaissetia nigra, A
Parthenolecanium persicae, A
Saissetia coffeae, A
Saissetia oleae, A
Clematis cunninghamii Turcz., Ranunculaceae, E
Ctenochiton chelyon, E
Clematis sp., Ranunculaceae, A
Saissetia coffeae, [P], A
Coprosma acutifolia Hook. f., Rubiaceae, E
Coccus hesperidum,A
Coprosma arborea Kirk, Rubiaceae, E
Kalasiris depressa, E
Coprosma colensoi Hook. f., Rubiaceae, E
Kalasiris depressa, E
Kalasiris perforata, E
Coprosma foetidissima J.R. Forst. & G. Forst., Rubiaceae, E
Kalasiris depressa, E
Kalasiris perforata, E
Coprosma lucida J.R. Forst. & G. Forst., Rubiaceae, E
Kalasiris perforata, E
Coprosma macrocarpa Cheeseman, Rubiaceae, E
Epelidochiton piperis, E
Coprosma propinqua A. Cunn., Rubiaceae, E
Aphenochiton inconspicuus, E
Saissetia coffeae, A
Coprosma repens Hook f., Rubiaceae, E
Kalasiris perforata, E
Saissetia oleae, A
Coprosma rhamnoides A. Cunn., Rubiaceae, E
Ceroplastes sinensis, A
Kalasiris depressa , E
Coprosma robusta Raoul, Rubiaceae, E
Ceroplastes sinensis, A
Epelidochiton piperis, E
Coprosma spathulata A. Cunn., Rubiaceae, E
Kalasiris perforata, E
Coprosma sp., Rubiaceae, E
Aphenochiton inconspicuus, E
Aphenochiton pronus, E
Ceroplastes sinensis, A
Coccus hesperidum, A
Crystallotesta fusca, E
Ctenochiton chelyon, E
Ctenochiton viridis, A
Kalasiris depressa, E
Kalasiris perforata, E
Plumichiton elaeocarpi, E
Siassetia oleae, A
Cordyline australis (G. Forst.) Endl., Asteliaceae, E
Saissetia coffeae, A
Cordyline banksii Hook. f., Asteliaceae, E
Aphenochiton pubens, E
Cornus alternifolia L. f., Cornaceae, A
Saissetia coffeae, A
Corokia cotoneaster Raoul, Escalloniaceae, E
Aphenochiton inconspicuus, E
Corokia sp., Escalloniaceae, E
Coccus hesperidum, A
Corynocarpus laevigatus J.R. Forst. & G. Forst., Corynocarpaceae, E
Aphenochiton subtilis, E
Ctenochiton chelyon, E
Epelidochiton piperis, E
Cucumis sativus L., Cucurbitaceae, A
Saissetia coffeae, [P], A
Cucurbita maxima Duchesne in Lamb., Cucurbitaceae, A
Coccus hesperidum, A
Cucurbita pepo L., Cucurbitaceae, A
Saissetia oleae, A
Cyathea sp., Cyathaceae, E
Coccus hesperidum, A
Kalasiris depressa, E
Cycas sp., Arecaceae, A
Saissetia oleae, A
Cydonia oblonga Mill., Rosaceae, A
Saissetia coffeae, A
Cymbidium sp., Orchidaceae, A
Coccus hesperidum, A
Saissetia oleae, A

Cyphomandra betacea (Cav.) Sendtner, Solanaceae, A
Ceroplastes sinensis, [P], A

Dacrycarpus dacrydioides (A. Rich.) de Laub., Podocarpaceae, E
Poropeza dacrydii, E
Dacrydium cupressinum Lamb., Podocarpaceae, E
Poropeza cologabata, E
Poropeza dacrydii, E
***Daphne* sp.**, Thymelaeaceae, A
Parasaissetia nigra, A
Saissetia oleae, [P], A
***Dendrobium* sp.**, Orchidaceae, A
Coccus hesperidum, A
Saissetia coffeae, A
***Dianthus* sp.**, Caryophyllaceae, A
Coccus hesperidum, A
Dichondra repens J.R. Forst. & G. Forst., Convolvulaceae, N
Saissetia oleae, A
Discaria toumatou Raoul, Rhamnaceae, E
Kalasiris perforata , E
Disphyma australe(W.T. Aiton) N.E. Br., Aizoaceae, N
Pulvinaria mesembryanthemi, A
Dodonaea viscosa Jacq., Sapindaceae, N
Ctenochiton paraviridis, E
Dracophyllum sinclairii Cheeseman, Epacridaceae, E
Aphenochiton grammicus, E
Dracophyllum subulatum Hook. f., Epacridaceae, E
Aphenochiton grammicus, E
Dracophyllum traversii Hook. f., Epacridaceae, E
Aphenochiton dierama, E
***Dracophyllum* sp.**, Epacridaceae, E
Aphenochiton dierama, E
Dysoxylum spectabile (G. Forst.) Hook. f., Meliaceae, E
Epelidochiton piperis, E

Elaeocarpus dentatus (J.R. Forst. & G. Forst.) M. Vahl., Elaeocarpaceae, E
Plumichiton flavus, E
Elaeocarpus hookerianus Raoul, Elaeocarpaceae, E
Plumichiton elaeocarpi, E
***Elaeocarpus* sp.**, Elaeocarpaceae, E
Crystallotesta ornata, E
Inglisia patella, E
Plumichiton elaeocarpi, E
***Elingamita* sp.**, Myrsinaceae, E
Aphenochiton subtilis, E
Ctenochiton chelyon, E
Entelea arborescens R. Br., Tiliaceae, E
Saissetia oleae, A
***Escallonia* sp.**, Escalloniaceae, A
Ceroplastes sinensis, [P], A
Eugenia uniflora L., Myrtaceae, A
Saissetia oleae, A

Fatsia japonica (Thunb.) Decne. & Planch., Araliaceae, A
Coccus hesperidum, A
Saissetia coffeae, A
Saissetia oleae, A
Feijoa sellowiana (Berg) Berg, Myrtaceae, A
Ceroplastes sinensis, A
Parasaissetia nigra, A
'fern', E/A
Coccus hesperidum, A
Pounamococcus cuneatus, E
Saissetia coffeae, A
***Ficus* sp.** [as rubber plant], Moraceae, A
Coccus hesperidum, A

***Gardenia* sp.**, Rubiaceae, A
Ceroplastes sinensis, A
Coccus hesperidum, A
Saissetia coffeae, A
***Gaultheria* sp.**, Ericaceae, E
Plumichiton diadema, E
***Geniostoma* sp.**, Loganiaceae, E
Saissetia coffeae, A
Griselinia littoralis Raoul, Griseliniaceae, E
Ctenochiton paraviridis, E
Kalasiris perforata, E
Griselinia lucida G. Forst., Griseliniaceae, E
Aphenochiton pubens, E
Ctenochiton paraviridis, E

Hebe brachysyphon Summerh., Scrophulariaceae, E
Kalasiris paradepressa, E
Hebe elliptica (G. Forst.) Pennell, Scrophulariaceae, E
Plumichiton flavus, E
Saissetia oleae, A
Hebe macrocarpa (Vahl.) Cockayne & Allan,. Scrophulariaceae, E
Saissetia coffeae, A

Hebe odora (Hook. f.) Cockayne, Scrophulariaceae, E
Kalasiris paradepressa, E
Hebe pauciramosa (Cockayne & Allan) L.B. Moore in Allan, Scrophulariaceae, E
Aphenochiton pronus, E
Hebe stricta (Benth.) L.B. Moore in Allan, Scrophulariaceae, E
Ceroplastes sinensis, A
Hebe sp., Scrophulariaceae, E
Ceroplastes sinensis, [P], A
Hedera sp., Araliaceae, A
Coccus hesperidum, A
Hedycarya arborea J.R. Forst. & G. Forst., Monimiaceae, E
Aphenochiton pubens, E
Aphenochiton subtilis, E
Ctenochiton paraviridis, E
Crystallotesta ornata, E
Epelidochiton piperis, E
Inglisia patella, E
Plumichiton elaeocarpi, E
Plumichiton flavus, E
Poropeza cologabata, E
Pounamococcus tubulus, E
Umbonichiton hymenantherae, E
Hibiscus tiliaceus L., Malvaceae, N [KE]
Coccus hesperidum, A
Hibiscus sp., Malvaceae, A
Saissetia oleae, A
Hoheria populnea A. Cunn., Malvaceae, E
Ceroplastes sinensis, A
Hoheria sp., Malvaceae, E
Ctenochiton paraviridis, E
Homalocladium sp., Polygonaceae, A
Saissetia coffeae, A
Hydrangea sp., Hydrangeaceae, A
Pulvinaria hydrangeae, A
Saissetia oleae, A
Hymenanthera sp., Violaceae, E
Crystallotesta fusca, E
Umbonichiton hymenantherae, E
Hypericum sp., Hypericaceae, A
Coccus longulus, A

Ileostylis sp., Loranthaceae, E
Plumichiton elaeocarpi, E
Ilex aquifolium L., Aquifoliaceae, A
Ceroplastes sinensis, A
Coccus hesperidum, A
Parasaissetia nigra, A
Ilex sp., Aquifoliaceae, A
Parasaissetia nigra, A
Saissetia oleae, [P], A
Iris germanica L., Iridaceae, A
Parasaissetia nigra, A

Kunzea ericoides (A. Rich.) Joy Thomps., Myrtaceae, N
Ceroplastes sinensis, [P], A
Crystallotesta leptospermi, E
Crystallotesta ornatella, E
Plumichiton pollicinus, E
Umbonichiton bullatus, E

Lagunaria patersonii (Andr.) G. Don, Malvaceae, A
Saissetia oleae, A
Lampranthus sp., Aizoaceae, A
Pulvinaria mesembryanthemi, A
'laurel', Lauraceae, A
Coccus hesperidum, A
Saissetia oleae, [P], A
Laurelia novae-zelandiae A. Cunn., Monimiaceae, E
Ctenochiton paraviridis, E
Epelidochiton piperis, E
Lavatera sp., Malvaceae, A
Saissetia oleae, A
Leptospermum scoparium J.R. Forst. & G. Forst., Myrtaceae, N
Ceroplastes sinensis, [P], A
Crystallotesta leptospermi, E
Crystallotesta ornatella, E
Plumichiton pollicinus, E
Umbonichiton bullatus, E
Leptospermum sp., Myrtaceae, N
Crystallotesta leptospermi, E
Crystallotesta ornatella, E
Plumichiton flavus, E
Plumichiton pollicinus, E
Leucopogon fasciculatus (G. Forst.) A. Rich., Epacridaceae, E
Crystallotesta ornatella, E
Litchi chinensis Sonn., Sapindaceae, A
Saissetia oleae, A
Litsea calicaris (A. Cunn.) Benth. & Hook f. ex Kirk, Lauraceae, E
Aphenochiton pubens, E
Ctenochiton chelyon, E
Plumichiton elaeocarpi, E
Lonicera sp., Caprifoliaceae, A
Ceroplastes sinensis, A

***Luculia* sp.**, Rubiaceae, A
Coccus hesperidum, A
Saissetia coffeae, A

Macropiper excelsum (G. Forst.) Miq., Piperaceae, E
Epelidochiton piperis, E
Magnolia stellata (Siebold & Zucc.) Maxim., Magnoliaceae, A
Coccus longulus, A
Malus* x *domestica Borkh., Rosaceae, A
Coccus hesperidum, A
Saissetia oleae, [P], A
Medicago sativa L., Fabaceae, A
Coccus hesperidum, A
Melicope simplex A. Cunn., Rutaceae, E
Ceroplastes sinensis, A
Coccus longulus, A
Ctenochiton chelyon, E
Kalasiris perforata, E
Melicope ternata J.R. Forst. & G. Forst., Rutaceae, E
Coccus longulus, A
Melicytus ramiflorus J.R. Forst. & G. Forst., Violaceae, E
Crystallotesta fusca, E
Plumichiton flavus, E
Umbonichiton hymenantherae, E
***Melicytus* sp.**, Violaceae, E
Crystallotesta fusca, E
Epelidochiton piperis, E
Meryta sinclairii (Hook. f.) Seem., Araliaceae, E
Aphenochiton subtilis, E
Ctenochiton viridis, E
Mesembryanthemum crystallinum L., Aizoaceae, A
Pulvinaria mesembryanthemi, A
***Mesembryanthemum* sp.**, Aizoaceae, A
Pulvinaria mesembryanthemi, A
Metrosideros excelsa Sol. ex Gaertn., Myrtaceae, E
Lecanochiton actites, E
Lecanochiton scutellaris, E
Metrosideros robusta A. Cunn., Myrtaceae, E
Lecanochiton actites, E
Metrosideros umbellata Cav., Myrtaceae, E
Lecanochiton metrosideri, E
Lecanochiton minor, E
***Metrosideros* sp.**, Myrtaceae, E
Crystallotesta ornatella, E
Epelidochiton piperis, E
Lecanochiton metrosideri, E
Lecanochiton minor, E
Mida salicifolia A. Cunn., Santalaceae, E
Aphenochiton pubens, E
Aphenochiton subtilis, E
Muehlenbeckia australis (G. Forst.) Meissn., Polygonaceae, E
Aphenochiton inconspicuus, E
Myoporum laetum G. Forst., Myoporaceae, E
Coccus hesperidum, A
Crystallotesta fusca, E
Saissetia coffeae, A
Saissetia oleae, A
Myrsine australis (A. Rich.) Allan, Myrsinaceae, E
Ctenochiton paraviridis, E
Plumichiton flavus, E
Saissetia oleae, A
Myrsine divaricata A. Cunn., Myrsinaceae, E
Umbonichiton hymenantherae, E
Myrsine salicina Heward ex Hook. f., Myrsinaceae, E
Ctenochiton paraviridis, E
Plumichiton flavus, E
***Myrtus* sp.**, Myrtaceae, E
Umbonichiton hymenantherae, E

