

Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.

Systematics and Biogeography of the New Zealand
Sub-Family Crambinae (Lepidoptera: Pyralidae)

Volume II - plates

A thesis presented in partial fulfilment
of the requirements for the degree of
Doctor of Philosophy (Ph.D) in Zoology
at Massey University, Palmerston North,
New Zealand.

David Edward Gaskin

1968

MASSEY UNIVERSITY LIBRARY



1061960759

NOTE

Where possible each figure in this volume is cross-referenced to the appropriate page or pages in volume I. However in the case of the systematic charts, which are referred to many times throughout the text, this is not practical.

CONTENTS

Diagrammatic representations of systematic relationships of crambine genera, species groups and species -----Figs.	1 - 8
Forewing patterns -----Figs.	9 - 12
Wing venation -----Figs.	13 - 35
Pupal cremasters -----Fig.	36
Keys to anatomy of male and female genitalial systems -----Figs.	37 - 42
Systematic drawings of male genitalia:	
<u>Orocrambus</u> -----Figs.	43 - 87
<u>Maoricrambus</u> -----Fig.	88
<u>Kupea</u> -----Fig.	89
<u>Corynophora</u> -----Fig.	90
<u>Tawhitia</u> -----Figs.	91 - 92
<u>Pareromene</u> -----Figs.	93 - 111
<u>Tauroscopa</u> -----Figs.	112 - 115
	and Fig. 204a
<u>Gadira</u> -----Figs.	116 - 124
	and Figs. 126, 127
<u>Hednota</u> -----Fig.	125
<u>Paragadira</u> -----Fig.	128
<u>Protyparcha</u> -----Fig.	129 - 130
Systematic drawings of female genitalia:	
<u>Orocrambus</u> -----Figs.	131 - 172
<u>Maoricrambus</u> -----Fig.	173

<u>Corynophora</u> -----	Fig. 174
<u>Tawhitia</u> -----	Figs. 175 - 176
<u>Pareromene</u> -----	Figs. 177 - 193
<u>Tauroscopa</u> -----	Figs. 194 - 197 and Fig. 204b
<u>Gadira</u> -----	Figs. 198 - 201
<u>Paragadira</u> -----	Fig. 202
<u>Protyparcha</u> -----	Figs. 203 - 204
Key to larval head capsule anatomy-----	Fig. 205
Head capsule patterns of <u>Orocrambus</u> larvae -----	Fig. 206 - 212
Crambine chaetotaxy (larval)-----	Fig. 213
Key to setae	
Chaetotaxy of crambine species-----	Fig. 214 - 225
Distribution maps -----	Fig. 226 - 300

THE APPLICATION OF PHYLOGENETIC SYSTEMATICS IN
THEORY AND PRACTICE - GUIDE TO FIGS.1-8.

The method of phylogenetic systematic analysis used in this thesis was propounded by Dr W.Hennig in two important papers ('Systematik und Phylogenese', Ber.Hundertjahrf.Deut.Entomol.Ges. Berlin 1957,pp.50-71, and 'Phylogenetic systematics',Ann.Rev.Ent. 1965,pp.97-116). He considered that unassailable reconstruction of the history of phyletic groups could only be carried out through detailed comparative study of 'plesiomorphic' (relatively primitive) and 'apomorphic' characters (derived or advanced relative to the primitive condition in any given instance). By his reasoning, only a pattern of apomorphic characters could be used to demonstrate that species and genera formed truly monophyletic groups with common lines of descent.

The reason for selecting this system is quite straightforward. The author believes that the systematic approach to a group in need of revision should be logical,consistent,and if possible subject to some kind of scaled quantitative plan, to facilitate comparison with other revisions. The only other method which allows this approach is the currently popular discipline generally referred to as 'numerical taxonomy',the mechanics of which have been propounded by Sokal and his co-workers (for example see 'Typology and empiricism in taxonomy', R.R.Sokal,J.Theoret.Biol.3,pp.230-67,1963). One of the tenets of this system is that characters shall not be weighted by the taxonomist; in practice this frequently results in associations of plesiomorphic characters having considerable and unwarranted attention focussed on them (Hennig 1965),since they show a high degree of statistical significance for correlation and hence presumed relationship. The proponents of this system tend to completely or partially ignore the vital factors of parallelism and convergence (Gunther 1963,A critical review of the above paper by Sokal in Ber.Wiss.Biol.,A,191,p.70, and Hennig,1965). Hence it is hard to see how their results can be interpreted in terms of real phylogenetic relationships, despite protestation to the contrary. Only in the case of enzymatic studies on micro-organisms could this approach be presently considered to be fruitful,since here a worker can code possible pathways of actual

molecular evolution.

Hennig's approach is essentially relative, and presupposed that detailed consideration of parallelisms and convergence has been carried out so that such can be eliminated from the phylogenetic analysis. Fig.i shows a highly simplified study of relationships which might be found to exist between 5 hypothetical species A,B,C,D and E by analysis using 'Hennig's Principle'. Black squares indicate the derived or apomorphic condition of a character, and a white square the relatively plesiomorphic condition. Arrows indicate the direction of character development. A shaded area between black squares indicates monophyly. In each following figure the small numbers represent the character with the same number in the accompanying key; each number above an arrow, indicating the direction of development has its parallel in the numbers within the matrix of the systematic 'tree' beneath the set of squares. The lower numbers enable one at a glance to make an assessment of the relative positions of the genera or species groups within the figure without looking up among the squares for the same number to see which characters are regarded as representing a major division.

For example, character 1 might, in fig.i, be a wing coupling mechanism composed of several elements in the primitive condition, but which shows a relative advance (in species D in this case), to a fused or partially fused condition. Of course the plesiomorphic condition might be found in the rest of this family, and perhaps even in other families too. Common ancestry of species A,B, and C could not be proposed on this point alone. However the three species might share another character (2, derived, judged by the experience of the taxonomist familiar with the group), from a generalized primitive condition present in species D, and perhaps in other species too. In reality of course the monophyletic descent of the ABC complex is unlikely to be based on a single character). Despite the apparent 'apomorphic character development & exchange from D to A,B,C, (indicated by the direction of the arrow, showing development from the primitive to the derived), we still could not postulate common ancestry of D with ABC unless we could find at least one character found in the apomorphic condition in

A,B,C, and D, but not in other species. Similarly, on the strength of the pattern of hypothetical characters shown in fig.i, E is totally unrelated to ABC and D, since they share only the the bottom character in the diagram, a plesiomorphic one (white). This could be a negative one such as 'walking legs not modified', shared by many other totally unrelated families of insects, for example. The A- E matrix in this diagram is held together only by the condition of 'symplesiomorphy' (Hennig,1965), which is not a valid base on which to discuss monophyly.

The characters 2- 6 in the rest of the diagram correspondingly provide a successively finer focus on the relationships firstly between AB and C, and then between A and B. We might postulate that the taxonomist would decide to give generic status to ABC, since it formed a natural grouping, and also generic status to D. Certainly E would merit separate status. Within genus ABC there might be considered to be two species groups, or in older taxonomic terminology, subgenera, with AB in one and C in the other, since B is more closely related to A than to C. AB in Hennig's nomenclature are 'sister species', while AB and C are 'sister groups'.

The weakness of this system of course, as with all systematics, is that in the final analysis, selection of character priorities- their relative importance, must lie with the taxonomist. However experience has shown (Hennig 1965), that this is better than allowing blind mechanical selection of character associations without consideration of environmental pressures which may have led to parallelism and convergence. His system is more rigorously critical of monophyletic postulations than any other yet devised. For deeper discussion the reader is referred to Hennig's original papers (1957,1965).

Fig.1. cont.

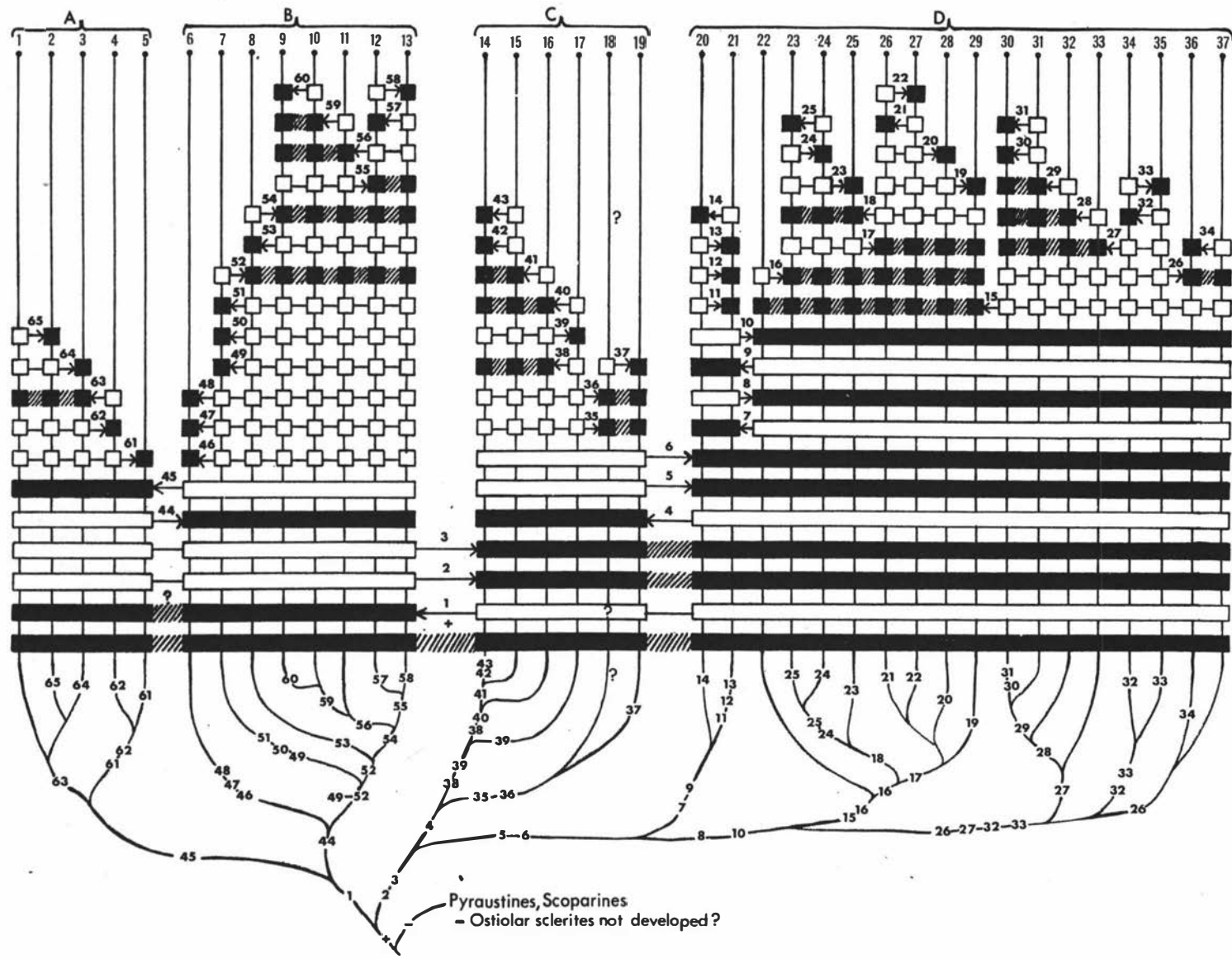
43. Ostiolar pouch very strongly developed into large bulb. 44. Ostiolar sclerites developed in lateral positions relative to ostium bursae. 45. Ostiolar sclerites developed in dorsal and ventral positions relative to ostium bursae. 46. Sacculus elaborately developed. 47. Hindwing discal cell open. 48. Sterigmal spines developed in intersegmental membrane between seventh and eighth sternite positions, apparently from posterior extremities of ostiolar sclerites. 49. Ostiolar sclerites very strongly developed with large brush of short setae, possibly with sensory function, only basal portions invaginated into ostium. 50. Strong setae developed on valval costa. 51. Aedoeagus apically bifid. 52. Tendency for ostiolar sclerites to be reduced. 53. Reduction of venation, semi-apterous forms. 54. Loss of primary (?) juxtal attachment to posterior extremity of aedoeagus. 55. Pseudosaccus developed. 56. Juxta strongly V-shaped, often apically setulose. 57. Huge cornutus frequently developed. 58. Chaetosemae lost. 59. Strong tendency to total sclerite loss in ostium bursae. 60. Tendency to development of transtilla. 61. Vinculum with characteristic lateral transparent "window". 62. Gnathos sharply angled dorsad. 63. Vinculum/saccus with deep anterior cup developed in most species. 64. Hindwings with m_2 stalked. 65. Forewing veins Sc, r_1 concurrent in most species.

Fig.1. cont.

characteristic "clog-shaped" coalescence of lateral lobes. 8. Forewing veins r_5, r_4 stalked. 9. Saccus with characteristic ventral leaf-like posterior extension. 10. Pseudosaccus developed. 11. Juxta folded into saddle shape. 12. Costa strongly produced into long prong. 13. Vinculum strongly developed. 14. Gnathos much reduced. 15. Sacculus strongly developed. 16. Female frenulum split. 17. Sacculus lobed. 18. Sacculus spined. 19. Signa completely lost. 20. Gnathos virtually lost. 21. Sacculus distally truncate. 22. Sacculus distally serrate. 23. Signa lost from corpus bursae. 24. Eighth abdominal sternite lost in all species. 25. Frons conical in all species. 26. Very dense ring of flattened scales on caudal margin of seventh abdominal sternite in female. 27. Anterior apophyses totally lost. 28. Female frenulum split. 29. Female frenulum of 3 elements. 30. Uncus spatulate. 31. Signa lost from corpus bursae. 32. Eighth abdominal sternite lost. 33. Sacculus showing weak degree of development, but never more than a small flange on inner surface of valve. 34. Aedoeagus with complex internal or external ornamentation. 35. Pseudosaccus developed. 36. Juxta lost. 37. Proboscis atrophied. 38. Juxta strongly developed, U or V-shaped. 39. Ostiolar sclerites fused medially, very long and protruding, posteriorly forked. 40. Valvae strongly asymmetrical. 41. Forewing r_5 stalked with r_4 . 42. Signa lost from ostium bursae.

Fig.1. Chart showing the systematic relationships within the Crambinae. Apomorphic characters shown in black, relatively plesiomorphic characters in white. Key to letters: A.Tribe Diptychophorini. B.Tribe Chiloini. C.Tribe Acigonini. D. Tribe Crambini. Top row of numbers indicates genera as follows; 1. Tamsica. 2. Pareromene. 3. Microchilo. 4. Diptychophora. 5. Microcausta. 6. Euchromius. 7. Paragadira. 8. Proty-parcha. 9. Tauroscopa. 10. Gadira/Hednota. 11. Chilo. 12. Talis. 13. Eschata. 14. Pseudoclasseya. 15. Pseudo-catharylla. 16. Classeya. 17. Acigona/Haimbachia. 18. Ancylolomia. 19. Calamotropha. 20. Corynophora. 21. Tawhitia. 22. Metacrambus. 23. Catoptria. 24. Chryso-teuchia. 25. Xanthocrambus. 26. Fernandocrambus. 27. Crambus. 28. Angustalius. 29. Flavocrambus. 30. Maoricrambus. 31. Orocrambus. 32. Agriphila. 33. Chrysocrambus. 34. Pediasia. 35. Fissicrambus. 36. Parapediasia. 37. Microcrambus.

Key to numbers within systematic scheme: 1. Ostiolar sclerites invaginated. 2. Ostiolar sclerites evaginated. 3. Strong tendency for eighth abdominal tergite to fuse with ostium bursae. 4. Ostiolar sclerites strongly developed in lateral positions relative to ostium bursae. 5. Ostiolar sclerites strongly developed in dorsal and ventral positions relative to ostium bursae. 6. Strong tendency to loss of anterior apophyses in most genera, and reduction of these structures in remaining genera relative to other tribes. 7. Anal papillae with very



Pyraustines, Scoparines
 - Ostiolar sclerites not developed?

Fig.2. Systematic relationships of Orocrambus with Maoricrambus, and of the species groups (1-5, shown by uppermost row of numbers) within the genus. Apomorphic characters shown in black, relatively plesiomorphic characters in white.

Key to numbers in systematic scheme: 1. Female frenulum triple. 2. Signa lost from corpus bursae. 3. Spatulate uncus. 4. Costa with characteristic vertical flange, sometimes produced into prong. 5. Ostiolar sclerites strongly fused into tube, and whole ostiolar region greatly elongate and coiled. 6. Aedoeagus sigmoid. 7. Cornuti lost from aedoeagus. 8. Strong development of saccus, usually very elongate. 9. Tendency to broad lateral development of vinculum. 10. Juxta lost. 11. Aedoeagus not inordinately elongate, but with long apical spur. 12. One signum on corpus bursae much reduced relative to other. 13. Juxta loss. 14. Ductus bursae with characteristic spiral pleating. 15. Saccus developed, usually elongate. 16. Juxta lost.

Fig.3. cont.

63. Aedoeagus with large thorn developed. 64. Cornuti secondarily lost in O.lewisi. 65. Sacculus flanged. 66. Eighth abdominal sternite weak. 67. Aedoeagus with ornamentation. 68. Saccus truncate apically. 69. Large thorn on aedoeagus. 70. Ostium bursae encircled by eighth abdominal tergite in female. 71. Cornuti reduced. 72. Costa strongly developed dorsally on valve. 73. Valve with subapical point. 74. Gnathos clubbed. 75. Aedoeagus with extra lateral thorn. 76. Costa of valve elongate antero-posteriorly. 77. One signum greatly reduced relative to other. 78. Sacculus flanged. 79. Ostium bursae complex. 80. Gross cornuti present in aedoeagus. 81. Female frenulum element reduced by fusion of one pair of elements. 82. Prong of valval costa clubbed. 83. Gnathos clubbed. 84. Ostium bursae encircled by eighth abdominal tergite. 85. Aedoeagus ornamented. 86. Aedoeagus with large thorn. 87. Cornuti reduced in size. 88. Compound eye diurnal type, with nude peri-orbital strip. 89. Saccus very elongate. 90. Aedoeagus rifle-shaped. 91. Aedoeagus with sub-apical thorn. 92. Eighth abdominal sternite weak in female. 93. Gnathos clubbed.

Fig.3. cont.

25. Sacculus with flange. 26. Aedoeagal thorn grossly developed, triangular. 27. Sacculus flanged. 28, 29. Ostium bursae encircled by eighth abdominal tergite. 30. Well developed ostiolar pouch present in female ductus bursae. 31. One signum reduced relative to the other. 32. Eighth abdominal sternite weak, lunate. 33. Sacculus flanged. 34. Aedoeagus ornamented. 35. Eighth abdominal sternite lost. 36. Aedoeagus with spur developed. 37. Sacculus flanged. 38. Ostium bursae not simple, complexly formed. 39. Female frenulum split into 6 elements. 40. Ostium bursae encircled by eighth abdominal tergite. 41. Ostiolar pouch swollen and corrugated. 42. Forewings with apices very acute, forewings very elongate, narrow. 43. Largest element of female frenulum at least partially split. 44. Aedoeagus with apical spur and lateral thorn. 45. Forewing termen with characteristic sigmoid sinuation. 46. Forewing pattern horizontal, darker posteriorly. 47. Aedoeagus with flat spur. 48. Ostium bursae encircled by eighth abdominal tergite. 49. Frons conical. 50. Ostium bursae with pouch region grossly swollen. 51. Costa of valve with dorsal prong developed. 52. Eighth abdominal sternite weak in female. 53. Eye diurnal type with nude peri-orbital strip. 54. Aedoeagus ornamented. 55. Costa of valve with prong developed dorsally. 56. Sacculus flanged. 57. Ostium bursae encircled with eighth abdominal tergite. 58. Frons conical. 59. Both signa greatly enlarged, diamond-shaped. 60. Frons conical. 61. Females with narrow reduced forewings, tending towards semi-apterous condition. 62. Aedoeagal ornamentation reduced.

Fig.3. Systematic relationships within Orocrambus.

Apomorphic characters shown in black, and relatively plesiomorphic characters in white.

Upper row of numbers indicate species as follows:

1. Orocrambus apicellus. 2. O.haplotomus. 3. O.dicrenellus.
4. O.flexuosellus. 5. O.horistes. 6. O.mylites. 7. O.aethonellus. 8. O.catacaustus. 9. O.fugitivellus.
10. O.tritonellus. 11. O.machaeristes. 12. O.heliotes.
13. O.thymiastes. 14. O.ventosus. 15. O.melampetrus.
16. O.clarkei. 17. O.scoparioides. 18. O.philpotti.
19. O.oppositus. 20. O.ephorus. 21. O.angustipennis.
22. O.melitastes. 23. O.corruptus. 24. O.ornatus.
25. O.cyclopicus. 26. O.jansoni. 27. O.lectus. 28. O.lewisi. 29. O.abditus. 30. O.simplex. 31. O.crenaeus.
32. O.ordishi. 33. O.heteraulus. 34. O.harpophorus.
35. O.ramosellus. 36. O.siriellus. 37. O.tuhualis.
38. O.vulgaris. 39. O.isochoytus. 40. O.scutatus. 41. O.paraxenus. 42. O.vittellus. 43. O.callirrhous. 44. O.enchophorus. 45. O.xanthogrammus.

Key to numbers in systematic scheme: 1-16 as in fig.2.

17. Aedoeagus with apical thorn greatly reduced. 18. Eighth abdominal sternite reduced or absent in female. 19. Frons conical. 20. Eighth abdominal sternite lost in female. 21. Aedoeagus with spur developed. Aedoeagus also far longer and narrower than in any other species in this group. 22. Compound eye diurnal type, with nude peri-orbital strip. 23. Strong aedoeagal thorn at dorso-posterior apex. 24. Aedoeagal thorn elongate and flattened.

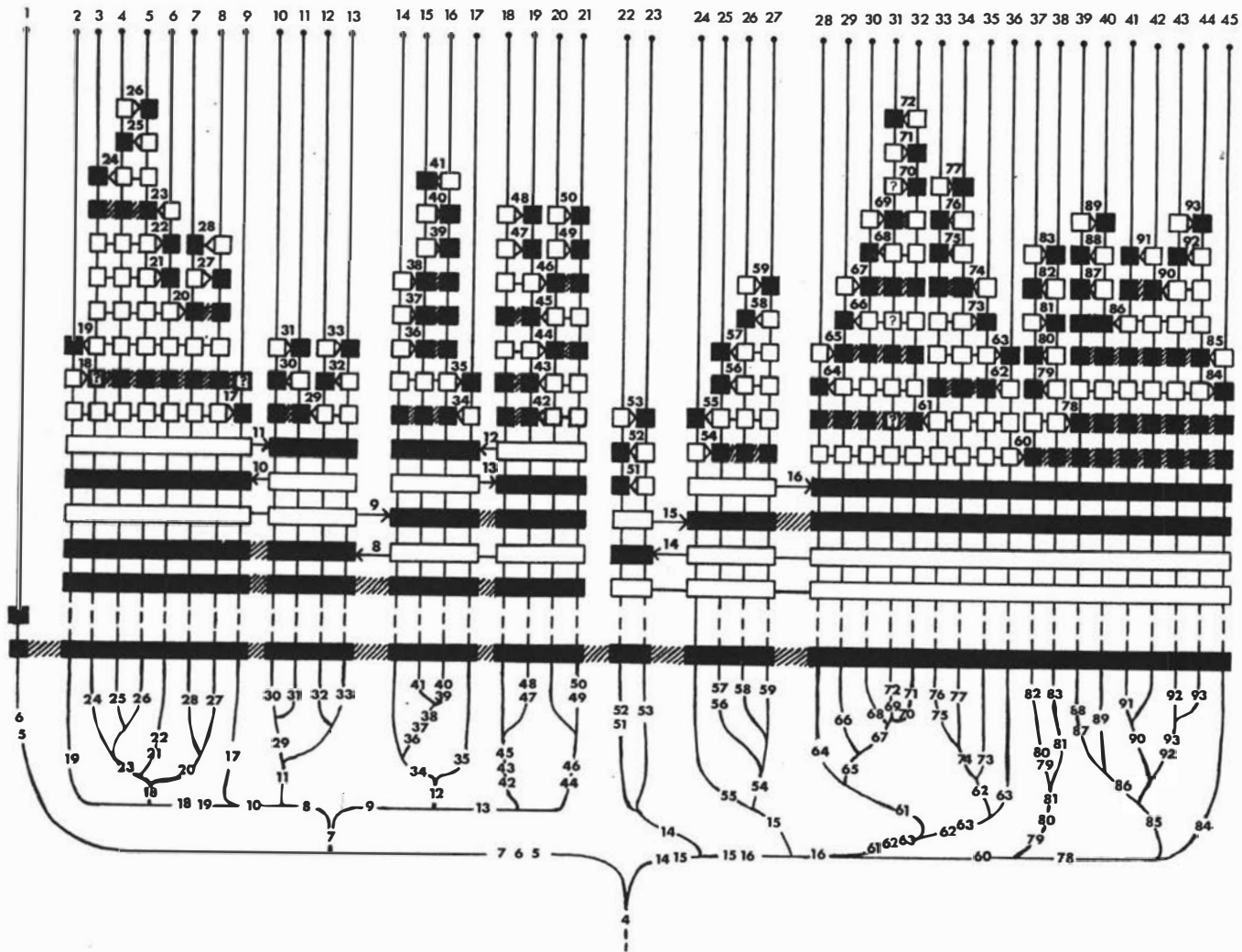


Fig.4. Systematic relationships within Pareromene.

Species groups (1-10) shown by upper row of numbers. Apomorphic characters shown in black, relatively plesiomorphic characters in white.

Key to numbers in systematic scheme: 1. Ventral vinculum with pair of anterior lobes, saccus poorly developed. 2. Saccus deeply cupped and rounded dorsally, anteriorly. 3. Gnathos elaborate. 4. Juxta complex. 5. Juxta bilobate apically. 6. Juxta apically setulose. 7. Gnathos strongly hooked apically. 8. Anellar lobes on juxta. 9. Gnathos with "toothbrush" apex. 10. Gnathos apex with "toothbrush" structure both dorsally and ventrally. 11. Costa deeply folded introrse ventrally. 12. Aedoeagus with ductus ejaculatorius entering dorso-anteriorly. 13. One large cornutus or spur present in or on aedoeagus. 14. One cornutus permanently everted into apical thorn. 15. Large cornutus developed, but remaining internal. 16. Uncus reduced in length. 17. Aedoeagus with apical permanently everted sac. 18. Uncus reduced in length. 19. Cornuti linearly arrayed, reduced in size. 20. Scoop-shaped gnathos. 21. Costal prong strongly developed on valve. 22. Valval costae strongly asymmetrical between the two valves. 24. Single large cornutus very elongate. 34. Uncus and gnathos hooked, apically swollen. 44. Stalked ostiolar pouch present on female ductus bursae. 45. Tendency for elongation or splitting of apical thorn on aedoeagus.

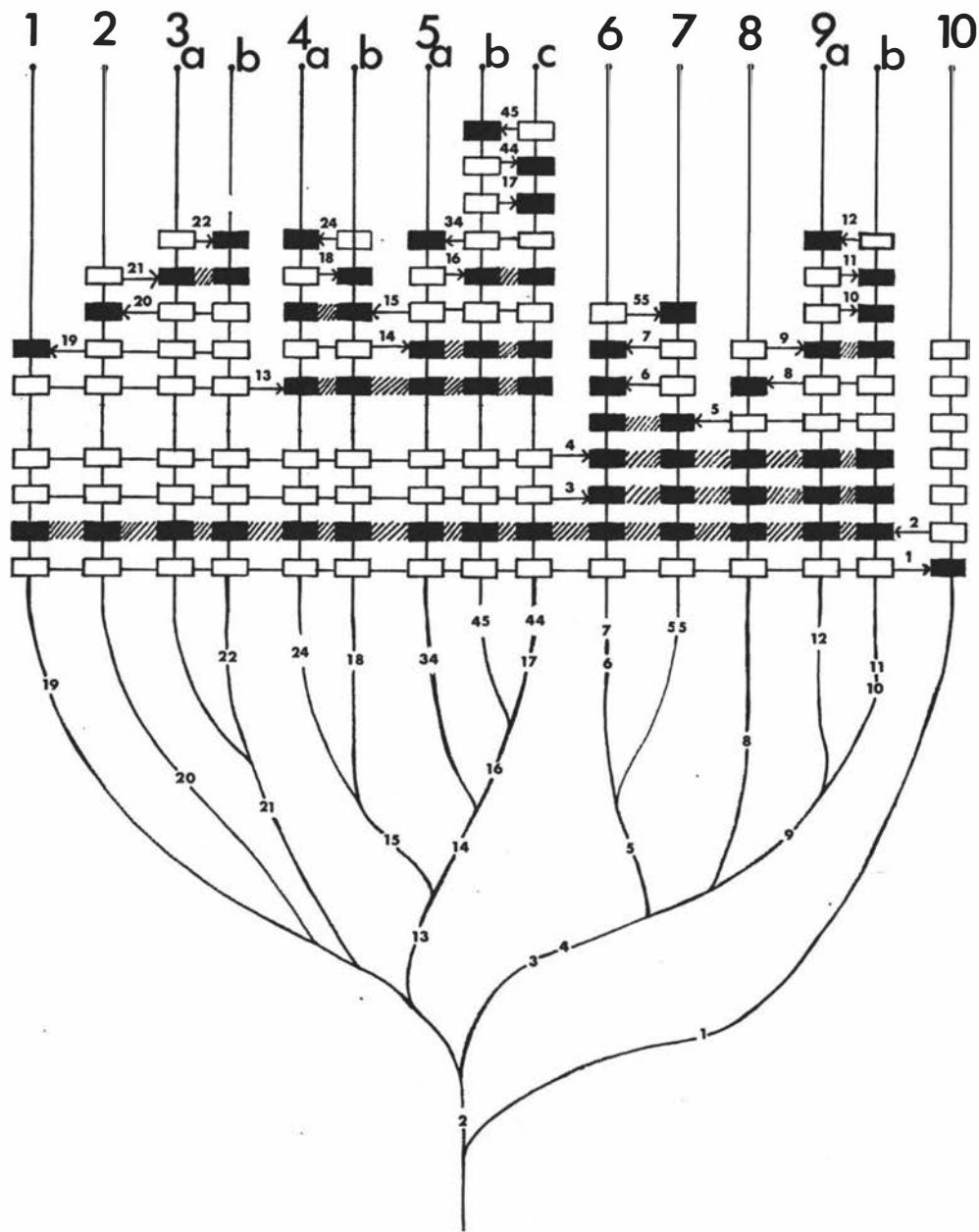


Fig.5. cont.

partly divided. 34. Uncus and gnathos swollen apically, strongly hooked. 35. Valval costa with two prongs. 36. Juxta medially constricted. 37. Juxta narrowed posteriorly. 38. Costal prong of valve clubbed. 39. Elongate everted cornutus present. 40. Ostium bursae flattened posteriorly. 41. Signa lost from corpus bursae. 42. Juxta stellate. 43. Juxta anteriorly truncate. 44. Ostiolar pouch present, distinctly stalked. 45. Tendency for elongation or splitting of thorn. 46. Juxta reduced in size. 47. Aedoeagal thorn completely divided. 48. Ostium bursae with **excavate** posterior margin to ventral sclerite. 49. Very elongate prong on valval costa. 50. Apical thorn twisted. 51. Elongate aedoeagal pouch present. 52. Very strong valval costa. 53. Tapered juxta. 54. Very elongate costal prong. 55. Juxta drawn posteriorly into two sharp prongs. 56. Juxta elongate. 57. Strong external thorn developed. 58. Cornuti lost. 59. "Toothbrush" structure strongly developed on gnathos. 60. Costa of valve with elongate prong. 61. Valval apex cleft. 62. cornuti reduced. 63. Juxta deeply cleft posteriorly. 64. Internal cornuti totally lost or permanently everted. 65. Very heavily sclerotised juxta.

Fig.5. Systematic relationships of the species of Pareromene. Species shown by upper row of numbers as follows:

1. P.chrysochyta. 2. P.euchromiella. 3. P.selenaea.
4. P.tripunctata. 5. P.omeishani. 6. P.parthenie.
7. P.gurri. 8. P.leucoxantha. 9. P.harmonica.
10. P.ajaxella. 11. P.auriscriptella. 12. P.bipunctella.
13. P.morobella. 14. P.elaina. 15. P.helioclypa.
16. P.lepidella. 17. P.moriokensis. 18. P.minutalis.
19. P.copernici. 20. P.vermeeri. 21. P.interrupta.
22. P.metallifera. 23. P.planetopa. 24. P.microdora.
25. P.bilinealis. 26. P.parorma. 27. P.pyrsophanes.
28. P.holanthes. 29. P.epiphaea. 30. P.ramona.
31. P.paradisella. 32. P.albilinealis. 33. P.subalbilinealis.
34. P.lathonia. 35. P.melistoma. 36. P.exsectella.
37. P.rosannoides. 38. P.rosanna. 39. P.electra.
40. P.ochracealis. 41. P.mutuurella.

Key to numbers in systematic scheme, apomorphic characters shown in black, relatively plesiomorphic characters in white: 1 - 22 as in Fig.4. 23. Costal prong of valve strongly developed. 24. One large cornutus greatly elongated. 25. Accessory cornuti lost. 26. Length of costa reduced relative to valve. 27. Costa with two prongs. 28. Costal length reduced relative to valve. 29. Juxta reduced posteriorly to narrowing lobe. 30. Cornutus with swollen base. 31. Length of costa relative to valve much reduced. 32. Ductus with sub-apical swollen region in female. 33. Cornutus fish-hooked,

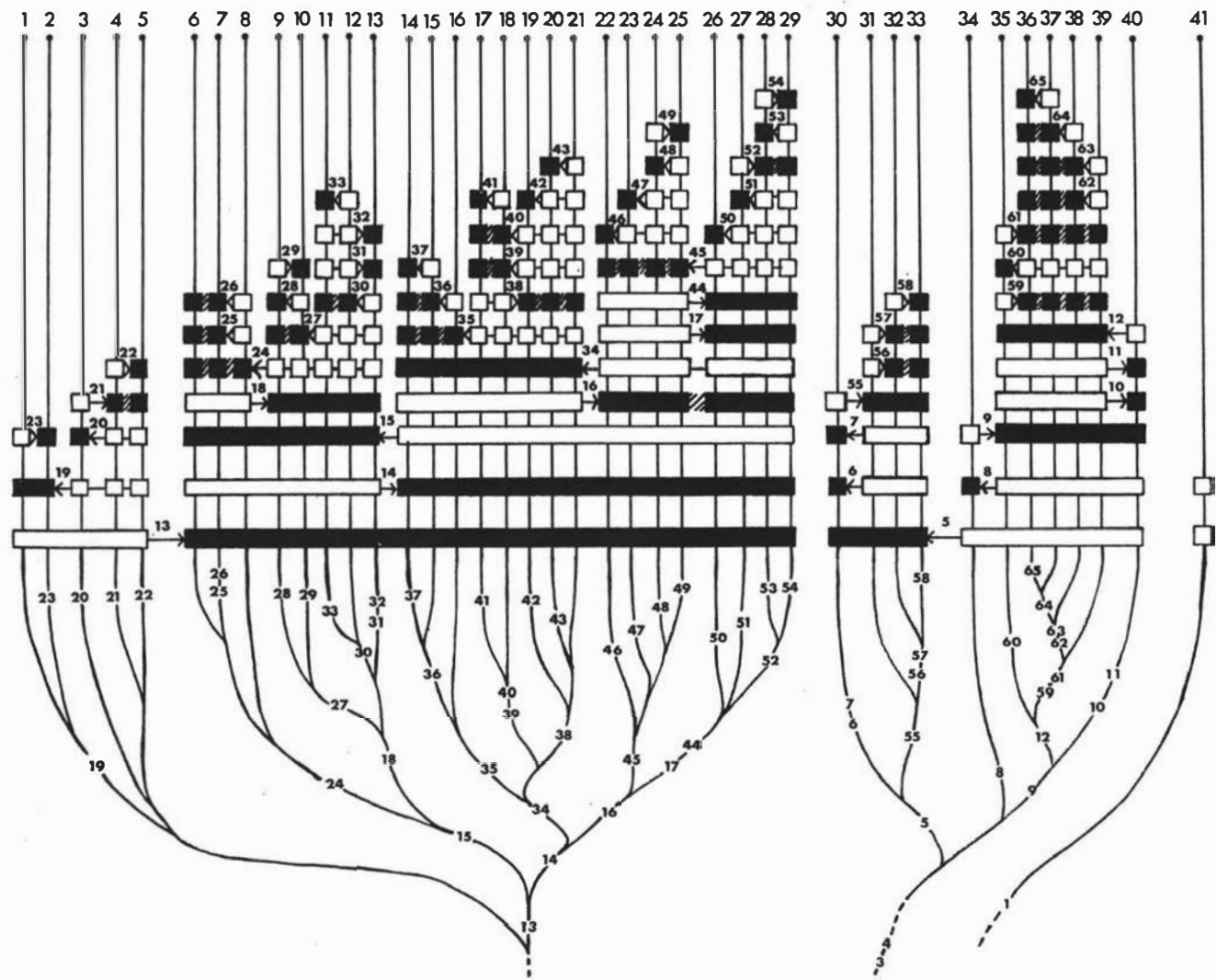


Fig.6. Chart of systematic relationships of the relatively primitive genera Corynophora and Tawhitia with other Crambini. Apomorphic characters shown in black, relatively plesiomorphic characters in white.

Key to symbols: A. Tawhitia pentadactyla, B. Tawhitia glaucophanes, Numbers within systematic plan:

1. Hindwing cell open.
2. Eighth abdominal tergite fused with ostium bursae.
3. Pseudosaccus not developed in these two genera.
4. Forewing vein r_5 not stalked with r_4 in these two genera.
5. Anal papillae fused.
6. Saccus/vinculum with ventral leaf-like posterior extension.
7. Relative reduction in size of gnathos.
8. Juxta/anellus folded into saddle shape.
9. Costal prong of valve strongly separated from valvula.
10. Sacculus of valve with strong elongate prong.
11. Gnathos reduced in size in T.glaucophanes relative to T.pentadactyla.
12. Vinculum arms swollen, quadrate.
13. Lamella postvaginalis very elongate relative to lamella antevaginalis.

Corynophora

Tawhitia

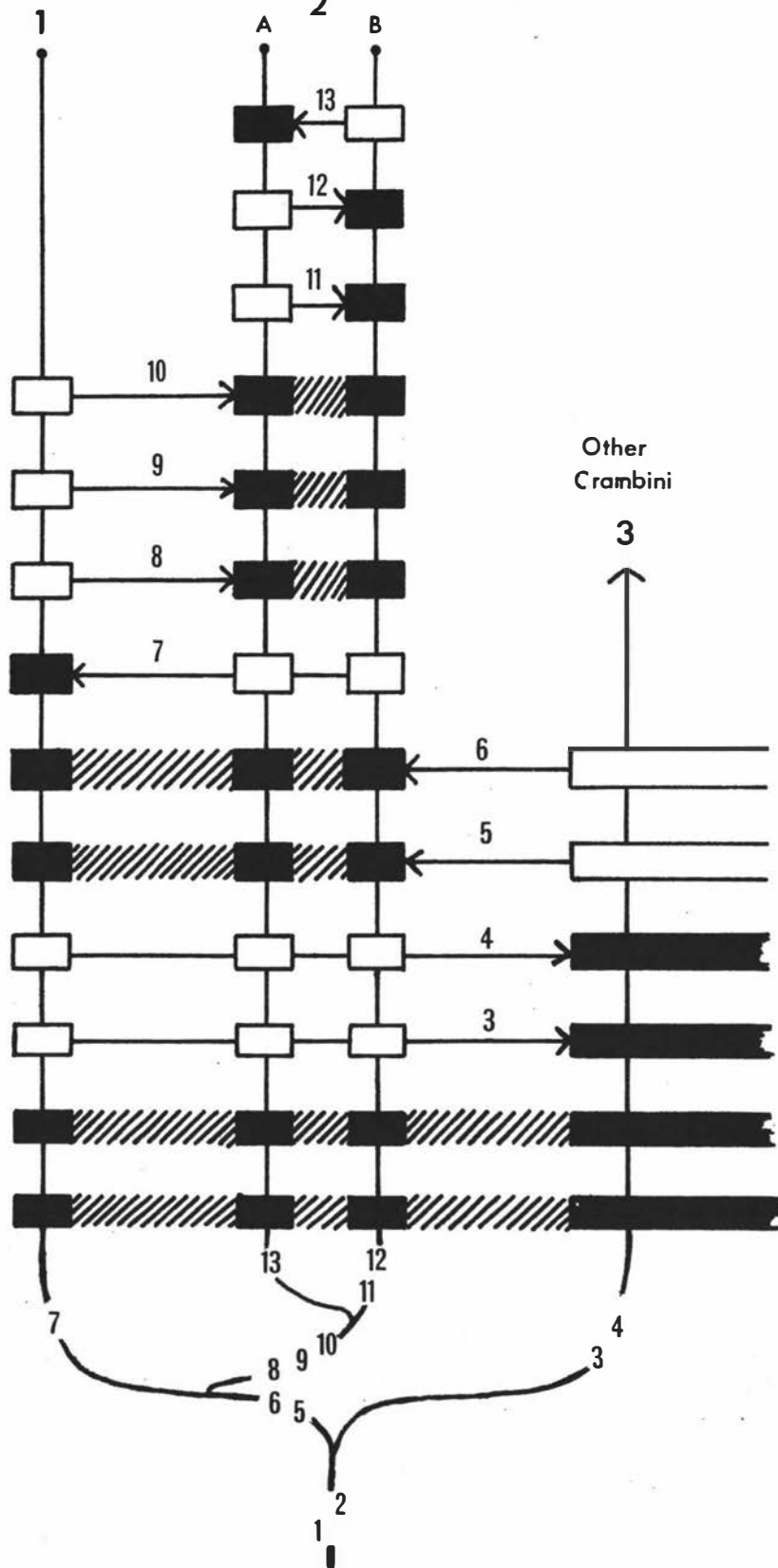


Fig.7. Chart of systematic relationships of the species of Tauroscopa, and of the genus as a whole with the Gadira/Hednota complex. Key to species: 1. Tauroscopa callixutha. 2. T.lachnea. 3. T.notabilis. 4. T. trapezitis. 5. T.gorgopis. Numbers within the systematic plan: 1. Tendency for spinose elaboration of valval costa. 2. Tendency for development of a transtilla. 3. Bell-shaped, flattened ostium bursae. 4. Cold-climate morphological adaptations- hairy palpi, melanism, compound eye with nude periorbital strip. 5. Transtilla strongly formed in New Zealand species. 6. Ostiolar sclerites functionless, totally internally and tending to be lost in New Zealand species. 7. Lateral transparent plane of weakness in eighth abdominal tergite of Australian species. 8. Juxta/anellus with serrate lobes in trapezitis and gorgopis. 9. Cornuti/thorns lost within aedoeagus. 10. Ostiolar sclerites almost completely absent. 11. Signa lost from corpus bursae in gorgopis. 12. Juxtal/anellar lobes bifid. 13. Juxta quadrilobate from base, with ventral prongs apically fused together. 14. dorsal lobes of juxta/anellus serrate. 15. Cornuti or thorns absent in aedoeagus of lachnea. Apomorphic characters shown in black, relatively plesiomorphic characters in white.

Tauroscopa

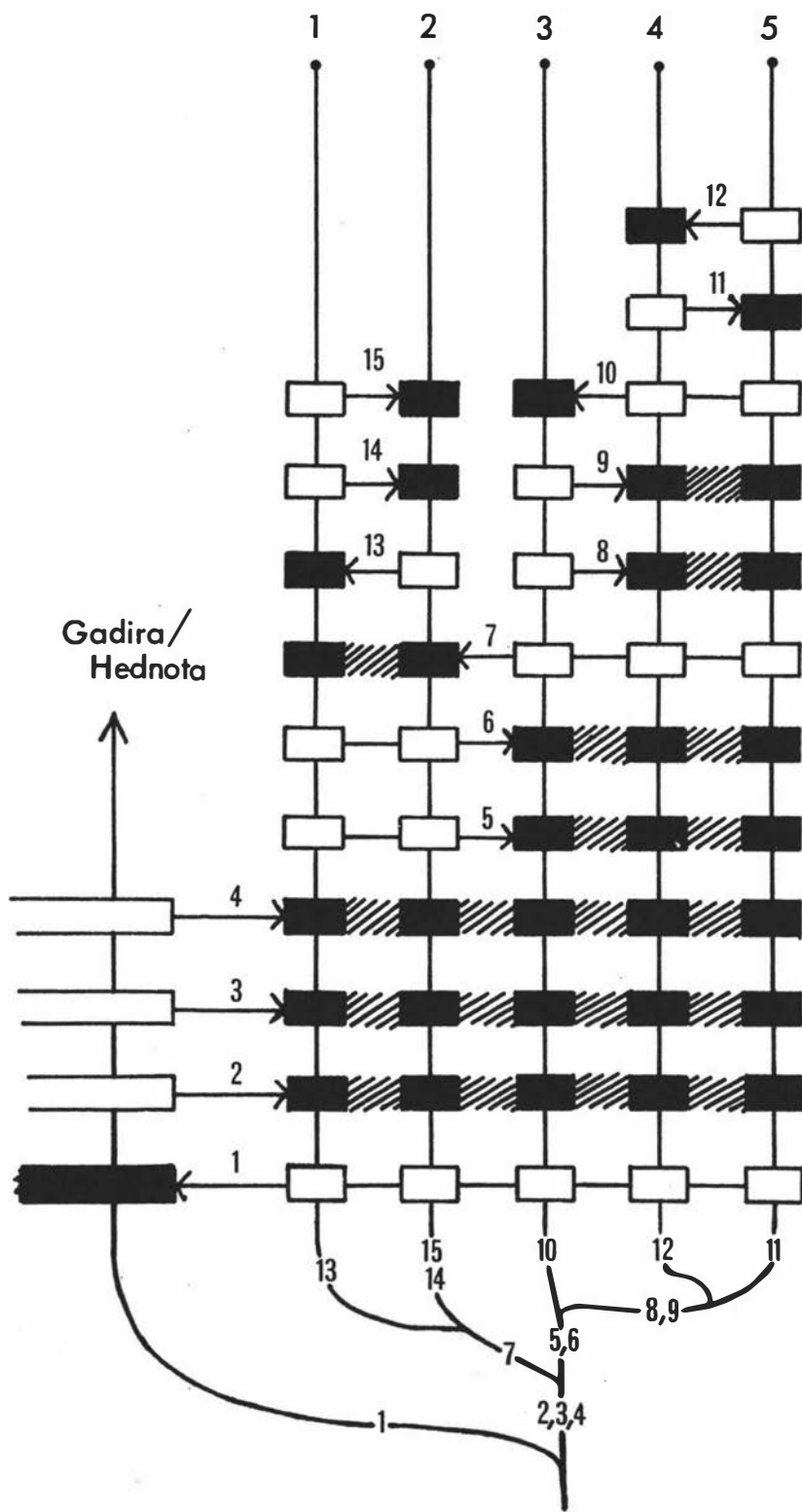


Fig.8 - cont.

17. Valve showing strong costal separation. 18. Size of vinculum/saccus reduced relative to that in G. panselenella. 19. Quadrilobed juxta. 20. Aedoeagus with apical prong. 21. Strong tendency to elaborate cornuti in the aedoeagus. 22. Only one large very elongate cornutus present. 23. Cornuti massed in a series of linear ranks. 24. Ostiolar sclerites greatly reduced within ostium bursae. 25. Elongate cornutus with two or more points. 26. Cornutus with three or more points. 27. Anellus/juxta with short median stalk. 28. Costal prong elongate (longer than uncus). 29. Ostium bursae with pouched swollen region. 30. Ostiolar sclerites almost totally lost. 31. Cornuti lost from aedoeagus. 32. Very complex juxta/anellus developed. 33. Juxta/anellus with further development of large median stalk.

Fig.8. Chart of systematic relationships within the Gadira/Hednota complex, and of the complex with Tauroscopa and Chilo. Key to symbols and uppermost

numbers: A. Hednota bifractella. B. H. empheres.

1,2a,2b,3,4 are the species groups of Gadira. Lower row of numbers indicates species as follows:

1. Gadira vittella. 2. G. gramella. 3. G. panselenella.
4. G. petraula. 5. G. acerella. 6. G. pedionoma.
7. G. panteucha. 8. G. ancylosticha. 9. G. pleniferella.
10. G. longipalpella. 11. G. crypsichroa. 12. G. haplotypa. 13. leucophthalma.

Key to numbers within systematic scheme, apomorphic characters shown in black, relatively plesiomorphic characters in white: 1. Tendency for reduction of ostiolar sclerites. 2. Tendency for development of large diamond-shaped signum. 3. Strong internal fusion of sclerites. 4. Tendency for spinose costal elaboration on valve. 5. Transtilla developed. 6. Bell-shaped, flattened ostium bursae. 7. Morphological modifications to cold-climate conditions (see fig.7). 8. Anellus encircling aedoeagus. 9. Very elongate re-curved costal lobe on valve. 10. Valve bearing thorny ampulla. 11. Eighth abdominal tergite with lateral swellings in female. 12. Valve having costa strongly produced. 13. Tendency towards constricted vinculum and ventrally cupped saccus. 14. Valval costa strongly lobed. 15. Vinculum with partial lateral constriction. 16. Gnathos strongly fish-hooked.

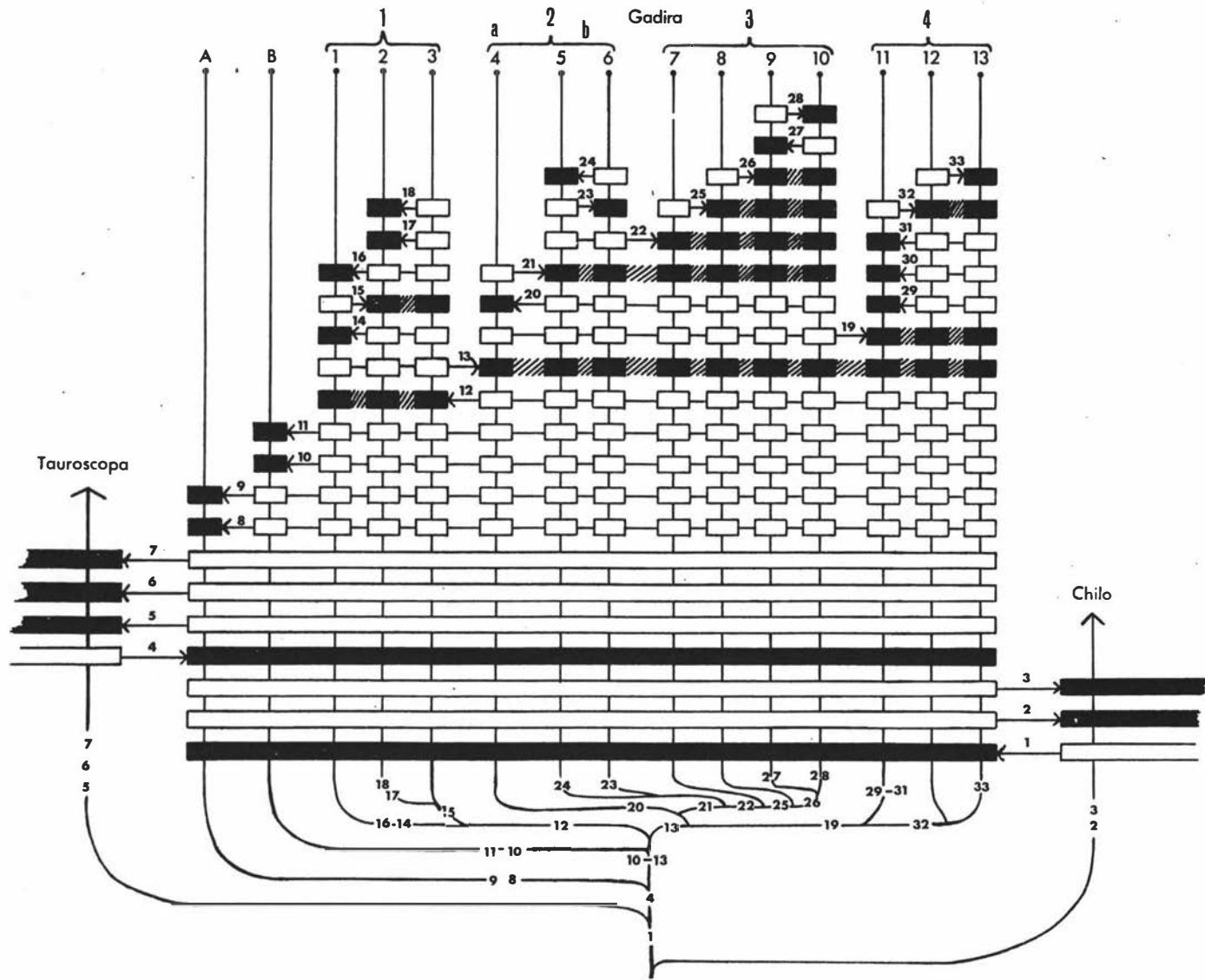


Fig.9 Forewing pattern variation
in Orocrambus vittellus.

Above: vapidus, nexalis form
(Lake Tekapo).

Centre: typical vittellus
(Palmerston North).

Below: conopias form.

(p.207-8)

Fig.10 Forewing pattern variation
in Tawhitia glaucophanes.

Above: Mt Burns form.

Centre: typical form
(Macetown).

Below: leonina form (Takitimus)

(p.226)

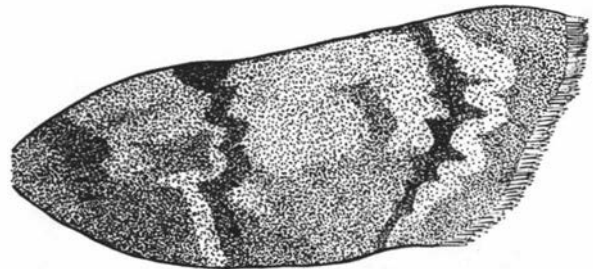
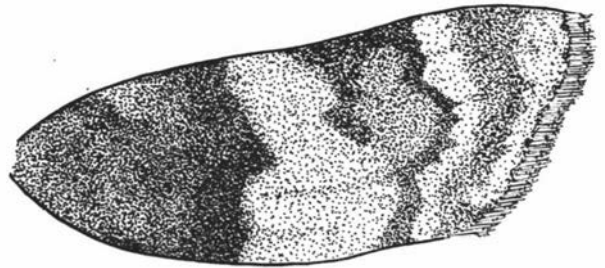
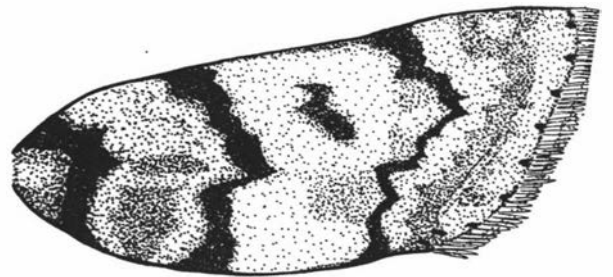
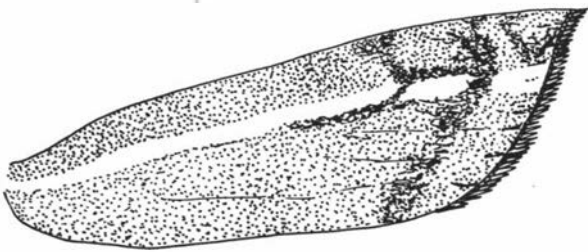
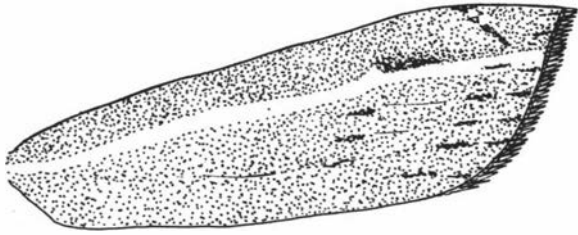
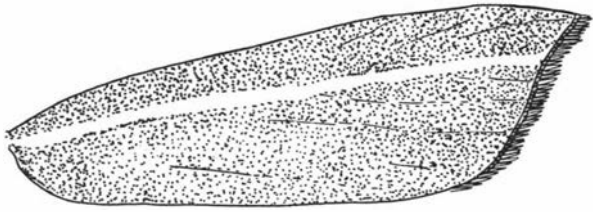


Fig.11 Forewing pattern variation in
Orocrambus ramosellus.
Above: typical form (Wellington).
Others: various specimens of
apselias form; Cass,
Waiouru (2), Mt. Grey (Cant.).

(p.175)

Fig.12 Forewing pattern variation in
Orocrambus vulgaris.
Above: dark form (Wairarapa).
Second, third: typical form
(Palmerston North).
Fourth: typical obstructus form
(Winchmore, Cant.).
Fifth: extreme obstructus form
(Winchmore, Cant.).

