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o Aotearoa

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Fauna of New Zealand
Ko te Aitanga Pepeke o Aotearoa

Number / Nama 51

Coccidae

(Insecta: Hemiptera: Coccoidea) :
adult males, pupae and prepupae
of indigenous species

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**Manaaki
Whenua
P R E S S**

Lincoln, Canterbury, New Zealand
2004

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Cataloguing in publication

HODGSON, Christopher John

Coccidae (Insecta: Hemiptera: Coccoidea): adult males, pupae and prepupae of indigenous species /

C. J. Hodson & R. C. Henderson

– Lincoln, Canterbury, N.Z. : Manaaki Whenua Press, 2004.

(Fauna of New Zealand, ISSN 0111–5383 ; no. 51).

ISBN 0-478-09360-8

I. Henderson, R. C. (Rosa Constance) II. Title III. Series

UDC 595.752.3(931)

Suggested citation:

Hodgson, C. J.; Henderson, R. C. 2004. Coccidae (Insecta: Hemiptera: Coccoidea): adult males, pupae and prepupae of indigenous species. *Fauna of New Zealand* 51, 228 pp.

Prepared for publication by the series editor using computer-based text processing and layout at Landcare Research, Private Bag 92170, Auckland, New Zealand

Māori text by H. Jacob, Levin.

Published by Manaaki Whenua Press, Landcare Research, P.O. Box 40, Lincoln, Canterbury, N.Z.

Website: <http://www.mwpress.co.nz/>

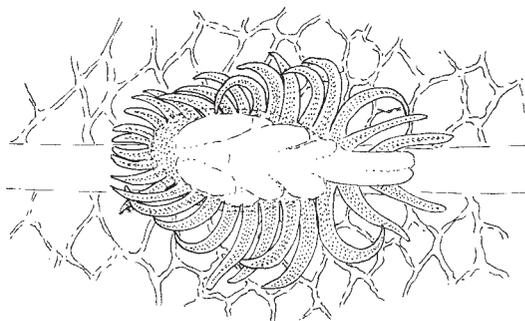
Printed by PrintLink Ltd, Wellington

Front cover: *Crystallotesta ornata* (Maskell): adult male and its test (Illustrator: C. J. Hodgson).

Publication of the *Fauna of New Zealand* series is the result of a research investment by the Foundation for Research, Science and Technology under contract number C09X0202.

POPULAR SUMMARY

HE WHAKARAPOPOTOTANGA

Class **Insecta**Order **Hemiptera**Suborder **Sternorrhyncha**Superfamily **Coccoidea**Family **Coccidae****Male soft scale insects**

The soft scale family Coccidae is one of ten families of plant sucking scale insects present in New Zealand. The adult females are relatively long lived (normally at least a month or more), and it is this stage that is usually found and thus most often used to identify any given species. The adult females differ greatly from the adult males and pass through 2 or 3 immature (nymphal) stages before finally moulting into a stage that is rather nymph-like but develops ovaries and can reproduce. Adult females lack wings and tend to have relatively short legs and antennae. In addition, the division of the body into head, thorax and abdomen is not obvious. It is this stage that is economically important. The adult females of all soft scale species known from New Zealand were described and illustrated by Hodgson & Henderson in 2000, when their biology, distribution, host-plant interactions, parasites and predators, and economic importance were discussed.

On the other hand, the adult males of all soft scales known from New Zealand are reasonably typical insects in that they have wings (although only the anterior pair are properly developed), long legs and antennae, and their body is clearly divided into head, thorax, and abdomen. However, they lack functional mouthparts and so live for only a day or two and are therefore much less well known – indeed, most of those studied have been reared in the laboratory. Even when the males described in this contribution are included, the adult males of less than 10% of the world's soft scale species are known.

The life cycle of the male differs significantly from that of the female. Males have a mobile 1st instar apparently identical morphologically to that of the 1st-instar female; these 1st instars are known as crawlers. They moult into a

(continued overleaf)

Illustration / Whakaahua: Test of 2nd-instar male of *Plumichiton elaeocarpi* (Maskell) on a leaf (Illustrator / Kaiwhakaahua: C. J. Hodgson).

Ngā pepeke unahi mohe tāne

Ko te whānau unahi mohe Coccidae tētahi o ngā whānau pepeke unahi tekau o Aotearoa he ngote tipu tā rātou mahi. Ka āhua roa tonu ngā uwaha pakeke e ora ana ki te mata o te whenua (ka kotahi marama, roa ake rānei), ā, koinei te tūātipu e kitea nuitia ana. Koinei anō i whakamahia nuitia ai te hanga pakeke hei tautuhi i ngā momo. He tino rerekē te āhua o ngā uwaha i ngā toa – e 2, e 3 rānei ngā tūātipu punua, kātahi ka kounu, ka puta ko te hanga pakeke e āhua rite tonu ana ki tō te punua, engari he whai kiato kākano, ka āheī anō ki te whakaputa uri. Kāore he parirau o te uwaha pakeke, he āhua poto anō ngā waewae me ngā pūhihi. Waihoki, kāore e tino mārama te kitea atu o ngā wehenga o te tinana, arā, o te upoko, te poho me te puku. Koinei te wā o tō rātou mataora e whai pānga ai ēnei pepeke ki te ōhanga. He mea whakaahua ā-kupu, ā-pikitia ngā uwaha pakeke o ngā momo unahi mohe katoa e mōhiotia ana i Aotearoa e Hodgson & Henderson i te tau 2000. I reira ka kōrerorerotia te koiora, te tītaringa, ngā hono ki ngā tipu e nohoia ana e ngā pepeke nei, ngā pirinoa, ngā hoariri me ngā pānga ohaoha.

Ko ngā toa pakeke o ngā unahi mohe katoa e mōhiotia ana i Aotearoa, he āhua rite te hanga ki te nuinga o ngā pepeke puta noa. Inā rā, he whai parirau (engari ko ngā parirau o mua anake e tino tika ana te hanga), he roa ngā waewae me ngā pūhihi, ā, he māmā noa iho te kite i ngā wehenga i waenga i te upoko, te poho me te puku. Heoi anō, kāore e kamū te waha, nō reira kotahi rā, e rua rā rānei te toa e ora ana ki tēnei ao. Nā

(haere tonu)

2nd stage nymph or instar that may initially be mobile but later settles (sometimes on a different plant species to those of the females) and feeds for a few weeks. As a 2nd instar, it secretes a glassy tent or test that completely covers the nymph, is firmly attached to the substrate by wax secreted by marginal tubular ducts around the margin, and forms a protective cover whilst the insect undergoes metamorphosis, shielding it from environmental excesses such as dehydration. The 2nd-instar nymph moults into the 3rd stage referred to as the prepupa, which lives beneath the test secreted by the 2nd instar and does not feed. The prepupa eventually moults into another non-feeding stage called a pupa and then finally into the adult male, still beneath the glassy test of the 2nd instar. This male cycle takes as long as that of the female so the males emerge at the same time as the adult females.

This volume of the *Fauna of New Zealand* describes all the known adult males, pupae, and prepupae of indigenous soft scales of New Zealand.

Contributor **Chris Hodgson** graduated from King's 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, mainly on soft scales, many of these publications covering the whole of the Ethiopian region. In 1967 he returned to England and lectured in Agricultural Entomology at Wye College, University of London 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 25 or so papers in this field, several of them on New Zealand scale insects, including an earlier volume on female soft scales in the *Fauna of New Zealand* Series. Chris has written, co-authored or edited 6 books, several book chapters and over 70 papers. In 1998, he organised

(continued overleaf)

konā i whāiti noa ake ai te mōhio ki ngā toa; ko te nuinga hoki kua rangahaua, he mea āta whakatipu ki rō taiwhanga pūtaiao. Ina tāpiria atu ngā kupu whakaahua i ngā toa o tēnei mahi rangahau nei ki ērā kua tuhia puta noa i te ao, kāore tonu e eke ki te 10% te rahi o ngā toa pakeke o ngā unahi mohe o te ao e mōhioitia ana.

He rerekē noa ake te mataora o te toa i te uwaha. Ka nekeneke ngā toa i te tūātipu tuatahi, ā, he rite tō rātou hanga i tēnei wā ki tō ngā uwaha. E rua, e rua, ka kīia he ngaoki i te tūātipu tuatahi. Ka kounu te toa, ka puta ko te tūātipu tuarua. Tērā pea ka nekeneke i te tūmatanga o tēnei tūātipu, engari kāore e roa ka tau te noho (tērā pea ka tatū ki tētahi tipu kē atu i tērā e nohoia ana e ngā uwaha), he kai te mahi mō ētahi wiki. I tēnei tūātipu tuarua, ka tukuna e te toa he kiri kōataata hei whakakapi i a ia. E honoa ana te 'tēneti' nei ki te mea e nohoia ana e te pepeke ki tētahi momo hararē ka tukuna e ētahi pū i te paenga o te pepeke. Hei kahu pītongatonga tēnei mōna kia kore ai ia e pakapaka i te hau, e raru rānei i ētahi atu āhuetanga taiao i te wā e huri ana tōna āhua. Kātahi ko te tūātipu tuatoru e kīia ana ko te ngeti-tōmua. Ka noho te ngeti-tōmua nei ki raro i te kahu i hangaia rā i te tūātipu tuarua, kāore e kai. Ka mea ā, ka kounu te ngeti-tōmua, ka puta ko te ngeti, ā, kāore tonu te mea nei e kai. Kotahi anō te kounutanga, ka puta ko te mea pakeke, e tiakina tonutia ana e te kahu kōataata o te tūātipu tuarua. He rite te roa e pakeke haere ana te toa me te uwaha, nō reira ka puta tahi ki te taiao ko ngā mea e rua.

I tēnei putanga o *Te Aitanga Pepeke o Aotearoa*, ka whakaahuatia te katoa o ngā toa pakeke, ngā ngeti me ngā ngeti-tōmua e mōhioitia ana o ngā pepeke unahi mohe māori o Aotearoa.

I puta ake tētahi o ngā kaituhi, a **Chris Hodgson**, i Te Kāreti o te Kīngi, Te Whare Wānanga o Rānana, i te tau 1960, ā, ka rua tau e whakaako ana i tētahi kura tūmatanui iti nei. I te tau 1962, ka neke ia ki Rhodesia, ka rima tau e mahi ana hei āpiha Rangahau mā ngā Ratonga Rangahautanga, Tohungatanga Whāiti, i Te Manatū Ahuwhenua. I taua wā ka tipu tana manako nui ki ngā pepeke unahi, me tana tuhi anō i ētahi pepa 16 ko te nuinga e pā ana ki ngā unahi mohe, ā, he maha anō e pā ana ki te rohe whānui o Ethiopia. I te tau 1967 ka hoki ia ki Ingarangi, ka noho hei pūkenga mō te Mātai Pepeke Ahuwhenua i te Kāreti o Wye, Te Whare Wānanga o Rānana, taka mai ki te tau 1999. I ōna tau tuatahi e 20 i reira, ko ngā aphid te aronga matua o tana mahi, tae atu ki te marara parirau-kore me ngā hononga i waenga i ngā aphid, ngā tipu me ngā wheori, koinei hoki te kaupapa o tana mahi rangahau tākutatanga. Ka tahuri mai anō a Chris ki ngā pepeke unahi i te tau 1990, ā, mai i taua wā, e 25

(haere tonu)

the VIIIth International Symposium on Scale Insect Studies at Wye. He “retired” in 1999 but is still working hard on scale insects at The National Museum of Wales in Cardiff, where he has been concentrating on the males and scale insect phylogeny.

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 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 UK for a short period, to work with Chris Hodgson at Wye College on this revision. Rosa is author or co-author of 24 scientific papers.

neke atu ngā tuhinga kua puta i a ia mō ngā unahi. Ko ngā pepeke unahi o Aotearoa te aronga o āna tuhinga maha tonu, tae atu ki tētahi atu putanga o *Te Aitanga Pepeke o Aotearoa* ko ngā unahi mohe uwaha te kaupapa. Ko Chris te kaituhi, tētahi rānei o ngā kaituhi, te ētita rānei o ētahi pukapuka e ono, ngā wāhanga pukapuka huhua, me ngā pepa e 70 neke atu. I te tau 1998, nāna i whakarite te Whakarauikatanga Tuawaru o te Ao e pā ana ki ngā Mātautanga Pepeke Unahi, i tū ki Wye. Ka mutu tana mahi tūturu i te tau 1999, engari kei te whakapau kaha tonu ia ki ngā pepeke unahi i te Whare Taonga ā-Motu o Wēra, i Cardiff. Ko ngā pepeke unahi toa me te whakapapa o ngā pepeke unahi āna tino kaupapa.

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 Tiroiro Āhuetanga 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 ngoikura me ētahi atu pūwereriki, e rua, e rua, kai ai i te pepeke unahi. Ko tēnei mahi whakamutunga, he kaupapa i whakatūria hei patu ā-koiora i ngā pepeke whakararu i te huakiwi. Nō te wāwāhanga o te DSIR i te tau 1992 kia 10 ngā Pūtahi Rangahau Karauna, ka noho a Rosa hei kaihangarau pūtaiao mā Manaaki Whenua. Ko tana kaupapa whāiti, ko te mātai i ngā pepeke 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 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. E 24 ngā tuhinga pūtaiao ko Rosa te kaituhi, tētahi rānei o ngā kaituhi.

Translation by **H. Jacob**
Levin

ABSTRACT

This contribution on soft scales (Coccidae: Coccoidea: Sternorrhyncha: Hemiptera) is divided into three parts. Part 1 describes and illustrates the adult males of 31 of the 43 indigenous soft scale species known from New Zealand. Part 2 describes and illustrates the 27 known pupae whilst part 3 describes and illustrates the 21 known prepupae. Keys to genera and species of each of these stages are provided as far as possible (some prepupae and pupae appear to be nearly identical). This is only the second study on adult males of any scale insect group for a complete geographic area and the first to include the pupae and prepupae.

Keywords: Hemiptera, Sternorrhyncha, Coccoidea, Coccidae, adult males, pupae, prepupae, taxonomy, keys, New Zealand.

Hodgson, C. J.; Henderson, R. C. 2004. Coccidae (Insecta: Hemiptera: Coccoidea): adult males, pupae and prepupae of indigenous species. *Fauna of New Zealand 51*, 228 pp.

Received: 30 June 2003. Accepted: 7 November 2003.

CHECKLIST OF TAXA

The column Female is the page number in *Fauna of New Zealand 41* (Hodgson & Henderson 2000), with the description of the adult female of each species.

Family Coccidae (indigenous species)

	Female	Male	Pupa	Prepupa
<i>Aphenochiton chionochloae</i> Henderson & Hodgson	68	—	—	—
<i>Aphenochiton dierama</i> Henderson & Hodgson	69	—	—	—
<i>Aphenochiton grammicus</i> Henderson & Hodgson	70	—	—	—
<i>Aphenochiton inconspicuus</i> (Maskell)	71	51	167	184
<i>Aphenochiton kamahi</i> Henderson & Hodgson	72	53	167	206
<i>Aphenochiton matai</i> Henderson & Hodgson	74	54	168	—
<i>Aphenochiton pronus</i> Henderson & Hodgson	75	—	—	—
<i>Aphenochiton pubens</i> Henderson & Hodgson	76	56	168	206
<i>Aphenochiton subtilis</i> Henderson & Hodgson	78	57	168	206
<i>Crystallotesta fagi</i> (Maskell)	87	64	—	—
<i>Crystallotesta fusca</i> (Maskell)	89	—	—	—
<i>Crystallotesta leptospermi</i> (Maskell)	90	66	169	—
<i>Crystallotesta neofagi</i> Henderson & Hodgson	92	—	170	—
<i>Crystallotesta ornata</i> (Maskell)	94	68	170	207
<i>Crystallotesta ornatella</i> Henderson & Hodgson	95	69	171	207
<i>Ctenochiton chelyon</i> Henderson & Hodgson	103	75	171	208
<i>Ctenochiton paraviridis</i> Henderson & Hodgson	105	76	172	—
<i>Ctenochiton toru</i> Henderson & Hodgson	107	—	—	—
<i>Ctenochiton viridis</i> Maskell	108	78	172	209
<i>Epelidochiton piperis</i> (Maskell)	112	81	173	209
<i>Inglisia patella</i> Maskell	117	83	173	210
<i>Kalasisis depressa</i> (Maskell)	124	89	174	210
<i>Kalasisis paradepressa</i> Henderson & Hodgson	126	—	—	—

<i>Kalasisis perforata</i> (Maskell)	127	90	174	211
<i>Lecanochiton actites</i> Henderson & Hodgson	132	95	175	211
<i>Lecanochiton metrosideri</i> (Maskell)	139	–	–	–
<i>Lecanochiton minor</i> (Maskell)	140	–	–	–
<i>Lecanochiton scutellaris</i> Henderson & Hodgson	141	96	175	212
<i>Plumichiton diadema</i> Henderson & Hodgson	144	–	–	–
<i>Plumichiton elaeocarpi</i> (Maskell)	151	102	–	–
<i>Plumichiton flavus</i> (Maskell)	153	104	176	212
<i>Plumichiton nikau</i> Henderson & Hodgson	155	106	176	–
<i>Plumichiton pollicinus</i> Henderson & Hodgson	156	107	177	213
<i>Plumichiton punctatus</i> Henderson & Hodgson	158	–	–	–
<i>Poropeza cologabata</i> Henderson & Hodgson	160	–	–	–
<i>Poropeza dacrydii</i> (Maskell)	164	111	177	213
<i>Pounamococcus cuneatus</i> Henderson & Hodgson	169	116	178	214
<i>Pounamococcus tubulus</i> Henderson & Hodgson	170	117	179	–
<i>Umbonichiton adelus</i> Henderson & Hodgson	173	125	–	215
<i>Umbonichiton bullatus</i> Henderson & Hodgson	179	126	180	215
<i>Umbonichiton hymenatherae</i> (Maskell)	180	128	–	–
<i>Umbonichiton jubatus</i> Henderson & Hodgson	181	130	180	–
<i>Umbonichiton pellaspis</i> Henderson & Hodgson	182	131	180	215
Species A (possibly <i>Crystallotesta fusca</i> (Maskell))	189	133	–	–

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Head	35	http://www.landcareresearch.co.nz/research/biodiversity/invertebratesprog/faunaofnz/extracts/FNZ41/fnz41ind.asp	
Thorax	37	See also Habitats of New Zealand soft scale insects: Ngā Ripoiinga o ngā Ngārara Unahi Mohi o Aotearoa online at:	
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ACKNOWLEDGMENTS

We are most grateful to Lewis Deitz, U.S.A.; Murray Fletcher, Australia; Jan Giliomee, South Africa, and Gary Miller, U.S.A., for their thorough and helpful reviews of the manuscript. Chris Hodgson is extremely grateful to the National Museum of Wales for providing him with research facilities.

This work was supported in part by the Foundation for Research, Science and Technology, New Zealand under Contract C09X0202.

INTRODUCTION

This paper describes the prepupae, pupae, and adult males of indigenous New Zealand soft scales, as far as the available material allows. Thus 43 species of indigenous soft scales are currently known from New Zealand and, of these, 21 prepupae, 27 pupae, and 31 adult males are described below. Introduced species are not covered.

This is only the second study on adult males of any scale insect group for a complete geographic area and the first to include the pupae and prepupae. The likely importance of the structure of the latter two groups in helping to understand the relationships within the family Coccidae is not yet known but knowledge of the structure of the adult males is considered to be essential.

Most studies on scale insects to date have been on the long-lived, and reasonably easily collected, adult females, although recently there has been a move to include the descriptions of other stages and these are proving useful in helping to confirm identifications and in clarifying taxonomic relationships. However, studies of the short-lived and rarely collected adult males have begun to offer real support to classifications based on phylogenetic analyses. This is because, although the adult females have relatively few characters and have a more "plastic" structure (which might allow them to undergo convergent evolution more easily than the more uniform males), the homology of adult male characters is much less doubtful, even between coccoid families, and there is an abundance of characters. Therefore this paper should provide a strong basis for a later phylogenetic study of the New Zealand soft scales, which is planned once all the immature stages have been described.

The history of scale insect taxonomy in New Zealand was described in the earlier volume (Hodgson & Henderson 2000), along with comments on the scale insect classification, biology, life cycle, distribution, host-plant associations, economic importance, predators and parasites, and collecting and mounting methods. Nevertheless, some of these topics need to be slightly augmented for this volume on the prepupal, pupal, and adult male stages.

Biology and life cycle. The life stages of a soft scale are shown in Fig. 1. The crawlers of male and female soft scales appear to be morphologically identical and it is this stage that does most of the dispersal. After a short feeding period and some growth, the crawler moults to become a 2nd-instar nymph and here the male and female nymphs can be fairly easily separated. Although both female and male 2nd-instar nymphs have well developed mouthparts and can feed, and both secrete a glassy wax tent or test which completely covers the body, the shape and structure of these tests are sexually dimorphic.

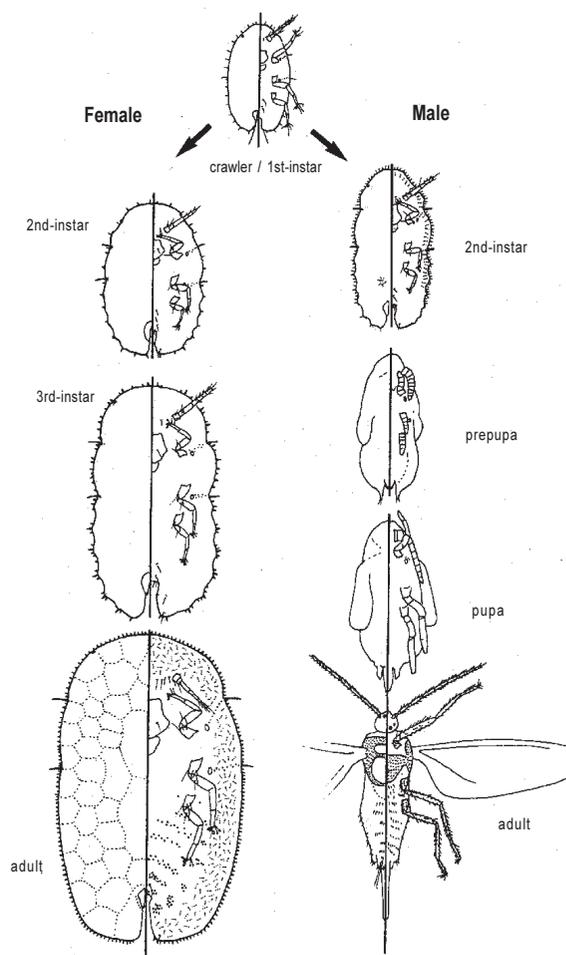


Fig. 1. Diagram showing the life stages of *Crystallotesta leptospermi* (Maskell). The left column shows the female stages and the right column the male stages. Note that male development involves a feeding 2nd-instar nymph and non-feeding prepupa, pupa, and adult male stages (after Hodgson & Henderson 2000).

The male test functions more like a box or garage (Henderson & Rhode 2001) and is firmly attached to the host-plant along its margin by wax secreted by marginal tubular ducts. This test forms a protective cover within which the insect undergoes metamorphosis, protecting it against environmental stress such as dehydration, etc. Eventually the 2nd-instar nymph moults into the 3rd stage referred to as the prepupa. The prepupa lives beneath the test secreted by the 2nd instar and does not feed. Eventually it moults into another non-feeding stage called a pupa and then finally into the adult male, still beneath the glassy test of the 2nd instar. This male cycle takes as long as that of the female so that the males emerge at the same time as the adult females.

The test of female indigenous coccids is constructed of a series of wax plates that increase in size as the insect grows and that are separated by sutures. In the tests of all known indigenous male coccids (Fig. 3–12), except the two *Pounamococcus* species, the wax plates are all fused together to form a rigid cover, but with an additional single suture separating a hinged plate at the posterior end (the back plate of Henderson & Rhode 2001) that eventually allows the male egress from the test after eclosion. Oddly, this back plate suture forms across the median of a transverse row of fused plates, rather than along an original suture line between plates (Fig. 7–11). However, the male tests of the two *Pounamococcus* species are constructed differently, with the plates not fused together (Fig. 13) but rather held together by criss-crossed wax strands on the inner surface of the sutures (Fig. 14). These joining wax strands are lacking on the lateral and median sutures near the posterior end of the test, thus forming an equivalent back plate, although the strands do form a pair of hinges on the corners where these plates meet.

During metamorphosis, the sticky wax holding the margin of the back plate to the substrate weakens, enabling the back plate to be lifted up a little. At each successive moult, the exuvia is shucked off posteriorly as the male wriggles to the posterior end of its test. At the same time, the back plate flexes upwards while held in place by a pair of wax hinges (Fig. 12), very much like a tilting garage door, and the exuvia is pushed out from beneath it (Fig. 2). The insect then moves forward inside the test and the back plate closes down again, apparently under its own weight. After the final moult to adult, the male rests inside the test for 2–3 days while its wings harden and its caudal wax filaments (if it has them) are produced. The white wax filaments protrude from under the back plate when fully developed; their function is unknown. The adult male emerges backwards with its wings folded across its body, possibly forming a smooth surface to slide beneath the test

and protect the more delicate abdomen. The antennae are held along the body length until after emergence when they are spread to the side and forwards and may be used as tactile appendages.

Being particularly fragile and short-lived, adult male coccids are seldom collected live in the field unless still in their pre-emergent phase, when they can be brought into the laboratory and observed. The emergence of an adult male from its test has not been fully observed, because they tend to come out after dark. However, the mechanics of emergence can be demonstrated by the structure of the test and the way it functions during the expelling of prepupal and pupal exuviae by the late-stage males (Henderson & Rhode 2001; Fig. 2). When collected on leaves or stems cut from the host plant, we have had some success rearing adult males from the pupal stage, but usually not from prepupal stage and never from the 2nd-instar.

The stance of an emerged adult male tends to be with head held higher than the rest of its body, appearing to “look around” rather like a jumping spider, and with its forelegs straighter than the other 2 pairs of legs. Flight take-off is very quick and may in part involve a spring into the air. Prior to flight, the wings are held in a delta shape, not meeting along the mid-line. The caudal-wax filaments may drag on the substrate or be flicked up when the abdomen is flexed upwards. The dorsal eyes appear to be used for orientating with the light and the ventral eyes for searching the substrate. Full mating has not been observed, but adult males, presumably attracted by chemical stimuli in particles of remaining waxes, persisted in the exploration of sites from which females had been removed. The males then bent the abdomen down and forward as though trying to insert their penial sheath into the site.

The bodies of most live adult males are usually variations of brown, sometimes more red-brown or lighter pinkish-brown, with dark eyes that may be dark brown or black. However, the adult male of *Inglisia patella* is pale yellow with red eyes, and the male of *Aphenochiton pubens* is pale green on the abdomen and light brown on the thorax. The head, thorax, and legs of all males appear much darker than the abdomen because they are more sclerotised. The wings are usually pale beige, with the radial vein forming a slightly darker line.

The structure of the male test can be very useful in identification. As their name suggests, *Plumichiton* species often have ornate wax plumes, that of *Plumichiton elaeocarpi* being particularly fine, with glassy-wax curls around the edge and softer plumes curling forwards like waves in the middle. The male test of *Lecanochiton scutellaris* also has a soft wax plume that resembles a tiny sail. Of the species that have rows of glassy wax plates in

(text continued page 33)

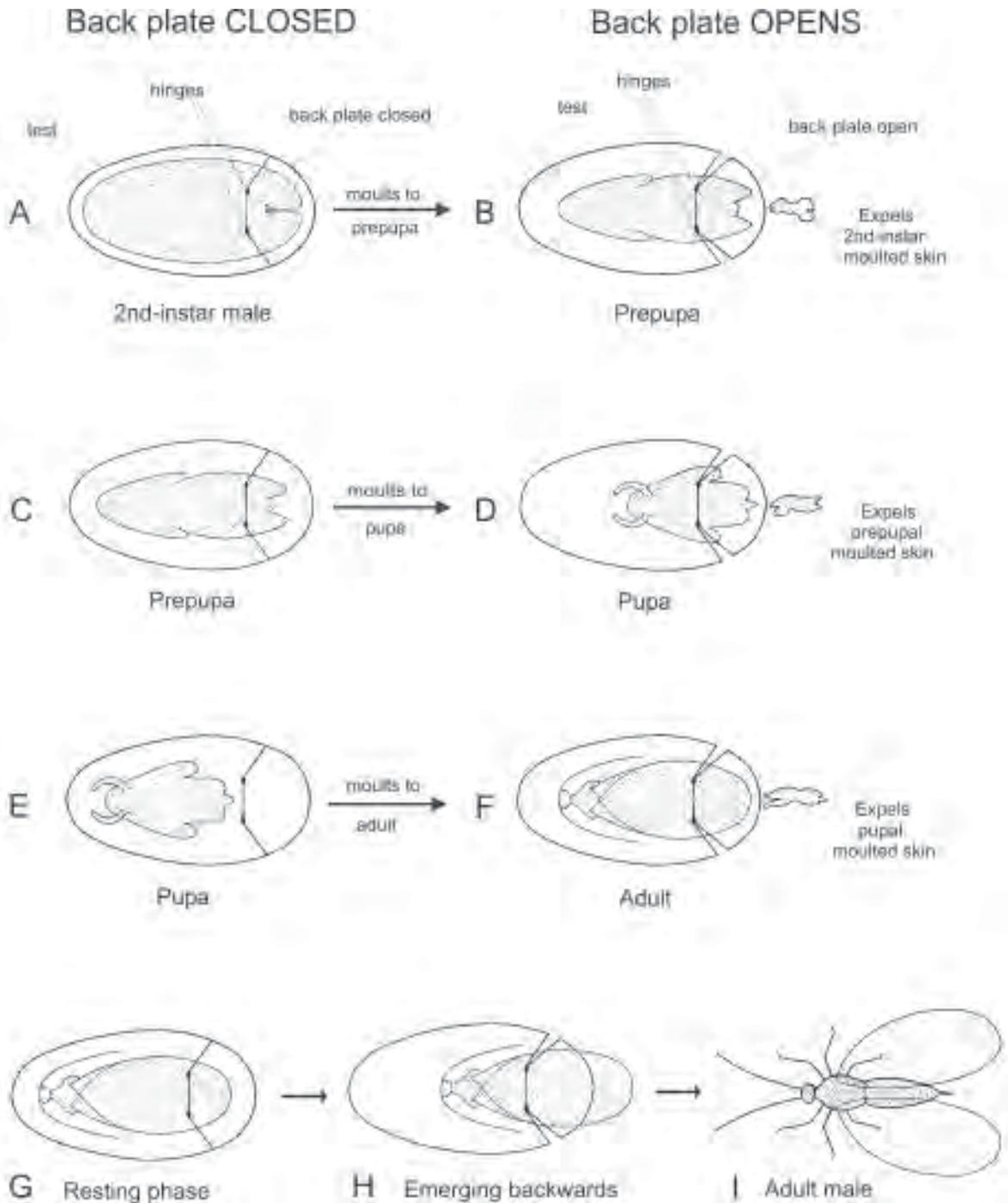


Fig. 2 Sequence of the opening and closing of the hinged back plate by the developing male for expelling in turn its 2nd-instar, prepupal, and pupal moulted exuviae, and finally its emergence as the adult male. (A) 2nd-instar male. (B–C) prepupa. (D–E) pupa. (F–I) adult male (after Henderson & Rhode 2001, with permission from Elsevier).

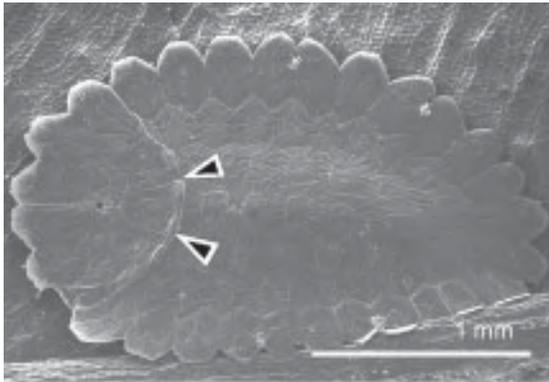
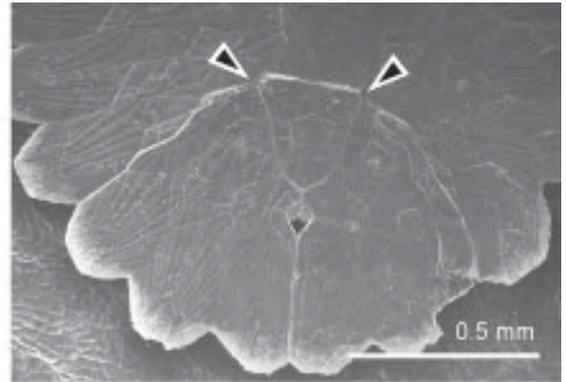
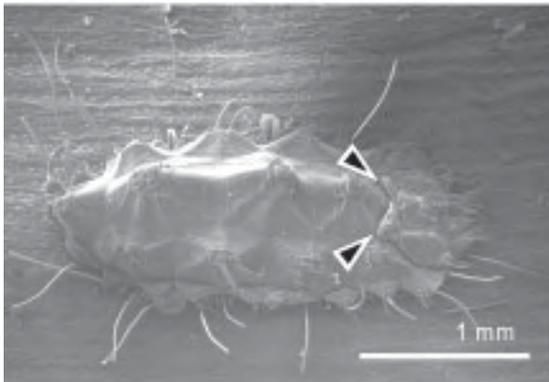
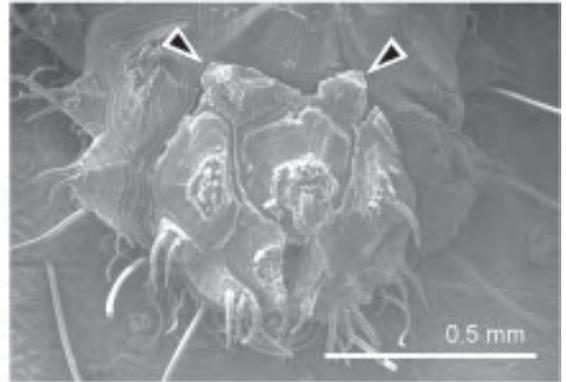
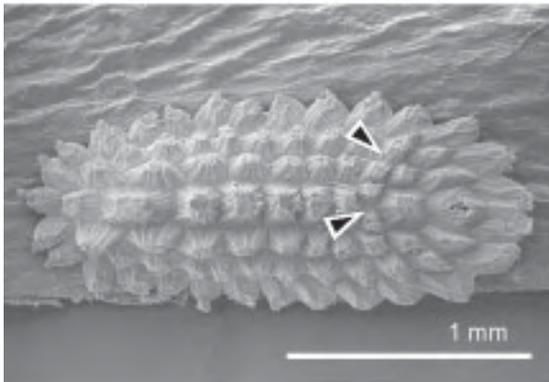
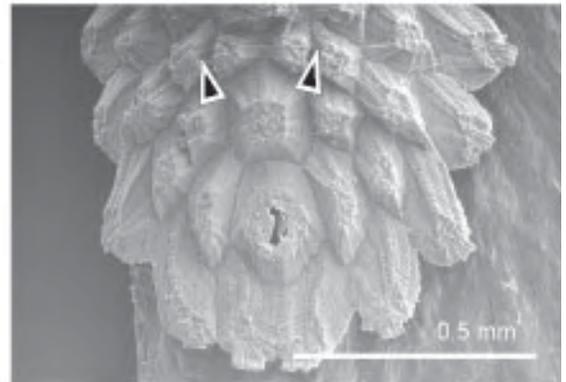
[3] *Aphenochiton subtilis*, male test[4] *Aphenochiton subtilis*, male test back plate[5] *Crystallotesta ornata*, male test[6] *Crystallotesta ornata*, male test back plate[7] *Umbonichiton bullatus*, male test[8] *Umbonichiton bullatus*, male test back plate

Fig. 3–8 Scanning electron micrographs (SEMs). Dorsal views of three types of male test with fused plates and single suture across the middle of a transverse row of plates; whole test (left), and hinged back plate with back plate suture (right); arrowheads indicate hinges. (3–4) Thin, flat test of *Aphenochiton subtilis*; (5–6) Reduced number of thick plates on convex test of *Crystallotesta ornata*; (7–8) Convex, knobby test of *Umbonichiton bullatus*. (3–4 and 7–8 after Henderson & Rhode 2001, with permission from Elsevier).

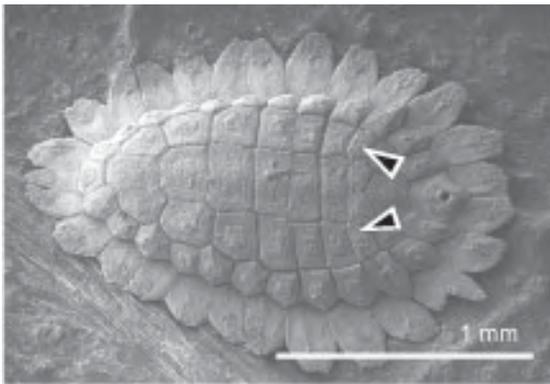
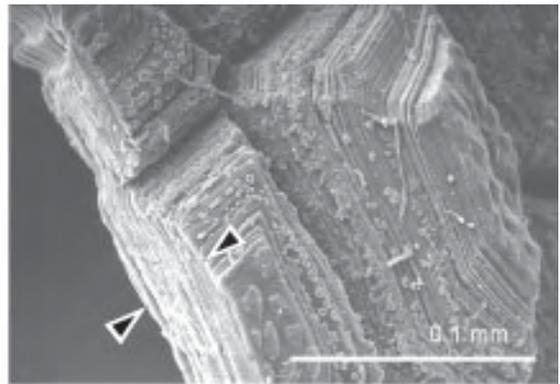
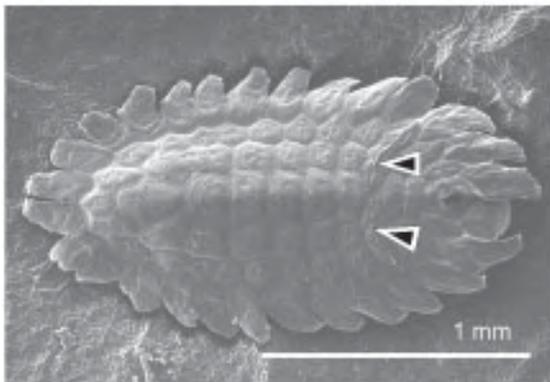
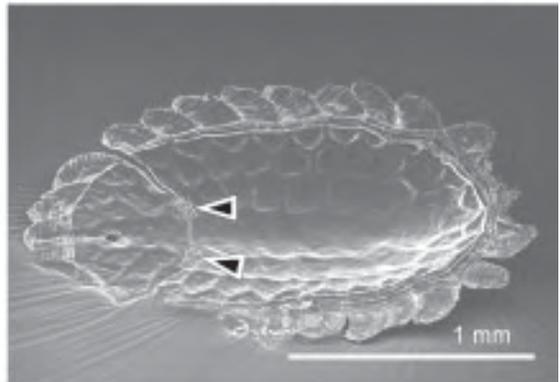
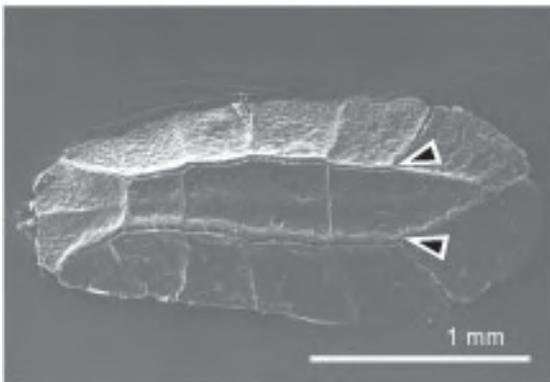
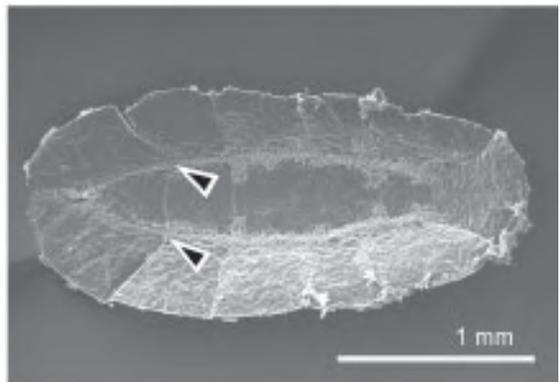
[9] *Epelidochiton piperis*, male test[10] *Epelidochiton piperis*, structure at back plate suture[11] *Ctenochiton paraviridis*, male test[12] *Ctenochiton paraviridis*, male test, inner surface[13] *Pounamococcus cuneatus*, male test[14] *Pounamococcus cuneatus*, male test, inner surface

Fig. 9–14 Scanning electron micrographs (SEMs). Structure of three types of male test. (9–10) *Epelidochiton piperis*: (9) dorsal view of moderately convex, single suture test (arrowheads indicate hinges); (10) abscission surface of part of back plate suture, bisecting layered wax plates (arrowheads) and not on original suture line. (11–12). *Ctenochiton paraviridis* (arrowheads indicate hinges); (11) dorsal view of thin, slightly convex test with single back plate suture; (12) inner surface view, pair of hinges formed from wax strands. (13–14) *Pounamococcus cuneatus* (arrowheads indicate hinges): (13) dorsal view of multiple suture test with fifteen plates; (14) inner surface view; plates held together by criss-crossed wax strands except laterally and medially at equivalent back plate suture. (After Henderson & Rhode 2001, with permission from Elsevier).

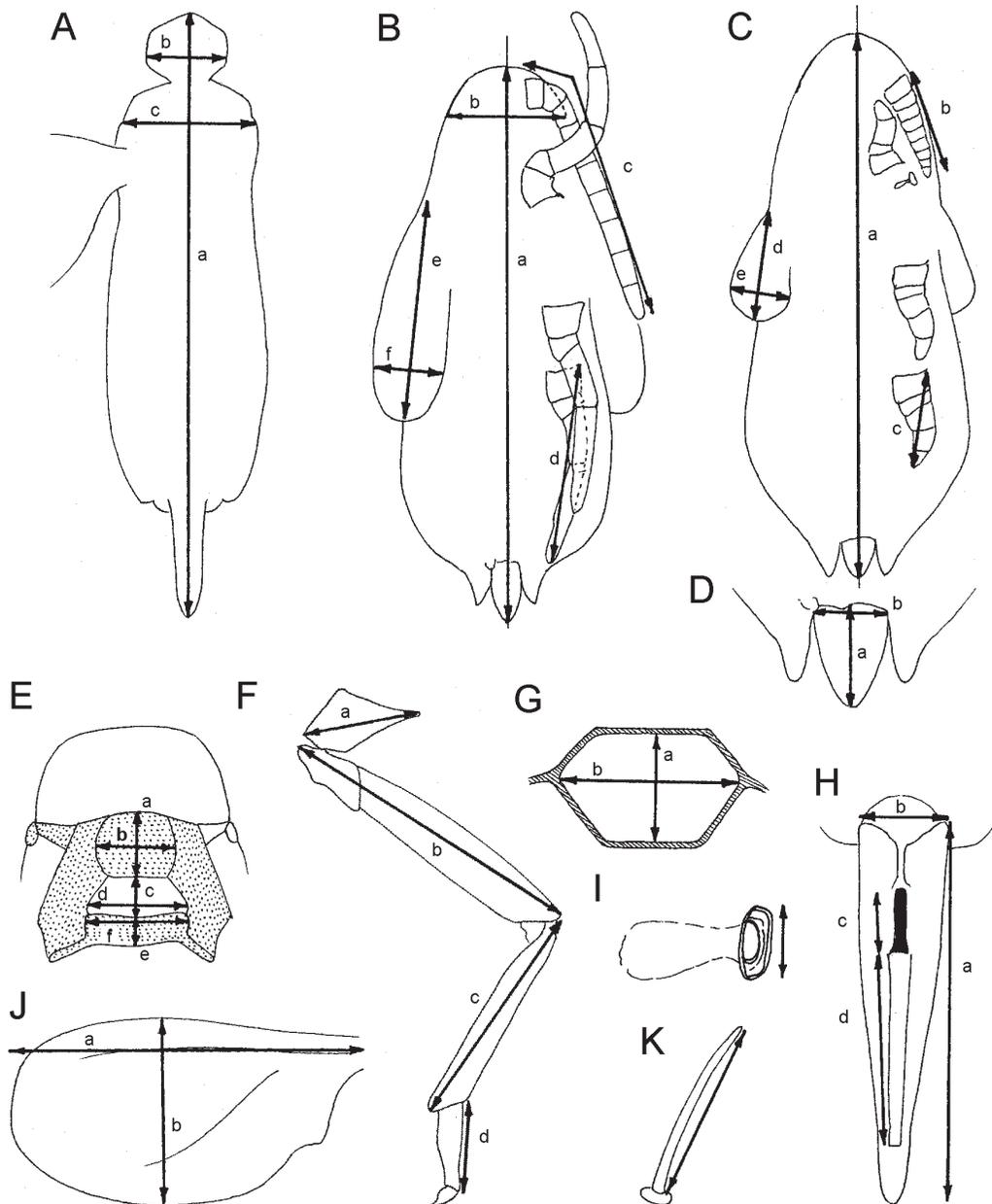


Fig. 15 Diagrams showing how most of the measurements given in the descriptions were taken. (A) Adult male; a = total body length, b = width across genae, c = width across thorax (between triangular plates). (B) Prepupa; a = total body length, b = antennal length, c = metathoracic leg length, d = wing-bud length, e = wing-bud width, f = wing-bud width. (C) Pupa; a = total body length, b = head width; c = antennal length (note that this is not a straight-line measurement), d = metathoracic leg length, e = wing-bud length, f = wing-bud width. (D) Width of spiracular peritreme. (E) Length (a) and width (b) of penial sheath of prepupa and pupa. (F) Length of fleshy seta (note that it does not include basal socket). (G) Adult male penial sheath; a = penial sheath length, b = width of base of penial sheath, c = length of basal rod, d = length of aedeagus. (H) Wing length (a) and width (b). (I) Dorsal mesothorax; a = length of prescutum, b = width of prescutum, c = length of membranous area of scutum, d = width of membranous area of scutum, e = length of scutellum, f = width of scutellum. (J) Basisternum length (a) and width (b) (note latter is "inner" width, between ridges). (K) Leg lengths; a = length of coxa, b = length of trochanter + femur, c = length of tibia, d = length of tarsus.

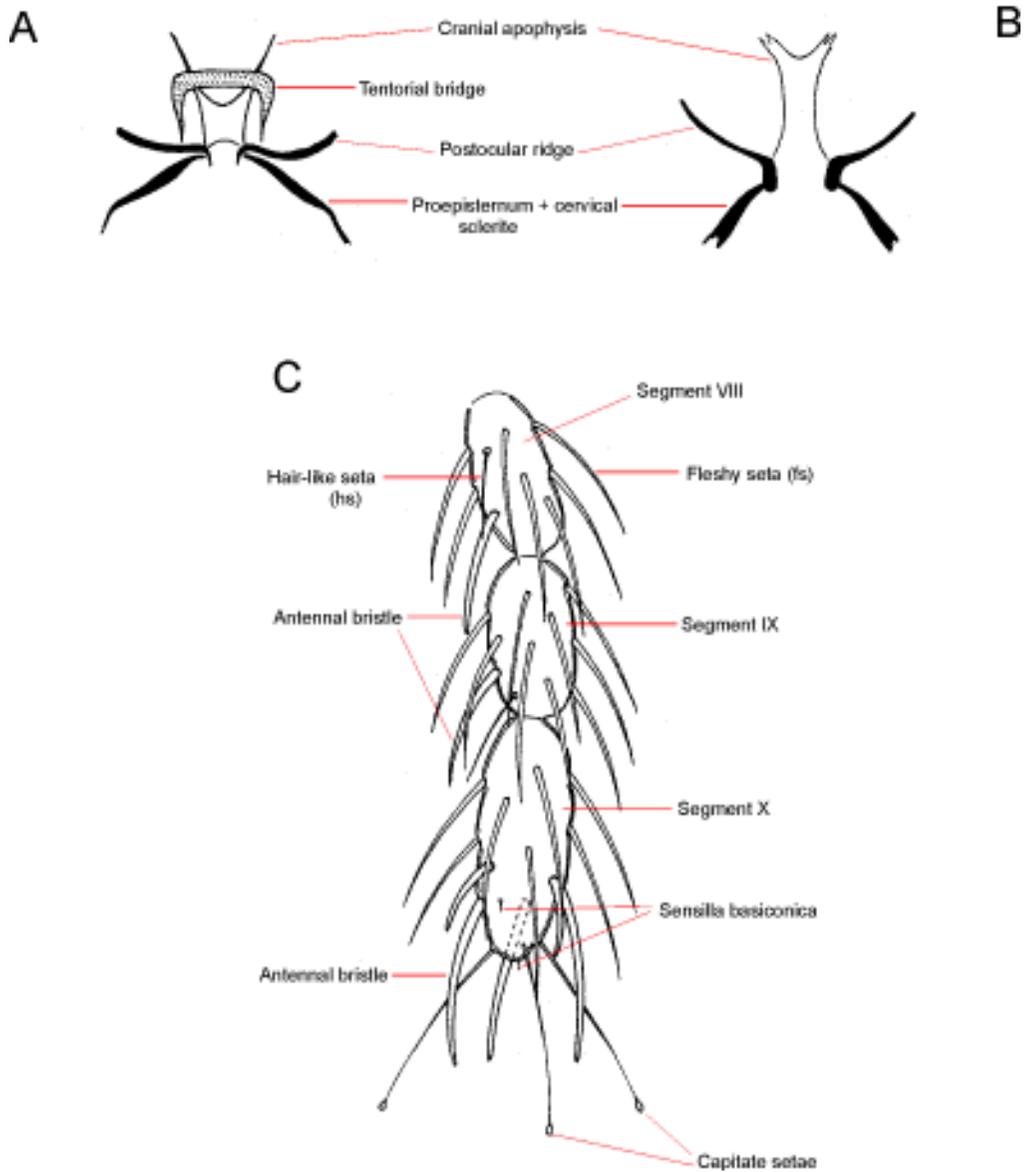


Fig. 16 Details of structure of adult males (I). (A) Cranial apophysis with tentorial bridge (note that, even when present, the tentorial bridge is not shown on most drawings); (B) Cranial apophysis without tentorial bridge, as on *C. ornatella*; (C) Structure of apical three antennal segments.

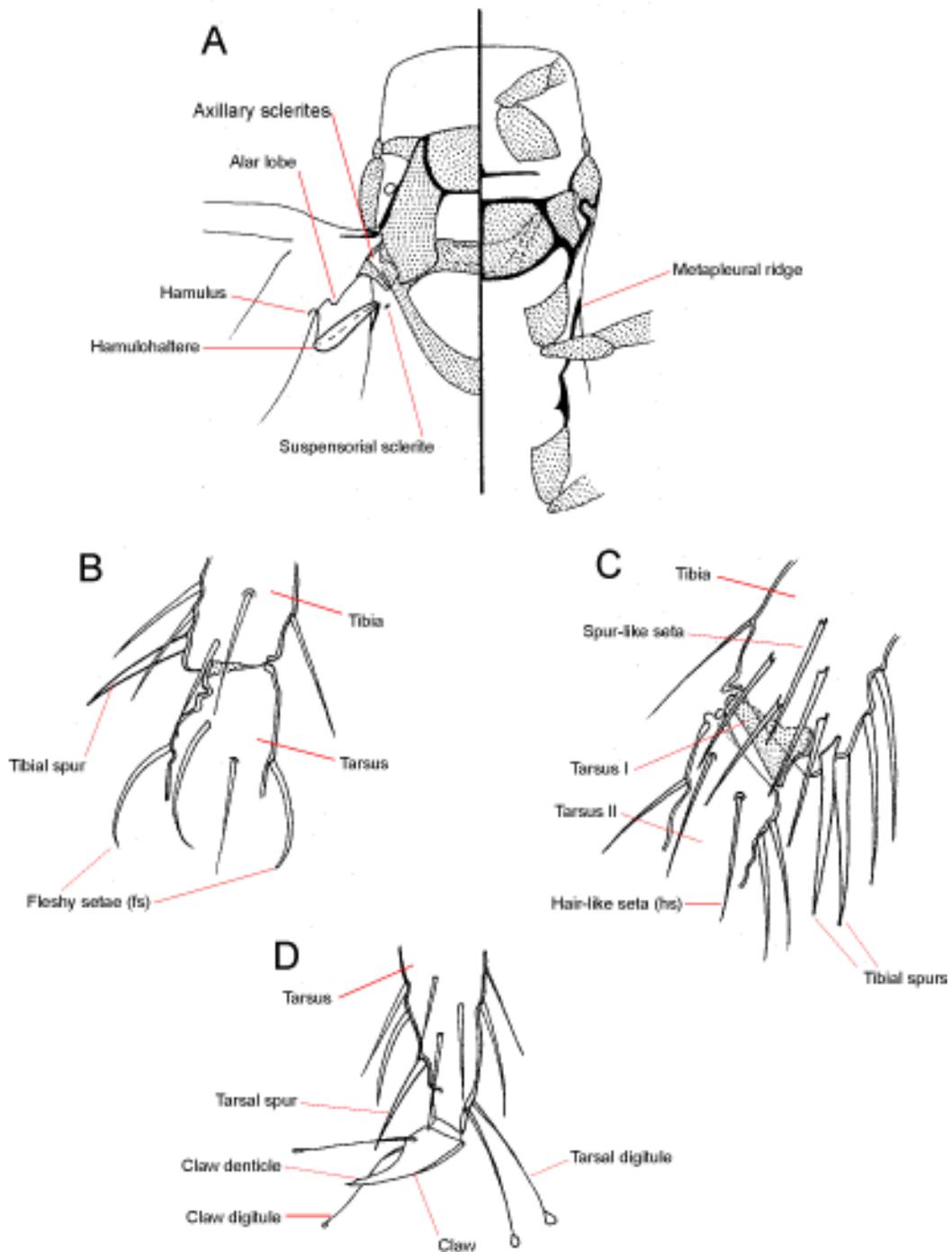


Fig. 17 Details of structure of adult males (II). (A) Thoracic area showing structures associated with presence of hamulohalteres; (B) Tibio-tarsal articulation when only one tarsal segment present; (C) Tibio-tarsal articulation when two tarsal segments present; (D) Structure of distal end of tarsus plus claw.

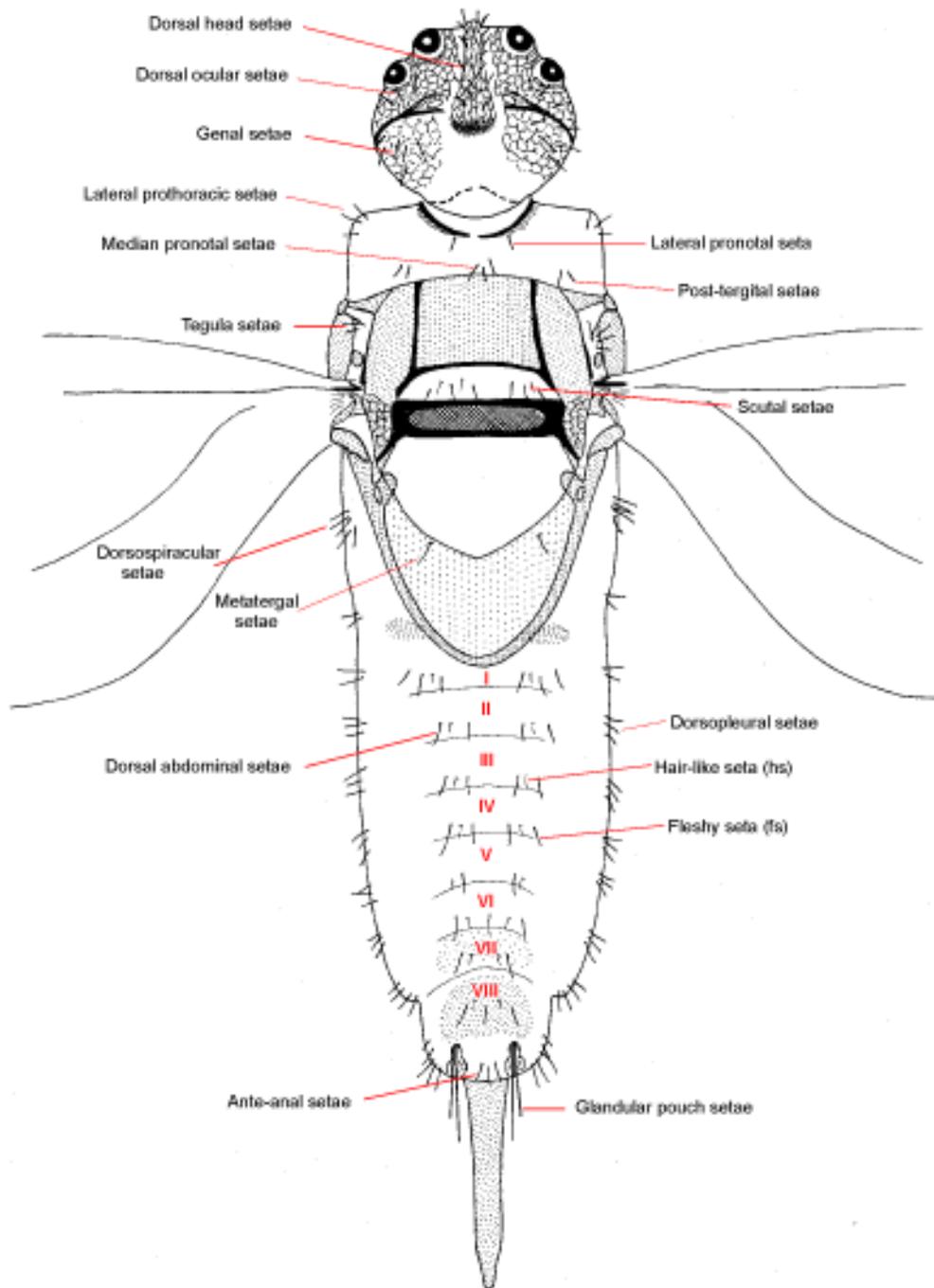


Fig. 18 Dorsal view of adult male (no particular species) but VIIIth abdominal segment extended as on *Crystallotesta ornata* and without hamulohalteres. Distribution of setae.

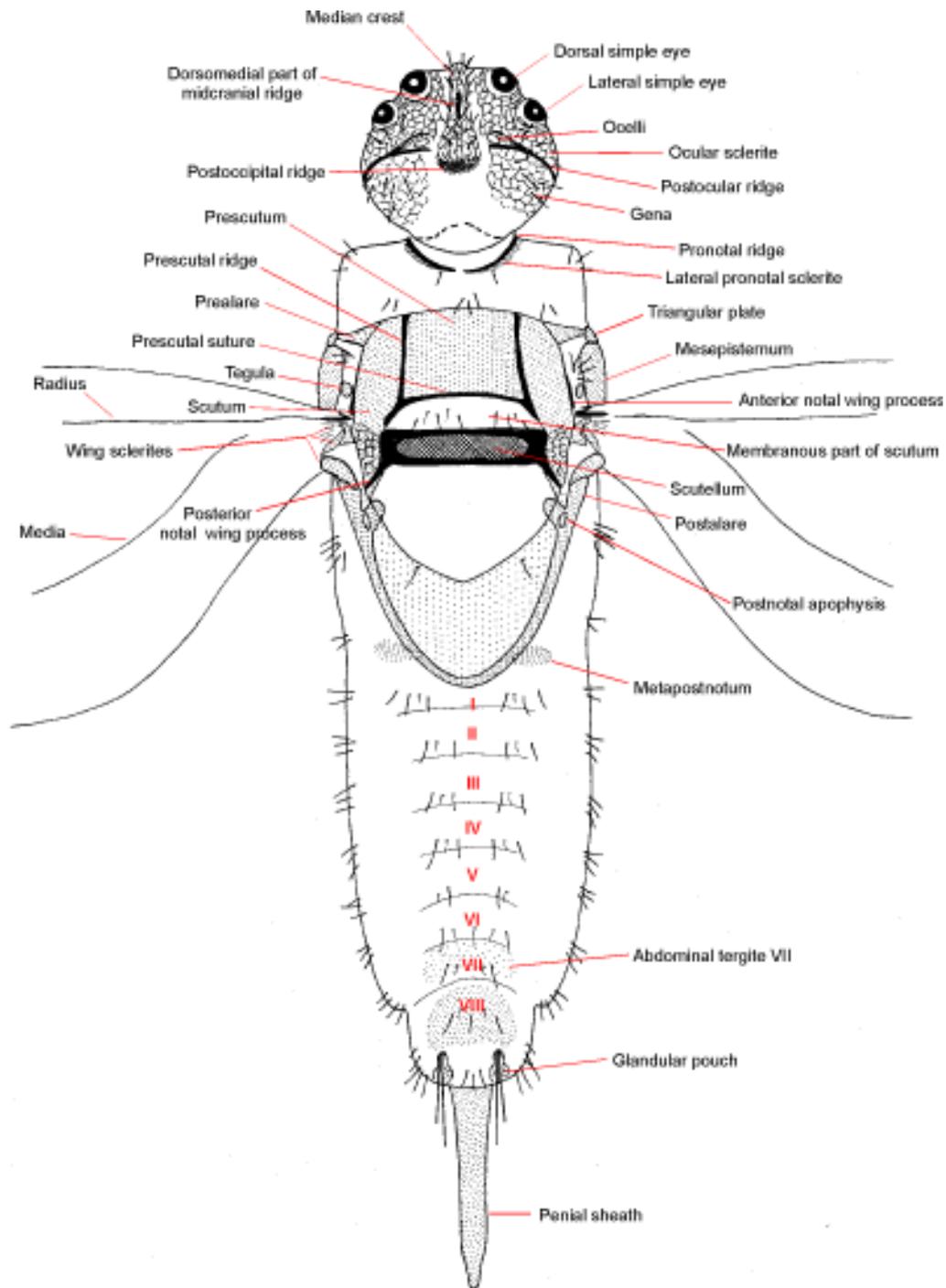


Fig.19 Dorsal view of adult male (no particular species) but VIIIth abdominal segment extended as on *Crystallotesta ornata* and without hamulohalteres. Distribution of characters other than setae.

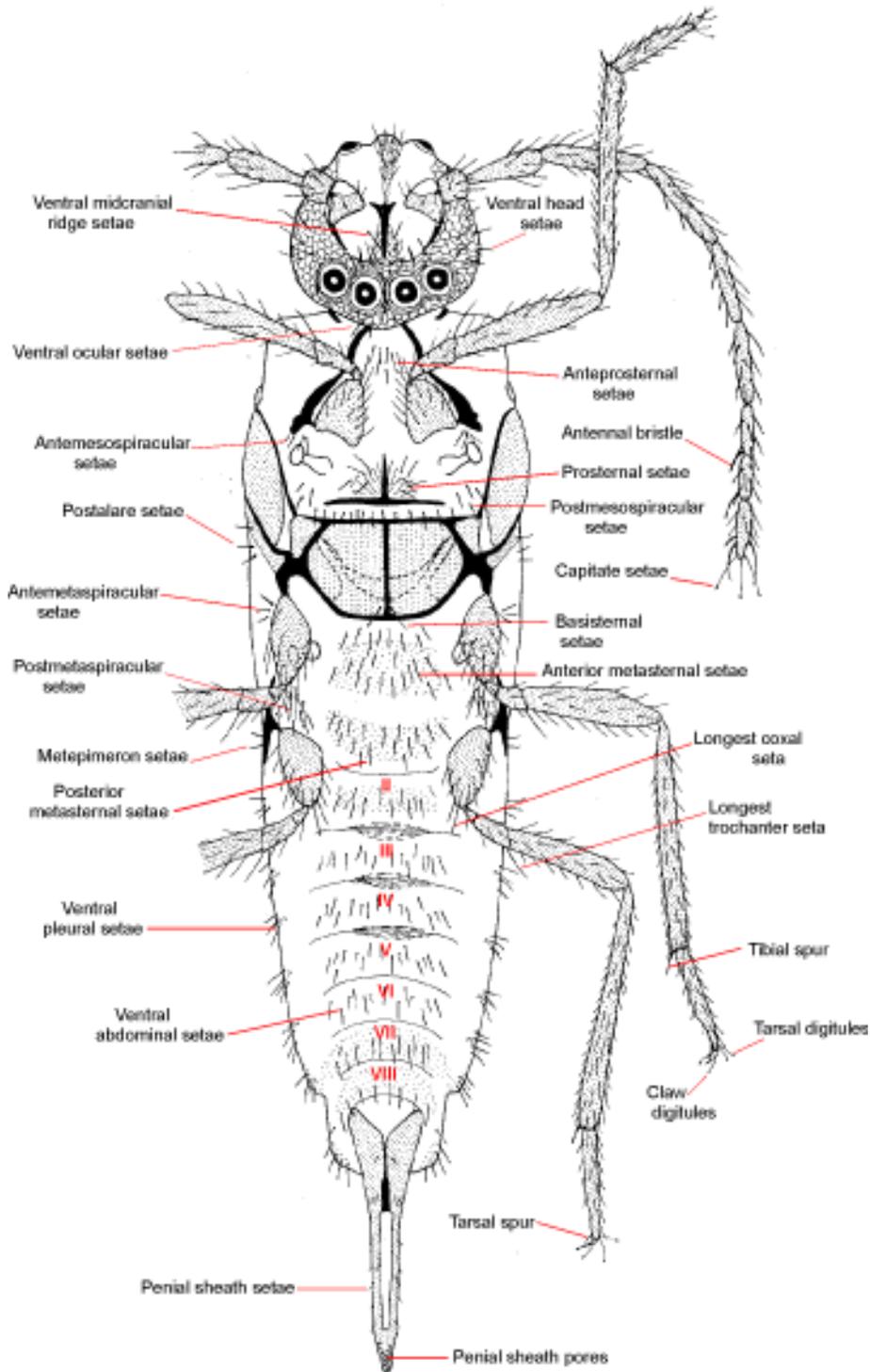


Fig. 20 Ventral view of adult male (no particular species) but VIIIth abdominal segment extended as on *Crystallotesta ornata* and without hamulohalteres. Distribution of setae.

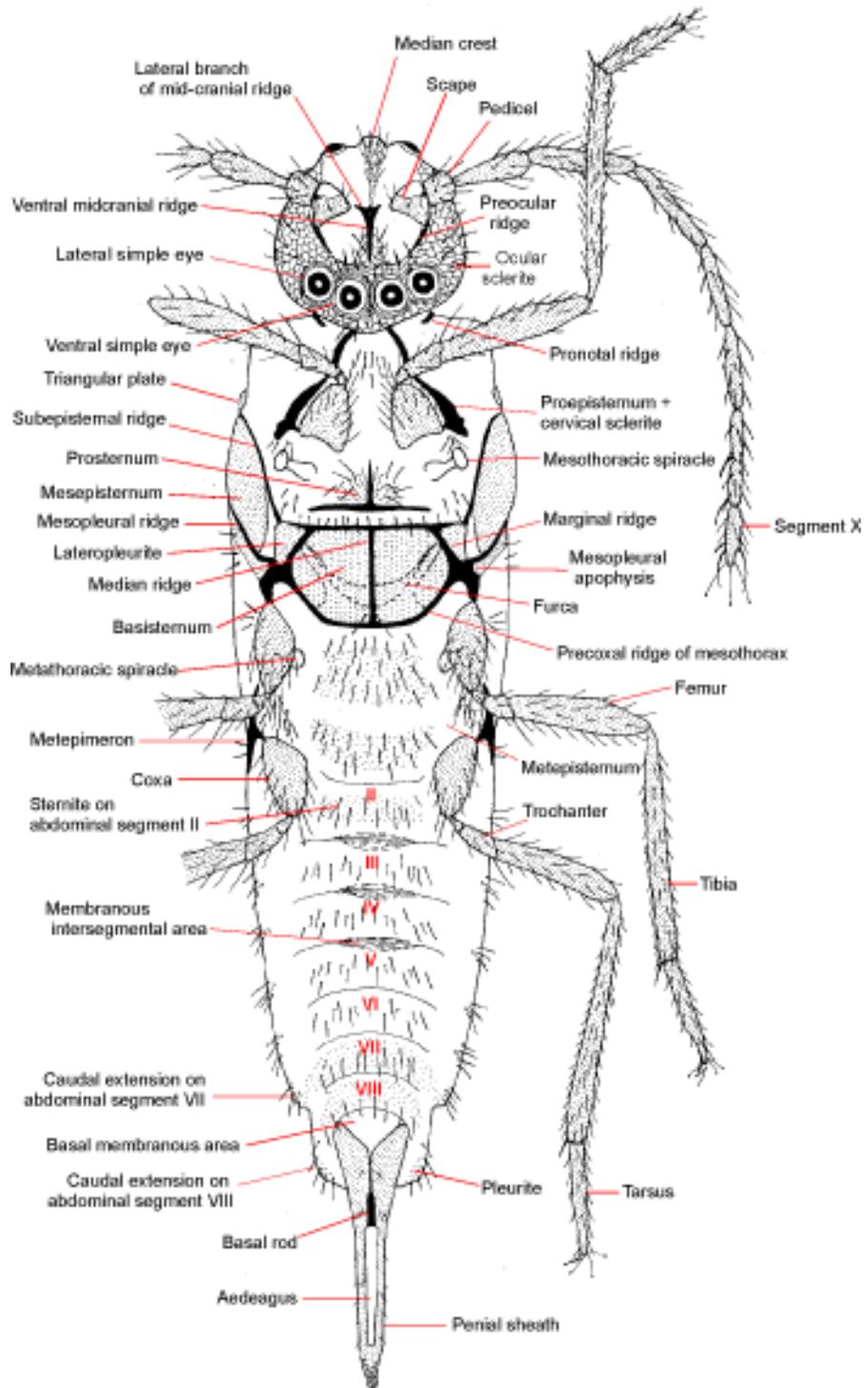


Fig. 21 Ventral view of adult male (no particular species) but VIIIth abdominal segment extended as on *Crystallotesta ornata* and without hamulohalteres. Distribution of characters other than setae.



[22] *Aphenochiton inconspicuus*, adult male in test, with caudal wax filaments showing



[23] *Aphenochiton inconspicuus*, adult male, test removed to one side



[24] *Aphenochiton kamaui*, prepupa in test



[25] *Aphenochiton kamaui*, adult male emerging from test, with wingtips showing



[26] *Aphenochiton pubens*, prepupa in test



[27] *Aphenochiton pubens*, adult male with empty test



[28] *Aphenochiton subtilis*, prepupa in test



[29] *Aphenochiton subtilis*, adult male in test, with expelled pupal moult



[30] *Aphenochiton subtilis*, pupa, brown (upper);
Aphenochiton pubens, pupa, light green and brown (lower);
Aphenochiton sp., female nymph, transparent, (middle)



[31] *Crystallotesta leptospermi*, prepupa (middle) and
 2 adult males in tests, one (left) with pupal moult



[32] *Epelidochiton piperis*, prepupae in tests



[33] *Inglisia pateifa*, adult male, with empty test



[34] *Crystallotesta ornata*, 2 prepupae in tests, one expelling 2nd-instar moult



[35] *Crystallotesta ornata*, adult male with empty test



[36] *Crystallotesta ornatefella*, adult male



[37] *Crystallotesta ornatefella*, empty test



[38] *Ctenochiton paraviridis*, prepupa in test



[39] *Ctenochiton paraviridis*, adult male expelling pupal moult from test



[40] *Ctenochiton paraviridis*, adult male in test, with caudal wax filaments showing



[41] *Ctenochiton chelyon*, adult male with empty test

[42] *Kalasiris depressa*, pupa in test[43] *Kalasiris perforata*, pupa in test[44] *Lecanochiton actites*, male 2nd-instar (yellow, upper), female nymphs (middle), empty glassy test (lower)[45] *Lecanochiton scutellaris*, adult female (upper), adult male (middle), and empty test (lower)



[46] *Lecanochiton scutellaris*, empty test with wax plume



[47] *Plumichiton elaeocarpi*, male 2nd-instar in plumed test



[48] *Plumichiton elaeocarpi*, adult male with empty test



[49] *Plumichiton flavus*, empty test



[50] *Plumichilton nikau*, adult male with empty test



[51] *Plumichilton pollicinus*, male 2nd-instar in test (left), empty test (right)



[52] *Paropeza dacrydii*, prepupa in glassy test [side view] with small nymph (yellow)



[53] *Paropeza dacrydii*, pupa in glassy test (lower) with female 2nd-instar (upper)



[54] *Poropezus dacrydi*, adult male



[55] *Pounamococcus cuneatus*, prepupa in test



[56] *Pounamococcus cuneatus*, adult male with empty test



[57] *Pounamococcus tubulus*, adult male in test



[58] *Umbonichiton bullatus*, empty test (left), pupa in test (right)



[59] *Umbonichiton hymenantherae*, adult male in test, pupal moult expelled



[60] *Umbonichiton pellespis*, pupa in test



[61] *Umbonichiton pellespis*, adult male with empty test

their tests, interspecific differences are less obvious, e.g., the tests of *Ctenochiton* species cannot be differentiated, nor some *Aphenochiton* species, but most tests of species in other genera, e.g., *Crystallotesta*, *Inglisia*, *Epelidochiton*, *Kalasis*, and *Pounamococcus*, are fairly distinctive. Where the test is relatively transparent, the colour of the male inside may aid identification.

Host-plant associations. As indicated in *Fauna N.Z. 41*, although the males tests are found usually on the same plants as the female stages, the plant host range of male soft scales seems to be slightly wider than for the females, with the male stages occasionally being found on other plants. This can lead to problems of identification although, if there is only one soft scale species in the immediate vicinity, it is likely that the male stages belong to it.

Identification of adult males in W.M. Maskell's collection. Males of some soft scale species were collected by Maskell and these are mentioned in the text. However, it can be very difficult to be sure as to which species any male collected in the wild actually belongs once it has left its test. In most instances, the material used in this review was bred out from pupae or from tests that contained adult males at the time of collection. These were usually fairly closely associated with other known stages (usually the adult female); their identity was therefore known with some confidence. The conditions under which Maskell collected his males are unknown, and it is here considered that some of these are unlikely to be the species he believed. A good example of this is the male of *Aphenochiton inconspicuus* (Maskell), which is clearly not conspecific with the material since collected under the conditions outlined above.

Further taxonomy. The original generic revision of the New Zealand soft scales was based only on adult female characters. Now that the prepupae, pupae, and adult males of about half of these species have been studied, it is clear that some changes may need to be made to the pre-existing arrangement. Thus, within *Aphenochiton*, *A. inconspicuus* (Maskell) (the type species) does not appear to be congeneric with the other species currently in this genus. Similarly, in *Crystallotesta* (type species *C. fagi* (Maskell)), *C. ornata* (Maskell) and *C. ornatella* Henderson & Hodgson are not congeneric and probably merit a new genus. Further research is being undertaken to determine whether creation of new genera for these species is appropriate.

CONVENTIONS

Figures. The drawings were all made from dorsoventrally mounted specimens by measuring each structure using a

graticule. All parts of a given species are therefore drawn to scale, but not necessarily to the same scale (i.e., small and large species were drawn to about the same finished size). The structure of each lateral vignette was drawn similarly, although again the vignettes on any given figure were not necessarily drawn to a consistent scale.

Some structures, such as the mesoprephragma and furca, are actually internal structures often shown by dotted lines by other authors (e.g., Giliomee 1968). However, these structures are often extremely easy to see and do not appear to be obviously internal when viewed on the slide and therefore were drawn in the present figures as they appear on the slide. Sclerotised structures, such as the prescutum, scutum, basisternum, legs, and antennae are dotted to indicate the sclerotisation; where the sclerotisation appears unusually dense, as on the scutellum, this is generally shown by cross-hatching, whereas ridges, which are even more heavily sclerotised, are shown in black.

Measurements and ratios. All measurements were taken as shown in Fig. 15. Basically, the greatest length or width was measured for each structure, apart from the lengths of the prescutum, membranous area of the scutum, and scutellum that were measured along their middles. All ratios mentioned in the descriptions below were calculated using the median of the measurements for those particular structures.

Material studied. As this publication is divided into 3 parts, each part often describing material with the same collection details, the Material studied is in an appendix following the descriptions.

References. Only references cited are listed. For further literature on the New Zealand Coccidae, see Hodgson & Henderson (2000).

Key for separation of growth stages (Fig. 1). See Hodgson & Henderson 2000, *Fauna of New Zealand 41*: 21. The relevant couplets are repeated below:

- 1 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 2
- 2(1) Wingbuds barely extending past metacoxae; length of leg segments subequal; penial sheath lobe short prepupa
- Wingbuds clearly extending past metacoxae; coxae and trochanter significantly shorter than femur, tibia, and tarsus; penial sheath lobe quite long pupa

PART 1

ADULT MALES

INTRODUCTION

The adult males of perhaps only about 60 species have previously been described adequately as they are rarely collected and seldom studied. In contrast, the adult females of most of the approximately 1200 species currently known in the family Coccidae have been sufficiently well described to be re-identified.

The importance of the structure of the adult male for a proper understanding of the relationships within the Coccoidea was recognised by Balachowsky (1937) and Ferris (1942, 1950) who considered that no satisfactory system of scale insect classification would be achieved without an understanding of male structure. Although a few earlier workers made some useful contributions, particularly Šulc (1932) and Borchsenius (1957), the first really detailed description of male scale insects (of 7 different taxa but including a male soft scale) was that by Theron (1958), who provided the basis for the modern study of adult male Coccidae. Unfortunately, Theron did not describe the chaetotaxy and pores.

Theron's work was supervised by Dr K. Boratyński of Imperial College, London University, who later instigated three further major studies on coccoid males: Ghauri (1962) who described 26 diaspidid males; Giliomee (1967) who described 23 coccid males, and Afifi (1968) who described 17 pseudococcid and 7 eriococcid males. Giliomee (1967), in his study of soft scale males, noted considerable variation among species and concluded that the resulting classification did not agree with that for the adult females. Whilst a few other soft scale males have been described (Gimpel *et al.* 1974; Ray & Williams 1980, 1983; Manuwadu 1986; Farrell 1990; Hodgson 1991, 1993; Hodgson & Henderson 1998; Foldi *et al.* 2001; Hodgson & Martin 2001), the next significant studies were those of Miller (1991) and Miller & Williams (1995, 2002), who described the known adult males of the 31 coccid species from North America. Miller (1991) revised Giliomee's (1967) groupings, and considered (based entirely on male characters) that these males could be divided into seven groups. As far as possible, these groups were then included in a classification of the Coccidae by Hodgson (1994), in which he recognised 10 subfamilies.

We describe the adult males of a further 31 soft scale species, all of which are considered to be indigenous to New Zealand (Hodgson & Henderson 2000).

MORPHOLOGY OF ADULT MALES

Basic shape: typical insects, with a cylindrical body di-

vided into 3 tagmata (head, thorax, and abdomen) and with well-developed forewings on the mesothorax and 3 pairs of long legs. The metathoracic wings have become modified into hamulohalteres (although these have been secondarily lost from most New Zealand species). Males also have long, filiform, 10-segmented antennae and a conspicuous, elongate, sclerotised, penial sheath which projects posteriorly from the abdomen.

Size: the adult males included in this study are relatively small, from around 1–2.3 mm, although coccid males from elsewhere can be up to about 3 mm long.

Chaetotaxy (Fig. 16, 18, 20): setae are of 2 main kinds, *fleshy setae* (fs) and *hairlike setae* (hs). *Hairlike setae* are, as their name suggests, hairlike or flagellate and have a small sclerotised ring or setal socket around the setal membrane at their base. *Fleshy setae* tend to be thicker and blunter and lack a sclerotised socket. However, the sclerotised ring can be hard to see and some fs are distinctly flagellate (as on *Crystallotesta ornata* (Maskell) and *C. ornatella* Henderson & Hodgson, Fig. 68, 69) and so differentiating between these two kinds of setae can be difficult. With the exception of *Poropeza dacrydii* (Maskell) (Fig. 84), hs are generally fewer and their positions tend to be more fixed and predictable. Thus, setae not in the predicted positions for hs are here generally referred to as fs unless the setal socket can be distinguished.

In addition, there are some setae that are referred to as *bristles*. These occur on antennal segments VIII, IX, and X (referred to as *antennal bristles*). Giliomee (1967), Miller (1991), and Miller & Williams (2002) also found bristles on the anterior coxae of some coccid species, but these are absent from New Zealand species. Bristles are similar to fs but generally significantly stouter and larger.

Spurs, which are probably enlarged and thickened hairlike setae, are also present on the ventral surface of the distal end of most tibiae and tarsi. Most New Zealand species have single *tibial* and *tarsal spurs*, but both *Pounamococcus* species (Fig. 85, 86) have 2 tibial spurs per tibia, whilst spurs are absent on *Inglisia patella* Maskell (Fig. 75). Some of the setae near the distal end of the tibia are also generally spurlike, but are less clearly differentiated and smaller. Although not always clearly differentiated, the most posterior ventral seta near each claw is also generally spurlike, and is here referred to as a *tarsal spur*.

MOUNTED MATERIAL (Fig. 16–21)

We stress that the following descriptions are based on specimens that were stained and slide-mounted dorsoventrally in Canada balsam. Consequently, the body shape will have become distorted to some extent; in particular:

(a) the head shape will have changed,

- (b) the sclerotised structures of the thorax have often been broken and distorted (they can be rather convex in life) and
 (c) the membranous abdomen appears broader in the figures than in real life.

Furthermore, marginal structures can be difficult to see; in particular, the basalare can rarely be seen and this sclerite may be important in separating higher taxa (Miller 1991).

In addition, it can be difficult to separate

- (a) the dorsospiracular setae on the metathorax from the antemetaspiracular setae, which lie more ventrally, and
 (b) the dorsopleural setae from the ventropleural setae.

The wing sclerites are also generally distorted and differences in their shape in the figures should not be taken as significant.

HEAD

The head capsule is rather oval to roundly quadrangular in shape, with either 2 or 4 pairs of *simple eyes*, with 1 or 2 pairs present anterodorsally and 1 or 2 pairs posteroventrally, the latter sometimes on a cone-shaped extension to the ventral surface of the head when seen from the side (as probably on *Pounamococcus* spp.). There is also a pair of smaller *ocelli* laterally. The *antennae* are long and 10-segmented, arising near the anterior margin of the head capsule. Mouthparts are entirely absent, but a non-functional mouth opening is present behind the ventral simple eyes.

Between the antennal bases is the *median crest*, which extends posteriorly on the dorsal surface to about half the length of the head: this is a slightly sclerotised and polygonally reticulated area, with fs and hs *dorsal head setae*; it is generally rounded at the posterior end, where it may be slightly more heavily sclerotised. Rarely, vestiges of a sclerotised *post-occipital ridge* may be present at right angles to the median crest (cf. on *P. dacrydii*, Fig. 84 and Species A, Fig. 92) at its posterior end. The median crest may also have vestiges of a sclerotised *dorsal section of the midcranial ridge* (cf. Species A, Fig. 92, and *Lecanochiton* spp., Fig. 78, 79). Ventrally, the *midcranial ridge* is present as a strongly sclerotised, Y-shaped, longitudinal ridge, with the ventral part extending posteriorly from the median crest towards the ocular sclerite and with a pair of sclerotised arms at the anterior end (*lateral arms of midcranial ridge*), each arm extending towards a scape but not articulating with it. The ventral midcranial ridge may reach the *ocular sclerite* posteriorly or only extend part way; it is usually well developed but may be reduced (as possibly on *Umbonichiton jubatus* Henderson & Hodgson: Fig. 90). Laterad to the ventral midcranial ridge and posterior to

each scape is a membranous area bounded laterally by the *preocular ridge*. The area immediately bordering the ventral midcranial ridge is usually polygonally reticulated, narrow anteriorly but widening posteriorly where it fuses with the ocular sclerite (but may be reticulated throughout, as on *Pounamococcus cuneatus* Henderson & Hodgson: Fig. 85); this area usually has a few fs and hs (here referred to as *ventral midcranial ridge setae*).

Articulating with the base of the antennae laterally is the *preocular ridge*, which is a heavily sclerotised ridge which extends both anteriorly and posteriorly from the antennal articulation and marks the antero-ventral margin of the *ocular sclerite*. On most mounted specimens, the anterior extension of the preocular ridge cannot be seen easily as it lies beneath the scape but is usually as long as the posterior part of the ridge, which varies in length from rather short (e.g., on *I. patella*, Fig. 75) to long, almost reaching the ventral midcranial ridge medially (as on *Aphenochiton kamahi* Henderson & Hodgson, Fig. 63) (on some non-indigenous species the ventral arms of the preocular ridge fuse medially). Making up most of the lateral part of the head is the *ocular sclerite*, which extends laterally from the *dorsal simple eyes* down between the *preocular* and *postocular ridges* to the *ventral simple eyes*, where they fuse. This sclerite is lightly sclerotised and polygonally reticulated throughout and has several to many fs and hs. The polygonal reticulations vary between species both in shape and size (i.e. each reticulation tends to be rather larger on *Ctenochiton* spp. than on most other indigenous species) and in the presence or absence of additional inner dermal ridges. These inner dermal ridges may take the form of 1 or 2 long, straightish microridges (as on *A. kamahi*, Fig. 63) or may be numerous, sinuous, divided or broken microridges (as on *Crystallotesta fagi* (Maskell), Fig. 67). Inner dermal microridges appear to be absent from *Plumichiton flavus* (Maskell) (Fig. 81). These differences appear to be fairly constant and are here considered to be of taxonomic significance. The setae on the ocular sclerite are referred to as *ventral head setae* and their number and distribution vary between taxa: they may be abundant and found throughout, including between the ventral eyes (as on *Plumichiton flavus* (Maskell), Fig. 81, and most *Umbonichiton* spp.), or they may be very few and restricted to just anterior to the ventral eyes (as on *Umbonichiton jubatus* Henderson & Hodgson, Fig. 90). Where these setae are also present posterior to the ventral eyes (as on *P. flavus*, Fig. 81), they are here referred to as *ventral ocular setae*. The area between the ocelli (or more properly the postocular ridge) and the dorsal simple eyes is part of the ocular sclerite and may bear setae, the *dorsal ocular setae*; when present, these are generally fs. When the postocular ridge is short (i.e., does not nearly reach the

ocelli, as on most New Zealand species), it can be difficult to identify the margin between the ocular sclerite and the genae, but this is usually identifiable by the change in shape of the polygonal reticulations (elongate near ocelli, squarish on gena); setae laterad to or just posterior to the ocelli (i.e., within the area of elongate reticulations) are considered to be dorsal ocular setae, *genal setae* being considered to be those on the area with non-elongate reticulations.

Marking the posterolateral margins of the ocular sclerite is a long, strongly sclerotised ridge, the *postocular ridge*; although most of this ridge runs along the lateral margins of the head, on mounted specimens it generally appears to lie lateroventrally and this is how it is illustrated; it is shown most naturally in the enlarged drawings for *Lecanochiton* spp. (Fig. 78, 79). The postocular ridge separates the ocular sclerite from the *genae* dorsally; anterodorsally, the postocular ridge may almost meet the median crest (as on *C. ornata* and *C. ornatella*, Fig. 69, 70) but is usually much shorter; when long dorsally, it runs just ventral to each ocellus, where it may divide, with a short arm running around the dorsal margin of each ocellus (common on many non-indigenous species; typical of *C. ornata* and *C. ornatella*, Fig. 69, 70); ventrally, the postocular ridge extends round posterior to the ventral simple eyes where it meets the *preoral ridge*. The *interocular ridge*, which runs between the preocular and postocular ridges on some soft scales species from elsewhere, is absent from all known indigenous New Zealand species.

The large area posterior to the postocular ridge is the *gena*, which is membranous and generally polygonally reticulated throughout. As on the ocular sclerite, these reticulations vary in structure: on *C. ornata* and *C. ornatella* and several other species, they are barely visible and appear to be represented by numerous raised spots (presumably very short microridges), some of which can form a faint reticulate pattern. On other species, the anterior reticulations are well developed whilst those more posteriorly become faint or absent (e.g., *Epelidochiton piperis* (Maskell), Fig. 74). They may also have extra inner microridges, which may be similar or dissimilar to those on the ocular sclerite. *Genal setae* are generally present and are usually fs, but a few hs may also be present; *genal setae* may be absent (as on *Aphenochiton* spp., Fig. 62–66).

The *simple eyes* consist of a dorsal pair and a ventral pair and (in New Zealand species) 0 or 2 pairs of *lateral eyes* (in non-indigenous species, there can be up to 3 pairs of lateral eyes). In general, the lateral eyes are clearly smaller than the dorsal and ventral pairs but occasionally may be similar in size. The dorsal eyes lie some distance apart (with the median crest between them), dorsolateral to the antennae, whilst the ventral simple eyes tend to be close together on a medioventral bulge. On a few species, such as

I. patella, *P. cuneatus*, and Species A (Fig. 75, 85, 92), the lateral eyes are absent. Posterior to each dorsal lateral simple eye and anterior to the dorsal end of each postocular ridge is an *ocellus*. These are lightly sclerotised spots, slightly larger than the polygonal reticulations, and can be quite obvious on some species (e.g., on *Lecanochiton* spp., Fig. 78, 79) but much less so on others (e.g., on *C. fagi*, Fig. 67). They may be absent on *Umbonichiton pellaspiis* Henderson & Hodgson (Fig. 91).

The *preoral ridge* is a weak inverted U-shaped structure (not shown in figures), each arm of which meets with a postocular ridge. Arising from the preoral ridge is the *cranial apophysis*, which is a strong scoop-like apodeme that extends anteriorly within the head (Fig. 16). Its apex is usually bifurcate but may be trifurcate (as on *Pounamococcus* spp., Fig. 85, 86, and *I. patella*, Fig. 75). Also lying internally, dorsad to the cranial apophysis, is a strong, inverted U-shaped structure, the *tentorial bridge* (Fig. 16). This structure is usually present but appears to be absent on *C. ornata* and *C. ornatella* (Fig. 69, 70).

Two kinds of *pore* are known from New Zealand soft scales. These pores are rare on the males of other, non-indigenous, coccids. *I. patella* (Fig. 75) has a small group of pores just laterad to the median crest near each scape. These pores are convex, of variable size and shape and are probably not homologous with the loculate pores in the same position on Pseudococcidae and Eriococcidae (Afifi 1968). The second kind of pore, the dorsal pore, is found on *P. dacrydii* (Fig. 27). It is more uniform in shape, small, round, and convex and is frequent not only on the head but also throughout the membranous areas of the dorsum, including the thorax and abdomen; it is also present on the pleurites but absent from the venter. Giliomee (1967) found small circular pores on *Ctenochiton* (probably = *Avricus*) sp., Genus B and on *Luzulaspis luzulae* (Dufour) (dorsally on prothorax or abdominal segment VIII or both). Miller & Williams (1995) noted them on *Toumeyella virginiana* Williams & Kosztarab, and Miller & Williams (2002) mention pores on the scutellum of *Philephedra floridana* Nakahara & Gill. Because none of these pores were noted on the head, they may not be homologous with the pores found on either New Zealand species.

Antennae: situated on the anterolateral margin of the head but appear ventral on most mounted specimens. They are filiform, 10-segmented (although fewer on some non-New Zealand species due to fusion of certain segments (Giliomee 1967)). They are usually about 0.6× total body length but may be as long as 0.8× (as on *Pounamococcus* sp.) or as little as 0.5× (*Aphenochiton subtilis* Henderson & Hodgson). The *scape* is short and broad, with (usually) 3 hairlike setae, 1 on the ventral surface and 2 near the inner margins on the dorsal surface (occasionally there are many setae, as on *P. dacrydii*, Fig. 84). The *pedicel* is roundish, with a few

polygonal reticulations and has both hs and fs; when these are few, they appear to be restricted to the ventral surface but can be found throughout when setae are abundant. The remaining *flagellar segments* (III–X) are elongate, mostly parallel-sided, with many fs and no, or very few, hs (many on *P. dacrydii*, Fig. 84), each fs generally about twice as long as the width of the flagellar segments but may be much shorter (as on *P. dacrydii*, Fig. 84). Segment III is sometimes club-shaped, with a few hs and fs and 1–3 *sensilla basiconica*; segments V–VI are usually the longest; segments VIII–IX (Fig. 16) usually each has a single *antennal bristle* but these can be hard to separate from fs on many species. Segment X (Fig. 16) is short and constricted near the apex on some species, with 3 *capitate setae* (only 2 on *I. patella*, Fig. 75), usually 3 long and 2 short *antennal bristles* near apex, some fs and a sensillum basiconicum on apex and another more proximally between the bases of 2 bristles.

THORAX

This is separated from the head by a deep cervical constriction and consists of a more or less membranous prothorax, a large and mainly sclerotised mesothorax, and a mainly membranous metathorax. Each segment has a pair of long, 5-segmented legs, which are subequal in length. From the mesothorax arise the fore wings, which are large and well developed, although the venation is much reduced. The hind wings are either absent or are represented by a pair of *hamulohalteres*, as on *Pounamococcus* spp. (Fig. 85, 86).

Prothorax: mostly membranous; with a strongly sclerotised ridge immediately posterior to the neck region on the dorsal surface, the *pronotal ridge*, which is usually in 2 lateral parts, with a broad gap ventrally where it articulates with the *proepisternum* + *cervical sclerite* and a narrow gap dorsally although, on some non-indigenous species, the 2 halves may be fused. Running along the lateral margins of the pronotal ridge is a sclerite, the *lateral pronotal sclerite*, which is either striated or polygonally reticulated; on New Zealand species, it is usually well developed and broad. *Lateral pronotal setae* are associated with the pronotal sclerite. These may be present or absent; when present they are usually represented by a pair of hs but, on *P. flavus* (Fig. 81), there are up to perhaps 7 fs on each side, although some could be *lateral prothoracic setae*.

On many Coccoidea, an area posterolaterally on each side of the dorsum is sometimes sclerotised and represents the *post-tergites*. These are absent from all New Zealand soft scales except *I. patella* (Fig. 75), although *C. ornata* (Fig. 69) has a few fs *post-tergital setae*, whilst *P. dacrydii*

has a group of *pores* in this position. In addition, *P. dacrydii* (Fig. 84) has 2 groups of setae and pores laterally on each side of the prothorax and these represent the *lateral prothoracic setae*.

Ventrally, a strongly sclerotised ridge — the *proepisternum* + *cervical sclerite* — runs posteriorly from each postoccipital ridge and fuses with a short *pleural ridge*, which articulates with the procoxae. An apophysis, the *propleural apophysis*, is probably present posteriorly but is generally not distinguishable.

Medially on the venter is the *prosternum*. This is usually somewhat reduced on New Zealand species but, in its most complete state, consists of a large triangular sternite, which is often ridged or even polygonally reticulated, bordered posteriorly by a strongly sclerotised transverse ridge, from which a longitudinal median ridge arises and extends anteriorly down the centre of the sclerite. On New Zealand species, the transverse ridge is always present (and remnants of the *prosternal apophyses* can sometimes be found laterally) and the sclerite is generally more or less present but the median ridge is absent or poorly developed (present on both *Pounamococcus* spp., Fig. 85, 86). Almost invariably there is an hs on either side of the sclerite; frequently there are also other hs and some fs; these are the *prosternal setae*; they do not usually extend anterior to the procoxae. On other non-indigenous species, these prosternal setae may spread laterally to anterior to the mesothoracic spiracle; on New Zealand species, when there are setae present anterior to the anterior spiracle (as on *C. fagi* and *C. ornata*, Fig. 67, 69), they form a distinct group and are here referred to as the *antemesospiracular setae*. Another group (of generally fs) are sometimes present between the prosternum and the mouth, the *anteprosternal setae*.

The *pores* found on *P. dacrydii* (Fig. 84) are located in groups approximately where the *median pronotal setae* and *post-tergital setae* would be and also in a diffuse group medially on the dorsum.

Mesothorax: this has numerous sclerites, many of them bounded by strong ridges. The shape and position of these sclerites varies little within the family.

Anteromedially on the dorsum is the strongly sclerotised *prescutum*. On unmounted specimens, the prescutum bulges over the prothorax and is quite convex, but on dorsoventrally mounted specimens this is not obvious. The prescutum is rectangular or almost square in shape, bordered anteriorly by the mesoprephragma (which extends internally beneath the dorsum of the prothorax), laterally by the *prescutal ridges*, and posteriorly by the *prescutal suture*. The surface of the prescutum is generally fairly smooth but, on a few species, it is clearly polygonally reticulated (e.g., on *I. patella* and *P. dacrydii*, Fig. 75, 84); a

few species show only very faint reticulations (e.g., *E. piperis*, Fig. 74). Rarely, it is divided longitudinally by a medial ridge, as on *C. ornata* (Fig. 69).

The *scutum* is more or less H-shaped, the central bar being represented by a membranous area between the prescutum and the scutellum, and the 2 upright arms being the sclerotised area laterad to the prescutum, membranous area of the scutum, and the scutellum. The membranous area is bounded anteriorly by the *prescutal suture*, laterally by a posterior extension of the *prescutal ridge*, and posteriorly by the scutellum. This membranous area varies somewhat in shape (although this might depend on how the specimen has been mounted): on *Lecanochiton* spp. and Species A (Fig. 78, 79, 92), it is about 6–8× wider than long, whilst on *Ctenochiton* spp. (Fig. 71–73), it is much longer, being only about 2× as wide as long. In addition, the membranous area may bear fs and hs *scutal setae*: usually there is at least 1 pair of hs, as on Species A and *Lecanochiton* spp. (Fig. 78, 79, 92), although it is possible that even these may occasionally be absent; on other species, setae may be extremely abundant, as on *P. dacrydii* (Fig. 84), which has about 60 setae, and some *Plumichiton* spp. (e.g. *P. flavus*, Fig. 81). Extending laterally from each anterolateral margin of the scutum is a pair of semitubular plates, the *prealare*; each end laterally in a heavily sclerotised *triangular plate*, which extends posteriorly to the *mesepisternum*. Posterior to each prealare, and bordered laterally by the *anterior notal wing process* and the *mesepisternum* is a membranous area, within which is a small, sclerotised plate, the *tegula*; usually associated with the tegula are *tegular setae*; these are usually hs but a few fs were also noted on some *Plumichiton* spp. and on *P. dacrydii* (Fig. 81, 82, 84); tegular setae are absent on some New Zealand species (e.g., *Kalasisir perforata* (Maskell), Fig. 27).

The anterior part of the scutum is rarely reticulated on New Zealand species (very lightly on *Ctenochiton chelyon*, Fig. 71, and *Inglisia patella*, Fig. 75) but the posterior part laterad to the scutellum is clearly reticulated on a few species (*Crystallotesta leptospermi* (Maskell), *C. ornatella*, *K. perforata* and both *Pounamococcus* species, Fig. 68, 70, 77, 85, 86) and this is considered to be of taxonomic importance.

The *scutellum* appears rectangular in dorsal view but, in fact, is usually more or less tubular, with the anterior and posterior margins having turned inwards and fused, leaving a medial foramen, which may be small (as on *K. perforata* (Fig. 77) and some *Ctenochiton* spp.), quite large (as apparently on some *Umbonichiton* spp.), or the foramen may be absent, the margins actually fusing, as perhaps on *Lecanochiton* and *Pounamococcus* spp. Extending posterolaterally from each side of the scutellum is a strongly

sclerotised ridge, the *posterior notal wing process*; this is particularly pronounced on *Lecanochiton* species (Fig. 78, 79).

Immediately posterior to the scutellum is a large more or less triangular membranous area, bordered posteriorly by the sclerotised *mesopostnotum*. The mesopostnotum is almost U-shaped, each arm extending anteriorly, where it becomes the *postalare*. Posteriorly, the mesopostnotum extends internally under the metathoracic *metapostnotum*, forming the *mesopostphragma*. Anterolaterally are a pair of strongly sclerotised *mesopostnotal apophyses*. Sometimes the whole of the mesopostnotum is mildly reticulated (e.g., *C. ornata*, Fig. 69, and (rather faintly) *I. patella*, Fig. 75). The *postalare* also extends anteriorly to articulate with the mesopleural ridge; anterolaterally, the postalare is often densely reticulated but these can sometimes take the form of punctations (e.g., on *I. patella*, Fig. 75) or the reticulations, etc., may be absent, as apparently on *Lecanochiton actites* Henderson & Hodgson (Fig. 78). Rarely setae, the *postalare setae*, are present on the anterior margins of the postalare and in the general area of the *mesopleural apophyses* (e.g., on *Plumichiton* spp., Fig. 80–83).

Ventrally, the main structure on the mesothorax is the *meso- or basisternum*, which is large and extends across the full width of the segment. Anteriorly, it is demarcated by the *marginal ridge* and posterolaterally by the *precoxal ridges*; the marginal and precoxal ridges fuse laterally and then join the *mesopleural ridge* just before it articulates with the mesothoracic coxae. The basisternum is usually divided down the middle by a strongly sclerotised *median ridge*, although this can be poorly defined or even absent (e.g., on *I. patella*). *Basisternal setae* are usually absent on New Zealand males, but are present at the base of the median ridge on *C. ornatella* (Fig. 70). Laterad to the marginal ridge is a narrow sclerite, the anterior part of which is the *lateropleurite*, which may be quite narrow or fairly broad and may or may not have a thin extension from the marginal ridge along its anterior margin; it is also occasionally reticulated (e.g., *Plumichiton nikau* Henderson & Hodgson, Fig. 82). The posterior margin of the basisternum is invaginated, forming the *furca*; from this 2 further invaginated arms extend anteriorly; these arms are fairly narrow, diverge strongly, and can vary in length between species (rather short on *I. patella*, Fig. 75, and long on *Lecanochiton scutellaris* Henderson & Hodgson and *P. flavus*: Fig. 79, 81). The base of the furca is rather broad on most species of Coccidae and has a “waist” between the base and the lateral arms.

Laterally on the mesothorax are a number of structures, many of which are hard to discern on dorsoventrally mounted specimens. The *mesopleural ridge* arises from

near the postalare and passes ventrally to articulate with the mesothoracic legs, being joined near its ventral end by the fused marginal and precoxal ridges of the basisternum. Also laterally, more or less at the anterior end of the mesopleural ridge is the *episternum*, which is a large sclerite just anterior to the wing articulations. It is divided into 2 parts, a dorsal part that is strongly sclerotised and sometimes reticulated (as on *P. dacrydii*, Fig. 84) and a ventral part that is attached laterally to the marginal ridge on the basisternum, fusing with the lateropleurite anteriorly. The dorsal part has a strong sclerotised ridge running along its anteroventral margin, the *subepisternal ridge*, which extends more or less to the lateropleurite ventrally.

The *mesothoracic spiracles* are placed just posterior to each procoxa and laterad to the prosternum. Lying between the basisternum and the prosternum is a narrow membranous area which bears the *postmesospiracular setae*; these are mainly fs and, when abundant, they extend the full width of the segment, as on most *Plumichiton* spp. They may be absent, however, as on *C. ornata* and *I. patella* (Fig. 69, 75), very few (as on *Lecanochiton* spp.) or they may be more or less restricted to just posterior to each spiracle (as on *U. jubatus*, Fig. 90).

In addition, dorsolaterally, there are 3 or 4 sclerites, the *axillary sclerites*, which form the articulation for the wings, but these are small and generally difficult to see properly but appear to show little variation between species.

The *pores* on *P. dacrydii* (Fig. 84) are present on the membranous area of the scutum, within the groups of tegular setae and on the membranous area between the scutellum and mesopostnotum.

Metathorax: due to the reduction or absence of the hindwings, the metathorax is largely membranous. Dorsally, on many Coccoidea, the *metapostnotum* is represented by a pair of small sclerites which largely overlie the *mesopostnotum*, but these are absent on most New Zealand Coccidae. On each metapostnotum, there is 1 or more setae, the *metatergal setae*; these are usually represented by a single pair of hs but, on *P. dacrydii* (Fig. 84), there is a group of hs and, on some *Plumichiton* spp., there are also groups of fs. Metatergal setae are apparently absent on some species (e.g., *Aphenochiton matai* Henderson & Hodgson, Fig. 63).

Laterally, the structure depends on whether *hamulohalteres* are present or not. On all species, the *metapleural ridge* extends from the metacoxal articulation anterodorsally; this ridge is short on species lacking the hamulohaltere (most New Zealand species) but is long on the 2 *Pounamococcus* spp. (the only New Zealand species on which hamulohalteres are present, Fig. 85, 86) and extend to the base of the hamulohaltere (Fig. 17). Just dorsad to this wing process is another small sclerite, the

suspensorial sclerite, which is connected to the hamulohaltere. Near the metacoxal articulation, the *metapleural ridge* may have 2 areas of sclerotisation: (a) one extending ventrally from the pleural ridge, the *metepisternum*, which is usually approximately triangular in shape (but not always sclerotised), and (b) another extending posteriorly just dorsad to the dorsal margin of the metacoxa, which is the *metepimeron*. The episternum usually carries some *postmetaspiracular setae*, which are mainly fs but may include an occasional hs. The epimeron may occasionally also have fs setae, the *metepimeron setae*, as on *U. bullatus* (Fig. 88).

Also laterally, between the *metatergal setae* and the wing sclerites near the margin of the metapostnotum, are the *dorsospiracular setae*; these are more or less in line with the dorsopleural setae laterally on the abdomen. When present, they are generally rather few and fs, but, on these dorsoventrally mounted specimens, can be very hard to separate from the *antemetaspiracular setae* which, when present, are just anterior to each metathoracic spiracle and are also apparently always fs. Dorsospiracular setae are considered to be present on most New Zealand males.

The *metathoracic spiracles* are found ventrally, apparently lying beneath the mesocoxae; they are similar in size and shape to the mesothoracic spiracles.

The *metasternum* is rarely sclerotised on New Zealand species, and only lightly when present, and there are no metasternal apophyses. The metasternum is divided into an anterior and posterior half, each of which usually bears a group of setae: the *anterior metasternal setae* and the *posterior metasternal setae*, both usually fs. However, setae may be missing from both areas (as on *I. patella* and *Pounamococcus* spp., Fig. 75, 85, 86, although these species can have hs instead); occasionally only the posterior metasternal setae are absent (as on *C. fagi* and Species A, Fig. 67, 92).

The *dorsal pores* on *P. dacrydii* (Fig. 84) are found along the margin of the *metapostnotum*, associated with the *metatergal* and *dorsospiracular setae*.

Wings: the *fore wings* are large and quite broad although narrow basally, with a broadly rounded apex. They are usually about 2× as long as broad and about 4/5 of the length of the body, but are longer on some species (c.f. *Pounamococcus tubulus* Henderson & Hodgson) and shorter on others (e.g., *C. fagi* and *C. ornatella*). On *Pounamococcus* species, on which *hamulohalteres* are present, a small lobe, the *alar lobe* is present on the hind margin, and this provides a structure for the *hamulus* or haltere seta to hook onto; when the hamulohaltere is absent, this lobe is lacking. The surface of the wing is covered in small hairlike *microtrichia*. Only 2 distinct veins are present, the *radius*, which runs along parallel to the ante-

rior margin, and the *media*, which runs more posteroventrally. *Alar setae* are present on some non-indigenous soft scale species but appear to be absent from all New Zealand males.

The *hamulohalteres* of *P. cuneatus* and *P. tubulus* (Fig. 85, 86) articulate with the *suspensorial sclerite* (Fig. 17); the hamulohalteres are mildly sclerotised, with a single *hamulus* or hooked *haltere seta* apically.

Legs: the legs are normal insect legs but with a single tarsal segment on most species (2 segments on *Pounamococcus* spp., Fig. 17) and a single claw. On New Zealand species, the anterior pair of legs is sometimes marginally the longest. All legs are covered in fs and hs setae, the former usually being the most frequent but, on *P. dacrydii* (Fig. 84), hs are more frequent. On most species, the *coxae* have 1 or 2 elongate setae on or near their apex on the inner margin that are here referred to as *long coxal setae*. A long hs is also present on each *trochanter* near the segmental membrane separating it from the coxa and this is here referred to as the *long trochanter seta*; these can vary considerably in length between species. Also on each trochanter is a ring of 6 *campaniform sensilla*.

The relative length of the *tibia* and *tarsus* varies between species, some species have the tibia about 1.6× the length of the tarsus, others up to 2.5×. Both the tibia and tarsus are covered in fs and hs but the setae tend to become spurlike more distally; in addition, with the exception of *Pounamococcus* spp. which have 2 (Fig. 85, 86), each tibia of New Zealand species has 1 strong *tibial spur* on its inner margin near the tarsus (Fig. 17). Similarly, on the tarsus, one of the setae on the inner margin next to the claw is often particularly long, strong, and spurlike, and is here referred to as the *tarsal spur* (Fig. 17). In addition, on the outer margin at the proximal end of each tarsus on *Pounamococcus* spp. (Fig. 17, 85, 86), there is a *tarsal campaniform pore*; these are absent on all other known coccid males. On the distal end of each tarsus is a pair of capitate *tarsal digitules* (Fig. 17), which are usually slightly shorter than the length of the claw.

The single *claw* is usually held more or less at right angles to the tarsus, slightly curved and pointed; on New Zealand males, the small *denticle* near the apex, typical of many other coccids, appears to be absent or very indistinct. Each claw has a pair of capitate *claw digitules*, which are slightly longer than the claw (Fig. 17).

ABDOMEN

The *abdomen* is elongate, more or less parallel-sided and slightly tapering, consisting of 8 membranous segments and the genital segment (IX), which is elongate and narrow, partly sclerotised, and carries the genital organs. The seg-

mentation is usually reasonably clear and most segments have a broad band of microtrichia on both the dorsal and ventral surfaces. Segments VII and VIII can be produced laterally to form well developed lobe-like *caudal extensions* on some male coccids, but these are short or absent on most New Zealand coccids. Also, segment VIII often has a pair of invaginated *glandular pouches*, each with 2 long *glandular pouch setae*, which support the long wax filaments found posteriorly on many live males. The glandular pouch and setae may be present or absent on New Zealand species, even within the same genus.

Segments I–VII: segment I is developed dorsally and pleurally but not ventrally. Segments I–VI are more or less membranous on New Zealand species, but segment VII usually shows some sclerotisation on the *tergite* and more particularly the *sternite*. On *P. cuneatus* (Fig. 85), all segments show some degree of reticulation; this is much less obvious on *P. tubulus* (Fig. 86). No pleural sclerites are present on segments I–VI on indigenous species. The *caudal extension* of segment VII is usually rounded, and could even be described as absent on most species, but is obvious on *C. ornata*, *C. ornatella*, *E. piperis*, *P. tubulus*, *P. dacrydii*, and Species A. The caudal extension on segment VII is lightly sclerotised on *Pounamococcus* species (Fig. 85, 86).

Each segment usually bears some *dorsal abdominal setae*, *ventral abdominal setae*, *dorsopleural setae*, and *ventropleural setae*. The *dorsal abdominal setae* usually consist of 1–3 pairs of hs on each segment, but many species also have some fs, particularly *C. ornata* and *C. ornatella* (Fig. 69, 70) and most *Plumichiton* spp. *Ventral abdominal setae* occur in a transverse line or band across each segment; when least abundant, there may be only 1 pair of hs but, when abundant (as on *Plumichiton* spp.), there are many fs and then there are always more fs on the ventral than on the dorsal surface. The *dorsal* and *ventral pleural setae* can be hard to differentiate on mounted specimens and can, in any case, run into each other when abundant. The *dorsopleural setae* may be all hs or varying combinations of fs and hs; the *ventropleural setae* are generally fewer and are mainly hs.

On *I. patella*, medially on the tergite of segment IV, are a pair of round, membranous *cicatrices* (Fig. 75). Cicatrices have been noted on a number of species on or near the apex of the caudal extension of segment VIII (see Giliomee 1967; Miller 1991) but not previously from elsewhere on the body.

Segment VIII: is usually similar in length to the preceding segments but is noticeably longer on *C. ornata* and *C. ornatella* (Fig. 69, 70). Both the tergum and the sternum of segment VIII are clearly sclerotised; the *caudal extension* is usually rounded and, like that for VII, could be described

as absent on some species, but is most obvious (although still small) on *I. patella* and *Plumichiton elaeocarpi* (Maskell) (Fig. 75, 80); it is mildly sclerotised on *Aphenochiton subtilis* Henderson & Hodgson (Fig. 66). The *tergite* bears the ante-anal setae: on many species, these are represented by a single pair of hs, but on others (e.g., *C. ornata*, *C. ornatella*, Fig. 69, 70, and most *Plumichiton* spp.), there are many fs, and these can appear to be in 2 groups, one group on the anterior half and the other on the posterior half of the tergite, just anterior to the anus. When abundant, these may merge with the pleural setae laterally on the caudal extension.

