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

Volume I - text.

A thesis presented in partial fulfilment
of the requirements for the degree of
Doctor of Philosophy (Ph.D) in Zoology
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New Zealand.

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SUMMARY

The status of the Sub-family Crambinae is examined in relation to other taxonomic units of the Super-family Pyraloidea. Relationships within the Sub-family have been studied using Hennig's system of phylogenetic analysis of apomorphic characters.

On the basis of a study of 37 revised world genera containing some 800 species, the Crambinae are divided into four tribes; the Crambini, with two sub-tribes, Crambina, with greatest development in the Palaearctic, and the Corynophorina which are Australasian; the Acigonini centred in the Ethiopian-Oriental regions, but with one genus strongly developed in South America; the Chiloini with moderate development in the Old World tropics but dominant in Australian grasslands; and the Diptychophorini which have a largely pan-tropical distribution.

The New Zealand crambine fauna has been completely revised. It consists of 80 known species: 48 of these are placed in Orocrambus Purdie, including the following new species; Orocrambus philpotti, O. jansoni, O. lewisi, O. ordishi and O. lindsayi. Twentyfive specific names are synonymised. A new genus Maoricrambus, is erected to contain a single species oncobolus Meyrick. Angustalius Marion and Kupea Philpott have one each. These 3 genera are all Crambina. Two species of Corynophorina are present, both placed in the genus Tawhitia Philpott. Eighteen species of Pareromene^{Osthelder} of the tribe Diptychophorini, are re-described, including one new species Pareromene gurri.

The Acigonini are not represented in New Zealand. The Chiloini are weakly represented by Tauroscopa Meyrick and Gadira Walker with 3 species each, and a new genus Paragadira which contains one species. Two species of Protyparcha Meyrick are confined to Campbell Island and the Auckland Islands in the subantarctic.

Phylogenetic analysis of these genera shows the following: Maoricrambus is a segregate of Orocrambus, as is probably Kupea. Orocrambus, Angustalius and Pareromene show clear affinities with Palaearctic groups, and presumably reached New Zealand via the Melanesian Arc. New Zealand Pareromene also have sister species in New Guinea. Angustalius may have been accidentally introduced. The affinities of Paragadira and Protyparcha are not known. Tawhitia, Tauroscopa and Gadira all show sister-species or sister-genus relationships with Australian groups, and are assumed to have become assembled in New Zealand by aerial dispersal across the Tasman Sea.

Biogeographical literature relating to dispersal of taxa to New Zealand is reviewed, and major biotic routes beyond the Australasian Region are briefly discussed. It is stressed that the New Zealand crambine fauna shows no indication of trans-Antarctic relationships. The time of arrival of Orocrambus in New Zealand is postulated as the Eocene, that of Pareromene as the Middle Miocene.

Crambine distributions within New Zealand are reviewed; 15 species have distributions correlating with Pleistocene biotic refuge regions postulated by phytogeographers. The age of Orocrambus species is briefly considered. It

is suggested on evidence of relict distribution patterns and the semi-apterous adaptations found in most of the species with these distributions that some peri-glacial region survival has occurred.

Success of Orocrambus in radiating into the New Zealand alpine sector in the late Pleistocene is attributed to pre-existing adaptation to conditions of physiological drought, possibly developed in savanna-arid conditions in the earlier Tertiary, reinforced by selection for advantageous morphological adaptations during the early Pleistocene cool-climate conditions.

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All the taxonomic typing was done by Mrs Christine Gradolf of 72 Brandon Street, Featherston.

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INTRODUCTION

A few New Zealand Crambinae were described by Doubleday (1843), Walker (1863; 1864; 1866), Zeller (1863; 1877), Felder (1875) and Butler (1877). In this early work the same species were often described nearly simultaneously by as many as three authors, leading to much confusion in nomenclature. The first attempts at a systematic presentation of the New Zealand Crambinae were made by Meyrick (1882 ; 1883; 1885; 1888), who also studied the Australian and Pacific Island Crambinae in the same period (1879; 1882a; 1886; 1897). His New Zealand studies culminated in the first revision of the group (1912a). In his descriptions, and in the revision, he relied almost entirely on the venation, forewing pattern and palpi structure for taxonomic characters. The great majority of the New Zealand Crambinae were grouped by Meyrick into the Palaearctic genus Crambus F. and the neotropical genus Diptychophora Zeller. He also erected an endemic genus Orocrambus (now attributed to Purdie, see later) to include a few alpine species. His type series were almost invariably specimens from the collections of G.V. Hudson in Wellington and R.W. Fereday in Christchurch.

The first systematic examination of New Zealand Crambine genitalia was carried out by Philpott (1929), who figured 68 sets of genitalia. In this paper Philpott queried the validity of a few of Meyrick's species, but accepted his generic classification. Unfortunately the value of this paper (which deals with male genitalia only) to present day workers is much reduced by 10 name caption errors in the 68 figures. These are not merely spelling errors; several pairs of species names have become substituted, probably through errors in the

original slide labelling. The confusion is compounded by two serious errors in his Crambus key. While basically a very valuable piece of work, Philpott's paper should not be used for Crambine male identification by anyone not fairly familiar with the genera concerned. However it can be used cautiously in conjunction with the very useful colour illustrations in Hudson's volumes (1928; 1939; 1951); then some of the errors become obvious.

During the last decade or so Bleszynski has revised the Palaearctic Crambinae (1965) and revised or begun to revise major genera in the Ethiopian Region (1964), the Old World tropics (1963b) and the Neotropical Region (1960a; 1966; 1967). A review of the world crambine genera and their types (1963a), and a catalogue of the known world species (Bleszynski and Collins, 1962) have also been very valuable contributions making the studies of regional workers, such as the present author, much easier.

The overall classification of the Crambinae is still in some confusion. In the present work I have outlined and discussed what I think are the major characters dividing the subfamily above the generic level, and considered the relationships of this subfamily with the Scopariinae and Pyraustinae, an area of study where much more investigation and clarification is needed.

All 80 known New Zealand species of Crambinae have been re-examined in the present study, and a preliminary re-examination and revision of 11 endemic Australian species has also been carried out. The latter study, although incomplete, has yielded valuable information concerning origins and relationships of the New Zealand Crambinae while the New

Zealand studies have in turn suggested the line that a revision of the large and important Australian genus Hednota should take.

My work has been made much easier by Dr. S. Bleszynski who has checked the types of the New Zealand Crambinae held in the British Natural History Museum collection and freely supplied me with his invaluable sketches of type genitalia; the efforts of Mr. P.E.S. Whalley and Mr. D. Carter of the Entomology Department, British Museum for listing type label data for me; Mr. I.F.B. Common of Entomology Division, CSIRO, Canberra, Mr. A. Neboiss of the National Museum of Victoria, Melbourne, and Mr. N. McFarland of the South Australian Museum, Adelaide who supplied me with valuable general information, label data and determined specimens for comparative study.

A number of convenient abbreviations have been used in this work, and these are listed below.

LIST OF ABBREVIATIONS USED IN
THE DESIGNATION OF COLLECTIONS.

National Collections.

- | | |
|------|--|
| AM | Auckland Institute and Museum, New Zealand. |
| ANIC | Australian National Insect Collection, CSIRO, Canberra. |
| BM | British Museum (Natural History), London, England. |
| CM | Canterbury Museum, Christchurch, New Zealand. Including Fereday and Lindsay collections. |
| DM | Dominion Museum, Wellington, New Zealand. Including Hudson and Salmon Collections. |
| ED | Entomology Division, DSIR, Nelson, New Zealand. |
| FRI | Forest Research Institute, Rotorua, New Zealand (now in part at ED). |
| LC | Lincoln College, Canterbury, New Zealand. |
| NMVC | National Museum of Victoria Collection, Melbourne. |
| PDD | Plant Diseases Division Collection, DSIR, Auckland. |

Private Collections.

- DC Davies Collection. T.H. Davies, R.D.2, Clifton,
Hawkes Bay.
- GC Gaskin Collection. Author's. Presently held in part
at Massey University, Palmerston North, New Zealand, and
in part at 25 Pembroke Street, Palmerston North, New
Zealand.

Other abbreviations: A group of three letters, the first two
capitals and the third capital or lower case indicates a
genitalia preparation by myself. A complete catalogue of all
genitalia preparations made in this study is attached as an
appendix to each thesis copy.

Letters have been used to distinguish between number
and letter combination labels, e.g. 666h, which are labels which
refer to the appropriate entry in the Hudson collection catalogue,
held at the Dominion Museum, Wellington.

MATERIALS AND METHODS

Maintenance of living specimens.

This study was carried out using specimens from the collections listed in the Introduction, supplemented by wild-caught and bred moths. A few of the larvae examined were found in the wild, but the majority were reared in captivity.

Larvae were maintained in small closed glass and plastic containers at room temperature, but conditions were not otherwise controlled. Foodplants were changed every few days, or at specific intervals indicated in the systematic section of the text. The larvae were examined each time the foodplants were replaced with fresh material, and instar changes recorded. When larvae appeared close to pupation they were transferred to preserving jars containing about 3" of soil and a thin layer of plant debris frequently used by larvae for cocoon construction. Jars containing pupae were stored at room temperature, but conditions were not otherwise controlled.

Adults were maintained in captivity in an indoor cage measuring 3' x 2' x 2' high made of bamboo struts and polythene sheeting, with a nylon gauze back. Moths were fed with sucrose solution pipetted into cotton balls placed in several petri dishes on the floor of the cage. Although foodplant (usually small clumps of grass grown from seed on moist blotting paper) was supplied to induce female oviposition, eggs were usually obtained by sweeping the floor of the cage with a fine squirrel hair brush. The collected eggs were transferred to small stoppered tubes and stored at room temperature.

Capture of adults.

Much of the adult material used in this work was taken using a 125 watt mercury vapour bulb light trap, set up at Massey University. This trap consisted of a bulb set in a V-shaped funnel leading into a large drum with partially transparent side partitions. ^{This} allowed moths to be taken alive.

Other material was collected using typical entomological field equipment. The most effective method other than light trapping for obtaining Crambinae adults is simple sweep netting, especially at dusk.

Anatomical Studies :

a) Microscopic equipment used

While adequate studies of forewing pattern can be made by eye, microscopic examination is necessary for interpretation of venation and genitalial characters. Equipment used was an "Olympus" stereo-zoom binocular, with 10x and 20x eyepieces and fixed objective allowing a magnification range from 10x to 80x using the zoom system, and later a Leitz binocular with 8x and 12.5x eyepieces and 1x, 2x, 4x, 8x and 12x objectives allowing a magnification range from 8x to 150x. All drawings were made using "Olympus" and Leitz camera lucida apparatus.

b) Examination of venation

A number of permanent preparations were made simply by placing wings on 3" x 1" microscope slides adding a drop of "Micrex" and covering with a coverslip of appropriate size.

When the wings could not be removed from a specimen, the moth was pinned on to a piece of cork with the abdomen parallel to and flush against a raised glass slide, so that the spread wings lay flat on the slide. They were then protected

with a coverslip, and a small amount of pure benzene was pipetted between coverslip and slide, renewed from time to time until the examination was completed.

c) Examination of genitalia in fresh specimens

For the examination of the delicate mesodermal structures in the genitalia of a number of species the following technique was used. Insects were decerebrated by crushing the head with a pair of forceps, and then pinned down in a wax lined dish under a stereo microscope. The abdomen was opened laterally with a fine pair of dissecting scissors under half an inch of insect ringer solution at 25-30°C. The heat of the microscope lamp was enough to maintain this temperature during the operation. When the tergites had been cut away fine needles were used to tease out the gut and associated glands, the tracheae and fat body elements so that the genitalia could be clearly seen.

d) Examination of genitalia in dried specimens

The great majority of moths examined were dried museum specimens. Treatment for males and females was the same. The whole abdomen was removed and softened in near-boiling 5% KOH for about 5 minutes, a few spots of concentrated detergent being added in the case of females to remove fat. The genitalia were then neutralised in acid alcohol and examined in a spot of glycerine under the microscope, with the parts displayed by teasing with a pair of dissecting needles. It was frequently necessary to remove the long hair-like scales from the tegumen and seventh sternite margin to expose the parts for drawing, and to pull the aedoeagus completely out, as this organ displays valuable specific taxonomic

characters in Orocrambus and Pareromene species.

Genitalia after examination were generally put into microvials containing 50-50 70% alcohol and glycerine, and pinned beneath the specimen from which they came. Where certain museums desired permanent mounted preparations the genitalia were passed through from 70% to absolute ethyl alcohol, put into toluol for about five minutes and then mounted in any suitable permanent mountant available. In a few cases Orange G stain was used to show up weakly sclerotised structures.

e) Examination of larvae

Larvae were preserved in 70% alcohol until required. Some specimens were examined without dissection or further treatment, but this was not satisfactory in the case of first, second and final instar larvae. These were placed in 5% near-boiling KOH for about 10 minutes. In the case of final instar larvae, and also third, fourth and fifth instar larvae on occasions when these were also treated in this fashion for permanent mounting, the larva was opened with dissecting scissors along the ventral midline before being put into the KOH, and a few drops of detergent were also added to the solution.

After 10 minutes in this solution first and second instar larvae were neutralised in acid alcohol and examined direct, while third instar (and upward) larvae were first washed in acid alcohol and the skins opened out by small lateral cuts behind the head capsule and near the anus. For permanent mounting the larval skins were taken up through the alcohols from 70% to absolute after staining with carmine, then into toluol and finally a mounting medium, usually Canada Balsam.

Several instars of one species could be mounted on one slide.

f) Attempted chromosome examinations

Chromosome counts were first attempted in adult males. Specimens were dissected in warm insect ringer as in section c, the testes removed and a squash preparation made. The stain used was 1% carmine. No spermatogenesis was observed in about a dozen preparations. White, (1957) noted that in a number of insect groups the whole process of spermatogenesis was completed in final instar nymphs or larvae, or in the pupal stage. Testes of 4 final instar larvae of O.flexuosellus (Dbl.) and 3 of P.elaina (Meyr.) were dissected out and made into smear preparations as before. In the larvae the testes are visible in the last two instars as yellowish masses lying in the dorso-lateral lines beneath the skin of the middle abdominal segments. Two male pupae of P.elaina had the testes removed and similarly treated, while a third pupa was opened, fixed for 5 minutes in Navashin's Fluid and then stained by a conventional crystal violet technique.

For examination of this material an Olympus binocular microscope with 10x eyepieces and a 100x oil emersion objective was used. Spermatogenesis was observed in only one of the O.flexuosellus samples. However the chromosomes were small and tangled, and the centromeres not distinct. Although about 10-15 seemed to be present I could not decide if this was the n or 2n condition or exactly how many chromosomes could be seen.

In practice Crambinae are almost invariably encountered in the adult stage, when spermatogenesis is

completed. In the wild the larvae and pupae of both Orocrambus and Pareromene species are exceedingly difficult to find without a great measure of luck. Even if larvae are found there seems to still be a measure of chance involved in dissecting them at just the right stage of development. Although I have had some success breeding species in captivity during this study, mortality to the final instar was quite heavy, and it was not always convenient or possible to use the same larvae for both chaetotaxy studies and dissection, and the first took priority. In some Orocrambus species the sixth and final instar is several months long, being the overwintering stage of the species, and even the earlier instars may last for three months or more. So, taking all factors into consideration, I can only conclude that while chromosome counts may eventually provide fresh evidence of systematic relationships within the Crambinae, they are not going to be easy to obtain for even a small number of species, and the technique is certainly not a useful practical method of identifying species.

g) Botanical names

These were taken from several sources, including Martin (1961); Hilgendorf and Calder (1918); Zotov (1960); Keble Martin (1965) and Burrows (1967).

h) Nomenclature in larval chaetotaxy

I have adhered to the system devised by Hinton (1946).

i) Nomenclature in genitalial studies.

This is considered in detail in the next section.

CONSIDERATIONS ON GENITALIA TERMINOLOGY
AND FUNCTION

For practical reasons most taxonomic studies of Lepidoptera are based on the sclerotised ectodermal portions of the genitalia. In the present work mesodermal structures have been examined where possible, although all critical generic characters are ectodermal.

Recently Diakonoff (1954) made a plea for uniformity in terminology and listed the major structures of the genitalia with names, largely taken from Pierce, which he strongly suggested should be standardised. In almost every case I have followed Diakonoff's terms, except that the term pseudosaccus of Bleszynski has been used, a structure which appears of diagnostic importance in the Crambinae. In the females of Orocrambus I sometimes use the separate names lamellae antevaginalis and postvaginalis indicated by Diakonoff rather than his suggested compound term of sclerites of the sterigma. Where referred to together in Orocrambus and the other genera I have used the term ostiolar sclerites, rather than sterigma, since the complexity of the peri-ostiolar region usually associated with the term sterigma, as for example in the Tortricids, is not found in the great majority of the New Zealand Crambinid representatives.

MALE GENITALIA:

The male system in fig. 37 was based on a specimen of Orocrambus flexuosellus Dbld., but mesodermal structures were also examined in fresh specimens of the following species; Orocrambus heliotes (Meyr.), O. corruptus (Butl.), O. enchophorus (Meyr.), O. simplex (Butl.), O. ramosellus (Dbld.), O. apicellus (Zell.), Pareromene auriscriptella (Walk.), P. elaina (Meyr.),

Gadira acerella Walker and from the Scopariinae, Eudoria cataxesta (Meyr.) and E.diphtheralis (Walk.). Except in very minor details of proportion the mesodermal structures were identical in all the above, reinforcing the suggestion of the very close relationship between the Crambinae and the Scopariinae shown by other characters (pp.21-7).

The male system of a fresh specimen of O.apicellus was dissected out intact, fixed in Navashin's Fluid (a 1:8 mixture of glacial acetic acid and 1% chromic acid, mixed fresh with 2cc of formalin), and sectioned serially at 5 μ . The stain used was Crystal Violet.

As in other Lepidoptera (Wigglesworth, 1947), the testes are combined in a single envelope. In the species examined this is a subspherical yellowish body lying dorsally beneath the 5th and 6th abdominal tergites. The testes are in the same position in the larva, but are separate in the right and left dorso-lateral lines. From this testis "globe" in the adult run a pair of ducts, the vasa deferentia, slender and much coiled, with medial swellings, the paired vesiculae seminales. The vasa join medially a pair of larger ducts which run from a pair of very elongated accessory glands. The latter fold back on themselves several times, and are fused together along their medial surfaces by a thin membranous envelope; these glands are dull white. After being joined by the vasa deferentia the pair of large ducts fuses to form a single ductus ejaculatorius. When viewed in water the anterior portion of the ductus has a refractive index very similar to that of glass. Beyond this section the ductus becomes white

and transparent again and passes into the aedoeagus. Shortly before passing into the aedoeagus the ductus is sharply angled and swollen. This area I tentatively call the hydrostatic bulb.

The ectodermal sclerotised structures in the male genitalia are shown in fig. 38. In the New Zealand Crambinae the male eighth tergite and sternite are largely unmodified, although often tending to be rather reduced in size relative to the seventh pair. The ninth tergite is highly modified to form the arched tegumen. Articulating with the lateral lower extremities of the tegumen are the arms of the vinculum, which is derived from the ninth sternite. In the ventral midline in some Crambinae there is a strong introrse fold which Bleszynski (1961) called the pseudosaccus, which articulates with the bases of the valvae. Many Crambinae have the junction of the ventro-anterior extremities of the arms of the vinculum fused into a structure called the saccus, which may be dorsally cupped, as in Pareromene (fig. 38x), ventrally cupped as in Gadira (fig. 38w), elongate as in some species of Orocrambus, or with a ventral leaf-like flange as in Corynophora and Tawhitia (fig. 38v).

A thin membranous structure at the apex of the saccus in some species of Orocrambus (see for example figs. 73, 76, 78), was called the "keel" by Philpott (1929).

The paired lateral valvae articulate anteriorly with the vinculum. Judging from the diagram given by Diakonoff (1954) they are ninth-tenth intersegmental structures. The inner surface of the valva usually bears a complex armature in the more advanced Crambinae. Diakonoff used the term harpe to collectively describe these, and this is synonymous with the

valva membrana interna of Bleszynski (1961). The valve can be regarded **as** consisting (in the advanced Crambinae) of three lobes or regions; a dorsal costal lobe of valval costa, often developed posteriorly into a strong flange or prong; a median valvula, weak compared to the costal region, and having at the posterior extremity a cucullus with a dense brush of fine hair on the inner surface; and a ventral sacculus. This is undifferentiated in many genera of Crambinae, but it may have, in more advanced forms, structures varying from a narrow strong posterior flange on the inner surface to a large strong curved lobe separated from the rest of the valve almost to the base. All parts of the valvae except the basal region between costa and sacculus, are finely setulose.

The major structure present between the arch formed by the tegumen and vinculum, and flanged posteriorly by the valvae, is the aedoeagus, which is a sclerotised or partially sclerotised tube developed from the elaboration of the posterior extremity of the ductus ejaculatorius. In structure it is like an eversible glove finger, having an internal vesica which frequently bears one or more strong spinose cornuti. Externally the aedoeagus in the Crambinae may have ornamentation in the form of ridges or thorns, and the apex may be drawn out into a slender apical spur. Adopting the terms of Pierce (1909; 1914), Diakonoff divided other structures in the male diaphragma, the region around the aedoeagus, into three parts. Structures ventral to the aedoeagus were designated the juxta, those lateral to or around the aedoeagus the anellus, and those above the aedoeagus, and having association with the basal junction of costa and tegumen, the transtilla. In Tauroscopa

the transtilla is a lightly sclerotised band joining the bases of the valvae and the arms of the tegumen via a dorsal strip above the aedoeagus.

Finally, the dorso-posterior apex of the tegumen articulates with the dorsal uncus (tenth tergite) and the ventral gnathos (tenth sternite), both of which in New Zealand genera are usually tapering tubular or subtubular structures, apically pointed or clubbed.

FEMALE GENITALIA: The female system shown in fig. 40 was drawn from a dissected specimen of Orocrambus flexuosellus. Mesodermal structures were also examined in Orocrambus heliotes, O.corruptus, O.vittellus, O.cyclopicus, O.ramosellus and O.apicellus, and the arrangement of gross structure and the ducts was identical with the situation shown for O.flexuosellus. However one specimen of O.flexuosellus was found in which the left ovary had five ovarioles and the right one only the usual four.

The ovarioles are slender and tapering, with the apices doubled back and tied against the lower (posterior) portions by connective tissue strands and fine tracheoles. The eggs are fully differentiated only in the posterior quarter of the ovariole, anterior to this they are cubical and irregular in shape. In the slender anterior half of the ovariole they are translucent and undifferentiated. Near the base of each ovariole is a yellow swelling, which when teased out under a microscope, can be seen to be composed of pigmented glandular cells, probably associated with the final stage of shell formation.