Nerium oleander L., Apocynaceae, A
Coccus hesperidum, [P], A
Saissetia coffeae, [P], A
Saissetia oleae, [P], A
Nestegis lanceolata (Hook. f.) L.A.S. Johnson, Oleaceae,E
Saissetia oleae, A
Nothofagus fusca (Hook. f.) Oerst., Fagaceae, E
Crystallotesta fagi, E
Crystallotesta neofagi, E
Nothofagus menziesii (Hook. f.) Oerst., Fagaceae, E
Crystallotesta fagi, E
Nothofagus truncata (Colenso) Cockayne, Fagaceae, E
Crystallotesta neofagi, E
Crystallotesta ornata, E

Olea europaea L., Oleaceae, A
Saissetia oleae, A
Olearia macrodonta Baker, Asteraceae, E
Plumichiton punctatus, E
Olearia nummularifolia Hook. f., Asteraceae, E
Aphenochiton inconspicuus, E
Coccus hesperidum, A
Plumichiton diadema, E

Olearia paniculata (J.R. Forst. & G. Forst.) Druce, Asteraceae, E
Saissetia coffeae, A
Saissetia oleae, A
Olearia traversii (F. Muell.) Hook. f., Asteraceae, E
Coccus hesperidum, A
***Olearia* sp.**, Asteraceae, E
Ceroplastes sinensis, [P], A
Saissetia oleae, A
'Orchids'
Saissetia coffeae, [P]. A
Ozothamnus leptophyllus (G. Forst.) Breitw. & J.M. Ward [syn. *Cassinia leptophylla* (G. Forst.) R. Br. including *Cassinia vauvilliersii* (Homb. & Jacq.) Hook. f.], Asteraceae, E
Plumichiton diadema, E
Saissetia oleae, A

'Palms'
Saissetia coffeae, [P], A
Saissetia oleae, [P], A
Parahebe lyalli (Hook. f.) W.R.B. Oliv., Scrophulariaceae, E
Saissetia coffeae, A
Parahebe olseni (Colenso) W.R.B. Oliv., Scrophulariaceae, E
Plumichiton diadema, E
***Parsonsia* sp.**, Apocynaceae, E
Kalasiris perforata, E
Passiflora edulis Sims, Passifloraceae, A
Saissetia coffeae, [P], A
Passiflora tetrandra DC, Passifloraceae, E
Kalasiris perforata, E
Pennantia corymbosa J.R. Forst. & G. Forst., Icacinaceae, E
Ctenochiton paraviridis, E
Peraxilla colensoi (Hook. f.) Tiegh., Loranthaceae, E
Ctenochiton paraviridis, E
Persea americana Mill., Lauraceae, A
Coccus hesperidum, A
***Phalaenopsis* sp.**, Orchidaceae, A
Coccus hesperidum, A
***Phlox* sp.**, Polemoniaceae, A
Coccus hesperidum, A
Picea pungens Engelm. cv. Glauca, Pinaceae, A
Saissetia coffeae, A
***Pimelea* sp.**, Thymelaeaceae, E
Coccus hesperidum, A
Pinus radiata D. Don, Pinaceae, A
Coccus hesperidum, A
Pittosporum colensoi Hook. f., Pittosporaceae, E
Inglisia patella, E
Pittosporum eugenioides A. Cunn., Pittosporaceae, E
Epelidochiton piperis, E
Kalasiris perforata, E
Pittosporum kirkii Hook. f., Pittosporaceae, E
Kalasiris perforata, E
Pittosporum tenuifolium Sol. ex Gaertn., Pittosporaceae, E
Aphenochiton pubens, E
Kalasiris perforata, E
Pittosporum turneri Petrie, Pittosporaceae, E
Kalasiris perforata, E
Umbonichiton jubatus, E
Pittosporum umbellatum Banks & Sol. ex Gaertn., Pittosporaceae, E
Kalasiris perforata, E
***Pittosporum* sp.**, Pittosporaceae, E
Aphenochiton subtilis, E
Ceroplastes sinensis, [P], A
Coccus hesperidum, A
Epelidochiton piperis, E
Inglisia patella, E
Kalasiris perforata, E
Plumichiton flavus, E
Saissetia oleae, A
Plagianthus divaricatus J.R. Forst. & G. Forst., Malvaceae, E
Aphenochiton inconspicuus, E
Saissetia oleae, A
***Plagianthus* sp.**, Malvaceae, E
Ctenochiton chelyon, E
Kalasiris depressa, E
Saissetia oleae, A
Podocarpus hallii Kirk, Podocarpaceae, E
Aphenochiton dierama , E
Podocarpus totara G. Benn. ex D. Don in Lamb., Podocarpaceae, E
Aphenochiton pubens, E
Crystallotesta ornata, E
Poropeza dacrydii, E
Umbonichiton adelus, E
Umbonichiton bullatus, E
Umbonichiton pellaspis, E
***Podocarpus* sp.**, Podocarpaceae, E
Poropeza dacrydii, E
Poncirus trifoliata L., Rutaceae, A
Coccus hesperidum, A
Populus* x *?nigra, Salicaceae, A
Pulvinaria vitis, A

Pouteria costata (Endl.) Baehni, Sapotaceae, E
Saissetia coffeae, A
Saissetia oleae, A

Pratia physaloides (A.M. Cunn.) Hemsl., Lobeliaceae, E
Coccus hesperidum, A
Saissetia coffeae, A

Prostanthera cuneata Benth., Lamiaceae, A
Coccus hesperidum, A

Prumnopitys ferruginea (D. Don) de Laub., Podocarpaceae, E
Plumichiton flavus, E
Poropeza dacrydii, E
Poropeza cologabata, E

Prumnopitys taxifolia (D. Don) de Laub., Podocarpaceae, E
Aphenochiton matai, E

Prunus armeniaca L., Rosaceae, A
Coccus hesperidum, A
Parasaissetia nigra, A
Parthenolecanium corni, A
Pulvinaria vitis, A
Saissetia oleae, [P], A

Prunus avium L., Rosaceae, A
Coccus hesperidum, A
Parthenolecanium corni, A
Pulvinaria hydrangeae, A

Prunus laurocerasus L., Rosaceae, A
Coccus hesperidum, A

Prunus persica (L.) Batsch, Rosaceae, A
Pulvinaria vitis, A

Prunus persica (L.) Batsch var ***nucipersica*** (Suckow) C.K. Schneid., Rosaceae, A
Coccus hesperidum, A
Saissetia coffeae, A

Prunus salicina Lindl., Rosaceae, A
Coccus hesperidum, A
Saissetia coffeae, A

Prunus serrulata Lindl., Rosaceae, A
Pulvinaria hydrangeae, A

Prunus **sp.**, Rosaceae, A
Parthenolecanium corni, A
Pulvinaria vitis, A
Saissetia oleae, [P], A

Pseudopanax arboreus (Murray) Philipson, Araliaceae, E
Crystallotesta fusca, E
Ctenochiton paraviridis, E
Ctenochiton viridis, E
Pounamococcus tubulus, E

Pseudopanax crassifolius (Sol. ex A. Cunn.) C. Koch, Araliaceae, E
Coccus hesperidum, A
Ctenochiton viridis, E

Pseudopanax ferox Kirk, Araliaceae, E
Ctenochiton viridis, E

Pseudopanax lessoni (DC) C. Koch, Araliaceae, E
Coccus hesperidum, A
Ctenochiton viridis, E
Pounamococcus tubulus, E

Pseudopanax linearis (Hook. f)C. Koch, Araliaceae, E
Ctenochiton viridis, E [host sp.?, record as *P. ?linearis*]

Pseudopanax simplex see *Raukaua simplex*, E

Pseudopanax **sp.**, Araliaceae, E
Coccus hesperidium, A
Pounamococcus tubulus, E
Saissetia oleae, E

Pseudowintera axillaris (J.R. Forst. & G. Forst.) Dandy, Winteraceae, E
Ctenochiton paraviridis, E
Inglisia patella, E
Plumichiton flavus, E

Pseudowintera colorata (Raoul) Dandy, Winteraceae, E
Aphenochiton inconspicuus, E
Ctenochiton paraviridis, E
Inglisia patella, E
Plumichiton flavus, E
Pounamococcus tubulus, E

Pseudowintera **sp.**, Winteraceae, E
Kalasiris perforata, E
Pounamococcus tubulus, E

Psidium **sp.**, Myrtaceae, A
Saissetia oleae, [P], A

Pteridium esculentum (G. Forst.) Cockayne, Dennstaedtiaceae, N
Ceroplastes sinensis, A
Saissetia oleae, A

Pyrus communis L., Rosaceae, A
Pulvinaria vitis, A
Saissetia oleae, A

Pyrus pyrifolia (Burm. f.) Nakai, Rosaceae, A
Saissetia oleae, A

Quercus p\alustris Münchh., Fagaceae, A
Parthenolecanium corni, A

Raukaua simplex (G. Forst.) A.D. Mitchell, D. Frodin & M. Heads [syn *Pseudopanax simplex* (G. Forst.) Philipson], Araliaceae, E
- *Aphenochiton subtilis*, E
- *Pounamococcus tubulus*, E

Rhopalostylis sapida H. Wendl. & Drude, Arecaceae, E
- *Plumichiton nikau*, E

Ribes nigrum L., Grossulariaceae, A
- *Coccus hesperidum*, A
- *Parthenolecanium corni*, A
- *Pulvinaria vitis*, A
- *Saissetia coffeae*, [P], A

Ripogonum scandens J.R. Forst. & G. Forst., Ripogonaceae, E
- *Ctenochiton paraviridis*, E
- *Plumichiton flavus*, E

***Rosa* sp.**, Rosaceae, A
- *Saissetia oleae*, A

***Rosmarinus* sp.**, Lamiaceae, A
- *Coccus hesperidum*, A
- *Saissetia oleae*, A

***Rubus* x** [as loganberry], Rosaceae, A
- *Coccus hesperidum*, A

***Rubus* sp.**, Rosaceae, A/E
- *Ctenochiton viridis*, E
- *Kalasiris perforata*, E

***Saintpaulia* sp.**, Gesneriaceae, A
- *Saissetia coffeae*, A

Schefflera digitata J.R. Forst. & G. Forst., Araliaceae, E
- *Ctenochiton paraviridis*, E
- *Epelidochiton piperis*, E
- *Poropeza cologabata*, E

***Schinus* sp.**, Anacardiaceae, A
- *Saissetia oleae*, [P], A

***Senecio* sp.**, Asteraceae, E
- *Coccus hesperidum*, A

Solanum aviculare G. Forst., Solanaceae, E
- *Ceroplastes sinensis*, A
- *Coccus hesperidum*, A
- *Saissetia oleae*, A

Solanum melongena L., Solanaceae, A
- *Coccus hesperidum*, [P], A
- *Saissetia coffeae*, [P], A

Sollya heterophylla Lindl., Pittosporaceae, A
- *Coccus hesperidum*, A

Streblus heterophyllus (Blume) Corner, Moraceae, E
- *Ctenochiton chelyon*, E

Tecomaria capensis (Thunb.) Spach., Bignoniaceae, A
- *Saissetia oleae*, [P], A

Tecomanthe speciosa W.R.B. Oliv., Bignoniaceae, E
- *Coccus hesperidum*, A

***Thunbergia* sp.**, Thunbergiaceae, A
- *Ceroplastes sinensis*, A
- *Saissetia coffeae*, A

Toronia toru (A. Cunn.) L.A.S. Johnson & B.G. Briggs, Proteaceae, E
- *Ctenochiton toru*, E

'tree fern', ?Cyatheaceae, E
- *Saissetia coffeae*, A

***Veronica* sp.**, Scrophulariaceae, A
- *Ceroplastes sinensis*, [P], A

Vitex lucens Kirk, Verbenaceae, E
- *Ceroplastes sinensis*, A
- *Coccus hesperidum*, A
- *Crystallotesta ornata*, E
- *Ctenochiton chelyon*, E
- *Epelidochiton piperis*, E
- *Saissetia oleae*, A

Vitis vinifera L., Vitaceae, A
- *Coccus hesperidum*, A
- *Coccus longulus*, A
- *Pulvinaria vitis*, A
- *Parthenolecanium corni*, A
- *Parthenolecanium persicae*, A
- *Saissetia coffeae*, A
- *Saissetia oleae*, A

Washingtonia robusta Wendl., Arecaceae, A
- *Saissetia coffeae*, A

Weinmannia racemosa L. f., Cunoniaceae, E
- *Aphenochiton kamahi*, E
- *Plumichiton elaeocarpi*, E
- *Plumichiton flavus*, E
- *Umbonichiton bullatus*, E

Weinmannia silvicola Sol. ex A. Cunn., Cunoniaceae, E
- *Aphenochiton kamahi*, E
- *Plumichiton elaeocarpi*, E

***Weinmannia* sp.**, Cunoniaceae, E
- *Plumichiton flavus*, E

***Wisteria* sp.**, Fabaceae, A
- *Parthenolecanium persicae*, A
- *Saissetia oleae*, [P], A

Appendix B. Alphabetical listing of endemic soft scale genera and species with their associated host plants and families.