Segment VIII also carries the *glandular pouch* and *glandular pouch setae*, when these are present. The glandular pouch is usually quite deep and contains 2 kinds of *pore*: those at the base of the pouch are not loculate, appearing like small cones (e.g., on Fig. 70, 80), whereas those near the opening (and sometimes outside the pouch) are loculate. Both pore kinds appear to be openings to small tubular ducts (cf. Fig. 70, *C. ornatella*); these ducts were also described by Šulc (1931). The frequency of each kind of pore varies between species. The glandular pouch setae are setose on New Zealand species (although they can be capitate on other species) and one is generally noticeably shorter than the other. Even within a genus of what appear to be closely related species (e.g., *Plumichiton* spp.), glandular pouches may be present on some species but absent on others, and thus the presence or absence of glandular pouches appear not to be an apomorphic character for the genus.

Ventrally, the *sternite* of VIII may or may not carry *ventral abdominal setae*; when present these are generally fs. In addition, there is usually a group of 3 hs just laterad to the glandular pouch; on many species, there may be additional fs pleural setae. When the glandular pouch is absent, 1 or more of these setae may be quite long (e.g., on *A. subtilis*, Fig. 66).

Genital segment: this is considered to represent segment IX. This consists of a (generally) long tubular structure that extends posteriorly and is referred to as the *penial sheath*, while dorsomedially, where the penial sheath joins segment VIII, is the *anus* although this is not usually visible. The *penial sheath* emerges from beneath segment VIII and varies somewhat in length, but is generally between 1/3 and 1/6 of total body length. It is broadest anteriorly, tapering posteriorly more or less to a point, although the apex is very blunt on some species (e.g., *Lecanochiton* spp., Fig. 78, 79); on *Plumichiton* spp. the penial sheath is distinctly constricted near the apex. The penial sheath is well sclerotised laterally but membranous ventromedially (Giliomee, 1967), with a slit ventrally towards the apex, through which the aedeagus emerges. The slit widens at the

anterior end into a large membranous area, which is referred to as the *basal membranous area*; this is approximately triangular and does not vary much in size or shape. Between the 2 sclerotised margins of the penial sheath just posterior to the basal membranous area, is a sclerotised ridge, the *basal rod*; this may be very short or rather long and may or may not reach the basal membranous area anteriorly; the basal rod of *Lecanochiton* spp. (Fig. 78, 79) appears to be made of parallel ridges. Posteriorly, the basal rod is attached to the anterior end of the *aedeagus*, which lies in a groove in the ventral wall of the penial sheath; the penial sheath generally ends in a blunt apex some distance from the end of the penial sheath but, on Species A, it appears to have a distinct “shovel-shaped” apex which extends posteriorly past the end of the sheath (Fig. 92). The length of the aedeagus is very variable between species.

Along the sides and near the apex of the penial sheath are a number of small setae, the *penial sheath setae*. In addition, towards the apex of the sheath are a group of minute pores, the *penial sheath pores*, which may be campaniform sensilla.

Comment. The taxonomic significance of male characters for defining higher taxa is becoming clearer. Some characters that had appeared likely to be of considerable importance are now considered of lesser significance. Two good examples of such characters are the number of simple eyes and the presence or absence of glandular pouches and glandular pouch setae. With regard to the number of simple eyes, *Pounamococcus cuneatus* has 2 (Fig. 85) and *P. tubulus* has 4 (Fig. 86). As there are numerous other significant characters shared by these two species, they are clearly congeneric. And with regard to glandular pouches, there are several genera where some species have them whilst others do not, i.e., *Aphenochiton*, *Plumichiton*, and *Umbonichiton*. Nonetheless, there are many characters that appear to be good for defining groupings here considered to represent genera, some apparently relatively insignificant. Thus, the males of three *Ctenochiton* species described here (Fig. 71–73) all have 1 or more setae on the metathorax immediately posterior to where the marginal ridge of the basisternum joins the precoxal ridge; these setae are absent from almost all other known male Coccidae (only otherwise known on *U. hymenantherae*, Fig. 89 and *Kalasis depressa*, Fig. 76). Equally, all the known males of *Plumichiton* species have a trochantofemur (Fig. 80–83), where the segmentation between the trochanter and femur is poorly defined or entirely absent; in addition, *Plumichiton* species also have a distinct constriction towards the apex of the penial sheath. *Pounamococcus* species have tarsal campaniform pores, 2-segmented tibiae, 2 tibial spurs per leg, and a tripartite cranial apophysis; male *Lecanochiton* have a poorly de-

finned basal rod (Fig. 78, 79); and the *ornata*-group of *Crystallotesta* have no tentorial bridge (Fig. 69, 70), an unusually long abdominal segment VIII, and the postocular sclerite extends around the ocelli (although this is shared with *P. cuneatus*, Fig. 85).

With regard to useful characters that might help in identifying species rather than higher taxa, the main new character used here is the structure of the dermal reticulations on the head. It was noted that the size and, more particularly, the structure of the inner microridges within each reticulation seemed to be highly variable between species but relatively uniform within a species; Fig. 62–92 show this structure for the gena and ocular sclerite for each species. Again, even within the genera as defined here, these characters can be reasonably constant: thus, *Ctenochiton* species (Fig. 71–73) tend to have large genal reticulations with very few or no inner microridges. In addition, the frequency of fleshy and hairlike setae on the metasternum, ventrally on the abdomen, and on the membranous area of the scutum appears to be important, particularly at the species level. Pores are only known from 2 species in New Zealand, *I. patella* (on the head only, Fig. 75) and *P. dacrydii* (all over the dorsum, Fig. 84), but the structure of these pores is quite different on the two species.

Important taxonomic characters

Characters that appear to be of help in diagnosing species and higher taxa of New Zealand Coccidae are therefore the following (where p/a = present/absent).

General: (i) overall size.

Head: (i) p/a dorsal midcranial ridge;

- (ii) p/a postoccipital ridge;
- (iii) p/a fleshy setae;
- (iv) p/a dorsal ocular setae;
- (v) p/a genal setae;
- (vi) p/a ventral head setae between or posterior to ventral eyes;
- (vii) whether postocular ridge reaches ocelli;
- (viii) form of genal and ocular sclerite reticulations;
- (ix) p/a tentorial bridge;
- (x) p/a pores;
- (xi) shape of cranial apophysis;
- (xii) number of simple eyes.

Antennae: (i) overall length;

- (ii) number of setae on scape;
- (iii) length and frequency of fleshy setae;
- (iv) p/a of hairlike setae on segments III–IX;
- (v) number of capitate setae;
- (vi) relative lengths of each segment.

Prothorax: (i) p/a fleshy setae;

- (ii) p/a lateral pronotal setae;
- (iii) p/a pores;
- (iv) p/a median ridge of prosternum;
- (v) frequency and kind of prosternal setae;
- (vi) p/a anteprosternal setae;
- (vii) p/a antemesospiracular setae;
- (viii) p/a post-tergite.

Mesothorax: (i) shape of membranous area of scutum;

- (ii) frequency and kind of setae on membranous area;
- (iii) p/a reticulations on scutum laterad to scutellum;
- (iv) p/a tegular setae;
- (v) frequency and distribution of postmesospiracular setae;
- (vi) p/a reticulation on mesepisternum;
- (vii) p/a median ridge on basisternum;
- (viii) p/a basisternal setae;
- (ix) p/a setae on/near lateropleurite and posterior part of mesepisternum;
- (x) p/a postalare setae.

Metathorax: (i) frequency and kinds of metatergal setae;

- (ii) p/a dorsospiracular setae;
- (iii) p/a anterior and posterior metasternal setae;
- (iv) p/a postmetaspiracular setae;
- (v) p/a setae just posterior to where marginal ridge of basisternum and precoxal ridge meet;
- (vi) p/a dorsal part of pleural ridge.

Wings: (i) p/a hamulohalteres;

- (ii) ratio of wing length to width.

Legs: (i) whether tarsi 1- or 2-segmented;

- (ii) p/a trochantofemur;
- (iii) number of tibial spurs;
- (iv) frequency of both hs and fs;
- (v) p/a long hairlike seta on trochanter;
- (vi) p/a tibiotarsal articulation;
- (vii) p/a tarsal campaniform pores.

Abdomen: (i) frequency and kind of setae;

- (ii) p/a tergites and sternites;
- (iii) p/a pleurites;
- (iv) p/a cicatrix;
- (v) p/a fleshy ante-anal setae;
- (vi) p/a glandular pouch;
- (vii) size of caudal extensions on segments VII and VIII;
- (viii) length of segment VIII.

Genital segment: (i) shape of penial sheath;

- (ii) relative length of penial sheath to total body length;
- (iii) shape of aedeagus;
- (iv) whether basal rod reaches basal membranous area;
- (v) length of basal rod;
- (vi) shape of aedeagus apex.

Key to adult males of New Zealand Coccidae

- 1 Dorsal and ventral abdominal setae very few and with only hairlike setae; head without fleshy setae; postmesospiracular, postmetaspiracular and posterior metasternal setae all absent 2
- Dorsal and ventral abdominal setae often abundant, usually including some fleshy setae, at least on venter; head with fleshy setae; some or all of postmesospiracular, postmetaspiracular and posterior metasternal setae present 3
- 2(1) Group of pores present between bases of antennae; with a pair of cicatrices medially on abdominal tergite IV; prescutum reticulated throughout; basisternum without median ridge
.....(p. 83)... *Inglisia patella* Maskell
- Pores entirely absent between bases of antennae; without a pair of cicatrices medially on tergite IV; prescutum not reticulated; basisternum with a well-developed median ridge
.....(p. 51) ... *Aphenochiton inconspicuus* (Maskell)
- 3(1) Hamulohalteres present; cranial apophysis trilobed; tarsal campaniform pores present; 2 tibial spurs present per tibia (*Pounamococcus* spp.)... 4
- Hamulohalteres absent; cranial apophysis bilobed; tarsal campaniform pores absent; only 1 tibial spur present per tibia 5
- 4(3) With 2 pairs of simple eyes only; aedeagus very broad, almost as broad as penial sheath near apex; some polygonal reticulation present on gena . . .(p. 116)...
... *Pounamococcus cuneatus* Henderson & Hodgson
- With 4 pairs of simple eyes; aedeagus quite narrow, much narrower than width of penial sheath; gena without polygonal reticulation (p. 117)...
..... *Pounamococcus tubulus* Henderson & Hodgson
- 5(3) Highly setose, with hairlike setae almost as abundant as fleshy setae; hairlike setae common on all antennal segments; dorsal membranous areas with frequent conical pores; prescutum reticulated throughout
.....(p. 111)... *Poropeza dacrydii* (Maskell)
- If highly setose, hairlike setae not nearly as abundant as fleshy setae; hairlike setae rare or absent on antennal segments IV–X; conical pores absent; prescutum not reticulated throughout 6
- 6(5) With only 2 pairs of simple eyes 7
- With 4 pairs of simple eyes 10
- 7(6) Tegular setae absent; penial sheath narrowing slowly towards an acute apex; body length > 1.2 mm 8
- Tegular setae present; penial sheath almost parallel-sided with a blunt apex; body length < 1.0 mm
..... (*Lecanochiton* spp.)... 9
- 8(7) Postoccipital-like ridge and dorsal midcranial ridge present; without fleshy setae on dorsal or ventral abdomen; aedeagus with a spade-like apex **Species A**
- Postoccipital-like ridge and dorsal midcranial ridge absent; with fleshy dorsal and ventral abdominal setae; aedeagus without an obvious spadelike apex
..... (p. 89)... *Kalasisiris depressa* (Maskell)
- 9(7) Postmesospiracular setae frequent, >10 (p. 96)... *Lecanochiton scutellaris* Henderson & Hodgson
- Postmesospiracular setae very few, <2 or absent ... (p. 95)... *Lecanochiton actites* Henderson & Hodgson
- 10(6) Penial sheath narrowing abruptly near apex; with several fleshy metatergal setae; segmentation between trochanter and femur absent or indistinct, particularly on metathoracic leg (*Plumichiton* spp.)... 11
- Penial sheath not narrowing abruptly near apex but narrowing gradually throughout its length; with 0 or 1 pair of hairlike metatergal setae (a few fs present on *A. pubens*); segmentation line between trochanter and femur distinct 14
- 11(10) Glandular pouch present; postmesospiracular setae very few, <5 or absent 12
- Glandular pouch absent; postmesospiracular setae abundant, >30 13
- 12(11) Postocular ridge extending around ocelli; anterior metasternal setae abundant; genal setae frequent, >10 / side ... (p. 102)... *Plumichiton elaeocarpi* (Maskell)
- Postocular ridge not reaching ocelli; anterior metasternal setae very few, 0–3 each side; genal setae very few... (p. 107)... *Plumichiton pollicinus* Henderson & Hodgson
- 13(11) Antemesospiracular setae present; fleshy setae abundant on both dorsal and ventral surfaces on all abdominal segments
..... (p. 104)... *Plumichiton flavus* (Maskell)
- Antemesospiracular setae absent; fleshy setae abundant on ventral surface but rare on dorsal surface of abdomen, restricted to posterior segments only
(p. 106)... *Plumichiton nikau* Henderson & Hodgson
- 14(10) Postocular ridge extending around ocelli; gena with genal setae but with only very faint reticulations; fleshy setae very flagellate and common, generally >6 / segment, on both abdominal surfaces
..... (*ornata*-group of *Crystallotesta*)... 15
- Postocular ridge not nearly reaching ocelli; gena generally with reticulations, although both reticulations and genal setae may be absent; fleshy setae rarely flagellate and not abundant on dorsal abdominal surface, with 0–2 each segment 16
- 15(14) Postmesospiracular setae absent; antemesospiracular setae present; basisternum without setae .
..... (p. 68)... *Crystallotesta ornata* (Maskell)

- Postmesospiracular setae quite abundant; antemesospiracular setae absent; basisternum with basisternal setae (p. 69)...
..... *Crystallotesta ornatella* Henderson & Hodgson
- 16(14) Scutum reticulated laterad to scutellum 17
- Scutum not reticulated laterad to scutellum 18
- 17(16) Glandular pouch present; tegular setae present; dorsospiracular setae present
.... (p. 66)... *Crystallotesta leptospermi* (Maskell)
- Glandular pouch absent; tegular setae absent; dorso-spiracular setae absent
..... (p. 90)... *Kalasis perforata* (Maskell)
- 18(16) Glandular pouch present 19
- Glandular pouch absent 25
- 19(18) Posterior metasternal setae absent; antemesospiracular setae present
..... (p. 64)... *Crystallotesta fagi* (Maskell)
- Posterior metasternal setae usually abundant; antemesospiracular setae absent 20
- 20(19) Genae without fleshy setae; genal reticulations with numerous crooked, short inner microridges (p. 53)... *Aphenochiton kamahi* Henderson & Hodgson
- Genae with fleshy setae; genal reticulations with few, usually no, inner microridges 21
- 21(20) Postmesospiracular setae common just posterior to each mesothoracic spiracle but rare or absent medially; legs with rather few setae, each femur with <15 setae; basal rod of aedeagus reaching membranous area anteriorly; ventral midcranial ridge short and poorly defined; ventral head setae absent laterally on ocular sclerite (p. 130)...
..... *Umbonichiton jubatus* Henderson & Hodgson
- Postmesospiracular setae common across entire segment; other characters not in this combination 22
- 22(21) Tegular setae present; basal rod of aedeagus very short (about 1/10 length of aedeagus) and not nearly reaching membranous area anteriorly; both gena and ocular sclerite reticulations with lots of either inner microridges or raised spots (p. 125)...
..... *Umbonichiton adelus* Henderson & Hodgson
- Tegular setae absent; basal rod of aedeagus quite long, at least 1/4 length of aedeagus; reticulations on gena and ocular sclerite with few or no inner microridges
..... (*Ctenochiton* spp.) ... 23
- 23(22) Basal rod of aedeagus quite long, about 2/3 length of aedeagus; cranial apophysis with short lateral arms; most reticulations of ocular sclerite without inner microridges (p. 75)...
..... *Ctenochiton chelyon* Henderson & Hodgson
- Basal rod of aedeagus only about 1/2–1/3 length of aedeagus; cranial apophysis with long lateral arms; most reticulations on ocular sclerite with some inner microridges 24
- 24(23) Some reticulations on ocular sclerite with >2 inner microridges; with no hs near mesothoracic precoxal ridges of basisternum (p. 76)...
..... *Ctenochiton paraviridis* Henderson & Hodgson
- Each reticulation on ocular sclerite with only 0 or 1 inner microridges; with a single hs near each mesothoracic precoxal ridge of basisternum
..... (p. 78)... *Ctenochiton viridis* (Maskell)
- 25(18) With only hairlike ventral abdominal setae present; without ventral abdominal setae on segment VIII; pleural setae on abdominal segment VIII including 1 or 2 setae much longer than other pleural setae; scutal setae only hs (p. 57)...
..... *Aphenochiton subtilis* Henderson & Hodgson
- With some fs ventral abdominal setae; with ventral abdominal setae on segment VIII; pleural setae on abdominal segment VIII not significantly longer than other pleural setae; scutal setae including fs 26
- 26(25) Fleshy setae on membranous area of scutum abundant (>40) 27
- Fleshy setae on membranous area of scutum much less frequent (< about 30) 28
- 27(26) Tegular setae present; prescutum with shallow microridges forming a reticulate pattern; with some fleshy metatergal setae (p. 56)...
..... *Aphenochiton pubens* Henderson & Hodgson
- Tegular setae absent; prescutum without shallow microridges forming a reticulate pattern; with 1 pair of hs metatergal setae only (p. 131)...
..... *Umbonichiton pellaspis* Henderson & Hodgson
- 28(26) Genae each with 15+ fs (p. 128)...
..... *Umbonichiton hymenantherae* (Maskell)
- Genae each with less than a total of 5 fs and/or hs . 29
- 29(28) Tergal setae present; prosternum with more than 2 pairs of prosternal setae (p. 54)...
..... *Aphenochiton matai* Henderson & Hodgson
- Tergal setae absent; prosternum with 1 or 2 pairs of prosternal setae only 30
- 30(29) Anteprosternal setae present; membranous area of scutum rather narrow (about 6–7× wider than long); reticulated border to ventral midcranial ridge narrow; genal reticulations only clear on anterior 1/3, posterior 2/3 with small dots
..... (p. 81)... *Epelidochiton piperis* (Maskell)
- Anteprosternal setae absent; membranous area of scutum rather broad (about 3× wider than long); reticulated border to ventral midcranial ridge broad; genal reticulations clear, each with small sinuous inner microridges (p. 126)...
..... *Umbonichiton bullatus* Henderson & Hodgson

DESCRIPTIONS OF INDIGENOUS SPECIES, ADULT MALES

APHENOCHITON Henderson & Hodgson

Aphenochiton Henderson & Hodgson: Hodgson & Henderson, 2000: 57

Type species: *Inglisia inconspicua* Maskell

Introduction. The genus *Aphenochiton* was proposed for 9 species (*A. chionochloae* Henderson & Hodgson, *A. dierama* Henderson & Hodgson, *A. grammicus* Henderson & Hodgson, *A. inconspicuus* (Maskell), *A. kamahi* Henderson & Hodgson, *A. matai* Henderson & Hodgson, *A. pronus* Henderson & Hodgson, *A. pubens* Henderson & Hodgson, and *A. subtilis* Henderson & Hodgson on the basis of adult female characters (Hodgson & Henderson 2000). Males of only 5 of these species were available: *A. inconspicuus*, *A. kamahi*, *A. matai*, *A. pubens*, and *A. subtilis*. These fall into 2 distinct groups, here referred to as the *inconspicuus*-group (with just *A. inconspicuus*) and the *kamahi*-group (including the other 4 species). These groups are dealt with separately below.

The *inconspicuus*-group

Diagnosis based on the adult male of *A. inconspicuus* only (significant character-states in italics) (Fig. 62).

General: of moderate size; *fs absent from body but present on legs and antennae*; fs normal, without extremely flagellate apices; dorsal pores absent. **Head:** *very few setae, hs only*; with 4 pairs of simple eyes, lateral eyes smaller than other eyes; *genal setae absent*; genal reticulations with sinuous inner microridges; ocular sclerite and genal reticulations dissimilar; ventral midcranial ridge with a few hs only; postocular ridge not nearly reaching ocelli; ocelli small; ocular sclerite reticulations with few or no inner microridges; *ventral head setae hs only, not extending to lateral areas of ocular sclerite*; ventral head setae absent between ventral eyes; ventral ocular setae absent; tentorial bridge present; cranial apophysis short and bifurcated. **Antennae:** of average length, about 0.6 total body length; with 3 hs on scape; segment X not constricted but narrowing towards apex; with very few or no hs on segments IV–X; segment X with 3 capitate setae. **Prothorax:** lateral pronotal setae absent; lateral prothoracic setae absent; median ridge of prosternum absent; *prosternal setae absent*; antemesospiracular setae absent; anteprosternal setae absent. **Mesothorax:** prescutum approximately square; prescutum without reticulations; membranous area of scutum about 3–4× wider than long; membranous area of scutum with hs only; scutum without reticulations anteriorly; scutum not reticulated laterad to scutellum; foramen on scutellum small; *postmesospiracular setae absent*; median ridge of basisternum well developed; furca fairly short, not

nearly reaching anterior border of basisternum; setae laterad to lateropleurite absent; tegular setae absent; mesepisternum without reticulations; anterior end of postalare reticulated; postalare setae absent. **Metathorax:** *with only hs anterior metasternal setae*; posterior metasternal setae absent; postmetaspiracular setae absent; metepimeron without setae; hamulohalteres absent; with 1 pair hs metatergal setae; *dorsospiracular setae absent*; setae near mesoprecoxal ridge absent. **Legs:** with 1 tibial spur per tibia; tarsal campaniform pores absent; trochanter-femur segmentation distinct; with more hs than fs on metafemur; tarsus 1-segmented. **Abdomen:** segment VIII of normal length; cicatrices absent; sternites and tergites on segments II–VI absent or poorly sclerotised; dorsal abdominal setae few, all hs; ventral abdominal setae few, all hs; pleural setae hs only, segmentally arranged; 1 pair of hs ante-anal setae only; caudal extensions on segments VII and VIII small and rounded; glandular pouches present; penial sheath about 1/4 of total body length; penial sheath gradually narrowing towards apex; basal rod short, about 1/3 length of aedeagus; basal rod reaching basal membranous area anteriorly; aedeagus long, about 2/3 length of penial sheath and with almost parallel margins.

Comment. The male of *A. inconspicuus* differs from all other New Zealand males, except those of *Inglisia patella*, in the apparent total absence of fleshy setae on the body. It differs from the latter species in many characters but particularly:

- (i) absence of pores on head;
- (ii) absence of a pair of cicatrices on dorsum of abdomen;
- (iii) in having a proper tibio-tarsal articulation;
- (iv) in having 3 capitate setae on apex of each antenna;
- (v) presence of a median ridge on basisternum;
- (vi) presence of tibial spurs.

In addition to the apparent complete absence of fleshy setae on the body, the male of *A. inconspicuus* differs significantly from those of the other 4 species of *Aphenochiton* described below in having the following (character-states for other 4 species in parentheses):

- (i) absence of postmesospiracular setae (present);
- (ii) absence of postmetaspiracular setae (present);
- (iii) absence of posterior metasternal setae (present);
- (iv) absence of dorsospiracular setae (present).

This species appears to be closest to *A. kamahi* in the absence of tegular setae, and in the presence of a pair of glandular pouches and setae. For further comparisons, see under *A. kamahi*. Adult female *A. inconspicuus* also differ from those of the other species in *Aphenochiton* in having broad spinose marginal setae (the other species have finely spinose or setose marginal setae), and pregenital disc-pores present medially across abdominal segments IV–VII (restricted to submedian folds only on the other species).

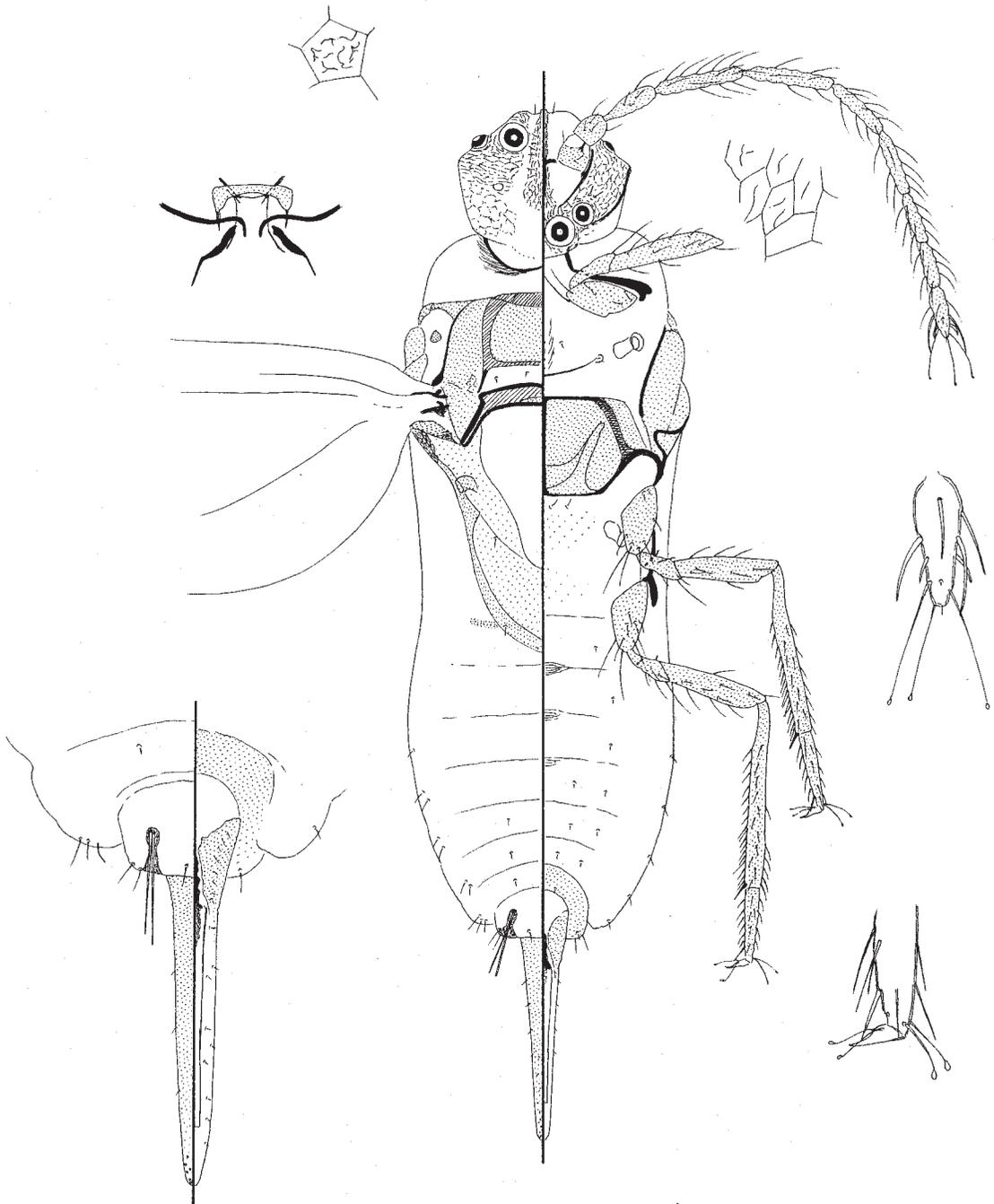


Fig. 62 Adult male, *Aphenochiton inconspicuus* (Maskell). On this and most subsequent figures of adult males, marginal vignettes illustrate the following: left of head — genal reticulations and cranial apophyses; right of head — ocular sclerite reticulations; bottom left — posterior abdominal segments plus penial sheath; mid-right — apical antennal segment; and bottom right — distal end of tarsus + claw . Note also that tibia + tarsus of anterior legs are not illustrated in the figures.

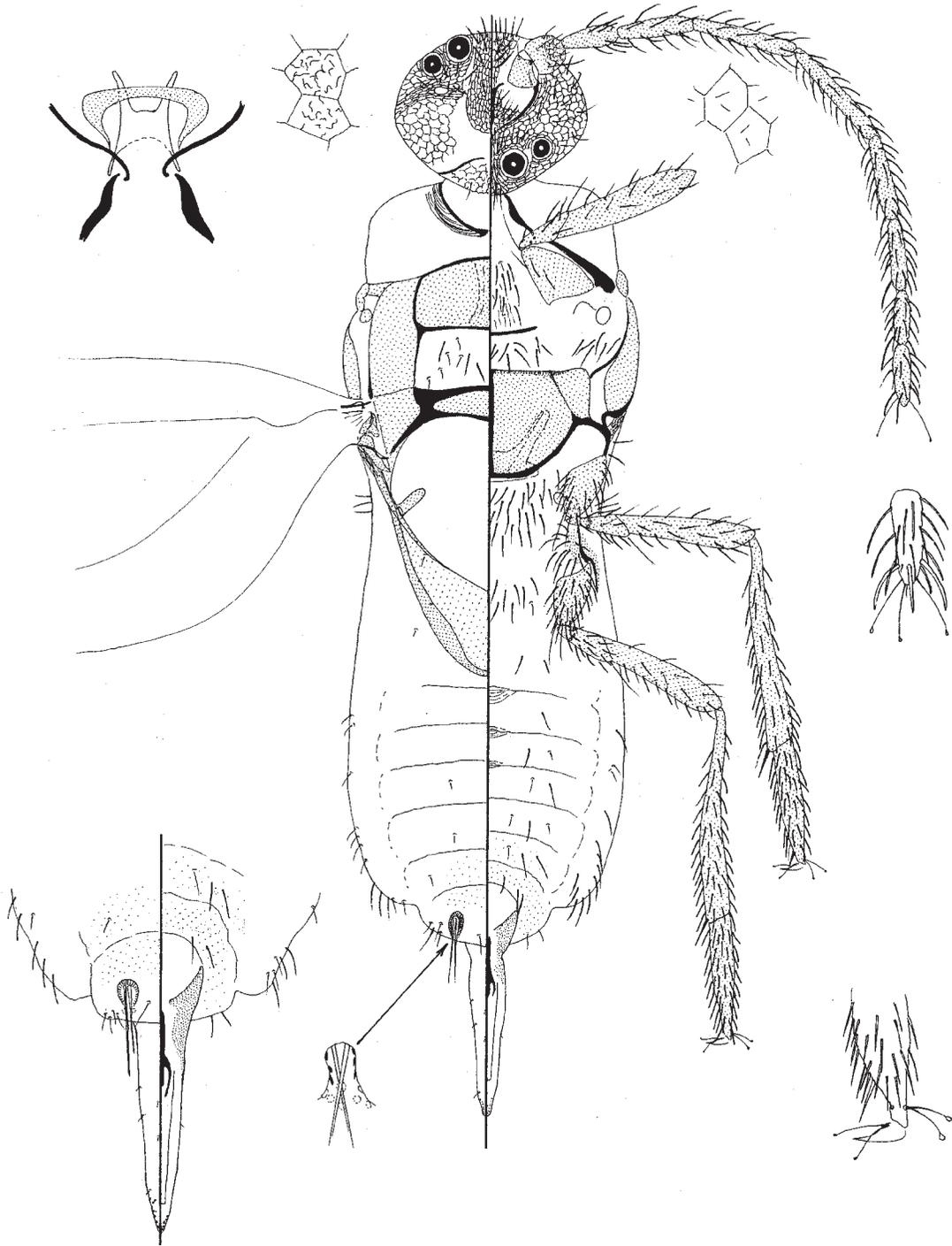


Fig. 63 Adult male, *Aphenochiton kamahi* Henderson & Hodgson.

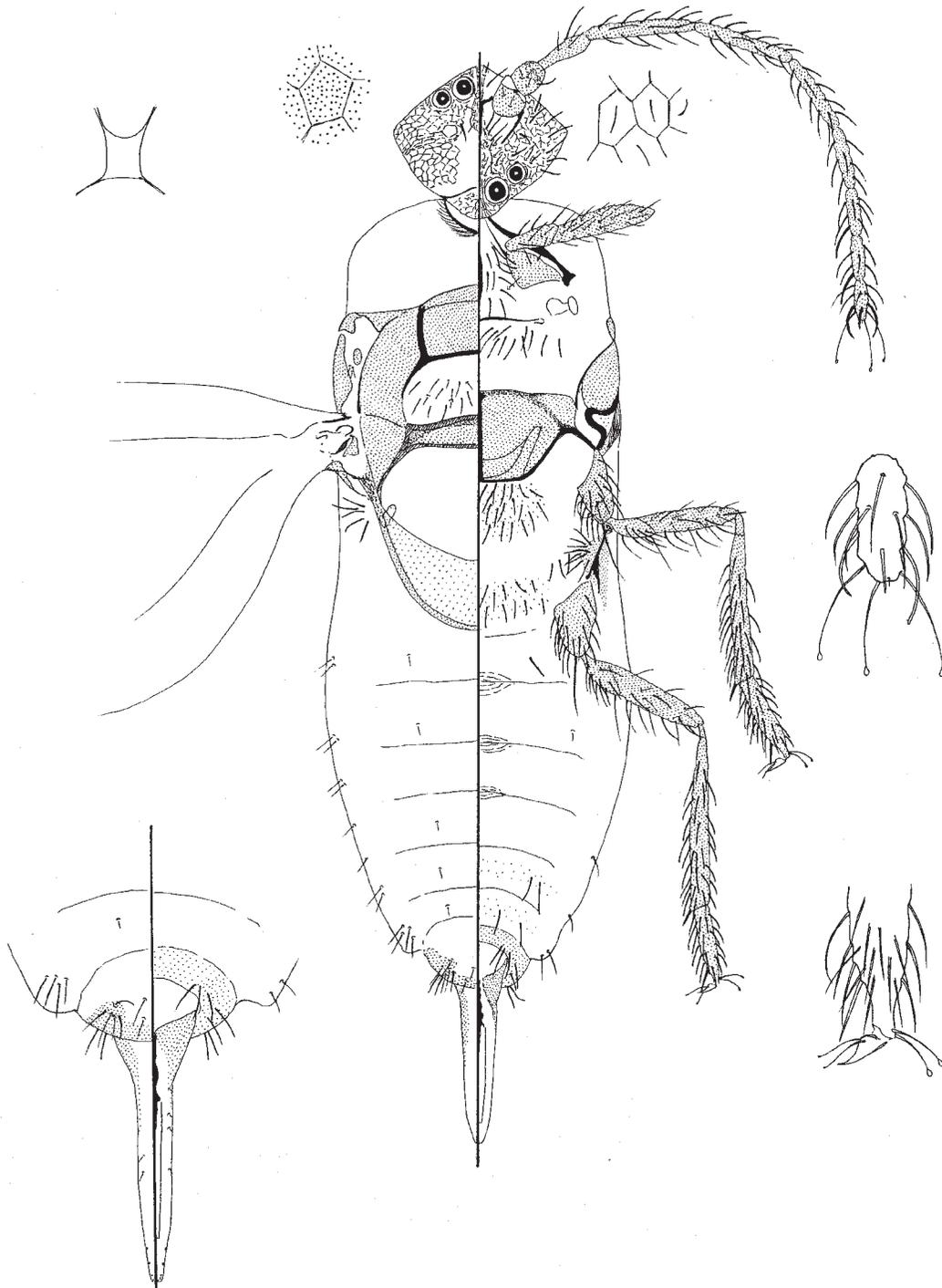


Fig. 64 Adult male, *Aphenoichiton matai* Henderson & Hodgson.

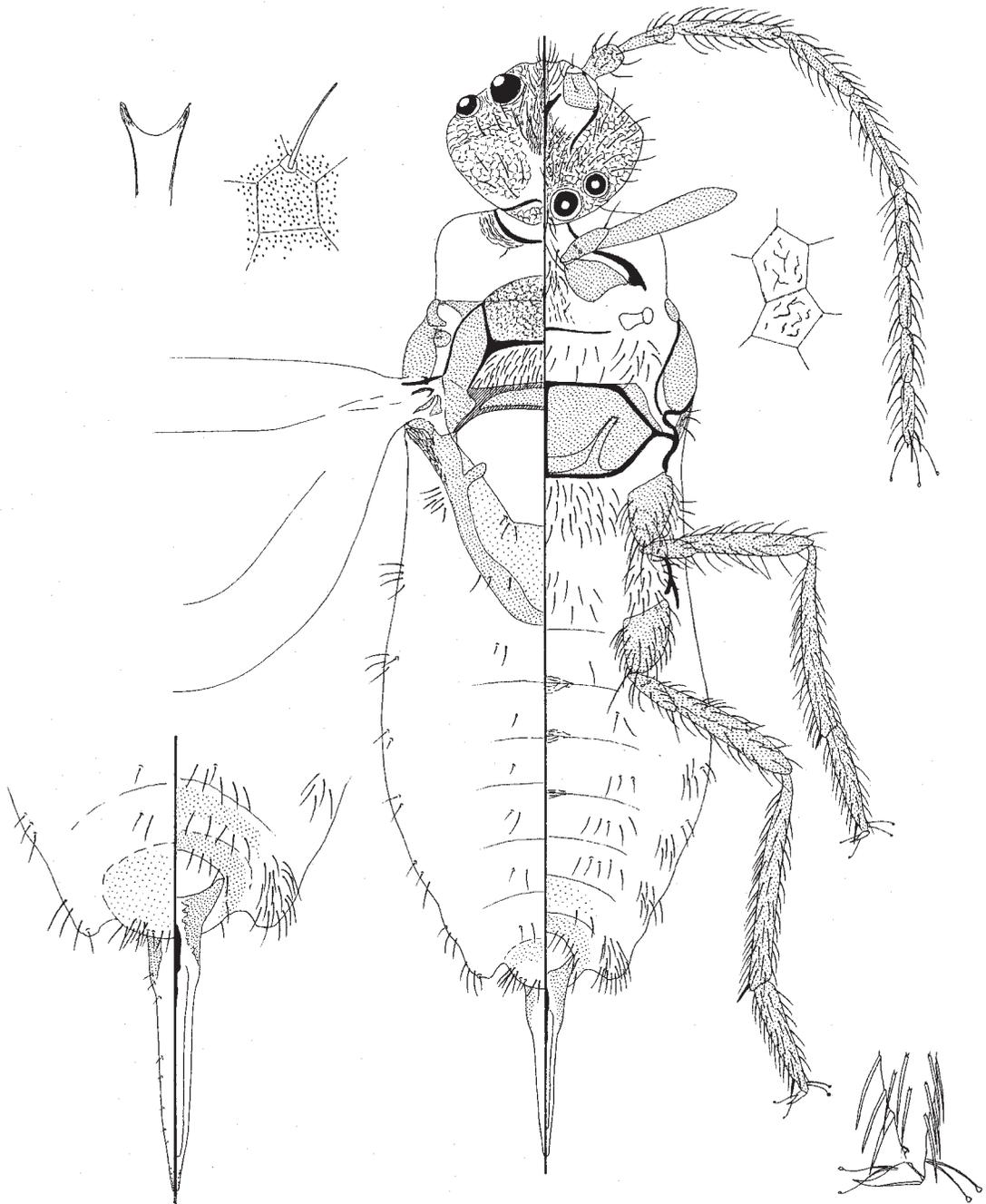


Fig. 65 Adult male, *Aphenochiton pubens* Henderson & Hodgson.

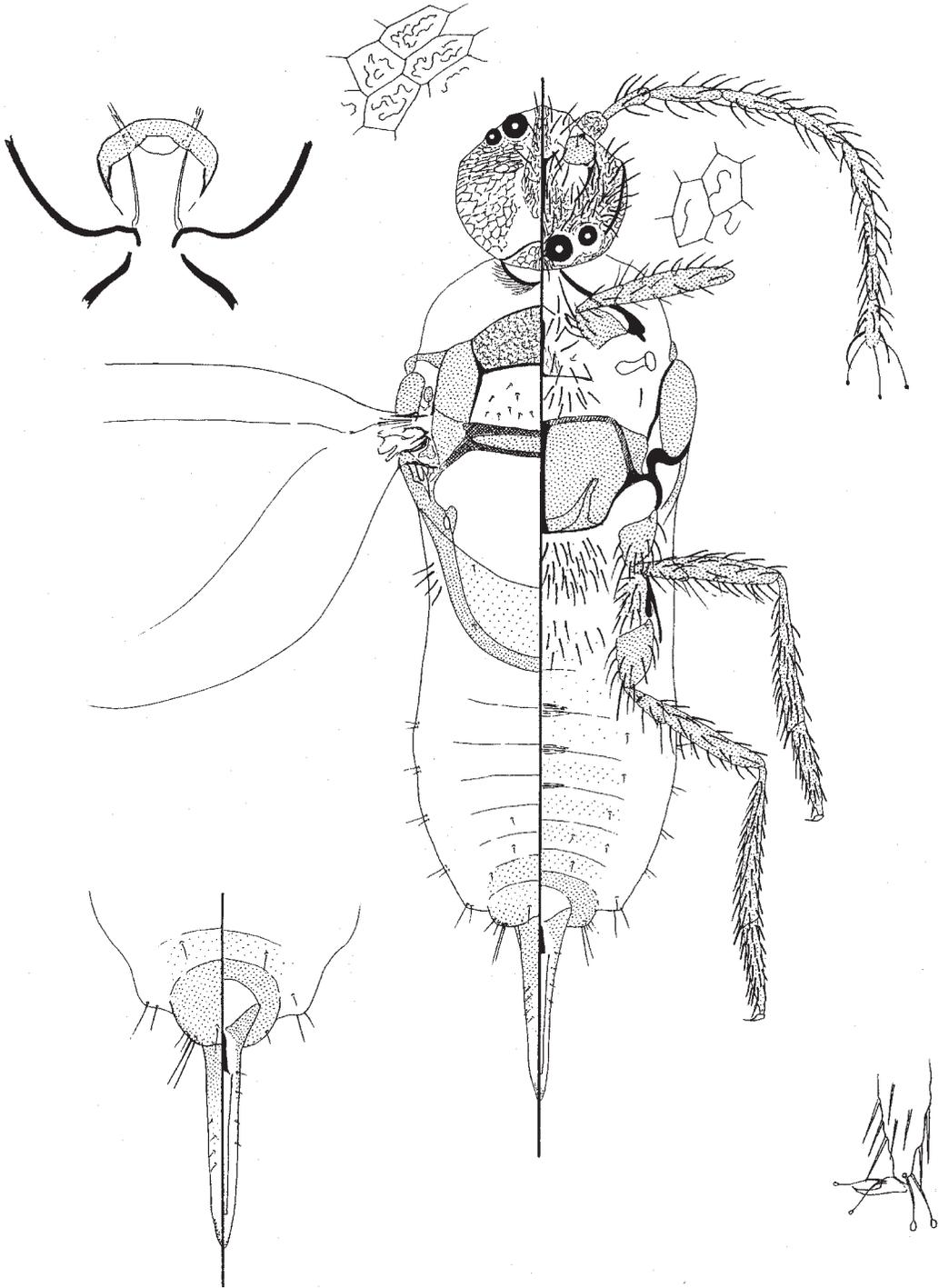


Fig. 66 Adult male, *Aphenoचितon subtilis* Henderson & Hodgson.

***Aphenochiton inconspicuus* (Maskell)**

Fig. 22, 23, 62

Live appearance: body light brown with black eyes; pair of caudal wax filaments present.

Test moderately convex, of translucent, glassy, fused wax plates, with a mid-dorsal row of thicker more convex plates; a V-shaped suture between back-plate suture and anal aperture absent. On leaves of host plants.

Material examined: see Appendix for collection details of specimens examined.

Described from 6 specimens in good to very good condition.

Mounted material: of moderate size, total body length 1.4–1.65 mm; antennae relatively short, about 3/5 total body length; body with very few setae, fleshy setae absent from body but generally easy to differentiate from hairlike setae on antennae; length of fs on antennae more than 2× width of antennal segments. Wings comparatively long, about 9/10 total body length; breadth rather less than 1/2 wing length. Hamulohalteres absent.

Head: approximately round in dorsal view; length of head about 225–235 µm; width across genae 254–266 µm. Median crest reticulated throughout its length although narrow antero-ventrally; with about 4–7 hs dorsal head setae on each side. Midcranial ridge: dorsal ridge absent: ventral ridge well defined, just reaching ocular sclerite posteriorly; with a quite narrow reticulated border anteriorly, which broadens posteriorly and fuses with ocular sclerite; lateral arms heavily sclerotised; with 0 or 1 hs ventral midcranial ridge setae. Genae large and polygonally reticulated throughout, each reticulation with numerous short highly tortuous inner microridges; genal setae absent. Simple eyes: 4 pairs; large dorsal and ventral pairs subequal in size, both pairs round, each 43–50 µm wide; each with a closely associated, slightly smaller, round, lateral simple eye, 28–36 µm wide, ventral pair perhaps slightly larger than dorsal pair. Ocelli each about 10–17 µm wide. Ocular sclerite polygonally reticulated, each reticulation with a few straight to slightly curved inner microridges. Preocular ridge: dorsal arm long, almost reaching larger dorsal simple eyes, but shorter than ventral arm; ventral arm reaching about 4/5 of way to midcranial ridge. Postocular ridge well developed but not nearly reaching ocelli dorsally. Dorsal ocular setae absent. Ventral head setae: with about 3–11 hs on each side, mainly dorsad to ventral simple eyes but with 0–3 more laterad; with none between or posterior to ventral eyes. Tentorial bridge well developed and broad. Cranial apophysis rather short and bifurcated, about 50 µm long. **Antennae:** 900–950 µm long (ratio of total body length to antennal length 1:0.61). Scape: 50–52 µm long and 41–47 µm wide; with 1 hs on ventral surface and 2 (or 3) hs on

inner margin. Pedicel: length 41–49 µm, width 42–47 µm; reticulated at distal end, with 0 fs + 2–5 hs + 1 placodeum basiconicum; setae restricted to ventral surface. Segments III–IX all rather narrow, each about 13–20 µm wide; lengths (µm): III: 89–98; IV: 141–150; V: 132–148; VI: 99–150; VII: 101–125; VIII: 74–87 and IX: 66–103; fs about 41–45 µm long; approximate number of setae per segment: III: 2–4 fs + 0–2 hs + 2 sensilla basiconica; IV: 15–17 fs + 0 or 1 hs; V: 10–15 fs + 0–2 hs; VI: 12–15 fs + 0 hs; VII: 13–15 fs + 0 hs; VIII: 9–15 fs + 0 hs + 1 bristle (barely differentiated from fs) and IX: 8–13 fs + 0 hs + 1 bristle (barely differentiated from fs). Segment X: length 77–85 µm; slightly constricted apically; with 3 capitate setae, 3 large and 2 small antennal bristles plus 5–7 fs; with 2 sensilla basiconica, one apically and one more proximally.

Thorax. Prothorax: pronotal ridge strong, with a broad reticulated or striated lateral pronotal sclerite; without lateral pronotal setae. Sternum with a distinct but not very strong transverse ridge and a suggestion of a prosternal apophysis; median ridge barely present; sternite broad and triangular, with faint striations; prosternal setae: 1 hs on each side. Anteprosternal setae and antemesospiracular setae absent. **Mesothorax:** prescutum distinctly wider than long (186–190 µm wide and 103–121 µm long); sometimes with faint reticulations. Scutum: median membranous area much wider than long (190–216 µm wide; about 33–63 µm long); scutal setae: 2 pairs of hs; lateral margins not reticulated (or with a few faint reticulations near scutellum); without setae. Scutellum 165–186 µm wide and 33–38 µm long; with a small foramen; posterior notal wing process long. Mesopostnotum well developed; postnotal apophysis well developed. Basisternum about 215–240 µm wide and 149–158 µm long; with a complete, strong median ridge, bounded by strong marginal and precoxal ridges; without basisternal setae; lateropleurite rather narrow, without a sclerotised extension from marginal ridge anteriorly; furca well developed, each arm extending anteriorly well past point where marginal and coxal ridges meet. Postalare reticulated at anterior end; without postalare setae. Mesothoracic spiracles: peritremes 21–23 µm wide. Postmesospiracular setae absent. Tegula: well developed but without tegular setae. **Metathorax:** metapostnotum represented by a narrow sclerotisation; metatergal seta: 1 hs on each side. Metapostnotum absent. Metapleural ridge reduced, only posterior half present; episternum narrow or absent; postmetaspiracular setae absent; metepimeron sclerotised, without setae. Antemetaspiracular setae and dorsospiracular setae absent. Metathoracic spiracles: width of peritremes 26–30 µm. Metasternum possibly lightly sclerotised. Anterior metasternal setae: 2–4 hs immediately posterior to basisternum; posterior metasternal setae absent.

Wings: hyaline, of moderate length (1325–1475 µm) and

width (635–675 μm) (ratio length to width 1:0.45; ratio of total body length to wing length 1:0.96). Hamulohalteres absent.

Legs: subequal in length. Coxa lengths (μm): I: 103–116; II: 115–112; III: 115–133; coxal III setae: about 9–12 hs; with 1 or 2 long apical setae on each coxa, each about 66–83 μm long. Trochanter + femur lengths (μm): I: 260–290; II: 259–257; III: 231–270; trochanter III with about 8–11 hs; long trochanter seta about 75 μm long; femur III with about 0–4 fs + 12–16 hs. Tibia lengths (μm): I: 299–323; II: 289–315; III: 298–323; tibia III with about 49–70 setae, many spurlike on distal third of leg; large apical spur 25–30 μm long. Tarsus lengths (μm): I: 124–158; II: 120–154; III: 120–137 (ratio length of tibia III to length of tarsus III 1:0.41); tarsus III with about 20–28 setae, many spurlike; distal tarsal spur 19–23 μm long; tarsal digitules shorter than claw. Claws subequal in length to width of tarsi, slightly curved, without a denticle; length: III: 23–25 μm ; claw digitules a little longer than claw.

Abdomen: segments I–VII: tergum and sternum of all segments with some reticulations + microtrichia but sternites only present on segment VII; with a broad membranous area between sternites II and III, and narrower ones between III–IV and IV–V. Caudal extension of segment VII rounded. Dorsal abdominal setae, on each side, segments: I: 1 hs; II–IV: 0 hs; V–VII: 1 hs. Pleural setae: per side: dorsopleural setae, segments: I–II: 0 hs; III–IV: 0–3 hs; V–VII: 1 large hs + 2 smaller hs; ventropleural setae: II–VII: 1 hs. Ventral abdominal setae: on each side, segments: II–VII: 1 or 2 hs. Segment VIII: tergum unsclerotised, with 0–3 ante-anal setae; sternite with 1 pair of hs ventral abdominal setae; caudal extension rounded, with 3 hs pleural setae. Glandular pouch present, deep; glandular pouch setae 91–150 μm long. **Genital segment:** penial sheath of moderate length, 372–383 μm long and 86–93 μm wide at base; about 1/4 of total body length (ratio of total body length to penial sheath length 1:0.25); gradually narrowing towards apex. Basal rod reaching basal membranous area anteriorly; fairly short, length 66–75 μm anterior to base of aedeagus, with only a faint extension about 17 μm long down aedeagus. Aedeagus 211–236 μm long (ratio length of aedeagus to length of basal rod 1:0.30), almost parallel sided. Penial sheath with 7–11 small setae along each margin, and with a cluster of about small sensilla present near apex.

The *kamahi*-group

Diagnosis based on the adult males of 4 species, *A. kamahi*, *A. matai*, *A. pubens*, and *A. subtilis* (Fig. 63–66).

General: moderate to fairly large; fleshy setae normal, without extremely flagellate apices; dorsal pores absent.

Head: fs fairly abundant; with 4 pairs of simple eyes,

lateral eyes smaller than other eyes; genal setae absent (present on *A. pubens*); genal reticulations with many inner microridges or raised spots; ocular sclerite and genal reticulations dissimilar; ventral midcranial ridge with many setae, both fs and/or hs; postocular ridge not nearly reaching ocelli; ocelli large and distinct; each reticulation on ocular sclerite with few inner microridges (more on *A. pubens*); ventral head setae present throughout ocular sclerite; ventral head setae present between ventral eyes (except on *A. matai*); ventral ocular setae absent (except on *A. kamahi*); tentorial bridge present; cranial apophysis bifurcated. **Antennae:** antennae of average length, 0.6–0.7 total body length (except on *A. subtilis* where very short, about 0.5); with 3 hs on scape; segment X not constricted; hs on segments IV–X very few or absent; with 3 capitate setae on segment X. **Prothorax:** lateral pronotal setae absent (occasionally present on *A. pubens* and *A. subtilis*); lateral prothoracic setae absent; median ridge of prosternum absent or poorly developed; fs prosternal setae present; antemesospiracular setae absent; anteprosternal setae absent. **Mesothorax:** prescutum about 2 \times wider than long; prescutum without reticulations (faint on *A. subtilis*); membranous area of scutum about 2 \times wider than long; membranous area of scutum with both fs and hs (*A. subtilis* with hs only); scutum not reticulated anteriorly; scutum not reticulated laterad to scutellum; foramen on scutellum large; with fs postmesospiracular setae; median ridge of basisternum well developed; furca fairly short, not nearly reaching anterior border of basisternum; setae laterad to lateropleurite absent; tegular setae present or absent; mesepisternum without reticulations; anterior end of postalar lightly reticulated; postalar setae present or absent. **Metathorax:** with numerous fs anterior metasternal setae; with many fs posterior metasternal setae; with many fs postmetaspiracular setae; metepimeron without setae; hamulohalteres absent; with 1 pair of hs metatergal setae (possibly absent on *A. matai*; few fs on *A. pubens*); dorsospiracular setae present; setae near mesoprecoxal ridge absent.

Legs: with 1 tibial spur per tibia; tarsal campaniform pores absent; trochanter–femur segmentation distinct; fs about as frequent as hs on metafemur; tarsus 1-segmented.

Abdomen: segment VIII of normal length; cicatrices absent; sternites and tergites on segments II–VI absent or poorly sclerotised; dorsal abdominal setae few, all hs (a few fs on *A. pubens*); ventral abdominal setae few, hs about as frequent as fs; pleural setae few, segmentally arranged (most abundant on *A. pubens*); generally with 1 or 2 pairs of hs ante-anal setae, but several fs on *A. pubens*; caudal extensions on segments VII and VIII fairly distinct and rounded; glandular pouches present or absent; penial sheath rather short, about 1/5 of total body length; penial sheath

gradually narrowing towards apex; basal rod short, about 1/4 length of aedeagus (longer on *A. matai*), reaching basal membranous area anteriorly on some species (not nearly reaching on *A. pubens* and *A. subtilis*); aedeagus about 2/3 length of penial sheath, slightly tapering.

Comment. There is no combination of characters that quickly separates the males of the *kamahi*-group of *Aphenochiton* from those of other genera, particularly *Umbochiton*. For differences from the *inconspicuus*-group, see under that group above.

Aphenochiton kamahi Henderson & Hodgson

Fig. 24, 25, 63

Live appearance: body very pale, pinkish-cream, with head, legs, and antennae pale grey-brown, eyes black; caudal wax filaments may be present.

Test moderately convex, of translucent glassy fused wax plates, with a mid-dorsal row of thicker more convex plates; light refracted from submarginal row of plates appearing as a silvery zigzag line; a V-shaped fused suture between back-plate suture and anal aperture present. On leaves of host plants.

Material examined: see Appendix for collection details of specimens examined.

Described from 3 specimens in good to fair condition.

Mounted material: moderate-sized, total body length about 1.28–1.5 mm; robust; antennae quite long, about 2/3 of total body length; body not particularly hirsute, but fleshy setae fairly frequent ventrally, these generally easily differentiated from hairlike setae; length of fs on antennae more than width of antennal segments. Wings about 9/10 of total body length and about 1/2 as wide as long. Hamulohalteres absent.

Head: approximately oval to round in dorsal view; length of head about 225–235 µm; width across genae 207–246 µm. Median crest quite broad and reticulated, with about 5–12 fs + 4–7 hs dorsal head setae on each side. Midcranial ridge: dorsal ridge absent; ventral ridge quite well developed, with well-developed lateral arms; not quite reaching ocular sclerite posteriorly; with a narrow reticulated border anteriorly which quickly broadens posteriorly, fusing with ocular sclerite; with 1–5 fs + 3 hs. Genae polygonally reticulated throughout, each reticulation with numerous short, sinuous, inner microridges or raised spots; genal setae absent. Simple eyes: four pairs; large dorsal eyes subequal in width to large ventral eyes, each 37–54 µm wide; each with a closely associated smaller, round lateral eye, about 28–38 µm wide. Ocelli distinct. Ocular sclerite sclerotised and polygonally reticulated throughout, each reticulation with a few small inner microridges. Preocular

ridge: dorsal arm almost as long as ventral arm; ventral arm long, extending to close to midcranial ridge. Postocular ridge quite strongly developed but not nearly reaching ocelli dorsally. Dorsal ocular setae: 4–7 hs on each side. Ventral head setae: with about 10–28 fs + 2–9 hs on each side anterior and laterad to ventral simple eyes, and with 8 or 9 fs + 1 hs between eyes; with 0 or 1 fs ventral ocular setae on each side. Tentorial bridge well developed and broad. Cranial apophysis with a deep distal bifurcation; length about 28–40 µm. **Antennae:** 887–992 µm long (ratio of total body length to antennal length 1:0.68). Scape: 46–54 µm long and 36–49 µm wide, with 1 hs on ventral surface and 1 hs on dorsal surface. Pedicel: length 43–49 µm, width 39–47 µm; with a few polygonal reticulations; with 5–7 fs + 3 or 4 hs (with few setae on dorsal surface). Segments III–X each about 14–21 µm wide; lengths (µm): III: 81–89; IV: 118–128; V: 126–166; VI: 126–167; VII: 99–135; VIII: 77–101 and IX: 63–81; fs about 32–36 µm long; approximate number of setae per segment: III: 2–12 fs + 1 or 2 hs + 1 (?), sensilla basiconica; IV: 14–23 fs + 0 hs; V: 23–32 fs + 0 hs; VI: 21–35 fs + 0 hs; VII: 21–34 fs + 0 hs; VIII: 18–25 fs + 0 hs + 1 bristle; IX: 16–26 fs + 0 hs + 1 bristle. Segment X: length 86–96 µm; not constricted apically; with 3 capitate setae, 3 large + 2 small antennal bristles, 13–17 fs, and with 2 sensilla basiconica, one apically and one more proximally between bristles.

Thorax. Prothorax: pronotal ridge strong, with broad, reticulated, lateral pronotal sclerite; without lateral pronotal setae. Sternum with a strong transverse ridge; median ridge absent, sternite broad and triangular, with shallow ridging and about 12–15 fs + 2 or 3 hs prosternal setae. Anteprosternal and antemesospiracular setae absent. **Mesothorax:** prescutum about 2× as wide as long (82–94 µm long and 176–188 µm wide); not reticulated. Scutum: median membranous area more than twice as wide as long (155–185 µm wide; perhaps 53–82 µm long); scutal setae rather few, more or less in a group on each side, each group with 3–6 fs + 3–11 hs; lateral margins not reticulated. Scutellum 180–189 µm wide and 32–45 µm long; tubular with a large foramen. Basisternum about 200–230 µm wide and 125–136 µm long; with a complete, strong median ridge, bounded by a weak marginal and strong precoxal ridges; without basisternal setae; lateropleurite with an indistinct extension from marginal ridge anteriorly; furca well developed, each arm extending anteriorly to a point midway between anterior margin and where marginal ridge and precoxal ridges join. Postalar slightly reticulated anteriorly; with 0–2 postalar setae. Mesothoracic spiracles; peritremes 22 µm wide. Postmesospiracular setae: about 25–35 fs, extending full width of prothorax. Tegula: well developed but without tegular setae. **Metathorax:** metapostnotum unsclerotised; with 1 or 2 hs metatergal seta on each side. Metapleural ridge reduced, only posterior half present and well developed; episternum

slightly sclerotised, with 11–15 fs postmetaspiracular setae. Metepimeron well developed, without setae. Metathoracic spiracles: width of peritremes 22–25 μm . Antemetaspiracular setae/dorsospiracular setae: perhaps 3–6 fs. Metasternum membranous. Anterior metasternal setae abundant: about 42–52 fs + 0 hs; posterior metasternal setae: about 14–16 fs + 2–3 hs.

Wings: hyaline, 1150–1300 μm long and 525–675 μm wide (ratio length to width 1:0.49; ratio of total body length to wing length 1:0.88). Hamulohalteres absent.

Legs: prothoracic legs subequal in length to or slightly longer than meso- and metathoracic legs. Coxa lengths (μm): I: 90–113; II: 102–121; III: 107–116; setae on coxa III: about 15–23 fs + 7–9 hs; with 2 long apical setae on each coxa, each about 45–54 μm long. Trochanter + femur lengths (μm): I: 237–291; II: 222–270; III: 217–263; trochanter III with about 11–16 fs + 1 or 2 hs; long trochanter seta up to 45–49 μm ; femur III with about 16–23 fs + 7–19 hs. Tibia lengths (μm): I: 262–330; II: 254–312; III: 238–313; tibia III with a total of about 50–65 setae, many fs, few hs, many setae becoming spurlike on distal third of leg; large apical spur 26–34 μm long. Tarsus lengths (μm): I: 143–206; II: 135–199; III: 135–192 (ratio length of tibia III to tarsus III 1:0.59); tarsus III with 54–65 setae, many of them spurlike; tarsal spurs each 22–29 μm ; tarsal digitules not quite as long as claw. Claws quite long and thin, rather shorter than width of tarsi, slightly curved, lacking a denticle; length: III: 21–23 μm ; claw digitules slightly longer than claw.

Abdomen: segments I–VII: tergum and sternum of all segments with some reticulations + microtrichia but tergites only present on segment VII and sternites on segments VI and VII; with a broad membranous area between sternum II and III, and narrower ones between III–IV and IV–V. Caudal extension of segment VII rounded. Dorsal abdominal setae: (totals) segments I–III: absent; IV–VII: 0–2 hs only. Pleural setae hard to separate: dorsopleural setae possibly: III–V: 0 fs + 0–3 hs; VI: 2 fs + 1 hs on each side; ventropleural setae possibly II–III: 1 fs + 0 or 1 hs; IV: 4 fs + 1 hs; V–VI: 5 fs + 1 or 2 hs; VII (dorsopleural + ventropleural setae): 7–9 fs + 2–5 hs on each side. Ventral abdominal setae totals per segment: II–IV: 0–5 fs + 2 hs; V–VII: 2–8 fs + 0–2 hs. Segment VIII: tergite lightly sclerotised, with 1 or 2 hs ante-anal setae; sternite lightly sclerotised, with 4 fs ventral abdominal setae; caudal extension rounded, with 1–3 fs + 1–5 hs pleural setae. Glandular pouch present; setae of glandular pouch 55–85 μm long (but unusually short on one specimen (about 21–36 μm), barely extending out of glandular pouch).

Genital segment: penial sheath rather short, generally distinctly constricted at base; length 262–281 μm ; width at base 77–84 μm (ratio of total body length to penial sheath length

1:0.19). Basal rod quite short, 50–52 μm anterior to aedeagus, but also extending posteriorly down aedeagus; anteriorly not quite reaching basal membranous area. Aedeagus short, 135–181 μm long (ratio length of aedeagus to length of basal rod 1:0.32), broadest basally, but rather parallel-sided; apex not nearly reaching distal end of penial sheath. Penial sheath with 3–6 small setae along each margin and with a cluster of small sensilla present near apex.

Comment. The males of *Aphenochiton* are rather varied. For a discussion of their differences, see under *A. subtilis*.

Aphenochiton matai Henderson & Hodgson

Fig. 64

Live appearance: no live or unmounted material available.

Material examined: see Appendix for collection details of specimens examined.

Described from 2 specimens, both rather distorted, but all characters could be seen except size of wings.

Mounted material: fairly large and robust; total body length about 1.67–1.79 mm; antennae quite long, about 3/5 of total body length; body not particularly hirsute, but fleshy setae fairly frequent ventrally, these generally easy to differentiate from hairlike setae; length of fs on antennae about twice width of antennal segments. Wings distorted and so dimensions unknown. Hamulohalteres absent.

Head: approximately quadrangular in dorsal view; length uncertain; width across genae 287 μm . Median crest rather narrow and reticulated, with about 0–3 fs + 3–6 hs dorsal head setae on each side. Midcranial ridge: dorsal ridge absent; ventral ridge with well-developed lateral arms; ventral midcranial ridge reaching about halfway to ocular sclerite posteriorly; with a narrow reticulated border anteriorly which quickly broadens posteriorly, fusing with ocular sclerite; with 2–5 fs + 3 or 4 hs. Genae polygonally reticulated throughout, each reticulation with numerous raised spots; genal setae absent. Simple eyes: four pairs; large dorsal eyes subequal in size to large ventral eyes, 39–45 μm wide; each with a closely associated smaller, round, lateral eye, about 30–36 μm wide. Ocelli unusually large and distinct. Ocular sclerite sclerotised and polygonally reticulated throughout, each reticulation with a small, almost straight, inner microridge. Preocular ridge: dorsal arm as long as ventral arm; ventral arm moderately long, extending about 2/3–3/4 to midcranial ridge. Postocular ridge apparently quite strongly developed but not nearly reaching ocelli dorsally. Dorsal ocular setae: with perhaps 0 or 1 fs + 0–2 hs on each side. Ventral head setae: with about 3–11 fs + 7–12 hs on each side anterior and laterad to ventral simple eyes, but without setae between eyes; ventral ocular setae absent. Preoral ridge well developed and broad.

Cranial apophysis with a moderately deep distal bifurcation; length about 28–40 μm . **Antennae:** 986–1129 μm long (ratio of total body length to antennal length 1:0.61). Scape: 55–72 μm long and 50–54 μm wide, with 1 hs seta on ventral surface and 2 hs setae on dorsal surface. Pedicel: length 54–63 μm , width 45–47 μm ; with a few polygonal reticulations; with 2 fs + 5 hs (with few setae on dorsal surface). Segments III–X all about 18–25 μm wide; lengths (μm): III: 99–110; IV: 171–191; V: 144–182; VI: 131–144; VII: 99–115; VIII: 77–81 and IX: 72–81; fs about 34–43 μm long; approximate number of setae per segment: III: 1 or 2 fs + 3 hs + 2 sensilla basiconica; IV: 15 fs + 0 hs; V: 23 fs + 0 hs; VI: 21–24 fs + 0 hs; VII: 15–18 fs + 0 hs; VIII: 17–21 fs + 0 hs + 1 bristle; IX: 15–17 fs + 0 hs + 1 bristle. Segment X: length 75–81 μm ; not constricted apically; with 3 capitate setae, 3 large + 2 small antennal bristles, about 8 or 9 fs and with 2 sensilla basiconica, one apically and one more proximally between bristles.

Thorax. Prothorax: pronotal ridge strong, with a broad, slightly reticulated, lateral pronotal sclerite; without lateral pronotal setae. Sternum with a strong transverse ridge; median ridge present but weakly developed and with a gap between it and the transverse ridge; sternite broad and triangular, with striations and about 6 fs + 2 hs prosternal setae on each side. Anteprosternal setae and antemesospiracular setae absent. **Mesothorax:** prescutum wider than long (176–187 μm wide and 102–115 μm long); not reticulated or striated. Scutum: median membranous area more than twice as wide as long (205–217 μm wide; perhaps 86–103 μm long); scutal setae in two lateral groups: with 12 or 13 fs + 4–10 hs in each group; lateral margins not reticulated. Scutellum 180–205 μm wide and 57 μm long, tubular with a large foramen. Basisternum about 233–252 μm wide and 151–172 μm long; with a complete, strong median ridge, bounded by a weak marginal and strong precoxal ridges; without basisternal setae; lateropleurite with a small, indistinct, extension from marginal ridge laterally; furca well developed, each arm extending anteriorly to just past point where marginal ridge and precoxal ridges join. Postalare reticulated anteriorly; postalare setae absent. Mesothoracic spiracles: peritremes 25–27 μm wide. Postmesospiracular setae: about 23 fs extending across full width of prothorax. Tegula: well developed, with 1–4 hs tegular setae. **Metathorax:** metapostnotum unsclerotised; metaternal setae apparently absent on both specimens. Metapleural ridge reduced, only posterior half present; episternum sclerotised, with 9 or 10 fs postmetaspiracular setae. Metepimeron well developed, without setae. Metathoracic spiracles: width of peritremes 27 μm . Antemetaspiracular setae/dorsospiracular setae: probably 7–11 fs. Metasternum membranous. Anterior metasternal setae: about 31–38 fs + 0 hs; posterior metasternal setae: about 20–25 fs + 0 hs.

Wings: both distorted: hyaline, probably of moderate length and width. Hamulohalteres absent.

Legs: prothoracic legs subequal in length to meso- and metathoracic legs. Coxa lengths (μm): I: 106–111; II: 106–111; III: 114–123; setae on coxa III: about 14 or 15 fs + 7 or 8 hs; with 1 or 2 long apical seta on each coxa, each about 66–72 μm long. Trochanter + femur lengths (μm): I: 241–262; II: 225; III: 230; trochanter III with about 8 or 9 fs + 1 or 2 hs; long trochanter seta up to 45–63 μm ; femur III with about 10–15 fs + 13–15 hs. Tibia lengths (μm): I: 270–300; II: 266–279; III: 291–300; tibia III with a total of about 57–59 setae, many fs, few hs, many setae becoming spurlike on distal third of leg; large apical spur 27–30 μm long. Tarsus lengths (μm): I: 141–148; II: 139–148; III: 131–134 (ratio length of tibia III to length of tarsus III 1:0.45); tarsus III with 30–39 setae, many of them spurlike; tarsal spurs 30–34 μm ; tarsal digitules about as long as claw. Claws quite long and thin, rather shorter than width of tarsi, slightly curved, lacking a denticle: length: III: 27–30 μm ; claw digitules a little longer than claw.

Abdomen: segments I–VII: tergum and sternum of all segments with some reticulations + microtrichia but sternites only present on segments VI and VII; with a broad membranous area between sternites II and III, and narrower ones between III–IV and IV–V. Caudal extension of segment VII small and rounded. Dorsal abdominal setae, totals: segments I–III: 0 fs + 0 or 1 hs; IV–VI: 0 fs + 1 or 2 hs. Pleural setae hard to separate: dorsopleural setae possibly on each side: III–VI: 0 fs + 0 or 1 hs; ventropleural setae III–VI: possibly 0 fs + 2 or 3 hs; VII: (dorsopleural + ventropleural setae) 4 fs + 3 or 4 hs on each side. Ventral abdominal setae on each side, segments: II: 1 fs; III–V: 0 fs + 0 or 1 hs; VI–VII: 0–3 fs + 1–3 hs. Segment VIII: tergite lightly sclerotised posteriorly, with no setae anteriorly but with 3 or 4 hs ante-anal setae posteriorly; sternite with 7 fs + 0–2 hs ventral abdominal setae; caudal extension lightly sclerotised, rounded, with 2–4 fs + 1–9 hs pleural setae. Glandular pouch absent. **Genital segment:** penial sheath rather short, about 1/6 of total body length; 278–316 μm long and 90–99 μm wide at base (ratio of total body length to penial sheath length 1:0.17); with a slight constriction near base. Basal rod moderately long, 66–90 μm to anterior end of aedeagus, but also extending somewhat down aedeagus; almost or just reaching basal membranous area anteriorly. Aedeagus quite long, 163–184 μm long (ratio length of aedeagus to length of basal rod 1:0.45), broadest basally, but rather parallel-sided; not nearly reaching distal end of penial sheath. Penial sheath with 5 or 6 small setae along each margin and with a cluster of small sensilla present near apex.

Comment. For a comparison with the males of other *Aphenochiton* species, see under *A. subtilis*.

***Aphenochiton pubens* Henderson & Hodgson**

Fig. 26, 27, 30, 65

Live appearance: body light brown, with red eyes, and pale green prothorax; caudal wax filaments absent.

Test slightly convex, of translucent glassy fused wax plates; a V-shaped suture between back-plate suture and anal aperture absent. On leaves of host plants.

Material examined: see Appendix for collection details of specimens examined.

Described from 5 specimens in good condition (1 significantly more hirsute than the others but apparently the same species).

Mounted material: fairly large and robust, total body length 1.6–1.73 mm; antennae quite long, about 2/3 of total length of body; body fairly hirsute, with fleshy setae fairly frequent on both dorsal and ventral surfaces, these generally easy to differentiate from hairlike setae; length of fs on antennae more than twice width of antennal segments. Wings comparatively long, about 8/10 of total body length; breadth just more than half wing length. Hamulohalteres absent.

Head: approximately round in dorsal view; length of head about 225–240 µm; width across genae 266–305 µm. Median crest reticulated, with about 14–20 fs + 4–6 hs dorsal head setae on each side. Midcranial ridge: dorsal ridge absent; ventral ridge well defined and long, just reaching ocular sclerite posteriorly; with a quite narrow reticulated border anteriorly, which broadens posteriorly and fuses with ocular sclerite; lateral arms heavily sclerotised; with 2 or 3 fs + 1–4 hs ventral midcranial ridge setae. Genae large and faintly polygonally reticulated throughout, each reticulation with numerous small spots; genal setae: about 3–5 fs on each side. Simple eyes: four pairs; large dorsal and ventral pairs subequal in size, both pairs round, 53–58 µm wide; each with a closely associated, slightly smaller, round, lateral simple eye, 44–50 µm wide. Ocelli distinct (2 specimens have what appear to be ocelli placed far more posteroventrally than normal, apparently within area of gena). Ocular sclerite polygonally reticulated, each reticulation with many short, sinuous inner microridges. Preocular ridge: dorsal arm as long as ventral arm; ventral arm reaching 2/3 of way to midcranial ridge. Postocular ridge well developed but not nearly reaching ocelli dorsally. Dorsal ocular setae: 3–6 fs on each side. Ventral head setae: with about 17–25 fs + about 5–9 hs on each side anterior and laterad to ventral simple eye, and with 1–5 fs between eyes; with 0 or 1 fs ventral ocular setae on each side. Tentorial bridge well developed and broad. Cranial apophysis bifurcated, about 50–58 µm long. **Antennae:** 1025–1075 µm long (ratio of total body length to antennal length 1:0.63). Scape: 58–67 µm long and 43–51 µm wide; with 1 hs on ventral surface and 2 hs on inner margin. Pedicel: length

48–58 µm, width 41–55 µm; reticulated, with 9 or 10 fs + 2–6 hs, restricted to ventral surface. Segments III–IX all about 18–25 µm wide; lengths (µm): III: 91–100; IV: 164–167; V: 141–156; VI: 149–158; VII: 112–125; VIII: 84–107 and IX: 73–88; fs about 44–48 µm long; approximate number of setae per segment: III: 2–4 fs + 0 or 1 hs + 2 sensilla basiconica; IV: 29–36 fs + 0 or 1 hs; V: 24–32 fs + 0 or 1 hs; VI: 31–40 fs + 0 or 1 hs; VII: 23–32 fs + 0 or 1 hs; VIII: 19–25 fs + 0 or 1 hs + 1 bristle (barely differentiated from fs) and IX: 20 or 21 fs + 0 hs + 1 bristle (barely differentiated from fs). Segment X: length 94–103 µm; not constricted apically; with 3 capitate setae, 3 large, 1 small and possibly 1 fine antennal bristles and 15–19 fs; with 2 sensilla basiconica, one apically and one more proximally.

Thorax. Prothorax: pronotal ridge strong, with a broad reticulated or striated lateral pronotal sclerite; with 0 or 1 pair of hs lateral pronotal setae. Sternum with a strong transverse ridge; median ridge absent; sternite broad and triangular, with faint striations; prosternal setae: 0 or 1 fs + 1 or 2 hs on each side (but one specimen with 12 fs between and just anterior to procoxae). Anteprosternal setae absent. Antemesospiracular setae normally absent but 1 fs on one side on one specimen. **Mesothorax:** prescutum distinctly wider than long (190–224 µm wide and 91–107 µm long); with faint reticulations. Scutum: median membranous area a little over twice as wide as long (198–245 µm wide; about 70–103 µm long); scutal setae numerous, with about 27–105 in total, of which 5–10 hs, rest fs; lateral margins not reticulated. Scutellum 190–228 µm wide and 41–50 µm long; with a large foramen. Basisternum about 277–315 µm wide and 153–166 µm long; with a complete, strong median ridge, bounded by strong marginal and precoxal ridges; without basisternal setae; lateropleurite rather narrow, without a sclerotised extension from marginal ridge anteriorly; furca well developed, each arm extending anteriorly well past point where marginal and coxal ridges meet. Postalare either reticulated or rather heavily sclerotised at anterior end; with 0–3 fs postalare setae on each side. Mesothoracic spiracles: peritremes 21–25 µm wide. Postmesospiracular setae: total about 28–40 fs, extending across full width of segment. Tegula: well developed, with 0–3 fs + 0–2 hs tegular setae. **Metathorax:** metapostnotum unsclerotised; metatergal seta: 0–5 fs + 1 or 2 hs on each side. Metapleural ridge reduced, only posterior half present and well developed; episternum unsclerotised, with 7–12 fs postmetaspiracular setae (1 specimen with 18–22, which extend into posterior metasternal setae); metepimeron well developed, without setae. Metathoracic spiracles: width of peritremes 24–26 µm. Antemetaspiracular setae / dorsospiracular setae: about 15–20 fs on each side (but 1 specimen with about 31). Metasternum membranous. Anterior metasternal setae: about 30–50 fs; posterior metasternal setae: 12–34 fs + 0 or 1 hs.

Wings: hyaline, of moderate length (1375–1450 μm) and width (725–750 μm) (ratio length to width 1:0.52; ratio of total body length to wing length 1:0.85). Hamulohalteres absent.

Legs: legs subequal in length. Coxa lengths (μm): I: 99–112; II: 120–129; III: 124–133; coxal III setae: about 32–35 fs + 5–8 hs; with 2 long apical seta on each coxa, each about 58–86 μm long. Trochanter + femur lengths (μm): I: 289–311; II: 273–294; III: 289–302; trochanter III with about 19 or 20 fs + 1 hs; long trochanter seta about 44–56 μm long; femur III with about 50–52 fs + 2–4 hs. Tibia lengths (μm): I: 293–331; II: 289–319; III: 310–343 μm ; tibia III with about 92–95 setae, many spurlike on distal third of leg; large apical spur 33–36 μm long. Tarsus lengths (μm): I: 173–190; II: 173–195; III: 169–191 (ratio length of tibia III to length of tarsus III 1:0.55); tarsus III with about 69–74 setae, many spurlike; distal tarsal spur 30–33 μm long; tarsal digitules subequal to length of claw. Claws slightly shorter than width of tarsi, slightly curved, without a denticle; length: III: 24–27 μm ; claw digitules a little longer than claw.

Abdomen: segments I–VII: tergum and sternum of all segments with some reticulations + microtrichia but tergites and sternites only present on segments VII (distinct) and on segment VI (light sclerotisation); with a broad membranous area between sternum II and III, and narrower areas between III–IV and IV–V. Caudal extension of segment VII pronounced and rounded. Dorsal abdominal setae on each side, segments: I: 0–3 fs + 0 hs; II–V: 0 or 1 fs + 0 or 1 hs; VI–VII: 4–7 fs + 1 or 2 hs. Pleural setae: per side: dorsopleural setae: I: 0 or 1; II: 1–3 hs; III–VI: 1–3 hs; ventropleural setae I–IV: 0–7 fs + 0 or 1 hs; V: 0–4 fs; VI: 2–6 fs; VII (dorsal + ventral pleural setae): 9–22 fs + 0–2 hs. Ventral abdominal setae, on each side, segments: II: 0–8 fs; III: 0–2 fs + 1 hs; IV–VI: 0–6 fs + 0–2 hs; VII: 2–4 fs + 0 or 1 hs. Segment VIII: tergite with 18–24 setae (hs + fs) along posterior margin of segment (including both ante-anal setae and pleural setae); sternite with 4–7 fs ventral abdominal setae; caudal extension rounded, with perhaps 4–10 fs + 0–2 hs pleural setae (though fs and hs hard to differentiate). Glandular pouch absent. **Genital segment:** penial sheath of moderate length, 310–320 μm long and 82–87 μm wide at base; about 1/5 of total body length (ratio of total body length to penial sheath length 1:0.2); gradually narrowing towards apex. Basal rod not nearly reaching basal membranous area anteriorly; rather short, length 43–50 μm to base of aedeagus, extending a further 58–88 μm within aedeagus. Aedeagus 177–200 μm long (ratio length of aedeagus to length of anterior part of basal rod 1:0.25), narrowing towards tip. Penial sheath with 8–12 small setae along each margin, those nearer basal rod relatively quite long, and with a cluster of small sensilla present near apex.

Comment. For a comparison with other *Aphenochiton* species, see under *A. subtilis*.

Aphenochiton subtilis Henderson & Hodgson

Fig. 3–4, 28–30, 66

Live appearance: body medium brown with a fawn-brown prothorax; caudal wax filaments absent.

Test not convex, of translucent glassy fused wax plates; a V-shaped fused suture between back-plate suture and anal aperture present. On leaves of host plants.

Material examined: see Appendix for collection details of specimens examined.

Described from 10 specimens, with some data taken from a further 8.

Mounted material: moderate-sized, total body length 1.37–1.58 mm; robust; antennae rather short, about 1/2 total body length; body not particularly hirsute, but fleshy setae fairly frequent ventrally on thorax (but absent from abdomen), these generally easy to differentiate from hairlike setae; length of fs on antennae a little more than 1.5 \times width of antennal segments. Wings a little more than 8/10 of total body length and about half as wide as long. Hamulohalteres absent.

Head: approximately round in dorsal view; length of head about 240–250 μm ; width across genae 247–273 μm . Median crest with about 9–16 fs + 3–9 hs dorsal head setae on each side. Midcranial ridge: dorsal ridge absent (except on one specimen – see *Discussion* below), ventral ridge quite well developed, reaching ocular sclerite posteriorly; with a narrow reticulated border anteriorly which quickly broadens posteriorly, fusing with ocular sclerite; with well-developed lateral arms; with 3–9 fs + 1–4 hs setae. Genae polygonally reticulated throughout, each reticulation with numerous short, sinuous, inner microridges, these shortest in posterior reticulations; genal setae absent. Simple eyes: four pairs; large dorsal eyes subequal in size to large ventral eyes (37–45 μm wide); each with a closely associated, smaller, round lateral eye, about 29–36 μm wide. Ocelli distinct. Ocular sclerite sclerotised and polygonally reticulated throughout, each reticulation with 1 or 2 small, sinuous, inner microridges. Preocular ridge: dorsal arm long but shorter than ventral arm; ventral arm quite long, extending to about 1/2–2/3 of way to midcranial ridge. Postocular ridge well developed but not nearly reaching ocelli dorsally. Dorsal ocular setae generally absent, occasionally 1 fs on one side. Ventral head setae: with about 20–37 fs + 3–10 hs on each side anterior and laterad to ventral simple eyes, and with 2–11 fs + 0 or 1 hs between eyes; ventral ocular setae absent. Tentorial bridge particularly well developed and broad. Cranial apophysis quite broad distally, with a

deep distal bifurcation; about 58–66 μm long. **Antennae:** short, 612–819 μm long (ratio of total body length to antennal length 1:0.49). Scape: 46–56 μm long and 38–46 μm wide, with one hs on ventral surface and 1 or 2 hs on dorsal surface. Pedicel: length 36–43 μm , width 35–45 μm ; with a few polygonal reticulations; with 3–8 fs + 2–4 hs, restricted to ventral surface. Segments III–X each about 17–23 μm wide; lengths of segments (μm): III: 68–88; IV: 89–132; V: 86–114; VI: 92–115; VII: 64–93; VIII: 53–70 and IX: 44–63; fs about 26–36–(41 μm) long; approximate number of setae per segment: III: 6–10 fs + 0–3 hs (sensilla basiconica possibly absent); IV: 15–31 fs + 0 hs; V: 21–34 fs + 0 hs; VI: 20–26 fs + 0 hs; VII: 12–32 fs + 0 hs; VIII: 17–23 fs + 0 hs; IX: 16–21 fs + 0 hs (bristles on VIII and IX not apparently differentiated). Segment X 43–63 μm long, with 5–8 fs, 3 capitate setae, 3 large bristles and 0–2 smaller bristles; with 2 sensilla basiconica, one on apex and one more proximally near bristle.

Thorax. Prothorax: pronotal ridge strong, with a broad, non-reticulated, lateral pronotal sclerite, with 0 or 1 hs lateral pronotal setae. Sternum with transverse ridge strong, with a suggestion of a prosternal apophysis; median ridge usually strong but occasionally rather weak; sternite broad and triangular, slightly reticulated, with about 6–11 fs + 1 hs prosternal setae on each side. Anteprosternal and antemesospiracular setae absent. **Mesothorax:** prescutum much wider than long (184–215 μm wide and 78–103 μm long); with faint ridges forming a reticulate pattern. Scutum: median membranous area almost twice as wide as long (194–224 μm wide and 82–125 μm long); scutal setae rather few, 0 fs + 4–24 hs; lateral margins not reticulated. Scutellum 194–226 μm wide and 37–46 μm long; tubular with a large foramen. Basisternum about 244–267 μm wide and 144–170 μm long; with a complete, strong median ridge, bounded by weak to moderately strong marginal and strong precoxal ridges; without basisternal setae; lateropleurite poorly developed, without an anterior extension from marginal ridge; furca rather short, each arm only extending anteriorly just past point where marginal ridge and precoxal ridges fuse. Postalarae slightly reticulated; postalarae setae absent. Mesothoracic spiracles: peritreme 18–22 μm wide. Postmesospiracular setae: 13–36 fs + 0 or 1 hs, almost restricted to medially posterior to prosternal transverse ridge (only 0–3 fs posterior to each spiracle). Tegula: well developed, with (0)–3 hs tegular setae. **Metathorax:** metapostnotum unsclerotised; with 1 hs metatergal seta on each side. Metapleural ridge reduced, only posterior half present; episternum possibly slightly sclerotised, with 8–25 fs + 0 or 1 hs postmetaspiracular setae. Metepimeron well developed, without setae. Metathoracic spiracles: width of peritremes 18–22 μm . Antemetaspiracular setae /dorsospiracular setae: 2–7 fs present. Metasternum slightly sclerotised. Anterior

metasternal setae: about 33–74 fs; posterior metasternal setae: 3–14 fs.

Wings: hyaline, 1150–1300 μm long and 587–700 μm wide (ratio length to width 1:0.5; ratio of total body length to wing length 1:0.83). Hamulohalteres absent.

Legs: subequal in length. Coxa lengths (μm): I: 82–99; II: 82–108; III: 95–107; setae on coxa III: about 10–17 fs + 5–8 hs; each coxa with 1 or 2 long apical setae, each about 34–50 μm long. Trochanter + femur lengths (μm): I: 186–261; II: 190–245; III: 198–257; trochanter III with about 8–18 fs + 1–4 hs; long trochanter seta up to 32–43 μm ; femur III with about 13–21 fs + 14–21 hs. Tibia lengths (μm): I: 186–257; II: 182–270; III: 198–277; tibia III with a total of about 48–71 setae, mostly fs, few hs, some setae becoming spurlike on distal third of leg; large apical spur 23–29 μm long. Tarsus lengths (μm): I: 120–146; II: 128–158; III: 124–154 (ratio length of tibia III to length of tarsus III 1:0.6); tarsus III with 44–60 setae, many of them spurlike; tarsal spurs 19–25 μm , often almost undifferentiated; tarsal digitules about as long as claw. Claws quite long and thin, rather shorter than width of tarsi, slightly curved, lacking a denticle, length: III: 16–23 μm ; claw digitules a little longer than claw.

Abdomen: segments I–VII: tergum and sternum of all segments with some reticulations + microtrichia but lightly sclerotised tergites present on segments II, III, IV and VII and distinct sternite present on segment VII; with a broad membranous area between sternites II and III, and narrower ones between III–IV and IV–V. Caudal extension of segment VII small, rounded and unsclerotised. Dorsal abdominal setae, totals per segment: segments I–III absent; IV–VII: 0 fs + 0–2 hs. Pleural setae: dorsopleural setae: III–VI: 1 long and 1 or 2 short hs on each side; ventropleural setae: III–VI absent; VII (dorsopleural + ventropleural setae): 2–6 hs on each side. Ventral abdominal setae, totals per segment: II: 0–2 fs + 0 hs; III–VII: 0 fs + 2 or 3 hs across each segment. Segment VIII: tergite distinct; with 2 hs ante-anal setae posteriorly; sternite without setae; caudal extension small, sclerotised, with 2–4 hs pleural setae of which 1 or 2 markedly long (44–60 μm long). Glandular pouch absent. **Genital segment:** penial sheath of moderate length; 250–287 μm long and 78–88 μm wide at base (ratio of total body length to penial sheath length 1:0.18). Basal rod short, 26–54 μm long, usually just about reaching basal membranous area anteriorly but when basal rod short, not nearly reaching basal membranous area. Aedeagus quite long, 139–182 μm long (ratio length of aedeagus to length of basal rod 1:0.26), broadest basally, but rather parallel-sided; not nearly reaching apex of penial sheath. Penial sheath with 7–11 small setae along each margin and with a cluster of small sensilla present near apex.

Comment. The males of the species currently included in the *kamahi*-group of *Aphenochiton* are rather varied and differ as follows (for a comparison with *A. inconspicuus*, see under that species above):

- (i) glandular pouches and glandular pouch setae: present on *A. kamahi*, absent on other 3 species;
- (ii) ventral head setae between eyes: absent on *A. matai*, present on other 3 species;
- (iii) genal setae: present on *A. pubens*, absent on other 3 species;
- (iv) setae on membranous area of scutum: hs only on *A. subtilis*, fs also present on other 3 species;
- (v) number of scutal setae: generally more than 40 on *A. pubens*, less than 20 on other 3 species;
- (vi) tegular setae: absent on *A. kamahi*, present on the other 3 species;
- (vii) fs metatergal setae: present on *A. pubens*, absent on other 3 species;
- (viii) metatergal setae: absent on *A. matai*, present on other 3 species;
- (ix) presence of postmesospiracular setae immediately posterior to anterior spiracle: few on *A. matai* and *A. subtilis*, numerous on *A. kamahi* and *A. pubens*;
- (x) fleshy ventral abdominal setae: absent on *A. subtilis*, present on other 3 species;
- (xi) ventral abdominal setae on abdominal segment VIII: absent on *A. subtilis*, present on other 3 species;
- (xii) ante-anal setae: some fleshy setae present on *A. pubens*, other 3 species with hs only.

Discussion: *A. subtilis* is one of the few species of Coccidae studied here for which there were sufficient good, well-stained slides to comment on the variability of the attributes used in the description for this species. The size range of some structures was substantially greater than on many other species, particularly in leg and antennal lengths. The size ranges for the sclerites on the mesothorax also varied somewhat but, despite being squashed dorsoventrally on the slide, their shape did not vary much (giving some confidence in the differences between species in shape of the membranous part of the scutum, for instance). Occasionally an individual would be noticeably more hirsute than the others, but the differences were never great enough to suggest another species was present. In particular, when setae were present or absent (e.g., absence of genal setae on the gena or postmesospiracular setae mainly restricted to medially, with few or none posterior to the spiracles), this arrangement was true of all specimens. However, it was found that a few characters were rather variable; these were:

- (i) length of the preocular ridge,
- (ii) presence/absence of lateral pronotal setae (as noted by Giliomee 1967);

- (iii) degree of development of the median ridge on the prosternum;
- (iv) degree of sclerotisation of the marginal ridge of the basisternum;
- (v) number of tegular setae (although rarely absent and then only on one side), and, perhaps most significantly,
- (vi) length of the basal rod, which did not nearly reach the anterior membranous area when short but clearly did when long; interpretation of this character clearly needs to be treated with some caution.

One specimen of *A. subtilis* had a very distinct sclerotised part to the midcranial ridge at the posterior end of the median crest. This ridge was well developed and expanded posteriorly to form a short transverse ridge. This ridge may represent a postoccipital ridge as it is in the position of the postoccipital ridge of the Pseudococcidae and Eriococcidae (Afifi 1968). This is also very similar to the structure present on Species A, described below. A similar structure has also been seen on a male *Cribropulvinaria tailungensis* Hodgson & Martin (Hodgson & Martin 2001) in the tribe Pulvinariini from Hong Kong.

CRYSTALLOTESTA Henderson & Hodgson

Crystallotesta Henderson & Hodgson: Hodgson & Henderson 2000: 79

Type species: *Inglisia fagi* Maskell

Introduction. The genus *Crystallotesta* was introduced based on adult female characters. It currently includes the following 6 species: *C. fagi* (Maskell), *C. fusca* (Maskell), *C. leptospermi* (Maskell), *C. neofagi* Henderson & Hodgson, *C. ornata* (Maskell), and *C. ornatella* Henderson & Hodgson (Hodgson & Henderson 2000). The present study of the adult males suggests that *C. ornata* and *C. ornatella* are somewhat different from the males of *C. fagi* and *C. leptospermi*, the only other species in this genus for which adult male material was available. This genus is, therefore, dealt with as 2 groups below: the *fagi*-group, including *C. fagi* and *C. leptospermi* (and possibly *C. fusca* and *C. neofagi*, but see also Species A), and the *ornata*-group, with *C. ornata* and *C. ornatella*. Based on the characters of *C. fagi* and *C. leptospermi*, the *fagi*-group appears to be most similar to *Plumichiton* and *Umbonichiton* and rather similar to the males of *Ctenochiton*, while the *ornata*-group is quite different, with an apparently unique combination of characters.

The *fagi*-group

Diagnosis based on the adult males of 2 species, *C. fagi* and *C. leptospermi* (significant character-states in italics) (Fig. 67, 68).

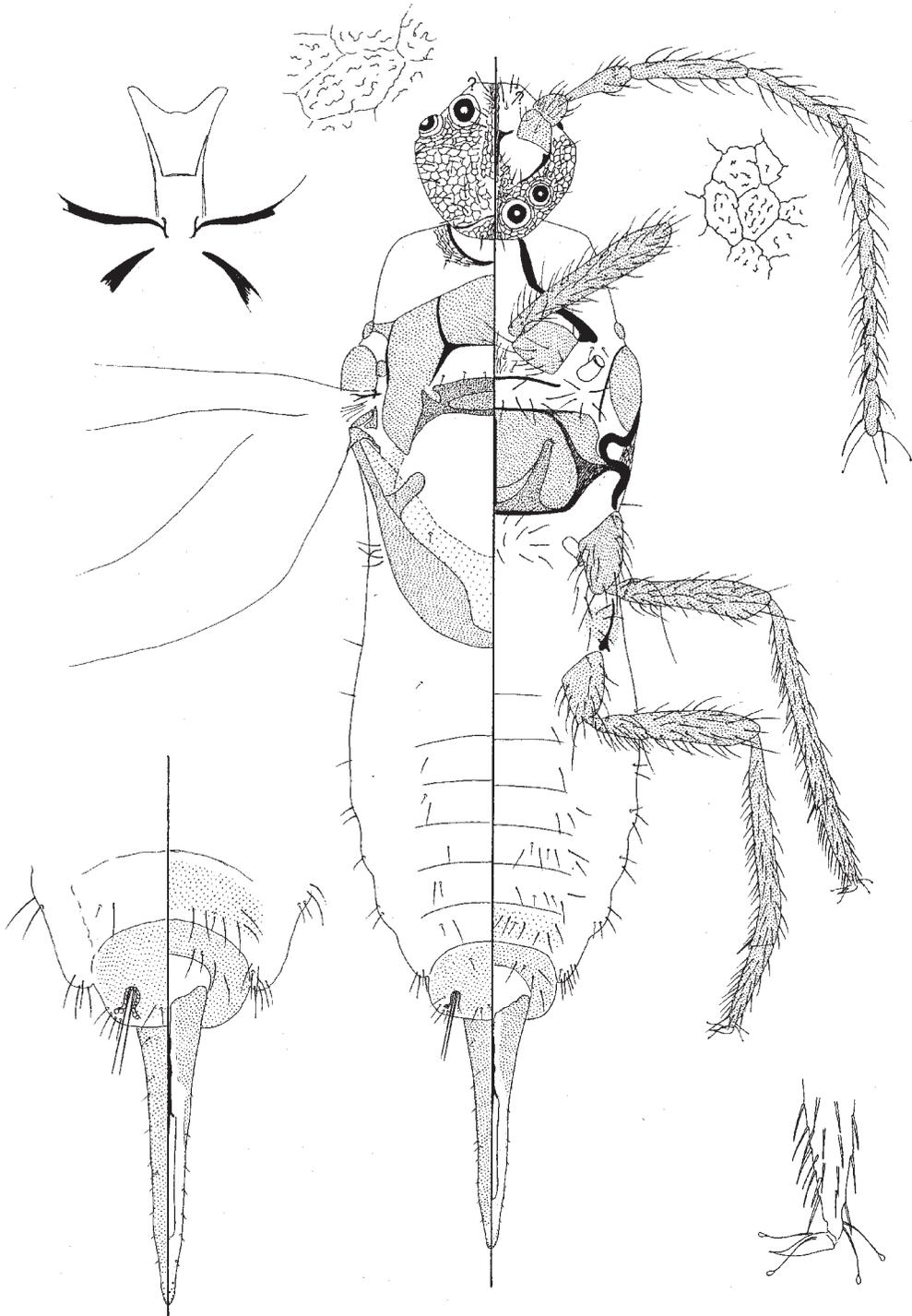


Fig. 67 Adult male, *Crystallotesta fagi* (Maskell).

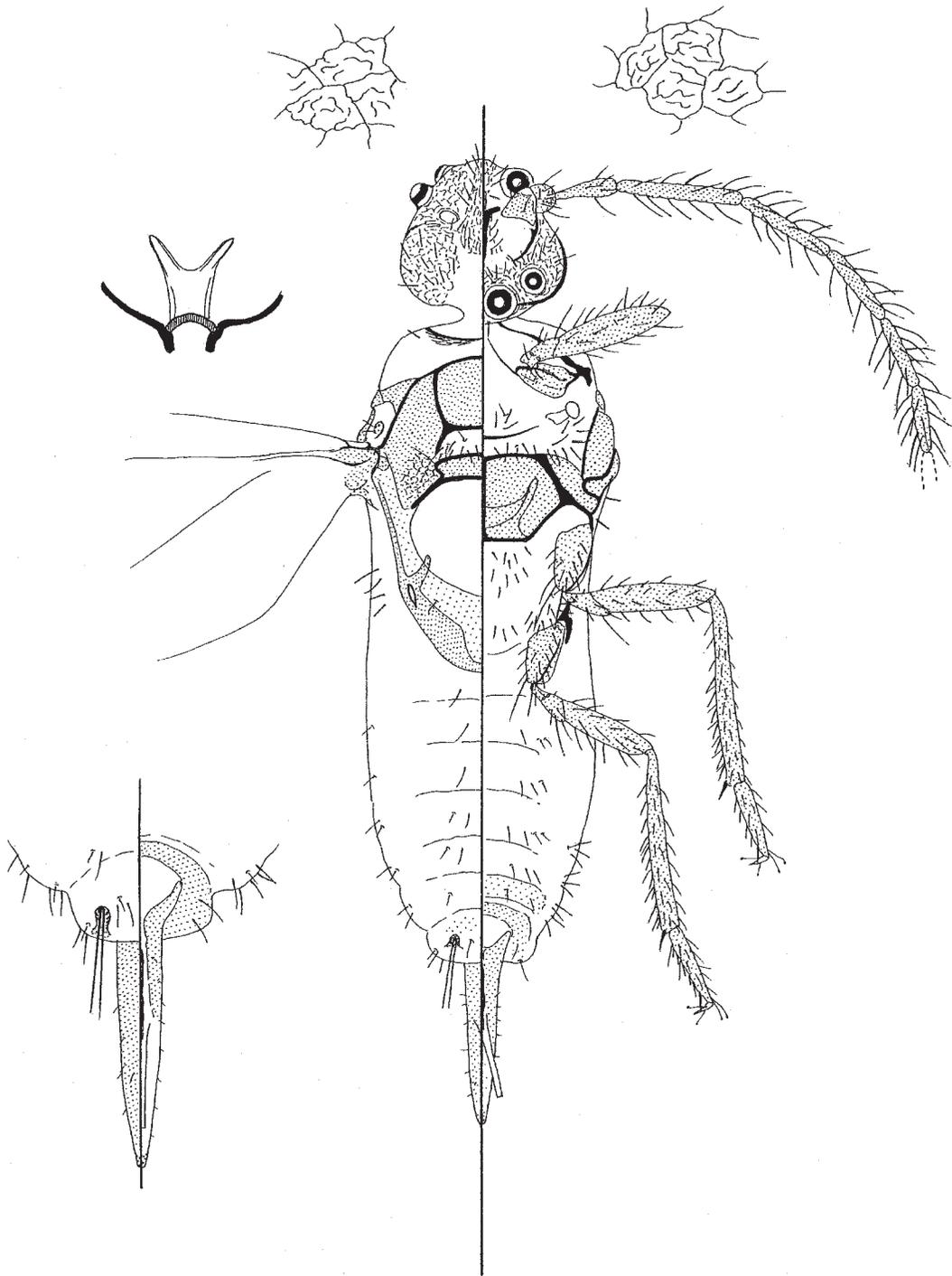


Fig. 68 Adult male, *Crystallotesta leptospermi* (Maskell)

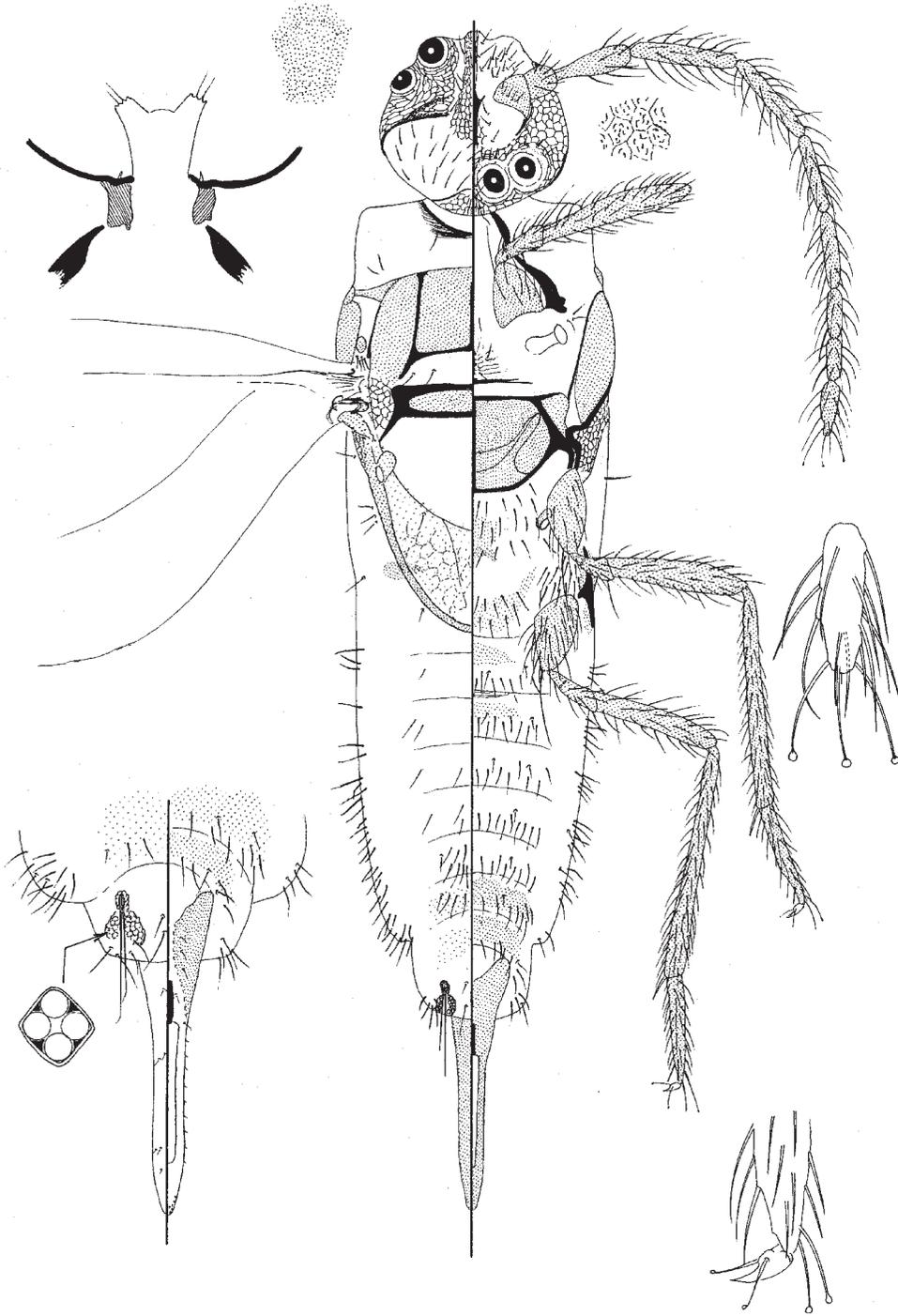


Fig. 69 Adult male, *Crystalloctesta ornata* (Maskell).

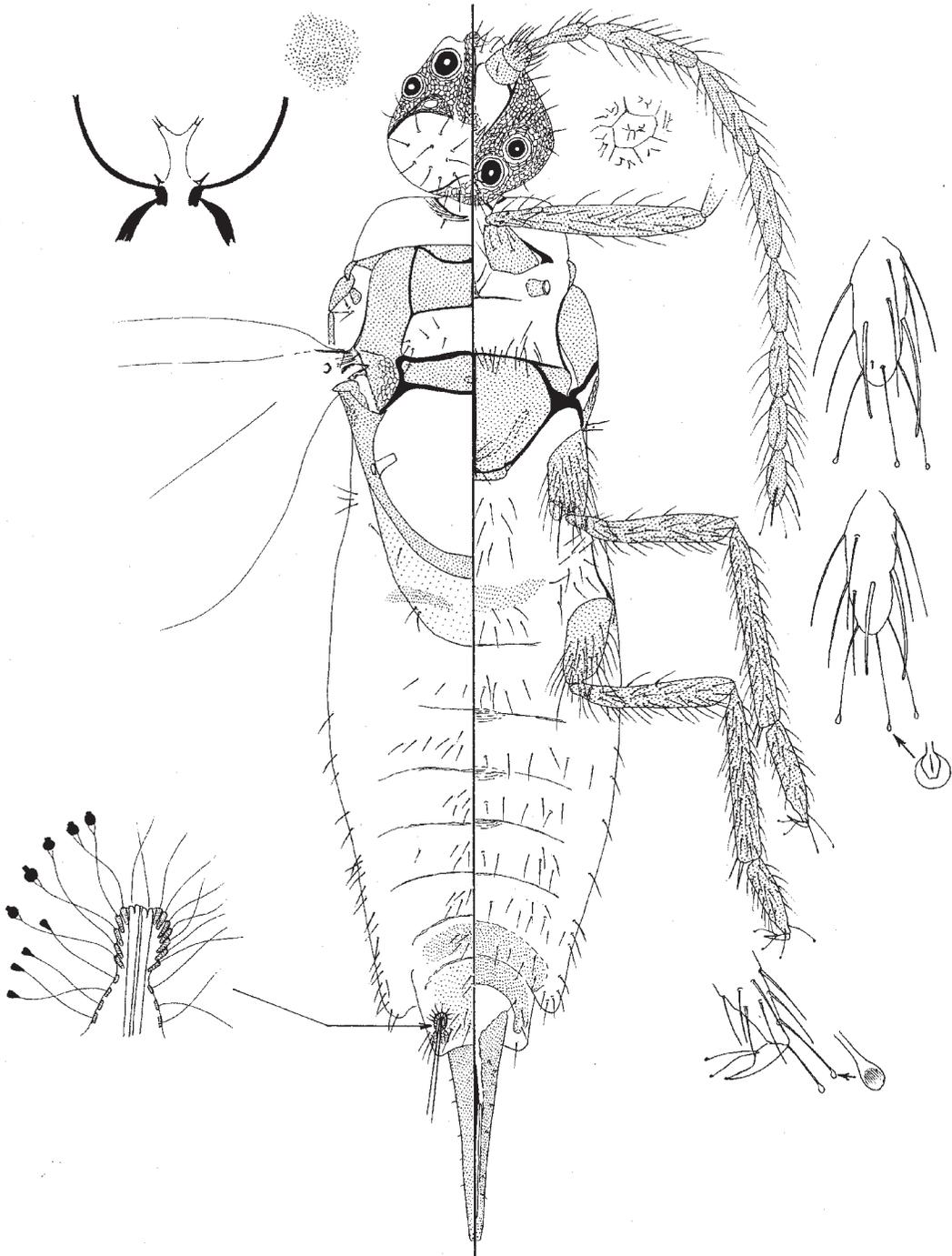


Fig. 70 Adult male, *Crystalloresta ornatella* Henderson & Hodgson. Structure of glandular pouch and associated tubular ducts shown bottom left.

General: small to large; fleshy setae normal; dorsal pores absent. **Head:** fs fairly abundant; with 4 pairs of simple eyes, lateral eyes distinctly smaller than other eyes; genal setae present; genal reticulations with small sinuous inner microridges; ocular sclerite and genal reticulations rather similar; ventral midcranial ridge with some fs; postocular ridge not nearly reaching ocelli; ocelli present although sometimes obscure; ocular sclerite reticulations with small sinuous inner microridges; ventral head setae present throughout ocular sclerite; ventral head setae present between ventral eyes; *ventral ocular setae present*; tentorial bridge present or possibly absent; cranial apophysis bifurcated. **Antennae:** average, about 0.6 of total body length; with 3 hs on scape; segment X not constricted; hs on segments IV–X absent; with 3 capitate setae on segment X. **Prothorax:** with 1 pair of lateral pronotal setae; lateral prothoracic setae absent; prosternum without median ridge; prosternum with prosternal setae; antemesospiracular setae present or absent; anteprosternal setae absent. **Mesothorax:** prescutum about 1.5× wider than long; prescutum without reticulations; membranous area of scutum narrow, 3–4× wider than long; membranous area of scutum with fs and hs setae; scutum not reticulated anteriorly; reticulations laterad to scutellum present or absent; scutellum with or without a large foramen; with fs postmesospiracular setae, extending across width of segment; median ridge of basisternum present; furca not nearly reaching anterior border of basisternum; setae laterad to lateropleurite absent; tegular setae present or absent; mesepisternum without reticulations; anterior end of postalare lightly reticulated; postalare setae generally present. **Metathorax:** with numerous fs anterior metasternal setae; *posterior metasternal setae many fewer or absent*; with fs postmetaspiracular setae; metepimeron with or without setae; hamulohalteres absent; with 1 pair of hs metatergal setae; dorsospiracular setae present; setae near mesoprecoxal ridge absent.

Legs: with 1 tibial spur per tibia; tarsal campaniform pores absent; trochanter–femur segmentation distinct; fs on metafemur much more abundant than hs; tarsus 1-segmented.

Abdomen: segment VIII of normal length; cicatrices absent; sternites and tergites on segments II–VI absent or poorly sclerotised; with few fs + hs dorsal abdominal setae; fs ventral abdominal setae subequal to or more abundant than fs dorsal abdominal setae; pleural setae segmentally arranged and hs + fs; with both hs and fs antennal setae; caudal extensions on segments VII and VIII small and rounded; glandular pouches present; penial sheath rather short (about 1/5th total body length); basal rod long but not reaching basal membranous area; aedeagus short, about 1/2 length of penial sheath, with rather parallel margins.

Comment. Whilst the *fagi*-group of *Crystallotesta* shares a few character-states with the *ornata*-group, there are a number of significant differences (see under *ornata*-group diagnosis below) suggesting that these 2 groups might not be congeneric.

Crystallotesta fagi (Maskell)

Fig. 67

Live appearance: no live or unmounted material available.

Material examined: see Appendix for collection details of specimen examined.

Described from 1 specimen in good condition, but last few segments of antennae not clear.

Mounted material: large and robust, total body length about 2.03 mm; antennae slightly more than half total body length; body not particularly setose, fleshy setae usually easily differentiated from long hairlike setae; length of fs about 2× width of antennal segments. Wings rather short, only about 6/10 of total body length, but each about half as wide as long. Hamulohalteres absent.