(p.209)

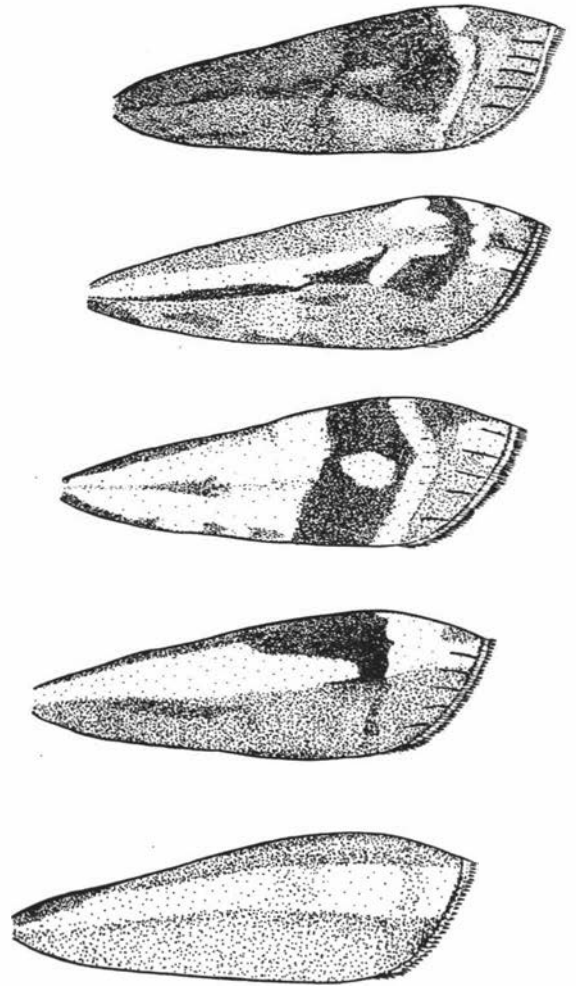
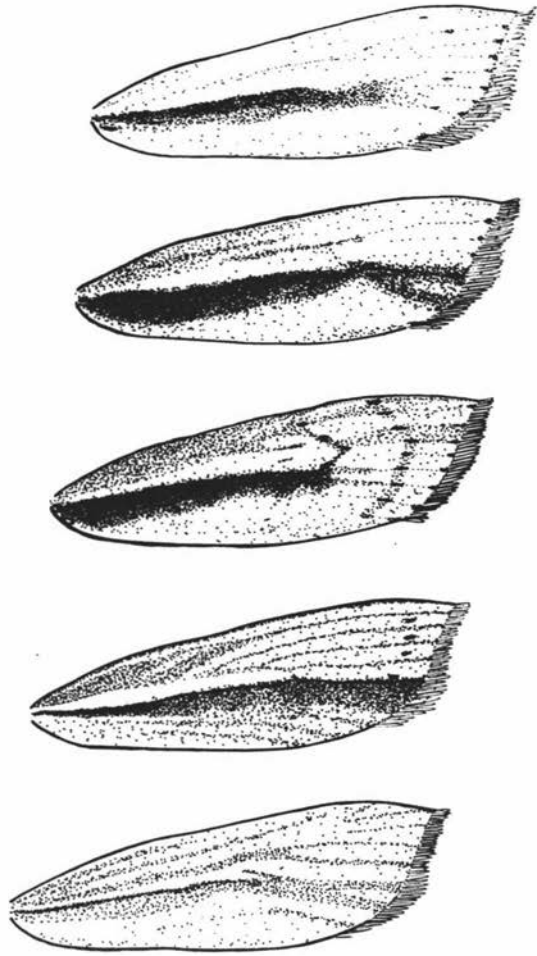


Fig.13 Venation of Homoeosoma
farinaria (Phycitinae)

Fig.14 Venation of Pyralis
farinalis (Pyralinae)

Fig.15 Venation of Eudoria
diphtheralis (Scopariinae)

Fig.16 Venation of Wittlesia
sabulosella
(Scopariinae)

(see: discussion on subfamily relationships, pp.21-27)

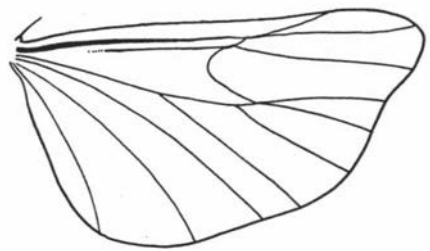
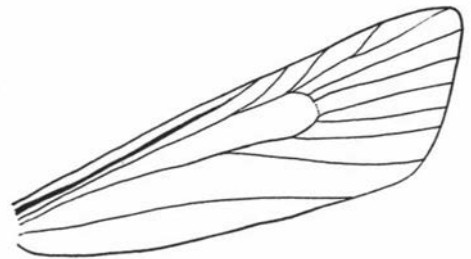
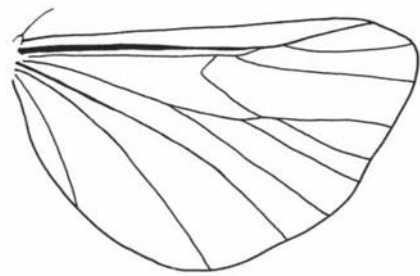
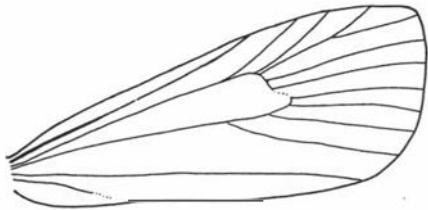
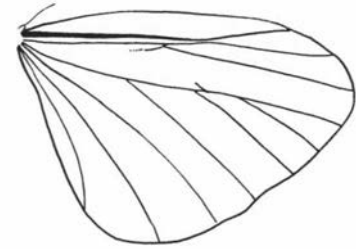
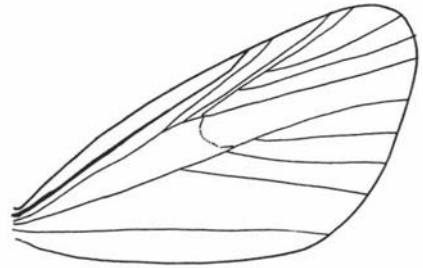
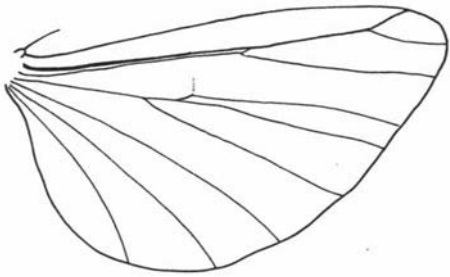
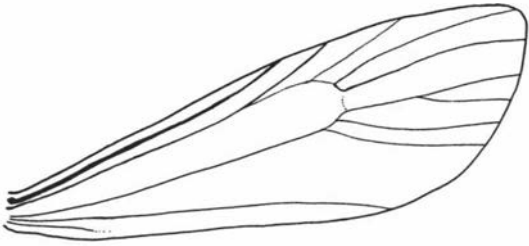


Fig.17 Venation of Orocrambus
vittellus (Crambini)
(p.200)

Fig.18 Venation of Orocrambus
clarkei clarkei (Crambini)
(p.127-3)

Fig.19 Venation of Orocrambus
clarkei clarkei (Crambini)
(II, drawn from nebulosa
syntype specimen) (p.127-3)

Fig.20 Venation of Orocrambus
clarkei eximia (Crambini)
(p.127-3)

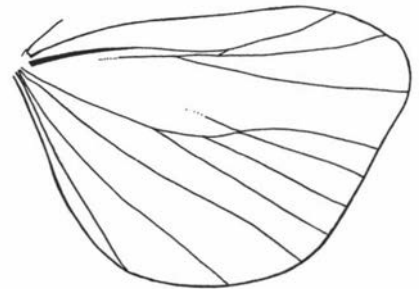
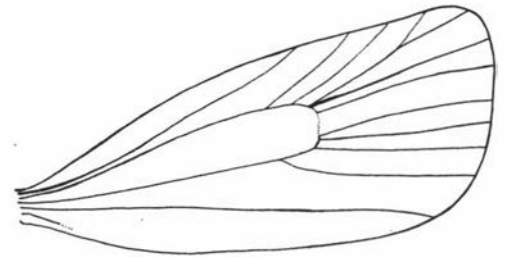
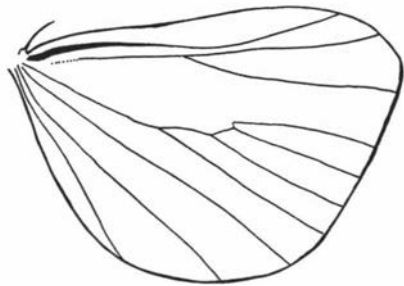
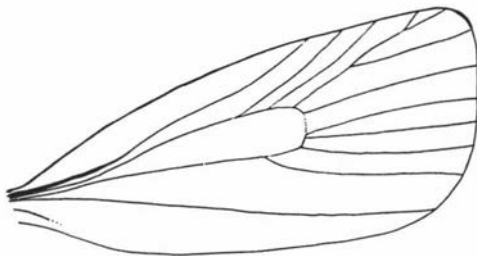
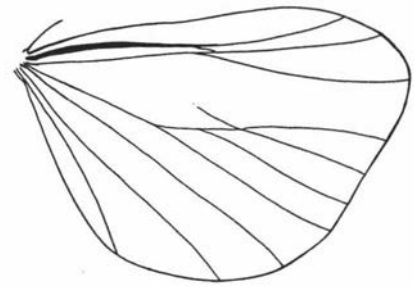
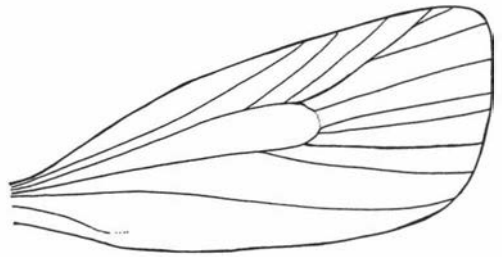
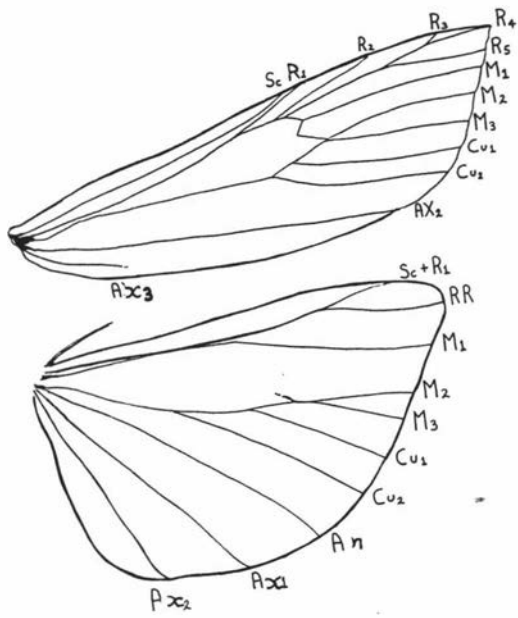


Fig.21 Venation of Orocrambus
lindsayi (Crambini)
(p.217)

Fig.22 Venation of Angustalius
malacelloides (Crambini)
(p.221)

Fig.23 Venation of Kupea
electilis (Crambini)
(p.222)

Fig.24 Venation of Corynophora
lativittalis (Crambini)
(p.231)

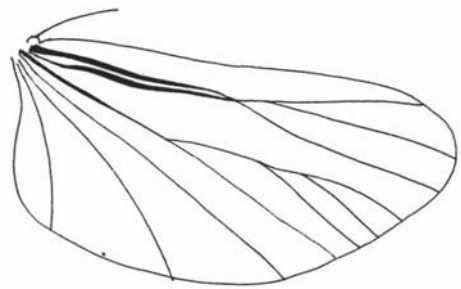
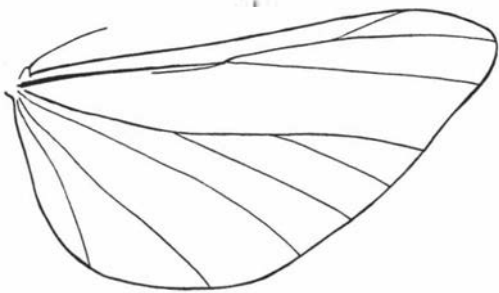
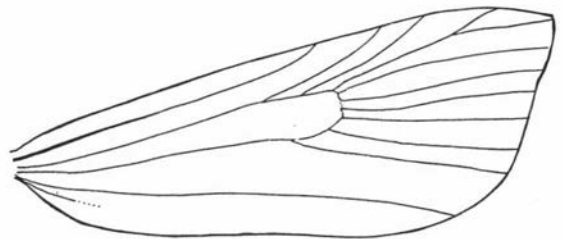
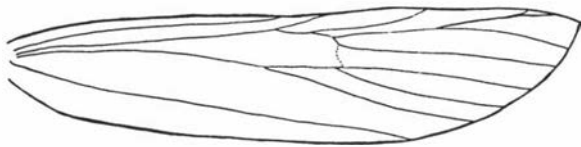
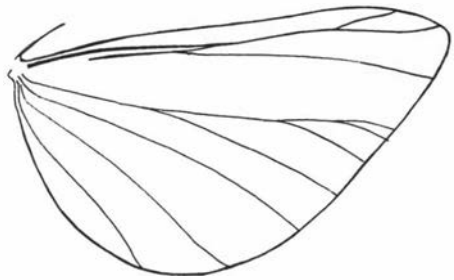
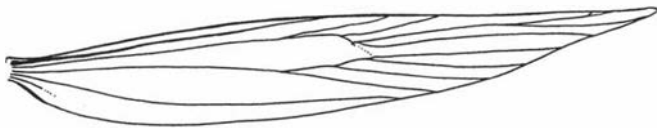


Fig.25 Venation of Tawhitia
glaucophanes (Crambini)
(p.226)

Fig.26 Venation of Pareromene
metallifera
(Diptychophorini)
(p.273)

Fig.27 Venation of Pareromene
epiphaea (Diptychophorini)
(p.279)

Fig.28 Venation of Tauroscopa
gorgopis (Chiloini)
(p.292)

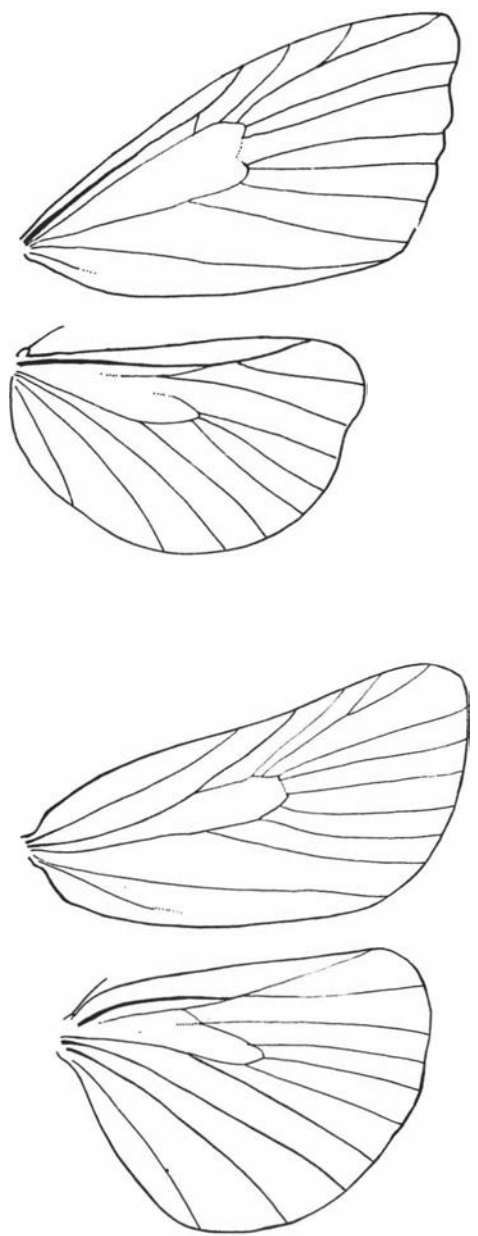
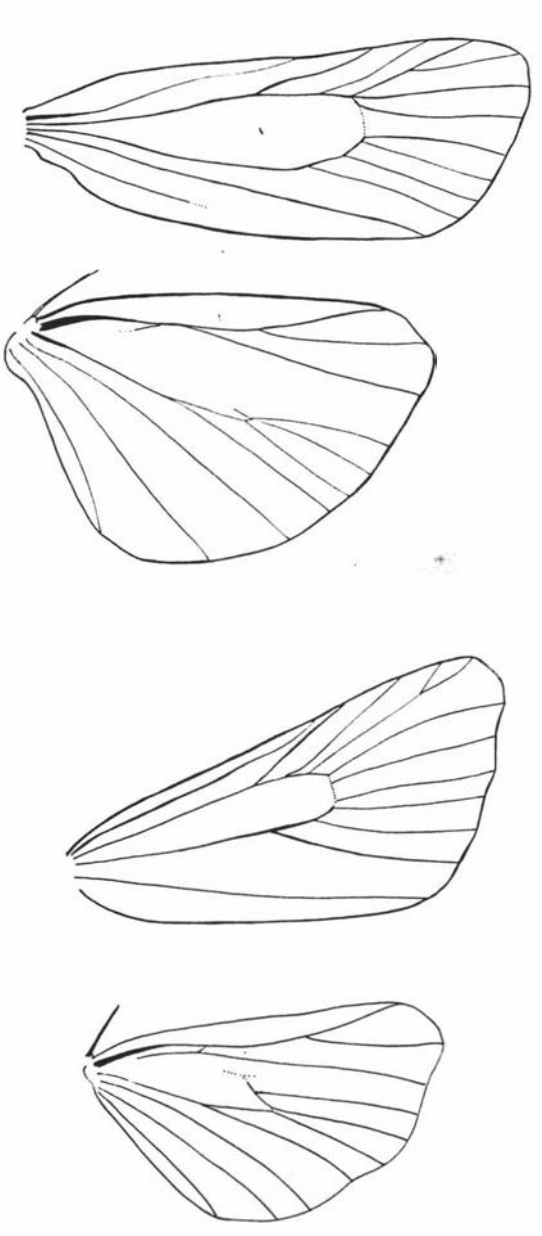


Fig.29 Venation of Gadira
acerella (Chiloini)
(p.319)

Fig.30 Venation of Gadira
petraula (Chiloini)
(p.317)

Fig.31 Venation of Gadira
leucophthalma (Chiloini)
(p.329)

Fig.32 Venation of Hednota
bifractella (Chiloini)
(p.304)

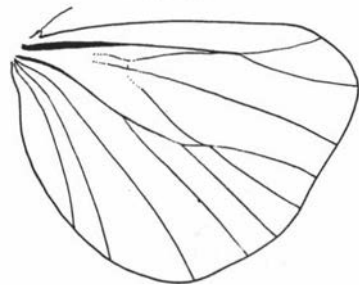
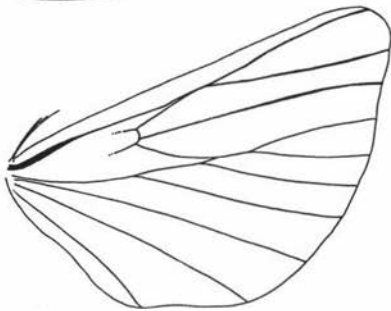
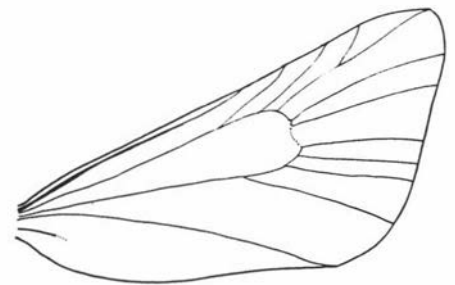
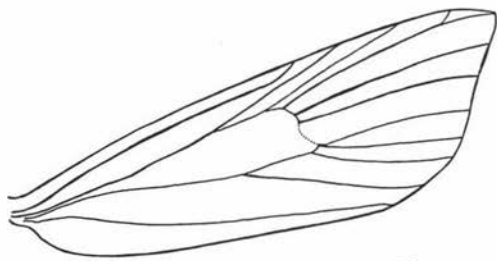
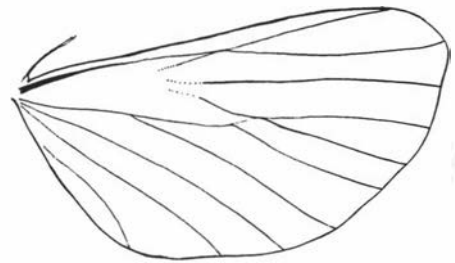
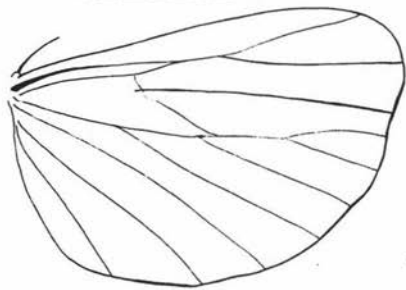
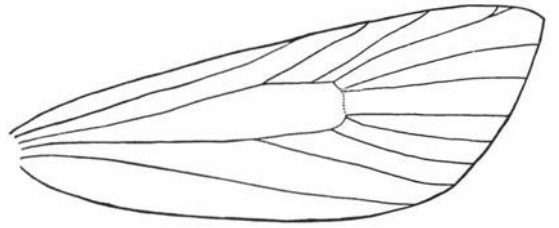
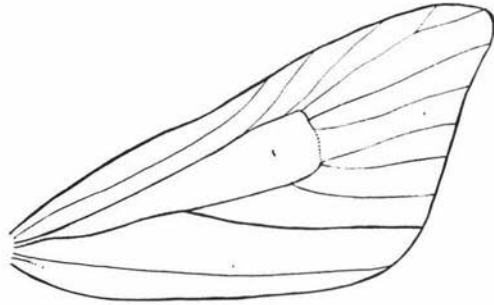


Fig.33 Venation of Paragadira
strophea (Chiloini)

(p.331)

Fig.34 Venation of Protyparcha
scaphodes (Chiloini?)

(p.334)

Fig.35 Venation of Protyparcha
graminea (Chiloini?)

(p.336)

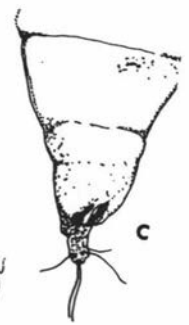
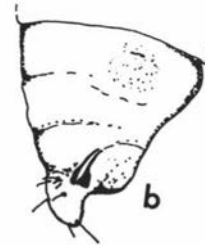
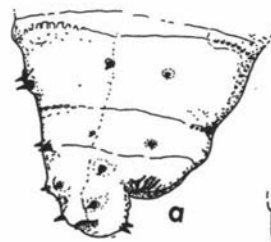
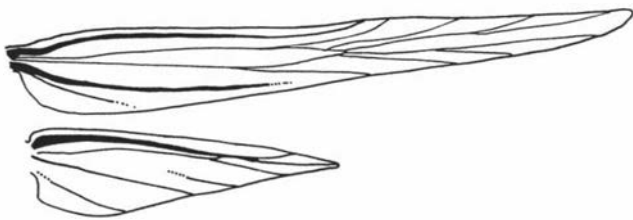
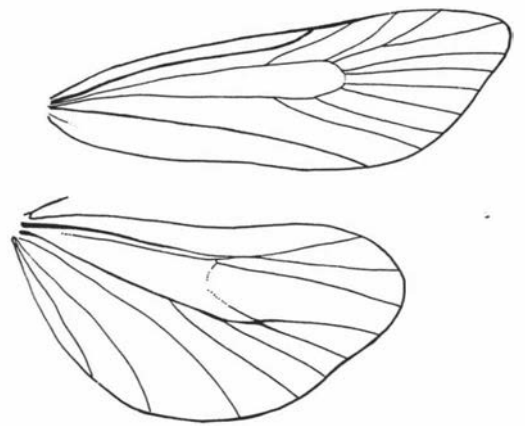
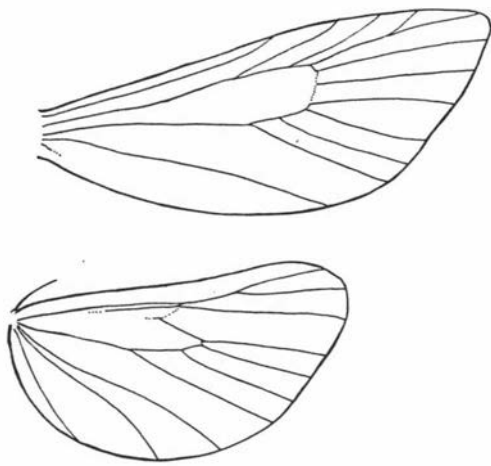
Fig.36 Anal segments of pupae: (right lateral
aspect)

a. Tauroscopa gorgopis

b. Orocrambus flexuosellus

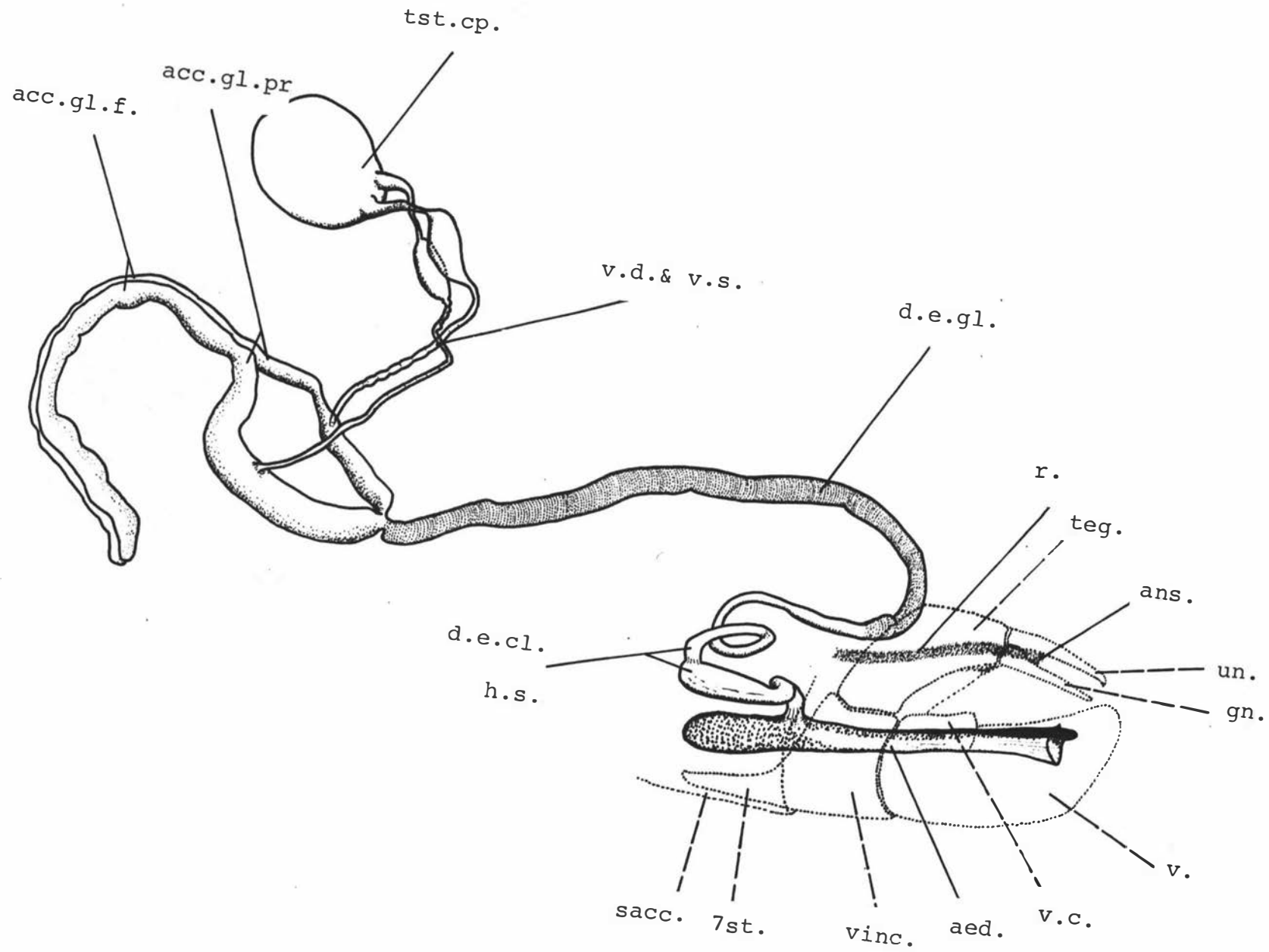
c. Pareromene elaina

(p.48-9)



- Fig.37 Dissected male genitalia of typical crambine species (Orocrambus flexuosellus) (see pp 11-15)
- Fig.38 Generalized diagram of ectodermal structures in crambine male genitalia (see pp.11-15)
- Fig.39 Diagram of organ position in Orocrambus flexuosellus during copulation (see p.18)

Legends: 7t, seventh tergite; teg., tegumen; un., uncus; gn., gnathos; c.f., costal flange; v.c., valval cucullus; v., valve; c.l., costal lobe; saccl.fl., sacculus flange; saccl., sacculus; tr., transtilla; psd., pseudosaccus; sacc., saccus; 7st., 7th sternite; k., keel of saccus; aed., aedoeagus; anl., anellus; cr., cornuti; th., aedoeagal thorn; a/j.h., anellar/juxtal horn; j., juxta; acc.gl.f., fused portion of accessory gland; acc.gl.pr., paired portion of accessory gland; tst.cp., testis capsule; v.d.&v.s., vas deferens with seminal vesicles; d.e.gl., glandular part of ductus ejaculatorius; d.e.cl., clear portion of ductus ejaculatorius; h.s., hydrostatic(?) sac; ans., anus; r., rectum; ev.vs., everted vesica; o.b., ostium bursae; d.b., ductus bursae; d.s., ductus seminal o., ostium; vinc., vinculum; A. Form of saccus in Tawhiti
 B. Form of saccus in Gadira; C. Form of saccus in Pareromene



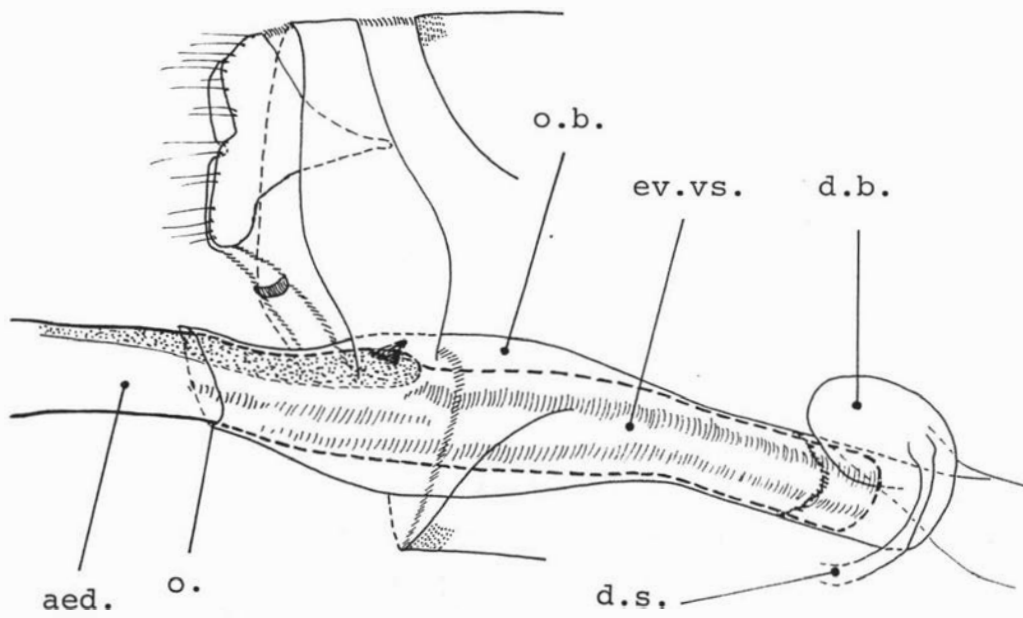
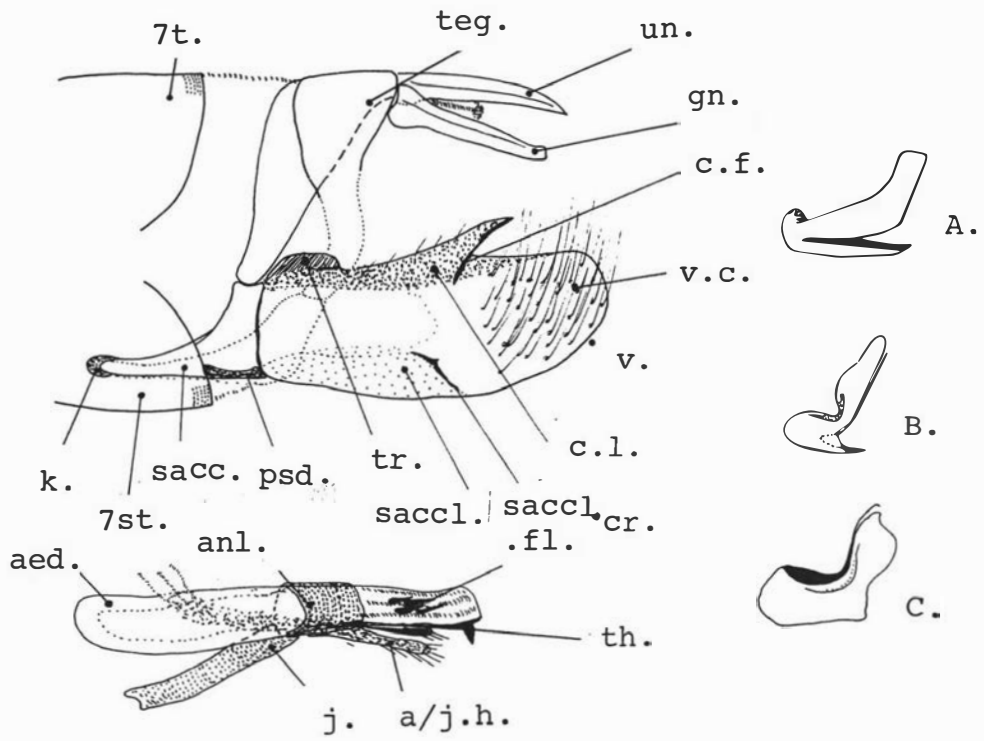


Fig.40 Dissection of female genitalia of typical species of Crambinae (Orocrambus flexuosellus).

(see pp.15-17).

Fig.41 Generalized diagram of ectodermal structures in crambine female genitalia (Tribe Crambini).

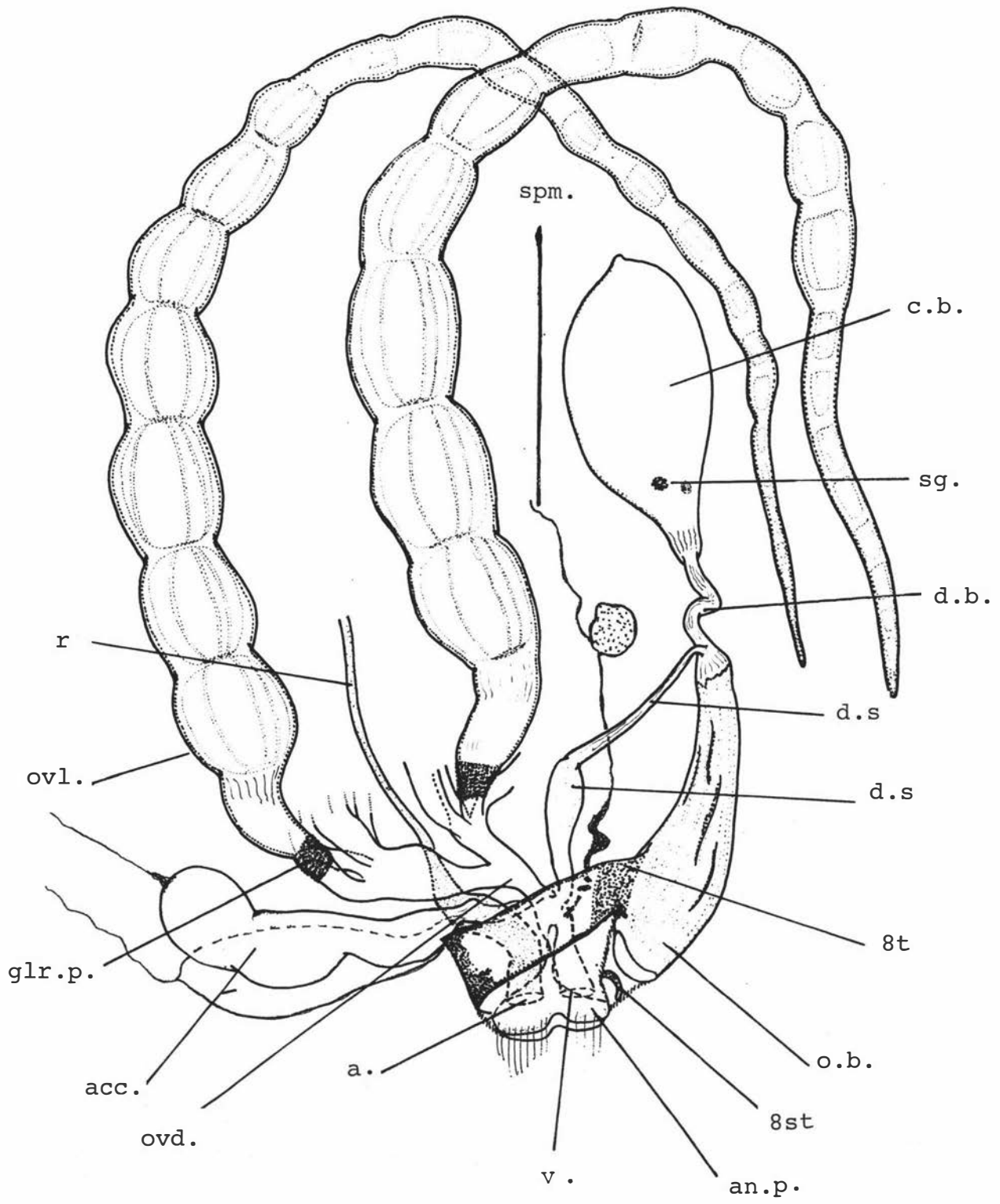
(see pp.32)

Fig.42 Generalized diagram of ectodermal structures in crambine female genitalia (Tribes Chiloini and Diptychophorini).

(see pp.35,37).

Legends: an.p., anal papillae; 8t, eight tergite; 7t, seventh tergite; d.s., ductus seminalis; c.b., corpus bursae; sg., signum; d.b., ductus bursae; 7st, seventh sternite; o.b. ostium bursae; l.av. lamella antevaginalis; 0: ostium; l.pv., lamellae postvaginalis; 8st, eighth sternite; r, rectum; ovl., ovariole; glr.p., glandular region of oviduct; acc. accessory glands; ovd., oviduct; spm., spermatophore with proximal chitinised hood and distal bulla.

Not all the parts shown in fig.40 are repeated in the diagnostic aid diagrams figs.41,42.



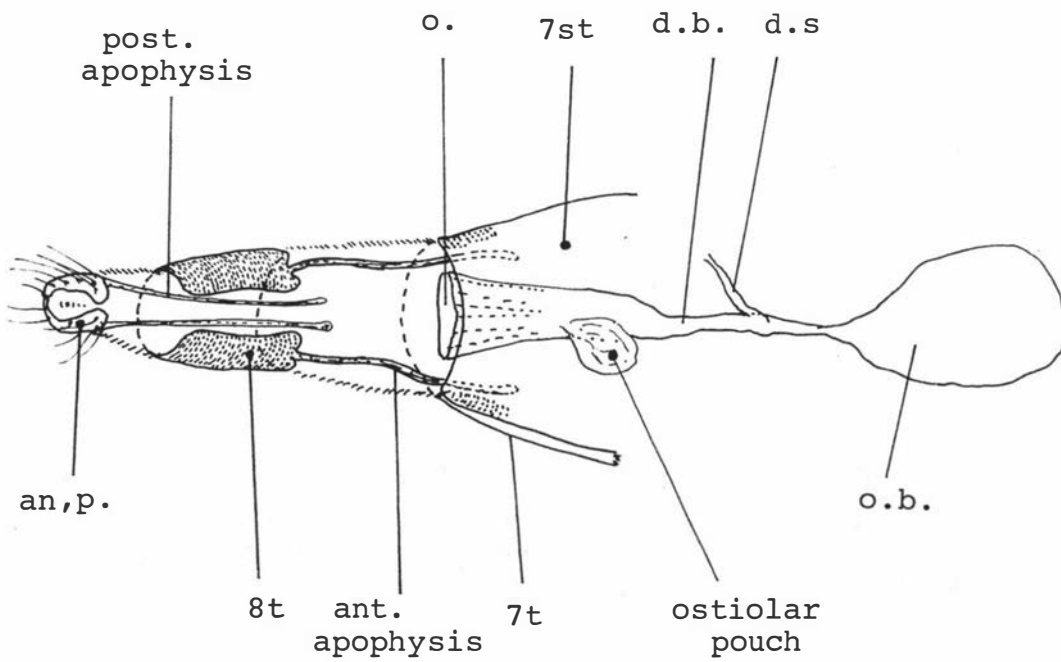
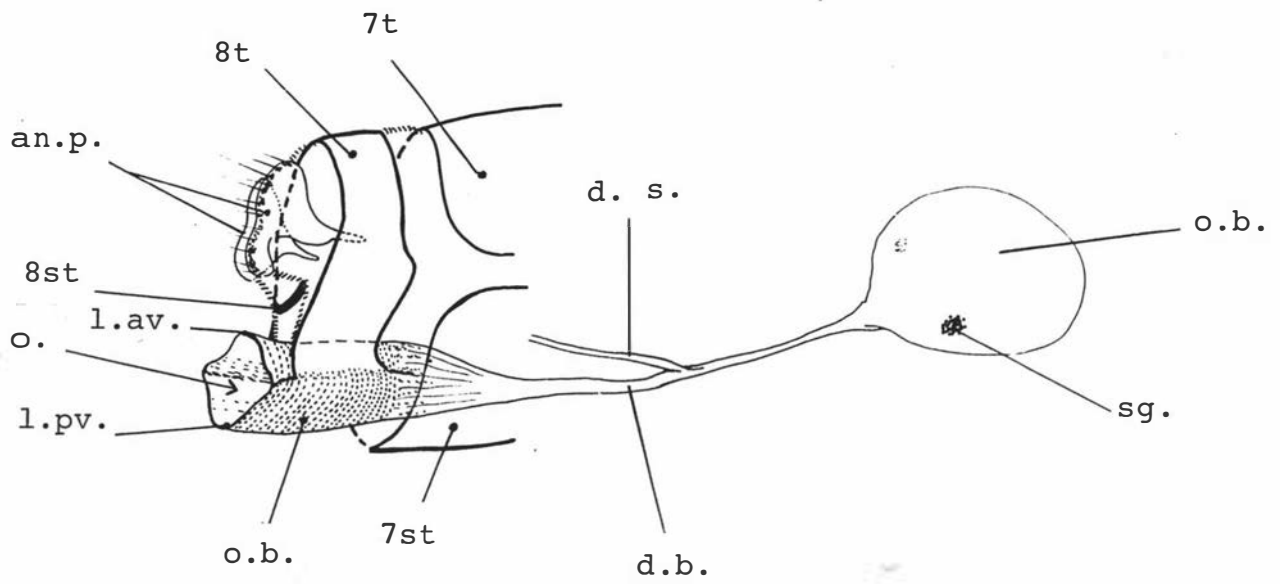


Fig.43 Male genitalia of Orocrambus apicellus,
left lateral aspect. (Palmerston North)

Note: In this and all following
genitalia drawings the scale line represents
0.5 mm.

(p.85)

Fig.44 Male genitalia of Orocrambus aethonellus,
left lateral aspect. (Mt Cook)

(p.91)

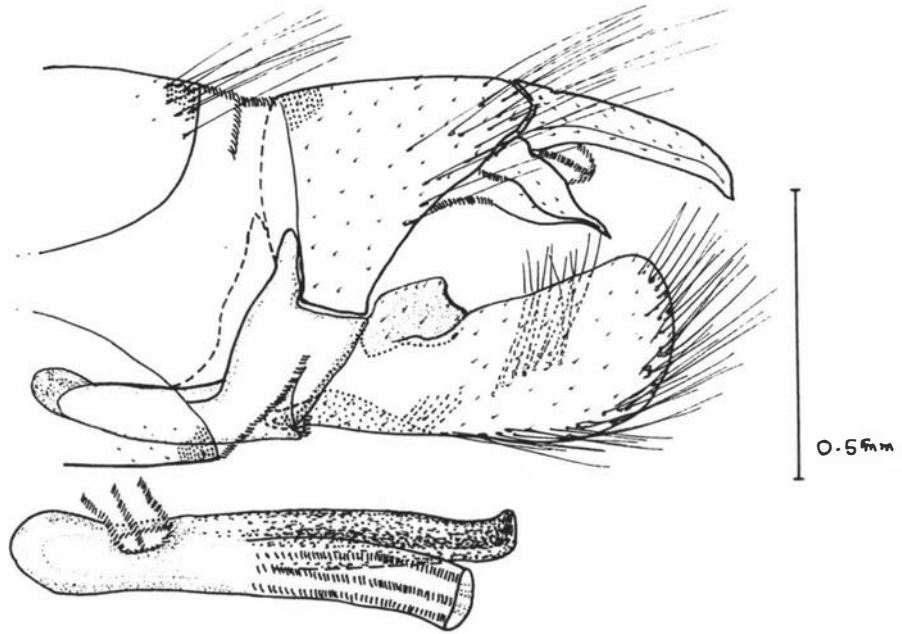
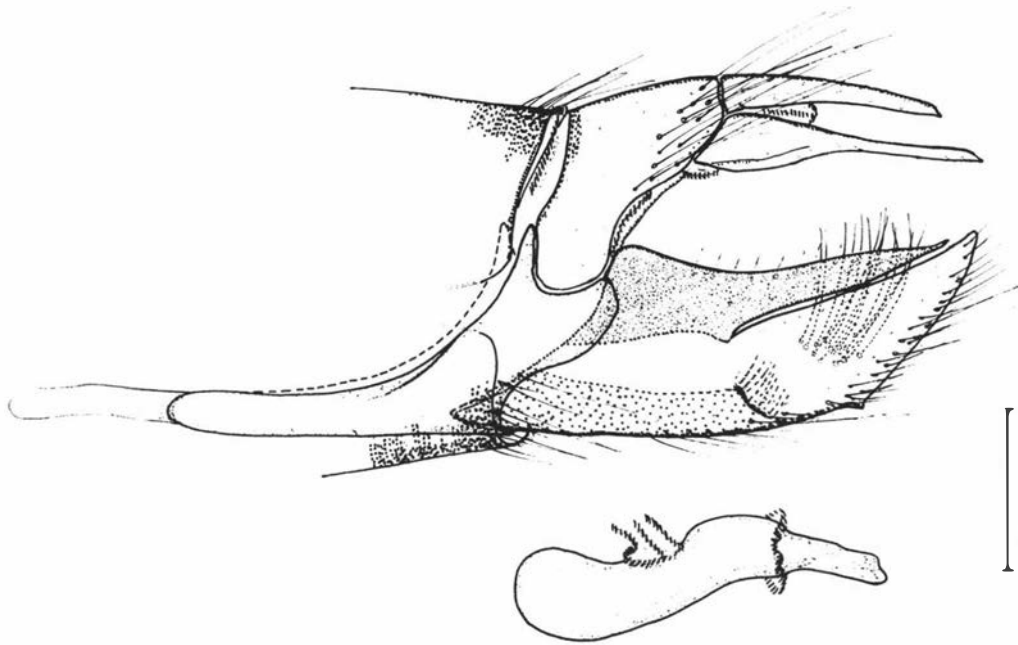
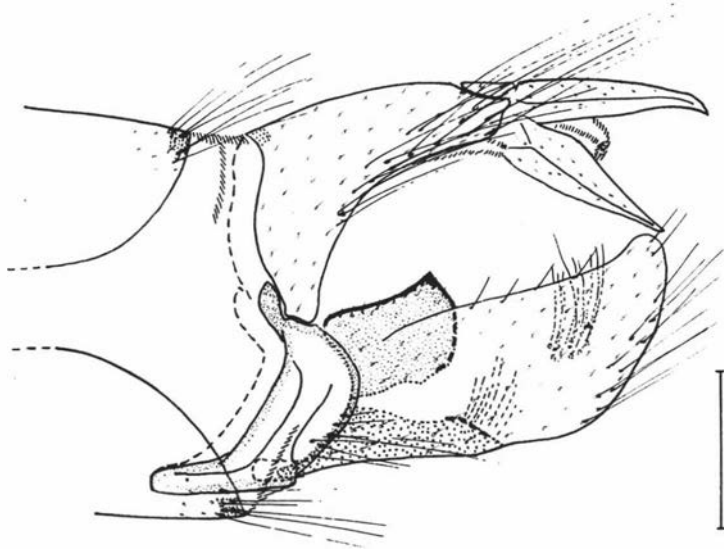


Fig 45 Male genitalia of Orocrambus catacaustus,
left lateral aspect. (Arthur's Pass)

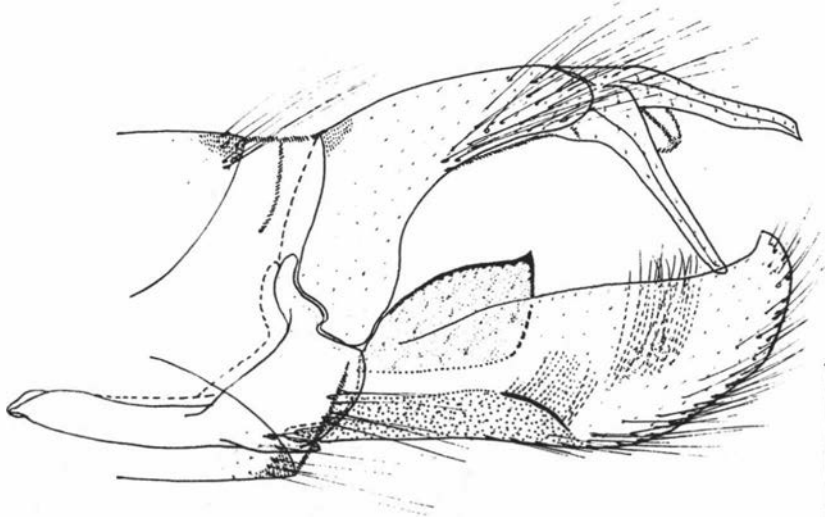
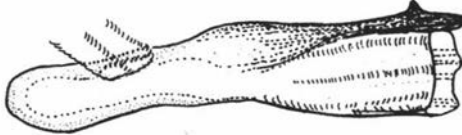
(p.95)

Fig 46 Male genitalia of Orocrambus dicrenellus,
left lateral aspect. (Ben Lomond)

(p.98)



0.5 mm



0.5 mm



Fig 47 Male genitalia of Orocrambus flexuosellus,
left lateral aspect. (Palmerston North)

(p.99)

Fig 48 Male genitalia of Orocrambus fugitivellus,
left lateral aspect.