Aphenochiton

chionochloae
- *Chionochloa flavescens* (Gramineae)

dierama
- *Dracophyllum traversii* (Epacridaceae)
- *Dracophyllum* sp. (Epacridaceae)
- *Podocarpus hallii* (Podocarpaceae)

grammicus
- *Dracophyllum sinclairii* (Epacridaceae)
- *Dracophyllum subulatum* (Epacridaceae)

inconspicuus
- *Aristotelia fruticosa* (Elaeocarpaceae)
- *Coprosma propinqua* (Rubiaceae)
- *Coprosma* sp.(Rubiaceae)
- *Corokia cotoneaster* (Escalloniaceae)
- *Muehlenbeckia australis* (Polygonaceae)
- *Olearia nummularifolia* (Asteraceae)
- *Plagianthus divaricatus* (Malvaceae)
- *Pseudowintera colorata* (Winteraceae)

kamahi
- *Weinmannia racemosa* (Cunoniaceae)
- *Weinmannia silvicola* (Cunoniaceae)

matai
- *Prumnopitys taxifolia* (Podocarpaceae)

pronus
- *Coprosma* sp.(Rubiaceae)
- *Hebe pauciramosa* (Scrophulariaceae)

pubens
- *Beilschmiedia tawa* (Lauraceae)
- *Cordyline banksii* (Asteliaceae)
- *Griselinia lucida* (Griseliniaceae)
- *Hedycarya arborea* (Monimiaceae)
- *Litsea calicaris* (Lauraceae)
- *Mida salicifolia* (Santalaceae)
- *Pittosporum tenuifolium* (Pittosporaceae)
- *Podocarpus totara* (Podocarpaceae)

subtilis
- *Corynocarpus laevigatus* (Corynocarpaceae)
- *Elingamita* sp. (Myrsinaceae)
- *Hedycarya arborea* (Monimiaceae)
- *Meryta sinclairii* (Araliaceae)
- *Mida salicifolia* (Santalaceae)
- *Pittosporum* sp.(Pittosporaceae)
- *Raukaua simplex* (Araliaceae)

Crystallotesta

fagi
- *Nothofagus fusca* (Fagaceae)
- *Nothofagus menziesii* (Fagaceae)

fusca
- *Brachyglottis repanda* (Asteraceae)
- *Coprosma* sp. (Rubiaceae)
- *Hymenanthera* sp. (Violaceae)
- *Melicytus ramiflorus* (Violaceae)
- *Melicytus* sp. (Violaceae)
- *Myoporum laetum* (Myoporaceae)
- *Pseudopanax arboreus* (Araliaceae)

leptospermi
- *Kunzea ericoides* (Myrtaceae)
- *Leptospermum scoparium* (Myrtaceae)
- *Leptospermum* sp. (Myrtaceae)

neofagi
- *Nothofagus fusca* (Fagaceae)
- *Nothofagus truncata* (Fagaceae)

ornata
- *Beilschmiedia tawaroa* (Lauraceae)
- *Elaeocarpus* sp. (Elaeocarpaceae)
- *Hedycarya arborea* (Monimiaceae)
- *Nothofagus truncata* (Fagaceae)
- *Podocarpus totara* (Podocarpaceae)
- *Vitex lucens* (Verbenaceae)

ornatella
- *Kunzea ericoides* (Myrtaceae)
- *Leptospermum scoparium* (Myrtaceae)
- *Leptospermum* sp. (Myrtaceae)
- *Leucopogon fasciculatus* (Epacridaceae)
- *Metrosideros* sp. (Myrtaceae)

Ctenochiton

chelyon
- *Clematis cunninghamii* (Ranunculaceae)
- *Coprosma* sp. (Rubiaceae)
- *Corynocarpus laevigatus* (Corynocarpaceae)
- *Elingamita* sp. (Myrsinaceae)
- *Litsea calicaris* (Lauraceae)
- *Melicope simplex* (Rutaceae)
- *Plagianthus* sp. (Malvaceae)
- *Streblus heterophyllus* (Moraceae)
- *Vitex lucens* (Verbenaceae)

paraviridis
- *Alepis flavida* (Loranthaceae)
- *Dodonaea viscosa* (Sapindaceae)
- *Griselinia littoralis* (Griseliniaceae)
- *Griselinia lucida* (Griseliniaceae)
- *Hedycarya arborea* (Monimiaceae)
- *Hoheria* sp. (Malvaceae)
- *Laurelia novae-zelandiae* (Monimiaceae)
- *Myrsine australis* (Myrsinaceae)
- *Myrsine salicina* (Myrsinaceae)
- *Pennantia corymbosa* (Icacinaceae)
- *Peraxilla colensoi* (Loranthaceae)

Pseudopanax arboreus (Araliaceae)
Pseudowintera axillaris (Winteraceae)
Pseudowintera colorata (Winteraceae)
Ripogonum scandens (Ripogonaceae)
Schefflera digitata (Araliaceae)

toru
Toronia toru (Proteaceae)

viridis
Coprosma sp. (Rubiaceae)
Meryta sinclairii (Araliaceae)
Pseudopanax arboreus (Araliaceae)
Pseudopanax crassifolius (Araliaceae)
Pseudopanax ferox (Araliaceae)
Pseudopanax lessoni (Araliaceae)
Pseudopanax ?linearis (Araliaceae)
Rubus sp. (Rosaceae)

Epelidochiton

piperis
Alectryon excelsus (Sapindaceae)
Aristotelia serrata (Elaeocarpaceae)
Chamaecyparis lawsoniana (Cupressaceae)
Coprosma macrocarpa (Rubiaceae)
Coprosma robusta (Rubiaceae)
Corynocarpus laevigatus (Corynocarpaceae)
Dysoxylum spectabile (Meliaceae)
Hedycarya arborea (Monimiaceae)
Laurelia novae-zelandiae (Monimiaceae)
Macropiper excelsum (Piperaceae)
Melicytus sp. (Violaceae)
Metrosideros sp. [rata] (Myrtaceae)
Pittosporum eugenioides (Pittosporaceae)
Pittosporum sp. (Pittosporaceae)
Schefflera digitata (Araliaceae)
Vitex lucens (Verbenaceae)

Inglisia

patella
Elaeocarpus sp. (Elaeocarpaceae)
Hedycarya arborea (Monimiaceae)
Pittosporum colensoi (Pittosporaceae)
Pittosporum sp. (Pittosporaceae)
Pseudowintera axillaris (Winteraceae)
Pseudowintera colorata (Winteraceae)

Kalasiris

depressa
Coprosma arborea (Rubiaceae)
Coprosma colensoi (Rubiaceae)
Coprosma foetidissima (Rubiaceae)
Coprosma rhamnoides (Rubiaceae)
Coprosma sp. (Rubiaceae)
Cyathea sp. (Cyatheaceae)
Plagianthus sp. (Malvaceae)

paradepressa
Hebe brachysyphon (Scrophulariaceae)
Hebe odora (Scrophulariaceae)

perforata
Coprosma lucida (Rubiaceae)
Coprosma repens (Rubiaceae)
Coprosma spathulata (Rubiaceae)
Coprosma sp. (Rubiaceae)
Discaria toumatou (Rhamnaceae)
Griselinia littoralis (Griseliniaceae)
Melicope simplex (Rutaceae)
Parsonsia sp. (Apocynaceae)
Passiflora tetrandra (Passifloraceae)
Pittosporum eugenioides (Pittosporaceae)
Pittosporum kirkii (Pittosporaceae)
Pittosporum tenuifolium (Pittosporaceae)
Pittosporum turneri (Pittosporaceae)
Pittosporum umbellatum (Pittosporaceae)
Pittosporum sp. (Pittosporaceae)
Pseudowintera sp. (Winteraceae)
Rubus sp. (Rosaceae)

Lecanochiton

actites
Metrosideros excelsa (Myrtaceae)
Metrosideros robusta (Myrtaceae)
Metrosideros sp. [rata] (Myrtaceae)

metrosideri
Metrosideros umbellata (Myrtaceae)
Metrosideros sp. [rata] (Myrtaceae)

minor
Metrosideros umbellata (Myrtaceae)
Metrosideros sp. (Myrtaceae)

scutellaris
Metrosideros excelsa (Myrtaceae)

Plumichiton

diadema
Gaultheria sp. (Ericaceae)
Olearia nummularifolia (Asteraceae)
Ozothamnus leptophyllus (Asteraceae)
Parahebe olseni (Scrophulariaceae)

elaeocarpi
Beilschmiedia tawa (Lauraceae)
Beilschmiedia tawaroa (Lauraceae)
Coprosma sp. (Rubiaceae)
Elaeocarpus hookerianus (Elaeocarpaceae)
Elaeocarpus sp. (Elaeocarpaceae)
Hedycarya arborea (Monimiaceae)
Ileostylus sp. (Loranthaceae)

Litsea calicaris (Lauraceae)
Weinmannia racemosa (Cunoniaceae)
Weinmannia silvicola (Cunoniaceae)

flavus
Beilschmiedia tawaroa (Lauraceae)
Brachyglottis sp. (Asteraceae)
Elaeocarpus dentatus (Elaeocarpaceae)
Hebe elliptica? (Scrophulariaceae)
Hedycarya arborea (Monimiaceae)
Leptospermum sp. (Myrtaceae)
Melicytus ramiflorus (Violaceae)
Myrsine australis (Myrsinaceae)
Myrsine salicina (Myrsinaceae)
Pittosporum sp. (Pittosporaceae)
Prumnopitys ferruginea (Podocarpaceae)
Pseudowintera axillaris (Winteraceae)
Pseudowintera colorata (Winteraceae)
Ripogonum scandens (Ripogonaceae)
Weinmannia racemosa (Cunoniaceae)
Weinmannia sp. (Cunoniaceae)

nikau
Rhopalostylis sapida (Arecaceae)

pollicinus
Kunzea ericoides (Myrtaceae)
Leptospermum scoparium (Myrtaceae)
Leptospermum sp. (Myrtaceae)

punctatus
Olearia macrodonta (Asteraceae)

Poropeza

cologabata
Blechnum fraseri (Blechnaceae)
Dacrydium cupressinum (Podocarpaceae)
Hedycarya arborea (Monimiaceae)
Schefflera digitata (Araliaceae)

dacrydii
Dacrycarpus dacrydioides (Podocarpaceae)
Dacrydium cupressinum (Podocarpaceae)
Podocarpus totara (Podocarpaceae)
Podocarpus sp. (Podocarpaceae)
Prumnopitys ferruginea (Podocarpaceae)

Pounamococcus

cuneatus
Blechnum fraseri (Lauraceae)
'fern'

tubulus
Hedycarya arborea (Monimiaceae)
Pseudopanax arboreus (Araliaceae)
Pseudopanax lessoni (Araliaceae)
Pseudopanax sp. (Araliaceae)
Pseudowintera colorata (Winteraceae)
Pseudowintera sp. (Cunoniaceae)
Raukaua simplex (Araliaceae)

Umbonichiton

adelus
Podocarpus totara (Podocarpaceae)

bullatus
Kunzea ericoides (Myrtaceae)
Leptospermum scoparium (Myrtaceae)
Podocarpus totara (Podocarpaceae)
Weinmannia racemosa (Cunoniaceae)

hymenantherae
?Astelia banksii (Asteliaceae)
Hedycarya arborea (Monimiaceae)
Hymenanthera sp. (Violaceae)
Melicytus ramiflorus (Violaceae)
Myrsine divaricata (Myrsinaceae)
Myrtus sp. (Myrtaceae)

jubatus
Pittosporum turneri (Pittosporaceae)

pellaspis
Podocarpus totara (Podocarpaceae)

Appendix C. Hymenopterous parasitoids recorded from Coccidae in New Zealand; arranged alphabetically by family, and by genus / species within family. Derived from Valentine & Walker (1991) and J.A. Berry (unpublished records).

APHELINIDAE

***Bardylis* sp.**
Inglisia patella

***Coccophagus ochraceus* Howard**
Ceroplastes sinensis
Saissetia coffeae
Saissetia oleae

***Coccophagus scutellaris* (Dalman)**
Coccus hesperidum
Pulvinaria hydrangeae

***Encarsia citrina* (Craw)**
Ceroplastes sinensis
Coccus hesperidum

***Euxanthellus philippiae* Silvestri**
Ceroplastes sinensis
Coccus hesperidum
Coccus longulus
Kalasiris perforata
Parthenolecanium persicae
Pulvinaria hydrangeae
Saissetia coffeae
Saissetia oleae

ENCYRTIDAE

***Adelencyrtoides blastothrichus* Noyes**
Ctenochiton sp.
Inglisia sp.
Kalasiris perforata

***Adelencyrtoides inconstans* Noyes**
Ctenochiton paraviridis
Ctenochiton viridis
Kalasiris depressa

***Adelencyrtoides mucro* Noyes**
Ctenochiton sp.

***Adelencyrtoides suavis* Noyes**
Ctenochiton sp.

***Adelencyrtoides unicolor* Noyes**
Lecanochiton sp.

***Adelencyrtoides variabilis* Noyes**
Crystallotesta leptospermi
Crystallotesta ornata
Ctenochiton viridis
Inglisia sp.
Kalasiris depressa
Kalasiris perforata
Pounamococcus cuneatus

***Adelencyrtoides* sp.** (♂)
Ctenochiton paraviridis

***Encyrtus infelix* (Embleton)**
Saissetia coffeae

***Eusemion cornigerum* (Walker)**
Coccus hesperidum

***Metaphycus aurantiacus* Annecke & Mynhardt**
Coccus hesperidum

***Metaphycus lounsburyi* (Howard)**
Saissetia coffeae

***Metaphycus timberlakei* (Ishii)**
Parthenolecanium persicae

***Microterys flavus* (Howard)**
Coccus hesperidum
Saissetia oleae

PLATYGASTRIDAE

***Errolium* sp.** (undescribed)
Inglisia patella

PTEROMALIDAE

***Aphobetus maskelli* Howard**
Ctenochiton chelyon
Ctenochiton paraviridis
Ctenochiton sp.
'Coccidae' in *Trioza* (Psyllidae) galls

***Aphobetus nana* (Bouček)**
Aphenochiton kamahi
Crystallotesta leptospermi
Ctenochiton paraviridis
Epelidochiton piperis
Inglisia patella
Kalasiris depressa
Kalasiris perforata
Lecanochiton scutellaris

***Moranila californica* (Howard)**
Saissetia oleae

Appendix D. Geographical coordinates of localities. Co-ordinates should be read as 00°00'S / 000°00'E. The two-letter area codes follow Crosby *et al.* (1998).