Head: roundish in dorsal view; length of head uncertain; width across genae 278 µm. Median crest reticulated, with 4 fs + 7 hs dorsal head setae on each side. Midcranial ridge: dorsal ridge absent; ventral part well-defined, extending to ocular sclerite posteriorly; lateral arms well-defined; with a reticulated border, narrow anteriorly but broadening posteriorly and fusing with ocular sclerite; with 1 or 2 fs + 2 hs setae on each side. Genae large, reticulations poorly developed and faint, each reticulation with numerous short, sinuous, inner microridges and raised spots; genal setae: about 8–11 fs + 1 hs on each side. Simple eyes: four pairs; large dorsal eyes subequal in size to large ventral eyes, both pairs round and 102–107 µm wide; each with a closely associated, round, slightly smaller, lateral eye: dorsal: 94 µm wide; ventral 82 µm wide. Ocelli indistinct (or maybe absent). Ocular sclerite sclerotised and polygonally reticulated throughout, each reticulation with several short, sinuous, inner microridges. Preocular ridge well developed with posterior arm quite long, extending some 2/3 of distance towards midcranial ridge. Postocular ridge well developed but not nearly reaching area of ocelli. Dorsal ocular setae absent. Ventral head setae: with about 7 or 8 fs + 10 or 11 hs on each side anterior and laterad to ventral simple eyes, and with 3 fs between eyes; ventral ocular setae: 0 or 1 fs. Tentorial bridge: possibly absent. Cranial apophysis about 63 µm long, with two short arms. **Antennae:** 1200–1225 µm long (ratio of total body length to antennal length 1:0.59). Scape: 51–58 µm long and 66 µm wide, with 3 hs. Pedicel: length 41–45 µm, width 50–58 µm; with weak polygonal reticulations; with about 5–7 fs + 7 or 8 hs, restricted to ventral surface. Segments III–IX all about 19–24 µm wide;

lengths (μm): III: 121–125; IV: 207; V: 182–196; VI: 151–166; VII: 133; VIII: 108 and IX: 83; fs 46–53 μm long; length of fs 45–50 μm ; approximate number of setae per segment: III: 4–7 fs + a few hs (no. of sensilla basiconica unknown); IV: 28 fs; V: 28–32 fs; VI: 20–23 fs; VII: 17 fs; VIII: about 15 fs + 1 bristle; IX: about 13 fs + 1 bristle. Segment X possibly not constricted apically; length 95 μm ; with 3 capitate setae, 3 large and (maybe only) 1 small antennal bristles plus an unknown number of fs setae and sensilla basiconica.

Thorax. Prothorax: pronotal ridge strong, with a broad, reticulated, lateral pronotal sclerite; with 1 pair of lateral pronotal setae. Sternum with a strong transverse ridge; median ridge absent; sternite broad, with light radial striations; with 2 hs prosternal setae on each side. Anteprosternal setae absent. Antemesospiracular setae: with 2 or 3 hs on each side. **Mesothorax:** prescutum wider than long (197 μm wide and 127 μm long); not reticulated. Scutum: median membranous area much wider than long (205 μm wide; perhaps 57–66 μm long); scutal setae: 2 or 3 hs on each side; lateral margins not reticulated. Scutellum 180 μm wide and 61 μm long; probably tubular with a large foramen. Basisternum about 287 μm wide and 188 μm long; with a strong median ridge, distinctly weaker at each end; bounded by distinct but weak marginal ridges and strong precoxal ridges; without basisternal setae; lateropleurite with a short extension of median ridge along anterior border; furca well developed, each arm extending anteriorly well past point where marginal ridge and precoxal ridges join. Postalare with polygonal reticulations; with 0 or 1 fs postalare setae. Mesothoracic spiracle: peritreme about 21 μm wide. Postmesospiracular setae: about 22, extending across full width of segment. Tegula: well developed, without tegular setae. **Metathorax:** metapostnotum probably unsclerotised; with 1 hs metatergal seta on each side. Metapleural ridge only present ventrally, well developed; episternum not sclerotised but with 8 or 9 postmetaspiracular setae. Metepimeron small or absent, possibly with 1 fs. Metathoracic spiracle: width of peritreme 25 μm . Antemetaspiracular setae probably absent but probably with about 4–6 fs dorsospiracular setae. Metasternum membranous. Anterior metasternal setae: about 18 fs; posterior metasternal setae: absent.

Wings: hyaline; comparatively rather short, 1275–1300 μm long, 650–675 μm wide (ratio length to width 1:0.51; ratio of total body length to wing length 1:0.63). Hamulohalteres absent.

Legs: prothoracic subequal in length to or slightly longer than other legs. Coxa lengths (μm): I: 114–120; II: 140–145; III: 136; coxa III with 13–21 fs + 5 hs; each coxa with 2 long apical setae, longest about 72 μm long. Trochanter + femur lengths (μm): I: 331–335; II: 289–294; III: 302–311; each trochanter III with about 10 fs + 4 or 5 hs; long

trochanter seta about 50–58 μm ; each femur III with about 30–35 fs + 15–22 hs. Tibia lengths (μm): I: 397; II: 356–373; III: 360; tibia III with about 77–82 setae + spurlike setae; large apical spur 36–38 μm long. Tarsus lengths (μm): I: 147–153; II: 157–162; III: 157–162 (ratio length of tibia III to length of tarsus III 1:0.44); tarsus III with about 40–46 setae + spurlike setae; tarsal spurs each about 25–30 μm long, noticeably slightly constricted at base; tarsal digitules subequal to or slightly shorter than claw. Claws subequal in length to width of tarsi, slightly curved but only gradually narrowing; denticle absent; length 25 μm ; claw digitules with slightly larger terminal knobs than on most other species.

Abdomen: segments I–VII: tergites and sternites only present on segment VII. Caudal extension of segment VII small, rounded. Dorsal abdominal setae, on each side: segments I–II: absent; III: 2 fs + 1 or 2 hs; IV: 2 fs + 2 hs; V: 2 fs + 1 hs; VI: 1 fs + 1 hs, and VII: 0 or 1 fs + 1 hs. Pleural setae: dorsopleural setae, on each side, segments: I–II: 0; III: 0 or 1 fs + 1 hs; IV: 1 or 2 fs + 0 or 1 hs; V: 0 or 1 fs + 0 or 1 hs; VI: 0 fs + 1 or 2 hs. Ventropleural setae, on each side, segments: I–II: 0 fs + 0 or 1 hs; III: 0 fs + 1 or 2 hs; IV: 0 or 1 fs + 1 hs; V: 0 fs + 1 or 2 hs; VI: 2 fs + 1 or 2 hs; VII (dorsopleural + ventropleural setae): 8 or 9 fs + 0 or 1 hs. Ventral abdominal setae, on each side, segments: II: 0 or 1 fs + 0 hs; III: 1 fs + 0 hs; IV: 2 or 3 fs + 1 hs; V: 5 fs + 0–2 hs; VI: 4 or 5 fs + 2 hs, and VII: 6 fs + 1–3 hs. Segment VIII: rounded; tergite with 4 fs + 1 hs ante-anal setae; sternite with 4 fs + 0 or 1 hs ventral abdominal setae; caudal extension rounded, with 4 hs pleural setae. Glandular pouch present; glandular pouch setae 129–133 μm long. **Genital segment:** penial sheath quite long: 442 μm long and 112 μm wide at base, about 1/5 of total body length (ratio of total body length to penial sheath length 1:0.22). Basal rod: length 116 μm to base of aedeagus, with a short, thin 16 μm long extension down centre of aedeagus; anterior end not nearly reaching basal membranous area (distance from basal membranous area about 40 μm). Aedeagus 166 μm long (ratio length of aedeagus to length of basal rod 1:0.7), broad basally and rather parallel-sided, apex far from distal end of penial sheath. Penial sheath with 13 or 14 small setae along each margin and with a cluster of small sensilla near apex.

Comment. *C. fagi* differs from *C. leptospermi* as follows (character-states on *C. leptospermi* in parentheses):

- (i) large size, >2.0 mm (small, <1.5 mm);
- (ii) absence of reticulations laterad to scutellum (present);
- (iii) absence of posterior metasternal setae (present);
- (iv) presence of antemesospiracular setae (absent).

C. fagi and *C. leptospermi* appear to be closest to *Plumichiton* and *Umbonichiton*. For differences between the *fagi*-group and the *ornata*-group, see under *C. ornatella* below.

***Crystallotesta fusca* (Maskell)**

see Species A (p. 133)

***Crystallotesta leptospermi* (Maskell)**

Fig. 31, 68

Live appearance: body pale fawn, including legs and antennae, with black eyes; a pair of caudal wax filaments present.

Test moderately convex and rounded, of translucent glassy wax, individual wax plates not particularly convex; with three large plates on mid-dorsum anterior to back-plate suture, and with smaller plates in submedian and submarginal rows; marginal fringe wax plates moderately long on fresh specimens with noticeably longer plates directed forwards at anterior end. On the leaves of host plants.

Material examined: see Appendix for collection details of specimens examined.

Described from 3 specimens in fair to good condition but 1 with a twisted head; none with complete antennae and all wings rather crumpled.

Mounted material: fairly small, total body length about 1.43–1.45 mm; body not particularly setose, fleshy setae easily differentiated from long hairlike setae; length of fs more than twice width of antennal segments. Wings apparently about same length as body, but each rather narrow, possibly much less than half wing length. Hamulohalteres absent.

Head: roundish in dorsal view; length of head 240–250 μ m; width across genae 240–260 μ m. Median crest reticulated, with 4–10 fs + 3 or 4 hs dorsal head setae on each side. Midcranial ridge: dorsal ridge absent; ventral part well-defined, extending to ocular sclerite posteriorly; lateral arms well-defined; with a faintly reticulated border, narrow anteriorly but broadening posteriorly and fusing with ocular sclerite; with 2 or 3 fs ventral midcranial ridge setae on each side. Genae large, reticulations distinct, each reticulation with numerous short, broken, sinuous, inner microridges; genal setae: about 1–10 fs + 0 or 1 hs on each side. Simple eyes: four pairs, all rather pronounced and convex; large dorsal and ventral eyes subequal in size (49–52 μ m wide), both pairs round; each with a closely associated, round, slightly smaller, lateral eye, each 38–45 μ m wide. Ocelli rather indistinct but about 18–25 μ m wide. Ocular sclerite sclerotised and polygonally reticulated throughout, each reticulation with several short, sinuous, inner microridges. Preocular ridge well developed with ventral arm quite long, extending some 2/3 of distance towards midcranial ridge; dorsal arm subequal in length to ventral arm. Postocular ridge well developed but not nearly reaching area of ocelli. Dorsal ocular setae: 1 or 2 fs on both sides. Ventral head setae: with about 8–11 fs + 2–8 hs on

each side anterior and laterad to ventral simple eyes; ventral ocular setae: 0 or 1 fs + 0–4 hs. Tentorial bridge: distinct. Cranial apophysis about 50–60 μ m long, with two short arms. **Antennae:** none complete, segments IX and X missing. Scape: 53–55 μ m long and 43–50 μ m wide, with 2 or 3 hs. Pedicel: length 43–48 μ m, width 40–45 μ m; with weak polygonal reticulation distally; with about 6 or 7 fs + 5 or 6 hs, restricted to ventral surface. Segments III–VIII all about 14–22 μ m wide; fs 40–45 μ m long; lengths (μ m): III: 86–95; IV: 165–200; V: 140–160; VI: 124–135; VII: 115 and VIII possibly 100; length of fs about 43 μ m; approximate number of setae per segment: III: 3 or 4 fs + 0–2 hs (no. of sensilla basiconica unknown); IV: 15–18 fs; V: 16–23 fs; VI: 15–17; VII: 12 fs and VIII 17 fs.

Thorax. Prothorax: pronotal ridge strong, with a broad, reticulated, lateral pronotal sclerite; with 0 or 1 pair of fs lateral pronotal setae. Sternum with a strong transverse ridge; median ridge absent; sternite broad, with light radial striations; with 2–4 fs + 1 hs prosternal setae on each side. Anteprosternal setae and antemesospiracular setae absent. **Mesothorax:** prescutum wider than long (145–165 μ m wide and 108–113 μ m long); not reticulated. Scutum: median membranous area much wider than long (165–200 μ m wide; perhaps 50 μ m long); scutal setae: 9–14 fs + 5 hs in total; margins laterad to scutellum strongly reticulated. Scutellum 150–185 μ m wide and 40–45 μ m long; probably tubular without a foramen. Basisternum about 230–250 μ m wide and 125–150 μ m long; with a strong median ridge; bounded by strong marginal ridges and strong precoxal ridges; without basisternal setae; lateropleurite with only a very weak extension of median ridge along anterior border; furca well developed, each arm extending anteriorly well past point where marginal ridge and precoxal ridges join. Postalare with polygonal reticulations; with 1 or 2 fs + 0 or 1 hs postalare setae. Mesothoracic spiracle: peritreme about 18–22 μ m wide. Postmesospiracular setae: about 20–27 fs + 0 or 1 hs, extending across full width of segment. Tegula: well developed, with 0 or 1 fs + 0–2 hs tegular setae. **Metathorax:** metapostnotum unsclerotised; with 1 hs metatergal seta on each side. Metapleural ridge only present ventrally, well developed; episternum not sclerotised but with 10 or 11 fs + 0 or 1 hs postmetaspiracular setae on each side. Metepimeron strong but short, possibly with 0 or 1 fs. Metathoracic spiracle: width of peritreme 25 μ m. Antemetaspiracular setae probably absent; dorsospiracular setae: 4–9 fs on each side. Metasternum membranous. Anterior metasternal setae: about 20–25 fs; posterior metasternal setae: 4–10 fs.

Wings: only 1 wing possibly measurable: hyaline; comparatively rather long, 1450 μ m long and maybe 650 μ m wide (ratio length to width 1:0.45; ratio of total body length to wing length 1:1). Hamulohalteres absent.

Legs: prothoracic slightly longer than other legs. Coxae

lengths (μm): I: 95; II: 108–111; III: 112–116; coxa III with 10–16 fs + 2–8 hs; each coxa with 2 long apical setae, longest about 50–60 μm long. Each trochanter + femur lengths (μm): I: 245–277; II: 207–230; III: 210–230; each trochanter III with about 6–8 fs + 1 hs; long trochanter seta about 40–50 μm , hardly differentiated from other setae; each femur III with about 23–25 fs + 3–6 hs. Tibia lengths (μm): I: 305–360; II: 250–294; III: 260–300; tibia III with about 70–80 setae + spurlike setae; large apical spur 25–28 μm long. Tarsi lengths (μm): I: 128–136; II: 124–140; III: 120–132 (ratio length of tibia III to length of tarsus III 1:0.45); tarsus III with about 48 setae + spurlike setae; tarsal spurs each about 25–30 μm long, not constricted at base; tarsal digitules significantly shorter than claw. Claws subequal in length to width of tarsi, slightly curved but only gradually tapering; denticle very small or absent; length 25 μm ; claw digitules with small terminal knobs.

Abdomen: segments I–VII: tergites absent; sternites only present on segment VII. Caudal extension of segment VII small, rounded. Dorsal abdominal setae (on each side): segments I–VII: 0–2 fs + 0 or 1 hs. Pleural setae: dorsopleural setae: I–II: 0; III: 0 or 1 fs + 1 hs; IV–VI: 1 or 2 fs + 0 or 1 hs on each side; those of segment VII fused with ventral pleural setae. Ventropleural setae: I–IV: 0 fs + 0 hs; V–VI: 1 fs + 1 hs; VII (dorsopleural + ventropleural setae): 5–7 fs + 1 hs on each side. Ventral abdominal setae, on each side: II–VII: 1–4 fs + 0–2 hs. Segment VIII: rounded; tergite lightly sclerotised, with 0–4 fs + 2 hs ante-anal setae; sternite with 0–2 fs + 0 hs ventral abdominal setae on each side laterad to penial sheath; caudal extension rounded, with 2 or 3 fs + 1 or 2 hs pleural setae. Glandular pouch present; glandular pouch setae 95–120 μm long. **Genital segment:** penial sheath quite stout: 300 μm long and 83 μm wide at base, about 1/5 of total body length (ratio of total body length to penial sheath length 1:0.21). Basal rod: length 80–95 μm to base of aedeagus, with a short, thin extension down centre of aedeagus; anterior end not quite reaching basal membranous area (distance from bma about 13–17 μm). Aedeagus 105–120 μm long (ratio length of aedeagus to length of basal rod 1:0.78), broad basally and rather parallel-sided, apex far from distal end of penial sheath but perhaps broadening slightly apically. Penial sheath with 7–12 small setae along each margin and with a cluster of small sensilla near apex.

Comment. For a comparison with *C. fagi*, see under *C. fagi* above.

Ornata-group

Diagnosis based on the adult males of 2 species, *C. ornata* and *C. ornatella* (significant character-states in italics) (Fig. 69, 70).

General: moderate to large; *fleshy setae very long and flagellate, similar to long hs and difficult to distinguish*; dorsal pores absent.

Head: fs fairly abundant; with 4 pairs of simple eyes, lateral eyes slightly smaller than other eyes; genal setae present; *genal reticulations represented by small dots*; structure of ocular sclerite and genal reticulations different; ventral midcranial ridge setae present or absent; *postocular ridge extending to and surrounding ocelli*; ocelli large and distinct; ocular sclerite reticulations with few short inner microridges; ventral head setae present or absent laterally on ocular sclerite; few ventral head setae present between ventral eyes; ventral ocular setae present or absent; *tentorial bridge absent*; cranial apophysis bifurcated. **Antennae:** long on *C. ornata* (about 0.8 of total body length) but short on *C. ornatella* (about 0.5); with 3–7 hs on each scape; segment X not constricted; setae on segments IV–X hard to differentiate between hs and fs; with 3 capitate setae on antennal segment X.

Thorax. Prothorax: with 1 pair of hs lateral pronotal setae; lateral prothoracic setae absent; post-tergital setae present on *C. ornatella*; prosternal median ridge absent or poorly developed; fs prosternal setae present or absent; antemesospiracular setae present or absent; anteprosternal setae absent. **Mesothorax:** prescutum 1.5–2 \times wider than long; prescutum without reticulations; membranous area of scutum narrow, 3–5 \times wider than long; setae on membranous area of scutum probably all hs; scutum not reticulated anteriorly; *scutum reticulated laterad to scutellum*; size of foramen on scutellum varied; postmesospiracular setae present or absent; median ridge of basisternum well developed; marginal ridge well developed; furca fairly short, not nearly reaching anterior border of basisternum; setae laterad to lateropleurite absent; regular setae present; mesepisternum without reticulations; anterior end of postalare lightly reticulated; postalare setae present. **Metathorax:** with numerous fs anterior metasternal setae; with many fs posterior metasternal setae; with some fs postmetaspiracular setae; metepimeron without setae; hamulohalteres absent; with 1 pair of hs metatergal setae; dorsospiracular setae present; setae near mesoprecoxal ridge absent.

Legs: with 1 tibial spur per tibia; tarsal campaniform pores absent; trochanter–femur segmentation distinct; fs and hs on metafemur hard to differentiate; tarsus 1–segmented.

Abdomen: *segment VIII unusually long, about as long as wide*; cicatrices absent; sternites and tergites on segments II–VI absent or poorly sclerotised; with few dorsal abdominal setae; more setae on venter than on dorsum of abdomen; *pleural setae not segmentally arranged but more or less in a marginal row and fairly abundant*; with both fs

and hs ante-anal setae; caudal extensions on both segments VII–VIII small and rounded; glandular pouches present; penial sheath quite long, about 1/4 of total body length; penial sheath gradually narrowing towards apex; basal rod short, not reaching basal membranous area; aedeagus short, about 1/2 length of penial sheath, with rather parallel margins.

Crystallotesta ornata (Maskell)

Fig. 5, 6, 34, 35, 69

Live appearance: light yellow–brown body and darker head with black eyes, and pale antennae and dark legs; a pair of caudal wax filaments present.

Test convex, of thick opaque wax plates; with 3 larger convex plates on mid–dorsum and with submarginal rows of smaller convex plates; with distinctive long fine wax filaments (whiskers) extending out from all around margin (no other New Zealand Coccidae male test has these). Generally on leaves, sometimes on young stems of host plants.

Material examined: see Appendix for collection details of specimens examined.

Described from 6 specimens in fair to good condition.

Mounted material: quite large, total body length about 1.9–2.1 mm, slender; antennae more than 3/4 total body length; body fairly setose; fleshy setae very long and flagellate, up to about 50 µm on body; not easily differentiated from long hairlike setae; length of fs on antennae about 2× width of antennal segments. Wings relatively short, only just over 3/4 of total body length, and width slightly under half length.

Head: approximately round in dorsal view; width across genae 315–349 µm. Median crest well developed, with 4–8 hs on each side on dorsal surface and with a group of perhaps 7–12 hs dorsal head setae on membranous area just anterior to each scape. Midcranial ridge: dorsal ridge absent; ventral ridge well-defined, with distinct lateral arms; with a narrow reticulated border which extends posteriorly and fuses with ocular sclerite; with 1–6 hs setae on each side. Genae large, not distinctly reticulated, but with numerous minute raised spots in which a reticulated pattern can usually be discerned; with about 12–18 fs genal setae on each side. Simple eyes: four pairs; large dorsal eyes subequal in size to large ventral eyes; both pairs round, dorsal simple eye 75–77 µm wide, ventral simple eye 70–74 µm wide; each with a closely associated, slightly smaller, lateral simple eye: dorsal lateral eyes: 57–70 µm; ventral lateral eyes 65–70 µm wide. Ocelli distinct. Ocular sclerite sclerotised and polygonally reticulated throughout, each reticulation with many inner microridges. Preocular ridge: dorsal arm about as long as ventral arm; latter short, ex-

tending only about 1/3 of distance to midcranial ridge. Postocular ridge well developed, dorsally reaching ocelli, where it divides, each arm extending round ocellus. Dorsal ocular setae: 0–2 fs on each side. Ventral head setae: about 4–8 setae on each side just anterior to ventral eyes, none laterally on ocular sclerite, and with 4–10 setae between eyes; without ventral ocular setae. Tentorial bridge absent. Cranial apophysis bifid, each arm quite broad; about 50–63 µm long. **Antennae:** 1475–1575 µm long (ratio of total body length to antennal length about 1:0.78). Scape: 64–72 µm long and 73–75 µm wide, with 3–7 hs setae. Pedicel: 54–61 µm long and 55–59 µm wide, with weak polygonal reticulations and with about 11–15 fs + 0–2 hs setae, almost all on ventral surface. Segments III–X all about 23–29 µm wide; segment lengths (µm): III: 127–144; IV: 176–196; V: 169–182; VI: 144–162; VII: 126–149; VIII: 93–106, and IX: 81–117; fs each 50–58 µm long; length of fs 55–60 µm; approximate number of setae per segment: III: 9–15 fs + 1 sensilla basiconica; IV: 15–29; V: 20–30; VI: 22–29; VII: 26–35; VIII: 15–19 + 1 bristle; IX: 13–15 + 1 bristle. Segment X: length 108–117 µm; not constricted apically; with 3 capitate setae, 3 large and 2 small antennal bristles, 9–13 fs setae and 2 sensilla basiconica, 1 on apex and 1 between 2 bristles.

Thorax. Prothorax: pronotal ridge strong, with a broad non-reticulated lateral pronotal sclerite; with 1 or 2 pairs of lateral pronotal setae. Post-tergital setae: 0–4 fs. Proepisternum + cervical sclerite with a small, unsclerotised, oval area about half-way along length. Sternum with a strong transverse ridge, probably with small apophyses at each end; sclerotised median ridge present but poorly developed; sternite broad and triangular, with light radial striations; with 0–2 fs + 0–2 hs prosternal setae on each side. Anteprosternal setae absent. Antemesospiracular setae: 1–3 near each propleural ridge. **Mesothorax:** prescutum slightly wider than long (180–205 µm wide and 139–168 µm long); not reticulated but with a distinct sclerotised, elongate, ridge medially. Scutum: median membranous area much wider than long (205–230 µm wide; perhaps 41 µm long); scutal setae: 0–2 fs + 0–2 hs on each side; lateral margins reticulated laterad to scutellum. Scutellum 205–230 µm wide and 49–70 µm long; tubular, with a large foramen. Basisternum about 258–308 µm wide and 153–185 µm long; with a strong median ridge, slightly weaker at each end; bounded by strong marginal and precoxal ridges; without basisternal setae; lateropleurite with a weak extension from marginal ridge; furca long, each arm almost reaching anterior margin of basisternum. Postalare with pronounced reticulations at anterior end; with 0–2 fs postalare setae. Mesothoracic spiracle: peritreme 28–32 µm wide. Postmesospiracular setae absent. Tegula: well developed, with 5–8 hs tegular setae (possibly occasionally absent). Membranous area of mesopostnotum lightly reticulated. **Metathorax:** metapostnotum present and

lightly sclerotised; with 1 hs metatergal seta on each side. Metapleural ridge only present ventrally, well developed; episternum not sclerotised but with 12–19 fs postmetaspiracular setae; epimeron well developed but without setae. Metathoracic spiracle: width of peritreme 28–34 μm . Antemetaspiracular setae: probably 0–2 fs on each side. Dorsospiracular setae: possibly 2–4 fs on each side. Metasternum: anterior part sclerotised medially; posterior part sclerotised, extending quite far laterally; metasternal apophyses absent. Anterior metasternal setae: about 22–37 fs; posterior metasternal setae: about 22–33 fs.

Wings: hyaline; 1475–1575 μm long and 625–750 μm wide (ratio length to breadth 1:0.47; ratio of total body length to wing length 1:0.76). Hamulohalteres absent.

Legs: legs subequal in length. Coxa lengths (μm): I: 127–135; II: 123–135; III: 135–156; coxa III: coxal setae: 36–50 fs + 1–4 hs + 2 long setae, longest seta about 57–85 μm long. Trochanter + femur lengths (μm): I: 344–365; II: 291–316; III: 291–328; each trochanter III with 11–16 fs + 1–3 hs; long trochanter seta up to 68–81 μm ; each femur III with about 32–42 fs + 17–19 hs. Tibia lengths (μm): I: 397–422; II: 365–385; III: 377–418; tibia III with about 86–104 setae + spurlike setae; large apical spur 36–56 μm long. Tarsus lengths (μm): I: 172–193; II: 172–189, and III: 176–205 (ratio length of tibia III to length of tarsus III 1:0.48); tarsus III with about 38–67 setae + spurlike setae; tarsal spurs each about 37–41 μm long; tarsal digitules subequal in length or shorter than claw. Claws normal, subequal in length to width of tarsi, slightly curved, without a denticle; length 24–29 μm ; claw digitules slightly longer than claw.

Abdomen: segments I–VII: sternum of all segments with some reticulations + microtrichia but these unclear on tergum of segments I–VI; tergites only present on segment VII, and sternites on segments II, III and VII; broad membranous areas between anterior sternites unclear but probably present. Caudal extension of segment VII small and rounded. All setae rather long and flagellate and hs and fs hard to differentiate; dorsal abdominal setae (totals per segment): segments I–II: 0 or 1 hs; III: 0–3 hs; IV: 0–4 fs + 0–5 hs; V: 4–11 fs + 2 hs; VI: 7–12 fs + 2–7 hs, and VII: 5–9 fs + 1–5 hs. Pleural setae: quite abundant but hard to distinguish between dorsal and ventral groups: dorsopleural setae, segments: I–II: 0; III: 1 or 2 fs + 1 hs; IV: 0–3 fs + 0 or 1 hs; V: 1–9 fs + 1 or 2 hs; VI: 2–9 fs + 0 or 1 hs; ventropleural setae, segments: II: 3 fs + 1 hs; III: 2 or 3 fs + 1 hs; IV: 1–6 fs + 1 or 2 hs; V: 2–7 fs + 1 or 2 hs; VI: 3–8 fs + 0–3 hs; VII (dorsopleural + ventropleural): 14–26 fs + 2 hs on each side. Ventral abdominal setae, totals per segment: II: 10–13 fs + 2–5 hs; III: 7–15 fs + 2–8 hs; IV–V: 6–19 fs + 1–6 hs; VI: 11–17 fs + 2–6 hs, and VII: 10–16 fs + 5–10 hs. Segment VIII: unusually elongate; tergite and sternite distinct;

tergite with 1–3 fs + 0–4 hs ante-anal setae; sternite with about 2–5 fs + 1–4 hs ventral abdominal setae; caudal extension with 4 or 5 fs + 1–3 hs pleural setae. Glandular pouch present; glandular pouch setae 144–184 μm long. **Genital segment:** penial sheath quite long, 435–447 μm long and 113–144 μm wide at base, about 1/5 of total body length (ratio of total body length to penial sheath length 1:0.22). Basal rod quite short; rather less than 1/2 length of aedeagus: length: 67–82 μm to base of aedeagus, with a short, thin 12–21 μm extension down centre of aedeagus; not nearly reaching basal membranous area anteriorly. Aedeagus 172–185 μm long (ratio length of aedeagus to length of anterior part of basal rod 1:0.41), broad basally and rather parallel-sided; apex far from distal end of penial sheath. Penial sheath with 14–16 small setae on each margin, some more proximal setae close to anterior membranous area, and with a small group of sensilla near apex.

Comment. The presence of a longitudinal median ridge on the prescutum is unusual on male Coccoidea. Apparent ridges in this position can be caused by distortion during slide making but in this case it is considered that an actual ridge is present.

The males of *C. ornata* can also be separated from *C. ornatella* by the following characters:

- (i) absence of postmesospiracular setae;
- (ii) presence of post-tergital setae;
- (iii) presence of antemesospiracular setae;
- (iv) presence of a median ridge on prescutum;
- (v) larger number of setae on scape,
- (vi) absence of setae on basisternum.

Crystallotesta ornatella Henderson & Hodgson

Fig. 36, 37, 70

Live appearance: body red-brown, with black eyes and reddish antennae and legs; pair of caudal wax filaments present.

Test convex and box-like, of thick translucent wax plates; with 3 larger plates on mid-dorsum and smaller rows of submarginal plates; test much smaller than that of *C. ornata*, and without long fine wax filaments extending from margin. On small stems of host plants, where old empty tests can remain for some time and appear more opaque than translucent.

Material examined: see Appendix for collection details of specimens examined.

Described from 2 specimens in fair to good condition, although that from Paoneone off *Kunzea ericoides* is significantly larger than that from Dargaville off *Leptospermum scoparium*; latter missing wings.

Mounted material: moderate in size, slender, total body length about 1.25–1.65 mm; antennae about 1/2 total body

length; body fairly setose, fleshy setae very long and flagellate, up to about 50 µm on body; not easily differentiated from long hairlike setae; length of fs on antennae more than 2× width of antennal segments. Wings proportionately rather small, only slightly more than 1/2 total body length; width slightly more than 1/2 length.

Head: approximately 6-sided in dorsal view; width across genae 226 µm. Median crest well developed, with 19 dorsal head setae on each side; without a group in front of each scape. Midcranial ridge: dorsal ridge poorly defined or absent; ventral ridge well-defined, extending about half-way to ocular sclerite; lateral arms distinct; with a narrow reticulated border, which extends posteriorly and fuses with ocular sclerite; without ventral midcranial ridge setae. Genae large; reticulations indistinct and represented by minute raised spots in which a reticulated pattern can sometimes be discerned; with 13–16 genal setae on each side. Simple eyes: 4 pairs; large dorsal eyes subequal in size with large ventral eyes; both pairs round, dorsal 38–50 µm wide, ventral 43–47 µm wide; each with a closely associated, slightly smaller, lateral simple eye, each 27–40 µm wide. Ocelli distinct. Ocular sclerite sclerotised and polygonally reticulated throughout, each reticulation with a few angular inner microridges. Preocular ridge: dorsal arm short; ventral arm extending more than half way to midcranial ridge. Postocular ridge well developed, dorsally reaching ocelli, where each divides, each arm extending round ocelli. Dorsal ocular setae: 2–5 fs on each side. Ventral head setae: with about 19–28 setae on each side anterior and laterad to ventral simple eyes, and with 13 setae between eyes; with 0–2 fs ventral ocular setae on each side. Tentorial bridge absent. Cranial apophysis bifid, each arm quite broad; length about 60 µm. **Antennae:** 755 µm long (only 1 antenna complete) (ratio of total body length to antennal length 1:0.52). Scape: 50–61 µm long and 46–59 µm wide, with 1 seta on ventral surface and 2 setae on dorsal surface. Pedicel: length 38–45 µm, width 36–58 µm; with weak polygonal reticulations and about 11 or 12 fs + 4–6 hs, present on both dorsal and ventral surfaces. Segments III–IX all about 21–26 µm wide; segment lengths (µm): III: 90–97; IV: 144–176; V: 122–162; VI: 103–158; VII: 77–81; VIII: 63–67 and IX: 54; each fs 52–63 µm long; approximate number of setae per segment: III: 7–10 fs + 2 sensilla basiconica; IV: 16–31 fs; V: 15–28 fs; VI: 16–25 fs; VII: 13–17 fs; VIII: 13–16 fs + 1 bristle; IX: 12 fs + 1 bristle. Segment X: 68 µm long; not constricted apically; with 3 capitate setae, 3 large and 2 small antennal bristles, 7 fs and 2 sensillum basiconica, 1 on apex and 1 more proximally between 2 bristles.

Thorax. Prothorax: pronotal ridge strong, with a broad striated lateral pronotal sclerite; 0 or 1 lateral pronotal seta present on each side. Sternum with a strong transverse ridge but without any sign of apophyses; sclerotised me-

dian ridge absent; sternite broad and triangular, with light radial striations; with 2–5 fs + 0–2 hs prosternal setae on each side. Anteprosternal setae and antemesospiracular setae absent. **Mesothorax.** Prescutum distinctly wider than long (147–176 µm wide and 84–94 µm long); not reticulated; without a sclerotised median ridge. Scutum: median membranous area much wider than long (156–176 µm wide; perhaps 61 µm long); with 12–14 fs scutal setae; lateral margins reticulated laterad to scutellum. Scutellum 164–180 µm wide and 33–49 µm long; with a small foramen. Basisternum large; about 192–238 µm wide and 123–164 µm long; with a strong median ridge, slightly weaker at each end; bounded by strong marginal and precoxal ridges; with 5 fs basisternal setae on posterior end of median ridge; lateropleurite well developed, with a strong extension from marginal ridge along anterior margin; furca well developed, each arm extending to about level with point where marginal ridge and precoxal ridges join. Postalare with weak reticulations at anterior end; with perhaps 2 or 3 postalare setae on each side. Mesothoracic spiracle: peritreme 25–29 µm wide. Postmesospiracular setae: about 23 fs, extending across full width of segment. Tegula: well developed, with 3 or 4 hs tegular setae. **Metathorax:** metapostnotum lightly sclerotised; with 1 hs metatergal seta on each side. Metapleural ridge only present ventrally, well developed; episternum not sclerotised; with 10 or 11 fs postmetaspiracular setae. Metepimeron well developed but without setae. Metathoracic spiracle: width of peritreme 25–32 µm. Antemetaspiracular setae absent; dorsospiracular setae: 0–3 fs. Metasternum: anterior part membranous; posterior part broadly sclerotised across segment; metasternal apophyses (stn₃a) absent. Anterior metasternal setae: about 20–23 fs; posterior metasternal setae: about 19 fs.

Wings: hyaline; rather small; 950 µm long and 475 µm wide (ratio length to width 1:0.6; ratio of total body length to wing length 1:0.55). Hamulohalteres absent.

Legs: prothoracic legs marginally longer than other legs. Coxa lengths (µm): I: 82–111; II: 86–123; III: 90–127; coxa III: each with 26–32 coxal setae; longest apical seta on each coxa about 65 µm long. Trochanter + femur lengths (µm): I: 241–308; II: 197–262; III: 209–271; each trochanter III with about 13–17 setae; long trochanter seta up to 43 µm; each femur III with about 31–43 setae. Tibia lengths (µm): I: 287–357; II: 246–299; III: 258–271; tibia III with about 72–85 setae + spurlike setae; large apical spur 30–34 µm long. Tarsus lengths (µm): I: 115–135; II: 115–148; III: 119–152 (ratio length of tibia III to length of tarsus III 1:0.50); tarsus III with about 30–42 setae + spurlike setae; tarsal spurs each about 31–34 µm long; tarsal digitules slightly shorter than or subequal to length of claw. Claws subequal in length to width of tarsi, slightly curved, denticle absent; length 27–32 µm; claw digitules slightly longer than claw.

Abdomen. Segments I–VII: sternum of all segments with some reticulations + microtrichia; tergites of segments VI and VII present, plus a sternite on segment VII; broad membranous areas between anterior sternites present. Caudal extension of segment VII small and rounded. Dorsal abdominal setae, all fs rather long and flagellate; totals per segment: segments I: 2 or 3 fs; II: 4–5 fs; III: 13 fs; IV: 10–13 fs; V: 7 or 8 fs + 2 or 3 hs; VI: 7–11 fs + 2 hs; VII: 7–12 fs. Pleural setae: dorsal and ventral pleural setae quite abundant but hard to distinguish: dorsopleural setae + ventropleural setae, totals per segment: II: 0–2; III: 1–3; IV: 1 or 2; V: 2–7; VI: 4–7; VII: 15–20. Ventral abdominal setae totals per segment: II: 8–16 fs + 1–2 hs; III: 4–8 fs + 2 hs; IV–VI: 8–11 fs + 4 hs; VII: 10–14 fs + 0 hs. Segment VIII unusually elongate; tergite with 2 groups of ante-anal setae, totalling 14–16 fs; sternite with about 3–5 fs ventral abdominal setae; caudal extension small, with 4 or 5 fs pleural setae. Glandular pouch present; each glandular pouch seta 128–162 μm long. **Genital segment.** Penial sheath quite long, about 1/4 of total body length: 270–328 μm long and 86–93 μm wide at base (ratio of total body length to penial sheath length 1:0.23) Basal rod quite long, more than 0.5 length of aedeagus: 65–70 μm long to base of aedeagus, with an additional thin 41–82 μm extension down centre of aedeagus; not nearly reaching basal membranous area anteriorly. Aedeagus 98–103 μm long (ratio length of aedeagus to length of basal rod 1:0.68); broad basally and rather parallel-sided, apex far from distal end of penial sheath. Penial sheath with 8 or 9 small setae along each margin, most anterior setae approximately level with anterior end of basal rod, and with a cluster of small sensilla present near apex.

Comment. For differences from *C. ornata*, see under that species above.

The specimen off *Kunzea ericoides* is some 25% smaller than that off *Leptospermum scoparium*, but otherwise appears to be similar; the main difference is the absence of a pair of lateral pronotal setae on the specimen off *Leptospermum*.

The *fagi*-group differs from the *ornata*-group as follows (character-states for the *ornata*-group in parentheses):

- (i) fs without long flagellate apices and usually (although not always) easy to separate from hs (fs with obvious flagellate apices but not always easy to separate from hs);
- (ii) postocular ridge not nearly reaching ocelli (reaching ocelli);
- (iii) abdominal segment VIII normal in shape (segment VIII rather elongate, about as wide as long);
- (iv) abdominal pleural setae clearly segmentally arranged (appearing to lie more or less in a line along margin).

CTENOCHITON Maskell

Type species: *Ctenochiton viridis* Maskell, 1879: 211 (designated by Fernald, 1903: 159)

Introduction. The genus *Ctenochiton* now includes 4 species: *C. chelyon* Henderson & Hodgson, *C. paraviridis* Henderson & Hodgson, *C. toru* Henderson & Hodgson, and *C. viridis* Maskell (Hodgson & Henderson 2000). No material was available of adult male *C. toru* but the males of the other 3 species are described below.

Diagnosis based on the adult males of 3 species, *C. chelyon*, *C. paraviridis*, and *C. viridis* (significant character-states in italics) (Fig. 71–73).

General: of moderate size; fleshy setae normal, without extremely flagellate apices; dorsal pores absent. **Head:** with rather few fs; with 4 pairs of simple eyes, lateral eyes smaller than other eyes; genal setae present; *genal reticulations large, without inner microridges or raised spots*; ocular sclerite and genal reticulations similar, although latter much larger; ventral midcranial ridge with a few fs and/or hs; postocular ridge not nearly reaching ocelli; ocelli distinct; each reticulation on ocular sclerite with few or no inner microridges; ventral head setae present throughout ocular sclerite; ventral head setae present or absent between ventral eyes; ventral ocular setae absent; tentorial bridge present; cranial apophysis bifurcated. **Antennae:** short to medium in length, 0.5–0.7 total body length; with 3 hs on scape; segment X not constricted but narrowing towards apex; hs on segments IV–X absent; with 3 capitate setae on segment X. **Prothorax:** lateral pronotal setae present or absent; lateral prothoracic setae absent; median ridge of prosternum absent or poorly developed; several fs prosternal setae present; antemesospiracular setae absent; anteprosternal setae absent. **Mesothorax:** prescutum about 2–3 \times wider than long; prescutum without reticulations; membranous area of scutum about 2–4 \times wider than long; membranous area of scutum with both fs and hs; reticulations anteriorly on scutum present or absent; scutum not reticulated laterad to scutellum; size of foramen on scutellum varied; with fs postmesospiracular setae; median ridge of basisternum well developed; furca fairly short, not nearly reaching anterior border of basisternum; setae laterad to lateropleurite absent; tegular setae absent; mesepisternum without reticulations; anterior end of postalare lightly reticulated; postalare setae absent. **Metathorax:** with many fs anterior metasternal setae; with fewer fs posterior metasternal setae; with fs postmetaspiracular setae; metepimeron with fs; hamulohalteres absent; with 1 pair of hs metatergal setae; dorsospiracular setae present; *setae near mesoprecoxal ridge present*.

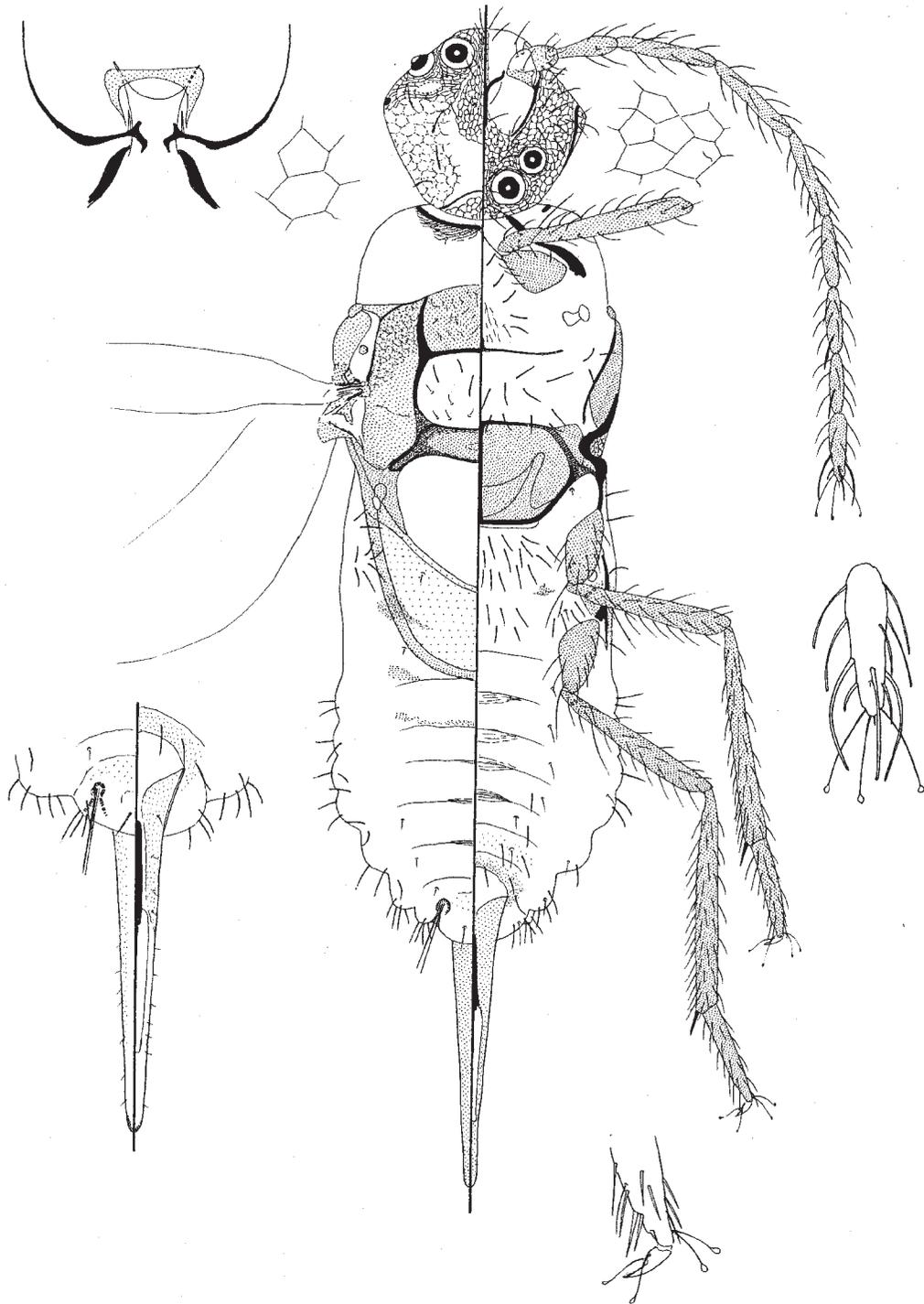


Fig. 71 Adult male, *Ctenochiton chelyon* Henderson & Hodgson.

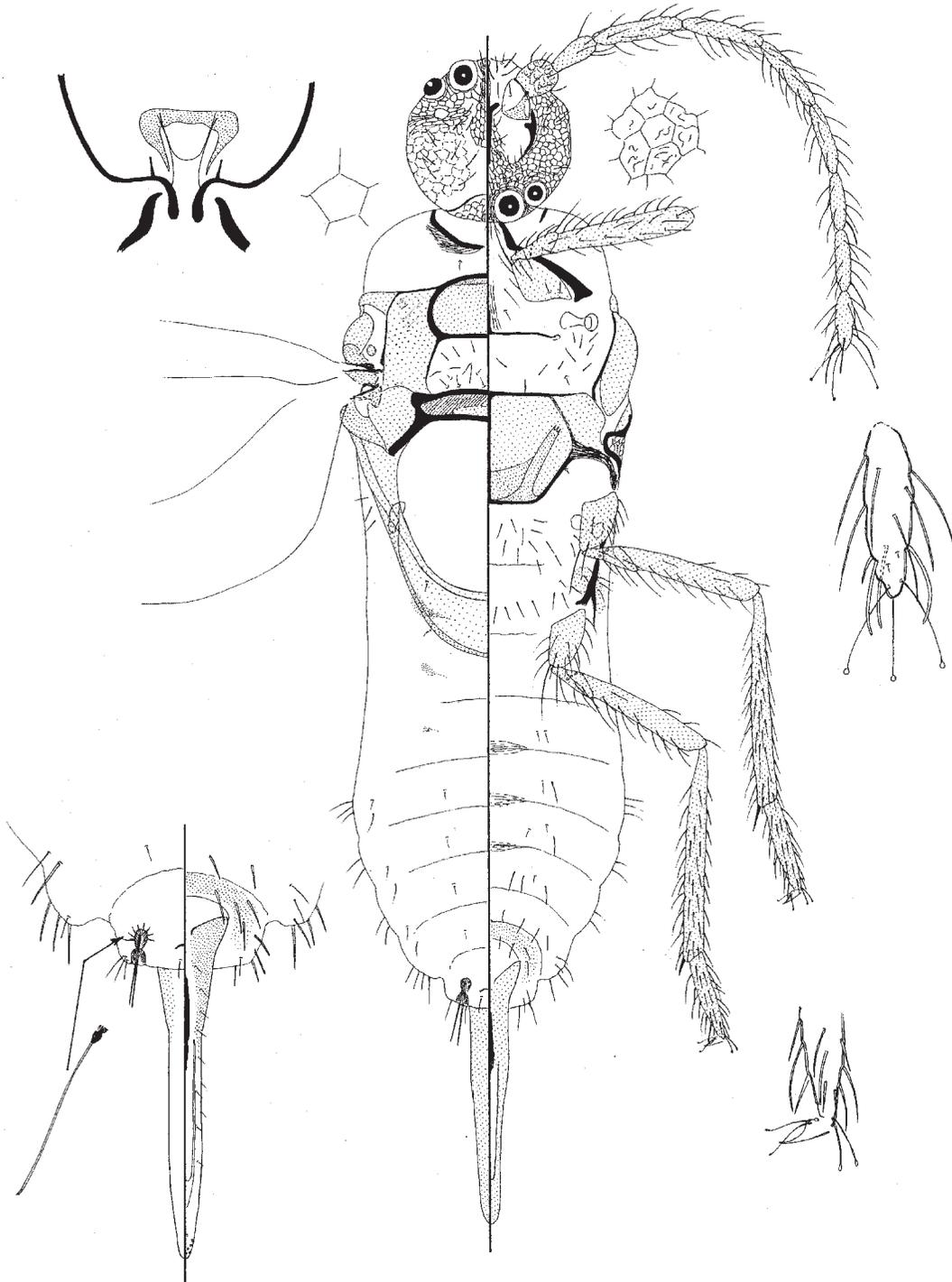


Fig. 72 Adult male, *Ctenochiton paraviridis* Henderson & Hodgson. A glandular pouch tubular duct shown bottom left.

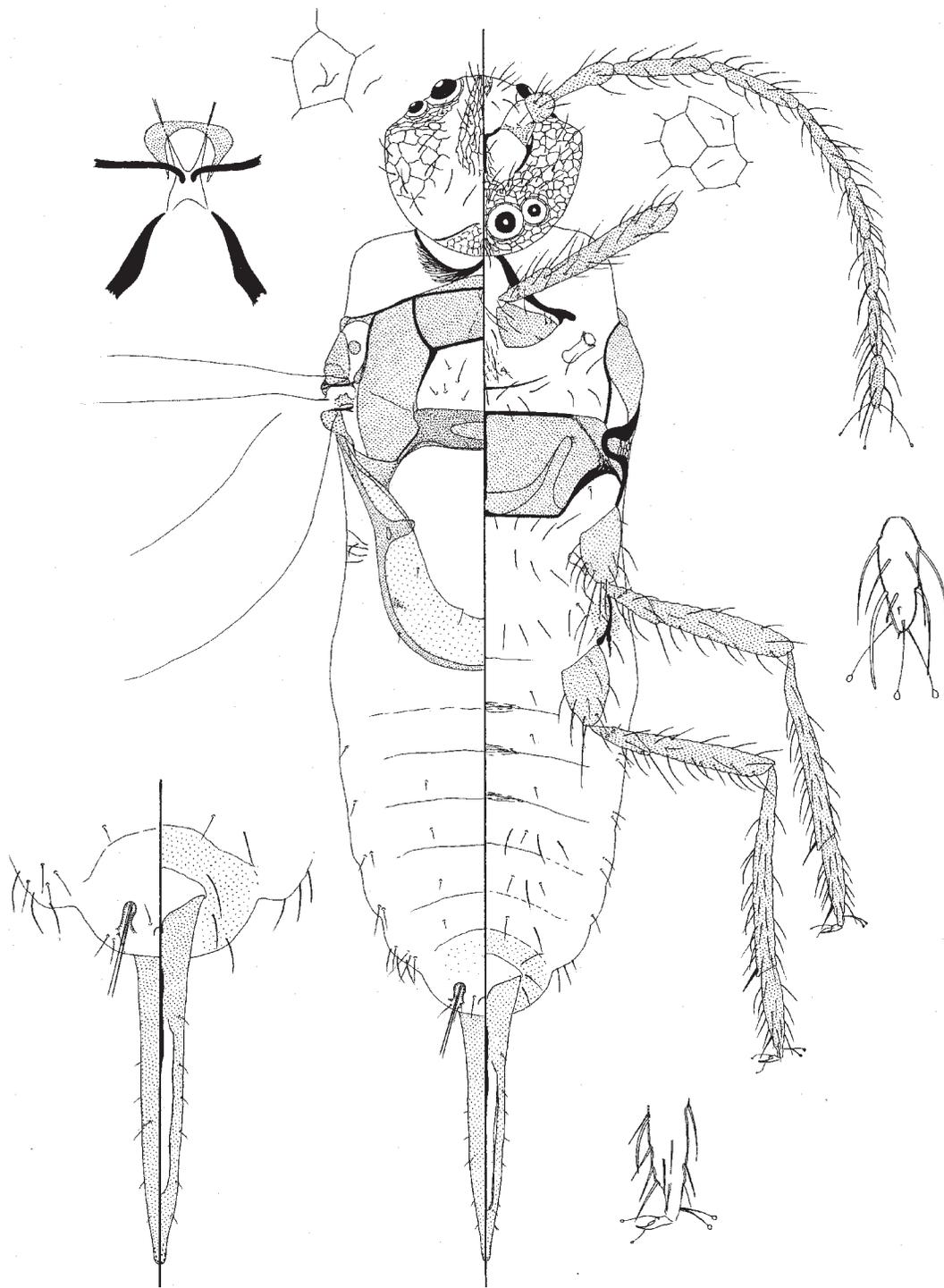


Fig. 73 Adult male, *Ctenochiton viridis* Maskell.

Legs: with 1 tibial spur per tibia; tarsal campaniform pores absent; trochanter–femur segmentation distinct; with more fs than hs on metafemur; tarsus 1-segmented.

Abdomen: segment VIII of normal length; cicatrices absent; sternites and tergites on segments II–VI absent or poorly sclerotised; dorsal abdominal setae few, all hs; ventral abdominal setae few, hs and fs about equally frequent; pleural setae few, segmentally arranged; with 1 pair of hs and sometimes a few fs ante-anal setae; caudal extensions on segments VII and VIII fairly distinct and rounded; glandular pouches present; penial sheath about 1/4–1/5 of total body length; penial sheath gradually narrowing towards apex; basal rod about 1/2 length of aedeagus, not reaching basal membranous area anteriorly; aedeagus short and slightly tapering.

Comment. The larger size of the genal reticulations compared to those on the ocular sclerite coupled with the almost complete absence of microridges within the ocular sclerite reticulations appears to be a significant attribute for identifying *Ctenochiton*; in addition, only *K. depressa* and *U. hymenantherae* share the presence of setae just posterior to the mesoprecoxal ridge.

Ctenochiton chelyon Henderson & Hodgson

Fig. 41, 71

Live appearance: with light yellow-brown body and slightly darker head with black eyes, and pale antennae and legs; a pair of caudal wax filaments present.

Test slightly convex, of translucent glassy plates; a V-shaped fused suture between back-plate suture and anal aperture absent; very similar to other *Ctenochiton* species. On leaves of host plants.

Material examined: see Appendix for collection details of specimens examined.

Described from 10 specimens, with some data checked on a further 18 specimens.

Mounted material: of moderate size and robust, total body length about 1.4–1.78 mm. Antennae slightly over half total body length; body with few fleshy setae, these often not easily differentiated from long hairlike setae; length of fs on antennae more than 2× width of antennal segments. Wings long, almost 9/10 of total body length; width about half wing length. Hamulohalteres absent.

Head: approximately 5- or 6-sided to almost round in dorsal view; length of head about 235–250 µm; width across genae 237–269 µm. Median crest well developed and polygonally reticulated, with 4–7 fs + 2–5 hs dorsal head setae on each side. Midcranial ridge: dorsal ridge absent; ventral ridge well defined and extending about half-way

towards ocular sclerite; with well-defined lateral arms; with a reticulated border, narrow anteriorly but broadening posteriorly and fusing with ocular sclerite; with 2 or 3 hs on each side. Genae large, reticulated throughout, each reticulation much larger than on ocular sclerite and with few or no inner microridges; genal setae: about 5–7 fs + 0 or 1 hs on each side. Simple eyes: 4 pairs: large dorsal eyes slightly smaller than ventral eyes; both round, dse 46–56 µm wide, vse 57–61 µm wide; each with a closely associated, round, slightly smaller, lateral simple eye, 33–43 µm wide. Ocelli distinct. Ocular sclerite sclerotised and polygonally reticulated throughout, each reticulation with few or no inner microridges; these reticulations smaller than those on gena. Preocular ridge: dorsal arm about 1/2 length of ventral arm; ventral arm extending more than 1/2 way to midcranial ridge. Postocular ridge well developed but dorsally not nearly reaching ocelli. Dorsal ocular setae: 0–2 fs on each side. Ventral head setae: with about 16 or 17 fs + 5 or 6 hs each side anterior and laterad to ventral simple eyes, and with 4–6 fs between eyes; ventral ocular setae absent. Tentorial bridge well developed. Cranial apophysis with a shallow distal bifurcation, each arm narrow; 45–58 µm long. **Antennae:** 875–1025 µm long (ratio of total body length to antennal length about 1:0.6). Scape: 49–52 µm long and 41–44 µm wide; with 1 seta on ventral surface and 2 setae on dorsal surface. Pedicel: length 36–48 µm, width 34–42 µm; with weak polygonal reticulations and about 3 or 4 fs + 5 or 6 hs, restricted to ventral surface. Segments III–X all about 19–24 µm wide; lengths (µm): III: 87–103; IV: 126–158; V: 134–156; VI: 111–138; VII: 87–116; VIII: 89–101 and IX: 74–81; fleshy setae about 46–54 µm long; approximate number of setae per segment: III: 3–5 fs + 1–3 hs + 1 sensilla basiconica; IV: 17–19 fs + 0 hs; V: 21 or 22 fs + 0 hs; VI: 20–22 fs + 0 hs; VII: 17–19 fs + 0 hs; VIII: 15–17 fs + 0 hs + 1 bristle; IX: 14–19 fs + 0 hs + 1 bristle. Segment X: length 87–98 µm; slightly constricted apically; with 3 capitate setae, 3 large and 2 small antennal bristles, about 9 or 10 fs; and with 2 sensilla basiconica, one on apex and one more proximally between two bristles.

Thorax. Prothorax: pronotal ridge strong, with a broad reticulated lateral pronotal sclerite and 0 or 1 hs lateral pronotal seta on each side. Sternum with a strong transverse ridge; median ridge poorly developed; sternite broad and triangular, with striations and about 2–5 fs + 1 hs prosternal setae on each side. Anteprosternal setae and antemesospiracular setae absent. **Mesothorax:** prescutum with shallow ridges; wider than long, 173–231 µm wide and 91–95 µm long. Scutum: median membranous area about 3× wider than long: 165–199 µm wide and perhaps 52–103 µm long; scutal setae: 5–7 fs + 7–13 hs; margins laterad to scutellum not reticulated but with faint reticulations on anterior part. Scutellum 157–190 µm wide and 41–50 µm long;

probably tubular with a small foramen. Basisternum about 231–289 μm wide and 128–153 μm long; with a complete, strong median ridge, bounded by rather weak marginal ridges and strong coxal ridges; without basisternal setae; furca well developed, each arm extending anteriorly well past point where marginal ridge and precoxal ridges join; lateropleurite without an extension from marginal ridge anteriorly. Postalare reticulated at anterior end; probably without postalare setae. Mesothoracic spiracle: peritreme 18–25 μm wide. Postmesospiracular setae: about 27 fs + 0 or 1 hs extending across full width of segment. Tegula: well developed but without tegular setae. **Metathorax:** metapostnotum present; with 0 or 1 fs + 1 hs metatergal seta on each side. Metapleural ridge only present ventrally, well developed; episternum present as a slightly sclerotised plate, with 4 or 5 fs + 1 hs postmetaspiracular setae. Metepimeron with 1–5 fs. Metathoracic spiracle: width of peritreme 18–20 μm . Antemetaspiracular setae: probably about 3 on each side; dorsospiracular setae: about 2–7 fs. With single hs near precoxal ridge on each side. Metasternum membranous apart from 2 small areas of sclerotisation mediolaterally. Anterior metasternal setae: about 17 fs; posterior metasternal setae: about 7 fs.

Wings: hyaline; relatively long (1512–1647 μm long and 810 μm wide) (ratio length to breadth 1:0.5; ratio of total body length to wing length 1:0.99). Hamulohalteres absent.

Legs: prothoracic legs marginally longer than other legs. Coxa lengths (μm): I: 82–95; II: 91–107; III: 98–116; each coxa III with 10 fs + 3 hs; longest apical seta on each coxa rather short, about 43 μm long. Trochanter + femur lengths (μm): I: 248–302; II: 231–267; III: 223–275; each trochanter III with about 15 fs + 3 hs; long trochanter seta up to 43 μm ; each femur III with about 13 fs + 13 hs. Tibia lengths (μm): I: 303–360; II: 277–337; III: 278–341; each tibia III with about 19 fs + 4 hs + about 23 spurlike setae, latter most common on distal third of leg; large apical spur 29–38 μm long. Tarsus lengths (μm): I, II and III: each 120–145 (ratio length of tibia III to length of tarsus III 1:0.43); each tarsus III with about 9 fs + about 21 spurlike setae; tarsal spurs not differentiated, each perhaps 25 μm long; tarsal digitules subequal in length to or rather shorter than claw. Claws subequal in length to width of tarsi, slightly curved, denticle very small or absent; length 19–23 μm ; claw digitules rather longer than claw.

Abdomen: segments I–VII: tergum and sternum of all segments with some reticulations + microtrichia; tergites only present on segments I and II and a sternite on segment VII; with a broad membranous area between anterior 5 sternites. Caudal extension of segment VII small, rounded and unsclerotised. Dorsal abdominal setae few, mainly hs, with on each side: I: 1 hs; II–III: absent; VI–VII: 0 or 1 fs + 0

1 hs; pleural setae: dorsal and ventral pleural setae sometimes hard to distinguish; dorsopleural setae: I–II: 0; III–VI: 1–3 fs + 0 or 1 hs on each side; ventropleural setae: I–III: 0; IV–VI: 1–3 fs + 0–2 hs; VII (dorsopleural + ventropleural setae): 1–6 fs + 0–3 hs on each side. Ventral abdominal setae, across each sternite: II–III: 0 fs + 0–2 hs; IV–VI: 0–2 fs + 0 or 1 hs; VII: 2–5 fs + 0 or 1 hs. Segment VIII: tergum unsclerotised or barely sclerotised, with 0–5 fs + 0–4 hs ante-anal setae; sternite with about 3–6 fs ventral abdominal setae on each side; caudal extensions small, each with 2 or 3 fs + 1–4 hs pleural setae. Glandular pouch deep; glandular pouch setae 112–127 μm long. **Genital segment:** penial sheath quite long; 372–409 μm long; 84–95 μm wide at base (ratio of total body length to penial sheath length 1:0.25). Basal rod: length rather variable, 83–100 μm to base of aedeagus (about 1/2 to 2/3 length of aedeagus), with a thin extension 45–108 μm long down centre of aedeagus; basal rod reaching to within 13–42 μm of basal membranous area anteriorly. Aedeagus broad basally and slightly tapering, apex far from distal end of penial sheath; 159–210 μm long (ratio length of aedeagus to length of basal rod 1:0.49). Penial sheath with 8–11 small setae along each margin, extending anteriorly past basal rod, and with a cluster of small sensilla present near apex.

Comment. For a discussion of the differences of the three *Ctenochiton* species discussed here, see under *C. viridis*.

Ctenochiton paraviridis Henderson & Hodgson

Fig. 11, 12, 38–40, 72

Live appearance: with light yellow-brown body and slightly darker head with black eyes, and pale antennae and legs; a pair of caudal wax filaments present.

Test slightly convex, of translucent glassy plates; a V-shaped, fused suture absent between back-plate suture and anal aperture; very similar to other *Ctenochiton* species. On leaves of host plants.

Material examined: see Appendix for collection details of specimens examined.

Described from about 9 specimens in good condition but some details checked on a further 7 specimens.

Mounted material: of moderate size and robust; total body length about 1.42–1.63 mm; with antennae about 2/3 of total body length; fleshy setae on body generally easy to differentiate from hairlike setae; length of fs on antennae more than twice width of antennal segments. Wings quite long, about 9/10 of total body length; width just under half wing length. Hamulohalteres absent.

Head: approximately round in dorsal view; length of head about 220–240 μm ; width across genae 207–236 μm . Median crest well developed and polygonally reticulated, with

about 8 fs + 4 hs dorsal head setae on each side. Midcranial ridge: dorsal ridge absent; ventral ridge long and well defined, extending to ocular sclerite; with well-defined lateral arms; with a reticulated border, narrow anteriorly but broadening posteriorly and fusing with ocular sclerite; each area laterad to midcranial ridge with 2–4 fs. Genae large and polygonally reticulated throughout, each reticulation much larger than those on ocular sclerite, with few or no inner microridges; genal setae: with about 7–9 fs + 0 or 1 hs on each side. Simple eyes: four pairs: large dorsal eyes slightly smaller than large ventral eyes: both pairs round; dorsal pair: 36–39 μm wide; ventral pair 41–46 μm ; each with a closely associated, slightly smaller, lateral simple eye 25–30 μm wide. Ocelli distinct. Ocular sclerite sclerotised and polygonally reticulated throughout, each reticulation usually with several inner microridges, these reticulations noticeably smaller than those on gena. Preocular ridge: dorsal arm as long or longer than ventral arm; ventral arm long, reaching 2/3 of way to midcranial ridge. Postocular ridge well developed but dorsally not nearly reaching ocelli. Dorsal ocular setae: with 0–3 hs + 0 or 1 fs on each side. Ventral head setae: with about 10–14 fs + about 3–8 hs on each side anterior and laterad to ventral simple eyes, and with 5–7 fs between ventral eyes; ventral ocular setae absent. Tentorial bridge well developed. Cranial apophysis with a deeply cleft distal end, each arm very narrow; length 45–54 μm . **Antennae:** 1000–1025 μm long (ratio of total body length to antennal length about 1:0.66). Scape: 41–44 μm long and 36–43 μm wide; with 1 seta on ventral surface and 2 setae on dorsal surface. Pedicel: length 36–48 μm , width 36–40 μm ; with weak polygonal reticulations and 2–4 fs + 3 or 4 hs, restricted to ventral surface. Segments III–X all about 17–24 μm wide; lengths (μm): III: 63–78; IV: 107–145; V: 107–130; VI: 106–121; VII: 87–97; VIII: 74–85 and IX: 63–80; fleshy setae about 41–45 μm long; approximate number of setae per segment: III: 4–6 fs + 0 or 1 hs + 0–2 sensilla basiconica; IV: 10–14 fs + 0 hs; V: 18–24 fs + 0 hs; VI: 19–21 fs + 0 hs; VII: 17–20 fs + 0 hs; VIII: 13–16 fs + 0 hs + 1 bristle and IX: 11–19 fs + 0 hs + 1 bristle (all segments on one antenna on one specimen with some very short fs). Segment X: length 75–100 μm ; perhaps slightly constricted apically; with 3 capitate setae, 3 large and 2 small antennal bristles plus about 15 fs; also with 2 sensilla basiconica, one on apex and one more proximally between two bristles.

Thorax. Prothorax: pronotal ridge strong, with a broad reticulated lateral pronotal sclerite; with 1 pair of hs lateral pronotal setae. Sternum: with a strong transverse ridge; median ridge present but only weakly sclerotised; sternite broad and triangular, with striations and with 0–4 fs + 0 or 1 hs prosternal setae. Anteprosternal setae and antemesospiracular setae absent. **Mesothorax:** prescutum about 2 \times as wide as long: 254–279 μm wide and 114–171

μm long; not reticulated. Scutum: median membranous area about 4 \times wider than long: 260–285 μm wide and perhaps 63–70 μm long; scutal setae: about 5–7 fs + 12–18 hs; lateral margins but not reticulated. Scutellum 241–248 μm wide and 50–70 μm long; probably tubular, with a medium-sized foramen. Basisternum large, about 387 μm wide and 196–241 μm long; with a complete, strong median ridge, bounded by weak marginal and strong precoxal ridges; without basisternal setae; furca very broad basally, each arm extending anteriorly well past point where marginal ridge and precoxal ridges join; lateropleurite with a lightly sclerotised extension from marginal ridge anteriorly. Postalar reticulated at anterior end; postalar setae: 0 or 1 (generally 0). Mesothoracic spiracle: peritreme 23–27 μm wide. Postmesospiracular setae: about 19 fs + 25 hs extending across full width of segment. Tegula: well developed but without tegular setae (a single seta found on one specimen). **Metathorax:** metapostnotum small; metatergal setae: 0 or 1 fs + 0–2 hs on each side. Metapleural ridge only present ventrally, well developed; episternum slightly sclerotised, with 7–13 fs + 0 or 1 hs postmetaspiracular setae. Metepimeron well developed, with 0–3 fs + 0–2 hs. Metathoracic spiracle: width of peritreme 23–27 μm . Antemesospiracular setae: about 2 fs on each side; dorsospiracular setae: about 1–3 fs + 0–1 hs on each side. Metasternum membranous. With 0–2 fs (generally 0) and 0–2 hs (generally 1) on either side just posterior to each basisternal precoxal ridge. Anterior metasternal setae: about 15–24 fs; posterior metasternal setae: 6–9 fs + 0 or 1 hs.

Wings: hyaline; comparatively long; 1350–1450 μm long and 650–700 μm wide (ratio length to breadth 1:0.48; ratio of total body length to wing length 1:0.92). Hamulohalteres absent.

Legs: subequal in length; fairly setose. Coxa lengths (μm): I: 77–99; II: 86–103; III: 95–108; coxa III with about 11–14 fs + 3–5 hs; longest apical seta on each coxa about 58–108 μm long. Trochanter + femur lengths (μm): I: 235–275; II: 227–252; III: 227–248; trochanter III with about 8–10 fs + 1 or 2 hs; femur III with about 17–25 fs + 7–10 hs; long trochanter seta about 41–75 μm long. Tibia lengths (μm): I: 277–294; II: 248–302; III: 269–299; tibia III with about 28–36 fs, 3–5 hs + about 16–30 spurlike setae, latter mainly on distal third of leg; large apical spur 23–27 μm long. Tarsus lengths (μm): I: 103–129; II: 112–132; III: 110–131 (ratio length of tibia III to length of tarsus III 1:0.42); tarsus III with about 10–15 fs + 0 hs + about 16–23 spurlike setae; tarsal spurs each about 21–25 μm long, often hard to differentiate; tarsal digitules subequal in length to or slightly shorter than claw. Claws III: 21–25 μm ; subequal in length to width of tarsi; slightly curved, denticle very small or absent; claw digitules slightly longer than claw.

Abdomen: segments I–VII: tergum and sternum of all segments with some reticulations + microtrichia; tergites only present on segments I and II, and a sternite on segment VII; with a broad membranous area between sternites III–V. Caudal extension of segment VII small and rounded. Dorsal abdominal setae: totals per segment: I–IV: 0 or 1 fs + 0 or 1 hs; V–VII: 0–2 fs + 2 hs; pleural setae per side: dorsopleural setae: I–III: 0 or 1 fs + 0 or 1 hs; IV–VI: 0–2 fs + 1–3 hs on each side; ventropleural setae: I–III: 0; IV–VI: 0–2 fs + 1 or 2 hs; VII (dorsopleural + ventropleural setae): 3–6 fs + 1 or 2 hs on each side. Ventral abdominal setae: totals per segment: II–III: 0–2 fs + 0–2 hs; IV–VI: 0–8 fs + 0–4 hs; VII: 4 fs + 0 hs. Segment VIII: tergum unsclerotised, with 0–4 fs (generally 0) + 2 or 3 long hs anteanal setae; sternite with 3–8 fs + 0 or 1 hs ventral abdominal setae; caudal extension small, each with 1–3 fs + 3 hs pleural setae. Glandular pouch deep; glandular setae each 79–111 μm long. **Genital segment:** penial sheath quite long: length 364–381 μm , 78–89 μm wide at base, about 1/4 of total body length (ratio of total body length to penial sheath length 1:0.24). Basal rod: length 61–86 μm anterior to base of aedeagus (a little less than half length of aedeagus), extending a further 28–57 μm posteriorly within aedeagus; basal rod reaching to within 40–58 μm of basal membranous area anteriorly. Aedeagus quite long, 162–172 μm long (ratio length of aedeagus to length of basal rod 1:0.44), rather parallel-sided, apex far from distal end of penial sheath. Penial sheath with 9–11 small setae along each margin, extending anteriorly past basal rod, and with a cluster of small sensilla present near apex.

Comment. For a discussion of the differences of the species with *Ctenochiton*, see under *C. viridis*.

Ctenochiton viridis Maskell

Fig. 73

Live appearance: with light yellow-brown body and slightly darker head with black eyes, and pale antennae and legs; a pair of caudal wax filaments present.

Test slightly convex, of translucent glassy plates; a V-shaped fused suture absent between back-plate suture and anal aperture; very similar to other *Ctenochiton* species. On leaves of host plants.

Material examined: see Appendix for collection details of specimens examined.

Described from 1 specimen in good condition.

Mounted material: of moderate size and robust, total body length about 1.35 mm; antennae slightly over 1/2 total body length; body with few fleshy setae, fs usually fairly easily differentiated from long hs setae; length of fs on antennae more than twice width of antennal segments.

Wings quite long, about 9/10 of total body length; width about half wing length. Hamulohalteres absent.

Head: approximately round in dorsal view; length of head about 210 μm ; width across genae 225 μm . Median crest well developed and polygonally reticulated, with 3–6 fs + 4 or 5 hs dorsal head setae on each side. Midcranial ridge: dorsal ridge absent; ventral ridge well defined ventrally and extending about half-way towards ocular sclerite; with well-developed lateral arms; with a reticulated border, narrow anteriorly but broadening posteriorly and fusing with ocular sclerite; area laterad to midcranial ridge with 1 or 2 fs + 0 or 1 hs ventral midcranial ridge setae on each side. Genae large and polygonally reticulated throughout, most reticulations much larger than those of ocular sclerite, with few or no inner microridges: genal setae: about 8 or 9 fs + 0 hs on each side. Simple eyes: four pairs; large dorsal eyes subequal in width to ventral eyes: both pairs round; width of dse: 40–45 μm , vse: 41 μm ; each with a closely associated, slightly smaller, lateral simple eye 28–31 μm wide. Ocelli distinct. Ocular sclerite sclerotised and polygonally reticulated throughout, each reticulation distinctly smaller than those on gena and each with 0 or 1 inner microridges. Dorsal ocular setae: 0 or 1 hs on each side. Preocular ridge: dorsal arm subequal in length to ventral ridge; ventral arm extending about half way to midcranial ridge. Postocular ridge well developed but not nearly reaching ocelli dorsally. Ventral head setae: with about 8 fs + 6–8 hs on each side anterior and laterad to ventral simple eyes, and with 4 fs between eyes; ventral ocular setae absent. Tentorial bridge well developed. Cranial apophysis with a deep distal bifurcation and narrow arms; 33 μm long. **Antennae:** 711 μm long (ratio of total body length to antennal length 1:0.53). Scape: 34–36 μm long and 38 μm wide; with 1 hs seta on ventral surface and 2 hs setae on dorsal surface. Pedicel: 33 μm long and 40 μm wide, with weak reticulations and about 1 or 2 fs + 5 hs, restricted to ventral surface. Segments III–IX all about 18–22 μm wide; length (μm): III: 78–81; IV: 111–114; V: 107–112; VI: 101–107; VII: 69–75; VIII: 66–68 and IX: 68; each fs about 41–47 μm long; approximate number of setae per segment: III: 5 or 6 fs + 1 hs + 1 sensilla basiconica; IV: 12–17 fs + 0 hs; V: 19–21 fs + 0 hs; VI: 20 or 21 fs + 0 hs; VII: 14–16 fs + 0 hs; VIII: 11 or 12 fs + 0 hs + 1 bristle; IX: 13–15 fs + 0 hs + 1 bristle. Segment X: length 59–63 μm ; perhaps slightly constricted apically; with 3 capitate setae, 3 large plus 2 small antennal bristles, about 6 or 7 fs and 2 sensilla basiconica, one on apex and one more proximally between two bristles.

Thorax. Prothorax: pronotal ridge strong, with a broad reticulated lateral pronotal sclerite; lateral pronotal setae absent. Sternum with a strong transverse ridge; median ridge poorly developed; sternite broad and triangular, with striations and about 2 or 3 fs + 1 hs prosternal setae on

each side. Anteprosternal setae and antemesospiracular setae absent. **Mesothorax:** prescutum not reticulated, about twice as wide as long: 161 μm wide and 78 μm long. Scutum: median membranous area about 2 \times wider than long: 153 μm wide and perhaps 83 μm long; scutal setae: 0 fs + 9 hs; lateral margins not reticulated. Scutellum 141 μm wide and 41 μm long; probably with a moderate-sized foramen. Basisternum about 228 μm wide and 120 μm long; median ridge strong anteriorly but weak posteriorly, bounded by moderately weak marginal ridges and strong precoxal ridges; without basisternal setae; lateropleurite without an extension from marginal ridge anteriorly; furca with lateral arms extending anteriorly well past point where marginal ridge and precoxal ridges fuse. Postalare reticulated at anterior end; postalare setae absent. Mesothoracic spiracle: peritreme 16–18 μm wide. Postmesospiracular setae: 16 fs + 0 hs, extending across full width of segment. Tegula: well developed but without tegular setae. **Metathorax:** metapostnotum small; with 1 hs metatergal seta on each side. Metapleural ridge only present ventrally, well developed; episternum slightly sclerotised, with 3 or 4 fs + 0 or 1 hs postmetaspiracular setae. Metepimeron well developed, each with 1 fs. Metathoracic spiracle: width of peritreme 19–20 μm . Antemetaspiracular setae absent; dorsospiracular setae: with 4–6 fs on each side. With a single hs just posterior to each basisternal precoxal ridge. Metasternum membranous. Anterior metasternal setae: 18 fs; posterior metasternal setae: 6 fs.

Wings: hyaline; 1175 μm long and 613 μm wide (ratio length to width 1:0.52; ratio of total body length to wing length 1:0.87). Hamulohalteres absent.

Legs: subequal in length or prothoracic legs marginally longer than other legs. Coxa lengths (μm): I: 77–82; II: 82–87; III: 82–91; coxa III with 8–17 fs + 2–5 hs; longest apical setae on each coxa rather short, about 54–56 μm long. Trochanter + femur lengths (μm): I: 231–236; II: 211–214; III: 209–220; each trochanter III with about 5 or 6 fs + 3 or 4 hs; long trochanter seta up to 41–58 μm ; each femur III with about 11–17 fs + 8 hs. Tibia lengths (μm): I: 240–254; II: 231–240; III: 240–245; each tibia III with about 38–47 setae, mainly spurlike on distal 1/3 of leg; each large apical spur 21–30 μm long. Tarsus lengths (μm): I, II, and III each 97–104 (ratio length of tibia III to length of tarsus III 1:0.41); each tarsus III with about 27 or 28 setae, mainly spurlike; tarsal spurs hard to separate from other spurlike setae, each perhaps 28–31 μm long; tarsal digitules subequal in length or slightly shorter than claw. Claws: subequal in length to width of tarsi, slightly curved, denticle very small or absent; claw digitules rather longer than claw; length 18–22 μm .

Abdomen: segments I–VII: tergum and sternum of all segments with some reticulations + microtrichia; tergites absent; sternites only present on segment VII; membranous

areas between sternites II–IV unclear. Caudal extension of segment VII small and rounded. Dorsal abdominal setae on each side: segment I: 1 hs; II–III: absent; IV–VII: 0 fs + 1 hs; dorsopleural setae on each side: I–II: 0; III–IV: 1 hs; V–VI: 2 hs; ventropleural setae on each side: I–III: 0; IV–VI: 1 or 2 hs; VII (dorsopleural + ventropleural setae): 3 fs + 4 hs. Ventral abdominal setae on each side, segment: II–IV: 1 hs; V–VII: 1–3 fs + 1 or 2 hs. Segment VIII: tergum probably unsclerotised, with 1 pair of hs ante-anal setae; sternite with about 3 fs ventral abdominal setae on each side; caudal extension small, with 3 hs pleural setae. Glandular pouch deep; glandular pouch setae: longest 90 μm long. **Genital segment.** Penial sheath quite long; 327 μm long and 83 μm wide at base (ratio of total body length to penial sheath length 1:0.21). Basal rod length 66 μm to base of aedeagus, with a thin 47 μm long extension down centre of aedeagus; clearly separated from basal membranous area anteriorly (about 33 μm from basal membranous area). Aedeagus approximately parallel-sided, 143 μm long (ratio length of aedeagus to length of basal rod 1:0.46), apex far from distal end of penial sheath. Penial sheath with 9 or 10 small setae along each margin and with a cluster of small sensilla near apex.

Comment. The males of the 3 *Ctenochiton* species described here are all very similar and the taxonomic importance of the differences is difficult to assess from the relatively small amount of material available. The single male of *C. viridis* appears to differ from those of *C. chelyon* and *C. paraviridis* in having

- (i) almost no inner microridges in reticulations on the ocular sclerite;
- (ii) a much deeper bifurcation on the cranial apophysis.

The most obvious character for separating *C. paraviridis* from *C. chelyon* is the presence of rather more inner microridges within each ocular sclerite reticulation on the former species. Until the value of these characters is better understood, they cannot be confidently recommended for separating these species.

EPELIDochITON Henderson & Hodgson

Epelidochiton Henderson & Hodgson: Hodgson & Henderson, 2000: 111

Type species: *Ctenochiton piperis* Maskell

Introduction. The genus *Epelidochiton* was proposed for the rather distinctive adult female of *Ctenochiton piperis* Maskell (Hodgson & Henderson 2000). This is the sole species currently placed in this genus. The adult male is not as distinctive.

Diagnosis based on the adult male of *E. piperis* only (significant character-states in italics) (Fig. 74).

General: fleshy setae normal, without extremely flagel-

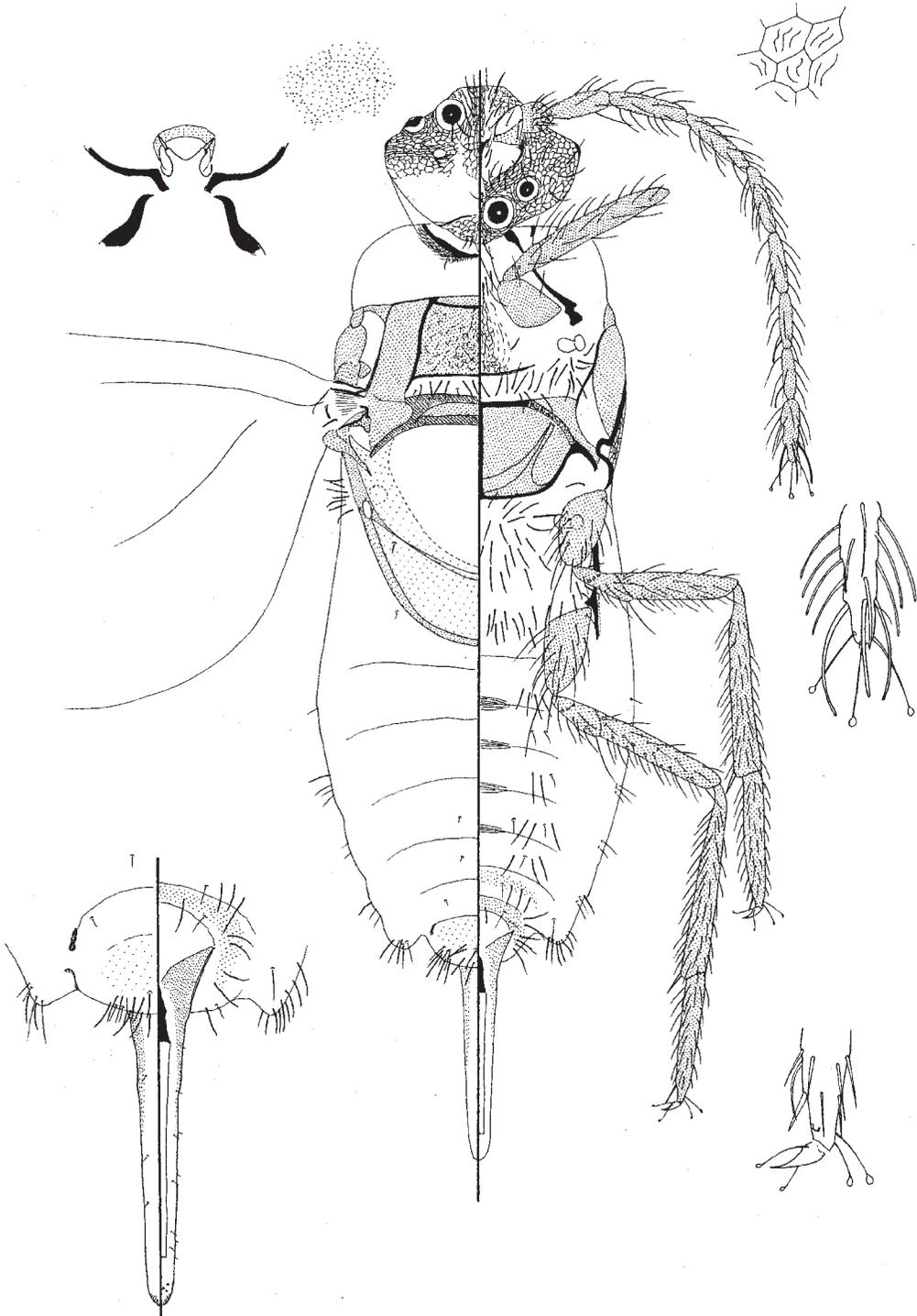


Fig. 74 Adult male, *Epelidochiton piperis* (Maskell).

late apices; dorsal pores absent. **Head:** fs fairly abundant; with 4 pairs of simple eyes, lateral eyes smaller than other eyes; *genal setae absent; genal reticulations present along anterior border but absent posteriorly, where represented by small raised spots anteriorly*; ocular sclerite and genal reticulations very dissimilar; ventral midcranial ridge with both fs and hs; postocular ridge not nearly reaching ocelli; ocelli distinct; each reticulation on ocular sclerite with a few inner microridges; ventral head setae present laterally on ocular sclerite; ventral head setae present between ventral eyes; ventral ocular setae absent; tentorial bridge present; cranial apophysis short and bifurcated. **Antennae:** short, 0.5–0.6 of total body length; with 3 hs on scape; segment X constricted near apex; hs on segments IV–X absent; with 3 capitate setae on segment X. **Prothorax:** lateral pronotal setae present; lateral prothoracic setae absent; median ridge of prosternum absent; with 1 pair of fs prosternal setae; antemesospiracular setae absent; *with fs anteprosternal setae present*. **Mesothorax:** prescutum about 2× wider than long; prescutum with some faint reticulations; *membranous area of scutum very narrow, 6–7× wider than long*; membranous area of scutum with both fs and hs; scutum without reticulations anteriorly; scutum not reticulated laterad to scutellum; foramen on scutellum large; with fs postmesospiracular setae; median ridge of basisternum well developed; furca fairly short, not nearly reaching anterior border of basisternum; setae laterad to lateropleurite absent; tegular setae absent; mesepisternum without reticulations; anterior end of postalare lightly reticulated; postalare setae absent. **Metathorax:** with numerous fs anterior metasternal setae; with fewer fs posterior metasternal setae; with fs postmetaspiracular setae; metepimeron without setae; hamulohalteres absent; with 1 pair of hs metatergal setae; dorsospiracular setae present; setae near mesoprecoxal ridge absent. **Legs:** with 1 tibial spur per tibia; tarsal campaniform pores absent; trochanter-femur segmentation distinct; fs about as frequent as hs on metafemur; tarsus 1-segmented. **Abdomen:** segment VIII normal, wider than long; cicatrices absent; sternites and tergites on segments II–VI absent or poorly sclerotised; dorsal abdominal setae few, all hs; ventral abdominal setae few, hs and fs about equally frequent; pleural setae few, segmentally arranged; with many fs and hs ante-anal setae; caudal extensions on segments VII and VIII distinct and rounded; glandular pouches absent; penial sheath about 1/5 of total body length; penial sheath gradually narrowing to a very blunt apex; basal rod short, just or almost reaching basal membranous area anteriorly; aedeagus quite long (about 2/3 length of penial sheath), with almost parallel margins.

Comment. *E. piperis* appears to be closely similar to species in *Aphenochiton*, particularly in the absence (except *A.*

puberis) of genal setae. The male of *E. piperis* is also similar to males of species in genera *Ctenochiton*, *Plumichiton*, and *Umbonichiton* but the almost complete absence of reticulations on most of the gena appears to separate this species from all the latter.

Epelidochiton piperis (Maskell)

Fig. 9, 10, 32, 74

Live appearance: pale to light brown, head medium to dark brown with dark reddish-brown eyes; thoracic bands dark brown; caudal wax filaments absent.

Test moderately convex, rounded, of translucent to opaque glassy fused wax plates, each plate rather convex, except marginal row plates which have a chevron pattern and end in triangular points. On leaves of host plants.

Material examined: see Appendix for collection details of specimens examined.

Described from 3 specimens from a single collection site, in fair to good condition.

Mounted material: of medium size, robust; total body length about 1.32–1.38 mm; with fairly long antennae; body not particularly hirsute, but fleshy setae fairly frequent ventrally, these generally easy to differentiate from hairlike setae; length of fs on antennae about 2× width of antennal segments. Wings quite long, about 9/10 of total body length; width rather more than half wing length. Hamulohalteres absent.

Head: approximately 4- or 5-sided to round in dorsal view but probably with a distinct posteroventral bulge in side view; length of head about 180–200 μm; width across genae 216–261 μm. Median crest reticulated, with a total of about 17 or 18 fs + 4–11 hs dorsal head setae. Midcranial ridge: dorsal ridge absent; lateral arms well defined; ventral ridge quite long and narrow, extending to ocular sclerite, with a narrow reticulated border which extends posteriorly and fuses with ocular sclerite; with 3 fs + 3 hs. Genae large and polygonally reticulated along anterior margin only, each reticulation narrow and broken; reticulations on posterior half of gena very indistinct with faint raised spots; genal setae absent. Simple eyes: 4 pairs; large dorsal eyes and ventral eyes subequal in size, both pairs round, each 45–49 μm wide; each with a closely associated, slightly smaller, round, lateral simple eye, each 36–40 μm wide. Ocelli present. Ocular sclerite polygonally reticulated, each reticulation with several more or less parallel inner microridges. Preocular ridge: dorsal arms subequal in length to ventral arms; ventral arm quite long, extending about 1/2–2/3 towards midcranial ridge. Postocular ridge well developed but not nearly reaching ocelli dorsally. Dorsal ocular setae: 0–2 fs on each side. Ventral head setae: with

about 13–15 fs + about 3 hs on each side anterior and laterad to ventral simple eyes, and with 1 fs between ventral eyes; ventral ocular setae absent. Tentorial bridge well developed. Cranial apophysis 23–31 μm long, with a shallow distal bifurcation, each arm with a short spine-like extension. **Antennae:** 0.81–0.85 mm long (ratio of body length to antennal length 1:0.56). Scape: 55–56 μm long and 37–40 μm wide, with one hs seta on ventral surface and 2 hs setae on dorsal surface. Pedicel: length 41–49 μm , width 36–43 μm ; with weak polygonal reticulations and 5 or 6 fs + 6 or 7 hs, restricted to ventral surface. Segments III–X all about 19–27 μm wide; lengths of segments (μm): III: 72–83; IV: 108–126; V: 109–117; VI: 97–112; VII: 88–92; VIII: 77–87 and IX: 68–69; fs about 45–47 μm long; approximate number of setae per segment: III: 2–7 fs + 1 hs + 1 sensilla basiconica; IV: 13–19 fs + 0 hs; V: 21–26 fs + 0 hs; VI: 21–30 fs + 0 hs; VII: 24–26 fs + 0 hs; VIII: 18–20 fs + 0 hs + 1 bristle; IX: 18 fs + 0 hs + 1 bristle. Segment X slightly constricted apically; length 93–101 μm ; with 3 (rather short) capitate setae, 3 large antennal bristles plus 2 shorter and finer setae similar to fs, and about 17 fs; with 2 sensilla basiconica, one apically and one slightly more proximally.

Thorax. Prothorax: pronotal ridge strong, with a broad reticulated lateral pronotal sclerite and with a pair of hs lateral pronotal setae. Sternum with a strong transverse ridge, with no obvious lateral apophyses; median ridge absent; sternite broad and triangular, with faint reticulations; prosternal setae: 1 fs on each side. Anteprosternal setae: about 1–3 fs on each side just anterior to each procoxa. Antemesospiracular setae absent.

Mesothorax: prescutum nearly 2 \times as wide as long (168–185 μm wide and 94–103 μm long); with faint reticulations throughout. Scutum: median membranous area narrow (200–205 μm wide; 33 μm long); scutal setae: number uncertain, perhaps 9–14 fs + 2 hs; lateral margins not reticulated. Scutellum 209 μm wide and 41–43 μm long; tubular with a large foramen. Basisternum about 266 μm wide and 123–127 μm long; with a complete, strong median ridge, bounded by fairly strong marginal and precoxal ridges; without basisternal setae; lateropleurite without an extension from marginal ridge anteriorly; furca with each arm extending anteriorly well past point where marginal ridge and precoxal ridges meet. Postalare polygonally reticulated at anterior end; without postalare setae. Mesothoracic spiracle: peritreme 22 μm wide. Postmesospiracular setae: about 31 fs, extending across full width of segment. Tegula: well developed but without tegular setae. **Metathorax:** metapostnotum not sclerotised; with 1 hs metatergal seta on each side. Metapleural ridge short, only present ventrally near metacoxae; episternum sclerotised, with 3–5 fs postmetaspiracular setae. Metepimeron slightly sclerotised but without setae. Metathoracic spiracle: width of peritreme 21–29 μm . Antemetaspiracular setae /

dorsospiracular setae: probably 5–10 fs. Metasternum membranous. Anterior metasternal setae: about 34 fs (occasionally with 1 fs anterior to mesocoxae); posterior metasternal setae: about 19–28 fs.

Wings: hyaline, of moderate length (1161–1215 μm) and width (648–689 μm) (ratio length to width 1:0.56; ratio of total body length to wing length 1:88). Hamulohalteres absent.

Legs: subequal in length. Coxa lengths (μm): I: 94–100; II: 105–116; III: 110–121; coxal III setae: about 23 fs + 8 hs; long apical seta on each coxa about 73–92 μm long. Trochanter + femur lengths (μm): I: 257–273; II: 231–252; III: 252–263; trochanter III with about 10 fs + 3 hs; long trochanter seta up to 53–58 μm ; femur III with about 20 fs + 24 hs. Tibia lengths (μm): I: 252–257; II: 236–247; III: 241–247; tibia III with about 55 setae, these fs and hs proximally, becoming spurlike on distal third of leg; large apical spur 28–30 μm long. Tarsus lengths (μm): I: 147–163; II: 157–168; III: 149–163 (ratio length of tibia III to length of tarsus III 1:0.63); tarsus III with about 64 setae, mainly spurlike; tarsal spur 28–36 μm ; tarsal digitules rather shorter than claw. Claws shortish, subequal in length or shorter than width of tarsi, slightly curved, lacking a denticle, length: III: 23–25 μm ; claw digitules a little longer than claw.

Abdomen. Segments I–VII: tergum and sternum of all segments with some reticulations + microtrichia; tergites absent; sternites only present on segment VII; with a broad membranous area between anterior 5 sternites. Caudal extension of segment VII small and rounded. Dorsal abdominal setae (total): segment I: 0 or 1 fs + 0–2 hs; II–IV: 0 fs + 0–2 hs; V–VII: 0 fs + 2 hs. Pleural setae hard to separate: dorsopleural setae + ventropleural setae possibly on each side: III: 0–2 fs + 0–3 hs; IV–VI: 1–3 fs + 2 or 3 hs; VII: 1–6 fs + 1–6 hs. Ventral abdominal setae total per segment: II: 2–5 fs + 0–2 hs; III: 0–3 fs + 0–2 hs; IV–VI: 4–8 fs + 2–4 hs; VII 6–13 fs + 2–7 hs. Segment VIII: tergite with 6–8 fs + 2–6 hs dorsal abdominal setae, including ante-anal setae; sternite with 3–5 fs + 1 or 2 hs ventral abdominal setae; caudal extension small, with possibly 3–5 fs + 1–4 hs pleural setae. Glandular pouch absent. **Genital segment.** Penial sheath quite long; 278–304 μm long and 82–86 μm wide at base, about 1/5 of total body length (ratio of total body length to penial sheath length 1:0.2). Basal rod short, 32–45 μm long, just or almost reaching basal membranous area anteriorly; with or without a short extension down aedeagus. Aedeagus long, broadest basally, tapering slightly towards apex, 172–181 μm long (ratio length of aedeagus to length of basal rod 1:0.22). Penial sheath with 7 small setae along each margin and with a cluster of small sensilla present near apex.

INGLISIA Maskell

Type species: *Inglisia patella* Maskell, 1879: 213 (designated by Fernald, 1903: 162)

Introduction. This genus contains the one very distinctive species, *I. patella* Maskell (see Morrison & Morrison, 1922; Hodgson & Henderson 2000). The adult females are quite different from most other Coccidae and the adult male is equally unusual.

Diagnosis based on the adult male of *I. patella* only (significant character-states in italics) (Fig. 75).

General: of moderate size; *fleshy setae almost entirely absent, very similar to hs; dorsal pores present on head.*

Head: fs absent except on antennae; *2 pairs of simple eyes only; genal setae absent;* reticulations few anteriorly on gena, with very sinuous inner microridges; ocular sclerite and genal reticulations very dissimilar; ventral midcranial ridge without setae; postocular ridge not nearly reaching ocelli; ocelli indistinct; ocular sclerite reticulations with 0 or 1 inner microridges; ventral head setae all hs and only present anterior to ventral eyes; ventral head setae absent between ventral eyes; ventral ocular setae absent; tentorial bridge present; *cranial apophysis trifurcated.* **Antennae:** normal, about 0.6 of total body length; with 3 hs on scape; segment X narrowing near apex; hs on segments IV–X absent; *with only 2 capitate setae on segment X.*

Thorax. Prothorax: lateral pronotal setae present; lateral prothoracic setae absent; median ridge of prosternum absent; without prosternal setae; antemesospiracular setae absent; anteprosternal setae absent. **Mesothorax:** prescutum about 1.5× wider than long; prescutum with faint reticulations; membranous area of scutum very narrow, 6–7× wider than long; membranous area of scutum with only hs; *scutum reticulated anteriorly;* scutum not reticulated laterad to scutellum; size of foramen on scutellum uncertain; without postmesospiracular setae; *median ridge of basisternum absent; furca fairly long, apparently easily reaching anterior border of basisternum;* setae laterad to lateropleurite absent; tegular setae present; mesepisternum without reticulations; anterior end of postalare lightly punctated; postalare setae absent.

Metathorax: *without anterior metasternal setae;* without posterior metasternal setae; without postmetaspiracular setae; metepimeron without setae; hamulohalteres absent; with 1 pair of hs metatergal setae; *dorsospiracular setae absent;* setae near metaprecoxal ridge absent.

Legs: *without a tibial spur on each tibia;* tarsal campaniform pores absent; *trochanter–femur segmentation indistinct or absent;* fs more abundant than hs on metafemur; tarsus 1-segmented.

Abdomen: segment VIII of normal length; *cicatrices present;* sternites and tergites on segments II–VI absent or poorly

sclerotised; dorsal abdominal setae few, all hs; ventral abdominal setae few, all hs; pleural setae few but with some fs, more or less segmentally arranged; with 1 pair of hs (or fs?) ante-anal setae; caudal extensions on abdominal segments VII and VIII small and rounded; glandular pouches present; penial sheath about 1/5 of total body length; *penial sheath narrowing abruptly near base and then with almost parallel-sides to a sharp apex;* basal rod short, just reaching basal membranous area anteriorly; aedeagus quite long (about 3/4 length of penial sheath), with almost parallel margins.

Comment. The adult male of *Inglisia patella* is quite different from any of the other males reviewed here. The above characters are mostly different from those described by Giliomee (1967) for *Inglisia theobromae* (Newstead); the main characters shared with the latter species are the presence of 2 capitate setae, absence of median ridge on basisternum, presence of glandular pouches and small caudal extensions to abdominal segments VII and VIII. Whilst the first two are significant shared characters, the presence of the pores on the head and a pair of cicatrices dorsally on the abdomen strongly suggests that the males of “*Inglisia*” *theobromae* and *Inglisia patella* are not congeneric. The presence of pores between the antennae on the head is otherwise known for Coccidae only on male *Poropezia dacrydii*, described below, although pores are a common feature of many Pseudococcidae and Eriococcidae, but are loculate on the latter (Afifi 1968). If the pores on *I. patella* are homologous with those on the other two families, then *I. patella* could be rather primitive. Pores were also noted by Miller & Williams (1995) on the prothorax of *Toumeyella virginiana* Williams & Koszarab and by Miller & Williams (2002) on the scutellum of *Philephedra floridana* Nakahara & Gill, but these are not here thought to be homologous to the pores found on either *I. patella* or *P. dacrydii*. Cicatrices have also been found on other male Coccidae but on abdominal segment VIII at or near the apex of the caudal extension. The presence of the pair of cicatrices medially on tergite IV is therefore unique within the Coccidae.

***Inglisia patella* Maskell**

Fig. 33, 75

Live appearance: cream to pale fawn with dark red eyes, fawn antennae and light brown legs; a pair of long caudal wax filaments present.

Test of opaque glassy wax, convex and elongate; composed of one large plate with 8 vertical ridges and a back plate, the ridges dividing test into approximately 8 sides; margin correspondingly sinuous. On leaves of host plants.

Material examined: see Appendix for collection details of specimens examined.

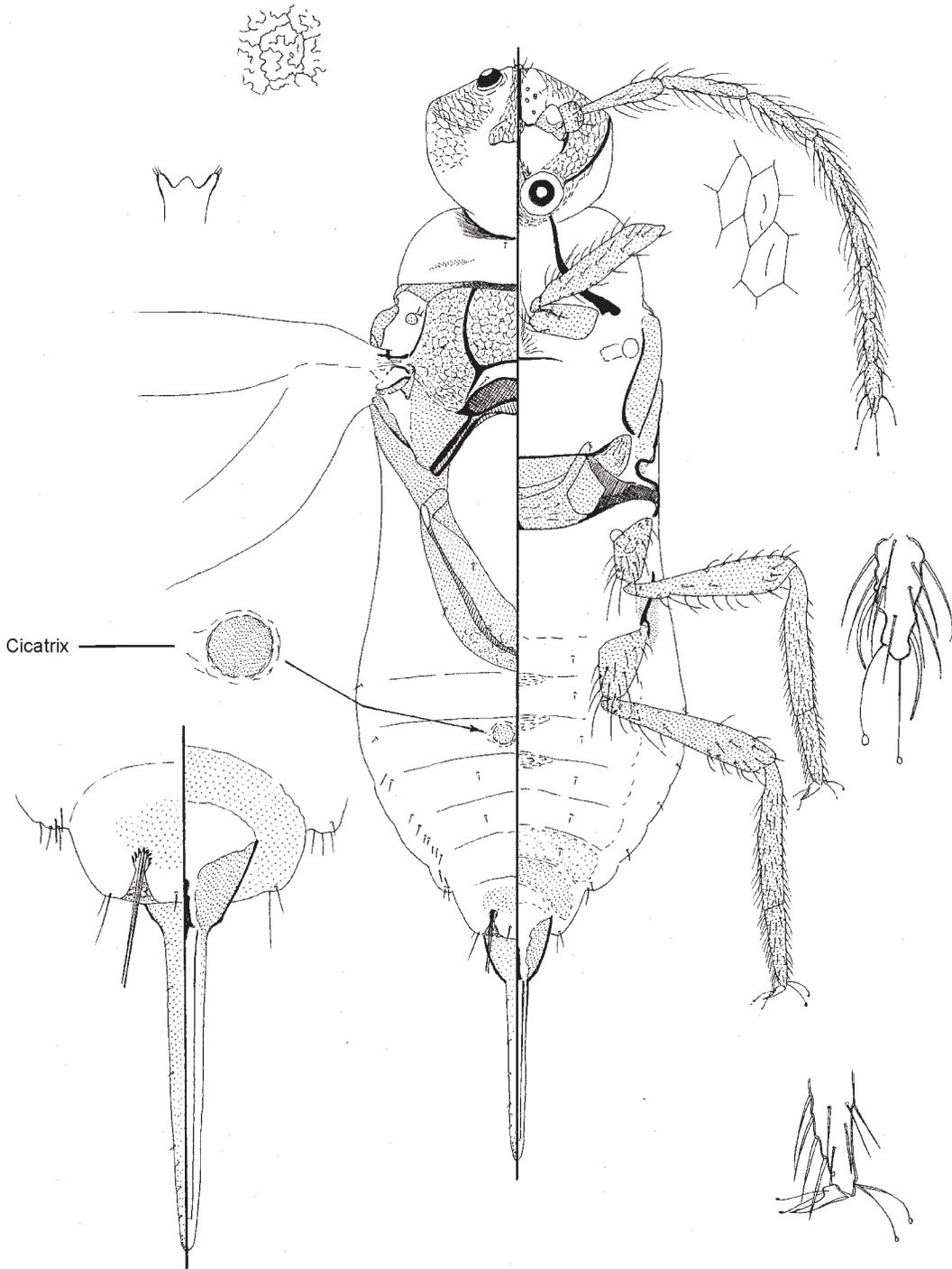


Fig. 75 Adult male, *Inglisia patella* Maskell.

Described from 2 specimens in good condition, but perhaps thorax very convex and, therefore, with scutellum and basisternum possibly bent anteriorly.

Mounted material: small to medium-sized and robust, total body length about 1.30–1.38 mm; antennae more than half total body length; appendages quite setose but fleshy setae not easily distinguishable from hairlike setae (on body, latter perhaps only present as pleural setae); length of fs on antennae not quite twice width of antennal segments. Wings quite long, about 9/10 of total body length; width slightly under half wing length. Hamulohalteres absent.

Head: rounded in dorso-ventral view; length 165–186 µm to posterior margin of head; width across genae about 234–252 µm. Median crest broad dorsally, becoming very narrow dorsad to lateral branches of midcranial ridge; ending abruptly posteriorly on dorsal surface; median crest polygonally reticulated; with 3–6 hs dorsal head setae on each side. Small convex pores of rather variable shape and size, present in a distinct group between and just anterior to each scape, with 2–6 in each group. Midcranial ridge: dorsal ridge absent; ventral ridge well defined, narrow, extending posteriorly from lateral branches and almost reaching ocular sclerite, before becoming less sclerotised, with polygonal reticulations in a narrow band anteriorly but broadening posteriorly and fusing with ocular sclerite; ventral midcranial ridge without ventral midcranial ridge setae. Genae large and polygonally reticulated throughout, each reticulation with sinuous marginal microridges and a few sinuous inner microridges; genal setae absent. Simple eyes: two pairs; dorsal pair slightly smaller (43–48 µm) than ventral pair (52 µm). Ocelli rather poorly defined, posterior to dorsal simple eye. Ocular sclerite sclerotised and polygonally reticulated throughout, each reticulation with straight marginal microridges and a few straightish inner microridges. Preocular ridge poorly defined, only extending a short distance ventrally from each antenna, but perhaps extending further dorsally. Postocular ridge well developed ventrally but nearly reaching ocelli. Dorsal ocular setae absent. Ventral head setae: with 1 or 2 hs anterolaterally to each ventral eye only, none between eyes or laterally on ocular sclerite; ventral ocular setae absent. Preoral ridge well developed. Cranial apophysis about 20–33 µm long, trifurcate, outer arms marginally longer than median arm. **Antennae:** 775–825 µm long (ratio of total body length to antennal length 1:0.64). Scape: 41–50 µm long and 46–50 µm wide, each with 2 hs, 1 on ventral surface and 1 on inner margin. Pedicel: length 26–35 µm, width 43–45 µm, with weak polygonal reticulations and about 3–9 hs on ventral surface only. Segments III–X all about 17–23 µm wide; lengths (µm): III: 112–128; IV: 116–146; V: 109–138; VI: 107–113; VII: 78–85; VIII: 66–70 and IX: 58–67; each fs about 31–37 µm long; approximate number of setae per

segment: III: 5–14 fs + 0 or 1 hs + 1 sensilla basiconica; IV: 26–34; V: 26–31; VI: 27–34; VII: 22–27; VIII: 21–27; IX: 17–22; segments VIII and IX with bristles undifferentiated. Segment X slightly narrowing towards apex; length 58–66 µm; with 2 capitate setae, 2–4 antennal bristles and about 13–17 fs; with 0 or 1 sensilla basiconica on apex.

Thorax. Prothorax: pronotal ridge strong, with well-developed, striated, lateral pronotal sclerites; with or without 1 pair of hs lateral pronotal setae. Post-tergites present but without setae. Sternum with a short, well-developed, slightly curved, transverse ridge; median ridge absent; sternite broad and triangular, with striations or polygonal reticulations; prosternal setae, anteprosternal setae and other prothoracic setae absent. **Mesothorax:** probably very convex in life (lateral margins of scutum split on available specimens); prescutum wider than long (145–149 µm wide and 103–124 µm long); bounded by well-developed lateral prescutal ridges and posterior prescutal suture; lightly reticulated throughout. Scutum: median membranous area much wider than long (143–166 µm wide; perhaps 20–41 µm long); with 1 or 2 long hs scutal setae; lateral margins distinctly reticulated on anterior 2/3 near prescutal ridge; without reticulations laterad to scutellum. Scutellum on both specimens appearing saddle-like, possibly bent forwards during mounting and therefore seen from behind; about 153–170 µm wide and of unknown length; structure unknown; without setae; postnotal wing process particularly long and well developed. Basisternum length 86–96 µm, 248–253 µm wide but, as with scutellum, may be laterally twisted during mounting; without a median ridge, but bounded by strong marginal and precoxal ridges; without basisternal setae; lateropleurite large and triangular, bounded anteriorly by a strong extension from marginal ridge: furca well developed, each arm extending past marginal ridge anteriorly; furca slightly reticulated medially near base on one specimen. Postalare not reticulated but perhaps punctated; without postalare setae. Mesothoracic spiracle: width of peritreme 26–30 µm. Postmesospiracular setae absent. Tegula: small, with 2–4 hs tegular setae. Antemetaspiracular setae absent. **Metathorax:** metapostnotum perhaps represented by faint reticulations overlying mesopostnotum; with 1 metatergal seta on each side. Metapleural ridge only present ventrally near metacoxae, short; metepisternum not sclerotised and without setae; metepimeron sclerotised, without setae. Metathoracic spiracle: width of peritreme 28–35 µm. Metasternum membranous. Dorsospiracular setae and antemetaspiracular setae absent. Anterior metasternal setae and posterior metasternal setae: with 0 or 1 of each.

Wings: hyaline; of moderate length (1175–1250 µm) and width (525–625 µm) (ratio length to width 1:0.47; ratio of total body length to wing length 1:0.91). Hamulohalteres absent.

Legs: subequal in length. Coxa lengths (μm): I: 86–92; II: 95–108; III: 102–108; coxal III setae 12–21 fs + 2–6 hs; each with two long apical setae, up to about 58–60 μm long. Trochanter + femur lengths (μm): I: 223–240; II: 207–224; III: 227–245; segmental division between trochanter and femur poorly defined; trochanter III each with 3 or 4 fs + 1 hs; long trochanter setae 56–67 μm : each femur slightly swollen distally, with about 22 or 23 fs + 8–10 hs. Tibia lengths (μm): I: 186–199; II: 182–199; III: 186–212; tibia III with 47–56 setae, mostly spurlike on distal third; apical spurs not differentiated from other spurlike setae, all finely pointed, length 24–29 μm ; little sign of articulation between tibia and tarsus. Tarsus lengths (μm): I: 125; II: 106–116; III: 111–116 (ratio length of tibia III to length of tarsus III 1:0.57); with 28–37 setae, mostly spurlike; distal tarsal spurs also finely pointed, each 25–30 μm long; tarsal digitules subequal in length and longer than claw; tarsal campaniform pores absent. Claws long and thin, subequal in length or slightly longer than width of tarsi, slightly curved, without a denticle; length 26–29 μm ; claw digitules subequal in length and slightly longer than claw.

Abdomen: segments I–VII: tergum and sternum of all segments with some reticulations + microtrichia; tergites absent; with a pair of quite large, round cicatrix medially on tergite IV; sternites present on segment VII only; with a wider membranous area in intersegmental areas between sternites II/III, III/IV, and IV/V. Caudal extension of segment VII small and rounded. Dorsal setae total per segment: I: 2 hs; II–V without setae; VI–VII: 2 hs. Pleural setae: dorsopleural setae, on each side: I–II: 0; III–IV: 1 hs; V–VI: 1–3 fs + 0 or 1 hs; ventropleural setae: II–V: 1 hs; VI + VII (dorsopleural + ventropleural setae) in a line of about 6–10 fs + 3 hs along margin on each side. Ventral abdominal setae, total per segment: II–VI: 0–2 hs. Segment VIII: tergite with 2 long hs (or fs?) ante-anal setae (each about 35 μm long); sternite without ventral abdominal setae; caudal extension small, rounded, each with 1 long + 2 short hs pleural setae. Glandular pouch present, each pouch quite deep, with a narrow entrance, with numerous loculate disc-pores and with two glandular setae, each 104–128 μm long. **Genital segment:** penial sheath 281–302 μm long and 95–96 μm wide at base, about 1/5 of total body length (ratio of total body length to penial sheath length 1:0.21); tapering quickly for about 1/5 length and then more or less parallel sided; clearly quite sharply curved ventrally when viewed from the side. Basal rod short, 35–45 μm long, just about reaching basal membranous area anteriorly but without an extension down aedeagus. Aedeagus 194–207 μm long (ratio length of aedeagus to length of basal rod 1:0.2), broadest basally and slightly tapering, almost as wide as penial sheath. Penial sheath with about 9 small setae on each side along margins and with a cluster of small sensilla present near apex.