The short common oviduct becomes the vagina located medially between the anal papillae (modified ninth and tenth

tergites and possible sternites). It is a membranous funnel situated immediately ventral to the anus.

Posteriorly the common oviduct is joined by the duct of the spermatheca, which has a distinctive chitinised hood proximally and a small thin walled bulla more distally. The ductus seminalis joins the oviduct slightly anteriorly to the spermatophore junction. The ductus seminalis lacks a bulla in the Crambinae. In Eudoria philerga (Scopariinae) the ductus is swollen and bulbous, but still lacks a constricted bulla. Anterior to the junction with the ductus seminalis the oviduct is joined by a duct which widens distally into a pair of accessory glands.

The ductus seminalis distally joins the ductus bursae, usually between $\frac{1}{2}$ and $\frac{7}{8}$ in Orocrambus, but often at about $\frac{1}{4}$ in Gadira and Tauroscopa. Anteriorly the ductus bursae terminates in a globular corpus bursae (the bursa copulatrix of Bleszynski in all his publications). This body bears one or more sclerotised signa in some genera, or the surface may be scobinate as in Gadira pleniferella Walk. Signa are usually oval or circular, but may be U-shaped or diamond-shaped. Posteriorly the ductus bursae passes out through the inter-segmental membrane of the seventh and eighth sternites. The eighth sternite is frequently much reduced or absent in this subfamily. In Orocrambus it is present as a small plate between the mouth of the ductus bursae and the anal papillae. The posterior section of the ductus bursae is often sclerotised, and in Orocrambus and some other genera fused with the narrow eighth tergite, which may encircle the posterior portion of the ductus. The eighth tergite bears in some genera slender anterior apophyses. The posterior apophyses are anterior

extensions from the anal papillae.

The mouth of the ductus bursae is usually called ostium bursae, but in this work I have found it convenient to refer to the actual opening simply as the ostium, and use the term ostium bursae to describe the (usually sclerotised) region from the actual mouth anteriorly to just beyond the junction (in Orocrambus) with the eighth tergite, and including the swollen ostiolar pouch region. Some authors, for example Dugdale (1961), have called this swelling the colliculum, but the development is so variable in the Crambinae that I prefer to retain the looser term ostiolar pouch. In some species of Gadira and Pareromene there is a large stalked sac in this region. In some tropical Crambinae, for example Pseudoclasseyia Blesz. there are species in which this sac appears to be taking over the function of the corpus bursae.

Diakonoff has called the intersegmental region around the mouth of the ostium ~~the~~ sterigma, ^{which is composed of} a pair of sclerites, the lamella antevaginalis and the lamella postvaginalis. The fate of these sclerites, which may be laterally placed in some crambine groups, are of great importance in understanding the phylogeny of the subfamily. In a few New Zealand Crambinae, and more especially in some Australian ones (T.lachnea and Corynophora lativittalis), the posterior margin of the seventh sternite is incorporated into the ventral lip of the ostium, a structure called the lodix by Diakonoff.

GENITALIAL FUNCTION IN MATING:

The spermatozoa in Lepidoptera are passed to the female enclosed in a spermatophore (Wigglesworth, 1947), and the paired medial accessory glands in the male Crambinae are probably concerned with the production of a medium for sperm survival.

If the transparent anterior region of the ductus ejaculatorius is punctured, it exudes a gelatinous fluid which coagulates in warm saline (30°C). Histologically the cell walls of the duct in this region are vacuolate and glandular in appearance. I consider that this section of the ductus is at least partially concerned with laying down the gelatinous wall of the spermatophore around the sperm "package" once it leaves the vesicula seminalis. In most of the fresh males examined one vesicula seminalis contained a thin-walled spermatophore, while the other was empty. In the other specimens both were empty.

Only two pairs of O.flexuosellus were examined in copula during this study, and none from any other species. In O.flexuosellus the mating flight takes place at twilight, normally high in the air, with the pairs almost always breaking apart again before coming to earth. Several pairs which had fluttered into shrubbery on descending separated when disturbed, indicating that copulation was complete. Of the two pairs examined in copula, one pair was found sitting on a leaf, and the other pair came to a house light. There is a possibility that in these cases, since the moths did not separate when disturbed, there was something abnormal about the matings, with separation not possible.

In this species the partners in copulation sat with abdomens joined directly end to end, the male's forewings overlapping the forewings of the female. No meaningful observations of the length of copulation were made.

The relative positions of the genitalia in copulation in O.flexuosellus are shown in fig. 39. The locking seemed to be carried out only by hydrostatic pressure of the everted vesica pressing against the walls of the narrower sclerotised

part of the ductus bursae anterior to the ostiolar pouch. In this species the total length of the everted vesica was slightly less than $\frac{3}{4}$ the total length of the aedoeagus. Hardwick (1965, p.35), studying copulation in Helicoverpa armigera (Noctuidae) found that the valvae were used to engage with and pull out the terminal segments of the female. Possibly the costal flanges in Orocrambus fulfil this function, but loose their hold once the aedoeagus is in place, since in the two pairs examined the flanges were not engaged with any part of the female anatomy.

The prominent thorn on the apex of the aedoeagus ^{of O. flexuosellus} ~~does~~ not engage with any complementary structure within the ostium bursae, or appear to serve any purpose. The gnathos and uncus were turned to the side of the anal papillae, and ^{were not observed to} ~~perform any~~ function in copulation. Bleszynski (1957) referred to them as "catching tongs".

In both females of these pairs a single spermatophore was already present in the corpus bursae, with the "tail" of the spermatophore lying close to the junction of the ductus seminalis, a condition reported in Helicoverpa by Hardwick (1965). The mechanism causing the spermatophore to swell is not known. Possibly it passes into the female under pressure and swells within the space of the thin-walled elastic corpus bursae. The maximum number of spermatophores found in any Crambine species was two. Possibly more than two matings take place, but in the third and subsequent matings a spermatophore insertion cannot be completed. O. flexuosellus virgins would not mate in captivity. O. ramosellus did once in captivity, but the actual copulation was not observed.

No examples of successful hybridisation were encountered in this study. The functions of some of the diverse sclerotised structures in the male appear obscure; or they have no function. Since some genitalic systems, to my eye, appear superficially compatible in the anatomical sense, we can assume that behaviour patterns, and/or genetic and physiological incompatibility keep sympatric species separate. Hardwick (1965), noted that attempted inter-specific matings were quite common in the genus Helicoverpa, I did not observe this in any Crambinae, but would certainly not discount the possibility.

THE STATUS OF THE CRAMBINAE

INTRODUCTION- BASIC PROBLEMS IN
RELATIONSHIPS WITHIN THE PYRALOIDEA

There is at present no conformity in the classification of higher taxonomic units within the Pyraloidea. While the Pyraloidea are generally easily separated from other major divisions by having abdominal tympanal organs and Sc and r_1 fused with r_s in the hindwing (Imms, 1946), criteria used to distinguish units within the superfamily are inconsistent. The rank equivalents of different authors are not homologous (table 1).

Where the rank of tribe Crambini is used in the present revision it is as a tribe within the subfamily Crambinae of Hampson (1895) and Meyrick (1928), and is not a homologue of the tribe Crambini of Handlirsch (1925) and Hasenfuss (1960).

Klots (1968) used the terms Crambini and Argyriini, but without citations. From the text it is obvious that his Crambini equate in general with my use of the term, or certainly with my sub-tribe Crambina, i.e. "Crambus-type" genera. Since the tropical genus Argyria is still almost totally unrevised, I am not prepared to comment on Klots' use of "Argyriini" or to attempt to place this genus in my phylogenetic scheme.

Bleszynski (1960a) described or redescribed a few species of Argyria, but I am unable to interpret his drawings of the female genitalia. However lateral coremata are strongly developed in the male genitalia of these species, a feature not found in other revised Crambinae. A separate tribe may be required for this genus and any allies.

Table 1			
EQUIVALENT RANKINGS WITHIN THE PYRALOIDEA (= PYRALIDINA of Meyrick 1928)*			
<u>PYRALIDAE</u> [Spelling 'Pyralididae' used by Brues et al. 1954]	<u>PYRALIDAE</u>	<u>PYRALINA</u>	<u>PYRALIDAE</u> (Includes Pyralinae, Crambinae)
PYRALINAE	PYRALINAE	<u>PYRALIDAE</u>	PYRALINI (in Pyralinae)
CRAMBINAE	CRAMBINAE	<u>CRAMBIDAE</u>	CRAMBINI (in Crambinae)
PHYCITINAE	PHYCITINAE	<u>PHYCITIDAE</u>	PHYCITINI (in Pyralinae)
GALLERIINAE	GALLERIINAE	<u>GALLERIIDAE</u>	GALLERIINI (in Pyralinae)
<u>PYRAUSTIDAE</u> [Not used by Hampson, Brues, but used by Rebel 1901. et al.]	PYRAUSTINAE	<u>PYRAUSTIDAE</u>	-
PYRAUSTINAE	-	PYRAUSTINAE	PYRAUSTINI (in Crambinae)
NYMPHULINAE	-	NYMPHULINAE	NYMPHULINI (in Crambinae)
SCOPARIINAE	-	SCOPARIINAE	SCOPARIINI (in Crambinae)
Hampson; 1895, 1896; 1897; 1898, 1899, 1910: Rebel; 1901: Brues ; Brues, et al.; 1954: Heinrich; 1956: Munroe; 1965; Gaskin; present work, (but not with recognition of Pyraustidae)	Beirne; 1952 Bleszynski; 1965	Imms; 1946	Handlirsch; 1925 Hasenfuss; 1960

* Meyrick recognised the subfamilies of column 1
at family level within the Pyralidina.

I think the subfamily system of Hampson (1895) and Meyrick (1928) should be retained until the relationships of the higher taxonomic units within the Pyraloidea have been completely re-examined. Only when this has been done will there be any logic in amending the system of classification now, albeit for convenience only. Any change made at the present time could only lead to another temporary compromise.

The rankings proposed by Handlirsch and Hasenfuss may actually represent something closer to the real status of the different phylogenetic units within the Pyraloidea than the subfamily ranks in general use, but at present the possibility cannot be realistically assessed.

Today great importance is attached to the study of genitalia in Lepidoptera, and most generic-level classifications are usually based more on these structures than anything else. Handlirsch's arrangement preceded the full development of these methods, and Hasenfuss concentrated entirely on the larval characters in a relatively small percentage of known Pyraloid genera.

These two authors, without undertaking a major revision of the Pyraloidea based on all known useful characters, especially genitalial systems, introduced a concept of a sub-family Crambinae which is not the homologue of the sub-family unit in general use. This would be acceptable if the system being introduced represented a major advance, but I do not find it in any way more well-founded than the classical subfamily system of Hampson. A premature reorganisation of this kind can lead to great taxonomic confusion of the kind that bedevils crambine studies at the generic level (see Bleszynski, 1957 on Crambus F.).

Possibly no single worker in the world today is in a position to carry out this urgent higher unit revision. The tropical Crambinae (Bleszynski, 1963; 1965; 1966; 1967), the tropical Scopariinae and Pyraustinae (Munroe, 1958) and the Phycitinae (Heinrich, 1956), all still require much more work.

THE PROBLEM OF DEFINING THE SUBFAMILY CRAMBINAE

Until the subfamily relationships within the Pyraloidea are clarified we cannot exclude the possibility that the Crambinae are a biphyletic or even polyphyletic assemblage. In my phylogenetic scheme the schisms between tribes are deep and basic, and possibly some tribes could prove to be more closely related to groups presently within other sub-families than to other crambine tribes.

The most recent and comprehensive writer on the Crambinae is Bleszynski (1965). In his revision of the Palaearctic Crambinae he summarised the characters of the subfamily as follows (in free translation):

"Chaetosema present; maxillary palpi triangular, covered in scales and well developed; r_5 in the forewing always present, hindwings with a basalward directed hair-pecten along the lower margin of the discal cell, hindwing Sc and r_1 to some extent amalgamated with the r sector; in the forewing ax_1, ax_3 lost; eighth abdominal tergite of male without powerful scales; gnathos usually present in male genitalia, while saccus usually absent or rudimentary."

"The Crambinae are distinguished from the **Pyraustinae/Scopariinae** as follows: They have chaetosema

present, a hair pecten on the hindwing, and ax_3 absent from the forewing."

"In the Phycitinae r_5 is always absent, but always present in the Crambinae."

"The Schoenobiinae retain part of ax_1 in the forewing (the distal part) and also have strong tufted scales on the eighth tergite of the male abdomen; both characters are lacking in the Crambinae. However in some cases these characters are not strongly developed, and such Schoenobiinae are very difficult to separate from Crambinae."

"Future taxonomic research should seek to find new characters and more sharply delimit the divisions between these subfamilies."

Bleszynski is obviously as aware of the present grave weaknesses in the existing definition of the subfamily Crambinae as anyone. Exceptions can be quoted to virtually all the generic criteria given by Bleszynski and he has listed some of these himself (1965, p.6-7).

Chaetosemae are absent in Eschata and vestigial or rudimentary in Pareromene according to Bleszynski, and in some Palaearctic crambines (he does not give the genera) the hindwing pecten is much reduced. In Angustalius malacellus (Dup.) the gnathos is vestigial. To these exceptions, from my own experience I would add that Protyparcha also lacks chaetosema, and that the hindwing pecten is barely distinguishable in some Chiloini. For example in Tauroscopa it is so weak it could not be used as a character to separate a species of this genus from an alpine Pyraustine. In Orocrambus many species have a very elaborate and elongate saccus, in contrast to Bleszynski's general rule.

Crambine larval systematics are equally unsatisfactory at the present time. By following Handlirsch (1925) in "degrading" Hampson's subfamilies to tribal rank, Hasenfuss (1960) implied that the differences found by him between larvae of the Pyraloid units were relatively small. I give below a free translation of the part of his key relating to the "Pyraustine-scoparine-crambine" complex of Bleszynski.

- "1 Abdominal setae VIII (V1) closer together on 10th segment than on 9th, or distances about equal. Cranial seta O3 nearer SO3 than O2.
2
- Abdominal setae VIII (V1) at least $1\frac{1}{2}x$ wider apart on 10th segment than on the 9th. Distance O3 - SO3 in cranial setae much greater than distance O2 - O3.
Tribe Pyraustini
- 2 Bases of abdominal setae III-IV(SD1-L1) make a straight line cephalad to 8th segment spiracular opening. On the 10th segment distance between setae VIII(V1) at least a third less than on 9th.
Tribe Crambini
- Bases of abdominal setae III-IV(SD1-L1) making straight line caudad of spiracular opening. On 10th segment distance between setae VIII (V1) equal to or very little less than equivalent distance on 9th.
Tribe Scopariini "

Hasenfuss did not study larvae of the crambine genus Pareromene in his paper. I found the characters given above could not be used to separate larvae of the New Zealand species Pareromene elaina (Meyrick) from the New Zealand scoparine Eudoria cataxesta (Meyrick). Comparable instars were virtually indistinguishable except on colour pattern. Obviously much more work remains to be done in Pyraloid larval systematics.

So really, at the higher level of taxonomy, despite the immense amount of work done at the generic and species levels, we have hardly progressed in the search for broad natural relationships since Meyrick produced his revision of the New Zealand Pyraloidea (1912a).

Further more, the character of a tuft of raised forewing scales used in classical entomological taxonomy to separate the Scopariinae and Pyraustinae does not work for many Hawaiian scopariines (Zimmerman, 1958). Beirne (1952) pointed out that a division between these two sub-families was not supported by differences in genitalial characters.

At the most basic level we are still relying almost entirely on small details of wing venation to absolutely define our major Pyraloid units. While the comments of Bleszynski (1961) on some species of Calamotropha and my own on the great wing venation variation found in Orocrambus clarkei (p.127) show how dangerous it can be to place real reliance on wing venation as a major criterion, it is useful to briefly summarise here what the classical Pyraloid sub-family distinctions are.

KEY TO MAJOR SUB-FAMILIES OF PYRALIDAE

(Modified from Imms, 1946, and Brues, Melander and Carpenter, 1954)

- 1 Cu_2 (Cu_{1b} of Tillyard, 1919) present in hindwing; $Sc + r_1$ approximating to or fused with r_s in hindwing; abdominal tympanal organs present; Hindwing with cubital hair pecten on upper surface2
- Characters as above, but hindwing without pecten.....4

- 2 Forewing having r_5 present.....3
 - Forewing with r_5 absent.....Subfamily Phycitinae
- 3 Maxillary palpi filiform.....Subfamily Galleriinae
 - Maxillary palpi triangularly dilated, scaled,
 vein ax_3 absent in forewing.....Subfamily Crambinae
- 4 Forewing r_5 free; small ax_3 present in forewing
 as loop or branch of ax_2 5
 - Forewing r_4, r_5 stalked with r_3Subfamily Pyralinae
- 5 Forewing disc with small tuft of raised scales,
 except in Hawaiian species (Zimmerman, 1958).
Subfamily Scopariinae
 - Forewings without such tuft.....Subfamily Pyraustinae

CONCLUSIONS

Present conceptions of higher taxonomic units within the Pyraloidea are demonstrably unsatisfactory. Consequently any definition of the sub-family Crambinae, including the one used in the present regional revision, must only be considered as provisional.

However while taking into account all the reservations given earlier in this section, the diagnosis provided by Bleszynski (1965) forms the basis of the best definition at present available, and is the one followed here.

SUB-FAMILY CRAMBINAE

ADULT CHARACTERS (modified from Bleszynski, 1965)

Small to medium size moths (wingspan 12-60 mm); ocelli and chaetosema present in all but a few genera; maxillary palpi triangular, covered with hair-like scales; labial palpi elongate, porrect, covered with hair-like scales; antennae filiform to deeply dentate; forewing Sc separate from r_1 in most genera; forewing ax_1, ax_3 absent; forewing r_4 stalked with r_3, r_5 frequently stalked with r_4 ; hindwing with m_2 usually present; hindwing discal cell open or closed, having well developed cubital hair pecten on lower margin of cell in most genera, but poorly developed in some Chiloini; frenulum single in male, single to sextuple in female.

In MALE GENITALIA: Pseudosaccus present or absent; saccus developed or undeveloped; uncus and gnathos almost always present, often elaborate, elements of gnathos generally fused; valvae narrow to broad, asymmetrical in a few genera between left and right; valvae frequently having costal, valvula and sacculus regions separately differentiated; costal and sacculus regions often ornamented with flange, lobe, prong or prongs, or serrations; juxta or juxta/anellus absent or present; if present, vestigial, plate-like, folded, lobed or complex 2-4 pronged structure; aedoeagus usually slender, slightly curved, about equal to length of valve or less, sometimes rifle-shaped or strongly sigmoid; external ornamentation often present on aedoeagus in form of thorns or spurs or sclerotised areas, usually dorsal or ventral; aedoeagus with or without cornuti.

In FEMALE GENITALIA: Ostiolar sclerites present, invaginated or evaginated, developed either laterally, or dorsal and ventral

to ostium bursae, in some genera developed as sterigmal plate with spines; ostiolar sclerites fused or unfused, sometimes very weak and almost lost in walls of posterior ductus bursae; Anal papillae free or coalescent, with long or short posterior apophyses; eighth tergite free or fused to ostium bursae, with or without anterior apophyses; ductus bursae weak or strong, with ostiolar pouch (colliculum) often swollen and sclerotised; ductus bursae often further sclerotised anteriorly from ostium to junction with ductus seminalis; corpus bursae asignate, or with one or two sclerotised oval, stellate or irregular signa.

SYSTEMATIC KEY TO TRIBES OF CRAMBINAE

- 1 Ostiolar sclerites evaginated into ostiolar tube protruding, sometimes with long pointed posterior extremities, through intersegmental membrane posterior to seventh sternite; posterior apophyses short, little longer than anal papillae are wide.....2
- Ostiolar sclerites invaginated into ostium bursae, sometimes very weak and functionless; posterior apophyses long, considerably more so than anal papillae are wide.....3
- 2 Ostiolar sclerites arranged dorsal (lamella antevaginalis) and ventral (lamella postvaginalis) to ostium bursae, fused along lateral midlines of ostium.....Tribe Crambini
- Ostiolar sclerites arranged laterally in ostium bursae, posterior extremities sometimes drawn out as long "fork"; fusion lines of sclerites dorsal and ventral, sometimes incompleteTribe Acigonini

- 3 Ostiolar sclerites arranged laterally in ostium bursae, partially fused or completely separate, sometimes very weak, functionless and placed deep in ostiolar pouch or colliculum.....Tribe Chiloini
- Ostiolar sclerites arranged dorsally and ventrally, only very weakly fused in lateral midlines of ostium bursae.....Tribe Diptychophorini

RELATIONSHIPS WITHIN THE CRAMBINAE

ADULT CHARACTERS

In the last decade Bleszynski has revised the Palaearctic Crambinae (1957; 1965) and made progress with a number of tropical and neotropical genera (1960a,b; 1961; 1962; 1963; 1964; 1966; 1967). Enough genera have now been revised to permit an assessment of phylogenetic relationships within the subfamily by analysing apomorphic characters using the method devised by Hennig (1957; 1965).*

I am convinced that a correct interpretation of the fate of the ostiolar sclerites in the female genitalia is essential for a proper understanding of the systematic relationships within the subfamily. Unfortunately Bleszynski has concentrated on other characters almost to the exclusion of ostiolar sclerite structure and position, although he did mention them as having taxonomic significance at the species level in the genus Euchromius Guenée, (Bleszynski, 1960b; 1961).

As a result the positions of many genera in the phylogenetic scheme presented in fig.1 are based only on

* A full explanation of the method of operation of this scheme accompanies the phylogenetic figures (1-8) in Vol. II, together with notes on the reasons for the selection of this particular quantitative method.

my interpretations of drawings in Bleszynski's papers. I found it difficult to interpret ostiolar region structure in some of these drawings. Many had obviously been made from flattened and distorted slide-mounted specimens, with little attempt made to amend the resulting two-dimensionality. I may have occasionally misinterpreted Bleszynski's drawings. For example I am still unsure of the relationships determined by me from Bleszynski (1965) of Ancylolomia (see fig.1), and have no material available to check the interpretation.

The ostiolar sclerites (collectively the sterigma) are structures present in the intersegmental membrane between the seventh and eighth abdominal sternite (Diakonoff, 1954; Dugdale, 1966). In some species of Euchromius (Chiloini) (Capps, 1966), a number of Australian species of Gadira (Chiloini), Australian Tauroscopa (Chiloini) and the Australian genus Corynophora (subtribe Corynophorina in Crambini), the sclerites of the sterigma still lie partly in the intersegmental membrane. Because these species exist, (especially since most are found in a continent notable for archaic taxa (see comments on archaic ductus ejaculatorius position in Pareromene ochracealis, p.287)), my opinion is that it is reasonable to assume that the marked conditions of invagination and evagination found in Crambinae came from an intermediate position and not one condition from the other.