Ahaura, BR .... 4221 / 17132
Akaroa, MC .... 4349 / 17258
Akatarawa Saddle, WN .... 4057 / 17507
Alfred R, L Daniells Tk, BR .... 4220 / 17215
Amodeo Bay, CL .... 3641 / 17526
Anchor I (by lake), FD .... 4545 / 16632
Arataki, SF 98, TO .... 3831 / 17546
Ardgowan, DN .... 4504 / 17058
Arthurs Pass, NC .... 4255 / 17133
Auckland, Owairaka, AK .... 3653 / 17443
Auckland, St Heliers, AK .... 3651 / 17451
Auckland, Titirangi, AK .... 3656 / 17440
Auckland University grounds, AK ...... 3651 / 17446
Auckland, Wattle Bay, AK .... 3703 / 17435
Awakau Road, TK .... 3841 / 17444

Bauza I, FD .... 4517 / 16655
Bethells, Te Henga Res, AK .... 3655 / 17430
Birdlings Flat, MC .... 4350 / 17242
Bligh Sound, Wild Natives R, FD .... 4453 / 16732
Blue Mountains, SL .... 4554 / 16923
Bluff Hill, Glory Track, SL .... 4637 / 16820
Bradshaw Sound, Precipice Cove, FD 4516 / 16709
Breaksea I, FD .... 4535 / 16638
Bridal Veil Falls, Raglan, WO .... 3754 / 17454
Bruce Park Scenic Res, WI .... 3958 / 17532
Buller Gorge, BR .... 4151 / 17147
Buller, nr Millerton, NN .... 4138 / 17153

Capleston, BR .... 4204 / 17155
Chalky Inlet, L. Cadman I, FD .... 4552 / 16643
Charleston - Addison Flat, BR ....
.... 4149 / 17132 – 4154 / 17126
Chaneys Corner, MC .... 4325 / 17239
Charles Sound, Elaenor I, FD .... 4506 / 16708
Christchurch, MC .... 4330 / 17245
Collingwood, NN .... 4041 / 17241
Colville Hill, CL .... 3638 / 17528
Cook Saddle, WD .... 4327 / 17004
Cornwallis, Spraggs Monument, AK .. 3701 / 17436
Corsair Bay, Lyttleton, MC .... 4337 / 17241
Cuttle Cove, Preservation Inlet, FD ... 4604 / 16640

Dad's Creek, upper Maitai R, NN ...... 4117 / 17322
Dagg Sound, Anchorage Arm, FD ..... 4523 / 16652
Dargaville, ND .... 3556 / 17352
Denniston, NN .... 4144 / 17148
Desert Road nr Waiouru, TO .... 3927 / 17541
Dunedin, DN .... 4553 / 17030
D'Urville I, SD .... 4050 / 17350
Dusky Sound, Seal I, FD .... 4547 / 16629

East Cape, GB .... 3741 / 17833
East Cape, Lighthouse Tk, GB .... 3741 / 17833
Eves Valley / Eves Bush, NN .... 4120 / 17304

Fairy Falls, Waitakere Ra, KA .... 3655 / 17433
Ferndown Tk, Waitakere Ra, AK .... 3655 / 17435
Fletcher Creek, Inangahua, BR .... 4159 / 17150
Flock House, WI .... 4016 / 17517
Franz Josef, WD .... 4328 / 17011

Garden's Valley, Nelson, NN .... 4125 / 17307
Garvey Creek, BR .... 4209 / 17157
Gilbert I 6, Breaksea Sound, FD .... 4536 / 16640
Girlies I, Dusky Sound, FD .... 4544 / 16656
Gisborne, GB .... 3840 / 17801
Glen Eden, Auckland, AK .... 3655 / 17439
Golden Downs, NN .... 4133 / 17253
Gordon Creek, Golden Downs, NN ... 4134 / 17253
Governors Bay, MC .... 4338 / 17239
Gowanbridge, Buller R, NN/BR .... 4143 / 17233
Granville Forest, BR .... 4219 / 17139
Grays Bush, Hexton, GB .... 3836 / 17757

Half Moon Bay, Kaikoura, KA .... 4215 / 17349
Halfmoon Bay, Stewart I, SI .... 4654 / 16809
Hauhungaroa Ra, TO .... 3845 / 17534
Hicks Bay, Wharekahika R, BP .... 3734 / 17818
Hinewai Res, Banks Peninsula, MC .. 4349 / 17301
Horokaka, Tangihua Ra, ND .... 3552 / 17408
Huia, AK .... 3700 / 17434
Huia Dam, AK .... 3700 / 17434
Hunua Ra, AK .... 3705 / 17512

Inangahua Landing, BR .... 4155 / 17154

Kaikoura, KA .... 4224 / 17341
Kaingaroa SF, BP .... 3824 / 17634
Kaiwaka, AK/ND .... 3610 / 17426
Kakanui, base of coastal cliff, GB ...... 3739 / 17824
Kakanui, 250m, GB .... 3739 / 17824
Kakanui, 300m, GB .... 3739 / 17824
Kakanui east-west saddle, GB .... 3739 / 17824
Kamo, ND .... 3541 / 17418
Karakatuwhero Valley Rd, Waipiata, GB ....
.... 3740 / 17818
Karamatura V, Waitakere Ra, AK ...... 3700 / 17434
Kauaeranga SF, CL .... 3709 / 17536
Kawau I, AK .... 3625 / 17451

Kaweka Road, Black Birch Ra, HB ... 3917 / 17625
Kohaihai Bluff, Karamea, NN .... 4106 / 17206
Kohukohu, ND .... 3521 / 17332
Kokakonui Stm, Kaharoa Station, GB 3829 / 17804
Kopu-Hikuai Rd [mid-point], CL .... 3710 / 17545

Laingholm, AK .... 3638 / 17438
Lake Sylvester, NN .... 4106 / 17238
Lake Tekapo, MK .... 4352 / 17034
Lake Waikaremoana, GB .... 3846 / 17705
Lees Valley Rd, nr Oxford, NC .... 4309 / 17212
Lincoln, MC .... 4339 / 17229
Little Barrier I, Hamilton Tk, CL .... 3613 / 17503
Little Barrier I, Summit Tk, CL .... 3613 / 17505
Little Barrier I, Te Maraeroa, west, CL 3613 / 17503
Little Barrier I, (upper) Valley Tk, CL . 3613 / 17504
Little I, Chalky Inlet, FD .... 4559 / 16635
Lottin Point, Otanga, BP .... 3732 / 17810
Lyttelton, MC .... 4336 / 17242

Maimai, BR .... 4209 / 17145
Maitai R, NN .... 4117 / 17320
Makahu Spur tk, Kaweka Ra, HB ...... 3917 / 17624
Makarora ("Makaroa"), OL .... 4415 / 16914
Mamaku, Aquarius Rd, BP .... 3803 / 17558
Manapouri, FD .... 4534 / 16736
Mangapohue, Natural Bridge, WO .... 3816 / 17454
Mangatangi Reservoir, Workman Tk, AK ....
.... 3707 / 17513
Mangawiri Basin, Whirinaki SF, TO ... 3835 / 17641
Marsden Valley, NN .... 4120 / 17315
Maruia, BR .... 4211 / 17213
Maruia Springs, BR .... 4223 / 17220
Matakana I, BP .... 3731 / 17601
Matakitaki R, Murchison, BR .... 4148 / 17219
Matuku Res, Taranga Tk, AK .... 3652 / 17428
Mawhera SF [Twelve Mile Creek], BR 4226 / 17123
Minginui area, TO .... 3836 / 17645
Motueka, NN .... 4106 / 17300
Motueka, Fearons Bush, NN .... 4106 / 17300
Motumoku Bush, 6km NW Murupara, BP ....
.... 3824 / 17638
Motupiko, NN .... 4127 / 17245
Mt Arthur, Flora Hut, NN .... 4111 / 17245
Mt Arthur, Flora Tk, NN .... 4110 / 17242
Mt Egmont, TK .... 3918 / 17404
Mt Lodestone, NN .... 4110 / 17245
Mt Mathews, Rimutaka Ra, WN .... 4121 / 17507
Mt Oxford, NC .... 4313 / 17205
Mt Ruapehu, TO .... 3916 / 17534
Mt Stevens Tk, nr Bainham, NN .... 4048 / 17227
Mt Te Aroha, Tui Mine roadside, BP .. 3732 / 17545

Murchison, BR .... 4148 / 17220

Nelson, NN .... 4116 / 17318
New Brighton, MC .... 4330 / 17244
Noises Is, Motuhoropapa I, AK .... 3641 / 17458
Noises Is, Otata I, AK .... 3642 / 17458

Oamaru, DN .... 4506 / 17057
Oban, Thule, SI .... 4654 / 16805
Ohakune, TO .... 3925 / 17525
Ohope, BP .... 3759 / 17705
Okiwi Bay, KA .... 4213 / 17352
Okura R , AK .... 3640 / 17444
Okuti Valley, Scenic Res, MC .... 4347 / 17250
Old Coach Road Tk, Waitakere Ra, AK ....
.... 3655 / 17433
Omahuta SF, Kauri Sanctuary, ND .... 3515 / 17337
Onekaka, NN .... 4046 / 17242
Onepoto Bay creek, Hicks Bay, BP ... 3736 / 17818
Opouri Valley, Marlborough, SD .... 4112 / 17341
Orete Forest, Te Puia Hut, BP .... 3740 / 17758
Orongorongo Valley, WN .... 4125 / 17454
Otaki Forks, WN .... 4052 / 17514
Otanerito Res, Banks Peninsula, MC 4350 / 17303
Otira, WD .... 4250 / 17134
Otira Gorge, WD .... 4248 / 17134
Owairaka, Auckland, AK .... 3653 / 17443

Palmer Road, Springs Junction, BR .. 4224 / 17208
Pangaki Stm, Paemako Res, WO ..... 3830 / 17456
Paoneone, GB .... 3739 / 17821
Paparata Rd, property P.S.Dale, AK 3711 / 17505
Papatea, BP .... 3740 / 17752
Para Swamp, nr Picton, SD .... 4122 / 17356
Pelorus Bridge, MB .... 4118 / 17334
Picnic Point, L Mahinapua, WD .... 4248 / 17056
Piropiro Road, Hauhungaroa Ra, TO 3837 / 17526
Pohangina Valley, Totara Res, RI ..... 4009 / 17551
Pohutu, Awatere R bridge, GB .... 3741 / 17821
Pokaka, TO .... 3918 / 17524
Pokoporo, Motueka V, NN .... 4113 / 17251
Poor Knights Is, Tawhiti Rahi, ND ..... 3528 / 17444
Porters Pass, MC .... 4318 / 17145
Port Motueka, NN .... 4108 / 17301
Pureora Forest, TO .... 3833 / 17536
Pureora Forest Lodge, Gully Rd, TO . 3829 / 17534
Pureora Forest, Waipapa Lodge Tk, Karamarama Stm, TO .... 3829 / 17534
Punakaiki, BR .... 4207 / 17120

Raglan, WO .... 3748 / 17452
Rai Valley, NN .... 4114 / 17335

Rangemore Tk, Waitakere Ra, AK .... 3656 / 17435
Rangitoto I, AK .... 3648 / 17452
Rangitoto I, Kidney Fern Glen, AK .... 3648 / 17451
Rangitoto Station, Mangatutu, TO .... 3820 / 17527
Raoul I, Kermadec Is, KE .... 2916 / 17755
Rawene, ND .... 3525 / 17331
Redmans Creek, Reefton, BR .... 4203 / 17153
Reefton, BR .... 4207 / 17151
Rereauira Swamp, Beech Ridge, BP. 3735 / 17804
Resolution I, Disappointment Cove, FD .... 4537 / 16639
Resolution I, Facile Harbour, FD .... 4543 / 16633
Riccarton Bush, MC .... 4332 / 17236
Riverhead Forest, Barlow Road res, AK .... 3642 / 17434
Riwaka, NN .... 4105 / 17300
Rockville, Aorere R, NN .... 4044 / 17238
Rocky Creek Bridge, SD .... 4122 / 17346
Rotoehu State Forest, BP .... 3800 / 17635
Rotorua, Atiamuri Rd, BP .... 3812 / 17614
Rotorua FRI Nursery, BP .... 3810 / 17616
Ruatahuna, Mimiha Stm, TO .... 3840 / 17656
Ruatahuna, Whakatane R, BP .... 3835 / 17658
Ruby Bay, Nelson, NN .... 4114 / 17305

Secretary I, FD .... 4514 / 16655
Secretary I, Grono Bay Tk, FD .... 4517 / 16657
Sewell Peak, nr Greymouth, BR .... 4224 / 17121
Sharp Bush, Waitakere Ra, AK .... 3654 / 17434
Sherry Valley, NN .... 4132 / 17242
Sign of the Bellbird, Port Hills, MC .... 4338 / 17236
Slab Hut Creek, BR .... 4210 / 17145
Sportsman Cove, Cooper I, FD .... 4544 / 16648
Springfield, MC .... 4320 / 17156
South Piha nr beach, AK .... 3658 / 17428
State Forest 90, Kaimanawa North FP, TO .... 3857 / 17614
St Heliers, Auckland, AK .... 3651 / 17451
Stonehenge, Rock & Pillar Ra, CO .... 4528 / 17003