(McKenzie Country)

(p.111)

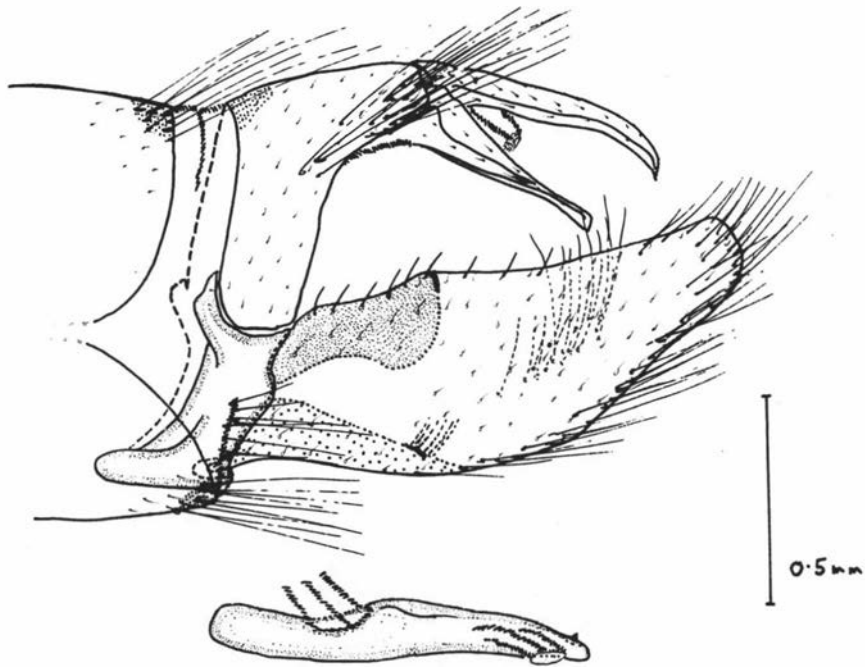
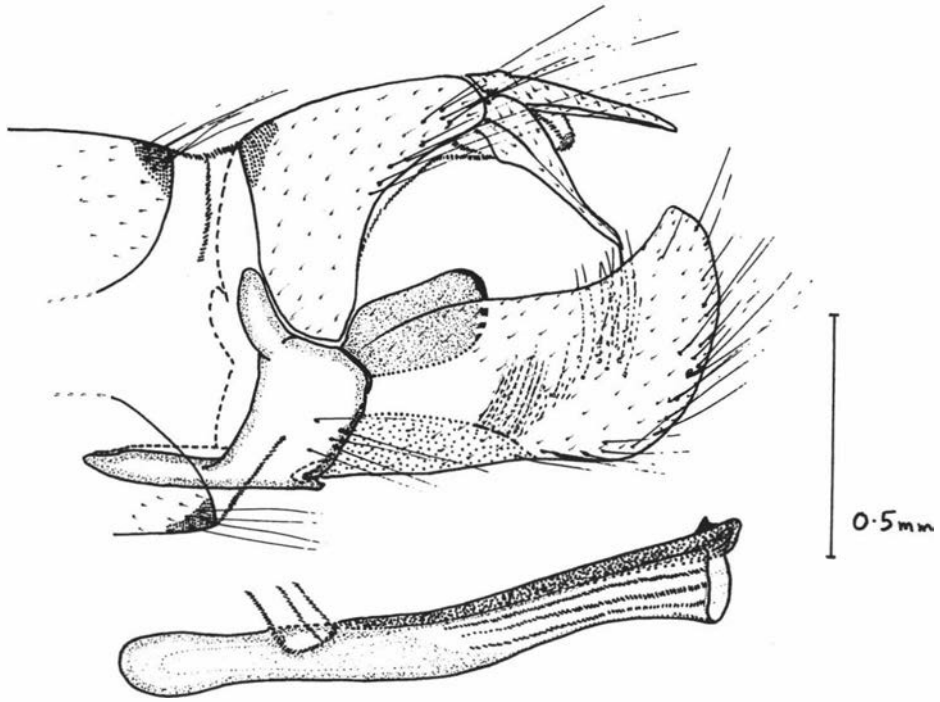
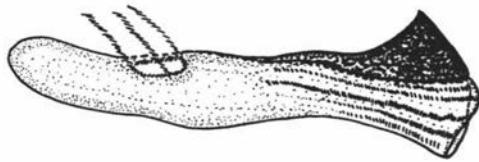
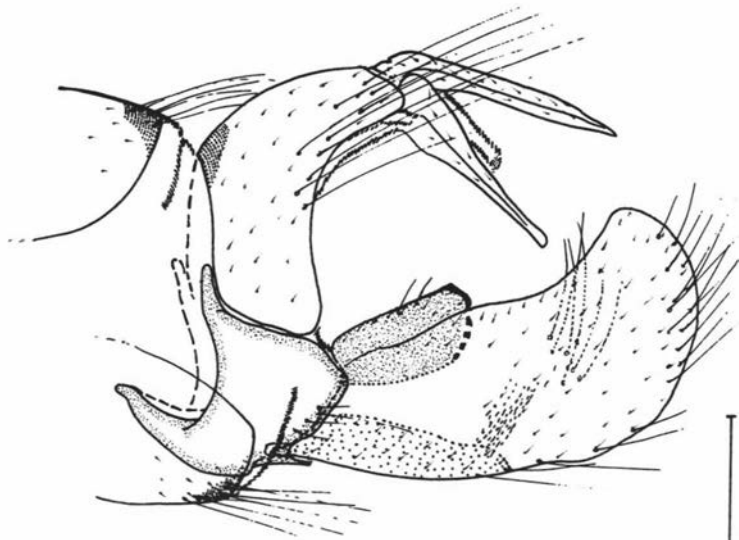
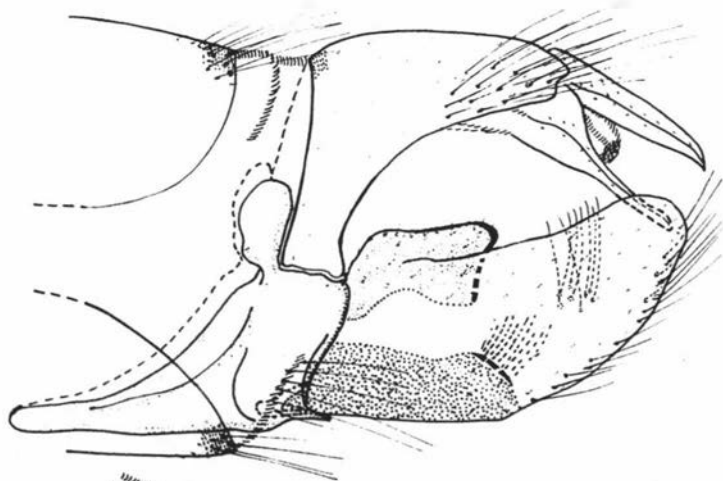


Fig.49 Male genitalia of Orocrambus horistes,
left lateral aspect. (Chatham Islands)
(p.112)

Fig.50 Male genitalia of Orocrambus mylites,
left lateral aspect. (Travers Range)
(p.114)



0.5mm



0.5mm

Fig.51 Male genitalia of Orocrambus haplotomus,
left lateral aspect. (Homer Tunnel)

(p.116)

Fig.52 Male genitalia of Orocrambus heliotes,
left lateral aspect. (National Park)

(p.118)

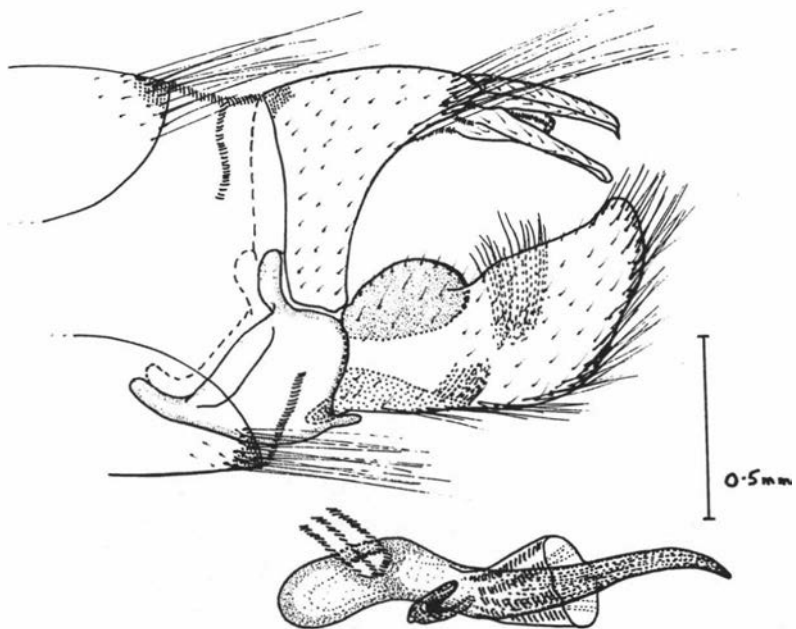
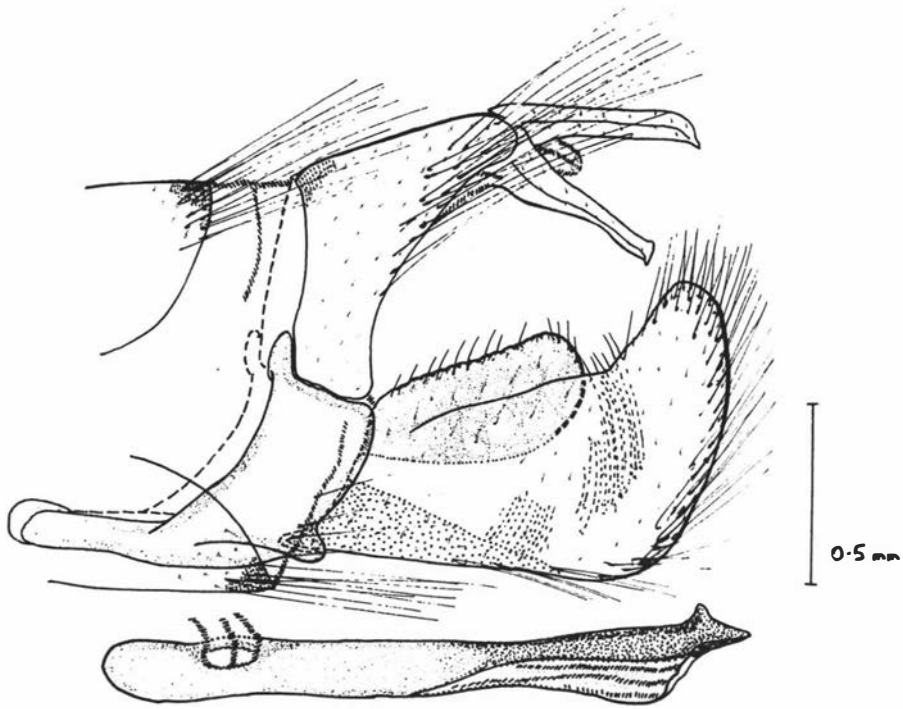


Fig.53 Male genitalia of Orocrambus machaeristes,
left lateral aspect. (Mt Earnslaw)

(p.121)

Fig.54 Male genitalia of Orocrambus thymiastes,
left lateral aspect. (Invercargill)

(p.123)

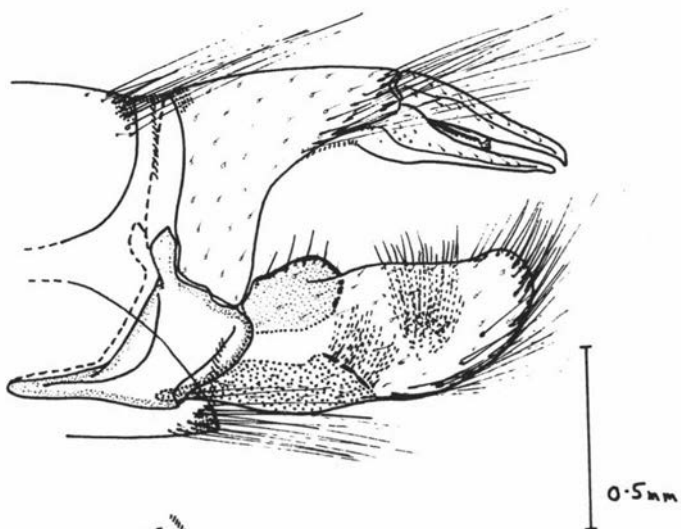
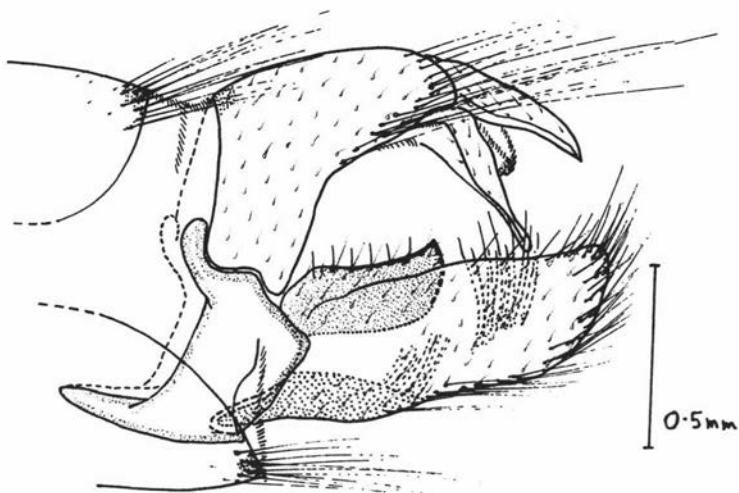


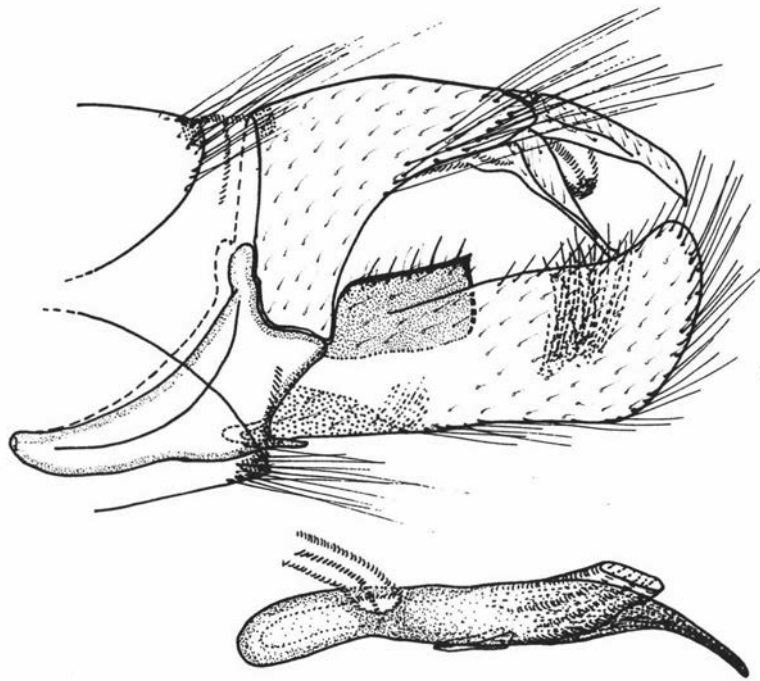
Fig.55 Male genitalia of Orocrambus tritonellus,
left lateral aspect. (Mt Grey)

(p.124)

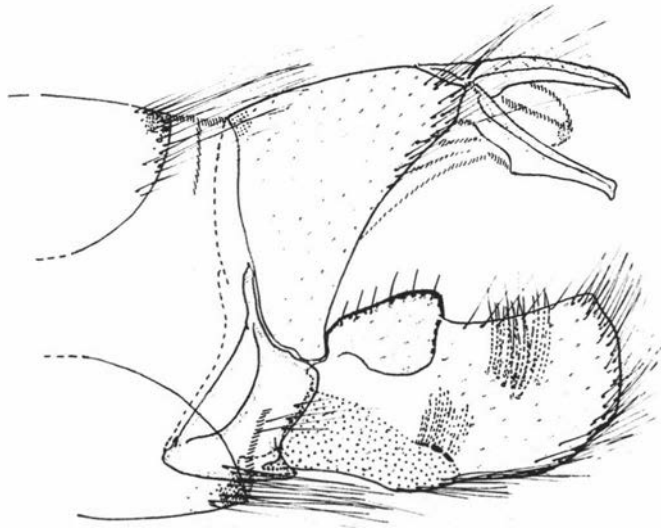
Fig.56 Male genitalia of Orocrambus clarkei,
left lateral aspect. (Homer Saddle)

(p.127)

(p.128)



0.5 mm



0.5 mm

Fig.57 Male genitalia of Orocrambus melampetrus,
left lateral aspect. (Franz Joseph Glacier)
(p.130)

Fig.58 Male genitalia of Orocrambus scoparioides,
left lateral aspect. (Invercargill)
(p.132)

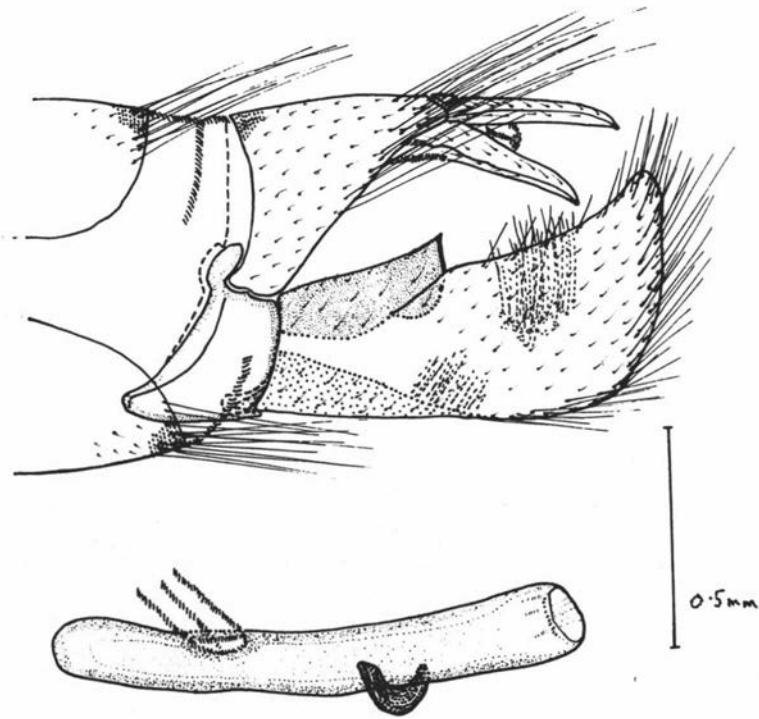
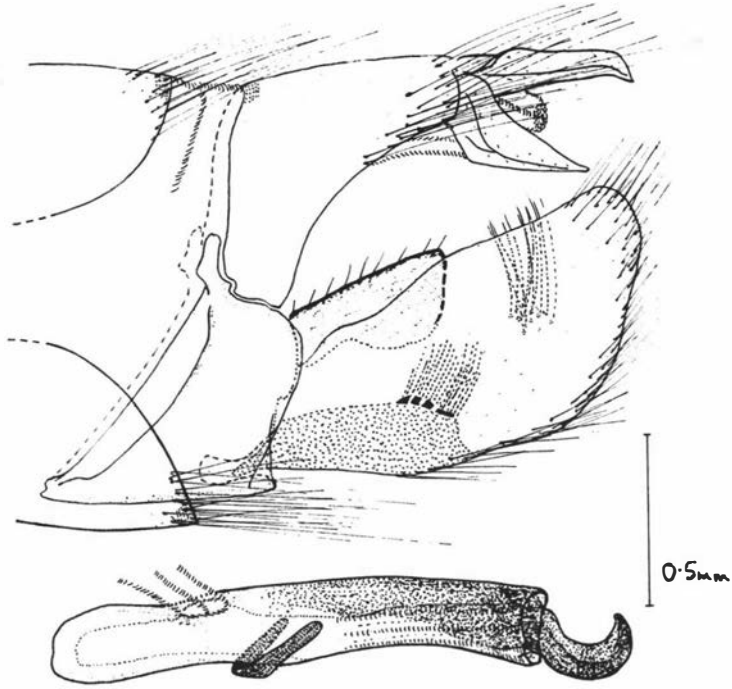
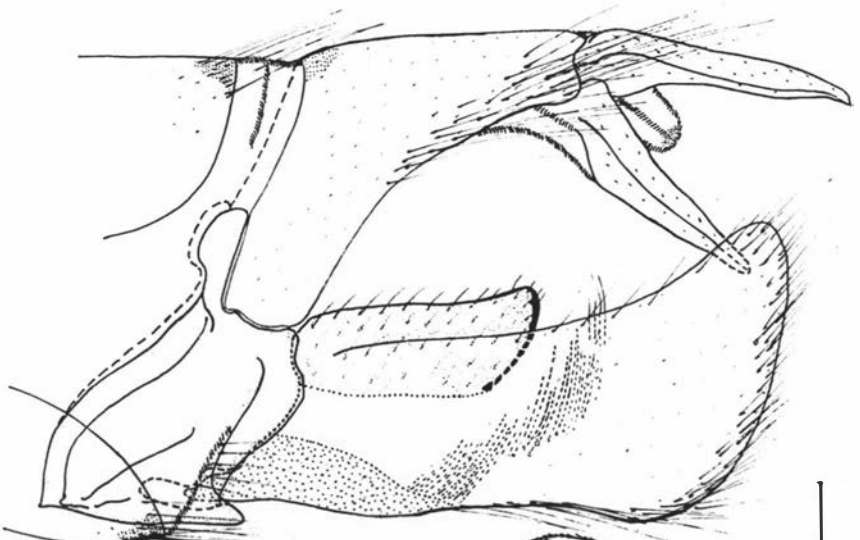
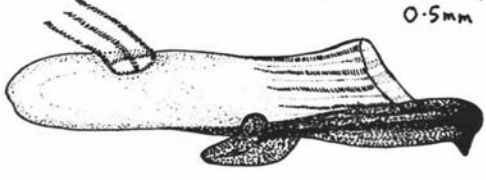
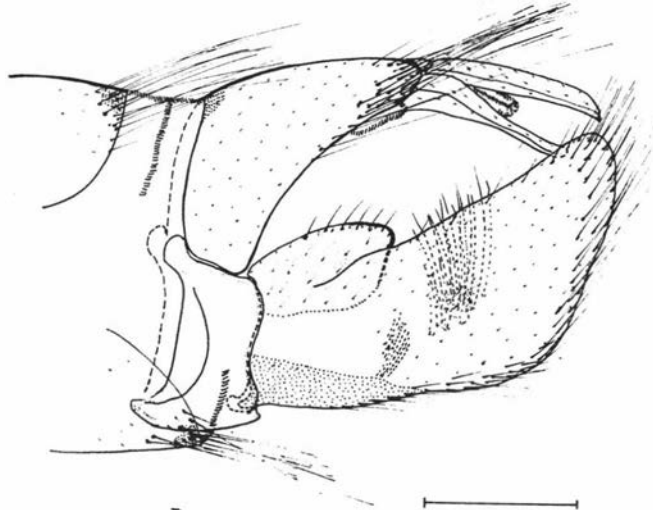


Fig.59 Male genitalia of Orocrambus ventosus,
left lateral aspect. (Gordon's Pyramid)
(p.134)

Fig.60 Male genitalia of Orocrambus ephorus,
left lateral aspect. (Arthur's Pass)
(p.137).



0.5mm

Fig.61 Male genitalia of Orocrambus oppositus,
left lateral aspect. (Southland)
(p.138)

Fig.62 Male genitalia of Orocrambus philpotti,
left lateral aspect. (Iron Hill, Nelson)
(p.140)

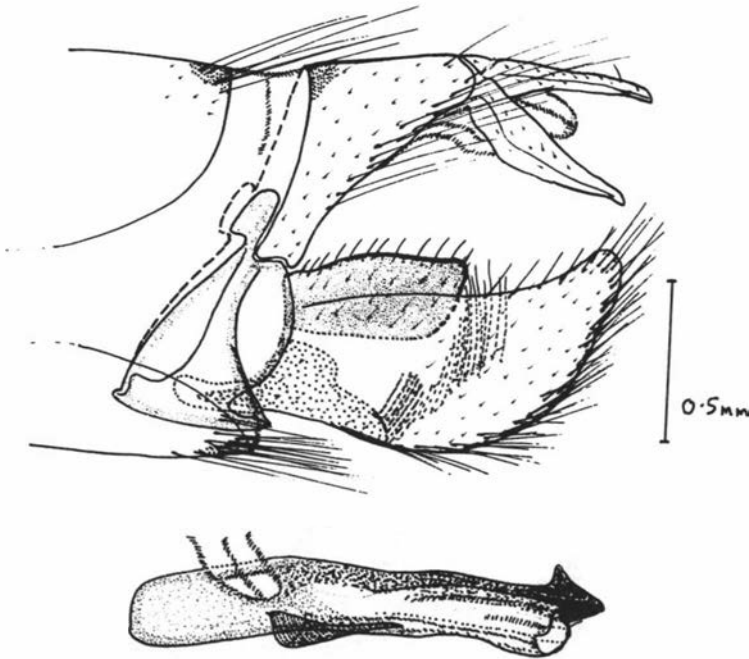
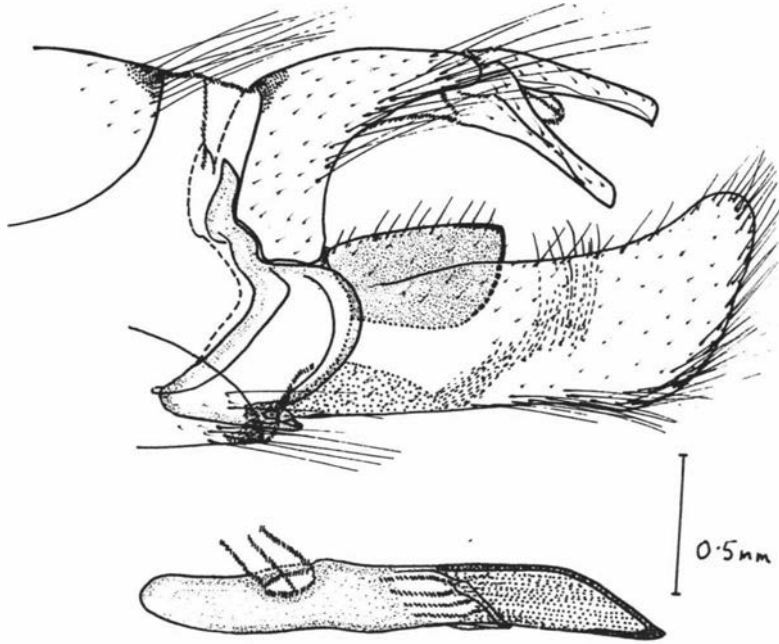


Fig.63 Male genitalia of Orocrambus angustipennis,
left lateral aspect. (Palmerston North)
(p.143)

Fig.64 Male genitalia of Orocrambus corruptus,
left lateral aspect. (Winchmore)
(p.147)

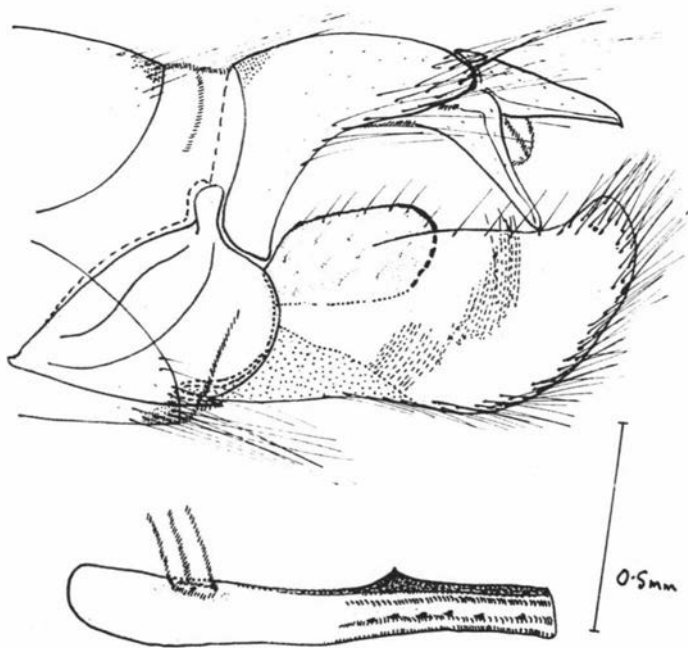
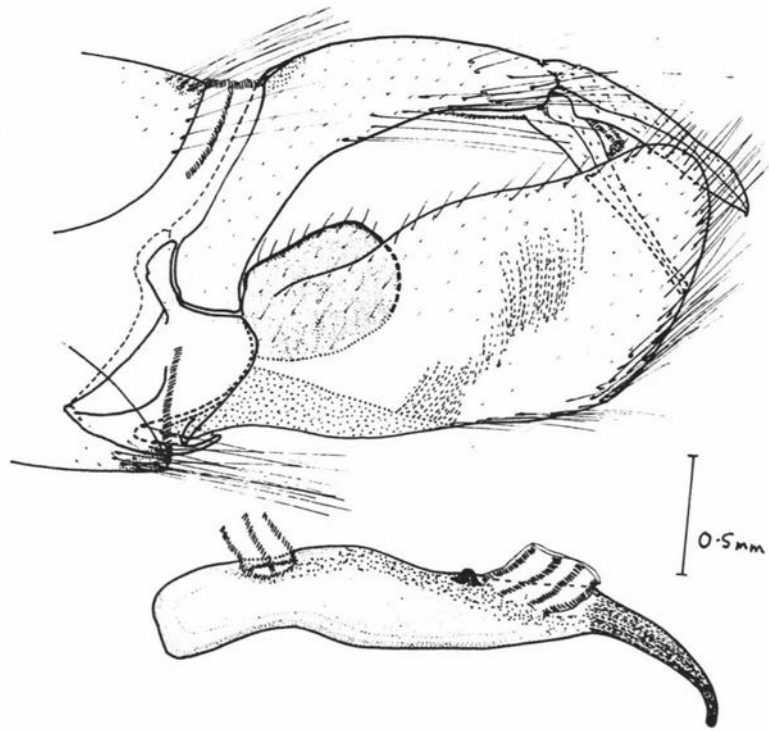


Fig.65 Male genitalia of Orocrambus melitastes,
left lateral aspect. (Southland)

(p.150)

Fig.66 Male genitalia of Orocrambus cyclopicus,
left lateral aspect. (Palmerston North)

(p.153)

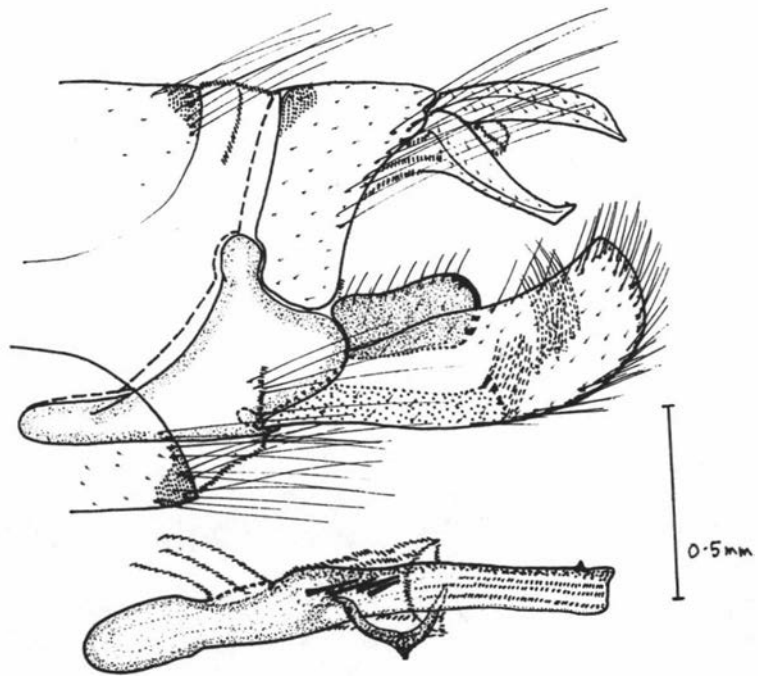
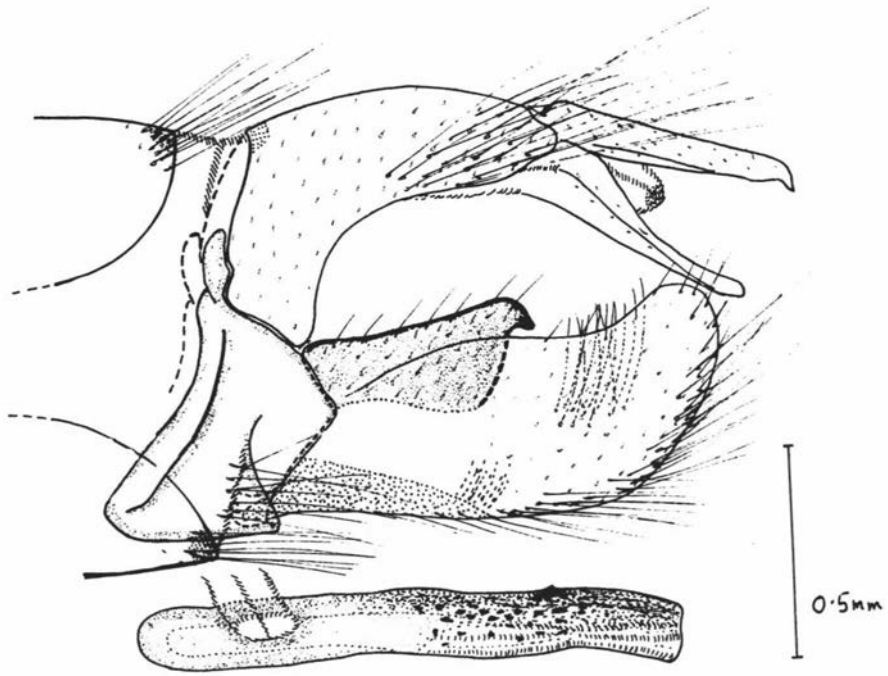
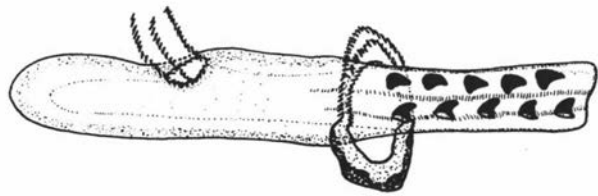
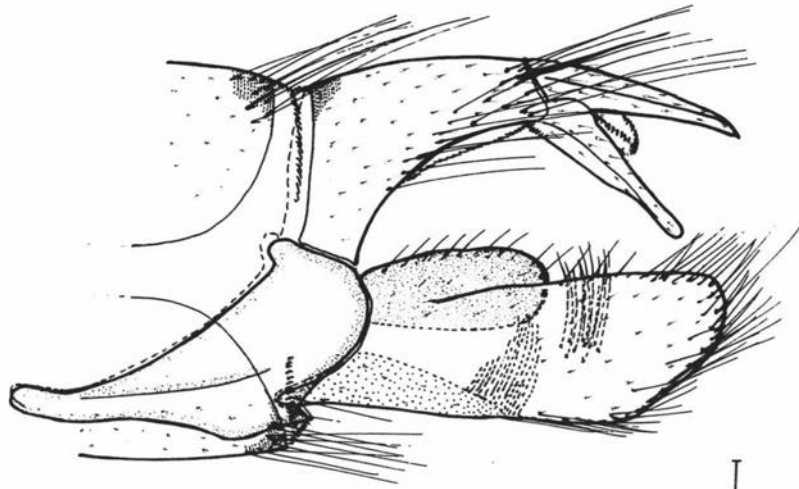


Fig.67 Male genitalia of Orocrambus lectus,
left lateral aspect. (Hanmer)

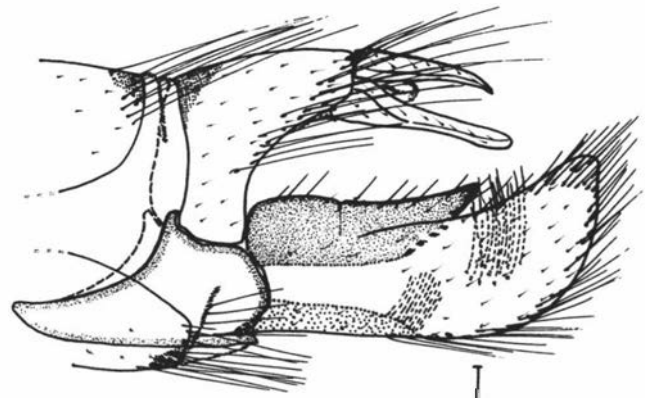
(p.157)

Fig.68 Male genitalia of Orocrambus ornatus,
left lateral aspect. (Golden Downs)

(p.158)



0.5mm



0.5mm

Fig.69 Male genitalia of Orocrambus jansoni,
left lateral aspect. (Waiouru)

(p.160)

Fig.70 Male genitalia of Orocrambus abditus,
left lateral aspect. (Springfield)

(p.163)

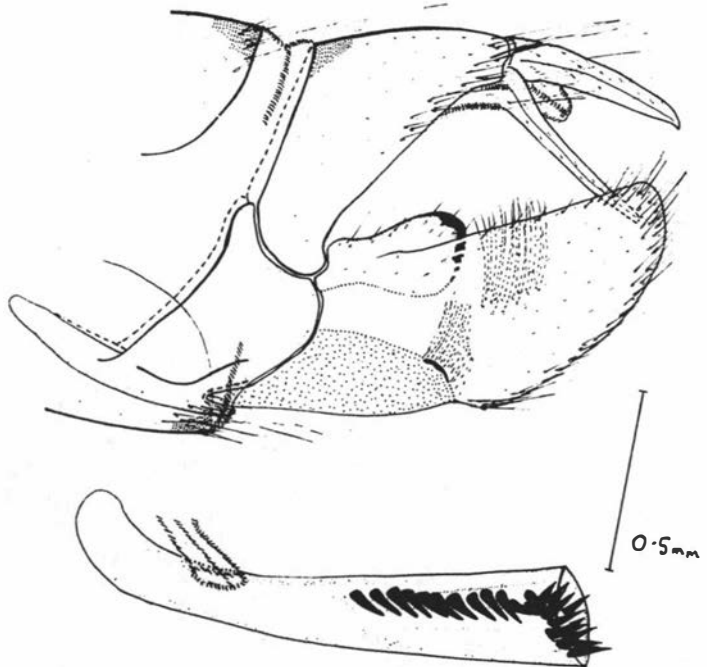
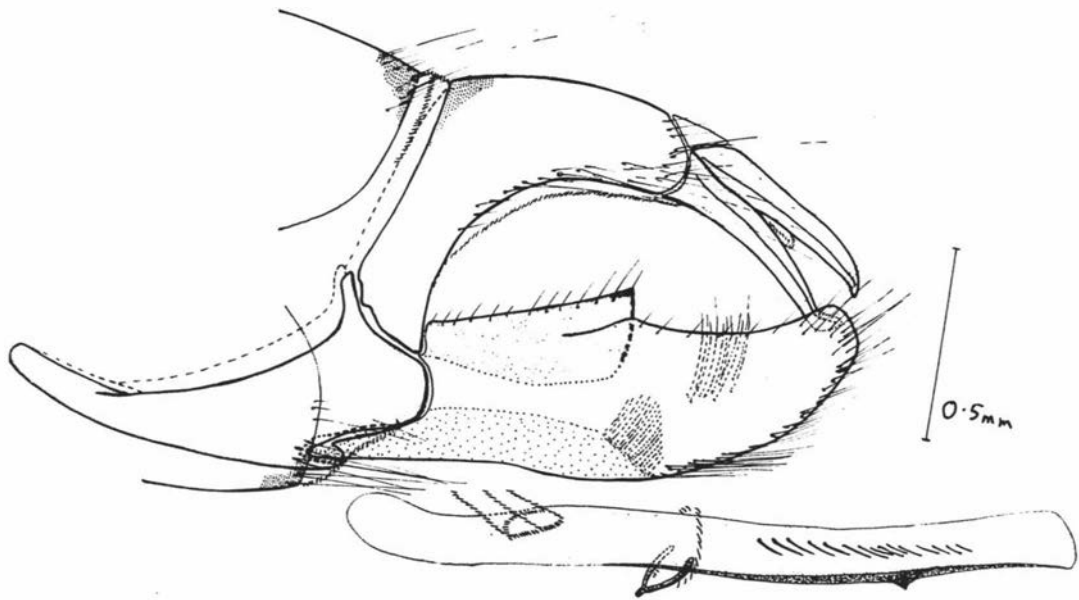


Fig.71 Male genitalia of Orocrambus crenaeus,
left lateral aspect. (Mt Peel, Nelson)

(p.165)

Fig.72 Male genitalia of Orocrambus harpophorus,
left lateral aspect. (Ben Lomond)

(p.168)

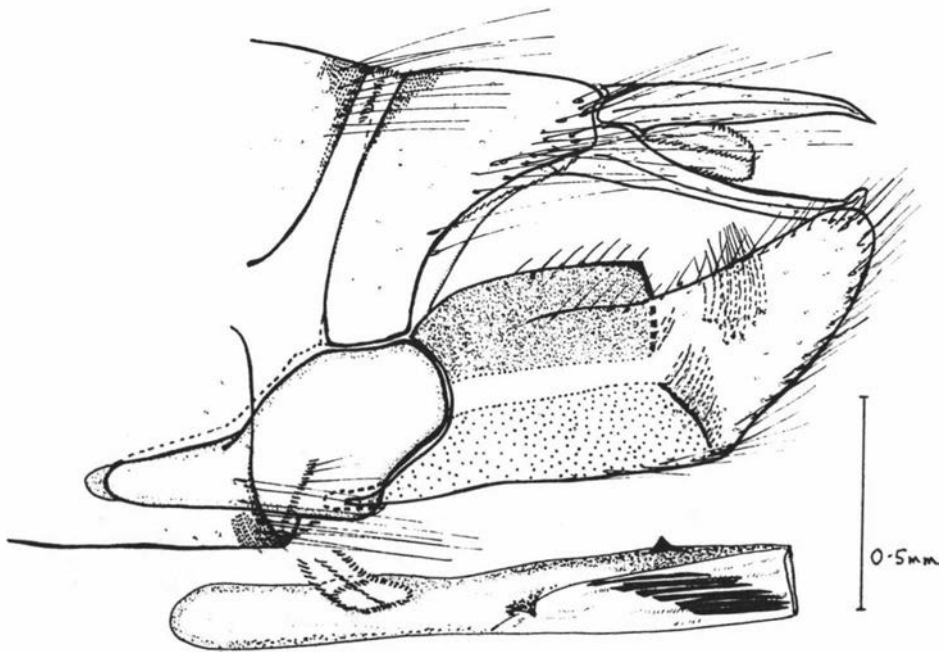
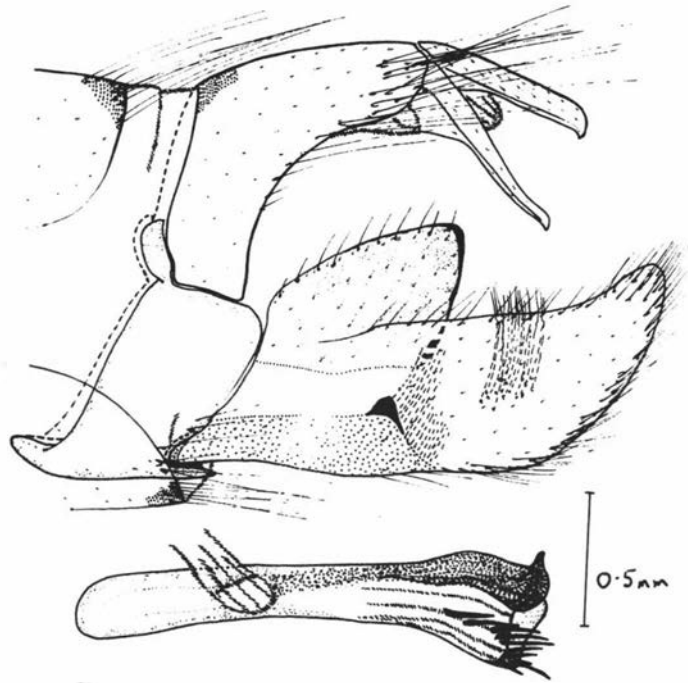


Fig.73 Male genitalia of Orocrambus heteraulus,
left lateral aspect. (Humboldt Mountains)
(p.169)

Fig.74 Male genitalia of Orocrambus lewisi,
left lateral aspect. (Titahi Bay)
(p.171)

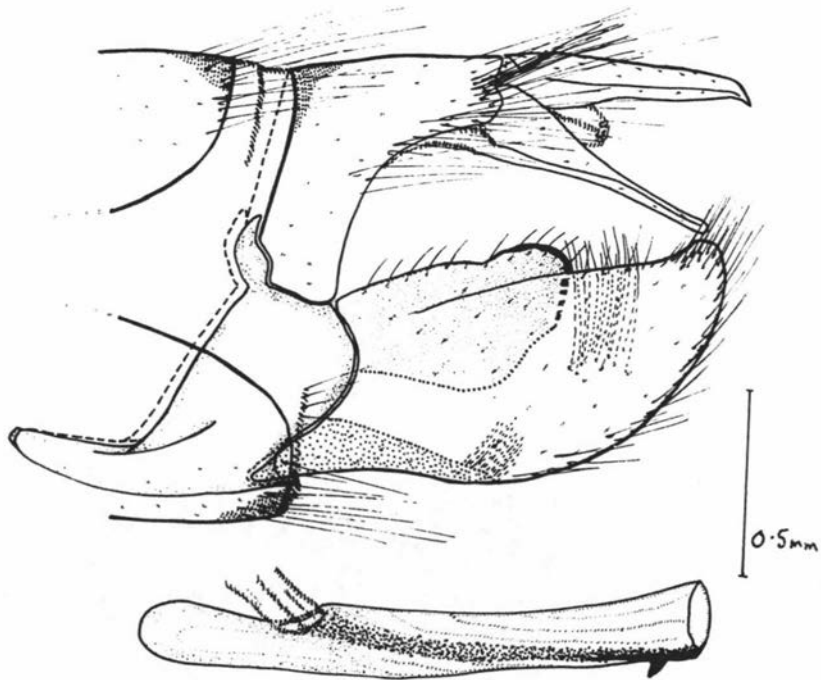
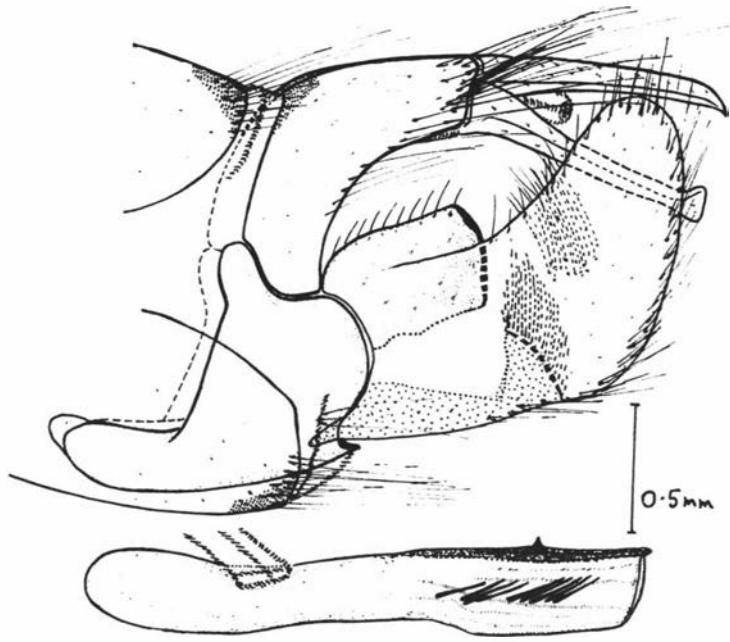


Fig.75 Male genitalia of Orocrambus ordishi,
left lateral aspect. (Mt Ida, Otago)
(p.173)

Fig.76 Male genitalia of Orocrambus ramosellus,
left lateral aspect. (Palmerston North)
(p.175)

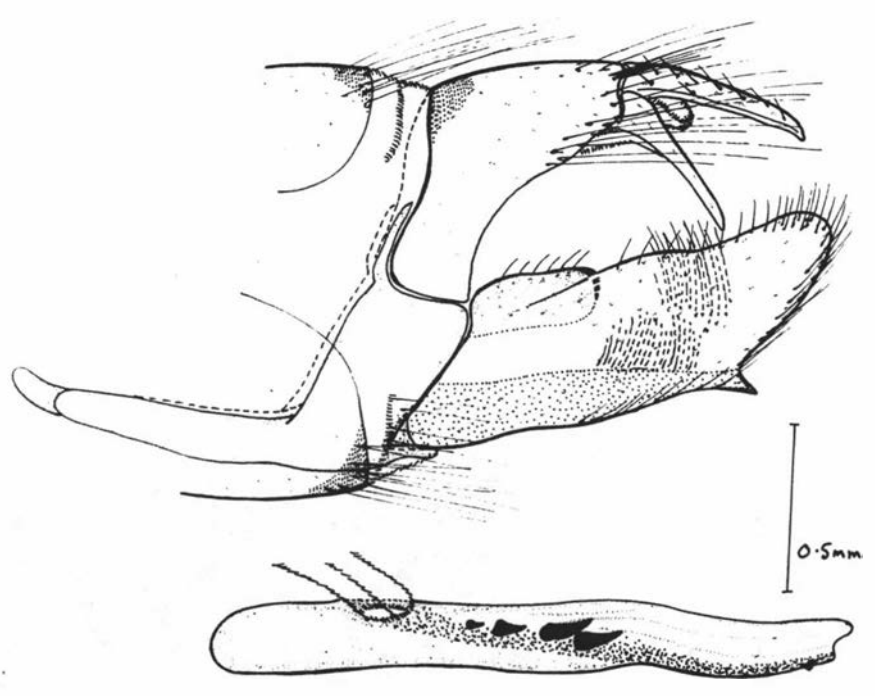
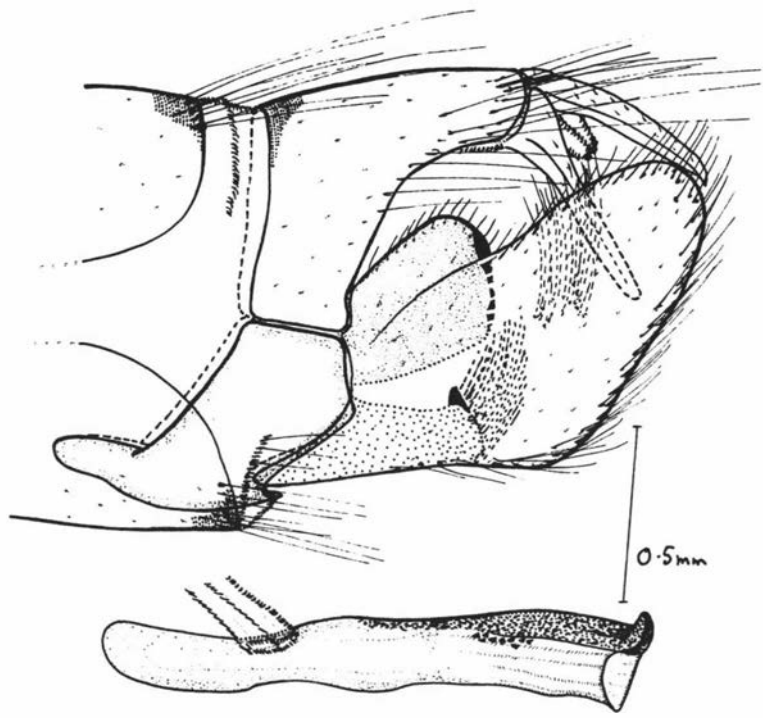


Fig.77 Male genitalia of Orocrambus simplex,
left lateral aspect. (Waiouru)

(p.182)

Fig.78 Male genitalia of Orocrambus siriellus,
left lateral aspect. (Mt Arthur)

(p.186)

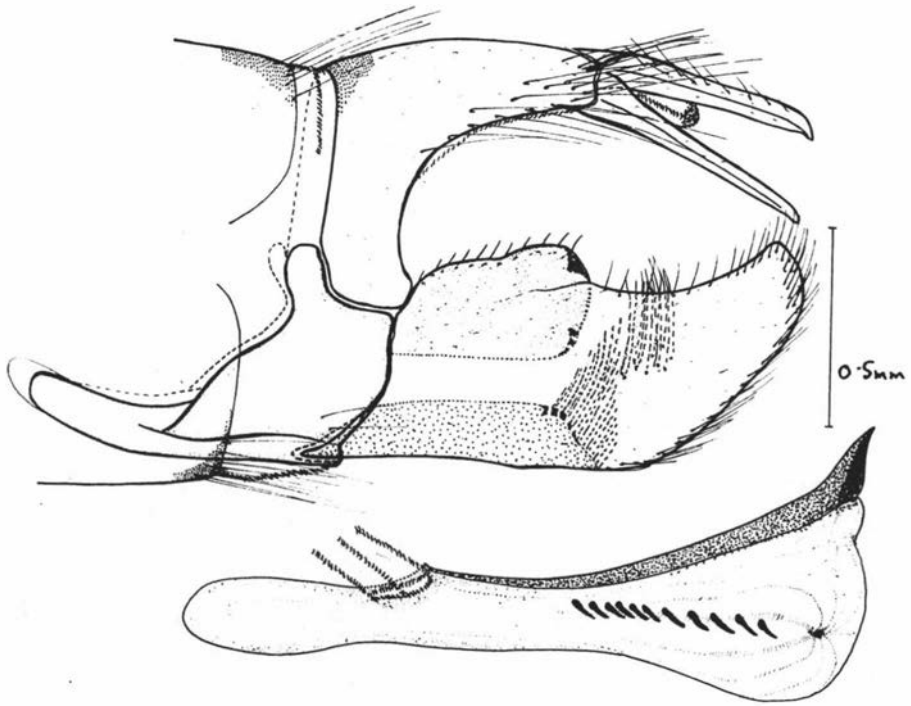
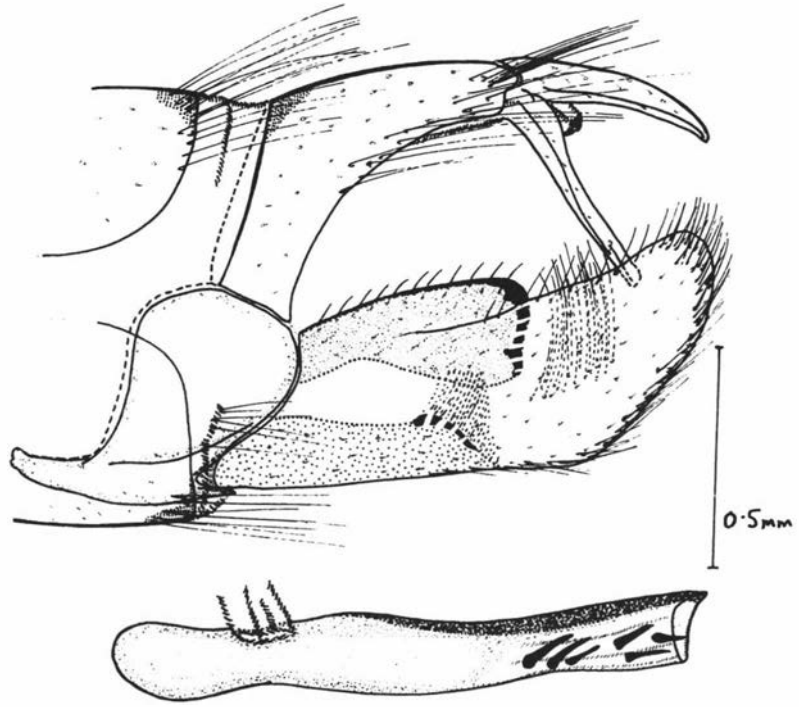


Fig.79 Male genitalia of Orocrambus callirrhous,
left lateral aspect. (Miramar, Wellington)

(p.188)

Fig.80 Male genitalia of Orocrambus enchophorus,
left lateral aspect. (Palmerston North)

(p.190)

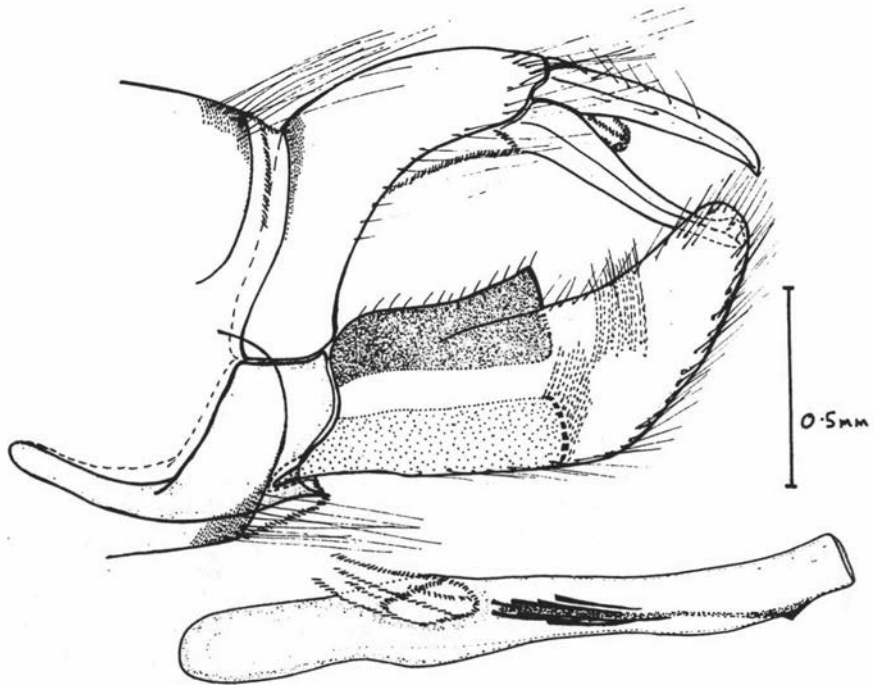
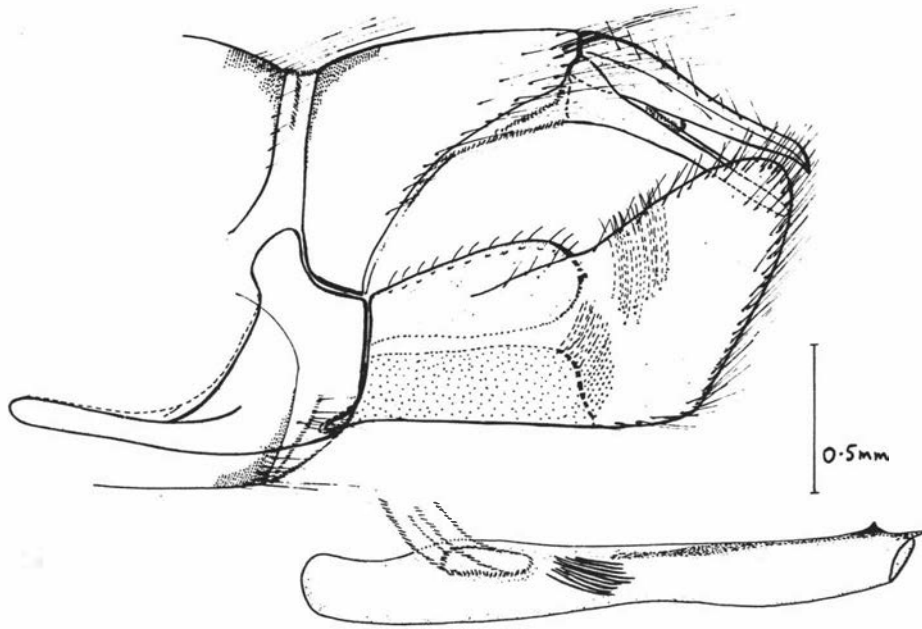
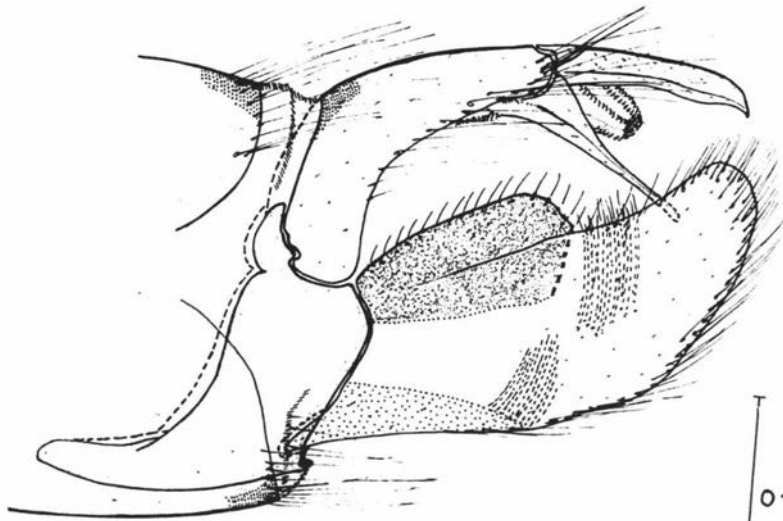


Fig.81 Male genitalia of Orocrambus isochytus,
left lateral aspect. (Mt Arthur)

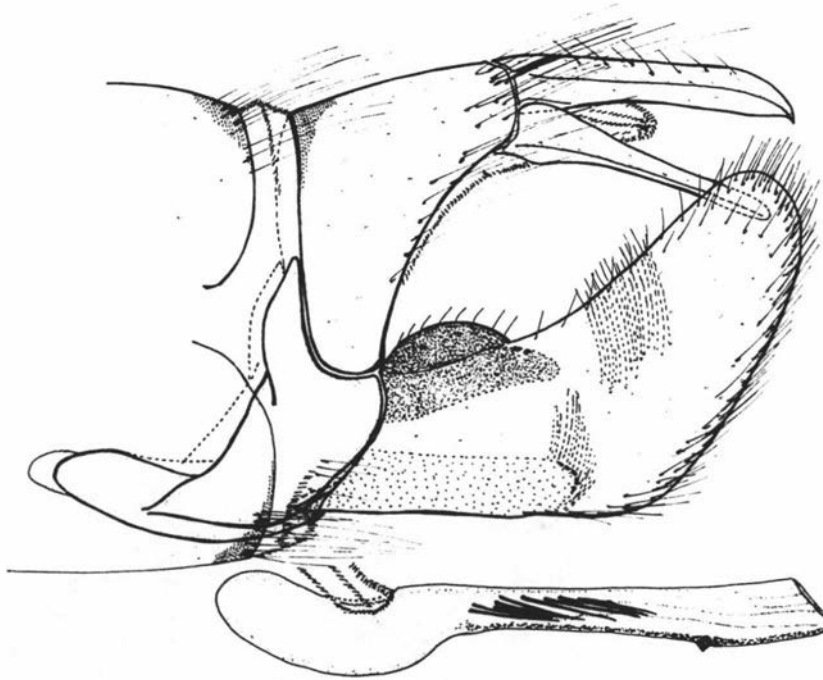
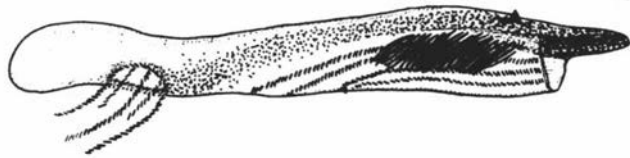
(p.195)

Fig.82 Male genitalia of Orocrambus paraxenus,
left lateral aspect. (Remarkable Range)

(p.197)



0.5mm



0.5mm

Fig.83 Male genitalia of Orocrambus scutatus,
left lateral aspect. (Southland)

(p.198)

Fig.84 Male genitalia of Orocrambus tuhualis,
left lateral aspect. (Kaitoke)

(p.199)

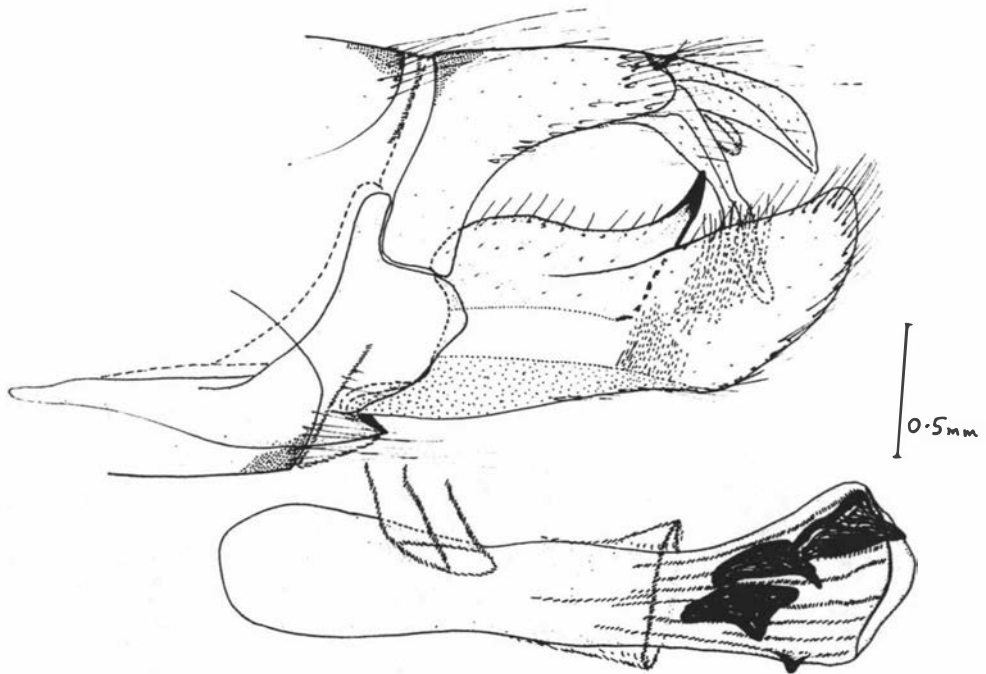
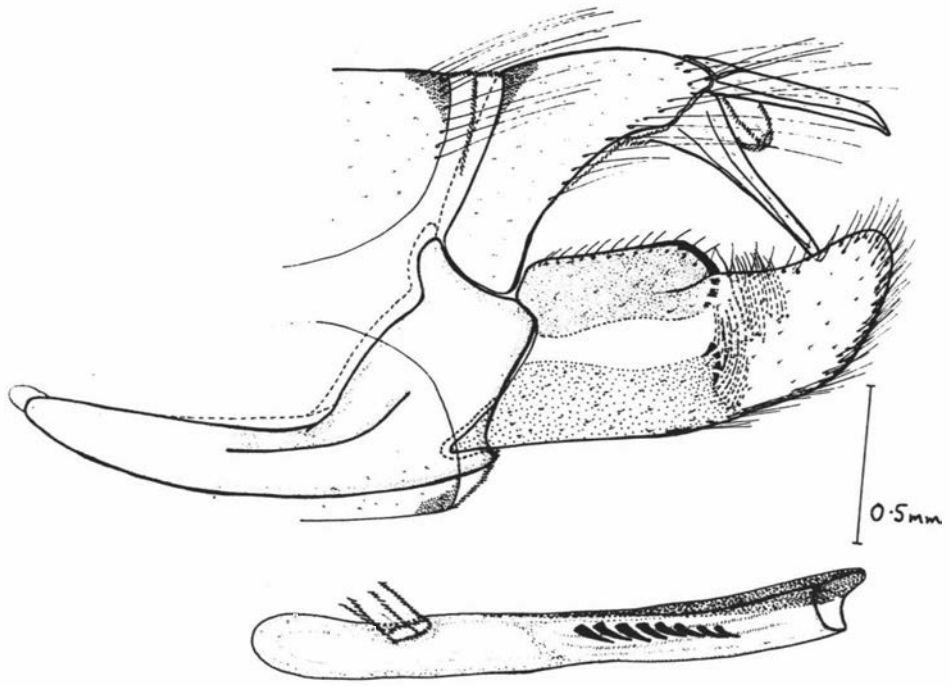