It is hard to see what particular biological advantage would be conferred by one type of sclerite development pattern rather than another. Probably none. In the two tribes with evaginated sclerites the aedoeagus is frequently heavily ornamented and sclerotised, but these

conditions probably evolved side by side. In my opinion the most likely reason for the development of these very distinct phyletic groups is that they were isolated in different regions of the world for sufficient time for complete genetic and morphological incompatibility to arise. Even if genera and species of different tribes now have sympatric ranges, the earlier "explosive" phase of evolution in each line has been extensive enough for genetic mixing now to be out of the question. "Detours" in the development of any organ, followed by "stabilisation" of the different lines of diversification strongly suggest a randomness in the process of organ or structure origin (Rensch, 1959). This is what one would expect in the evolution of new structural types brought about by mutation followed by selection effects (Rensch, *ibid*). On this basis it would be erroneous to even expect one sclerite pattern to necessarily have some biological advantage not possessed by another.

It is now pertinent to examine the tribes one by one, comparing features where necessary, and considering the geographical distribution of the revised genera to see if tribal dispersal patterns and infra-tribal phylogenetics suggest isolated centres of evolution as postulated above.

Tribe Crambini

In the Crambini the ostiolar sclerites have become evaginated to form a tube projecting through the intersegmental membrane between the seventh and eighth sternites. This tube is composed of two distinct plates, one dorsal (lamella antevaginalis) and the other ventral (lamella postvaginalis), (Diakonoff, 1954; Dugdale, 1961; 1966).

In all Crambina the sclerites are strongly fused together laterally; in the Corynophorina they are completely fused in Tawhitia, but only partially fused in the relatively more primitive genus Corynophora. The Crambina are unified by the apomorphic characters of forewing veins r_5 and r_4 on a common stalk (fig.1, character 8), and the development of a pseudosaccus (fig.1, character 10). Conversely the Corynophorina are unified by the characteristic coalescence of the anal papillae (fig.1, character 7) and the development of a ventral flange on the saccus (fig.1, character 9).

There is a general tendency among the Crambina for loss of the functionless eighth sternite. However in the relatively unspecialised Orocrambus it is present as a small plate, and in the sister genus of Orocrambus, Agriphila, where the eighth tergite is not always fused to the ostium bursae, the sternite sometimes acts as a "bridge" (Bleszynski, 1957) between the tergite and the ostium bursae. Although genera from the relatively primitive branch of the Crambina which have little or no development of the male sacculus (fig.1, character 15), Orocrambus and Agriphila share the apomorphic characters of reduction of anterior apophyses almost to the point of total loss, and a split female frenulum. The two genera are now divergent. Orocrambus shows complete fusion of the eighth tergite with the ostium bursae but retention of two signa on the corpus bursae, while in Agriphila the fusion of the tergite is usually incomplete, while one of the signa has become lost in all species.

There is a parallel tendency in several genera, for example Orocrambus, Catoptria, Crambus and Fernandocrambus, for the eighth tergite line of fusion to advance posterior

and diagonally, until in some species in each genus the eighth tergite comes to encircle the ostium. Even within Orocrambus this tendency appears to be random, it is found in species completely unrelated within the generic pattern of species groups. There is no correlation between this process and the loss of the eighth sternite.

In two neotropical genera, Microcrambus and Parapediasia, the ventral margin of the seventh sternite in the female has a dense brush of flattened scales (fig.1, character 26). This apomorphic character separates both these genera from other revised Crambini (Klots, 1968).

In the more advanced genera of Crambina there is a tendency to elaborate sclerotisation in the genitalia of both sexes, especially in the ornamentation of the male valvae. Crambus, Fernandocrambus, Metacrambus, Catoptria, Chrysoteuchia, Xanthocrambus, Angustalius and Flavocrambus have marked development of the sacculus into a strong lobe or prong (fig.1, characters 15, 17, 18).

Similarly within the Corynophorina the sacculus and costa are ornately produced in the more advanced genus Tawhitia, but not in Corynophora, (fig.1, character 12).

Distributions of genera

Orocrambus Purdie and Maoricrambus gen.nov. are endemic New Zealand genera. Catoptria Hübner is a montane Palaearctic genus with a few representatives in the Nearctic, while Crambus Fabr. is a Holarctic genus strongly developed in North America and less in the Old World. In the far east of the Asian landmass it appears to be partly replaced by Flavocrambus Blesz. and Chrysoteuchia Hübner. Other Palaearctic

genera are Angustalius, one species of which reaches Tasmania and New Zealand, Metacrambus Blesz. and Xanthocrambus Blesz., the latter being genera developed in the Mediterranean basin.

Crambus Fabr. also extends into the Brazilian Shield area through Central America (Bleszynski, 1967). In Patagonia and on the Juan Fernandez Islands it is replaced by the very closely allied genus Fernandocrambus Aurivillius. This is so close to some species of Crambus, for example C. sapidus Blesz. and C. geleches Blesz., in Bleszynski (1967), that I find it hard to accept the distinctions between the two genera as important.

Listed by Bleszynski (1967) the characters separating the two genera are largely differences in the shape of the sacculus and the vinculum. Fernandocrambus possesses a large oblate sacculus lobe, but in the Crambus species given above this condition is approached very closely. In Holarctic Crambus, on the other hand, the sacculus is a lobe with a strongly serrate margin.

Fissicrambus Blesz. and Microcrambus Blesz. are both neotropical genera with about 55 species between them.

The only two genera presently placed in the Corynophorina, Corynophora and Tawhitia are known respectively only from Australia, and from Australia and New Zealand.

Tribe Diptychophorini

In this tribe the ostiolar sclerites have become invaginated as dorsal and ventral plates within the mouth of the ostium. The ostium has become a dorso-ventrally flattened opening protected by the posterior margin of the seventh

sternite. Long anterior apophyses are retained in this tribe, and there is no sign of the eighth tergite tending to fuse with the ostium bursae. However the tribe does show the relatively apomorphic character of the loss of the eighth sternite.

I include in this tribe five genera which appear to be closely related. The three most distinct genera are Diptychophora Zeller, redefined as a neotropical genus with three known species (Bleszynski, 1967); Microcausta Hampson with five species, redescribed by Bleszynski (1966); and Pareromene Osthelder, redefined by Bleszynski (1965), with about 70 known species, not all revised. Of the other two genera in this tribe Tamsica Zimmerman has six species, and Microchilo Okano has at least six (Bleszynski, 1966).

Bleszynski pointed out (1966; 1967) that the relationship between the known genera is so close that some may require synonymising after more study. Pareromene, Tamsica and Microchilo are largely separated by small characters of wing venation, particularly the position of m_2 in the hindwing (Bleszynski, 1966, p. 463). Diptychophora and Microcausta both have distinctive apomorphic characters in the genitalia which set them apart from Pareromene and its allies (fig. 1, characters 61, 62). Pareromene, Tamsica and Microchilo share the apomorphic character of a dorsally cupped vinculum/saccus structure.

Pareromene is the major genus in the tribe. It ranges throughout the Old World tropics, and the range extends a way into the southern part of the Palaearctic and the temperate zone of the southern hemisphere. The genus occurs

through Malaysia and Indonesia to Australia and New Zealand. In each of the latter countries the genus is known to have speciated prolifically, more intensive collecting will probably reveal more species in the tropics. In the tropics the genus extends to Samoa and Fiji (Bleszynski and Collins, 1962 as Diptychophora).

At least four species are known from the Seychelles or Africa south of the Sahara (Bleszynski and Collins, 1962; Bleszynski, 1966). In a recent paper Bleszynski lists (1967) 9 species from Mexico to Argentina.

Microchilo occurs in the Oriental Region, especially Japan, while Tamsica is endemic in Hawaii. Microcausta is entirely neotropical in distribution.

Tribe Chiloini

In the Chiloini the ostiolar sclerites are situated laterally, and are partially or completely invaginated into the ostium bursae. Once the sclerites become deeply seated within the posterior ductus bursae they tend to lose their function as structural members and become very weak or lost, as in Gadira petraula (Meyrick), and in Tauroscopa notabilis Philpott. In other species of these genera internal sclerites are clearly visible.

In the genus Tauroscopa we find in fact a complete series of stages towards sclerite loss, illustrating within one genus the pattern found in the tribe. In the Australian T.lachnea (Turner) and T.callixutha Turner the sclerites are still partly in the primitive intermediate positions, i.e. in the ventro-lateral region of the membrane posterior to the seventh sternite.

However the anterior margin of each sclerite has become twisted into the ostium, forerunning the situation found in the New Zealand T. trapezitis Meyrick. Here the sclerites are a pair of plates isolated from each other in the lateral walls of the ostium bursae. In T. gorgopis Meyrick, the sclerites are smaller, and set slightly deeper in the ostium. Finally in T. notabilis the sclerites are vestigial. Very faint traces can be found under high magnification in some specimens.

I include 8 revised or partially revised genera in the Chiloini; Euchromius Guenée, Paragadira gen. nov., Protyparcha Meyrick, Tauroscopa Meyrick, Gadira Walker (referred to in the present work as the partially revised Gadira/Hednota complex), Chilo Zincken, Talis Guenée, and Eschata Walker.

In the Chiloini forewing vein r_5 remains free, the anterior apophyses of the female eighth tergite are well developed, often very long, the anal papillae are coalescent, the sacculus of the male valva is undifferentiated (except in some species of Euchromius), and the juxta is a strongly developed, usually V-shaped structure (fig. 1, character 56). All these characters are paralleled morphologically in some genera of the Acigonini, leading Bleszynski, for example, to comment (1966, p. 477) on the close resemblance between Chilo and Acigona.

However a cleft juxta is also found in some species of Pareromene (Diptychophorini), eg. P. lathonia Blesz. from New Britain, and coalescence of anal papillae has occurred independently in both Tawhitia (Crambini) and Pareromene. It is apparent from a study of fig. 1 that similarities between Chilo and Acigona are the partial result of parallelism

in anal papillae coalescence, and juxtal differentiation (fig.1, characters 38 and 56), and symplesiomorphy in other characters. There is thus no justification for regarding Acigona and Chilo as closely related.

In fact the two tribes differ in two major characters. In the Acigonini the eighth tergite has become strongly fused to the ostium bursae and the posterior apophyses are short; in the Chiloini the tergite remains free and the posterior apophyses are long to very long.

Euchromius shows a number of advanced features, namely the elaborate male valval sacculus (fig.1, character 46), the opening of the hindwing discal cell (fig.1, character 47) and the development of strong curved sterigmal spines, apparently from the posterior extremities of the ostiolar sclerites (fig.1, character 48). In a number of species (Bleszynski 1961) the ostiolar pouch region is grossly swollen and ornamented into a "basket". This genus has no sister genus among the revised crambine genera (fig.1, line 6).

The relationships of Paragadira are equally obscure (fig.1, line 7), and this genus shows some unique features in the development of ostiolar sclerites into hemispherical domes covered with dense short setae, possibly sensory in function (fig.1, character 49); the corresponding development of about a dozen strong setae on the otherwise undifferentiated male costa (fig.1, character 50), and the split bifurcate serrate apex of the aedoeagus. Its position may be clarified after further study of currently unrevised tropical Crambinae.

Equally isolated in the scheme is Protyparcha

(fig.1, line 8). Although its affinities are uncertain I do not accept the theory of Munroe (1964) that species of Protyparcha (as Exsilirarcha Salmon and Bradley in part, in his paper) are extremely primitive Crambinae.

Munroe noted that "These (two) genera resemble in a general way a group of primitive Crambinae distributed in cool environments in Australia and New Zealand." Since he did not name the genera concerned I cannot evaluate this statement. He regarded P.graminea as possibly being a genuine relict species which had survived the glaciations of the Pleistocene, with such generalised genitalial characters that he could not decide whether it should be placed in the Crambinae or the Pyraustinae, although he favoured the former because of the tussock-feeding habits of the larvae.

If this is a relict subantarctic genus resulting from pre-Pleistocene colonisation then it is a remarkable exception among the insects of these islands, which are otherwise post-Pleistocene colonists (Fleming, 1963). The Pleistocene glaciations were exceedingly severe in the New Zealand subantarctic, and survival of taxa on Auckland and Campbell Island does seem unlikely (Fleming, 1963).

A study of larvae held by Munroe (1964) may decide the final position of these interesting insects, but to the best of my knowledge the results of this work have not yet been published.

On the whole I would agree with Munroe that the male genitalia of both Protyparcha species have a generalised appearance, but the form of the anal papillae,

eighth tergite and ostium bursae strongly resemble the conditions found in some species of Gadira and Tauroscopa. I regard the present generalised form of the genitalia as the result of secondary simplification with sclerite loss, as in Gadira petraula and Tauroscopa notabilis.

This genus is not primitive in the systematic sense, as the reduction of wings in the female and venation in both sexes are obviously highly apomorphic conditions. The almost completely apterous female simulates antiquity and relict distribution, since apparent the two species could hardly be less well adapted for over-water dispersal.

The time available for such marked morphological adaptation in this genus could have been about 150,000 years, assuming it colonised the islands near the beginning of the Last Interglacial. Judging by relative ice formation in New Zealand (Gage, 1958) the later Otiran glaciation was perhaps less severe than the one before. Protyparcha probably survived this. On the basis of general ideas held at present on the length of time needed for evolution of a full species (Rensch, 1959; Sylvester-Bradley, 1963), this appears to be a very short period. This was probably in Munroe's mind when he considered the possibility of Protyparcha being a relict genus.

However the two species are in fact in ideal conditions for rapid evolution to occur. They have been completely isolated from related species and subjected to rigorous environmental conditions where the chances of selection for semi-apterousness would be high, and the character itself would be beneficial for survival. Because of the limited size of the islands the species would be able to maintain only

a relatively small absolute population size, and because of environmental conditions this population might be subject to considerable fluctuations in size from one year to the next. Under these circumstances a relatively large percentage of mutations would be passed on to the next generation (Clarke, 1954).

The remaining five genera form a relatively closely knit group within the Chiloini. While a pseudo-saccus is present in Talis and Eschata, I am by no means certain that this is an important character in this tribe. Since it appears to be a thickening in the ventral midline of the saccus (p. 13) serving a supporting function as a subsidiary part-tube or bar, caused by an infolding process from the saccus or perhaps part of the juxta, its presence in more than one tribe may be the result of parallelism. Eschata shows other apomorphic characters, notably the loss of chaetosema (fig. 1, character 58).

The relationships between the partially revised Talis, Gadira/Hednota and Chilo need more study. Talis and Gadira/Hednota have a number of plesiomorphic characters relative to Chilo and Tauroscopa, and I regard Gadira/Hednota as more archaic than Talis since it lacks a pseudosaccus. If this view is accepted then Australia appears to have been the evolutionary centre for the Chiloini. Chilo seems to have been an ancient segregate (possibly Cretaceous) of Gadira/Hednota which has spread throughout the Old World tropics, but not extensively into the New World tropics. Tauroscopa is a more recent (probably mid-Tertiary) alpine segregate. In relative isolation following this phase of evolution Gadira/Hednota has developed

unique differentiation of the juxta/anellus in the male genitalia. The function of the elaborate lobes or prongs in copulation in Gadira/Hednota species has yet to be studied.

Distributions of genera

Euchromius is largely distributed in the tropics of the Ethiopian-Oriental region (Bleszynski, 1965), with one species known from the neotropics (Bleszynski, 1967).

Paragadira is a monotypic New Zealand endemic, and Protyparcha is confined to the New Zealand subantarctic islands of Auckland and Campbell. Gadira/Hednota, with perhaps 50 known species is restricted to Australia except for three species found in New Zealand, one conspecific with Australia. Tauroscopa is restricted to the alpine zones of southeastern Australia and the South Island of New Zealand.

Chilo appears to be very poorly developed in South America, but about 11 species have been described from the Palaearctic, and there are many more revised or unrevised species in Africa, southern Asia and northern Australia (Bleszynski, 1962; 1965). Eschata and Talis, with 10-20 species each, occur respectively in the Ethiopian-Oriental sector, and the Palaearctic-Oriental region.

Tribe Acigonini

In this tribe the ostiolar sclerites have developed laterally relative to the ostium, and have become evaginated to form a tube or pair of projecting plates with dorsal and ventral fusion lines protruding through the inter-segmental membrane posterior to the seventh sternite. The eighth tergite has become fused to the ostium bursae, possibly by way of the eighth sternite and/or parts of the

ostiolar sclerites, but this is not immediately clear from Bleszynski's drawings.

The short posterior apophyses, the evagination of ostiolar sclerites (fig.1, character 2) and the strong tendency for the eighth tergite to fuse with the ostium bursae (fig.1, character 3), all point to a closer relationship between the Acigonini and the Crambini than with either of the other tribes.

The Acigonini could perhaps be sub-divided into two sub-tribes; in one Calamotropha Zeller and Ancylolomia Hübner, with a pseudosaccus present and forewing veins r_4 and r_5 on a common stalk; and in the other the Classeya group of genera and Acigona without pseudosaccus and r_5 usually free, except in the small genus Pseudocatharylla.

However I have only been able to study material of Calamotropha from this tribe, and I am not in a position to take a study of this tribe any further except to point out the broad conclusions I have drawn from Dr Bleszynski's illustrations.

Distributions of genera

The tribe is most strongly developed in the Ethiopian region, with eastward extensions into the Oriental region (Bleszynski, 1964). The exception is Acigona with at least 49 species, which is largely confined to the neotropics.

Classeya Blesz., Pseudoclasseya Blesz., and Pseudocatharylla Blesz. are entirely Ethiopian and Oriental in distribution. These three genera are remarkable for the grossly asymmetrical valvae in the male genitalia (fig.1, character 40).

Ancylolomia has a few representatives in the southern Palaearctic, but has most strongly speciated in the Ethiopian region, with about 50 known species (Bleszynski and Collins, 1962).

Calamotropha is absent from the New World but is widely distributed through the tropics and subtropics of the Old World, with some species extending into the warmer parts of the temperate regions. The genus does not occur in New Zealand.

The distribution of the revised genera indicates very strongly an Ethiopian-Oriental evolutionary centre for this tribe.

CHARACTERS OF IMMATURE STAGES

When the characters of immature stages are well known they can be used to test for possible systematic incongruence in taxonomic schemes based on adult characters (Van Emden, 1957). If immature stage and adult systematics run parallel the probability that true lines of descent are represented is increased.

Larvae

Most contributions to immature stage taxonomy concentrate on larval chaetotaxy rather than egg or pupal systematics. This is true of this subfamily. More is known of crambine larvae than their eggs or pupae, and it is thus logical to begin with the former.

Systematic study of crambine larvae is hampered by lack of material. The only major contribution to date has been that of Hasenfuss (1960), who studied eight European genera in the course of an examination of Pyraloid

systematics. In this study he included six major genera revised by Bleszynski which are considered in the present work. These are Euchromius, Chilo, Calamotropha, Crambus, Agriphila and Pediasia. This permits comparison between the larvae of three crambine tribes. I have also examined larvae of nine species of Orocrambus, and one species of Pareromene from the fourth tribe the Diptychophorini. I do not refer here to the part of Hasenfuss' work concerned with Cephis Ragonot, which he showed as close to Chilo. This genus is in chaos (Bleszynski, 1962), and in need of thorough revision. In his paper Hasenfuss referred to Euchromius as Ommatopteryx Kirby.

I give below a key to 8 genera of Crambinae by larval characters, modified from Hasenfuss (1960). The terms used are summarised in figs. 205 and 213.

- 1 Distance of cranial setae P2-P2 equal to or less than P1-P1; Adfrontal portion of coronal suture less than fifth of total.....2
- P2-P2 greater than P1-P1; Adfrontal portion of coronal suture third or more of total.....3

- 2 SV1, SV2 present on meso and metathorax; proleg crochets often lateral.....Chilo
- Only SV1 present on meso and metathorax; proleg crochets in circle.....Calamotropha

- 3 Adfrontal section of coronal suture more than four fifths of total.....Pareromene
- Adfrontal section only about a third of total.....4

- 4 Crochets of prolegs complete; supernumary
pinaculum L on meso and metathorax.....5
- Crochets lateral, $\frac{1}{4}$ open; only supernumary ..
pinaculum D on meso and metathorax.....Euchromius
- 5 No secondary setae on anal shield each side
of D2.....Orocrambus, Crambus, Agriphila
- 2-4 small secondary setae present each side of
D2.....Pediasia

I hesitate to criticise Hasenfuss' key structure because of my relative lack of experience in larval work, but I do not think the couplets can be taken to really indicate systematic divisions, since Hasenfuss did not work in plesiomorphic and apomorphic characters. In the first couplet the split is based on different proportions, in the second on loss of somatic setae, in the third (mine, not Hasenfuss') on proportions, in the fourth on different proleg structure and absence of a pinaculum, and in the fifth again on somatic setae.

In my opinion the different types of proleg crochet structure, either lateral or ventral in a complete circle, are probably of more basic importance taxonomically than either loss of a secondary seta or a change in head capsule proportions. The latter are presumably affected by differential allometric growth and development in different taxa. Loss of a seta I would regard as probably more important in turn than capsule proportions.

Accepting this sequence, then from this key two genera have lateral crochets; Euchromius and Chilo, which I place in my scheme in the same tribe, the Chiloini.

Calamotropha (Acigonini), and Crambus, Agriphila, Orocrambus and Pediasia (all Crambini), have the circle of proleg crochets complete. This would support my earlier contention based on adult characters (p. 44) that the Acigonini are closer to the Crambini than to the other two tribes. They differ in the first couplet of the above key in the ratios of cranial setae P1-P1 to P2-P2 distances, but I regard this as indicating a lesser degree of divergence than crochet pattern.

Crochets in the only Diptychophorinid examined were not lateral, but arranged in a circle, although part of this circle (about a fifth) is open. This is a different condition from any of the above, and is parallel to the situation found in many pyraustines (Hasenfuss, 1960).

Absence of meso and metathoracic SV2 in Calamotropha could be a modification associated with the stem boring habit of this genus. MacKay (1963) noted that some modification in larval structure could result from stem-boring habits, although the mechanism bringing this about is not fully understood. The shortest coronal suture is found in the Diptychophorini, which I tend to regard as the most primitive tribe of Crambinae on balance of characters, and perhaps closer to the scoparine -pyraustine complex than the other tribes. MacKay (1963) regarded presence of a short coronal suture as a primitive character in tortricine larvae.