Taikawakawa, nr Maungakaka, GB ... 3740 / 17829
Tairua SF [lookout tower nr Whangamata], CL .... 3710 / 17549
Tamaki R, RI .... 4008 / 17603
Tarakohe, NN .... 4050 / 17254
Tawhai Falls, Whakapapanui Stm, TO3910 / 17530
Tawhai SF [Merrijigs], BR .... 4214 / 17154
Tawhiti Rahi I, Poor Knights Is, ND ... 3528 / 17444
Te Arai Sanctuary, Houhora, ND .... 3442 / 17256
Te Araroa beach, [Punaruku Stm], BP3636 / 17819
Te Koau, Bush Walk, BP .... 3736 / 17817
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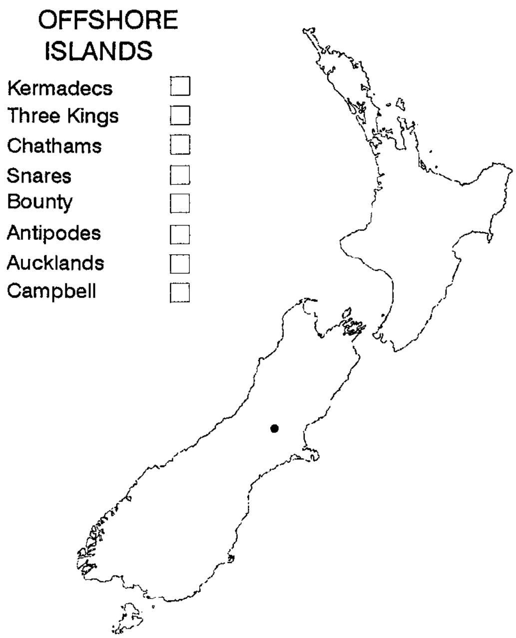

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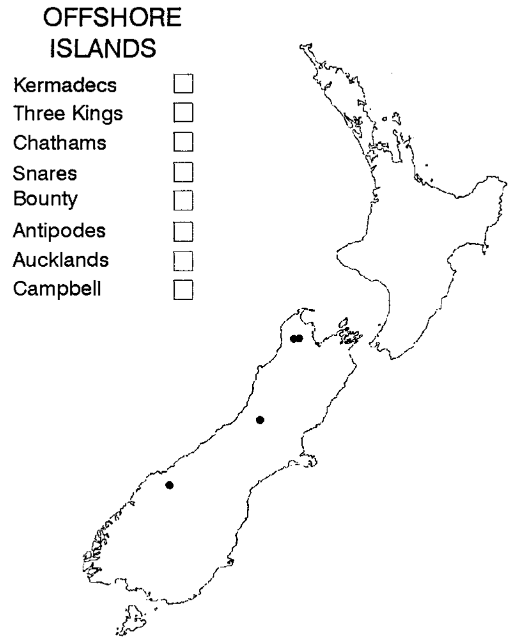

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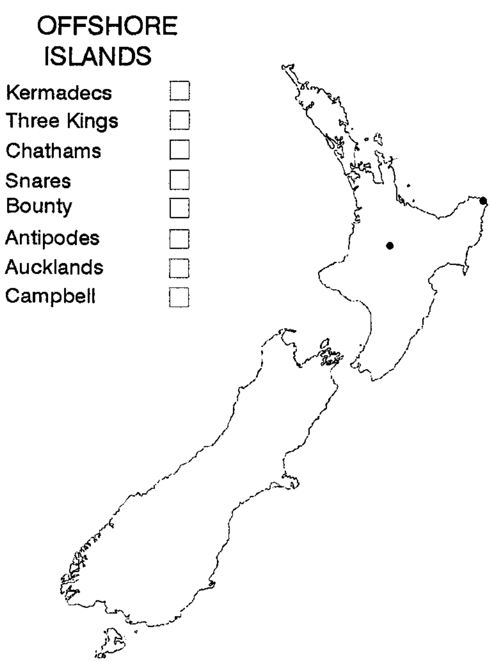

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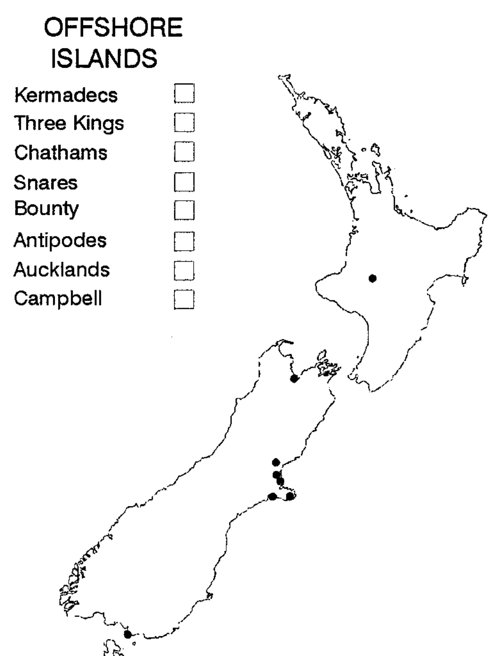

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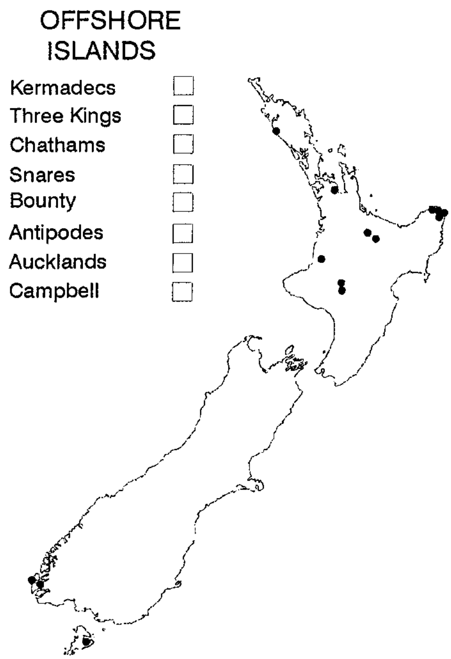

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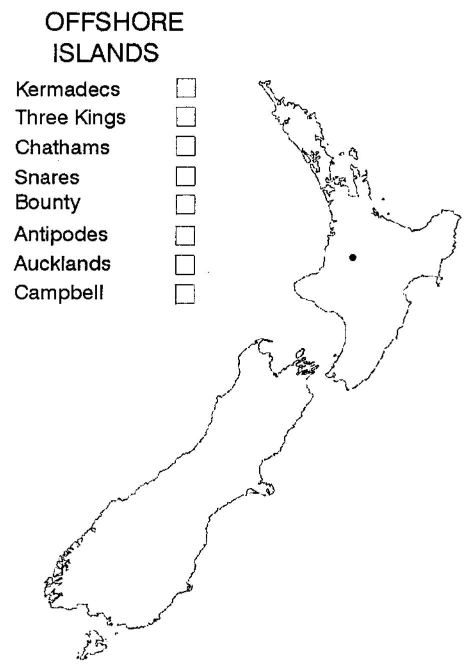

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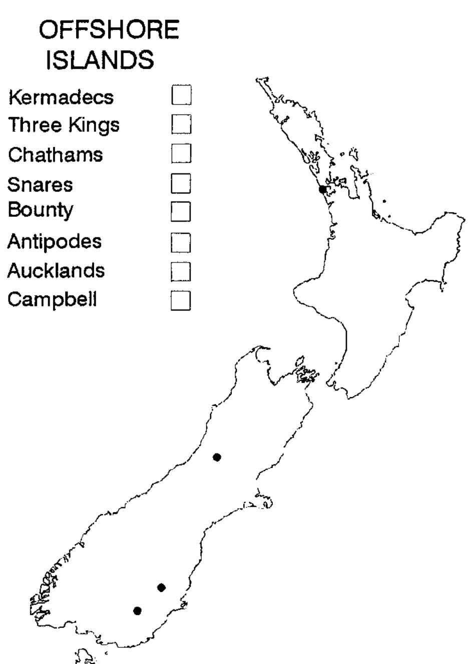

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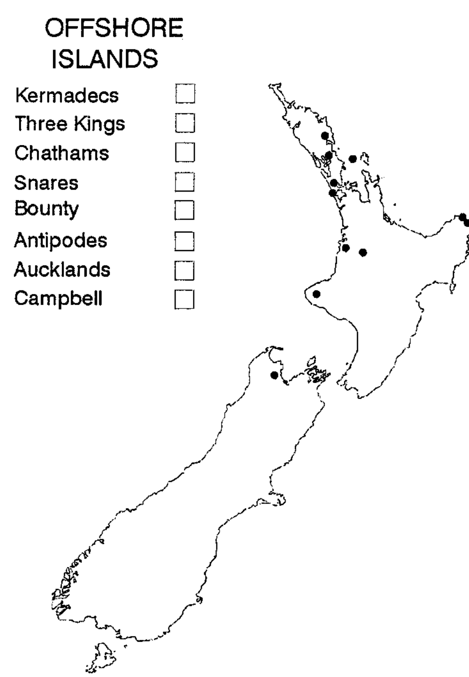

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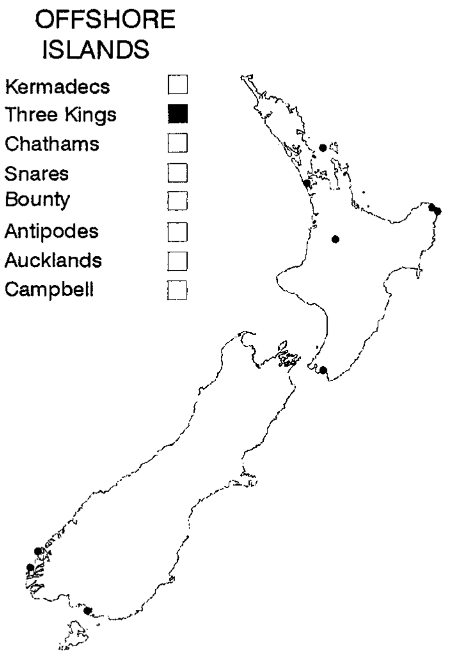

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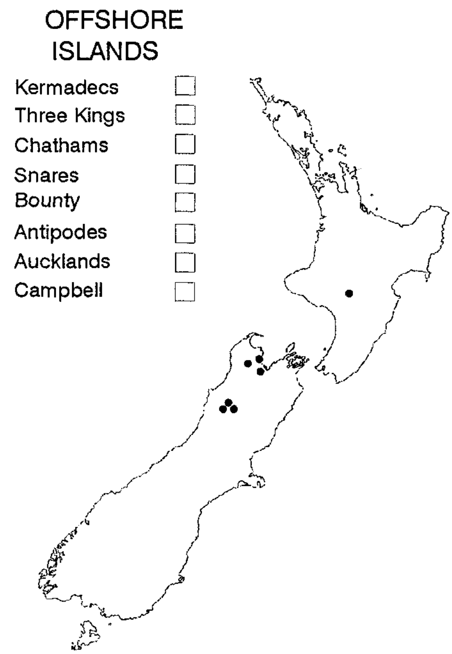

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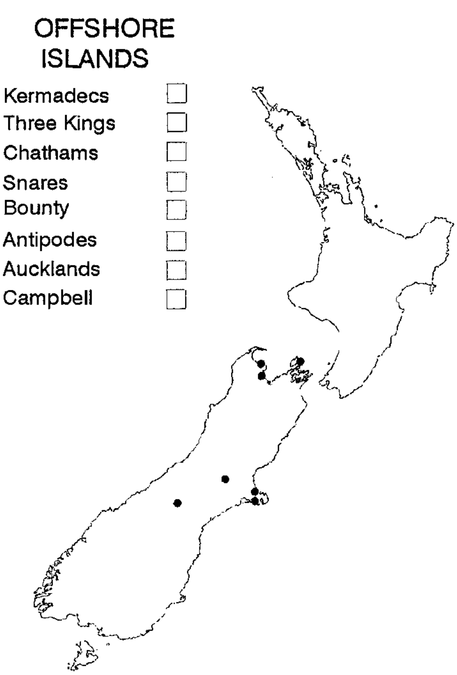

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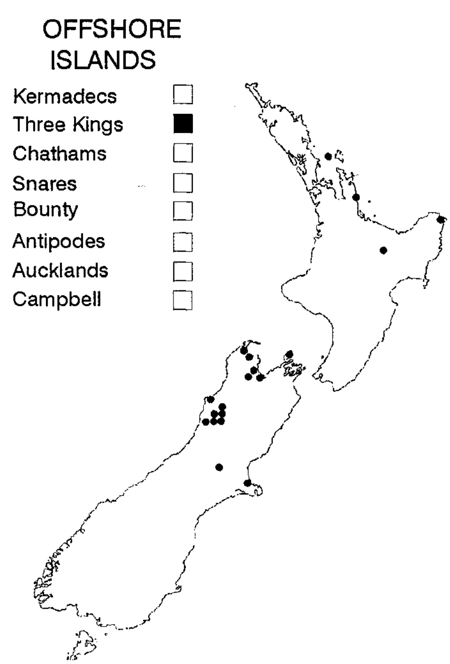

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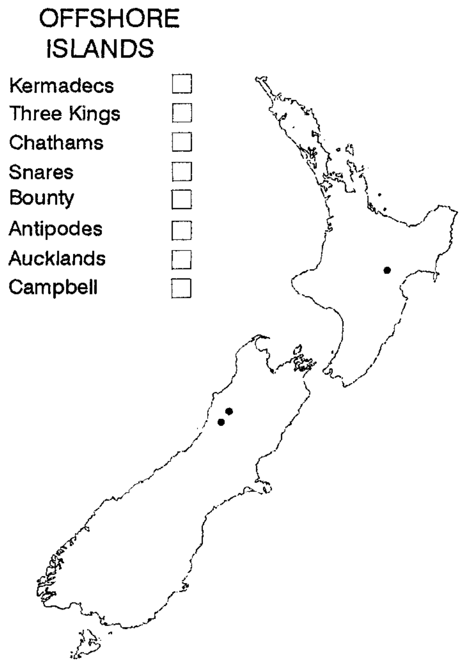

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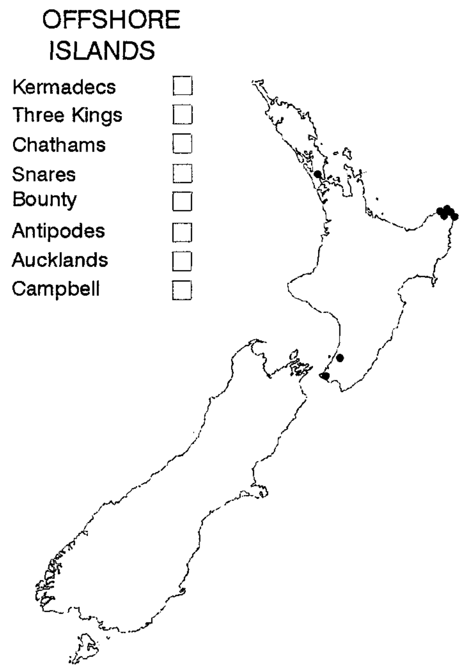