Fig.85 Male genitalia of Orocrambus vittellus,
left lateral aspect. (Palmerston North)

(p.201)

Fig.86 Male genitalia of Orocrambus vulgaris,
left lateral aspect. (Palmerston North)

(p.209)

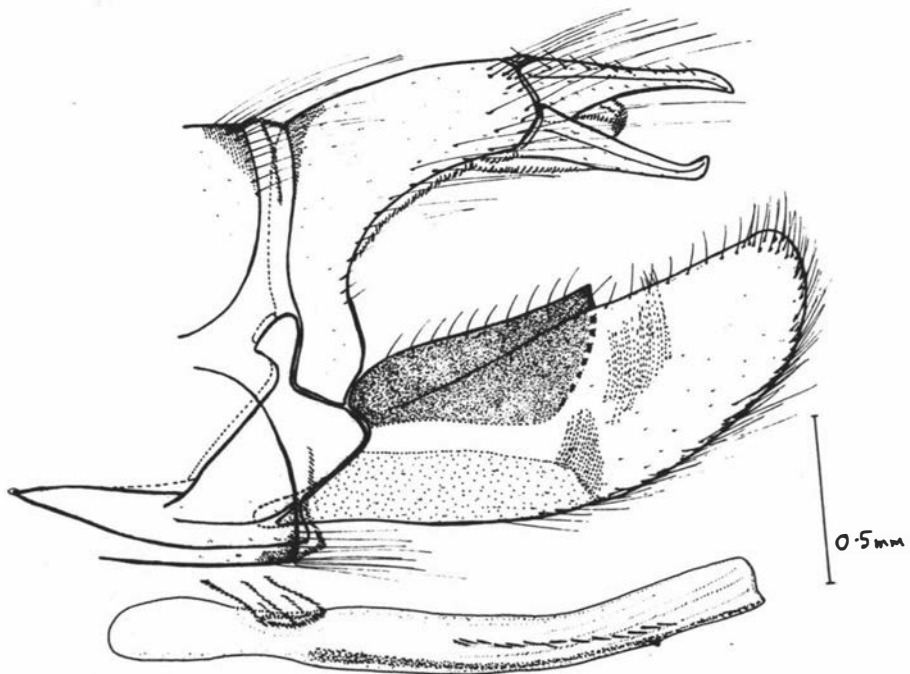
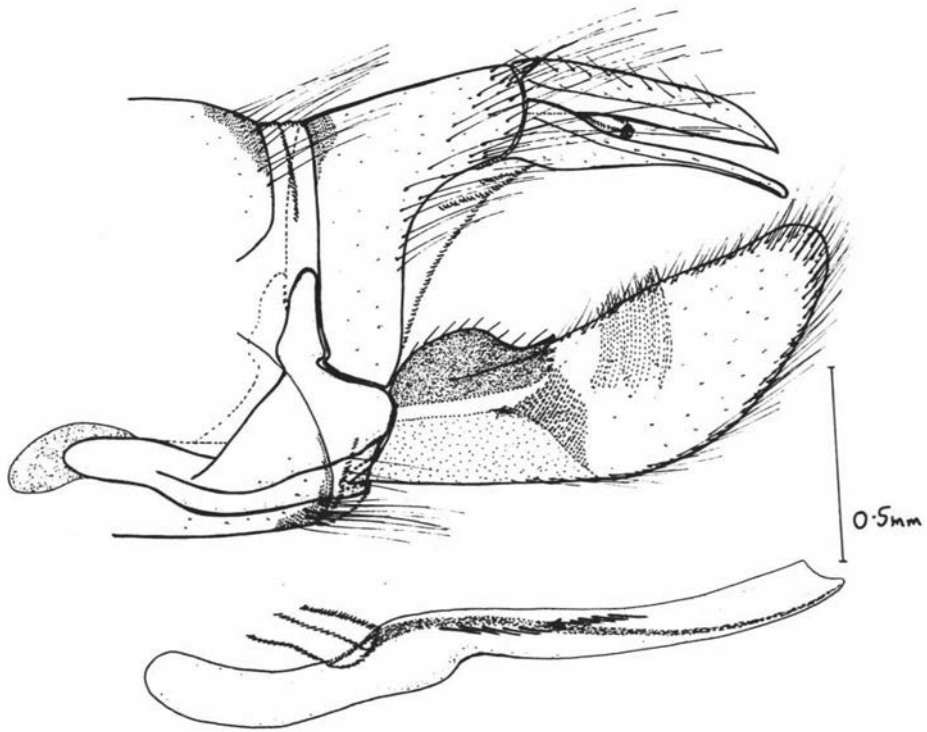


Fig.87 Male genitalia of Orocrambus xanthogrammus,
left lateral aspect. (Kaikoura)
(p.213)

Fig.88 Male genitalia of Maoricrambus oncobolus,
left lateral aspect. (Broken River, Cant.)
(p.220)

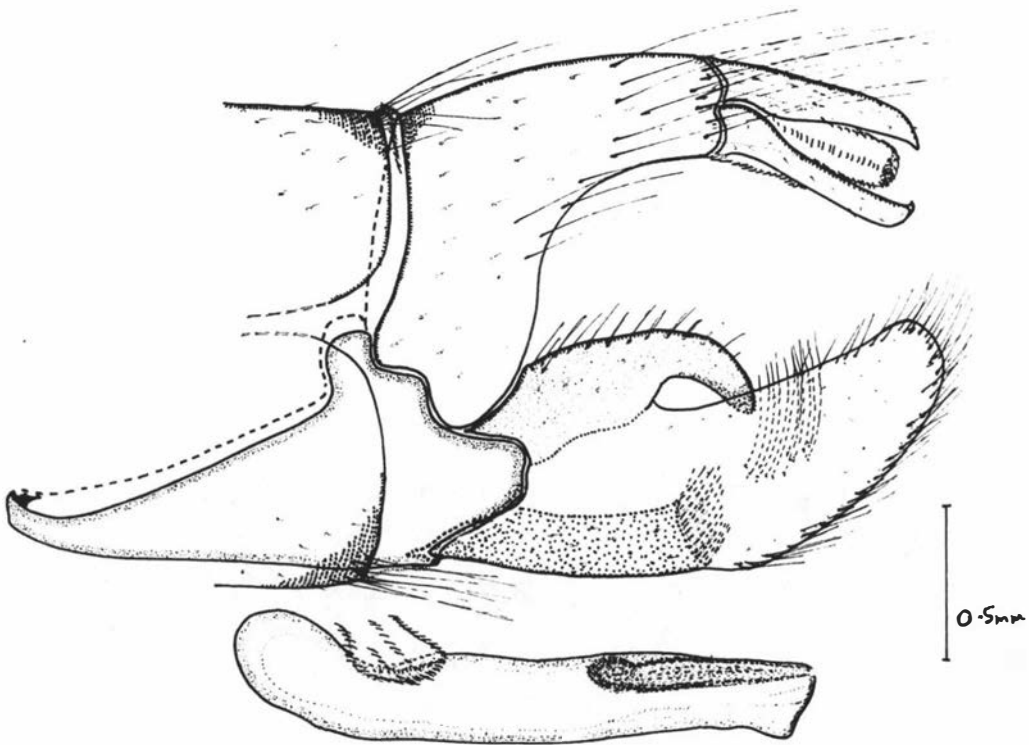
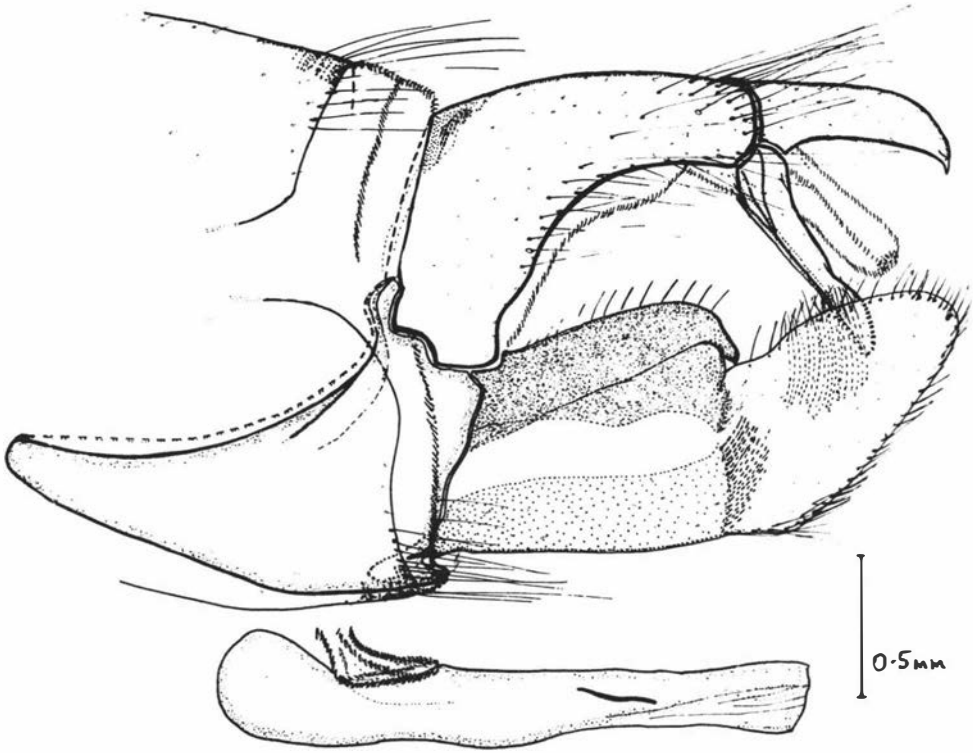
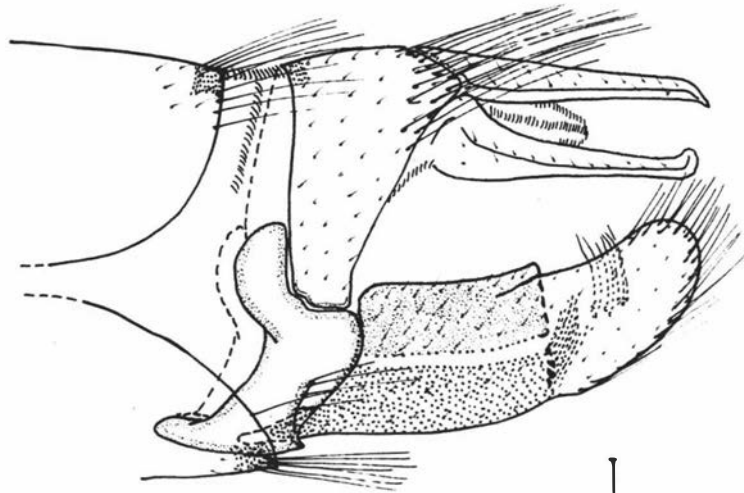
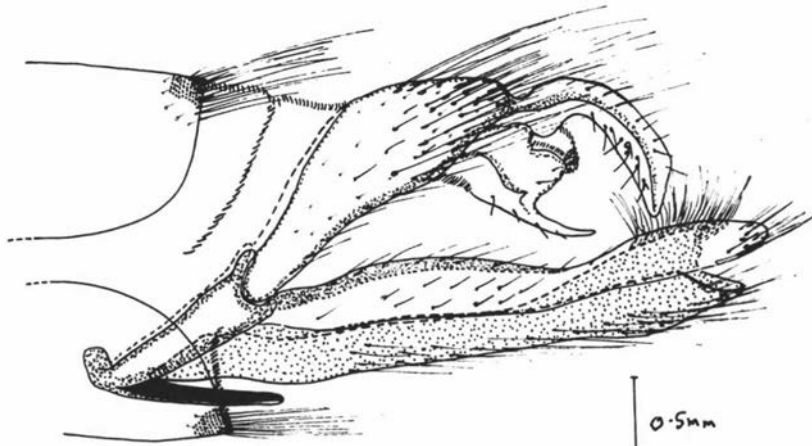
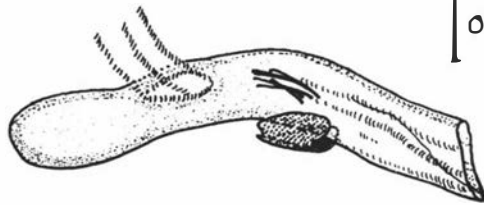


Fig.89 Male genitalia of Kupea electilis,
left lateral aspect. (Birdlings Flat,Cant.)
(p.223)

Fig.90 Male genitalia of Corynophora lativittalis,
left lateral aspect. (Jervis Bay,N.S.W.)
(p.233)



0.5mm



0.5mm

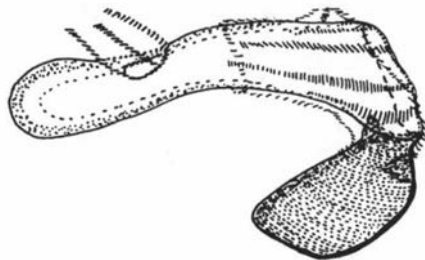


Fig.91 Male genitalia of Tawhitia glaucophanes,
left lateral aspect. (Macetown)
(p.227)

Fig.92 Male genitalia of Tawhitia pentadactyla,
left lateral aspect. (Sedgemere)
(p.229)

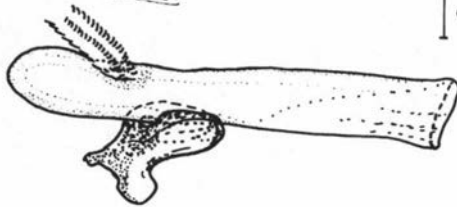
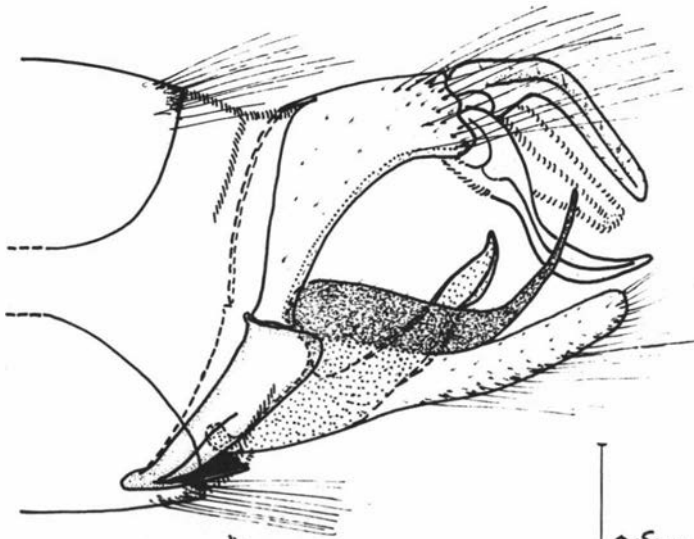
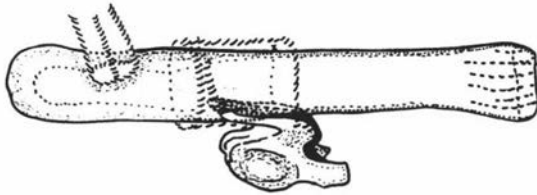
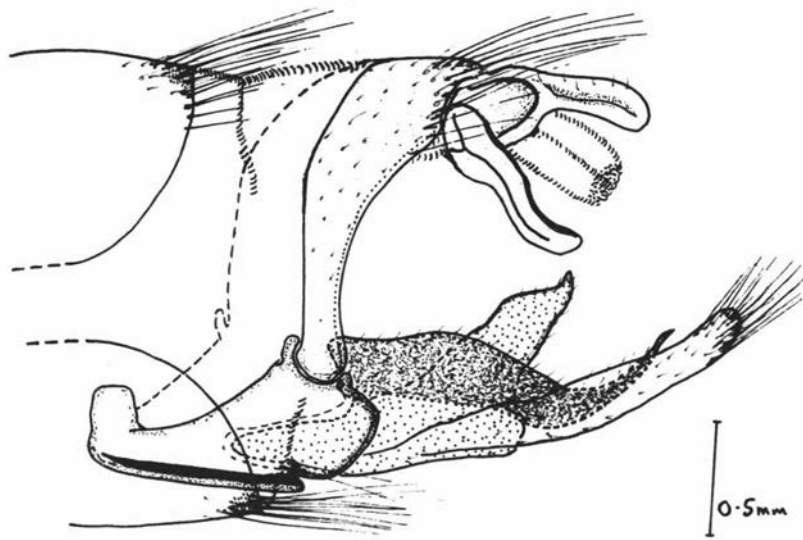


Fig.93 Male genitalia of Pareromene chrysochyta,
left lateral aspect. (Wellington)

(p.246)

Fig.94 Male genitalia of Pareromene selenaea,
left lateral aspect. (Longwoods)

(p.248)

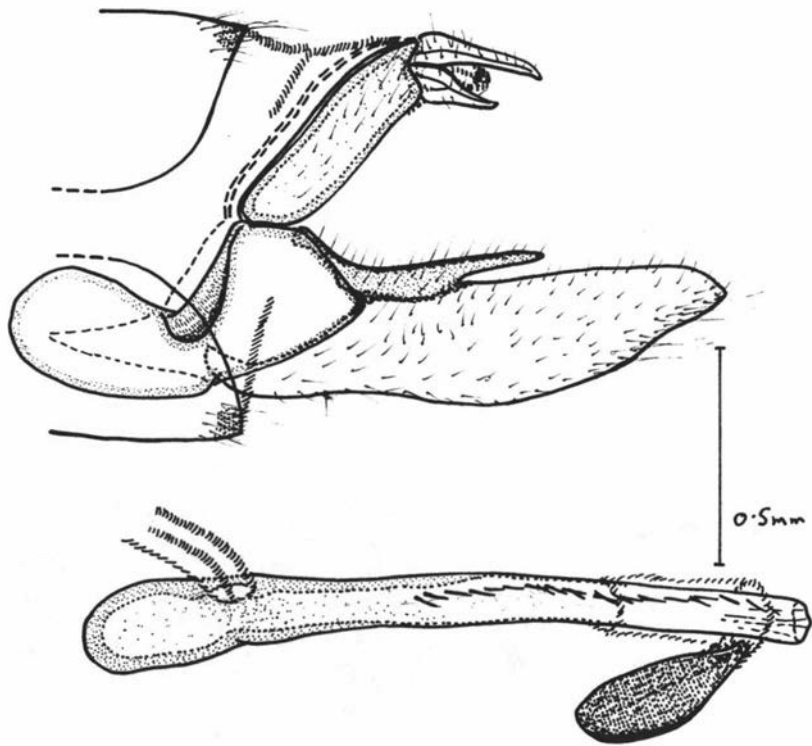
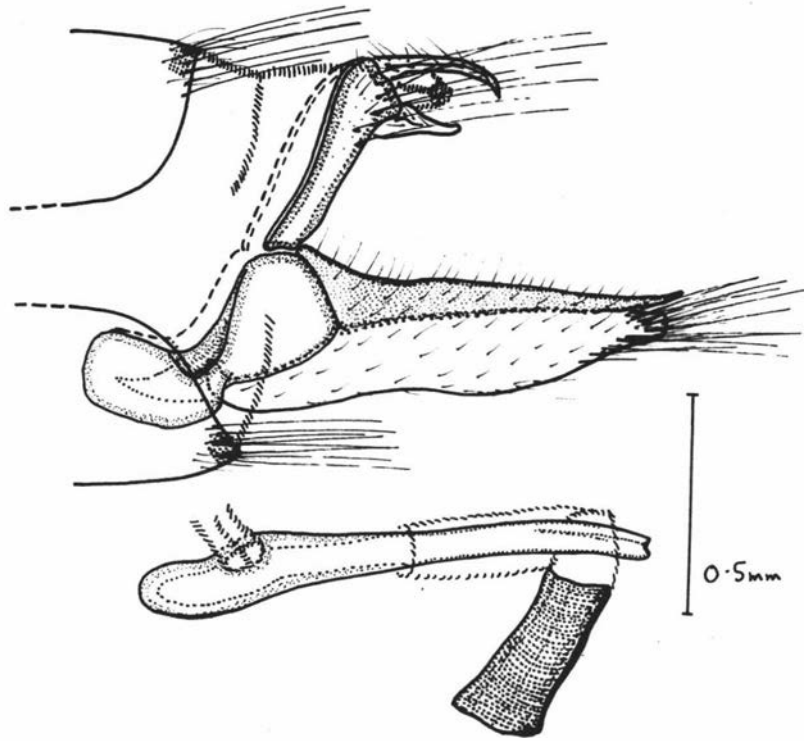


Fig.95 Male genitalia of Pareromene gurri,
left lateral aspect. (Coromandel
Ranges)

(p.252)

Fig.96 Male genitalia of Pareromene leucoxantha,
left lateral aspect. (Mt.Ruapehu)

(p.253)

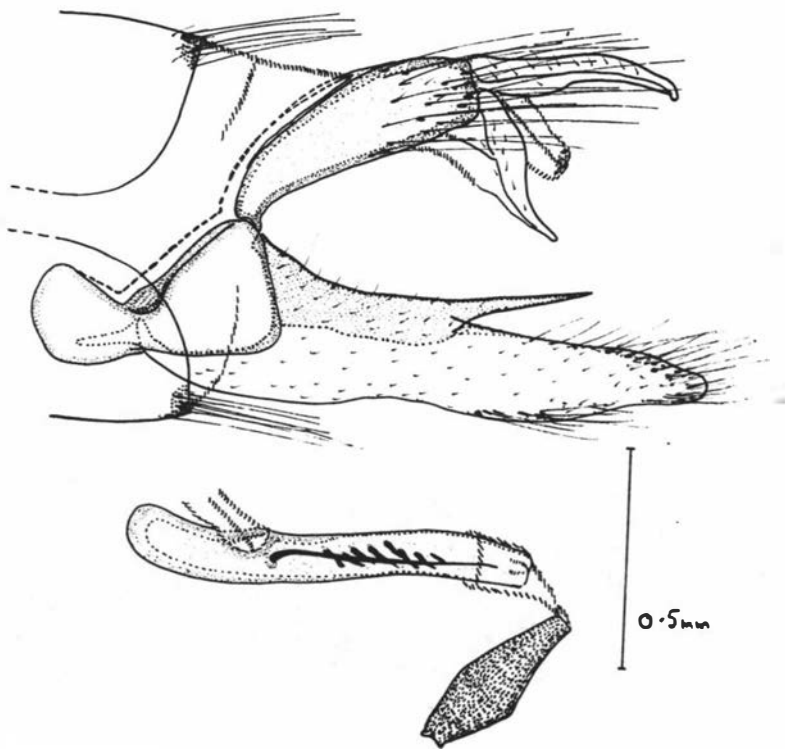
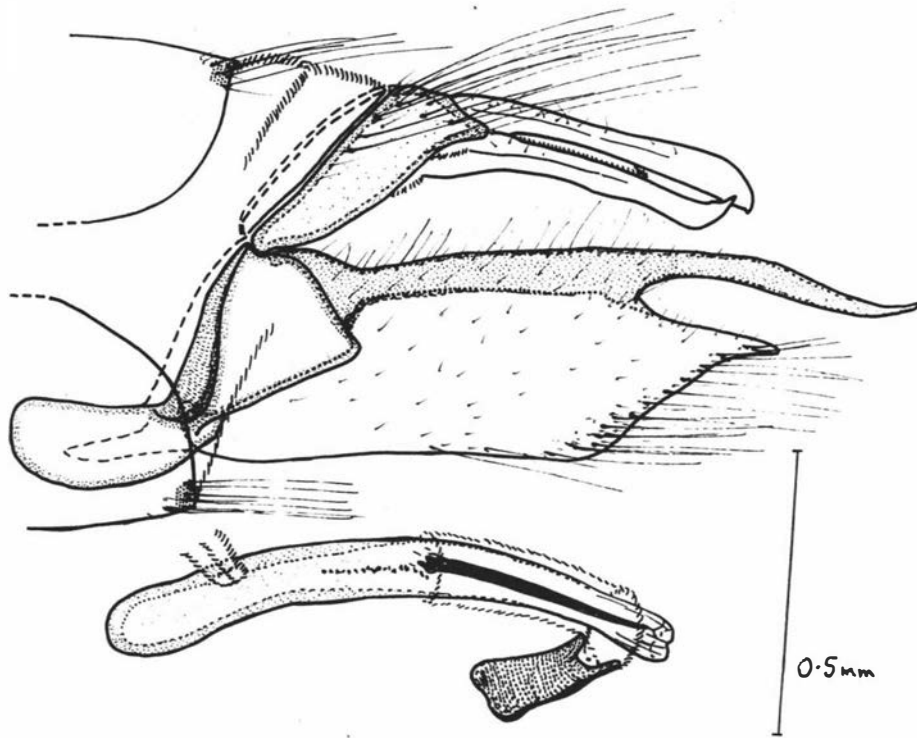


Fig.97 Male genitalia of Pareromene aurisciptella,
left lateral aspect. (Palmerston North)
(p.256)

Fig.98 Male genitalia of Pareromene bipunctella,
left lateral aspect. (Pohangina Valley)
(p.258)

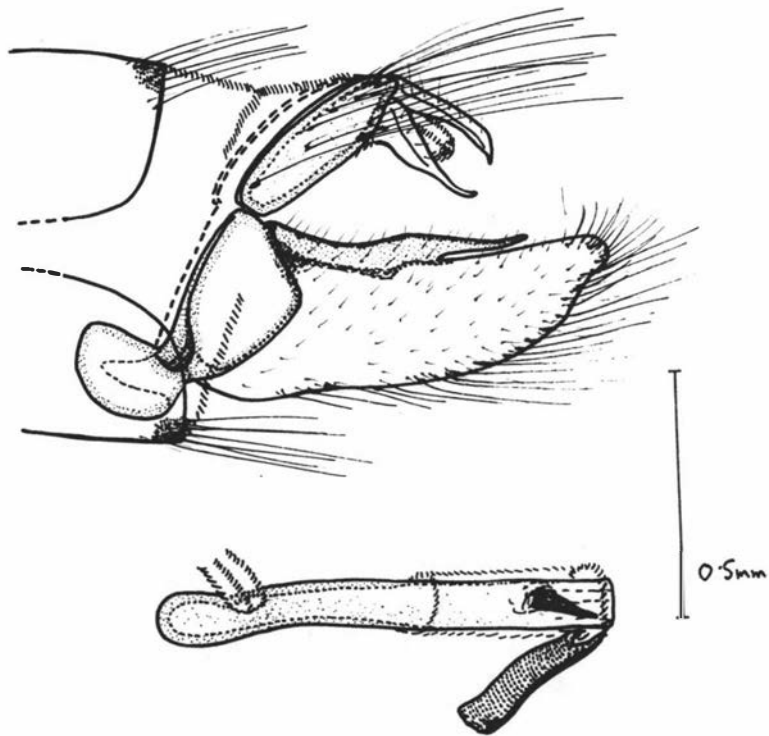
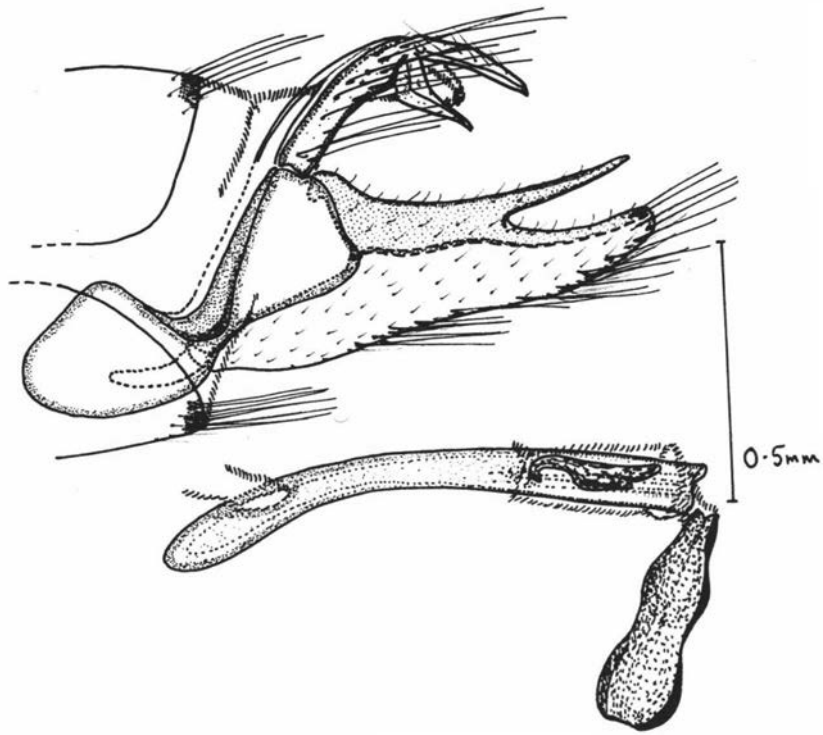


Fig.99 Male genitalia of Pareromene harmonica,
left lateral aspect. (Wellington)
(p.259)

Fig.100 Male genitalia of Pareromene elaina,
left lateral aspect. (Palmerston North)
(p.263)

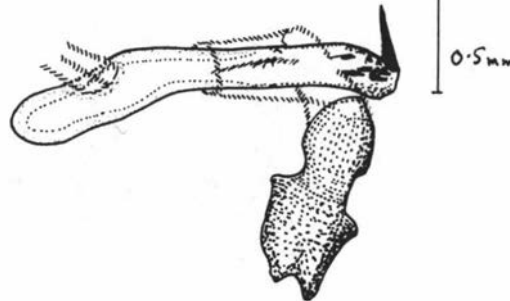
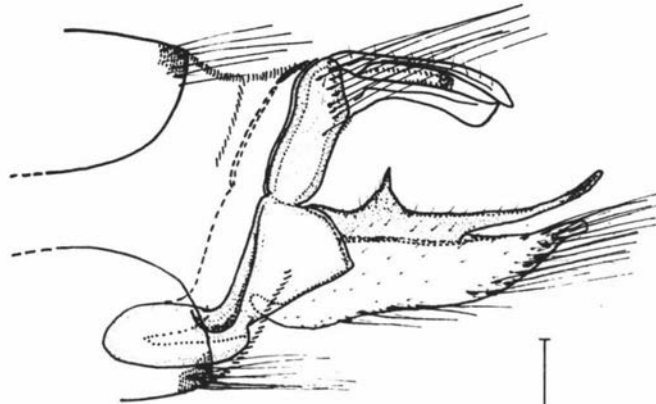
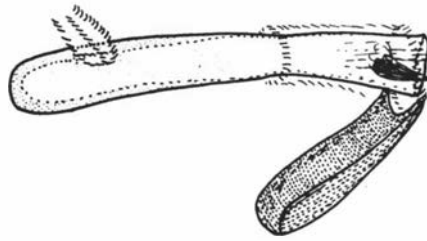
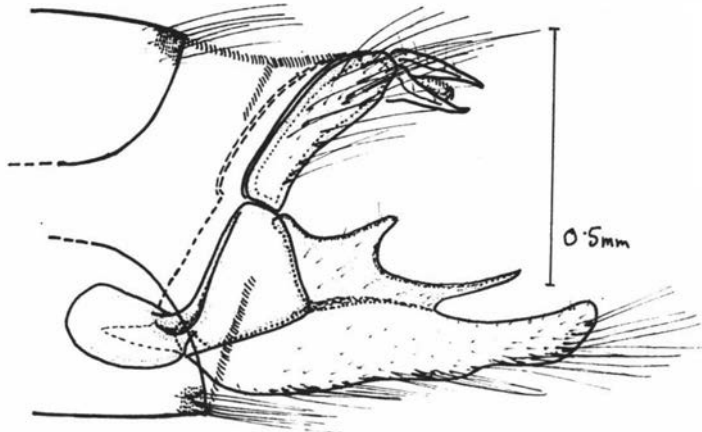
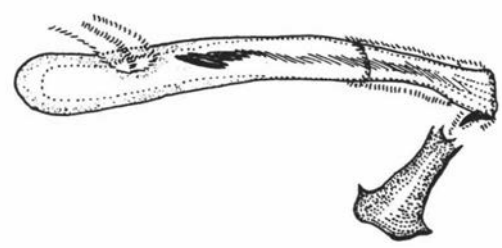
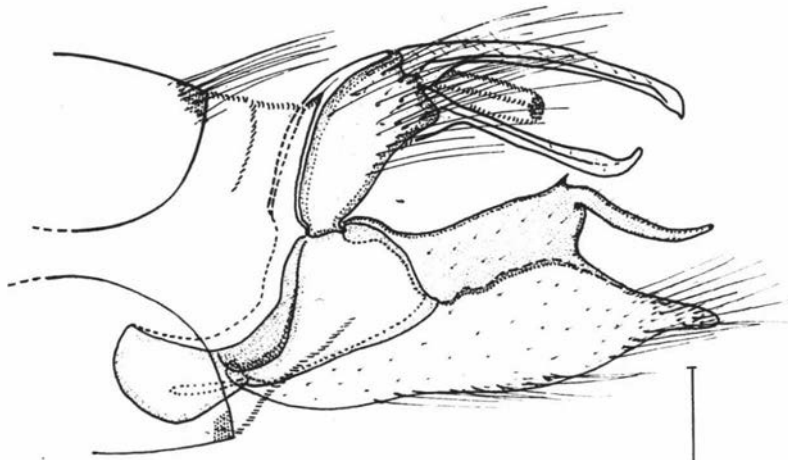
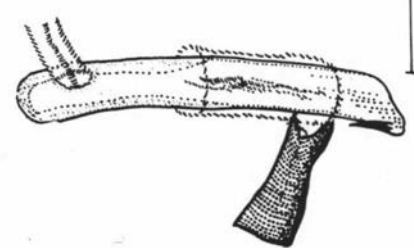
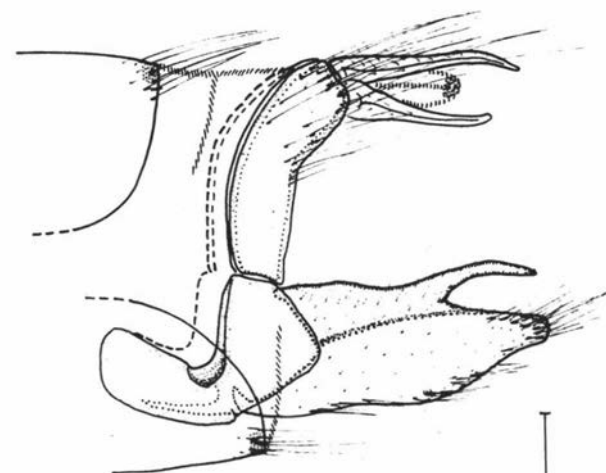


Fig.101 Male genitalia of Pareromene helioctypa,
left lateral aspect. (Milford Sound)
(p.267)

Fig.102 Male genitalia of Pareromene interrupta,
left lateral aspect. (Homer)
(p.269)



0.5mm



0.5mm

Fig.103 Male genitalia of Pareromene lepidella,
left lateral aspect. (Dunedin)
(p.272)

Fig.104 Male genitalia of Pareromene metallifera,
left lateral aspect. (Wellington)
(p.274)

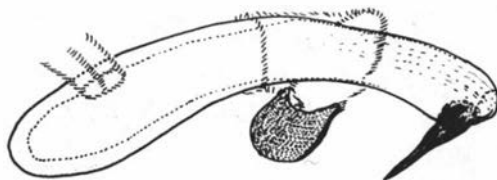
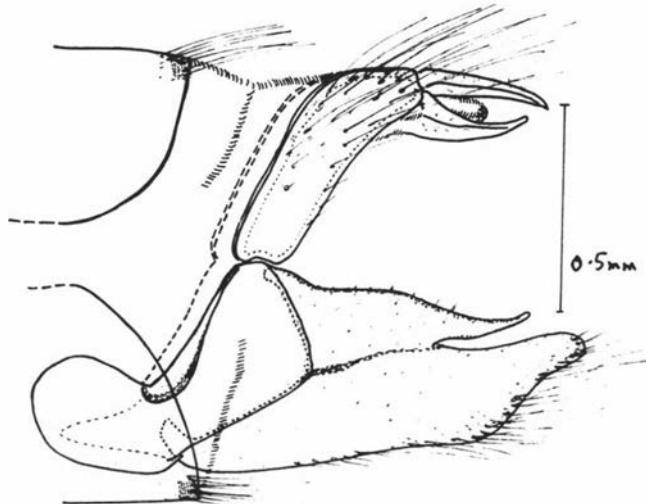
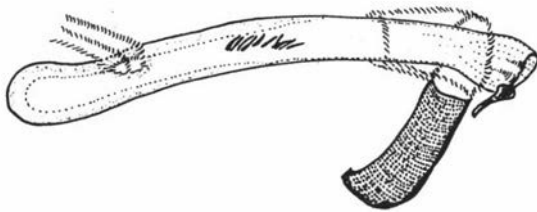
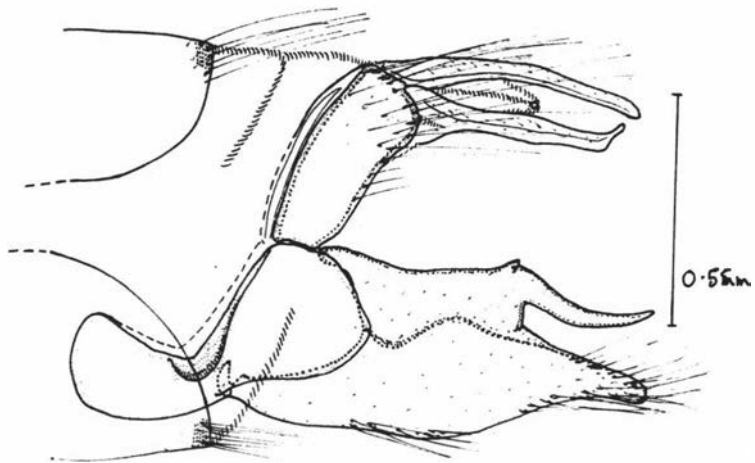
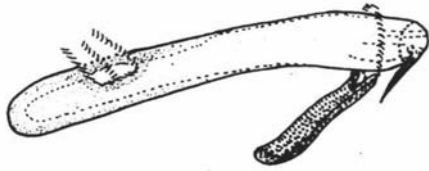
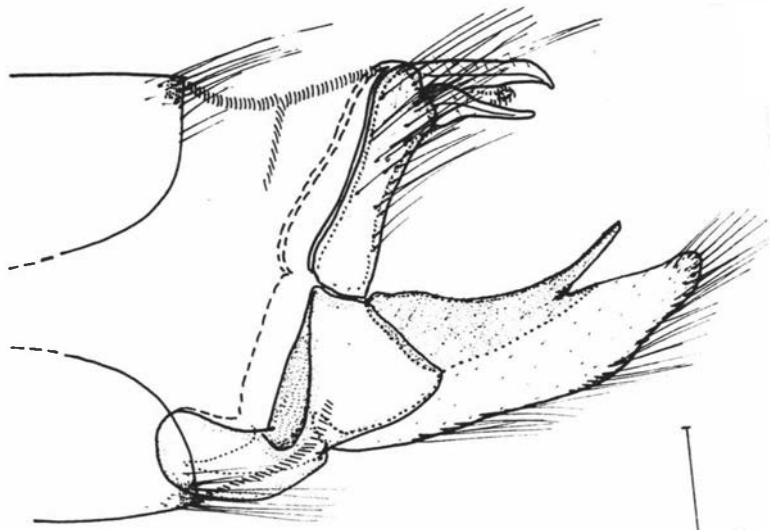


Fig.105 Male genitalia of Pareromene microdora,
left lateral aspect. (Wellington)

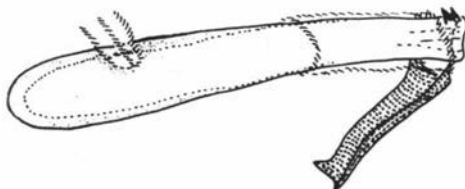
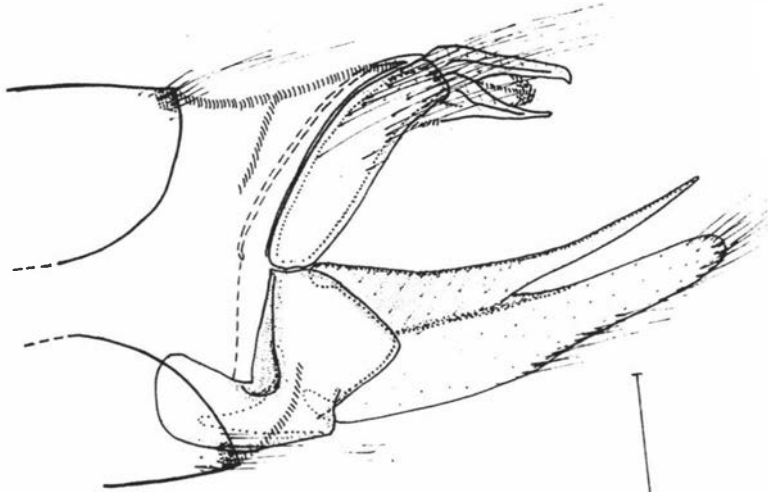
(p.276)

Fig.106 Male genitalia of Pareromene planetopa,
left lateral aspect. (Arthur's Pass)

(p.278)



0.5mm



0.5mm

Fig.107 Male genitalia of Pareromene epiphaea,
left lateral aspect. (Cleddau)
(p.279)

Fig.108 Male genitalia of Pareromene holanthes,
left lateral aspect. (Mt.Ruapehu)
(p.281)

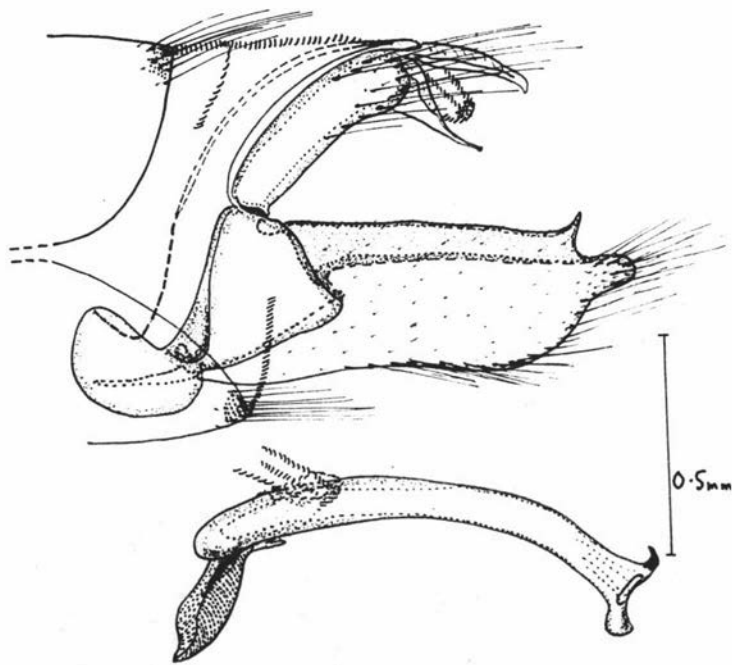
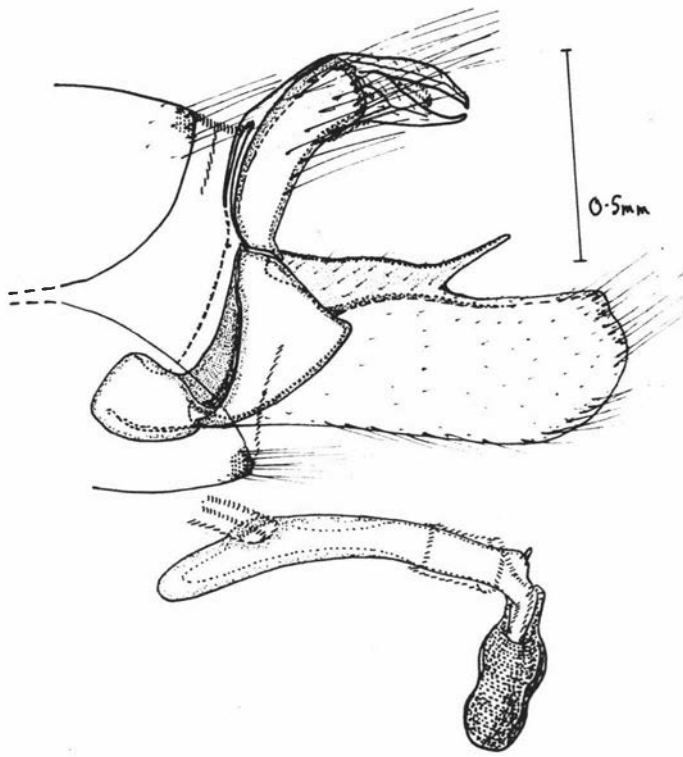


Fig.109 Male genitalia of Pareromene parorma,
left lateral aspect. (Wainuiomata)
(p.283)

Fig.110 Male genitalia of Pareromene pyrsophanes,
left lateral aspect. (Mt.Ruapehu)
(p.284)

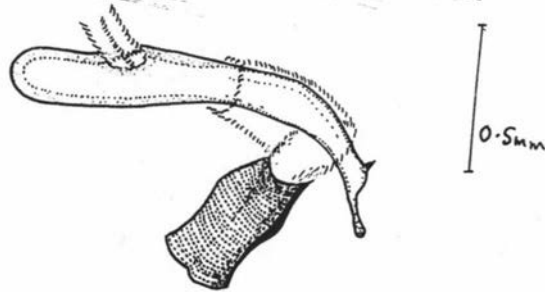
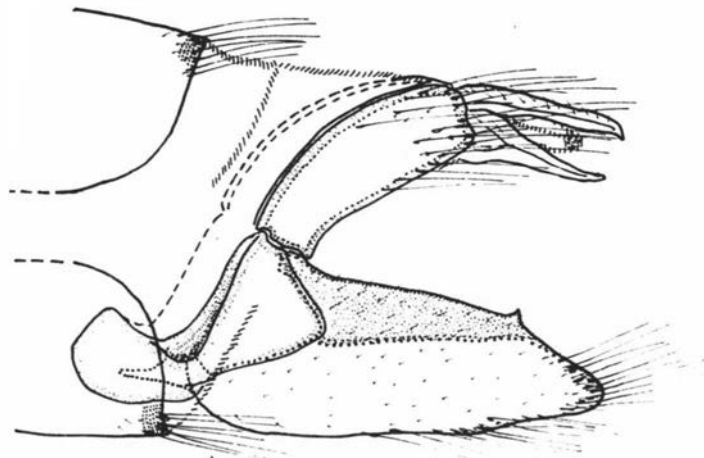
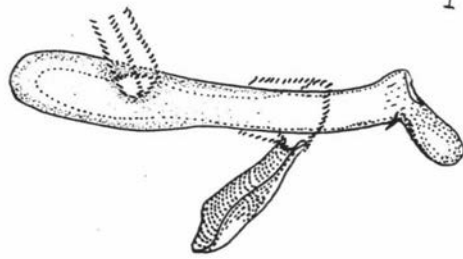
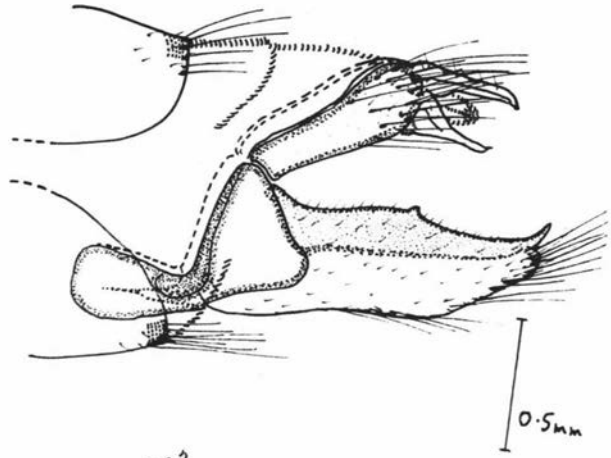


Fig.111 Male genitalia of Pareromene ochracealis,
left lateral aspect. (Sydney, N.S.W.)
(p.287)

Fig.112 Male genitalia of Tauroscopa gorgopis,
left lateral aspect, but aedoeagus in
dorsal aspect. (Obelisk)
(p.299)

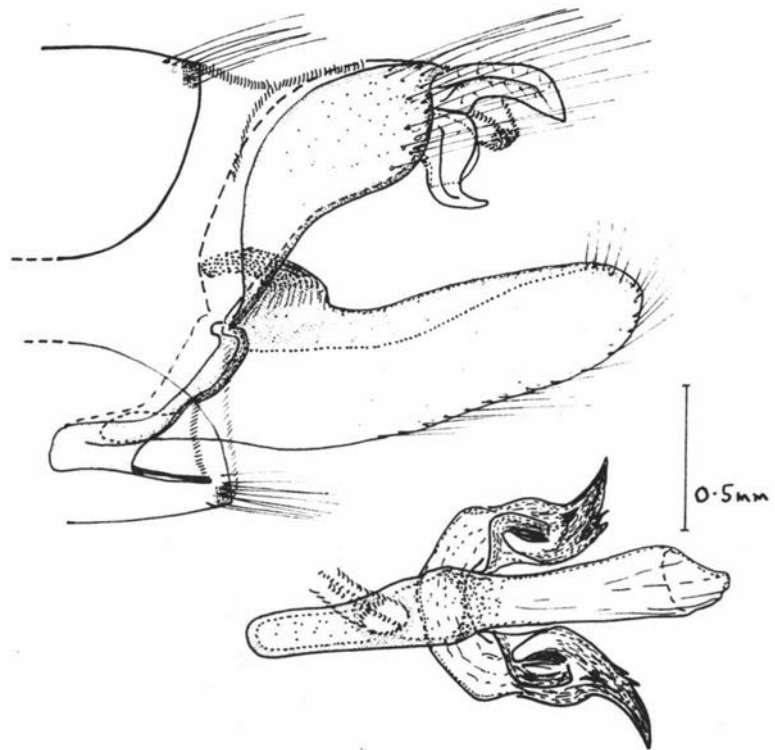
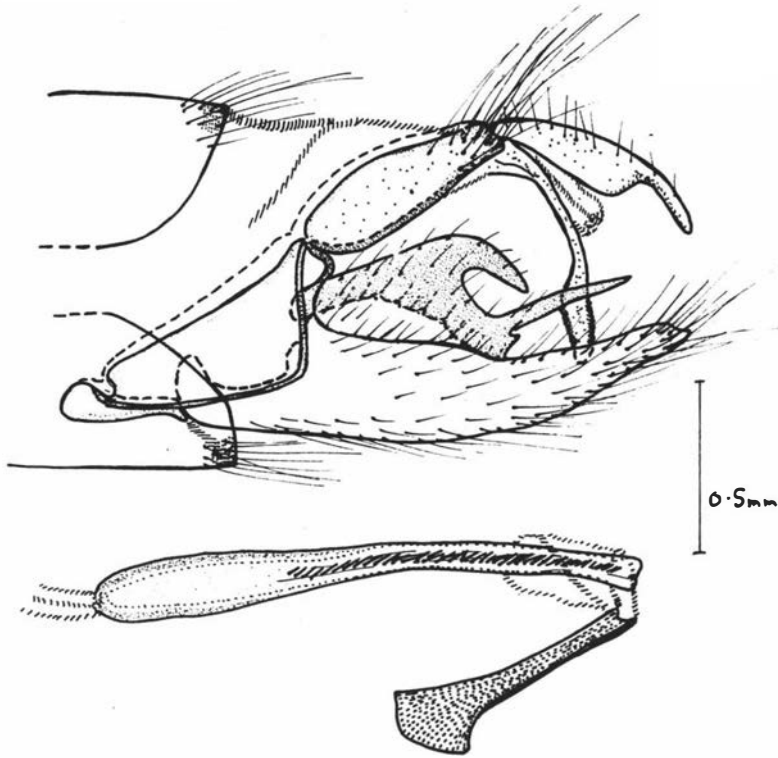


Fig.113 Male genitalia of Tauroscopa trapezitis,
left lateral aspect, but aedoeagus in
dorsal aspect. (Vanguard Peak)

(p.301)

Fig.114. Male genitalia of Tauroscopa notabilis,
left lateral aspect, but aedoeagus in
dorsal aspect. (Iron Hill, Nelson)

(p.297)

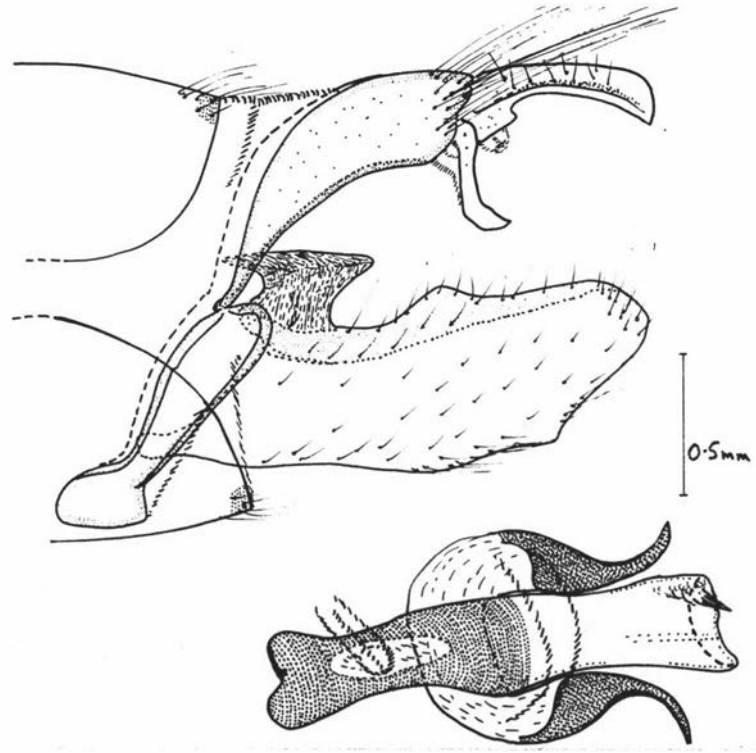
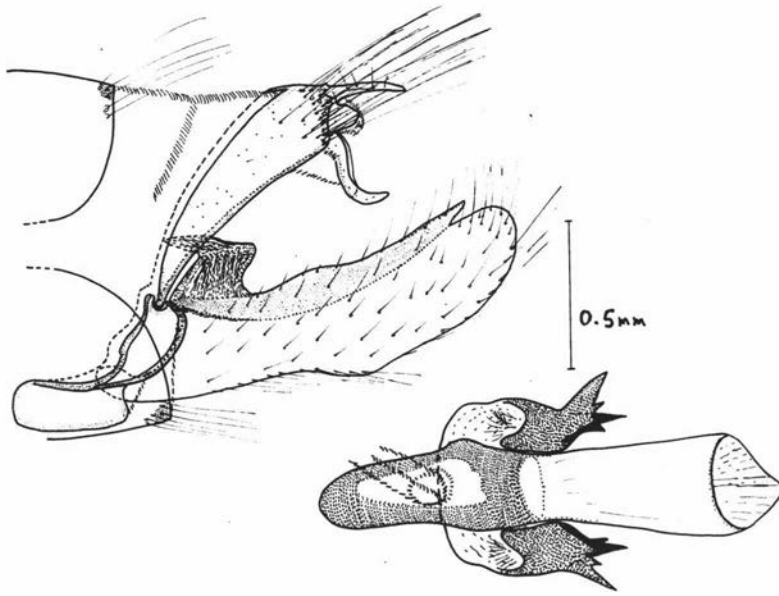


Fig.115 Male genitalia of Tauroscopa lachnea,
ventral aspect, but aedoeagus in left
lateral aspect. (Mt Hotham, Victoria)

(p.294)

Fig.116 Male genitalia of Gadira acerella,
left lateral aspect, but aedoeagus in
dorsal aspect. (Palmerston North)

(p.319)