KALASIRIS Henderson & Hodgson

Kalasis Henderson & Hodgson: Hodgson & Henderson, 2000: 119

Type species: *Ctenochiton perforatus* Maskell

Introduction: this genus includes 3 rather distinctive adult females: *Kalasis depressa* (Maskell), *K. paradedpressa* Henderson & Hodgson, and *K. perforata* (Maskell) (Hodgson & Henderson 2000). Of these, suitable material of adult males was available for *K. depressa* and *K. perforata*.

Diagnosis based on the adult males of *K. depressa* and *K. perforata* only (significant character-states in italics) (Fig. 76).

General: moderate in size; fleshy setae normal, without extremely flagellate apices; dorsal pores absent.

Head: rather few fs; with either 2 or 4 pairs of simple eyes, lateral eyes (when present) smaller than other eyes; genal setae few; genal reticulations with or without sinuous inner microridges; ventral midcranial ridge with both fs and hs; postocular ridge not nearly reaching ocelli; ocelli large and distinct; ocular sclerite reticulations with or without inner microridges, when present sometimes with branched inner microridges; ventral head setae present laterally on ocular sclerite; ventral head setae present between ventral eyes; ventral ocular setae present or absent; tentorial bridge well developed; cranial apophysis bifurcated. **Antennae:** long, 0.6–0.7 total body length; with 3 hs on scape; segment X perhaps slightly constricted near apex; hs on segments IV–X absent; with 3 capitate setae on segment X. **Prothorax:** lateral pronotal setae present or absent; lateral prothoracic setae absent; *median ridge of prosternum quite well developed along part of its length*; with several pairs of fs prosternal setae; antemesospiracular setae absent; anteprosternal setae absent. **Mesothorax:** prescutum about 2 \times wider than long; prescutum with or without faint striations; membranous area of scutum about 2–3 \times wider than long; membranous area of scutum with both fs and hs; scutum without reticulations anteriorly; scutum with or without reticulations laterad to scutellum; foramen on scutellum small; with fs postmesospiracular setae; median ridge of basisternum well developed; furca fairly short, not nearly reaching anterior border of basisternum; setae laterad to lateropleurite absent; *tegular setae absent*; mesepisternum without reticulations; anterior end of postalare lightly reticulated; postalare setae absent. **Metathorax:** with numerous fs anterior metasternal setae; with fewer fs posterior metasternal setae; with fs postmetaspiracular setae; metepimeron with or without setae; hamulohalteres absent; *dorsospiracular setae absent*; setae near mesoprecoxal ridge present or absent.

Legs: with 1 tibial spur per tibia; tarsal campaniform pores absent; trochanter–femur segmentation distinct; fs about

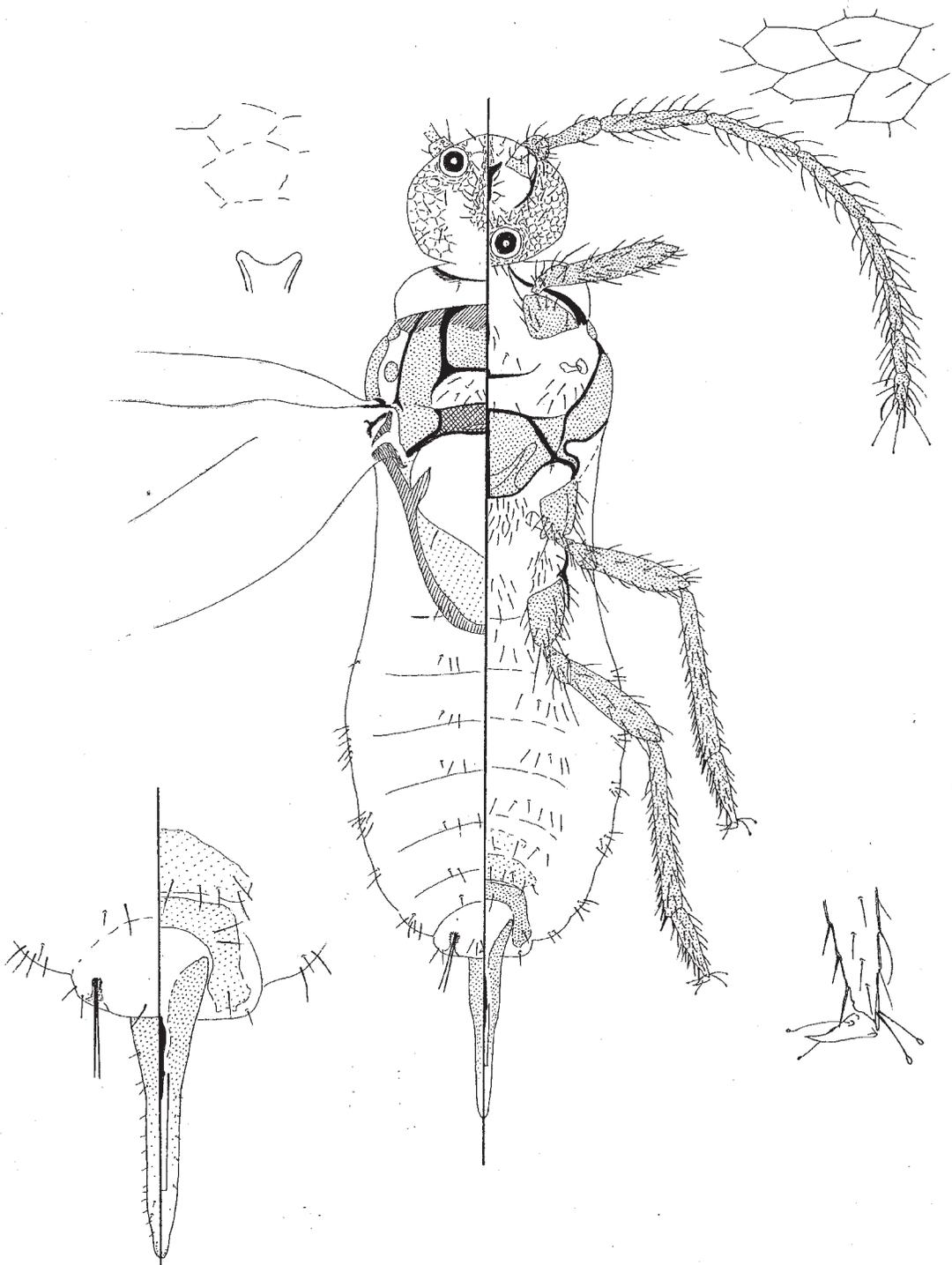


Fig. 76 Adult male, *Kalasiris depressa* (Maskell)

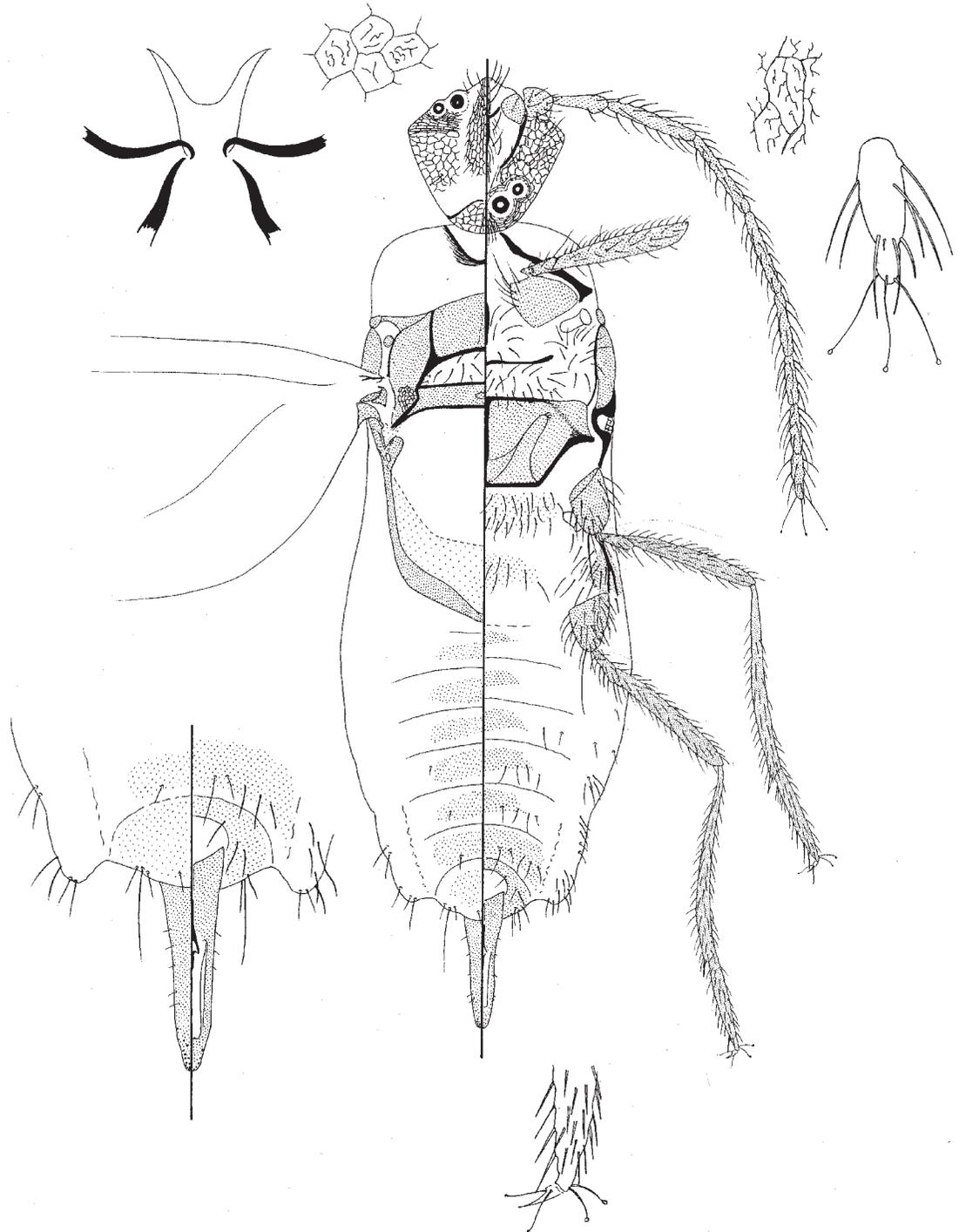


Fig. 77 Adult male, *Kalasiris perforata* (Maskell).

as frequent as hs on metafemur; tarsus 1-segmented.

Abdomen: segment VIII of normal length; cicatrices absent; sternites and tergites on segments II–VI present or absent; dorsal abdominal setae fewer than ventral abdominal setae; ventral abdominal setae with hs and fs about equally frequent; pleural setae few, segmentally arranged; with hs and/or fs ante-anal setae; caudal extensions on segments VII and VIII rounded; glandular pouches present or absent; penial sheath 1/5–1/7 of total body length; penial sheath quite broad, gradually narrowing to a very blunt apex; *basal rod short, not nearly reaching basal membranous area anteriorly*; aedeagus short, about 1/2–1/3 length of penial sheath, with more or less parallel margins.

Comment. The males of *K. depressa* and *K. perforata* are rather similar to those of *Ctenochiton* species and *Epelidochiton piperis*.

Kalasis depressa (Maskell)

Fig. 42, 76

Live appearance: medium brown with black eyes, and fawn wings and antennae; a pair of long caudal wax filaments present, with an additional wax spike at base of each filament.

Test convex, of translucent glassy wax, with two long wax plates in middle of median dorsal row. On leaves of host plants.

Material examined: see Appendix for collection details of specimens examined.

Described from 2 specimens in fair condition.

Mounted material: of medium size and robust; total body length about 1.57–1.64 mm; with antennae of moderate length, about 0.6 of total body length, and long legs; body not particularly hirsute, but fleshy setae fairly frequent, these easy to differentiate from hairlike setae; length of fs on antennae about twice width of antennal segments. Wings long, about 0.85 as long as total body length; width slightly less than half wing length. Hamulohalteres absent.

Head: roundish in dorsal view; length about 220 μ m; width across genae 270 μ m. Median crest reticulated, with 6–9 fs + 3–5 hs dorsal head setae on each side. Midcranial ridge: dorsal ridge absent; lateral arms well defined; ventral ridge fairly short and narrow, extending about 2/3 of way to ocular sclerite, bordered by a few faint reticulations or striations, which extend posteriorly and fuse with ocular sclerite; with 2–4 fs + 0 or 1 hs ventral midcranial ridge setae on each side. Genae large and faintly polygonally reticulated, particular dorsally, each reticulation broad but apparently without inner microridges; genal setae: each side with 2–5 fs + 0 hs on each side. Ocelli distinct, 21x15 μ m in size. Simple eyes: two pairs only, subequal in size,

each round and 43–58 μ m wide; lateral simple eyes absent. Ocular sclerite reticulations often with one or two short, straight inner microridges. Preocular ridge: both dorsal and ventral ridge quite long, latter extending about 2/3 towards midcranial ridge. Postocular ridge well developed but not nearly reaching ocelli dorsally. Dorsal ocular setae absent. Ventral head setae: with about 8–10 fs + 4–6 hs on each side anterior and laterad to ventral simple eyes, and with perhaps 2 fs + 0–2 hs between eyes; ventral ocular setae: 3–5 fs + 0–1 hs. Tentorial bridge well developed. Cranial apophysis hard to discern but perhaps bifid and 30 μ m long. **Antennae:** each 950–1050 μ m long (ratio of total body length to antennal length 1:0.63). Scape: 54–58 μ m long and 46–53 μ m wide, with one hs seta on ventral surface and 2 hs setae on dorsal surface. Pedicel: length 35–43 μ m, width 44–48 μ m; with weak polygonal reticulations and 3 fs + 4–6 hs, on ventral surface only. Segments III–X all about 10–26 μ m wide: fs 33–42 μ m long; segment lengths (μ m): III: 100–103; IV: 170–190; V: 158–170; VI: 157–163; VII: 115–122; VIII: 90–98 and IX: 74–87; approximate number of setae per segment: III: 2–4 fs + 2 hs + 1 sensilla basiconica; IV: 23–33 fs + 0 hs; V: 23–27 fs + 0 hs; VI: 22–27 fs + 0 hs; VII: 20–24 fs + 0 hs; VIII: 22–24 fs, 0 hs + 1 bristle; IX: 17–19 fs, 0 hs + 1 antennal bristle. Segment X: length 63–85 μ m; with a slight or no constriction apically; with 3 capitate setae, 3 large and 2 shorter and finer antennal bristles, similar to fs, plus about 11–15 fs; with 1 sensilla basiconica.

Thorax. Prothorax: pronotal ridge strong, with a lightly-reticulated lateral pronotal sclerite; with 0 or 1 hs lateral pronotal seta. Sternum with a strong, narrow transverse ridge; median ridge moderately developed; sternite with faint striations; prosternal setae: about 2 or 3 fs + 1 hs on each side. Anteprosternal setae and antemesospiracular setae absent. **Mesothorax:** prescutum much wider than long (157–163 μ m wide and 107 μ m long). Scutum: median membranous area quite large (157–187 μ m wide and perhaps 50 μ m long); scutal setae: total 7 fs + 6 hs; margins laterad to scutellum not reticulated. Scutellum 157–166 μ m wide and 45 μ m long; tubular, with a small central foramen. Basisternum about 250 μ m wide and 157–163 μ m long; median ridge strong; bounded by strong precoxal ridges and slightly less sclerotised marginal ridges; lateropleurite with a clear extension from marginal ridge on one specimen; without basisternal setae; furca with each arm extending anteriorly about 2/3 of way to anterior margin. Postalare without polygonal reticulations at anterior end; without postalare setae. Mesothoracic spiracle: peritreme about 21 μ m wide. Postmesospiracular setae fairly abundant, with 10–20 fs extending across full width of segment. Tegula: well developed but tegular setae absent. **Metathorax:** metapostnotum unsclerotised; metatergal setae: 2 or 3 fs + 1 or 2 hs. Metapleural ridge only present ventrally near metacoxae, short; episternum unsclerotised, with 8 fs + 0 or 1 hs

postmetaspiracular setae (esp₃s). Metepimeron sclerotised, with 0 or 1 fs. Metathoracic spiracle: width of peritreme perhaps 27 µm. Antemetaspiracular setae and dorsospiracular setae absent. With 1 hs seta on each side just posterior to where mesoprecoxal ridge and marginal ridge meet. Metasternum apparently unsclerotised. Anterior metasternal setae: about 29–32 fs + 0 hs; posterior metasternal setae: 10–12 fs + 0 hs.

Wings: hyaline, of moderate length (1325–1425 µm) and width (603–625 µm) (ratio length to width 1:0.45; ratio of total body length to wing length 1:0.86). Hamulohalteres absent.

Legs: subequal in length. Coxae length (µm): I: 107; II: 107–112; III: 120–125; coxa III with about 11 or 12 fs + 5–7 hs; long apical seta on each coxa about 55–68 µm long. Trochanter + femur length (µm): I: 275–285; II: 230–245; III: 240–255; trochanter III with about 6 or 7 fs + 4 or 5 hs; long trochanter seta up to 60–80 µm; femur III with about 13–19 fs + 5–7 hs. Tibia length (µm): I: 315–325; II: 290–300; III: 305–310; tibia III with 70–85 setae, fs and hs, these becoming more spurlike on distal third of leg; large apical spur 31–34 µm long. Tarsi length (µm): I: 110–120; II: 125; III: 120–130 (ratio length of tibia III to length of tarsus III 1:0.41); tarsus III with about 29–40 setae, mostly spurlike; tarsal spur 22 µm long; tarsal digitules normal, not reaching claw tip. Claws shortish, subequal in length or shorter than width of tarsi, slightly curved, lacking a denticle, length: III: 23–25 µm; claw digitules extending slightly past tip of claw.

Abdomen: segments I–VII: tergites absent; sternites present on segments VI–VIII. Caudal extension of segment VII rounded. Dorsal abdominal setae (total): segments I–VI: 2–5 fs + 0–2 hs; VII: 0–2 fs + 2 hs. Pleural setae: dorsopleural setae: III–VI: 0–3 fs + 1 or 2 hs; VII: 2–5 fs + 1 or 2 hs; ventral pleural setae: II–IV: 1–3 fs + 0–3 hs; V: 2–5 fs + 1 hs; VI: 1–3 fs + 1 or 2 hs; VII: 2 fs + 0 or 1 hs on each side. Ventral abdominal setae (total): II: 1–4 fs + 1 or 2 hs; III–VII: 5–8 fs + 2–4 hs. Segment VIII: tergite with 3 or 4 fs + 0–2 hs ante-anal setae; sternite with 2 or 3 fs + 0 or 1 hs ventral abdominal setae; caudal extension rounded, with 0–2 fs + 2 or 3 hs pleural setae. Glandular pouch present, glandular pouch setae each 100–115 µm long. **Genital segment:** penial sheath of moderate length, 322–340 µm; 85–95 µm wide at base; about 1/5 of total body length (ratio of total body length to penial sheath length 1:0.21). Basal rod rather short, not quite reaching basal membranous area (16–18 µm to basal membranous area), length about 62–70 µm from anterior end of aedeagus and with a short extension (0–40 µm) down aedeagus. Aedeagus rather short: 125–138 µm long (ratio length of aedeagus to length of basal rod 1:0.5); about equally wide along entire length. Penial sheath with 8–14 small setae on each margin and with a cluster of small sensilla present near apex.

Comment: there is also a single slide labelled *K. depressa* (Maskell) from the Maskell collection (New Zealand: no location (probably Hawke's Bay (**HB**)), ex *Plagianthus* sp., May 1883, WMM (NZAC): 1/1ad male + 2nd male (although labelled 2nd female)) but this is in a very poor condition. However, it is clearly not conspecific with the specimens described above as it has (i) 4 pairs of simple eyes; (ii) no glandular pouches, and (iii) a proportionately much longer penial sheath.

Male *K. depressa* differ from male *K. perforata* as follows (character-states for *K. perforata* in parentheses): (i) only 2 pairs of simple eyes (4 pairs of simple eyes); (ii) presence of glandular pouches and glandular pouch setae (absent, although a long seta present on each side in this position); (iii) reticulations on scutum laterad to scutellum absent (present); (iv) reticulations on ocular sclerite and gena simple (each reticulation with several sinuous, branching inner microridges); (v) presence of a small hs just posterior to each mesoprecoxa (absent).

Just as with the males of *Pounamococcus cuneatus* Henderson & Hodgson and *P. tubulus* Henderson & Hodgson, males of *K. depressa* and *K. perforata* differ in the presence or absence of glandular pouches and associated setae and in the number of simple eyes, 2 characters which might intuitively have been considered to be of generic significance. In addition to *P. cuneatus*, 2 pairs of simple eyes are also shared with *Inglisia patella*, both species of *Lecanochiton* and Species A. *K. depressa* differs from *P. cuneatus* in (amongst many other characters) the absence of hamulohalteres; from *I. patella* in the absence of a cicatrix on the abdomen, 3 pairs of capitate setae on antennal segment X and the absence of pores on the head; from *Lecanochiton* species in the absence of tegular setae, presence of fleshy setae on the membranous area of the scutum and in the shape of the penial sheath (much more pointed on *K. depressa*); and from Species A in the presence of fleshy dorsal and ventral abdominal setae, fleshy setae on the membranous area of the scutum, faint reticulations on the gena, and absence of a spatulate apex to the aedeagus. The presence of the small setae just posterior to each mesoprecoxa is shared only by the males of *Ctenochiton* species and *Umbonichiton hymenantherae*.

Kalasisis perforata (Maskell)

Fig. 43, 77

Live appearance: body overall pale buff/fawn, legs and antennae light brown, head with black eyes, wings pale fawn, iridescent; lacking caudal wax filaments.

Test slightly convex, of translucent glassy fused wax plates,

marginal row appearing like feathers, curved and with lines of small aircells. On leaves of host plants.

Material examined: see Appendix for collection details of specimens examined.

Described from 3 specimens in good condition and 2 others in poor condition.

Mounted material: of medium size and robust; total body length about 1.67–1.78 mm; with long antennae, length about 3/4 of total body length, and long legs; body not particularly hirsute, but fleshy setae frequent ventrally, these easy to differentiate from hairlike setae; length of fs on antennae about twice width of antennal segments. Wings long, almost as long as total body length; width slightly more than half wing length. Hamulohalteres absent.

Head: slightly quadrangular in dorsal view; width across genae 298–319 μm . Median crest reticulated, with about 6–8 fs + 5 or 6 hs dorsal head setae on each side. Midcranial ridge: dorsal ridge absent; lateral arms well defined; ventral ridge quite long and narrow, extending almost to ocular sclerite, bordered by faint reticulations or striations, which extend posteriorly and fuse with ocular sclerite; with 3–6 fs + 0–2 hs ventral midcranial ridge setae. Genae large and polygonally reticulated, each reticulation broad, with many sinuous and broken inner microridges; genal setae: each side with 1 fs + 0 or 1 hs. Ocelli distinct. Simple eyes: four pairs; large dorsal eyes slightly smaller than large ventral eyes; both pairs round: dorsal 39–49 μm wide; ventral 48–52 μm wide; each with a closely associated, slightly smaller, round, lateral simple eye, each 36–38 μm wide. Ocular sclerite reticulations with many sinuous and broken inner microridges. Preocular ridge: both dorsal and ventral ridge quite long, latter extending about 2/3 towards midcranial ridge. Postocular ridge well developed but not nearly reaching ocelli dorsally. Dorsal ocular setae absent. Ventral head setae: with about 19–21 fs + 2–5 hs on each side anterior and laterad to ventral simple eyes, and with 4–6 fs + 0–3 hs between eyes; ventral ocular setae absent. Tentorial bridge well developed. Cranial apophysis 45–54 μm long, bifurcated but depth of bifurcation variable, each arm rather pointed apically. **Antennae:** each 1129–1179 μm long (ratio of total body length to antennal length 1:0.7). Scape: 54–63 μm long and 55–63 μm wide, with 1 hs seta on ventral surface and 2 hs setae on dorsal surface. Pedicel: length 55–63 μm , width 48–54 μm ; with weak polygonal reticulations and 3 or 4 fs + 4–7 hs on ventral surface only. Segments III–X all about 22–24 μm wide: fs 45–54 μm long; segment lengths (μm): III: 104–126; IV: 172–191; V: 163–187; VI: 158–167; VII: 115–131; VIII: 90–103 and IX: 88–94; approximate number of setae per segment: III: 4–10 fs + 1 or 2 hs + 2 sensilla basiconica; IV: 20–32 fs + 0 hs; V: 27–31 fs + 0 hs; VI: 30–33 fs + 0 hs; VII: 22–28 fs + 0 hs; VIII: 17–23 fs + 0 hs; IX: 15–25 fs + 0 hs (bristles on segments VIII and

IX undifferentiated). Segment X: length 108 μm ; slightly or not constricted apically; with 3 capitate setae, 3 large and 2 shorter and finer antennal bristles similar to fs, plus about 11–15 fs; with 2 sensilla basiconica, one apically and one slightly more proximally.

Thorax. Prothorax: pronotal ridge strong, with a lightly-reticulated lateral pronotal sclerite; lateral pronotal setae absent. Sternum with a strong transverse ridge which broadens slightly at each end; median ridge moderately developed for a short distance anterior to transverse ridge; sternite broad and triangular, with faint reticulations; prosternal setae: about 3–8 fs + 0 or 1 hs on each side. Anteprosternal setae and antemesospiracular setae absent. **Mesothorax:** prescutum nearly twice as wide as long (209 μm wide and 90–107 μm long); possibly with some striations medially. Scutum: median membranous area quite large (209–238 μm wide and 65–90 μm long); scutal setae: 16–19 fs + 4 or 5 hs; reticulated laterad to scutellum. Scutellum 209–238 μm wide and 41–43 μm long; tubular, with a small central foramen. Basisternum about 287–328 μm wide and 164–168 μm long; median ridge strong anteriorly but fading posteriorly; bounded by strong precoxal ridges and slightly less sclerotised marginal ridges; lateropleurite with a small extension from marginal ridge; without basisternal setae (stn₃s); furca with each arm extending anteriorly almost to anterior margin. Postalar polygonally reticulated at anterior end; without postalar setae. Mesothoracic spiracle: peritreme 25–32 μm wide. Postmesospiracular setae abundant, with 30–47 fs + 0–6 hs extending across full width of segment. Tegula: well developed but without tegular setae. **Metathorax:** metapostnotum unsclerotised; metatergal seta absent. Metapleural ridge only present ventrally near metacoxae, short; episternum sclerotised, with 8–14 fs postmetaspiracular setae (esp₃s). Metepimeron sclerotised with 0 or 1 fs. Metathoracic spiracle: width of peritreme 30–32 μm . Antemetaspiracular setae and dorsospiracular setae absent. Metasternum lightly sclerotised. Anterior metasternal setae: about 34–47 fs + 0 or 1 hs; posterior metasternal setae: 12–14 fs.

Wings: hyaline, of moderate length (1650–1725 μm) and width (825–925 μm) (ratio length to width 1:0.53; ratio of total body length to wing length 1:0.98). Hamulohalteres absent.

Legs: subequal in length. Coxae length (μm): I: 102–127; II: 110–123; III: 123–131; coxa III with about 19–24 fs + 9–13 hs; long apical seta on each coxa about 63 μm long. Trochanter + femur length (μm): I: 311–332; II: 287–307; III: 278–311; trochanter III with about 11–21 fs + 1–6 hs; long trochanter seta up to 54 μm ; femur III with about 23–38 fs + 11–31 hs. Tibia length (μm): I: 340–353; II: 332–344; III: 323–349; tibia III with 73–86 setae, fs and hs, these becoming more spurlike on distal third of leg; large apical spur 34–38 μm long. Tarsi length (μm): I: 164–185;

II: 172–174; III: 168–180 (ratio length of tibia III to length of tarsus III 1:0.52); tarsus III with about 42–58 setae, mostly spurlike; tarsal spur 34–38 µm long; tarsal digitules normal, not reaching claw tip. Claws shortish, subequal in length to or shorter than width of tarsi, slightly curved, lacking a denticle, length: III: 30–32 µm; claw digitules extending slightly past tip of claw.

Abdomen: segments I–VII: tergites and sternites of all segments lightly sclerotised, with some reticulations + microtrichia. Caudal extension of segment VII small and rounded. Dorsal abdominal setae (total): segments I–IV: absent; V–VII: 0 fs + 2 hs. Pleural setae hard to separate: dorsopleural + ventropleural setae: III: 0 fs + 0 or 1 hs; IV: 0 or 1 fs + 0–2 hs; V: 1–3 fs + 0–3 hs; VI: 1–3 fs + 1 or 2 hs; VII: 5–8 fs + 2–5 hs on each side. Ventral abdominal setae (total): II: absent; III–IV: 0 or 1 fs + 0–2 hs; V: 1–5 fs + 0 or 1 hs; VI: 3–6 fs + 1 or 2 hs; VII: 1–5 fs + 1 or 2 hs. Segment VIII: tergite with 2 hs ante-anal setae; sternite with 0–3 fs + 0–3 hs ventral abdominal setae; caudal extension rounded, with 1 or 2 fs + 2–6 hs pleural setae. Glandular pouch absent, but each caudal extension with one long seta in similar position, each 68–77 µm long. **Genital segment:** penial sheath rather short, length 254–267 µm; 75–82 µm wide at base; about 1/7 of total body length (ratio of total body length to penial sheath length 1:0.15). Basal rod short, not nearly reaching basal membranous area (35–44 µm to bma), length about 35–60 µm from anterior end of aedeagus and with a short extension (17–35 µm) down aedeagus. Aedeagus short: 88–103 µm long (ratio length of aedeagus to length of basal rod 1:0.58); about equally wide along entire length. Penial sheath with 5–8 small setae on each margin and with a cluster of small sensilla present near apex.

Comment. Maskell (1887) illustrated the head of a male *K. perforata* (as *Ctenochiton perforatus*), dorsal and ventral view. Whilst the ventral view shows 1 pair of large ventral eyes and a pair of smaller eyes (as expected), the dorsal view shows a pair of large dorsal eyes with 2 pairs small lateral eyes. Presumably the more posterior pair refers to the ocelli. There is also a small illustration of a whole bright brown insect, but this colour may be from dried material.

For a comparison with *K. depressa*, see under that species.

LECANOCHITON Maskell

Type species: *Lecanochiton metrosideri* Maskell, 1882: 222, by monotypy

Introduction. The genus *Lecanochiton* was described by Maskell (1882) for *L. metrosideri* Maskell; he later added *L. minor* (Maskell 1891). During their revision of the New Zealand Coccidae, Hodgson & Henderson (2000) added 2 more species: *L. actites* Henderson & Hodgson and *L.*

scutellaris Henderson & Hodgson. Of the 4 species now included in this genus, all apparently restricted to species of the plant genus *Metrosideros*, males were only available for the latter 2 species and these are described below.

Diagnosis based on adult males of *L. actites* and *L. scutellaris* only (significant character-states in italics) (Fig. 78, 79).

General: small; fleshy setae normal, without extremely flagellate apices; dorsal pores absent.

Head: fs setae frequent; *with 2 pairs of simple eyes only*; genal setae absent; genal reticulations without inner microridges; *ocular sclerite and genal reticulations similar*; ventral midcranial ridge with both fs and hs; *postocular ridge nearly reaching ocelli*; ocelli large and distinct; reticulations on ocular sclerite without inner microridges; ventral head setae present laterally on ocular sclerite; ventral head setae present between ventral eyes; ventral ocular setae absent; tentorial bridge well developed; cranial apophysis bifurcated. **Antennae:** short, 0.5–0.6 total body length; with 3 hs on scape; segment X not constricted near apex; hs on segments IV–X absent; with 3 capitate setae on antennal segment X.

Thorax. Prothorax: lateral pronotal setae absent; lateral prothoracic setae absent; median ridge of prosternum present but short or ill-defined; with several fs prosternal setae; antemesospiracular setae absent; anteprosternal setae absent. **Mesothorax:** prescutum about 1.5× wider than long; prescutum without reticulations; *membranous area of scutum very narrow, 7–8× wider than long*; membranous area of scutum with hs only; scutum without reticulations anteriorly; scutum not reticulated laterad to scutellum; foramen on scutellum small or absent; with fs postmesospiracular setae; median ridge of basisternum present but variably developed; furca fairly short, not nearly reaching anterior border of basisternum; setae laterad to lateropleurite absent; tegular setae present; mesepisternum without reticulations; anterior end of postalare lightly reticulated; postalare setae absent. **Metathorax:** with numerous fs anterior metasternal setae; with many fs posterior metasternal setae; with fs postmetaspiracular setae; metepimeron without setae; hamulohalteres absent; with 1 pair of hs metatergal setae; dorsospiracular setae present; setae near mesoprecoxal ridge absent.

Legs: with 1 tibial spur per tibia; tarsal campaniform pores absent; trochanter–femur segmentation distinct; fs about as frequent as hs on metafemur; tarsus 1-segmented.

Abdomen: segment VIII of normal length; cicatrices absent; sternites and tergites on segments II–VI absent or poorly sclerotised; dorsal abdominal setae few, all hs; ventral abdominal setae few, mostly hs; pleural setae very few, segmentally arranged; with fs and hs ante-anal setae; cau-

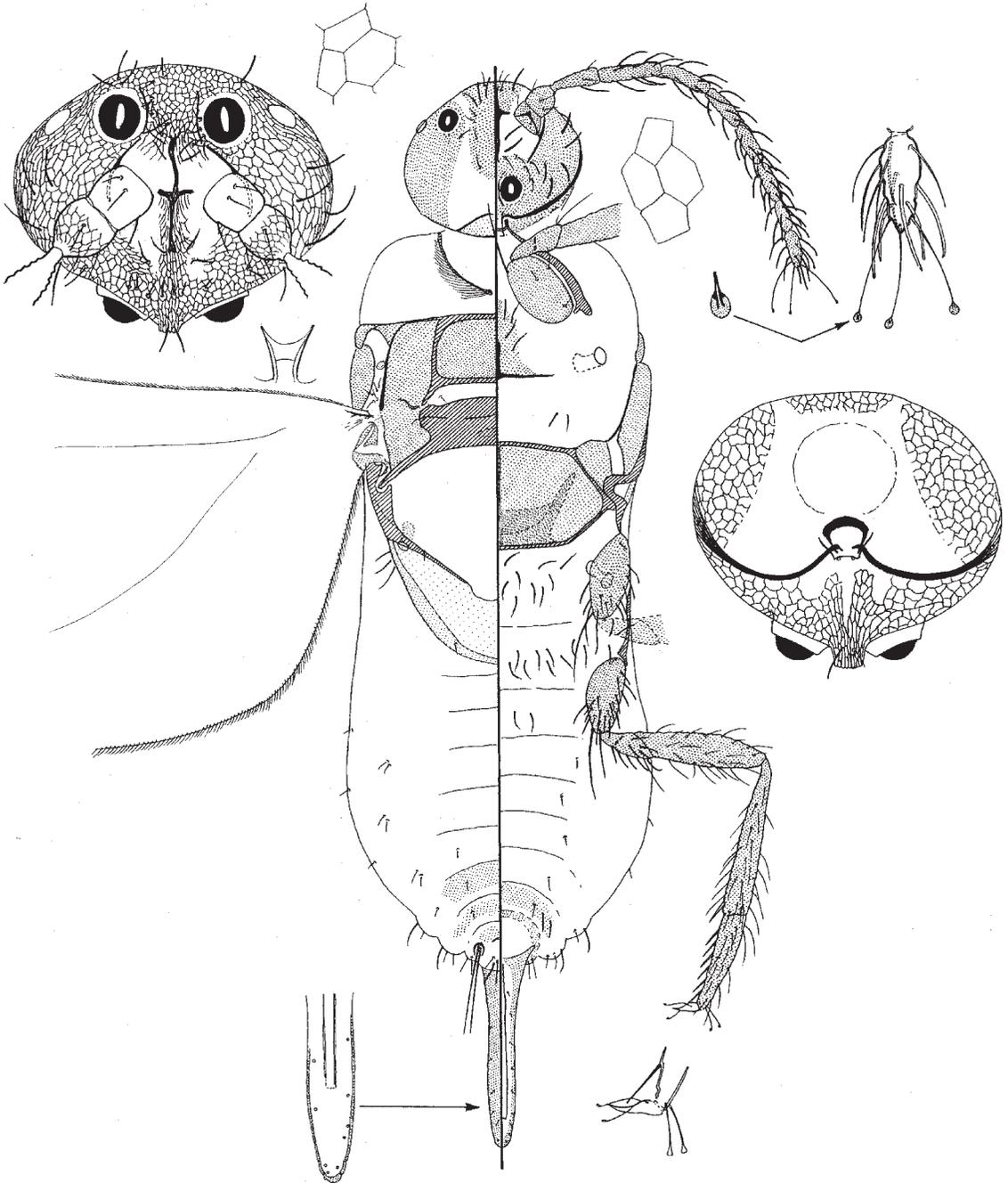


Fig. 78 Adult male, *Lecanochiton actites* Henderson & Hodgson. Top left – anterior view of head; middle right – posterior view of head.

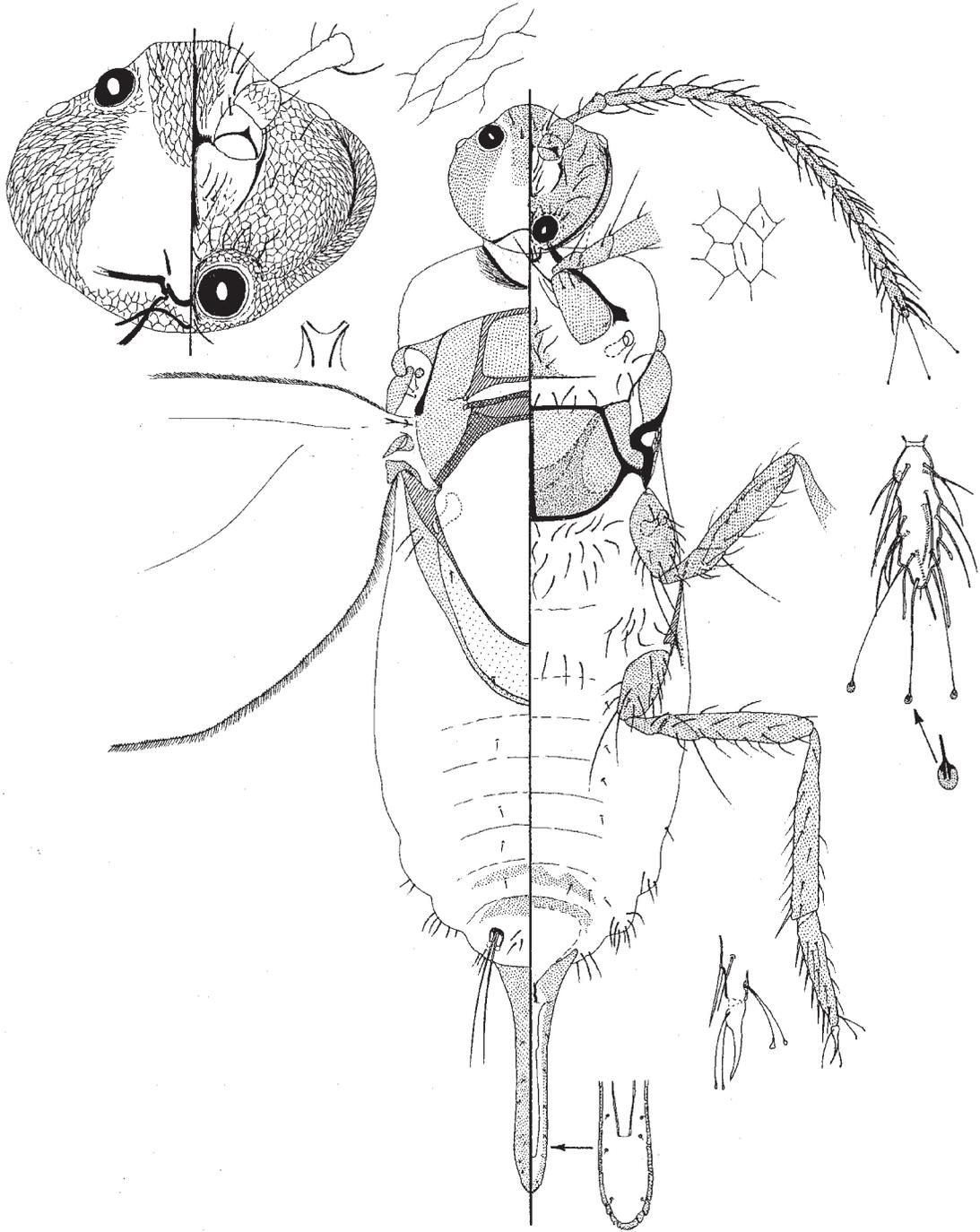


Fig. 79 Adult male, *Lecanochiton scutellaris* Henderson & Hodgson. Top left – enlarged dorsal and ventral view of head.

dal extensions on segments VII and VIII small and rounded; glandular pouches present; penial sheath about 1/5 of total body length; *penial sheath almost spatulate, broadening slightly towards apex; basal rod poorly developed and possibly composed of ridges*; aedeagus quite long, about 2/3–3/4 length of penial sheath.

Comment. The other New Zealand species known with only 2 pairs of simple eyes are *Kalasis depressa*, *Inglisia patella*, *Pounamococcus cuneatus*, and Species A, but these species are easily separated from *Lecanochiton* using the key and significant characters-states given above.

Lecanochiton actites Henderson & Hodgson

Fig. 44, 78

Live appearance: body colour cream-fawn, with darker legs and antennae, very dark red eyes, and dark brown thoracic band; caudal wax filaments not noted (glandular pouch present but with few pores).

Test small, moderately convex, of fused translucent glassy wax plates that tend to be thicker medially. By main veins on under leaf surfaces of host plant.

Material examined: see Appendix for collection details of specimens examined.

Described from 8 specimens in fair to good condition.

Mounted specimens: rather small, length 1.01–1.13 mm; antennae short, less than half total body length; body with rather few fleshy setae, these not easily differentiated from long hs; length of fs on antennae slightly less than twice width of antennal segments. Wings fairly short, about 3/4 of total body length; width slightly more than wing length. Hamulohalteres absent.

Head: round to oval in dorsal view; width across genae 205 μ m. Median crest reticulated, with about 3–7 hs + 3 or 4 fs on each side. Midcranial ridge: dorsal ridge probably absent; ventral ridge with short, well-developed lateral branches; ventral ridge well developed and extending to ocular sclerite posteriorly; with a few polygonal reticulations posterolaterally, which fuse with ocular sclerite posteriorly; with 0 or 1 fs + 0–2 hs ventral midcranial ridge setae. Genae large, with distinct polygonal reticulations, each reticulation without inner microridges; without genal setae. Simple eyes: 2 pairs, both pairs round; ventral eyes perhaps slightly larger; dorsal eyes 34–38 μ m wide; ventral eyes 37–42 μ m wide. Ocelli distinct and quite large, about 13 μ m wide, surrounded by an even larger area without reticulations. Ocular sclerite polygonally reticulated throughout except around ocelli, each reticulation with few or no inner microridges. Preocular ridge: ventral arm rather short, extending for about 1/4–2/3 towards midcranial ridge; dorsal arm subequal to ventral arm. Postocular ridge well

developed ventrally, but fading laterally near ocelli. Dorsal ocular setae: 0–3 fs on each side. Ventral head setae: about 2–5 fs + 6–8 hs on each side anterior and laterad to ventral eyes, plus 0–3 fs + 0 or 1 hs between eyes; ventral ocular setae absent. Tentorial bridge well developed. Cranial apophysis with apex bifurcate; about 18–24 μ m long. **Antennae:** each 497–525 μ m long (ratio of total body length to antennal length 1:46). Scape: 34–36 μ m long and 36–40 μ m wide; usually with one hs on ventral surface and 1 or 2 hs on dorsal surface. Pedicel: 34–36 μ m long and 34–40 μ m wide; with distinct polygonal reticulations and 7 or 8 hs on ventral surface only. Segments III–X each 18–23 μ m wide; each fs 27–31 μ m long; lengths of segments (μ m): III: 52–56; IV: 84–112; V: 46–61; VI: 57–86; VII: 52–65; VIII: 50–61 and IX: 43–48; approximate number of setae per segment: III: 0–2 fs + 2 hs (possibly with 1 or 2 sensilla basiconica); IV: 10–21 fs; V: 10–14 fs; VI: 11–16 fs; VII: 13–15 fs; VIII: 13–17 + 1 bristle; IX: 10–12 fs + 1 bristle. Segment X: length 50–61 μ m; not constricted apically; with 3 capitate setae, 3 large and 2 small antennal bristles, plus 5–8 fs and 1 sensilla basiconica.

Thorax. Prothorax: pronotal ridge well developed, with a broad, striated or reticulated lateral pronotal sclerite; without pronotal setae. Prosternum with a strong transverse ridge without apophyses; median ridge short, situated on a slightly sclerotised sclerite with faint reticulations; with 2–5 fs + 0–2 hs prosternal setae. Anteprosternal setae and antemesospiracular setae absent. **Mesothorax:** prescutum about 2/3 as long as wide: 127–136 μ m wide, 77–90 μ m long; anterior margin rather straight, laterally bounded by prescutal ridges and posteriorly by prescutal suture; not reticulated. Membranous area of scutum very narrow: length about 1/7 of width; about 139–146 μ m wide and 16–20 μ m long; with (total) 0 or 1 fs + 2–4 hs scutal setae; lateral areas of scutum without reticulations. Scutellum narrow: 155–164 μ m wide and 29–40 μ m long, heavily sclerotised and with or without a small foramen; without setae; posterior notal wing process particularly strongly developed. Basisternum about 225–238 μ m wide and 123–131 μ m long; median ridge generally more or less complete but sometimes reduced or absent posteriorly; marginal and precoxal ridges well developed; basisternal setae absent; lateropleurite without an extension of marginal ridge; furca well developed, each arm extending nearly to anterior margin. Postalare with only very slight reticulations at anterior end and lacking postalare setae. Mesothoracic spiracle: width of peritreme 18–20 μ m. Postmesospiracular setae: with 0–2 fs + 0 or 1 hs. Tegula well developed, with 1–5 hs tegular setae. **Metathorax:** metapostnotum unsclerotised; with 1 hs metatergal seta on each side. Metapleural ridge only present ventrally near metacoxae, short; episternum unsclerotised but with 6–10 fs + 0 or 1 hs postmetaspiracular setae; metepimeron sclerotised

but without setae. Metathoracic spiracle: width of peritreme 18–20 μm . Antemetaspiracular setae: generally absent but occasionally 1 fs; dorsospiracular setae: 1–5 fs on each side. Metasternum unsclerotised. Anterior metasternal setae: with 15–30 fs; posterior metasternal setae: 14–21 fs + 0 or 1 hs.

Wings: hyaline; length 775–850 μm , width 387–450 μm (ratio length to width 1:0.53; ratio of total body length to wing length 1:0.76). Hamulohalteres absent.

Legs: short and rather slender; prothoracic legs marginally longer than other legs. Coxa length (μm): I: 86–103; II: 86–98; III: 94–98; coxa III with about 7–15 fs + 5–7 hs; long apical setae on each coxa about 57–81 μm long. Trochanter + femur length (μm): I: 201–219; II: 172–187; III: 184–197; trochanter III with 8–10 fs + 0 or 1 hs; long trochanter seta 37–54 μm ; femur III with about 8–15 fs + 9–12 hs. Tibia length (μm): I: 164–185; II: 151–172; III: 184–201; tibia III with a total of about 30–51 setae, some fs, few hs, most setae becoming spurlike on distal third of leg; apical spur 27–33 μm long. Tarsi length (μm): I: 102–115; II: 114–123; III: 115 (ratio length of tibia III to length of tarsus III 1:0.6); tarsus III with about 26–39 setae, mostly spurlike; tarsal spurs 25–27 μm long. Claws: length: III: 23–27 μm ; rather elongate and fairly thin, longer than width of tarsi, slightly curved, denticle absent; claw digitules marginally longer than claw.

Abdomen: segments I–VII: tergum and sternum of all segments with some reticulations + microtrichia; tergites and sternites only present on segment VII (tergite less obviously); caudal extension of VII small and rounded. Dorsal abdominal setae: with 0–2 hs across each segment. Pleural setae (dorsal + ventral) on each side: I–III: absent; IV–V: 1 or 2 fs + 2 hs; VI: 1–3 fs + 2 or 3 hs; VII: 0–4 fs + 4–6 hs. Ventral abdominal setae (totals across segment): II: 1–5 fs + 0–3 hs; III–VII: 0 or 1 fs + 2–4 hs. Segment VIII: short; tergite only lightly sclerotised, with 3–7 fs + 0–2 hs ante-anal setae; sternite without ventral abdominal setae; with rounded lateral caudal extensions, each with 3 or 4 hs pleural setae. Glandular pouch present, with rather few multilocular disc-pores; glandular pouch setae 70–83 μm long. **Genital segment:** penial sheath rather broad, even broadening towards apex; quite long, length 211–240 μm ; width 65–70 μm at base (ratio of total body length to length of penial sheath 1:0.21). Basal rod probably represented by a short sclerotised groove or series of ridges extending from anterior end of aedeagus to anterior basal membranous area, 37–45 μm long. Aedeagus: 151–166 μm long (ratio length of aedeagus to length of basal rod 1:0.25); quite broad and parallel sided, ending some distance from end of penial sheath. Penial sheath with 5–10 minute setae on each margin and a cluster of small sensilla near apex, giving it a rather saw-like apex.

Comment: the adult males of *L. actites* and *L. scutellaris* are very similar, only differing in a few fairly small details;

the most obvious differences appear to be:

- (i) presence of only 1 or 2 postmesospiracular setae (13 on *L. scutellaris*);
- (ii) presence of fleshy setae ventrally on abdominal segment II (absent on *L. scutellaris*);
- (iii) claw rather short (long and apparently narrower on *L. scutellaris*).

The antennae of *L. actites* are also noticeably short (< 0.5 total body length) whilst those of *L. scutellaris* are noticeably long (> 0.6 total body length).

***Lecanochiton scutellaris* Henderson & Hodgson**

Fig. 45–46, 79

Live appearance: body colour fawn, with black eyes, legs brown and dorsal thoracic band appearing striped dark and light brown; caudal wax filaments rather short, about 3/4 length of wings.

Test: hatbox-shaped, distinctive in having a conical plume of soft wax on flat dorsal area, with sides of box of translucent glassy wax. Tests on upper leaf surfaces, including margins, of host plant.

Material examined: see Appendix for collection details of specimens examined.

Described from 1 specimen in good condition.

Mounted specimen: rather small, length 1.13 mm; antennae of normal length, approximately 2/3 of total body length; body with rather few fleshy setae, these often not easily differentiated from long hs; length of fs on antennae more than 2 \times antennal width. Wings fairly long, about 9/10 of total body length; width about 1/2 wing length. Hamulohalteres absent.

Head: round to oval in dorsal view; width across genae 223 μm . Median crest distinctly polygonally reticulated, with about 3 or 4 hs + 0 or 1 fs on each side. Midcranial ridge: dorsal ridge absent; lateral arms of midcranial ridge distinct: ventral ridge, with short, well-developed lateral branches and extending posteriorly to ocular sclerite; laterally with a few polygonal reticulations posteriorly which fuse with ocular sclerite; with 1–3 fs + 1 or 2 hs vmcres. Genae large, with distinct polygonal reticulations, each reticulation without inner microridges; without genal setae. Simple eyes: 2 pairs, both pairs round; ventral eyes marginally larger: dorsal eyes 41 μm wide; ventral eyes 45 μm wide. Ocelli distinct and quite large, about 13 μm wide, surrounded by an even larger area without reticulations. Ocular sclerite polygonally reticulated throughout except around ocelli, each reticulation with few or no inner microridges. Preocular ridge: ventral arm extending about 2/3 towards midcranial ridge; dorsal arm subequal in length. Dorsal ocular setae absent. Ventral head setae: about 4 or 5 fs + 7 or 8 hs on each side anterior and laterad to ventral

eyes, plus 2 fs between eyes; ventral ocular setae absent. Tentorial bridge well developed. Cranial apophysis with a bifurcate apex; about 23 μm long. **Antennae:** each 718 μm long (ratio of total body length to antennal length 1:64). Scape: 39–41 μm long and 39–41 μm wide; with 1 hs on ventral surface and 1 or 2 hs on dorsal surface. Pedicel: 38–41 μm long, 36–41 μm wide; with distinct polygonal reticulations and 7–9 hs, restricted to ventral surface. Segments III–X each 16–18 μm wide; each fs 36–38 μm long; lengths of segments (μm): III: 66–68; IV: 126–130; V: 104; VI: 95–99; VII: 81; VIII: 75–77 and IX: 70; approximate number of setae per segment: III: 0 or 1 fs + 2 hs (possibly without sensilla basiconica); IV: 12–14 fs: V: 12 or 13 fs; VI: 15 fs: VII: 12–14 fs; VIII: 11–13 + 1 bristle; IX: 13 or 14 fs + 1 bristle. Segment X: length 68 μm ; not constricted apically; with 3 capitate setae, 3 large and 2 small antennal bristles, plus 11 or 12 fs and 1 sensilla basiconica on apex.

Thorax. Prothorax: pronotal ridge well developed, with a broad, striated or reticulated lateral pronotal sclerite. Prosternum with a strong transverse ridge; median ridge short, on a lightly sclerotised, triangular sternite with faint reticulations, and with 9 fs + 4 hs prosternal setae. Anteprosternal setae and antemesospiracular setae (am_1s) absent. **Mesothorax:** prescutum about 2/3 as long as wide: 131 μm wide and 90 μm long; anterior margin rather straight, laterally bounded by prescutal ridges and posteriorly by prescutal suture; not reticulated. Scutum: median membranous area very narrow: width 146 μm , length about 16 μm ; without scutal setae; lateral areas of scutum without reticulations. Scutellum narrow, 148 μm wide and 29 μm long; heavily sclerotised and tubular but possibly open across its entire width; lacking setae. Basisternum about 221 μm wide and 99 μm long; median ridge complete but slightly reduced anteriorly; marginal and precoxal ridges well developed; basisternal setae absent; lateropleurite with a slight extension of marginal ridge; furca well developed, each arm extending nearly to anterior margin. Postalare with some reticulations at anterior end; without postalare setae. Mesothoracic spiracle: width of peritreme 20 μm . Postmesospiracular setae: 13 fs, extending across full width of segment. Tegula well developed, with 2 or 3 hs tegular setae. **Metathorax:** metapostnotum membranous; with 1 hs metatergal seta on each side. Metapleural ridge short, only present ventrally near metacoxae; episternum unsclerotised but with 9 fs postmetaspiracular setae; metepimeron sclerotised but without setae. Metathoracic spiracle: width of peritreme 18 μm . Antemetaspiracular setae absent; dorsospiracular setae: 1–3 fs on each side. Metasternum unsclerotised. Anterior metasternal setae: 34 fs; posterior metasternal setae: 5 fs.

Wings: hyaline, 1025 μm long; 500 μm wide (ratio length to width 1:0.49; ratio of total body length to wing length

1:0.91). Hamulohalteres absent.

Legs: short and rather slender; prothoracic legs marginally longer than other legs. Coxa length (μm): I: 82; II: 98; III: 90; coxa III with about 6 fs + 9 hs; long apical bristle on each coxa about 81 μm long. Trochanter + femur length (μm): I: 209; II: 186; III: 197; trochanter III with 5 fs + 3 hs; long trochanter seta up to 90 μm ; femur III with about 6 fs + 16 hs. Tibia length (μm): I: 185; II: 176; III: 187; tibia III with a total of about 39 setae, some fs, few hs, many setae becoming spurlike on distal third of leg; apical spurs 29 μm long. Tarsi length (μm): I: 107; II: 105; III: 94 (ratio length of tibia III to length of tarsus III 1:0.5); tarsus III with about 28 setae, mostly spurlike; tarsal spurs 27 μm ; tarsal digitule distinctly shorter than length of claw. Claws: length: III: 33 μm ; rather elongate and particularly thin, longer than width of tarsi, slightly curved, denticle absent; claw digitules slightly longer than claw.

Abdomen: segments I–VII: tergum and sternum of all segments with some reticulations + microtrichia; tergites and sternites only present on segment VII (tergite less obvious); caudal extension of VII small and rounded. Dorsal abdominal setae: each with 0 or 1 hs setae on each side. Pleural setae (dorsal + ventral) on each side: I–III: absent; IV–V: 0–2 hs: VI: 0–3 fs + 1–3 hs; VII: 2–5 fs + 2 hs. Ventral abdominal setae (totals): II–V: 2 hs; VI: 0 or 1 fs + 1–3 hs; VII: 0 or 1 fs. Segment VIII: short; tergite only lightly sclerotised; with 5 long hs ante-anal setae; sternite with 1 fs ventral abdominal seta on one side; with rounded caudal extensions, each with 4 hs pleural setae. Glandular pouch present, each with rather few multilocular disc-pores; each glandular pouch seta 94–108 μm long. **Genital segment:** penial sheath quite long: 250 μm long and 82 μm wide at base (ratio of total body length to length of penial sheath 1:0.22), rather broad, even broadening towards apex. Basal rod probably represented by a short sclerotised groove or series of ridges extending anteriorly from about proximal end of aedeagus to basal membranous area: 25 μm long. Aedeagus 164 μm long (ratio length of aedeagus to length of basal rod 1:0.15); quite broad and parallel sided, ending some distance from end of penial sheath. Penial sheath with 6 or 7 minute setae on each margin and a cluster of small sensilla near apex, giving it a rather saw-like tip.

Comment: for a comparison with the male of *L. actites*, see comments under that species above.

PLUMICHITON Henderson & Hodgson

Plumichiton Henderson & Hodgson: Hodgson & Henderson, 2000: 142

Type species: *Plumichiton pollicinus* Henderson & Hodgson

Introduction. This genus was proposed for 6 species: *P. diadema* Henderson & Hodgson, *P. elaeocarpi* (Maskell), *P. flavus* (Maskell), *P. nikau* Henderson & Hodgson, *P. pollicinus* Henderson & Hodgson, and *P. punctatus* Henderson & Hodgson, based on the adult female characters (Hodgson & Henderson 2000). Males were available for all species except *P. diadema* and *P. punctatus*.

Diagnosis based on the adult males of 4 species, *P. elaeocarpi*, *P. flavus*, *P. nikau*, and *P. pollicinus* (significant character-states in italics) (Fig. 80–83).

General: large, except *P. pollicinus*, which is quite small; fleshy setae normal, without extremely flagellate apices; dorsal pores absent.

Head: fs fairly abundant; with 4 pairs of simple eyes, lateral eyes smaller than other eyes; genal setae present; genal reticulations with few or no additional inner microridges; *ocular sclerite and genal reticulations fairly similar*; ventral midcranial ridge with few or no setae; postocular ridge not nearly reaching ocelli (except *P. elaeocarpi*); ocelli large and distinct; each reticulation on ocular sclerite without inner microridges; ventral head setae present laterally on ocular sclerite; ventral head setae present between ventral eyes; *ventral ocular setae present*; tentorial bridge present (possibly absent on *P. pollicinus*); cranial apophysis bifurcated. **Antennae:** short to medium, 0.5–0.6 total body length; with 2 or 3 hs on scape; constriction on segment X present or absent; hs on segments IV–X absent; with 3 capitate setae on segment X. **Prothorax:** lateral pronotal setae present or absent; lateral prothoracic setae absent; median ridge of prosternum absent or poorly developed; with several fs prosternal setae; antemesospiracular setae absent; anteprosternal setae present or absent (absent on *P. elaeocarpi* and *P. pollicinus*). **Mesothorax:** prescutum about 2× wider than long or less; prescutum without reticulations; membranous area of scutum about 3–5× wider than long; membranous area of scutum with both fs and hs; scutum without reticulations anteriorly; scutum not reticulated laterad to scutellum; foramen on scutellum moderate to large; with fs postmesospiracular setae (very few on *P. elaeocarpi* and *P. pollicinus*); median ridge of basisternum well developed; furca moderately long but not reaching anterior border of basisternum; setae laterad to lateropleurite absent; tegular setae present; mesepisternum with or without reticulations; anterior end of postalare lightly reticulated; postalare setae present (occasionally absent on *P. pollicinus*). **Metathorax:** with many fs anterior metasternal setae (few on *P. pollicinus*); with fewer fs posterior metasternal setae (very

few on *P. pollicinus*); with fs postmetaspiracular setae (absent on *P. pollicinus*); metepimeron with or without setae; hamulohalteres absent; *with fs metatergal setae, except P. pollicinus with only 1 pair of hs*; dorsospiracular setae present; setae near mesoprecoxal ridge absent (present on *P. flavus*).

Legs: with 1 tibial spur per tibia; tarsal campaniform pores absent; *trochanter–femur segmentation poorly defined or absent*; *fs on metafemur 3–4× as frequent as hs*; tarsus 1-segmented.

Abdomen: segment VIII of normal length; cicatrices absent; sternites and tergites on segments II–VI absent or poorly sclerotised; fs dorsal abdominal setae present or absent (*P. pollicinus*); fs abdominal setae present, infrequent (*P. pollicinus*) or common; frequency of pleural setae variable but segmentally arranged; with both hs and fs ante-anal setae; caudal extensions on segments VII and VIII fairly distinct and rounded; glandular pouches present or absent; penial sheath about 1/4–1/5 of total body length; *penial sheath constricted towards apex*; basal rod rather variable in length, not nearly reaching basal membranous area; aedeagus short, about 1/3 length of penial sheath and slightly tapering.

Comment. Although *P. pollicinus* appears to be different from the other 3 species, it shares with them 2 important attributes:

- (i) absence or near absence of segmentation between femur and trochanter;
- (ii) distinct constriction to penial sheath near apex (otherwise only found on *C. fagi*).

Males of *Plumichiton* are otherwise very similar to *Aphenochiton* and *Umbonichiton*.

***Plumichiton elaeocarpi* (Maskell)**

Fig. 47, 48, 80

Live appearance: body colour light reddish-brown, with black eyes and wing veins prominent; with a pair of caudal wax filaments of approximately same length as wings.

Test very distinctive; elongate oval in shape, of translucent glassy wax plates, sides raised like a palisade, slightly higher at anterior end, and with a fringing row of long curled glassy plates extending out from top of palisade; median dorsal area covered with a series of soft white wax plumes curling forwards, and with an area of transparent wax through which colour of male shows dorsally between soft wax plumes and margin. On underside of leaves of host plants.

Material examined: see Appendix for collection details of specimens examined.

Described from 2 specimens in fair condition.

Mounted material: large and robust, total body length



Fig. 80 Adult male, *Plumichiton elaeocarpi* (Maskell). Bottom left – a glandular pouch tubular duct and a multilocular disc-pore.

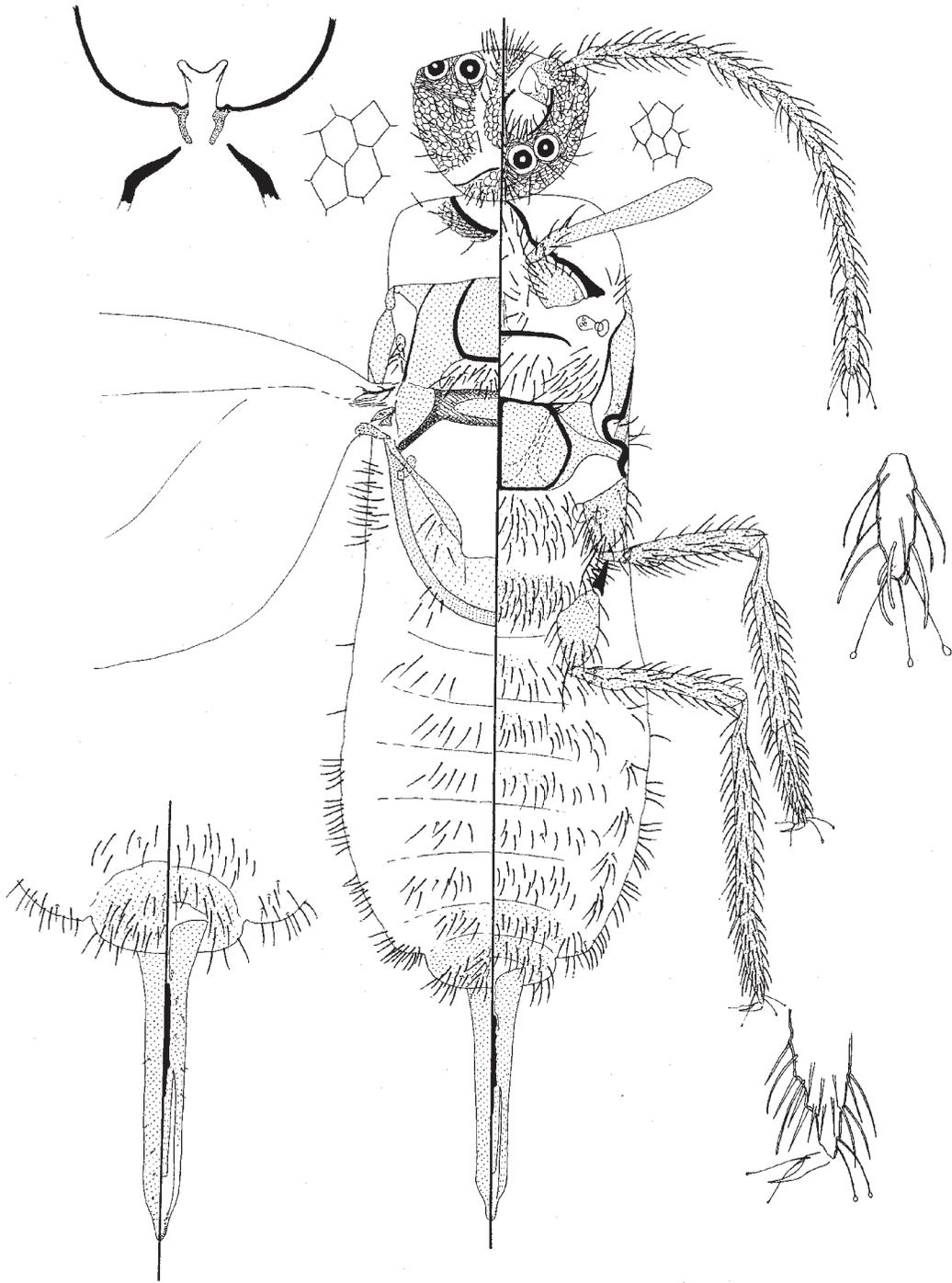


Fig. 81 Adult male, *Plumichiton flavus* (Maskell).

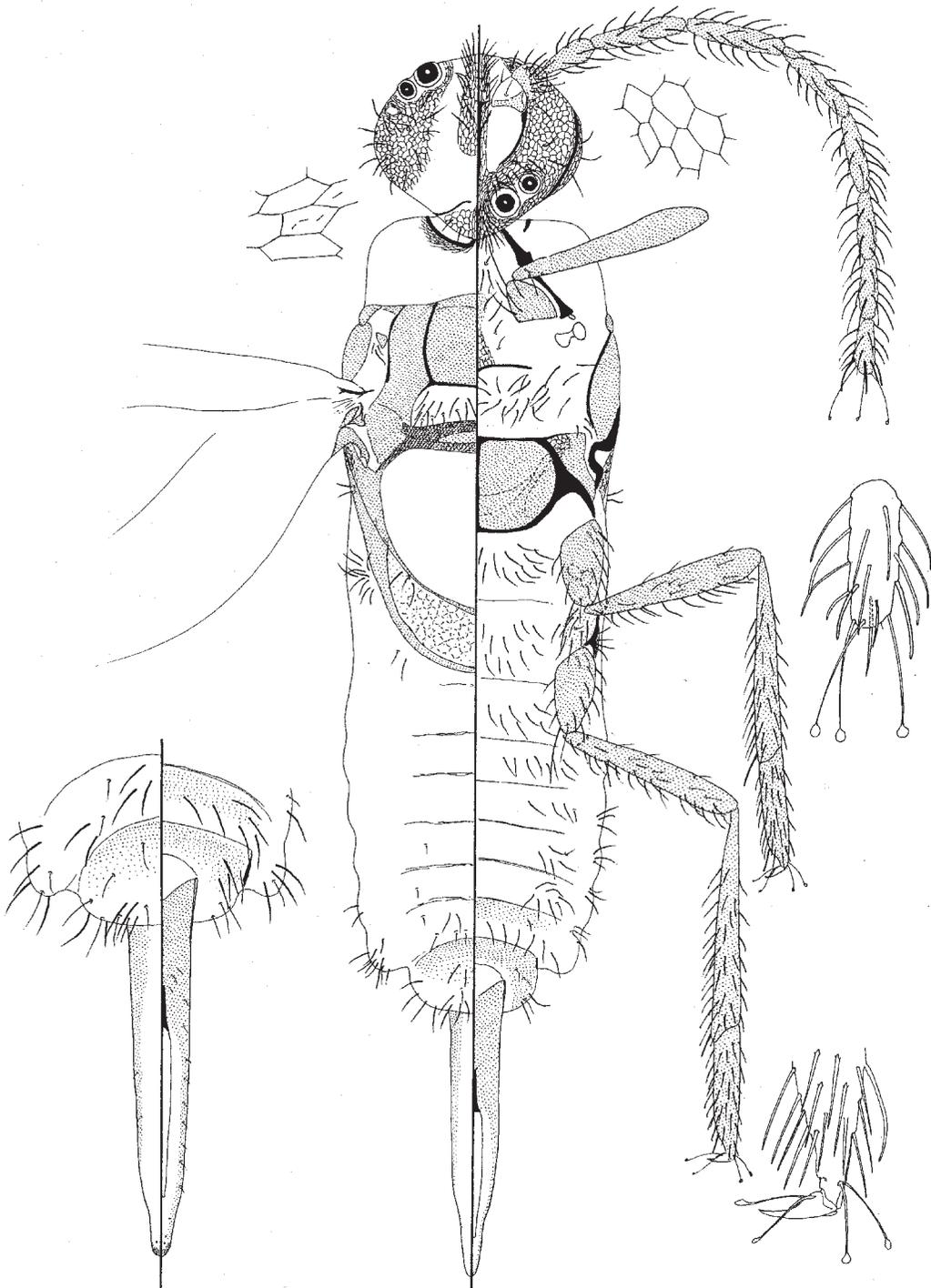


Fig. 82 Adult male, *Plumichiton nikau* Henderson & Hodgson.

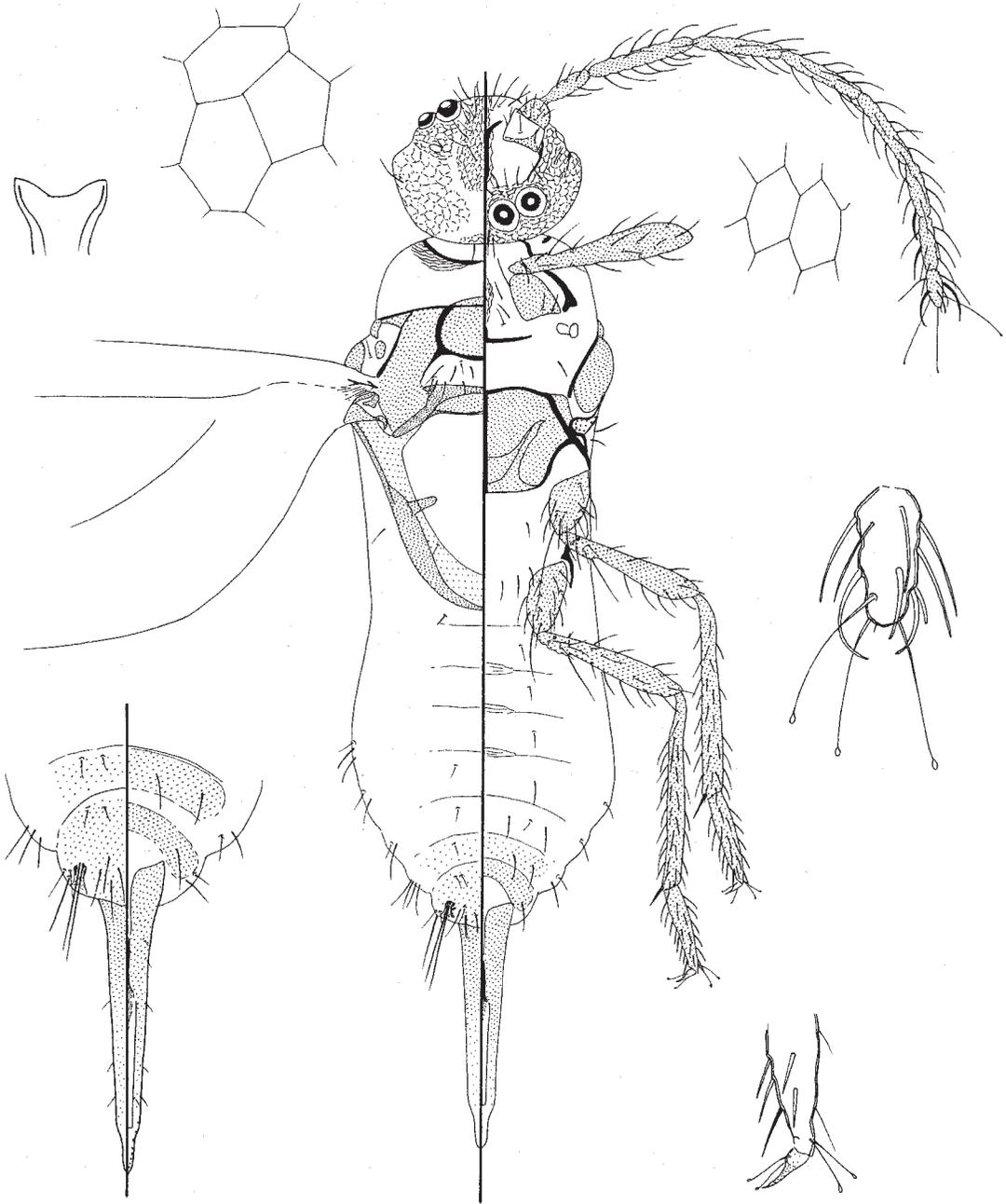


Fig. 83 Adult male, *Plumichiton pollicinus* Henderson & Hodgson.

about 1.9–2.3 mm, width of mesothorax about 486 μm ; antennae quite long; body with numerous (mainly fleshy) setae throughout; fleshy setae generally easy to differentiate from hairlike setae; length of fs on antennae more than twice width of antennal segments. Wings moderately long, about 8/10 of total body length; width just less than 1/2 wing length. Hamulohalteres absent.

Head: approximately quadrangular, tapering posteriorly in dorsal view; length of head 235 μm ; width across genae 266 μm . Median crest reticulated, quite broad throughout but broadest posteriorly on dorsum; with 13–15 fs + 5 or 6 hs dorsal head setae on each side. Midcranial ridge: dorsal ridge absent; lateral arms well-developed; ventral ridge narrow but well-defined, extending posteriorly almost as far as ocular sclerite, with a narrow reticulated border, which extends posteriorly and fuses with ocular sclerite; with only 0–2 fs ventral midcranial ridge setae. Genae large and polygonally reticulated throughout, each reticulation without inner microridges but also with a few spots; genal setae: about 14 fs + 3 hs on each side. Simple eyes: 4 pairs; large dorsal and ventral pairs subequal in width, definitely slightly oval, 57–61x47–54 μm wide; each with a closely associated, slightly smaller, slightly oval, lateral simple eye, 46x40 μm wide. Ocelli distinct. Ocular sclerite polygonally reticulated, each reticulation without inner microridges. Preocular ridge with ventral arm long but not reaching midcranial ridge; dorsal arm subequal in length. Postocular ridge well developed and reaching ocelli dorsally and extending round both anterior and posterior margins. Dorsal ocular setae absent. Ventral head setae: with about 18 fs + 2 or 3 hs each side anterior and laterad to ventral eyes and about 14 fs between eyes; with 0 or 1 ventral ocular seta on each side. Tentorial bridge apparently well defined. Cranial apophysis perhaps 54 μm long, with a shallow distal bifurcation. **Antennae:** 1.20–1.26 mm long (ratio of total body length to antennal length 1:0.6). Scape: 61–65 μm long and 49–54 μm wide, with 2 hs setae. Pedicel: length 61–63 μm , width 52–56 μm ; reticulated, with about 6–17 fs + 2–4 hs, most abundant on ventral surface but with 1 or 2 fs on dorsal surface. Segments III–IX all about 23 μm wide; lengths (μm): III: 98–107; IV: 172–185; V: 155–168; VI: 164–180; VII: 147–156; VIII: 94–119 and IX: 94; fs about 41 μm long; approximate number of setae per segment: III: 13–16 fs + 2 hs + 3 sensilla basiconica sensilla; IV: 31 fs + 0 hs; V: 25 or 26 fs + 0 hs; VI: 33 or 34 fs + 0 hs; VII: 22–33 fs + 0 hs; VIII: 21 or 22 fs + 0 hs + 1 bristle; IX: 14 or 15 fs + 0 hs + 1 bristle. Segment X: length 94–106 μm ; constricted apically, with 3 capitate setae, 5 antennal bristles (3 long + 2 short) and about 11–14 fs; with 2 sensilla basiconica, one almost on apex and one between bases of two bristles.

Thorax. Prothorax: pronotal ridge with strong, striated

lateral pronotal sclerites, but without lateral pronotal setae. Sternum with a strong transverse ridge; median ridge absent; sternite broad and triangular, with polygonal reticulations; prosternal setae: 4–8 fs + 0 or 1 hs on each side. Anteprosternal setae and antemesospiracular setae absent. **Mesothorax:** prescutum about as long as broad (169–195 μm wide and 143–176 μm long); not reticulated. Scutum: median membranous area about three times as wide as long (188–214 μm wide; perhaps 65 μm long); scutal setae: about 21 fs + 4–10 hs; lateral margins of scutum not reticulated. Scutellum 188–200 μm wide and 45–49 μm long; with a moderate-sized foramen. Basisternum about 330–345 μm wide and 169–182 μm long; with a complete, strong median ridge, bounded by strong marginal and precoxal ridges; without basisternal setae; lateropleurite bounded anteriorly by a strong extension from marginal ridge; furca well developed, each arm extending anteriorly nearly to marginal ridge. Postalare not reticulated; probably with 3 or 4 fs postalare setae on each side. Mesothoracic spiracle: width of peritreme 38–41 μm . Postmesospiracular setae: 0 or 1 fs only, just posterior to mesothoracic spiracles. Tegula: small, with a single (fimbriate) tegular seta. **Metathorax:** metapostnotum membranous; with a group of 4 or 5 fs + 1 hs metatergal seta on each side. Metapleural ridge short, only present ventrally near metacoxae; episternum not sclerotised but with 6–8 fs postmetaspiracular setae; metepimeron sclerotised, with 1–3 fs. Metathoracic spiracle: width of peritreme 45–49 μm . Antemetaspiracular setae: probably 3–6 fs present but difficult to separate from dorsospiracular setae; dorsospiracular setae: about 7 or 8 fs. Metasternum membranous. Anterior metasternal setae: about 30 fs; posterior metasternal setae: about 28 fs.

Wings: hyaline; of moderate length (1647–1809 μm) and width (783–810 μm) (ratio length to width 1:0.47; ratio of total body length to wing length 1:0.82). Hamulohalteres absent.

Legs: subequal in length or prothoracic legs marginally longer than other 2 pairs; highly setose. Coxa lengths (μm): I: 135–144; II: 139–152; III: 155–160; coxa III with 30–38 fs + 8–10 hs + 1 longer setae; longest seta about 102–117 μm long. Each trochanter + femur partially or completely fused, with almost no indication of a joint, lengths (μm): I: 365–386; II: 307–316; III: 317–332; trochanter III with about 14–16 fs + 2 or 3 hs; long trochanter seta short or even absent, perhaps 34–36 μm long when present; each femur III with about 34–36 fs + 10–15 hs. Tibia lengths (μm): I: 377–385; II: 344–349; III: 373; tibia III with 91–98 setae, these becoming more spurlike on distal 1/3 of leg; large apical spur about 34–37 μm long. Tarsus lengths (μm): I: 192–197; II: 200–213; III: 192–217 μm long (ratio length of tibia III to length of tarsus III 1:0.55); tarsus III with 59–71 setae, many of them spurlike; distal spur 32–

36 µm long; tarsal digitules slightly shorter than claw. Claws distinctly shorter than width of tarsi, slightly curved, lacking a denticle, length 28–31 µm; claw digitules slightly longer than claw.

Abdomen: segments I–VII: sternites and tergites represented by a moderate sclerotisation on segment VII and slight sclerotisations on VI. Caudal extension of segment VII small and rounded. Dorsal abdominal setae, total across segment: segments I–VI: 4–8 fs + 2–4 hs; VII: 10–12 fs + 2 hs. Pleural setae: dorsopleural setae on each side: I–II: absent; III: 3 fs + 0 hs; IV: 4 fs + 1 hs; V: 6 fs + 1 hs; VI: 12–14 fs + 2–4 hs; ventropleural setae on each side: I–VI: 0–2 hs; VII (dorsopleural + ventropleural setae): 7 fs + 1 hs. Ventral abdominal setae on each side of sternite: II: 4–6 fs + 1 or 2 hs; III: 7 or 8 fs + 1 or 2 hs; IV: 11 fs + 3 hs; V: 13 fs + 1 hs; VI: 11 fs + 1 hs; VII: about 8 fs + 1 hs. Segment VIII: tergite large, without setae on anterior half but with 5–7 pairs fs + 0 or 1 pairs hs ante-anal setae posteriorly; sternite large, with 8 or 9 pairs fs ventral abdominal setae; caudal extension not very pronounced, with 3 fs + 3 hs pleural setae, 2 of them long (on one specimen, up to 130 µm). Glandular pouch present, each with 2 setae, each 145–162 µm long. **Genital segment:** penial sheath quite long: length 534–580 µm, 116–134 µm wide at base, about 1/4 of total body length (ratio of total body length to penial sheath length 1:0.28), distinctly constricted near apex. Basal rod only slightly shorter than aedeagus, length 123–143 µm anterior to aedeagus; anterior end far from basal membranous area anteriorly. Aedeagus 143–156 µm long (ratio length of aedeagus to length of basal rod 1:0.89), of uniform width or narrowing slightly apically. Penial sheath with 5–8 small setae along each margin and with a cluster of small sensilla present near apex.

Comment. The males of *P. elaeocarp* differ from the males of other known *Plumichiton* species in having:

- (i) postocular sclerite extending round ocelli (not nearly reaching ocelli on other 3 species);
- (ii) 1 or no postmesospiracular setae (abundant on the other 3 species);
- (iii) no dorsal ocular setae (present on other 3 species).

Characters which differ between 1 or more of the other 3 species are:

- (i) lateropleurite not reticulated (reticulated on *P. nikau*);
- (ii) absence of antemesospiracular setae (present on *P. flavus*);
- (iii) glandular pouch present (absent on *P. flavus* and *P. nikau*).

In addition, the basal rod is rather long, subequal in length to aedeagus.

Plumichiton flavus (Maskell)

Fig. 49, 81

Live appearance: not recorded for adult male.

Test elongate oval, of rather thick glassy wax plates, sides raised like a palisade, higher at anterior end and sloping down towards posterior end, with row of plates on top of palisade reduced to small curves on margin; median dorsum flat, opaque and without plumes of wax. (Note: test of *P. flavus* probably indistinguishable from that of *P. nikau* below but latter's exclusive host specificity avoids misidentification).

Material examined: see Appendix for collection details of specimens examined.

Described from 4 specimens, 3 in good and 1 in fair condition.

Mounted material: large and robust, total body length about 1.8–2.2 mm; antennae about 1/2 of total body length; body with numerous fleshy setae throughout, these generally easy to differentiate from hairlike setae; length of fs on antennae about twice width of antennal segments. Wings comparatively rather short, less than 3/4 of total body length; width a little less than 1/2 wing length. Hamulohalteres absent.

Head: roundly oval; width across genae about 279–311 µm. Median crest reticulated, with about 14–17 fs + 6 hs dorsal head setae on each side. Midcranial ridge: dorsal ridge absent; lateral arms generally well developed; ventral ridge reaching ocular sclerite posteriorly; with a narrow reticulated border, which broadens posteriorly, fusing with ocular sclerite; with 0–2 fs + 0 or 1 hs on each side only. Genae large and polygonally reticulated throughout, each reticulation without inner microridges; genal setae: with about 23 or 24 fs on each side. Simple eyes: 4 pairs; large dorsal and ventral eyes subequal in width, round, 50–54 µm wide; each with a closely associated, slightly smaller, round, lateral simple eye, width 34 µm (dorsal) and 41–45 µm (ventral). Ocelli distinct. Ocular sclerite sclerotised and polygonally reticulated throughout, each reticulation without inner microridges. Preocular ridge with ventral arm quite long but not reaching midcranial ridge; dorsal arm subequal in length. Postocular ridge well developed but dorsally not nearly reaching ocelli. Dorsal ocular setae: 3–7 fs on each side. Ventral head setae abundant anteriorly and laterad to ventral eyes, with perhaps 30 fs + 2 or 3 hs each side, and with 10 fs between eyes; with 3–5 fs ventral ocular setae on each side. Tentorial bridge well developed. Cranial apophysis with a shallow distal bifurcation, 21–25 µm long. **Antennae:** 1.09–1.17 mm long (ratio of total body length to antennal length 1:0.55). Scape: 61–68 µm long and 64–72 µm wide, with 3 hs. Pedicel: length 41 µm, width 61–65 µm; reticulated, with about 8 or 9 fs + 4 or 5 hs, mostly on

ventral surface but perhaps with 1 or 2 fs on dorsal surface. Segments III–IX all about 21–25 µm wide; lengths (µm): III: 81–92; IV: 174–191; V: 153–180; VI: 142–151; VII: 147–162; VIII: 106–128 and IX: 93–112; fs about 50–54 µm long; approximate number of setae per segment: III: 9–13 fs + 1 hs + 1 sensilla basiconica; IV: 26–51 fs + 0 hs; V: 26–43 fs + 0 hs; VI: 29–40 fs + 0 hs; VII: 30–43 fs + 0 hs; VIII: 25–28 fs + 0 hs + 1 bristle; IX: 19–29 fs + 0 hs + 1 bristle. Segment X: length 74–89 µm; possibly slightly constricted apically; with 3 capitate setae, 3 large + 2 small antennal bristles and about 11–14 fs; with 1 apical sensilla basiconica.

Thorax. Prothorax: pronotal ridge strong, with very broad, reticulated, lateral pronotal sclerites; with 0–7 fs lateral pronotal setae along length of lateral pronotal sclerite (more lateral setae may be lateral prothoracic setae). Sternum with a strong transverse ridge; median ridge absent; sternite broad and triangular, with striations; prosternal setae: about 8–13 fs + 2–4 hs, extending a long way anteriorly. Anteprosternal setae: about 3–7 fs. Antemesospiracular setae in a small group of 4–11 fs. **Mesothorax:** prescutum almost square, 139–176 µm wide and 176–184 µm long; not reticulated. Scutum: median membranous area much wider than long (197–254 µm wide; perhaps 53–66 µm long); scutal setae numerous, about 28 fs + 12 hs; lateral margins not reticulated. Scutellum 184–238 µm wide and 62–66 µm long; with a moderate to large foremen. Basisternum about 254–320 µm wide and 164–172 µm long; with a complete, strong median ridge, bounded by strong marginal and precoxal ridges; without basisternal setae; lateropleurite with a weak extension from marginal ridge anteriorly; furca well developed, each arm extending anteriorly almost to anterior border of basisternum. Postalar punctate at anterior end; with about 5–7 postalar setae. Mesothoracic spiracle: peritreme 27–34 µm wide. Postmesospiracular setae very flagellate: abundant, with about 50–70 fs extending across full width of segment. Tegula: well developed, with 2–5 fs + 1–7 hs tegular setae. **Metathorax:** metapostnotum not sclerotised; with a group of 5–10 fs + 1 hs metatergal seta on each side. Metapleural ridge short, only present ventrally near metacoxae; episternum lightly sclerotised, with 11–23 fs postmetaspiracular setae; metepimeron sclerotised, with 1–3 fs. Metathoracic spiracle: width of peritreme 23–25 µm. Antemetaspiracular setae: possibly about 10–15 fs present but group appears to coalesce with dorsospiracular setae; dorsospiracular setae: about 3 or 4 fs but group perhaps joined to antemetaspiracular setae. Metasternum membranous. Anterior metasternal setae: about 35–50 or more fs; posterior metasternal setae: about 30–60 fs + 1 hs.

Wings: hyaline; of moderate length 1375–1485 µm and width 625–702 µm (ratio length to width 1:0.47; ratio of total body length to wing length 1:0.71). Hamulohalteres absent.

Legs: subequal in length; highly setose. Coxa lengths (µm): I: 98–112; II: 118–147; III: 127–143; coxa III with 23 fs +

5 hs + 2 longer setae; longest setae on each coxa about 43–65 µm long. Trochanter + femur partially or completely fused, usually with only slight signs of segmentation, lengths (µm): I: 311–353; II: 262–287; III: 266–303; trochanter III with about 14 fs + 2 hs; long trochanter seta short or even absent, perhaps 34–36 µm; each femur III with about 44 fs + 10 hs. Tibia lengths (µm): I: 332–364; II: 332–348; III: 340–381; tibia III with about 95 setae, these becoming more spurlike on distal 1/3 of leg; large apical spur about 31–41 µm long. Tarsus lengths (µm): I, II, and III: 168–180 (ratio length of tibia III to length of tarsus III 1:0.48); tarsus III with about 79 setae, many of them spurlike; distal spur 27–33 µm long; tarsal digitules slightly shorter than claw. Claws distinctly shorter than width of tarsi, slightly curved, lacking a denticle, length 21–26 µm; claw digitules slightly longer than claw.

Abdomen: segments I–VII: tergites and sternites represented by light sclerotisation on tergum VII and sternites V–VII. Caudal extension of segment VII small and rounded. Dorsal abdominal setae totals across segment: segments I: 8 fs; II–III: 3–11 fs + 0 hs; IV: 8–15 fs + 0–2; V: 1–12 fs + 2 or 3 hs; VI: 7–18 fs + 2 or 3 hs; VII: 6–13 fs + 2 or 3 hs. Pleural setae: dorsopleural setae on each side: II: 1–3 fs + 0 hs; III–IV: 2–5 fs + 0–2 hs; V–VI: 5–8 fs + 0–2 hs; ventropleural setae on each side: II–VI: 0–7 fs + 0–2 hs; VII (vps + dps): 15–21 fs + 2–10 hs. Ventral abdominal setae totals across segment: II–VII: 11–36 fs + 0–4 hs. Segment VIII: tergite with a broad group of about 9 fs + 2–6 hs ante-anal setae; sternite with a total of about 16–20 fs ventral abdominal setae; caudal extension small, with 7–10 fs + 1 hs pleural setae. Glandular pouch absent. **Genital segment:** penial sheath quite long: length 422–451 µm, 94–106 µm wide at base, about 1/4–1/5 of total body length (ratio of total body to length of penial sheath 1:0.22), constricted near apex; with a rather small basal membranous area. Basal rod 113–144 µm long, subequal in length to or slightly shorter than length of aedeagus; not nearly reaching basal membranous area anteriorly. Aedeagus short, 127–151 µm long (ratio length of aedeagus to length of basal rod 1:0.92), parallel-sided, apex not nearly reaching apex of penial sheath. Penial sheath with 7–10 small setae along each margin and with a cluster of small sensilla present near apex.

Comment. The males of *P. flavus* differ from those of other known *Plumichiton* species in having antemesospiracular setae (absent on the other 3 species). Other characters which differ from 1 or more of the other 3 species are:

- (i) postocular sclerite not nearly reaching ocelli (reaches ocelli on *P. elaeocarpi*);
- (ii) presence of dorsal ocular setae (absent on *P. elaeocarpi*);
- (iii) lateropleurite not reticulated (reticulated on *P. nikau*);
- (iv) presence of numerous postmesospiracular setae (absent or rare on *P. elaeocarpi*);
- (v) glandular pouch absent (present on *P. elaeocarpi* and *P. pollicinus*).

In addition, it has:

- (i) anteprosternal setae (as on *P. nikau*);
- (ii) basal rod quite long, subequal in length to aedeagus;
- (iii) no obvious long trochanter seta.

Plumichiton nikau Henderson & Hodgson

Fig. 50, 82

Live appearance: reddish-brown with paler abdomen, antennae, and legs, and with black eyes; caudal wax filaments absent.

Test elongate oval, of rather thick glassy wax plates, sides raised like a palisade, higher at anterior end and sloping down towards posterior end, with row of plates on top of palisade reduced to small curves on margin; median dorsum flat, opaque, and without any plumes of wax. (Note: test of *P. nikau* probably indistinguishable from that of *P. flavus* above, but *P. nikau* host specific on *Rhopalostylis sapida*).

Material examined: see Appendix for collection details of specimens examined.

Described from 3 specimens, 2 in good condition, 1 rather distorted.

Mounted material: quite large and robust, total body length about 1.72–1.88 mm; antennae comparatively short, only just over 1/2 total length of body; body fairly hirsute, with fleshy setae fairly frequent on both dorsal and ventral surfaces, these generally easy to differentiate from hairlike setae; length of fs on antennae only slightly longer than width of antennal segments. Wings quite long, about 8/10 of total body length; width about 1/2 wing length. Hamulohalteres absent.

Head: approximately round to oval in dorsal view; length 241–279 μm , width across genae 285–311 μm . Median crest reticulated, with about 7–13 fs + 15–19 hs dorsal head setae on each side. Midcranial ridge: dorsal ridge absent; ventral ridge and lateral arms less well defined than on some other species or even absent but, when present, ventral ridge reaching ocular sclerite posteriorly; with a quite broad reticulated border which extends posteriorly and fuses with ocular sclerite; with 0 or 1 fs + 0–2 hs ventral midcranial ridge setae. Genae large and polygonally reticulated throughout, each reticulation with an occasional inner microridge and some spots posteriorly; genal setae: about 10–15 fs + 0 or 1 hs on each side. Simple eyes: four pairs; large dorsal and ventral pairs subequal in size, round, 48–52 μm wide; each with a closely associated, slightly smaller, round, lateral simple eye, each 39–44 μm wide. Ocelli distinct, each about 25 μm wide. Ocular sclerite polygonally reticulated, a few reticulations with inner microridges. Preocular ridge with ventral arm reaching 2/3 of way to midcranial ridge; dorsal ridge slightly shorter or subequal in length. Postocular ridge well developed but not nearly reaching ocelli dorsally. Dorsal ocular setae: 2 or 3 fs on each

side. Ventral head setae: with 8–11 fs + 4–7 hs on each side anterior and laterad to ventral simple eyes, about 6 fs + 6 hs between eyes and with 0–2 fs ventral ocular setae on each side. Tentorial bridge well developed. Cranial apophysis 36 μm long and bifid. **Antennae:** 937–1150 μm long (ratio of total body length to antennal length 1:0.58). Scape: 54–59 μm long and 51–59 μm wide; with 1 hs on ventral surface and 2 hs on inner margin. Pedicel: length 33–42 μm , width 44–52 μm ; reticulated, with 3–8 fs + 3–5 hs (no setae on dorsal surface). Segments III–IX all about 21–27 μm wide; lengths (μm): III: 81–92; IV: 136–186; V: 142–164; VI: 121–148; VII: 114–146; VIII: 91–105 and IX: 84–98; fs about 25–37 μm long; approximate number of setae per segment: III: 5–8 fs + 1 or 2 hs (possibly with no sensilla basiconica); IV: 25–35 fs + 0 hs; V: 23–34 fs + 0 hs; VI: 32–34 fs + 0 hs; VII: 32–36 fs + 0 hs; VIII: 20–27 fs + 0 hs + 1 bristle and IX: 22–27 fs + 0 hs + 1 bristle. Segment X: length 81–92 μm ; not constricted apically; with 3 capitate setae, 3 large + 2 small antennal bristles and 13–15 fs; possibly with only 1 apical sensilla basiconica.

Thorax. Prothorax: pronotal ridge strong, with a broad reticulated lateral pronotal sclerite; without lateral pronotal setae. Sternum with a strong transverse ridge; median ridge absent or very short; sternite broad and triangular, with faint striations, becoming rather reticulated between and just anterior to coxae; prosternal setae: 2 or 3 fs + 1 hs on each side; anteprosternal setae: 4–7 fs + 0 or 1 hs. Antemesospiracular setae absent. **Mesothorax:** prescutum distinctly wider than long (156–178 μm wide and 107–149 μm long); without striations or reticulations medially. Scutum: median membranous area much wider than long (185–198 μm wide; perhaps 33–62 μm long); scutal setae: 9–16 fs + 14–25 hs; lateral margins of scutum not reticulated. Scutellum 176–223 μm wide and 53 μm long; with a moderately large foramen. Mesopostnotum lightly reticulated. Basisternum about 260–294 μm wide and 144–162 μm long; with a complete, strong median ridge, bounded by strong marginal and precoxal ridges; without basisternal setae; lateropleurite with a narrow sclerotised extension from marginal ridge anteriorly; slightly reticulated near marginal ridge; furca well developed, each arm extending anteriorly almost to marginal ridge. Postalare reticulated at anterior end, with 2 or 3 fs postalare setae on each side. Mesothoracic spiracle: peritreme 26–29 μm wide. Postmesospiracular setae: total about 22–30 fs + 2–7 hs, extending across full width of segment. Tegula: well developed, with 1 or 2 fs + 0–2 hs tegular setae. **Metathorax:** metapostnotum not sclerotised; metatergal setae rather hard to see, but perhaps with 0–2 fs + 0 or 1 hs on each side. Metapleural ridge short, only present ventrally near metacoxae; episternum slightly sclerotised, with 8–13 fs + 0 or 1 hs postmetaspiracular setae; metepimeron sclerotised, with about 4 fs. Metathoracic spiracle: width of peritreme 29–32 μm . Antemetaspiracular setae and dorsospiracular setae hard to separate, former possibly absent, latter per-

haps 3–12 fs on each side. Metasternum lightly sclerotised. Anterior metasternal setae: 24–26 fs + 0–3 hs; posterior metasternal setae: 21–31 fs + 0–2 hs.

Wings: hyaline, of moderate length (1400–1500 µm) and width (675–875 µm) (ratio length to width 1:0.56; ratio of total body length to wing length 1:0.81). Hamulohalteres absent.

Legs: prothoracic legs subequal to or slightly longer than meso- and metathoracic legs. Coxa lengths (µm): I: 90–116; II: 114–132; III: 106–141; coxal III setae: about 17–22 fs + 6–9 hs; long apical setae about 61–101 µm long. Trochanter + femur lengths (µm): I: 307–360; II: 258–310; III: 262–319; trochanter III with about 13 fs + 1 or 2 hs; femur III with about 26–45 fs + 7–23 hs; long trochanter seta short, only about 30–38 µm long; segmental line between trochanter and femur indistinct or absent. Tibia lengths (µm): I: 315–364; II: 291–332; III: 303–356; tibia III with about 75–100+ setae, many spurlike on distal third of leg; large apical spur 31–36 µm long. Tarsus lengths (µm): I: 164–173; II: 176–186; III: 166–186 µm long (ratio length of tibia III to length of tarsus III 1:0.53); tarsus III with about 100 setae, many spurlike on distal third; tarsal spur 28–33 µm long; tarsal digitules not quite as long as claw. Claws slightly shorter than width of tarsi, slightly curved, perhaps with indications of a minute denticle; length: III: 23–25 µm; claw digitules a little longer than claw.

Abdomen: segments I–VII: tergites represented by slight sclerotisation on segment VII and sternites by slight sclerotisation on segments VI–VII. Caudal extension of segment VII small and rounded. Dorsal abdominal setae: totals across segment: I–V: 0 or 1 fs + 0–3 hs; VI–VII: 3–7 fs + 1–3 hs. Pleural setae: on each side: dorsopleural setae: I–III: 0 or 1 fs + 0 hs; IV: 1–4 fs + 0–3 hs; V: 0–3 fs + 0 or 1 hs; VI: 2 or 3 fs + 1 or 2 hs; ventropleural setae on each side: II–VI: 0–3 fs + 0–3 hs; VII (dps + vps): 5–12 fs + 3–5 hs. Ventral abdominal setae: totals across segment: II: 15–20 fs + 0–2 hs; III–VI: 10–12 fs + 0–4 hs; VII: 2–6 fs + 0–2 hs. Segment VIII: tergite moderately sclerotised, with 13 fs + 1 or 2 hs ante-anal setae covering most of tergite; sternite moderately sclerotised, with 4–7 fs + 0–2 hs ventral abdominal setae; caudal extension small, with 2–5 fs + 2–6 hs pleural setae, one generally rather longer than others, 40–45 µm long. Glandular pouch absent. **Genital segment:** penial sheath quite long, length 434–448 µm, width at base 79–104 µm (ratio of total body length to penial sheath length 1:0.23); distinctly constricted near apex. Basal rod not nearly reaching basal membranous area anteriorly; rather short, length 78–80 µm anterior to base of aedeagus, extending a further 50 µm within aedeagus. Aedeagus 166–186 µm long (ratio length of aedeagus to basal rod length 1:0.45), slightly narrower basally than medially. Penial sheath with 10–13 small setae along each margin and with a cluster of about 10–15 small sensilla present near apex.

Comment. The males of *Plumichiton nikau* differ from

those of other known species of *Plumichiton* in having lateropleurites with some reticulations. Other characters which differ from 1 or more of the other 3 species are:

- (i) postocular sclerite not reaching ocelli (reaches ocelli on *P. elaeocarp*);
- (ii) postmesospiracular setae abundant (rare or absent on *P. elaeocarp*);
- (iii) absence of antemesospiracular setae (present on *P. flavus*);
- (iv) presence of fleshy metatergal setae (absent on *P. pollicinus*);
- (v) glandular pouch absent (present on *P. elaeocarp* and *P. pollicinus*).

In addition, *P. nikau* has:

- (i) quite broad wings, width about 1/2 wing length;
- (ii) a short basal rod;
- (iii) a rather long aedeagus, more than 2× length of basal rod.

Plumichiton pollicinus Henderson & Hodgson

Fig. 51, 83

Live appearance: not recorded for adult male.

Test elongate oval, of rather thick glassy wax plates, sides raised, higher at anterior end and sloping down towards posterior end, with a fringing row of thick pointed plates on top of this palisade extending beyond margin; dorsum medially with several curled plumes of thick glassy wax which become fused with age. On uppersides of leaves of host plants.

Material examined: see Appendix for collection details of specimens examined.

Described from 2 specimens in good condition.

Mounted material: moderate in size, total body length about 1.25 mm, width of mesothorax about 280 µm; antennae nearly 2/3 of total body length; body with frequent (mainly fleshy) setae throughout; fleshy setae generally easy to differentiate from hairlike setae; length of fs on antennae more than twice width of antennal segments. Wings moderately long, about 9/10 of total body length; width less than half wing length. Hamulohalteres absent.

Head: approximately oval; length from apex to neck region about 170 µm; width across genae 232 µm. Median crest reticulated, quite broad throughout but broadest posteriorly; with 2 or 3 fs + 10 or 11 hs dorsal head setae on each side. Midcranial ridge: dorsal ridge absent; lateral arms well-developed; ventral arm narrow but well-defined, extending posteriorly to ocular sclerite, with a narrow reticulated border, which extends posteriorly and fuses with ocular sclerite; without ventral midcranial ridge setae. Genae large and polygonally reticulated throughout, each reticulation quite large, with only an occasional inner microridges; genal setae: 1 or 2 fs on each side. Simple eyes: 4 pairs; large

dorsal and ventral pairs subequal in width and more or less round, each about 33 μm wide; each with a closely associated, slightly smaller, round lateral simple eye, each 26 μm wide. Ocelli distinct, about 18–20 μm wide. Ocular sclerite polygonally reticulated, each reticulation much smaller than on genae and with inner microridge only present in reticulations near ventral eyes. Preocular ridge: with ventral arm reaching about half way to midcranial ridge; dorsal arm subequal or slightly longer in length. Postocular ridge well developed but not reaching ocelli dorsally. Dorsal ocular setae: 0 or 1 on each side. Ventral head setae: with about 3–5 fs + 2–5 hs on each side anterior and laterad to ventral eyes, and about 2 fs + 2 hs between eyes; without ventral ocular setae on each side. Tentorial bridge apparently absent. Cranial apophysis short, perhaps 33 μm long, with a shallow distal bifurcation. **Antennae:** 775 μm long (ratio of total body length to antennal length 1:0.62). Scape: 42 μm long and 38 μm wide, with 1 hs ventrally and 2 hs mediolaterally. Pedicel: length 36 μm , width 33 μm ; reticulation indistinct; with 5 or 6 hs, mostly on ventral surface. Segments III–IX all about 15–20 μm wide; lengths (μm): III: 63–66; IV: 134–140; V: 114–117; VI: 107–109; VII: 101–103; VIII: 68–73 and IX: 61–67; fs about 31–33 μm long; approximate number of setae per segment: III: 2 or 3 fs + 2–4 hs (no sensilla basiconica detected); IV: 16–18 fs + 0 hs; V: 13 or 14 fs + 0 hs; VI: 15 fs + 0 hs; VII: 15 or 16 fs + 0 hs; VIII: 10 or 11 fs + 0 hs + 1 bristle; IX: 10–13 fs + 0 hs + 1 bristle. Segment X: length 48–50 μm ; not obviously constricted apically, with 3 capitate setae, 5 antennal bristles (3 long + 2 short) and about 6–8 fs; with 2 sensilla basiconica, 1 almost on apex and 1 between bases of 2 bristles.

Thorax. Prothorax: pronotal ridge with strong, striated lateral pronotal sclerites, but without lateral pronotal setae. Sternum with a strong transverse ridge; median ridge slightly indicated; sternite broad and triangular, with polygonal reticulations; prosternal setae: 2 fs + 1 hs on each side. Anteprosternal setae and antemesospiracular setae absent. **Mesothorax:** prescutum 137 μm wide and 85 μm long; not reticulated. Scutum: median membranous area much wider than long, 137 μm wide and perhaps 33–37 μm long; scutal setae: about 4–6 fs + 2 or 3 hs; lateral margins of scutum not reticulated. Scutellum 145 μm wide and 33 μm long; with a large foramen. Basisternum about 207 μm wide and 124 μm long; with a complete, strong median ridge, bounded by strong marginal and precoxal ridges; without basisternal setae; lateropleurite probably rather narrow, possibly with a short extension from marginal ridge; furca well developed, each arm extending anteriorly more than half way to marginal ridge. Postalare not reticulated; with 0 or 1 fs postalare setae on each side. Mesothoracic spiracle: width of peritreme 17–19 μm . Postmesospiracular setae: 0 or 1 fs only, just posterior to mesothoracic spiracles. Tegula: small, with a single hs tegular seta. **Metathorax:** metapostnotum

membranous; with 1 hs metatergal seta on each side. Metapleural ridge short, only present ventrally near metacoxae; episternum not sclerotised but with about 4 fs + 1 hs postmetaspiracular setae; metepimeron sclerotised. Metathoracic spiracle: width of peritreme probably similar to mesothoracic but spiracles unclear. Antemetaspiracular setae: possibly absent; dorsospiracular setae: 0 or 1 fs on each side. Metasternum sclerotised on posterior half. Anterior metasternal setae: about 1 fs on each side; posterior metasternal setae: a total of 6 fs.

Wings: hyaline; of moderate length, 1100 μm long and 475 μm wide (ratio length to width 1:0.43; ratio of total body length to wing length 1:0.88). Hamulohalteres absent.

Legs: subequal in length or prothoracic legs marginally longer than other 2 pairs. Coxa lengths (μm): I: 78–80; II: 86–92; III: 93–96; coxa III with 9–11 fs + 6 or 7 hs + 1 longer seta; longest seta about 51–59 μm long. Trochanter + femur completely fused, with no indication of segmentation, lengths (μm): I: 235–240; II: 186–190; III: 194–203; trochanter III with about 3–5 fs + 3 or 4 hs; long trochanter seta 41–45 μm long; each femur III with about 15–17 fs + 6 or 7 hs. Tibia lengths (μm): I: 256–259; II: 231–240; III: 252–261; tibia III with 50–52 setae, these becoming more spurlike on distal 1/3 of leg; large apical spur about 20–25 μm long. Tarsus lengths (μm): I: 115–118; II: 120–125; III: 117–120 (ratio length of tibia III to length of tarsus III 1:0.46); tarsus III with 30–32 setae, many of them spurlike; distal spur 23 μm long; tarsal digitules distinctly shorter than claw. Claws subequal to width of tarsi, slightly curved, with a hint of a denticle, length 22–24 μm ; claw digitules slightly longer than claw.

Abdomen: segments I–VII: sternites and tergites represented by a slight sclerotisation on all segments but especially VII. Caudal extension of segment VII small and rounded. Dorsal abdominal setae (totals across segment): fs absent: segments I–V: 0–2 hs; VI–VII: 2–4 hs. Pleural setae: dorsopleural setae on each side: I–IV: absent; V–VI: 0–2 fs + 1 hs; VII: 3–5 fs + 1 hs; ventropleural setae: I–IV: absent; V–VI: 1 hs; VII 3–5 fs + 1 hs. Ventral abdominal setae, totals across segment: II–V: 0 fs + 0 or 1 hs; VI: 1 or 2 fs + 1 or 2 hs; VII: 1 or 2 fs. Segment VIII: tergite large, without setae on anterior half but with 7 fs + 2 hs ante-anal setae posteriorly; sternite large, with 1 fs ventral abdominal seta on each side; caudal extension not very pronounced, with 2 fs (one rather long: 42 μm) + 2 hs pleural setae. Glandular pouch present, each with 2 relatively short setae, 73–77 μm long. **Genital segment:** penial sheath quite long: length 315 μm , width at base 75 μm , about 1/4 of total body length (ratio of total body length to penial sheath length 1:0.25), with a distinct constriction near apex. Basal rod much shorter than aedeagus, length 58 μm anterior to aedeagus; anterior end 60 μm from basal membranous area anteriorly.

Aedeagus 130 µm long (ratio length of aedeagus to length of basal rod 1:0.45), gradually narrowing towards apex. Penial sheath with 6 small setae along each margin and with a cluster of small sensilla present near apex.

Comment. On the basis of these specimens, the male of *P. pollicinus* differs from the males of the other *Plumichiton* described here in having:

- (i) few setae on gena;
- (ii) few postmesospiracular setae (as on *P. elaeocarpi*);
- (iii) few anterior metasternal setae;
- (iv) few dorsospiracular setae (and perhaps no antemetaspiracular setae);
- (v) only *hs* metatergal setae;
- (vi) no *fs* dorsal abdominal setae and very few *fs* ventral abdominal setae, and
- (vii) a pair of glandular pouches (as on *P. elaeocarpi*).

However, it shares 2 important attributes with the other three species:

- (i) the absence or near absence of segmentation between the femur and trochanter;
- (ii) the distinct constriction to the penial sheath near its apex (otherwise only found on *C. fagi*).

It is, perhaps, worth noting that the presence of glandular pouches is not a synapomorphic character-state for species in the genus *Plumichiton*. In addition, the absence of a segmental line between the trochanter and femur was previously thought to be a characteristic of male Lecanodiaspididae but is now known from several Coccidae, the above *Plumichiton* species and *Cribropulvinaria tailungensis* Hodgson & Martin (Hodgson & Martin 2001).

POROPEZA Henderson & Hodgson

Poropeza Henderson & Hodgson: Hodgson & Henderson, 2000: 159

Type species: *Ctenochiton dacrydii* Maskell

Introduction: the genus *Poropeza* was proposed for 2 atypical species, *Poropeza cologabata* Henderson & Hodgson and *P. dacrydii* (Maskell) (Hodgson & Henderson 2000). The biology of these 2 species appeared to be unusual, possibly involving the youngest female instars feeding on the roots, while the 3rd instar and adult females, with new 1st instars, being found beneath bark on the trunks of their host trees. Because of this unique habit, it was considered (Hodgson & Henderson 2000: 165) that species in this genus were likely to be parthenogenetic. However, the discovery of some very unusual males, which are not congeneric with any other known males from New Zealand, on the same host plant species in the same locality as adult female *P. dacrydii*, lead to further investigation. Male and female nymphs were collected over several months from the leaves and young stems of host trees at the above

locality and reared in the laboratory (see under Material examined). These have been identified as belonging to *P. dacrydii* through association with its 1st-instar nymphs, which are very distinctive, with 2 pairs of long pregenital setae. No males of *P. cologabata*, either nymphs or adults, have yet been found.

Diagnosis based on the adult male of *P. dacrydii* only (significant character-states in italics) (Fig. 84).