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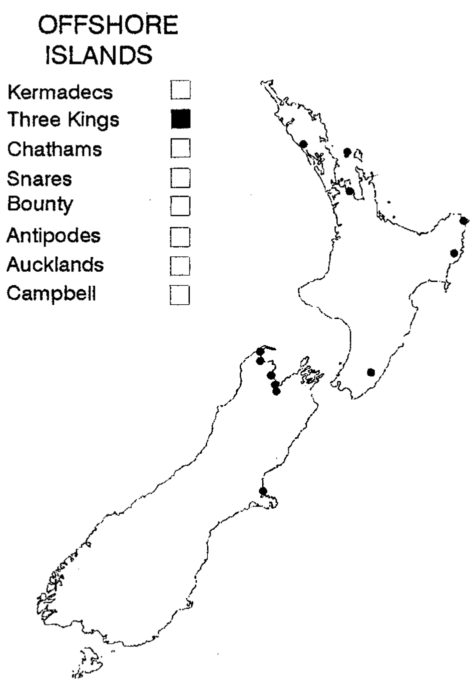

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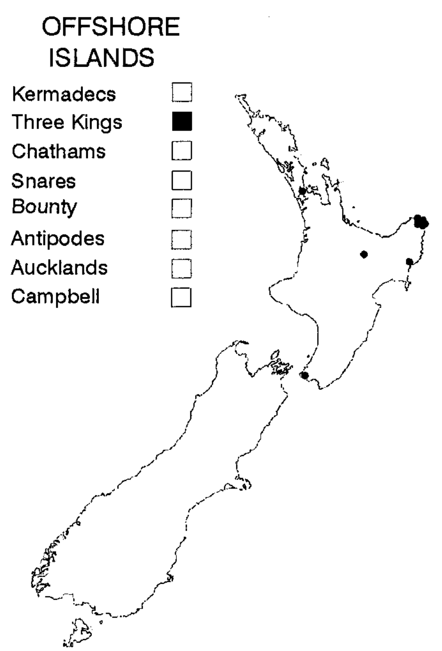

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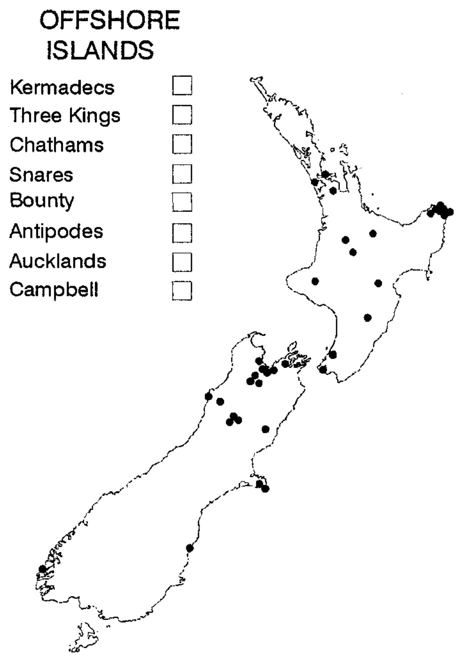

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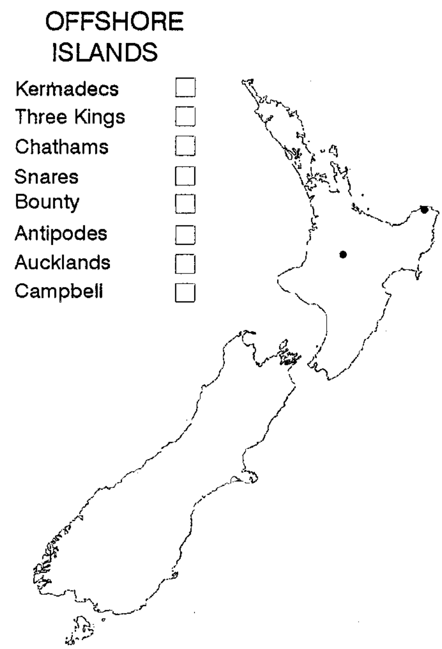

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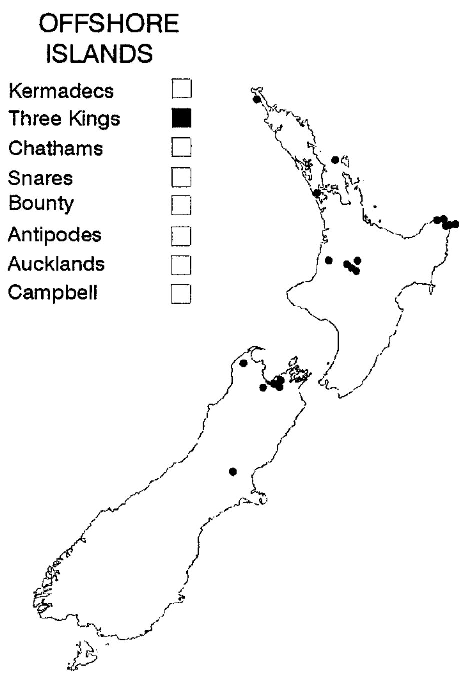

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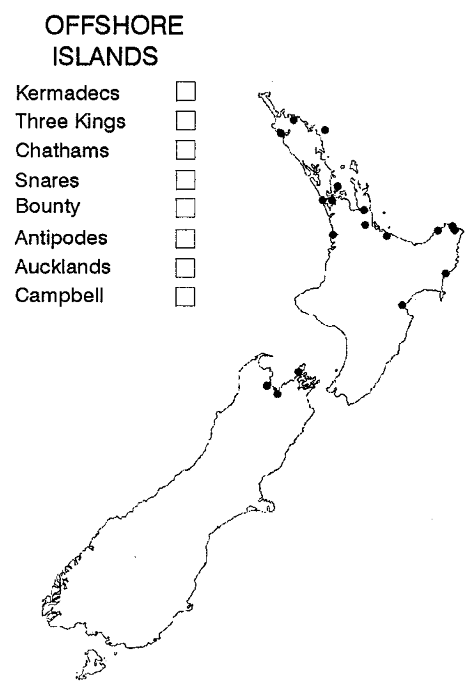

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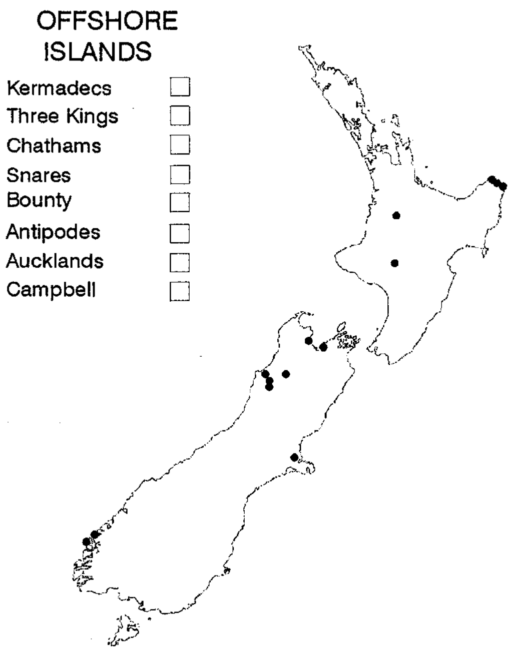

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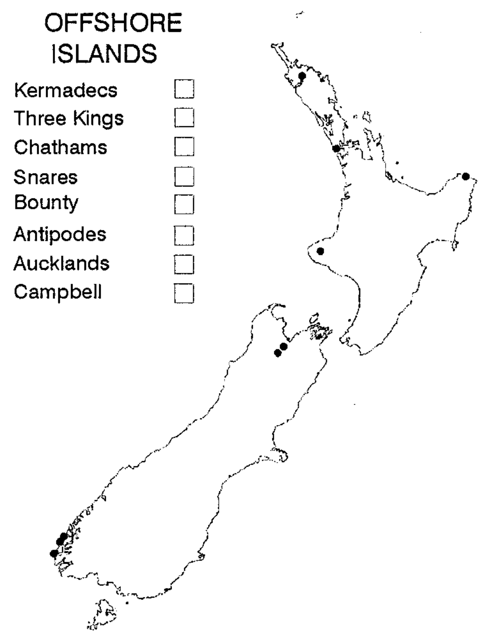

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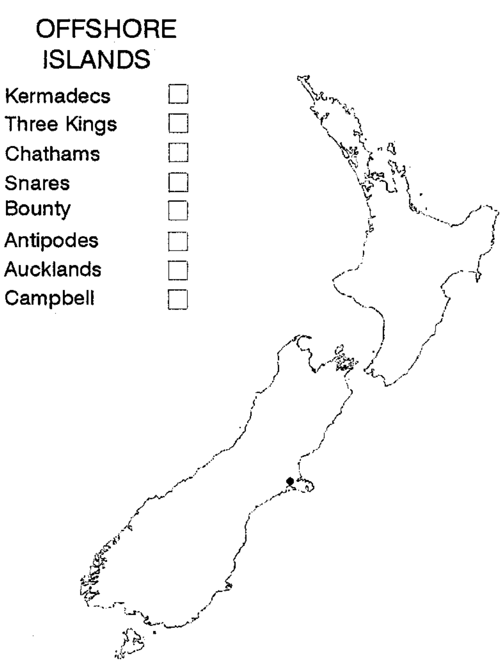

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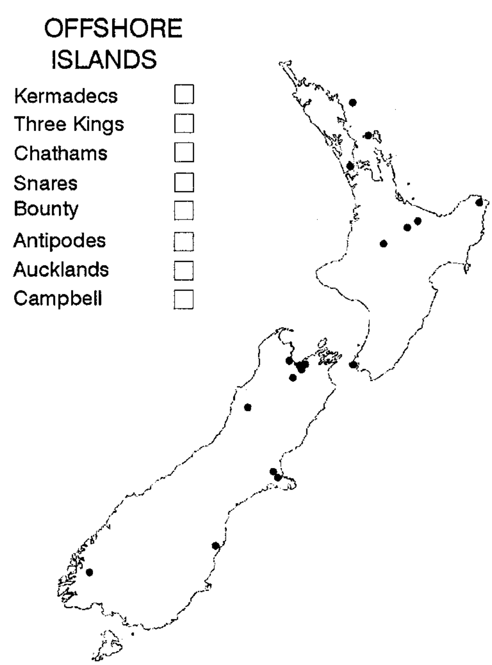

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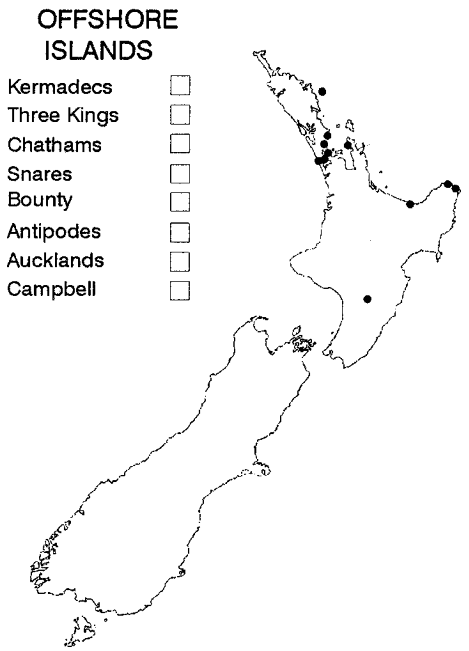

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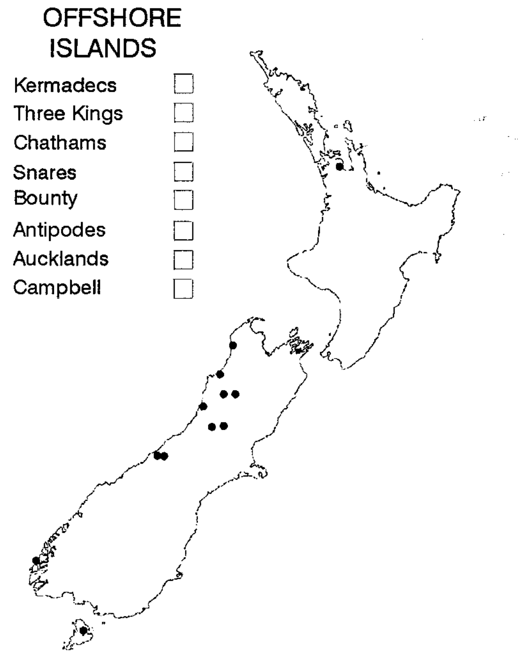

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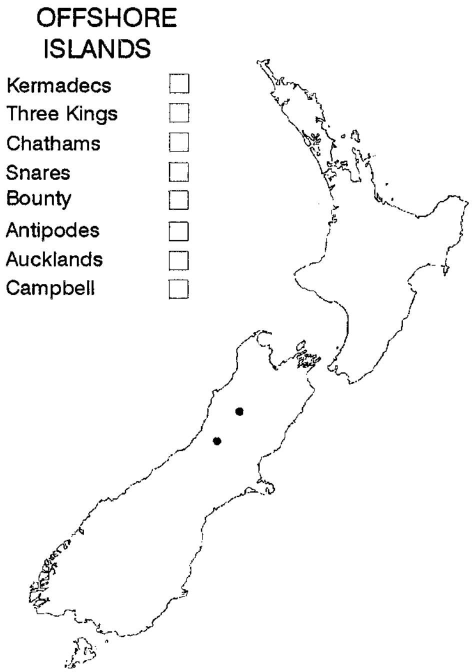