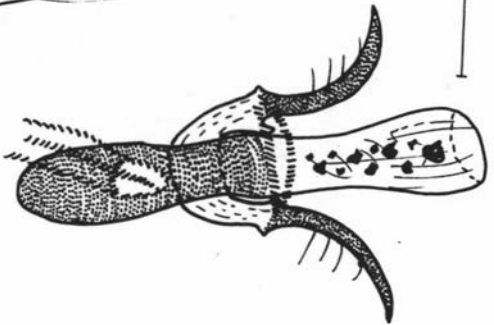
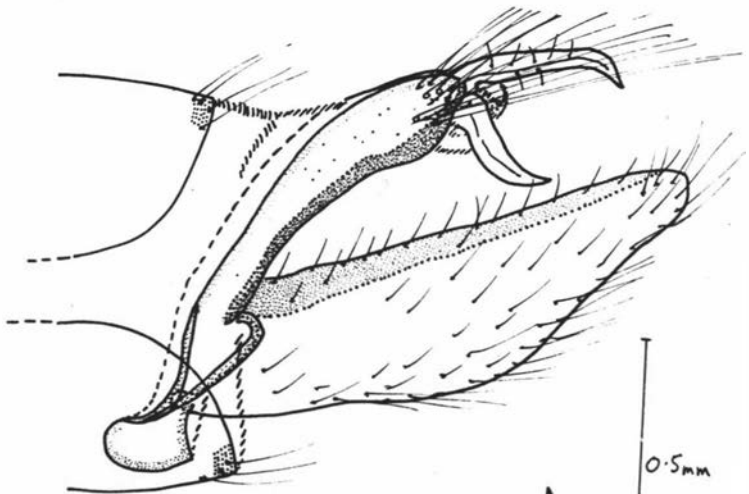
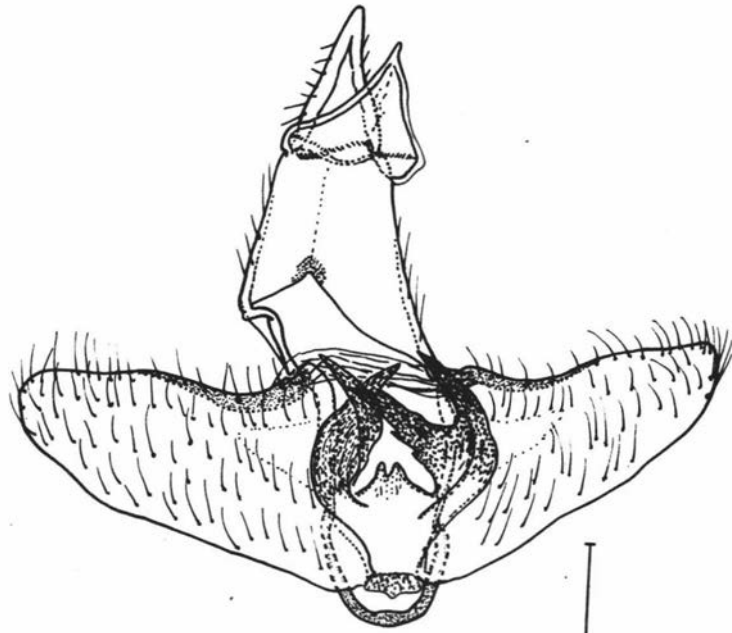


Fig.117 Male genitalia of Gadira leucophthalma,
left lateral aspect. (Birdling's Flat,Cant.)
(p.329)

Fig.118 Male genitalia of Gadira pedionoma,
left lateral aspect, but aedoeagus in
dorsal aspect. (Black Mountain,A.C.T.)
(p.321)

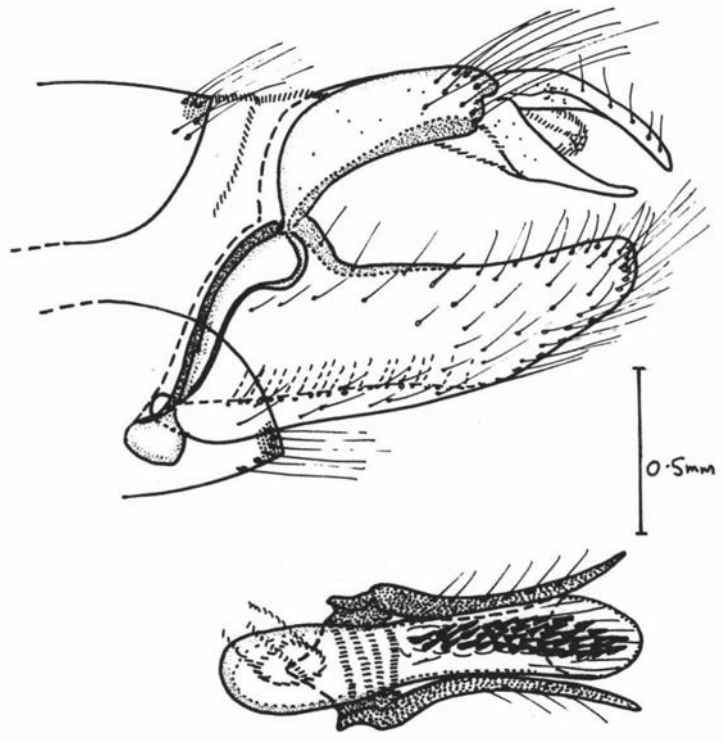
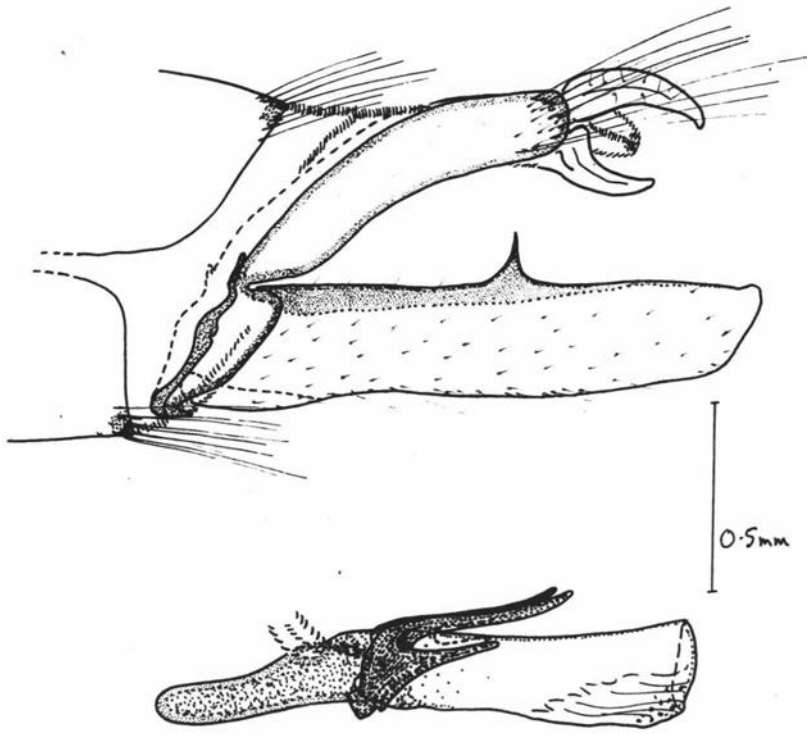


Fig.119 Male genitalia of Gadira petraula,
left lateral aspect. (Port Hills,Cant.)
(p.317)

Fig.120 Male genitalia of Gadira gramella,
left lateral aspect. (Macedon,Victoria)
(p.313)

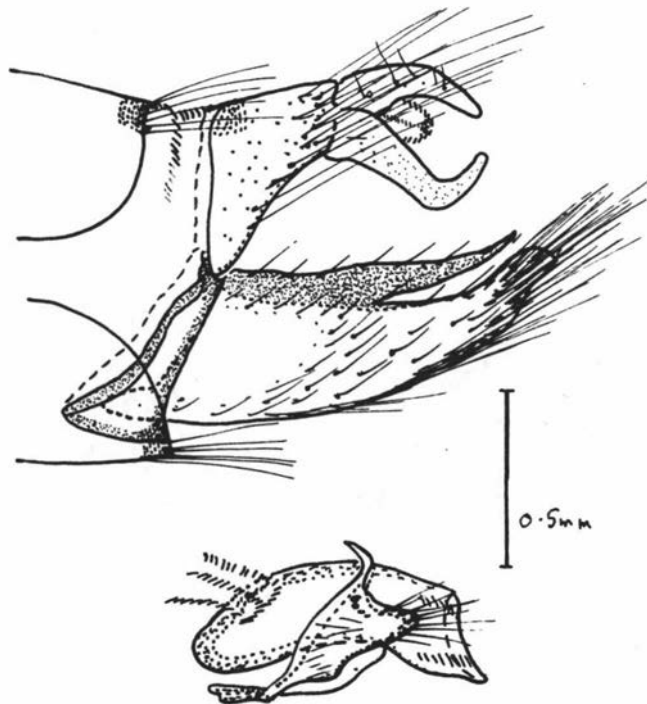
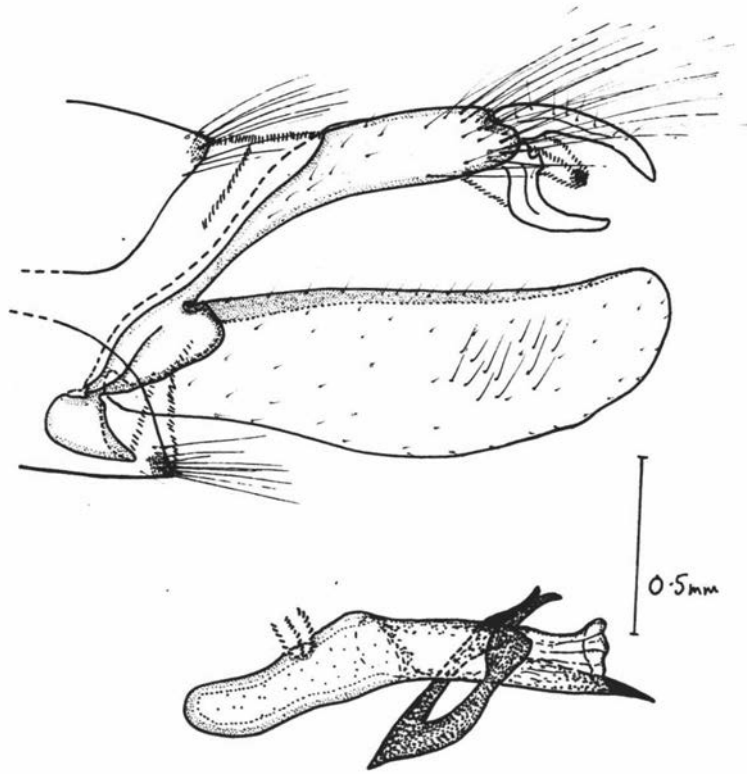
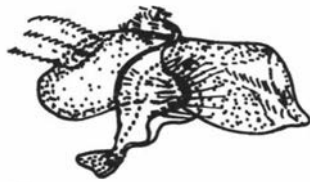
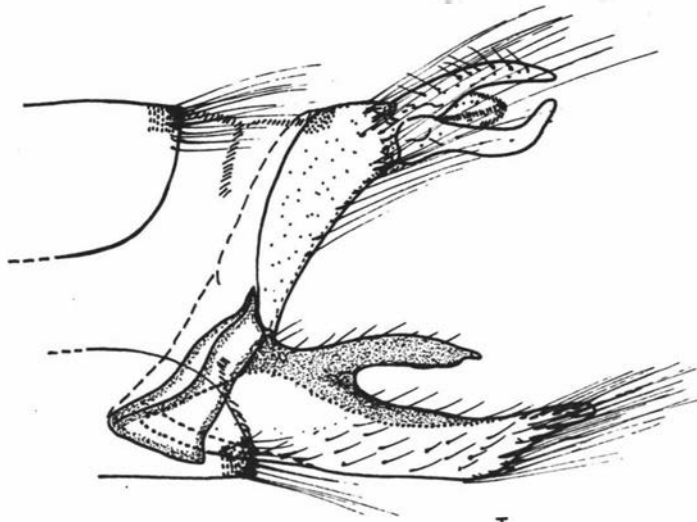
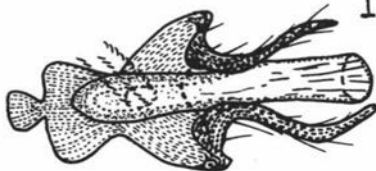
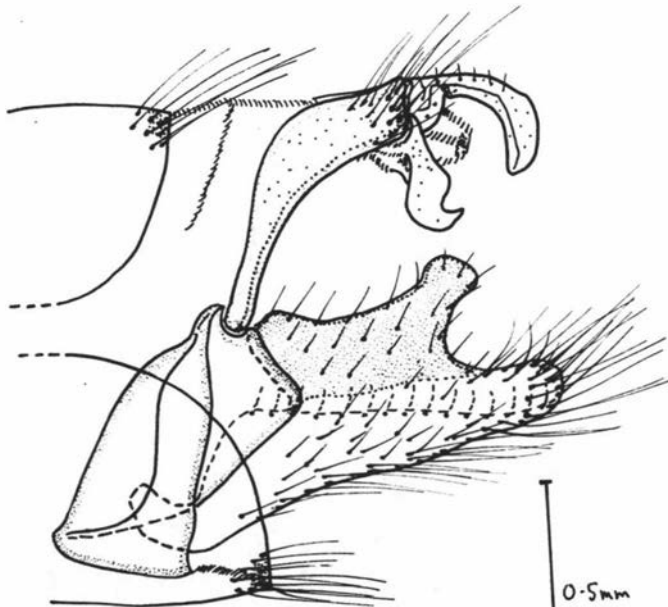


Fig.121 . Male genitalia of Gadira panselenella,
left lateral aspect. (Tasmania)
(p.314)

Fig.122 . Male genitalia of Gadira vittella,
left lateral aspect, but aedoeagus in
dorsal aspect. (Black Mountain, A.C.T.)
(p.316)



0.5mm



0.5mm

Fig.123 Male genitalia of Gadira longipalpella,
left lateral aspect. (Black Mountain,A.C.T.)
(p.323)

Fig.124 Male genitalia of Gadira pleniferella,
left lateral aspect. (Ringwood,Victoria)
(p.325)

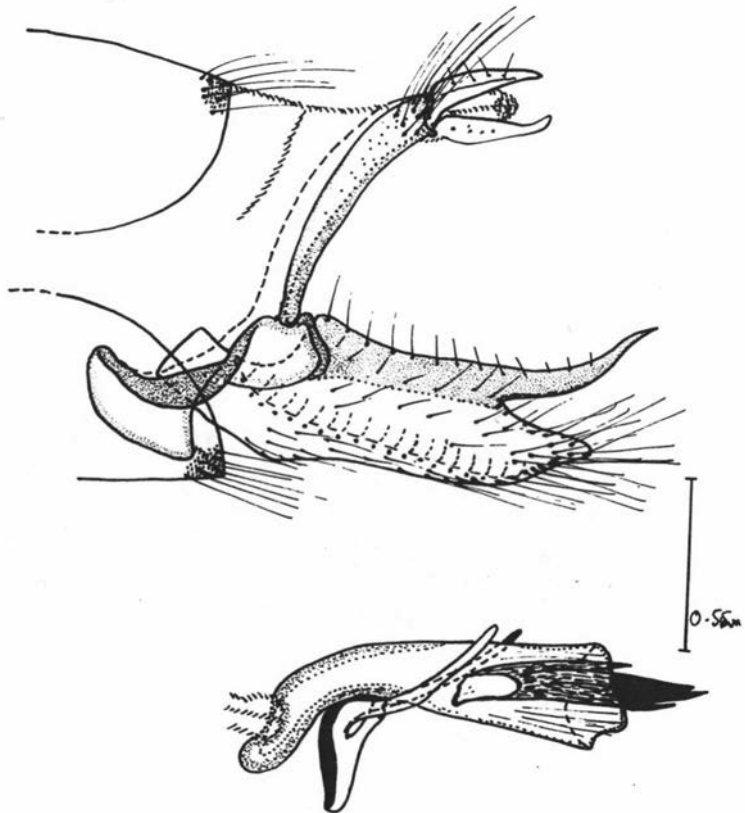
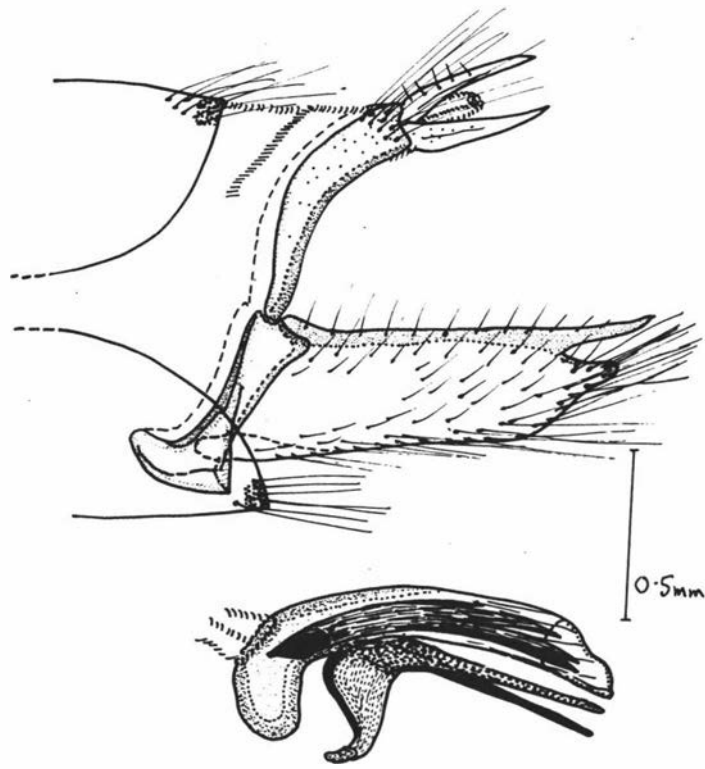
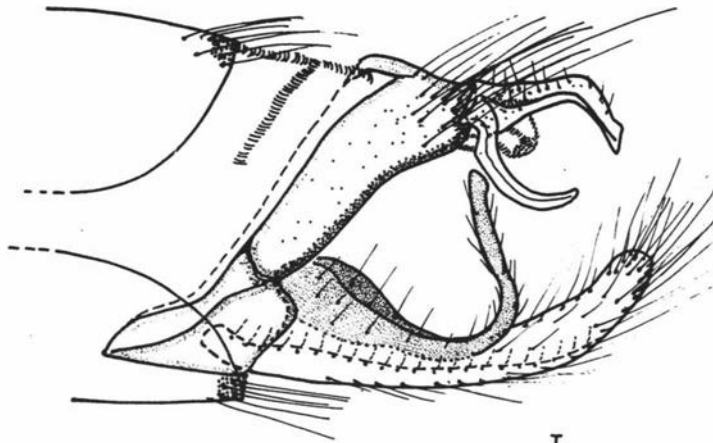
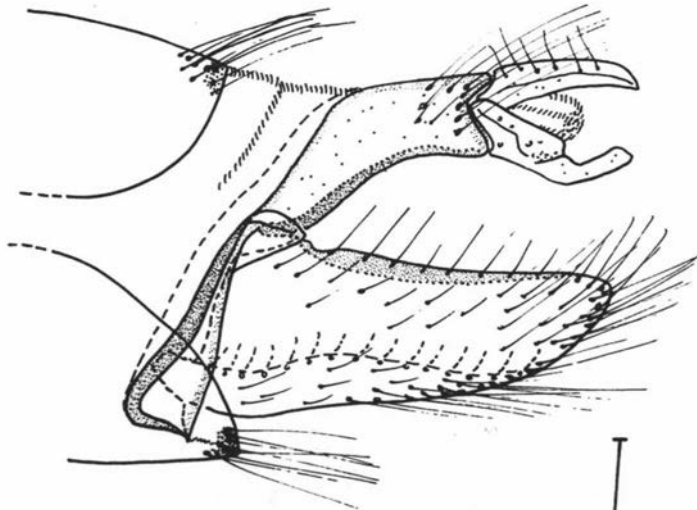
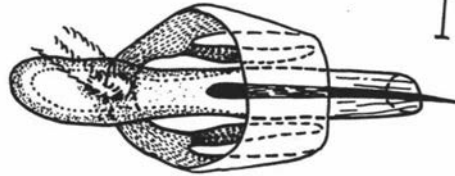


Fig.125 Male genitalia of Hednota bifractella,
left lateral aspect, but aedoeagus in
dorsal aspect. (Black Mountain, A.C.T.)
(p.305)

Fig.126 Male genitalia of Gadira crypsichroa,
left lateral aspect. (Black Mountain)
(p.326)



0.5mm



0.5mm

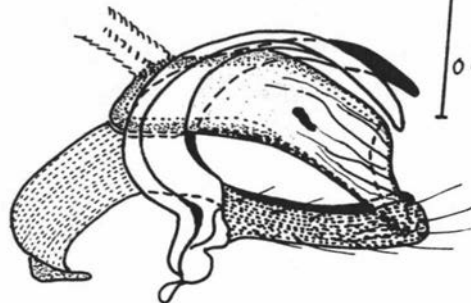
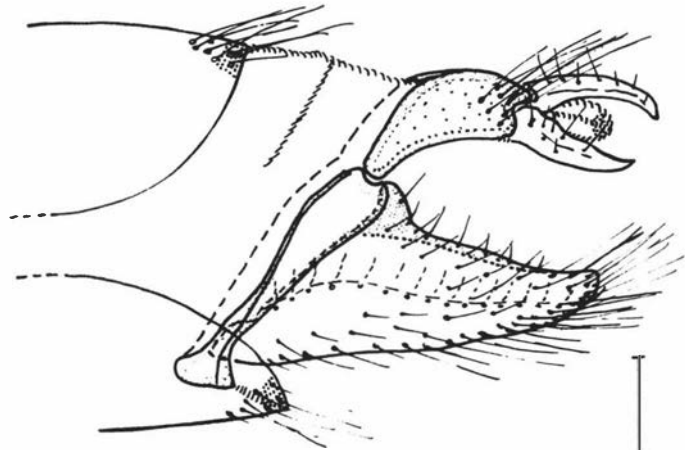
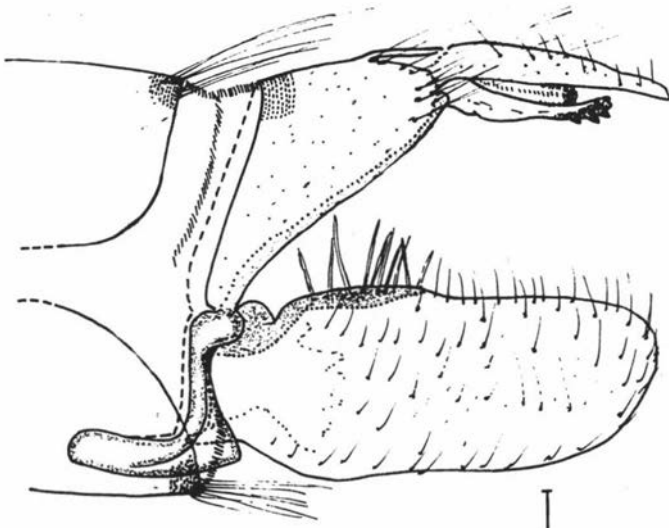
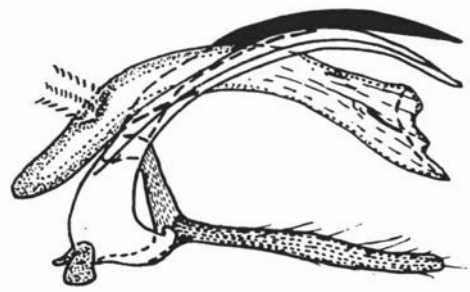


Fig.127 Male genitalia of Gadira haplotypa,
left lateral aspect. (Glen Innes, N.S.W.)
(p.327)

Fig.128 Male genitalia of Paragadira strophea,
left lateral aspect. (Wainuiomata)
(p.332)



0.5mm



0.5mm

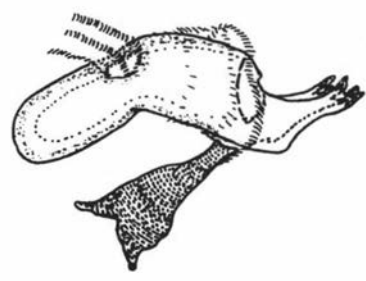


Fig.129 Male genitalia of Protyparcha scaphodes,
left lateral aspect. (Auckland Island)
(p.335)

Fig.130 Male genitalia of Protyparcha graminea,
ventral aspect, but aedeagus in left
lateral aspect. (Campbell Island)
(p.336)

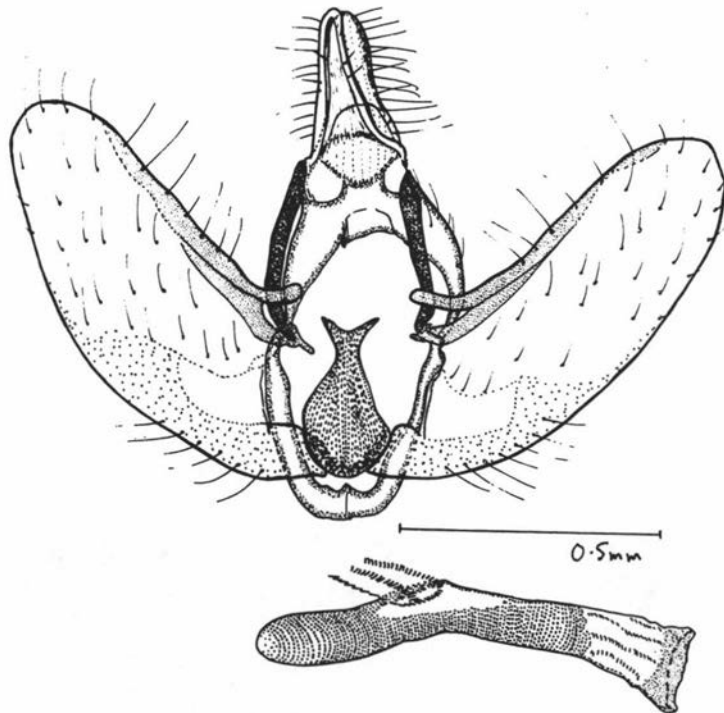
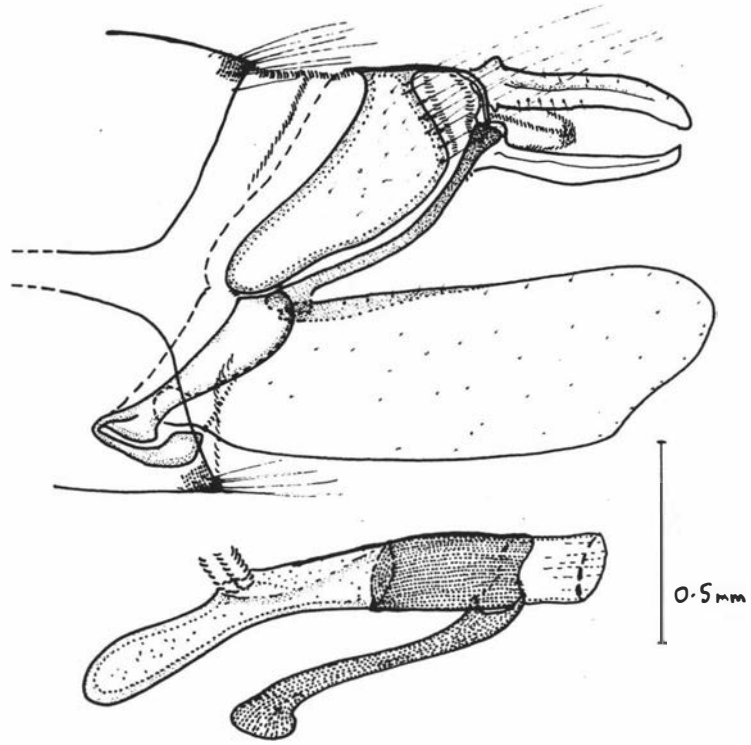


Fig.131 Female genitalia of Orocrambus apicellus,
right lateral aspect. (Palmerston North)
(p.86)

Fig.132 Female genitalia of Orocrambus aethonellus,
right lateral aspect. (Mt.Cook)
(p.91)

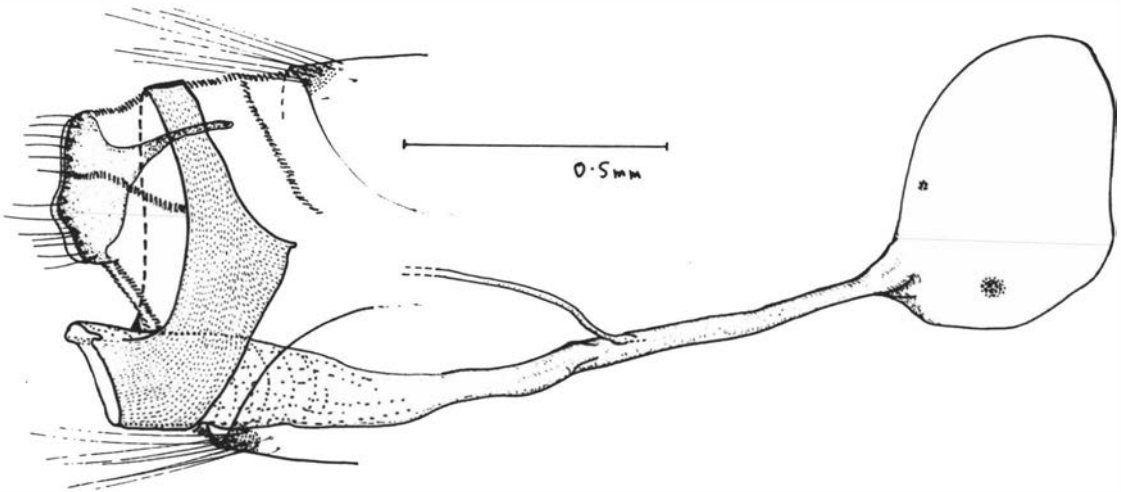
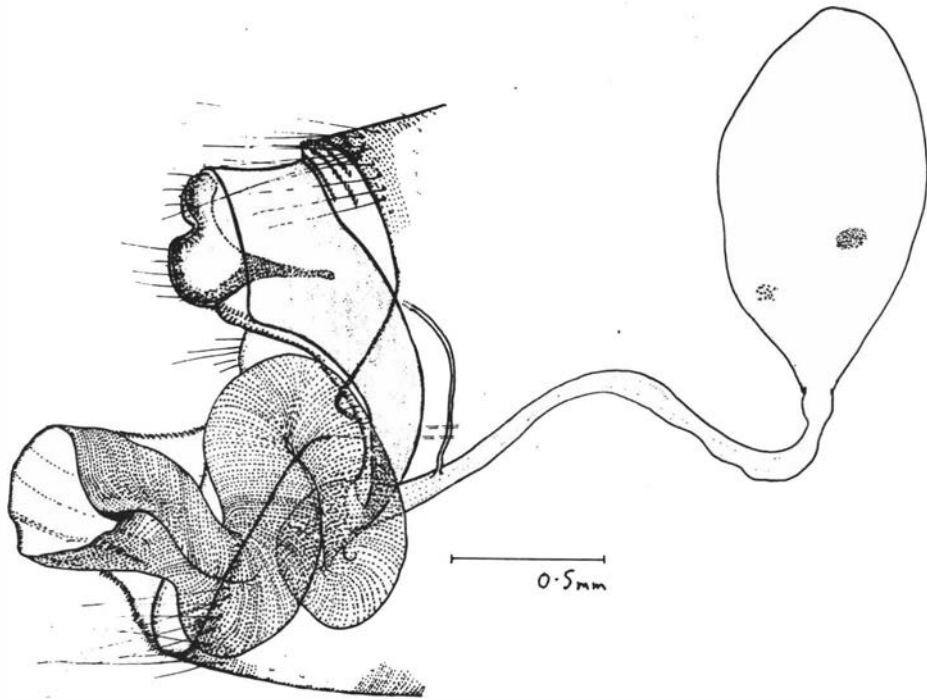


Fig.133 Female genitalia of Orocrambus catacaustus,
right lateral aspect. (Arthur's Pass)
(p.95)

Fig.134 Female genitalia of Orocrambus flexuosellus,
right lateral aspect. (Palmerston North)
(p.100)

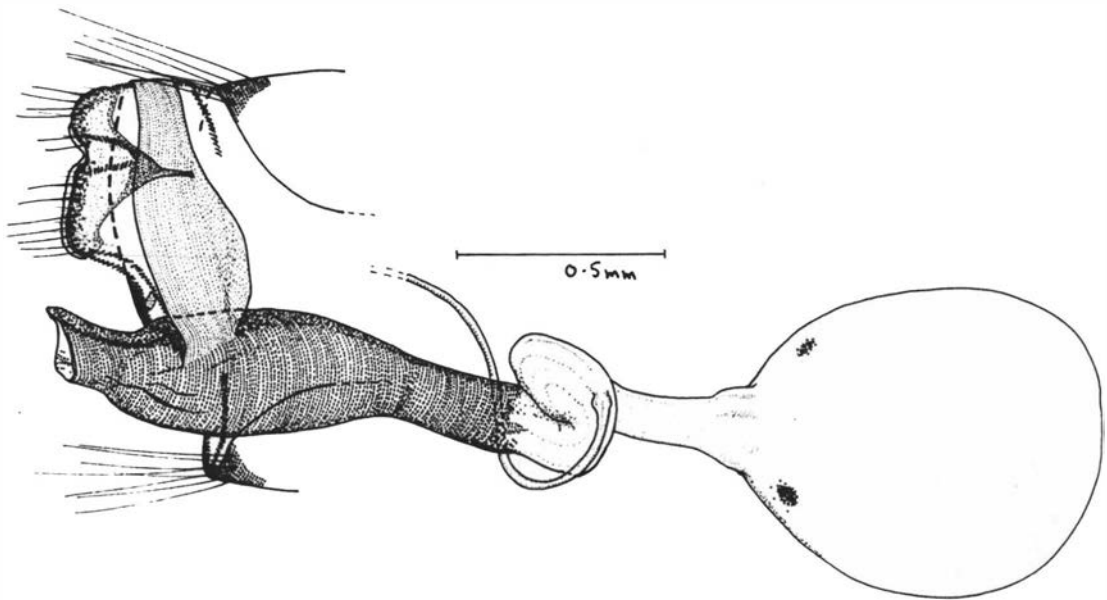
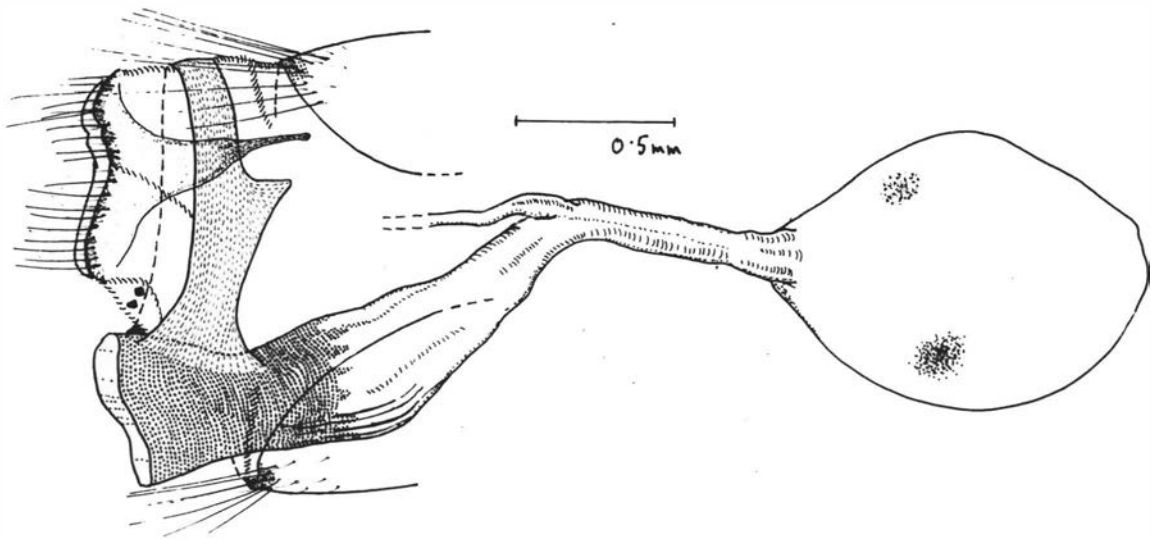


Fig.135 Female genitalia of Orocrambus horistes,
right lateral aspect. (Chatham Islands)
(p.113)

Fig.136 Female genitalia of Orocrambus mylites,
right lateral aspect. (Travers Range)
(p.114)

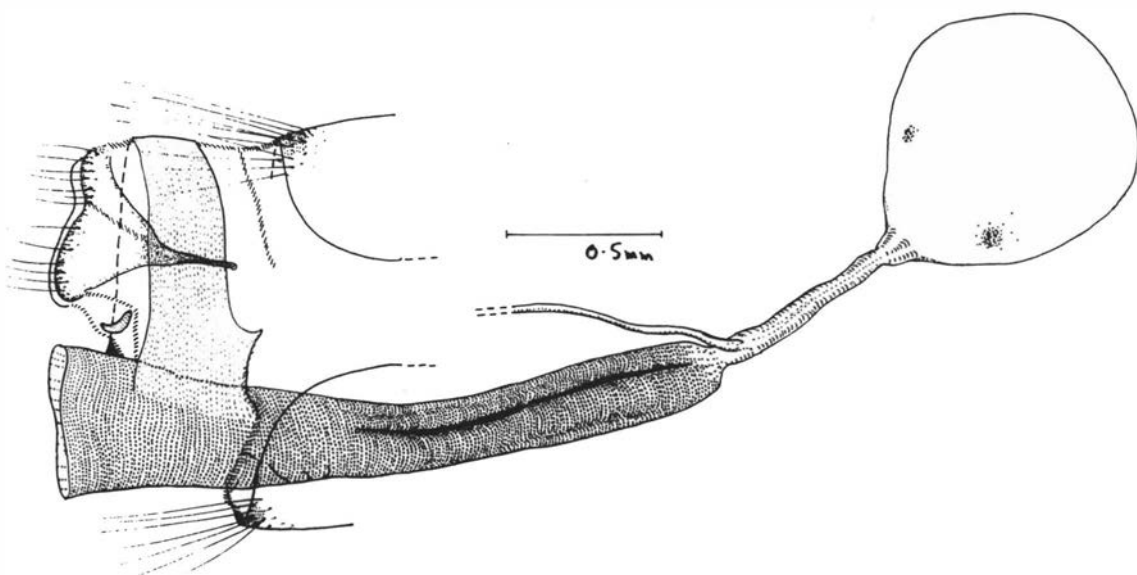
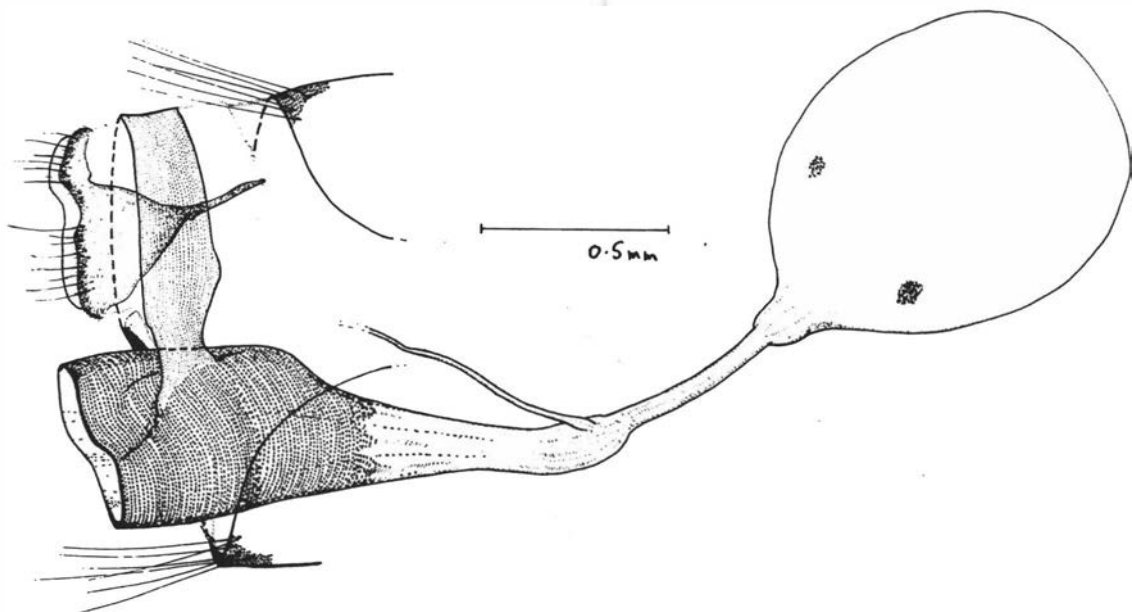


Fig.137 Female genitalia of Orocrambus haplotomus,
right lateral aspect. (Milford Sound)

(p.116)

Fig.138 Female genitalia of Orocrambus heliotes,
right lateral aspect. (Waiouru)

(p.118)

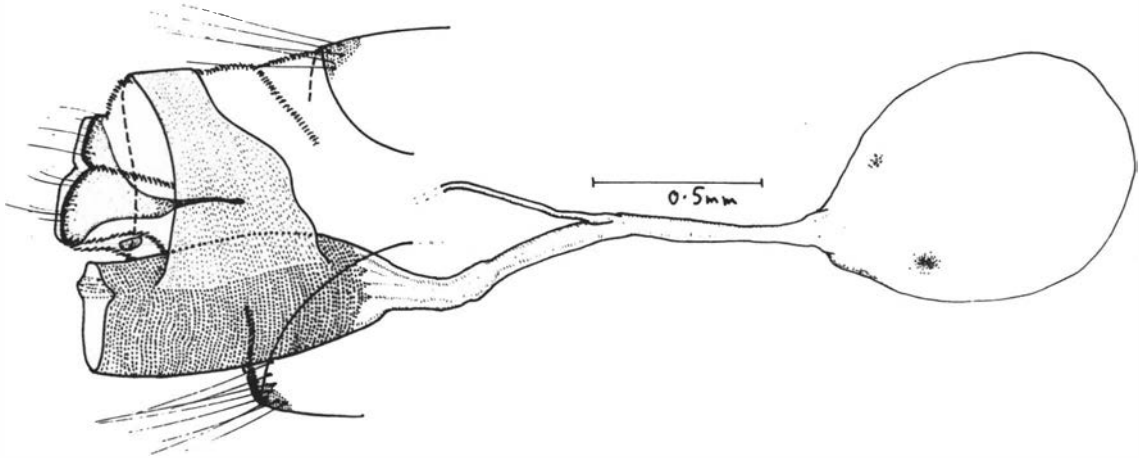
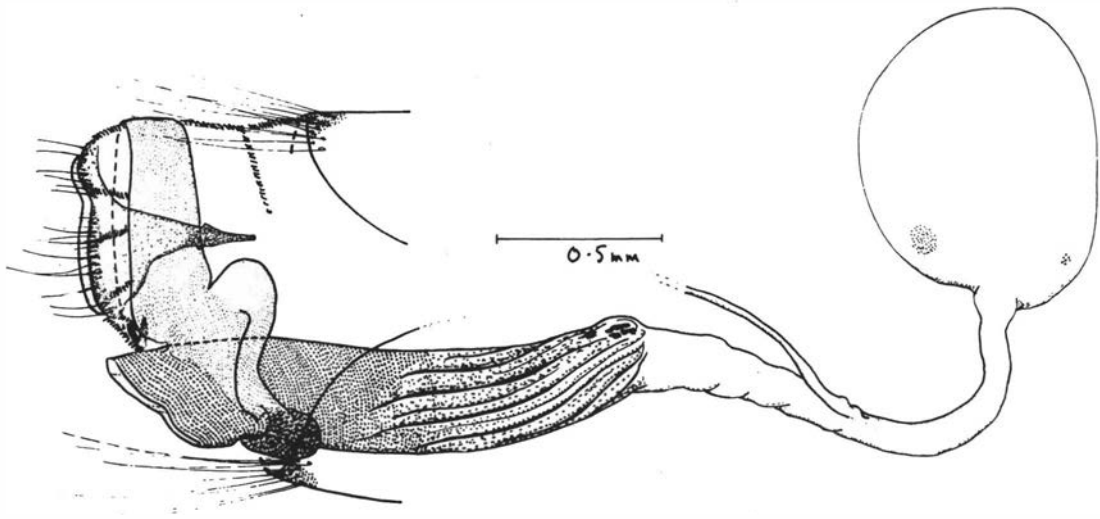


Fig.139 Female genitalia of Orocrambus machaeristes,
right lateral aspect. (Mt.Earnslaw)

(p.122)

Fig.140 Female genitalia of Orocrambus thymiastes,
right lateral aspect. (Invercargill)

(p.123)

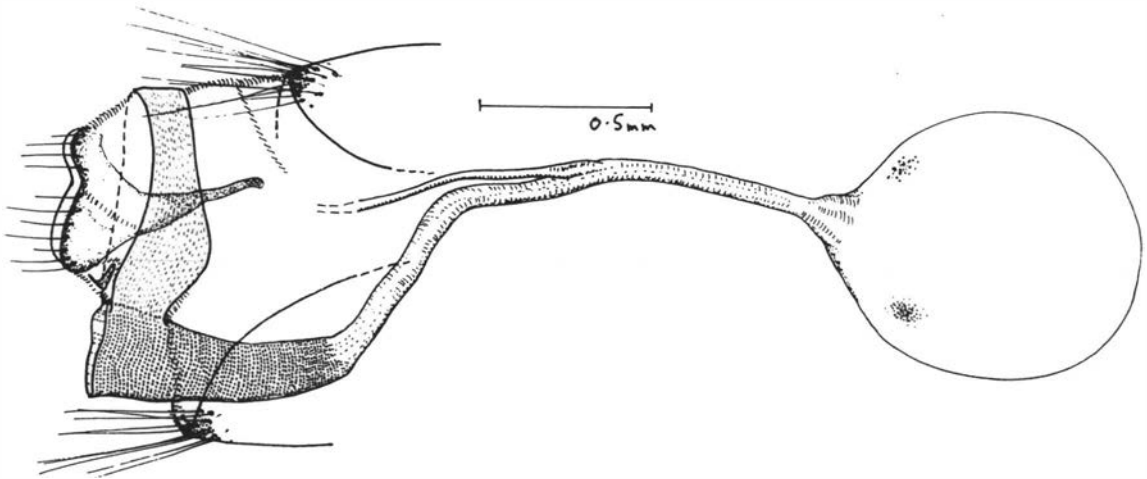
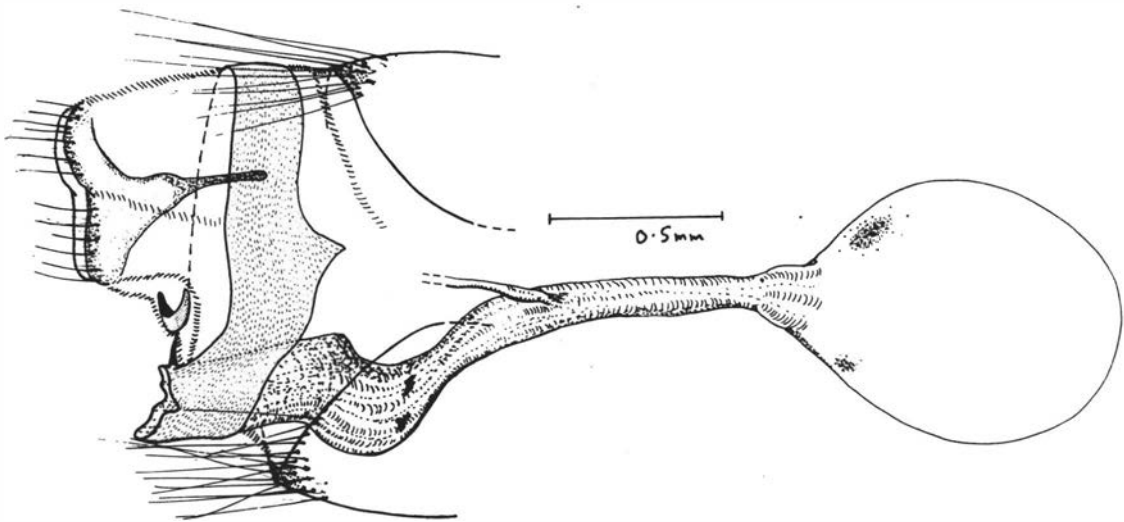


Fig.141 Female genitalia of Orocrambus tritonellus,
right lateral aspect. (Mt.Grey)
(p.124)

Fig.142 Female genitalia of Orocrambus clarkei,
right lateral aspect. (Humboldt Range)
(p.129)

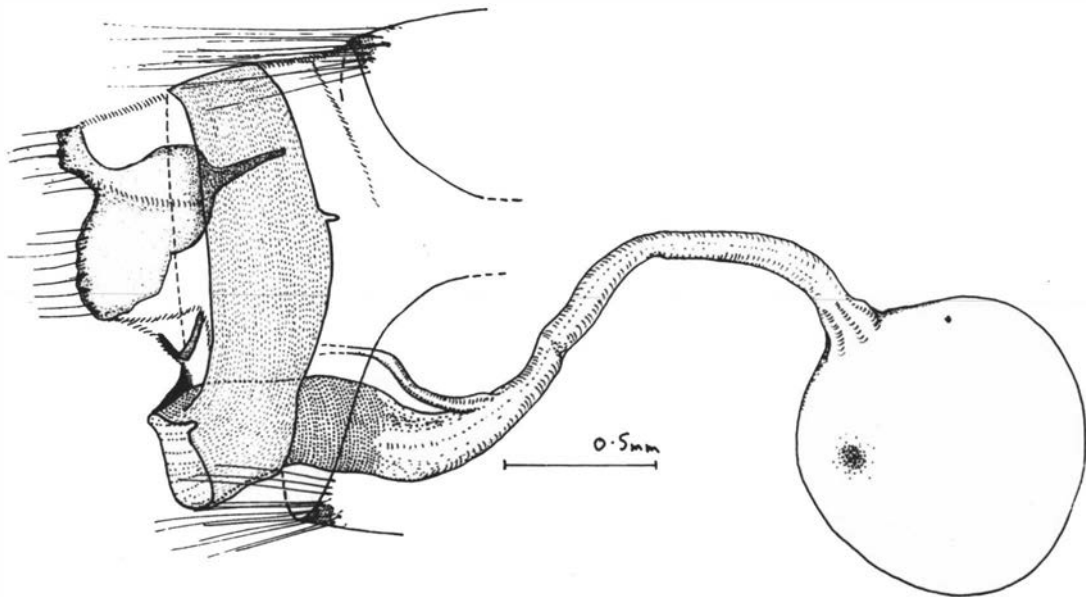
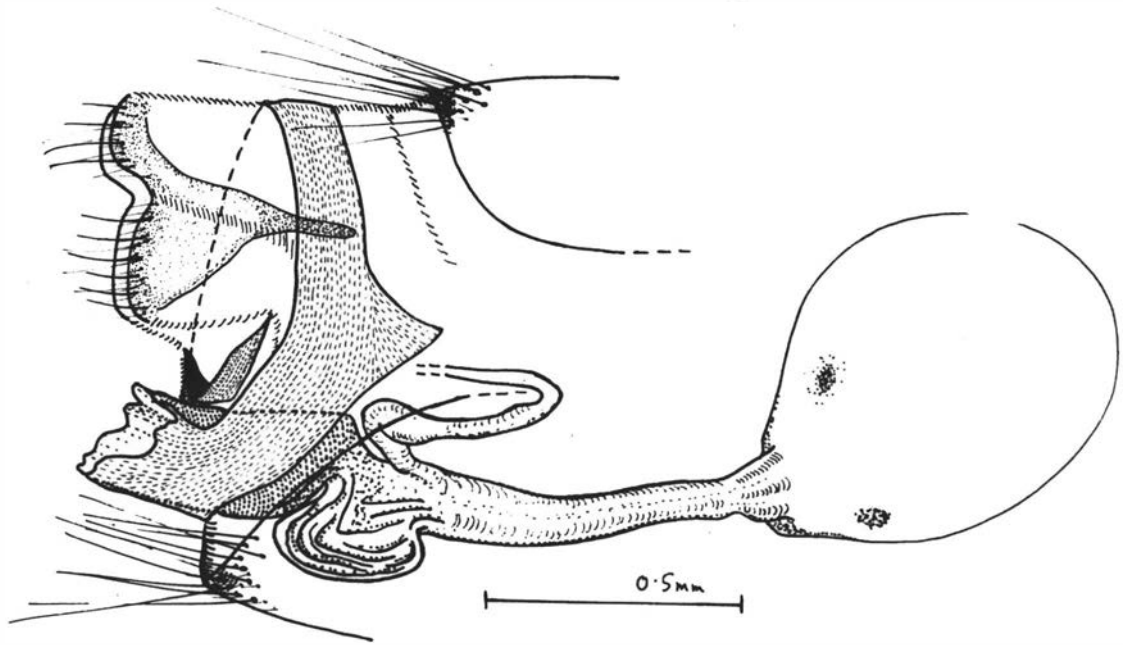


Fig.143 Female genitalia of Orocrambus melampetrus,
right lateral aspect. (Mt.Hutt,Cant.)
(p.130)

Fig.144 Female genitalia of Orocrambus scoparioides,
right lateral aspect. (Invercargill)
(p.133)

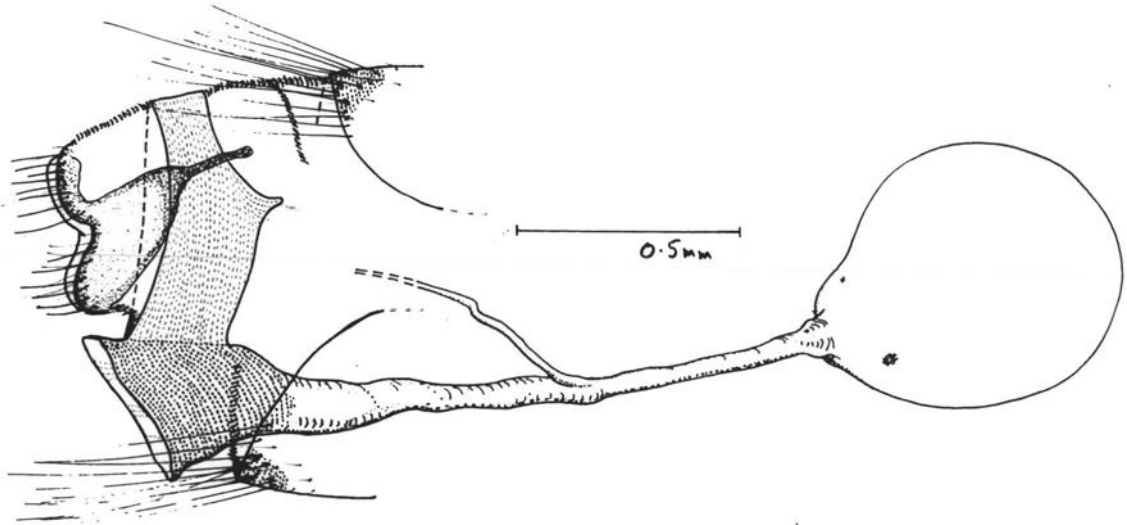
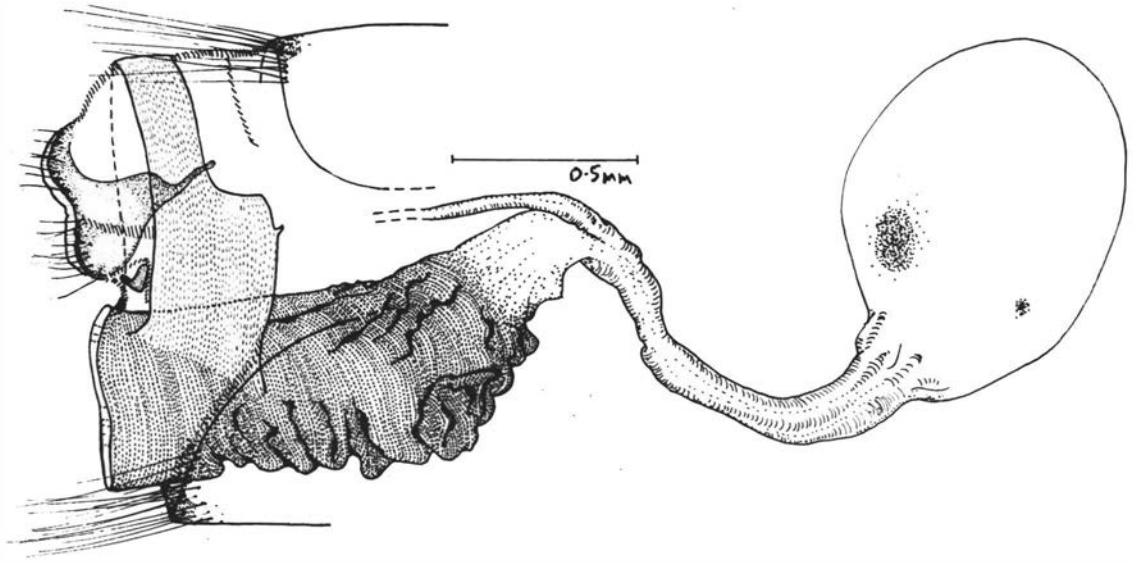


Fig.145 Female genitalia of Orocrambus ventosus,
right lateral aspect. (Gordon's Pyramid)
(p.134)

Fig.146 Female genitalia of Orocrambus ephorus,
right lateral aspect. (Arthur's Pass)
(p.137)