General: large; *fleshy setae with extremely flagellate apices; convex pores (dp) present on dorsum of head, thorax and abdomen.*

Head: *hs and fs setae abundant;* with 4 pairs of simple eyes, lateral eyes smaller than other eyes; genal setae present; genal reticulations faint, without inner microridges; ocular sclerite and genal reticulations fairly similar, but latter more distinct; ventral midcranial ridge with many *fs* and *hs*; postocular ridge not nearly reaching ocelli; ocelli indistinct; each reticulation on ocular sclerite without inner microridges; ventral head setae present laterally on ocular sclerite; ventral head setae present between ventral eyes; *ventral ocular setae present;* tentorial bridge well developed; cranial apophysis bifurcated. **Antennae:** short, 0.5 total body length; *with 6+ hs on scape;* segment X slightly constricted; *with many hs on segments IV–X;* with 3 capitate setae on antennal segment X.

Thorax. Prothorax: lateral pronotal setae absent; *lateral prothoracic setae present both anteriorly and posteriorly;* median ridge of prosternum absent; *with abundant fs prosternal setae which extend both laterally and anteriorly;* antemesospiracular setae possibly present; anteprosternal setae present. **Mesothorax:** prescutum about 2× wider than long or less; prescutum with faint reticulations; membranous area of scutum about 2–3× wider than long; membranous area of scutum with many *fs* and *hs*; reticulations anteriorly on scutum absent; scutum not reticulated laterad to scutellum; foramen on scutellum large; *with fs and hs postmesospiracular setae;* median ridge of basisternum well developed; furca moderately long but not reaching anterior border of basisternum; *setae laterad to lateropleurite present;* tegular setae present; *mesepesternum with reticulations;* anterior end of postalare lightly reticulated; with many postalare setae. **Metathorax:** *with many fs and hs anterior metasternal setae;* with many *fs* and *hs* posterior metasternal setae; with *fs* and *hs* postmetaspiracular setae; metepimeron without setae; hamulohalteres absent; *with fs and hs metatergal setae;* dorsospiracular setae present; setae near mesoprecoxal ridge absent. **Legs:** with 1 tibial spur per tibia; tarsal campaniform pores absent; trochanter–femur segmentation distinct; *hs on metafemur 2–3× as frequent as fs;* legs rather long; *long coxal and trochanter setae absent;* tarsus 1-segmented.

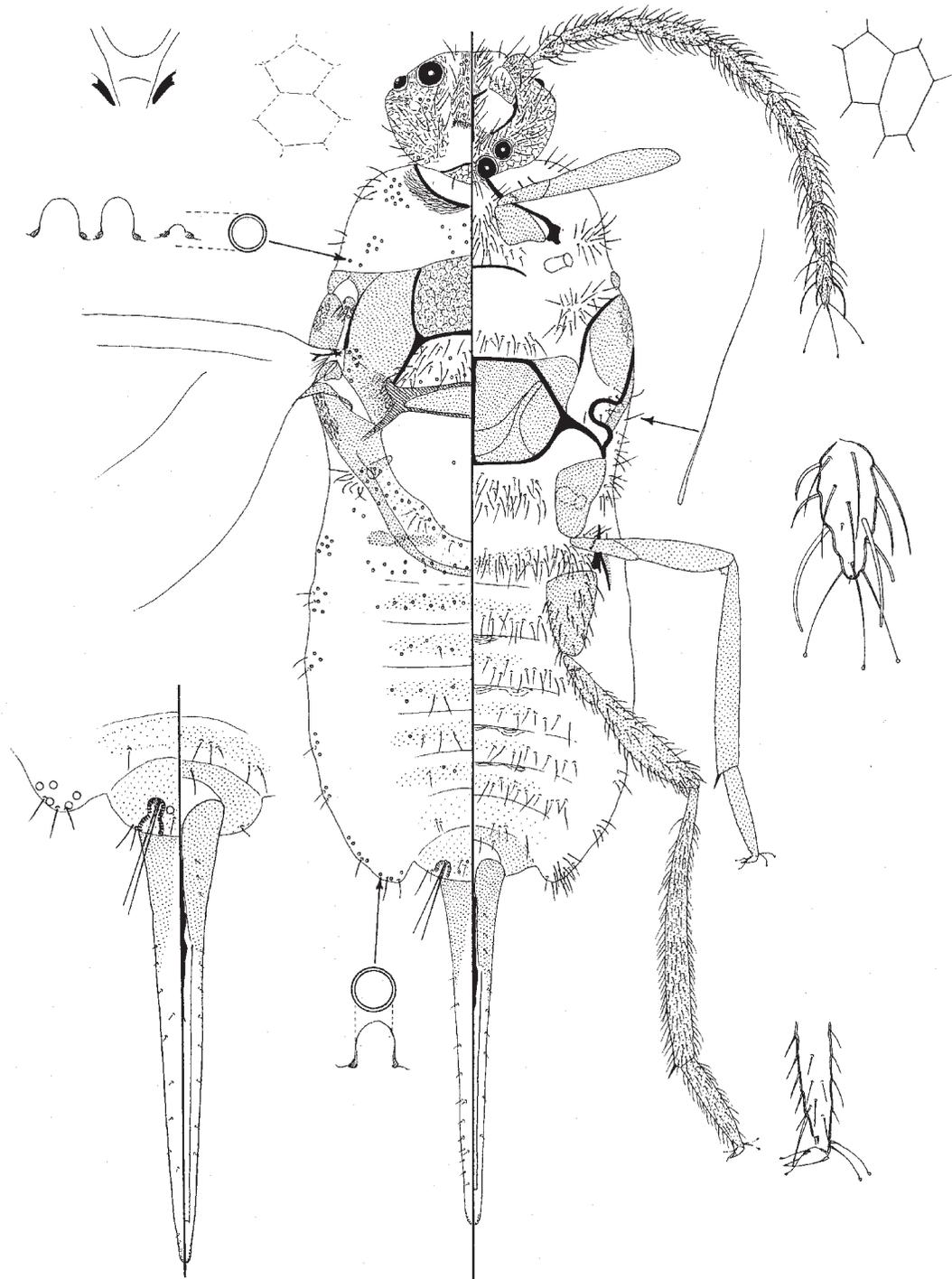


Fig. 84 Adult male, *Poropeza dacrydii* (Maskell).

Abdomen: segment VIII of normal length; cicatrices absent; sternites and tergites on segments II–VI moderately sclerotised; dorsal abdominal setae few, hs and fs; ventral abdominal setae abundant, mainly hs; pleural setae few, segmentally arranged; with 1 or 2 pairs hs ante-anal setae; caudal extensions on segment VII large and rounded; that of segment VIII small and rounded; glandular pouches present; *penial sheath long, about 1/3rd total body length*; penial sheath gradually narrowing towards sharp apex; basal rod short, not reaching basal membranous area; aedeagus quite long, about 1/3–1/2 length of penial sheath and almost parallel sided.

Comment. As with the adult females, the adult males of *P. dacrydii* are quite unlike any other known male in the family Coccidae. The presence of convex pores over much of the dorsum and the abundance of hs throughout makes this a very distinctive species.

Poropeza dacrydii Henderson & Hodgson

Fig. 52–54, 84

Live appearance: dark red-brown with black eyes; a pair of caudal wax filaments present.

Test convex, of translucent glassy wax; plates in median row not much larger than submedian or submarginal plates; each plate convex, giving a uniformly knobby appearance. On twigs or leaves of host plant.

Material examined: see Appendix for collection details of specimens examined.

Described from 5 specimens in fair to good condition and another in poor condition.

Mounted material: large and robust, total body length about 1.78–2.15 mm, width across mesothorax about 463–508 μm ; with fairly short antennae, about half total body length; body extremely hirsute, with numerous fs and hs setae throughout, including appendages; fleshy setae easy to differentiate from hairlike setae; hairlike setae rather variable but often very flagellate, up to 50 μm long; length of fs on antennae short, subequal to width of antennal segments. Also with numerous convex pores (dp), 6–9 μm in diameter, throughout membranous areas of dorsum. Wings rather short and wide, about 0.6 \times total body length. Hamulohalteres absent.

Head: oval to 5-sided in dorsal view but ventral eyes probably on a pronounced posteroventral cone when viewed from side; length about 231–244 μm ; width across genae 230–250 μm . Median crest quite broad dorsally but narrow ventrally; with 11–16 fs + 4–7 hs dorsal head setae plus 5–11 dp on each side; postoccipital sclerite sometimes dimly indicated. Midcranial ridge: dorsal ridge ab-

sent; ventral ridge narrow but well-defined, extending posteriorly as far as ocular sclerite and with well-developed lateral arms anteriorly; with a narrow reticulated margin anteriorly which broadens posteriorly where it joins ocular sclerite; with 3–7 fs + 1–5 hs ventral midcranial ridge setae. Preocular ridge distinct and extending posteriorly about 3/4 of way to midcranial ridge; dorsal ridges subequal in length to ventral ridges. Genae large; polygonal reticulations most distinct anteriorly, each reticulation lacking inner microridges but perhaps with small dots; reticulations fading posteriorly; genal setae: with about 16–26 fs + 9–15 hs plus 0–3 dp on each side. Simple eyes: four pairs: large dorsal eyes slightly smaller than large ventral eyes: dorsal eyes 45–50 μm wide, ventral eyes 50–54 μm wide; each with a closely associated, slightly smaller, oval to round, lateral simple eye, each 30–40 μm wide. Ocular sclerite polygonally reticulated, each reticulation more distinct than those on gena, without inner microridges. Postocular ridge not nearly reaching ocelli dorsally, but appearing to become bifurcate near dorsal apex. Dorsal ocular setae: 0–3 fs + 0–4 hs plus 0–3 dp on each side. Ventral head setae: rather abundant, with about 21–25 fs + 13–24 hs each side anterior and laterad to ventral eyes and at least 3–14 fs + 1 hs between ventral eyes; and 1–5 fs + 0 or 1 hs ventral ocular setae on each side. Tentorial bridge well developed. Cranial apophysis with a shallow distal bifurcation; length 36–42 μm . **Antennae:** short, 840–1100 μm long (ratio of total body length to length of antennae 1:0.50); all segments with numerous hs. Scape: 41–58 μm long and 58–63 μm wide, with 6–11 hs, mainly on ventral surface. Pedicel: length 46–67 μm , width 48–60 μm ; lightly reticulated, with about 3–8 fs + 10–14 hs, mainly on ventral surface. Segments III–IX all of rather uniform width, about 33–40 μm wide; lengths (μm): III: comparatively short and club-shaped, 71–83; IV: 109–150; V: 126–170; VI: 119–153; VII: 108–133; VIII: 104–112 and IX: 69–108; fs about 36–38 μm long; approximate number of setae per segment: III: 8–11 fs + 5–11 hs (no sensilla basiconica noted); IV: 31–33 fs + 12–14 hs; V: 39–41 fs + 15 or 16 hs; VI: 34–42 fs + 11–18 hs; VII: 31–38 fs + 9–19 hs; VIII: 19–30 fs + 10–14 hs + 1 bristle; IX: 16–24 fs + 6–11 hs + 1 bristle; bristles long and fine. Segment X: length 56–97 μm ; slightly constricted apically; with 3 capitate setae, 5 antennal bristles (3 long + 2 short) and 5–12 fs + 0–4 hs; with 2 sensilla basiconica, 1 almost on apex and 1 between bases of 2 bristles.

Thorax. Prothorax: pronotal ridge with strong lateral pronotal sclerites, each striated but not reticulated; without lateral pronotal setae. Lateral prothoracic setae represented by (i) an anterior group of 0–6 fs plus 8–15 dp near shoulder, some extending ventrally to near proepisternum + cervical sclerite, and (ii) a posterior, quite compact, group of about 13+ fs + 2+ hs (actual number very difficult to

count on available material but total number over 30) present laterad to each procoxa and perhaps extending dorsally, plus 4–6 dp approximately in position of post-tergite. In addition, with a rather diffuse group of 4–6 dp medially between pronotal ridge and prescutum in position of median pronotal setae. Sternum with a strong transverse ridge; median ridge absent; sternite absent; prosternal setae abundant with many fs and hs in a group extending well anterior to procoxae and, therefore, possibly including some anteprosternal setae; group also extending laterally near transverse ridge and therefore possibly including some antemesospiracular setae. **Mesothorax:** prescutum about half as long as wide (200–228 μm wide and 111–145 μm long); faintly reticulated. Scutum: median membranous area about three times as wide as long (225–275 μm wide; perhaps 62–104 μm long); scutal setae: numerous and hard to count — perhaps about 47 fs + 16 hs plus 8–12 dp; lateral margins of scutum not reticulated, with a group of 3–7 dp near posterolateral margin. Scutellum 217–246 μm wide and 40–70 μm long; with a large foramen. Mesepisternum reticulated; with a group of 0 or 1 fs + 4–9 hs laterad to lateropleurite, exact position unclear but perhaps on posteroventral end of mesepisternum, on the membranous area between the posterior and more anterodorsal section of the mesepisternum, or near or in the mesopleural apophyses. Basisternum about 295–315 μm wide and 185–197 μm long; with a complete, strong median ridge and bounded by strong marginal and precoxal ridges; without basisternal setae; lateropleurite with or without an extension from marginal ridge; furca well developed, each arm extending anteriorly well past point where marginal ridge and precoxal ridges join. Postalare punctate at anterior end; with 5–8 fs + 4 or 5 hs postalare setae. Mesothoracic spiracles: width of peritreme 27–32 μm . Postmesospiracular setae abundant, with perhaps 50 fs + 40 hs, extending full width of segment. Tegulae: quite large, with 2–4 fs + 4–6 hs tegular setae plus 3–6 dp. **Metathorax:** metapostnotum represented by a pair of small to medium-sized lateral sclerites; metatergal setae represented by a group of 5–13 fs + 1 or 2 hs plus 6–10 dp on each side along margin of metapostnotum. Ventral section of metapleural ridge well developed; episternum not sclerotised but with 7–20 fs + 10–19 hs postmetaspiracular setae (but group coalesces with posterior metasternal setae); metepimeron well developed and sclerotised but without setae. Metathoracic spiracles: width of peritreme 30–36 μm . Antemetaspiracular setae almost certainly present and probably represented by 5–9 fs + 0–4 hs; dorsospiracular setae: with about 4–10 fs + 0 or 1 hs plus 1–16 dp. Metasternum membranous; anterior metasternal setae abundant, with about 31–40 fs + 30–40 hs; posterior metasternal setae abundant, with about 18–25 fs + 24–28 hs.

Wings: hyaline, of moderate length, 1150–1250 μm long; width 587–625 μm (ratio length to width 1:0.5; ratio of

total body length to wing length 1:0.61). Hamulohalteres absent.

Legs: coxa lengths (μm): I: 108–126, II: 114–142, III: 133–160; coxal III setae: about 6–9 fs + 22–35 hs; without long setae. Trochanter + femur lengths (μm): I: 300–349; II: 254–301, III: 273–324; each trochanter III with 5–12 fs + 12–15 hs; without long hs trochanter setae; each femur III with about 14–25 fs + 59–70 hs. Tibia particularly long, lengths (μm): I: 349–410; II: 323–385, III: 387–492, each tibia III with about 200 setae, many of them hs; apical spur present but with several other setae rather spurlike; tibial spurs quite short, 19–28 μm long. Tarsus rather narrow, lengths (μm): I: 139–157, II: 143–163, III: 165–193 (ratio length of tibia III to length of tarsus III 1:0.4); each metatarsus with 45–50 setae, many of them spurlike; distal spur each 31–40 μm long; tarsal digitules about as long as claw and with moderate apical knobs. Claws fairly short and blunt, length about equal to width of tarsi, lacking a denticle, length 28–36 μm ; claw digitules as long as claw, with smaller apical knobs than tarsal digitules.

Abdomen: segments I–VII: tergites and sternites represented by a moderate sclerotisation on segment VII and slight sclerotisations on segments II–VI. Caudal extension of segment VII distinct and rounded. Dorsal abdominal setae and pores, total across each segment (hs often very flagellate): segment I: 0–3 fs + 0–4 hs plus 16–27 dp; II: 0–4 fs + 1 or 2 hs plus 5–16 dp; III: 0–4 fs + 0–2 hs plus 4–10 dp; IV: 2–4 fs + 0–2 hs plus 5–8 dp; V: 0–3 fs + 1 or 2 hs plus 2–6 dp; VI: 0–2 fs + 2–4 hs plus 2–6 dp; VII: 0–2 fs + 1–4 hs plus 0–2 dp. Pleural setae: dorsopleural setae on each side: I: 0–6 dp; II: 2 or 3 hs plus 2–6 dp; III–V: 1 or 2 hs plus 1–8 dp; VI: 0–2 fs + 1–3 hs plus 5–7 dp; ventropleural setae on each side: I: 0 or 1 fs + 0 or 1 hs; II: 0–3 fs + 0–2 hs; III: 0–2 fs + 0–2 hs; IV: 0–2 fs + 0–2 hs; V: 0–3 fs + 0–2 hs; VI: 0–4 fs + 0–3 hs; VII: (dorsopleural + ventropleural setae) 6–10 fs + 2–7 hs plus 0–8 dp. Ventral abdominal setae, totals across sternite: II: 0–3 fs + 10–24 hs; III: 0–6 fs + 10–21 hs; IV: 2–7 fs + 12–26 hs; V: 4–7 fs + 16–20 hs; VI: 5–8 fs + 15–24 hs; VII: 0–2 fs + 6–14 hs plus 0 or 1 dp. Segment VIII: tergite with 0 or 1 fs, 2 large and 1 or 2 short hs ante-anal setae plus 0 or 1 dp; sternite with 0–3 fs + 0–4 hs ventral abdominal setae; caudal extension absent, with 2–4 hs pleural setae plus 0–3 dp. Glandular pouch present, each with two setae, 140–195 μm long. **Genital segment:** penial sheath extremely long, about 1/3 total body length; length 546–656 μm ; 107–135 μm wide at base (ratio of total body length to length of penial sheath 1:0.31). Basal rod about 1/3 length of aedeagus, length 127–143 μm anterior to aedeagus; anterior end not reaching basal membranous area on most specimens. Aedeagus 311–422 μm long (ratio length of aedeagus to length of basal rod 1:0.37),

of uniform width. Penial sheath with 16–30 small setae on each margin, extending anteriorly almost past anterior margin of basal rod, and with a cluster of small sensilla present near apex.

Comment. The presence of the conical pores over much of the dorsum immediately separates this species from all others currently known from New Zealand. There are a number of other characters unknown on other New Zealand species:

- (i) hairlike setae all very flagellate, much longer than on most other New Zealand Coccidae;
- (ii) all antennal segments with many hairlike setae;
- (iii) presence of lateral prothoracic setae;
- (iv) presence of a group of setae laterad to lateropleurite;
- (v) setae on legs abundant and all rather short, with many more hs than fs;
- (vi) caudal extension on abdominal segment VII larger and more pronounced than that on segment VIII;
- (vii) penial sheath very long, almost 1/3 of total body length.

POUNAMOCOCCUS Henderson & Hodgson

Pounamococcus Henderson & Hodgson: Hodgson & Henderson, 1998: 606

Type species: *Pounamococcus tubulus* Henderson & Hodgson

Introduction. The genus *Pounamococcus* was proposed for 2 rather remarkable species, *P. cuneatus* Henderson & Hodgson and *P. tubulus* Henderson & Hodgson (Hodgson & Henderson 1998). The adult females of these 2 species have a number of characters which are either unique or very unusual in the Coccidae. Although descriptions of the adult males were included in the original publication, slightly amended descriptions are included here for completeness.

Diagnosis based on the adult males of 2 species, *P. cuneatus* and *P. tubulus* (significant character-states in italics) (Fig. 85, 86).

General: fleshy setae normal, without extremely flagellate apices; dorsal pores absent.

Head: setae few; with 2 or 4 pairs of simple eyes, lateral eyes (when present) smaller than other eyes; genal setae absent; genal reticulations with mainly raised spots, occasionally with a few inner microridges; ocular sclerite and genal reticulations dissimilar; ventral midcranial ridge with few hs; *postocular ridge extending past ocelli*; ocelli large and distinct; each reticulation on ocular sclerite with few or no inner microridges; *ventral head setae absent laterally on ocular sclerite*; ventral head setae absent between ventral

eyes; ventral ocular setae absent; *tentorial bridge absent*; *cranial apophysis trifurcated*. **Antennae:** very long, about 0.8 of total body length; with 3 hs on scape on *P. tubulus*, more on *P. cuneatus*; segment X with a slight constriction; hs on segments IV–X absent; with 3 capitate setae on segment X.

Thorax. Prothorax: lateral pronotal setae absent; lateral prothoracic setae absent; *median ridge of prosternum moderately or well developed*; with 1 pair of hs prosternal setae only; antemesospiracular setae absent; anteprosternal setae absent. **Mesothorax:** prescutum about 1.5× or less wider than long; prescutum with few or no reticulations; membranous area of scutum about 3× wider than long; membranous area of scutum with few hs only; reticulations anteriorly on scutum absent; *scutum reticulated laterad to scutellum*; foramen on scutellum large; *postmesospiracular setae absent*; median ridge of basisternum well developed on *P. tubulus*, less well developed on *P. cuneatus*; furca fairly short, not reaching anterior border of basisternum; setae laterad to lateropleurite absent; tegular setae present; mesepisternum without reticulations; anterior end of postalar with or without reticulations; postalar setae absent. **Metathorax:** *with very few or no anterior metasternal setae*; with very few or no posterior metasternal setae; with no postmetaspiracular setae; metepimeron without setae; *hamulohalteres present*; with 1 pair of hs metatergal setae; *dorsospiracular setae absent*; setae near mesoprecoxal ridge absent.

Legs: *with 2 tibial spurs per tibia*; *tarsal campaniform pores present*; trochanter–femur segmentation distinct; more fs than hs on metafemur, but hard to separate; *tarsus 2-segmented*.

Abdomen: segment VIII of normal length; cicatrices absent; sternites and tergites on segments II–VI moderately sclerotised; dorsal abdominal setae few, all hs; ventral abdominal setae few, all hs; pleural setae few but segmentally arranged; 1 or 2 pairs of hs ante-anal setae; caudal extensions on segments VII and VIII fairly distinct and rounded; glandular pouches absent; penial sheath short, about 1/6th total body length; penial sheath broad, then tapering; basal rod moderately long, reaching basal membranous area; aedeagus either short and broad (*P. cuneatus*) or narrow (*P. tubulus*).

Comment. The males of *Pounamococcus* are immediately recognisable by the presence of a 2-segmented tarsus, each tibia with 2 tibial spurs, and each tarsus with a tarsal campaniform pore; none of these characters are known on any other male Coccidae. These 2 species are also the only indigenous coccids in New Zealand to have hamulohalteres and all the associated structures.

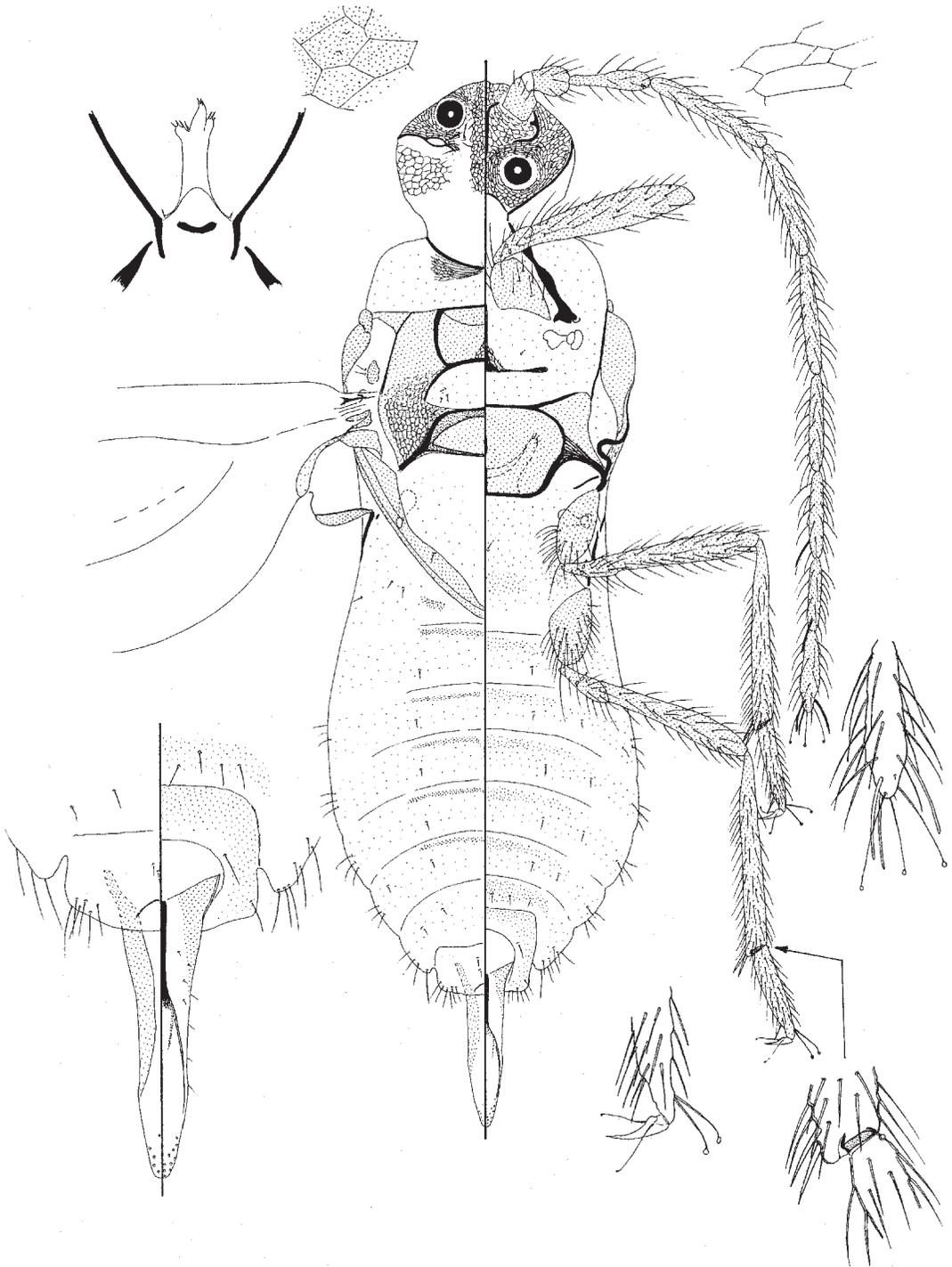


Fig. 85 Adult male, *Pounamococcus cuneatus* Henderson & Hodgson. Bottom right: — structure of tibio-tarsal articulation.

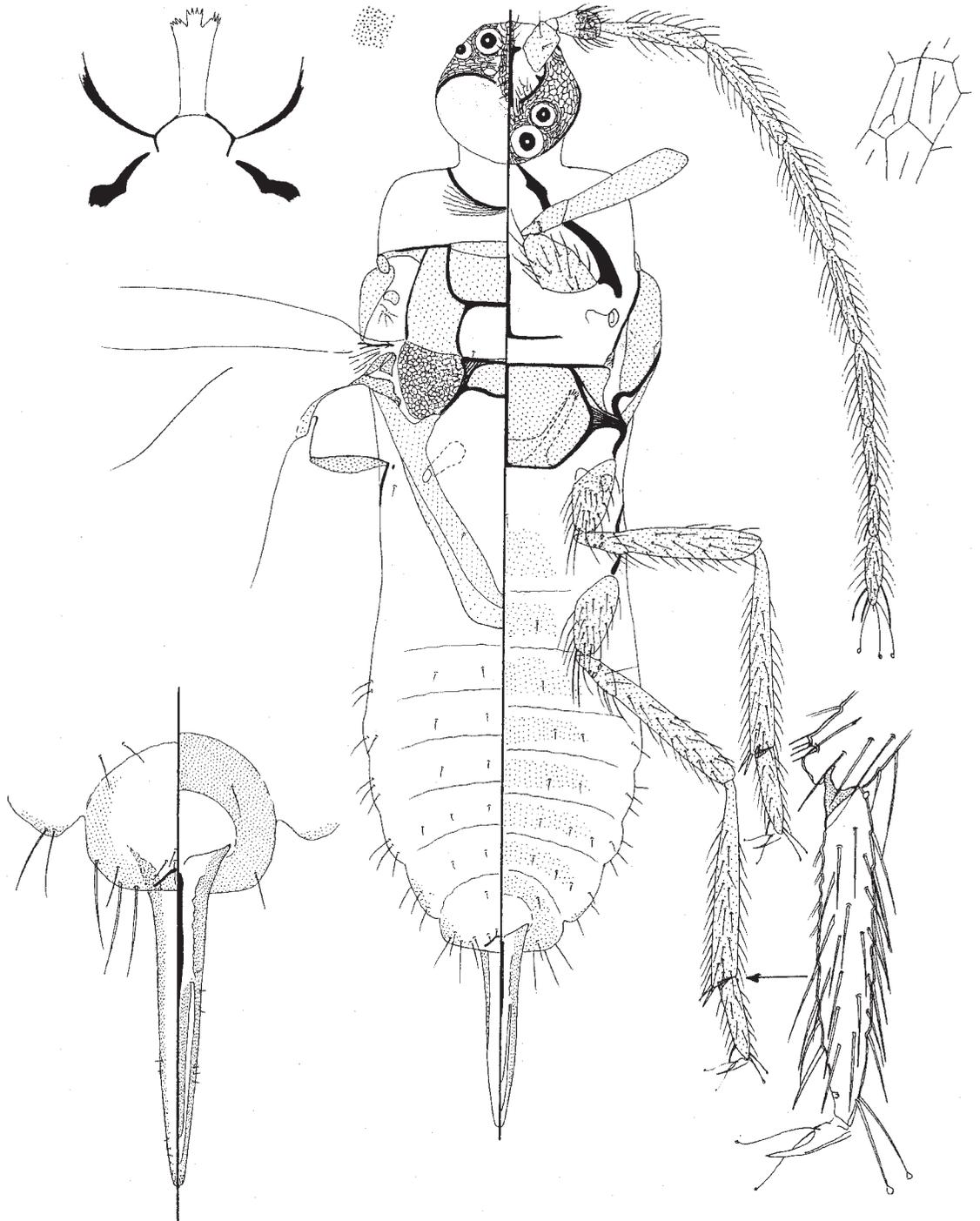


Fig. 86 Adult male, *Pounamococcus tubulus* Henderson & Hodgson.

***Pounamococcus cuneatus* Henderson & Hodgson**

Fig. 13, 14, 55, 56, 85

Live appearance: light brown, with paler antennae and black eyes; caudal wax filaments absent.

Test slightly convex, composed of 15 translucent glassy wax plates held together on internal side by multiple strands of a different kind of wax; strands absent from 2 posterior lateral sutures which act together as back-plate suture. On leaves of host plants.

Material examined: see Appendix for collection details of specimens examined.

Described from 2 specimens in good condition.

Mounted material: robust, moderate in size, total body length about 1.5–1.63 mm; antennae very long, more than 3/4 of total body length; with few setae on body but setae abundant on appendages; fleshy setae on body absent or undifferentiated and rather hairlike on appendages; length of fs on antennae a little less than 2× width of antennal segments. With clear reticulations throughout most of derm, even on membranous areas. Wings long, subequal to total body length; width about half wing length. Hamulohalteres present.

Head: almost round in dorsal view, but probably with a distinct posteroventral bulge in side view; length from apex to pronotal ridge 227 µm; width across genae 260–284 µm. Median crest long, slightly sclerotised and polygonally reticulated (each reticulation with a hash mark on each border); with a total of about 9–11 hs dorsal head setae. Midcranial ridge: dorsal ridge absent; ventral ridge narrow but well-defined, almost reaching preocular ridge posteriorly; lateral arms well developed; entire area laterad to ventral midcranial ridge mildly reticulated, with 0–3 hs ventral midcranial ridge setae on each side. Genae with distinct polygonal reticulations anterodorsally, each with numerous small spots; without genal setae. Simple eyes: two pairs, large; dorsal eyes (36–42 µm wide), distinctly smaller than ventral eyes (50–56 µm wide); lateral pairs absent. Ocelli well developed, oval, 22–35 µm long, surrounded by dorsal end of postocular ridge. Ocular sclerite with rather small, elongate, polygonal reticulations, each with one or no inner microridges. Preocular ridge with ventral arm reaching about half-way to ventral midcranial ridge; dorsal arm subequal in length. Postocular ridge dorsally extending around ocelli and almost reaching median crest. Dorsal ocular setae: 2 or 3 hs on each side. Ventral head setae: about 7–12 hs present anterior to ventral eyes on each side but none laterally or between ventral eyes; ventral ocular setae absent. Tentorial bridge distinct. Cranial apophysis with a tripartite inner apex, each with minute, sharp spines; length 61–63 µm. **Antennae:** very long, each 1275–1325 µm long (ratio of total body length to antennal

length 1:0.83). Scape: 53–60 µm long and 50–67 µm wide, each with 2–6 fs + 2–5 hs. Pedicel: length 59–67 µm, width 44–65 µm, with weak reticulations and about 24 fs + 8–10 hs, common on both surfaces. Segments III–IX all about 20–25 µm wide; lengths (µm): III: 115–139; IV: 182–212; V: 177–203; VI: 174–192; VII: 144–162; VIII: 124–141 and IX: 109–125; length of fs 41–49 µm; approximate number of fs setae per segment: III: 18 fs + 2–4 hs + 2 sensilla basiconica; IV: 47–62; V: 39–46; VI: 41–44; VII: 38–43; VIII: 30–41 + 1 bristle; IX: 29–37 + 1 bristle. Segment X: length 114–137 µm; slightly constricted apically; with 3 capitate setae, 5 antennal bristles (shorter bristles very like fs), 23–32 fs, and 2 sensilla basiconica, one on apex and one slightly more proximally.

Thorax. Prothorax: derm membranous and lightly reticulated. Pronotal ridge strong and touching medially; lateral pronotal sclerites well developed, reticulated; without lateral pronotal setae. Post-tergites possibly present and lightly reticulated. Sternum with strongly sclerotised transverse ridge; median ridge less sclerotised; sternite small and triangular, with reticulations; with 1 pair of hs prosternal setae near transverse ridge of sternum. Anteprosternal and antemesospiracular setae absent. **Mesothorax:** prescutum 156–174 µm wide and 82–128 µm long; laterally bounded by strong prescutal ridges and posteriorly by prescutal suture; sometimes reticulated medially. Scutum: median membranous area 170–186 µm wide and 66–78 µm long; with 2–5 hs scutal setae on each side; scutum reticulated laterad to scutellum and with a few light reticulations more anteriorly. Scutellum about 131–160 µm wide and 49–53 µm long; probably not tubular; without setae. Basisternum about 238–270 µm wide and 128–131 µm long; with a weak and incomplete medium ridge, bounded by strong marginal and precoxal ridges; without basisternal setae; lateropleurite quite heavily sclerotised throughout, with an extension from marginal ridge anteriorly; furca well developed, each arm extending more than half way to anterior margin. Postalare well developed, striated or reticulated anteriorly; postalare setae absent. Mesothoracic spiracles: peritreme 32–38 µm wide. Postmesospiracular setae absent. Tegula small with some reticulations; with 2–5 hs tegular setae. **Metathorax:** metapostnotum probably unsclerotised; metatergal setae: with 0 or 1 hs on each side. Suspensorial sclerite distinct; dorsal and ventral sections of pleural ridge well developed; episternum mostly unsclerotised, lacking postmetaspiracular setae; metepimeron present, also lacking setae. With a distinct additional sclerite extending posteromedially from each mesoprecoxal ridge. Metathoracic spiracles: peritreme 31–34 µm wide. Antemetaspiracular setae and dorsospiracular setae absent. Metasternum represented by a weak, transverse sclerotisation. Anterior metasternal setae: 0–2; posterior metasternal setae absent.

Wings: hyaline; long, length 1550–1620 µm, width 700–

810 µm (ratio length to width 1:0.48; ratio of total body length to wing length 1:1.01); small alar lobe present; alar setae absent. Hamulohalteres 107–122 µm long and 23–29 µm wide, with one apically hooked seta, about 54–73 µm long.

Legs: subequal in length. Coxae lengths (µm): I: 118–128; II: 114–132; III: 133–140; coxal III setae: about 27–38 fs + 7–13 hs; with 2 long apical setae on each coxa, longest about 53–61 µm long. Trochanter + femur lengths (µm): I: 299–318; II: 287–311; III: 292–312; trochanter III with about 22–30 fs + 5–7 hs; long trochanter seta up to 60 µm; femur III with about 44–46 fs + 10–19 hs. Tibia lengths (µm): I: 307–315; II: 291–300; III: 303–312; tibia III with about 95–110 setae, mainly fs and hs proximally, becoming spurlike on distal third of leg; with two apical spurs, each 36–38 µm long. Tarsi two segmented, more proximal segment short but distinct: total lengths (µm): I: 149–156; II: 139–145; III: 139–148 (ratio length of tibia III to length of tarsus III 1:0.47); tarsus III with about 54 setae, mainly spurlike; tarsal spur 23–31 µm; tarsal digitules short, less than length of claw digitules; each tarsus with a campaniform pore. Claws long and thin, slightly longer than width of tarsi, slightly curved and apparently lacking a denticle; length: III: 34–38 µm; claw digitules subequal in length and slightly longer than claw.

Abdomen: segments I–VII: tergites and sternites represented by a some sclerotisation, both showing distinct reticulations. Caudal extension of segment VII small, rounded and possibly lightly sclerotised. Setae mainly long and flagellate: dorsal abdominal setae, across each segment: with 2–4 pairs of hs. Pleural setae: dorsopleural setae and ventropleural setae hard to separate (combined, on each side): I: 0 or 1, II–VI: 2–4; VII: 4–7, variable in size, mostly quite long and flagellate. Ventral abdominal setae, across each segment: II: 2; III–V: 4; VI: 4–6; VII: 7. Segment VIII: tergite barely sclerotised; with 2–4 hs ante-anal setae; sternite rather more heavily sclerotised, with 2 hs ventral abdominal setae; caudal extension rounded and sclerotised, with 5–7 hs pleural setae, of which 1–3 quite long and flagellate. Glandular pouch absent. **Genital segment:** penial sheath quite short, perhaps broadening slightly towards apex; length 211–253 µm, width at base 94–106 µm (ratio of total length of body to length of penial sheath 1:0.15). Basal rod: length 70–90 µm, reaching basal membranous area anteriorly; with some extension down aedeagus. Aedeagus broadening to almost width of penial sheath apically, 101–123 µm long (ratio length of aedeagus to length of basal rod 1:0.71). Penial sheath with 6–8 small setae on each margin, some on ventral surface laterad to basal rod, and with a cluster of about 25 small sensilla near apex.

Comment. The adult male of *P. cuneatus* differs from that of *P. tubulus* in having (character-states on *P. tubulus* in parentheses):

- (i) only 2 pairs of simple eyes (4 pairs);
- (ii) postocular ridge extending dorsally around both sides of ocelli (without an extension anterior to ocelli);
- (iii) presence of polygonal reticulations throughout most of derm (absent from most membranous areas);
- (iv) penial sheath rather short (significantly longer);
- (v) aedeagus broad (narrow);
- (vi) presence of small additional sclerite near each mesoprecoxal ridge (absent).

The only other New Zealand species known with only 2 pairs of simple eyes are *Kalasisis depressa*, *Inglisia patella*, both *Lecanochiton* species, and Species A, but these species are easily separated using the key and significant character-states given above.

***Pounamococcus tubulus* Henderson & Hodgson**

Fig. 57, 86

Live appearance: not known for adult male.

Test slightly convex, composed of 19 translucent glassy wax plates held together on internal side by multiple strands of a different kind of wax; strands absent from 2 posterior lateral sutures which act together as back-plate suture. On leaves of host plants.

Material examined: see Appendix for collection details of specimens examined.

Described from 3 specimens in moderate condition.

Mounted material: robust, moderate in size; total body length about 1.5–1.8 mm; antennae very long, more than 3/4 of total body length; body with few setae but setae abundant on appendages; fleshy setae on body absent or undifferentiated and rather hairlike on appendages; length of fs on antennae a little less than twice width of antennal segments. Derm showing clear reticulations only on head and thorax. Wings very long, longer than total body length; width slightly greater than half wing length. Hamulohalteres present.

Head: almost round in dorsal view, but probably with a distinct posteroventral bulge in side view; length from apex to pronotal ridge 248–276 µm; width across genae 227 µm. Median crest slightly sclerotised and polygonally reticulated; with 15–17 hs dorsal head setae on each side. Midcranial ridge: dorsal ridge absent; ventral ridge narrow but well-defined, almost reaching preocular ridge posteriorly; lateral arms well developed; lateral area not reticulated, but with 2 or 3 hs setae on each side. Genae large, with very faint polygonal reticulations, each with many small dots; without genal setae. Simple eyes: four pairs; dorsal and ventral pairs large and oval: subequal in width, 41–61×45–50 µm; lateral pairs slightly smaller;

width of dorsal eyes 26–28 μm , ventral eyes 36–38 μm . Ocelli well developed. Ocular sclerite with rather small, elongate, polygonal reticulations, each with one or two inner microridges. Preocular ridge with ventral arm not quite reaching midcranial ridge; dorsal arm subequal in length. Postocular ridge well developed and extending posteriorly some distance past ocelli but without an extension anteriorly around ocelli. Dorsal ocular setae: 0 or 1 hs on each side; ventral head setae: 9–13 hs on each side; none between ventral eyes; ventral ocular setae absent. Tentorial bridge absent. Cranial apophysis quite long (length 65 μm), with a tripartite apex, each arm with minute spines. **Antennae:** very long, each 1420–1650 μm long (ratio of total body length to antennae 1:0.93). Scape: 75–83 μm long and 53–63 μm wide, with 1 hs on ventral surface and 2 hs on dorsal surface. Pedicel: length 66–75 μm , width 51–54 μm ; with weak reticulations and about 15–18 fs + 7 or 8 hs, common on both surfaces. Segments III–IX each about 24–30 μm wide; lengths (μm): III: 196–218; IV: 220–233; V: 197–205; VI: 160–175; VII: 126–150; VIII: 103–110 and IX: 82–98; length of fs 44–50 μm ; approximate number of setae per segment: III: 14–20 fs + 3 or 4 hs + 2 sensilla basiconica; IV: 39–51 fs; V: 36–46; VI: 36–50; VII: 38–42; VIII: 29–31 + 1 bristle; IX: 19–23 + 1 bristle. Segment X: 43–50 μm long; slightly constricted apically; with 3 capitate setae, 3 antennal bristles, 17–26 fs and 2 sensilla basiconica, 1 on apex and 1 slightly more proximally.

Thorax. Prothorax: derm membranous and not reticulated. Pronotal ridge strong; lateral pronotal sclerites well developed, without lateral pronotal setae. Post-tergites absent. Sternum with strong transverse and median ridges; sternite unsclerotised; with 0 or 1 prosternal setae on each side. Other body setae apparently absent from prothorax. **Mesothorax:** prescutum not reticulated but with groups of punctations; about 2/3 as long as wide (207–217 μm wide and 143–172 μm long); laterally bounded by prescutal ridges and posteriorly by prescutal suture. Scutum: median membranous area about twice as wide as long (213–240 μm wide; 82–102 μm long); with 0–2 hs scutal setae on each side; lateral margins reticulated laterad to scutellum. Scutellum 180–213 μm wide and 71–81 μm long; probably not tubular; without scutellar setae. Basisternum about 246–355 μm wide and 184–206 μm long; with a complete, strong medium ridge; bounded by strong marginal and precoxal ridges; without basisternal setae; lateropleurite with an extension from marginal ridge anteriorly; furca well developed, each arm extending anteriorly nearly to marginal ridge. Subepisternal ridge with small reticulations posteriorly near where it meets lateropleurite. Postalare well developed, not reticulated; without postalare setae. Mesothoracic spiracle 38–44 μm wide. Postmesospiracular setae absent. Tegula small, with 6–9 hs setae. **Metathorax:** metapostnotum unsclerotised; metatergal

setae: 0 or 1 hs on each side. Metapleural ridge well developed both dorsally and ventrally; suspensorial sclerite distinct; episternum distinctly sclerotised, lacking postmetaspiracular setae; metepimeron present, also lacking setae. Metathoracic spiracles 38–42 μm wide. Antemetaspiracular setae and dorsospiracular setae absent. Metasternum represented by a weak, transverse plate. Anterior metasternal setae: 1 or 2 pairs; posterior metasternal setae: 0 or 1 pairs.

Wings: hyaline; very long and wide: length 1775 μm , width 938 μm (ratio length to width 1:0.53; ratio of total body length to wing length 1:1.08); alar lobe present; alar setae absent. Hamulohalteres 110–148 μm long and 28–31 μm wide, with 1 apically hooked seta, about 68 μm long.

Legs: prothoracic legs perhaps marginally longer than other 2 pairs; fs and hs hard to differentiate. Coxa: length (μm): I: 144; II: 132–137; III: 153; coxa III with 22–38 fs + 4 hs, plus several longer setae, longest 66 μm . Trochanter + femur: length (μm): I: 351; II: 361; III: 343–348; each trochanter with 8 or 9 setae; length of long trochanter seta 70 μm ; each femur with about 49–54 setae. Tibia length (μm): I: 389–397; II: 364; III: 368–377; tibia III with about 77–80 setae, mostly spurlike: with 2 apical spurs, each 39–42 μm long. Tarsi 2 segmented, more proximal segment short but distinct: total length (μm): I: 153–161; II: 149; III: 153–156 (ratio length of tibia III to length of tarsus III 1:0.42); tarsus III with 34–38 setae, mostly spurlike; tarsal spurs 34–36 μm long; each tarsus with a campaniform pore; tarsal digitules subequal in length and about as long as claw digitules. Claws long and thin, slightly longer than width of tarsi: length 37–40 μm ; slightly curved and apparently lacking a denticle; claw digitules subequal in length and slightly longer than claw.

Abdomen: segments I–VII: sternites each represented by a median sclerotisation; tergites unsclerotised. Caudal extension of segment VII small, rounded and possibly lightly sclerotised. Setae all rather long and flagellate: dorsal abdominal setae: with 2 or 3 pairs across each segment. Pleural setae: dorsopleural setae: with 2 or 3 on each side of each segment + probably 1 ventropleural seta on each side per segment. Ventral abdominal setae: 1–3 pairs on each sternite. Segment VIII: tergite mildly sclerotised; with 4 hs ante-anal setae; sternite more heavily sclerotised, with 2 fs + 0–2 hs ventral abdominal setae; caudal extension distinct, each with 3 long and 2 shorter pleural setae marginally. Glandular pouch absent. **Genital segment:** penial sheath quite long, about 1/4 of total body length; length 383–426 μm , width at base 121–128 μm (ratio of total body length to penial sheath length 1:0.24). Basal rod: length 120–135 μm , reaching basal membranous area anteriorly. Aedeagus 191–199 μm long, narrow and pointed (ratio of aedeagus length to basal rod length 1:0.65). Penial sheath with 8 or 9 small setae

on each side and with a cluster of small sensilla present near apex.

Comment. For a comparison with *P. cuneatus*, see under that species.

The combination of characters diagnosing *Pounamococcus* is very distinctive and easily separates the males of *P. cuneatus* and *P. tubulus* from other known male Coccidae. It is perhaps worth noting that the number of simple eyes is not a synapomorphic character-state for the two species in the genus *Pounamococcus*.

A major diagnostic character is the 2-segmented tarsus. This was not noted when this genus was originally described. As with the presence of the tarsal campaniform pore and the two tibial spurs, this character is otherwise unknown on coccid males, suggesting that this is a rather primitive genus; these character-states are known otherwise only from more basal families in the Coccoidea, such as the Margarodidae, Pseudococcidae, and Eriococcidae.

UMBONICHITON Henderson & Hodgson

Umbonichiton Henderson & Hodgson: Hodgson & Henderson, 2000: 171

Type species: *Ctenochiton hymenantherae* Maskell

Introduction. The genus *Umbonichiton* was proposed for 5 species: *U. adelus* Henderson & Hodgson, *U. bullatus* Henderson & Hodgson, *U. hymenantherae* (Maskell), *U. jubatus* Henderson & Hodgson, and *U. pellaspi* Henderson & Hodgson (Hodgson & Henderson 2000). Adult males of all 5 species were available.

Diagnosis based on the adult males of all 5 *Umbonichiton* species (significant character-states in italics) (Fig. 87–91).

General: fleshy setae normal, without extremely flagellate apices; dorsal pores absent.

Head: fs frequent to abundant; with 4 pairs of simple eyes, lateral eyes smaller than other eyes; genal setae present; genal reticulations with few inner microridges; ocular sclerite and genal reticulations rather dissimilar; ventral midcranial ridge with fs and/or hs (setae absent on *U. jubatus*); postocular ridge not nearly reaching ocelli; ocelli large and distinct (indistinct/absent on *U. pellaspi*); each reticulation on ocular sclerite with a few inner microridges; ventral head setae present throughout ocular sclerite (except on *U. pellaspi*); ventral head setae present between ventral eyes (except on *U. pellaspi*); ventral ocular setae absent (except occasionally on *U. adelus*); tentorial bridge

well developed; cranial apophysis bifurcated. **Antennae:** of short to medium length, 0.4–0.6 total body length; with 3 hs on scape; segment X not constricted or only slightly; hs on segments IV–X rare or absent; with 3 capitate setae on segment X.

Thorax. Prothorax: generally with 1 pair of hs lateral pronotal setae; lateral prothoracic setae absent; median ridge of prosternum weak or absent; with several fs prosternal setae; antemesospiracular setae absent; with fs anteprosternal setae (absent on *U. jubatus*). **Mesothorax:** prescutum about 1.5–2.5× wider than long; reticulations on prescutum absent or as light striations; membranous area of scutum about 2–3× wider than long; membranous area of scutum with both fs and hs; reticulations anteriorly on scutum absent; scutum not reticulated laterad to scutellum; size of foramen on scutellum varied; with fs postmesospiracular setae; median ridge of basisternum well developed (incomplete on *U. adelus*); furca fairly short, not nearly reaching anterior border of basisternum; setae laterad to lateropleurite absent; tegular setae present or absent; mesepisternum without reticulations; reticulations on anterior end of postalare present or absent; postalare setae generally absent. **Metathorax:** with many fs anterior metasternal setae; with fewer fs posterior metasternal setae; with fs postmetaspiracular setae; metepimeron with or without setae; hamulohalteres absent; with 1 pair of hs metatergal setae; dorsospiracular setae present; setae near mesoprecoxal ridge absent.

Legs: with 1 tibial spur per tibia; tarsal campaniform pores absent; trochanter + femur segmentation distinct; fs more abundant or as frequent as hs on metafemur; tarsus 1-segmented.

Abdomen: segment VIII of normal length; cicatrices absent; sternites and tergites on segments II–VI absent or poorly sclerotised; fs dorsal abdominal setae few or absent; fs ventral abdominal setae few; pleural setae few, segmentally arranged; ante-anal setae with both hs and fs; caudal extensions on segments VII and VIII fairly distinct and rounded; glandular pouches present or absent; penial sheath rather short, about 1/5 total body length; penial sheath gradually narrowing to a fairly blunt apex; basal rod short, 1/4 or more length of aedeagus, not reaching basal membranous area anteriorly (except on *U. jubatus*); aedeagus fairly long, more than 1/2 length of penial sheath, slightly tapering.

Comment. There are no attributes that separate the males of *Umbonichiton* from those of *Aphenochiton*. *Umbonichiton* is also similar to *Ctenochiton* and *Epelidochiton*, but see under their diagnoses for differences.

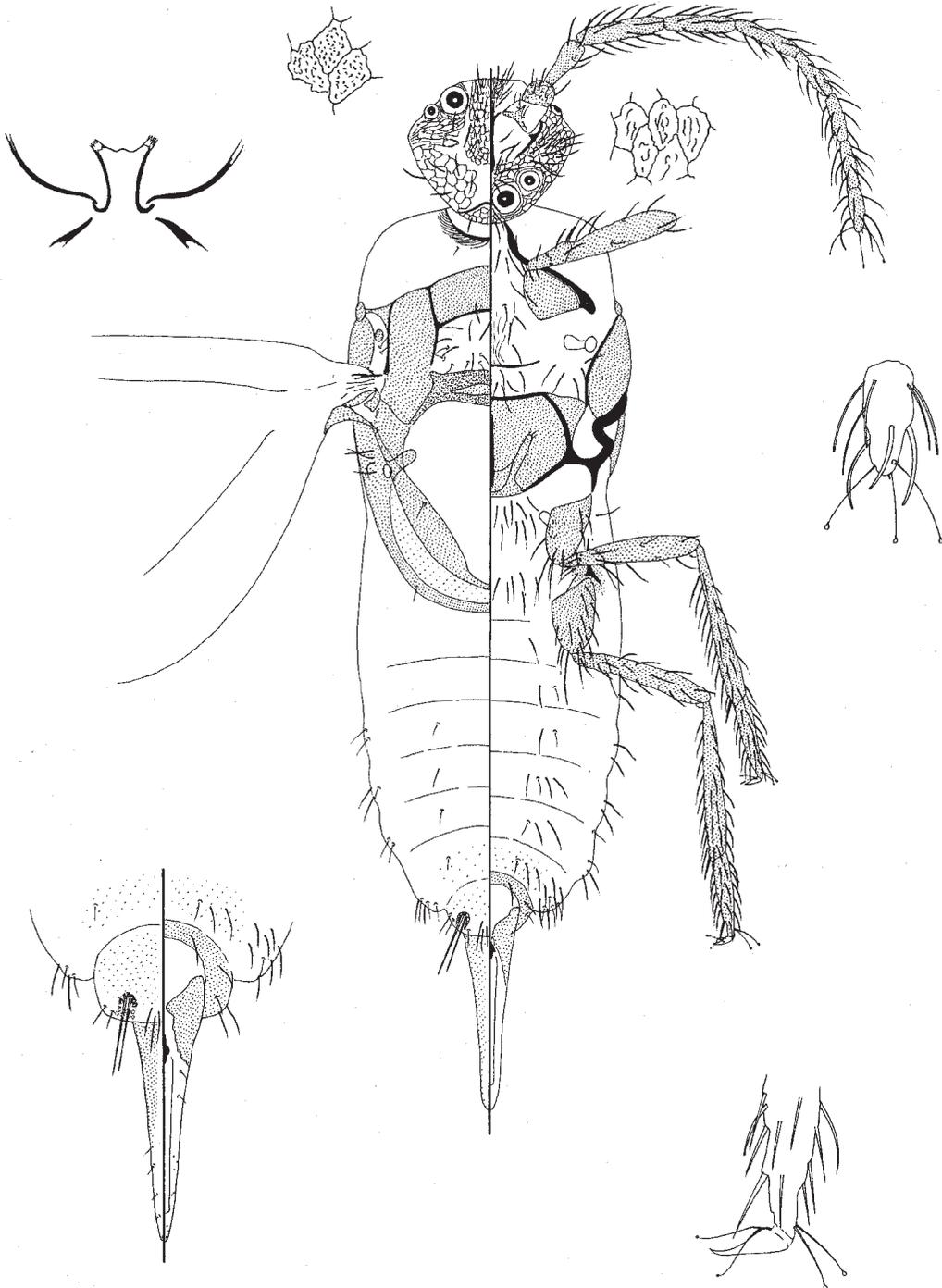


Fig. 87 Adult male, *Umbonichiton adelus* Henderson & Hodgson.

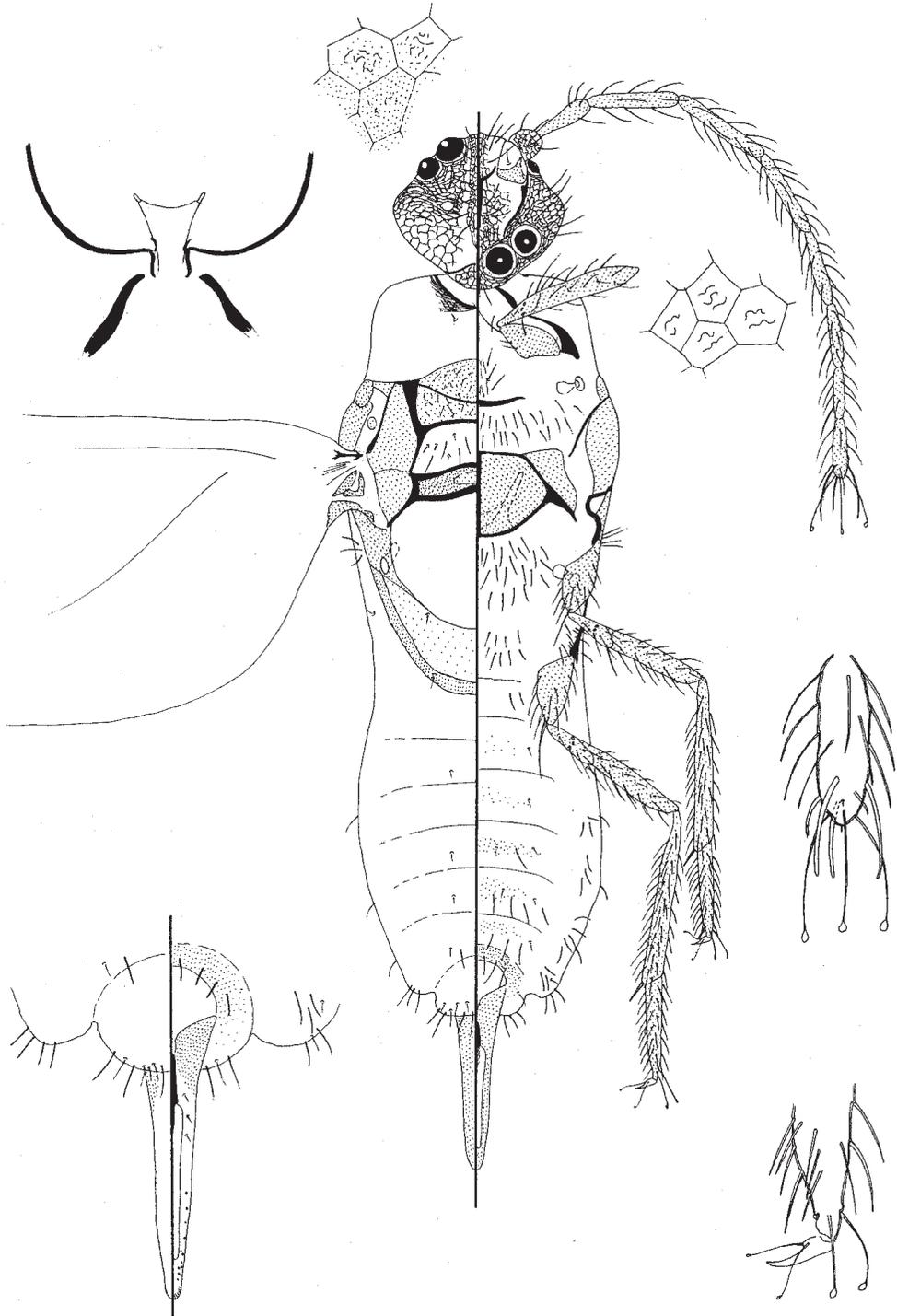


Fig. 88 Adult male, *Umbronichiton bullatus* Henderson & Hodgson.

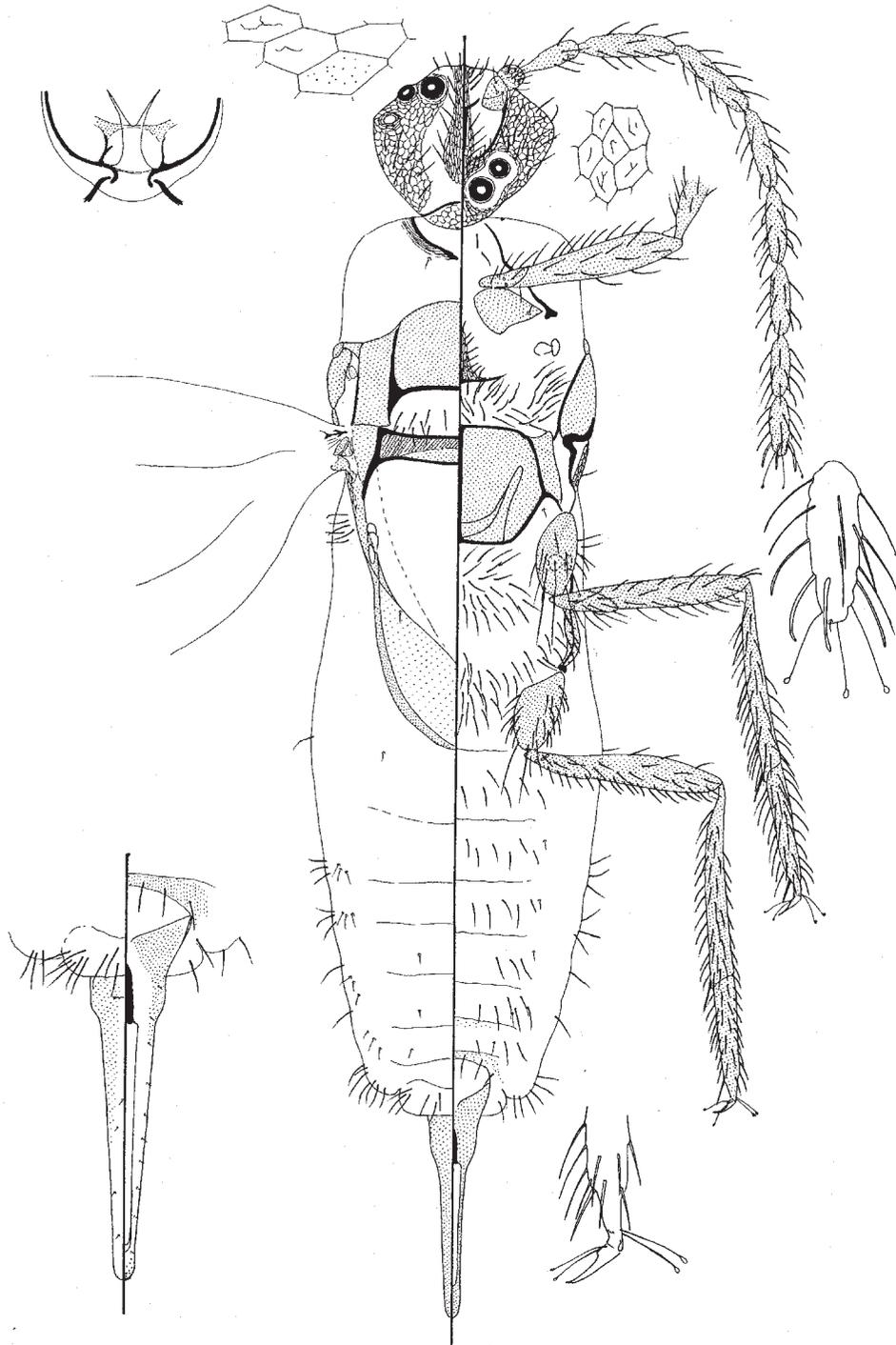


Fig. 89 Adult male, *Umbonichiton hymenantherae* (Maskell).

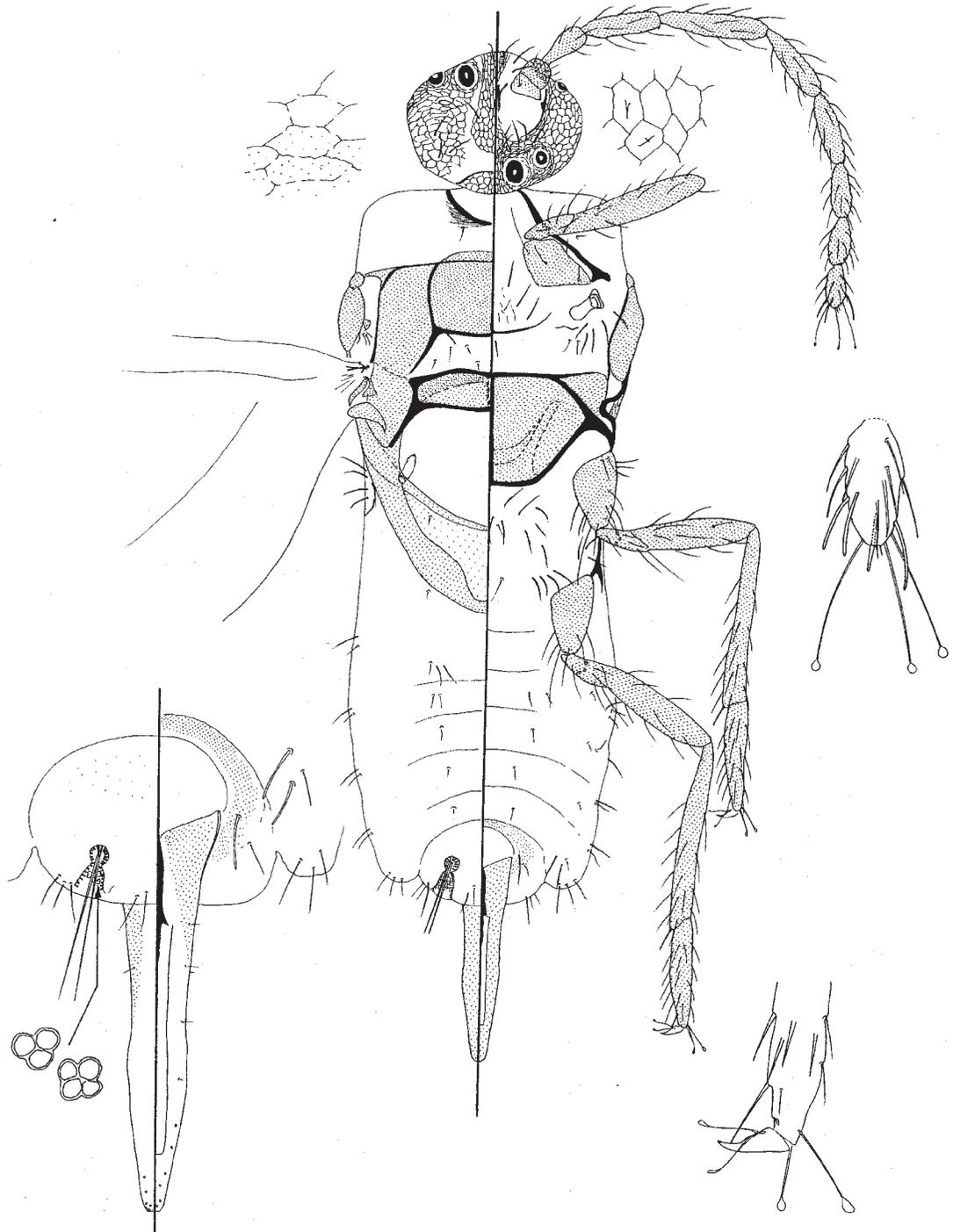


Fig. 90 Adult male, *Umbonichiton jubatus* Henderson & Hodgson.

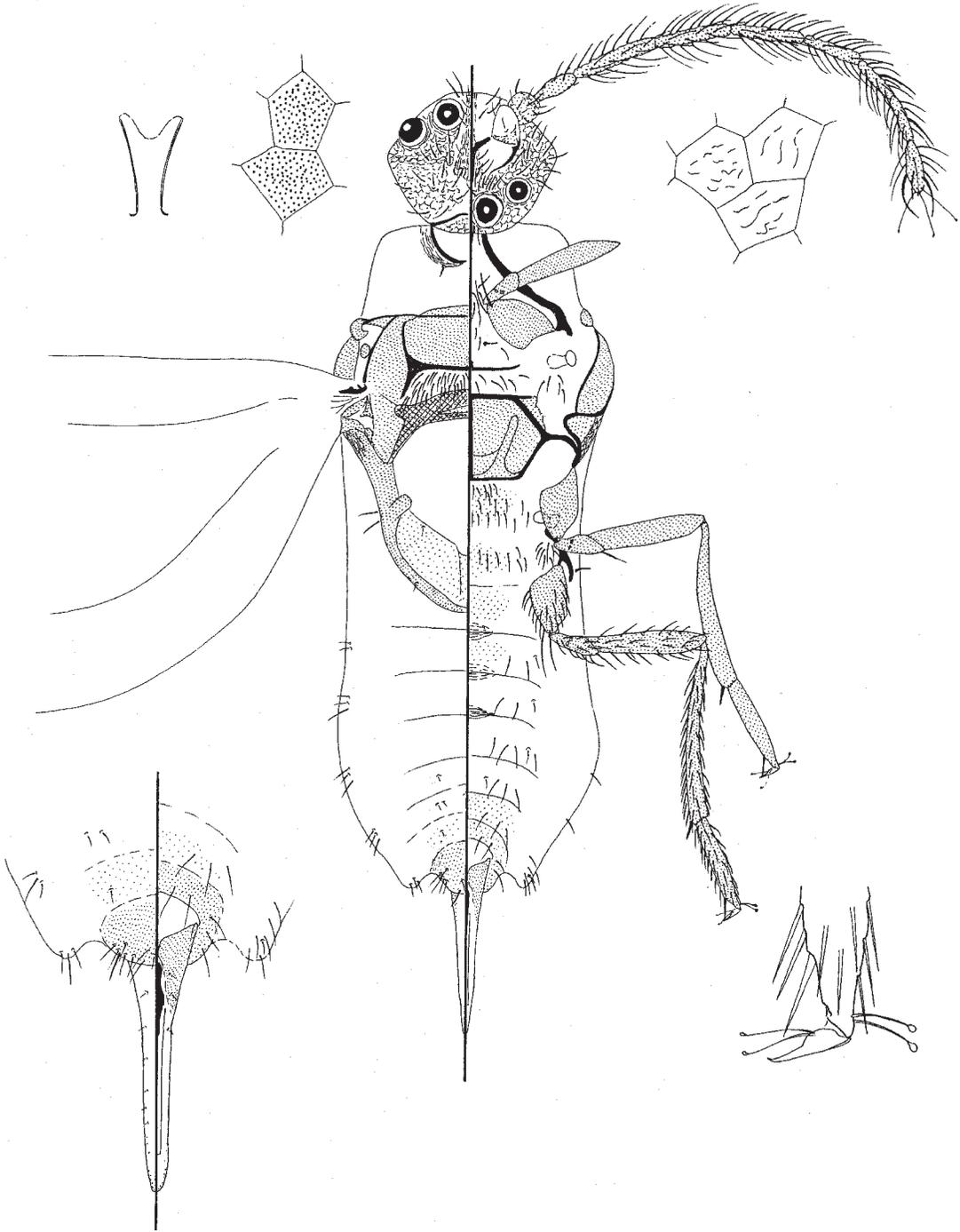


Fig. 91 Adult male, *Umbonichiton pellaspiis* Henderson & Hodgson.

***Umbonichiton adelus* Henderson & Hodgson**

Fig. 87

Live appearance: not recorded for adult male.**Test** convex, of translucent wax plates; yellow colour of male nymph visible inside; median row of 6–8 plates larger and more convex than other plates. When on *Podocarpus totara* leaves, test often twisted to follow curving leaf petiole.**Material examined:** see Appendix for collection details of specimens examined.

Described from 1 specimen in fair condition.

Mounted material: smallish, total body length about 1.3 mm, rather slender, with comparatively short antennae, less than 1/2 of total body length; body not very hirsute, fleshy setae rare dorsally but frequent ventrally, these generally easy to differentiate from hairlike setae; length of fs on antennae about twice width of antennal segments. Wings of moderate length, about 8/10 of total body length; width about half wing length. Hamulohalteres absent.**Head:** approximately round to slightly quadrangular in dorsal view; width across genae 213 μm . Median crest reticulated, with about 6 fs + 4 hs dorsal head setae on each side. Midcranial ridge: dorsal ridge absent or indistinct; ventral ridge normal, with posterior ridge long and well defined, reaching ocular sclerite posteriorly; with a very narrow reticulated border; with 1 or 2 fs ventral midcranial ridge setae on each side. Genae polygonally reticulated throughout, each reticulation quite large and with many short inner microridges or spots; genal setae: with 11–16 fs on each side. Simple eyes: four pairs; large and round; large ventral eyes slightly larger than large dorsal eyes: dorsal each 36–38 μm and ventral 41 μm wide; each with a closely associated, rather smaller, round, lateral simple eye, dorsal 21–23 μm , ventral 23–27 μm wide. Ocelli poorly defined. Ocular sclerite polygonally reticulated with many inner microridges, each inner microridge much longer than on gena. Preocular ridge: ventral arm extending about 2/3 of way to midcranial ridge; dorsal arm subequal in length. Postocular ridge well developed but not nearly reaching ocelli dorsally. Dorsal ocular setae: 1 or 2 fs on each side. Ventral head setae: with about 19–21 fs + 1 or 2 hs anterior and laterad to ventral eyes on each side and with 6 fs between ventral eyes; ventral ocular setae: 0 or 1 fs on each side. Tentorial bridge well developed. Cranial apophysis 32 μm long, with a shallow distal bifurcation. **Antennae:** about 780 μm long (ratio of total body length to length of antennae 1:0.60). Scape: 43–68 μm long and 41–43 μm wide, with 3 hs. Pedicel: length 41–45 μm , width 40 μm ; with some reticulations and 3 or 4 fs + 1–3 hs, very few setae present on dorsal surface. Segments III–X all about 18–23 μm wide; segment lengths (μm): III: 68–70; IV: 126–130; V:108–119; VI: 95–103; VII: 76–86; VIII: 72–74 and IX: 68; fs about 32–38 μm long; approximate number of setae per segment: III: 1–3 fs + 1 or 2 hs + ?1 sensilla basiconica; IV: 15–18 fs + 0 hs; V: 20 or 21 fs + 0 hs; VI: 14–18 fs + 0 hs; VII: 17–21 fs + 0 hs; VIII: 16–19 fs + 0 hs + 1 bristle; IX: 15 or 16 fs + 0 hs + 1 bristle. Segment X: length 61–67 μm ; possibly constricted apically; with 3 capitate setae, 3 large + 1 small antennal bristle and about 9 or 10 fs; with possibly only 1 sensilla basiconica, located apically.**Thorax. Prothorax:** pronotal ridge strong, with lateral pronotal sclerite distinctly striated but not reticulated; with 1 pair of hs lateral pronotal setae. Sternum with a strong transverse ridge; median ridge slight or absent; sternite narrow and triangular, with faint striations; prosternal setae: about 3 fs + 1 hs on each side. Anteprosternal setae: possibly represented by 2 or 3 fs, but these positioned just anterior to procoxae. Antemesospiracular setae absent. **Mesothorax:** prescutum distinctly wider than long (160 μm wide and 62 μm long); without reticulations. Scutum: median membranous area perhaps only 1.5 times wider than long (131 μm wide, perhaps 81 μm long); scutal setae: 12 fs + 13 hs; lateral margins not reticulated. Scutellum 139 μm wide and 49 μm long; tubular with a large foramen; without scutellar setae. Basisternum about 209 μm wide and 131 μm long; with a strong median ridge but incomplete at each end, bounded by strong marginal and precoxal ridges; without basisternal setae; lateropleurite with no extension from marginal ridge anteriorly; furca well developed, each arm extending anteriorly well past point where marginal ridge and precoxal ridges join; with 0 or 1 hs just anterior to precoxal ridge near basisternum. Postalare not reticulated but with striations; without postalare setae. Mesothoracic spiracle: peritreme 17–20 μm wide. Postmesospiracular setae: about 21 fs, extending full width of segment. Tegula: well developed, with 1 fs + 2 hs tegular setae. **Metathorax:** metapostnotum unsclerotised; with 1 hs metatergal seta on each side. Metapleural ridge short, only present ventrally near metacoxae; episternum sclerotised, with 4 fs postmetaspiracular setae; metepimeron sclerotised with no setae. Metathoracic spiracle: width of peritreme 22 μm . Antemetaspiracular setae and dorsospiracular setae hard to distinguish, perhaps 1 fs of former and 3 or 4 fs of latter. Metasternum membranous. Anterior metasternal setae: about 22 fs; posterior metasternal setae: about 12 fs.**Wings:** of moderate size, length 1025–1050 μm , width 462–475 μm (ratio length to width 1:0.45; ratio of total body length to wing length 1:0.8). Hamulohalteres absent.**Legs:** prothoracic legs slightly longer than meso- and metathoracic legs, particularly trochanter + femur. Coxa lengths (μm): I: 78; II–III: 82–90; coxa III with about 15 fs, 6 hs + 2 long setae on inner margin; long setae on each coxa about 45–54 μm long. Trochanter + femur lengths (μm): I:

209–217; II: 189–193; III: 192–197; trochanter III with about 5 fs + 1–3 hs; long trochanter seta up to 41 μm ; femur III with about 9 fs + 6 hs. Tibia lengths (μm): I: 213; II: 208–213; III: 196–209; tibia III with about 35 setae, mainly fs and hs proximally, becoming mainly spurlike on distal third; large apical spur 23–29 μm long. Tarsus lengths (μm): I: 106–119; II: 111; III: 111–115 (ratio length of tibia III to length of tarsus III 1:0.56); tarsus III with 31 setae, mainly spurlike setae; distal tarsal spur 25–29 μm long; tarsal digitules about as long as claw. Claws long and thin, subequal to or slightly longer than width of tarsus, slightly curved, possibly lacking a denticle; length: III: 24–26 μm ; claw digitules a little longer than claw.

Abdomen: segments I–VII: segment VII with tergites and sternites lightly sclerotised; other segments with microtrichia. Caudal extension of segment VII small and rounded. Dorsal abdominal setae total per segment: I–VII: 0 or 1 fs + 0–2 hs. Pleural setae: dorsopleural setae on each side: I–VI: 0–3 hs; ventropleural setae on each side: II–V: 1 or 2 fs + 0 or 1 hs; VI: 2 or 3 fs + 0 or 1 hs; VII (dorsopleural + ventropleural setae): 5–7 hs. Ventral abdominal setae on each half of segment: II–VII: 1 or 2 fs + 0–2 hs. Segment VIII: tergite lightly sclerotised, with a group of 9 fs ante-anal setae; sternite more heavily sclerotised than tergite; with about 2 fs ventral abdominal setae; caudal extension small, with 1 or 2 fs + 3 hs pleural setae. Glandular pouch present, with rather few loculate pores; glandular pouch setae 75–86 μm . **Genital segment:** penial sheath reasonably long and sclerotised; length 266 μm , 74 μm wide at base; about 1/5 of total body length (ratio of total body length to length of penial sheath 1:0.20). Basal rod very short, 19 μm long anterior to aedeagus, with a short, 14 μm long, extension within aedeagus; not nearly reaching basal membranous area anteriorly. Aedeagus 194 μm long (ratio length of aedeagus to length of basal rod 1:0.1), broadest basally and either parallel sided or tapering slightly. Penial sheath with 8 small setae along each margin and with a cluster of small sensilla present near apex.

Comment: the males of *Umbonichiton* are all rather alike. *U. adelus* can be separated from the other four species by the following combination of characters:

- (i) dorsal ocular setae present anterior to ocelli (absent on *U. hymenantherae* and *U. jubatus*);
- (ii) margin of reticulations laterad to ventral midcranial ridge very narrow (broader on other species);
- (iii) ventral head setae common laterally on ocular sclerite between ventral and dorsal simple eyes (absent on *U. jubatus*);
- (iv) tegular setae present (absent on *U. bullatus* and *U. pellaspis*; also maybe on *U. hymenantherae*);
- (v) with few prosternal setae (abundant on *U. hymenantherae*);

- (vi) postmesospiracular setae rather few (relatively few on other species but abundant on *U. hymenantherae*);
- (vii) genal reticulations with few short inner microridges (similar on *U. bullatus*, spots on *U. pellaspis*, and inner microridges absent from other 2 species);
- (viii) polygonal reticulations of ocular sclerite with many inner microridges (as on *U. pellaspis*; few inner microridges on other 3 species);
- (ix) glandular pouch present (also present on *U. jubatus*, but absent on other 3 species);
- (x) posterior metasternal setae rather few (abundant on *U. hymenantherae*, much less frequent on other 3 species).

Umbonichiton bullatus Henderson & Hodgson

Fig. 7, 8, 58, 88

Live appearance: reddish-brown with black eyes, and paler legs and antennae.

Test elongate, moderately convex, of rows of translucent wax plates, each convex and mostly uniform in size, giving an overall knobby appearance. Generally on thin twigs of host plants.

Material examined: see Appendix for collection details of specimens examined.

Described from 7 specimens in good condition, but one headless.

Mounted material: smallish and rather slender, total body length about 1.29–1.67 mm, with moderately long antennae, a little over 1/2 of total body length; body not very hirsute, fleshy setae rare dorsally but fairly frequent ventrally, these generally easy to differentiate from hairlike setae; length of fs on antennae more than 2 \times width of antennal segments. Wings of moderate length, about 8/10 of total body length; width rather narrow, about 4/10 of wing length. Hamulohalteres absent.

Head: approximately oval to quadrangular in dorsal view; length about 200 μm ; width across genae 235–291 μm . Median crest reticulated, with about 6–9 fs + 4–10 hs dorsal head setae on each side. Midcranial ridge: dorsal ridge absent; lateral arms well defined; ventral ridge long and generally distinct (occasionally rather faint and ghost-like²³), with a narrow reticulated border anteriorly, which broadens posteriorly and fuses with ocular sclerite; with 2 or 3 fs + 1 or 2 hs ventral midcranial ridge. Genae large and polygonally reticulated throughout, each reticulation rather faint, with a few, short, sinuous inner microridges or (more frequently) small spots; genal setae: with 0–6 fs + 0 or 1 hs on each side. Simple eyes: 4 pairs, each more or less round; each large dorsal eye 35–53 μm and each ventral eye 37–49 μm wide; each with a closely associated, slightly smaller,

round, lateral simple eye each 30–43 μm wide. Ocelli well defined, 13–17 μm wide. Ocular sclerite polygonally reticulated, each reticulation with a few sinuous inner microridges. Preocular ridge: ventral arm long but not reaching midcranial ridge; dorsal arm subequal in length. Postocular ridge well developed but not nearly reaching ocelli dorsally. Dorsal ocular setae: 1–6 fs + 0 or 1 hs on each side. Ventral head setae: with about 9–17 fs + 6–8 hs on each side anterior and laterad to ventral eyes, and with 2 or 3 fs + 0 or 1 hs between ventral eyes; ventral ocular setae absent. Tentorial bridge well developed. Cranial apophysis 41–52 μm long, with a shallow distal bifurcation. **Antennae:** 810–975 μm long (ratio of total body length to length of antennae 1:0.6). Scape: 43–58 μm long and 38–46 μm wide, with 1 (rarely 2) hs ventrally and 2 hs mediodorsally. Pedicel: length 36–44 μm , width 36–45 μm ; reticulated, with 5–13 fs + 4 or 5 hs (setae on both surfaces). Segments III–IX all about 13–18 μm wide; lengths (μm): III: 68–97; IV: 136–161; V: 116–169; VI: 117–137; VII: 87–121; VIII: 69–96 and IX: 64–76; fs about 36–40 μm long; approximate number of setae per segment: III: 0–3 fs + 1 or 2 hs + 1 sensilla basiconica; IV: 16–24 fs + 0 or 1 hs; V: 17–22 fs + 0 hs; VI: 20–24 fs + 0 or 1 hs; VII: 16 fs + 0 or 1 hs; VIII: 15–17 fs + 0 hs + 1 bristle; IX: 13–17 fs + 0 hs + 1 bristle (bristles on VIII–IX sometimes barely differentiated). Segment X: length 74–95 μm ; not constricted apically; with 3 capitate setae, 3 large + 2 small antennal bristles and about 9–17 fs; with 2 sensilla basiconica, 1 apically and 1 slightly more proximally.

Thorax. Prothorax: pronotal ridge strong, with lateral pronotal sclerite distinctly striated or reticulated; with 0 or 1 lateral pronotal setae on each side. Sternum with a strong transverse ridge; median ridge absent; sternite narrow and triangular, with faint striations; prosternal setae: about 1–3 fs + 1–3 hs on each side. Anteprosternal setae: possibly 0–2 on each side but these just anterior to procoxae. Antemesospiracular setae absent. **Mesothorax:** prescutum distinctly wider than long (156–185 μm wide and 82–107 μm long); with slight striations medially. Scutum: median membranous area wider than long (140–186 μm wide; perhaps 62–91 μm long); scutal setae: 6–14 fs + 5–20 hs; lateral margins not reticulated. Scutellum 153–178 μm wide and 35–40 μm long; tubular, with a small foramen; without scutellar setae. Basisternum about 205–234 μm wide and 124–160 μm long; with a complete, strong median ridge, bounded by strong marginal and precoxal ridges; without basisternal setae; lateropleurite with no extension from marginal ridge anteriorly; furca well developed, each arm extending anteriorly well past point where marginal ridge and precoxal ridges fuse. Mesothoracic spiracle: peritreme 18–22 μm wide. Postmesospiracular setae: about 25–43 fs + 0–4 hs, extending full width of segment. Tegula well developed

but without tegular setae. **Metathorax:** metapostnotum not sclerotised; with 0 or 1 hs metatergal seta on each side. Metapleural ridge short, only present ventrally near metacoxae; episternum unsclerotised, with 6–12 fs + 0 or 1 hs postmetaspiracular setae; metepimeron sclerotised with 0–2 fs. Metathoracic spiracle: width of peritreme 19–24 μm . Antemetaspiracular setae: about 1–4 fs (but difficult to separate from dorsospiracular setae); dorsospiracular setae: about 3 or 4 fs. Metasternum mildly sclerotised. Anterior metasternal setae: about 34–45 fs + 0 or 1 hs; posterior metasternal setae: about 13–15 fs.

Wings: of moderate length (1200–1325 μm) and width (550–600 μm) (ratio length to width 1:0.46; ratio of total body length to wing length 1:0.85). Hamulohalteres absent.

Legs: subequal in length. Coxa lengths (μm): I: 90–103; II: 103–107; III: 99–112; coxal III setae: about 12–15 fs, 4–11 hs + 2 long setae; long apical setae on each coxa about 58–61 μm long. Trochanter + femur lengths (μm): I: 227–252; II: 186–232; III: 190–236; trochanter III with about 6–13 fs + 1 or 2 hs; long trochanter seta 26–54 μm ; femur III with about 8–18 fs + 13–18 hs. Tibia lengths (μm): I: 248–298; II: 230–270; III: 240–278; tibia III with about 50–61 setae, mainly fs + hs proximally, becoming mainly spurlike setae on distal 1/3; large apical spur 23–29 μm long. Tarsus lengths (μm): I: 132–169; II: 124–154; III: 136–158 (ratio length of tibia III to length of tarsus III 1:0.57); III with a total of 44–49 setae, many spurlike; distal tarsal spur 26–33 μm ; tarsal digitules shorter than claw. Claws long and thin, longer than width of tarsus, slightly curved, lacking a denticle; length: III: 22–28 μm ; claw digitules extending a little past tip of claw.

Abdomen: segments II–VII: tergum unsclerotised; sternum unsclerotised or possibly with slight sclerotisations, particularly on segment VII. Caudal extension of segment VII small and rounded. Dorsal abdominal setae, total across each segment: segments I–VII: 0 or 1 fs + 0–2 hs. Pleural setae: dorsopleural setae: segments I–VI: 0 or 1 fs + 1–3 hs on each side; ventropleural setae on each side: II–V: 0–3 fs + 0 or 1 hs; VI: 0–5 fs + 0–3 hs; VII (dorsopleural + ventropleural setae): 4–12 fs + 1–3 hs. Ventral abdominal setae, total across each segment: II: 6–8 fs + 0–2 hs; III–IV: 0–3 fs + 0–4 hs; V–VII: 3–9 fs + 0–3 hs. Segment VIII: tergum unsclerotised, with a group of 0–7 fs + 2–4 hs antennal setae which, when abundant, tend to fuse with pleural setae on caudal extension; sternite with about 4–6 fs + 0 or 1 hs ventral abdominal setae on each side; caudal extension small, with 1–6 fs + 0–5 hs pleural setae. Glandular pouch absent. **Genital segment:** penial sheath quite short and sclerotised; length 264–300 μm , width at base 74–85 μm ; about 1/5 of total body length (ratio of total body length to

length of penial sheath 1:0.22). Basal rod short, 38–42 µm long anterior to aedeagus, not nearly reaching basal membranous area anteriorly and with a short (20–33 µm) extension down aedeagus. Aedeagus 154–189 µm long (ratio length of aedeagus to length of basal rod 1:0.6), broadest at basally and either parallel sided or tapering slightly towards apex. Penial sheath with 7–9 small setae along each margin and with a cluster of small sensilla present near apex.

Comment. The material from Waitakere differs from that from Paoneone and Otanga in having a group of 4–7 fs + 0–4 hs ante-anal setae rather than 2 long hs. It otherwise appears to be very similar.

The males of *Umbonichiton* are all rather alike. *U. bullatus* can be separated from the other 4 species by the following combination of characters:

- (i) dorsal ocular setae present anterior to ocelli (absent on *U. hymenantherae* and *U. jubatus*);
- (ii) border of reticulations laterad to ventral midcranial ridge fairly broad (very narrow on *U. adelus*);
- (iii) ventral head setae common laterally on ocular sclerite between ventral and dorsal simple eyes (absent on *U. jubatus*);
- (iv) tegular setae absent (as on *U. pellaspis*; present on *U. adelus* and *U. jubatus*, and also maybe on *U. hymenantherae*);
- (v) with only a few prosternal setae (abundant on *U. hymenantherae*);
- (vi) genal reticulations with mainly spots (as on *U. pellaspis*; with a few short microridges on *U. adelus*; inner microridges/spots absent from other two species);
- (vii) polygonal reticulations of ocular sclerite with few inner microridges (many on *U. adelus* and *U. pellaspis*);
- (viii) glandular pouch absent (also absent on *U. hymenantherae* and *U. pellaspis*, but present on other two species);
- (ix) posterior metasternal setae rather few (abundant on *U. hymenantherae*, much less frequent on other species).

Umbonichiton hymenantherae (Maskell)

Fig. 59, 89

Live appearance: body pinkish-brown, head brown with black eyes; coxae and femora appearing paler and tibiae and tarsi darker than body; caudal wax filaments absent.

Test convex, of translucent golden-coloured wax plates, median row of 6–8 plates larger and more convex than other plates; each plate composed of a raised knob with sharp corners that together give an overall roughened appearance. On underside of leaves of host plant.

Material examined: see Appendix for collection details of specimens examined.

Described from 1 specimen in good condition.

Mounted material: fairly small and robust, total body length about 1.5 mm, width at mesothorax about 300 µm; with fairly short antennae, only just over half body length; body with numerous setae on appendages and ventrally, but rather few on dorsum; fleshy setae generally easy to differentiate from hairlike setae; length of fs on antennae slightly less than twice width of antennal segments. Wings quite long, about 9/10 of total body length; width about half wing length. Hamulohalteres absent.

Head: quadrangular, somewhat tapering posteriorly in dorsal view; length from apex to posterior margin of head 203 µm; width across genae 267 µm. Median crest reticulated: with 12–14 fs + 4–6 hs dorsal head setae on each side. Midcranial ridge: dorsal ridge absent; ventral ridge narrow but well-defined, extending posteriorly almost as far as ocular sclerite; with a narrow reticulated border, which broadens posteriorly, fusing with ocular sclerite; with 3–5 fs + 2 hs ventral midcranial ridge setae on each side. Genae large and faintly polygonally reticulated throughout, a few anterior reticulations with a 1–2 inner microridges, most reticulations with small dots; with 17 or 18 fs genal setae on each side. Simple eyes: four pairs; dorsal and ventral pairs large, subequal in size, almost circular, each 43–46 µm wide; each with a closely associated, slightly smaller, slightly oval, lateral simple eye, 34–38 µm wide. Ocelli well defined. Ocular sclerite: most reticulations with a few branched inner microridges anteriorly and small spots posteriorly. Preocular ridge long, with ventral arm not quite reaching midcranial ridge; dorsal arm subequal in length. Postocular ridge well developed throughout, although not quite reaching ocelli dorsally. Dorsal ocular setae absent. Ventral head setae: with about 20 fs + 3 or 4 hs on each side anterior, laterad and medially between posterior ventral eyes; and with 2 fs just posterior to ventral eyes; ventral ocular setae absent. Tentorial bridge well developed. Cranial apophysis 41 µm long and deeply divided distally. **Antennae:** 832 µm long (ratio of total body length to length of antennae 1:0.55). Scape: 56 µm long and 39 µm wide; with 1 hs ventrally and 2 hs dorsally. Pedicel: length 40 µm and width 39–44 µm; lightly reticulated, with about 5 fs + 4 hs, setae present on both surfaces. Segments III–IX all about 23 µm wide; lengths (µm): III: 74; IV: 110; V: 115; VI: 95; VII: 88; VIII: 85 and IX: 81; length of fs about 36–43 µm; approximate number of setae per segment: III: 4 fs + 1 hs + 3 sensilla basiconica; IV: 21 fs + 0 hs; V: 22 fs + 2 hs; VI: 20 fs + 0 hs; VII: 22 fs + 0 hs; VIII: 16 fs + 0 hs + 1 bristle; IX: 20 fs + hs + 1 bristle. Segment X: length 72 µm; not constricted apically; with 3 capitate setae, 3 long and 2 short antennal bristles and about 15 fs; with 2 sensilla basiconica, 1 almost on apex and 1 between bases of 2 bristles.

Thorax. Prothorax: pronotal ridge strong; lateral pronotal sclerites broad and striated; with a pair of lateral pronotal

hs. Sternum with a strong transverse ridge; median ridge weak; sternite broad, with polygonally reticulated margins; prosternal setae: 6 fs + 1 hs on each side. Anteprosternal setae: 2 fs on each side, well forward of procoxae. Antemesospiracular setae absent. **Mesothorax:** prescutum nearly twice as wide as long (176 μm wide and 94 μm long); not reticulated. Scutum: median membranous area much wider than long (164 μm wide; perhaps 49 μm long); scutal setae: about 12 fs + 8 hs; lateral margins not reticulated. Scutellum 164 μm wide and 29 μm long; with a moderate to large foramen. Basisternum about 205 μm wide and 123 μm long; with a complete, strong median ridge, bounded by strong marginal and precoxal ridges; without basisternal setae (stn_s); lateropleurite bounded anteriorly by a short extension from marginal ridge; furca well developed, each arm extending anteriorly well past point where marginal ridge and precoxal ridges join. Postalare reticulated anteriorly, with 0 or 1 postalare setae. Mesothoracic spiracle: width of peritreme about 27 μm . Postmesospiracular setae abundant, about 50 fs + 4 hs, extending full width of segment. Tegula small, with 1 or 2 hs tegular setae. **Metathorax:** metapostnotum unsclerotised; with a single metatergal hs on each side. Metapleural ridge short, only present ventrally near metacoxae; episternum sclerotised, with 3 fs postmetaspiracular setae; metepimeron well developed, without setae. Metathoracic spiracle: width of peritreme about 27 μm . Antemetaspiracular setae: 3 or 4 fs; dorsospiracular setae: 5 or 6 fs. Metasternum membranous. Anterior metasternal setae: about 55 fs; posterior metasternal setae: about 34 fs.

Wings: of moderate length (1269 μm) and width (621 μm) (ratio length to width 1:0.49; ratio of total body length to wing length 1:0.85). Hamulohalteres absent.

Legs. Prothoracic legs slightly longer than meso- and metathoracic legs; with rather few setae. Coxa lengths (μm): I: 94–99; II: 99–103; III: 100–107; coxal III setae: about 16–21 fs + 5–9 hs; long apical seta on each coxa about 60 μm long. Trochanter + femur lengths (μm): I: 246–251; II: 217–221; III: 225–230; trochanter III with about 11–13 fs + 2 or 3 hs; femur III with about 17–23 fs + 12 hs; long trochanter seta about 59 μm long. Tibia lengths (μm): I: 250–258; II: 225–230; III: 237–242; tibia III with about 47–54 setae, these becoming spurlike on distal third of leg; apical spur 36–38 μm long. Tarsus lengths (μm): I: 153–160; II: 155–160; III: 147–152 (ratio length of tibia III to length of tarsus III 1:0.63); tarsus III with about 48 setae, mainly spurlike; spur at base of tarsus fine, 36 μm long; tarsal digitules about as long as claw. Claws: length subequal to width of tarsi, inner margin barely indented, without a denticle; length: III: 30–33 μm ; claw digitules a little longer than claw.

Abdomen: segments I–VII: sternite and tergite VII represented by light sclerotisation. Caudal extension of segment VII small and rounded. Dorsal abdominal setae, across each segment: I–II: 0 or 1 fs + 2 hs, III–IV: no setae; V–VII: 2 hs. Pleural setae: dorsopleural setae on each side: segments I–VI: 0–3 hs; ventropleural setae on each side: II–VI: 1–4 fs + 1 hs; VII (dorsopleural + ventropleural setae): 5 or 6 fs + 2 or 3 hs. Ventral abdominal setae across each segment: 7–14 fs + 0 or 1 hs. Segment VIII: tergum unsclerotised, lacking setae anteriorly but with 5 fs ante-anal setae posteriorly; sternite moderately sclerotised, with 4 pairs of fs ventral abdominal setae; caudal extension small, rounded and unsclerotised, with 1 or 2 fs + 4 hs pleural setae; glandular pouch absent. **Genital segment:** penial sheath quite long; 260 μm long and 81 μm wide at base; about 1/6 of total body length (ratio of total body length to length of penial sheath 1:0.17). Basal rod short, length 45–50 μm , anteriorly reaching to within about 13 μm of basal membranous area. Aedeagus 135 μm long (ratio length of aedeagus to length of basal rod 1:0.35), slightly tapering. Penial sheath with 8–10 small setae along margins and with a cluster of small sensilla present near apex.

Comment: the males of *Umbronichiton* are all rather alike. *U. hymenantherae* is considerably more hirsute than the other 4 species, from which it can be separated also by:

- (i) dorsal ocular setae absent anterior to ocelli (also absent on *U. jubatus*; present on other 3 species);
- (ii) border of reticulations laterad to ventral midcranial ridge fairly broad (narrow on *U. adelus*);
- (iii) ventral head setae common laterally on ocular sclerite between ventral and dorsal simple eyes (absent on *U. jubatus*);
- (iv) prosternal setae abundant (few on other 4 species);
- (v) postmesospiracular setae abundant (many fewer on other species);
- (vi) genal reticulations with a few inner microridges anteriorly, with many spots posteriorly (spots only on *U. pellaspi*; small inner microridges present throughout on *U. adelus* and *U. bullatus*; faint spots only on *U. jubatus*);
- (vii) polygonal reticulations of ocular sclerite with few inner microridges (many on *U. adelus* and *U. pellaspi*);
- (viii) glandular pouch absent (also absent on *U. bullatus* and *U. pellaspi* but present on other 2 species);
- (ix) posterior metasternal setae rather abundant (rather fewer on other 4 species).

The Maskell material has the same collection data as the lectotype series but was not designated a paralectotype by Hodgson & Henderson (2000).

***Umbonichiton jubatus* Henderson & Hodgson**

Fig. 90

Live appearance: not known for adult male.**Test** convex, noticeably higher at anterior end than posteriorly, of translucent glassy wax plates, median row of plates larger than other plates. Site on host plant unknown.**Material examined:** see Appendix for collection details of specimens examined.

Described from 2 specimens in fair condition.

Mounted material: fairly small but robust, total body length about 1.45 mm; with antennae just over 1/2 total length of body; setae few on body, fleshy setae particularly scarce on both dorsal and ventral surfaces but fs generally easy to differentiate from hairlike setae; length of fs on antennae about 1.5× width of antennal segments. Wings quite long, about 9/10 of total body length; width about half wing length. Hamulohalteres absent.**Head:** approximately round to oval in dorsal view; width across genae 277–305 µm. Median crest reticulated, with about 0 or 1 fs + 2 or 3 hs dorsal head setae on each side. Midcranial ridge: dorsal ridge absent; ventral ridge short and poorly defined; lateral arms also poorly defined: with a narrow reticulated border which extends posteriorly where it broadens and fuses with ocular sclerite; ventral midcranial ridge without setae. Genae large and polygonally reticulated throughout, each reticulation faint, poorly defined and elongate, with faint spots but no inner microridges; genal setae: with about 1–3 fs + 0 or 1 hs on each side. Simple eyes: four pairs; large dorsal and ventral pairs subequal in size, slightly oval, 39–49 µm wide; each with a closely associated, slightly smaller, round, lateral simple eye, 25–29 µm wide. Ocelli poorly defined. Ocular sclerite with polygonal reticulations, each with an occasional inner microridge or some faint spots. Preocular ridge with ventral arm reaching 2/3 towards midcranial ridge; dorsal arm slightly shorter. Postocular ridge well developed but not nearly reaching ocelli dorsally. Dorsal ocular setae: 0 or 1 fs on each side. Ventral head setae: with about 1–3 fs + 3 or 4 hs on each side anterior to ventral eyes; absent laterally between ventral and dorsal eyes; with 1 hs between ventral eyes; ventral ocular setae absent. Tentorial bridge well developed. Cranial apophysis short, with a shallow bifurcation; length uncertain. **Antennae:** 864 µm long (ratio of total body length to length of antennae 1:0.6). Scape: 46–54 µm long and 54–63 µm wide; with 3 hs setae. Pedicel: length 43–45 µm, width 45–54 µm; slightly reticulated, with 0 fs + 2–4 hs; no setae on dorsal surface. Segments III–IX all about 23–29 µm wide; lengths (µm): III: 75–78; IV: 118–158; V: 135–139; VI: 118–119; VII: 97–101; VIII: 79–80 and IX: 70–71; fs about 34–36 µm long; approximate number of setae per segment: III: 2 fs + 0 hs (possibly with no sensilla

basiconica); IV: 12 fs + 1(?) hs; V: 25 fs + 0 hs; VI: 19 fs + 2(?) hs; VII: 14–19 fs + 1(?) hs; VIII: 17 fs + 0 hs and IX: 16 fs + 0 hs; bristles apparently not differentiated on segments VIII and IX. Segment X: length 63–72 µm; short and stout, not obviously constricted apically; with 3 capitate setae, 3 large + 2 small antennal bristles (but these hard to differentiate from fs) and about 8–11 fs; with 1 or 2 apical sensilla basiconica.

Thorax. Prothorax: pronotal ridge strong, with small, barely sclerotised, lateral pronotal sclerites; with 1 pair of hs lateral pronotal setae. Sternum with a strong transverse ridge; median ridge absent; sternite poorly defined; prosternal setae: 2–4 fs + 2 hs. Anteprosternal setae and antemesospiracular setae absent. **Mesothorax:** prescutum less than 2× as wide as long (135–152 µm wide and 112–115 µm long); without striations medially. Scutum: median membranous area wider than long (164–181 µm wide; perhaps 49–62 µm long); scutal setae: 1 or 2 fs + 4–6 hs; lateral margins not reticulated. Scutellum 164–172 µm wide and 49–53 µm long; with a large foramen. Basisternum about 225–242 µm wide and 143–160 µm long; with a complete, strong median ridge, bounded by strong marginal and precoxal ridges; without basisternal setae (stn₃s); lateropleurite with a lightly sclerotised extension from marginal ridge anteriorly; furca well developed, each arm extending anteriorly past point where marginal ridge and precoxal ridges meet. Postalare reticulated anteriorly; without postalare setae. Mesothoracic spiracles: peritreme 23–25 µm wide. Postmesospiracular setae few, about 4–6 fs + 0–2 hs posterior to each mesothoracic spiracle plus 1 fs medially. Tegula: well developed, with 0 or 1 fs + 2 or 3 hs. **Metathorax:** metapostnotum unsclerotised; metatergal setae: 0–1 fs + 1 hs on each side. Metapleural ridge only present ventrally near metacoxae, short; episternum membranous, with 3 or 4 fs postmetaspiracular setae. Metepimeron sclerotised but without setae. Metathoracic spiracle; width of peritreme 27 µm. Antemetaspiracular setae and dorsospiracular setae hard to distinguish, perhaps 2 or 3 fs of former on each side and 6–8 fs of latter. Metasternum membranous. Anterior metasternal setae: about 15–23 fs + 0–2 hs; posterior metasternal setae: 1 hs medially and 3–8 fs laterally.**Wings:** hyaline, of moderate length (1310 µm) and width (648 µm) (ratio length to width 1:0.49; ratio of total body length to wing length 1:0.91). Hamulohalteres absent.**Legs:** prothoracic legs only slightly longer than meso- and metathoracic legs; with rather few setae. Coxa lengths (µm): I: 90–107; II: 90–103; III: 94–107; coxal III setae: about 5–7 fs + 6 or 7 hs; long apical seta on each coxa about 56 µm long. Trochanter + femur lengths (µm): I: 246–259; II: 198–218; III: 221–225; trochanter III with about 9 fs + 2 hs; long trochanter seta about 70 µm long; femur III with about 10 fs + 10 hs. Tibia lengths (µm): I: 233–263; II:

225–246; III: 237–242; tibia III with about 44 setae, mostly hs and fs, few spurlike; apical spur rather fine and not clearly defined, length 23–28 μm . Tarsus lengths (μm): I: 127–130; II: 127–144; III: 131–152 (ratio length of tibia III to length of tarsus III 1:0.59); tarsus III with about 31 setae, mainly fs and hs; spur at base of tarsus fine, 23–26 μm long; tarsal digitules about as long as claw, knob-like apex slightly larger than usual. Claws: length subequal to width of tarsi, inner margin barely indented, without a denticle; length: III: 23–25 μm ; claw digitules a little longer than claw.

Abdomen: segments I–VII: tergites unsclerotised or only lightly; sternites unsclerotised. Caudal extension of segment VII small and rounded. Dorsal abdominal setae: total across segment: I–VII: 0–4 fs + 0–3 hs. Pleural setae: dorsopleural setae on each side: I–VI: 0 or 1 fs + 0–2 hs; ventropleural setae on each side: I–VI: 0 or 1 fs + 0 or 1 hs, VII: dorsopleural + ventropleural setae: 3–6 fs + 2–5 hs (quite long). Ventral abdominal setae: totals across segment: I–VII 0–2 fs + 2 hs. Segment VIII: tergum unsclerotised, with 3 long hs ante-anal setae posteriorly; sternite moderately sclerotised, with 1 fs + 1–3 hs ventral abdominal setae; caudal extension small, each with 0 or 1 fs + 2 or 3 hs pleural setae. Glandular pouch present; length of glandular pouch setae 95–116 μm . **Genital segment:** penial sheath rather short and broad; length 270–275 μm ; 82–95 μm wide at base; about 1/5 of total body length (ratio of total body length to length of penial sheath 1:0.19). Basal rod extending to basal membranous area anteriorly; quite short, length 63 μm anterior to base of aedeagus, and with a short extension within aedeagus. Aedeagus 162–173 μm long (ratio length of aedeagus to length of basal rod 1:0.37), broadest basally and more/less parallel sided. Penial sheath with 5–7 small setae along each margin of penial sheath and with a cluster of about 6–11 small sensilla near apex.

Comment: the males of *Umbonichiton* are all rather alike. *U. jubatus* can be separated from the other 4 species by the following combination of characters:

- (i) dorsal ocular setae absent anterior to ocelli (present on *U. adelus*, *U. bullatus* and *U. pellaspsis*);
- (ii) border of reticulations laterad to ventral midcranial ridge fairly broad (very narrow on *U. adelus*);
- (iii) ventral head setae absent laterally on ocular sclerite between ventral and dorsal simple eyes (common on other four species);
- (iv) tegular setae absent (present on *U. adelus*; occasionally present on *U. hymenantherae*);
- (v) prosternal setae few (abundant on *U. hymenantherae*);
- (vi) postmesospiracular setae few (abundant on *U. hymenantherae*);
- (vii) genal reticulations with only faint spots, no inner microridges (spots on *U. pellaspsis*; some inner

- microridges present on other 3 species);
- (viii) polygonal reticulations of ocular sclerite with an occasional inner microridges (many microridges on *U. adelus* and *U. pellaspsis*);
- (ix) glandular pouch present (absent on *U. bullatus*, *U. hymenantherae* and *U. pellaspsis*);
- (x) posterior metasternal setae rather few (abundant on *U. hymenantherae*).

Umbonichiton pellaspsis Henderson & Hodgson

Fig. 60, 61, 91

Live appearance: body colour light brown; head dark with black eyes, and with antennae and legs pale.

Test slightly convex, of rows of translucent glassy wax plates, each slightly convex and mostly uniform in size. On underside of leaves of host plant

Material examined: see Appendix for collection details of specimens examined.

Described from 2 specimens in good condition, but 1 missing both antennae and a meso- and metathoracic leg, and other specimen with head somewhat distorted.

Mounted material: slender and of moderate size, total body length about 1.43–1.56 mm; antennae about half total body length; body fairly hirsute, fleshy setae rare dorsally (except on scutum) but fairly frequent ventrally, these generally easy to differentiate from hairlike setae; length of fs on antennae about twice width of antennal segments. Wings of moderate length, about 8/10 of total body length; width about 1/2 wing length. Hamulohalteres absent.

Head: approximately round in dorsal view; length 234 μm , width across genae 230–260 μm . Median crest reticulated, with about 3–6 fs + 6–12 hs dorsal head setae on each side. Midcranial ridge: dorsal ridge absent; ventral ridge with lateral arms well defined and ventral ridge long and distinct, with a narrow reticulated border which broadens posteriorly and fuses with ocular sclerite; with 4 fs + 1 hs ventral midcranial ridge setae on each side. Genae large and polygonally reticulated throughout, each reticulation with numerous small spots; genal setae: with 5 or 6 fs + 0–3 hs on each side. Simple eyes: four pairs, each more or less round; large dorsal eyes each 45–55 μm and ventral eyes each 48–50 μm wide; each with a closely associated, slightly smaller, round, lateral simple eye, those dorsally 43–51 μm wide and those ventrally 38–40 μm wide. Ocelli possibly absent. Ocular sclerite polygonally reticulated, each reticulation with several rather varied inner microridges, mostly short, angular and divided. Preocular ridge: ventral arm long and almost reaching midcranial ridge; dorsal arm subequal in length or shorter. Postocular ridge well devel-

oped but not nearly reaching dorsal surface. Dorsal ocular setae: 6 or 7 fs on each side. Ventral head setae: with about 18 fs + 3–5 hs on each side anterior and laterad to ventral eyes; with or without setae between ventral eyes; ventral ocular setae absent. Tentorial bridge well developed. Cranial apophysis 60 µm long, with a shallow distal bifurcation, each arm quite broad. **Antennae:** 810–815 µm long (ratio of total body length to antennae length 1:0.5); scape: 49–58 µm long and 38–43 µm wide, with 1 hs ventrally and 2 hs mediodorsally. Pedicel: length 41–45 µm, width 41–46 µm; reticulated, with 4–7 fs + 2–8 hs, setae present on both surfaces. Segments III–IX all about 17–20 µm wide; lengths (µm): III: 64–68; IV: 134–136; V: 117–121; VI: 114–119; VII: 92–100; VIII: 79–87 and IX: 68–73; fs about 36–44 µm long; approximate number of setae per segment: III: 1 or 2 fs + 0 or 1 hs (possibly with no sensilla basiconica); IV: 24–27 fs + 0 hs; V: 24 or 25 fs + 0 hs; VI: 25 fs + 0 hs; VII: 21 fs + 0 hs; VIII: 18–22 fs, 0 hs + 1 bristle, and IX: 16–21 fs, 0 or 1 hs + 1 bristle. Segment X: length 76–78 µm; not obviously constricted apically; with 3 capitate setae, 3 large + 2 small antennal bristles and about 11 or 12 fs; with 1 or 2 apical sensilla basiconica.

Thorax. Prothorax: pronotal ridge strong; lateral pronotal sclerite broad, distinctly striated but not reticulated; with 0 or 1 hs lateral pronotal setae on each side. Sternum with a strong transverse ridge; median ridge lightly sclerotised basally on 1 specimen and for its full length on other; sternite triangular, with faint striations; prosternal setae: 2–4 fs + 1 hs on each side; anteprosternal setae: with 5–8 fs in total. Antemesospiracular setae absent. **Mesothorax:** prescutum 178 µm wide, 104 µm long; with slight striations medially. Scutum: median membranous area much wider than long (165–178 µm wide; perhaps 45–50 µm long); scutal setae abundant, possibly 26–40 fs + 6–10 hs; lateral margins not reticulated. Scutellum with larger than usual lateral horns; 153–166 µm wide without horns, 29–34 µm long; tubular, possibly with a fairly narrow foramen; without scutellar setae. Basisternum about 210–236 µm wide, 145–154 µm long; with a complete, strong median ridge, bounded by moderately strong marginal and precoxal ridges; without basisternal setae; lateropleurite rather narrow and lacking an extension from marginal ridge anteriorly; furca well developed, each arm extending anteriorly well past point where marginal ridge and precoxal ridges fuse. Postalare vaguely reticulated anteriorly; with 0 or 1 postalare setae. Mesothoracic spiracle: peritreme 18–25 µm wide. Postmesospiracular setae: about 18–30 fs extending full width of segment. Tegula well developed but without tegular setae. **Metathorax:** metapostnotum unsclerotised; with 0 or 1 hs metatergal setae on each side + 0 or 1 fs medially. Metapleural ridge short, only present ventrally near metacoxae; episternum unsclerotised, with

8–15 fs postmetaspiracular setae; metepimeron sclerotised, with 1 or 2 fs. Metathoracic spiracle: width of peritreme 18–25 µm. Antemesospiracular setae possibly absent; dorsospiracular setae: 2 or 3 fs (or up to 6 fs?) on each side. Metasternum slightly sclerotised. Anterior metasternal setae: about 32–45 fs; posterior metasternal setae: 7–13 fs.