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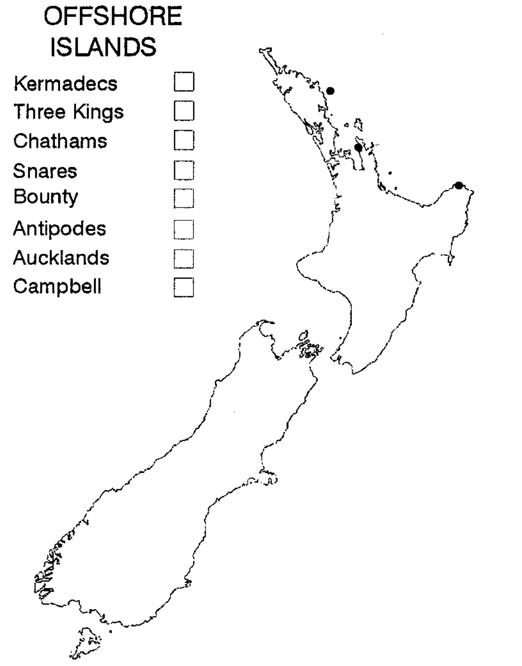

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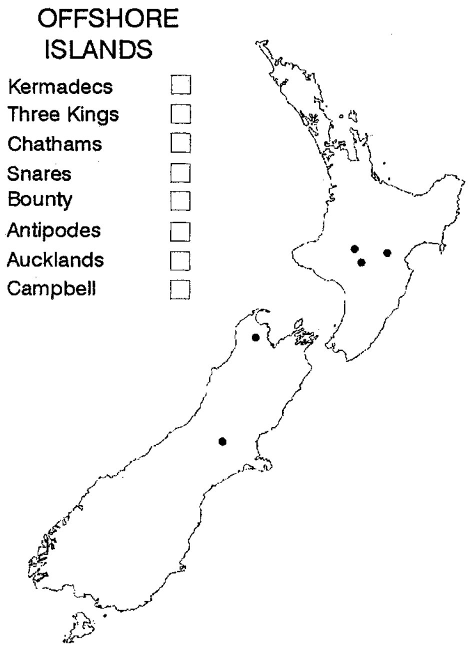
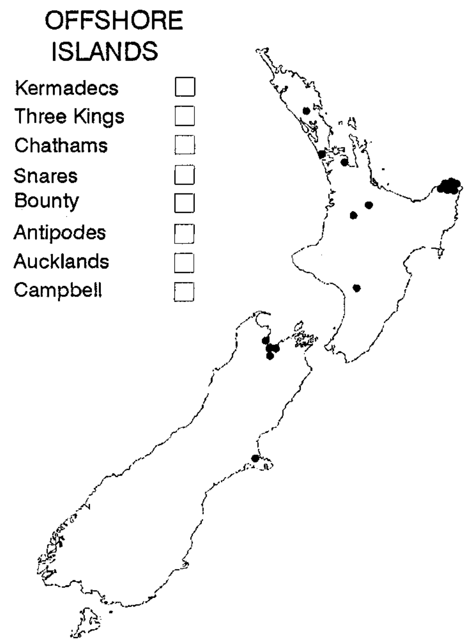


Map 29 Collection localities, *Plumichiton diadema.*



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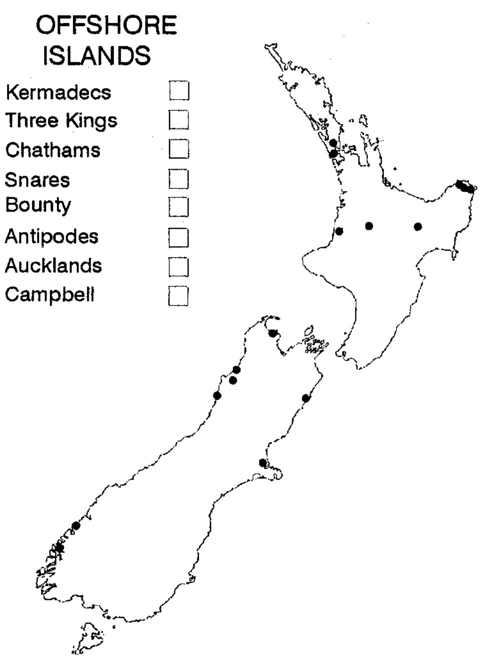

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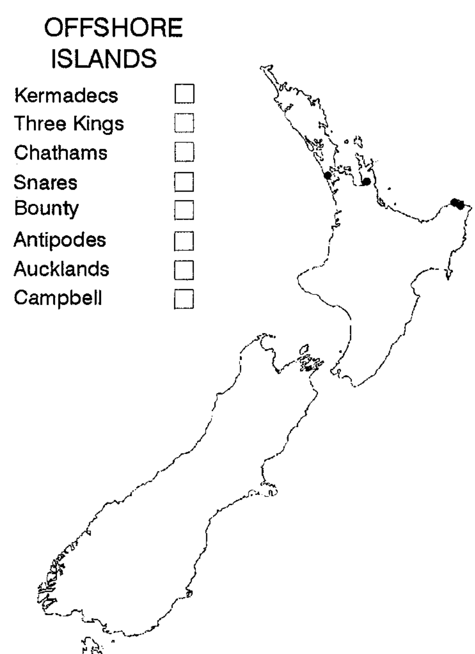

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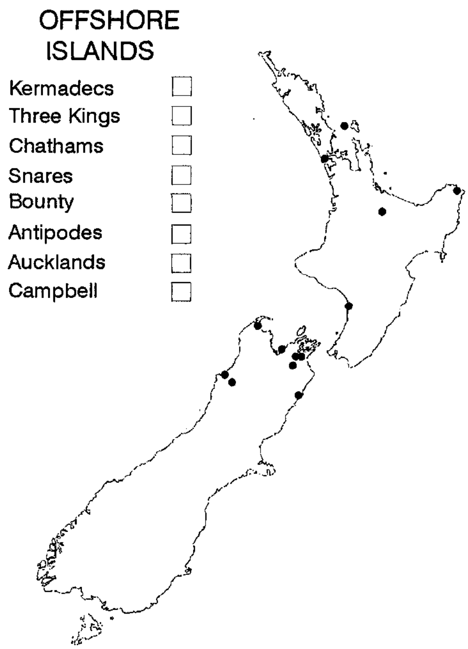

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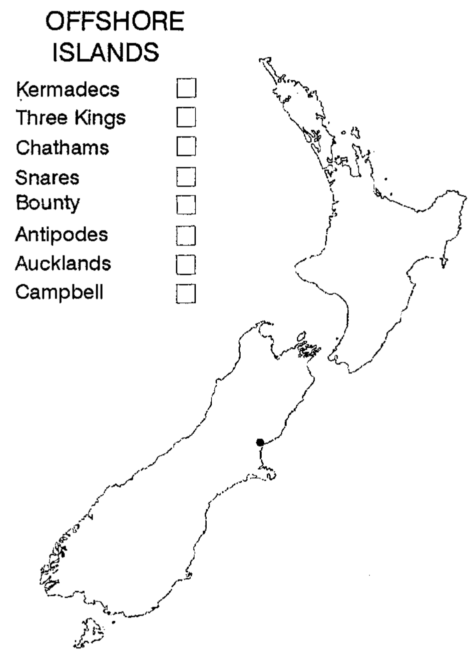

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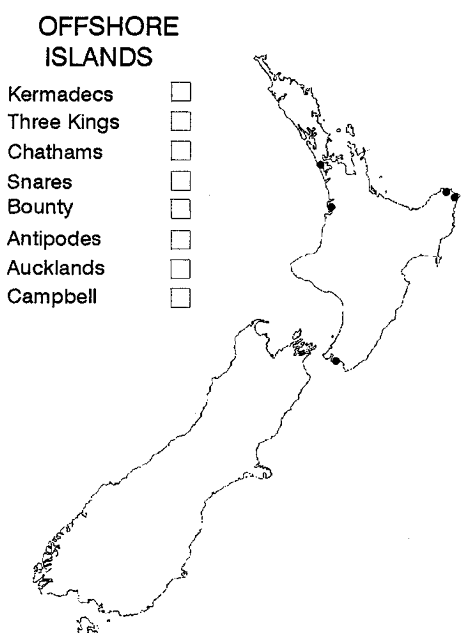

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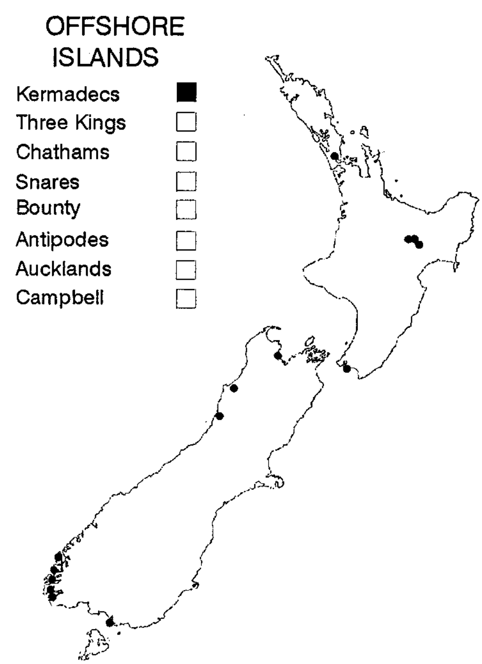

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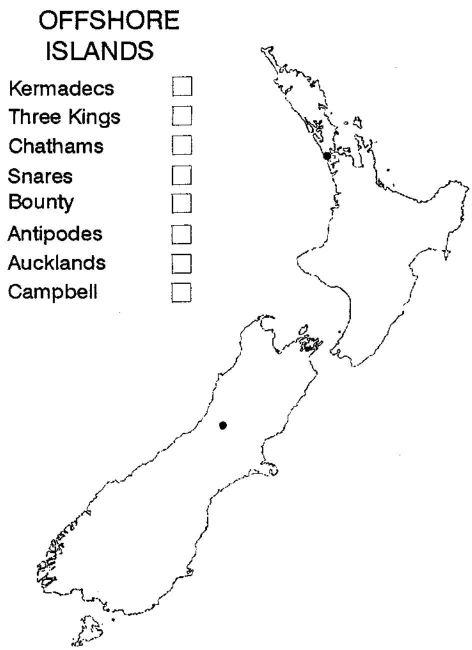

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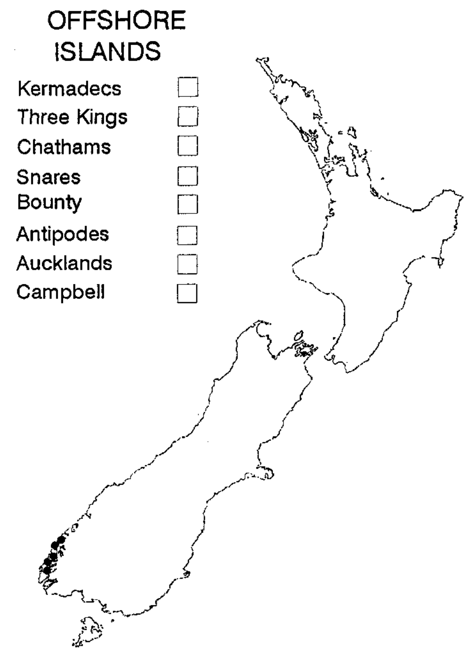

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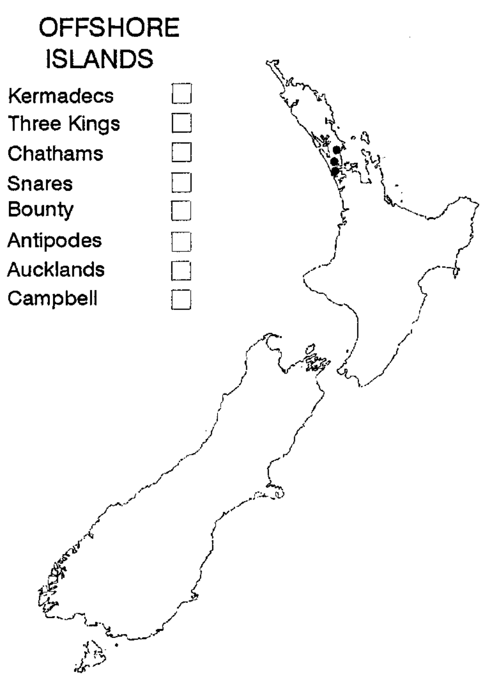

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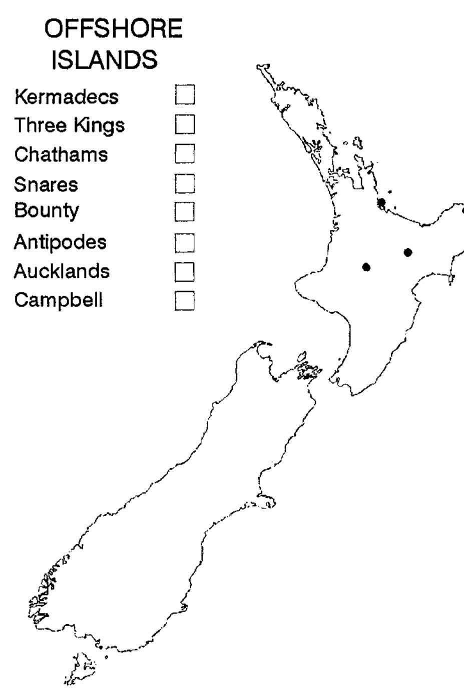