Pupae

There is very little information in published literature concerning crambine pupal characters. Bleszynski (1965) figured pupae of the following species; Catoptria

lithargyrella (Hübner) (Crambini), and four species of Chilo, all the drawings of which were taken from a paper by Fletcher and Gosh (1920). These were Chilo partellus (Swinhoe), C. infuscatellus Snellen, C. auricilius Dudgeon and C. suppressalis (Walker).

Koch (1965) figured drawings of the cremaster region of pupae of four species of Gadira (= Hednota) (Chiloini). These were Gadira panteucha (Meyrick), G. longipalpella (Meyrick), G. pedionoma (Meyrick), and G. crypsichroa (Lower).

I have examined pupae of several species of Orocrambus, of Pareromene elaina (Meyrick) (Diptychophorini), and of Tauroscopa gorgopis (Chiloini). No material or drawing of a member of the Acigonini was available for study. According to Bleszynski (1965), the pupa of Calamotropha shichito Marumo was figured by Marumo (1931), but I was unable to obtain the latter paper.

In the pupae of Pareromene elaina the cremaster is slender and subtubular with a rounded apex, the medial setae are clustered very closely together, and all the setae on the cremaster are strong, slender, and longer than the cremaster. All other abdominal setae are unmodified and microscopic. The cremastal region of the pupae of this species is compared with that of Tauroscopa gorgopis and Orocrambus flexuosellus in fig. 36.

In Tauroscopa gorgopis the abdominal setae are modified. They are short, thick and massive, bluntly pointed, directed posteriad, and sit in thick-walled crateriform pits. The cremaster is thick and spatulose, with massive short setae. The setal structure gives the whole abdomen a

roughened appearance. In Bleszynski's drawings the pupae of the Chilo species listed earlier show very similar cremaster region structure to that of T.gorgopis, as also do three of the four Gadira species drawn by Koch (1965). The tendency to cremastal lobing found in T.gorgopis is also found in all the Gadira species but longipalpella, where it is less strongly developed, and in all four Chilo species. It is especially marked in C.suppressalis and G.pedionoma. In C.partellus and C.auricilius the setae are as massive as in T.gorgopis. Koch only drew outlines, so it is not possible to see setal development in the Gadira species.

The form of the cremaster in Orocrambus species and Catoptria lithargyrella is almost identical, except that lateral abdominal setae are somewhat more strongly developed in the latter, judging from Bleszynski's drawing (1965, fig. 231). In both genera the cremaster is short and rounded, resembling in a general way the final larval segment. The setae are stronger in both genera on the cremaster than on the rest of the abdomen, but these setae are shorter than the length of the cremaster, and widely spaced. The condition found in both these genera differs considerably from the structure found in the Diptychophorinid Pareromene elaina, and the structure in the three genera of Chiloini is different again.

Eggs

Even less information is available here than for pupae. Most of the available data were summarised in a few paragraphs by Bleszynski (1965, pp10-11), after Schwarz, 1964. However Bleszynski does not give a citation for this author in his references. He notes that the eggs of the following

genera are ellipsoidal with varying numbers of well-defined vertical ribs; Chrysoteuchia Hbn, Crambus F., Catoptria Hbn., Agriphila Hbn., Pediasia Hbn., Xanthocrambus Blesz., and Platytes Gn., and to this list I would add Orocrambus Purdie, in which I have examined the eggs of ten species.

All the above genera, with the possible exception of Platytes, are Crambini. I have not placed Platytes in my crambine phylogenetic scheme for the following reasons; In the drawings of the female genitalia of P. cerussella (Denis and Schiffermüller) (Bleszynski, 1965, plate 128, fig. 317) and P. atlantivolella Zerny (loc. cit. plate 128, fig. 318), the ostiolar sclerites appear to be placed laterally, as in Talis. In other species drawn by Bleszynski the sclerite position cannot be seen. Since the structures apparently present in the two above species may be tergitic structures such as are found in Orocrambus haplotomus (Meyrick) (fig. 51), I would need to examine material rather than just drawings before placing this genus.

Mention must be made of remarks by Bleszynski (1957) concerning the egg shape of Crambus alienellus (Germar and Kaulfuss), which he described as having a hexagonal pattern instead of ribbing as in other members of the genus known.

Koch (1965) gives a photograph and drawing of the egg of Gadira panteucha, and it is almost identical to the egg shape and form of any Crambini. On the other hand the eggs of Pareromene elaina are quite different, being subspherical with a microscopic hexagonal pattern on the shell. I regard this as the more primitive form of the two types of egg, and in fact eggs of Pareromene species are

indistinguishable from those laid by some New Zealand species of Eudoria (Scopariinae).

However in structure the eggs of Lepidoptera are so simple that basing phylogenetic relationships merely on their external characters is likely to be very dangerous, as excessive parallelism is certain to have occurred. For example as well as in genera discussed above, the oval or ellipsoidal egg with vertical ribs is found in the genus Musotima Meyrick (Pyraustinae) and Leptomeris Hübner (Sterrhinae), Hudson (1928, frontispiece, figs. 22, 23 respectively).

It is not clear what biological advantage might be conferred by this ribbing. It may be a device which increases the surface area of the egg and enables respiration to continue in grassland areas covered for some time by standing water after flash flooding. I have recovered Orocrambus flexuosellus eggs which have been totally immersed in more than three inches of rain water for 48 hours. Viability was still 100 percent after this time. Orocrambus females drop their eggs free, and presumably Australian grassland Gadira species do the same. On the other hand the female of Pareromene elaina inserts her eggs one at a time among moss using the long flexible ovipositor. Much more work needs to be done on crambine egg structure: before we will be in a position to make sense out of the few pieces of information currently available.

CONCLUSIONS

I recognise in this work 4 tribes, Crambini, Acigonini, Chiloini and Diptychophorini, containing between them 37 revised genera of Crambinae with about 800 known species.

These tribes are separated by very basic differences in the arrangement of ostiolar sclerites in the female genitalia, supported by different patterns of development in male genitalia and wing venation. Studies to date on immature stages have been very limited. However these either support the tribal system based on adult characters, or alternatively do not contradict it.

The Diptychophorini are in my opinion the most primitive tribe. The Acigonini are more closely related to the Crambini than to the Chiloini, and it appears that while sclerite invagination has taken place from a primitive intermediate position twice, once in the Diptychophorini and independently again in the Chiloini, evagination only occurred once, and the Acigonini and Crambini arose from common stock. Thus the Crambinae may be tri-phyletic. This problem cannot be assessed until the whole crambine-pyraustine-scoparine complex has been broadly revised. Without such re-interpretation any discussion of the possible evolution of the crambine sclerite patterns and the relationships of any one tribe to more primitive or more advanced Pyraloidea is bound to be only guesswork.

The Crambini, with 18 revised genera, are split into the relatively primitive tribe Corynophorina, known only from Australia-New Zealand, and the Crambina which reach their maximum development in the Palaearctic. The most primitive genera of Crambina occur in the Eur-Asian landmass, indicating this region as the most probable centre of evolution and diversification of this sub-tribe. More Corynophorina may be found among unrevised Crambinae in the Old World tropics.

The Acigonini contain 6 revised genera with an

apparent Ethiopian centre of diversification. One genus has speciated strongly in tropical America and others in the Oriental region. Like the sub-tribe Crambina, the Acigonini are almost totally absent from Australia. However while some Crambina have reached and speciated prolifically in New Zealand, the Acigonini are completely lacking in the archipelago.

The Chiloini are very weakly represented in South America, moderately developed in the Ethiopian-Oriental tropics and subtropics, and have weak extensions into the Palaearctic. I recognise 8 revised genera. They are the dominant crambine tribe in Australia, and a more detailed study of the Australian crambine fauna, which is largely unrevised, and where a number of archaic taxa occur with primitive sclerite positions, may show that the Corynophorina and the Chiloini arose from a common stock. If this was so then the Crambinae might only appear to be bi-phyletic instead of tri-phyletic. Chiloini are poorly represented in New Zealand by a few Australian elements.

The Diptychophorini appear to be ancient, possibly not monophyletic with the other crambine tribes, and are pan-tropical in distribution, from Central America and South America, to Japan, New Zealand and Oceania. Without having been able to examine American material I am not prepared to speculate on their centre of evolution and diversification.

KEY TO THE MAINLAND GENERA OF NEW
ZEALAND (i.e. EXCLUDING Protyparcha)

This key is included not to represent systematic relationships, which are shown in fig. 1 in detail, with a large number of overseas genera incorporated in the scheme as well as New Zealand genera, but to be of assistance to other workers who may not have a specialist interest in the Crambinae, but need to identify specimens.

- 1 Hindwing discal cell closed.
 m. Sacculus not differentiated.
 f. Ostiolar sclerites internal. 2
- Hindwing discal cell open.
 m. Sacculus differentiated (only very weakly in some species of Orocrambus, but always with a cucullus of hair in place where flange occurs in most species).
 f. Ostiolar sclerites external. 4
- 2 Forewing veins Sc and r_1 separate, hindwing m_1 absent or vestigial in discal area for proximal third.
 m. Juxta V-shaped.
 f. Ostiolar sclerites lateral; strong or very weak. 3
- Forewing vein r_1 running into Sc (or running very close together in two species), hindwing m_1 absent or vestigial for proximal tenth in discal cell.
 m. Juxta platelike.
 f. Ostiolar sclerites dorso-ventral. Pareromene
3. Hindwing veins m_2 , m_3 bases distant at discal cell margin.
 m. Transtilla present.
 f. Ostium bursae bell-shaped posterior margin of seventh sternite medially indented, thickened. Tauroscopa
- Hindwing veins m_2 , m_3 bases approximated or stalked at discal margin of cell.
 m. Transtilla absent.
 f. Posterior margin of seventh sternite not thickened, ostium bursae not bell-shaped. Gadira

- 4 Forewing r_5 free.
 m. Sacculus a long, free, pointed lobe.
 f. Eighth tergite forming a broad, long closed tube, with ostium opening as a sclerotised funnel at its base. Tawhitia
- Forewing r_5 stalked with r_4 (except in Orocrambus clarkei eximia).
 m. Sacculus a blunt very short lobe, or only differentiated from rest of valve by a small flange on inner posterior margin, or lacking even flange but still possessing a hair tuft where flange occurs in other species.
 f. Eighth tergite fused to or encircling ostium bursae . . . 5
- 5 Forewing vein m_2 absent Kupea
 - Forewing vein m_2 present 6
- 6 Forewing pattern including subterminal metallic line, sharply angled towards costa, cutting off apical triangle; junction of hindwing m_2 , m_3 only $\frac{1}{8}$ total wing width from termen, hindwing m_2 without short stalk into disc.
 m. Sacculus a large scalloped lobe. Vinculum ventrally divided, gnathos much reduced.
 f. Eighth sternite absent, tergite fusing with ostium bursae Angustalius
- Forewing pattern not as above; junction of hindwing m_2 , m_3 more than $\frac{3}{8}$ total wing width from termen, hindwing m_2 stalked briefly into discal area.
 m. Sacculus weakly developed, flange or hair tuft. Vinculum rarely excavate, but never cleft ventrally. Gnathos normal.
 f. Eighth sternite present or absent. Tergite fusing with or encircling ostium bursae Orocrambus
-

Tribe Crambini

Nec Crambini (=Crambinae, Hampson, 1896) Handlirsch 1925 Pyralididae, In Schröder, Chr. Handbuch der Entomologie - Fischer, Jena 3: 900.

Nec Crambini (=Crambinae, Hampson, 1896) Hasenfuss 1960 Abhandlungen zur Larvalsystematik der Insekten 5:152.

Type of the tribe: Crambus pascuella (Linnaeus), Syst. Nat. ed. 10:535
(Phalaena Tinea)

Europe, Near East, Amur.

TRIBAL DIAGNOSIS:

Antennae filiform to serrate; maxillary palpi triangular with hair-like scales; labial palpi elongate, porrect, with hair-like scales; chaetosemae present; frons planoconvex or conical; ocelli present, relatively large in diurnal species; compound eye with nude peri-orbital margin in diurnal species; proboscis fully developed; forewings with r_5 stalked with r_4 except in sub-tribe Corynophorina where r_5 is free; hindwing with discal cell open and well-developed cubital hair pecten on lower margin of cell; male frenulum single, female frenulum ~~usually~~ single, often double, or triple in New Zealand genera.

In MALE GENITALIA: Pseudosaccus developed; saccus poorly developed in most genera of Crambina, but elongate, with partially separated flat laminate posterior extension in Corynophorina; valve with distinct costal lobe, sacculus and valvula regions developed; valvula usually with strong hair brush on inner surface; valvula very slender in Corynophorina, generally rather broad in Crambina; costal portion of valve usually flanged, lobed or pronged; sacculus of valve either barely developed, lobed, pronged or flanged; uncus and gnathos usually well developed, apically pointed, clubbed or spatulate; juxta usually

vestigial or absent in Crambina, strong, plate-like or saddle-shaped in Corynophorina; aedoeagus tubular, sigmoid or more usually slightly curved ventrad; cornuti present (rarely deciduous) or absent; aedoeagus frequently having elaborate spur-like or thorn-like ornamentation.

In FEMALE GENITALIA: Ostiolar sclerites evaginated as short protruding tube, fused in lateral midlines and strongly developed in dorsal and ventral positions, distinguishing this tribe from other Crambine tribes; the limen so formed completely encircles the ostium bursae; in Corynophorina the anterior margins of the sclerites are still in the 7th-8th intersegmental membrane and attached to anterior angles of eighth tergite; in Crambina ostiolar sclerites fused into tube not attached only to anterior angles of eighth tergite; eighth tergite free in a very few genera or fused to eighth sternite which is in turn fused to the lamella antevaginalis (dorsal ostiolar sclerite), or more usually strongly fused to lateral fusion line of both sclerites; in several genera the line of fusion of the eighth tergite has advanced posteriorly, becoming diagonal or in some species of several genera coming to completely encircle the ostium bursae; In Crambina - eighth tergite usually broad but often reduced to narrow strap-shaped structure, eighth sternite sometimes a strong lunate or oblongate plate, but frequently fused with lamella antevaginalis, vestigial or completely lost, anal papillae free, medially indentate and setulose in Crambina; In Corynophorina - eighth sternite vestigial or lost, eighth tergite fused into broad tube with ostium bursae retracted as smaller strong tube at its base, anal papillae fused into very characteristic "dutch-clog" shape, strongly setulose; posterior apophyses usually shorter than papillae in Crambina, much longer than papillae in Corynophorina; eighth tergite with medium-length or short apophyses in a very few genera, but usually lost or vestigial in both sub-tribes; ostiolar region of ductus bursae usually swollen anterior to limen, frequently sclerotised; corpus bursae asiginate,

or with one or two signa, usually star-shaped, circular or diamond-shaped.

KEY TO SUB-TRIBES OF CRAMBINI

- 1(2) Forewing r_5 stalked with r_4 ; In male genitalia saccus without laminate ventral projection, pseudosaccus present, juxta a vestigial crescentic plate or absent; In female genitalia anal papillae free, eighth tergite fused directly with ostium bursae or via eighth sternite but not forming a closed tube dorsal to ostium bursae as in Corynophorina.
Sub-tribe Crambina
- 2(1) Forewing r_5 free; In male genitalia saccus with ventral laminate posterior flap, pseudosaccus absent, juxta strongly developed, plate-like or saddle-shaped; In female genitalia anal papillae fused into characteristic "dutch clog" shape, eighth tergite fused into a broad closed tube with ostium bursae a smaller flattened tube at its base.
Sub-tribe Corynophorina

Sub-tribe Crambina

Sub-tribal diagnosis: As for tribal diagnosis but without the features given there as applicable only to Corynophorina.

Type of sub-tribe: Crambus pascuella (Linnaeus), as for type of tribe.

Genus Orocrambus Purdie

Orocrambus Purdie, 1884, New Zealand Journal of Science (Dunedin) 2:168.

Type species Orocrambus melampetrus Purdie 1884

(By monotypy)

Orocrambus Meyrick, 1885, Trans. N.Z. Inst., 17, p. 133, Type species
Orocrambus melampetrus Purdie 1884.

Crambus sensu Meyrick, 1882, 1883 (nec Fabricius, 1798, in Supplementum
Entomologiae Systematicae. Type species Phalaena
Tinea pascuella Linn. 1758).

Chilo sensu Butler, 1877 (nec Zincken, 1817, Mag. ent. 2, p. 34
Type species Chilo phragmitella (Hübner) 1805).

Hypochoalcia sensu Butler, 1877 (nec Hübner, 1825, Verz. bekannt. Schmett.,
23, p. 368, Type species Tinea aenealla Hübner 1796).

DIAGNOSIS: Labial palpi porrected, tapering, smooth-scaled or hair-scaled,
from 1.6 to 2.9x head length. Forewings often with median white fascies.
Few species unicolourous, others with transverse or variegated markings.
Dotted subterminal line present in a number of species, but never a sharply
angled metallic line. Reniform stigma present in a few species. Hindwings
unicolourous, occasionally with a dark margin. Frenulum typically single
in male, triple in female. Exceptions: O.vulgaris female has double
frenulum but with one element apically bifid; O.ephorus and O.oppositus
have quadruple frenulum in female, O.clarkei eximia sextuple.

Venation: Veins r_4 and r_5 typically stalked in forewing, m_2 present in fore
and hindwings. Vein r_5 is free in O.clarkei eximia only. Hindwing discal
cell open, $Sc+r_1$ fused with or with cross-connection to r_5 , except in some
specimens of O.clarkei clarkei. (See fig. 17. O.vittellus figs. 18, 19,
20. O.clarkei)

Male genitalia: Rounded oblong valve, with costal lobe developed with
flange on posterior inner margin, drawn into an introse lobe in a few
species. Sacculus undeveloped or weakly developed into a flange on inner
posterior margin. Uncus tapered, pointed, gnathos pointed or clubbed.
Cornuti present or absent, aedoeagal ornamentation present or absent. Juxta
present in some species, usually rather weak, as a rounded plate, sometimes
only as a slender pair of U-shaped filiform arms. Juxta often completely
absent. Pseudosaccus present.

Female genitalia: Two signa present on corpus bursae, one often reduced relative to other. Eighth abdominal sternite a small lunate or oval or triangular strong or weak plate, or absent. Eighth tergite fused to ostium bursae. Anterior apophyses absent or represented by very small triangular projections in lateral midlines of anterior margin of eighth tergite.

COMMENTS:

1. Historical background

Purdie did not actually describe the genus Orocrambus, but used details from an abstract of a paper prepared by Meyrick for publication at a later date. He omitted to mention this in the brief note (1884) recording the capture of a series of Orocrambus melampetrus. In the major work by Hudson (1928), the genus has been attributed to Meyrick, but in the later catalogue by Bleszynski and Collins (1962) the genus has correctly been attributed to Purdie.

The whole business appears to have been a rather unfortunate piece of unintentional pre-publication. Hampson (1893) listed the genus under Purdie's name, an action which provoked an indignant comment from Meyrick (1912a p.32). In fact the brief diagnosis given by Purdie is of little use (1884), and Meyrick's description (1885) is much more detailed. He first described Orocrambus as containing a single species melampetrus. He separated the genus from Crambus on hindwing venation (Sc running into r_s and then separating again) but this is not a constant character even within the species. Meyrick obviously realised this, because although it appears in his 1885 paper, he had dropped the character from use by the time he produced his revision of the New Zealand Pyralidina (1912a). In the latter paper he separated the genus from Crambus in having a dense hairy covering on palpi, coxae and the underside of the thorax. An examination and comparison of tritonellus, which Meyrick put into Orocrambus, and O.heliotes, which went into Crambus (sensu Meyrick) shows how unreliable this character

was. The genus was thus tacitly established as different from all other New Zealand ones by general appearance alone. Nevertheless the separation of the "pale, long-winged" species into one genus and the "dark, short-winged" species into another (except heliotes), was satisfactory by the taxonomic standards of the day. This is the scheme followed by Hudson (1928).

2. Distinction of the revised genus Orocrambus from allied genera.

The systematic relationships of Orocrambus and other genera of the "Crambus" line are shown in fig. 1; however for convenience I give a brief comparative table listing the differences between them (table 2).

TABLE 2

Differences between Orocrambus and allied genera

	Valval sacculus	Gnathos	Pseudo saccus	Eighth tergite	Eighth sternite	Ant. apoph.	Signa	Frenulum
<u>Agriphila</u>	Undevel.	Tapered	Present	Not fus. to ostium bursae	Present	Lost	1	2
<u>Chrysocrambus</u>	Undevel.	Tapered	Present	Not fus. to o.burs.	Present	Lost	0	1
<u>Pediasia</u>	Undevel.	Tapered	Present	Not fus. to o.burs.	Absent	Present	0	1
<u>Fissicrambus</u>	Undevel. to Lobed	Swollen	Present	Not or weakly fus. to o.burs.	Present	Present	0	1
<u>Microcrambus</u>	Undevel. to Lobed	Tapered	Present	Not or weakly fus. to o.burs.	Absent?	Lost	0-2	2
<u>Orocrambus</u>	Undevel. or with sm.flange	Tapered	Present	Fus. to o.burs.	Present or Absent	Lost	2	3
<u>Maoricrambus</u>	Undevel.	Spatul- ate	Present	Fus. to o.burs.	Absent	Lost	0	3
<u>Catoptria</u>	Spine	Tapered	Present	Fus. to o.burs.	Present	Lost	1	2
<u>Metacrambus</u>	Spine	Tapered	Present	Fus. to o.burs.	Present	Lost	0	1
<u>Chrysoteuchia</u>	Spine	Tapered	Present	Fus. to o.burs.	Absent	Lost	1-2	2
<u>Flavocrambus</u>	Spine	Tapered	Present	Fus. to o.burs.	Absent	Lost	0	2
<u>Angustalius</u>	Lobed	Tapered	Present	Fus. to o.burs.	Absent	Lost	2	2
<u>Xanthocrambus</u>	Lobed	Tapered	Present	Fus. to o.burs.	Absent	Lost	0	2
<u>Crambus</u>	Lobed, serrate	Tapered	Present	Fus. to o.burs.	Absent	Lost	2	2
<u>Fernando- crambus</u>	Lobed	Tapered	Present	Fus. to o.burs.	Absent	Lost	2	2
<u>Tawhitia</u>	Compl. sep. lobe	Tubular	Absent	Fus. to o.burs.	Absent	Lost	0	3
<u>Corynophora</u>	Lobe	Tubular	Absent	Fus. to o.burs.	Absent	Present short	1	

THE SPECIES GROUPS OF Orocrambus (Fig. 2)

With a few exceptions the species of Orocrambus show considerable homogeneity of structure, and there is much convergence in forewing patterns. As a result, application of the phylogenetic systematic method of analysis (Hennig, 1957; 1965) meets with some difficulty. There has been some shuffling of characters into various possible combinations, leading to a degree of confusion in the evolutionary picture of the genus, similar to the situation described by Mayr, Linsley and Usinger (1953) for some genera of bees. As a result the intrageneric systematics of Orocrambus could be interpreted in more than one way, especially if treated in isolation without reference to allied genera. Since, as Simpson (1945) said, phylogeny cannot be observed but only inferred from observations, my intrageneric phylogeny of Orocrambus has been constructed according to systematic principles, but the selection of characters on which the scheme is based has been influenced by a study of related genera.