Wings: hyaline, of moderate length (1.2–1.25 mm) and width (575–625 µm) (ratio length to width 1:0.49; ratio of total body length to wing length 1:0.82). Hamulohalteres absent.

Legs: subequal in length. Coxa lengths (µm): I: 97–108; II–III: 107–125; coxal III setae: about 16 or 17 fs, 6–8 hs + 2 long setae; long apical setae on each coxa about 51–60 µm long. Trochanter + femur lengths (µm): I: 248–260; II: 232; III: 240–245; trochanter III with about 15 or 16 fs + 1 hs; long trochanter seta short, about 33–37 µm; femur III with about 20 or 21 fs + 12 or 13 hs. Tibia lengths (µm): I: 269; II: 257–269; III: 281–285; tibia III with about 54–56 setae, mainly fs + hs proximally, becoming mainly spurlike on distal third; large apical spur 30–31 µm long. Tarsus lengths (µm): I: 161–170; II: 161–165; III: 153–162 (ratio length of tibia III to length of tarsus III 1:0.56); tarsus III with about 51–55 setae, mainly spurlike; distal tarsal spur 33 µm; tarsal digitules rather shorter than claw. Claws long and thin, subequal in length to width of tarsus, rather straight, without a denticle; length: III: 27–29 µm; claw digitules extending a little past tip of claw.

Abdomen: segments II–VII: tergite VII lightly sclerotised; sternites VI and VII lightly sclerotised, particularly on segment VII, and perhaps II and III as well. Caudal extension of segment VII quite distinct and rounded. Dorsal abdominal setae, on each side: segment I: 0 or 1 hs; II–IV: absent; V–VII: 1 or 2 hs. Pleural setae: dorsopleural setae, on each side: segments I–II: absent; III–VI: 1 fs + 1 or 2 hs; ventropleural setae, on each side: I–III: absent; IV–VI: 1 fs; VII (dorsopleural + ventropleural setae): 6–8 fs + 2–5 hs. Ventral abdominal setae, on each side: II: 0 or 1 fs; III–V: 1–4 fs + 1 hs; VI: 3–5 fs + 0 or 1 hs; VII: 3–6 fs. Segment VIII: tergite moderately sclerotised, with a group of 2–6 fs + 9–11 hs setae posteriorly, extending across width of segment and including pleural and ante-anal setae; sternite with about 3–5 fs ventral abdominal setae on each side; caudal extension insignificant and rounded, pleural setae fusing with ante-anal setae. Glandular pouch absent. **Genital segment:** penial sheath quite short and sclerotised; length 269–286 µm, width 74–83 µm at base; about 1/5 of total body length (ratio of total body length to length of penial sheath 1:0.19). Basal rod short, 41–48 µm long, with a longer extension down aedeagus; not nearly reaching basal membranous area anteriorly (distance from bma 20–25 µm). Aedeagus 149–163 µm long (ratio length of aedeagus to length of basal rod 1:0.28), broadest basally but with posterior 2/3 parallel-sided. Penial sheath

with 7–11 small setae along each margin and with a cluster of small sensilla present near apex.

Comment. *U. pellaspis* is fairly typical of the genus *Umbonichiton*. It differs from the other 4 species in possessing the following combination of characters:

- (i) dorsal ocular setae present (absent on *U. hymenantherae* and *U. jubatus*);
- (ii) border of reticulations laterad to ventral midcranial ridge fairly broad (very narrow on *U. adelus*);
- (iii) ventral head setae common laterally on ocular sclerite between ventral and dorsal simple eyes (absent on *U. jubatus*);
- (iv) tegular setae absent (present on *U. adelus*; occasionally present on *U. hymenantherae*);
- (v) prosternal setae few (abundant on *U. hymenantherae*);
- (vi) genal reticulation with spots (faint spots only on *U. jubatus*; some inner microridges present on other 3 species);
- (vii) polygonal reticulations of ocular sclerite with many inner microridges (few on all but *U. adelus*);
- (viii) glandular pouch absent (present on *U. adelus* and *U. jubatus*);
- (ix) posterior metasternal setae rather few (abundant on *U. hymenantherae*).

It is, perhaps, worth noting that the presence of glandular pouches is not a synapomorphic character-state for species in the genus *Umbonichiton*.

Species A

Fig. 92 (*Crystallotesta fusca?*)

Live appearance: not recorded for adult male.

Material examined: see Appendix for collection details of specimens examined.

Described from 1 specimen in fair condition.

Mounted material: moderate-sized, robust, total body length about 1.4 mm; antennae about 1/2 total length of body (ratio of total body length to antennal length 1:0.52); setae few, fleshy setae particularly scarce on both dorsal and ventral surfaces but fs generally easy to differentiate from hairlike setae. Wing length and width unknown.

Head: approximately round to diamond-shaped in dorsal view; width across genae 240 μ m. Median crest reticulated, with a sclerotised ridge posteriorly, which splits into two transverse arms, apparently representing a postoccipital ridge; with about 1 or 2 fs and 1 or 2 hs dorsal head setae. Midcranial ridge: dorsal ridge absent or represented by sclerotised ridge extending into postoccipital ridge; ventral ridge long, extending posteriorly almost to ocular sclerite; lateral arms rather short, with a narrow

reticulated border anteriorly, which broadens posteriorly where it fuses with ocular sclerite; ventral midcranial ridge without ventral midcranial ridge setae. Genae large but polygonally reticulated only in a narrow band posterior to ocelli, each reticulation with spots but no extra inner microridges; genal setae absent. Simple eyes: 2 large pairs, dorsal eyes possibly slightly larger than ventral eyes: each about 38–42 μ m wide. Ocelli well developed. Ocular sclerite: polygonally reticulated, each reticulation without inner microridges. Preocular ridge with ventral arm short, perhaps reaching 1/2 way to midcranial ridge. Postocular ridge well developed but not nearly reaching ocelli dorsally. Dorsal ocular setae absent. Ventral head setae: with about 1 or 2 fs + 1 or 2 hs on each side anterior to ventral eyes; none between ventral eyes; ventral ocular setae absent. Tentorial bridge well developed. Cranial apophysis short and bifid, but with each arm very long and thin; length about 56 μ m. **Antennae:** about 724 μ m long. Scape 51–54 μ m long and 54 μ m wide; with 1–3 hs setae. Pedicel slightly reticulated: length 46–48 μ m, width 43–45 μ m; with 2 or 3 fs and 3–5 hs (no setae on dorsal surface). Segments III–IX all about 19–25 μ m wide; lengths (μ m): III: 86–98; IV: 151–160; V: 116; VI: 83–108; VII: 86; VIII: 69–74 and IX: 53; fs about 38–40 μ m long; approximate number of setae per segment: III: 3 fs + 1 or 2 hs + with 3 sensilla basiconica; IV: 7–13 fs + 0 hs; V: 6–9 fs + 0 hs; VI: 7–13 fs + 0 hs; VII: 12 fs + 0 hs; VIII: 5 fs + 0 hs + 1 bristle, and IX: 5 or 6 fs + 0 hs + 1 bristle. Segment X both slightly deformed, short, possibly slightly constricted apically; length 59 μ m; with 3 capitate setae (cap), 2 large + 2 small antennal bristles and perhaps 1 or 2 fs; number of sensilla basiconica uncertain.

Thorax. Prothorax: pronotal ridge well developed but status of lateral pronotal sclerite and lateral pronotal setae uncertain. Sternum with a fairly strong transverse ridge; median ridge absent; prosternal setae: 2 hs. Anteprosternal setae and antemesospiracular setae absent.

Mesothorax: prescutum almost square (144 μ m long and 162 μ m wide); sclerotised but not reticulated. Scutum: median membranous area apparently much wider than long (161 μ m wide; perhaps 21 μ m long); scutal setae: 2 hs; lateral margins sclerotised but not reticulated. Scutellum 45–50 μ m long and 145 μ m wide; with a large foramen. Basisternum well developed, about 124 μ m long and 236 μ m wide; with a complete, strong median ridge, bounded by rather weak marginal ridges but strong precoxal ridges; without basisternal setae (stn₃s); lateropleurite with a lightly sclerotised extension from marginal ridge anteriorly; furca long and well developed, extending anteriorly to anterior margin of basisternum. Mesepisternum striated; subepisternal ridge well developed. Mesothoracic spiracles: peritreme 23–25 μ m wide. Postmesospiracular setae few, about 5 fs only. Tegula: well developed but without tegular setae. Antemetaspiracular se-

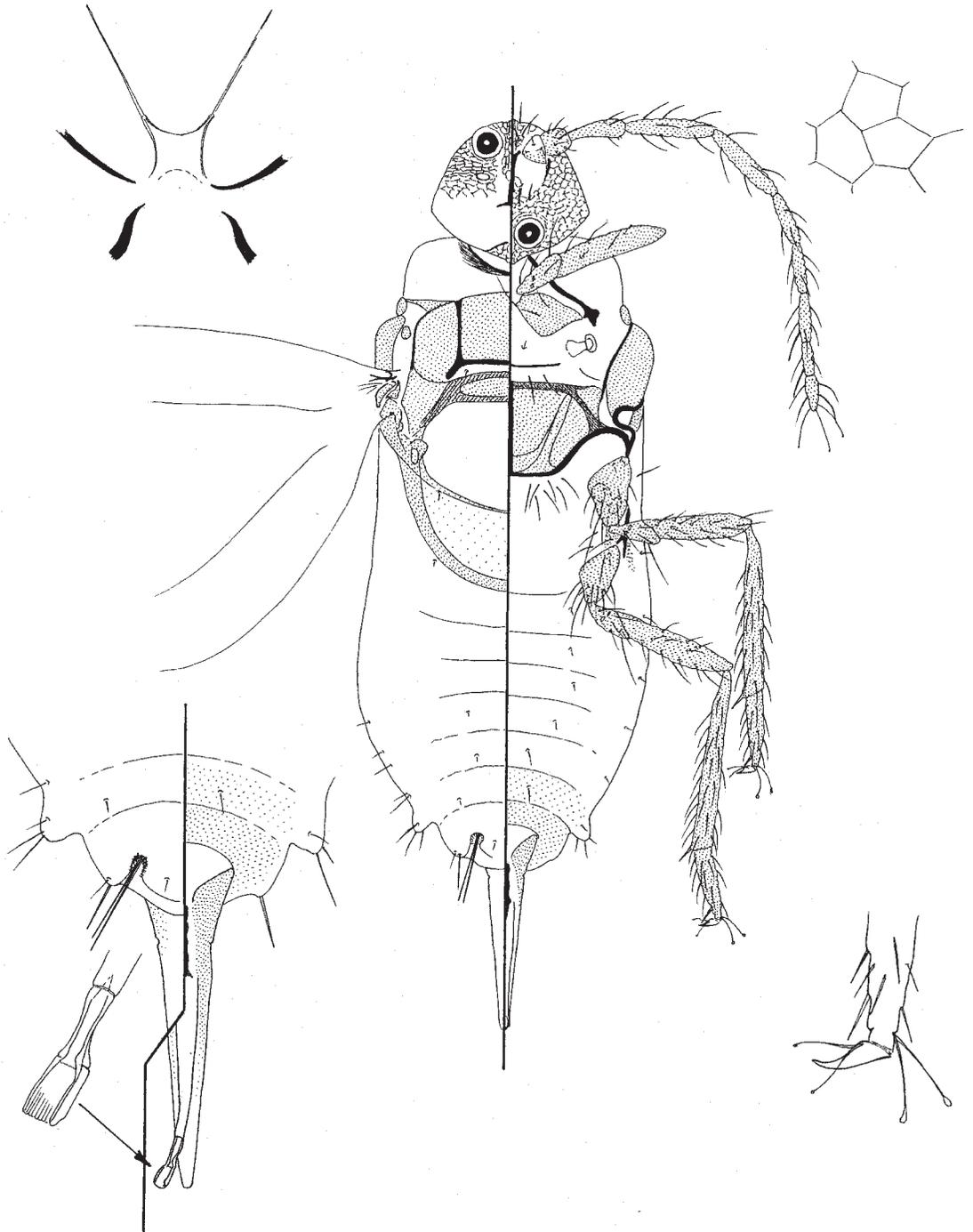


Fig. 92 Adult male, Species A (possibly *Crystallotesta fusca* (Maskell)). Bottom left — spatulate apex to aedeagus.

tae absent. **Metathorax:** metatergal seta: 1 hs on each side. Ventral section of pleural ridge well developed; episternum sclerotised, with 2–4 fs + 0 or 1 hs postmetaspiracular setae. Metepimeron sclerotised but without setae. Metathoracic spiracle; width of peritreme 28–33 μm . Dorsospiracular setae: possibly 1 fs on each side. Metasternum membranous. Anterior metasternal setae: about 14 fs; posterior metasternal setae absent.

Wings: hyaline, about 1.05 μm long, 469 μm wide (ratio of wing length to wing width 1:0.45; ratio of total body length to wing length 1:0.75). Hamulohalteres absent.

Legs: subequal in length; with rather few setae. Coxa lengths (μm): I: 66; II: 66–70; III: 70; coxal setae (III): about 10 or 11 fs + 3–5 hs + 2 bristles; long apical bristle on each coxa about 91 μm long. Trochanter + femur lengths (μm): I: 157–161; II: 140–145; III: 149–158; trochanter (III) with about 5 fs + 3 hs; femur (III) with about 7 fs + 9–13 hs; long trochanter seta about 76 μm long. Tibia lengths (μm): I: 151–158; II: 157–161; III: 166; tibia III with about 26–29 setae, these becoming spurlike on distal third of leg; each tibial spur 19–26 μm . Tarsus lengths (μm): I: 62–64; II: 66–72; III: 74–77; tarsus III with about 11–13 setae, mainly spurlike, spur at base of tarsus fine, 19–23 μm long; tarsal digitules about as long as claw. Claws: length shorter than width of base of tarsus; without a denticle; length (III) 23–26 μm ; claw digitules a little longer than claw.

Abdomen. Segments I–VII: tergum unsclerotised; sternum mildly sclerotised on segment VII. Caudal extension of segment VII pronounced, small and unsclerotised. Dorsal setae: totals per segment: I–IV: absent; V–VII: 0 fs + 2 hs. Pleural setae: per side: dorsopleural setae: I–III: absent; IV–VI: 0 or 1 fs + 1 hs; ventropleural setae: I–III absent; IV–VI: 1 hs; VII (dps + vps): 3 longish fs + 1 hs. Ventral setae: totals per segment: I–VII: 0–2 hs. Segment VIII: tergum unsclerotised, with 2 ante-anal setae (only basal sockets present); sternite sclerotised, without setae; caudal extension small or absent, with 1 long and 1 short hs pleural setae on each side. Glandular pouch present; length of glandular pouch setae 66–75 μm . **Genital segment.** Penial sheath moderately long and tapering, about 1/5 of total body length (ratio of total body length to penial sheath length 1:0.22); length 306 μm ; 99 μm wide at base. Basal rod extending to basal membranous area anteriorly; quite short, length 69–73 μm anterior to base of aedeagus, and with a short, 13 μm extension down aedeagus. Aedeagus 205 μm long (ratio length of aedeagus to basal rod length 1:0.36), broadest basally and tapering to an extraordinary spatulate-like apex, which is about level with apex of penial sheath. Penial sheath with 5–9 pairs small setae along margins of penial sheath and with a cluster of small sensilla present near apex.

Comment: in addition to the above material, there is a poor slide mounted from Maskell's dry collection, labelled *Ctenochiton fuscus* Mask. #39, mounted 2.iii.72 (NZAC): 1/1 pharate pupa. The adult male in the latter differs from the above description in a number of major ways:

- (i) membranous area of scutum much longer, with both fs and hs;
- (ii) penial sheath constricted near apex;
- (iii) aedeagus much shorter (150 μm) and without a spatulate apex;
- (iv) basal rod much longer, but not nearly reaching basal membranous area;
- (v) glandular pouches absent;
- (vi) tegular setae present;
- (vii) body apparently much more hirsute.

Little more can be seen on the Maskell slide but it is clearly not conspecific (or even perhaps congeneric) with the above specimen. Which (if either) is a male of *C. fusca* will have to await further collections. Nonetheless, the above specimen is unusual for a member of the Coccidae, to which it does appear to belong. Because of the interesting combination of characters, it was thought worthwhile to include it in this revision.

PART 2

PUPAE

Introduction. The pupae of only 13 soft scale species have been described previously, namely: *Ceroplastes pseudoceriferus* Green (Sankaran 1962); *Etiennae montrichardiae* (Newstead); *E. petasus* Hodgson, and *E. sinetuberculum* Hodgson (Hodgson 1993); *Eulecanium kunoense* (Kuwana) (Husseiny & Madsen 1962); *E. tiliae* (L.) (Kawecki 1958); *Neolecanium cornuparvum* (Thro) (Ray & Williams 1983); *Parafairmairia gracilis* Green (Koteja & Rosciszewska 1970); *Pseudophilippia quaintancii* Cockerell (Ray & Williams 1980); *Pseudopulvinaria sikkimensis* Atkinson (Hodgson 1991); *Rhodococcus luberonensis* Foldi & Kozár (Foldi *et al.* 2001); *Prionococcus americanus* Williams, Hodgson & Danzig (Williams *et al.* 2002); and *Pharangococcus iquitensis* Hodgson & Matile-Ferrero (Hodgson & Matile-Ferrero 2003). *Lichtensia viburni* Signoret was included by Williams (1997), but this was almost certainly an error. None of the above species is present in New Zealand.

Below are described a further 27 pupae, all indigenous to New Zealand. As with the prepupae discussed later, the significance of differences in the character-states of any given character remains to be ascertained with confidence.

The main differences between the pupal and prepupal

stages are the greater development of the antennae, wing-buds and legs on the pupa, where the prothoracic legs extend around anterior to the head and the penial sheath is larger in comparison with the lobes of abdominal segment VII than on prepupae (compare Fig. 93 and 121).

Important taxonomic characters

As with the prepupae (described in Part 3) and adult males, the characters of the pupae appear to offer reasonably strong support for the generic divisions Hodgson & Henderson (2000) introduced based entirely on adult female characters. There were rather more pupae available than there were prepupae, both in terms of species and of specimens. From this material, the features which are here considered important as taxonomic characters of pupae are:

- (i) basic size (small on *Lecanochiton* and moderate to large in the other genera);
- (ii) number and distribution of the spiracular disc-pores associated with the anterior spiracles — usually in a broad crescent anterolaterally to the peritreme, but occasionally forming a line laterad to peritreme (as on *Kalasis depressa*) or extending a long way mesad to the muscle plate (as on *Plumichiton* species);
- (iii) shape and size of the lobes on abdominal segment VII: these are generally approximately triangular and about 1/2 the length of the penial sheath, but are short and rounded on the *ornata*-group of *Crystallotesta* and are particularly long and pointed on *Kalasis depressa*;
- (iv) frequency of dorsal and ventral abdominal setae: generally with a single pair of small setae dorsally on segments V–VII and a pair of small ventral setae on II–VII, many species with an occasional 2nd pair on some segments; however, *Pounamococcus* species have 1 or 2 pairs dorsally on all abdominal segments and 2 pairs ventrally;
- (v) size and distribution of the dorsopleural setae, particularly on segment VII: fleshy and in a line on the *ornata*-group, otherwise generally segmentally arranged, with 2 (rarely 3) setae on each side per segment on the remaining species;
- (vi) size and arrangement of the setae on the apex of the lobes of abdominal segment VII — setae probably absent on the apex on *Inglisia patella*, and long on *Ctenochiton* species;
- (vii) presence or absence and the size of lobes and setae on abdominal segment VIII — apparently absent on *Inglisia patella*, but as large as the lobes of segment VII on *Pounamococcus* species;
- (viii) presence or absence of ante-anal setae on segment VIII;
- (ix) size and shape of the penial sheath, particularly in

relation to the length of the lobes on segment VII;
 (x) presence of pairs of setae and their size on the dorsal surface of the penial sheath — quite large on *Pounamococcus* species, minute on *Ctenochiton* and *Plumichiton* species.

The presence or absence of spiracular disc-pores associated with the posterior spiracle appears not to be very constant and may not be a useful character (indeed, on some species they are apparently present on the prepupae of some species and absent on the pupae, e.g., *Crystallotesta ornata* and *Kalasis depressa*). Another character that varies between the prepupae and pupae is the presence or absence of ante-anal setae. These are absent on a number of prepupae, despite being present on the pupae (e.g., some *Aphenochiton* species, *Kalasis* species, and *Umbronichiton* species); it is worth noting that there are no species where they are present on the prepupae but absent on the pupae. Some characters show constancy between the two stages; thus, the distribution of the spiracular disc-pores is very similar, with, for instance, those of *P. flavus* extending a long way medially past the inner margin of the muscle plate and those of *K. depressa* extending a long way laterad of the peritreme on both the prepupae and pupae.

BASIC DESCRIPTION OF A COCCID PUPA (Fig 93)

Unmounted pupa cylindrical in shape, rounded at each end.

Mounted specimens elongate oval, sometimes rather pointed at each end (note that, as all descriptions were made from mounted specimens, their shape will be different from that in life). Division into head, thorax, and abdomen (Fig. 93) usually clear, although segmentation often obscure apart from on abdomen. Derm membranous, with small dermal spinules. All ducts and pores, except spiracular disc-pores, absent and setae few.

Head: lacking mouthparts and simple eyes. With pair of moderately long antennae pointing posteriorly, usually at least reaching mesocoxae (ratio of antennal length to total body length usually between 1:1.7–2.3 — exceptionally 1:1.5 (e.g., *P. cuneatus*) and 1:2.5 (e.g., *Ctenochiton chelyon* and *C. paraviridis*); with 10 segments but segmentation often obscure; often with 1–3 short fleshy fingers, probably incipient capitate setae, plus a single sensilla basiconica, apparent on apex; basal segments usually slightly to moderately sclerotised. A yokelike structure present posteroventrally on *Pounamococcus cuneatus* (Fig. 116). Setae: usually with 1–3 pairs of minute setae medially on dorsal surface (more on *P. cuneatus*), 1–3 pairs on anterior ventral surface, and with a group of 1–5 (more on *P.*

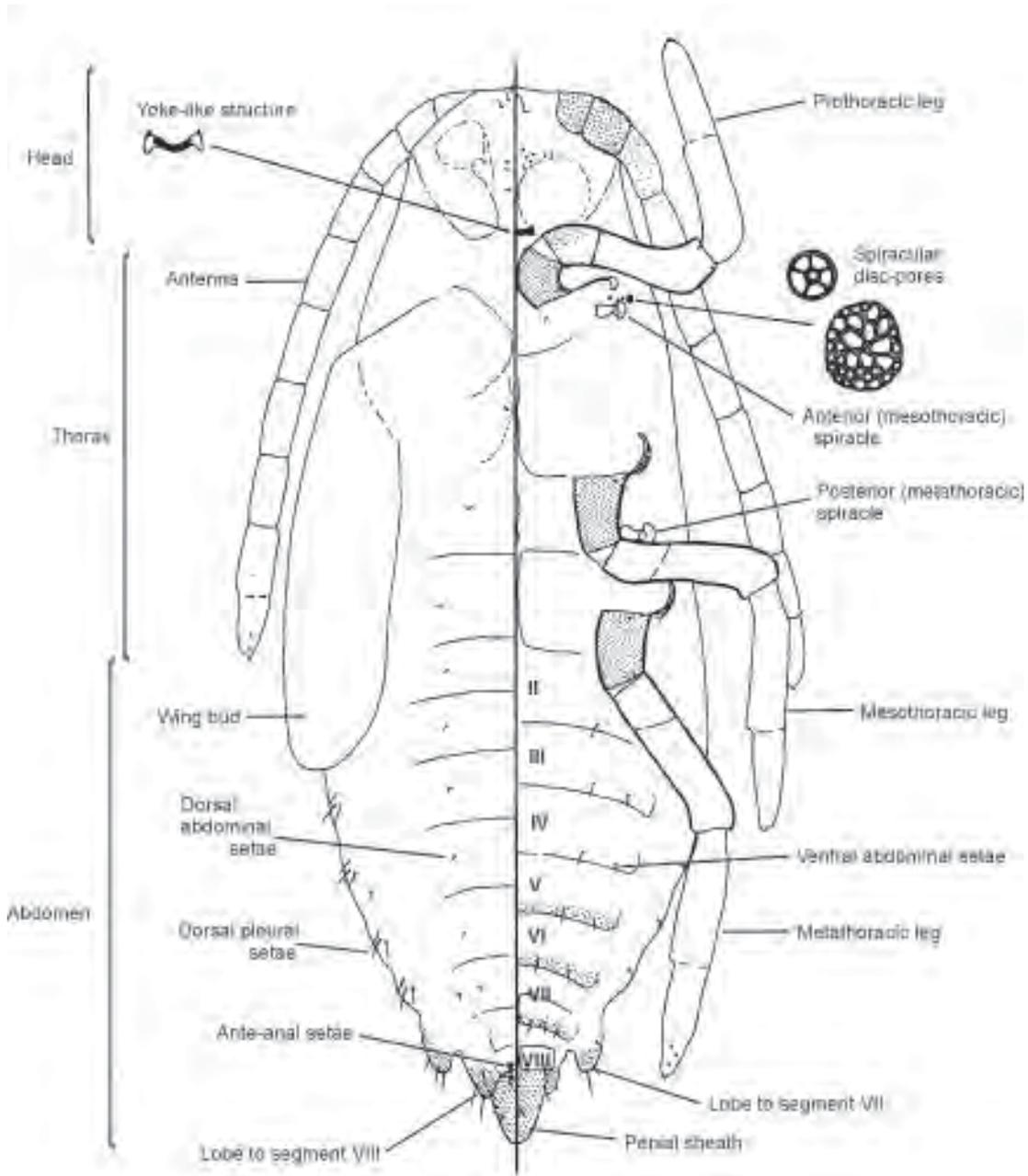


Fig. 93 Structure of a generalised pupa.

cuneatus (Fig. 116)) medially just posterior to each scape.

Thorax: unsclerotised, segmentation usually apparent. With three pairs of moderately well-developed legs; segmentation usually clear; coxa and trochanter generally showing some sclerotisation; prothoracic legs C-shaped, directed

anteriorly and curving round in front of anterior margin of head; metathoracic legs extending posteriorly to about abdominal segment VI or VII; coxae with 1 or 2 minute setae; tarsal campaniform pores absent; each with a small triangular finger on apex, probably an incipient claw. With a pair of

long wing-buds on either side, extending to about abdominal segment III, becoming mildly sclerotised; ratio length to width usually between 1:0.35–1:0.41 (exceptionally 1:31 on *Lecanochiton actites*; and 1:44 on *Aphenochiton subtilis* and *Epelidochiton piperis*). With 2 pairs of spiracles; mesothoracic pair just posterior and laterad to procoxae and metathoracic pair just posterior and laterad to mesocoxae; mesothoracic pair usually with spiracular disc-pores, whose number and distribution probably of taxonomic significance, varying from none on *Inglisia patella* (Fig. 107) to over 30 on some specimens of *Kalasisiris perforata* and *Plumichiton flavus* (but see comments under *A. subtilis*; Fig. 98, 109, 112); number of loculi in each disc-pore highly variable, from 1 to 15+; disc-pores usually absent from posterior spiracles but, if present (some specimens of *A. subtilis*, *C. chelyon*, *K. perforata*, *L. actites*, and *L. scutellaris*, Fig. 98, 109, 110, 111) probably of taxonomic significance. Setae: ventral: usually with a single seta mesad and just posterior to each procoxa, and mesad and anterior to each meso- and metacoxa; dorsal: three pairs, with one pair medially on prothorax, and with a pair dorsad to each meso- and metacoxa.

Abdomen: segmentation usually distinct, anteriormost segment on venter considered to represent segment II and therefore 7 segments visible (segments II–VIII) ventrally anterior to penial sheath. Setae: with pairs of small dorsal abdominal setae medially on segments V to VII (all segments on *Pounamococcus* spp. (Fig. 116, 117)); with pairs of small ventral abdominal setae on segments II–VII, although occasionally there may be 2 pairs on some segments (2 pairs on all segments on *Pounamococcus* species); whilst usually small, those on segment VII are sometimes longer, as on *Aphenochiton matai* (Fig. 96); usually with a pair of dorsopleural setae on each side of segments III–VI, often with 1 long seta and 1 short seta (but more frequent and not arranged segmentally on *Crystallotesta ornata*, *C. ornatella* and *I. patella*, Fig. 101, 102, 107); and with single minute ventropleural seta usually present on each side of segments III to VII. Segment VII with a pair of lateral membranous lobes (sclerotised on *P. cuneatus*), which may be short and rounded, as on *C. ornata*, *C. ornatella* and *I. patella* (Fig. 101, 102, 107), or long (subequal to or longer than penial sheath) and pointed (particularly long on *Kalasisiris depressa*, Fig. 108 on which they are longer than penial sheath); each lobe with 1–4 dorsopleural setae, which may be short or long, fleshy or flagellate, but usually with at least 1 long seta on each apex (number and distribution of these setae may be of taxonomic significance); also each lobe usually with one minute ventropleural seta. Segment VIII with or without a pair of lobes: when present, located on either side of base of penial sheath on dorsal surface, generally membranous although slightly

sclerotised on a few species, particularly on *Pounamococcus* spp. (Fig. 116, 117) on which they are subequal in size to lobes of segment VII; when present, usually with 1 or more setae, these largest and best developed when lobes well developed (as on *Plumichiton flavus* and *Pounamococcus* spp., Fig. 112, 116, 117). Some genera with a pair of setae medially on tergite VIII just anterior to penial sheath, here considered to be homologous with ante-anal setae of adult males; on some species, ante-anal setae well developed, on others only represented by one to two setal sockets; presence or absence of these setae here considered to be of taxonomic significance. Also with a pair of setae present ventrally on segment VIII on *Pounamococcus* spp. (Fig. 116, 117). Penial sheath sclerotised, usually longer than lobes of segment VII (except on *K. depressa*, Fig. 108) and slightly longer than broad (ratio length to breadth usually between 1:5–1:99 but with a few rather longer (e.g., *Ctenochiton viridis*, Fig. 105) or broader (e.g., *P. cuneatus*, Fig. 116); usually with two pairs of either minute setae (setae larger on *Pounamococcus* spp.) or pores (which could be setal sockets without setae) on dorsal surface; genital opening present medially on ventral surface of penial sheath although not always apparent; usually with very few or no dermal spinules but these abundant on *I. patella* (Fig. 107).

Comment. The taxonomic significance of these characters is uncertain because so few coccid pupae have ever been studied. The figures and descriptions have been made from mounted specimens and so the normal cylindrical shape has been flattened and the membranous derm may have shrunk during preparation, especially on the abdomen (this would be particularly significant with regard to the lengths of the lobes on abdominal segment VII). In addition, the absence of particular minute setae on the dorsum and venter in the figures simply means that they could not be found and does not mean that they are necessarily absent. The presence or absence of disc-pores near the posterior spiracles also appears to be variable — some specimens had 1 or 2 on one side and none on the other (e.g., on some *Ctenochiton* species); on the other hand, where several specimens have been studied and none found, their absence is then thought to be normal. Note that the presence of pharate males within the pupa can make it very difficult to discern some characters, particularly setal distribution.

The pupae of New Zealand Coccidae fall into 5 groups: the first group contains only *Pounamococcus* species, which appear to be quite different from the rest, particularly in having pairs of dorsal abdominal setae on all abdominal segments (only V, VI, and VII on other groups), and in the large size of the lobes on abdominal segment VIII.

The second group contains just *Inglisia patella*, which differs from the remaining species in lacking spiracular

disc-pores, having rather small lateral lobes on abdominal segment VII, lacking lobes on segment VIII and in having abundant dermal spinules on the penial sheath.

The third group contains the *ornata*-group of *Crystallotesta* (*C. ornata* and *C. ornatella*) on which the pleural setae on the abdomen form a line of fleshy setae and on which the lobes of abdominal segment VII are short and rounded.

The fourth group contains just *Poropeza dacrydii*, which has small convex pores, and the lobes of abdominal segment VII are much shorter than the penial sheath, which is very large.

The remaining genera are all in the fifth group and appear to be closely related.

KEY TO PUPAE OF NEW ZEALAND COCCIDAE

Note: due to the small amount of material available for most species, the significance of some of the apparent differences between species noted here is unclear. It is likely that some of these couplets will need to be changed when more material has been studied.

- 1 Spiracular disc-pores absent
 (p. 173)... *Inglisia patella*
 —Spiracular disc-pores present near anterior spiracles 2
- 2(1) Dorsal abdominal setae present on all abdominal segments; lobes on abdominal segment VIII as large as those on segment VII
 (p. 178)... *Pounamococcus* spp.
 —Dorsal abdominal setae present on segments IV to VI only; lobes on abdominal segment VIII not as large as those of segment VII 3
- 3(2) Ante-anal setae absent 4
 —Ante-anal setae present (even if pore-like) 7
- 4(3) Lobes of abdominal segment VII rounded; dorsopleural setae fleshy and not arranged segmentally; spiracular disc-pores associated with anterior spiracles arranged anteriorly and laterally to peritreme, not extending medially past muscle plate
 (p. 170)... *Crystallotesta* – *ornata* group
 —Lobes of abdominal segment VII distinct and triangular; dorsopleural setae arranged segmentally and not clearly fleshy; spiracular disc-pores sometimes extending medially past muscle plate of anterior spiracles 5
- 5(4) Small, about 1 mm or less; generally with 1 or 2 spiracular disc-pores associated with each posterior spiracle; generally with less than 10 disc-pores associated with each anterior spiracle and with few laterad to peritreme; lobes of abdominal segment VII

short, less than 1/2 length of penial sheath
 (p. 175)... *Lecanochiton* spp.

—More than 1.2 mm long; without spiracular disc-pores associated with posterior disc-pores; other characters not in this combination 6

6(5) Generally with no spiracular disc-pores extending mesad past inner margin of muscle plate of anterior spiracle; lobes of abdominal segment VIII small, with 2 or 3 minute setae
 (p. 173)... *Epelidochiton piperis*

—With several spiracular disc-pores extending medially well past inner margin of muscle plate of anterior spiracles; lobes of abdominal segment VIII well developed, with at least 3 setae and some pores
 (p. 176)... *Plumichiton* spp.

7(3) Longest setae on lobes of abdominal segment VII generally more than 30 µm long; with less than 10 spiracular disc-pores associated with anterior spiracles; penial sheath about 2× longer than lobes of abdominal segment VII (p. 171)... *Ctenochiton* spp.

—Longest setae on lobes of abdominal segment VII less than 25 µm and generally about 15 µm or less; other characters not in this combination 8

8(7) Penial sheath extremely large, about 4–6× length of lobes on abdominal segment VII; with small conical pores present, particularly laterally on dorsum of abdomen (p. 177)... *Poropeza dacrydii*

—Penial sheath usually 1.5× or less length of lobes on abdominal segment VII; small conical pores absent from dorsum of abdomen 9

9(8) Lobes of abdominal segment VII longer than penial sheath (p. 174)... *Kalasisis depressa* (Maskell)

—Lobes of abdominal segment VII shorter than penial sheath 10

10(9) Spiracular disc-pores extending medially past inner margin of muscle plate of anterior spiracles; each lobe of abdominal segment VIII with 1 minute seta only ... (p. 170)... *Crystallotesta neofagi* Henderson & Hodgson

—Spiracular disc-pores not extending medially past inner margin of muscle plate of anterior spiracles; each lobe of abdominal segment VIII generally with more than 1 seta All other taxa*

*The remaining taxa (all *Aphenochiton* and *Umbonichiton* spp. plus *Crystallotesta leptospermi* and *Kalasisis perforata*) are all rather similar. Until the characters that appear to diagnose them have been properly evaluated, they have been omitted from this key.

(text continues on page 167)

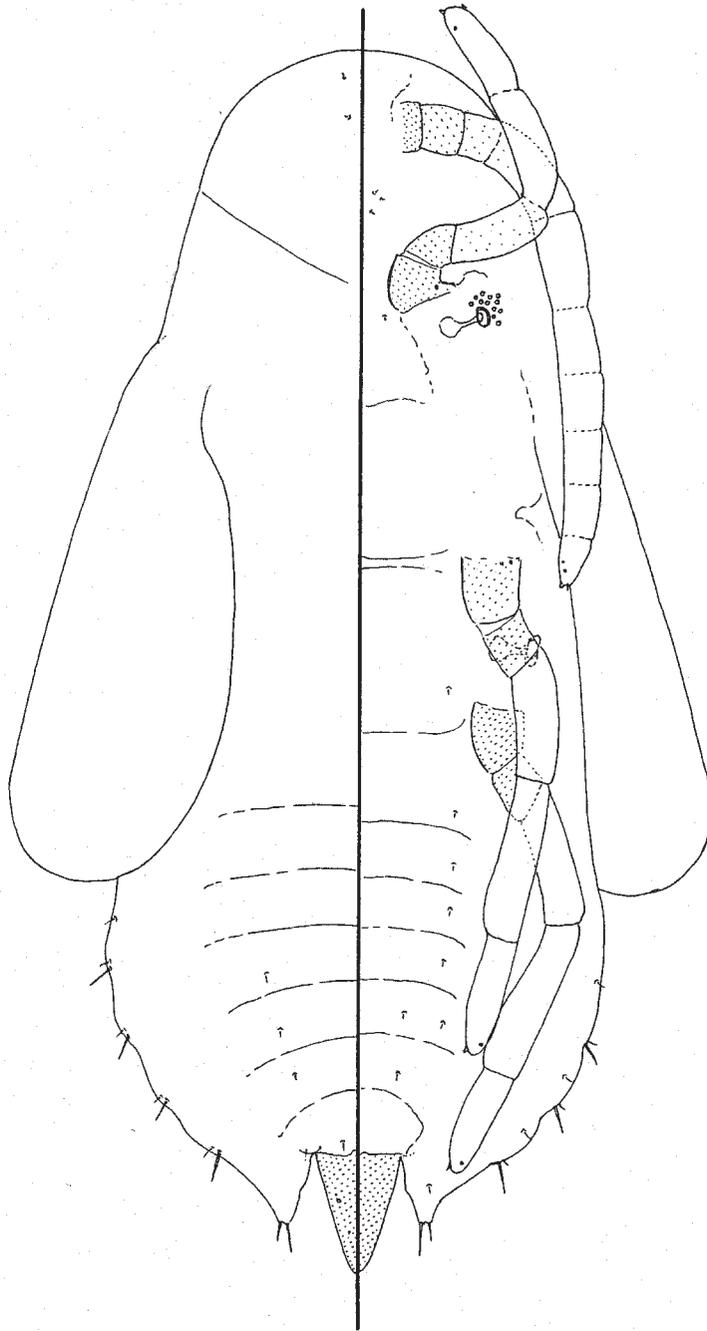


Fig. 94 Pupa, *Aphenochiton inconspicuus* (Maskell).

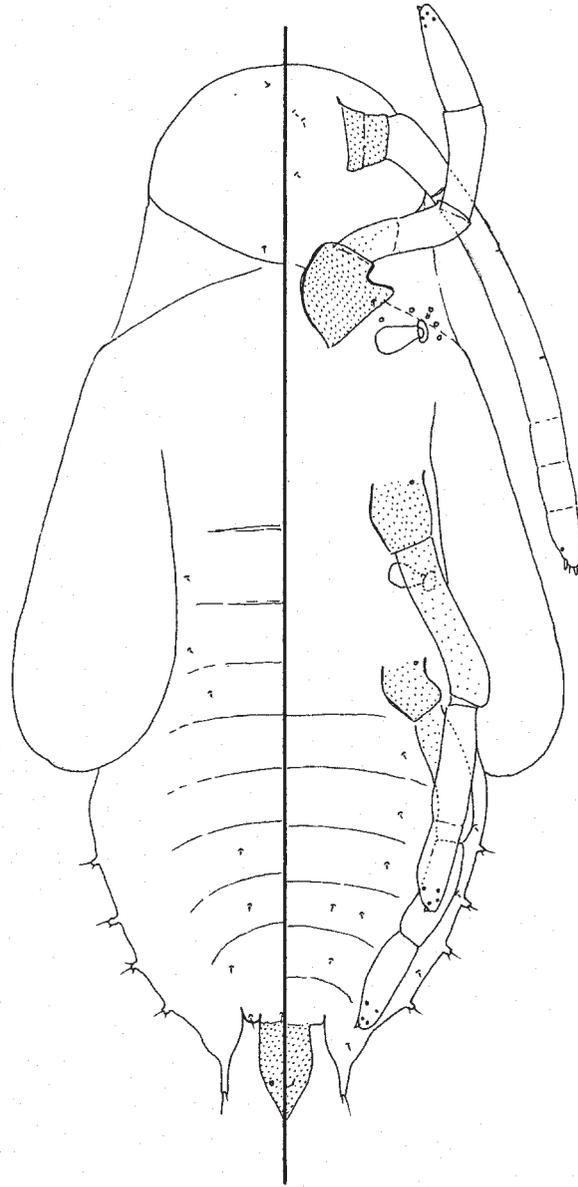


Fig. 95 Pupa, *Aphenochiton kamahi* Henderson & Hodgson.

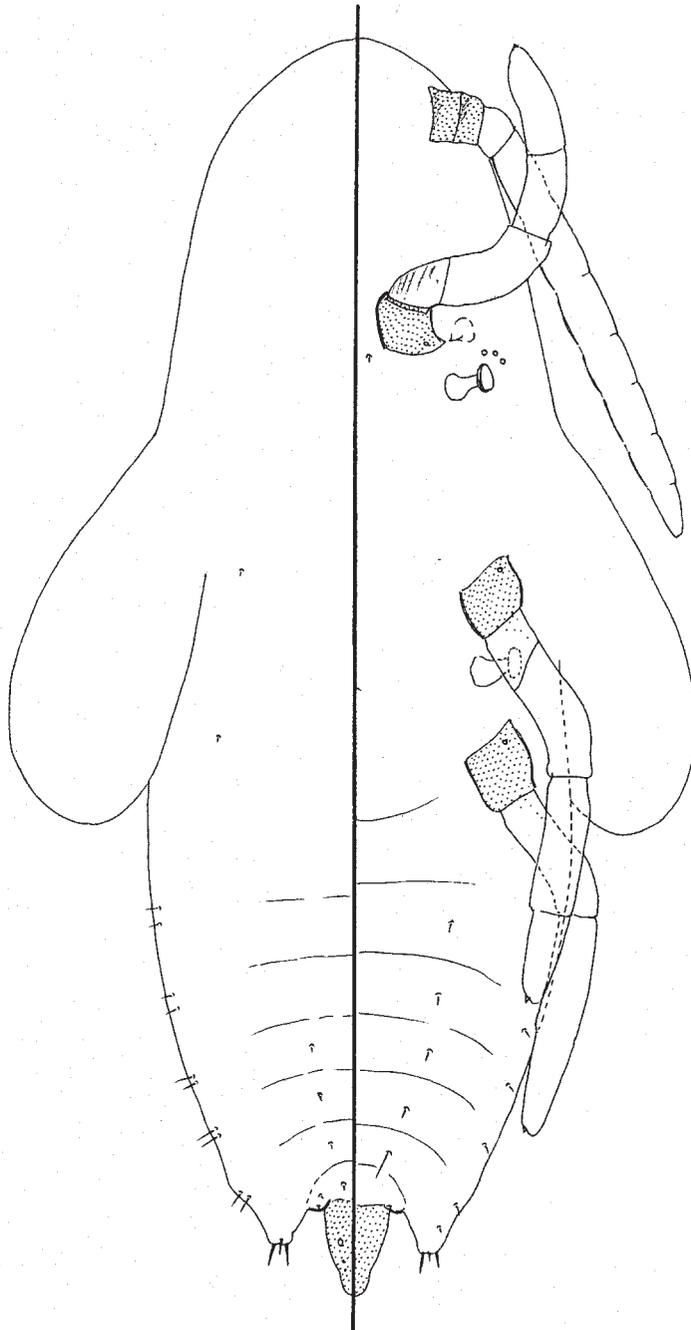


Fig. 96 Pupa, *Aphenochiton matai* Henderson & Hodgson.

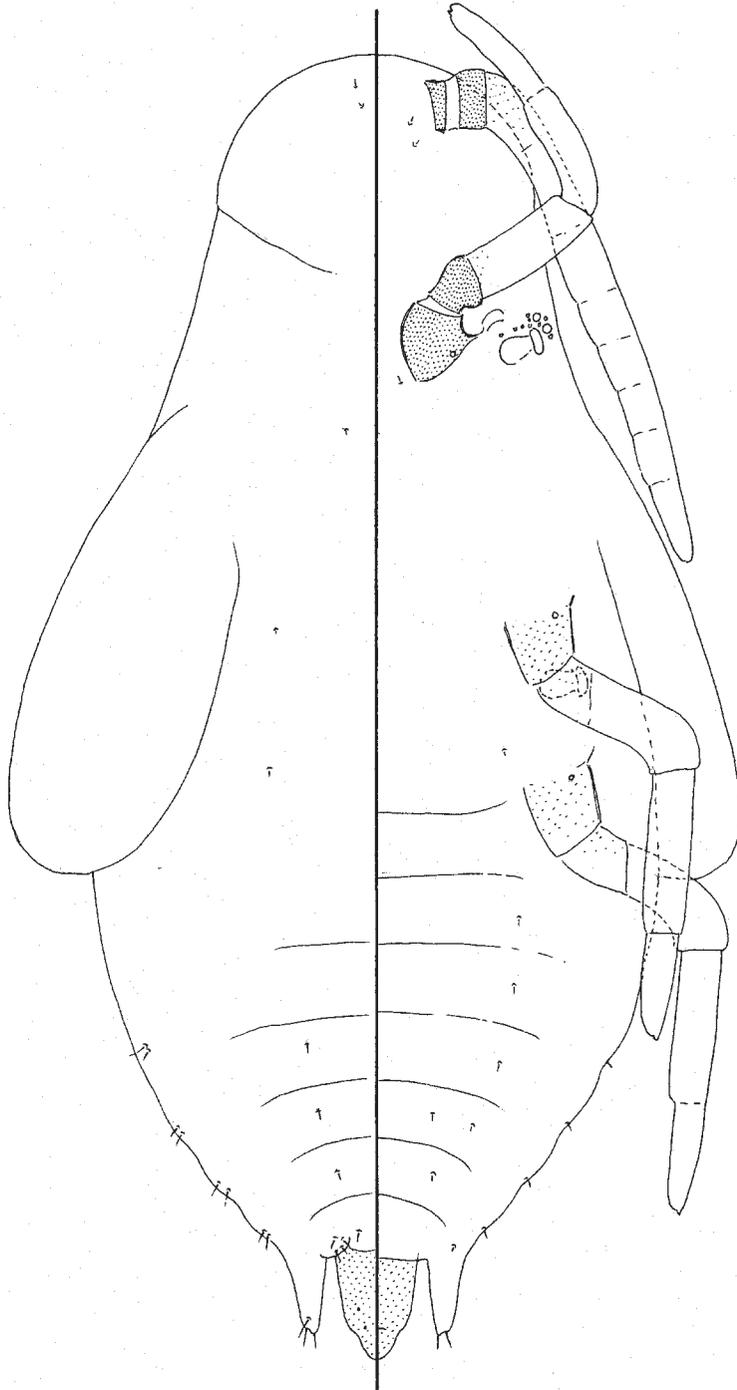


Fig. 97 Pupa, *Aphenochiton pubens* Henderson & Hodgson.

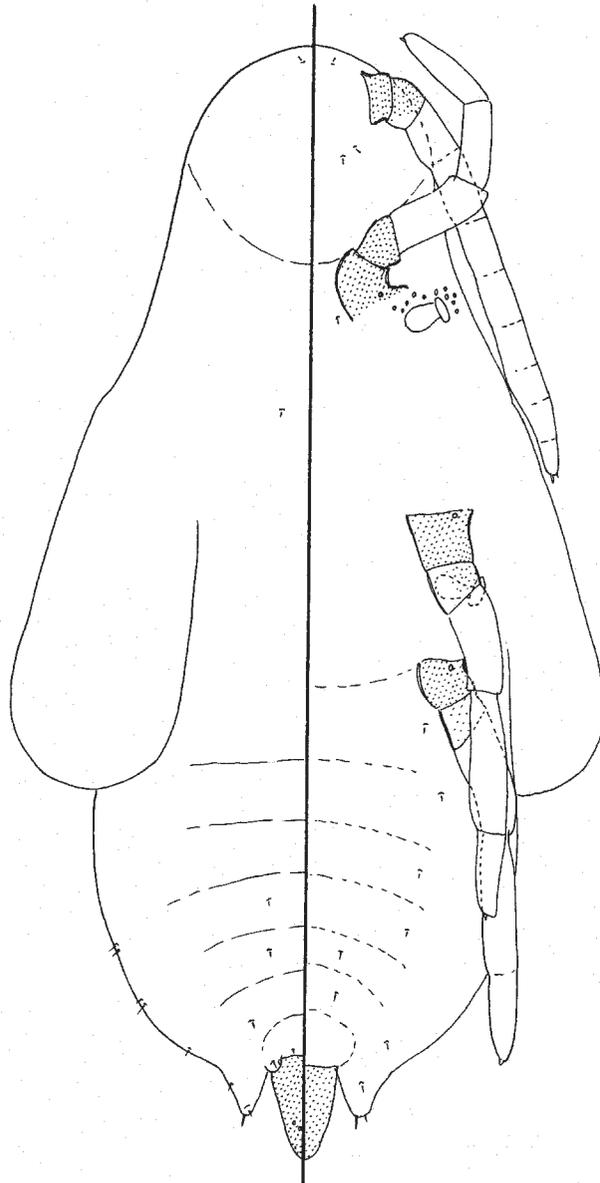


Fig. 98 Pupa, *Aphenochiton subtilis* Henderson & Hodgson.

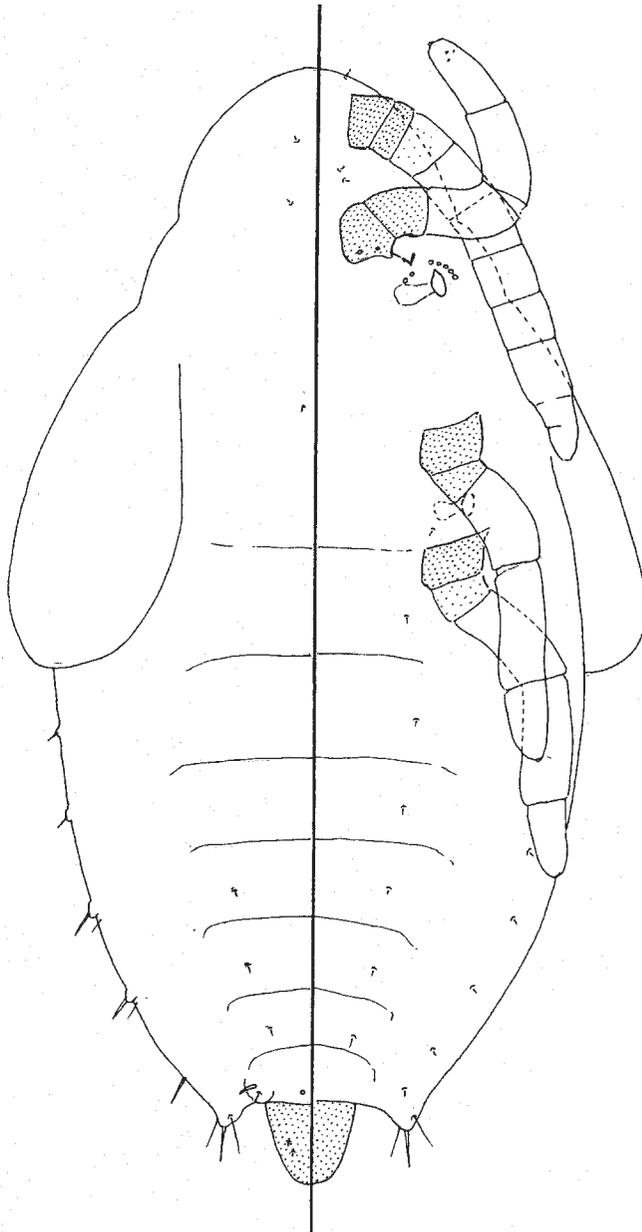


Fig. 99 Pupa, *Crystallotesta leptospermi* (Maskell).

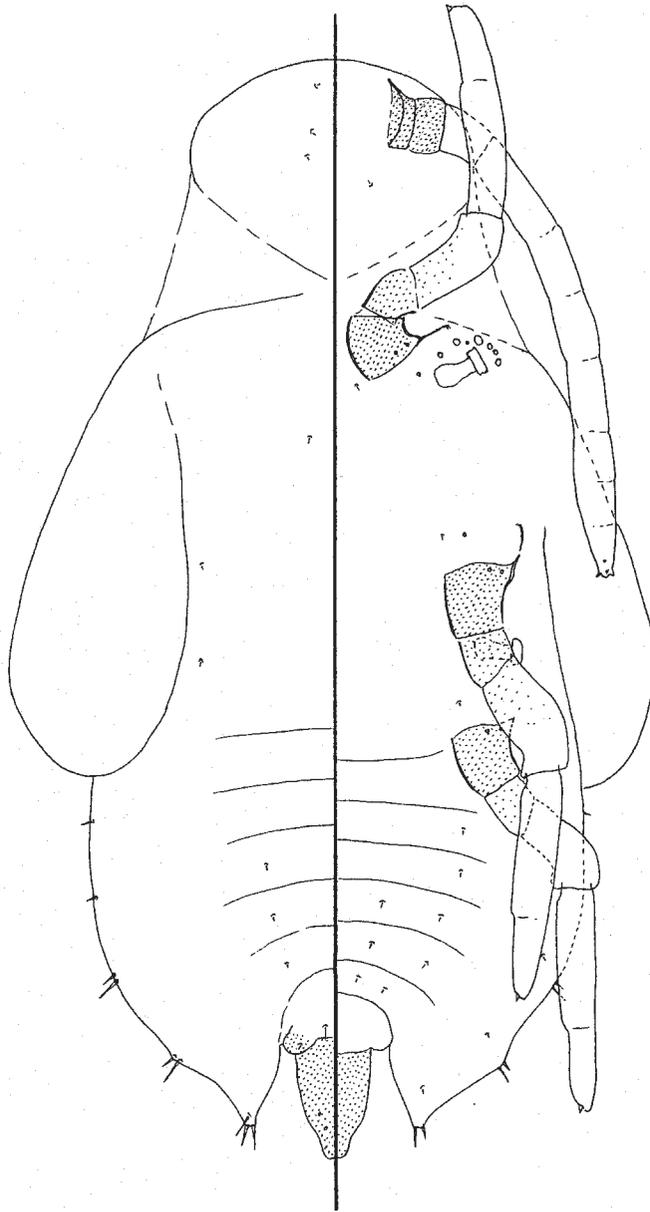


Fig. 100 Pupa, *Crystallotesta neofagi* Henderson & Hodgson.

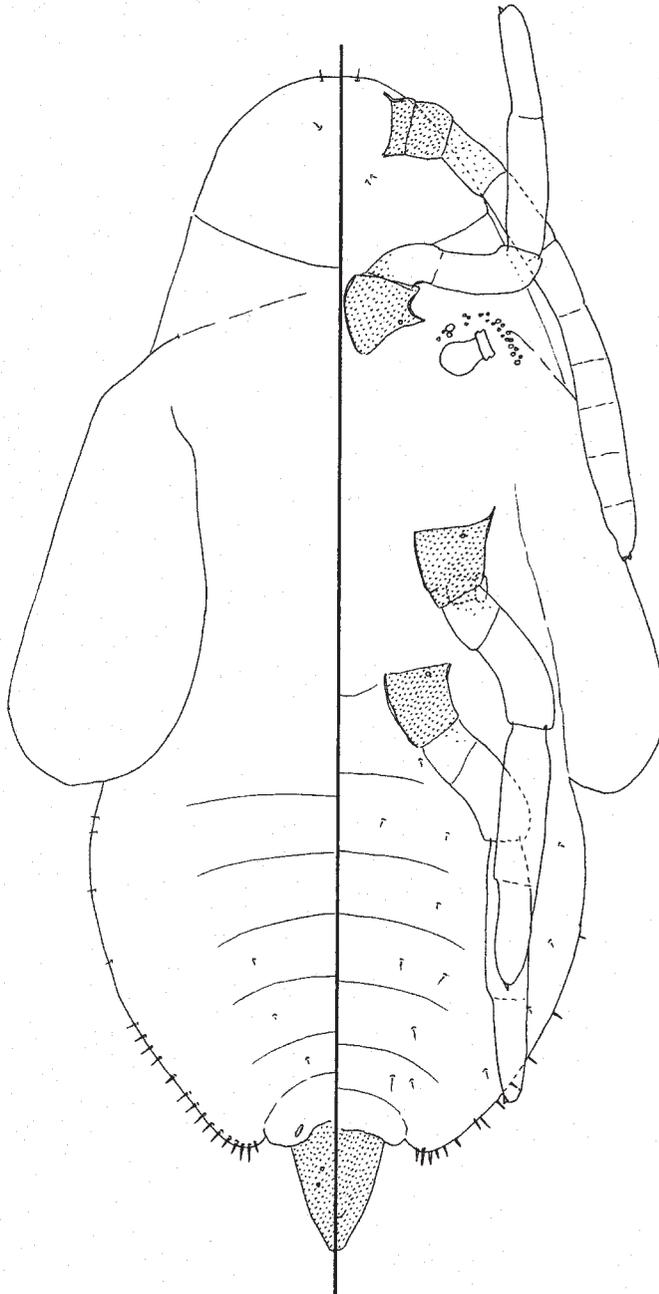


Fig. 101 Pupa, *Crystallotesta ornata* (Maskell).

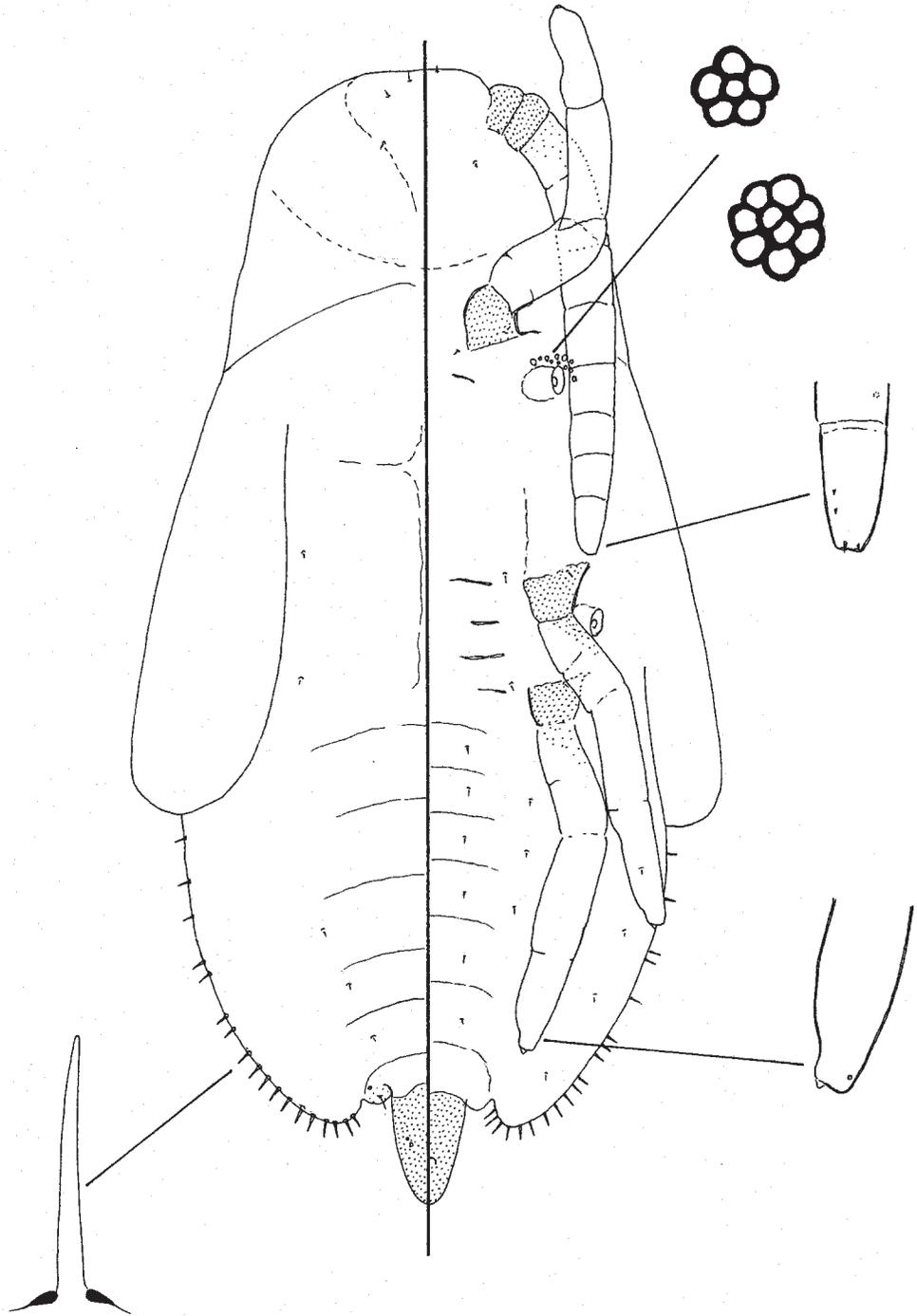


Fig. 102 Pupa, *Crystallotesta ornatella* Henderson & Hodgson.

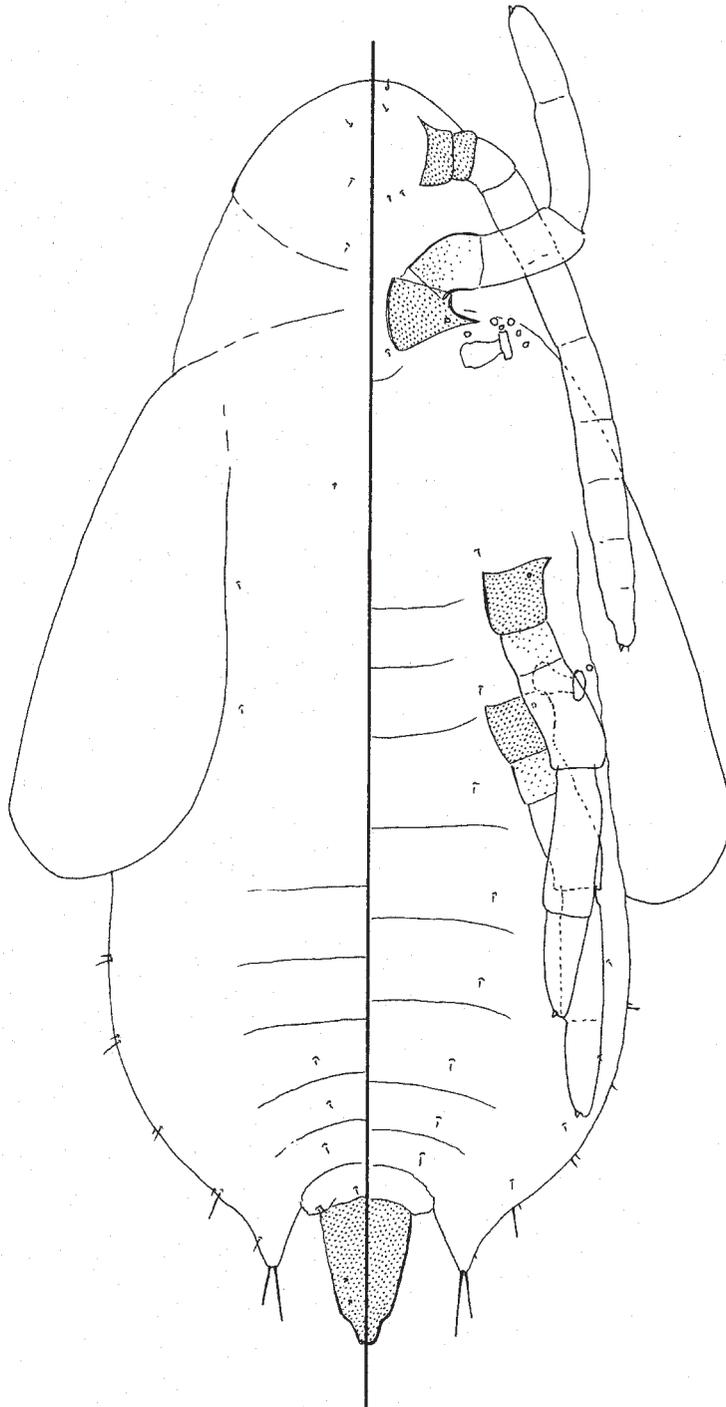


Fig. 103 Pupa, *Ctenochiton chelyon* Henderson & Hodgson.

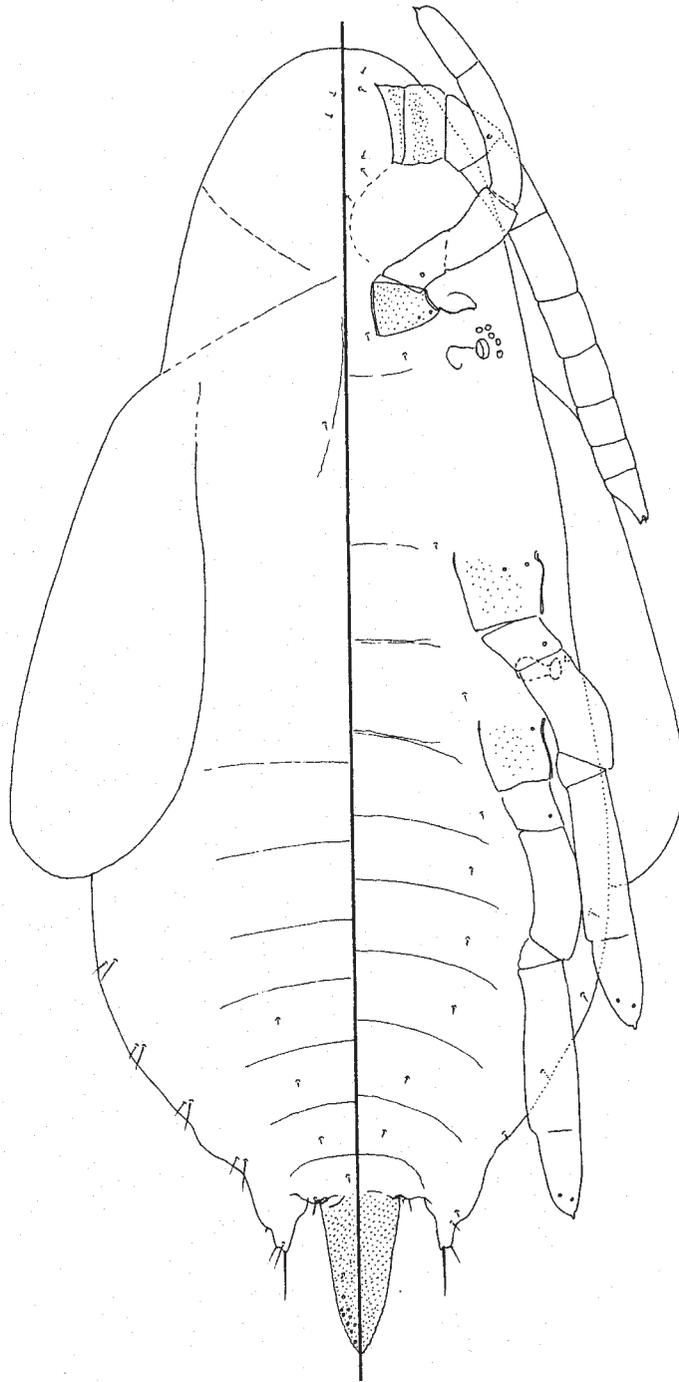


Fig. 104 Pupa, *Ctenochiton paravidis* Henderson & Hodgson.

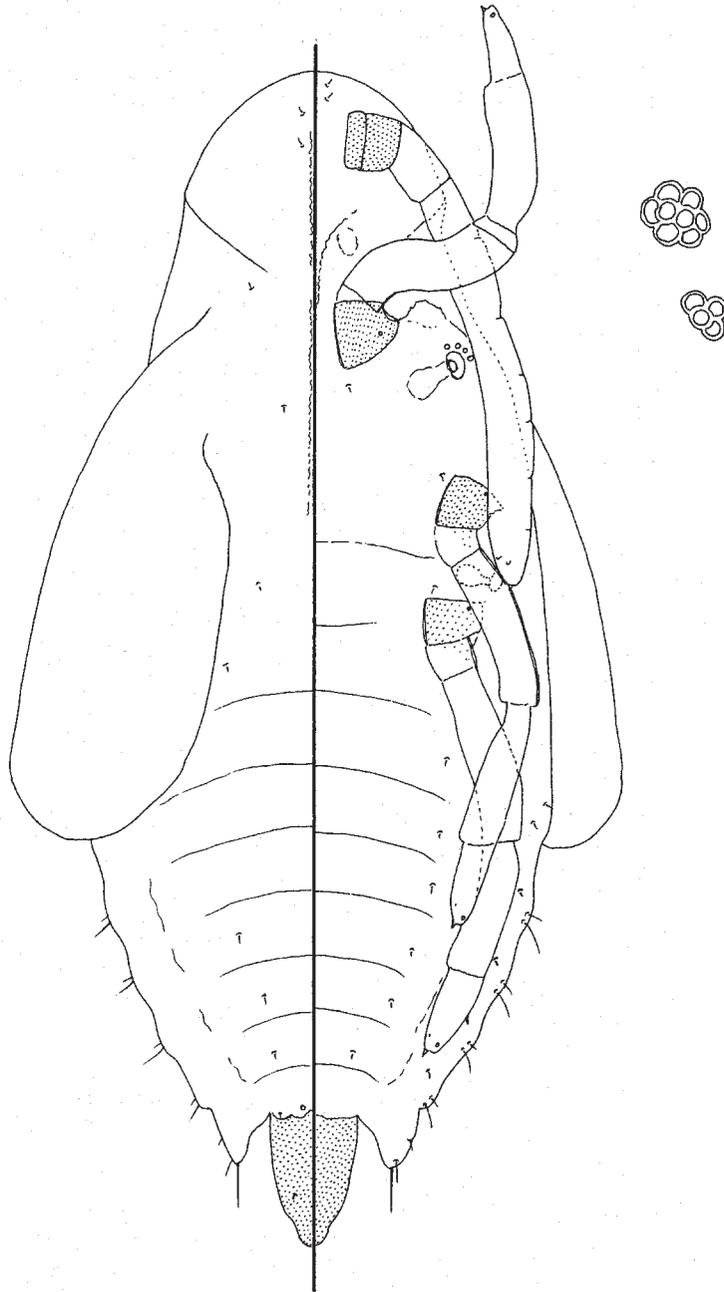


Fig. 105 Pupa, *Ctenochiton viridis* Maskell.

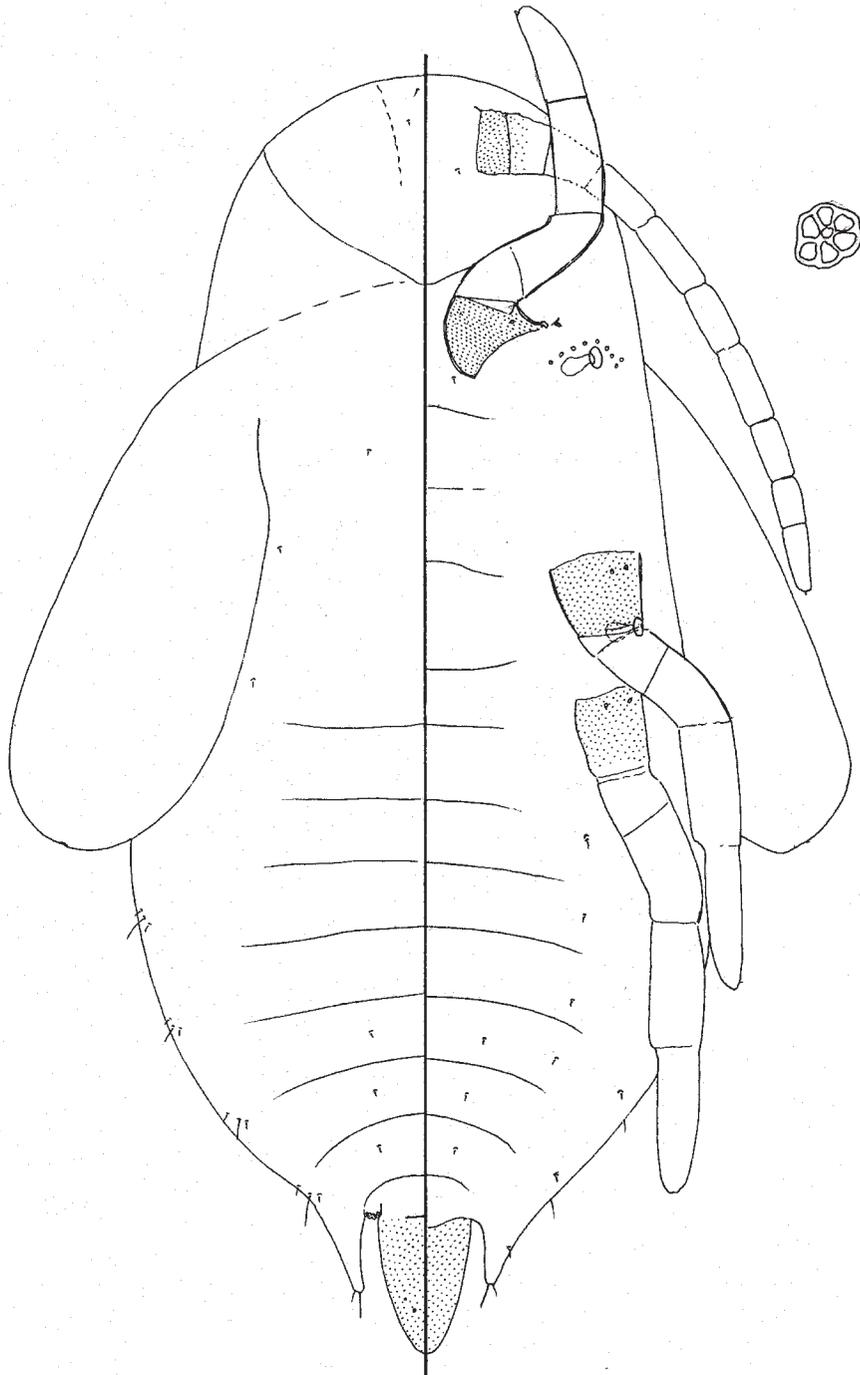


Fig. 106 Pupa, *Epelidochiton piperis* (Maskell).

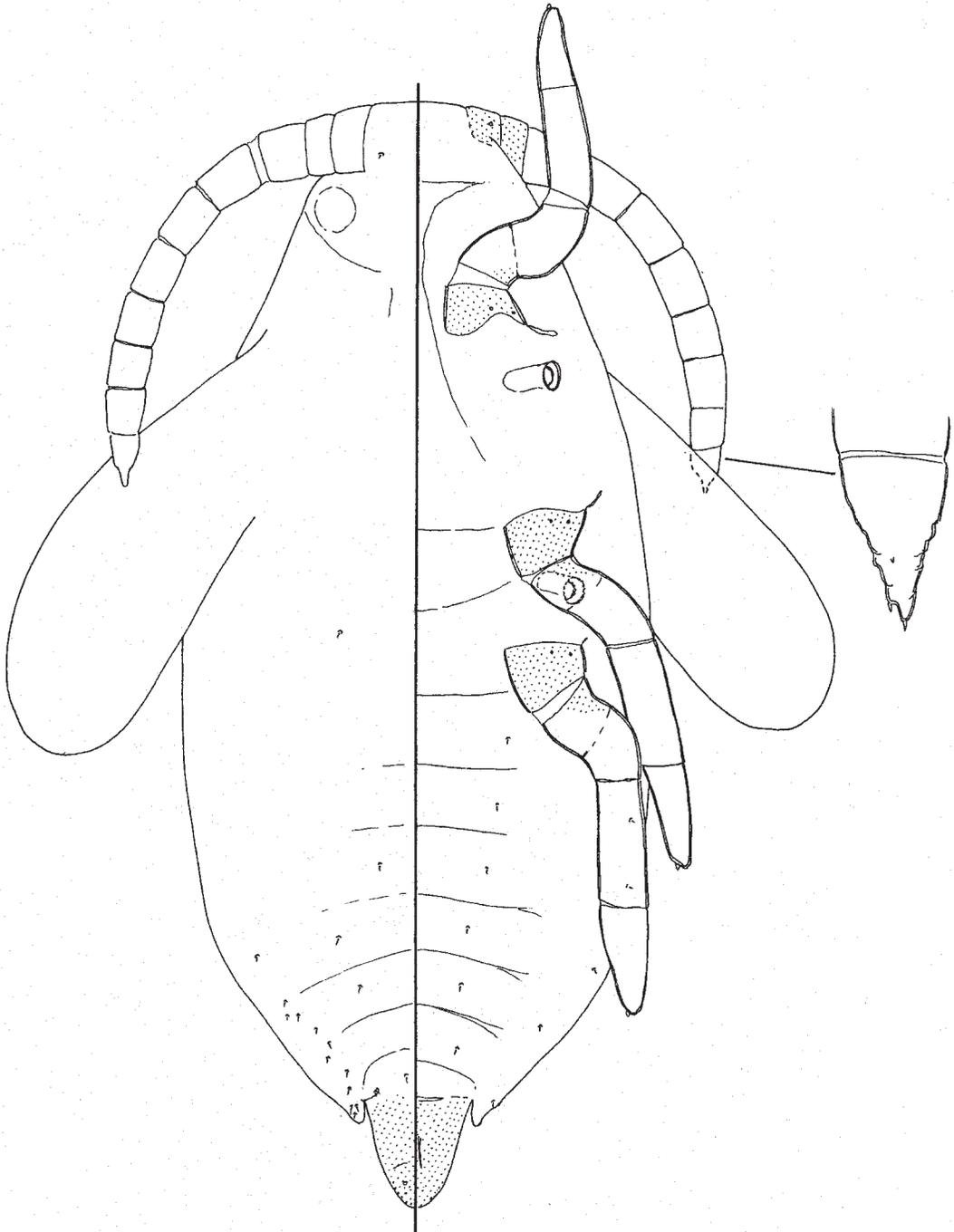


Fig. 107 Pupa, *Inglisia patella* Maskell.

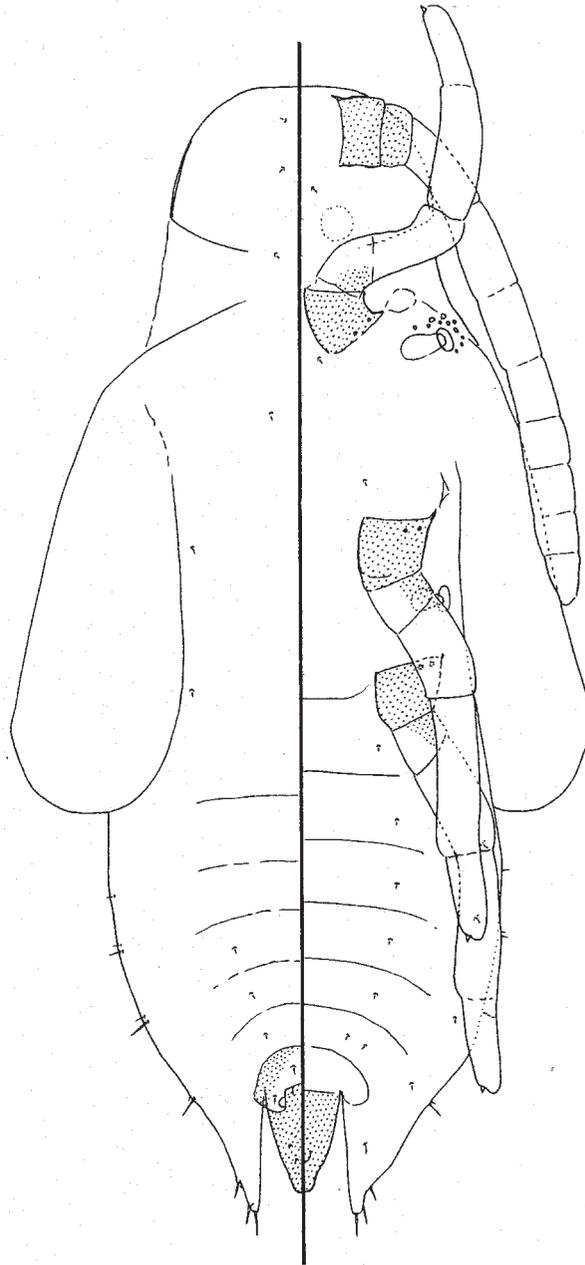


Fig. 108 Pupa, *Kalasiris depressa* (Maskell).

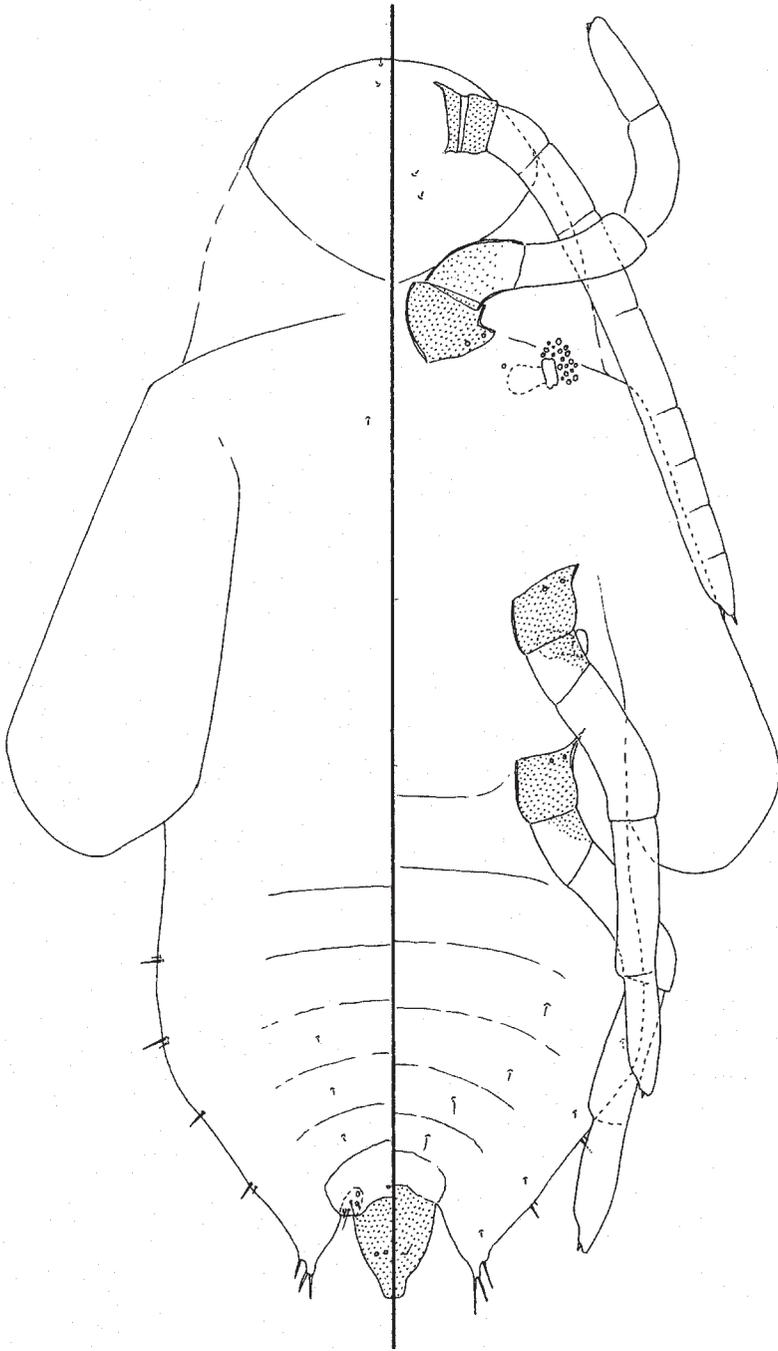


Fig. 109 Pupa, *Kalasiris perforata* (Maskell).

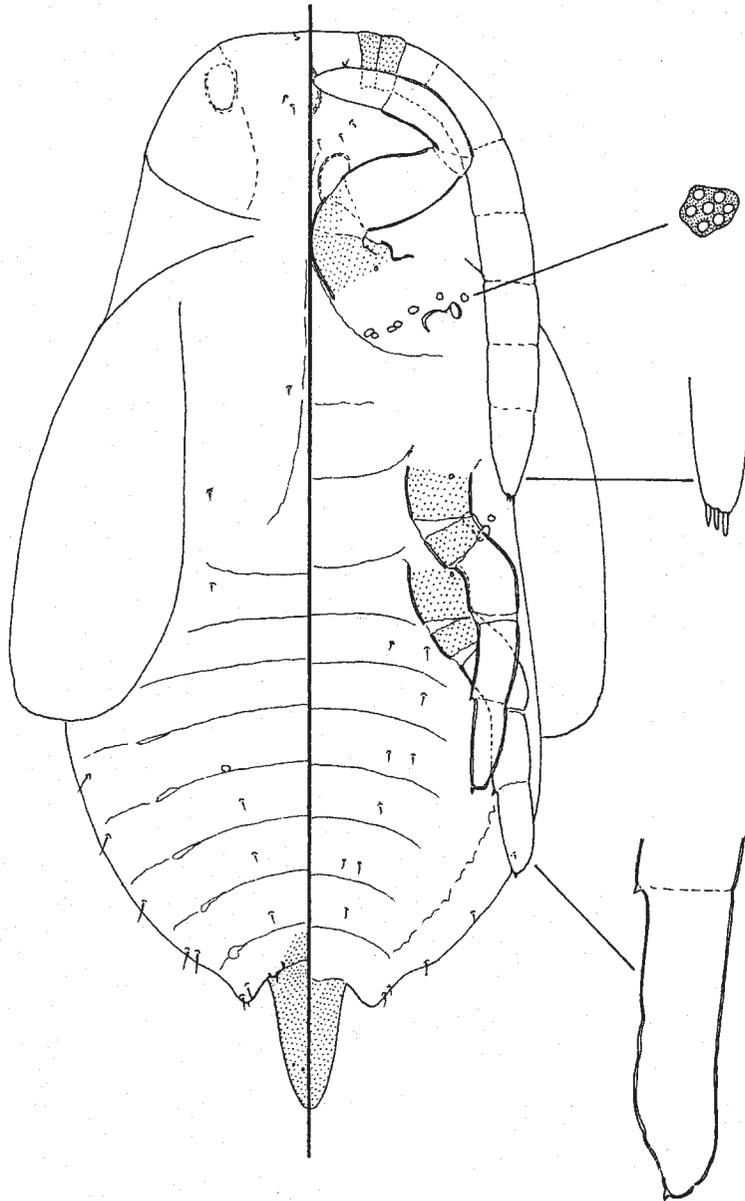


Fig. 110 Pupa, *Lecanochiton actites* Henderson & Hodgson.

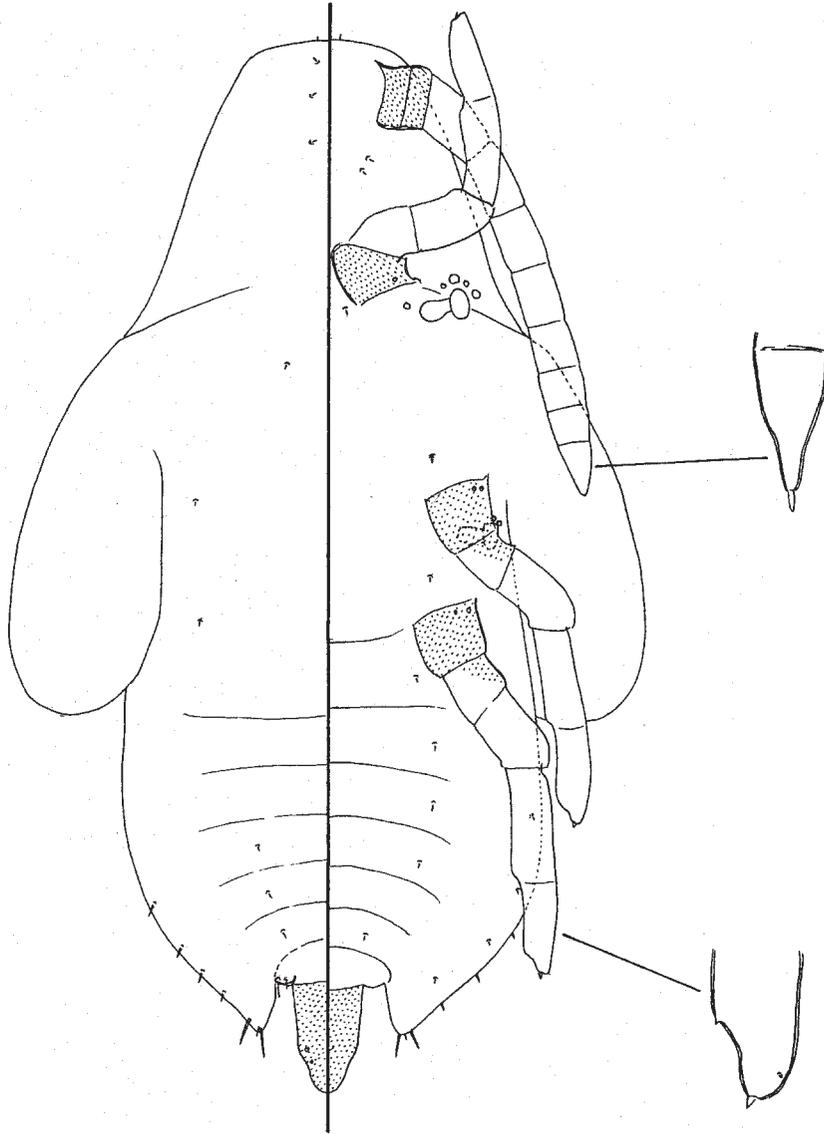


Fig. 111 Pupa, *Lecanochiton scutellaris* Henderson & Hodgson.

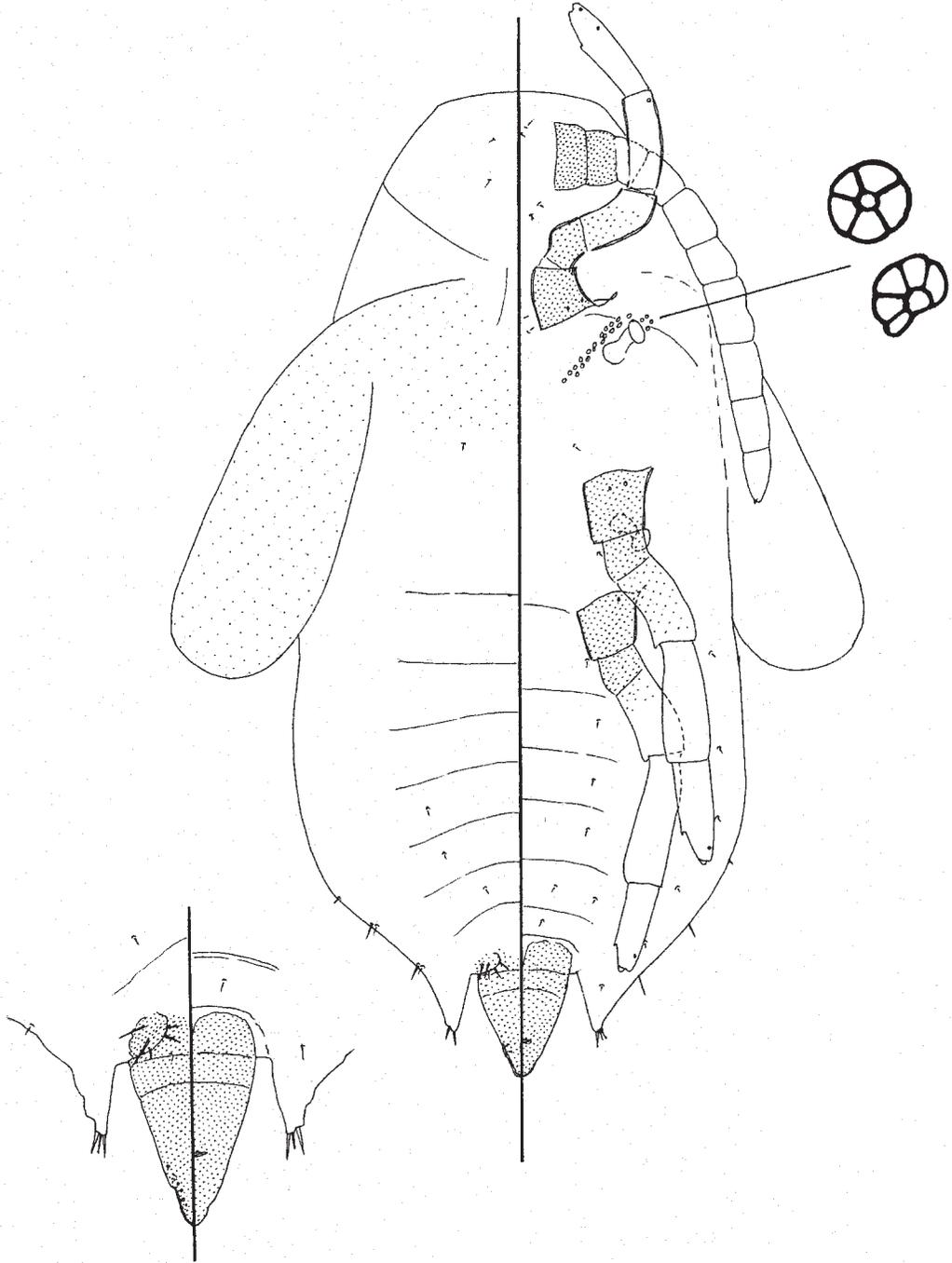


Fig. 112 Pupa, *Plumichiton flavus* (Maskell).

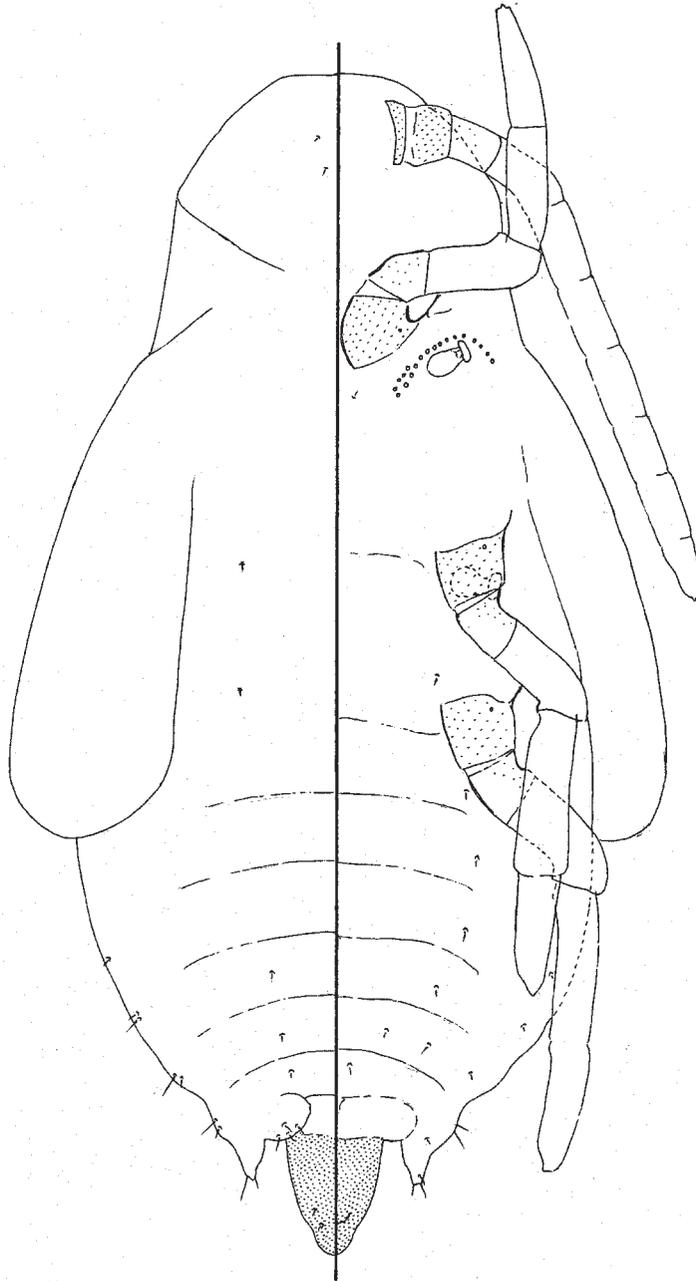


Fig. 113 Pupa, *Plumichiton nikau* Henderson & Hodgson.

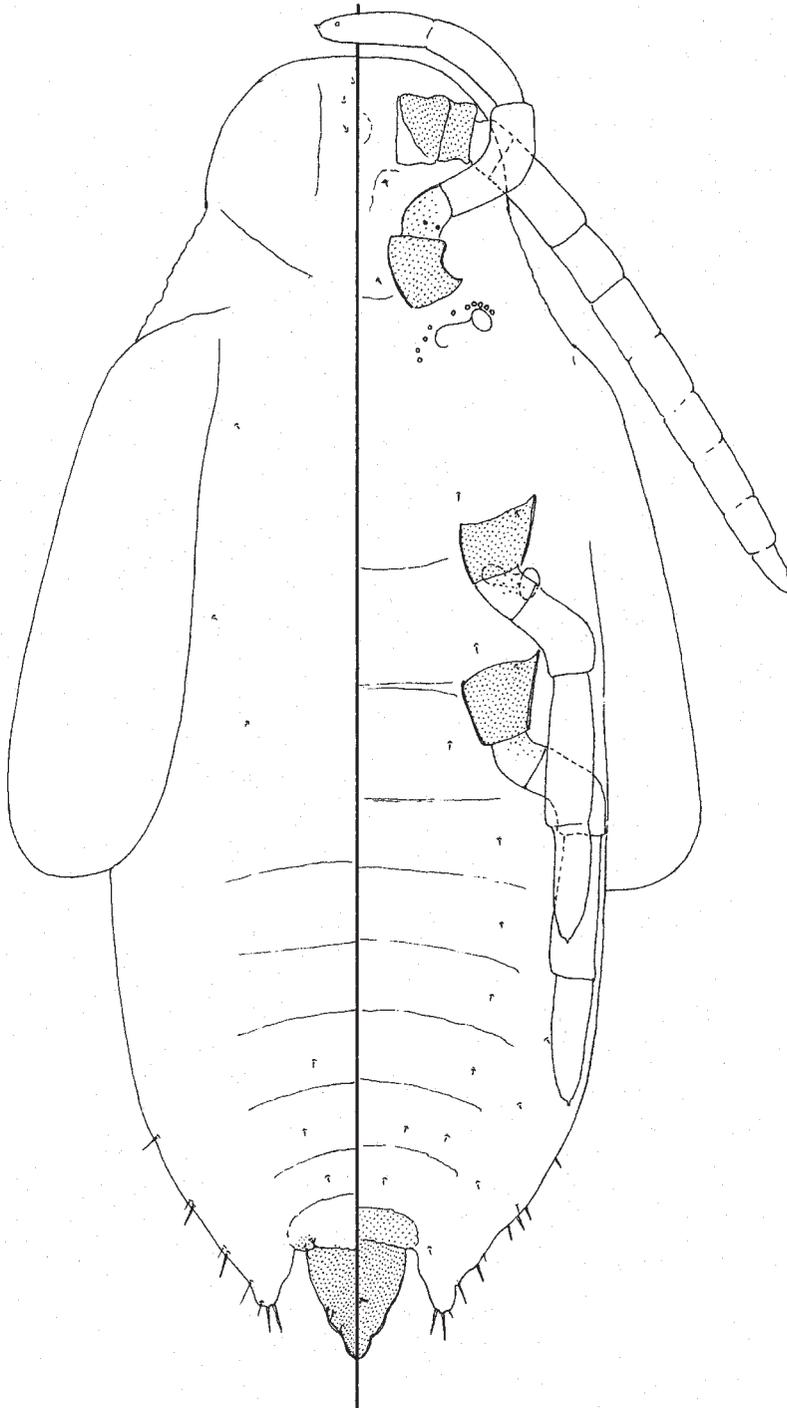


Fig. 114 Pupa, *Plumichiton pollicinus* Henderson & Hodgson.

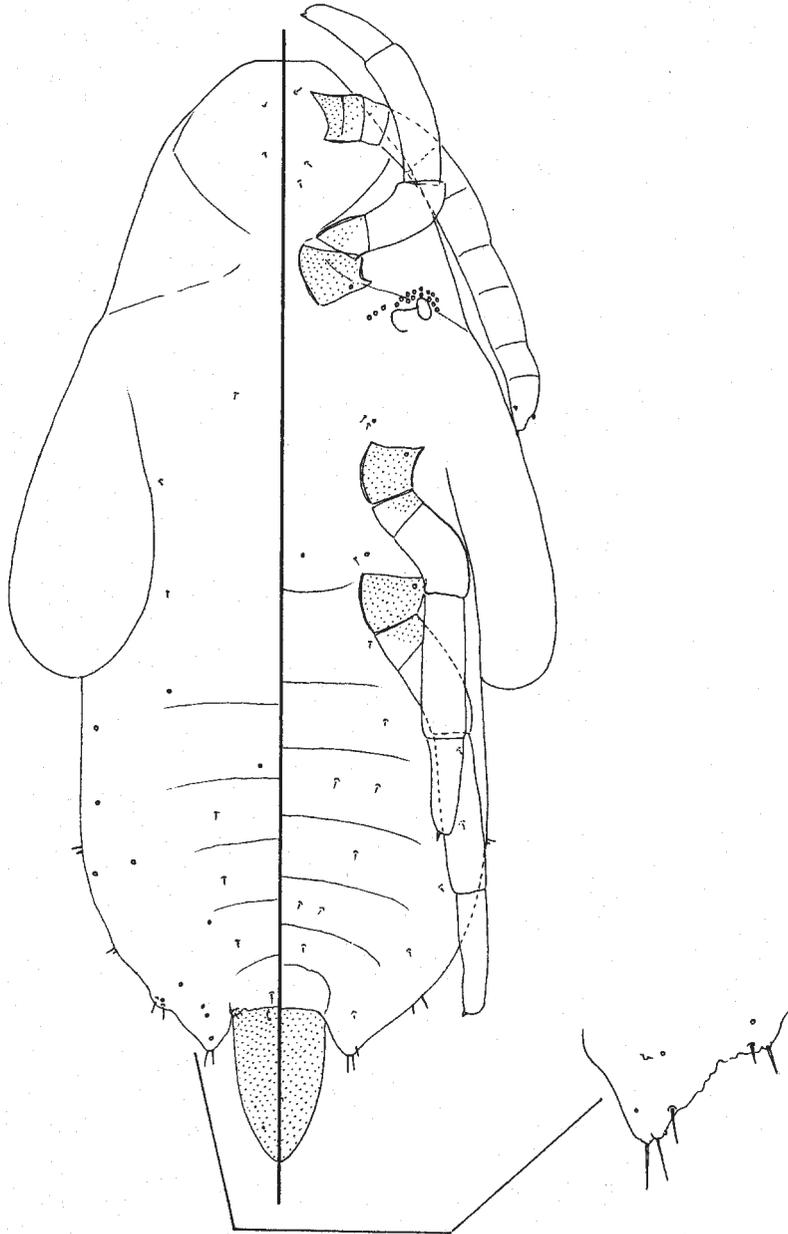


Fig. 115 Pupa, *Poropeza dacrydii* (Maskell).

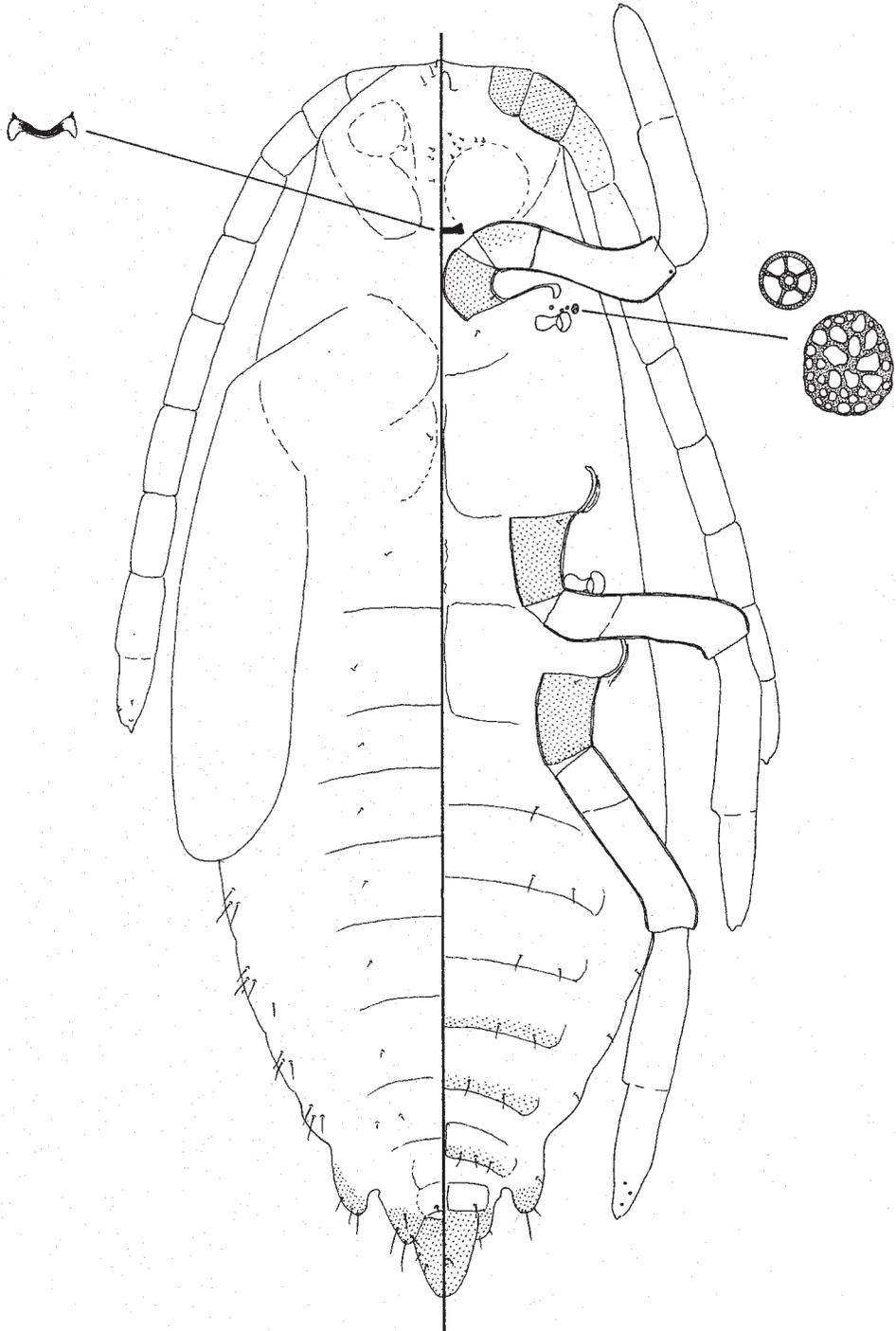


Fig. 116 Pupa, *Pounamococcus cuneatus* Henderson & Hodgson.

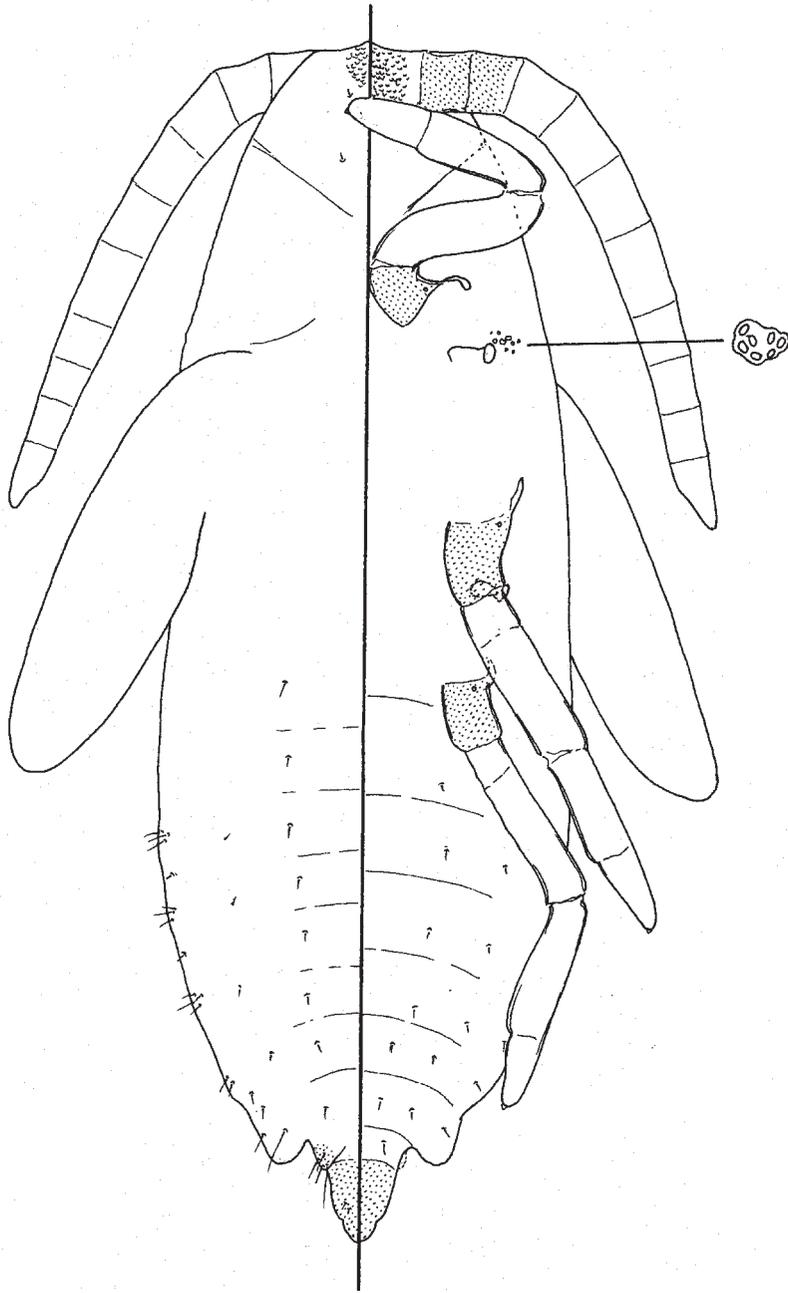


Fig. 117 Pupa, *Pounamococcus tubulus* Henderson & Hodgson.

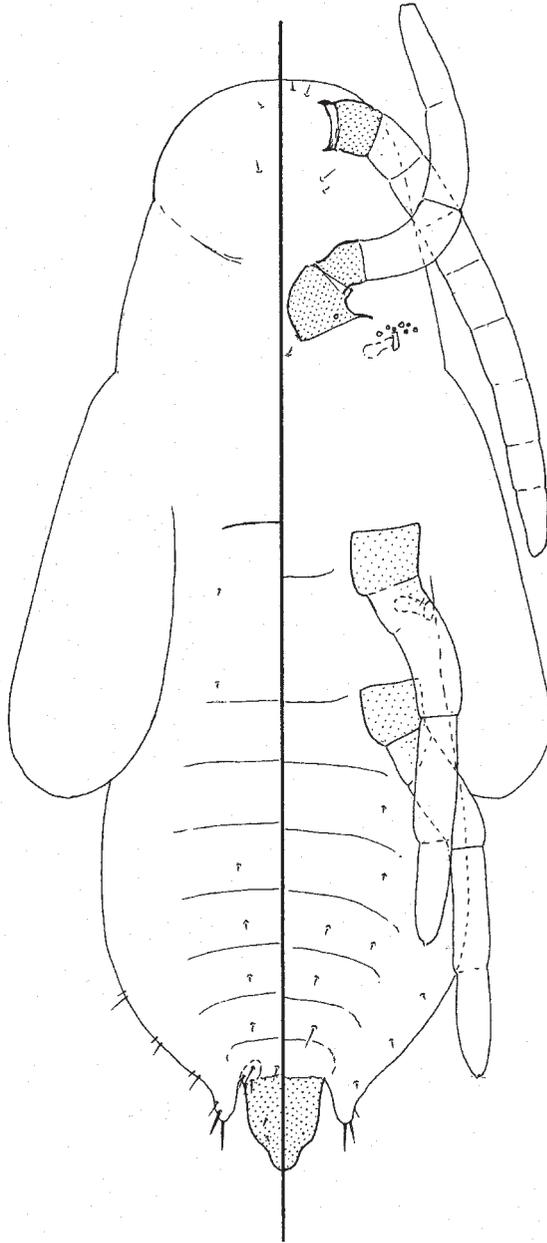


Fig. 118 Pupa, *Umbonichiton bullatus* Henderson & Hodgson.