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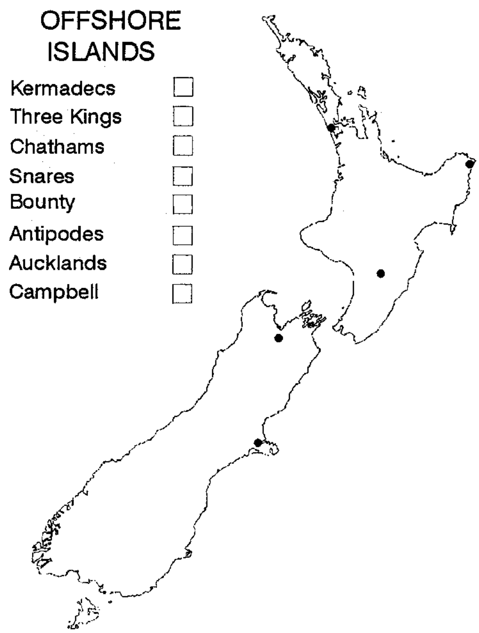

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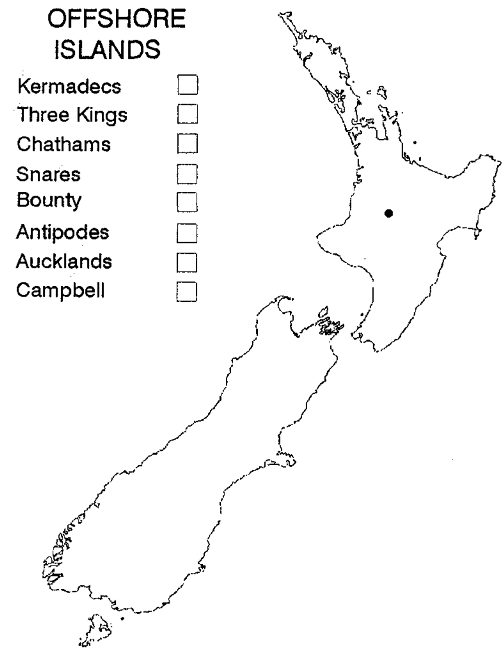

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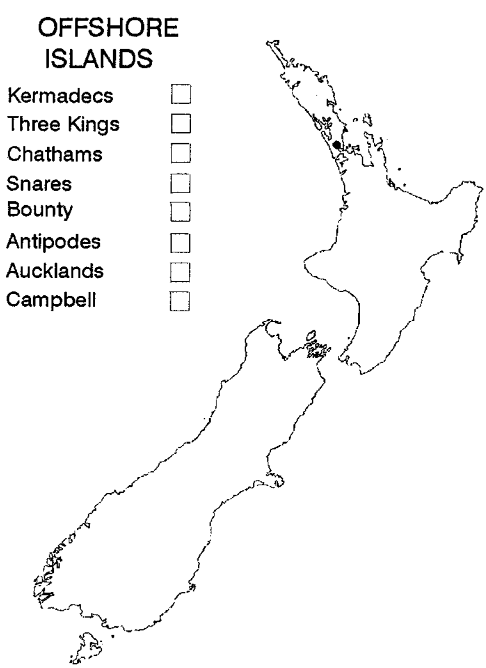

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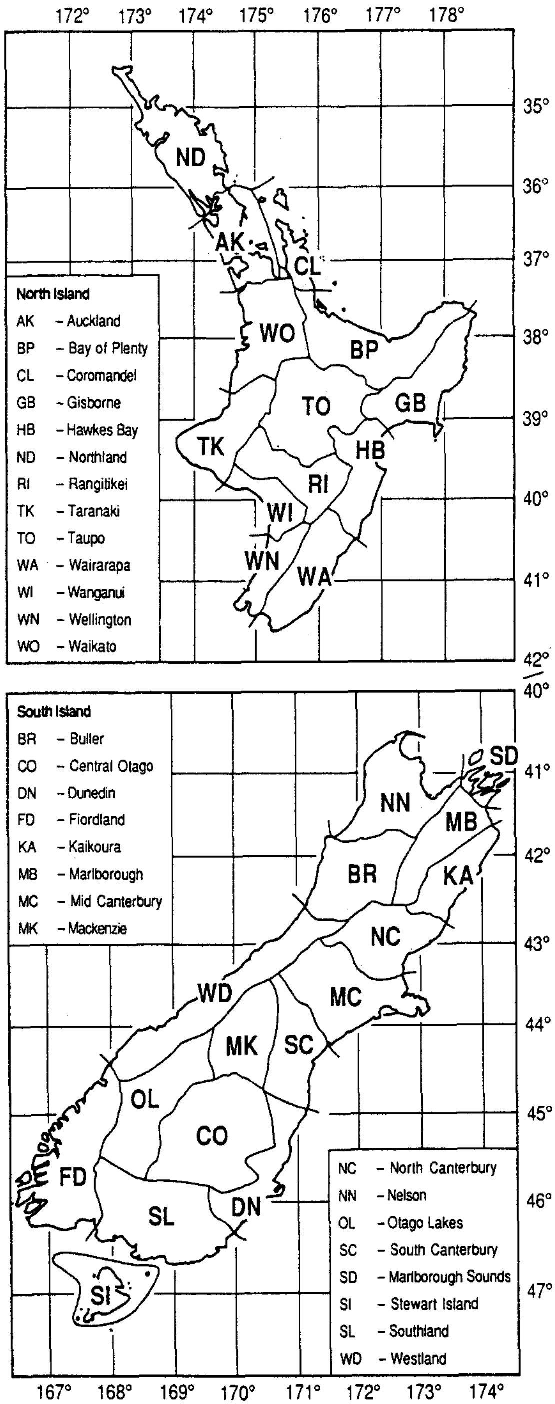
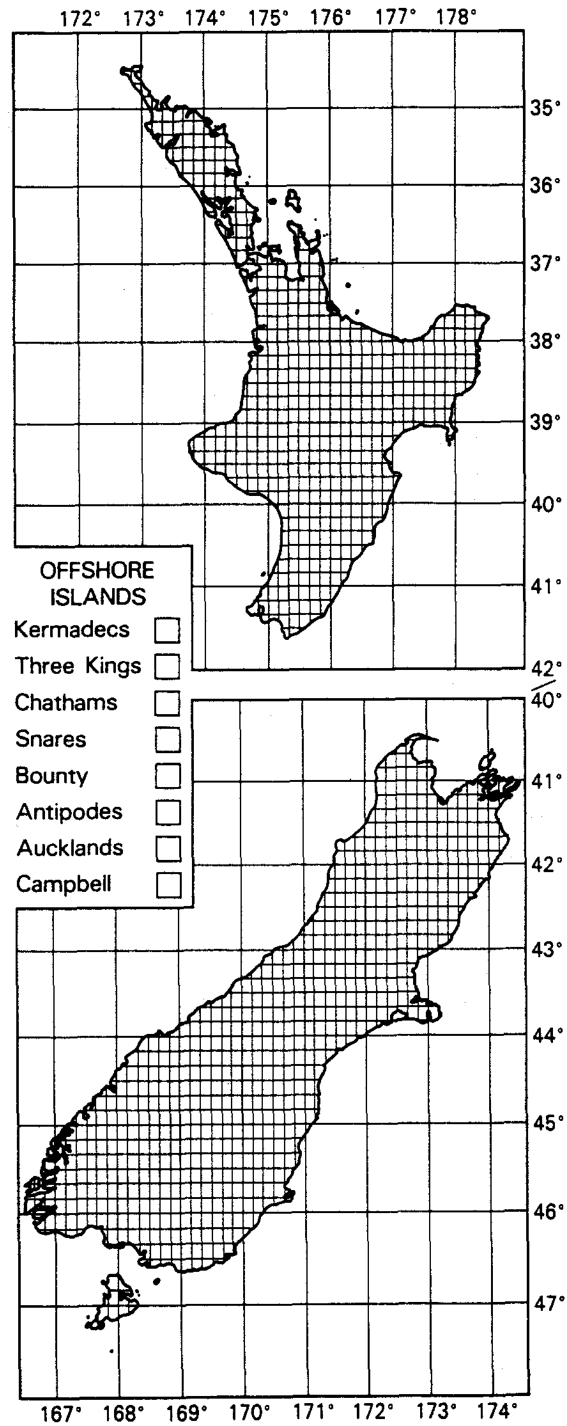
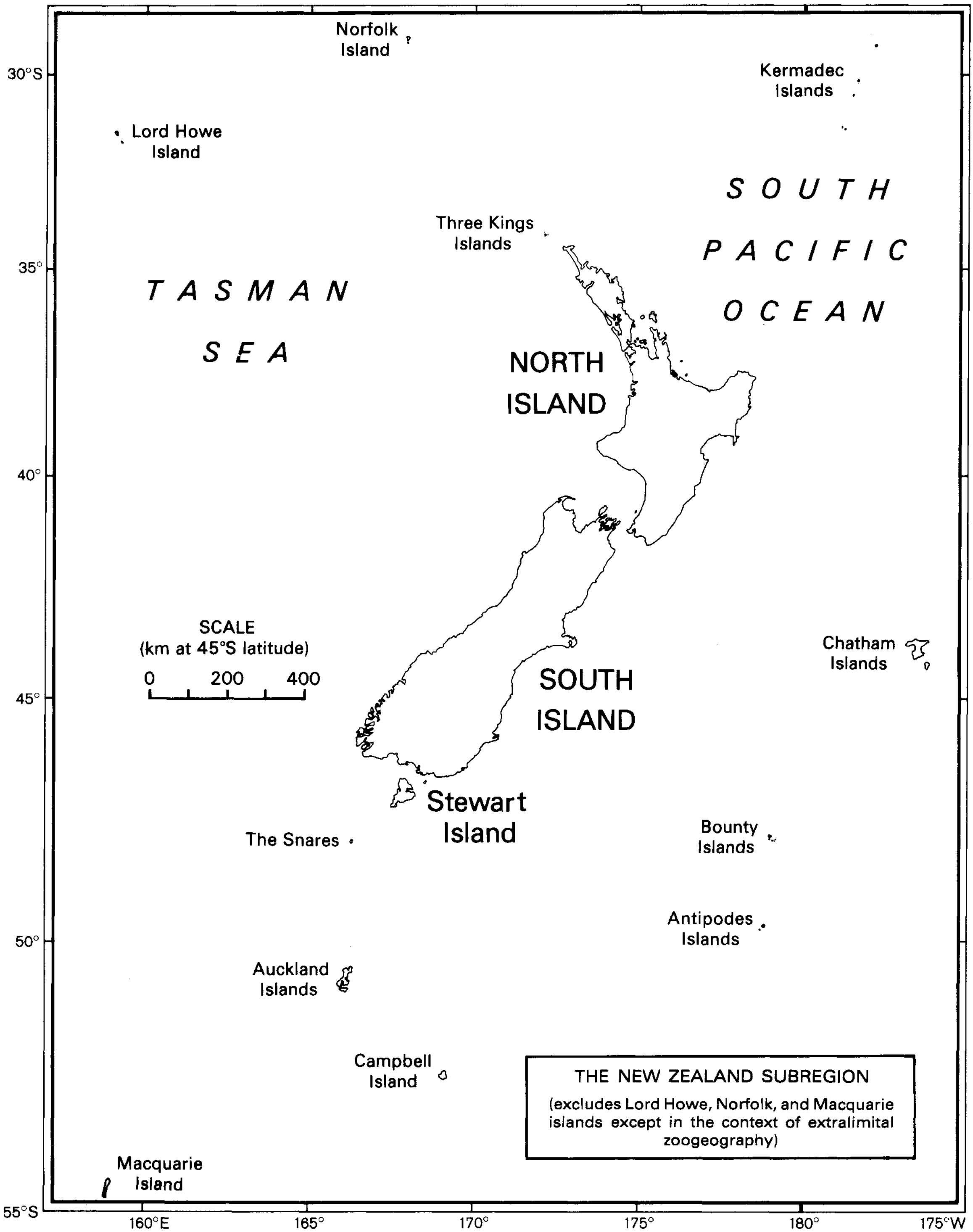


Area codes and boundaries used to categorise specimen locality data (after Crosby *et al.* 1976)



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


Norfolk Island
Kermadec Islands
30°S
Lord Howe Island
SOUTH PACIFIC OCEAN
Three Kings Islands
35°
TASMAN SEA
NORTH ISLAND
40°
SCALE
(km at 45°S latitude)
0 200 400
Chatham Islands
45°
SOUTH ISLAND
Stewart Island
The Snares
Bounty Islands
Antipodes Islands
50°
Auckland Islands
Campbell Island
THE NEW ZEALAND SUBREGION
(excludes Lord Howe, Norfolk, and Macquarie islands except in the context of extralimital zoogeography)
Macquarie Island
55°S
160°E
165°
170°
175°
180°
175°W

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NGĀ PĀNUI

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 tirotiro mā te tangata mehemea he āwhina kei reira.

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Ko te hunga pīrangi **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 tono i ōna wā anō.

Te utu (tirohia "Titles in print", whārangi 66). 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.

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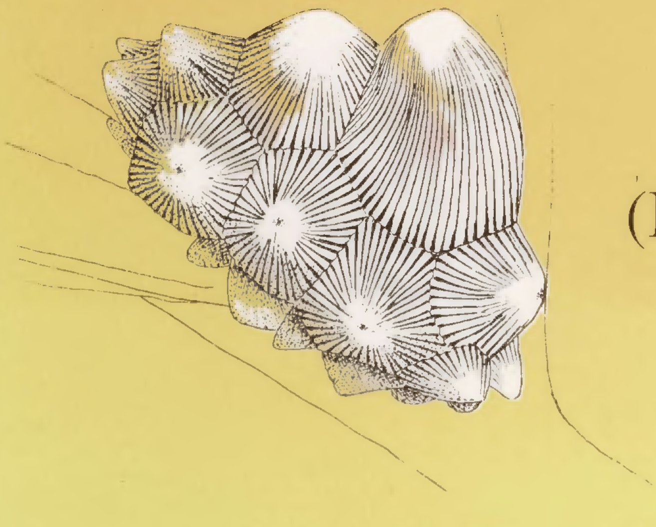

Coccidae

(Insecta : Hemiptera : Coccoidea)

C. J. Hodgson
R. C. Henderson

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