I regard the male genitalia of Orocrambus as showing the most important characters for determining subgeneric systematics, for the following reasons. A study of allied genera, such as Crambus Fabricius (Bleszynski, 1957; 1965) and Fernandocrambus Aurivillius (Bleszynski, 1967) shows that parallelism in evolutionary development of the female genitalia is very marked. Among these tendencies the most important are; reduction or loss of the eighth abdominal sternite, the eighth abdominal tergite encircling the limen of the ostium bursae by a process of diagonal fusion, shortening of the ductus bursae, and reduction or loss of one signum on the corpus bursae.

On the other hand a number of apomorphic divergencies can be found in the male genitalia which are not common to the other genera. For example in Orocrambus there is a tendency for great elongation of the saccus, while the sacculus of the valve is only weakly differentiated. In Crambus and Fernandocrambus the sacculus is a very ornate structure tending to separate in a distinct valvular lobe. In both Crambus and Fernandocrambus the costa

of the valve is often pronged by an apical separation of the costa from the valve proper. In Orocrambus there is development of a dorso-ventral flange on the inner posterior margin of the costa, and though the costa may be pronged, as in O.xanthogrammus or O.aethonellus, this prong has developed from the dorsal end of the flange, which is still distinct.

Orocrambus, like several other large genera in the subfamily which have speciated prolifically (e.g. the Palaearctic genus Catoptria, (Bleszynski, 1957)) could be separated into two subgenera or sections, where the frons was conical in one and planoconvex in the other. The conical frons predominates in a number of revised genera, such as Acigona, Agriphila and Chilo (Bleszynski, 1965), and the planoconvex frons in others, for example Calamotropha, Pseudocatharylla and Fernandocrambus (Bleszynski, 1964, 1965, 1967).

If Orocrambus is divided into two such sections the patterns of development in the genitalia are so parallel that one at once doubts if this could represent a basic schism in the genus. However if it is demonstrated at some time in the future that this is an important systematic character for division of the genus, my phylogenetic plan is so constructed that it could be split with ease. Each species group is arranged in alphabetical order within two untitled subgroups, the first with planoconvex frons and the second with conical frons.

Only O.apicellus shows apomorphic characters of deviation from the rest of the genus in both male and female genitalia characters. Although there is a case for separating this species into a subgenus of its own, on balance I think it should remain within Orocrambus. However I have removed Crambus oncobolus Meyr. to a new genus Maoricrambus since not only have both signa been lost from the corpus bursae, but the male uncus is formed differently from any other species in Orocrambus.

Excessive parallelism does not allow a key to species groups by female genitalia and forewing pattern, and overall generic keys are provided for these. Species within species groups have however been keyed by male

genitalia. This has a practical significance since males predominate in light trap catches. See also fig.2.

SYSTEMATIC KEY TO Orocrambus SPECIES GROUPS

- 1 Male genitalia: costa drawn into long narrow tapering prong. Female genitalia: Eighth abdominal tergite fusing with ductus bursae at $\frac{1}{2}$, ostiolar region serpentine GROUP 1.
- Male genitalia: costa flanged, or with a short blunt point (in 1 species only), or a blunt lobe (in 1 species only). Female genitalia: Eighth abdominal tergite fusing with ductus bursae close to ostium, ostiolar region caudal to point of fusion not serpentine 2
- 2 Except in O.lewisi, Cornuti absent - See note A 3
- Cornuti present 6
(Warning. cornuti are deciduous in O.crenaeus)
- 3 Tapered saccus 4
- Undeveloped saccus 5
- 4 SPECIES GROUP 2.
- Juxta present Subgroup a
- Juxta absent Subgroup b
- 5 SPECIES GROUP 3.
- Except in O.philpotti, Juxta present - See note B Subgroup a
- Juxta absent Subgroup b
- 6 Undeveloped saccus SPECIES GROUP 4
- Tapered saccus 7
- 7 SPECIES GROUP 5.
- Juxta present Subgroup a
- Juxta absent Subgroup b

Notes:

A: Loss of cornuti in O.lewisi, a sibling species of the "simplex" complex, is regarded as a case of parallelism, the loss being more recent than in all other known members of the genus which lack these structures. The trend to loss in this cluster of species can be traced from large elongate structures in simplex

and abditus, through small grit-like cornuti in ordishi to none in lewisi.
O.lewisi therefore does not fit into this key, which has been kept as simple
as possible, while still representing the broad systematic relationships.

An unidentified Orocrambus which keys through to species groups 2 or 3
and does not fit any of the descriptions or sub-keys will either be O.lewisi
or a new species. To check for lewisi treat the specimen as having cornuti
and take the alternative part of second couplet through to 6.

B: On balance of other characters O.philpotti is regarded as indifferent to
the subgrouping character used here. It is placed systematically in 3b
although it actually keys out in 3a.

SYNONYMIC LIST OF SPECIES IN THE GENUS Orocrambus

SPECIES GROUP 1.

1. Orocrambus apicellus (Zeller, 1863: Crambus) N.comb.

SPECIES GROUP 2A. FRONS PLANOCONVEX

2. Orocrambus aethonellus (Meyrick, 1882: Crambus) N.comb.
antimorus (Meyrick, 1901: Crambus) N.syn.
heteranthes (Meyrick, 1901: Crambus) N.syn.
saristes (Meyrick, 1909: Crambus) N.syn.
aulistes (Meyrick, 1909: Crambus) N.syn.
meristes (Meyrick, 1919: Crambus) N.syn.
meritus (Philpott, 1930: Crambus) N.syn.
3. Orocrambus catacaustus (Meyrick, 1885: Crambus)
pervius (Meyrick, 1912) Syn. Bleszynski & Collins, 1962.
4. Orocrambus dicrenellus (Meyrick, 1882: Crambus) N.comb.
5. Orocrambus flexuosellus (Doubleday, 1843: Crambus) N.comb.
6. Orocrambus fugitivellus (Hudson, 1951: Crambus) N.comb.
7. Orocrambus horistes (Meyrick, 1902: Crambus) N.comb.
8. Orocrambus mylites Meyrick, 1888.

FRONS CONICAL

9. Orocrambus haplotomus (Meyrick, 1882: Crambus) N.comb.

SPECIES GROUP 2B.

10. Orocrambus heliotes (Meyrick, 1888: Crambus) N.comb.
11. Orocrambus machaeristes Meyrick, 1905.
12. Orocrambus thymiastes Meyrick, 1901.
13. Orocrambus tritonellus (Meyrick, 1885: Crambus)

SPECIES GROUP 3A

14. Orocrambus clarkei clarkei Philpott, 1930.
nebulosa (Philpott, 1930: Tauroscopa) N.syn.
- 14a. Orocrambus clarkei eximia (Salmon, 1946: Tauroscopa) N.comb.
15. Orocrambus melampetrus Purdie, 1884.

16. Orocrambus scoparioides Philpott, 1914.

17. Orocrambus ventosus Meyrick, 1920.

SPECIES GROUP 3B FRONS PLANOCONVEX

18. Orocrambus ephorus (Meyrick, 1885: Crambus) N.comb.

corylana (Clarke, 1926: Crambus) N.syn.

19. Orocrambus oppositus (Philpott, 1915: Crambus) N.comb.

20. Orocrambus philpotti sp.nov.

FRONS CONICAL

21. Orocrambus angustipennis (Zeller, 1877: Chilo) N.comb.

SPECIES GROUP 4

22. Orocrambus corruptus (Butler, 1877: Hypochoalcia) N.comb.

luridus (Hudson, 1923: Crambus)

23. Orocrambus melitastes (Meyrick, 1909: Crambus) N.comb.

SPECIES GROUP 5A FRONS PLANOCONVEX

24. Orocrambus cyclopicus (Meyrick, 1882: Crambus) N.comb.

sophistes (Meyrick, 1905: Crambus) N.syn.

25. Orocrambus lectus (Philpott, 1929: Crambus) N.comb.

26. Orocrambus ornatus (Philpott, 1927: Crambus) N.comb.

FRONS CONICAL

27. Orocrambus jansoni sp.nov.

SPECIES GROUP 5B FRONS PLANOCONVEX

28. Orocrambus abditus (Philpott, 1924: Crambus) N.comb.

29. Orocrambus crenaeus (Meyrick, 1885: Crambus) N.comb.

diplorrhous (Meyrick, 1885: Crambus) N.syn.

30. Orocrambus harpophorus (Meyrick, 1882: Crambus) N.comb.

31. Orocrambus heteraulus (Meyrick, 1905: Crambus) N.comb.

32. Orocrambus lewisi sp.nov.

33. Orocrambus ordishi sp.nov.

34. Orocrambus ramosellus (Doubleday, 1843: Crambus) N.comb.
rangona (Felder, 1875: Crambus)
leucanialis (Butler, 1877: Crambus)
apselias (Meyrick, 1907: Crambus) N.syn.
35. Orocrambus simplex (Butler, 1877: Chilo) N.comb.
36. Orocrambus siriellus (Meyrick, 1882: Crambus) N.comb.
- FRONS CONICAL
37. Orocrambus callirrhous (Meyrick, 1882: Crambus) N.comb.
schedias (Meyrick, 1911: Crambus) N.syn.
38. Orocrambus enchophorus (Meyrick, 1885: Crambus) N.comb.
pedias (Meyrick, 1885: Crambus) N.syn.
scitulus (Philpott, 1925: Crambus) N.syn.
39. Orocrambus isochytus (Meyrick, 1888: Crambus) N.comb.
40. Orocrambus paraxenus (Meyrick, 1885: Crambus) N.comb.
41. Orocrambus scutatus (Philpott, 1917: Crambus) N.comb.
42. Orocrambus tuhualis (Felder, 1875: Crambus) N.comb.
thrincoodes (Meyrick, 1910: Crambus)
43. Orocrambus vittellus (Doubleday, 1843: Crambus) N.comb.
nexalis (Walker, 1863: Crambus)
transcissalis (Walker, 1863: Crambus)
sublicellus (Zeller, 1863: Crambus)
incrassatellus (Zeller, 1863: Crambus)
vapidus (Butler, 1877: Crambus)
conopias (Meyrick, 1907: Crambus) N.syn.
44. Orocrambus vulgaris (Butler, 1877: Crambus) N.comb.
tuhualis nec Felder, (Meyrick, 1883: Crambus)
obstructus (Meyrick, 1911: Crambus) N.syn.
45. Orocrambus xanthogrammus (Meyrick, 1882: Crambus) N.comb.

SP. INCERTAE SEDIS. a.

46. Orocrambus punctellus (Hudson, 1951: Crambus) N. comb.
 47. Orocrambus sophronellus (Meyrick, 1885: Crambus) N. comb.
 48. Orocrambus lindsayi sp. nov.

The three species in this group belong to Orocrambus but cannot be assigned to species groups in the absence of male specimens.

SP. INCERTAE. b.

49. Orocrambus cultus Philpott, 1917.

All known specimens of this species were deposited in the Pasco collection (Philpott, 1917; Hudson, 1928). I have not been able to trace this collection, which may have been lost or destroyed.

ALPHABETICAL LIST OF SPECIFIC NAMES IN
Crambus (SENSU MEYRICK) and Orocrambus PURDIE
 WHICH BECOME SYNONYMS IN THIS WORK, OR HAVE
 BEEN SYNONYMISED CORRECTLY BY OTHER WORKERS.

- | | |
|---|---------------------------------------|
| 1. <u>Crambus antimorus</u> Meyrick | see: <u>Orocrambus aethonellus</u> |
| 2. <u>Crambus apselias</u> Meyrick | see: <u>Orocrambus ramosellus</u> |
| 3. <u>Crambus aulistes</u> Meyrick | see: <u>Orocrambus aethonellus</u> |
| 4. <u>Crambus bisectellus</u> Zeller | see: <u>Orocrambus vittellus</u> |
| 5. <u>Crambus corylana</u> Clarke | see: <u>Orocrambus ephorus</u> |
| 6. <u>Crambus diplorrhous</u> Meyrick | see: <u>Orocrambus crenaeus</u> |
| 7. <u>Crambus heteranthes</u> Meyrick | see: <u>Orocrambus aethonellus</u> |
| 8. <u>Crambus incrassatellus</u> Zeller | see: <u>Orocrambus vittellus</u> |
| 9. <u>Crambus leucanialis</u> Butler | see: <u>Orocrambus ramosellus</u> |
| 10. <u>Crambus luridus</u> Hudson | see: <u>Orocrambus corruptus</u> |
| 11. <u>Crambus malacellus</u> Duponchel | see: <u>Angustalius malacelloides</u> |
| 12. <u>Crambus meristes</u> Meyrick | see: <u>Orocrambus aethonellus</u> |
| 13. <u>Crambus nexalis</u> Walker | see: <u>Orocrambus vittellus</u> |

- | | |
|---|------------------------------------|
| 14. <u>Crambus obstructus</u> Meyrick | see: <u>Orocrambus vulgaris</u> |
| 15. <u>Crambus pedias</u> Meyrick | see: <u>Orocrambus enchophorus</u> |
| 16. <u>Crambus rangona</u> Felder | see: <u>Orocrambus ramosellus</u> |
| 17. <u>Crambus saristes</u> Meyrick | see: <u>Orocrambus aethonellus</u> |
| 18. <u>Crambus schedias</u> Meyrick | see: <u>Orocrambus callirrhous</u> |
| 19. <u>Crambus scitulus</u> Philpott | see: <u>Orocrambus enchophorus</u> |
| 20. <u>Crambus sophistes</u> Meyrick | see: <u>Orocrambus cyclopicus</u> |
| 21. <u>Crambus sublicellus</u> Zeller | see: <u>Orocrambus vittellus</u> |
| 22. <u>Crambus thrincodes</u> Meyrick | see: <u>Orocrambus tuhualis</u> |
| 23. <u>Crambus transcissalis</u> Walker | see: <u>Orocrambus vittellus</u> |
| 24. <u>Crambus vapidus</u> Butler | see: <u>Orocrambus vittellus</u> |
| 25. <u>Orocrambus pervius</u> Meyrick | see: <u>Orocrambus catacaustus</u> |

SPECIES EXCLUDED FROM CRAMBINAE

- | | |
|---------------------------------------|---------------------------------|
| 1. <u>Orocrambus caesius</u> Philpott | see: <u>Scoparia (?) caesia</u> |
| 2. <u>Orocrambus subitus</u> Philpott | see: <u>Scoparia (?) subita</u> |

KEY TO EXTERNAL CHARACTERS OF
Orocrambus and Maoricrambus (see end note)
 (All colours from British Colour Council Dictionary
 of Colour Standards, 2nd ed. 1951)

- 1 Moth semi-apterous 2
- Moth with normal wings 3
- 2 Forewings grey (B.C.C.154) lindsayi, f.
- Forewings pale yellow (B.C.C.4) with median white streak . . . ordishi, f.
- 3 Labial palpi to head length ratio 2.2-2.8:1;
 labial and maxillary palpi smooth-scaled 4
- Labial palpi to head length ratio 1.6-2.2:1;
 labial and maxillary palpi with long hair-like scales 37
- 4 Compound eye with partial or complete nude periorbital strip 5
- Compound eye without such margin 7
- 5 Frons conically protuberant; ocelli small; female frenulum of
 3 units; apex of forewing acute to very acute; forewings brown
 (B.C.C.66 or 67) and white 6
- Frons evenly planoconvex; ocelli large; female frenulum of 4 units;
 apex of forewings almost a right angle; forewings bronze (B.C.C.116)
 with median white streak oppositus
- 6 Forewings divided horizontally into creamy white
 anteriorly, brown (B.C.C.67) posteriorly; apex very acute;
 wingspan 34-50 mm angustipennis
- Forewings with whitish streaks on dorsum and costa, median
 streak present; wingspan only 35-42 mm. isochytus
- 7 Forewing median streak not present, or if present not
 reaching termen and becoming very indistinct in subterminal
 region 8
- Forewing median streak distinct, white or cream, reaching termen,
 although often with broken cross dots or lines in subterminal
 region 22
- 8 Forewings fawn (B.C.C.138) or grey (B.C.C.154), usually with
 incomplete black median streak from forewing base, cross lines
 and/or oval stigma in the disc 9

- Forewings not as above 11
- 9 Forewings uniform grey (form sophistes) or with one or more
waved cross lines and oval stigma in the disc cyclopicus
- Forewings with white-edged black streak from base into disc 10
- 10 Forewings having termen sharply edged with black just within
cilia harpophorus
- Forewings without termen so edged, subterminal dotting
totally absent Maoricrambus oncobolus
- 11 Forewings grey (B.C.C.81), often with some brown, and
a hint of a plae median streak 12
- Forewings not as above 13
- 12 Forewings grey (B.C.C.81) with an indistinct median streak
reaching termen vittellus
(form vapidus)
- Forewings grey (B.C.C.81) or brownish (B.C.C.204) with
an indistinct streak not reaching termen or just
touching apex vulgaris
(form obstructus)
- 13 Forewings anteriorly white, posteriorly saffron
(B.C.C.54) or yellowish (B.C.C.5) 14
- Forewings not as above 15
- 14 Saffron band on forewings not covering dorsum ephorus
- Yellowish band on forewings covering dorsum ephorus
(form corylanus)
- 15 Forewing colour buff (B.C.C.66) or yellowish (B.C.C.5)
with black or dark brown (B.C.C.129 or 205) median streak
from base, often edged with white, subterminal cross lines
present or absent 16
- Forewings not as above 17
- 16 Forewings with sharp black median streak from base to $\frac{3}{4}$,
anterior to this an indistinct white streak, ground colour

- buff (B.C.C.66), no trace of cross lines or terminal spots. Hindwings fawn (B.C.C.138) lectus
- Forewings similar to above but black streak to $\frac{2}{3}$, white streak lacking, cross lines or dots present at $\frac{3}{4}$ in many specimens. Terminal dots also often present. Ground colour pale yellowish (B.C.C.5). Hindwings yellowish white (B.C.C.62 or 64) ramosellus
- 17 Forewings reflective buff (B.C.C.66), median white streak present but ending abruptly at $\frac{3}{4}$ and breaking into several thin white streaks along veins in subterminal region heteraulus
- Forewings not as above 18
- 18 Forewings with oval white stigma edged with black at least posteriorly 19
- Forewings without white stigma or with rectangular one not edged narrowly with black 20
- 19 Forewings lacking first line, with clear wavy white subterminal line narrowly edged with dark brown (B.C.C.129), not sharply indented above tornus ornatus
- Forewings with angled white first line usually present, subterminal line as in ornatus but sharply indented above tornus tuhualis
- 20 Forewings with 2 or more usually 3 thick brownish (B.C.C.139) cross lines, sharply indented medially. Ground colour green with silvery reflections (B.C.C.8), main veins thickly marked with reddish (B.C.C.55) xanthogrammus
- Forewings not as above 21
- 21 Forewings whitish with an ill-defined brownish (B.C.C.129) wedge-shaped marking in disc punctellus
- Forewing with 2 distinct angled white cross-lines at $\frac{1}{3}$ and $\frac{2}{3}$ with a dark brown (B.C.C.169) area between them containing a rectangular and often indistinct white stigma. . vulgaris
- 22 Frons bearing conical protuberance 23
- Frons evenly planoconvex 29

- 23 Forewings brown (B.C.C.167 or 169) with an incomplete but sharply defined line on the costa and an incomplete ill-defined white line on the dorsum, and a distinct median white line from base to termen. Sub costal area brown (B.C.C.169), darker than rest (B.C.C.167) and broken by a small sharply defined white triangle on termen just below apex apicellus
- Forewings not as above 24
- 24 Costal area of forewings dark brown with no trace of cross lines. Wingspan 22mm or less jansoni
- Forewings not as above 25
- 25 Median white streak of forewing having an anterior spur or spike on the margin, projecting into the costal region just outside $\frac{1}{2}$, this is sometimes small but very rarely absent. One or more distinct or indistinct rows of sub-terminal crosslines or rows of dots often present vittellus
- Forewings not as above 26
- 26 Forewings yellowish (B.C.C.5) with narrow white median streak edged with brown (B.C.C.167) posteriorly to $\frac{1}{2}$, anteriorly to termen. Veins often lightly picked out in white in costal region haplotomus
- Forewings not exactly as above, though quite similar 27
- 27 Forewings creamy yellow (B.C.C.64), otherwise reflective greyish brown (B.C.C.138); costal area veins and dorsum heavily marked with white callirrhous
- Forewings not exactly as above 28
- 28 Forewings pale brown (B.C.C.63 or 127), veins picked out in white, spaces between them violet grey (B.C.C.41) so that forewings have an almost corrugated appearance. Edge of forewing costa narrowly marked with white to $\frac{1}{4}$ or $\frac{1}{2}$ enchophorus
- Forewings very pale brown (B.C.C.4), veins not marked in any way, costa and dorsum not marked with white paraxenus
- 29 Forewing expanse 20 mm or less. Forewings having costa and dorsum marked with white; white median streak present.

- Sub-costa and sub-dorsum pale brown (B.C.C.167) fugitivellus
- Forewing expanse 25 mm or more, almost always actually
28 mm or more 30
- 30 Costal or sub-costal area of forewing coffee colour
(B.C.C.19), much darker than sub-dorsum (B.C.C.72).
Subterminal lines completely or partially present 31
- Forewings not as above 32
- 31 Forewings with costa coffee-coloured, and having a median white
streak curving anteriorly so that margin just touches apex;
coffee-coloured brown mark just below the median streak at $\frac{2}{3}$, and
a complete or incomplete cross line at $\frac{3}{4}$. Hindwings ochreous
with wide brown margin. flexuosellus
- Forewings as above, but having cross line reduced to faint
trace, usually completely absent. The mark at $\frac{2}{3}$ very small
or absent. Hindwings uniform creamy yellow (B.C.C.64) horistes
- 32 Forewings reddish brown (B.C.C.67), white streak on costa
edged anteriorly and posteriorly with blackish. Hindwings
creamy yellow (B.C.C.64) siriellus
- Forewings not exactly as above 33
- 33 Forewings buff (B.C.C.66) with white streak on costa, median
white streak usually without blackish edging, if present, only
anteriorly; ill-defined pale streak on dorsum. Hindwings
khaki (B.C.C.72) but cilia with buff bases scutatus
- Forewings not as above 34
- 34 Forewings plain reflective golden brown (B.C.C.115) with sinuate
termen, and cilia white barred with yellowish (B.C.C.64), veins
not picked out, white median streak present philpotti
- Forewings not as above 35
- 35 Forewings khaki (B.C.C.72), median streak not edged with
blackish, but veins picked out with blackish in the
subterminal region dicrenellus
- Forewings not exactly as above 36
- 36 Forewings plain pale yellow (B.C.C.4) to buff (B.C.C.66),
veins not picked out, median streak edged narrowly with blackish,

costa often marked with white, wing span almost always greater than 33 mm. crenaeus

- Forewings as above, but with median white streak edged with blackish anteriorly to termen, posteriorly to $\frac{1}{2}$ or $\frac{1}{3}$. Main forewing veins frequently but not always picked out with white. Forewing span almost always less than 34 mm. . The "simplex" species cluster.