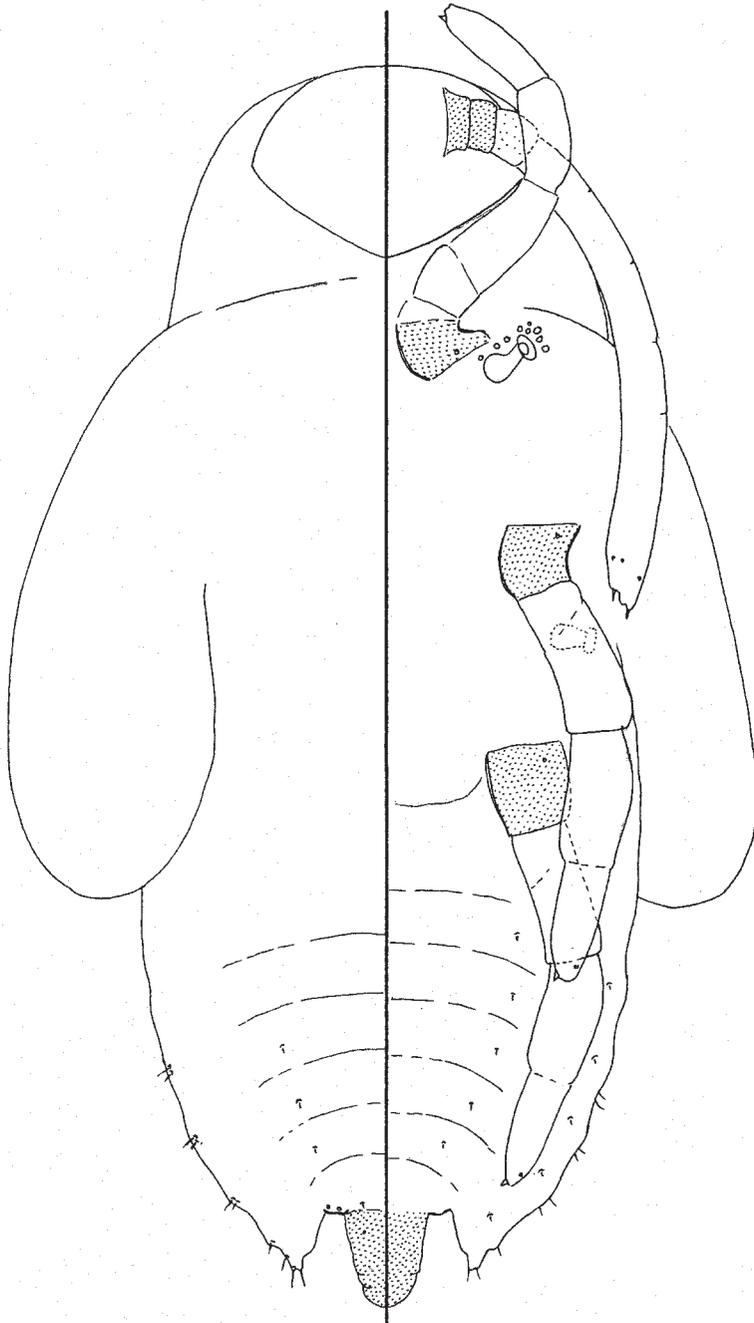


Fig. 119 Pupa, *Umbonichiton jubatus* Henderson & Hodgson.

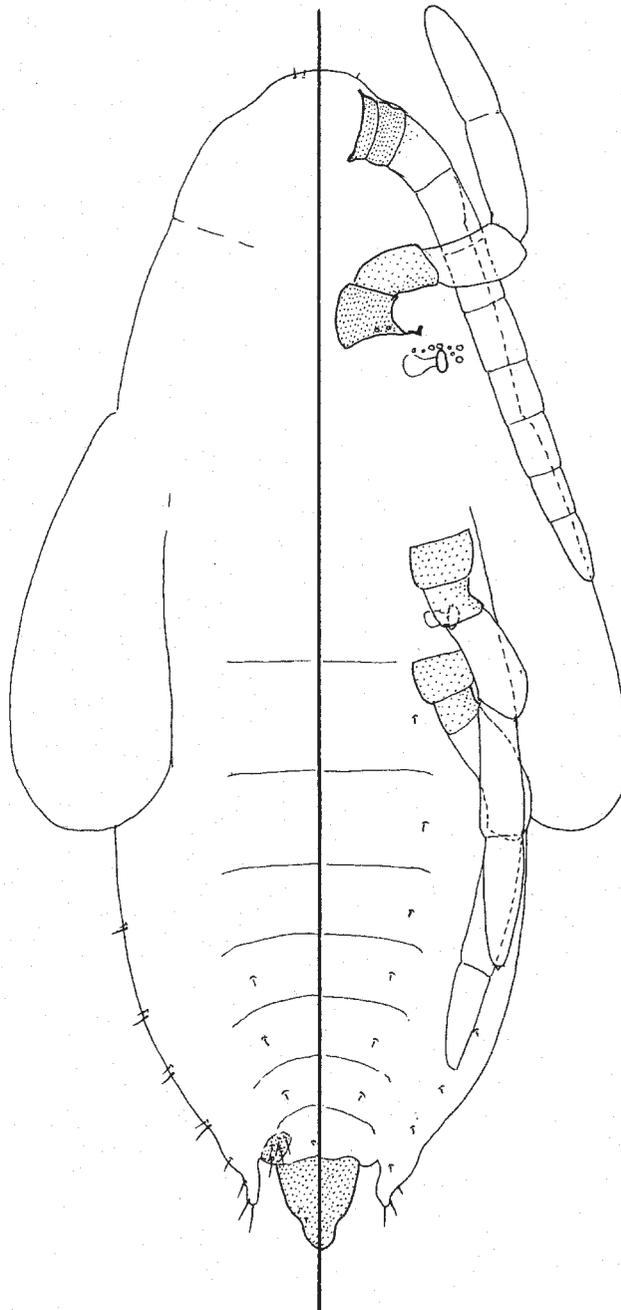


Fig. 120 Pupa, *Umbonichiton pellaspi* Henderson & Hodgson.

DESCRIPTIONS OF INDIGENOUS SPECIES, PUPAE

APHENOCHITON Henderson & Hodgson

Introduction. This genus currently contains 9 species; pupae were available for 5: *A. inconspicuus*, *A. kamahi*, *A. matai*, *A. pubens*, and *A. subtilis*.

Generic diagnosis (*inconspicuus*-group + *kamahi*-group combined) based on the pupae of 5 species (significant character-states in italics) (Fig. 94–98).

General: of moderate size, 1.1–1.6 mm long.

Head: yoke-like structure on head absent.

Thorax: spiracular disc-pores mainly distributed around anterior and lateral areas of each anterior spiracle, rarely extending either more laterally or much past inner end of each muscle plate; spiracular disc-pores absent from the posterior spiracles (rarely present on *A. subtilis*).

Abdomen: pairs of dorsal abdominal setae restricted to segments V, VI, and VII; usually 1 pair of ventral abdominal setae per segment, rarely 2 pairs on 1 or 2 segments; ante-anal setae present (although sometimes quite small); with 2 pairs of dorsopleural setae on segments (III)IV–VI, relative lengths varying between species; dorsopleural setae arranged segmentally; lobes of abdominal segment VII generally about 1/2 to 2/3 length of penial sheath; with 2 or 3 moderately short pleural setae (<20 µm long) on each lobe of segment VII; lobes of segment VIII very small or possibly absent occasionally but with a single minute seta in this position (perhaps more prominent on *A. pubens*); penial sheath longer than broad.

Comment. The pupae of the 5 species described here are all very similar and are also similar to those in other genera with ante-anal setae, namely *Crystallotesta* (*fagi*-group), *Ctenochiton*, *Kalasisir*, and *Umbonichiton*.

Aphenochiton inconspicuus (Maskell)

Fig. 94

Material examined: see Appendix for collection details of specimens examined.

Described from 7 pupae in good condition plus 1 poor specimen.

Mounted material: of moderate size: length 1.12–1.5 mm; head width 300–341 µm.

Head: antennae: total length 532–646 µm (ratio of antennal length to total body length 1:2.4).

Thorax: with 6–13 spiracular disc-pores (1 specimen with only 3), some very large, associated with each anterior spiracle, distributed antero–laterally to peritreme; no disc-pores associated with posterior spiracle. Spiracles: width of peritremes 23–30 µm. Length of metathoracic legs 461–

514 µm. Wing-buds: length 475–560 µm, width 152–206 µm (ratio length to width 1:0.35).

Abdomen: with 2 ante-anal setae, often quite long; with 1 or 2 pairs of small ventral abdominal setae on segments II–VI; with usually 2 dorsopleural setae (1 longer than other) on each side on segments III–VI; ventropleural setae as normal. Segment VII with a pair of well-developed triangular lateral lobes, each about 1/2–3/4 length of penial sheath and each with 1 long (16–23 µm) and 1 shorter pleural seta. Lobes of segment VIII small, with 1–3 setae, each occasionally as long as 15 µm. Penial sheath about 1.3–1.5× longer than lateral lobes of segment VII, distinctly longer than wide (about 120–150 µm long and 88–110 µm wide at base; ratio length to width 1:0.73); sheath with 2 pairs of minute setae or pores.

Comment. For a comparison with other *Aphenochiton* species, see under *A. subtilis*.

Aphenochiton kamahi Henderson & Hodgson

Fig. 95

Material examined: see Appendix for collection details of specimens examined.

Described from 1 pupa plus a caste skin in good condition.

Mounted material: of moderate size: length 1.30 mm; head width 355 µm.

Head: antennae: total length 710 µm (ratio of antennal length to total body length 1:1.8).

Thorax: with 6 spiracular disc-pores associated with each anterior spiracle, distributed anterolaterally to peritreme, but with an occasional pore more medially over muscle plate; with no pores associated with posterior spiracles. Spiracles: width of peritremes 20 µm. Length of metathoracic legs 540 µm. Wing-buds: length 560 µm, width 205–213 µm (ratio length to width 1:0.37).

Abdomen: with 2 ante-anal setae (pupal specimen with only 1 setal socket); with single pairs of small ventral abdominal setae on segments II–VI (2 pairs on V); and with usually 2 dorsopleural setae (1 longer than other) on each side, each pair on a rather obvious small bulge; ventropleural setae as normal. Segment VII with a pair of long, rather narrow lateral lobes, rather parallel sided near apex, each just shorter than penial sheath; each with 1 longer pleural seta (16 µm) and 1 shorter seta. Lobes of segment VIII small and membranous, each with one minute seta. Penial sheath a little longer than lateral lobes of segment VII, much longer than broad (about 117 µm long and 63 µm wide at base; ratio length to width 1:0.54).

Comment. For a comparison with other *Aphenochiton* species, see under *A. subtilis*.

***Aphenochiton matai* Henderson & Hodgson**

Fig. 96

Material examined: see Appendix for collection details of specimens examined.

Described from 1 specimen in good condition plus 1 with a paratype adult male.

Mounted material: of moderate size: length 1.53 mm; head width 369 μ m.

Head: antennae: total length 688–760 μ m (ratio of antennal length to total body length 1:2.1).

Thorax: with 2–5 spiracular disc-pores associated with each anterior spiracle, distributed anterolaterally to peritreme, with no pores associated with posterior spiracles. Spiracles: width of peritreme 27 μ m. Length of metathoracic legs 589–611 μ m. Wing-buds quite broad: length 518 μ m, width 220 μ m (ratio length to width 1:0.42).

Abdomen: with 2 ante-anal setae; with single pairs of small ventral abdominal setae on segments III–VI, that on VII usually long (18–24 μ m) and those on III–VI longer than dorsal abdominal setae on dorsum; and usually with 2 dorsopleural setae, subequal in length on each side; ventropleural setae as normal. Segment VII with a pair of shortish, blunt lateral lobes, each about half length of penial sheath; each with 2 shortish pleural setae (22–24 μ m) and 1 shorter seta. Lobes of segment VIII small and slightly sclerotised, each with 2 or 3 minute setae or pores. Penial sheath about twice length of lateral lobes of segment VII and much longer than broad (about 113–126 μ m long and 86–92 μ m wide at base; ratio length to width 1:0.74).

Comment. For a comparison with other *Aphenochiton* species, see under *A. subtilis*.

***Aphenochiton pubens* Henderson & Hodgson**

Fig. 30, 97

Material examined: see Appendix for collection details of specimens examined.

Described from 4 specimens in good condition plus 3 with paratype adult males.

Mounted material: of moderate size: length 1.47–1.73 mm; head width 315–375 μ m.

Head: antennae: total length 615–790 μ m (ratio of antennal length to total body length 1:2.3).

Thorax: with 8–23 spiracular disc-pores associated with each anterior spiracle, mainly distributed anterolaterally to peritreme, but some extending medially to near inner end of muscle plate and, when abundant, extending posteriorly laterad to peritreme; no disc-pores associated with posterior spiracle. Spiracles: width of peritremes 21–27 μ m. Length of metathoracic legs 514–635 μ m. Wing-buds: length

520–610 μ m, width 184–230 μ m (ratio length to breadth 1:0.37).

Abdomen: with 2 short ante-anal setae; with 1 pair of small ventral abdominal setae on III–VII, 2 on VI; with 2 (occasionally 3) pairs of dorsopleural setae on IV–VI, 0 on segment II–III, these sometimes on convex dermal extensions; ventropleural setae situated just below group of dorsopleural setae, 1 pair on each side per segment, one moderately to significantly longer than other. Lobes of segment VII elongate, each about 1/4–2/3 length of penial sheath, with 2 pleural setae on apex and 1 just subapically, longest setae 9–22 μ m; with a single ventropleural seta basally. Lobes of segment VIII membranous but distinct, each with 2–5 quite long setae (each 8+ μ m long). Penial sheath about 1.3–1.5 \times length of lateral lobes of segment VII, rather narrow (about 119–170 μ m long and 83–120 μ m wide at base; ratio length to width 1:0.7).

Comment. For a comparison with other *Aphenochiton* spp., see under *A. subtilis*.

***Aphenochiton subtilis* Henderson & Hodgson**

Fig. 30, 98

Material examined: see Appendix for collection details of specimens examined.

Described mainly from 10 specimens in good condition but a further 17 specimens studied for some details.

Mounted material: moderate to large: length 1.2–1.43 mm; head width 298–330 μ m.

Head: antennae: quite short, total length 508–540 μ m (ratio of antennal length to total body length 1:2.5).

Thorax: with 7–33 spiracular disc-pores associated with each anterior spiracle, distributed mainly laterally and anterolaterally to peritreme, but also extending medially to inner end of muscle plate; very rarely (on 1 spiracle of 2 out of 24 specimens) with 1 or 2 disc-pores associated with posterior spiracle. Spiracles: width of peritremes 21–22 μ m. Length of metathoracic legs 444–520 μ m. Wing-buds: length 425–485 μ m, width 171–203 μ m (ratio length to width 1:0.41).

Abdomen: with 2 small ante-anal setae; with 1 pair of small ventral abdominal setae on II–VII; with 2 pairs of short dorsopleural setae on IV–VI and 0 or 1 on segments III–IV; with 1 ventropleural seta just ventral to dorsopleural setae on each segment IV–VI. Segment VII with 2 moderately long but bluntly triangular lobes (material from Te Koau) or rather pointed lobes (Sharp Bush material), each about 2/3 length of penial sheath, with 2 shortish pleural setae on apex, longest setae 13–15 μ m, plus another 1 or 2 short setae about half-way down lobe on outer margin; also each with a ventropleural seta ventrally near base of

lobe. Lobes of segment VIII inconspicuous and membranous, each with 1 or 2 minute setae and sometimes a small concavity. Penial sheath distinctly longer than lateral lobes of segment VII, rather narrow (about 106–125 µm long and 63–91 µm wide at base; ratio length to width 1:0.67).

Comment. The relatively large amount of material available of this species has allowed some assessment of the taxonomic significance of some of the characters. Most of the structures described above appear constant apart from the number of disc-pores associated with the mesothoracic spiracles. The large range found (7–33) suggests that the frequency of the disc-pores may not be a good character but the distribution did appear reasonably constant.

The pupae of the 5 available species of *Aphenochiton* are all rather similar but possibly differ:

- (i) in the distribution of the spiracular disc-pores, which tend to extend medially to the inner end of muscle plate on *A. kamahi*, *A. pubens*, and *A. subtilis* but are more restricted on the other 2 species;
- (ii) in the shape of the lobes on abdominal segment VII — rather triangular and blunt on *A. inconspicuus*, *A. matai*, and *A. subtilis*; rather long and almost parallel sided on *A. kamahi* and *A. pubens*;
- (iii) in the ratio of length to basal width of penial sheath — quite long, about 1.3–1.5× longer than broad on *A. inconspicuus*, relatively shorter on *A. pubens* and *A. subtilis* and relatively longer on *A. kamahi*.

In addition, the following were found to vary, but the value of these as diagnostic characters is even less obvious: the relative lengths of the dorsal and ventral abdominal setae, the relative length of the dorsopleural setae, and the presence or absence of small convex lobes at the base of the dorsopleural setae.

CRYSTALLOTESTA Henderson & Hodgson

Introduction. There are 6 species currently known in this genus. These species can be divided into 2 distinct groups, with *C. ornata* and *C. ornatella* forming one group (the *ornata*-group) and the remaining species (*C. fagi*, *C. fusca*, *C. leptospermi*, and *C. neofagi*) possibly forming another (the *fagi*-group). Pupae of both *C. ornata* and *C. ornatella* were available from the *ornata*-group, but the only species for which a pupa was available from the *fagi*-group were *C. leptospermi* and *C. neofagi*.

Fagi-group

Diagnosis based on the pupae of 2 species, *C. leptospermi* and *C. neofagi* (significant character-states in italics) (Fig. 99, 100).

General: of moderate size, 1.3–1.65 mm long.

Head: yoke-like structure on head absent.

Thorax: spiracular disc-pores distributed around anterior and lateral areas of each anterior spiracle (extending medially past inner end of each muscle plate on *C. neofagi*); spiracular disc-pores absent from the posterior spiracles.

Abdomen: pairs of dorsal abdominal setae restricted to segments V, VI, and VII; with 1 or 2 pairs of ventral abdominal setae on segments II–VII; ante-anal setae present; with 2 pairs of dorsopleural setae on segments III–VI, one of each pair significantly longer than other; dorsopleural setae arranged segmentally; lobes of abdominal segment VII shorter than length of penial sheath; each abdominal lobe on segment VII with 3 pleural setae near apex (quite long on *C. leptospermi*); lobes on segment VIII distinct, each with a 1 or 2 small to minute setae; penial sheath about as long as broad (*C. leptospermi*) or much longer (1.5× longer than broad on *C. neofagi*).

Comment. Although the dorsopleural setae on the abdomen appear to be rather fleshy, their distribution on these 2 species is quite different from that on *C. ornata* and *C. ornatella*; the latter 2 species also lack ante-anal setae.

Crystallotesta leptospermi (Maskell)

Fig. 99

Material examined: see Appendix for collection details of specimens examined.

Described from 3 specimens in fair condition but rather squashed.

Mounted material: quite large: length 1.3–1.35 mm; head width 317–350 µm.

Head: antennae short: total length 495–530 µm (ratio of antennal length to total body length 1:2.58).

Thorax: with 5–7 spiracular disc-pores associated with each anterior spiracle, distributed anterolaterally and anteriorly to peritreme, none extending laterad to muscle plate; no disc-pores associated with posterior spiracle. Spiracles quite large: width of peritremes 25–27 µm. Length of metathoracic legs 406–425 µm. Wing-buds: length 431–445 µm, width 184–200 µm (ratio length to width 1:0.44).

Abdomen: with 2 very short (almost pore-like) ante-anal setae; with 1 or 2 pairs of small ventral abdominal setae on segments II–VII; with 1 long and 1 short dorsopleural seta on each side on segments IV–VI, plus 1 on segments II and III; ventropleural setae as for genus. Lobes of segment VII triangular, rather less than half length of penial sheath, with 3 apical setae, longest 25 µm. Segment VIII represented by a pair of small, prominent lobes, each with a short fleshy seta and a short hairlike seta. Penial sheath perhaps 3× longer than lobes of segment VII and about as

long as broad (about 87–92 µm long and 71–105 µm wide at base; ratio length to width 1:0.95).

Comment. *C. leptospermi* can be separated from *C. neofagi* by the relative lengths of the lobes on abdominal segment VII (much longer on *C. neofagi*), by the absence of spiracular disc-pores laterad to anterior spiracular muscle plate (present on *C. neofagi*), and the much shorter antennae (almost twice as long on *C. neofagi*).

Crystallotesta neofagi Henderson & Hodgson

Fig. 100

Material examined: see Appendix for collection details of specimens examined.

Described from 5 specimens in good condition.

Mounted material: quite large: length 1.32–1.65 mm; head width 341–405 µm.

Head: antennae: total length 724–824 µm (ratio of antennal length to total body length 1:1.91).

Thorax: with 7–15 spiracular disc-pores associated with each anterior spiracle, a few extending mesad to inner margin of spiracular muscle plate; no disc-pores associated with posterior spiracle. Spiracles quite large: width of peritremes 27–33 µm. Length of metathoracic legs 575–632 µm. Wing-buds: length 617–675 µm, width 220–284 µm (ratio length to width 1:0.39).

Abdomen: with 2 ante-anal setae; with 1 or 2 pairs of small ventral abdominal setae on segments V–VII and 0 or 1 pairs on segments II–IV; with 1 long and 1 short dorsopleural setae on each side on segments V and VI, plus 1 on segments III and IV; ventropleural setae as for genus. Lobes of segment VII broad, almost as long as penial sheath, with 1–3 apical setae, longest 14–18 µm. Segment VIII represented by a pair of small, prominent, slightly sclerotised, lobes, each with a single small seta or pore. Penial sheath just longer than lobes of segment VII and about 1.5× longer than broad (about 142–170 µm long and 78–114 µm wide at base; ratio length to width 1:0.62).

Comment. For comparison with *C. leptospermi*, see under that species above.

Ornata-group

Diagnosis based on the pupae of 2 species, *C. ornata* and *C. ornatella* (significant character-states in italics) (Fig. 101, 102).

General: variable in size, 1.1–1.8 mm long.

Head: yoke-like structure on head absent.

Thorax: spiracular disc-pores distributed around anterior and lateral areas of each anterior spiracle (and extending

posteriorly laterad to peritreme on *C. ornata*); spiracular disc-pores absent from the posterior spiracles.

Abdomen: pairs of dorsal abdominal setae restricted to segments V, VI, and VII; with 1 or 2 pairs of ventral abdominal setae on segments II–VI; *ante-anal setae absent; dorsopleural setae appearing rather fleshy and distributed in a line along margins of abdomen; dorsopleural setae not arranged segmentally; lobes of abdominal segment VII much shorter than length of penial sheath, rounded and blunt; each abdominal lobe on segment VII with setae in a line, without separate long setae; lobes on segment VIII fairly distinct, each with or without a seta or pore; penial sheath about 1.2–1.7× longer than broad.*

Comment. The pupae of *C. ornata* and *C. ornatella* are immediately separable from most other New Zealand soft scales by the line of fleshy dorsopleural setae along each side of the abdomen (*I. patella* has rather similar dorsopleural setae but has no spiracular disc-pores). In addition, the *ornata*-group differs from the *fagi*-group in lacking ante-anal setae.

Crystallotesta ornata (Maskell)

Fig. 101

Material examined: see Appendix for collection details of specimens examined.

Described from 1 specimen in good condition.

Mounted material: large: length 1.78 mm; head width 483 µm.

Head: antennae: total length 888 µm (ratio of antennal length to total body length 1:2.0).

Thorax: with 24 or 25 spiracular disc-pores associated with each anterior spiracle, mainly in a diagonal line laterad to peritreme but also extending medially to inner margin of muscle plate; no disc-pores associated with posterior spiracle. Spiracles: width of anterior peritremes 28–30 µm. Length of metathoracic legs 766–774 µm. Wing-buds: length 724–732 µm, width 284 µm (ratio length to width 1:0.39).

Abdomen: ante-anal setae absent; with 1 or 2 pairs of small ventral abdominal setae on all segments, some of these setae rather longer than normal; with a line of 11 or 12 rather blunt, quite fleshy-looking, dorsopleural setae on each side, each seta about 18 µm long, extending along margin from lobes of segment VII; ventropleural setae as normal. Lobes of segment VII short and broad. Lobes of segment VIII slightly sclerotised, small, without setae or pores but with a sclerotised spot. Penial sheath much longer than lateral lobes and about 1.2x longer than broad (185 µm long and 155 µm wide at base; ratio length to width 1:0.84).

Comment. Based on this single specimen, the pupa of *C.*

ornata appears to differ from that of *C. ornatella* in the much greater overall size of the former (*C. ornata* is about 50% larger) and in the distribution of the spiracular disc-pores laterad to the mesothoracic peritremes (not extending as far laterally or medially on *C. ornatella*).

***Crystallotesta ornatella* Henderson & Hodgson**

Fig. 102

Material examined: see Appendix for collection details of specimens examined.

Described from 3 specimens in good condition.

Mounted material: of medium size: length 1.12–1.5 mm; head width 341–384 μm .

Head: antennae: short, total length 518–788 μm (ratio of antennal length to total body length 1:2.28).

Thorax: with 9–16 spiracular disc-pores associated with each anterior spiracle, mainly distributed anterolaterally to peritreme but with a few over muscle plate; no disc-pores associated with posterior spiracle. Spiracles: width of anterior peritremes 23–33 μm . Length of metathoracic legs 426–639 μm . Wing-buds: rather narrow, length 426–696 μm , width 166–227 μm (ratio length to width 1:0.35).

Abdomen: ante-anal setae absent; with single pairs of small ventral abdominal setae on segments II, VI–VII, 2 pairs on segments III–V; with a line of 18–21 rather blunt, quite fleshy-looking, dorsopleural setae on each side (each seta about 20 μm long), extending along margin from lobes of segment VII; ventropleural setae as normal. Lobes of segment VII very short and broad. Lobes of segment VIII small, each with 0–2 minute setae. Penial sheath much longer than lateral lobes and about 1.4 \times longer than broad (104–144 μm long and 79–99 μm wide at base; ratio length to width 1:0.72).

Comment. See under *C. ornata* for comparison with *C. ornatella*.

The rather large size ranges given above for *C. ornatella* is notable. The largest individual was nearly mature, with an almost fully-developed adult male inside; the smallest was some 25% smaller and showed no signs of internal male development. This suggests that there could be a degree of swelling and enlargement of the pupa as the inner adult male develops. This was also noted with other species when the pupae were at different stages of development.

CTENOCHITON Maskell

Introduction: the genus *Ctenochiton* currently contains 4 species. Pupae were available for *C. chelyon*, *C. paraviridis*, and *C. viridis*.

Generic diagnosis based on the pupae of three species, *C. chelyon*, *C. paraviridis*, and *C. viridis* (significant character-states in italics) (Fig. 103–105).

General: of moderate size, 1.2–1.7 mm long.

Head: yoke-like structure on head absent.

Thorax: spiracular disc-pores few (10 or fewer), distributed around anterior and lateral areas of each anterior spiracle, none extending either more laterally or medially past inner end of muscle plate; with or without spiracular disc-pores associated with posterior spiracles, when present, with a maximum of 2.

Abdomen: pairs of dorsal abdominal setae restricted to segments V, VI, and VII; with 1 pair of ventral abdominal setae on segments II–VII; ante-anal setae present; with 2 pairs of dorsopleural setae on segments III–VI, 1 of each pair significantly longer than other; dorsopleural setae arranged segmentally; lobes of abdominal segment VII rather pointed, much shorter than length of penial sheath; *each lobe on segment VII with 2 or 3 setae near apex, longest generally more than 30 μm long*; lobes on segment VIII small, each with a 1 or 2 small to minute setae; *penial sheath generally about 1.5–2 \times longer than broad*.

Comment. The pupae of these 3 species of *Ctenochiton* are all very similar and appear to differ in small details only, the significance of which is uncertain.

***Ctenochiton chelyon* Henderson & Hodgson**

Fig. 103

Material examined: see Appendix for collection details of specimens examined.

Described from 10 specimens but some details were also taken from a further 5 specimens.

Mounted material: moderately large but limbs relatively short: length 1.67 mm; head width 320–391 μm .

Head: antennae: relatively short, total length 630–693 μm (ratio of antennal length to total body length 1:2.5).

Thorax: with 6–10 spiracular disc-pores associated with each anterior spiracle, distributed mainly anterolaterally to peritreme but usually with one mesad near muscle plate; with 1 or 2 disc-pores associated with each posterior spiracle. Spiracles: width of peritremes 23 μm . Length of metathoracic legs 282 μm . Wing-buds: length 400–464 μm , width 145–173 μm (ratio length to width 1:0.37).

Abdomen: with 2 ante-anal setae; with single pairs of small ventral abdominal setae on segments II–VI plus 1 or 2 pairs on VII; with 2 dorsopleural setae (1 generally longer than other) and 1 small ventropleural seta on each side on segments III–VI. Segment VII with a pair of rather short, pointed lateral lobes, each about 1/3 or less length of penial

sheath, each with 2 or 3 long (some very long, up to 58 μm long) setae on apex and 1 shorter seta on lateral margin. Lobes of segment VIII membranous, small, each with 1–3 small seta. Penial sheath about 2 or 3 \times longer than lateral lobes of segment VII and a little longer than broad (122 μm long and about 103 μm wide at base; ratio length to width 1:0.84); with 1 pore or minute seta on dorsal surface.

***Ctenochiton paraviridis* Henderson & Hodgson**

Fig. 104

Material examined: see Appendix for collection details of specimens examined.

Described from 3 specimens in good condition plus 2 further specimens with pharate adult males.

Mounted material: moderately large: length 1.28–1.40 mm; head width 309–346 μm .

Head: antennae: short, total length 482–582 μm (ratio of antennal length to total body length 1:2.5).

Thorax: with 3–10 spiracular disc-pores associated with each anterior spiracle, distributed anterolaterally to peritreme; with 0 (rarely up to 2) disc-pores associated with each posterior spiracle. Spiracles quite large: width of peritremes 25–28 μm . Length of metathoracic legs 436–528 μm . Wing-buds: rather narrow, length 509–619 μm , width 182–209 μm (ratio length to width 1:0.35).

Abdomen: with 2 ante-anal setae; with single pairs of small ventral abdominal setae on segments II–VII; with 1 or 2 dorsopleural setae (1 generally longer than other) and 1 small ventropleural setae on each side on segments III–VI. Segment VII with a pair of well-developed, pointed, lateral lobes about 1/4–1/3 length of penial sheath, each with 1 or 2 rather long (28–41 μm) plus 1 or 2 shorter setae. Lobes of segment VIII membranous, small, each with 1 longer seta and 1 short seta. Penial sheath 3 or 4 \times longer than lateral lobes of segment VII and about 2 \times as long as wide (227–269 μm long and about 118–128 μm wide at base; ratio length to width 1:0.5); with a pair of minute setae dorsally.

***Ctenochiton viridis* Maskell**

Fig. 105

Material examined: see Appendix for collection details of specimens examined.

Described from 3 good specimens.

Mounted material: of moderate size: length 1.4–1.54 mm; head width 315–350 μm .

Head: antennae: total length 540–660 μm (ratio of antennal length to total body length 1:2.45).

Thorax: with 3–10 spiracular disc-pores associated with each anterior spiracle, distributed anterolaterally to

peritreme, rarely with one anterior to muscle plate; with no disc-pores associated with posterior spiracle. Spiracles quite large: width of peritremes 23–27 μm . Length of metathoracic legs 500–560 μm . Wing-buds: length 495–540 μm , width 195–225 μm (ratio length to width 1:0.41).

Abdomen: with 2 very short ante-anal setae; with single pairs of small ventral abdominal setae on segments II–VII; generally with 2 dorsopleural setae (one 4–6 \times longer than other) and 1 small ventropleural setae on each side on segments III–VI. Segment VII with a pair of well-developed, pointed, lateral lobes, about 1/3–2/3 length of penial sheath, each with 1 or 2 long (20–48 μm , usually over 30 μm) and 1 shorter seta, and with a short seta on each lateral margin. Lobes of segment VIII indistinct and membranous, each with 0 or 1 minute setae. Penial sheath about 2 or 3 \times longer than lateral lobes of segment VII and more than 2 \times longer than wide (140–175 μm long and about 84–108 μm wide at base; ratio length to width 1:0.61); with a pair of minute setae on dorsal surface.

Comment. The pupa of *C. viridis* is very similar to those of *C. chelyon* and *C. paraviridis* but may differ in the shortness of the ante-anal setae.

The pupae of *Ctenochiton* appear to be very similar to those of *Aphenochiton*, *Crystallotesta* (*fagi*-group), *Kalasis*, and *Umbonichiton* but differ in the (generally) much greater length of the setae on the apex of lobes of abdominal segment VII.

***EPELIDCHITON* Henderson & Hodgson**

Introduction. This genus contains only a single species, *E. piperis*.

Generic diagnosis based on pupa of *E. piperis* only (significant character-states in italics) (Fig. 106).

General: of moderate size, 1.2–1.3 mm long.

Head: yoke-like structure on head absent.

Thorax: spiracular disc-pores few (10 or fewer), distributed in a line over top of anterior spiracle *which extends medially past end of muscle plate*; without spiracular disc-pores associated with posterior spiracles.

Abdomen: pairs of dorsal abdominal setae restricted to segments V, VI, and VII; with 1 or 2 pairs of ventral abdominal setae on segments II–VI; *ante-anal setae absent*; with 2 pairs of dorsopleural setae on segments III–VII, 1 of each pair significantly longer than other; dorsopleural setae arranged segmentally; lobes of abdominal segment VII rather pointed, much shorter than length of penial sheath; each abdominal lobe on segment VII with 1 long and 1 short seta near apex, longest less than 25 μm long; *lobes on segment VIII small, knobby and sclerotised, each with a 2 or 3 minute setae; penial sheath about as 1.5 \times longer than broad.*

Comment. *Epelidochiton* is one of the group of genera which lack ante-anal setae (along with *Lecanochiton*, the *ornata*-group of *Crystallotesta*, and *Plumichiton*)

***Epelidochiton piperis* (Maskell)**

Fig. 106

Material examined: see Appendix for collection details of specimens examined.

Described from 2 specimens in good condition plus 1 with a pharate adult male.

Mounted material: of moderate size: length 1.2–1.35 mm; head width 355–384 μm .

Head: antennae: total length 617–675 μm (ratio of antennal length to total body length 1:1.97).

Thorax: with 5–10 spiracular disc-pores associated with each anterior spiracle, distributed in a line over top of spiracle and extending medially past inner margin of muscle plate; with no disc-pores associated with posterior spiracle. Spiracles: width of peritremes 21–25 μm . Length of metathoracic legs 482–582 μm . Wing-buds: rather broad, length 482–582 μm , width 227–241 μm (ratio length to width 1:0.44).

Abdomen: ante-anal setae absent; with single pairs of small ventral abdominal setae on segments II–VII (2 pairs on V); generally with 2 dorsopleural setae (one longer than other) and 1 small ventropleural setae (close to dorsopleural setae) on each side on segments III–VI. Segment VII with a pair of well-developed, pointed, lateral lobes, about 2/3 length of penial sheath, each with 1 long (16–24 μm) and 1 shorter seta, and a short seta on each lateral margin. Lobes of segment VIII rather knobby and sclerotised, with 2 or 3 minute setae. Penial sheath about 1/3 longer than lateral lobes of segment VII but longer than broad (124–153 μm long and about 97–112 μm wide at base; ratio length to width 1: 0.73).

INGLISIA Maskell

Introduction. This genus contains only a single species, *I. patella*.

Generic diagnosis based on the pupa of *I. patella* only (significant character-states in italics) (Fig. 107).

General: of moderate size, 1.2–1.3 mm long.

Head: yoke-like structure on head absent; antennae apparently extending out laterally from head.

Thorax: both anterior and posterior spiracles without spiracular disc-pores.

Abdomen: pairs of dorsal abdominal setae restricted to

segments V, VI, and VII; with 1 pair of ventral abdominal setae on segments II–VII; ante-anal setae present; *dorsopleural setae more or less in a line along margin between segments V–VII, all subequal in length; dorsopleural setae not arranged segmentally; lobes of abdominal segment VII rather short and squat, less than 1/4 length of penial sheath;* each abdominal lobe on segment VII without long pleural setae but with setae in a marginal line; lobes on segment VIII small or absent, with 0 or 1 minute seta; *penial sheath about 1.5× longer than broad; both surfaces of penial sheath covered in dermal spinules.*

Comment. In the total absence of spiracular disc-pores, the pupa of *I. patella* is quite unlike any others currently known from New Zealand.

***Inglisia patella* (Maskell)**

Fig. 107

Material examined: see Appendix for collection details of specimens examined.

Described from 3 good specimens plus 1 good and 1 fair specimen with pharate adult males.

Mounted material: of moderate size: length 1.25–1.30 mm; head width 362 μm . Dermal spinules quite clear, those on dorsum broad and blunt, those on venter sharp and cone shaped.

Head: antennae appear to emerge more laterally from head than in other species: total length 546–641 μm (ratio of antennal length to body length 1:2.16); tip rather pointed.

Thorax: without disc-pores associated with either anterior or posterior spiracles. Spiracles relatively rather large: width of peritremes 26–33 μm . Length of metathoracic legs 450–558 μm . Wing-buds: length 482–571 μm , width 184–209 μm (ratio length to width 1:0.37).

Abdomen: with 2 short ante-anal setae on 2 specimens and 2 spots on 2 others specimens; with single pairs of small ventral abdominal setae on segments II–VII; dorsopleural setae rather short, more or less in a line of 7–14 from segment VII anteriorly to about segment V and with a few more ventrally; ventropleural setae as normal. Segment VII with a pair of small, triangular, bluntly pointed lobes, much shorter than penial sheath and without setae on apex but with 3 setae subapically. Lobes of segment VIII apparently absent on material from Motueka but with small membranous lobes without setae on those from Sharp Bush. Penial sheath much longer than lobes of segment VII and usually rather longer than broad (129–146 μm long and about 84–132 μm wide at base; ratio length to width 1:0.78); both surfaces with abundant dermal spinules.

KALASIRIS Henderson & Hodgson

Introduction. The genus *Kalasisiris* contains 3 species; pupae were available for *K. depressa* and *K. perforata*.

Generic diagnosis based on the pupae of 2 species, *K. depressa* and *K. perforata* (significant character-states in italics) (Fig. 108, 109).

General: of moderate size, 1.3–1.5 mm long.

Head: yoke-like structure on head absent.

Thorax: spiracular disc-pores in a fairly tight group anterolateral to peritreme of anterior spiracles, with or without a disc-pore mesad of muscle plate; with or without spiracular disc-pores associated with posterior spiracles.

Abdomen: pairs of dorsal abdominal setae restricted to segments V, VI, and VII; with 1 or 2 pairs of ventral abdominal setae on segments II–VII; ante-anal setae present; with 1 or 2 pairs of dorsopleural setae on segments III–VI, 1 of each pair significantly longer than other; dorsopleural setae arranged segmentally; lobes of abdominal segment VII rather pointed, length variable (1/2–2/3 length of penial sheath on *K. perforata*; longer than penial sheath on *K. depressa*; each abdominal lobe on segment VII with 2 or 3 shortish setae near apex, each less than 30 mm long; lobes on segment VIII pronounced and slightly sclerotised, each with a 1–4 minute setae or pores; penial sheath about as 1.5–2× longer than broad.

Comment. The pupae of *K. depressa* and *K. perforata* are rather similar to those of *Aphenochiton*, *Crystallotesta* (fagi-group), *Ctenochiton*, and *Umbonichiton* from which they are difficult to separate.

Kalasisiris depressa (Maskell)

Fig. 42, 108

Material examined: see Appendix for collection details of specimens examined.

Described from 3 specimens, 1 in good condition, 1 pharate specimen in fair to good condition and a cast skin.

Mounted material: of moderate size: length 1.32 mm; head width: 298 µm.

Head: antennae: long, total length 545–615 µm (ratio of antennal length to total body length 1:1.75).

Thorax: with 9–12 spiracular disc-pores associated with each anterior spiracle, distributed anteriorly and laterad to peritreme, extending medially about half-way along muscle plate; rarely with 1 disc-pore associated with posterior spiracles. Spiracles: width of anterior peritremes 25–27 µm. Length of metathoracic legs 539–554 µm. Wing-buds: length 510–568 µm, width 197–213 µm (ratio length to width 1:0.38).

Abdomen: 2 ante-anal setae present on pupa, apparently absent on pharate pupa; with 2 pairs of small ventral setae on segment VII and 1 pair on II–VI; dorsopleural setae: 2 (one longer than other) on each side of segments IV–VII, plus single seta on segment III; ventropleural setae as normal. Lateral lobe of VII long, subequal to length of penial sheath, each with a long apical seta (21–23 µm long) and 2 shorter setae laterally. Segment VIII lobes quite prominent, each with a minute seta and perhaps with a small concavity on inner margin. Penial sheath subequal to or slightly longer than lateral lobes of segment VII and much longer than broad (139 µm long and about 94 µm wide at base; ratio length to width 1:0.68); with a pair of minute setae on dorsal surface.

(Note: On all specimens, the lobes of segment VII were shrunken and their exact length uncertain. The drawing was made from the pupal specimen but, as the shape of the lobes on segment VII on the pharate specimen were considered the least distorted, these were illustrated from the pharate pupa within the prepupa).

Comment: for a comparison with *K. perforata*, see under that species below.

Kalasisiris perforata (Maskell)

Fig. 43, 109

Material examined: see Appendix for collection details of specimens examined.

Described from 4 good specimens plus 7 others with pharate adult males.

Mounted material: of moderate size: length 1.42–1.55 mm; head width 369–383 µm.

Head: antennae: total length 809–838 µm (ratio of antennal length to total body length 1:1.82).

Thorax: with 11–33 (mainly more than 25) spiracular disc-pores laterad to each anterior peritreme, extending posteriorly to lower margin of peritreme, plus 0–2 dorsad to inner end of muscle plate; usually without disc-pores associated with each posterior spiracle but rarely with 1–3. Spiracles quite large: width of anterior peritremes 27–31 µm. Length of metathoracic legs 681–738 µm. Wing-buds: length 617–661 µm, width 248–277 µm (ratio length to width 1: 0.41).

Abdomen: with 2 short ante-anal setae, sometimes just represented by their sockets; with single pairs of ventral setae on segments III–VII, occasionally 2 pairs on V and VI; those on segments V–VII often unusually long; dorsopleural setae: with 2 (one longer than other) on each side of segments IV–VII plus a single seta on segment III; ventropleural setae as normal. Lateral lobe of VII pointed, broad basally, each 1/2–2/3 length of penial sheath, each

with 1 or 2 fairly long apical setae (about 28 µm long) and 1 or 2 shorter setae more laterally. Lobes of segment VIII distinct and membranous, each with 2–4 moderate to minute setae and 1 or 2 pores. Penial sheath slightly longer than lateral lobes of segment VII and almost as long as broad (94–102 µm long and about 86–94 µm wide at base; ratio length to width 1:0.91).

Comment. The pupae of *K. depressa* and *K. perforata* are very similar, but *K. perforata* tends to have many more spiracular disc-pores associated with the anterior spiracles (11–33 on *K. perforata* as compared with 9–12 on *K. depressa*), these concentrated almost entirely laterad to each peritreme. In addition, the lobes of abdominal segment VIII of *K. perforata* have more setae and pores than those of *K. depressa* (2–4 on *K. perforata* as compared with 1 minute seta on *K. depressa*).

LECANOCHITON Maskell

Introduction. The genus *Lecanochiton* contains 4 species. Pupae were available for *L. actites* and *L. scutellaris*.

Generic diagnosis based on the pupae of 2 species, *L. actites* and *L. scutellaris* (significant character-states in italics) (Fig. 110, 111).

General: small, 0.9–1.1 mm long; host plant restricted to species of *Metrosideros*.

Head: yoke-like structure on head absent.

Thorax: spiracular disc-pores few (4–10), in a group anterolateral to peritreme of anterior spiracles and tending to extend mesad of muscle plate; spiracular disc-pores generally present associated with posterior spiracles (up to 2/spiracle).

Abdomen: pairs of dorsal abdominal setae restricted to segments V, VI, and VII; with 1 or 2 pairs of ventral abdominal setae on segments II–VII; ante-anal setae absent; generally with 1 pair of fairly short dorsopleural setae on segments III–VI, occasionally 2 on VI; dorsopleural setae arranged segmentally; lobes of abdominal segment VII rather rounded and 1/2 or less length of penial sheath; each abdominal lobe on segment VII with 2 setae near apex plus 1 seta laterally; lobes on segment VIII small, slightly sclerotised, each with 1 or 2 setae; penial sheath about 1.5–2× longer than broad.

Comment. In lacking ante-anal setae, the pupae of *Lecanochiton* resemble those of *Epelidochiton*, *Plumichiton* and the *ornata*-group of *Crystallotesta*. The pupae of *Lecanochiton* differ in having few disc-pores associated with each anterior spiracle but, nonetheless, generally having 1 or 2 associated with each posterior spiracle.

Lecanochiton actites Henderson & Hodgson

Fig. 110

Material examined: see Appendix for collection details of specimens examined.

Described from 1 good specimen plus one with pharate adult male.

Mounted material: small, length 0.95–0.98 mm; head width 291–305 µm.

Head: antennae rather short and pointed: total length 469 µm (ratio of antennal length to total body length 1:2.06).

Thorax: with 7–10 spiracular disc-pores associated with each anterior spiracle, in a line anterior to spiracle, extending quite a long way medially past inner end of muscle plate; with 0 or 1 disc-pores associated with each posterior spiracle. Spiracles: width of peritremes 18 µm. Length of metathoracic legs 383–390 µm. Wing-buds: narrow, length 433–469 µm, width 134–149 µm (ratio length to width 1:0.31).

Abdomen: ante-anal setae absent; with 1 or 2 pairs ventral abdominal setae on segments II–VII; with 2 dorsopleural setae (1 long and 1 short) on each side of segment VI and 1 on segments III–V; ventropleural setae as normal. Lateral lobes of segment VII very short and rounded, about 1/4 length of penial sheath, each with 2 shortish setae near apex (each about 12 µm long) and 2 short setae laterally. Lobes of segment VIII very small, with a single minute seta; tergum showing some sclerotisation. Penial sheath much longer than lobes of segment VII and much longer than wide (117 µm long and about 70–96 µm wide at base; ratio length to width 1:0.71).

Comment. The pupae of *L. actites* and *L. scutellaris* are very similar but differ mainly in the length of the lobes on abdominal segment VII, which are small on *L. actites* but about 1/2 the length of the penial sheath on *L. scutellaris*.

Lecanochiton scutellaris Henderson & Hodgson

Fig. 111

Material examined: see Appendix for collection details of specimens examined.

Described from 1 good and 1 fair specimen.

Mounted material: small, length 1.04 mm; head width 277 µm.

Head: antennae rather small and pointed: total length 525 µm (ratio of antennal length to total body length 1:1.98).

Thorax: with 4 or 5 spiracular disc-pores associated with each anterior spiracle, distributed mainly just anterior to each peritreme but also with one mesad to muscle plate; with 1 or 2 disc-pores associated with each posterior

spiracle. Spiracles: width of peritremes 20 µm. Length of metathoracic legs 376 µm. Wing-buds: rather narrow, length 426 µm, width 149 µm (ratio length to width 1:0.35).

Abdomen: ante-anal setae absent; with 1 or 2 pairs of ventral abdominal setae on II–VII; with possibly only 1 dorsopleural seta on each side of segments III–VI. Lateral lobes of segment VII quite large, about half length of penial sheath, each with 1 long (each 21–23 µm long) and 1 short seta on apex, and another longish seta laterally. Lobes of segment VIII very small, slightly sclerotised, with 1 longer and 1 short seta. Penial sheath about 2× as long as lobes of segment VII and much longer than wide (119 µm long and about 75 µm wide at base; ratio length to width 1:0.63).

Comment. For a comparison with *L. actites*, see under that species above.

PLUMICHITON Henderson & Hodgson

Introduction. The genus *Plumichiton* contains 6 species; pupae were available for 3 species: *P. flavus*, *P. nikau*, and *P. pollicinus*.

Generic diagnosis based on the pupae of three species, *P. flavus*, *P. nikau* and *P. pollicinus* (significant character-states in italics) (Fig. 112–114).

General: small to moderate in size, 1.1–1.7 mm long.

Head: yoke-like structure on head absent.

Thorax: spiracular disc-pores quite abundant, in a band anterolateral to peritreme of anterior spiracles, extending well past inner margin of muscle plate; without spiracular disc-pores associated with posterior spiracles.

Abdomen: pairs of dorsal abdominal setae restricted to segments V, VI and VII; with 1 or 2 pairs of ventral abdominal setae on segments II–VII; ante-anal setae absent; with 1 or 2 pairs of dorsopleural setae on segments (III)IV–VI, 1 of each pair significantly longer than other; dorsopleural setae arranged segmentally; lobes on abdominal segment VII moderately developed, about 1/3–2/3 as long as penial sheath; each abdominal lobe on segment VII with 1–4 shortish setae near apex, each less than 25 µm; lobes on segment VIII small to pronounced, sclerotised or unsclerotised, each with a 2–4 setae or pores; penial sheath a little longer than broad.

Comment. In lacking ante-anal setae, the pupae of *Plumichiton*, resemble those of *Epelidochiton*, *Lecanochiton*, and the *ornata*-group of *Crystallotesta*. Within *Plumichiton*, pupae of *P. flavus*, *P. nikau*, and *P. pollicinus* are fairly similar, the most obvious synapomorphic character state being the extension of the line of spiracular disc-pores medially well past the inner end of each anterior muscle plate.

Plumichiton flavus (Maskell)

Fig. 112

Material examined: see Appendix for collection details of specimens examined.

Described from 1 good specimen plus 3 with pharate adult males.

Mounted material: of moderate size: length 1.45–1.65 mm; head width 418–426 µm.

Head: antennae: total length 717–824 µm (ratio of antennal length to total body length 1:2.0).

Thorax: with 21–31 spiracular disc-pores associated with each anterior spiracle, mainly in a diagonal line over top of spiracle, extending a long way medially past inner margin of muscle plate; no disc-pores associated with posterior spiracle. Spiracles: width of anterior peritremes 23–34 µm. Length of metathoracic legs 610–667 µm. Wing-buds rather narrow: length 546–617 µm, width 191–206 µm (ratio length to width 1:0.34).

Abdomen: ante-anal setae absent; with single pairs of small ventral abdominal setae on all segments bar VI which had 2 pairs; setae rather longer than normal; with 2 dorsopleural setae (1 long and 1 short) on VI and V, IV with only a short seta on each side; ventropleural setae as normal. Lobes of segment VII about 1/2–1/3 length of penial sheath, each lobe with 2 or 3 longish setae (longest 16–34 µm) and none laterally. Lobes of segment VIII quite pronounced and sclerotised, each with 4 or 5 longish setae (15–20 µm long). Penial sheath about 2 or 3× longer than lateral lobes of segment VII and almost as wide as long (about 165–195 µm long and 140–146 µm wide at base (ratio length to width 1:0.79); with 2 pairs of minute setae on dorsal surface.

Comment. *P. flavus* and *P. nikau* differ from *P. pollicinus* in having much more pronounced lobes and more and longer setae on abdominal segment VIII. *P. flavus* and *P. nikau* may not be separable.

Plumichiton nikau Henderson & Hodgson

Fig. 113

Material examined: see Appendix for collection details of specimens examined.

Described from 1 specimen in good condition.

Mounted material: of moderate size: length 1.44 mm; head width 381 µm.

Head: antennae: total length 730 µm (ratio of antennal length to total body length 1:1.97).

Thorax: with 20 spiracular disc-pores associated with each anterior spiracle, mainly in a diagonal line over top of

spiracle, extending a long way medially past inner margin of muscle plate; no disc-pores associated with posterior spiracle. Spiracles: width of anterior peritremes 26–28 μm . Length of metathoracic legs 596 μm . Wing-buds rather narrow: length 559 μm , width 184–197 μm (ratio length to width 1:0.35).

Abdomen: ante-anal setae absent; with single pairs of small ventral abdominal setae on all segments bar VI which had 2 pairs; with 2 dorsopleural setae (1 long and 1 short) on VI and V, IV with only a short seta on each side; ventropleural setae as normal. Lobes of segment VII about 1/2–1/3 length of penial sheath, each lobe with 2 longish setae (longest 13–15 μm) and none laterally, but with 1 minute ventropleural seta near base. Lobes of segment VIII quite pronounced and membranous, each with 4 longish setae (9–17 μm long). Penial sheath about 2 or 3 \times longer than lateral lobes of segment VII, rather longer than broad (about 149 μm long and 116 μm wide at base (ratio length to width 1:0.78); with 2 pairs of minute setae on dorsal surface.

Comment. The pupa of *P. nikau* is very similar to that of *P. flavus*.

Plumichiton pollicinus Henderson & Hodgson

Fig. 114

Material examined: see Appendix for collection details of specimens examined.

Described from 6 good specimens plus 3 with pharate adult males.

Mounted material: of moderate size: length 1.07–1.45 mm; head width 318–377 μm .

Head: antennae: total length 617–781 μm (ratio of antennal length to total body length 1:1.8).

Thorax: with 3–26 (mainly less than 15) spiracular disc-pores associated with each anterior spiracle, mainly anterior to muscle plate and extending in a line medially well past inner margin of muscle plate (restricted on two specimens to anterior to muscle plate only); no disc-pores associated with posterior spiracle. Spiracles: width of anterior peritremes 21–27 μm . Length of metathoracic legs 468–554 μm . Wing-buds: length 447–583 μm , width 163–206 μm (ratio length to width 1:0.36).

Abdomen: ante-anal setae absent; with single pairs of small ventral abdominal setae on all segments except VI which had 2 pairs, setae rather longer than normal; dorsopleural setae: usually with 1 long and 1 short seta on each side of segments V and VI, but sometimes with intermediate setae and appearing rather random along margin; with 0 or 1 short or long seta on segments IV and III; ventropleural setae as normal. Lobes of segment VII about 1/2–2/3 length

of penial sheath, with a blunt apex; each lobe with 1–4 longish setae (longest 21–25 μm), and a short seta laterally. Lobes of segment VIII small, indistinct but sclerotised, each with 1 long seta, 1 or 2 shorter setae and 0–2 minute pores. Penial sheath about 1.5–2 \times length of lateral lobes of segment VII and about as wide as long (about 111–137 μm long and 86–135 μm wide at base; ratio length to width 1:0.96); with 2 pairs of minute setae on dorsal surface.

Comment. The pupa of *P. pollicinus* differs from those of *P. flavus* and *P. nikau* in the size of the lobes on abdominal segment VIII, which are large on *P. flavus* and *P. nikau* but small on *P. pollicinus*.

POROPEZA Henderson & Hodgson

Introduction. There are 2 species currently included in this genus; pupae were available for *P. dacrydii* only.

Generic diagnosis based on the pupa of *P. dacrydii* only (significant character-states in italics) (Fig. 115).

General: moderately large, 1.7 mm long; *small convex pores present on venter of thorax and dorsum of abdomen.*

Head: yoke-like structure on head absent.

Thorax: *spiracular disc-pores quite abundant, in a band anterolateral to peritreme of anterior spiracles, extending past inner margin of muscle plate; without spiracular disc-pores associated with posterior spiracles.*

Abdomen: pairs of dorsal abdominal setae restricted to segments V, VI, and VII; with 1 or 2 pairs of ventral abdominal setae on segments II–VII; ante-anal setae present; with 1 or 2 pairs of dorsopleural setae on segments IV–VI, one of each pair slightly longer than other; dorsopleural setae arranged segmentally; lobes on abdominal segment VII short and triangular in shape, about 1/4–1/6 length of penial sheath; each abdominal lobe on segment VII with 1–3 shortish setae near apex, each less than 20 μm ; lobes on segment VIII very small, each with a 1 or 2 minute setae; *penial sheath about 2 \times longer than broad.*

Comment. On the basis of the available material, the pupa of *P. dacrydii* can be quickly identified by the very large penial sheath, which is much longer than the lobes on abdominal segment VII, and the presence of the small convex pores which are dotted over the dorsum of the abdomen and venter of the thorax.

Poropeza dacrydii (Maskell)

Fig. 53, 115

Material examined: see Appendix for collection details of specimens examined.

Described from 3 specimens in fair to good condition.

Mounted material: quite large: length 1.78 mm; head width 387 μm .

Head: antennae: total length 673 μm (ratio of antennal length to total body length 1:2.6). Without minute conical pores.

Thorax: with 16–20 spiracular disc-pores associated with each anterior spiracle, distributed anterolaterally to peritreme and extending medially past end of muscle plate; no disc-pores associated with posterior spiracle. Single minute conical pores present on venter just anterior to each meso- and metacoxa, and another medially on metathorax. Spiracles: width of peritremes 28–30 μm . Length of metathoracic legs 685 μm . Wing-buds: length 514 μm , width 209 μm (ratio length to width 1:0.41).

Abdomen: minute conical pores dotted over dorsum in no apparent arrangement, mainly associated with pleural setae, but also occasionally medially. With 1 pair of short ante-anal setae; with 1 or 2 pairs of small ventral abdominal setae on all segments; dorsopleural setae: with 1 pair on each side of segments IV–VI; ventropleural setae as normal. Lateral lobes of segment VII short, about 1/4–1/6 length of penial sheath, each rather triangular, with 2 longer setae (15–19 μm) on apex and a slightly shorter seta laterally. Lobes of segment VIII very small, with 1 or 2 minute setae. Penial sheath about 4–6 \times longer than lobes of segment VII and about 1.7 \times longer than wide (259 μm long and 149 μm wide at base; ratio length to width 1:0.58); with 2 pairs of small pores on dorsum.

POUNAMOCOCCUS Henderson & Hodgson

Introduction. The genus *Pounamococcus* contains 2 species; pupae of both species were available.

Generic diagnosis based on the pupae of two species, *P. cuneatus* and *P. tubulus* (significant character-states in italics) (Fig. 116, 117).

General: moderate in size, 1.4–1.8 mm long.

Head: *yoke-like structure present on head of P. cuneatus.*

Thorax: spiracular disc-pores few, restricted to a group more or less anterolateral to peritreme, none extending mesad past inner margin of muscle plate; without spiracular disc-pores associated with posterior spiracles.

Abdomen: *pairs of dorsal abdominal setae present on all segments; with 2 pairs of ventral abdominal setae on segments III–VI, 2 or 3 pairs on segment VII and 1 pair on segments II and VIII; ante-anal setae present; with 3 pairs of dorsopleural setae on segments III–VII, rather variable in length; dorsopleural setae arranged segmentally; lobes*

on abdominal segment VII well developed, about 1/2–1/4 as long as penial sheath; each abdominal lobe on segment VII sclerotised, with 2 or 3 shortish setae, each less than 20 μm long; lobes on segment VIII very pronounced, sclerotised and as large as lobes on segment VII, each with 4 or 5 setae; penial sheath a little longer than broad.

Comment. The pupae of *Pounamococcus* species are easily separated from all other known pupae of indigenous Coccidae in New Zealand by the above italicised character-states.

Pounamococcus cuneatus Henderson & Hodgson

Fig. 116

Material examined: see Appendix for collection details of specimens examined.

Described from 3 good specimens plus 2 with pharate adult males.

Mounted material: of moderate size: length 1.4–1.53 mm; head width 292–304 μm .

Head: antennae exceptionally long: length 800–896 μm (ratio of antennal length to total body length 1:1.73). With a sclerotised, transverse, yoke-like structure present posteroventrally, 43–50 μm wide (see comments below).

Thorax: with 4–6 spiracular disc-pores associated with each anterior spiracle, several with many (10+) loculi, distributed anterolaterally to peritreme and muscle plate; with no disc-pores associated with posterior spiracles. With a pair of small setae medially on dorsum of all 3 segments, in line with dorsal abdominal setae on abdomen. Spiracles: width of peritremes 25–27 μm . Length of metathoracic legs: 641–692 μm , almost or actually reaching posterior end of abdomen. Wing-buds: narrow, length 527–584 μm , width 158–210 μm (ratio length to width 1:0.34).

Abdomen: with some sclerotisation on sternites V–VII; dorsally with a pair of small setae arranged segmentally in two longitudinal lines, extending from prothorax through to segment VII, where there are 2 pairs (2 pairs also occasional on other abdominal segments); ante-anal setae present between lobes of segment VIII; with 2 pairs of ventral abdominal setae on segments II–VII, occasionally 3 pairs on segment VIII; with 2–4 dorsopleural setae on each side on segments III–VI; ventropleural setae as normal. Segment VII with a pair of well-developed lobes, each about 1/3 length of penial sheath, slightly sclerotised, with 1 or 2 longish setae apically (each 21–24 μm long), 1 short seta subapically and a further short seta laterally. Segment VIII also with a pair of well-developed, prominent, rounded lateral lobes, subequal in size to lobes of segment VII, slightly sclerotised, each with 4 or 5 setae (longest seta apically 23–28 μm long), 2 pairs medially, 1 dorsally and 1

laterally/ventrally. Penial sheath rounded, about 3× longer than lobes of segment VIII, about as long as wide (101–118 µm long and about 106–122 µm wide at base; ratio length to width 1:1.03), with 2 pairs of setae on dorsal surface.

Comment. The pupa of *P. cuneatus* is very similar to that of *P. tubulus*. It can be distinguished by the presence of the yoke-like structure ventrally on the head (absent on *P. tubulus*). In addition, the antennae of *P. cuneatus* are proportionately much longer.

The homology of the yoke-like structure posteroventrally on the head (on both young pupae and young prepupae) is unknown but it appears to be very similar in position and, to a lesser extent, in shape to the tentorial bridge found on the adult male. It was present on all specimens but appeared to be absent from the pupae of *P. tubulus* and is absent on the prepupae and pupae of all other soft scales discussed here. The fact that it is present on young prepupae suggests that it is either a structure rather special to *P. cuneatus* or that the tentorial bridge (if that is what it is) is one of the first parts of the male to be formed in this species (which seems rather unlikely). This structure was also noted on the pupa of *Rhodococcus luberonensis* Foldi & Kozár (Foldi *et al.* 2001).

***Pounamococcus tubulus* Henderson & Hodgson**

Fig. 117

Material examined: see Appendix for collection details of specimens examined.

Described from 1 specimen in fairly poor condition with pharate adult male.

Mounted material: large: length 1.75 mm; head width 375 µm.

Head: antennae: length 951–966 µm (ratio of antennal length to total body length 1:1.82). Sclerotised, transverse, yoke-like structure absent.

Thorax: with 6–9 spiracular disc-pores associated with each anterior spiracle, placed anterolaterally to peritreme. With a pair of small setae medially on meso- and metathorax, in line with dorsal abdominal setae on abdomen. Spiracles large: width of peritreme 37–42 µm. Length of metathoracic legs 710–781 µm. Wing-buds: very narrow, length 681–781 µm; width 206 µm (ratio length to width 1:0.28).

Abdomen: no apparent sclerotisation on sternites; with 1 pair of small dorsal abdominal setae on segments II–VII; ante-anal setae absent (although 1 small pale “pore” was present in this position); with 2 pairs of small ventral abdominal setae on segments II–VII and one pair on segment VIII; with 2–4 dorsopleural setae on each side on segments II–VI; ventropleural setae as normal. Segment VII with a pair of well-developed small, rounded lobes,

each without an apical seta but with a long seta and a shorter seta laterally. Lobes of segment VIII almost as large as those of segment VII, rather pointed and slightly sclerotised, each with 3 long (longest 23 µm) and 1 short seta. Penial sheath about 4× longer than lobes of segment VII and almost as wide as long (131–135 µm long and about 122–125 µm wide at base; ratio length to width 1:0.93); with 2 pairs of short setae on dorsal surface.

Comment. For a comparison with *P. cuneatus*, see under that species above.

***UMBONICHITON* Henderson & Hodgson**

Introduction. The genus *Umbonichiton* contains 5 species. Pupae were available for *U. bullatus*, *U. jubatus*, and *U. pellaspis*.

Generic diagnosis based on the pupae of 3 species, *U. bullatus*, *U. jubatus*, and *U. pellaspis* (significant character-states in italics) (Fig. 118–120).

General: small to moderate in size, 1.1–1.5 mm long.

Head: yoke-like structure on head absent.

Thorax: spiracular disc-pores few (<15), in a group anterolateral to peritreme of anterior spiracles, extending medially to inner margin of muscle plate; without spiracular disc-pores associated with posterior spiracles.

Abdomen: pairs of dorsal abdominal setae restricted to segments V, VI, and VII; with 1 pair of ventral abdominal setae on segments (II)III–VII; ante-anal setae present; with 1–3 pairs of dorsopleural setae on segments (III)IV–VI, one of each pair sometimes distinctly longer than others; dorsopleural setae arranged segmentally; lobes on abdominal segment VII moderately developed, bluntly pointed and about 2/3 as long as penial sheath; each abdominal lobe on segment VII with 2 shortish setae near apex, each less than 20 µm; lobes on segment VIII small or pronounced (*U. pellaspis*), sclerotised (*U. pellaspis*) or unsclerotised, each with a 2–5 setae; penial sheath a little longer than broad or up to 1.5× longer.

Comment. The pupae of *Umbonichiton* are very similar to those of *Aphenochiton*, *Crystallotesta* (*fagi*-group), *Ctenochiton*, and *Kalasisiris*. At the present time there is too little material to be confident about possible characters which might separate these genera, although the number and arrangement of the spiracular disc-pores, the size of the lobes on abdominal segment VIII and the number of pores/setae on the lobes of both segments VII and VIII are considered likely to be important.

***Umbonichiton bullatus* Henderson & Hodgson**

Fig. 58, 118

Material examined: see Appendix for collection details of specimens examined.

Described from 2 good specimens plus 1 poor specimen, 1 quite good with pharate adult male, 1 parasitised, and a good caste skin.

Mounted material: of moderate size: length 1.1–1.33 mm; head width 254–340 μm .

Head: antennae rather long: total length 490–650 μm (ratio of antennal length to total body length 1:2.12).

Thorax: with 1–11 spiracular disc-pores associated with each anterior spiracle, distributed around anterior margin of peritreme but also with one mesad to inner margin of muscle plate when most abundant; no disc-pores associated with posterior spiracle. Spiracles small: width of peritremes 18–22 μm . Length of metathoracic legs 370–520 μm . Wing-buds: rather narrow, length 430–485 μm , width 150–195 μm (ratio length to width 1:0.38).

Abdomen: with 2 quite long ante-anal setae; with small dorsal abdominal setae on segments IV–VII; with a single pair of small ventral abdominal setae on segments II–VII; dorsopleural setae: 2 or 3 setae on each side of segments III–VI, longest 2 \times length of shorter seta. Lateral lobes of segment VII bluntly pointed, rather broad at base, about 2/3 length of penial sheath; each with 1 or 2 longer setae (14–20 μm) + 1 short dorsopleural seta. Lobes of segment VIII membranous, well developed, each with 3 or 4 setae of moderate length. Penial sheath about 1/3 longer than lobes of segment VII and longer than broad (105–112 μm long and 85–100 μm wide at base; ratio length to width 1:0.85).

Comment. The pupa of *U. bullatus* appears to be very similar to that of *U. jubatus*. Two of the 3 good specimens had small dorsal abdominal setae on segment IV, which is very unusual. Whether this is a significant species character is unknown.

***Umbonichiton jubatus* Henderson & Hodgson**

Fig. 119

Material examined: see Appendix for collection details of specimens examined.

Described from 1 poor specimen with pharate adult male.

Mounted material: of moderate size: length 1.24 mm; head width 348 μm .

Head: antennae: total length 572 μm (ratio of antennal length to total body length 1:2.17).

Thorax: with 11–13 spiracular disc-pores associated with each anterior spiracle, distributed anterolaterally to

peritreme, with a few extending medially along full length of muscle plate; no disc-pores associated with posterior spiracle. Spiracles: width of peritremes 20 μm . Length of metathoracic legs 454 μm . Wing-buds: length 596 μm , width 220–249 μm (ratio length to width 1:0.39).

Abdomen: with 1 pair of ante-anal setae; with single pairs of small ventral abdominal setae on segments II–VII; dorsopleural setae: with 1 pair on each side of segments IV–VI; ventropleural setae as normal. Lateral lobes of segment VII about 1/2–2/3 length of penial sheath, each rather triangular, with 2 shortish setae apically, longest about 15 μm . Lobes of segment VIII very small or absent but with 2 or 3 minute setae or pores in this position. Penial sheath about 1.5–2 \times longer than lobes of segment VII and about as long as wide (100 μm long and 92 μm wide at base; ratio length to width 1:0.92).

Comment. Possibly indistinguishable from the pupa of *U. bullatus*.

***Umbonichiton pellaspi* Henderson & Hodgson**

Fig. 60, 120

Material examined: see Appendix for collection details of specimens examined.

Described from 1 fair specimen, but with a well-developed pharate adult male.

Mounted material: of moderate size: length 1.45 mm; head width 318 μm .

Head: antennae: total length 635 μm (ratio of antennal length to total body length 1:2.3).

Thorax: with 5–8 spiracular disc-pores associated with each anterior spiracle, distributed anterolaterally to peritreme, with a few extending medially along about half length of muscle plate; no disc-pores associated with posterior spiracle. Spiracles: width of peritremes 21–23 μm . Length of metathoracic legs 533 μm . Wing-buds: length 495 μm , width 190 μm (ratio length to width 1:0.38).

Abdomen: with 1 pair of ante-anal setae; with single pairs of small ventral abdominal setae on segments II–VII; dorsopleural setae: with 1 pair on each side of segments IV–VI, one about 1.5 \times length of other; ventropleural setae as normal. Lateral lobes of segment VII about 1/2 length of penial sheath, each lobe rather narrow, with 2 shortish setae apically, each about 16–18 μm long. Lobes of segment VIII pronounced, slightly sclerotised, each with 5 setose setae. Penial sheath about 1.5–2 \times longer than lobes of segment VII and about as long as wide (100 μm long and 98 μm wide at base; ratio length to width 1:0.97).

Comment. The pupa of *U. pellaspi* is easily separable from those of *U. bullatus* and *U. jubatus* by the large, slightly sclerotised lobes on abdominal segment VIII, each with 5 setae.

PART 3

PREPUPAE

Introduction. The prepupae have been studied only rarely — indeed, according to Williams (1997), the prepupal stage has only been described for 6 soft scale species: *Ceroplastes pseudoceriferus* Green (Sankaran 1962); *Eulecanium tiliae* (L.) (Kawecki 1958); *Neolecanium cornuparvum* (Thro) (Ray & Williams 1983); *Parafairmairia gracilis* Green (Koteja & Rosciszewska 1970); and *Pseudophilippia quaintancii* Cockerell (Ray & Williams 1984). The inclusion of *Lichtensia viburnae* Signoret by Williams (1997) appears to have been an error.

Because so few prepupae have been described, the value of the taxonomic characters for identifying species and genera is still unclear. However, it is hoped that the present study, describing a further 20 species, all indigenous to New Zealand, will suggest characters which appear to be typical both for individual species and for genera.

Important taxonomic characters

Hodgson & Henderson (2000), when revising the soft scales of New Zealand, augmented the original 3 genera introduced by Maskell in the previous century with a further 8 genera, based entirely on adult female characters. Whilst only a relatively few prepupae have been available for this study, their character-states by and large appear to support these taxonomic groupings. From this material, the features which appear to be of importance as taxonomic characters are:

- (i) overall size (small on *Lecanochiton* and moderate to large in the other genera);
- (ii) shape of head (narrow on *Aphenochiton* and *Umbonichiton* and broad on the *ornata*-group of *Crystallotesta* and on *Plumichiton*);
- (iii) number and distribution of the spiracular disc-pores associated with the anterior spiracles — usually in a broad crescent anterior and laterad to the peritreme, but may form a line laterad to peritreme (as on *K. depressa*) or may extend mesad past the muscle plate (as on *Plumichiton* species);
- (iv) presence or absence of disc-pores associated with the posterior spiracle — this character appears to be most useful at the generic level;
- (v) shape and size of the lobes on abdominal segment VII — these are short and rounded on the *ornata*-group and on *I. patella*, but are particularly long and pointed on *Aphenochiton* species, *K. depressa*, and on some *Umbonichiton* species;
- (vi) size and distribution of the dorsopleural setae — fleshy and in a line on the *ornata*-group and on *I. patella*, but

- generally segmentally arranged, with 2 setae on each side per segment on the remaining species; also, the size and arrangement of setae on the apex of the lobes of abdominal segment VII appears to be useful;
- (vii) presence or absence of lobes and setae on abdominal segment VIII;
 - (viii) presence or absence of ante-anal setae on segment VIII;
 - (ix) size and shape of the penial sheath, particularly in relation to the length of the lobes on segment VII.

The taxonomic value of these characters needs to be tested (a) with more material (to show their variance) and (b) by comparison with both other species in the same genus and other, less closely related, species.

BASIC DESCRIPTION OF A COCCID PREPUPA

Fig. 121

Unmounted prepupa nearly cylindrical in shape, some species rather pointed at both ends, others rather blunt (note that all descriptions below were made from flattened mounted specimens). Division into head, thorax, and abdomen (Fig. 121) usually reasonably clear although segmentation often obscure except on abdomen. Derm membranous, with small dermal spinules, more or less rounded on dorsum but more spine-like on venter. Spiracular disc-pores usually present (absent on *I. patella* and *P. cuneatus*, Fig. 131, 139); all other ducts and pores absent; setae few and minute unless otherwise stated.

Head: lacking mouthparts and simple eyes. With a pair of shortish antennae directed posteriorly, usually just reaching anterior spiracles; 10-segmented, segmentation often obscure; usually with 1–3 short fleshy fingers on apex, these probably incipient capitate setae; basal segments usually slightly sclerotised; antennal length to total body length ratio generally between 1:3.8–1:4.4, but with a few rather shorter, up to 1:4.6. Setae: usually with 1–3 pairs of minute setae medially on dorsal surface, 1–3 medially and anteriorly on ventral surface, and with a group of 1–5 medially just posterior to each scape. Sclerotised yokelike structure present ventrally on *P. cuneatus*.

Thorax: with 3 pairs of short legs, their segmentation usually more or less visible, coxa and trochanter generally somewhat sclerotised; anterior pair almost straight, directed anteriorly and barely reaching scape; other two pairs directed posteriorly; each with a small triangular “finger” on apex, probably an incipient claw (Fig. 121). With a short wing-bud on each side, rarely extending posteriorly past metacoxae; ratio of width to length usually 1:0.34–1:0.43, but those of *C. ornata* and *Umbonichiton* species 1:31 or less, and those of *C. ornatella* broader (1:0.45). With 2

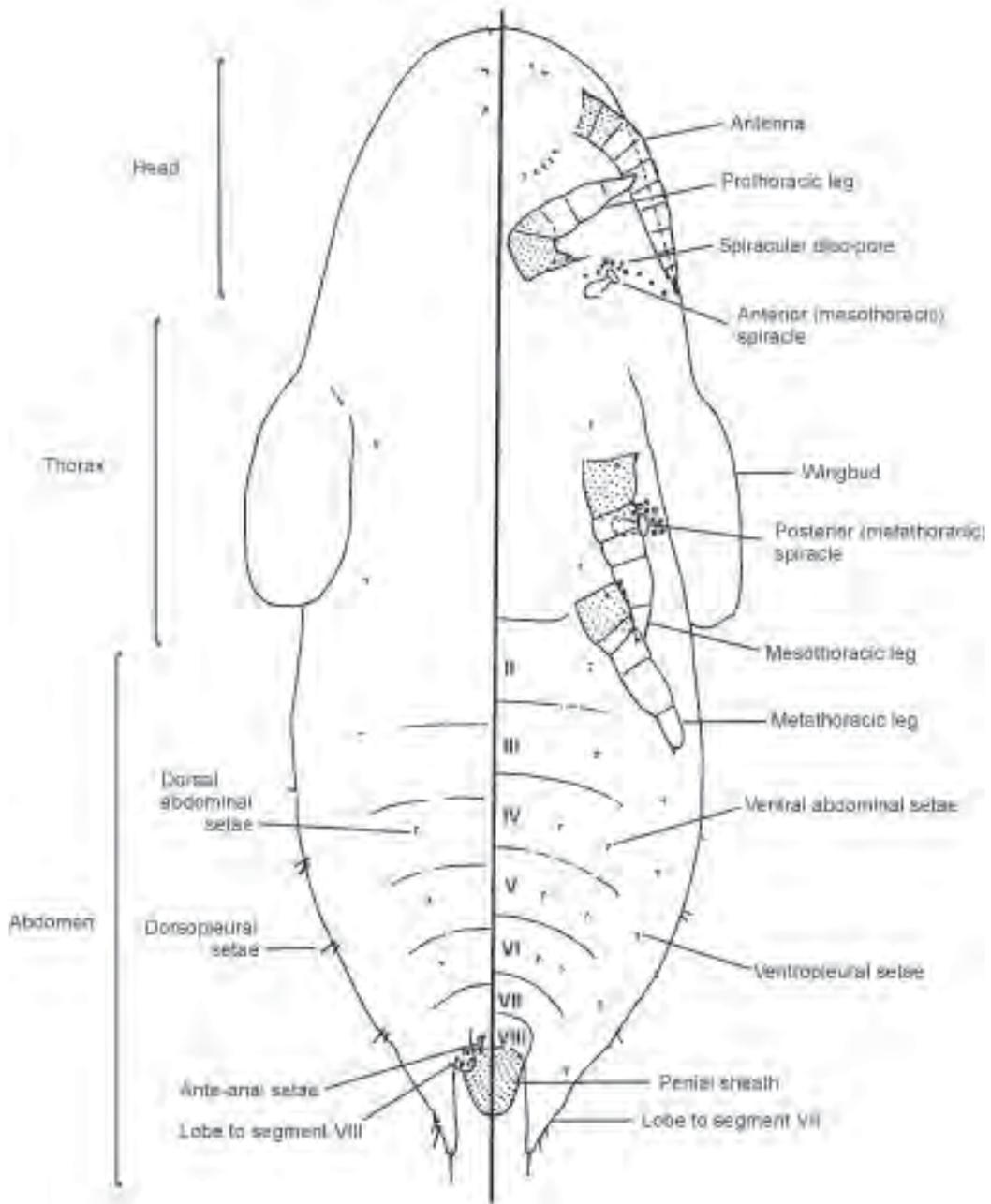


Fig. 121 Structure of a generalised prepupa.

pairs of spiracles, anterior pair (mesothoracic) just posterior to procoxae and posterior pair (metathoracic) just posterior to mesocoxae; anterior pair almost invariably with spiracular disc-pores, number and distribution of disc-pores probably of taxonomic significance, varying from none on *I. patella* and *P. cuneatus* to 17 on *A. pubens* (Fig.

131, 139, 124); number of loculi in each disc-pore highly variable, from 1–15+ (Fig. 121); disc-pores usually absent from posterior spiracles but, if present, few and probably of taxonomic significance (9 disc-pores on *K. depressa* (Fig. 132)). Setae: ventrally, usually with a single seta mesad and just posterior to each procoxa, and mesad and

anterior to each meso- and metacoxa, but with 4 or 5 on *P. dacrydii* (Fig. 138); dorsally with three pairs, one pair medially on prothorax, and others dorsad to each meso- and metacoxa.

Abdomen: segmentation usually visible, anteriormost segment ventrally considered to represent segment II, so that there are 7 visible segments (segments II to VIII) on venter anterior to penial sheath. Setae: with pairs of minute dorsal abdominal setae medially on segments V to VII (more on *P. cuneatus*, Fig. 139); with pairs of minute ventral abdominal setae on segments II–VII, although occasionally there may be 2 pairs on some segments (always 2 pairs on *P. cuneatus* and *P. dacrydii*); usually with a pair of dorsopleural setae on each side of segments III–VI, but more frequent and arranged along margin rather than segmentally on *C. ornata*, *C. ornatella* and *I. patella* (Fig. 126, 127, 131); and with single minute ventropleural seta on each side of segments II–VI. Segment VII with a pair of lobes, which may be short and rounded, as on *C. ornata*, *C. ornatella*, and *I. patella* (Fig. 126, 127, 131), or long (up to 2× length of penial sheath) and pointed, as on *Aphenochiton* species, *K. depressa* (Fig. 132), and some *Umbonichiton* species; each lobe with 1–3 dorsopleural setae, which may be short or long, fleshy or flagellate, but usually with at least 1 long seta on each apex (number and distribution of these setae may be of taxonomic significance); also each lobe usually with 1 minute ventropleural seta. Segment VIII generally with small pair of lobes dorsally on either side of base of penial sheath: when present, usually membranous and found at base of penial sheath (best developed on *K. depressa*, *P. flavus* and *P. cuneatus* (Fig. 132, 136, 139), on which they are slightly sclerotised, or reduced or absent, as on *U. adelus* (Fig. 140); when present, usually with 1 or more setae, which are small to minute (5 rather long setae on *P. flavus* and *P. cuneatus*, Fig. 136, 139). Segment VIII with a pair of setae medially (considered here to be homologous with ante-anal setae of adult males) present or absent (presence or absence of these setae may be of taxonomic significance). Triangular, sclerotised penial sheath present medially on posterior end of abdomen; usually shorter than lobes of segment VII (longer on *C. ornata*, *C. ornatella* and *I. patella*, Fig. 126, 127, 131) and usually about as long as broad but highly variable between species (ratio length to width varying from 1:0.79–1:1.5 (the latter *P. flavus*, Fig. 136, which has a particularly narrow penial sheath); usually with line of minute pores around margin near apex, genital opening medially on ventral surface (not always visible) and with 1 or 2 pairs of minute setae (although these usually appear as white spots) on dorsal surface. Anus located just anterior to penial sheath dorsally but often not visible (and probably non-functional), possibly representing segment IX.

Comment. The taxonomic significance of these characters is unclear as few coccid prepupae have been studied. The figures and descriptions have been made from mounted specimens and so the near cylindrical shape has been flattened and the membranous derm may have shrunk, especially on the abdomen (this would be particularly significant with regard to the lengths of the lobes on abdominal segment VII). In addition, the absence of some minute setae on the dorsum and venter in the figures simply means that they could not be found and does not mean that they are necessarily absent. The presence or absence of disc-pores near the posterior spiracles may also be a bit variable — some specimens had 1 or 2 on one side and none on the other side; on the other hand, where several specimens have been studied and none found, their absence is then thought to be normal for that species.

Note that care is needed when there is a pharate pupa present, as the characters of the pupa show through and might be thought to be prepupal. This is particularly important when counting spiracular disc-pores as it is easy to count the prepupal and pupal pores together.

PRELIMINARY KEY TO PREPUPAE OF NEW ZEALAND COCCIDAE

Note: this is a preliminary key because rather few specimens of most of the species have been studied and therefore the taxonomic value of the character-states discussed in the key and in the descriptions below is uncertain.

- 1 Dorsal abdominal setae present on all abdominal segments; head with sclerotised yokelike structure posteroventrally (p. 214)...
.. *Pounamococcus cuneatus* Henderson & Hodgson
- Dorsal abdominal setae restricted to segments IV, V, and VI; head without sclerotised yokelike structure posteroventrally 2
- 2(1) Anterior spiracles without spiracular disc-pores (p. 210)... *Inglisia patella* Maskell
- Anterior spiracles with a few spiracular disc-pores . 3
- 3(2) Posterior spiracles with more than 5 spiracular disc-pores; spiracular disc-pores associated with anterior spiracles forming a line laterad to peritreme (p. 210)... *Kalasisis depressa* (Maskell)
- Posterior spiracles with only 1 or 2 spiracular disc-pores at most; spiracular disc-pores associated with anterior spiracles not forming a line laterad to peritreme 4
- 4(3) Dorsopleural setae not apparently segmentally arranged but forming a line along posterior margin of abdomen; ante-anal setae absent; lobes on abdominal segment VII squat and rounded (p. 207)... *Crystallotesta* spp. — *ornata*-group

- Dorsopleural setae few and arranged segmentally, never forming a line along posterior margin of abdomen; other characters not in this combination 5
- 5(4) Ante-anal setae present; spiracular disc-pores always present associated with posterior spiracles 6
- Ante-anal setae absent; spiracular disc-pores associated with posterior spiracles present or absent 7
- 6(5) Penial sheath very large, about 2× longer than lobes of abdominal segment VII (p. 213)...
..... *Poropeza dacrydii* (Maskell)
- Penial sheath subequal to or shorter than lobes on abdominal segment VII ... (p. 208)... *Ctenochiton* spp.
- 7(5) Body size small (about 1 mm or less long); lobes on abdominal segment VIII small or absent and without setae or pores; on *Metrosideros* species
..... (p. 211)... *Lecanochiton* spp.
- Body of moderate size (about 1.2 mm or more long); lobes of abdominal segment VIII usually distinct, with setae and/or pores; usually found on hosts other than *Metrosideros* species 8
- 8(7) Body very broad, only about 1.5× longer than broad (p. 209)... *Epelidochiton piperis*
- Body more elongate, about 2 or more times longer than broad 9
- 9(8) Anterior spiracles each with disc-pore mesad to muscle plates; abdominal segments V, VI and VII each with long dorsopleural seta
..... (p. 212)... *Plumichiton* spp.
- Anterior spiracles without spiracular disc-pores mesad to muscle plates; dorsopleural setae on segments V, VI, and VII not always with a long seta .. *Aphenochiton* and *Umbochiton* species plus *Kalasisis perforata**

*No character could be found to separate these species but *Aphenochiton* species and *K. perforata* tend to have more spiracular disc-pores and the penial sheath tends to be broader.

The prepupae of 11 genera and 20 species of indigenous New Zealand Coccidae are described below. Although the genus *Poropeza* Henderson & Hodgson was thought to be parthenogenetic (Hodgson & Henderson 2000), males have been discovered subsequently and the prepupa is described below.

The size range for the antennae, wing-buds, legs, and penial sheath of many species below varies greatly when both young and old prepupae (i.e., specimens containing a pharate pupa) were available (e.g., *A. inconspicuus*). Clearly considerable growth occurs during this stage and thus their relative size may not be a useful character.

DESCRIPTIONS OF INDIGENOUS SPECIES, PREPUPAE *APHENOCHITON* Henderson & Hodgson

Introduction. There are currently 9 species in the genus *Aphenochiton*, but prepupae were available for only *A. inconspicuus*, *A. kamahi*, *A. pubens*, and *A. subtilis*.

Generic diagnosis (*inconspicuus*-group + *kamahi*-group combined) based on 4 species, *A. inconspicuus*, *A. kamahi*, *A. pubens*, and *A. subtilis* (significant character-states in italics) (Fig. 122–125).

General: elongate oval.

Head: head narrow on *A. inconspicuus* and *A. kamahi*, broad on *A. pubens* and *A. subtilis*; yoke-like structure on venter absent.

Thorax: each anterior spiracle with 4–17 spiracular disc-pores; anterior spiracular disc-pores distributed laterad and anterior to spiracles, none extending mesad to muscle plate; posterior spiracular disc-pores present or absent.

Abdomen: dorsal abdominal setae present on segments V, VI and VII only; with 1 or 2 pairs of dorsopleural setae on segments IV–VII, 1 longer than other; dorsopleural setae arranged segmentally; *lateral lobes on segment VII about 2× length of penial sheath*; each lobe of segment VII with 2 or 3 pleural setae; lobes on segment VIII small and fleshy; lobes on segment VIII unsclerotised; lobes on segment VIII with or without setae; penial sheath about as long as wide; ante-anal setae present or absent.

Comment. The prepupae of *Aphenochiton* species are all very similar and no significant differences were apparent between the *inconspicuus*-group and the *kamahi*-group. The prepupae of *Aphenochiton* appear to be very similar to those of *Ctenochiton*, *Epelidochiton*, *Kalasisis*, *Plumichiton*, and (particularly) *Umbochiton*, mainly differing in the length of the lobes on abdominal segment VII (also long on some *Umbochiton* species).

Aphenochiton inconspicuus (Maskell)

Fig. 122

Material examined: see Appendix for collection details of specimens examined.

Described from 2 good specimens plus 1 fair, 2 poor, and 1 with a pharate pupa.

Mounted material: length 1.5–1.6 mm. Elongate oval, head only about 1/3 width of abdomen.

Head: antennae: total length 295–340 μm (ratio of antennal length to total body length 1:4.9).

Thorax: with 3–5 spiracular disc-pores associated with each anterior spiracle, distributed laterad and anterior to peritreme; with no disc-pores associated with posterior spiracles. Spiracles: width of peritremes 22–24 μm. Length

(text continues on page 206)

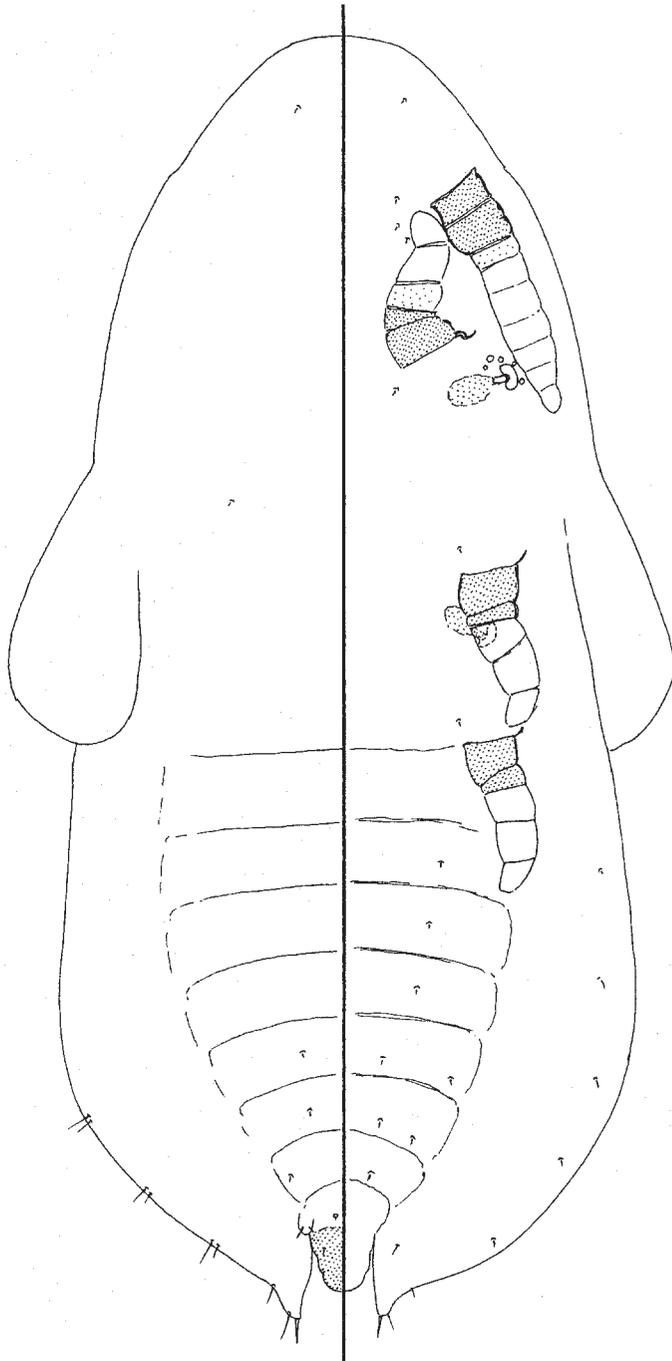


Fig. 122 Prepupa, *Aphenochiton inconspicuus* (Maskell).

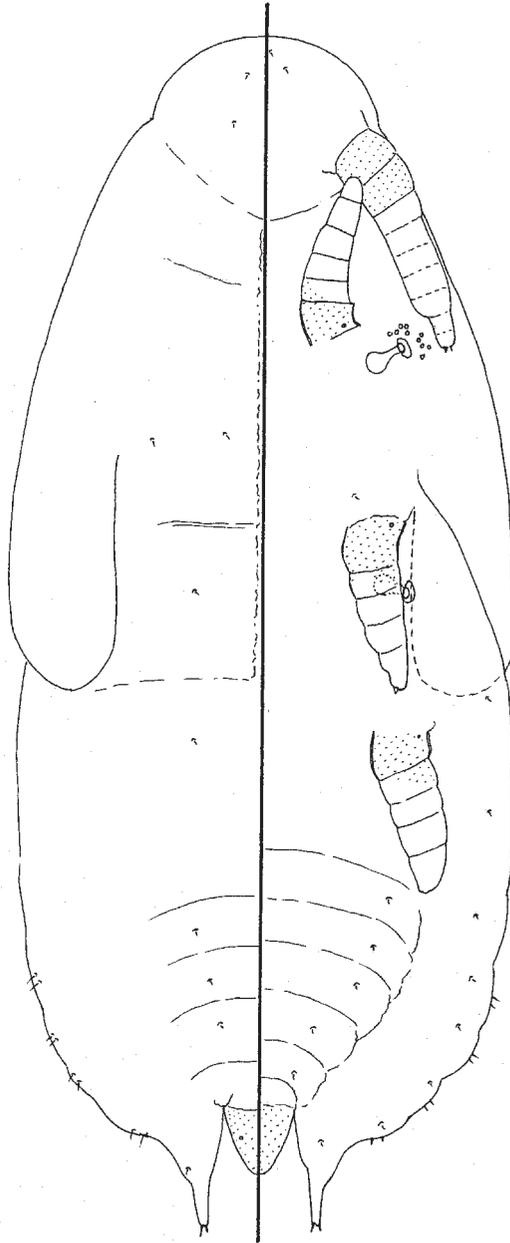


Fig. 123 Prepupa, *Aphenochiton kamahi* Henderson & Hodgson.

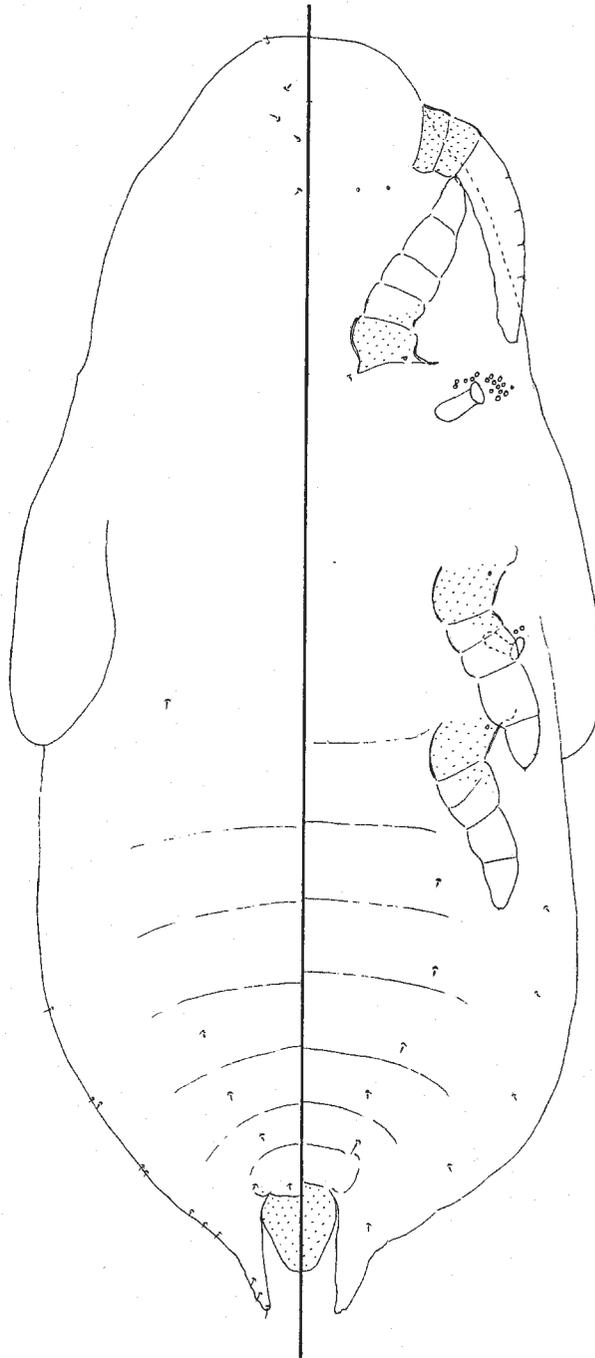


Fig. 124 Prepupa, *Aphenochiton pubens* Henderson & Hodgson.

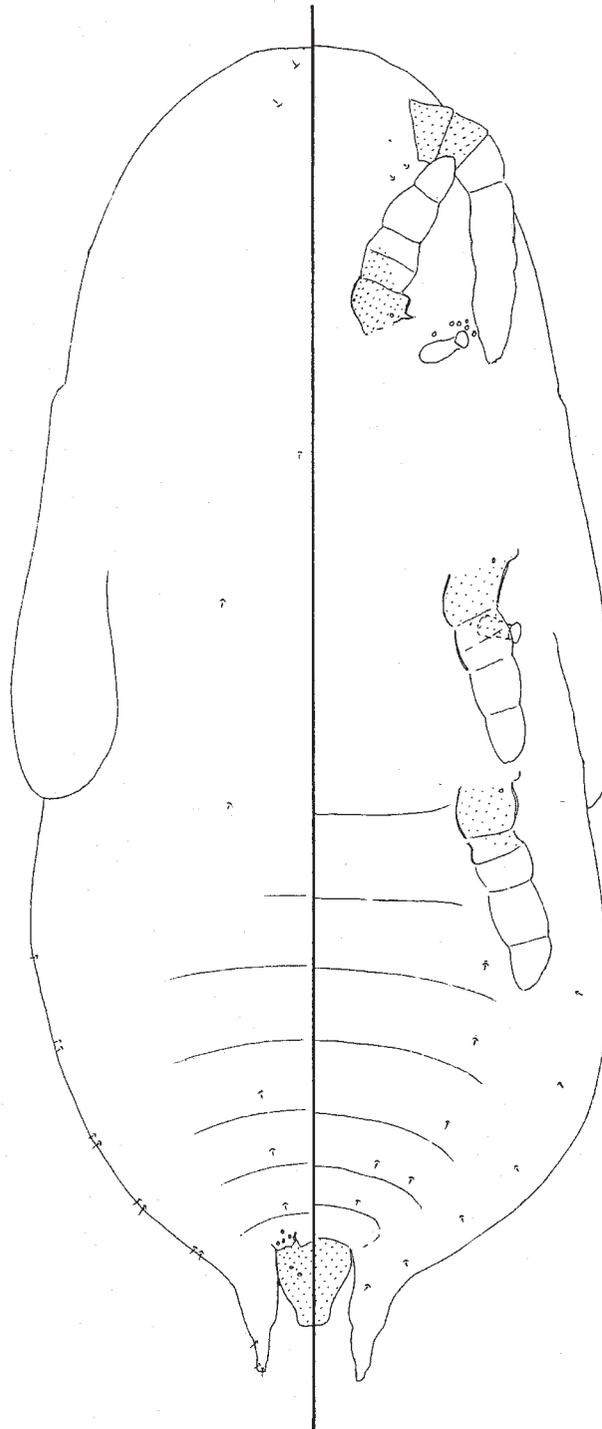


Fig. 125 Prepupa, *Aphenochiton subtilis* Henderson & Hodgson.

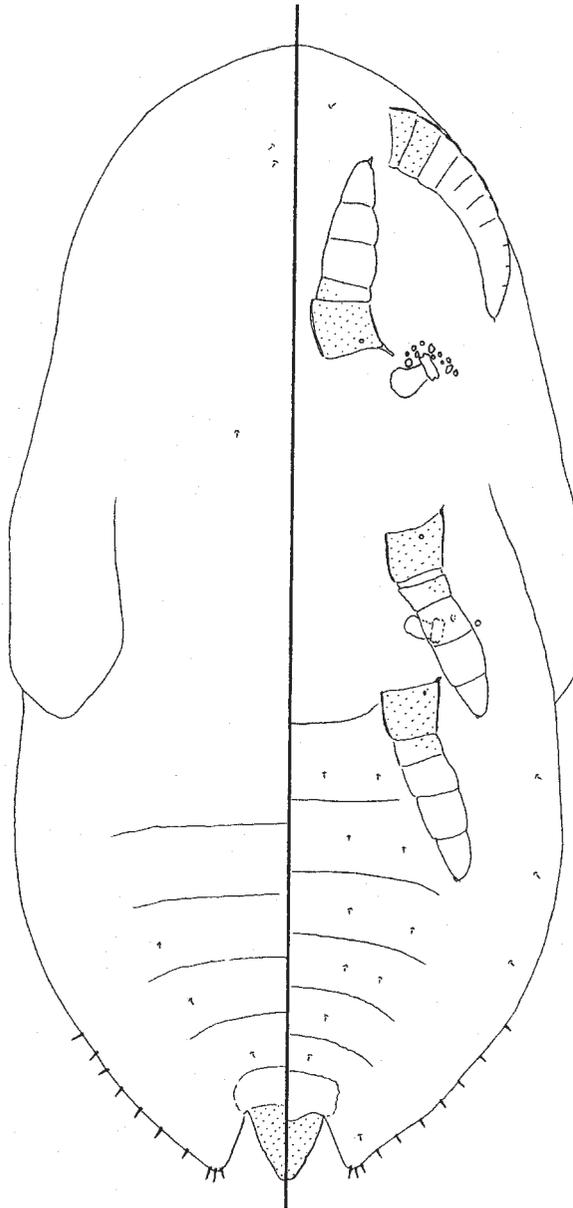


Fig. 126 Prepupa, *Crystallotesta ornata* (Maskell).

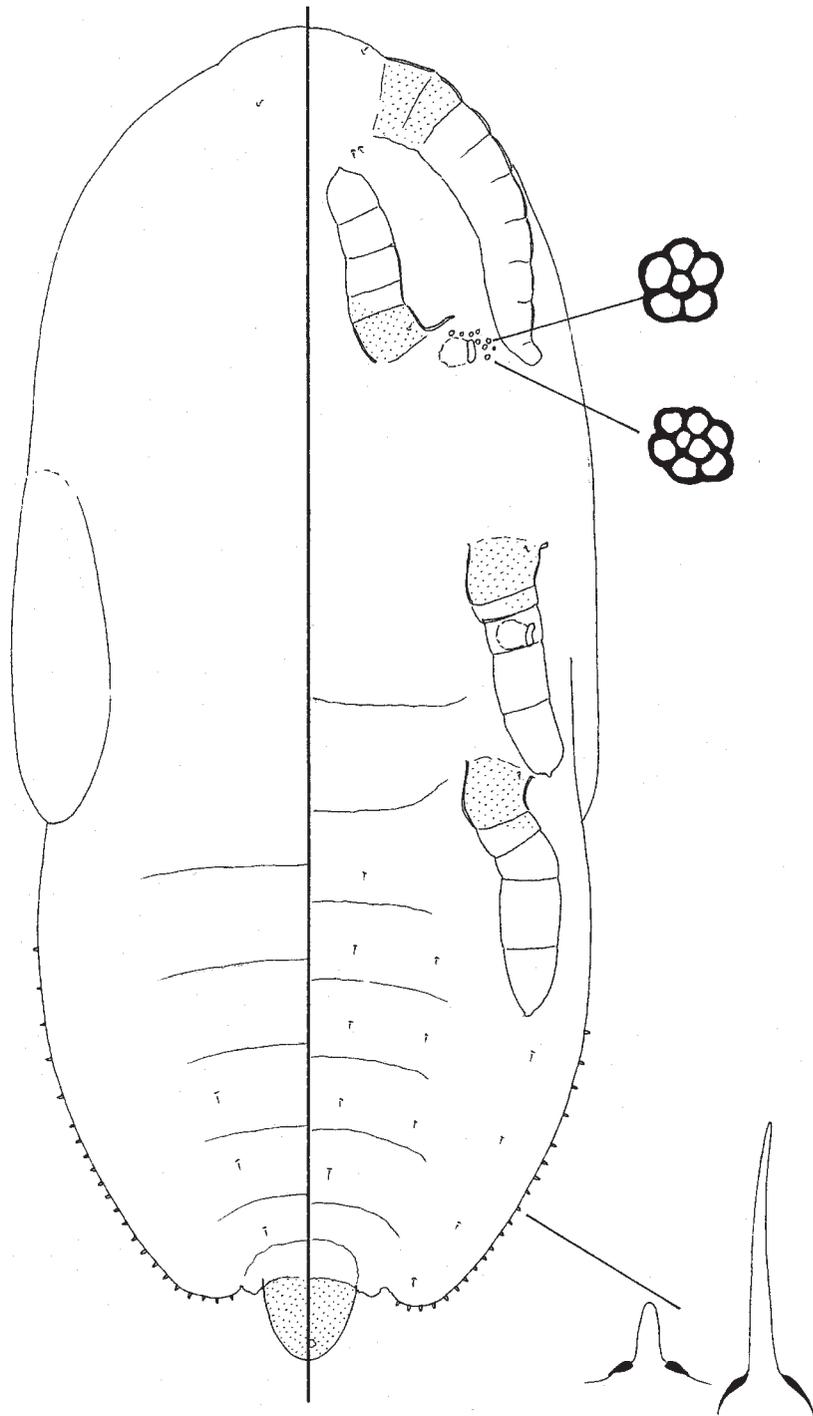


Fig. 127 Prepupa, *Crystallotesta ornatella* Henderson & Hodgson.

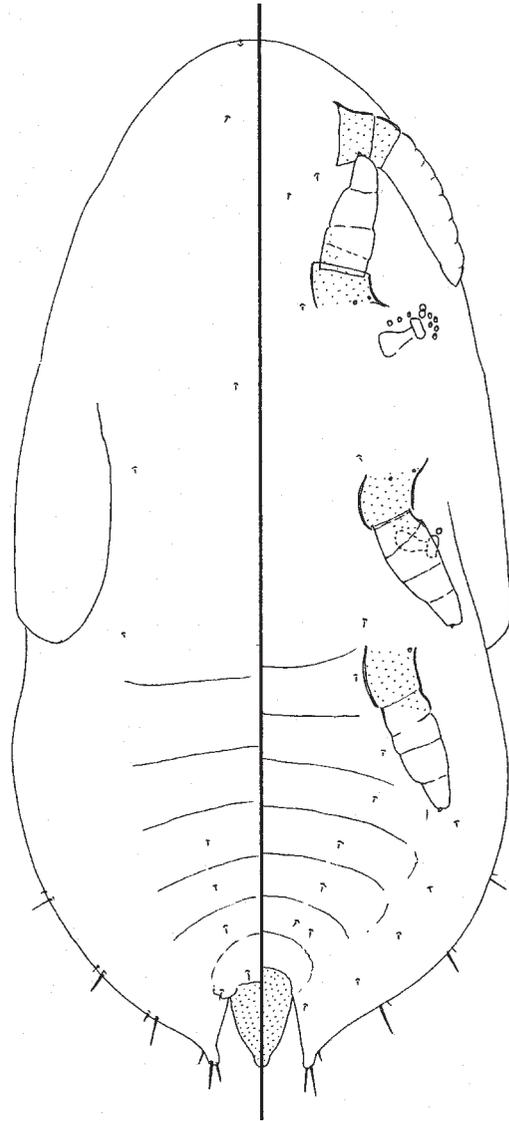


Fig. 128 Prepupa, *Ctenochiton chelyon* Henderson & Hodgson.

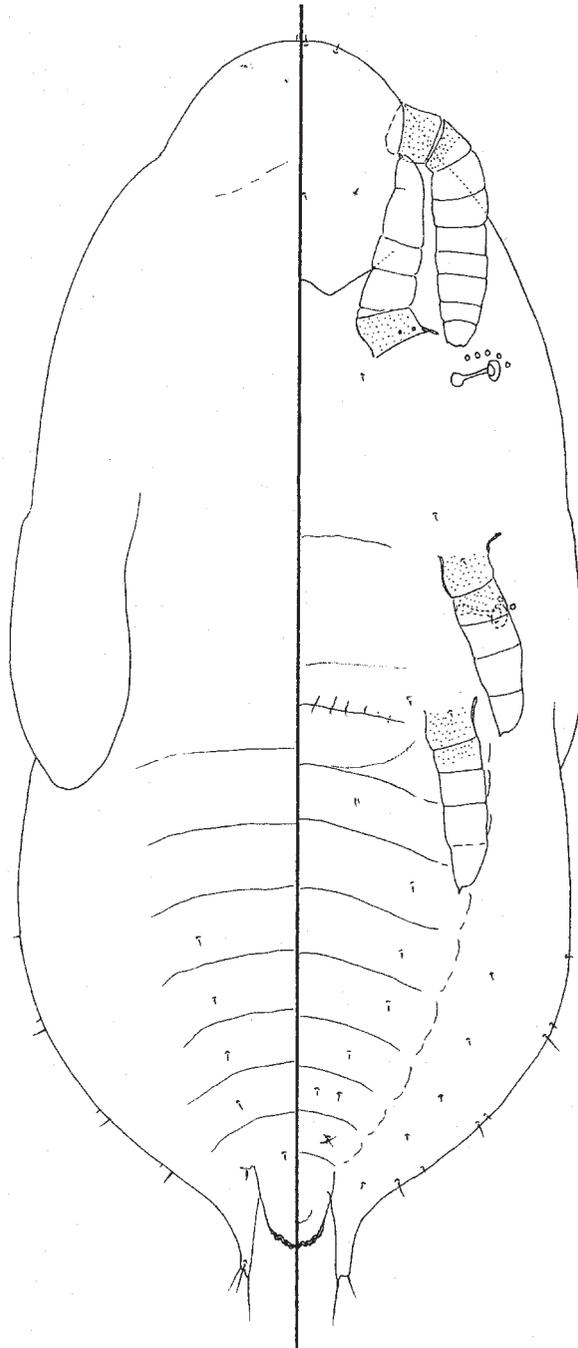


Fig. 129 Prepupa, *Ctenochiton viridis* Maskell.

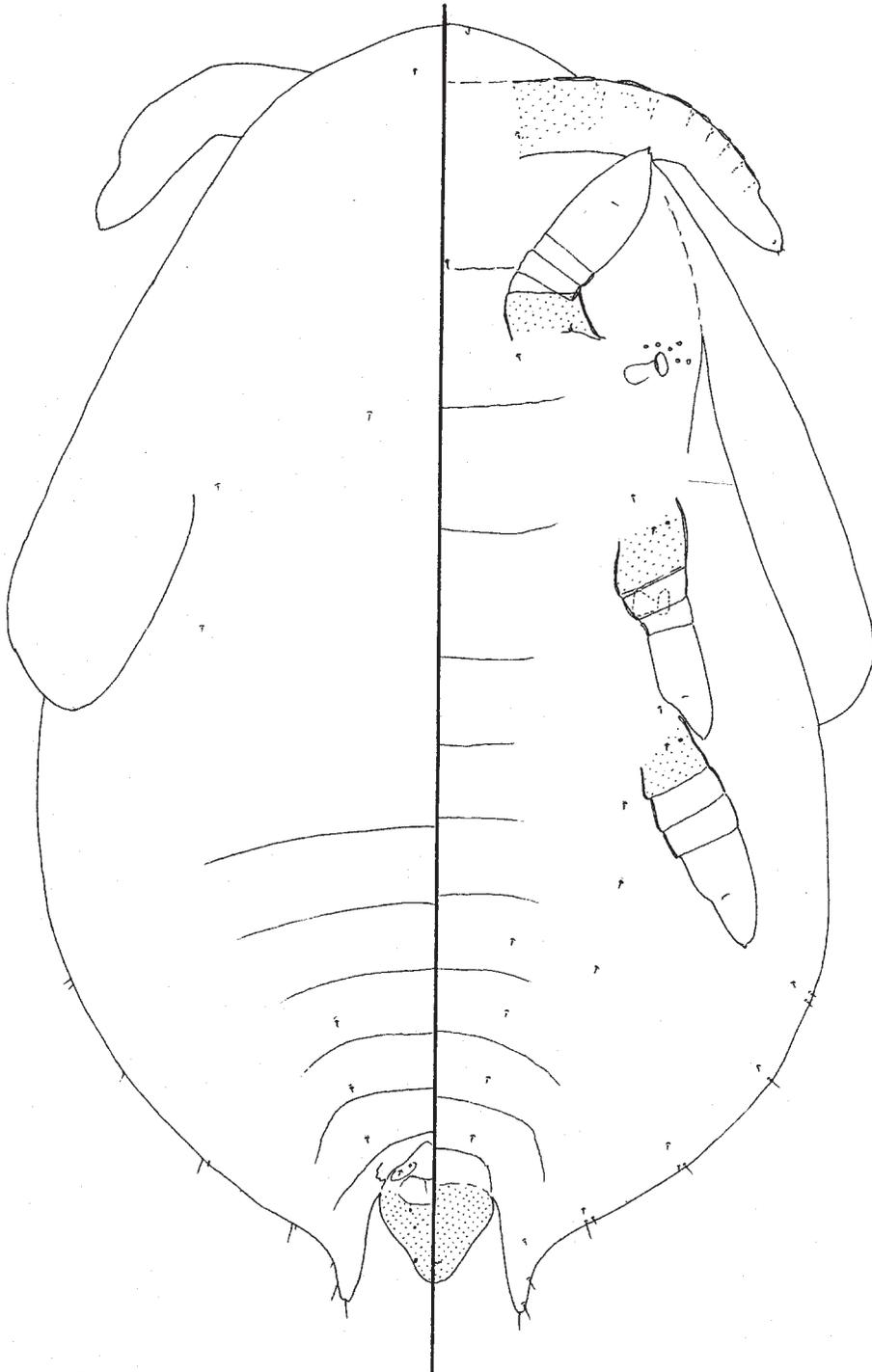


Fig. 130 Prepupa, *Epelidochiton piperis* (Maskell).