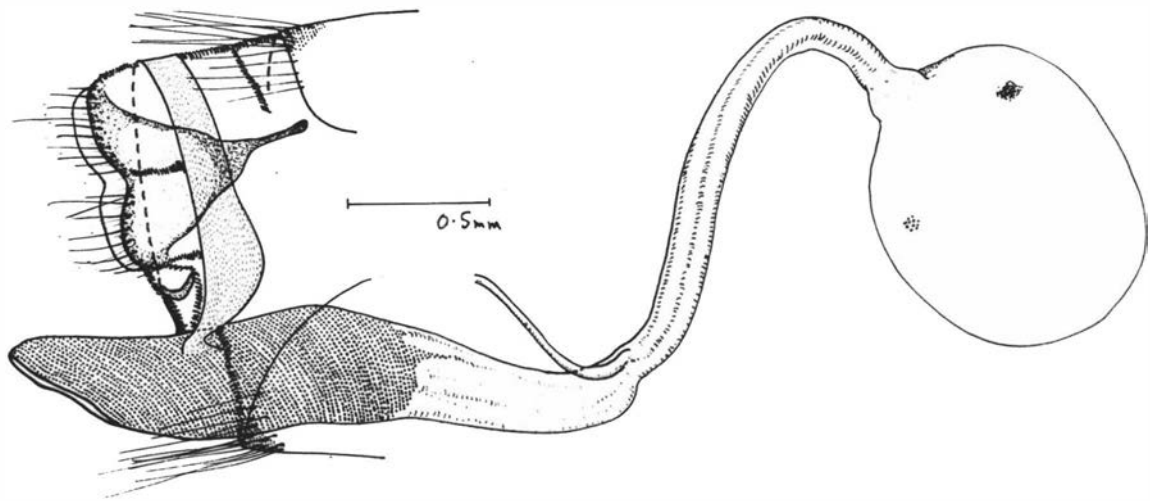
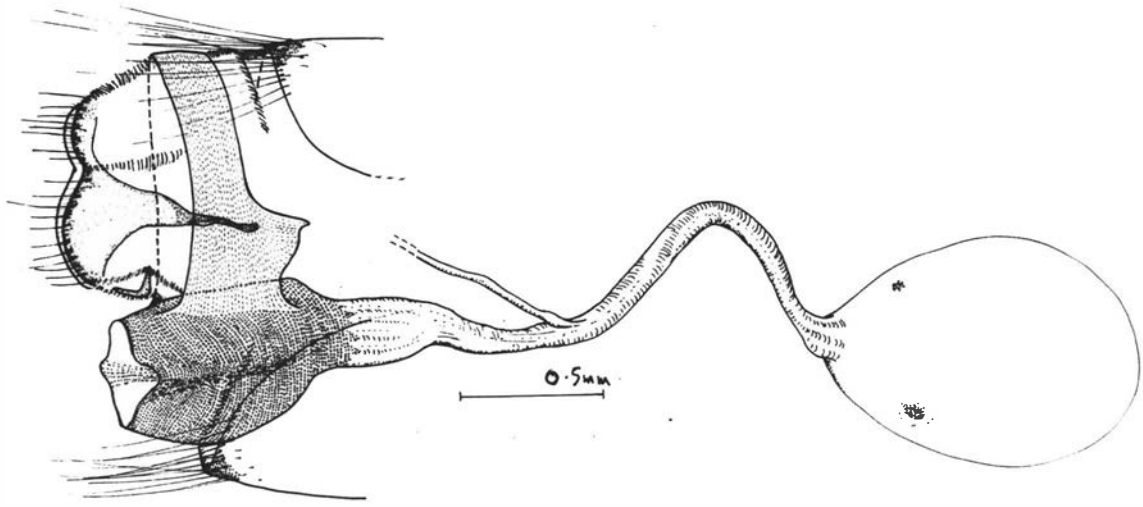


Fig.147 Female genitalia of Orocrambus oppositus,
right lateral aspect. (Southland)
(p.139)

Fig.148 Female genitalia of Orocrambus philpotti,
right lateral aspect. (Iron Hill, Nelson)
(p.140)

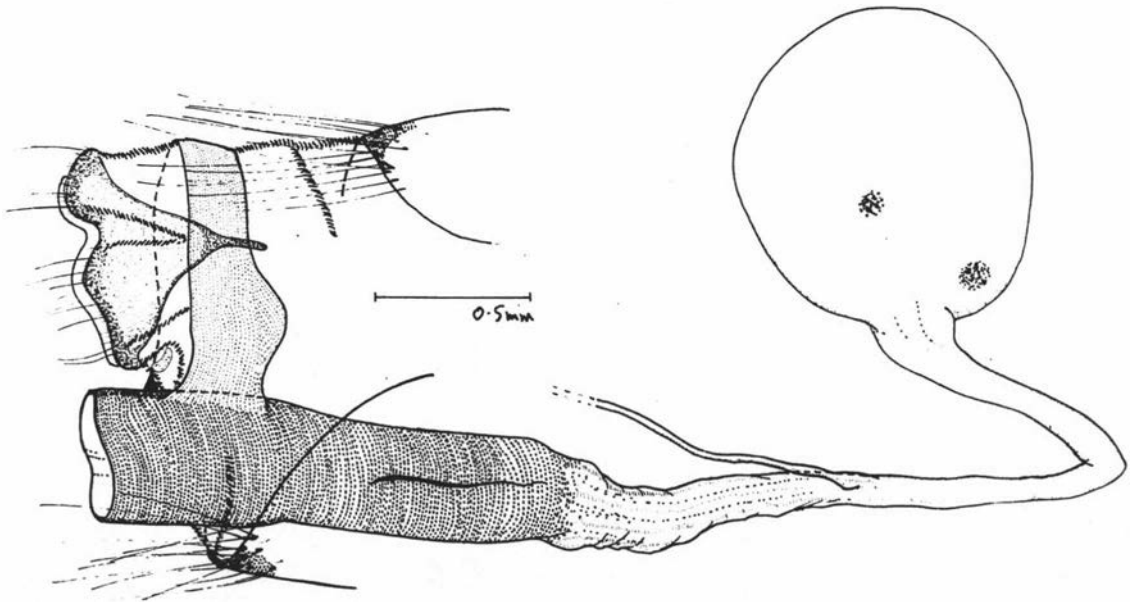
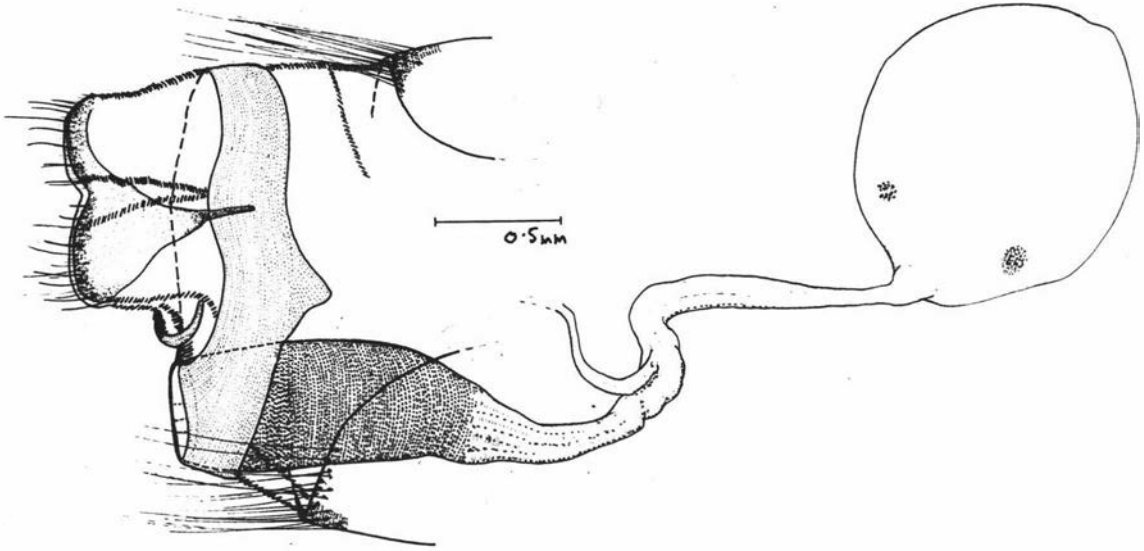


Fig.149 Female genitalia of Orocrambus angustipennis,
right lateral aspect. (Palmerston North)
(p.143)

Fig.150 Female genitalia of Orocrambus corruptus,
right lateral aspect. (Port Hills,Cant.)
(p.147)

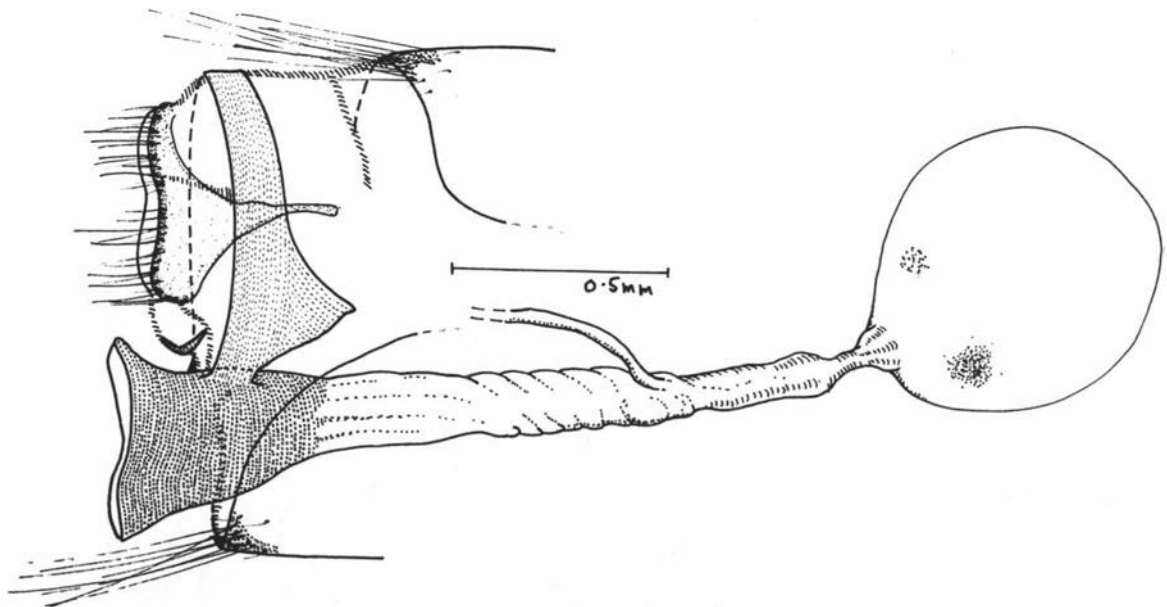
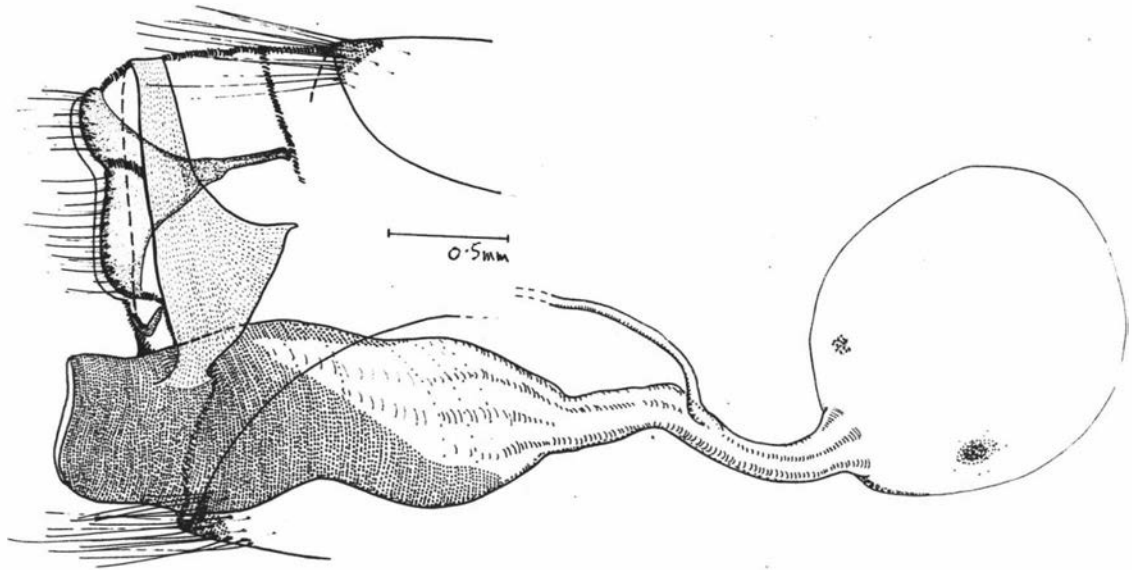


Fig.151 Female genitalia of Orocrambus melitastes,
right lateral aspect. (Southland)
(p.150)

Fig.152 Female genitalia of Orocrambus cyclopicus,
right lateral aspect. (Palmerston North)
(p.153)

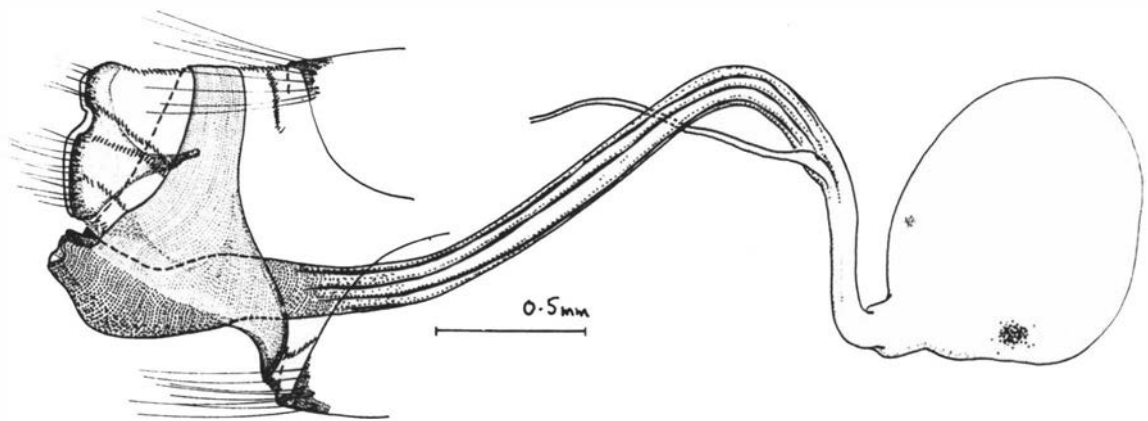
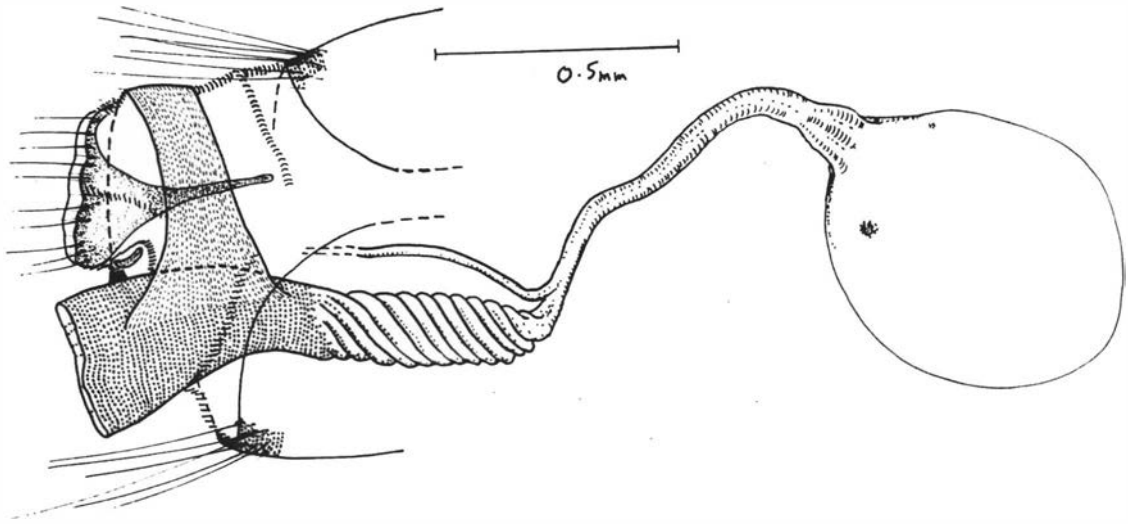


Fig.153 Female genitalia of Orocrambus lectus,
right lateral aspect. (Hammer)
(p.157)

Fig.154 Female genitalia of Orocrambus jansoni,
right lateral aspect. (Waiouru)
(p.160)

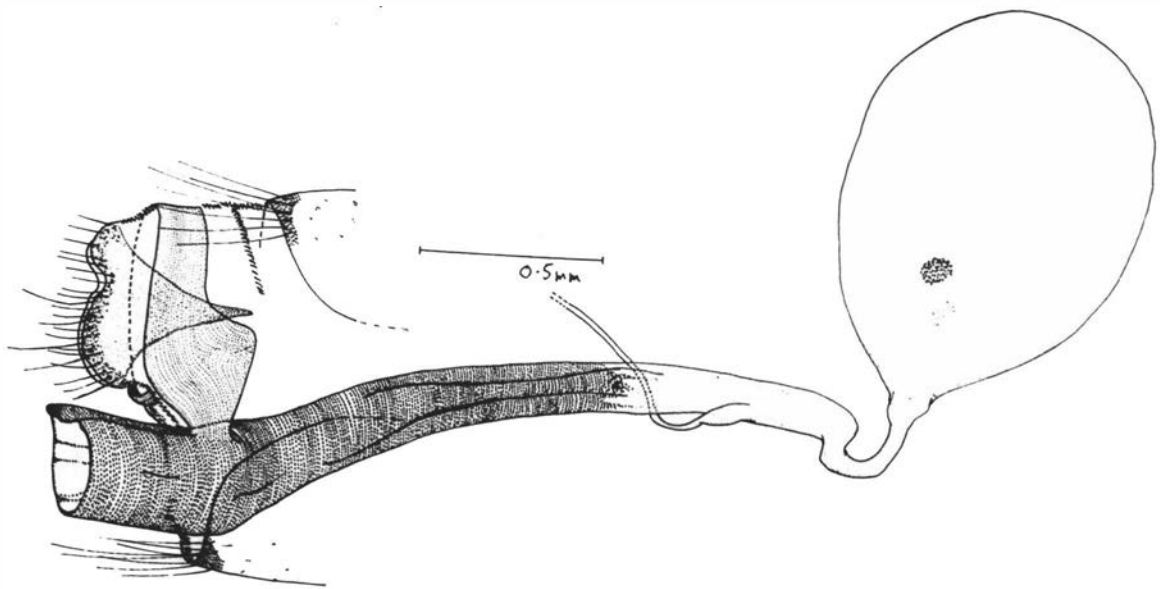
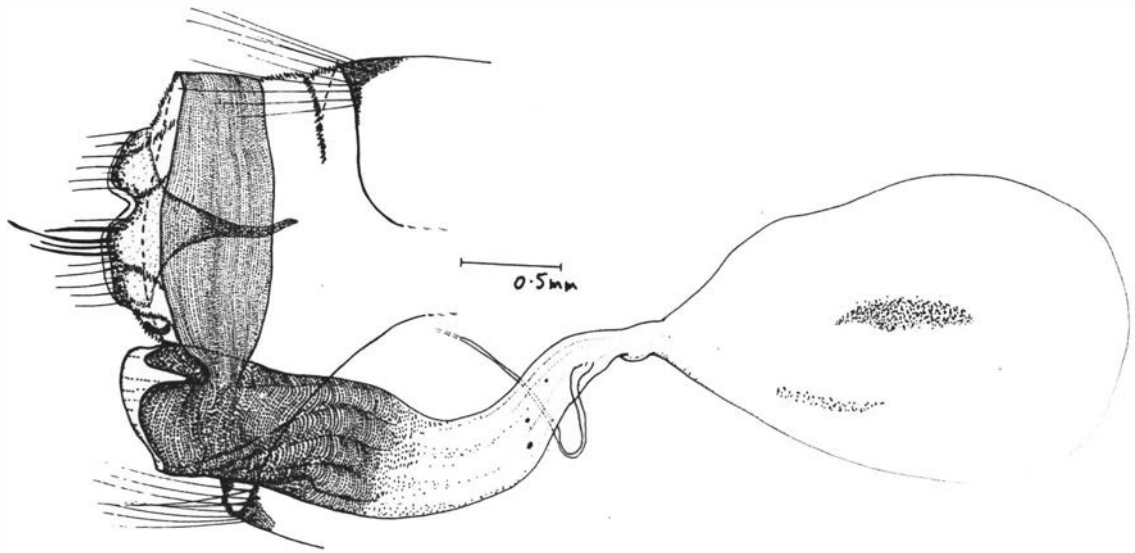


Fig.155 Female genitalia of Orocrambus abditus,
right lateral aspect. (Otorama)

(p.164)

Fig.156 Female genitalia of Orocrambus harpophorus,
right lateral aspect. (Ben Lomond)

(p.168)

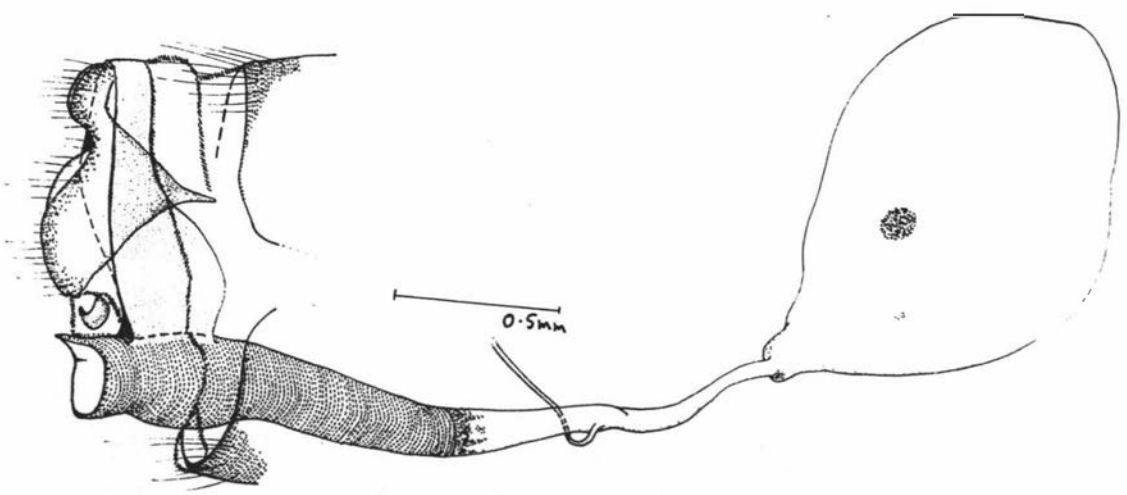
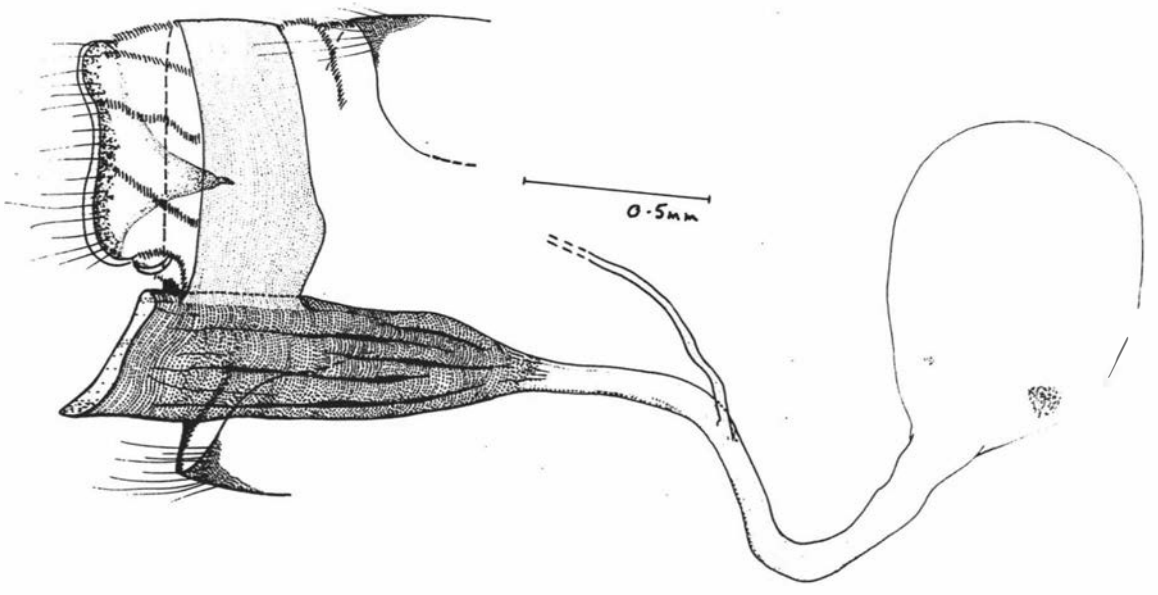


Fig.157 Female genitalia of Orocrambus heteraulus,
right lateral aspect. (Humboldt Mountains)
(p.170)

Fig.158 Female genitalia of Orocrambus lewisi,
left lateral aspect. (Stephen's Island)
(p.171)

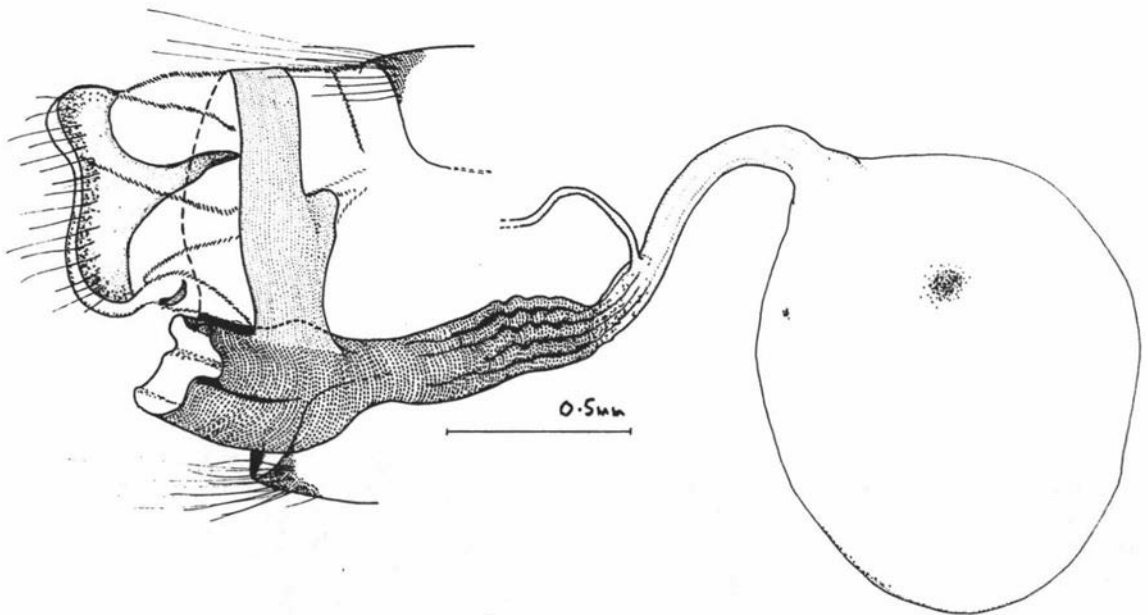
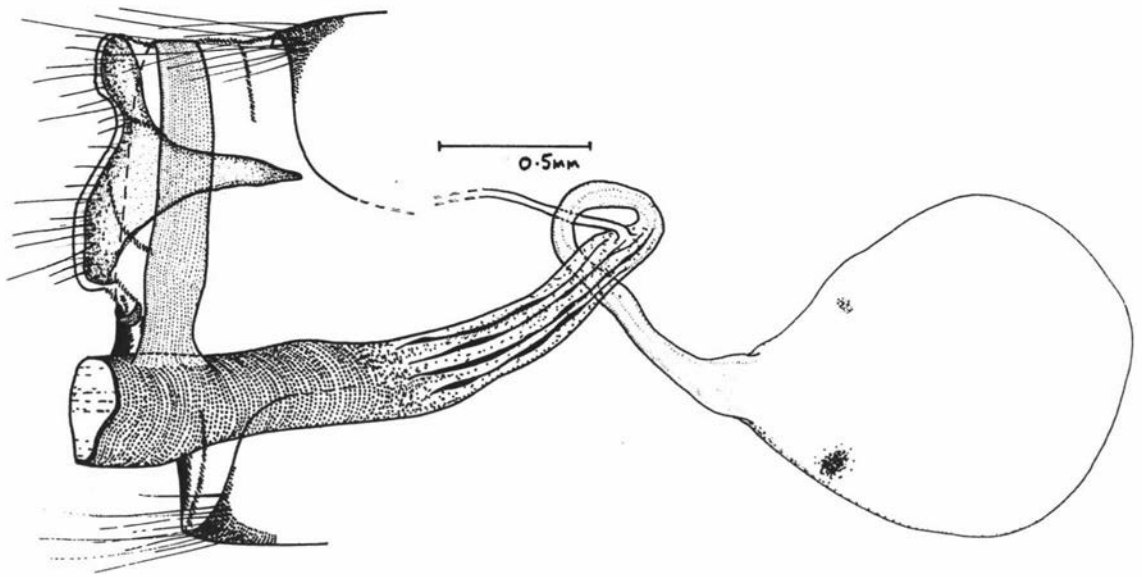


Fig.159 Female genitalia of Orocrambus ordishi,
right lateral aspect. (Mt Ida, Otago)

(p.174)

Fig.160 Female genitalia of Orocrambus ramosellus,
right lateral aspect. (Palmerston North)

(p.176)

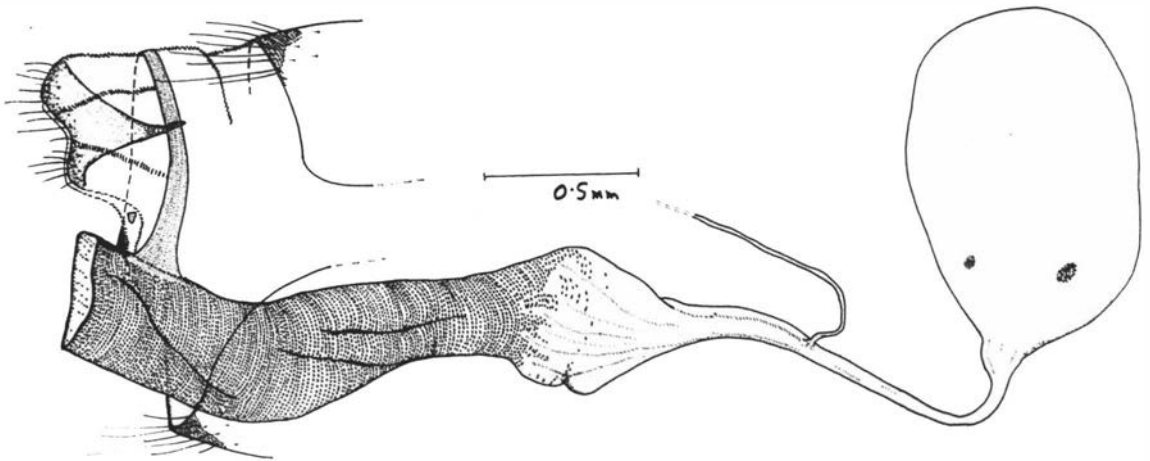
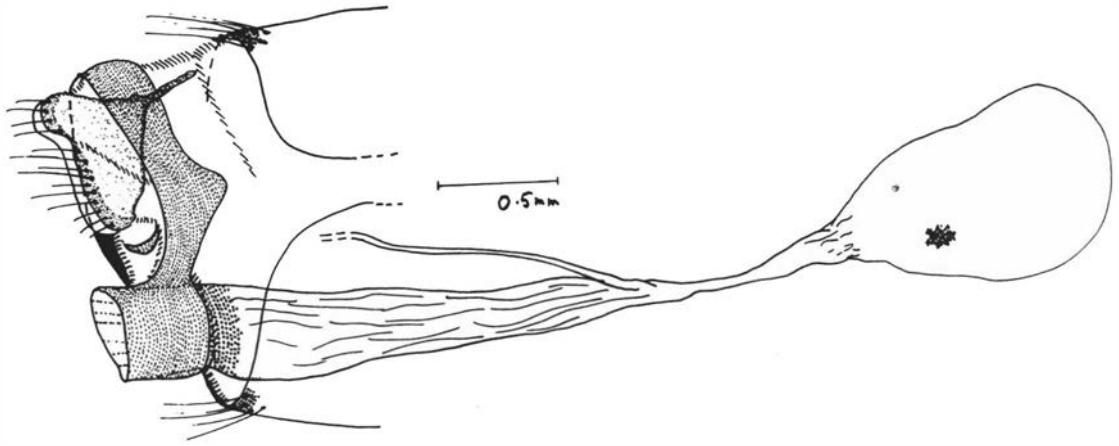


Fig.161 Female genitalia of Orocrambus simplex,
right lateral aspect. (Waiouru)
(p.182)

Fig.162 Female genitalia of Orocrambus siriellus,
right lateral aspect. (Mt.Holdsworth)
(p.185)

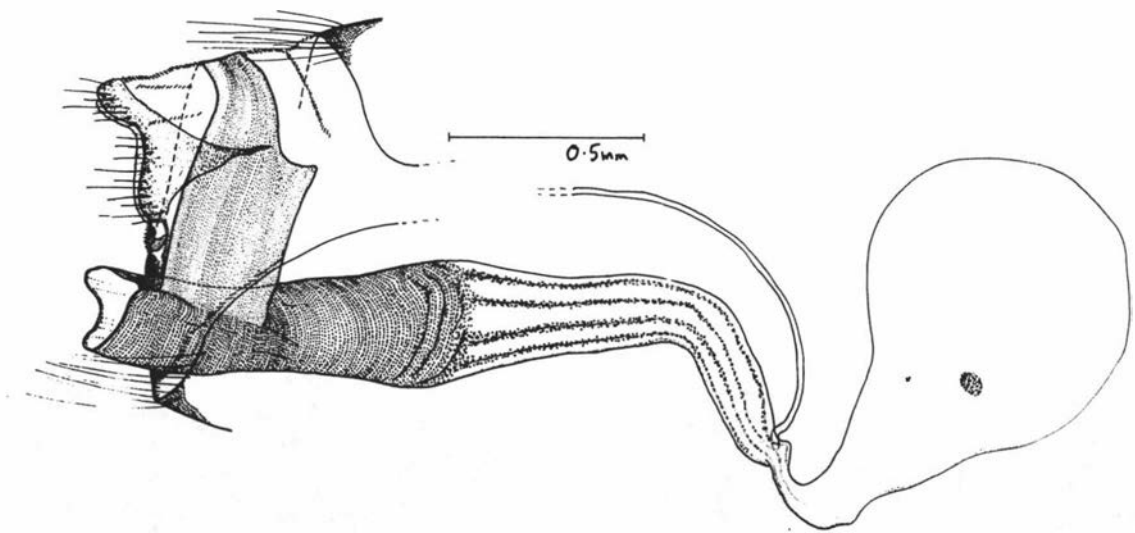
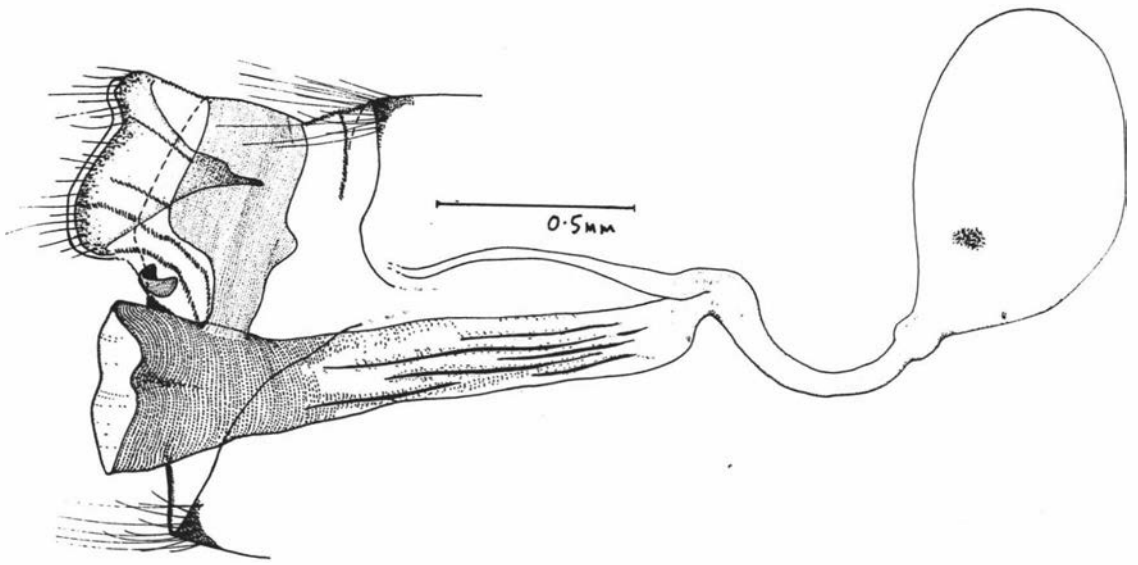


Fig.163 Female genitalia of Orocrambus callirrhous,
right lateral aspect. (Wellington)
(p.188)

Fig.164 Female genitalia of Orocrambus enchophorus,
right lateral aspect. (Palmerston North)
(p.190)

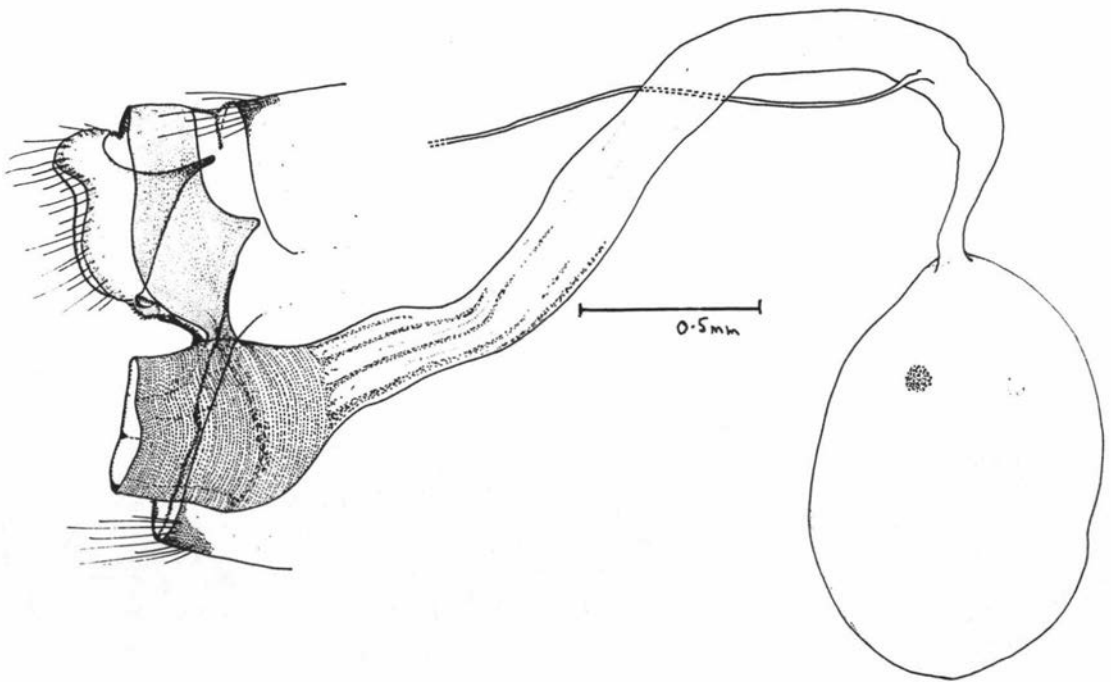
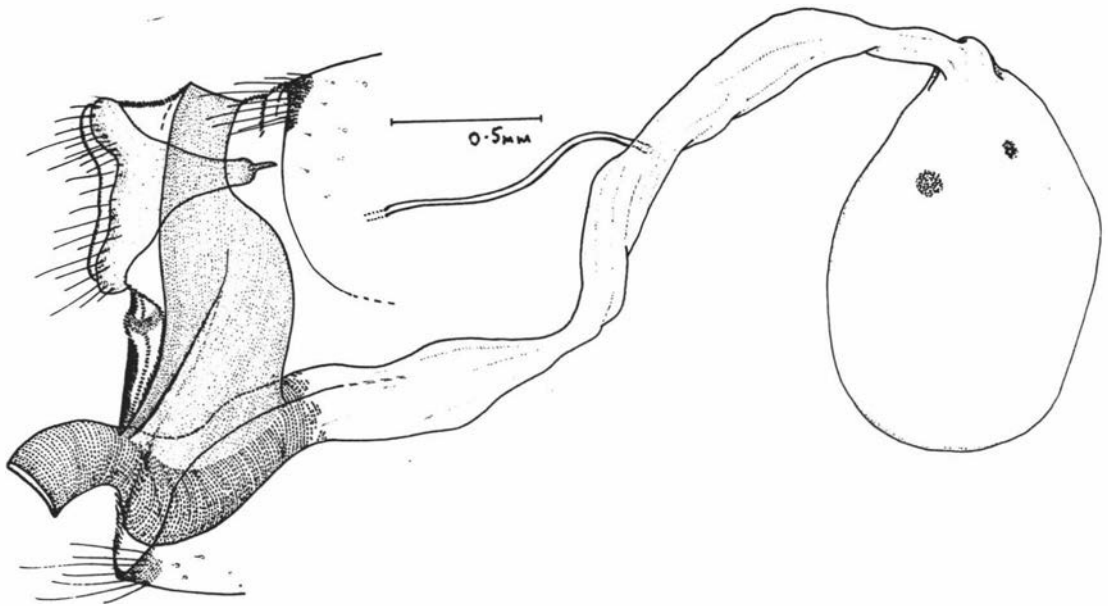


Fig.165 Female genitalia of Orocrambus isochytus,
right lateral aspect. (Mt.Arthur)
(p.195)

Fig.166 Female genitalia of Orocrambus tuhualis,
right lateral aspect. (Kaitoke)
(p.199)

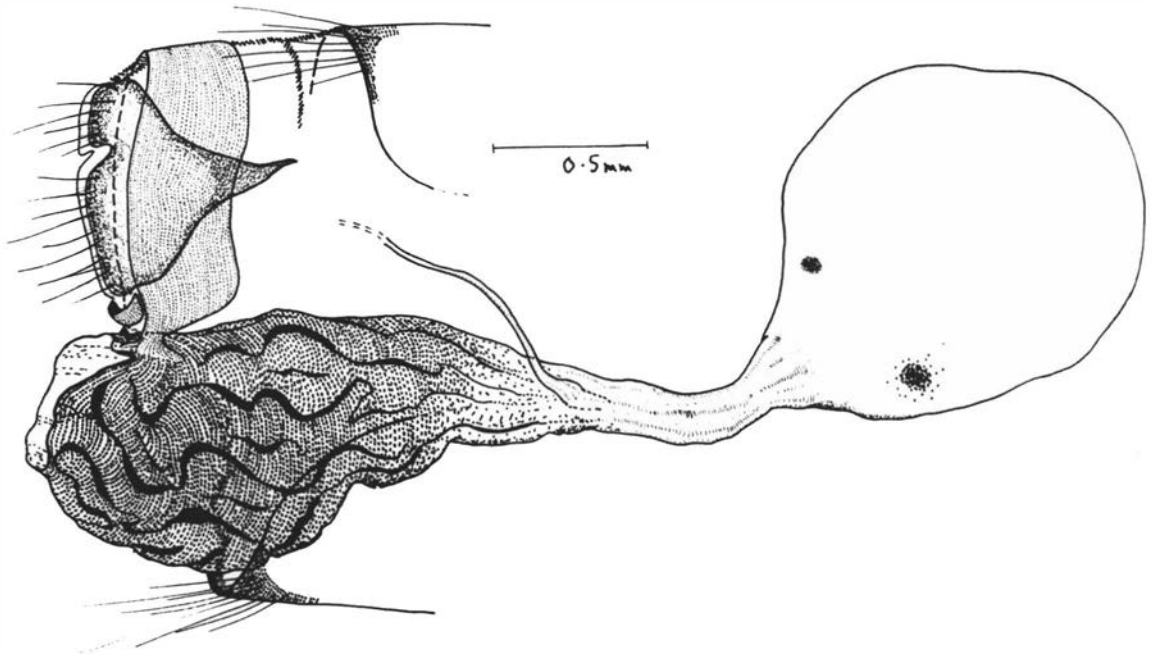
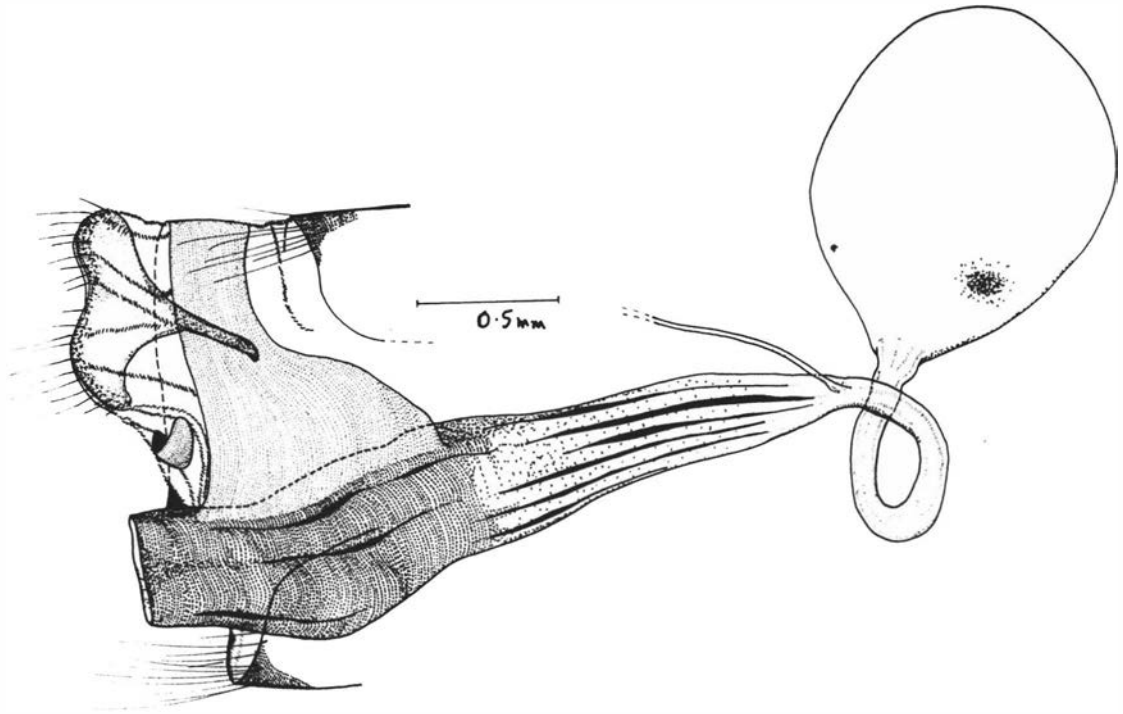


Fig.167 Female genitalia of Orocrambus vittellus,
right lateral aspect. (Palmerston North)
(p.202)

Fig.168 Female genitalia of Orocrambus vulgaris,
right lateral aspect. (Wellington)
(p.209)

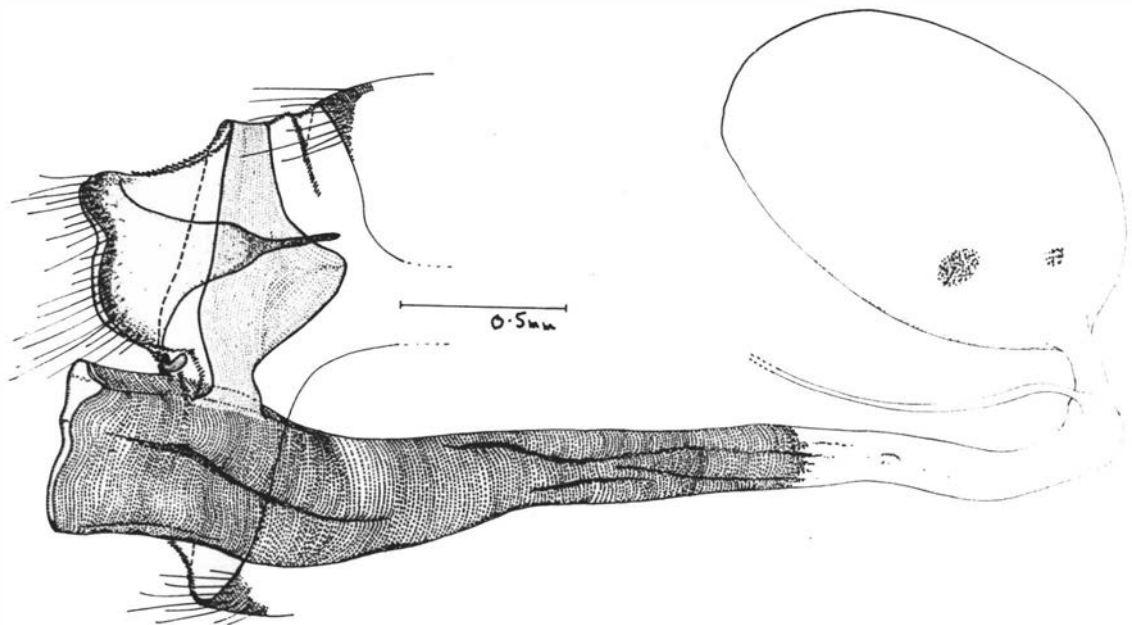
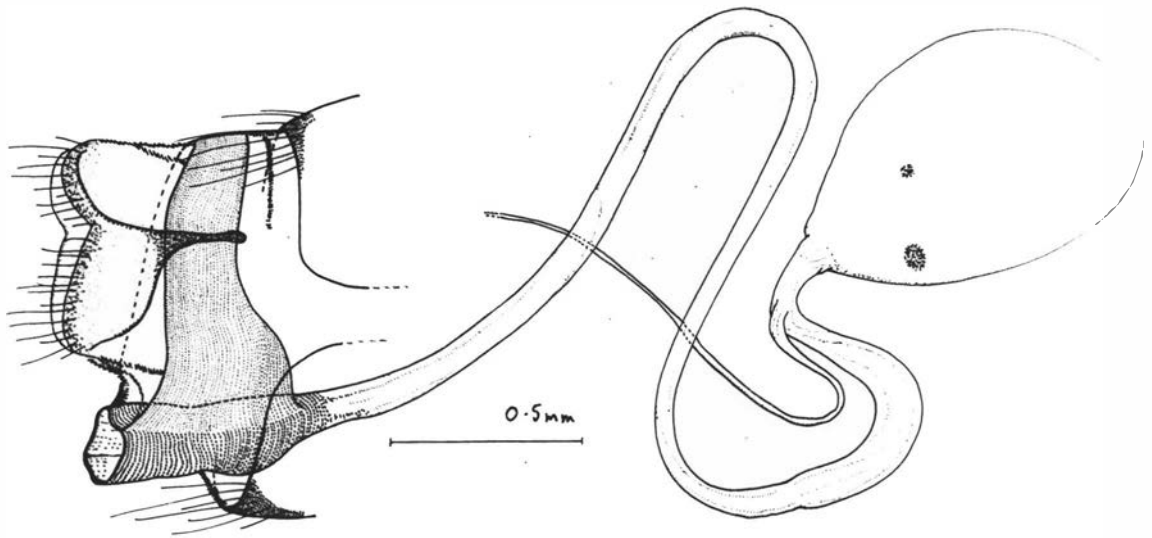


Fig.169 Female genitalia of Orocrambus xanthogrammus,
right lateral aspect. (Kaikoura)
(p.213)

Fig.170 Female genitalia of Orocrambus punctellus,
right lateral aspect. (Portobello)
(p.215)

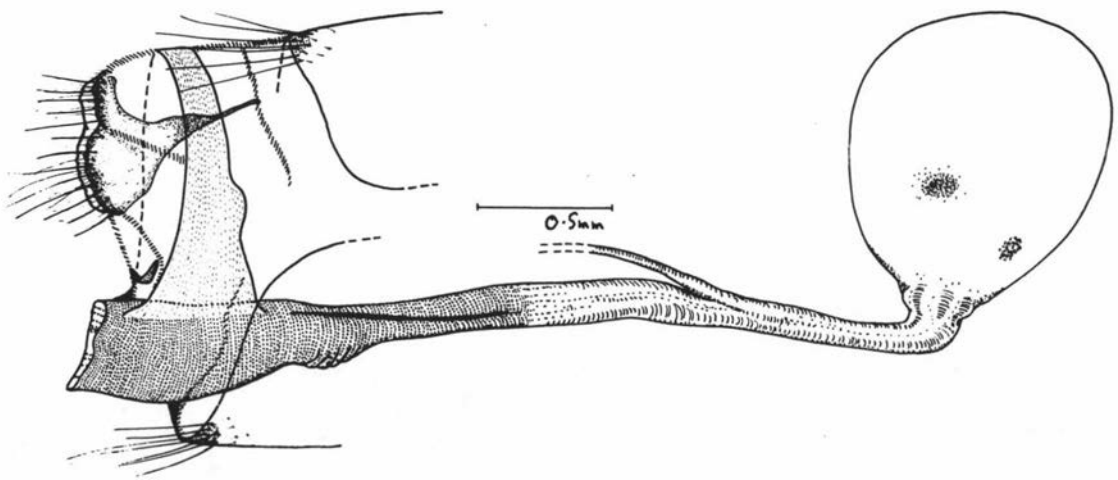
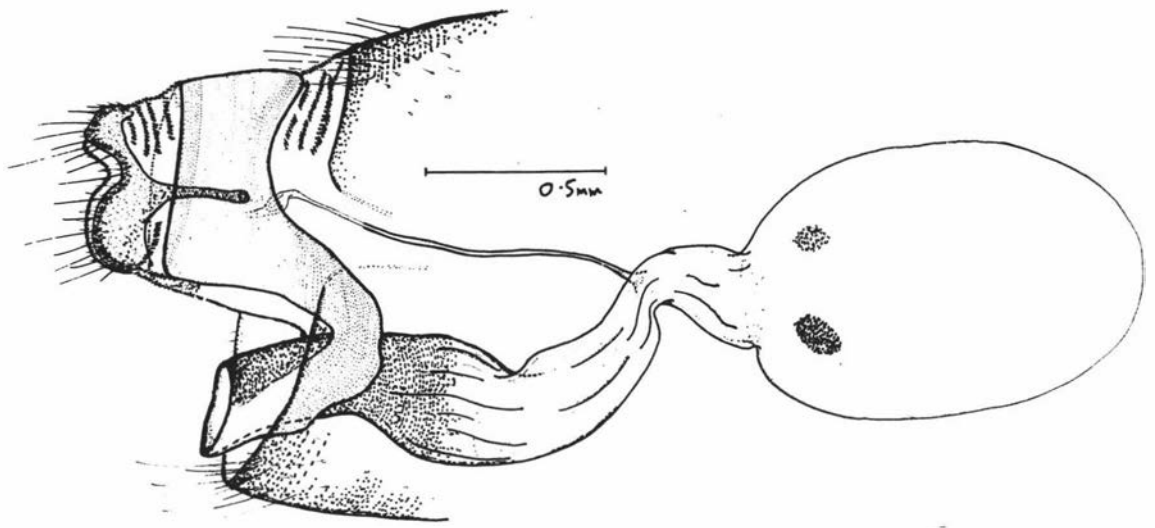


Fig.171 Female genitalia of Orocrambus saphronellus,
right lateral aspect. (Wedderburn)
(p.216)

Fig.172 Female genitalia of Orocrambus lindsayi,
right lateral aspect. (Mt.Ida,Otago)
(p.217)

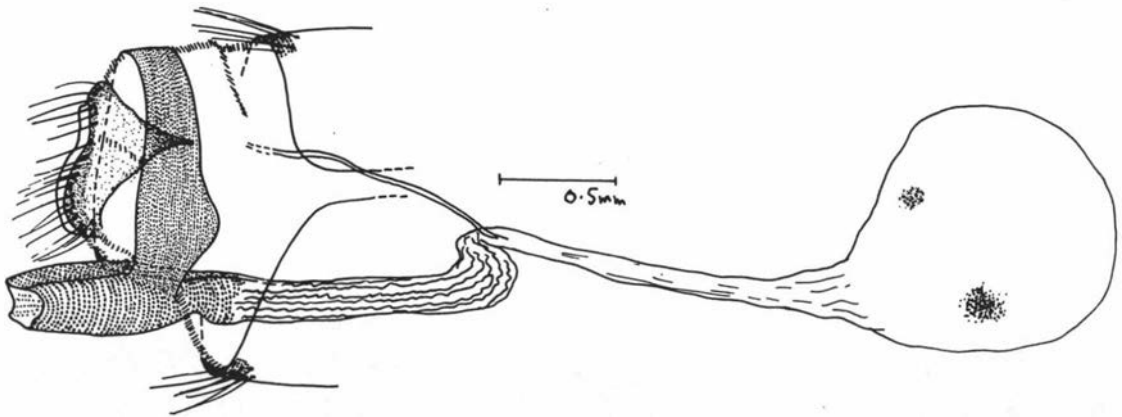
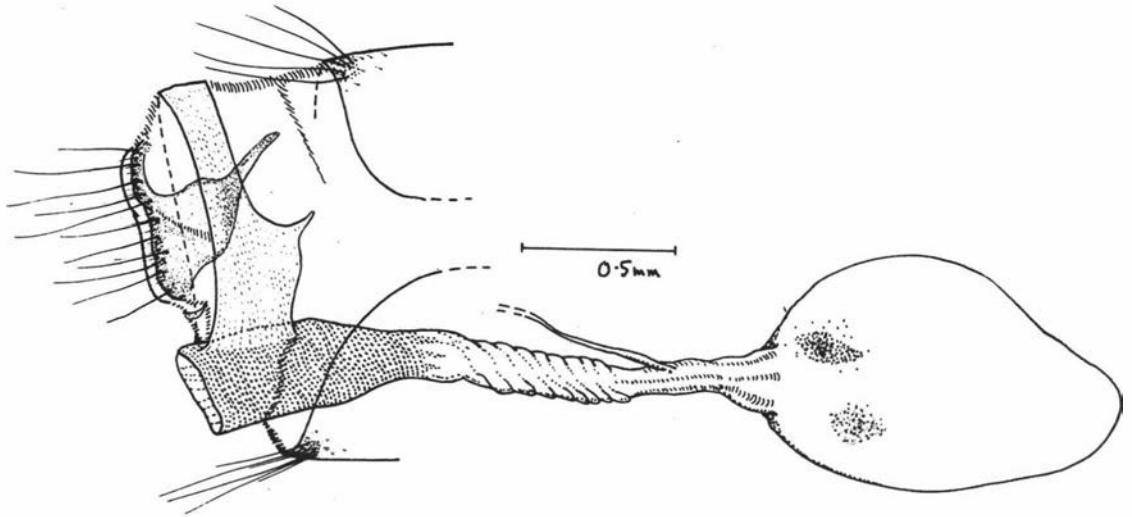


Fig.173 Female genitalia of Maoricrambus oncobolus,
right lateral aspect. (Broken River, Cant.)