This cluster of species consists of O.simplex, O.ordishi, O.abditus and O.lewisi. Only the semi-apterous female of ordishi can be identified without recourse to genitalia.

- 37 Forewings uniformly greyish (B.C.C.138), thinly speckled with dark brown (B.C.C.129). Wingspan about 18 mm. sophroneilus (or a rare form of aethonellus. Check identification by examination of genitalia).
- Forewings not as above 38
- 38 Forewings plain blackish brown, almost always with thickly scattered bluish scales. Hindwings either dirty brown or sable margin with inner area white 39
- Specimen not as above 40
- 39 Hindwings muddy brown, usually paler in disc; forewing vein r_5 stalked with r_4 clarkei clarkei
- Hindwings white with broad sable (B.C.C.129) margin; forewing vein r_5 free clarkei eximia
- 40 Forewings brown (B.C.C.67) or having white markings, hindwings saffron heliotes
- Specimen not as above 41
- 41 No trace of median forewing streak 42
- Median white or grey forewing streak present, reaching or not reaching termen 44
- 42 Forewings reddish brown (B.C.C.67) with whitish cross lines. . scoparioides
- Forewings and hindwings dark brown (B.C.C.140 or 168). 43
- 43 Forewings with whitish markings between veins from $\frac{1}{3}$ to termen. . ventosus
- Forewings glossy dark brown (B.C.C.140) with one or more faint cross lines, not white markings melampetrus

- 44 Whitish median streak present, not reaching termen, or
if reaching termen, grey and diffuse 45
- Clear whitish median streak reaching termen 46
- 45 Forewings golden reddish brown (B.C.C.74) with median streak
from base to $\frac{3}{4}$, curving posteriad, and anterior to this
another from $\frac{3}{4}$ to termen thymiastes
- Specimen not as above 47
- 46 Forewings dark brown (B.C.C.169) with a median diffuse
grey streak (B.C.C.189) expanding towards termen mylites
- Forewings greyish brown (B.C.C.236) with a thick white
streak to $\frac{2}{3}$, termen with a broad grey border (B.C.C.41). . . machaeristes
- 47 Forewings brown (B.C.C.168) with a whitish streak a
little anterior to the median position; most major
veins picked out in dark brown (B.C.C.140) tritonellus
- Forewings not as above 48
- 48 Forewings brown (B.C.C.168) to buff (B.C.C.66) with a median
whitish streak, indented at $\frac{2}{3}$, another on costa to $\frac{1}{2}$ and a
third in sub-costa from $\frac{1}{2}$ to apex; black markings near base;
2 elongate black markings at $\frac{1}{3}$, 2 more near $\frac{1}{2}$ and a broken
black band on termen corruptus
- Forewings brown (B.C.C.169 to 140) with distinct white
median streak 49
- 49 Forewings with a white mark on termen and the adjacent cilia. . melitastes
- Forewings without such a mark 50
- 50 Forewings brown (B.C.C.68), hindwings greyish (B.C.C.139),
wing span almost always more than 22 mm catacaustus
- Forewings golden brown (B.C.C.74) with greyish hindwings
as above, or white, wing span almost always less than 18 mm . . . 51
- 51 Hindwings greyish aethonellus
- Hindwings white aethonellus
(form antimorus)

- NB 1. Maoricrambus oncobolus is included in this key because of the convergent similarity to O.harpophorus.
- NB 2. The male of the semi-apterous female of O.lindsayi has not yet been collected.

KEY TO FEMALE GENITALIA OF GENUS Orocrambus

- 1 Ostium bursae very elongate, serpentine, posterior to junction with eighth tergite apicellus
- Ostium not long and serpentine posterior to junction with eighth tergite 2
- 2 Corpus bursae with pair of very elongate diamond-shaped signa lectus
- Corpus bursae with pair of oval signa, one frequently reduced relative to other 3
- 3 Ostium bursae grossly swollen, strong, and irregularly corrugated and pleated 4
- Ostium bursae not grossly swollen, though sometimes with longitudinal pleats 5
- 4 Junction of eighth tergite with ostium bursae dorsal, narrow, less than $\frac{1}{2}$ as wide at junction than in dorsal midline. One signum about half or one-third other . . . tuhualis
- Junction diagonal, broad, more than twice as wide at junction with ostium bursae than in dorsal midline. One signum one-tenth other melampetrus
- 5 Eighth tergite fusing diagonally with ostium bursae, almost encircling, drawn ventro-laterally into pairs of cupped "wings" haplotomus
- Junction not as above 6
- 6 Eighth tergite encircling ostium bursae 7
- Eighth tergite fusing dorsally or dorso-laterally with ostium bursae 14
- 7 Eighth sternite weak or absent 8
- Eighth sternite strong 10

- 8 Ductus bursae 9-10x length of anal papillae cyclopicus
- Ductus bursae only $3\frac{1}{2}$ -5x length of anal papillae 9
- 9 Eighth tergite very sharply angled posteriorly, two large oval signa, ductus seminalis joining ductus bursae at $\frac{3}{4}$. . xanthogrammus
- Eighth tergite not sharply angled anteriorly, one signum much reduced relative to the other, ductus seminalis joining ductus bursae at $\frac{1}{2}$ aethonellus
- 10 Anterior apophyses represented as a small distinct spur on anterior margin of tergite in lateral midline clarkei
- No such spur, although anterior margin of tergite may have a broad triangular flap-like extension 11
- 11 Ductus bursae angled at $\frac{1}{4}$ - $\frac{3}{8}$, where there is a swollen ostiolar pouch 12
- Ostiolar region smoothly tapering from ostium 13
- 12 Ductus seminalis joining ductus bursae at $\frac{1}{2}$, 1 or 2 strong spots on ostiolar pouch, signa very unequal machaeristes
- Ductus seminalis joining ductus bursae at $\frac{3}{8}$, pouch without strong spots, signa very nearly equal in size tritonellus
- 13 Ostium bursae strong only in region of encirclement, signa very unequal ordishi
- Ostium bursae strong to about $\frac{1}{3}$, signa very nearly equal in size oppositus
- 14 Eighth sternite a small triangular plate; ductus bursae with large pleated swelling at $\frac{1}{2}$ ramosellus
- Eighth sternite present or absent, but not triangular; ductus bursae without large pleated swelling at $\frac{1}{2}$ 15
- 15 Eighth sternite represented by two strong spots on membrane between lamella postvaginalis and anal papillae catacaustus
- Eighth sternite present or absent, weak or strong, but not as above 16
- 16 Ductus bursae with weak but quite distinct spiral pleating

- between about $\frac{1}{3}$ and $\frac{2}{3}$ 17
- Ductus bursae without such spiral pleating 19
- 17 Ductus seminalis joining ductus bursae at $\frac{1}{2}$, signa very small, smaller than eighth sternite melitastes
- Ductus seminalis joining at $\frac{5}{8}$ or $\frac{3}{4}$ 18
- 18 Eighth sternite strong corruptus
- Eighth sternite weak sophroneilus
- 19 Eighth sternite clearly absent or fused to lamella postvaginalis as a lip 20
- Eight sternite present as a strong lunate or a weak lunate or oval plate^x 22
- 20 Ductus bursae 10-11x length of anal papillae vittellus
- Ductus bursae 7-8x length of anal papillae or less 21
- 21 Ostium bursae flared, ductus bursae only about 4x length of anal papillae, signa very small and one nearly vestigial scoparioides
- Ostium bursae a narrow compressed funnel, ductus bursae about 7-8x length of anal papillae, signa large, oval, nearly equal in size lindsayi
- 22 Eighth sternite a weak lunate or oval plate 23
- Eighth sternite a strong lunate plate 29
- 23 Ductus seminalis joining ductus bursae at $\frac{7}{8}$, ostium bursae goblet shaped enchophorus
- Ductus seminalis joining ductus bursae at $\frac{2}{3}$ or closer to ostium, ostium bursae not goblet shaped 24
- 24 Ductus bursae with reverse loop at about $\frac{5}{8}$, ostium bursae vase-shaped flexuosellus
- No such loop, ostium bursae not vase-shaped 25
- 25 Ductus bursae sharply angled in ostiolar pouch region, which is abruptly swollen callirrhous
- Ductus bursae not so angled, not abruptly swollen 26

^xUse 40x stereo power with sub-stage illumination, or sternite may not be seen.

- 26 Signa markedly unequal in size, one at least
 3x other 27
- Signa very nearly equal in size 28
- 27 Ostium bursae a very even funnel, with circular aperture,
 almost tubular to $\frac{1}{2}$ philpotti
- Ostium with exaggerated ventral lip, ductus bursae
 narrowing sharply at about $\frac{1}{3}$ abditus
- 28 Eighth tergite as wide as fusion as in dorsal midline. . . horistes
- Eighth tergite $2\frac{1}{2}$ -3x wider at fusion than in dorsal
 midline heliotes
- 29 Ostium opening ventrad, dorsal lip very greatly
 exaggerated ephorus
- Ostium opening posteriorly 30
- 30 Ductus bursae very swollen to $\frac{1}{2}$, strong laterally to $\frac{1}{2}$,
 dorsally only to $\frac{1}{4}$, so that a weak V appears dorsally
 in the chitinised area angustipennis
- Ductus bursae not as above 31
- 31 Ostium bursae of an abruptly formed goblet shape 32
- Ostium bursae not goblet shaped 33
- 32 Ductus bursae strong and pleated to $\frac{1}{2}$, one signum almost
 vestigial lewisi
- Ductus bursae strong only to about $\frac{1}{4}$ ventosus
- 33 Eighth tergite only third as wide at fusion with ostium
 bursae as in dorsal midline, posterior margin
 characteristically angled simplex
- Tergite not as above 34
- 34 Ductus seminalis joining ductus bursae at $\frac{7}{8}$ 35
- Ductus seminalis joining ductus bursae at $\frac{1}{2}$ to $\frac{3}{4}$ 36
- 35 Eighth tergite more than twice as wide at fusion as in
 dorsal midline; one signum nearly vestigial, less than
 $\frac{1}{10}$ other siriellus

- Eighth tergite only half as wide again at fusion as in dorsal midline; one signum about $\frac{1}{4}$ the other vulgaris

- 36 Corpus bursae with very unequal signa, one about 8-10x the other 37
- Corpus bursae with equal or unequal signa; but if unequal one no greater than 2-3x other 38

- 37 Ductus bursae a very broad pleated funnel, fusion of eighth tergite with ostium bursae very broad, taking up nearly $\frac{1}{4}$ of total length of ductus bursae, ostium with even mouth . . isochytus
- Ductus bursae a relatively narrow even funnel with slight swelling in ostiolar pouch region; fusion of eighth tergite with ostium bursae taking up less than $\frac{1}{8}$ total length of ostium bursae; ostium with dorsal lip exaggerated harpophorus

- 38 Anterior apophyses represented by distinct triangular projections on anterior margin of eighth tergite in lateral midlines; ductus bursae strong to $\frac{3}{4}$ mylites
- No such projections; ductus bursae strong to $\frac{2}{3}$ or less 39

- 39 Eighth tergite about 3x as wide at fusion as in dorsal midline punctellus
- Eighth tergite about as wide at fusion as in dorsal midline 40

- 40 Ductus bursae strong to about $\frac{2}{3}$, ductus seminalis joining at about $\frac{3}{4}$ jansoni
- Ductus bursae strong only to about $\frac{1}{3}$, ductus seminalis joining at $\frac{2}{3}$, or closer to ostium 41

- 41 Ductus bursae relatively broad, pleated from $\frac{1}{3}$ to $\frac{2}{3}$, one signum 2-3x the other heteraulus
- Ductus bursae relatively slender, not pleated, signa equal in size thymiastes

Females of the following species have not yet been collected and will not therefore be found in this key:

O.crenaeus, O.cultus, O.dicrenellus, O.fugitivellus,
O.ornatus, O.paraxenus, O.scutatus.

SPECIES GROUP 1.

Frons smooth, planoconvex. Cornuti absent from aedoeagus. Saccus very elongate. Juxta absent. Costa produced into a long narrow tapering prong. Sacculus slightly developed, with small flange on inner surface. Gnathos slightly longer than uncus. Eighth abdominal tergite fusing with ductus bursae at about $\frac{1}{2}$, ostiolar region caudal to fusion serpentine. Tergite only about $\frac{1}{8}$ as wide at fusion as in dorsal midline. Ductus bursae about 10x length of anal papillae. Eighth sternite absent. Ductus seminalis joining ductus bursae a little after $\frac{1}{2}$, corpus bursae with two oval signa nearly equal in size.

Contains a single species, O.apicellus which is found throughout the North and South Islands of New Zealand, on Stewart Island and also the Chatham Islands (J.S. Dugdale, in litt.).

Orocrambus apicellus (Zeller) comb.nov.

Crambus apicellus Zeller, 1863, Chilonidarum et Crambidarum genera et species. Berolinesis, p.31.

The type appears to be lost. According to Dr. S. Bleszynski it is not located in Vienna or the British Museum. I thus designate as a neotype a specimen labelled "Orocrambus apicellus m. Neotype". "Palmerston North, New Zealand 22 October 1965" Author's genitalia preparation ODA. Specimen deposited in Entomology Division, DSIR, Nelson, New Zealand.

EXTERNAL CHARACTERS (Slide 1): Brief description by Zeller (1863), and a more detailed description by Meyrick (1883). Coloured illustration by Hudson (1928, Plate XX, fig. 20 m.) and an abbreviated description. Wing span 22-26 mm (both sexes). Female frenulum double. Eye nocturnal type. At once distinguished from any other species by the subapical triangular patches of white on the costa of the forewings.

MALE GENITALIA (Fig. 43): As for species group diagnosis.

FEMALE GENITALIA (Fig. 131): As for species group diagnosis.

EGG: Oblate, 22-27 vertical ribs, 0.40-0.43 x 0.36-0.39 mm, creamy white when first laid, turning orange after 24-36 hours. Duration of egg stage 19 days (November), 21 days (November-December). Gross embryological changes visible through shell as for O.flexuosellus (p. 100).

LARVA: Length of final instar larva 12-14 mm; stout, sluggish. Reddish brown with darker brown pinacula giving appearance of a dorsal and pair of doro-lateral stripes, ventrally pinkish. Head capsule shown in fig. 206, final instar larva in fig. 214. Prothorax: XD2 closer to SD1 than XD1; L1 caudad to L2; SV1 caudad to SV2. Mesothorax and metathorax: D1 shorter than D2; SD2 shorter than SD1. Abdominal segments: SD2 very small; on A1, A2, setae SV3, SV2, SV1 lie nearly in a vertical line, and nearly in a horizontal line on A3-6. On A7 SV1 longer than SV2. On A9, D1, SD1 are on a common pinaculum.

DURATION OF LARVAL INSTARS: All larvae maintained in small containers at room temperature, conditions not controlled, fresh foodplant (rooted) given every ten days. Duration of instars as follows; First instar: 8-16 days (November-December), 6-13 days (December); Second instar: 7-13 days (December); Third instar: 8-12 days (December), 7-14 days (December-January); Fourth instar: 6-13 days (December), 11-16 days (December-January); Fifth instar: 10-17 days (December-January), 12-19 days (January); Sixth instar: 19-21 days (January), 19-38 days (January-February).

LARVAL BEHAVIOUR: The larva of O.apicellus is very sluggish; I never observed any larva feed outside its protective chamber either by day or by night. The larva constructs a vertical tunnel up between the leaves of the foodplant, closely woven against the side of at least one stem, and usually incorporating two or more in the chamber walls. One branch of the tunnel may be abandoned as the larva grows, and a new extension constructed from the basal expansion of the first tunnel. In such cases the first tunnel is then used to store

frass. The larva appears to extend the tunnel as it feeds, and always to feed within the tunnel. Pupation occurs in the basal part of the tunnel, which is of strong silk and soil construction and from 1 to 3" below the soil. The upper feeding part of the chamber may extend 1-3" above the soil.

HOST PLANTS: Juncus spp., judging from the associations of the species in the wild, and almost certainly Juncus polyanthemos. In captivity larvae fed readily on Juncus bufonius L., but would not eat Poa annua, Bromus spp. or any other grasses offered to them.

PUPA: Golden brown, stout, 9-10 mm in length. Spiracles dark, slightly raised. Abdominal setae very small, unmodified. Duration of pupal stage 33-50 days (January to March).

DISTRIBUTION (Fig. 226): North, South, Stewart and Chatham Islands, from sea level to 3,000 ft. in swampy areas, but also in poorly drained pasture where Juncus spp. and Carex spp. grow. As well as the localities given below, the species has been taken at Little Bush, Hawkes Bay (T.H. Davies). On Mt. Ruapehu at about 2,000 ft. I have found this species to be the most common Crambid in December, sitting in large numbers among Juncus polyanthemos (?) in clearings in the bush. Adult flight period ^{is from} October to April, ~~with~~ two protracted generations. Light trap records for Palmerston North (at Massey University, using a 125 watt MV bulb from dusk to dawn each night) are shown below in table 3 .

TABLE 3

No. of <u>O. apicellus</u> taken by MV trap at Massey University in three seasons of total operation.							
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1965-6	4	1	2	1	5	6	0
1966-7	3	7	5	4	2	7	1
1967-8	2	5	3	1	4	4	0

MATERIAL EXAMINED: 74 m. 10 f.

Alford Forest, Cant.: 2 m. 5.2.28, CM, S. Lindsay.

Ashley Gorge, Cant.: 2 m. 4-5.1.21, CM, S. Lindsay.

- Bluecliff, Sthld.: 1 m. 2.1.16, ED, A. Philpott.
- Christchurch: 1 m. 10.1.1865; 1 m. 26.1.1867; CM, R.W. Fereday.
- Drayton Station, Cant.: 1 m. Jan. 1877; CM, R.W. Fereday.
- Dun Mountain, Nel.: 4 m. 8.1.22; 2 m. 22.1.23; ED, A. Philpott.
- Flagstaff, Dunedin: 3 m. 4.2.16, AM, C.E. Clarke.
- Golden Downs, Nel.: 2 m. 8.1.26; ED, A. Philpott.
- Gouland Downs, Nel.: 1 m. 7.2.22; ED, A. Philpott.
- Elfin Bay, St.I.: 1 m. 24.12.18; ED, A. Philpott.
- Horseshoe Lake, Cant.: 1 m. 7.12.23, ED, W. Heighway; 1 m. 7.1.28;
2 m. 3. 4.32; CM, S. Lindsay.
- Kaitoke: 1 m. 27.12.07, ED, G.V. Hudson.
- Kinloch, Otago: 2 m. Jan. 1881, CM, R.W. Fereday.
- Knife and Steel, Sthld.: 1 m. 27.12.16, ED, A. Philpott.
- Lake Luella: 2 m. 22.12.19, ED, A. Philpott.
- Lake Rotoiti: 1 m. 30.12.33, CM, S. Lindsay.
- Longwoods, Sthld.: 1 m. 29.12.15, ED, A. Philpott.
- Maruia Springs, Nel.: 1 m. 3.1.48, CM, S. Lindsay.
- Mt. Arthur, Nel.: 1 m. 21.2.21, ED, A. Philpott.
- Mt. Cleaughearn: 1 m. 20.1.17, ED, A. Philpott.
- Mt. Egmont: 1 m. 29.12.32, DM, C.E. Fenwick.
- Mt. Grey, Cant.: 3 m. Jan, 1921, ED (1), CM (2), White; 1 m. 14.11.23
CM; 7 m. 20-30.12.24, DM (2), CM (5); 1 m. 22.12.28, CM;
5 m. 2 f. 15.12.29, ED (2 m.), CM (3 m. 2 f.) S. Lindsay.
- Mt. Mangahua, Ruahines, 2,200 ft: 1 f. 24.11.66, GC, P.J. Wigley.
- Mt. Ruapehu: 2 m. 7.12.66, GC, D.J. Greenwood.
- North Mavora Lake: 1 m. 1.1.40, DM, G. Howes.
- Palmerston North: 1 m. ODA, 22.10.65. (Neotype); 1 m. ODB, 6.12.65;
1 m. ODC, 15.2.66; 1 f. ODD, 6.10.66; 1 f. ODH, 17.10.66;
2 m. ODE, ODF, 29.10.66; 1 m. ODG, 4.11.66; 1 m. ODI,
7.11.66; 1 m. ODJ, 15.11.66; GC, D.E. Gaskin.
- Pouakai Range, Tar.: 1 m. 3 f. 7.11.66, GC, D.E. Gaskin.

Sandhill Point, Sthld.: 2 m. 1.1.17, ED, A. Philpott.
 Tisbury, Sthld.: 1 m. 10.1.17, ED, A. Philpott.
 Waiouru.: 3 m. 7.12.66, GC, D.J. Greenwood.
 Waihi Gorge, Cant.: 1 m. 6.1.44, CM, S. Lindsay.
 Wellington: 1 m. (335 q) no date, ED, G.V. Hudson.
 West Plains, Sthld.: 1 m. no date, ED, A. Philpott.

REMARKS: The phylogenetic analysis suggests that this species is derived from the same line as all other species in Orocrambus, but has diverged from the common stock almost to the extent of oncobolus, for which I have erected a new genus. However O.apicellus retains a number of typical characters of the genus, notably the shape of the uncus and gnathos, and two signa on the corpus bursae. No variation of forewing pattern was noted in any of the species examined.

SPECIES GROUP 2.

Frons smooth, planoconvex except in O.haplotomus. Cornuti absent from aedoeagus. Saccus tapered. Juxta present in subgroup 2b, absent in 2a.

Subgroup a.