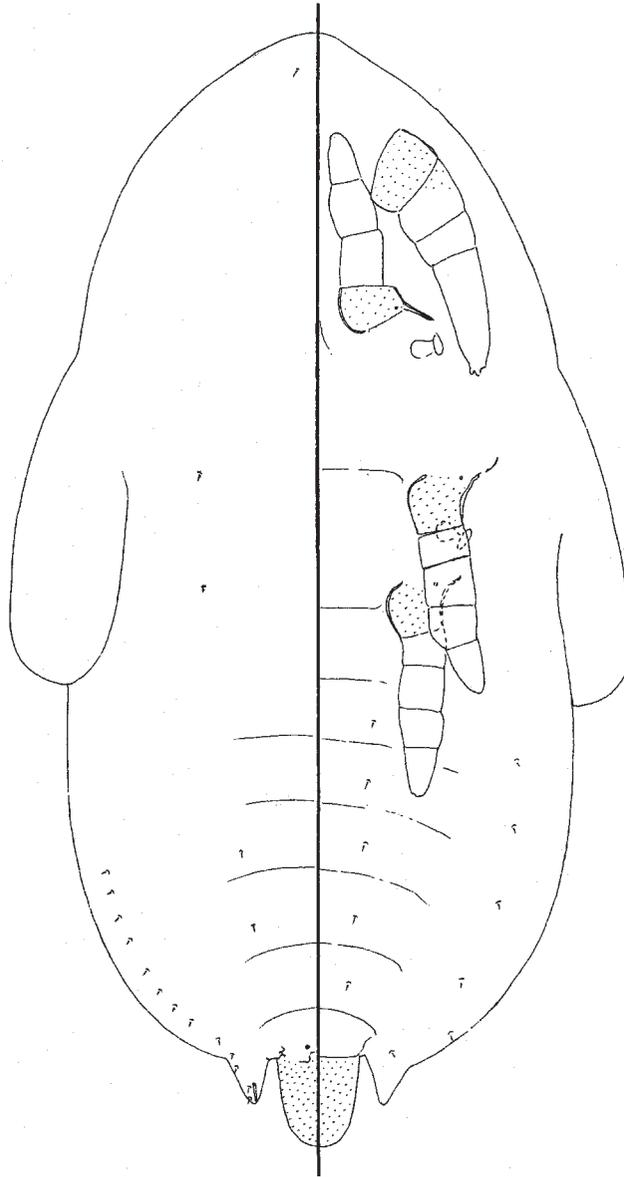


Fig. 131 Prepupa, *Inglisia patella* Maskell.

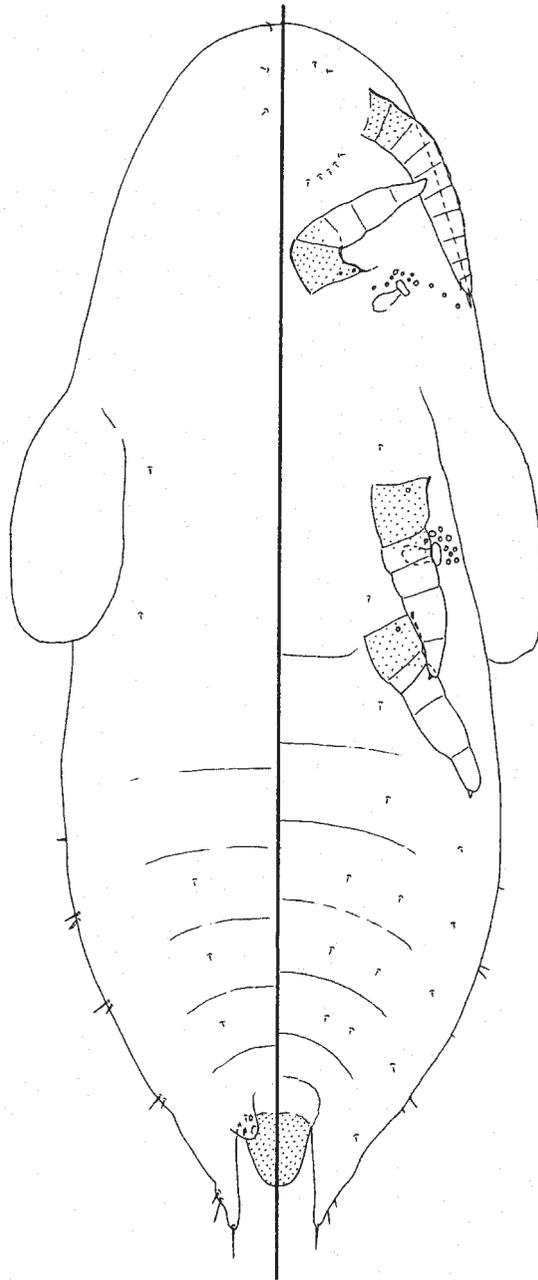


Fig. 132 Prepupa, *Kalasiris depressa* (Maskell).

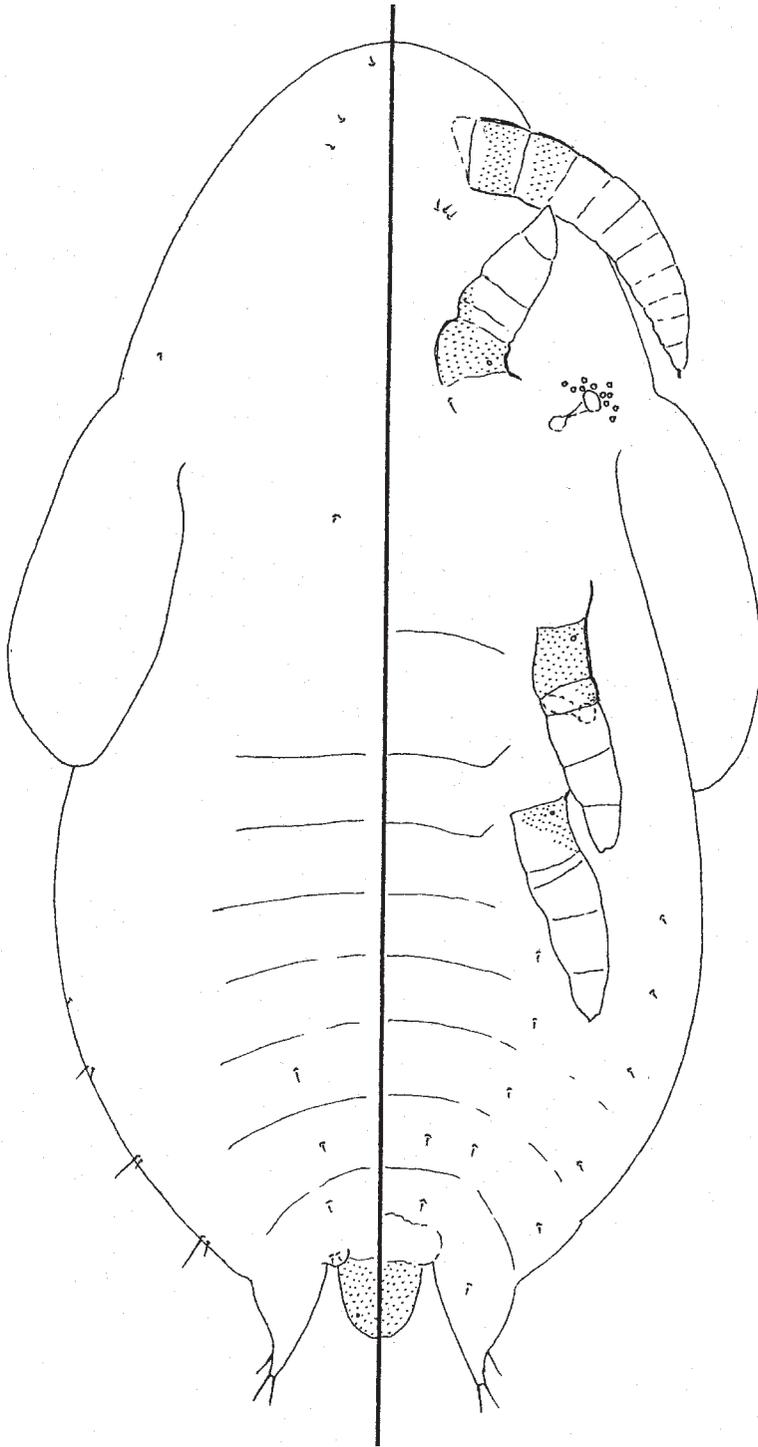


Fig. 133 Prepupa, *Kalasiris perforata* (Maskell)

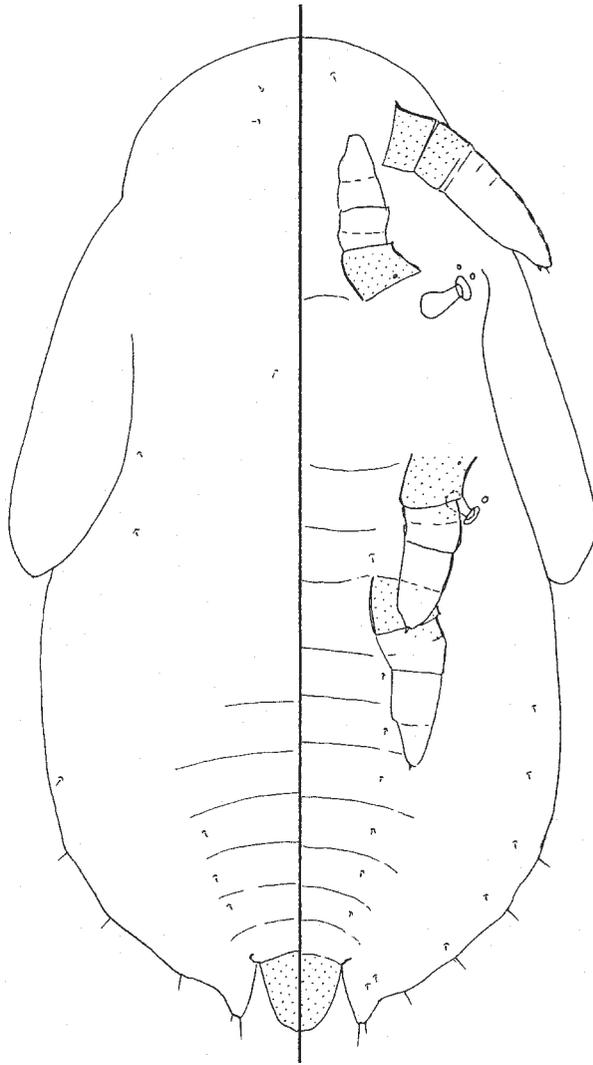


Fig. 134 Prepupa, *Lecanochiton actites* Henderson & Hodgson.

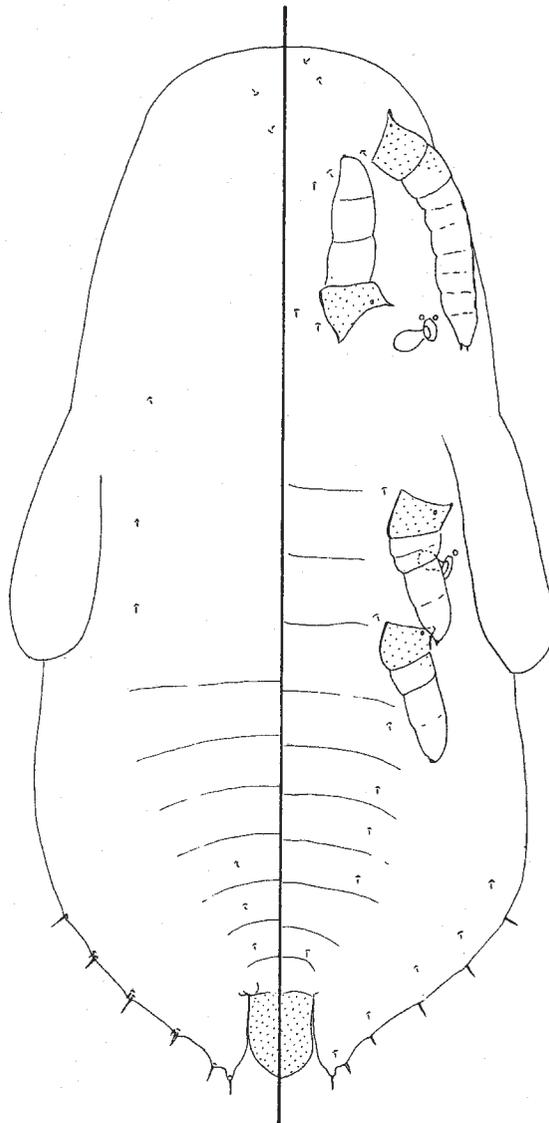


Fig. 135 Prepupa, *Lecanochiton scutellaris* Henderson & Hodgson.

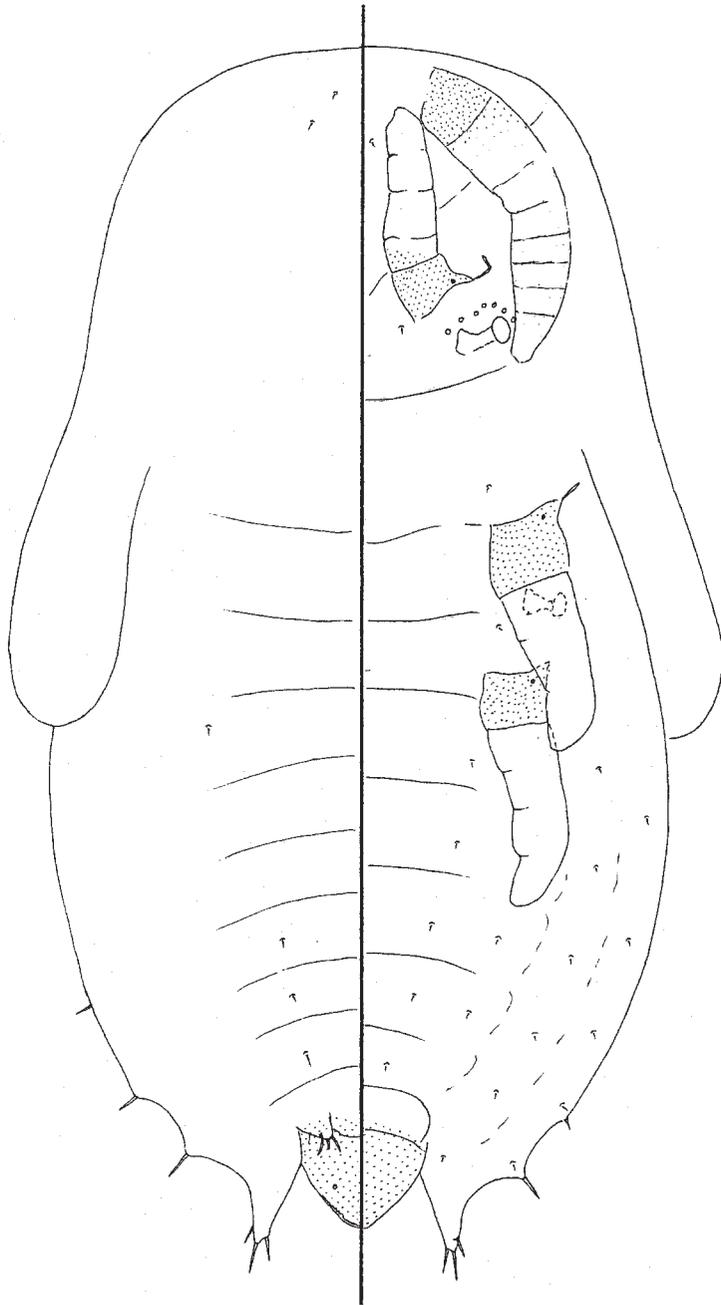


Fig. 136 Prepupa, *Plumichiton flavus* (Maskell).

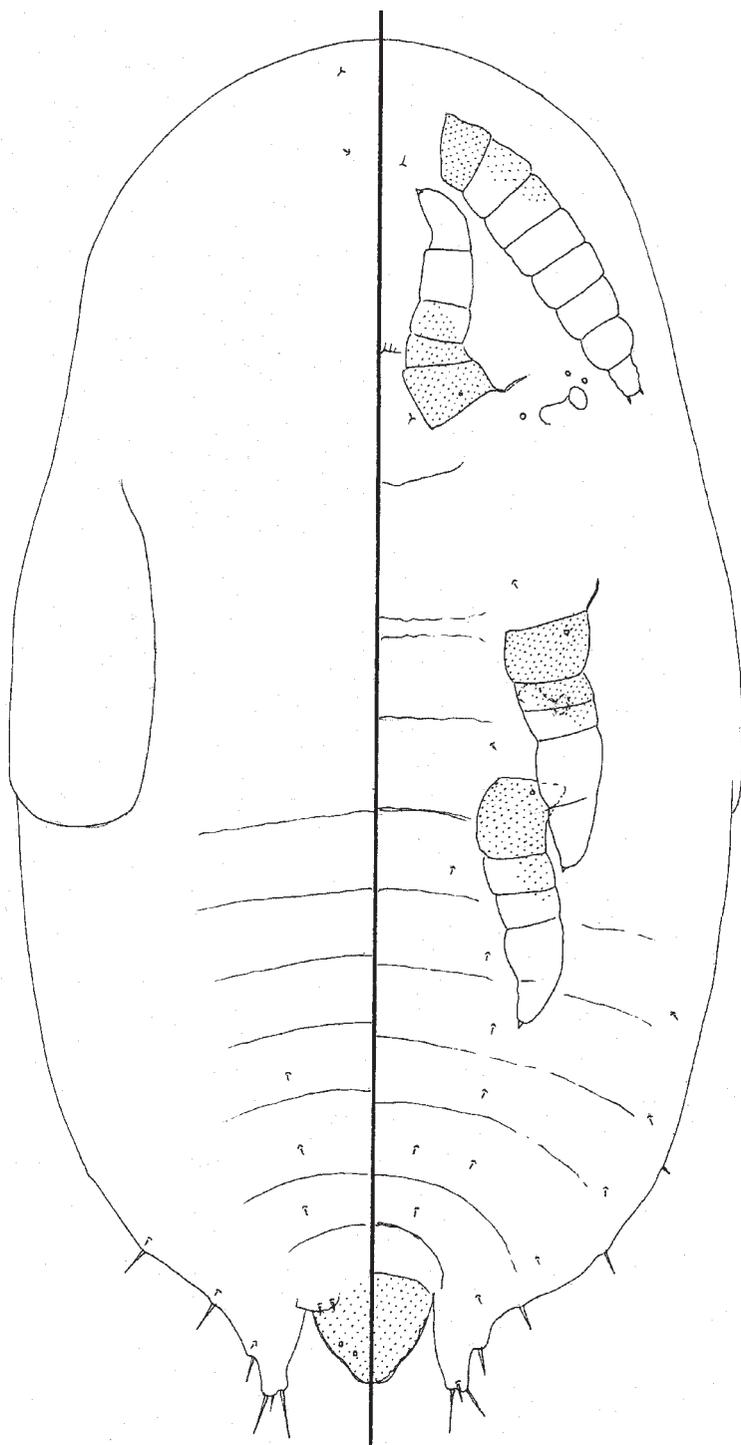


Fig. 137 Prepupa, *Plumichiton pollicinus* Henderson & Hodgson.

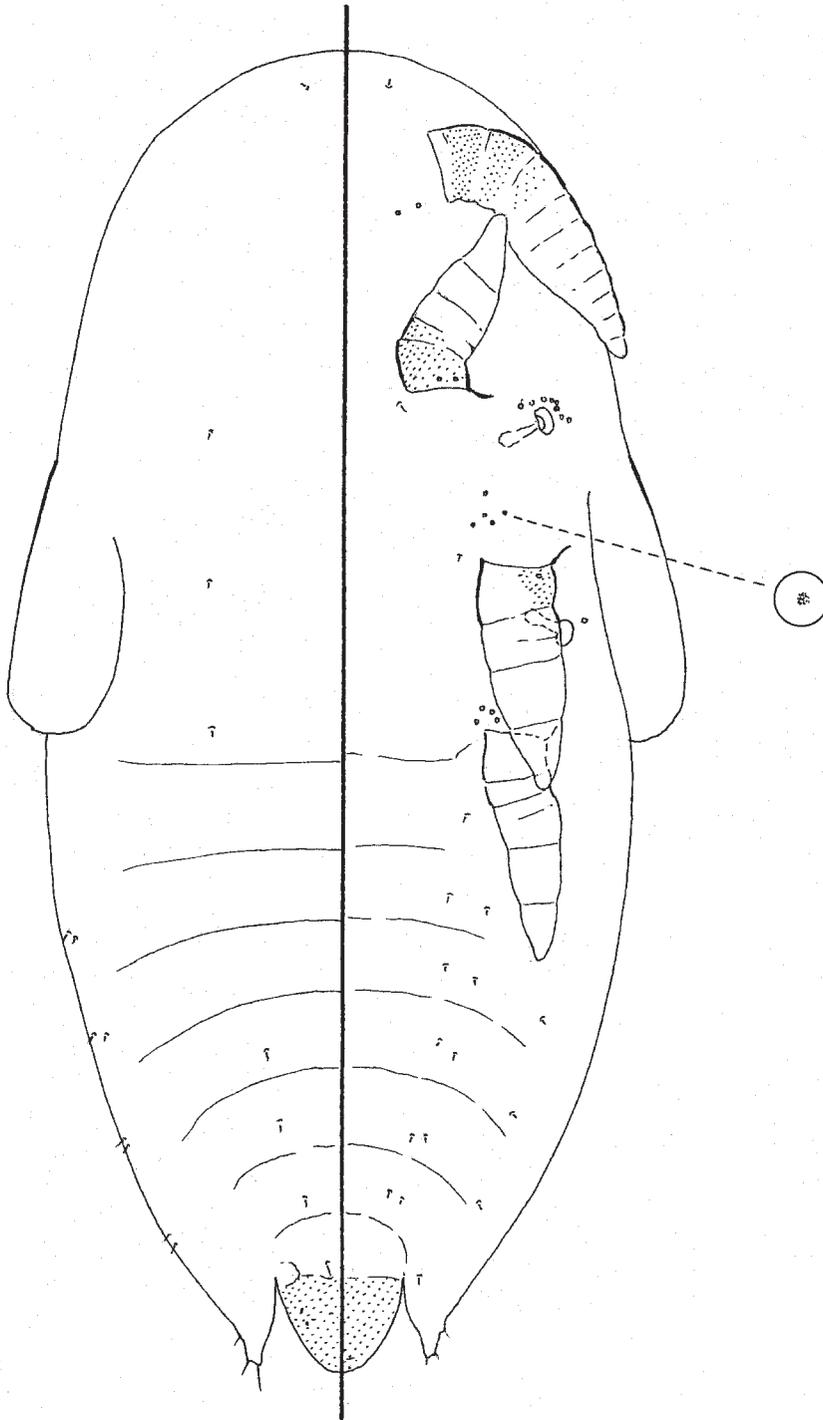


Fig. 138 Prepupa, *Poropeza dacrydii* (Maskell)

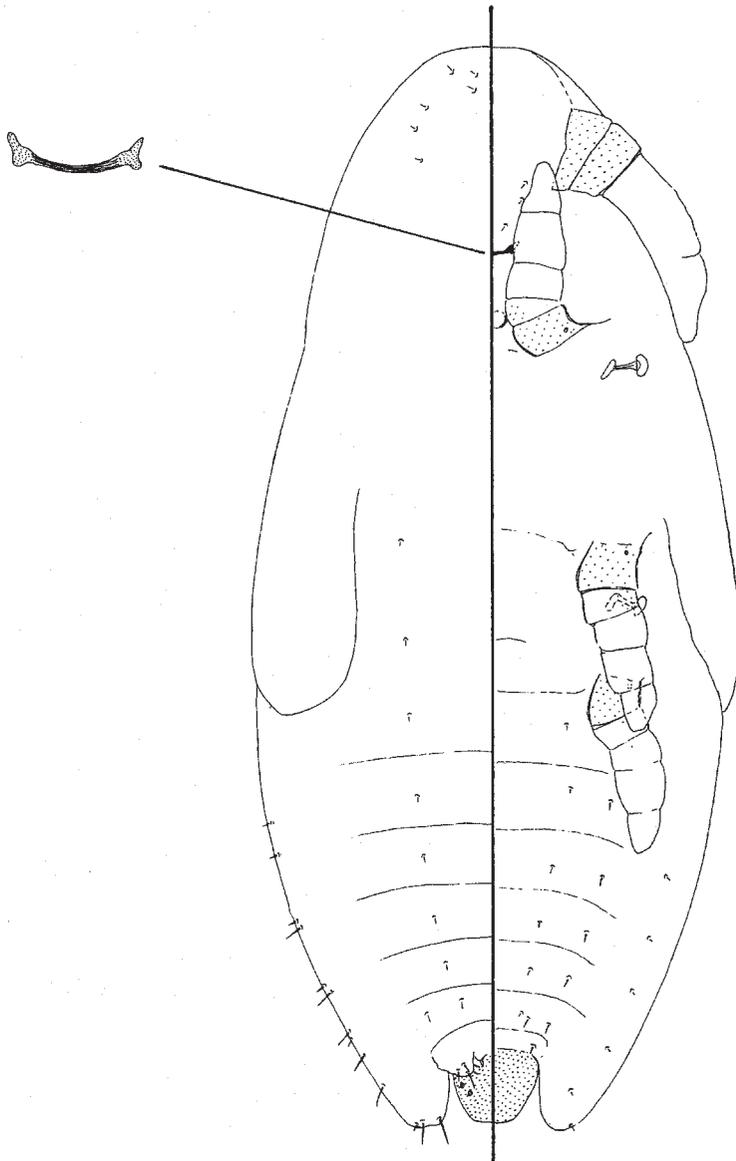


Fig. 139 Prepupa, *Pounamococcus cuneatus* Henderson & Hodgson.

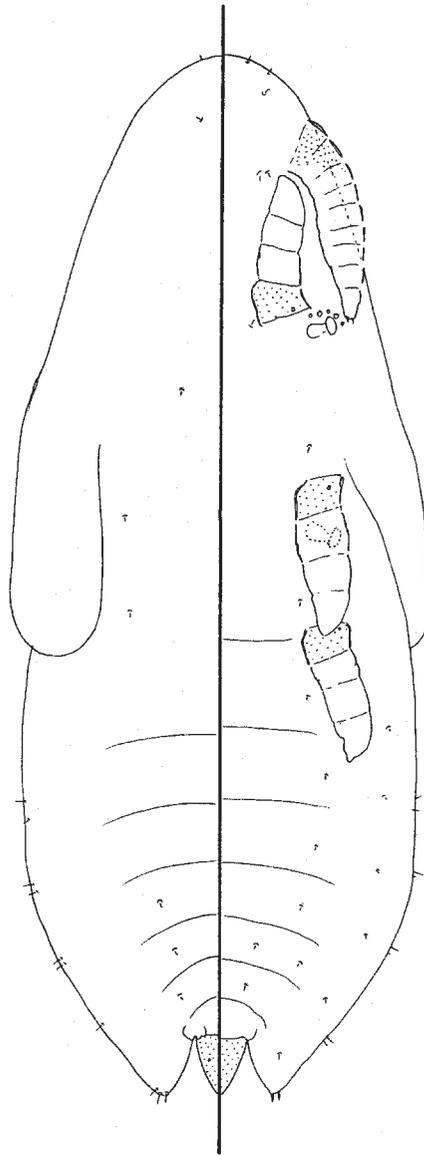


Fig. 140 Prepupa, *Umbonichiton adelus* Henderson & Hodgson.

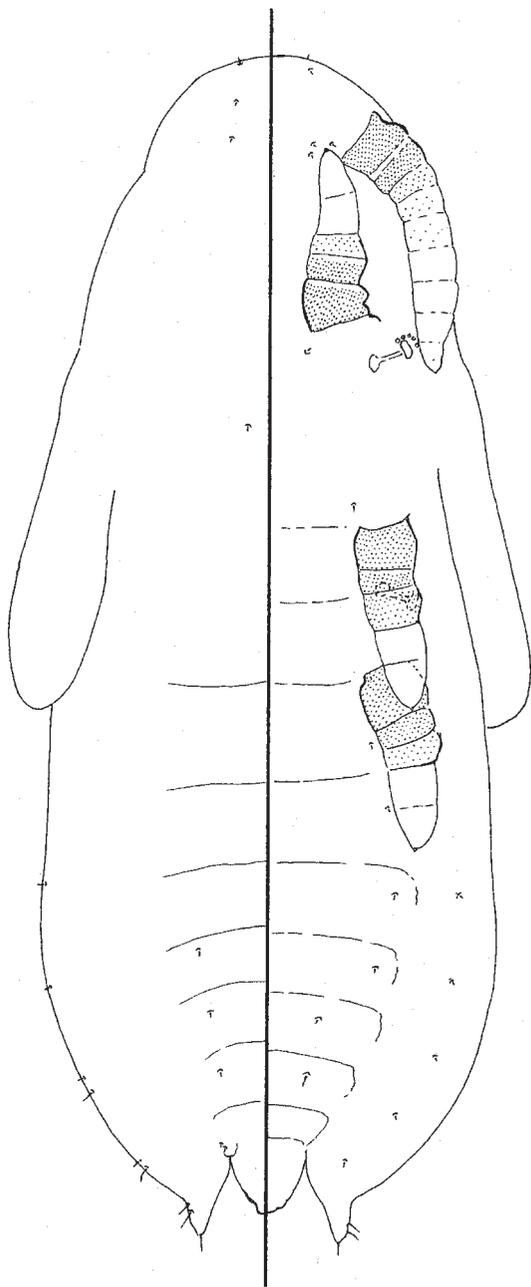


Fig. 141 Prepupa, *Umbonichiton bullatus* Henderson & Hodgson.

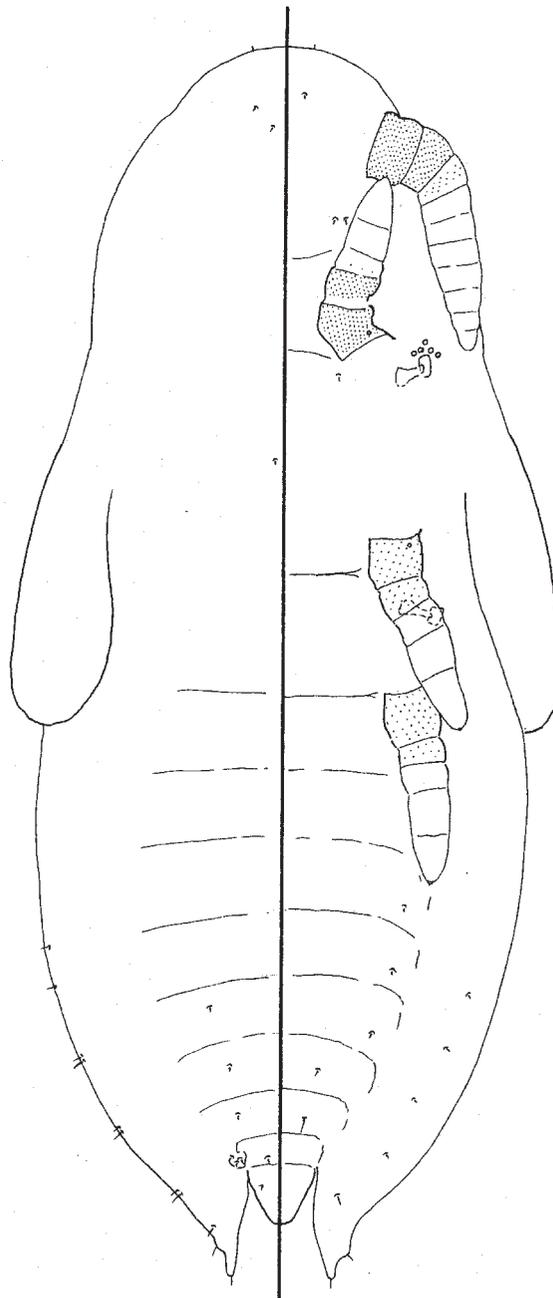


Fig. 142 Prepupa, *Umbonichiton pellaspi* Henderson & Hodgson.

of metathoracic legs 175–260 µm. Wing-buds: length 323–470 µm, width 130–175 µm (ratio length to width 1:0.38).

Abdomen: with a pair of ante-anal setae; with 1 or 2 pairs of small ventral abdominal setae on segments II–VII; with 2 pairs of dorsopleural setae (one clearly longer than other) on segments V and VI (also sometimes on IV). Segment VII with a pair of rather bluntly pointed lateral lobes, each lobe about 1.5–2× length of penial sheath; each lobe with 1 long (rather fleshy) seta (13–32 µm long) and 1 setose seta (18–25 µm long). Lobes of segment VIII indicated by 2 small fleshy bulges, each with setae 2 or 3 setae (3–12 µm long). Penial sheath much shorter than lateral lobes of segment VII and about as wide as long (73–105 µm long and 70–95 µm wide at base; ratio length to width 1:0.93).

Comment. The prepupa of *A. inconspicuus* is similar to those of other *Aphenochiton* species and differs from all other New Zealand prepupae bar that of *Kalasisiris depressa* in the length of the lobes on abdominal segment VII, which are much longer than the penial sheath; it differs from *K. depressa* in lacking disc-pores associated with the posterior spiracles.

***Aphenochiton kamahi* Henderson & Hodgson**

Fig. 24, 123

Material examined: see Appendix for collection details of specimens examined.

Described from 3 good specimens plus 1 with a pharate pupa.

Mounted material: length 1.5–1.6 mm. Elongate oval, head only about 1/2 width of abdomen.

Head: antennae: total length 295–362 µm (ratio of antennal length to total body length 1:4.3).

Thorax: with 4–13 spiracular disc-pores associated with each anterior spiracle, distributed laterad and anterior to peritreme; with no disc-pores associated with posterior spiracles. Spiracles: width of peritremes 18–20 µm. Length of metathoracic legs 220–241 µm. Wing-buds: length 362–454 µm, width 92–156 µm (ratio length to width 1:0.33).

Abdomen: without ante-anal setae; with single pairs of small ventral abdominal setae on segments II–VII (sometimes 2 pairs on VI); with 2 pairs of dorsopleural setae (one slightly longer than other) on segments III–VI. Segment VII with a pair of long, rather pointed, lateral lobes, each lobe about 2× length of penial sheath; each with 1 longer (16 µm) and 1 shorter (9 µm long) pleural setae. Lobes of segment VIII indicated by two small fleshy bulges dorsally on either side of base of penial sheath, without setae. Penial sheath much shorter than lateral lobes of segment VII and about as wide as long (81–99 µm long and 72–96 µm wide at base; ratio length to width 1:0.93).

***Aphenochiton pubens* Henderson & Hodgson**

Fig. 26, 124

Material examined: see Appendix for collection details of specimens examined.

Described from 2 good and 2 poor specimens.

Mounted material: length 1.45–1.7 mm. Elongate oval, head rather broad.

Head: antennae: total length 298–356 µm (ratio of antennal length to total body length 1:4.8).

Thorax: with 12–17 spiracular disc-pores associated with each anterior spiracle, distributed anterolaterally and laterad to peritreme, with a few extending medially about half way along muscle plate; with no pores associated with posterior spiracles on 3 specimens, 2–3 pores on another specimen. Spiracles: width of peritremes 18–22 µm. Length of metathoracic legs 216–254 µm. Wing-buds: length 374–508 µm, width 114–153 µm (ratio length to width 1:0.29).

Abdomen: with 2 minute ante-anal setae (shorter than width of basal socket); with single pairs of small ventral abdominal setae on segments II–VII (sometimes 2 pairs on VI); with 2 pairs of very short dorsopleural setae on segments IV–VI, 1 on III. Segment VII with a pair of long, rather pointed, lateral lobes, each lobe about 1.5× length of penial sheath; each with 1 short (5–7 µm long) apical pleural seta, a short subapical seta and another on lateral margin. Lobes of segment VIII small and membranous, each with 1–4 very short setae. Penial sheath much shorter than lateral lobes of segment VII and about as wide as long (94–105 µm long and 86–108 µm wide at base; ratio length to width 1:0.96).

***Aphenochiton subtilis* Henderson & Hodgson**

Fig. 28, 125

Material examined: see Appendix for collection details of specimens examined.

Described from about 10 specimens, but some data taken from a further 9 specimens.

Mounted material: length 1.27–1.58 mm. Elongate oval in shape, head rather broad.

Head: antennae short: total length 183–330 µm (ratio of antennal length to total body length 1:5.55).

Thorax: with 4–16 spiracular disc-pores associated with each anterior spiracle, mainly anterolaterally and laterad to peritreme, but with 1 or 2 extending about half-way along muscle plate; usually without disc-pores associated with posterior spiracles, but 1 or 2 pores on 2 individuals (out of 19). Spiracles: width of peritremes 19–22 µm. Length of metathoracic legs 190–260 µm. Wing-buds: length 336–476 µm, width 107–135 µm (ratio length to width 1:0.29).

Abdomen: ante-anal setae either apparently absent or represented by 1 or 2 very small setae or basal sockets; with single pairs of small ventral abdominal setae on segments III–VII (sometimes 2 pairs on V); with 2 pairs of very short dorsopleural setae on segments III–VI, 1 on II. Segment VII with a pair of long, rather pointed, lateral lobes, each lobe about 2× length of penial sheath; each with 1 short (2–5 µm long) apical pleural seta, a short subapical seta and another on lateral margin. Lobes of segment VIII small and fleshy, usually without minute setae but sometimes with up to 5 minute setae. Penial sheath much shorter than lateral lobes of segment VII and only slightly longer than wide (79–92 µm long and 64–87 µm wide at base; ratio length to width 1:0.87); with 2 pairs of small pores on dorsal surface.

Comment. The prepupae of *Aphenochiton* species are very similar.

The large amount of material available of this species has allowed the variance of the above characters to be tested. The characters which showed most variability were:

- (i) the presence or absence of ante-anal setae;
- (ii) the number of spiracular disc-pores associated with each spiracle, and
- (iii) the number of minute setae on the lobes of abdominal segment VIII.

CRYSTALLOTESTA Henderson & Hodgson

Introduction. There are 6 species currently known in this genus. These species can be divided into 2 distinct groups, of which *C. ornata* and *C. ornatella* form 1 group, the *ornata*-group, and the other 4 species (*C. fagi*, *C. fusca*, *C. leptospermi*, and *C. neofagi*) are here placed in the *fagi*-group. Whilst prepupae are known for both species in the *ornata*-group, none were available for any of the 4 species in the *fagi*-group.

Generic diagnosis, *ornata*-group, based on two species, *C. ornata* and *C. ornatella* (significant character-states in italics) (Fig. 126, 127).

General: elongate oval.

Head: head only slightly narrower than abdomen; yoke-like structure on venter absent.

Thorax: each anterior spiracle with 8–12 disc-pores; anterior spiracular disc-pores distributed laterad and anterior to spiracles, none extending mesad to muscle plate; posterior spiracular disc-pores present or absent.

Abdomen: dorsal abdominal setae present on segments V, VI and VII only; *dorsopleural setae in a line of rather fleshy setae along margin; lateral lobes on segment VII short and squat, equal to or less than length of penial sheath;* pleural setae on each lobe of segment VII in a line;

lobes on segment VIII very small or absent; lobes on segment VIII unsclerotised; lobes on segment VIII without setae; penial sheath wider than long (width about 1.2× length); ante-anal setae absent.

Comment. The prepupae of the *ornata*-group of *Crystallotesta* appear to differ significantly from the other species considered here in the distribution of their dorsopleural setae.

Crystallotesta ornata (Maskell)

Fig. 34, 126

Material examined: see Appendix for collection details of specimens examined.

Described from 1 good specimen with a pharate pupa.

Mounted material: length 1.71 mm. Elongate oval, head rather broad, not much narrower than abdomen.

Head: antennae: total length 391 µm (ratio of antennal length to total body length 1:4.37).

Thorax: number of disc-pores associated with each anterior spiracle uncertain, perhaps as many as 12 but probably less, in a group anterior and laterad to peritreme; with 2 or 3 disc-pores associated with each posterior spiracle. Spiracles relatively large: width of anterior peritremes 32–34 µm. Length of metathoracic legs 326–344 µm. Wing-buds: length 560–611 µm, width 170–185 µm (ratio length to width 1:0.30).

Abdomen: ante-anal setae absent; with single pairs of small ventral abdominal setae on segments VI and VII and two pairs on segments II–V; with a line of 10 or 11 blunt, quite fleshy-looking, dorsopleural setae on each side, each seta about 9 µm long; ventropleural setae as normal. Lobes of segment VII not elongate but rounded and squat, with a line of fleshy ventropleural setae extending anteriorly onto segment VI. Lobes of segment VIII either very small or absent, without setae. Penial sheath about as long as lateral lobes of segment VII, wider than long (99 µm long and about 126 µm wide at base; ratio length to width 1:1.27).

Comment. See under *C. ornatella* below.

Crystallotesta ornatella Henderson & Hodgson

Fig. 127

Material examined: see Appendix for collection details of specimens examined.

Described from 3 good specimens plus one with a pharate pupa.

Mounted material: length 1.37–1.7 mm. Elongate oval in shape, head rather broad, not much narrower than abdomen.

Head: antennae: total length 319–355 µm (ratio of antennal length to total body length 1:4.56).

Thorax: with 8–12 spiracular disc-pores associated with each anterior spiracle, in a group anterior and laterad to peritreme; no disc-pores associated with posterior spiracle. Spiracles quite large: width of anterior peritremes 27 µm. Length of metathoracic legs 234–277 µm. Wing-buds: length 390–433 µm, width 177–192 µm (ratio length to width 1:0.45).

Abdomen: ante-anal setae absent; with 1 pair of small ventral abdominal setae on segments II and VI, 2 pairs on segments III–V; with a line of 16–22 blunt, quite fleshy-looking, dorsopleural setae on each side, each seta about 2–20 µm long; ventropleural setae as normal. Lobes of segment VII not elongate but rounded and squat, with a line of fleshy ventropleural setae extending onto segment VI. Lobes of segment VIII either very small or absent, without setae. Penial sheath much longer than lateral lobes of segment VII and broader than long (79–87 µm long and about 90–105 µm wide at base; ratio length to width 1:1.17).

Comment. The prepupae of *C. ornata* and *C. ornatella* are immediately separable from known prepupae of other New Zealand soft scales (apart from *Inglisia patella*) by fleshy dorsopleural setae which are in a non-segmental line along the margin of the abdomen; they differ from *I. patella* in having disc-pores associated with the anterior spiracles. On the basis of the available material, the prepupa of *C. ornata* can be separated from that of *C. ornatella* in having:

- (i) spiracular disc-pores associated with posterior spiracles (absent on *C. ornatella*);
- (ii) fewer dorsopleural setae (10 or 11 on *C. ornata* and 16–22 on *C. ornatella*).

CTENOCHITON Maskell

Introduction. The genus *Ctenochiton* currently contains 4 species. Prepupae were available for *C. chelyon* and *C. viridis* (Fig. 128, 129).

Generic diagnosis based on two species, *C. chelyon* and *C. viridis* (significant character-states in italics).

General: elongate oval.

Head: head significantly narrower than abdomen; yoke-like structure on venter absent.

Thorax: each anterior spiracle with 5–10 disc-pores; anterior spiracular disc-pores distributed laterad and anterior to spiracles, none extending mesad to muscle plate; with 0–3 disc-pores present laterad to each posterior spiracle.

Abdomen: dorsal abdominal setae present on segments V, VI, and VII only; with 1 or 2 pairs of dorsopleural setae on segments (III) IV–VII, 1 significantly longer than other; dorsopleural setae arranged segmentally; lateral lobes on segment VII only slightly longer than penial sheath; with 2 or 3 long pleural setae on each lobe of segment VII; lobes on segment VIII small and fleshy; lobes on segment VIII unsclerotised; lobes on segment VIII with a single minute seta; penial sheath slightly longer than broad; ante-anal setae present.

Comment. The prepupae of *Ctenochiton* appear to be very similar to those of *Aphenochiton*, *Epelidochiton*, *Kalasisiris*, *Plumichiton*, and *Umbonichiton*, mainly differing in the extra-long pleural setae.

Ctenochiton chelyon Henderson & Hodgson

Fig. 128

Material examined: see Appendix for collection details of specimens examined.

Described from 1 good specimen.

Mounted material: length 1.56 mm. Elongate oval, head end rather pointed and significantly less wide than abdomen.

Head: antennae: total length 355–362 µm (ratio of antennal length to total body length 1:4.35).

Thorax: with 8–10 spiracular disc-pores associated with each anterior spiracle, distributed laterad and anterior to peritreme; with 1 or 2 disc-pores associated with each posterior spiracle. Spiracles: width of peritremes 23–25 µm. Length of metathoracic legs 277 µm. Wing-buds: length 404–454 µm, width 142–163 µm (ratio length to width 1:0.35).

Abdomen: with 2 ante-anal setae; with single pairs of small ventral abdominal setae on segments II–VII (2 pairs sometimes on VII); with 2 pairs of dorsopleural setae (one significantly longer than other) on segments III–VI. Segment VII with a pair of long, rather pointed, lateral lobes, each lobe a little longer than length of penial sheath; each with 3 pleural setae (2 long (28–31 µm) and 1 shorter) near apex. Lobes of segment VIII small and fleshy, each with a single seta. Penial sheath just shorter than lateral lobes of segment VII; longer than broad (121 µm long and about 99 µm wide at base; ratio length to width 1:0.82).

Comment: the prepupae of *C. chelyon* and *C. viridis* are very similar but can, perhaps, be separated by the considerably larger size of *C. chelyon*.

Ctenochiton viridis Maskell

Fig. 129

Material examined: see Appendix for collection details of specimens examined.

Described from 4 specimens in good condition.

Mounted material: length 1.19–1.3 mm. Elongate oval, head end rather pointed and significantly less wide than abdomen.

Head: antennae: total length 255–284 μm (ratio of antennal length to total body length 1:4.63).

Thorax: with 5–8 spiracular disc-pores associated with each anterior spiracle, distributed laterad and anterior to peritreme; with (0)–3 pores associated with each posterior spiracle. Spiracles: width of peritremes 18–20 μm . Length of metathoracic legs 191–206 μm . Wing-buds: length 255–320 μm , width 92–121 μm (ratio length to width 1:0.37).

Abdomen: with 1 or 2 ante-anal setae; with single pairs of small ventral abdominal setae on segments II–VII; with 2 pairs of dorsopleural setae (one significantly longer than other) on segments IV–VI. Segment VII with a pair of long, rather pointed, lateral lobes, each lobe about 1.5 \times length of penial sheath; each with 2 long (16–20 μm) and 1 shorter pleural seta. Lobes of segment VIII small and fleshy, each with a minute seta. Penial sheath distinctly shorter than lateral lobes of segment VII and generally slightly longer than wide (72–90 μm long and about 73–76 μm wide at base; ratio length to width 1:0.93).

Comment. The prepupae of *C. chelyon* and *C. viridis* are very similar; see under *C. chelyon* above.

EPELIDOCHITON Henderson & Hodgson

Introduction: this genus contains the 1 species, *E. piperis*.

Generic diagnosis based on *E. piperis* (significant character-states in italics) (Fig. 130).

General: *body only about 1.5 \times longer than broad, much broader than most prepupae, particularly abdomen.*

Head: head broad; yoke-like structure on venter absent.

Thorax: each anterior spiracular with 6 or 7 disc-pores; anterior spiracular disc-pores distributed laterad and anterior to spiracles, none extending mesad to muscle plate; posterior spiracular disc-pores absent.

Abdomen: dorsal abdominal setae present on segments V, VI and VII only; with 1 or 2 pairs of dorsopleural setae on segments IV–VII, 1 longer than other; dorsopleural setae arranged segmentally; lateral lobes on segment VII only slightly longer than penial sheath; with 2 or 3 long pleural setae on each lobe of segment VII; lobes on segment VIII small and fleshy; lobes on segment VIII unsclerotised; lobes

on segment VIII with a single minute seta; penial sheath slightly longer than broad; ante-anal setae present.

Comment. On the basis of the small amount of available material, the prepupa of *E. piperis* appears to be most similar to the prepupae of *Aphenochiton*, *Plumichiton*, and *Umbonichiton*, from which it may be separated by its generally very broad shape.

Epelidochiton piperis (Maskell)

Fig. 32, 130

Material examined: see Appendix for collection details of specimens examined.

Described from 1 specimen in excellent condition.

Mounted material: length 1.25 mm. Elongate oval, but rather broader than in most species.

Head: antennae: total length 319 μm (ratio of antennal length to total body length 1:3.92).

Thorax: with 6 or 7 spiracular disc-pores associated with each anterior spiracle, distributed anterior and laterad to peritreme; with no disc-pores associated with posterior spiracle. Spiracles: width of anterior peritremes 19–22 μm . Length of metathoracic legs 234 μm . Wing-buds: length 233–369 μm , width 94–156 μm (ratio length to breadth 1:0.42).

Abdomen: ante-anal setae absent; with a pair of small ventral abdominal setae on all segments, occasionally 2 pairs on segment VI, some setae quite long; dorsopleural setae: segments III–VI each with 1 long and 1 short seta; ventropleural setae as normal. Lateral lobes of segment VII significantly longer than penial sheath, each lobe with 2 longish pleural setae on or near apex, length of longest 16 μm long. Lobes of segment VIII small, each with 2 or 3 very small setae. Penial sheath considerably shorter than lateral lobes of segment VII; broader than long (92 μm long and about 122 μm wide at base; ratio length to width 1:1.32).

INGLISIA Maskell

Introduction: the genus *Inglisia* contains just the 1 species, *I. patella* Maskell.

Generic diagnosis based on *I. patella* only (significant character-states in italics) (Fig. 131).

General: broad, elongate oval.

Head: *head about as broad as abdomen*; yoke-like structure on venter absent.

Thorax: *anterior spiracular disc-pores absent*; posterior spiracular disc-pores absent.

Abdomen: dorsal abdominal setae present on segments V and VI only; with 1 pair of ventral abdominal setae on segments III–VI only; *dorsopleural setae in a line from segment VII to V; lateral lobes on segment VII short, only half length of penial sheath*; lobes on segment VIII distinct and membranous; lobes on segment VIII unsclerotised; lobes on segment VIII with 1 or 2 minute seta; penial sheath slightly longer than broad; ante-anal setae present.

Comment. The prepupa of *I. patella* shares the lack of spiracular disc-pores with *Pounamococcus* species, but can be separated by the absence of a yoke-like structure ventrally on the head, absence of dorsal abdominal setae on segments II–IV, and in the distribution of the dorsopleural setae.

Inglisia patella Maskell

Fig. 131

Material examined: see Appendix for collection details of specimens examined.

Described from 1 very good specimen.

Mounted material: length 1.3 mm. Head quite broad, body about 2× as broad as long.

Head: antennae: total length 304–311 µm (ratio of antennal length to total body length 1:4.2).

Thorax: without spiracular disc-pores associated with either anterior or posterior spiracles. Spiracles: width of anterior peritremes 23–26 µm. Length of metathoracic legs 254 µm. Wing-buds: length 285–337 µm, width 133 µm (ratio length to width 1:0.43).

Abdomen: ante-anal setae represented by 2 very short setae; with 1 pair of small dorsal abdominal setae on segments V and VI only; with a pair of small ventral abdominal setae on segments III–VI, possibly 0 on II and VII; dorsopleural setae: with a line of 9–11 small setae extending from VII anteriorly to about segment V; ventropleural setae as normal. Lateral lobe of VII short, about 0.5× length of penial sheath, each without apical setae but with a longer fleshy seta subterminally, each about 8–12 µm long. Lobes of segment VIII distinct and membranous, with 1 or 2 minute setae. Penial sheath about twice length of lateral lobes of segment VII and a little longer than broad (111 µm long and 95 µm wide at base; ratio length to width 1:0.86); apparently without setae or pores.

KALASIRIS Henderson & Hodgson

Introduction. The genus *Kalasis* contains 3 species, but prepupae were only available for 2, *K. depressa* and *K. perforata*.

Generic diagnosis based on 2 species, *K. depressa* and *K. perforata* (significant character-states in italics) (Fig. 132, 133).

General: narrow, elongate oval.

Head: head about as broad as abdomen; yoke-like structure on venter absent.

Thorax: each anterior spiracle with 9–12 disc-pores; anterior spiracular disc-pores mainly distributed in a diagonal line laterad to peritreme, none extending mesad to muscle plate; *each posterior spiracle with about 9 disc-pores*.

Abdomen: dorsal abdominal setae present on segments V, VI and VII only; with 1 or 2 pairs of dorsopleural setae on segments IV–VII, 1 longer than other; dorsopleural setae arranged segmentally; *lateral lobes on segment VII about 2× length of penial sheath*; with 2 or 3 pleural setae on each lobe of segment VII; lobes on segment VIII particularly obvious and fleshy; *lobes on segment VIII lightly sclerotised*; lobes on segment VIII with setae and pores; penial sheath about as long as wide; ante-anal setae absent.

Comment. In having long lobes on abdominal segment VII, it is similar to the prepupae of *Aphenochiton* and some *Umbonichiton* species, but differs in possessing a large group of disc-pores associated with each posterior spiracle. Prepupae of *Kalasis* are otherwise also rather similar to those of *Ctenochiton*, *Epelidochiton*, and *Plumichiton*.

Kalasis depressa (Maskell)

Fig. 132

Material examined: see Appendix for collection details of specimens examined.

Described from 1 specimen in good condition.

Mounted material: length 1.43 mm. Body rather narrow, elongate oval.

Head: antennae: total length 298 µm (ratio of antennal length to total body length 1:4.8).

Thorax: with 9 (possibly)–12 spiracular disc-pores associated with each anterior spiracle, mainly in a diagonal line laterad to peritreme; with 9 disc-pores near each posterior spiracle. Spiracles: width of anterior peritremes 17–22 µm. Length of metathoracic legs 241–243 µm. Wing-buds: length 333–362 µm, width 113–135 µm (ratio length to width 1:0.36).

Abdomen: ante-anal setae absent; with 2 pairs of small ventral abdominal setae on segments V–VII, and 1 pair on III and IV, possibly 0 on II; dorsopleural setae: 2 (one significantly longer than other) on IV–VI and a single seta on III; ventropleural setae as normal. Lateral lobe of VII very long, about 2× length of penial sheath, each with a

long apical pleural seta (each about 23 μm long) plus 1 long and 1 short seta on lateral margins. Lobes of segment VIII particularly obvious and bulbous, each with a minute seta, plus 2 or 3 pores and possibly a concavity on each inner margin. Penial sheath about half length of lateral lobes of segment VII, about as long as broad (86 μm long and 90 μm wide at base; ratio length to width 1:1.05).

***Kalasis perforata* (Maskell)**

Fig. 133

Material examined: see Appendix for collection details of specimens examined.

Described from 1 specimen in good condition.

Mounted material: length 1.6 mm. Body broad, particularly abdomen.

Head: antennae: total length 350 μm (ratio of antennal length to total body length 1:4.6).

Thorax: with 10 or 11 spiracular disc-pores associated with each anterior spiracle, distributed anterior and laterad to peritreme; with 0–2 disc-pores near each posterior spiracle. Spiracles: width of anterior peritremes 20–22 μm . Length of metathoracic legs 260. Wing-buds: length 390–400 μm , width 155–160 μm (ratio length to width 1:0.4).

Abdomen: ante-anal setae absent; with 2 pairs of small ventral abdominal setae on segment VI and 1 pair on segments III–V and VII; 0 on II; dorsopleural setae: 2 (one significantly longer than other) on IV–VI and a single seta on III; ventropleural setae normal. Lateral lobes of VII very long, about 1.5 \times length of penial sheath, each with 2 long apical pleural setae (each about 21–23 μm long) and 1 long seta on lateral margin. Lobes of segment VIII obvious and bulbous, each with 2 minute setae or pores. Penial sheath about 2/3 length of lateral lobes of segment VII, a little broader than long (83 μm long and 95 μm wide at base; ratio length to width 1:1.14).

Comment. The prepupae of *K. depressa* and *K. perforata* are quite similar but differ (based on the small amount of material available) mainly in (character-states for *K. perforata*; those for *K. depressa* in parentheses):

(i) rather few spiracular disc-pores associated with posterior spiracles (almost as many as associated with anterior spiracles);

(ii) lobes of abdominal segment VIII quite small and rather inconspicuous (larger and more conspicuous), and

(iii) each lateral lobe of abdominal segment VII with 2 setae on apex and 1 laterally (with only 1 on apex, but 2 laterally).

LECANOCHITON Maskell

Introduction. The genus *Lecanochiton* contains 4 species. Prepupae were available for *L. actites* and *L. scutellaris*.

Generic diagnosis based on 2 species, *L. actites*, and *L. scutellaris* (significant character-states in italics) (Fig. 134, 135).

General: rather small; broad, elongate oval; *only known plant host* *Metrosideros species*.

Head: about 1/2 width of abdomen; yoke-like structure on venter absent.

Thorax: *each anterior spiracle with 2 or 3 disc-pores; anterior spiracular disc-pores distributed mainly anterior to each peritreme, none extending mesad to muscle plate; with 1 disc-pore associated with each posterior spiracle.*

Abdomen: dorsal abdominal setae present on segments V, VI and VII only; with 1 or 2 pairs of dorsopleural setae on segments IV–VII, 1 significantly longer than other; dorsopleural setae arranged segmentally; *lateral lobes on segment VII subequal to length of penial sheath; with 2 pleural setae on each lobe of segment VII; lobes on segment VIII poorly developed or absent; lobes on segment VIII unsclerotised; lobes on segment VIII without setae and pores; penial sheath longer than or about subequal to width; ante-anal setae absent.*

Comment. The prepupae of *Lecanochiton* differ from the other prepupae described here in having very few spiracular disc-pores associated with the anterior spiracles but with disc-pores present associated with the posterior spiracles. In addition, *Lecanochiton* species are only known from *Metrosideros* species and are unusually small. They otherwise show similarities to the prepupae of *Aphenochiton*, *Ctenochiton*, *Epelidochiton*, *Kalasis*, *Plumichiton*, and *Umbonichiton*.

***Lecanochiton actites* Henderson & Hodgson**

Fig. 134

Material examined: see Appendix for collection details of specimens examined.

Described from 1 specimen in fair condition with a pharate pupa.

Mounted material: small, length 0.93 mm. Elongate oval, with a broad head.

Head: antennae: total length 238 μm (ratio of antennal length to total body length 1:3.91).

Thorax: with 2 or 3 spiracular disc-pores associated with each anterior spiracle, distributed anterior to each peritreme; with 1 disc-pore associated with each posterior spiracle. Spiracles small: width of peritremes 18 μm . Length of

metathoracic legs 195 µm. Wing-buds: length 270–279 µm, width 98 µm (ratio length to width 1:0.36).

Abdomen: ante-anal setae absent; with 1 pair of small ventral abdominal setae on all segments; with single dorsopleural setae on III–VI. Lateral lobes of segment VII subequal in length to penial sheath, each with 1 longer seta and 1 shorter pleural seta on apex, longest 15–17 µm. Lobes of segment VIII either very small or absent, without setae. Penial sheath fractionally longer than lateral lobes of segment VII and about as long as wide (81 µm long and 85 µm wide at base; ratio length to width 1:1.05).

Comment. The prepupae of *L. actites* and *L. scutellaris* are similar. From the available material, *L. actites* and *L. scutellaris* appear to differ in the number and distribution of the dorsopleural setae, *L. actites* having only 1 long seta on each side per segment, whereas *L. scutellaris* has a long seta and a short seta each side per segment.

Lecanochiton scutellaris Henderson & Hodgson

Fig. 135

Material examined: see Appendix for collection details of specimens examined.

Described from 1 good specimen with a pharate pupa.

Mounted material: small, length 1.06 mm; head width 346 µm. Elongate oval, with a broad head.

Head: antennae: total length 264 µm (ratio of antennal length to total body length 1:4.02).

Thorax: with 2 spiracular disc-pores associated with each anterior spiracle, distributed anterior to peritreme; with 1 disc-pore associated with each posterior spiracle. Spiracles small: width of peritremes 16 µm. Length of metathoracic legs 177 µm. Wing-buds: length 255 µm, width 69–103 µm (ratio length to width 1:0.33).

Abdomen: ante-anal setae absent; with 1 pair of ventral abdominal setae on all segments; with 1 long and 1 short dorsopleural seta on segments III–VI. Lateral lobes of segment VII slightly longer than penial sheath, each lobe with 2 long pleural setae on apex, each 21–23 µm. Lobes of segment VIII very small or absent, without setae. Penial sheath slightly shorter than lobes of segment VII and longer than broad (87 µm long and about 69 µm wide at base; ratio length to width 1:0.79).

Comment. The prepupa of *L. scutellaris* is very similar to that of *L. actites*. For comments and a comparison, see under *L. actites* above.

PLUMICHITON Henderson & Hodgson

Introduction: the genus *Plumichiton* contains 6 species; prepupae were available for only *P. flavus* and *P. pollicinus*.

Generic diagnosis based on two species, *P. flavus* and *P. pollicinus* (significant character-states in italics) (Fig. 136, 137).

General: body broad, elongate oval.

Head: head about as broad as abdomen; yoke-like structure on venter absent.

Thorax: each anterior spiracle with 1–8 spiracular disc-pores; anterior spiracular disc-pores distributed laterad and anterior to spiracles, *often with 1 mesad to muscle plate*; posterior spiracular disc-pores usually absent (occasionally 1 or 2 pores on *P. flavus*).

Abdomen: dorsal abdominal setae present on segments V, VI and VII only; with 1 or 2 pairs of dorsopleural setae on segments V–VII, 1 much longer than other; dorsopleural setae arranged segmentally; lateral lobes on segment VII only slightly longer than penial sheath; with 2 or 3 pleural setae on each lobe of segment VII; *lobes on segment VIII bulbous and distinct*; lobes on segment VIII sclerotised or unsclerotised; lobes on segment VIII with 2–4 setae (quite large on *P. flavus*); *penial sheath distinctly wider than long*; ante-anal setae absent.

Comment. The prepupae of *Plumichiton* appear to be very similar to those of *Aphenochiton*, *Ctenochiton*, *Epelidochiton*, *Kalasis*, and *Umbonichiton*.

Plumichiton flavus (Maskell)

Fig. 136

Material examined: see Appendix for collection details of specimens examined.

Described from 3 good specimens and another with a pharate pupa.

Mounted material: length 1.27–1.48 mm. Elongate oval in shape, head rather rounded and almost as broad as abdomen.

Head: antennae: total length 326–376 µm (ratio of antennal length to total body length 1:3.9).

Thorax: with 1–8 spiracular disc-pores associated with each anterior spiracle, spread around anterior margin and along muscle plate; usually with no disc-pores associated with posterior spiracle, rarely 1 or 2. Spiracles: width of anterior peritremes 27–31 µm. Length of metathoracic legs 241–284 µm. Wing-buds: length 326–384 µm, width 127–178 µm (ratio length to width 1:0.43).

Abdomen: ante-anal setae absent; with 1 pair of small ventral abdominal setae on segments II–III, 1 or 2 pairs on

segments VI–VII; some of these setae quite long; dorsopleural setae: VI with 1 short and 1 long seta; V with 1 or 2 short or long setae; IV with either a short or a long seta and III without setae; ventropleural setae as normal. Lateral lobes of segment VII slightly longer than penial sheath, each lobe with 2 or 3 long pleural setae on apex (length of longest 16–22 μm) plus a shorter seta on outer margin a little more anteriorly. Lobes of segment VIII distinct, each lobe slightly sclerotised, with 3 or 4 longish setae. Penial sheath considerably shorter than lateral lobes of segment VII and length significantly shorter than width (97–103 μm long and about 138–162 μm wide at base; ratio length to width 1:1.5).

Comment. The prepupae of *P. flavus* and *P. pollicinus* (described below) are very similar and may not be separable, although, from the available material, those of *P. flavus* appear to have more spiracular disc-pores associated with each anterior spiracle.

Plumichiton pollicinus Henderson & Hodgson

Fig. 137

Material examined: see Appendix for collection details of specimens examined.

Described from 4 good specimens and another poor specimen with a pharate pupa.

Mounted material: length 1.1–1.33 mm. Elongate oval, head rather rounded and almost as broad as abdomen.

Head: antennae: total length 275–298 μm (ratio of antennal length to total body length 1:4.2).

Thorax: with 2–4 spiracular disc-pores associated with each anterior spiracle, mainly anterior and laterad to peritreme, but usually with 1 mesad to each muscle plate; with no disc-pores associated with posterior spiracle. Spiracles: width of anterior peritremes 19–22 μm . Length of metathoracic legs 203–222 μm . Wing-buds: length 298–390 μm , width 95–115 μm (ratio length to width 1:0.31).

Abdomen: ante-anal setae absent; with 1 pair of small ventral abdominal setae on all segments, occasionally 2 pairs on segment VI; setae on VI longer; dorsopleural setae: IV–VI usually with 1 short and 1 long seta; III without setae; ventropleural setae as normal. Lateral lobes of segment VII about 1/3–1/2 longer than penial sheath, each lobe with 1 apical seta and 1 or 2 more lateral pleural setae, length 10–17 μm long. Lobes of segment VIII bulbous, each lobe with 2 minute setae (quite hard to see on some specimens). Penial sheath considerably shorter than lateral lobes of segment VII and significantly shorter than width (66–96 μm long and 95–105 μm wide at base; ratio length to width 1:1.12).

Comment. The prepupae of this species are very similar to those of *P. flavus* (described above). For a comparison, see under that species.

POROPEZA Henderson & Hodgson

Introduction: the genus *Poropeza* contains 2 species but prepupae were available for only *P. dacrydii*.

Generic diagnosis based on *P. dacrydii* (significant character-states in italics) (Fig. 138).

General: quite large, body elongate oval.

Head: head quite broad, almost as wide as abdomen; yoke-like structure on venter absent.

Thorax: each anterior spiracle with 8 or 9 disc-pores; anterior spiracular disc-pores distributed laterad and anterior to peritremes; with 1 disc-pore associated with each posterior spiracle. *With groups of minute setae or pores just anterior to each meso- and metacoxa.*

Abdomen: dorsal abdominal setae present on segments V, VI, and VII only; *with 2 pairs of ventral abdominal setae on segments III–VII, 1 pair on II;* with 2 pairs of short dorsopleural setae on segments III–VI; dorsopleural setae arranged segmentally; lateral lobes on segment VII about equal in length to length of penial sheath; with 1 short pleural seta on apex of each lobe of segment VII plus 2 laterally; lobes on segment VIII small and membranous; *penial sheath large, as wide as long;* ante-anal setae present.

Comment. The prepupa of *P. dacrydii* differs from those of all other species described here in having groups of minute setae or pores just anterior to each meso- and metacoxa, and two pairs of small ventral abdominal setae on segments III–VII.

Poropeza dacrydii (Maskell)

Fig. 52, 138

Material examined: see Appendix for collection details of specimens examined.

Described from 1 rather misshapen specimen.

Mounted material: quite large, length 1.6 mm. Elongate oval, rounded anteriorly.

Head: antennae: total length 395 μm (ratio of antennal length to total body length 1:4.1).

Thorax: with 7 or 8 spiracular disc-pores associated with each anterior spiracle, distributed dorsolaterally to peritreme; with 1 disc-pore present associated with each posterior spiracle. Spiracles: width of anterior peritremes 28 μm . Length of metathoracic legs 290 μm . Wing buds: length 333–355 μm , width 132 μm .

Abdomen: with 2 short ante-anal setae; with 2 pairs of small ventral abdominal setae on segments II–VI and 1 on segment II; dorsopleural setae longer than ventral pleural setae, with 2 on each side of segments III–VI; ventral pleural setae as normal. Lateral lobes of segment VII well developed and subequal to length of penial sheath; with 1 short seta on apex (9–12 µm long) and two laterally. Lobes of segment VIII inconspicuous and membranous; apparently without setae or pores. Penial sheath quite large, as wide as long (150 µm long, 137 µm wide at base; length to width ratio 1:0.91); with 3 small pores on dorsal surface.

POUNAMOCOCCUS Henderson & Hodgson

Introduction. The genus *Pounamococcus* contains 2 species, but prepupae were available for only *P. cuneatus*.

Generic diagnosis based on *P. cuneatus* (significant character-states in italics) (Fig. 139).

General: body broad, elongate oval.

Head: head about half as broad as abdomen; *yoke-like structure present on venter*.

Thorax: *anterior spiracular disc-pores absent*; posterior spiracular disc-pores absent.

Abdomen: *with 1 pair of dorsal abdominal setae on all abdominal segments*; with 2 pairs of ventral abdominal setae on segments III–VII; with 1 or 2 pairs of dorsopleural setae on segments IV–VII, 1 longer than other; dorsopleural setae arranged segmentally; lateral lobes on segment VII only slightly longer than penial sheath; with 2 or 3 pleural setae on each lobe of segment VII; *lobes on segment VIII bulbous and distinct*; lobes on segment VIII slightly sclerotised; lobes on segment VIII with about 5 long setae; *penial sheath distinctly wider than long*; ante-anal setae present.

Comment. The prepupa of *P. cuneatus* can be immediately separated from those of the other species described here by the presence of the yoke-like structure ventrally on the head and the absence of spiracular disc-pores (a character-state shared with *I. patella*). The homology of the yoke-like structure is discussed under *P. cuneatus* in the pupa section.

Pounamococcus cuneatus Henderson & Hodgson

Fig. 55, 139

Material examined: see Appendix for collection details of specimens examined.

Described from 2 specimens in good condition.

Mounted material: length 1.12–1.38 mm. Elongate oval,

head rather rounded but not as broad as abdomen.

Head: antennae: total length 276–299 µm (ratio of antennal length to total body length 1:4.36). A sclerotised transverse, yoke-like structure present posteroventrally, about 50 µm wide.

Thorax: without spiracular disc-pores associated with either anterior or posterior spiracles. Spiracles: width of anterior peritremes 18–22 µm. Length of metathoracic legs 196–223 µm. Wing-buds: length 311–419 µm, width 120–146 µm (ratio length to width 1:0.36).

Abdomen: with 2 short ante-anal setae; with one pair of small dorsal abdominal setae on abdominal segments II–VII and also on meso- and metathorax; with 2 pairs of small ventral abdominal setae on segments III–VII and 0 or 1 on II; dorsopleural setae: segments IV–VI with 1 short and 1 long seta; segment III with 0 or 1 small seta; ventropleural setae as normal. Lateral lobes of segment VII slightly longer than penial sheath, each lobe rounded, with 2 long and 1 very short pleural setae on apex (length of longest 22 µm) plus a long seta on outer margin near base of lobe. Lobes of segment VIII very distinct, slightly sclerotised, each lobe with 5 long setae (longest 15 µm long). Penial sheath subequal in length to lobes of abdominal segment VII, and slightly broader than long (66–78 µm long and about 81–104 µm wide at base; ratio length to width 1:1.3); with 2 pairs of minute setae.

UMBONICHITON Henderson & Hodgson

Introduction: the genus *Umbonichiton* contains 5 species. Prepupae were available for *U. adelus*, *U. bullatus*, and *U. pellaspis*.

Generic diagnosis based on three species, *U. adelus*, *U. bullatus*, and *U. pellaspis* (significant character-states in italics) (Fig. 140–142).

General: fairly narrow, elongate oval.

Head: head narrow; yoke-like structure on venter absent.

Thorax: each anterior spiracle with 5–9 disc-pores; disc-pores distributed laterad and anterior to anterior spiracles, none extending mesad to muscle plate; posterior spiracular disc-pores absent.

Abdomen: dorsal abdominal setae present on segments V, VI and VII only; with 1–2 pairs of rather short dorsopleural setae on segments IV–VII, 1 sometimes longer than other; dorsopleural setae arranged segmentally; lateral lobes on segment VII subequal to (*U. adelus*) or about 1.5–2× length of penial sheath; with 1–3 pleural setae on each lobe of segment VII; lobes on segment VIII small and fleshy or apparently absent; lobes on segment VIII unsclerotised;

lobes on segment VIII with or without setae; penial sheath about as wide as long or a little wider (*U. pellaspis*); ante-anal setae present or absent.

Comment. The prepupae of *Umbonichiton* are rather variable but otherwise similar to those of *Aphenochiton*, *Ctenochiton*, *Epelidochiton*, *Kalasisis*, and *Plumichiton*.

Umbonichiton adelus Henderson & Hodgson

Fig. 140

Material examined: see Appendix for collection details of specimens examined.

Described from 2 specimens in good condition.

Mounted material: length 1.2–1.33 mm. Elongate oval; head rather pointed and much narrower than abdomen.

Head: antennae: total length 262–270 μm (ratio of antennal length to total body length 1:4.6).

Thorax: with 6–9 spiracular disc-pores associated with each anterior spiracle, distributed anterior and laterad to peritreme; with no disc-pores associated with posterior spiracles. Spiracles: width of anterior peritremes 18–22 μm . Length of metathoracic legs 184–199 μm . Wing-buds narrow: length 284–391 μm , width 96–114 μm (ratio length to width 1:0.31).

Abdomen: ante-anal setae absent; with 1 pair of small ventral abdominal setae on all segments, occasionally 2 pairs on segment VI; dorsopleural setae: III–VI usually with 1 or 2 short setae; ventropleural setae as normal. Lateral lobes of segment VII subequal in length to length of penial sheath, rather blunt, each lobe with 1 longer (14–18 μm long) and 0–2 slightly shorter pleural setae. Lobes of segment VIII very small and fleshy or absent, without setae. Penial sheath subequal in length to lobes of segment VII and about as wide as long (74–81 μm long and 83 μm wide at base; ratio length to width 1:1.06).

Comment. The prepupae of *U. adelus* differ from those of *U. bullatus* and *U. pellaspis* in having the lobes of segment VII squat and rounded and of about the same length as the penial sheath (much longer and more pointed in the other two species).

Umbonichiton bullatus Henderson & Hodgson

Fig. 141

Material examined: see Appendix for collection details of specimens examined.

Described from 2 specimens in good condition, but both containing pharate pupae.

Mounted material: length 1.4–1.47 mm. Elongate oval; head rounded and much narrower than abdomen.

Head: antennae: total length 315–325 μm (ratio of antennal length to total body length 1:4.8).

Thorax: with 5–9 spiracular disc-pores associated with each anterior spiracle, distributed anterior and laterad to peritreme (one specimen appears to have many more and extending far laterally, but some belong to pharate pupa); with no disc-pores associated with posterior spiracles. Spiracles: width of anterior peritremes 17–19 μm . Length of metathoracic legs 215–230 μm . Wing-buds narrow: length 412–420 μm , width 108 μm (ratio length to width 1:0.26).

Abdomen: ante-anal setae absent; with 1 pair of small ventral abdominal setae on all segments but those on VI significantly longer; dorsopleural setae: III with 0 or 1 short setae; IV–VI with 1 short seta + 0 or 1 significantly longer setae; ventropleural setae as normal. Lateral lobes of segment VII much longer than penial sheath, slightly pointed, each lobe with 1 seta on apex (10–14 μm long) and 1 or 2 setae of about same length on lateral margin. Lobes of segment VIII very small and fleshy or absent, with 0–2 minute setae. Penial sheath much shorter than lobes of segment VII; about as wide as long (86–92 μm long and 66–86 μm wide at base; ratio length to width 1:0.85); apparently without setae on dorsal surface.

Comment. The prepupae of *U. bullatus* and *U. pellaspis* appear to be very similar but, based on the available material, can be separated by the presence of ante-anal setae on the latter species.

Umbonichiton pellaspis Henderson & Hodgson

Fig. 142

Material examined: see Appendix for collection details of specimens examined.

Described from 1 specimen in good condition but containing a pharate pupa.

Mounted material: length 1.53 mm. Elongate oval; head rounded and much narrower than abdomen.

Head: antennae: total length 305 μm (ratio of antennal length to total body length 1:5.0).

Thorax: with 5–8 spiracular disc-pores associated with each anterior spiracle, distributed anterior and laterad to peritreme (pharate pupal disc-pores present and so disc-pores very difficult to separate); with no disc-pores associated with posterior spiracles. Spiracles: width of anterior peritremes 20 μm . Length of metathoracic legs 230 μm . Wing-buds narrow: length of sclerotised part 350 μm (plus unsclerotised part 445 μm), width 120 μm (ratio total length to width 1:0.27).

Abdomen: probably with a pair of small ante-anal setae; with 1 pair of small ventral abdominal setae on all seg-

ments but that on VI significantly longer; dorsopleural setae: III with 0 or 1 short setae; IV–VI with 1 short seta + 0 or 1 significantly longer setae; ventropleural setae as normal. Lateral lobes of segment VII about 2× as long as penial sheath, pointed, each lobe with 1 seta on apex (9 µm long) and 2 setae of about same length on lateral margin. Lobes of segment VIII reduced to small fleshy lobes, with 2 or 3 small setae, each about 2.5–5 µm long. Penial sheath much shorter than lobes of segment VII; a little wider than long (71 µm long and 85 µm wide at base; ratio length to width 1:1.2); with a pair of short setae on dorsal surface.

Comment. For a discussion of the differences from the other 2 species, see under *U. adelus* and *U. bullatus* above.

REFERENCES

- Afifi, S.A. 1968: Morphology and taxonomy of the adult males of the families Pseudococcidae and Eriococcidae (Homoptera: Coccoidea). *Bulletin of the British Museum (Natural History), Entomology supplement no. 13*. 210 pp.
- Balachowsky, A. 1937: Les cochenilles de France, d'Europe, du Nord de l'Afrique et du bassin Méditerranéen. I. Caractères généraux des cochenilles. Morphologie externe. *Actualités Scientifique et Industrielles* 526. 68 pp. Paris, Hermann-Cie, Editeurs.
- Borchsenius, N. S. 1957: Sucking insects, vol. IX. Suborder mealybugs and scale insects (Coccidae). Family cushion and false scale insects (Coccidae). *Fauna SSSR. Zoologicheskii Institut Akademii Nauk SSSR, Novaya seriya* 66. 493 pp.
- Ferris, G. F. 1942: Atlas of Scale Insects of North America. Ser. IV. Stanford, Stanford University Press. Serial nos. 385–448.
- 1950: Atlas of Scale Insects of North America. Ser. V. Stanford, Stanford University Press. 278 pp.
- Farrell, G. S. 1990: Redescription of *Cryptes baccatus* (Maskell) (Coccoidea: Coccidae), an Australian species of soft scale. *Memoirs of the Museum of Victoria* 51: 65–82.
- Foldi, I; Kozár, F.; Hodgson, C. J. 2001: *Rhodococcus luberonensis*, a new species of soft scale from France (Hemiptera: Coccidae). *Bulletin de la Société de France* 106: 449–461.
- Ghauri, M. S. K. 1962: The morphology and taxonomy of male scale insects (Homoptera: Coccoidea). London, British Museum (Natural History). 221 pp.
- Gillio mee, J. H. 1967: Morphology and taxonomy of the adult males of the family Coccidae (Homoptera: Coccoidea). *Bulletin of the British Museum (Natural History), Entomology supplement no. 7*. 168 pp.
- Gimpel, W. F.; Miller, D. R.; Davidson, J. A. 1974. A systematic revision of the wax scales, genus *Ceroplastes*, in the United States (Homoptera: Coccoidea: Coccidae). *Miscellaneous Publications of the Agricultural Research Station, University of Maryland 841*: 1–85.
- Henderson, R. C.; Rhode, B. E. 2001: The hinged back plate mechanism in glassy wax tests of New Zealand male soft scale insects (Hemiptera: Coccoidea: Coccidae). *Arthropod Structure and Development* 30: 1–14. [Figures 2–11 of this paper, Copyright 2001, reprinted with permission of Elsevier.]
- Hodgson, C. J. 1991: A redescription of *Pseudopulvinaria sikkimensis* Atkinson (Homoptera: Coccoidea), with a discussion of its affinities. *Journal of Natural History* 25: 1513–1529.
- 1993: The immature instars and adult male of *Etiennaea* (Homoptera: Coccidae), with a discussion of its affinities. *African Journal of Zoology* 107: 193–215.
- 1994: The Scale Insect Family Coccidae: an Identification Manual to Genera. Wallingford, CABI International. 639 pp.
- ; Henderson, R. C. 1998: A new genus and two new species of soft scale insect (Hemiptera: Coccoidea: Coccidae) from New Zealand. *Journal of the Royal Society of New Zealand* 28: 605–639.
- ; ——— 2000: Coccidae (Insecta: Hemiptera: Coccoidea). *Fauna of New Zealand*. 41. Lincoln, Canterbury, N.Z., Manaaki Whenua Press. 264 pp.
- ; Martin, J.H. 2001: Three noteworthy scale insects (Hemiptera: Coccoidea) from Hong Kong and Singapore, including *Cribropulvinaria tailungensis*, new genus and species (Coccidae), and the status of the cycad-feeding *Aulacaspis yasumatsui* (Diaspididae). *The Raffles Bulletin of Zoology* 49: 227–250.
- ; Matile-Ferrero, D. 2003: The immature stages of *Pharangococcus iquitensis* Hodgson & Matile-Ferrero off guava from Peruvian Amazonia (Hemiptera: Coccoidea, Coccidae). *Revue française d'Entomologie (N.S.)* 25: 33–42.
- Husseiny, M. M.; Madsen, H. F. 1962: The life history of *Lecanium kunoensis* Kuwana (Homoptera: Coccidae).

- Hilgardia* 33: 170–203.
- Kawecki, Z. 1958: Studies on the genus *Lecanium* Burm. Part V. The nut or thorn scale — *Lecanium coryli* (L.) sensu Marchal (Homoptera: Coccoidea: Lecaniidae). *Polskie Pismo Entomologiczne* 27: 40–69.
- Koteja, J.; Rosciszewska, M. 1970: Revision of the genus *Parafairmairia* Cockerell (Homoptera; Coccoidea). *Polskie Pismo Entomologiczne* 40: 233–265.
- Manuwadu, D. 1986: A new species of *Eriopeltis* Signoret (Homoptera: Coccidae) from Britain. *Systematic Entomology* 11: 317–326.
- Maskell, W. M. 1879: On some Coccidae in New Zealand. *Transactions and Proceedings of the New Zealand Institute* 11: 187–228.
- 1882: Further notes on the Coccidae of New Zealand, with descriptions of new species. *Transactions and Proceedings of the New Zealand Institute* 14: 215–229.
- 1887: An Account of the Insects Noxious to Agriculture and Plants in New Zealand. The Scale Insects (Coccidae). Wellington, Government Printer, State Forests–Agriculture Department. 116 pp. + XXIII plates.
- Miller, G. L. 1991: Morphology and systematics of the male tests and adult males of the family Coccidae (Homoptera: Coccoidea) from America north of Mexico. Ph.D. thesis. Auburn, USA, Auburn University.
- ; Williams, M. L. 1995: Systematic analysis of the adult males of *Toumeyalla* Group, including *Mesolecanium nigrofasciatum*, *Neolecanium cornuparvum*, *Pseudopulvinaria quaintancii* and *Toumeyella* spp. (Homoptera: Coccidae) from America north of Mexico. *Contributions of the American Entomological Institute* 28 (4): 68 pp.
- 2002: Systematics of the adult male soft scales of America north of Mexico (Homoptera: Coccidae). *Contributions on Entomology, International* 5 (2): 49–126.
- Morrison, H.; Morrison, E. 1922: A redescription of the type species of the genera of Coccidae based on species originally described by Maskell. *Proceedings of the United States National Museum, Washington* 1015. vi + 206 pp.
- Ray, C. H.; Williams, M. L. 1980: Description of the immature stages and adult male of *Pseudophilippia quaintancii* (Homoptera: Coccoidea: Coccidae). *Annals of the Entomological Society of America* 73: 437–447.
- 1983: Description of the immature stages and adult male of *Neolecanium cornuparvum* (Homoptera: Coccidae). *Proceedings of the Entomological Society of Washington* 85: 161–173.
- Sankaran, T. 1962: The life history and biology of the wax scale, *Ceroplastes pseudoceriferus* Green (Coccidae: Homoptera). *Indian Journal of Entomology* 24: 1–18.
- Šulc, K. 1931: O skladbe voskových stetu a jejich prislusnych zlaz u samcu puklic (*Lecanium*: Coccidae). *Sborník Přírodovědecké Společnosti V Moravia Ostravé 1930–1931*: 85–96.
- 1932: Ceskoslavenske druhy rodu puklic (gn. *Lecanium*, Coccidae, Homoptera). *Acta Societatis Scientiarum Naturalium Moravo–Silesiacae* 7: 1–134.
- Theron, J. G. 1958: Comparative studies on the morphology of male scale insects (Homoptera: Coccoidea). *Annals of the University of Stellenbosch* 34(A). 71 pp.
- Williams, M. L. 1997: The immature stages. Pp. 31–48 In Ben-Dov, Y.; Hodgson, C. J. (Eds), *Soft Scale Insects, their Biology, Natural Enemies and Control*. World Crop Pests Vol. 7A. Amsterdam, Elsevier. 452 pp.
- Williams, M.; Hodgson, C.; Danzig, E. M. 2002: A new genus and new species of Coccidae from Central America (Homoptera: Coccinea). *Zoosystematica Rossica* 11: 111–126.

APPENDIX: MATERIAL EXAMINED

Collection details listed alphabetically by genus and species. All NZAC except where noted. The number of slides and specimens studied, including their life stages, is given thus: "7/6admm, 4 prepupae (3 pharate), 6 pupae" indicates 7 slides with 6 adult males, 4 prepupae (3 of which were pharate), and 6 pupae.

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

Aphenochiton inconspicuus (Maskell)

TK. Mt. Taranaki, Egmont National Park, Veronica Loop Walk, *Coprosma rigida* leaves, 18 Jan 2001, N.A. Martin, #01-024: 7/6admm, 4 prepupae (3 pharate), 6 pupae. **MC.** Birdlings Flat, property of G. Taylor, on leaves of *Coprosma ?propinqua*, 26 Sept 1997, RCH, #97-133: 1/ pharate prepupa, 3 pupae (dead).

Aphenochiton kamahi Henderson & Hodgson

BP. Rotorua, *Weinmannia racemosa*, 19 Jan 1998, C.J. Hodgson, #98-042, 1/adm; Te Koau, 200m, Bushwalk Tk, leaves of *W. racemosa*, 31 Oct 1994, RCH, #94-106: 1/ prepupa. **GB.** Paoneone, leaves of *W. racemosa*, 2 Nov 1994, RCH, #94-107, 1/adm, prepupa, 2ndm; Kakanui, 300m, *W. racemosa*, 30 April 1993, RCH, #93-284: 1/ adm, prepupa 2ndm. **TK.** Awakau Rd, leaves of *W. racemosa*, 12 Dec 1993, RCH, #93-373: 1/pharate prepupa, 4 2ndmm. **FD.** Dusky Sound, Resolution Is, Facile Harbour, 5 Feb 1996, ex underside of leaves of *W. racemosa*, RCH, #97-075: 2/adm, pupa + a caste pupal skin.

Aphenochiton matai Henderson & Hodgson

WO SF97, Waimiha, (Te Kuiti), *Podocarpus spicatus* [= *Prumnopitys taxifolia*], 1 Oct 1957, R. C. Howie (FRNZ) R32: 1/4adff, 2admm, 2 pupae (Holotype slide).

Aphenochiton pubens Henderson & Hodgson

AK. Waitakere Range, Sharp Bush, large-leaved sapling of *Mida salicifolia*, 22 Feb 1998, RCH, #98-028: 2/pupa, pharate 2ndm; as previous, leaves of *Mida salicifolia*, 22 March 1998, RCH, #00-066: 1/adm (very hirsute); as previous, leaves of large-leaved sapling *M. salicifolia*, #00-043: 1/pupa; as previous, *M. salicifolia* [at upper kauris], 18 Feb 2000, #00-020: 2/2 prepupa, pharate 2ndm; as previous, 27 Feb 2000 #00-025: 4/3admm, 2nd instar moult, pupa, 2 pupal moults, prepupa moult; as previous, but *M. salicifolia* (large-leaved sapling), 27 Feb 2000, #00-021: 1/ prepupa; as previous, but *M. salicifolia* by upper kauris, 8

Mar 2000, #00-030: 1/adm. Riverhead Forest, Barlow Road Reserve, underside leaves of *Podocarpus totara*, 13 Apr 2000, RCH, #00-073: 2/3 pupae, prepupa.

Aphenochiton subtilis Henderson & Hodgson

AK. Waitakere Range, Sharp Bush, large-leaved sapling of *Mida salicifolia*, 22 Feb 1998, RCH, #98-030: 1/adm, pupal moult; as previous but on narrow-leaved shrub, 22 March 1998, #98-046: 1/adm; as previous but on *M. salicifolia* [at upper kauris], 18 Feb 2000, #00-020: 16/ 9mm, 24 pupae, 19 prepupae + some pharate pupae and prepupae and moults; as previous but 27 Feb 2000, #00-025: 1/adm. **BP.** Te Koau, 225m, under leaves of *Hedycarya arborea*, 14 March 1994, RCH, #99-059: 5/2admm, 2 pupae, pharate pupa, pupal moult; Te Koau, 130m, Bushwalk to Twin Puriris, leaves of *H. arborea*, 2 Nov 1993, RCH, #93-347: 2/2admm, pupa, 2ndm.

Crystallotesta fagi (Maskell)

BR. Hochstetter Forest, near Reefton, ex *Nothofagus menziesii*, 9 Nov 1972, J.A. de Boer no. 945: 1/adm.

Crystallotesta leptospermi (Maskell)

CL. Little Barrier I., Te Maraeroa, on leaves of *Kunzea ericoides*, 17 Sept 1994, RCH, # 03-026: 3/3admm. **BR.** Waipuna (Reefton District), on *Kunzea ericoides* [as *Leptospermum*], 22 Oct 1958, R. Zondag (FRNZ, R64): 1/ 4 pupae, 2ndm.

Crystallotesta neofagi Henderson & Hodgson

GB. L. Waikaremoana, ex *Nothofagus fusca*, 19 June 1991, C. F. Morales, #97-074: 1/5 pupae.

Crystallotesta ornata (Maskell)

AK. Riverhead Forest, Barlow Road Reserve, *Podocarpus totara* leaves, collected 14 Aug 1997 and reared, emerged Sept, RCH, #97-121: 6/6admm, 4 pupal moults (very poor), 3 2ndmm moults; as previous, 25 July 1999, RCH, #99-093: 2/ prepupa, pupa (reared to 3rd Aug.), 2ndm.

Crystallotesta ornatella Henderson & Hodgson

ND. 3 miles north of Dargaville, *Leptospermum scoparium*, 9 Aug 1954, J. M. Hoy no 160: 2/adm, pupa. **GB:** Paoneone, *Kunzea ericoides*, 15 Mar 1994, RCH, #94-049, 1/adm, pupa. **NN:** Collingwood, ex *Leptospermum ericoides*, 4 Aug 1948, T. G. Sewell (Hoy coll. no. 60): 2/ prepupa, pupa; Onekaka, ex *L. ericoides*, 4 Aug 1948, T. G. Sewell (Hoy coll., no. 62): 3/3 prepupae.

***Ctenochiton chelyon* Henderson & Hodgson**

BP. Lottin Point, Otanga, on old leaves of *Vitex lucens*, 3 Nov 1993, RCH, #93-350: 2/3admm, 3 pupae; Waiaroho, old leaves of *Streblus heterophyllus* (as *microphyllus*), 3 Nov 1993, RCH, #93-342: 2/3admm, 2 pupae; Te Araroa beach, north end, old leaves of *Corynocarpus laevigatus*, 31 Oct 1994, RCH, #94-132: 1/4 pupae; Murupara (as Murapara), Motumoku Bush C1230, *Litsea calicaris*, 17 Nov 1959 (probably all collected on 4th Nov and reared to 17th Nov), N.O. Seccombe (FRNZ): 6/21mm, 4 pupae. **GB:** Karakatuwhero V road, Waipiata, *Melicope simplex*, 4 Nov 1993, RCH, #93-348: 2/adm, 2 pupae, prepupa, 2ndmm.

***Ctenochiton paraviridis* Henderson & Hodgson**

BP. Te Koau, Bushwalk Tk, corner to lookout Tk, on *Ripogonum scandens*, 31 Oct 1994, RCH, #94-133: 2/2admm, 2 pupae; Whakarewarewa (F.R.I.), on *Griselinia littoralis*, 2 Nov 1960, R. Zondag (FRNZ) R(a)68: 1/5admm (in good condition); as previous but numbered R(a)69: 1/2admm (rather poor). **GB.** Pohutu, Awatere R. bridge, underside of leaves of *Hedycarya arborea*, 1 Nov 1994, RCH, #95-022: 1/pupa, 3 2ndmm. **BR.** Springs Junction, Palmer Road, old leaves of *Peraxilla colensoi*, 4 Nov 1993, J. S. Dugdale, #93-330: 4/7admm, 2 pupae, 2ndm.

***Ctenochiton viridis* Maskell**

AK. Waitakere Range, Sharp Bush, underside of old leaves of *Pseudopanax arboreus*, 6 Oct 1997, RCH, #97-139: 2/adm, pupa. **GB.** East Cape Lighthouse Tk, old leaves of *Pseudopanax crassifolius*, 30 Oct 1994, RCH, #94-130: 2/4 prepupae, 2 pupae.

***Epelidochiton piperis* (Maskell)**

AK. Glen Eden, 17 Oct 93, underside leaves of *Vitex lucens*, RCH, #93-302: 3/3admm, 2 pharate prepupae, 2 pupae, 2ndm; as previous, 11 Sept 1994, #94-069e: 1/prepupa, pupa.

***Inglisia patella* Maskell**

AK. Waitakere Ra, Opanuku Pipeline Tk, underside of leaves of *Pittosporum cornifolium*, 28 Oct 2000, N.A. Martin, #00-139: 2/adm, pupa; Waitakere Ra, Sharp Bush, underside of leaves of *Hedycarya arborea*, 28 Feb 2000, RCH, #00-026: 3/2 pupae, prepupa, 2ndm moult. **BP:** Onepoto Bay, *H. arborea*, underside of leaves, 15 March 1994, RCH, #94-048: 1/1adm. **NN:** Motueka, on *Elaeocarpus*, 2 Feb 1938, G. Brittin #107 (USNM): 1/2 pupae.

***Kalasisis depressa* (Maskell)**

AK. Waitakere Ra., Karamatura V, underside of leaves of *Coprosma arborea*, 21 Oct 1994, RCH, #95-098c: 3/2admm, pupa + pharate pupa; as previous but 8 Oct 1995, RCH, #95-098c: 1/pupa, prepupa.

***Kalasisis perforata* (Maskell)**

No locality, *Coprosma* sp., Nov 1877, W.M.M.: 2/2admm (poor). **MC.** Christchurch, Riccarton Bush, underside of leaves of *Pittosporum eugenioides*, 26 Sept 1997, RCH, #97-135: 6/3admm, 11 pupae.

***Lecanochiton actites* Henderson & Hodgson**

AK. Okura River, midrib on undersurface of leaves of *Metrosideros excelsa*, 25 Oct 1993, RCH, #93-336: 10/8admm, 2 pupae, prepupa, 4 2ndmm.

***Lecanochiton scutellaris* Henderson & Hodgson**

BP. Lottin Point, Otanga, upper leaf surface of *Metrosideros excelsa*, 3 Nov 1993, RCH, #93-366: 2/adm, pupa, pharate prepupa.

***Plumichiton elaeocarpi* (Maskell)**

TO. Wairoho, *Hedycarya arborea* on undersurface of leaves, 29 Sept 1993, RCH, #93-338: 1/adm; as previous, 3 Nov 1993 #93-359: 1/adm.

***Plumichiton flavus* (Maskell)**

No locality: *Ctenochiton flavus*, from *Brachyglottis*, two males, June 1882, W.M.M.: 1/2mm (very poor). **AK.** Riverhead Forest, Barlow Road Res, leaves of *Myrsine australis*, 22 July 1998, RCH, #98-085: 1/prepupa. **GB.** Kakanui, W-East head of Waipohatuhatu Stream, on *Ripogonum scandens*, 22 Sept 1992, RCH, #92-315: 1/adm; Kakanui, 300m, on *Myrsine salicina*, 30 April 1993, RCH #93-083: 1/adm. **FD.** Bligh Sound, Wild Natives River, stems, twigs and leaves of *Weinmannia racemosa*, 21 Jan 1996, RCH, #96-048: 3/2admm, 4 pupae, 3 prepupae.

***Plumichiton nikau* Henderson & Hodgson**

AK. Waitakere Ra., Parau Tk, upperside of leaves of *Rhopalostylis sapida*, 15 March 2000, RCH, #00-034: 2/adm, pupa; as previous, Destruction Gully Tk, 30 April 2000, #00-095: 1/adm, pupal + prepupal moults. **BP.** Te Koau, 243 m, on *R. sapida*, 4 Nov 1993, RCH, #93-363: 1/adm, 2ndm.

***Plumichiton pollicinus* Henderson & Hodgson**

AK. Waitakere Range, Sharp Bush roadside, on *Kunzea ericoides*, 22 March 1998, RCH, #98-052: 1/2 prepupae, 2 pupae; Waitakere Range, Sharp Bush, Mountain Road, on *K. ericoides*, 7 July 1998, RCH, #98-078: 1/adm (pre-emergent), 2 pupae, 2ndm. **CL:** Little Barrier I, Upper Valley track, upperside of leaves of *Leptospermum scoparium*, 6 June 1994, RCH, #94-065: 1/pupa, 3 2ndmm (Paratypes); as previous but numbered #94-084: 1/adm. **SD.** Para Swamp, nr. Picton, *L. scoparium*, 9 Aug 1948, T. G. Sewell (Hoy coll. No. 78): 1/adf, pupa, prepupa; Rocky Creek Bridge, *L. scoparium*, 9 Aug 1948, T.G. Sewell (Hoy coll. No. 74): 1/pupa. **MB.** Waihopai Valley, on *L. scoparium*, 5 Aug 1948, T. G. Sewell (Hoy coll. #73): 4/2 pupae, 2 prepupae. **BR.** Landing (a few miles from Inangahua), *L. scoparium*, 9 Nov 1959, J. G. R. McBurney (FRNZ) R(a)3: 1/adm (very poor).

***Poropeza dacrydii* (Maskell)**

AK. Riverhead Forest, Barlow Road Res, leaves of *Podocarpus totara*, 13 Oct 1995, RCH, #95-109: 4/2admm (1 poor, 1 fair), 3 pupae, prepupa; as previous but collected on 1 Sept 2000 and reared out #00-115; 3/2admm, prepupa; as previous, on stem of *P. totara*, 7 Sept 2000 #00-126: 1/adm.

***Pounamococcus cuneatus* Henderson & Hodgson**

AK. Waitakere Ra., Sharp Bush, underside of leaves of *Blechnum fraseri*, 14 March 1997, RCH, #97-058: 2/adm, 4 pupae, pupal moult; Waitakere Ra., Farley Track, underside of fronds of *B. fraseri*, 15 March 2000, RCH, #00-035: 3/adm, pupa, 2 prepupae.

***Pounamococcus tubulus* Henderson & Hodgson**

FD. Dusky Sound, Cooper I, Sportmans Cove, on *Pseudopanax arboreus*, 7 Feb 1996, RCH, #96-040: 5/3admm, pharate pupa, pupa; Breaksea Sound, Breaksea Is, *P. arboreus*, 29 Jan 1996, RCH, #96-074: 1/pharate 2ndm (very poor); Doubtful Sound, *Pseudopanax [Raukaua] simplex* leaves, 28 Jan 1996, RCH, #96-042: 1/pharate 2ndm (very poor).

***Umbonichiton adelus* Henderson & Hodgson**

AK. Riverhead Forest, Barlow Road reserve, leaves of *Podocarpus totara*, 14 Aug 1997, RCH, #97-125: 1/adm; as previous, #97-126: 1/2 prepupae.

***Umbonichiton bullatus* Henderson & Hodgson**

AK. Waitakere Ra, Destruction Gully Tk, on young stems of *Kunzea ericoides*, 4 May 2000, RCH, #00-091: 6/5admm, 5 pupae, 2 prepupae. **BP.** Waenga Bush, Otanga, on *Prumnopitys ferruginea*, 3 Nov 1994, RCH, #94-099: 1/adm (headless). **GB:** Paoneone, on twigs of *K. ericoides*, 15 Mar 1994, RCH, #94-050: 1/adm, pupal moult.

***Umbonichiton hymenantherae* (Maskell)**

No locality, Maskell slide labelled '*Ctenochiton hymenantherae*', male, from *Hymenanthera* sp., Aug 1884, W.M.M: 1/adm (poor). **GB.** Pohutu, ex *Hedycarya arborea* (undersurface of leaves), 15 March 1994, RCH, #94-046: 1/adm.

***Umbonichiton jubatus* Henderson & Hodgson**

TO. Hauhungaroa Ra, on *Pittosporum turneri*, 7 Nov 1982, C. F. Butcher, #94-110d: 2/2admm, pupa (rather poor), 2 2ndmm.

***Umbonichiton pellaspi* Henderson & Hodgson**

AK. Riverhead Forest, Barlow Road Reserve, leaves of *Podocarpus totara*, 23 March 2000, L. H. Clunie & RCH, #00-045b: 1/adm; as previous, 13 April 2000, RCH, #00-074c: 3/adm, pupa, prepupa.

Species A

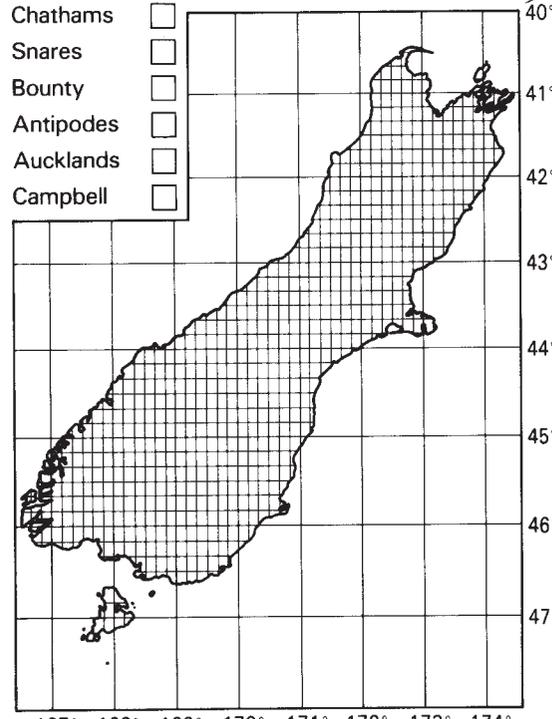
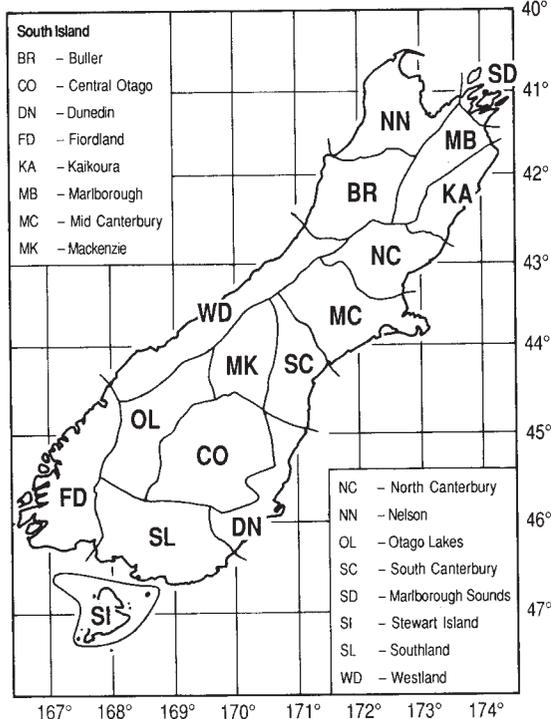
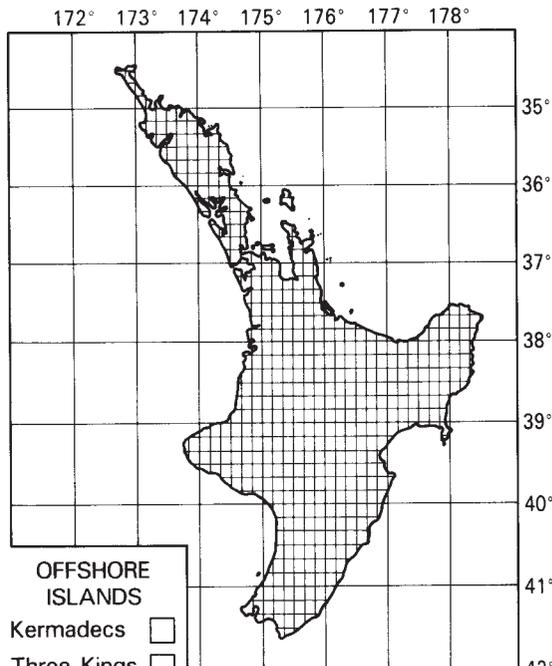
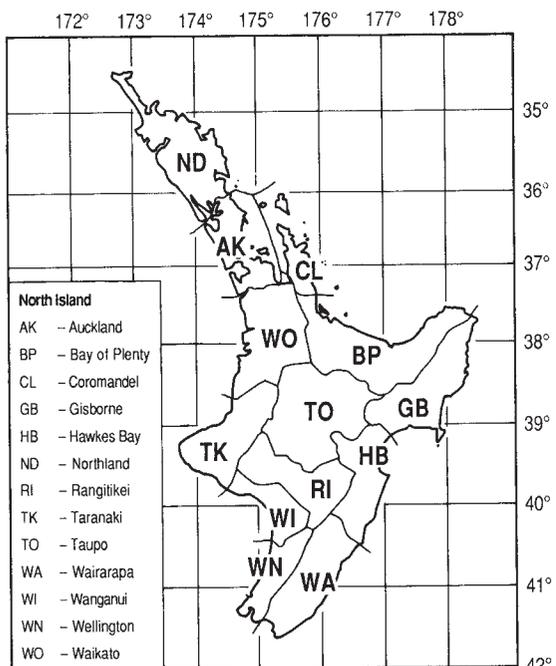
MC. Lyttleton, ex *Myoporum laetum*, no date, Brittin # 110 : 1/adm labelled *Ctenochiton testudo* Brittin (a manuscript name). The adult females collected at the same site were identified as *Crystallotesta fusca* (Maskell) (Hodgson & Henderson, 2000).

TAXONOMIC INDEX:

This index covers the nominal invertebrate taxa mentioned in the text, regardless of their current status in taxonomy. Taxa in bold type are those included in the checklist. Page numbers in bold type denote the start of a description, and in *italic* type a figure. The letter 'k' after a page number indicates a key. Scanning electron micrographs are located on pages 14–15 and colour plates are on pages 23–32.

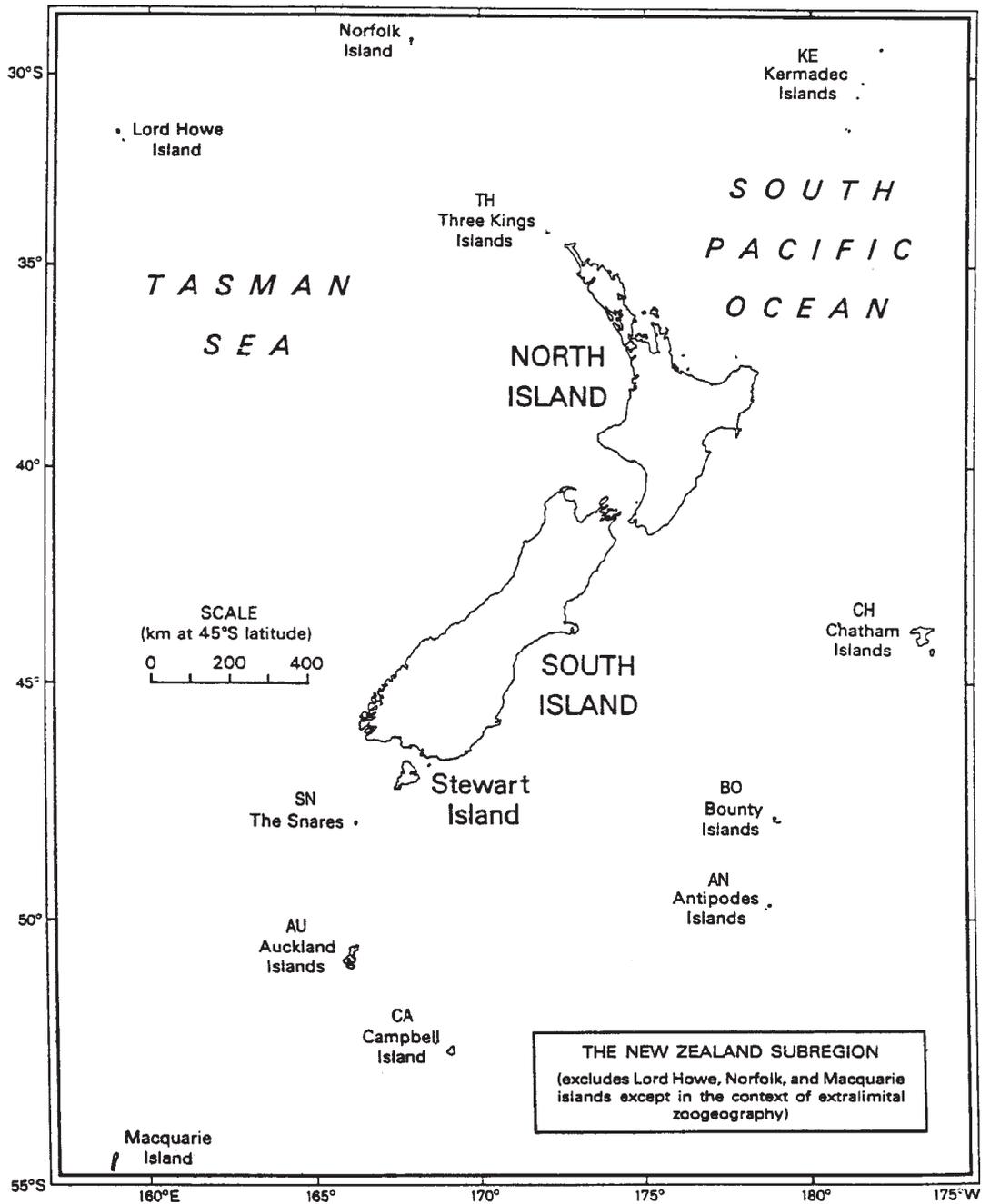
- actites**, *Lecanochiton* 10, 28, 38, 43k, 92, 93, **95**–97, 138, 156, **175**, 176, 197, **211**, 212, 219
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Area codes and boundaries used to categorise specimen locality data (after Crosby *et al.* 1976)

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



The New Zealand subregion with area codes (from Crosby *et al.* 1998).

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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.*

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

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Te utu (tirohia “Titles in print”, whārangi 225). Ko te kōpaki me te pane kuini kei roto i te utu. Me utu te hunga e noho ana i Aotearoa me Ahitereiria ki ngā tāra o Aotearoa. Ko ētahi atu me utu te moni kua tohua, ki ngā tāra Merikana, ki te nui o te moni rānei e rite ana.

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