(p.220)

Fig.174 Female genitalia of Corynophora lativittalis,
right lateral aspect. (Warouna, Victoria)

(p.233)

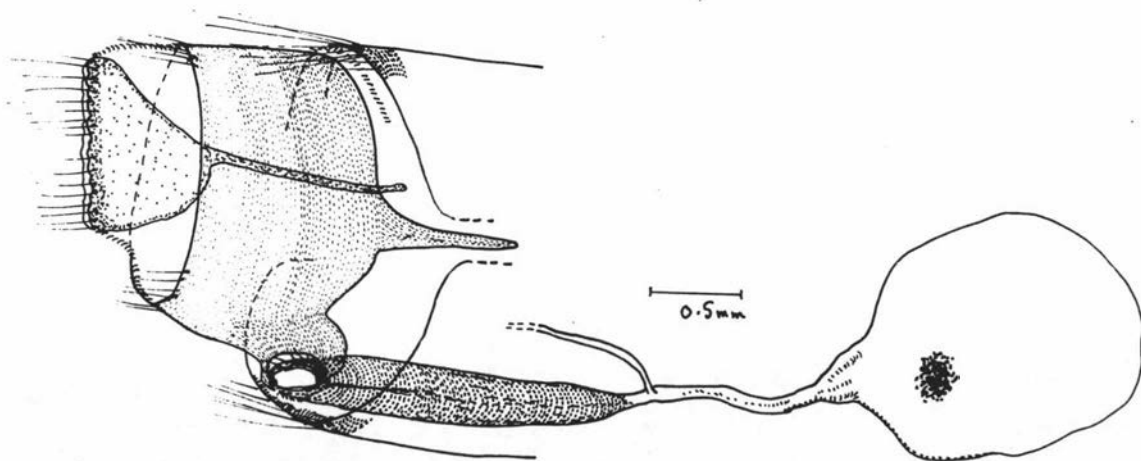
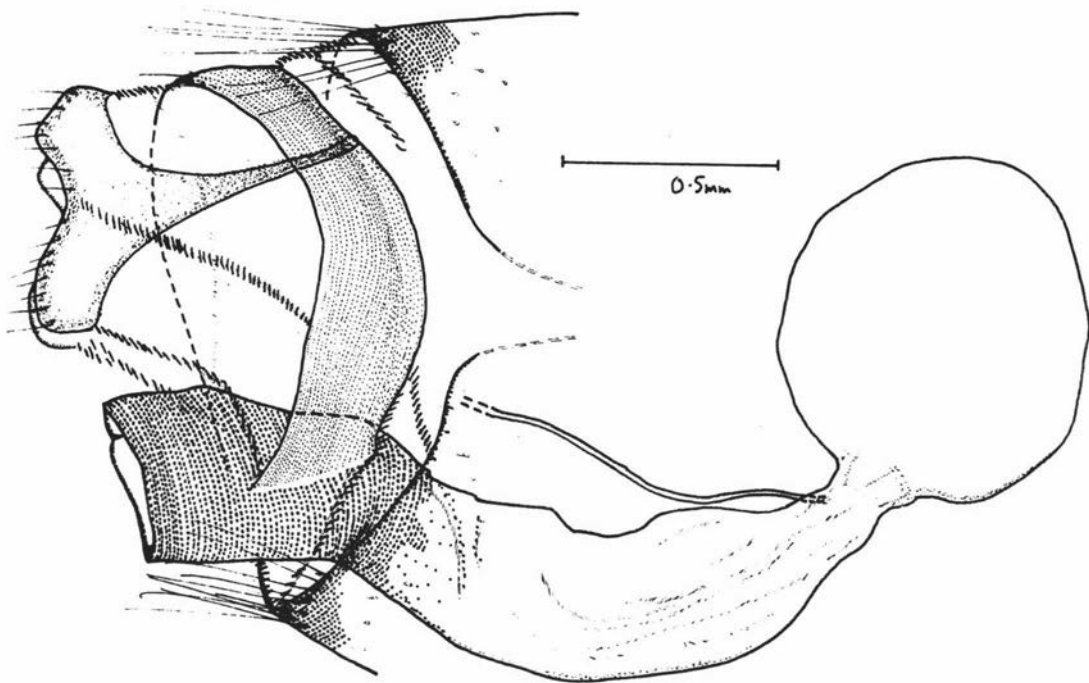


Fig.175 Female genitalia of Tawhitia glaucophanes,
ventral aspect; inset A showing ostium in
lateral aspect. (Macetown)
(p.227)

Fig.176 Female genitalia of Tawhitia pentadactyla,
ventral aspect; inset A showing ostium in
lateral aspect. (Long Acre)
(p.230)

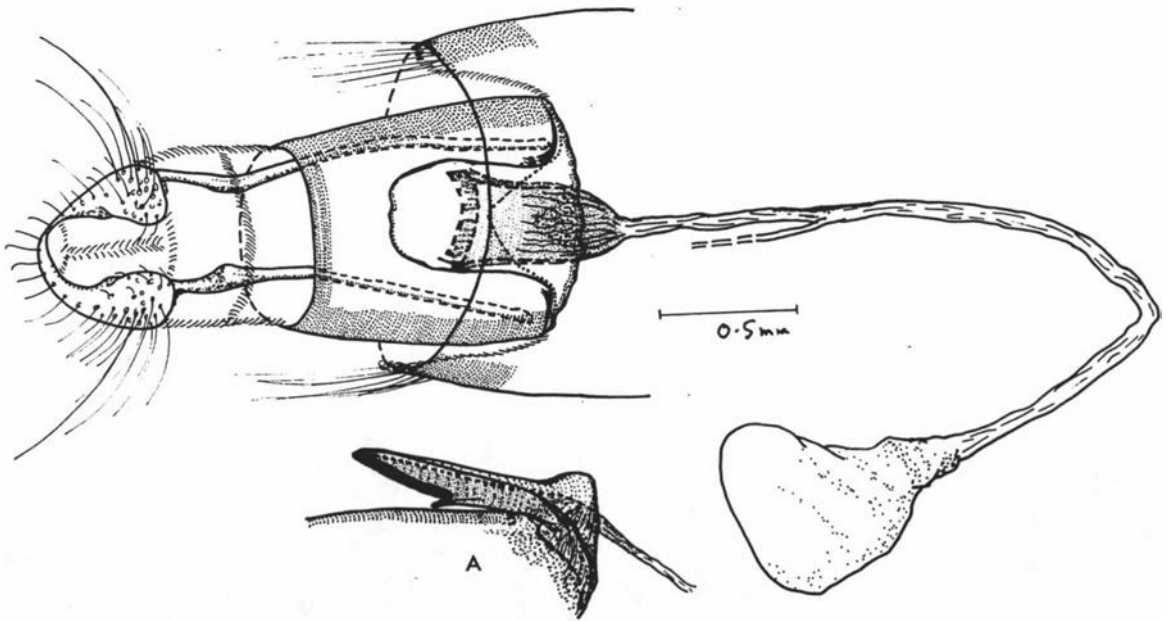
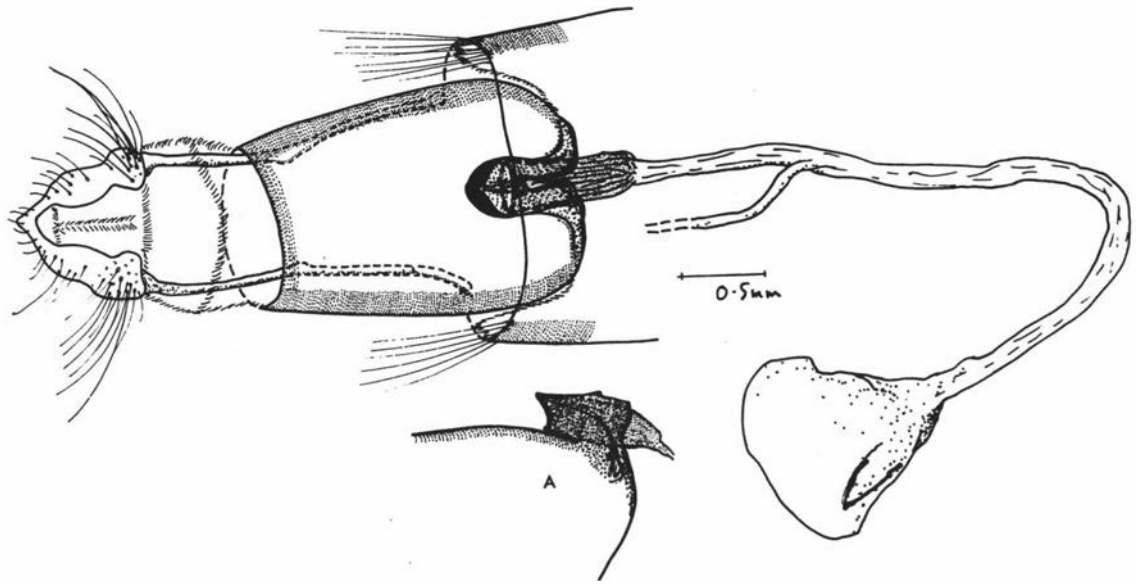


Fig.177 Female genitalia of Pareromene chrysochyta,
ventral aspect. (Wellington)
(p.247)

Fig.178 Female genitalia of Pareromene selenaea,
ventral aspect. (Longwoods)
(p.249)

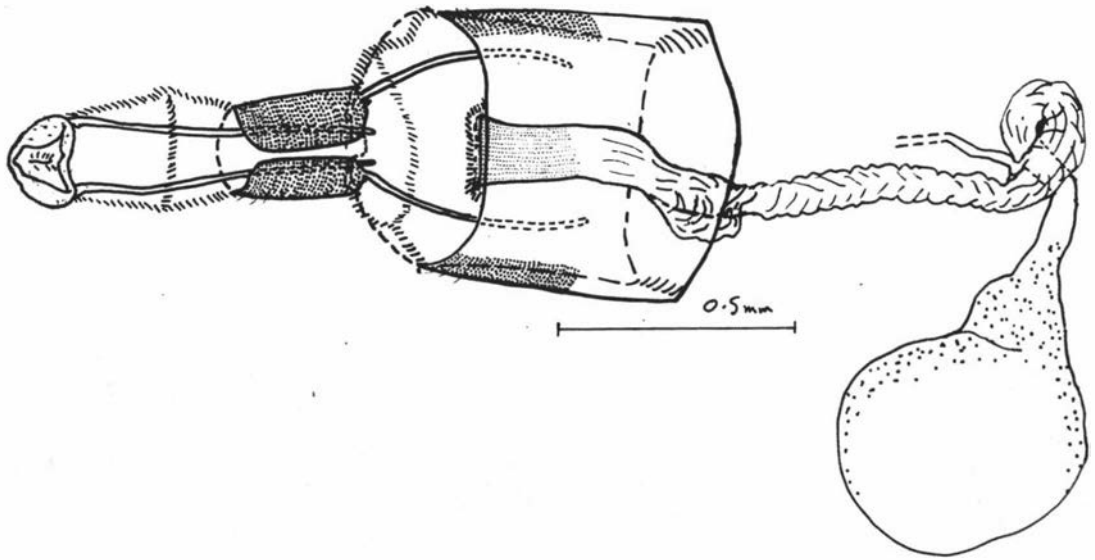
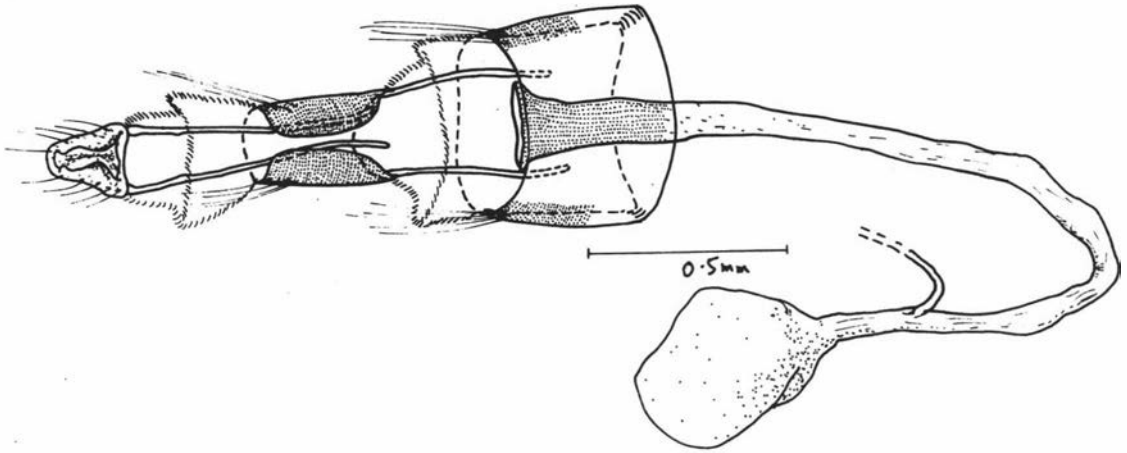


Fig.179 Female genitalia of Pareromene gurri,
ventral aspect. (Coromandel Ranges)
(p.252)

Fig.180 Female genitalia of Pareromene leucoxantha,
ventral aspect. (Mt. Ruapehu)
(p.254)

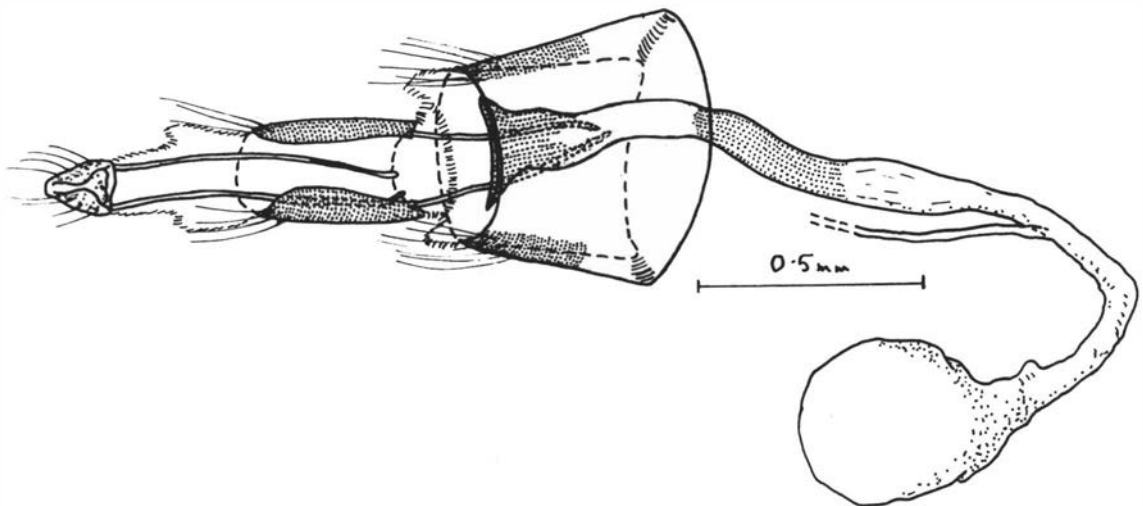
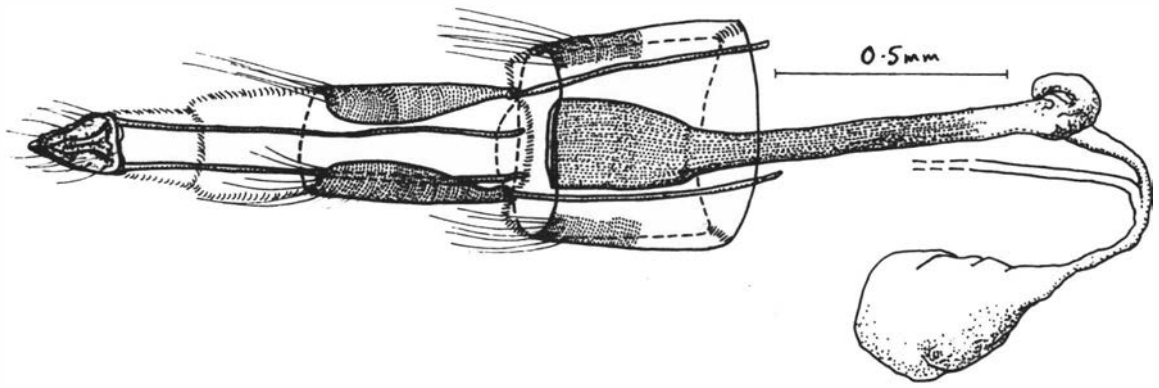


Fig.181 Female genitalia of Pareromene auriscriptella,
ventral aspect. (Palmerston North)
(p.256)

Fig.182 Female genitalia of Pareromene bipunctella,
ventral aspect. (Pohangina Valley)
(p.258)

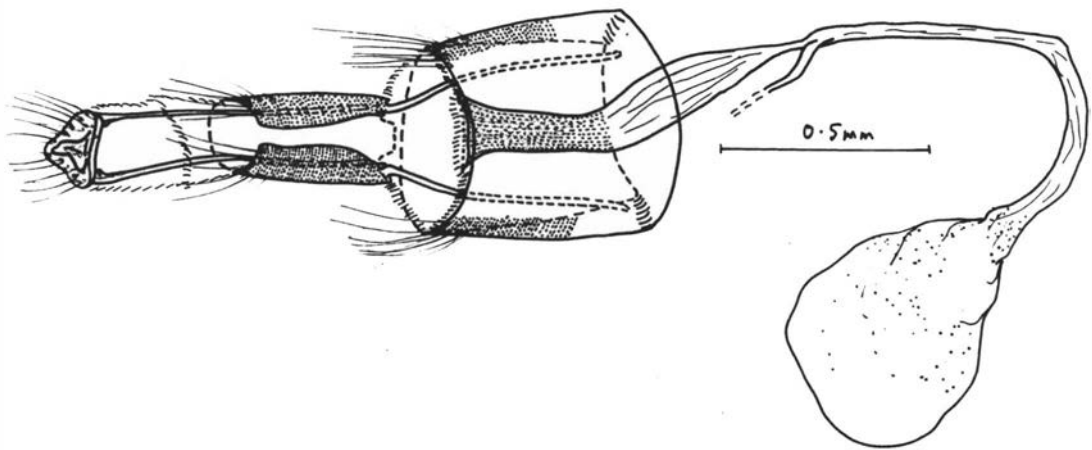
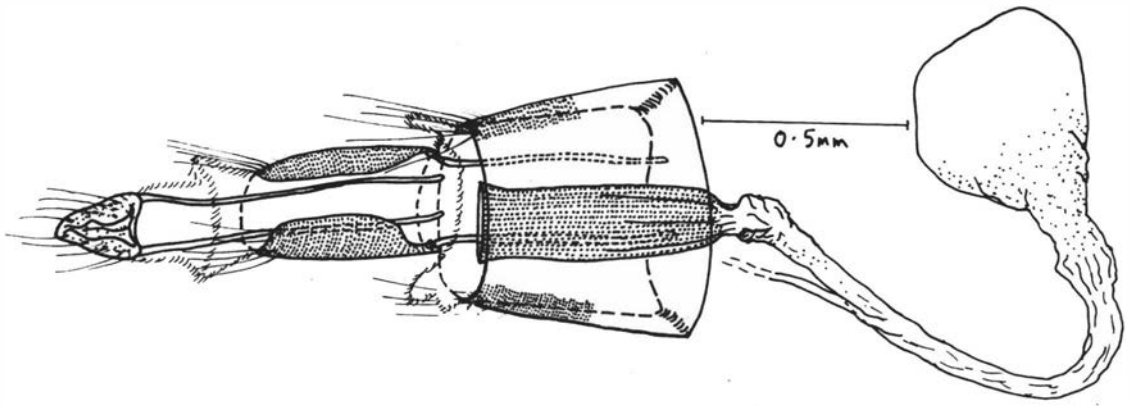


Fig.183 Female genitalia of Pareromene harmonica,
ventral aspect. (Wellington)
(p.260)

Fig.184 Female genitalia of Pareromene elaina,
ventral aspect. (Palmerston North)
(p.263)

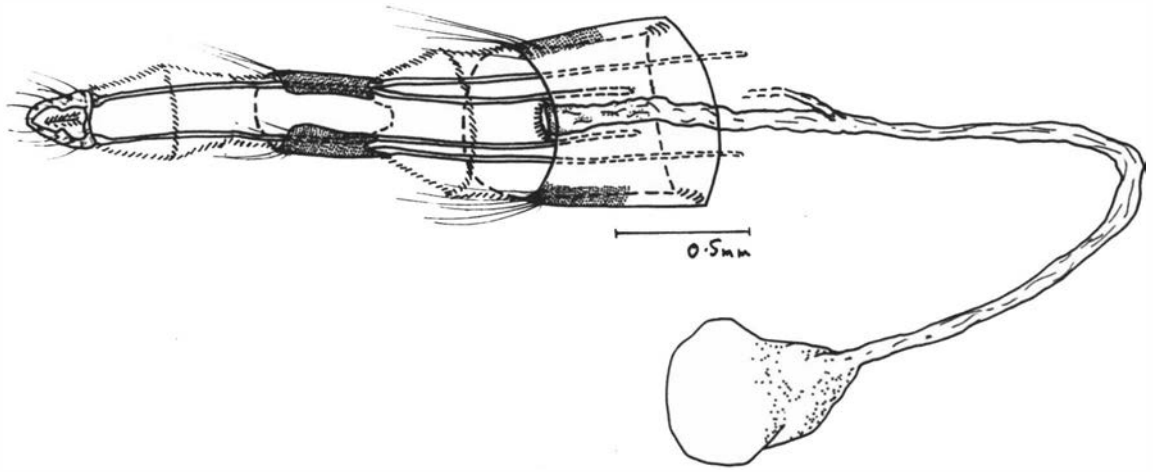
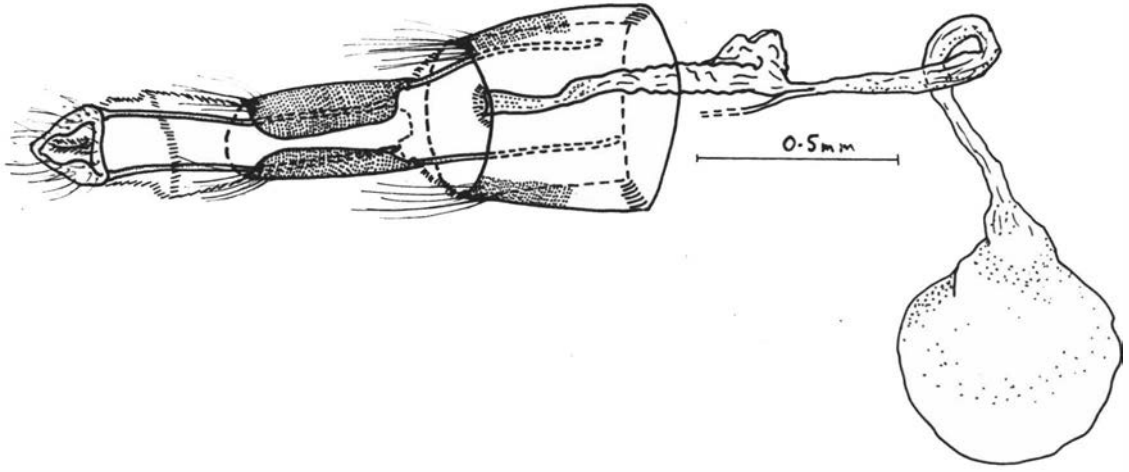


Fig.185 Female genitalia of Pareromene helioctypa,
ventral aspect. (Milford Sound)

(p.267)

Fig.186 Female genitalia of Pareromene interrupta,
ventral aspect. (Homer)

(p.270)

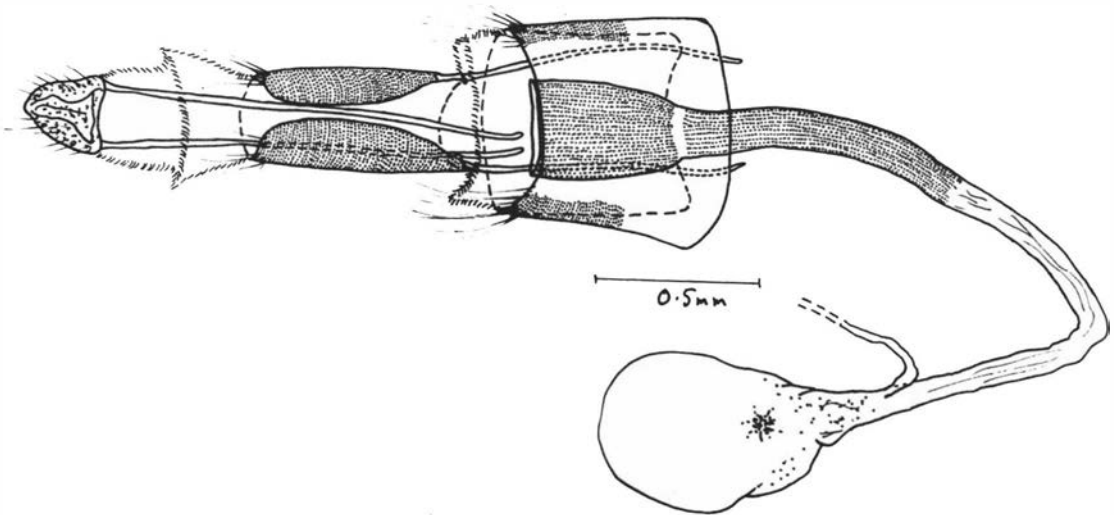
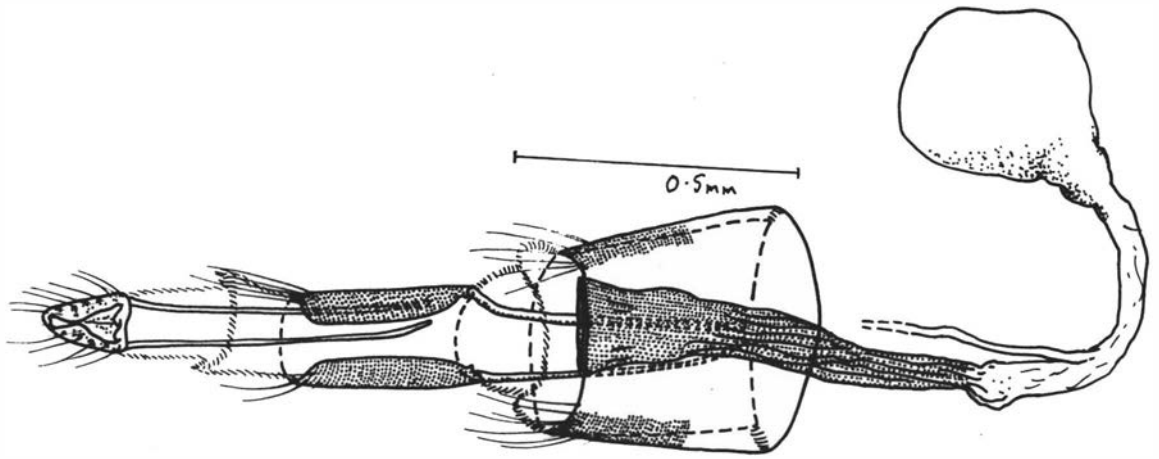


Fig.187 Female genitalia of Pareromene lepidella,
ventral aspect. (Dunedin)
(p.272)

Fig.188 Female genitalia of Pareromene metallifera,
ventral aspect. (Wellington)
(p.274)

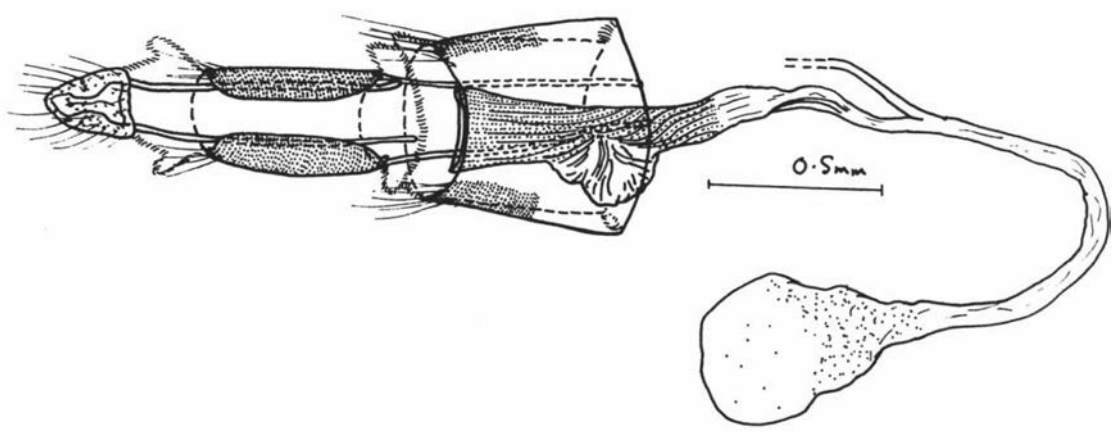
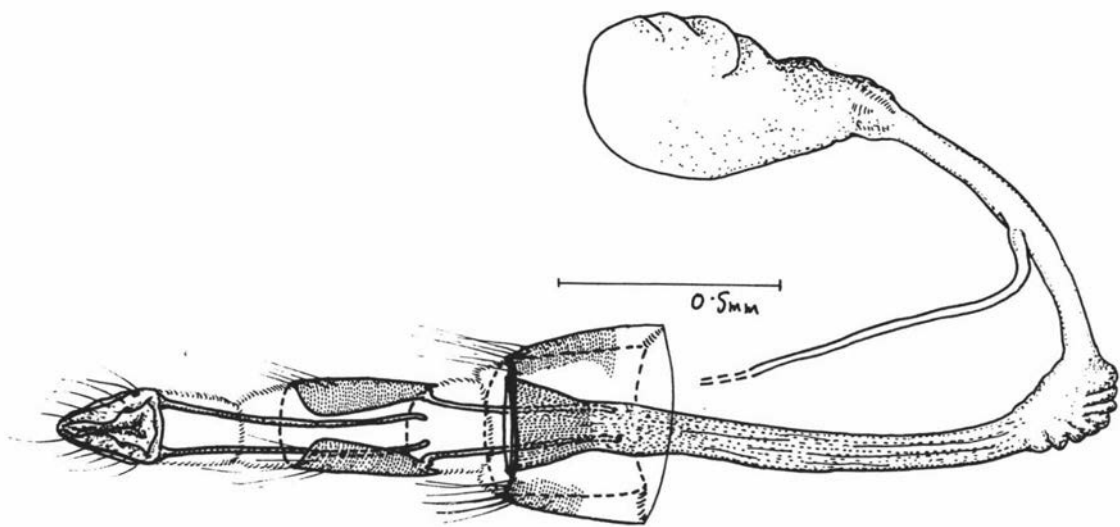


Fig.189 Female genitalia of Pareromene microdora,
ventral aspect. (Wellington)
(p.276)

Fig.190 Female genitalia of Pareromene epiphaea,
ventral aspect. (Cleddau)
(p.279)

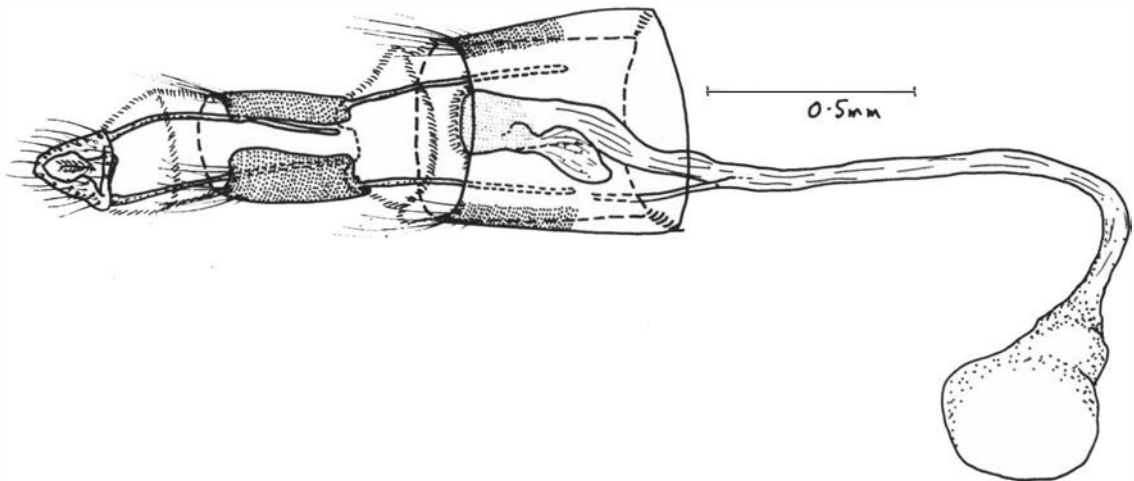
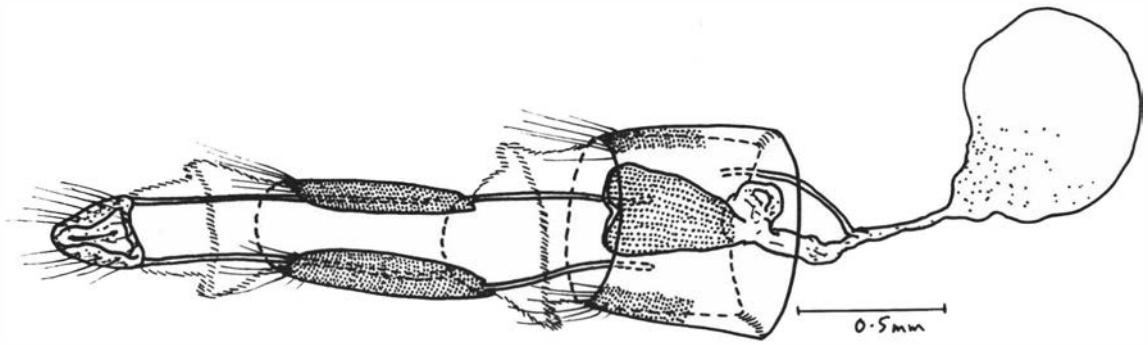


Fig.191 Female genitalia of Pareromene holanthes,
ventral aspect. (Mt.Ruapehu)
(p.281)

Fig.192 Female genitalia of Pareromene parorma,
ventral aspect. (Wainuiomata)
(p.283)

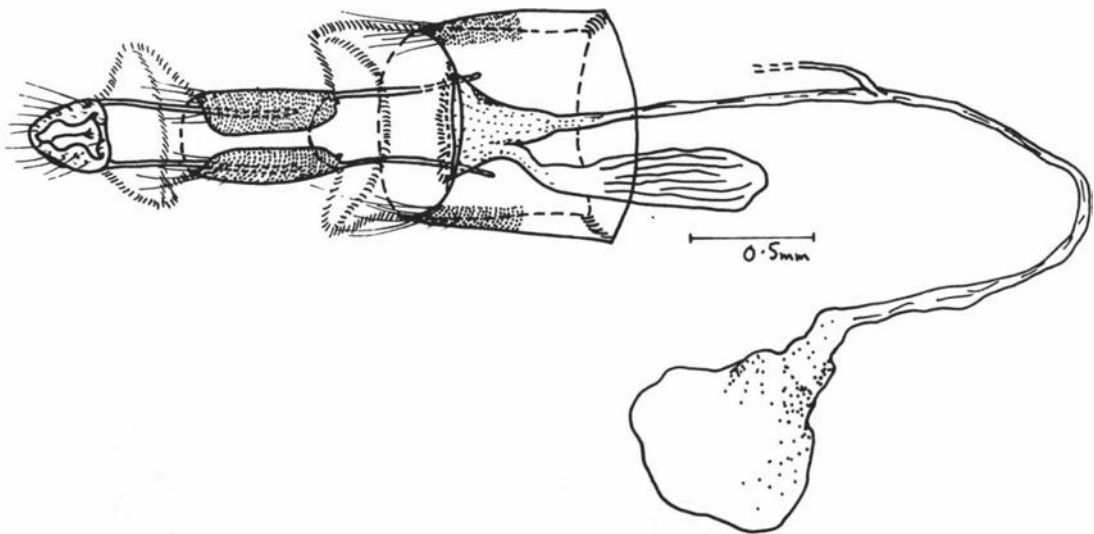
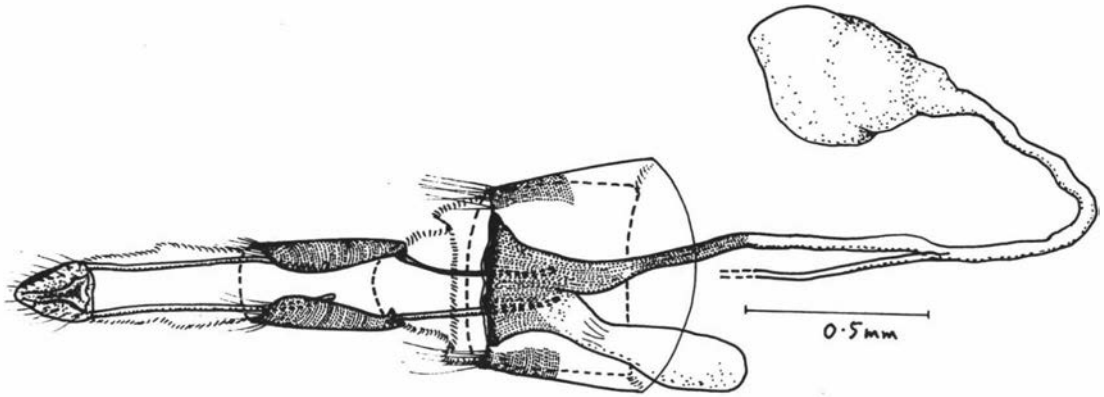


Fig.193 Female genitalia of Pareromene pyrsophanes,
ventral aspect. (Mt.Ruapehu)
(p.284)

Fig.194 Female genitalia of Tauroscopa gorgopis,
ventral aspect. (Obelisk)
(p.300)

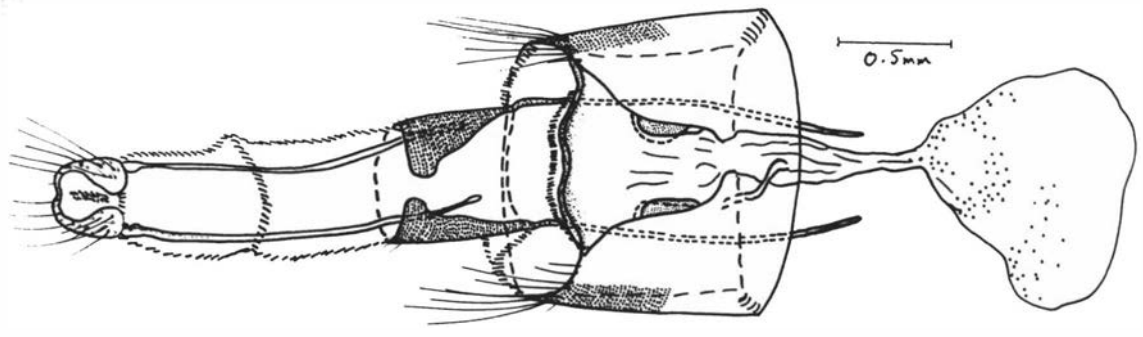
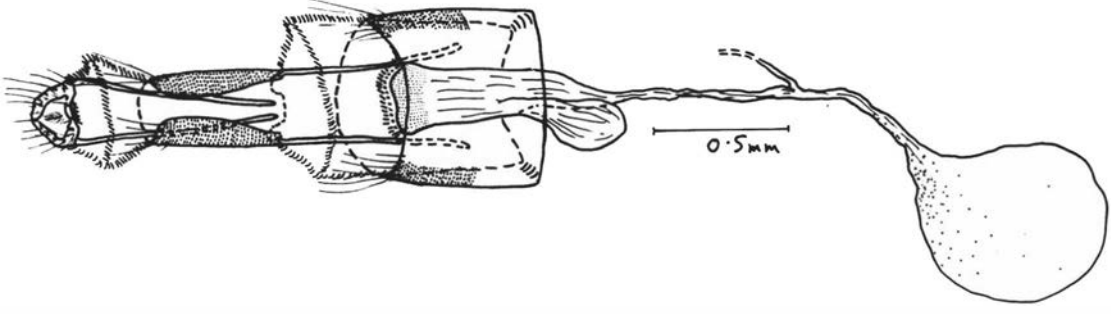


Fig.195 Female genitalia of Tauroscopa trapezitis,
ventral aspect. (Vanguard Peak)
(p.302)

Fig.196 Female genitalia of Tauroscopa notabilis,
ventral aspect. (Iron Hill,Nelson)
(p.298)

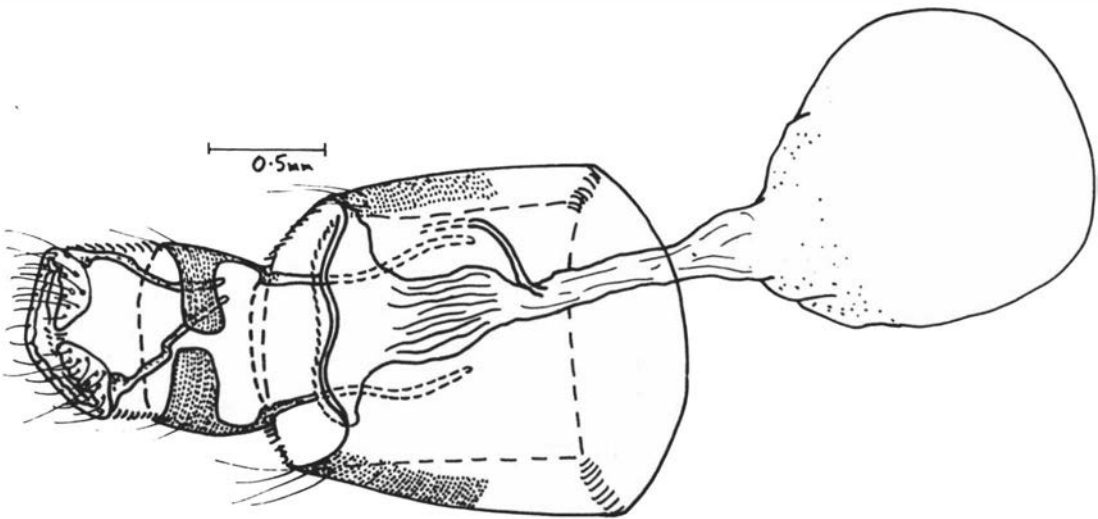
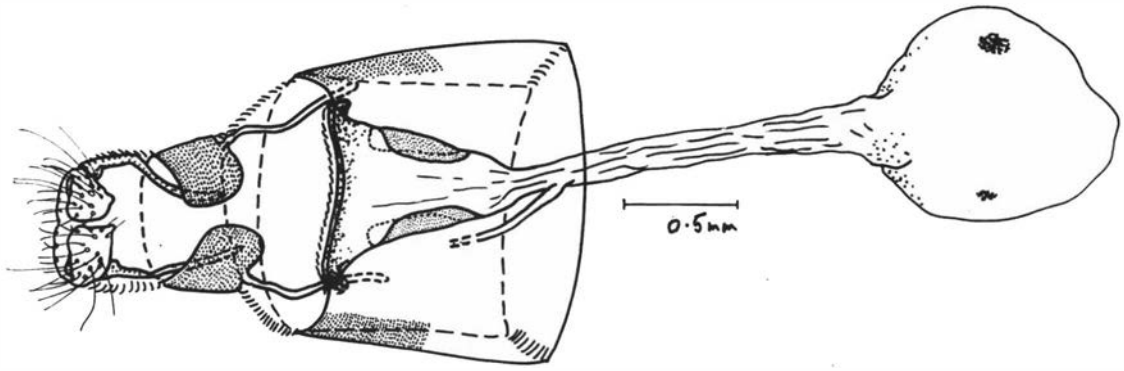


Fig.197 Female genitalia of Tauroscopa lachnea,
ventral aspect. (Mt.Hotham,Victoria)
(p.295)

Fig.198 Female genitalia of Gadira acerella,
ventral aspect. (Mokoia Island,Lake Rotorua)
(p.319)

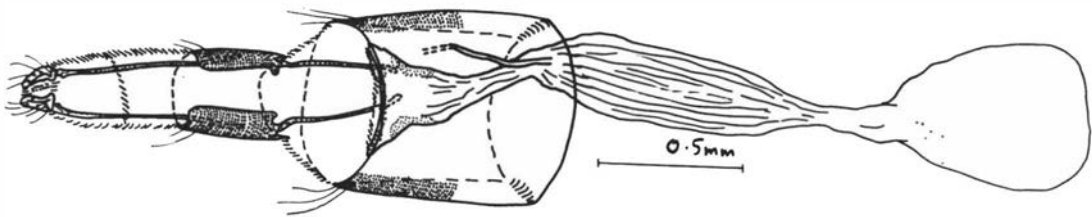
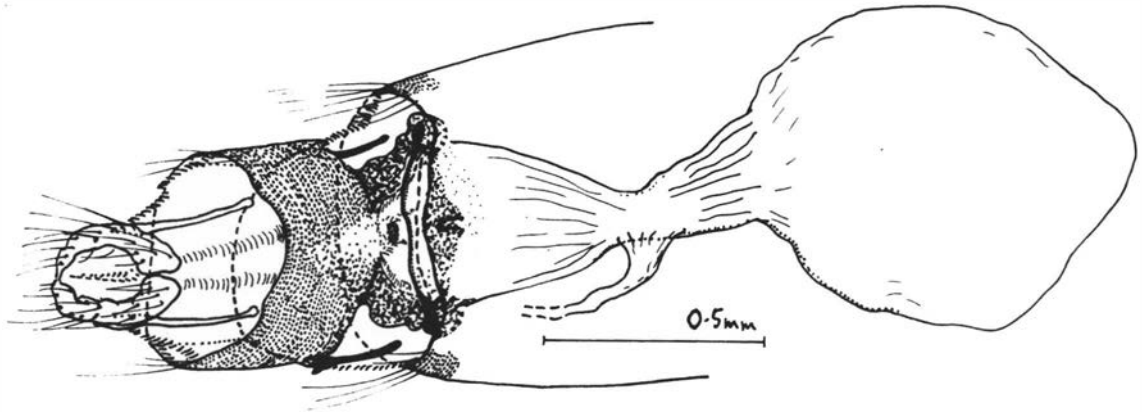


Fig.199 Female genitalia of Gadira leucophthalma,
ventral aspect. (Birdling's Flat, Cant.)
(p.329)

Fig.200 Female genitalia of Gadira petraula,
ventral aspect. (Port Hills, Cant.)
(p.318)

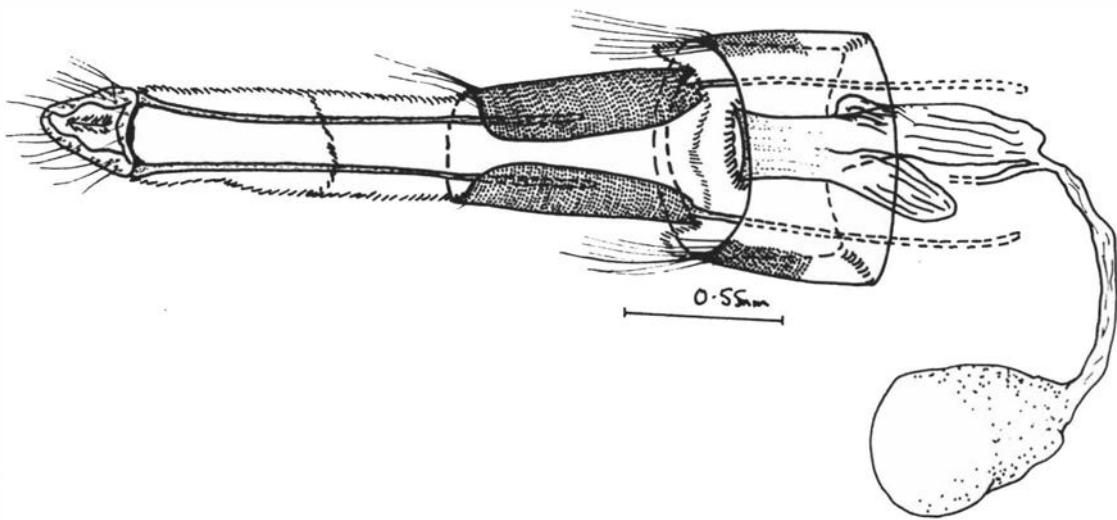
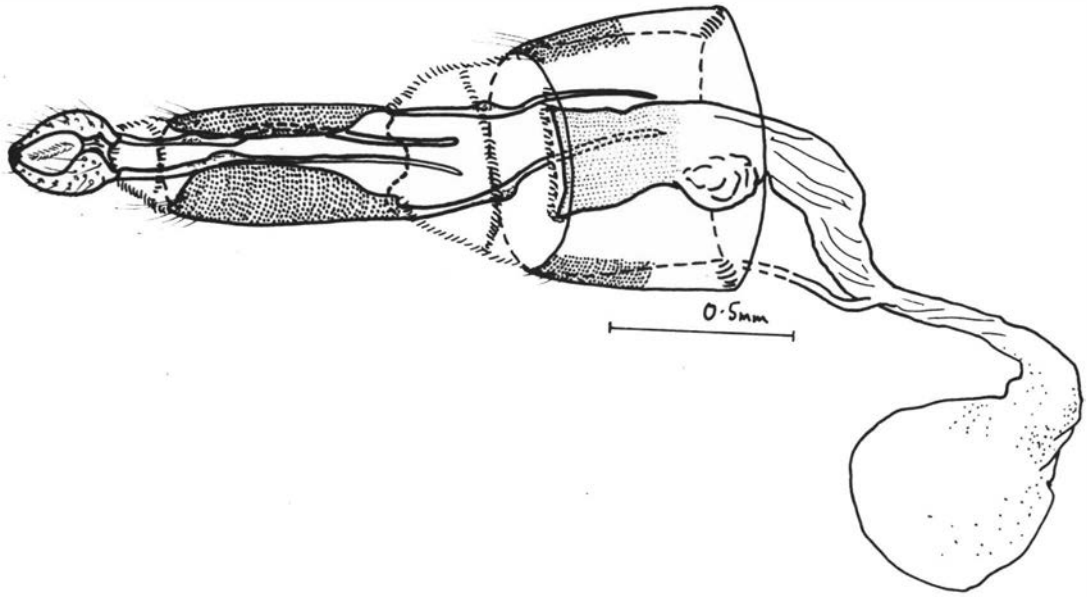


Fig.201 Female genitalia of Gadira pleniferella,
ventral aspect. (Ringwood,Victoria)
(p.325)

Fig.202 Female genitalia of Paragadira strophea,
ventral aspect. (Raurimu)
(p.332)

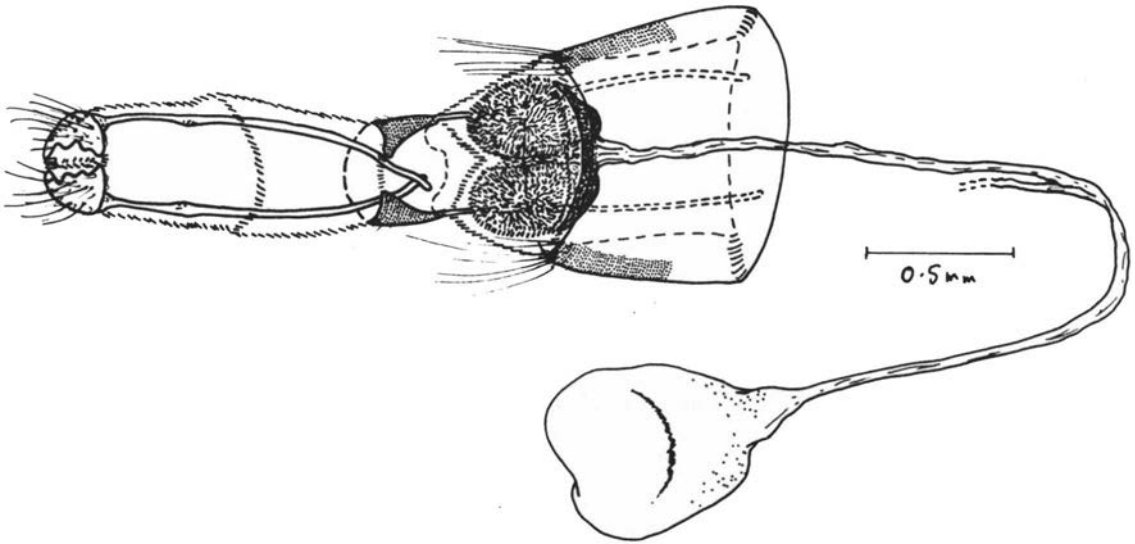
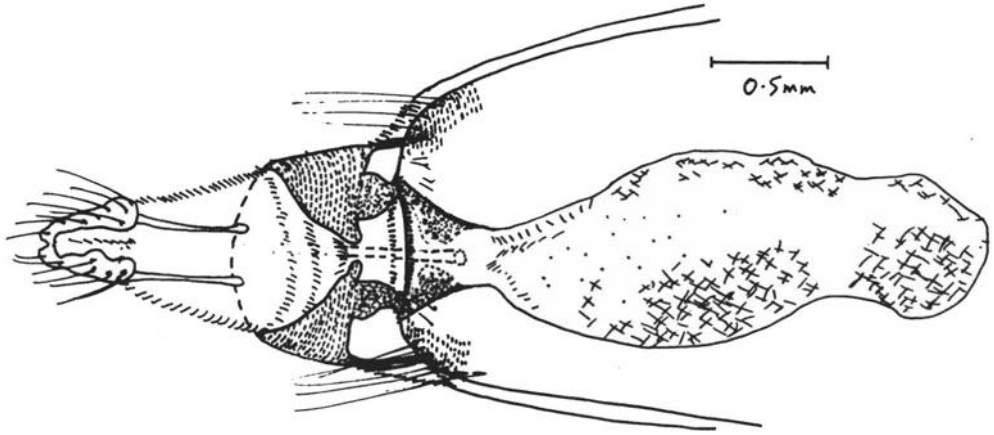


Fig.203 Female genitalia of Protyparcha scaphodes,
ventral aspect. (Auckland Island)
(p.335)

Fig.204 Female genitalia of Protyparcha graminea,
ventral aspect. (Campbell Island)
(p.337)

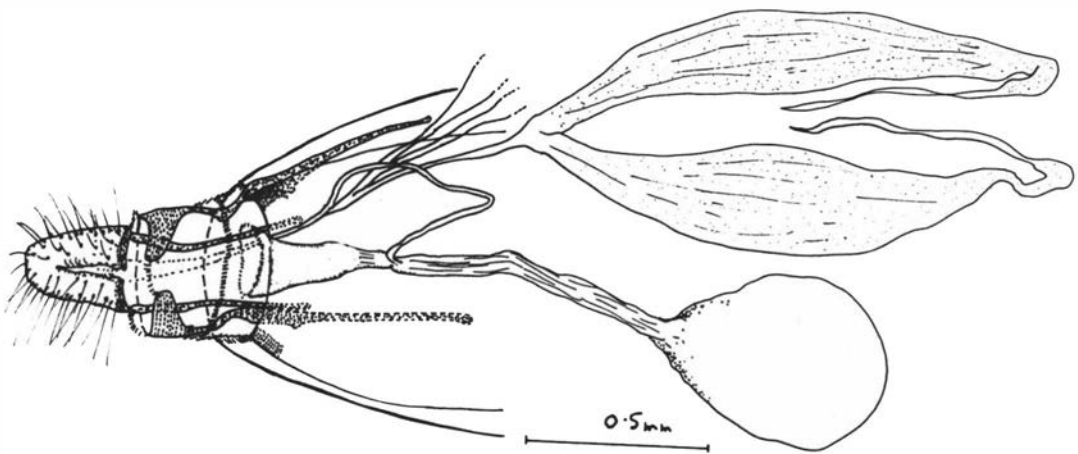
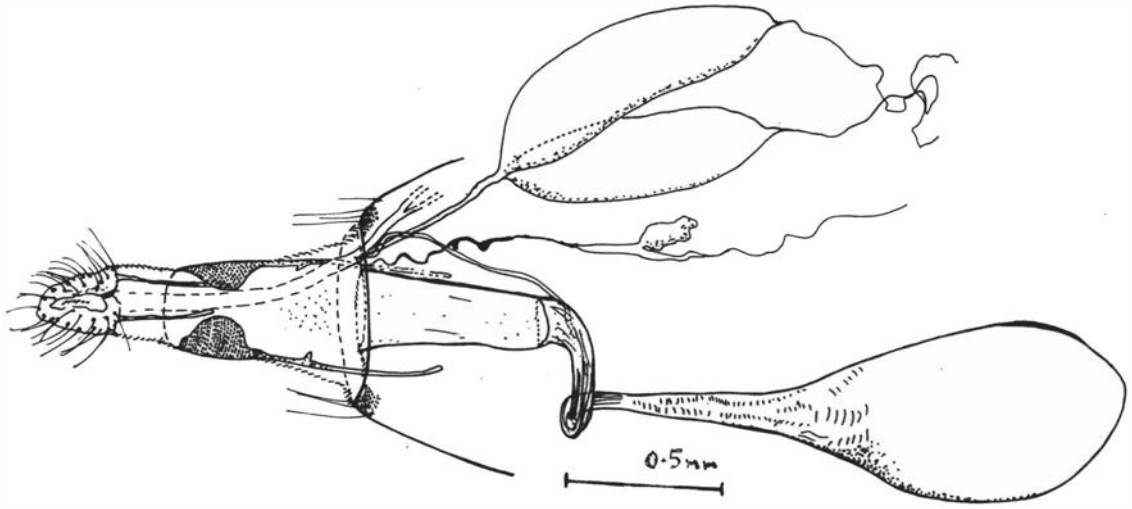


Fig.204a. Male genitalia of Tauroscopa callixutha,
lateral aspect. (New South Wales)
(p.204a)

Fig.204b. Female genitalia of Tauroscopa callixutha,
ventral aspect. (New South Wales)
(p.204b)

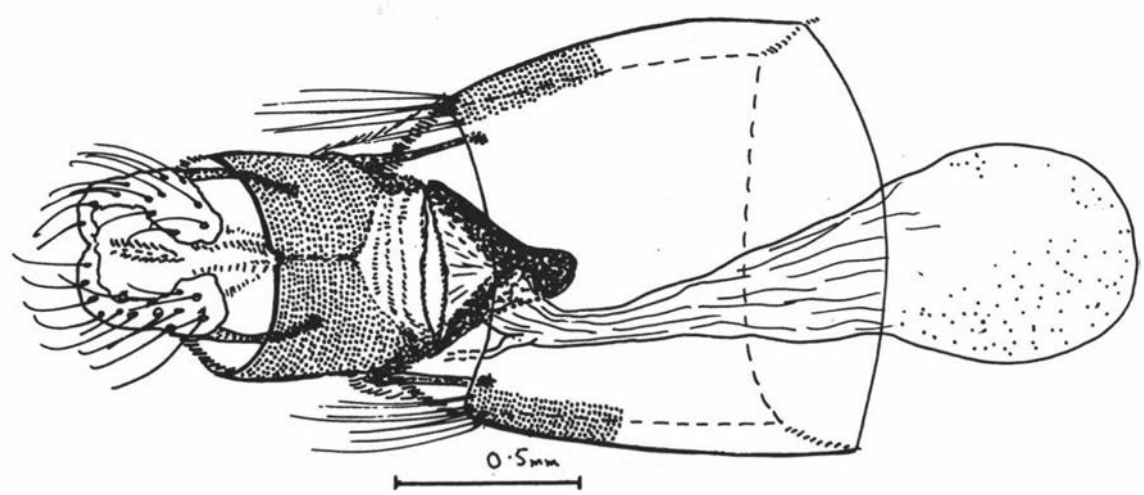
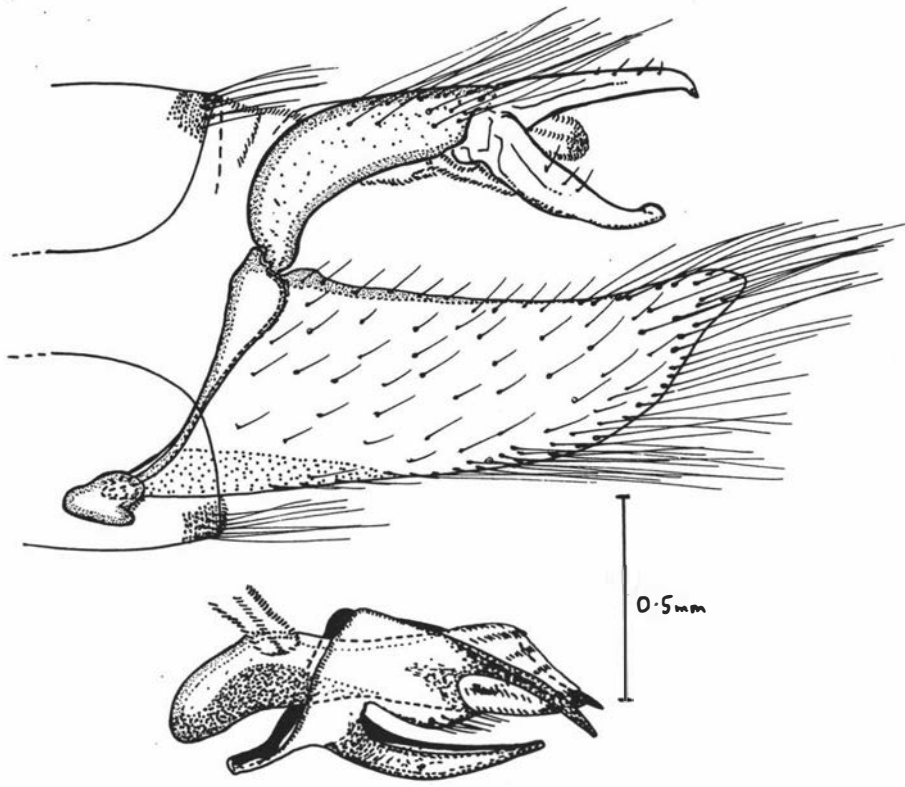


Fig.205 Key to structures and chief markings on head of Crambine larva, together with the detail of the prothoracic shield.