Contains eight species; O.aethonellus, O.catacaustus, O.dicrenellus, O.flexuosellus, O.fugitivellus, O.haplotomus, O.horistes and O.mylites. Only O.flexuosellus occurs in the North Island, in the southern part of which it is the most abundant lowland species of the genus. O.horistes is restricted to the Chatham Islands and is more closely related to O.flexuosellus in the phylogenetic scheme, than to any other species. O.fugitivellus is known only from 4 males from the Mackenzie Plains in the South Island. O.mylites has a restricted alpine distribution in the mountains of the Nelson Province. Specimens referred to this species by White (1963) which were taken at Cass in Canterbury are retained in the Lincoln College collection and are in fact rubbed specimens of O.catacaustus. Specimens in the Hudson collection from Central Otago labelled O.mylites were also O.catacaustus. O.aethonellus and O.catacaustus occur throughout the South Island in boggy alpine localities.

The former occurs at sea level near Invercargill. O.dicrenellus is found in alpine and subalpine tussock grasslands of the central South Island.

O.haplotomus is restricted to the Lake Wakatipu/Te Anau region.

Group 2a. KEY TO SPECIES: male genitalia.

- | | | |
|---|---|---------------------|
| 1 | Aedoeagus with long apical spur | 2 |
| - | Without spur, although apical or subapical thorn often present | 3 |
| 2 | Spur sigmoid, flattened and spear-shaped | <u>dicrenellus</u> |
| - | Tapered, oval in cross-section | <u>mylites</u> |
| 3 | Aedoeagus weakly chitinised, apically tapered, with minute apical thorn | <u>fugitivellus</u> |
| - | Dorsally chitinised, truncate or slightly dilate apically, apical thorn strong | 4 |
| 4 | Gnathos about $\frac{2}{3}$ uncus | <u>aethonellus</u> |
| - | Gnathos equal to uncus | 5 |
| 5 | Dorsal thorn of aedoeagus pyramidal, very large, saccus sloping antero-dorsad | <u>horistes</u> |
| - | Dorsal thorn of aedoeagus relatively small, saccus tapered, straight | 6 |
| 6 | Aedoeagus slender, length to median breadth ratio 10:1 or more | 7 |
| - | Stout, length to median breadth ratio about 6:1. | <u>catacaustus</u> |
| 7 | Dorsal margin of valval costa longer than uncus, and with characteristically "crimped" edge | <u>haplotomus</u> |
| - | Dorsal margin of costa about $\frac{3}{4}$ uncus | <u>flexuosellus</u> |

Orocrambus aethonellus (Meyrick) comb.nov.

Crambus aethonellus Meyrick, 1882, New Zealand Journal of Science (Dunedin), 1, p. 187.

Crambus aethonellus Meyrick, 1883, Trans. N.Z. Inst., 15, p.19.

Crambus antimorus Meyrick, 1901, Trans. ent. Soc. Lond. 1901, p. 567 (N.Syn.)

Crambus heteranthes Meyrick, 1901, Trans. ent. Soc. Lond. 1901, p. 567.(N.Syn.)

Crambus saristes Meyrick, 1909, Trans. N.Z. Inst., 41, p.8. (N.Syn.)

Crambus aulistes Meyrick, 1909, Trans. N.Z. Inst., 41, p.9. (N.Syn.)

Crambus meristes Meyrick, 1919, Trans. N.Z. Inst., 51, p.351. (N. Syn.)

Crambus meritus Philpott, 1929, Trans. N.Z. Inst., 60, P.496. (Misspelling of meristes)

Lectotype m. (Dr. S. Bleszynski) in British Museum (Natural History), slide BM Pyral 5630, labelled "Mt. Hutt New Zealand /1/01 R.W.F. Crambus aethonellus n.sp."

Holotype m. in British Museum (Natural History), slide BM Pyral 5636, labelled "Mt. Cook New Zealand GVH. /12/99 Crambus antimorus". Checked against figure by Philpott (1929, p.495) by Dr. S. Bleszynski.

Lectotype m. (Dr. S. Bleszynski) In British Museum (Natural History) slide BM Pyral 5637, labelled "Mt. Cook New Zealand /12/99 GVH. Crambus heteranthes".

Lectotype m. (Dr. S. Bleszynski) in British Museum (Natural History) slide BM Pyral 7974, labelled "Invercargill New Zealand, A.P.1.07 Crambus saristes".

Holotype m. in British Museum (Natural History), slide BM Pyral 5631, labelled "Invercargill New Zealand GVH./00 Crambus saristes". Checked against genitalia of lectotype aethonellus by Dr. S. Bleszynski.

Lectotype m. (Dr. S. Bleszynski) in British Museum (Natural History), slide BM Pyral 7973, labelled "Longwoods New Zealand AP.2700' 12.10. Crambus meristes", with 4 paralectotypes.

Probable syntypes of aethonellus m. f., author's preps AGP, AGQ in CMNZ labelled "Mt. Hutt New Zealand Jan 77 Crambus aethonellus n.sp." and "Mt. Hutt New Zealand Jan 82 Crambus aethonellus n.sp."

EXTERNAL CHARACTERS (Slides 2, 3) Detailed descriptions by Meyrick (1883; 1901; 1909; 1919). Coloured illustrations by Hudson (1928, Plate XIX, figs. 7 m. 23 m. Plate XLV, fig. 18 f) and abbreviated descriptions. Wing span: 13-20 mm (m), 15-21 mm (f). Female frenulum triple. This variable species lacks the subapical white patch typical of the forewing of the superficially similar O.melitastes. Eye diurnal type (see Dugdale 1966).

MALE GENITALIA (Fig. 44): As for generic and subgroup description except: Arms of vinculum about $\frac{5}{8}$ uncus; saccus tapered with "keel" of Philpott (1929); costa flanged on inner posterior edge, dorsal margin about $\frac{1}{2}$ uncus. Sacculus not differentiated. Gnathos tapered, pointed, short, $\frac{2}{3}$ uncus. Aedoeagus $2\frac{1}{4}$ - $2\frac{1}{2}x$ uncus, length to median breadth ratio 6-7:1, dorsal midline strong with apical torsion 45° sinistrad, small apical thorn dorso-sinistrad.

FEMALE GENITALIA (Fig. 132. From female compared with CMNZ probable syntype): As for generic description except: Eighth abdominal tergite encircling ostium,

2-3 times as wide in ventral as in dorsal midline. Eighth sternite absent, ductus bursae $4\frac{1}{2}$ -5x length of anal papillae, weak. Ductus seminalis joining at $\frac{1}{2}$. Ostium bursae narrow, dorso-ventrally compressed, with exaggerated dorsal lip, ostiolar pouch not swollen. Corpus bursae with two markedly unequal oval signa.

LARVA: Not known.

HOST PLANTS: Not known, but possibly red tussock, Ch.rubra.

DISTRIBUTION (Fig. 227): South Island of New Zealand from sea level in the extreme south, where it occurs among sandhills near Invercargill (Hudson, 1928), to 4,000 ft. in the mountains of the main axis. Associated with boggy areas, adult flight period late October to late January, suggesting one protracted emergence by a single generation each year.

MATERIAL EXAMINED: 159 m. 23 f.

5 m. no date or locality, CM, R.W. Fereday.

Beaumont: 2 m. NBG, NBH, 2 f. NBC, NBD, 7.12.63, FRI, J.S. Dugdale.

Cass, Cant.: 3 m. Nov. 1924, CM, A. Tonnoir.

Dansy's Pass, 3,067 ft.: 1 m. NBF, 2 f. NBI, NBJ, 1.12.63, FRI, J.S. Dugdale.

Drayton Station, Cant.: 1 m. 6.11.1879, CM, R.W. Fereday.

Flagstaff, Dunedin: 5 m. 1 f. 12.1.15, ED, A. Philpott.

Gore Hill: 3 m. MAD, MAF, MAG, 1 f. PAB, 9.1.45, DM, J.T. Salmon.

Jack's Pass, Hanmer: 6 m. 15-22.11.32, CM, S. Lindsay.

Lake Ohau: 4 m. 26.12.35, CM, S. Lindsay.

Lake Tekapo: 10 m. 1 f. ED, 4 m. CM, 24.12.28; S. Lindsay.

Leith: 2 m. 27.11.21, AM, C.E. Clarke.

Longwoods, Sthld.: 1 m. MAC, 1 f. PAA, DM, 6 m. ED, 5.12.13, 2 m. MAA, RAB, DM, 4 m. ED, 20.12.15, 1 m. MAE, 1 f. MAB, 1.1.16, DM; A. Philpott.

Maruia Springs: 2 m. 22.12.39, CM, S. Lindsay.

Mt. Cook, 3,000 ft.: 3 m. GFF, GFG, GFH, 15-18.12.1899, DM, G.V. Hudson; 6 m. ED, 4 m. CM, 3-4.1.29, S. Lindsay; 3 m. SAA, SAC, SAD, 2 f. SAB, GFM, DM, 9 m. ED, 11 m. 1 f. CM, 12.12.29, A. Philpott.

Mt. Gog, Cant. 2-2,900 ft.: 2 m. 30.11.62, LC, E.G. White.

Mt. Grey, Cant.: 3 m. 1 f. CM, 6 m. ED, 11.11.23, S. Lindsay; 1 m. CM, 1 f. ED, 14-15.11.25, S. Lindsay; 1 m. 1 f. ED, 2 m. CM, 30.10.27, S. Lindsay; 1 m. 1 f. 8.1.29, CM, 2 m. 3.11.29, CM, S. Lindsay.

Mt. Hutt, Cant.: 1 m. AGP, Jan. 1877, CM, 1 f. AGQ, Jan. 1882, CM, R.W. Fereday.

Mt. Mangatua, 2,100 ft.: 1 m. NBE, 10.12.63, FRI, J.S. Dugdale.

Mt. Peel: 3 m. 27.1.27, CM, S. Lindsay.

Mt. Wakefield, 4-5,000 ft.: 1 f. JBA, 14.1.64, FRI, J.S. Dugdale.

Nevis: 4 m. 5.11.10, AM, C.E. Clarke.

Omao hut: 1 f. NBB, 7.12.63, FRI, J.S. Dugdale.

Peel Forest: 2 m. Nov. 1920, ED, A. Philpott; 6 m. 20.11.30, CM, S. Lindsay.

Puhi-puhi, Marl.: 1 m. 1 f. 3-6.12.59, ED, E.S. Gourlay.

Seaward Moss, Sthld.: 1 m. RAC, 1 f. RAA, DM, 2 m. ED, no date, A. Philpott; 2 m. 27.1.15, ED, A. Philpott.

Silverstream, Otago: 1 m. QAB, 14.12.15, DM, 7 m. AM, C.E. Clarke.

Table Hill, Sthld.: 1 m. 30.12.13, ED, A. Philpott

Takitimu Mountains: 2 m. 28.12.17, ED, A. Philpott.

Waitaki, 2,000 ft.: 1 f. NBA, 1.12.63, FRI, J.S. Dugdale.

Waitati: 1 m. BFB, 7.12.16, DM, G.V. Hudson; 4 m. 16.11.17, AM, C.E. Clarke

Wedderburn: 1 m. no date, ED, G. Howes.

White Rock, Cant.: 1 m. Nov. 1919, CM, 1 f. PAC, 26.11.22, DM, S. Lindsay.

REMARKS: This variable species was described six times by Meyrick (1882-1919). The form saristes has a median constriction in the transverse white fascia of the forewings, but this is neither a constant or reliable character for the type locality. Hudson (1928) expressed doubts concerning the specific status of saristes. Similar doubts concerning the status of aulistes and meritus (= meristes) were made by Philpott (1929). There is no geographical separation which could be used to justify subspecific status. Form saristes, form meristes and form aulistes have been taken near Invercargill at the same locality as typical aethonellus, although it must be noted that Meyrick (1919) insisted with some vehemence that they were not flying together, apparently to counter some

unpublished remarks by A. Philpott that they were all the same species. In the Hudson collection in the Dominion Museum, Wellington the specimens labelled heteranthes are larger than those labelled saristes, but such a size difference between alpine and lowland specimens is commonly found in other members of this genus, for example enchophorus and flexuosellus. Form antimorus is characterised by white hindwings and a paler brown forewing colour than the other forms, but although this form appears to be confined to the Mount Cook and Lake Tekapo areas, a series of specimens taken by S. Lindsay and A. Philpott at both localities include all graduations in hindwing colour from pure white to the dark glossy brown of typical aethonellus. Dr. S. Bleszynski has informed me (in litt.) that the genitalia of syntype males of each form in the British Museum are identical. Differences in the genitalia of male saristes, meristes, antimorus and heteranthes shown by Philpott (1929), are very slight and fall well within the range of variation found by me for the species by examining far more material than was available to Philpott, or than he was prepared to examine. There are some points of inaccuracy in his drawings, especially in the shape of the vinculum and saccus. However they are minor and due to the preparations being compressed at slightly different angles on the slides and being drawn apparently without compensation for this.

Although the foodplant of this species is unknown, the known distribution of aethonellus is coincident with that shown for red tussock Chionochloa rubra (Burrows, 1967). His remarks about the sites of rubra in the alpine zone also suggest a relationship; "... are very poorly-drained, flat to gently-sloping areas on cirque floors or flat-topped ridges up to about 5,000 ft. at 41°S and 4,000 ft. at 45°S. ... in wetter sites Ch.rubra vegetation grades into bog."

Orocrambus catacaustus (Meyrick)

Crambus catacaustus Meyrick, 1885, Trans. N.Z. Inst., 17, p.134.

Orocrambus catacaustus Meyrick, 1888, Trans. N.Z. Inst., 20, p.67.

Orocrambus pervius Meyrick, 1912, Trans. N.Z. Inst., 44, p.118. (Syn. Bleszynski & Collins, 1962)

I choose as lectotype a syntype in CMNZ, author's prep. AGJ, labelled "Arthur's Pass New Zealand 3,000' 25/1/83 RWF, Crambus catacaustus" 4 other syntypes in British Museum (Natural History) have the same label data.

Lectotype m (Dr. S. Bleszynski) in British Museum (Natural History) and 1 paralectotype labelled "L. Wakatipu New Zealand GVH. 2.11. Orocrambus pervius". Checked against catacaustus by Dr. S. Bleszynski.

EXTERNAL CHARACTERS (Slide 4): Detailed descriptions by Meyrick (1888; 1912). Coloured illustrations by Hudson (1928, Plate XX, figs. 24 m, 25 m), and abbreviated descriptions. Wing span 21-27 mm (both sexes). A larger insect than O.aethonellus, but best separated with certainty by an examination of genitalia. Female frenulum triple, but with two elements occasionally partly fused for about basal $\frac{1}{2}$. Eye diurnal type.

MALE GENITALIA (Fig. 45): As for generic and subgroup description except: Arms of vinculum about $\frac{1}{3}$ - $\frac{1}{2}$ uncus; saccus apically truncate or slightly excavate; sacculus with small flange; gnathos tapered, pointed; aedoeagus stout, $2\frac{1}{4}$ - $2\frac{1}{2}$ x uncus, length to median breadth ratio 6-7:1, dorsal midline strong with 45° sinistral torsion towards apex, and with a simple thorn in this line $\frac{1}{8}$ from apex.

FEMALE GENITALIA (Fig. 133. From topotypic female): As for generic description except: Eighth abdominal tergite fusing dorsolaterally with ostium bursae, twice as wide at fusion as in dorsal midline. Anterior apophyses represented only by vestigial projections on the anterior margin of the eighth tergite in the lateral midline s. Eighth sternite represented only by two small chitinised spots in the membrane between the anal papillae and the lamella postvaginalis. Ductus bursae 3 - $3\frac{1}{2}$ x length of anal papillae, caudal $\frac{1}{4}$ strong, with ventral pleats between $\frac{1}{4}$ and $\frac{3}{8}$ from ostium. Ostium bursae a simple dorso-ventrally compressed funnel. Corpus bursae with two large oval signa.

LARVA: Not known.

HOST PLANTS: Not known, possibly red tussock, Ch.rubra or some alpine bog plant.

DISTRIBUTION (Fig. 228) South Island of New Zealand, associated with bogs.

Adult flight period December to early March.

MATERIAL EXAMINED: 91 m. 44f.

Arthur's Pass, 3,000 ft.: 1 m. AGJ, (lectotype), 25.1.1883, CM, R.W. Fereday;
3 m. CM, 1 f. ED, 1.2.15, G.V. Hudson; 1 m. BDA, 7.2.15, DM, C.E. Fenwick;
1 m. 1 f. 17.1.20, ED, A. Philpott; 1 m. Feb. 1920, CM, G.V. Hudson;
13 m. 2 f. 7-21.22, AM, C.E. Clarke; 8 m. 1 f. CM, 12 m. 1 f. ED, 6-9.2.26,
S. Lindsay; 4 m. 23.1.28, ED, S. Lindsay; 2 m. BDH, BDM, 22.2.40, DM,
J.T. Salmon; 4 m. 1 f. AGK, 25-28.12.40, CM, S. Lindsay; 1 f. 2.1.43, ED,
E.S. Gourlay.

Billow Mountains: 1 m. 20.1.20, ED, A. Philpott.

Bold Peak: 2 m. BDK, BDL, 1 f. BDI, DM, 1 f. ED, 11.2.13, G. Howes;
1 m. BDN, 1 f. BDC, 10.2.43, DM, G. Howes.

Cascade Creek, Angelus Basin, 5,700 ft.: 1 m. 9.2.64, FRI, J.S. Dugdale.

Gordon's Pyramid: 1 f. 2.3.27, ED, A. Philpott.

Homer: 1 m. BDB, 28.12.44, DM, G. Howes.

Hump Range: 2 m. 28.2.19, ED, A. Philpott.

Iron Hill 4,300-5,300 ft.: 4 m. 5 f. 8-9.2.66, FRI, J.S. Dugdale.

Kepler Mountains: 1 m. 3.1.25, AM, C.E. Clarke.

Key Ridge, Ailsa, 3-3,500 ft.: 9 m. 4 f. 11.1.66, FRI, J.S. Dugdale.

Key Summit: 1 m. BDD, 22.12.44, DM, J.T. Salmon.

Lake Sylvester Track: 1 f. 11.2.66, FRI, J.S. Dugdale.

Mt. Arthur, 4,000-4,500 ft.: 1 m. 1 f. 14.1.22, 3 f. 2.2.23; ED, A. Philpott;
2 m. 1 f. 2-3.10.36, ED, G.V. Hudson, 3 m. CM, 1 f. ED, 27-28.1.44, G. Howes.

Mt. Arthur Tableland, 5,000 ft.: 1 m. 28.1.24, CM, S. Lindsay.

Mt. Burns: 1 m. BDJ, 23.1.14, DM, G. Howes; 3 m. 1 f. 14-22.1.16, ED,
A. Philpott.

Mt. Crystal Ridge, 4,500-5,900 ft.: 2 m. 8 f. 14.2.66, FRI, J.S. Dugdale.

Mt. Gertrude, Barrier Stream, 3,700 ft.: 1 f. BDE, 16.1.63, FRI, J.S. Dugdale.

Mt. Luxmore, 3,500 ft.: 1 m. BDG, 5 f. FRI, J.S. Dugdale.

Nuggety Peak, 5-5,200 ft.: 1 m. 13.1.65, FRI, J.S. Dugdale.

Red Hills: 14. BDF, 10.2.64, FRI, J.S. Dugdale.

REMARKS: No consistent differences were found in either male or female genitalia of pervius and typical catacaustus forms. Slight variation in proportional size of structures was noted from specimen to specimen, but this variation was found in both forms. Meyrick separated pervius from catacaustus primarily on its constricted white forewing fascia. Hudson (1951), doubted the specific distinctness of pervius, and in the long series examined in this study I found a complete range of intermediates. J.S. Dugdale (pers.comm.) mentions that the pervius form appears to predominate in the Mt. Arthur region, but there are also typical catacaustus specimens from this locality in the Canterbury Museum collection. Both forms have been taken together at Arthur's Pass and the mountains around Lake Wakatipu. I therefore find no grounds at this stage to give pervius even subspecific rank. The constriction of the fascia generally (although not invariably) occurs in small dark males. The syntypic specimens were first examined by Dr. S. Bleszynski some years ago, and pervius was published as a synonym of catacaustus in the catalogue of world Crambinae by Bleszynski and Collins (1962).

In the phylogenetic scheme set out in this work O.catacaustus is more closely related to O.aethonellus than to any other species.

Orocrambus dicrenellus (Meyrick) comb.nov.

Crambus dicrenellus Meyrick, 1882, New Zealand Journal of Science (Dunedin), 1, p. 187.

Crambus dicrenellus Meyrick, 1883, Trans. N.Z. Inst., 15, p. 22.

Lectotype m and paralectotype m. (Dr. S. Bleszynski) in British Museum (Natural History), slide BM Pyral 7983. Labelled "Mt. Hutt New Zealand /1/81 RWF; Crambus dicrenellus".

Probable syntype m. in CMNZ, author's preps AGX, AGY, labelled "Mount Hutt, 5.1.68 RWF Crambus dicrenellus n.sp." and "Drayton Station (Mt. Hutt) 5.1.68 RWF Crambus dicrenellus n.sp."

EXTERNAL CHARACTERS (Slide 5): Coloured illustration by Hudson (1928, Plate XX, fig. 18 "f." (although the female is not known) and abbreviated description. Both the description by Hudson on p. 164 and the more detailed description by Meyrick (1883) can be assumed to include O.philpotti as well. Separated at once from the very similar O.paraxenus by the conical frons of the latter. Best separated from O.philpotti by examination of genitalia. Wing span of male 29 - 33 mm.

MALE GENITALIA: (Fig. 46 compared with probable syntype in CMNZ and with lectotype drawing by Dr. S. Bleszynski): As in generic and species group description except for following: Arms of vinculum $\frac{2}{3}$ uncus, saccus tapered, with "keel" of Philpott (1929). Costa of valve flanged, dorsal margin about $\frac{3}{4} - \frac{7}{8}$ uncus. Gnathos tapered, pointed, equal to uncus. Aedoeagus apically dilate, $2\frac{3}{4} - 3x$ uncus, length to median breadth ratio 11-12:1, dorsal midline strong, terminating in a sigmoid spear-shaped apical spur about $\frac{1}{4}$ total length of aedoeagus.

LARVA: Not known.

HOST PLANTS: Not known, but possibly Chionochloa australis.

DISTRIBUTION (Fig. 229): Alpine and subalpine tussock grasslands of the central South Island of New Zealand to 4,000 ft. Adult flight period November to February, but no December records presently known. Records given by Hudson (1928, p. 164 include O.philpotti and should be ignored.)

MATERIAL EXAMINED: 15 m.

Ball Glacier: 1 m. CFT, DM, 2 m. BGA, BGC, CM, 2 m. ED, 7-14.2.29, A. Philpott.

Ben Lomond: 1 m. FFS, 25.11.12, DM, A. Philpott.