Legend: Dark areas of head capsule; a. Dorsal, b. Subdorsal, c. Dorsolateral, d. Lateral, e. Ocellar. Other structures and details; 1. Prothoracic shield, 2. Pale medial line, 3. Anterior dorsal mark, 4. Posterior dorsal mark, 5. Seta XD1, 6. Posterior mark, 7. Seta D1, 8. Upper dorsolateral mark, 9. Seta D2, 10. Lower dorsolateral mark, 11. Seta XD2, 12. Medial mark, 13. Seta SD2, 14. Prothoracic spiracle, 15. Spiracular mark, 16. Seta SD1, 17. Seta L1, 18. Seta L2, 19 Seta L1 (head), 20. Seta O2, 21. Seta O1, 22. Ocellus, 23. Seta A3, 24. Aa (no bristle), 25. Antenna, 26. Seta A1, 27. Seta A2, 28. Labrum, 29. Seta Cl2, 30. Membrana labro-clypealis, 31. Clypeus, 32. Seta Fl, 33. Frons, 34. Adfrons, 35. Seta Fr11, 36. Seta Pl, 37. Seta Fr12, 38. Coronal suture (ad-frontal section), 39. Seta P2, 40. Coronal suture (dorsal section).

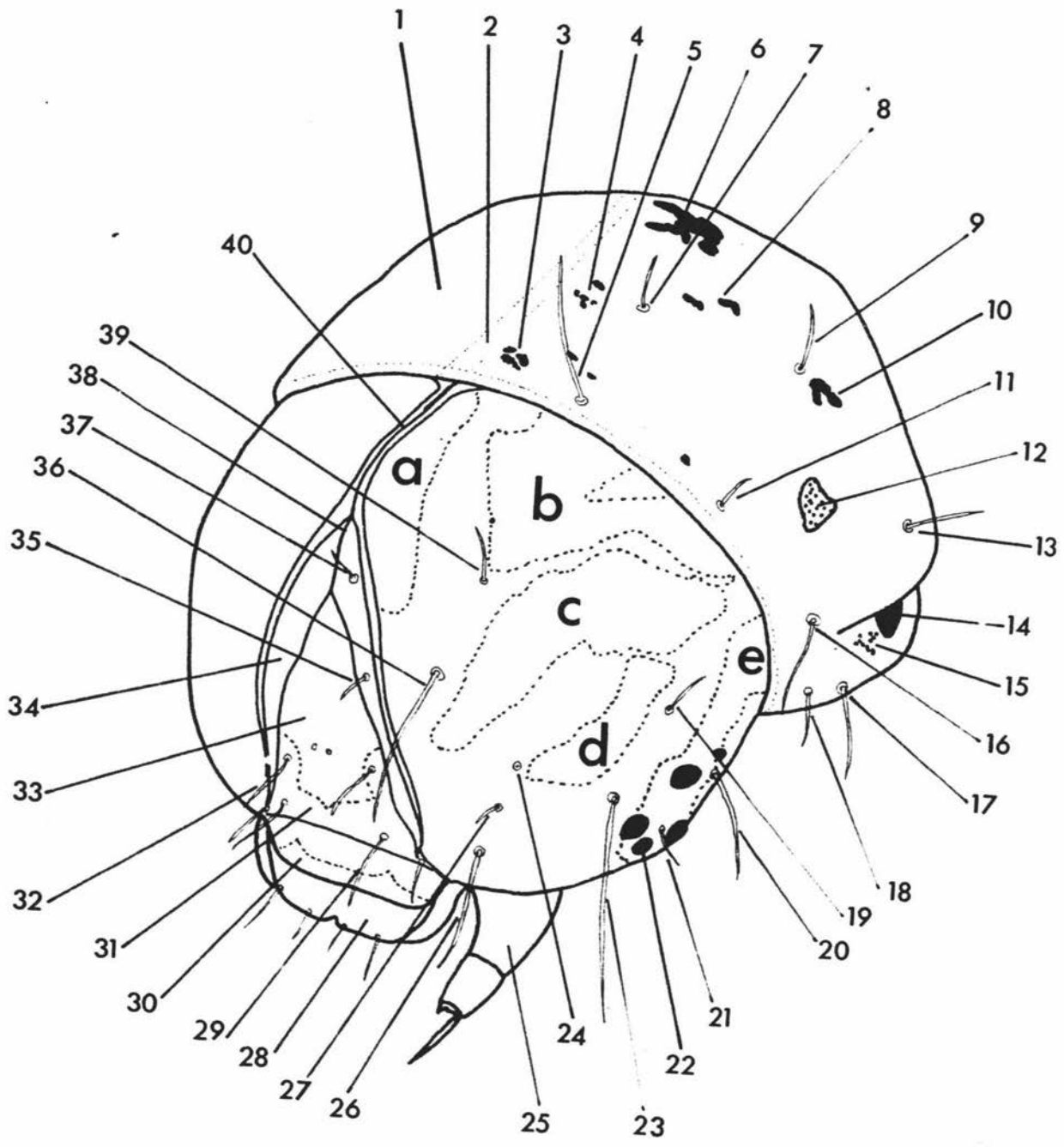


Fig.206 Head capsule and prothorax
of Orocrambus apicellus
larva. (6th instar) (p.86)

Fig.207 Head capsule and prothorax
of Orocrambus flexuosellus
larva. (6th instar) (p.101)

Fig.208 Head capsule and prothorax
of Orocrambus cyclopicus
larva. (6th instar) (p.153)

Fig.209 Head capsule and prothorax
of Orocrambus simplex larva.
(4th instar) (p.182)

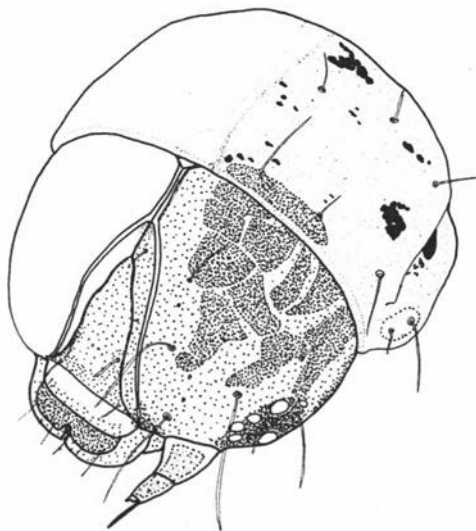
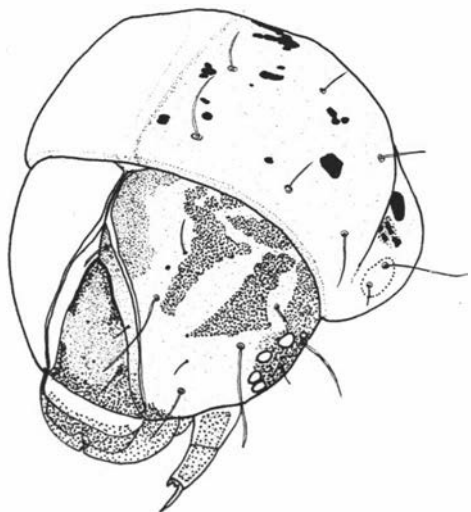
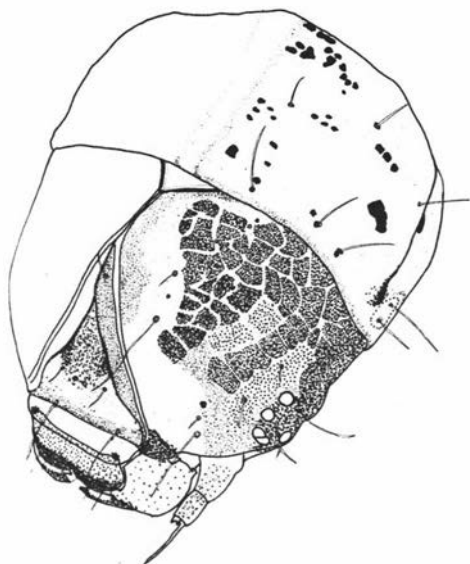
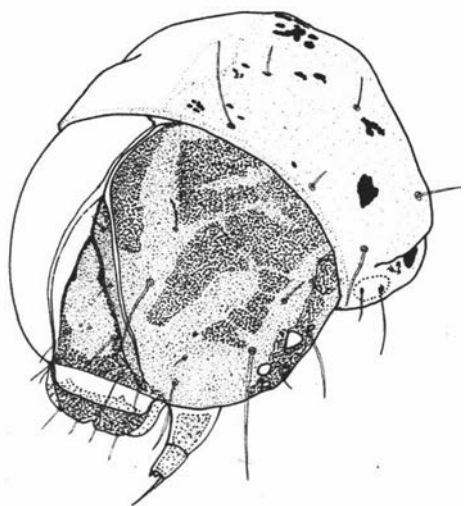


Fig.210 Head capsule and prothorax
of Orocrambus enchophorus
larva. (6th instar)
(p.191)

Fig.211 Head capsule and prothorax
of Orocrambus ramosellus
larva. (6th instar) (p.176)

Fig.212 Head capsule and prothorax
of Orocrambus vittellus larva.
(6th instar) (p.202)

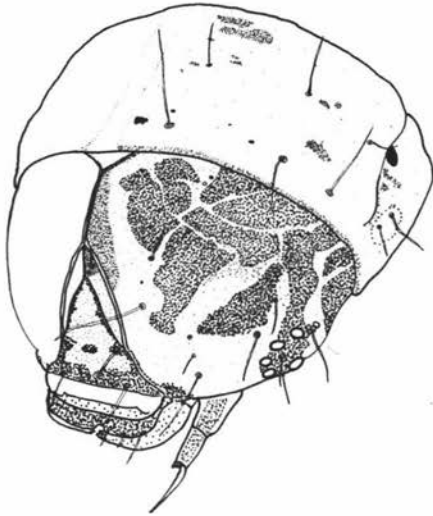


Fig.213 Crambine chaetotaxy

(discussion 45-8)

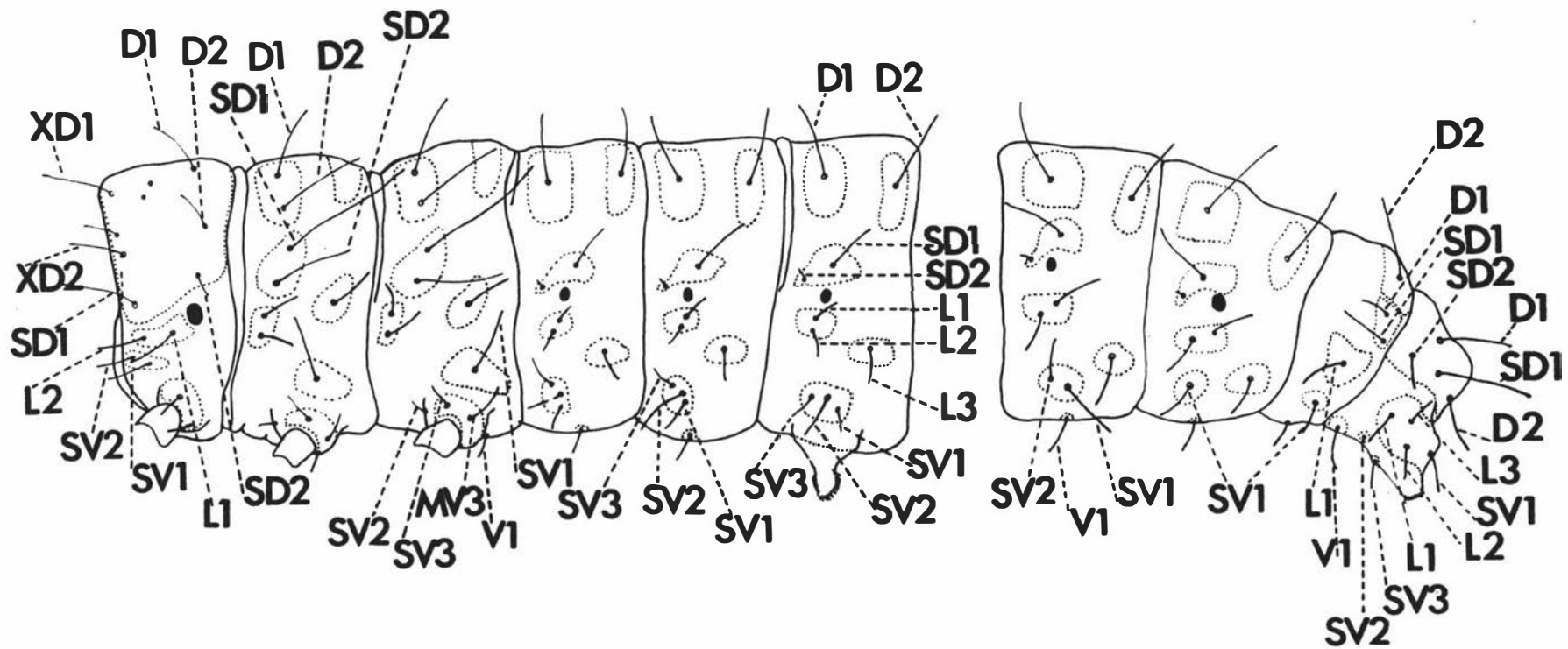


Fig.214 Chaetotaxy of Orocrambus apicellus
(final instar)
(p.86)

Fig.215 Chaetotaxy of Orocrambus flexuosellus
(fourth instar)
(p.101)

Fig.216 Chaetotaxy of Orocrambus flexuosellus
(final instar)
(p.101)

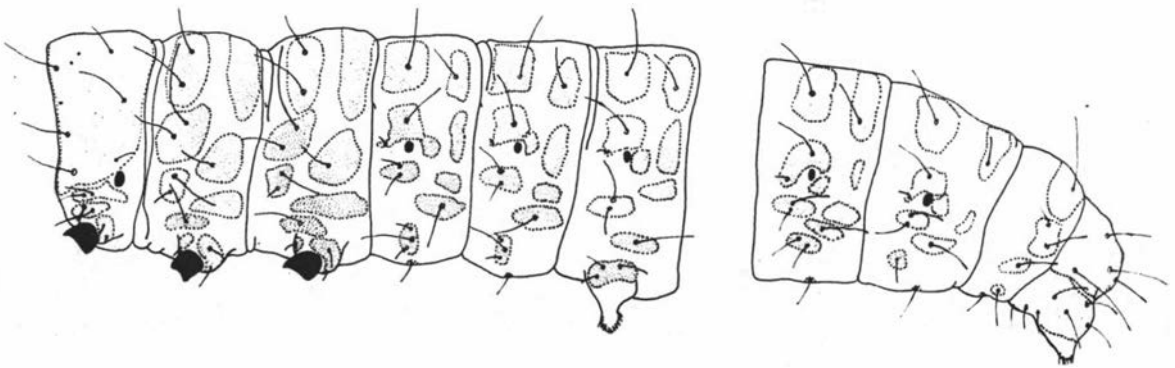
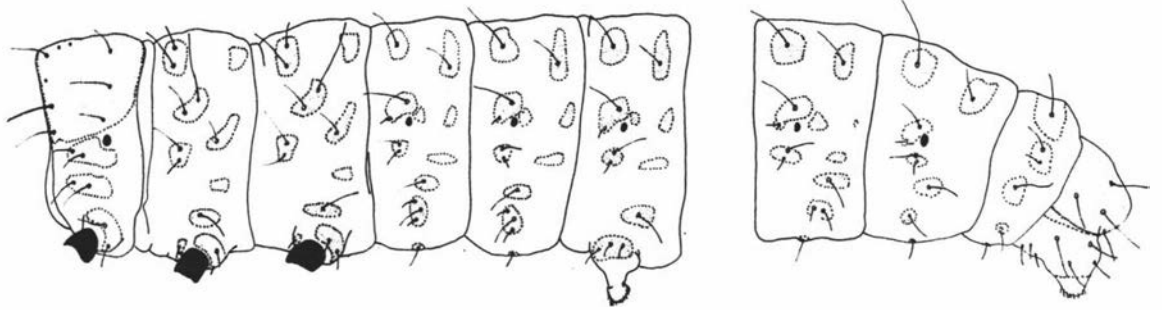
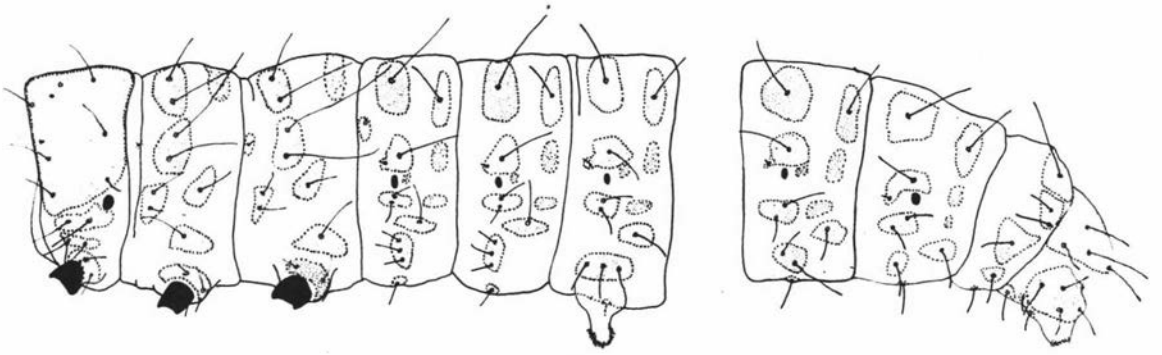


Fig.217 Chaetotaxy of Orocrambus heliotes
(fourth instar)
(p.118)

Fig.218 Chaetotaxy of Orocrambus angustipennis
(fourth instar)
(p.144)

Fig.219 Chaetotaxy of Orocrambus cyclopicus
(fifth instar)
(p.153)

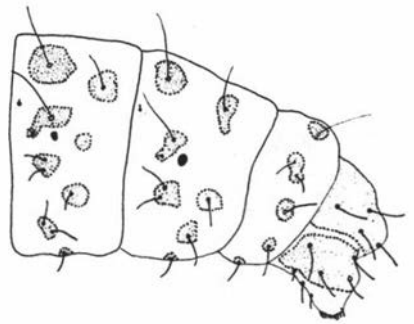
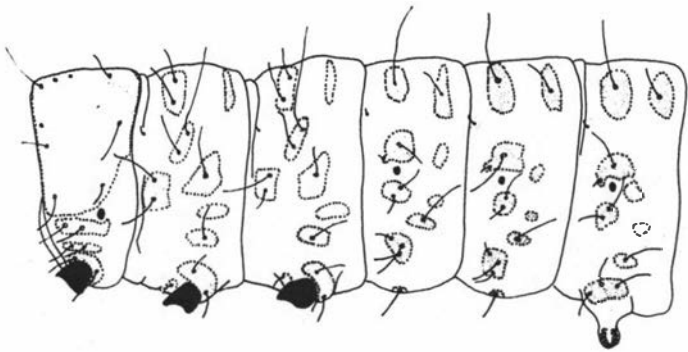
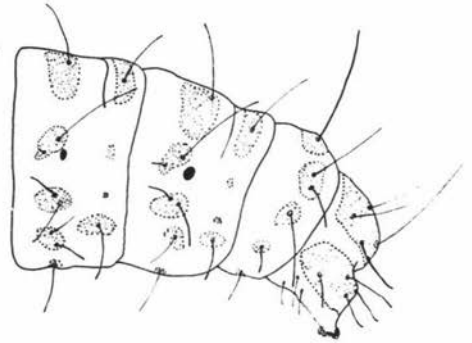
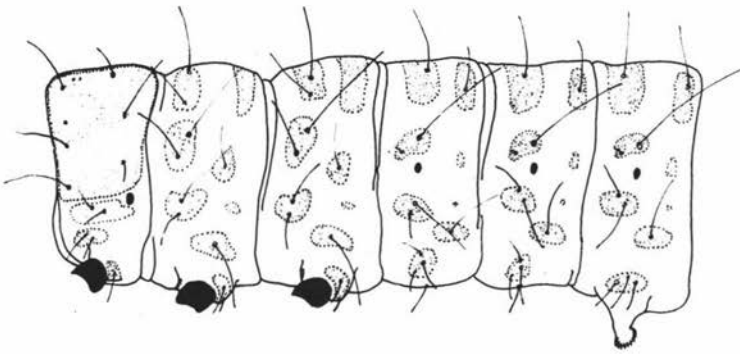
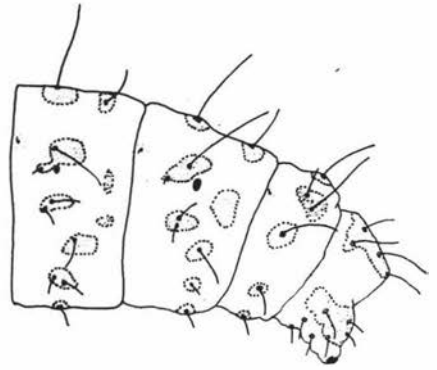
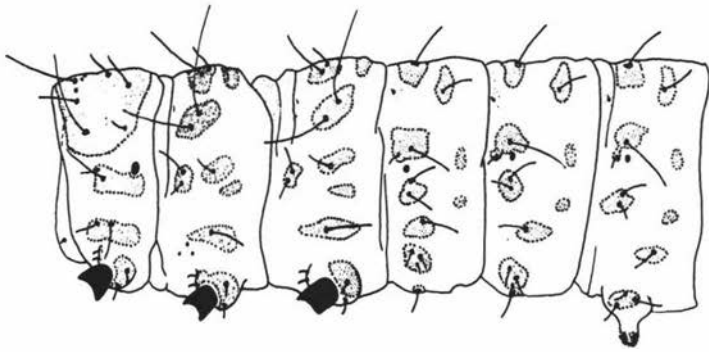


Fig.220 Chaetotaxy of Orocrambus enchophorus
(final instar)
(p.191)

Fig.221 Chaetotaxy of Orocrambus ramosellus
(final instar)
(p.176)

Fig.222 Chaetotaxy of Orocrambus vittellus
(fourth instar)
(p.202)

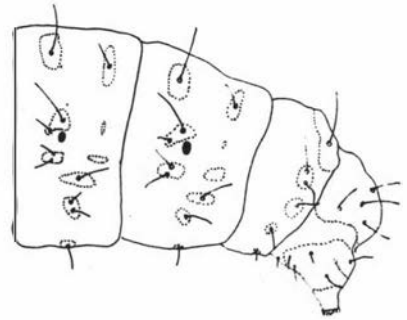
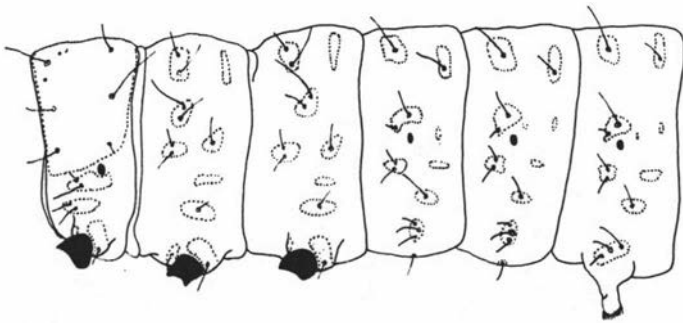
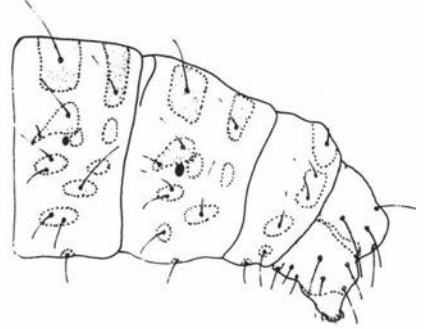
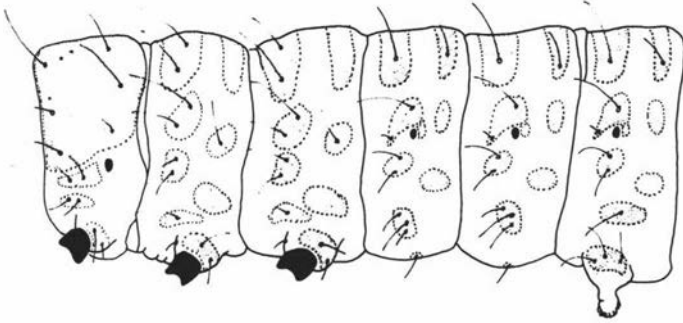
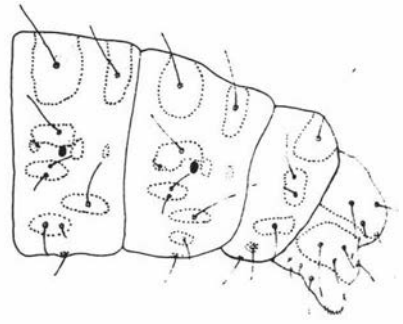
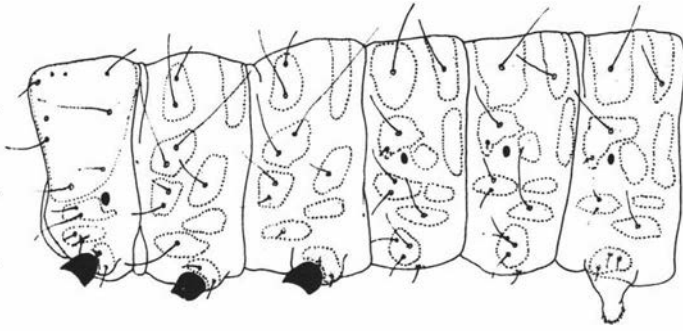


Fig.223 Chaetotaxy of Orocrambus vittellus
(final instar)
(p.202)

Fig.224 Chaetotaxy of Pareromene elaina
(fourth instar)
(p.264)

Fig.225 Chaetotaxy of Eudoria cataxesta
(Scopariinae) (final instar)
(comparison; p.26)

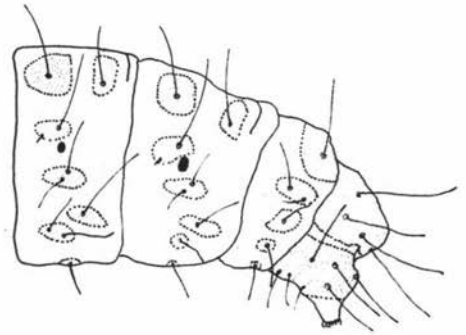
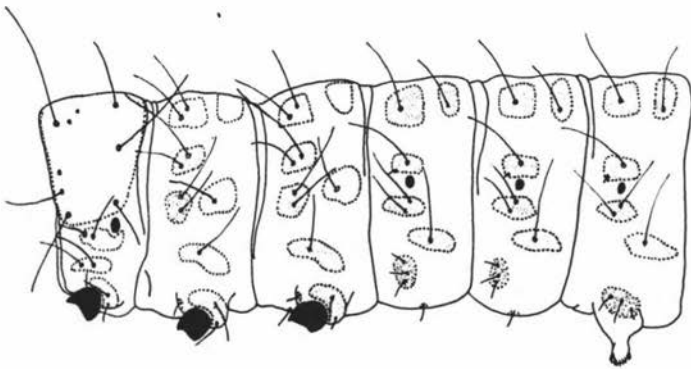
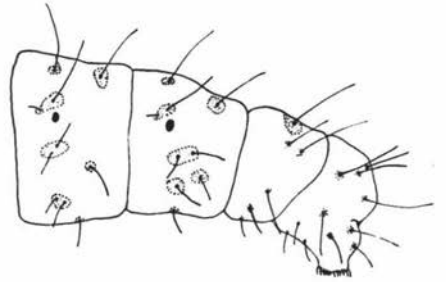
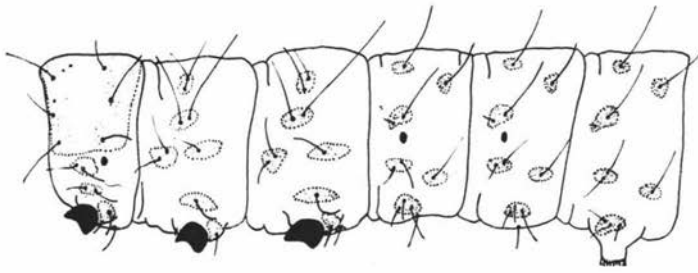
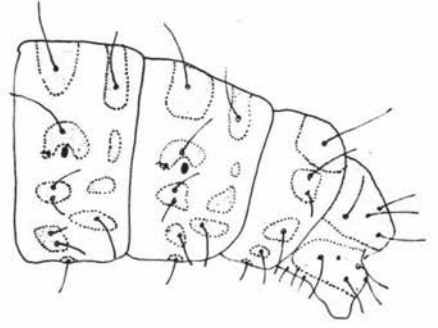
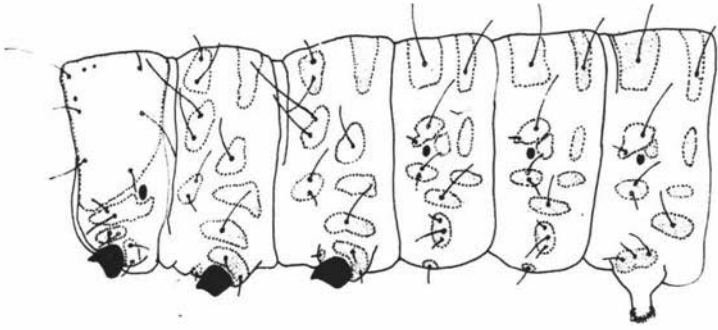


Fig.226 Distribution of
Orocrambus apicellus.
(p.87)

Fig.227 Distribution of
Orocrambus aethonellus.
(p.92)

Fig.228 Distribution of
Orocrambus catacaustus.
(p.96)

Fig.229 Distribution of
Orocrambus dicrenellus.
(p.98)

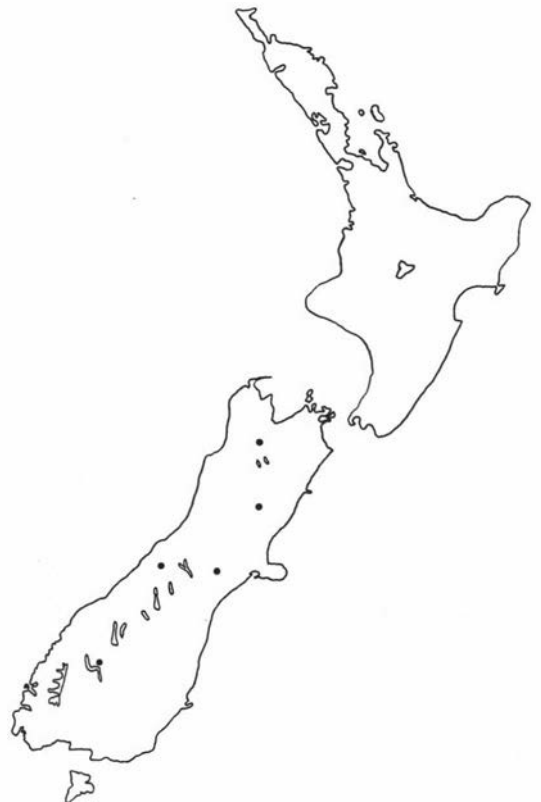


Fig.230 Distribution of
Orocrambus flexuosellus.
(p.103)

Fig.231 Distribution of
Orocrambus fugitivellus.
(p.112)

Fig.232 Distribution of
Orocrambus mylites.
(p.114)

Fig.233 Distribution of
Orocrambus haplotomus.
(p.116)

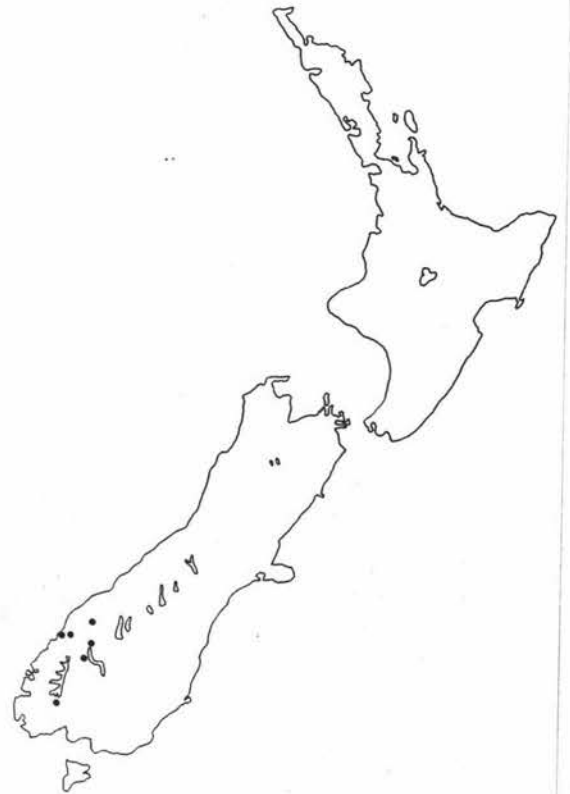
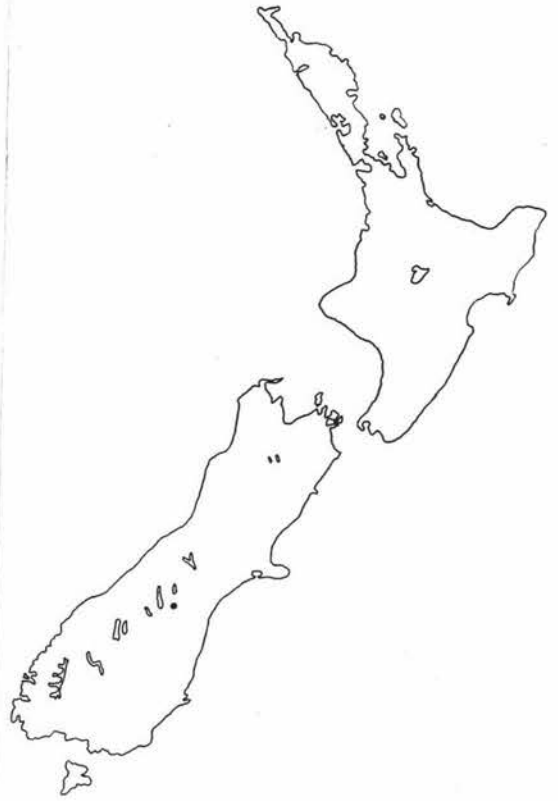


Fig.234 Distribution of
Orocrambus heliotes.
(p.119)

Fig.235 Distribution of
Orocrambus machaeristes.
(p.122)

Fig.236 Distribution of
Orocrambus thymiastes.
(p.123)

Fig.237 Distribution of
Orocrambus tritonellus.
(p.125)



Fig.238 Distribution of
Orocrambus clarkei.
(subspecies eximia ringed)
(p.127,129)

Fig.239 Distribution of
Orocrambus melampetrus.
(p.130)

Fig.240 Distribution of
Orocrambus scoparioides.
(p.133)

Fig.241 Distribution of
Orocrambus ventosus.
(p.135)

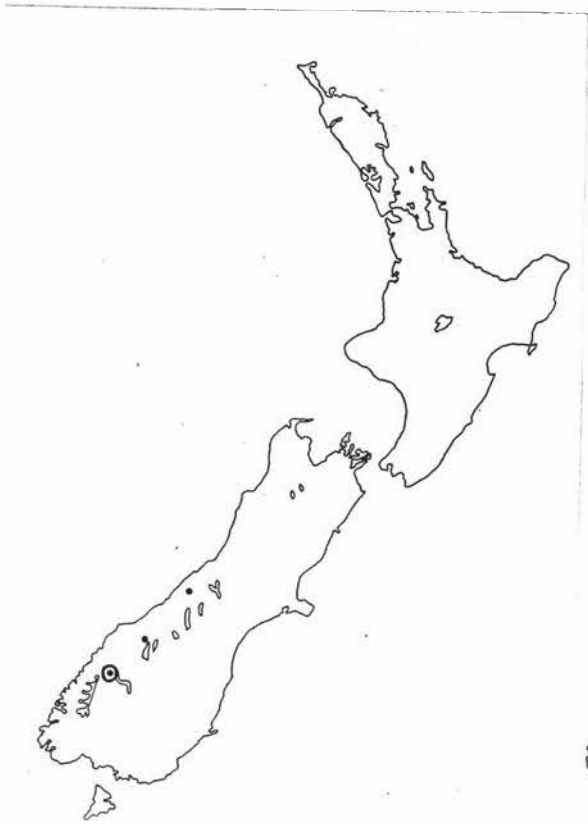


Fig.242 Distribution of
Orocrambus ephorus.
(p.137)

Fig.243 Distribution of
Orocrambus oppositus.
(p.139)

Fig.244 Distribution of
Orocrambus philpotti.
(p.141)

Fig.245 Distribution of
Orocrambus angustipennis.
(p.145)



Fig.246 Distribution of
Orocrambus corruptus.
(p.148)

Fig.247 Distribution of
Orocrambus melitastes.
(p.150)

Fig.248 Distribution of
Orocrambus cyclopicus.
(p.154)

Fig.249 Distribution of
Orocrambus lectus.
(p.157)



Fig.250 Distribution of
Orocrambus ornatus.
(p.159)

Fig.251 Distribution of
Orocrambus jansoni.
(p.161)

Fig.252 Distribution of
Orocrambus abditus.
(p.164)

Fig.253 Distribution of
Orocrambus crenaeus
(p.166)

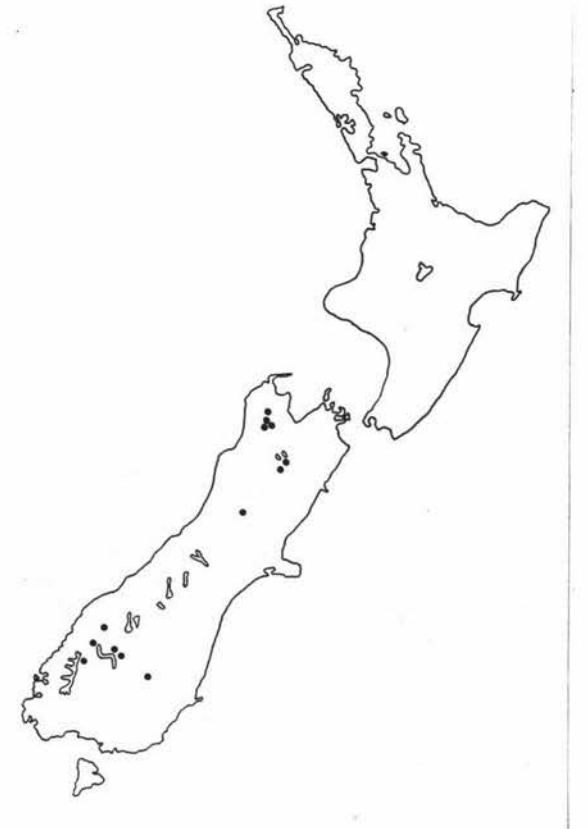
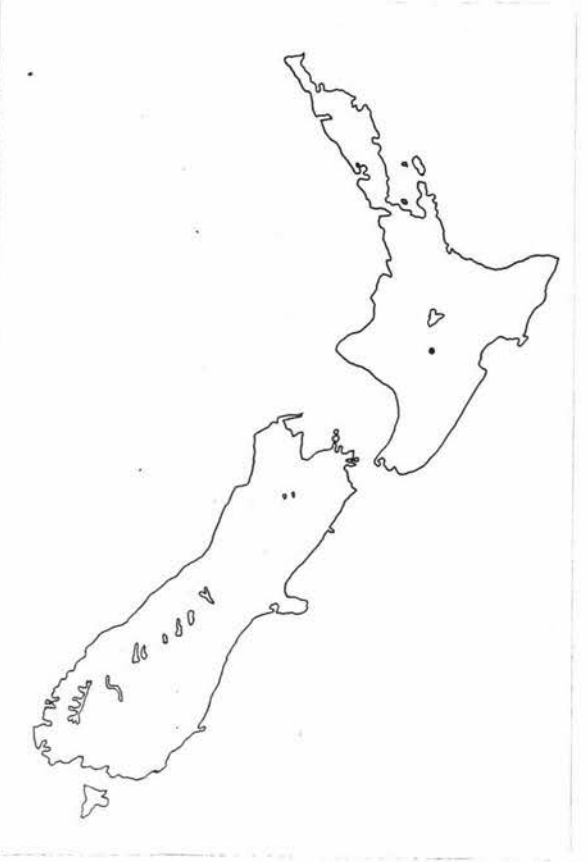


Fig.254 Distribution of
Orocrambus harpophorus.
(p.168)

Fig.255 Distribution of
Orocrambus heteraulus.
(p.170)

Fig.256 Distribution of
Orocrambus lewisi.
(p.172)

Fig.257 Distribution of
Orocrambus ordishi.
(p.174)

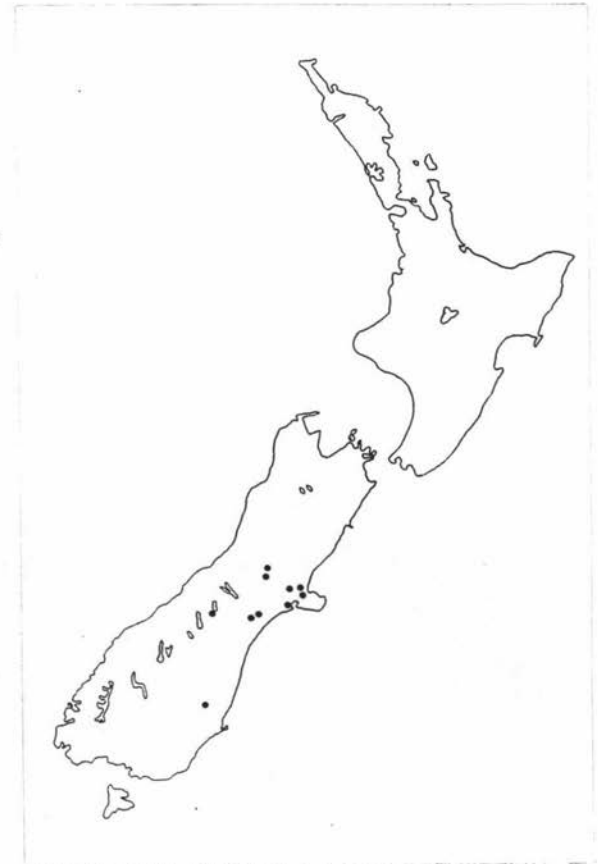
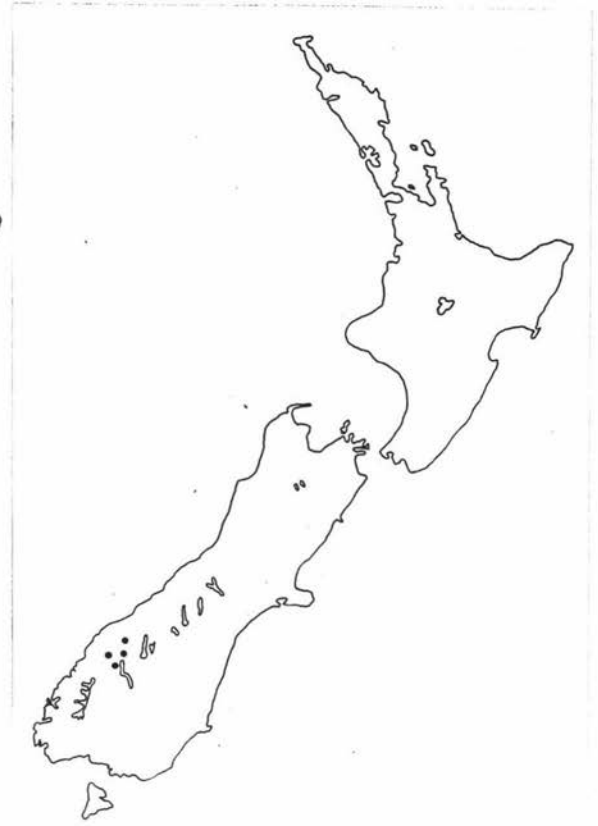


Fig.258 Distribution of
Orocrambus ramosellus.
(p.178)

Fig.259 Distribution of
Orocrambus simplex.
(p.184)

Fig.260 Distribution of
Orocrambus siriellus.
(p.186)

Fig.261 Distribution of
Orocrambus callirrhous.
(p.188)

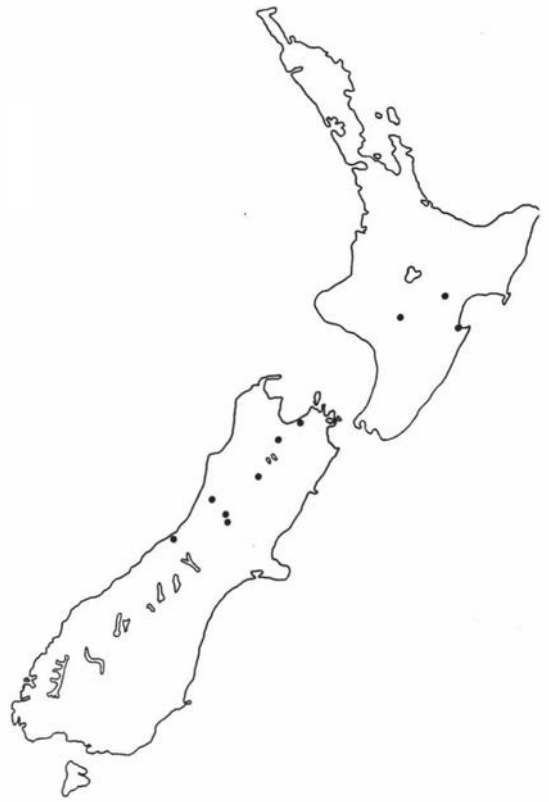


Fig.262 Distribution of
Orocrambus enchophorus.
(p.192)

Fig.263 Distribution of
Orocrambus isochytus.
(p.195)

Fig.264 Distribution of
Orocrambus paraxenus.
(p.197)

Fig.265. Distribution of
Orocrambus scutatus.
(p.198)



Fig.266 Distribution of
Orocrambus tuhualis.
(p.199)

Fig.267 Distribution of
Orocrambus vittellus.
(p.203)

Fig.268 Distribution of
Orocrambus vulgaris.
(p.210)

Fig.269 Distribution of
Orocrambus xanthogrammus.
(p.213)



Fig.270 Distribution of
Orocrambus punctellus.
(p.215)

Fig.271 Distribution of
Orocrambus sophronellus.
(p.216)

Fig.272 Distribution of
Orocrambus lindsayi.
(p.217)

Fig.273 Distribution of
Maoricrambus oncobolus.
(p.220)

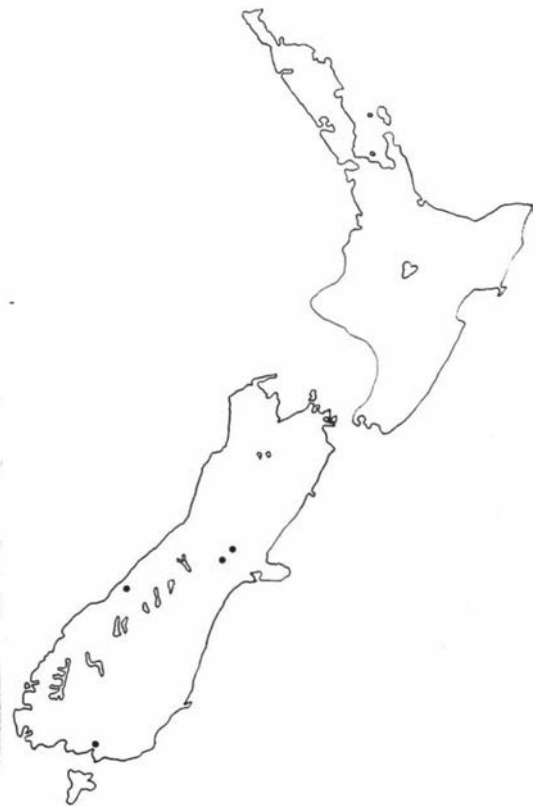
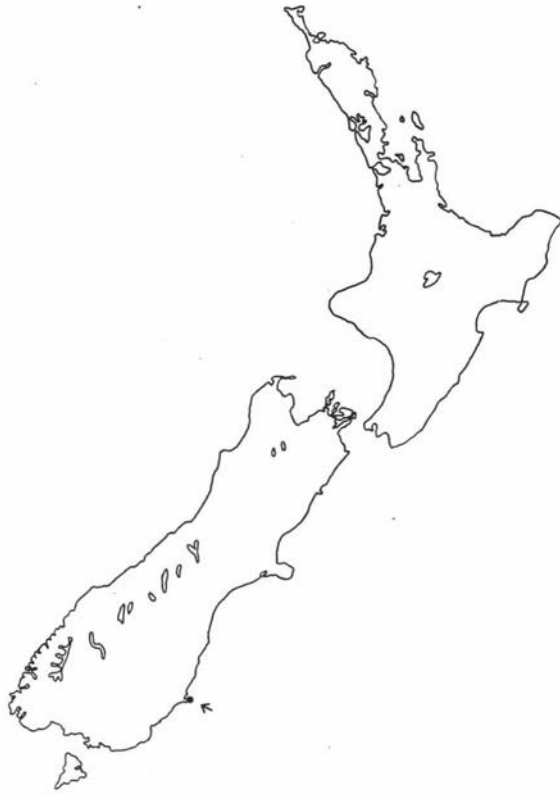


Fig.274 Distribution of
Kupea electilis.
(p.223)

Fig.275 Distribution of
Tawhitia glaucophanes.
(p.228)

Fig.276 Distribution of
Tawhitia pentadactyla.
(p.230)

Fig.277 Distribution of
Pareromene chrysochyta.
(p.247)



Fig.278 Distribution of
Pareromene selenaea.
(p.249)

Fig.279 Distribution of
Pareromene gurri.
(p.252)

Fig.280 Distribution of
Pareromene leucoxantha.
(p.254)

Fig.280 Distribution of
Pareromene auriscriptella.
(p.256)



Fig.281 Distribution of
Pareromene bipunctella.
(p.258)

Fig.282 Distribution of
Pareromene harmonica.
(p.260)

Fig.283 Distribution of
Pareromene elaina.
(p.265)

Fig.284 Distribution of
Pareromene helioctypa.
(p.268)



Fig.285 Distribution of
Pareromene interrupta.
(p.270)

Fig.286 Distribution of
Pareromene lepidella.
(p.272)

Fig.287 Distribution of
Pareromene metallifera.
(p.275)

Fig.288 Distribution of
Pareromene microdora.
(p.277)



Fig.289 Distribution of
Pareromene planetopa.
(p.278)

Fig.290 Distribution of
Pareromene epiphaea.
(p.280)

Fig.291 Distribution of
Pareromene holanthes.
(p.281)

Fig.292 Distribution of
Pareromene parorma.
(p.283)

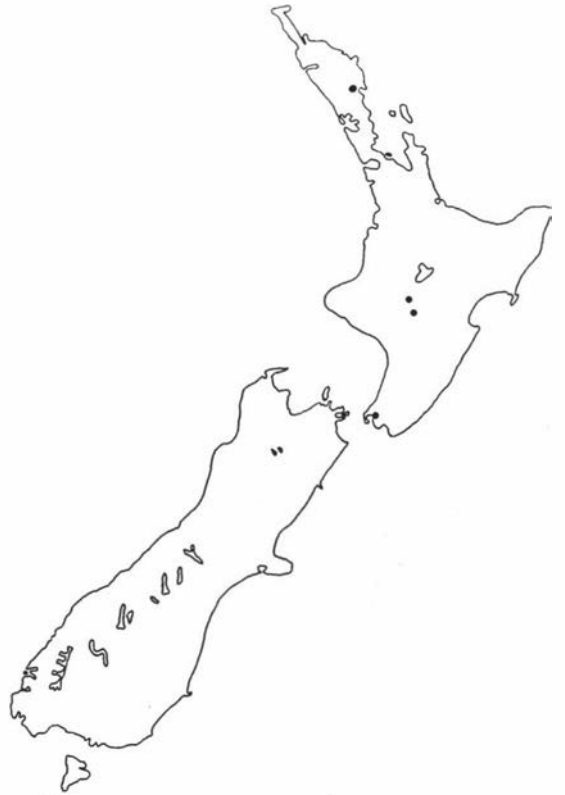


Fig.293 Distribution of
Pareromene pyrsophanes.
(p.284)

Fig.294 Distribution of
Tauroscopa gorgopis.
(p.300)

Fig.295 Distribution of
Tauroscopa notabilis.
(p.298)

Fig.296 Distribution of
Tauroscopa trapezitis.
(p.302)

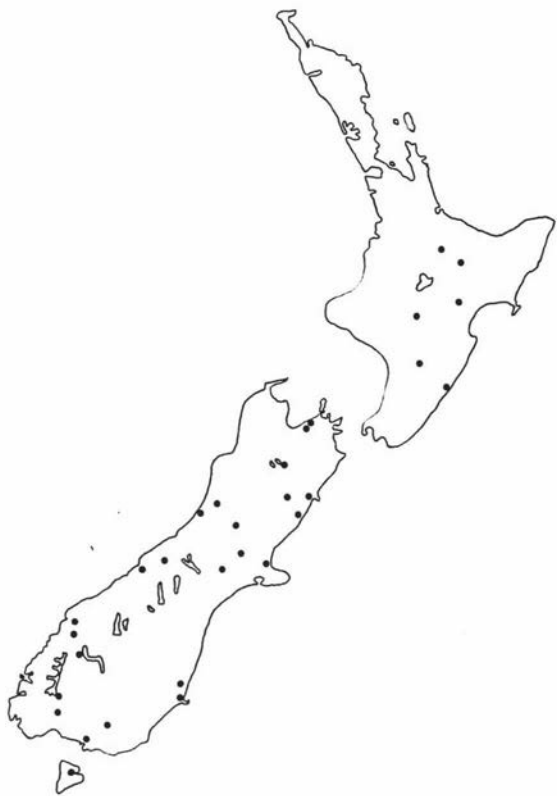


Fig.297 Distribution of
Gadira acerella.
(p.320)

Fig.298 Distribution of
Gadira leucophthalma.
(p.330)

Fig.299 Distribution of
Gadira petraula.
(p.318)

Fig.300 Distribution of
Paragadira strophea.
(p.332)