Jack's Pass, Hanmer: 1 m. BGE, 8.2.31, CM, S. Lindsay.

Mt. Cook: 2 m. ABA, BGB, CM, 3 m. ED, 8-14.2.29, A. Philpott.

Mt. Hutt, Cant.: 2 m. AGX, AGY, 5.1.1879, CM, R.W. Fereday.

Sedgmere, 3,550 ft., Nel.: 1 m. DGB, 15.2.66, FRI, J.S. Dugdale.

REMARKS: Every series of Crambus dicrenellus examined by me in the New Zealand museum collections contained a mixture of this species and O.philpotti.

When the specimens are in good condition the two species can be distinguished at sight with a little experience. The forewing colour of O.philpotti is a rich lustrous bronze-yellow intermediate between the colour of O.oppositus and O.heteraulus. The termen of the forewings in O.philpotti is slightly sinuate, while that of O.dicrenellus is moderately convex, and the forewing colour is dull glossy brown.

While the female of O.dicrenellus has yet to be collected, the males of dicrenellus and philpotti are quite distinct on genitalia characters, philpotti having a thorn at the dorsal apex of the aedoeagus. The drawing of the male genitalia by Philpott (1929, fig. 35), labelled Crambus dicrenellus Meyr. is based on a specimen of O.philpotti.

The distribution of specimens of O.dicrenellus is coincidental with the range of Chionochloa australis (carpet grass) shown by Burrows (1967), but Ch.pallens (midribbed snowgrass), Ch.rubra (red tussock) and Ch.rigida (narrow-leaved snowgrass) are also possibilities.

In the phylogenetic scheme this species is placed closer to O.flexuosellus and O.horistes than any other species.

Orocrambus flexuosellus (Doubleday) comb.nov.

Crambus flexuosellus Doubleday, 1843, in Dieffenbach's Travels in New Zealand, 2, p. 289.

Syntype m. in British Museum (Natural History), labelled "New Zealand 42.55".

EXTERNAL CHARACTERS (Slide 6): Detailed description by Meyrick (1883), coloured illustration by Hudson (1928, Plate XX fig. 31) and abbreviated description, photograph by Gaskin (1966, Plate 18, fig. 1). Female frenulum triple, eye nocturnal type. Easily separated from all other members of the genus so far known by the dark costa of the forewing and the dark subterminal markings interrupting the white forewing fascia. Wing span 19 - 26 mm. (both sexes).

MALE GENITALIA (Fig. 47): As for generic and species group except for following: Arms of vinculum about $\frac{1}{2}$ uncus; saccus tapered; costa of valve with flange,

dorsal margin about $\frac{3}{4}$ uncus. Sacculus with very small flange. Gnathos tapered, pointed, equal to uncus. Aedoeagus $3-3\frac{1}{4}x$ uncus, length to median breadth ratio 10:1, dorsal line strong from apex to $\frac{1}{2}$, with subapical thorn dorsad.

FEMALE GENITALIA (Fig. 134): Eighth abdominal tergite fusing dorso-laterally with ostium bursae, half as wide again at fusion as in dorsal midline. Eighth sternite a weak lunate plate. Ductus bursae about 8x length of anal papillae, chitinised to $\frac{1}{2}$, with reverse loop at $\frac{5}{8}$, ductus seminalis joining at $\frac{5}{8}$. Ostium bursae narrowed at mouth, with exaggerated dorsal lip, ostiolar pouch swollen, general appearance of ostiolar region vase-shaped (urceolate). Corpus bursae with two oval signa nearly equal in size.

EGG: Figured by Hudson (1928, Frontispiece, fig. 24). Oblate, 11 - 17 vertical ribs, 0.40 - 0.45 x 0.28 - 0.32 mm, creamy yellow when first laid, turning pinkish about 24 - 35 hours after being laid and vermilion after 4 - 7 days. First described by Watt (1914). Duration of egg stage 9 - 20 days between October and February, 24 - 29 days in July, (not under controlled conditions). Infertile eggs do not undergo the above colour changes. About one third of the way through the period of development the orange colour deepens to one side near the waist of the egg. This is the embryo becoming large and distinct enough to be visible through the shell. About half way through the development period the embryo becomes detached from the wall of the egg except in one small lateral area. This may approximate to the stages F-G shown for the dragonfly Catopteryx by Imms (1946, after Tillyard and Brandt), but the embryology of O.flexuosellus has not been studied in detail in this work. After two thirds of the development of O.flexuosellus through the egg stage is complete, two approximated dark brown patches become visible. These are the lateral halves of the head capsule. Shortly before hatching a third can be seen, this is the pigmented prothoracic shield. At about this stage the last of the pigmented yolk is absorbed by the larva, leaving only some transparent fluid. This is taken up about twelve hours before emergence.

HATCHING BEHAVIOUR: Some movement of the larva may be seen up to two days before emergence, but in the last six or so hours movement of the head is almost continuous. In 18 batches (each containing 27 - 65 fertile eggs) of this species maintained under uncontrolled conditions, all hatching took place between 0700 hours and 1200 hours, with 13 batches completing their emergence before 0900. In 3 batches some hatching which did not occur on the first day took place in the same period on the following day. In no batch did hatching take place over a longer period than two days. The larva opens a hole in the wall of the shell with a diagonal slicing movement of the mandibles. This hole is usually on the "shoulder" of the curve of the oblate egg, but may occasionally be lateral. The newly hatched larva is sluggish for 1 - 2 hours after hatching, but begins to feed 3 - 4 hours after freeing itself from the shell. The eggshell is not consumed. Some larvae have difficulty divesting themselves of the empty shell which remains firmly clipped around the last three or four abdominal segments. One larva was seen to remain in this condition until the skin of the first instar was cast 8 days after hatching.

LARVA: (Fig. 207, head capsule; fig. 215, fourth instar; fig. 216, final (sixth) instar): Length of final instar larva 12 - 18 mm, moderately stout, greenish grey with dark grey pinacula. Head dark brown with pale adfrontalia, so that there appears to be a large Y marking, much broader than in any other species so far examined. Prothorax: having well developed shield dorsally, strong in 5th and 6th instars; L2 cephalad to L1. Mesothorax and Metathorax: L1 longer than L2, D2 longer than D1. Abdominal segments: On A1, 2; D1 longer than D2, L1 dorsal to L2, SV2 more than twice SV1, SV3. On A3-6; SV2 dorsad to SV1 and SV3. On A7; L1 nearly dorsad to L2, SV1 ventro-caudad to SV2. On A9; D1, SD1 on common pinaculum. In 5th and 6th instar larvae only, the dorsal pinacula are continuous in the midline. In prior instars they are separate.

DURATION OF LARVAL INSTARS: All larvae maintained at room temperature in small containers, conditions not controlled, food changed every two days. First instar:

8 - 12 days (October-November, December-January); 14 - 17 days (February, March). Second instar: 16 - 22 days (October-November); 9 - 13 days (December-January, February); 20 - 21 days (March-April). Third instar: 14 - 20 days (October-November); 11 - 15 days (December-January); 13 - 17 days (March-April). Fourth instar: 13 - 17 days (November, December-January, February); 15 - 18 days (March-April, April-May). Fifth instar: 8 - 21 days (December, December-January, February, March, April); 13 - 17 days (May). Sixth instar: 16 - 23 days (January, February), 14 - 29 days (March), 27 - 37 days (April), 14 - 59 days (May).

LARVAL BEHAVIOUR: Initial feeding behaviour (from 3 to 8 hours after hatching) is variable. Some larvae at once construct a rudimentary shelter by pulling fragments of soil debris and moss leaves together with a few silk threads. Others climb a grass stem and construct a similar slight shelter between two leaves, and begin at once to eat shallow furrows in the epidermis. The young larvae of this species are polyphagous; in cultures I have seen them begin to eat mosses, Bryum (?) sp., Bartramia (?) sp. and Funaria hygrometrica without any hesitation, and also red clover Trifolium pratense and white clover Trifolium repens, after searching around the container for up to 3 hours. I have reared this species through to the pupa solely on Funaria hygrometrica. Between 8 and 24 hours after hatching the larva reinforces the silk walls of the initial fragile structure, filling in the spaces between the first threads and incorporating some frass particles, or in the case of those making tunnels in soil debris, handy-sized particles of the latter as well as frass. Living moss stems may also be bent and woven into the structure as the chamber becomes more elaborate. At about 72 hours after hatching the larva is completely enclosed by the chamber, which has a flexible opening at each end. The chamber is extended as the larva grows, eventually becoming a tunnel up to four inches long, with the section of the tunnel posterior to the larva being used as a receptacle for such frass as is not incorporated into the walls. Larvae which begin feeding between two leaves construct a tunnel down the side of the grass stem into the

soil debris. Larvae which begin feeding in the soil litter construct a tunnel upwards between grass stems, often incorporating two or more into the walls of the tunnel. These tunnels are very hard to find in samples, resembling strongly twisted matted plant debris. Fifth and sixth instar larvae extend part of their tunnel down into the soil to a depth of approximately one to two inches, cutting off and abandoning the older section filled with frass. The base of the new tunnel extension is widened and the wall constructed strongly with silk and soil particles. This is the pupal chamber, and just prior to pupation the larva ceases feeding, retreats into this basal chamber and seals the connection with the upper part of the tunnel. At this stage of its life the larva becomes much darker in colour, and the thoracic segments hunched and swollen, while the rest of the body becomes contracted.

No strict feeding pattern was observed in the captive larvae, although only at night did they actually leave their tunnels, and then rarely completely. Larvae whose tunnels were in deep shadow would feed during the day, with only the head and thoracic segments protruding. During the nocturnal feeding larvae attached silk threads in a loose canopy over the upper entrance of the tunnel. Where numbers of larvae occur close together these canopies gradually merge into a "web", which is easily visible in short turf, ^{especially} when spangled with dew shortly after dawn.

PUPA: Medium to golden brown, 7 - 8 mm in length, spiracles dark, slightly raised, abdominal setae small, unmodified. Duration of pupal stage 13 - 19 days (January, February), 24 - 31 days (April-May).

DISTRIBUTION (Fig. 230): North and South Islands of New Zealand, Stewart Island. The dominant Orocrambus numerically in the southern part of the North Island, and probably also in all lowland parts of New Zealand. Becomes less common in dry pastures and above altitudes of 2,000 ft. although taken up to 4,100 ft. by J.S. Dugdale near Lake Sylvester. As well as the localities given in "material examined" section, this species is very common at Puketitiri and Haumoana in

Hawkes Bay district (T.H. Davies, in litt.). Adult flight period ^{is from} end of September to June, apparently (judging by breeding results) with any given population producing only two complete generations per year. ~~Although some~~ ~~light trap results suggest that.~~ Results of MV trapping at Massey University between 1965 and 1968 are given in table 4, results of trapping with a 100 watt tungsten bulb at Highbury on the western side of Palmerston North in the same period in table 5, results of MV trapping at Winchmore, South Canterbury, at Lincoln College, Canterbury, at Manutuke, Gisborne, and at Kaikohe, Northland in table 6.

Table 4

Results of MV trapping for <u>O.flexuosellus</u> at Massey University using 125 watt bulb, total operation.										
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July
1965-6	163	8013	5992	1552	2509	5675	1925	103	10	0
1966-7	710	5220	7625	1578	2609	20502	9329	669	15	2
1967-8	1696	5 614	2590	294	9196	28400	4350	581	31	0

Table 5

Results of 100 watt tungsten bulb trapping at author's home, Highbury, Palmerston North, total operation.									
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June
1965-6	221	684	1080	141	577	1673	538	33	1
1966-7	109	875	407	92	207	2040	1344	63	0
1967-8	355	3503	996	149	402	3968	482	18	0

Table 6

Results of MV trapping for <u>O.flexuosellus</u> at Winchmore Irrigation Research Station (Department of Agriculture) Canterbury; Lincoln College, Canterbury; Manutuke Agricultural Research Station, Gisborne; and Grasslands Division of DSIR, Kaikohe, Northland, in 1966-7.									
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June
Winchmore	1	95	1181	1112	3811	120	116	0	0
Lincoln	12	529	714	454	614	663	167	21	0
Manutuke	167	829	141	23	55	119	0	0	0
Kaikohe	0	11	0	2	23	13	17	0	0

Further information on the adult flight period of this species has been given for Wellington by Gaskin (1964.; a; b), for Paiaka by Cumber (1951) and for the Cass district by White (1963).

FLIGHT BEHAVIOUR: Flight behaviour was studied in the garden at my home in Palmerston North in the summer of 1965-6. O.flexuosellus may be seen flying during the day, but by and large is a crepuscular species. During the day both males and females roost in trees, shrubs and large herbs bordering grassy areas. Although the species can be beaten from almost any plant offering shelter during the main flight periods, narrow-leaved plants, such as the cultivated Asclepias, Pinus spp., Juniperus spp., Cupressus spp. and large shrubs of the family Compositae are particularly favoured. Relatively few individuals remain among the grass if it has been cut short, relatively more if it is long and uncut. Subjective observation suggests that a large enough fraction of the population in a given area could be in "roosts" to seriously affect the validity of sweep-netting methods carried out in pasture, as for example those of Cumber and Eyles (1961), to estimate the relative abundance of this species.

Some of the drawbacks of light trapping as a method of estimating population size and studying the flight behaviour of Lepidoptera and other insects are considered by Southwood (1966). On 27 February 1966 I studied the flight behaviour of O.flexuosellus both by light trapping and by direct

observation, supplemented by sweep netting.

After dark, weather conditions were very mild and $\frac{7}{8}$ overcast, with a partly veiled moon, air temperature of 65°F at sunset, no rain, and a light westerly wind. Sunset was at 1900 hours. The wind conditions were identical on each side of the house, the air stream crossing both front and back lawns parallel to the house. Moths coming to a 100 watt tungsten bulb at the front of the house were collected at 15 minute intervals, taken from the trap, killed and sexed. The results are shown in table 7, and suggest that the males are initially attracted in larger numbers than females, then for a short time females predominate, and finally both sexes are attracted in approximately equal proportions but progressively smaller numbers as the night draws on.

Table 7

Results of light trapping for <u>O.flexuosellus</u> at Palmerston North on 27 February 1966; moths counted and sexed at 15 minute intervals. Sunset at 1900 hours.											
	Time intervals										
	1930	1945	2000	2015	2030	2045	2100	2115	2130	2145	2200
males	2	9	12	10	8	4	6	4	2	1	1
females	0	1	2	5	16	3	5	6	1	0	1

The study made by direct observation showed that this proportional difference in the sex ratio being attracted to the light was at least in part due to different activity by the sexes at different times. Observations after dark were made using a torch with a red gelatin filter and a net.

Sporadic activity was noted as early as 1525 hours on this day. Specimens of O.flexuosellus flew up from the lawns at irregular intervals, usually flying directly into the nearest bordering shrub. Where the landing position was accurately marked the specimen was collected. Fourteen specimens, 6 males and 8 females were collected in this way, and all the females were unfertilised (no spermatophores in corpus bursae). The partially flaccid

condition of the wings of three males showed that they were freshly emerged. In one case the initial point of flight was carefully noted and the pupal case found lodged within the opening of the pupal chamber.

Active flight, as opposed to this sporadic flight associated with emergence, began at about 1910, less than a quarter of an hour after sunset. The type of flight observed was a wild zig-zagging flight from two to perhaps thirty feet above the ground. Only a small percentage of the specimens known to be roosting in various shrubs bordering the lawn were seen to take off to participate in this flight. Eleven specimens were netted on the wing; 9 males and 2 females. Copulation was seen 4 times, the pairs fluttering down into herbage. One such pair was collected and preserved in copula. This early flight is thus assumed to be at least in part the mating flight. At the same time some specimens were taken from flowers, usually Compositae, where they were feeding. All these specimens (8 taken), were worn and tattered males. By 1930 many more specimens were flying to flowers; between 1930 and 1935 12 specimens were netted on flower heads and sexed; all but one were males.

At 1935 a few specimens were noted making slow zig-zag flights over the back lawn, with frequent stops. At this time, immediately prior to servicing the light trap at the front of the house, I examined two Asclepias which had been the roost plants for 7 and 10 O.flexuosellus respectively. Only one moth was present on the first plant, and two on the second. Both were agitated, one walking and the other two cleaning antennae. At 1950 I returned to the back lawn and swept 32 specimens with the net. The number was not counted at the time, for economy of time the net was folded into a polythene bag and a second net taken up for use. All 32 specimens were found to be females. Further sporadic sweep-netting between 2005 and 2025 produced 19 more moths from the lawn, all but one females, but the density of moths flying over the lawn declined drastically in this latter period. One female, observed at close range, was seen to drop two eggs while sitting on a grass blade. The 32 moths captive in the net were later found to have oviposited freely. After 2025 very few moths were observed crossing the lawn, although many were crawling over flower heads.

Of 7 sweep-netted on the lawn between 2035 and 2040, 4 were males and 3 females. Twelve taken from flower heads between 2050 and 2055 consisted of 7 males and 5 females. Thus the pattern of male feeding and female oviposition flight had broken down by this time. At 2005 the number of moths in the roost plants had risen to 5 again, 2 in the first and 3 in the second. These numbers continued to rise as the evening progressed; by 2105 the first bush contained 6 specimens and the second 12. These numbers were still constant when the two bushes were examined for the last time at 2300 hours.

The results of this study suggest the following relationship of flight to light trapping: there is an initial flight beginning about ten minutes after sunset, when mating of freshly emerged females takes place. The flight seems to be a predominantly male one, and some males are engaged in feeding, not mating. Neither sex seems to be vulnerable to tungsten light at this stage, possibly because the amount of residual light in the sky is still high enough to overcome the attracting power of the bulb. As the mating flight comes to an end and more insects take the wing, moving around the flower beds, the males become vulnerable to the light. The females are not at this stage, many of them engaged in the oviposition flight. As this flight activity declines at about $1\frac{1}{2}$ hours after sunset the proportion of females in the light trap catch rises sharply as they too become vulnerable to the light. After this both sexes are **caught**, but by two hours after sunset the main flight is over, moths are settling in the roosts again, and since they are not on the wing, the vulnerability of both sexes to light declines almost to nil. Comparing the number of moths taken on the back lawn with the number taken in the trap on the front lawn, suggests very strongly that a tungsten light does not have a very marked "pulling power" for this species. It has been shown by other authors (summarised by Southwood, 1966) that the mercury vapour light has a greater disruptive effect on insect behaviour than tungsten light since it produces a far greater proportion of its light in the ultraviolet. This explains the great discrepancy, at least in part, of the numbers of specimens of this species taken by trapping at Massey University and at my home. Little evidence on the life span of the adults in the wild is available.

No specimens taken from the MV trap at Massey could be kept alive more than 3 days, probably as a result of permanent damage caused by several hours exposure to the heat inside the receptacle. Cage-bred individuals fed by sugarwater soaked into cotton wool pellets were maintained for up to 18 days, although loss of co-ordination was noted 3 - 4 days before death.

HOST PLANTS: Although this species has long been considered one of the most common lowland species of New Zealand Lepidoptera (Hudson, 1928; Cumber, 1951; Gaskin, 1964), only three brief observations have been made on the life history prior to this study. Kelsey (1957) and Cumber and Eyles (1961) reported that the larvae tunnelled through grass roots and soil, while White (1963) reared some adults from pupae found in the bases of un-named tussocks. None of these workers gave descriptions of the larvae found and bred.

I have found larvae of O.flexuosellus feeding on the following grasses in the wild state; Poa annua L., Dactylis glomerata L., Phleum pratense L., and Festuca rubra var. comutata Gaudin, and on the moss Ceratodon purpureus. In captivity the species feeds readily on Funaria hygrometrica, Bryum (?) sp., Bartramia (?) sp., Agrostis tenuis Sibth. and Alopecurus pratensis L.

MATERIAL EXAMINED: 225 m. 101 f.

Akaroa, Cant.: 1 m. Jan. 1872; 1 m. 5.2.1878; CM, R.W. Fereday.

Aramoho, Wanganui: 1 m. 6.5.22, ED, J.G. Myers.

Arapawa Island, Marl.: 5 m. 3 f. 9.5.63, GC, D.E. Gaskin, M.W. Cawthorn.

Auckland: 1 m. 1 f. 2.10.18, ED, A. Philpott

Castlepoint, Wairarapa: 11 m. 4 f. 28.12.63, GC, D.E. Gaskin.

Christchurch: 3 m. no date; 1 m. 16.2.1867, CM, R.W. Fereday; 1 m. 17.3.36; 2 m. 2.12.39, CM, S. Lindsay.

Dunedin: 1 m. 24.2.06; 1 m. 4.12.07; ED, A. Philpott.

East Cape: 2 m. 5.10.64, GC, D.E. Gaskin.

Featherston: 2 m. 3 f. 4.4.65, GC, D.E. Gaskin.

Hurworth, Tar.: 1 m. 7.11.66, GC, D.E. Gaskin.

Kaikohe, Nrthld.: 3 m. 1 f. March 1966, GC, Grasslands, DSIR.

Kaingora: 1 m. 12.12.09, ED, G.V. Hudson.

Kapiti Island: 2 m. 2 f. 12.2.66, GC, D.E. Gaskin.

Karori, Wellington: 5 m. 4 f. 7.3.64, GC, D.E. Gaskin.

Key Ridge, 3,300 ft., Nel.: 1 m. 11.1.66, FRI, J.S. Dugdale.
 Lake Paringa, S.Westland: 3 m. 6-10.12.60, ED, J.I. Townsend and P.R. Kettle.
 Lake Sylvester Track, 4,100 ft., Nel.: 1 m. 11.2.60, FRI, J.S. Dugdale.
 Lake Tynnyson, Nel.: 2 m. 16.2.66, FRI, J.S. Dugdale.
 Mahara, Nel.: 2 m. 25.12.57, ED, E.S. Gourlay.
 Manaia, Tar.: 4 m. 2 f. 4.11.66, GC, D.E. Gaskin, K. Fox.
 Manutuke, Gisb.: 7 m. 3 f. Nov. 1966, GC, Agric. Station
 Mt. Egmont: 1 m. 1 f. 5.11.66, GC, D.E. Gaskin.
 Mt. Hutt, Cant.: 1 m. 15.1.1885, CM, R.W. Fereday.
 Mt. Sugar Loaf, 2,000 ft., Cant.: 1 m. 1 f. 28.2.62, LC, E.G. White.
 Napier: 4 m. 1 f. 7.1.65, GC, D.E. Gaskin.
 Nelson: 1 f. 5.5.20; 2 m. 8-9.11.20; 1 f. 16.11.20; 3 m. 29.11.20; ED, A. Philpott;
 1 m. 1.12.55, ED, E.S. Gourlay.
 Palmerston North: 8 m. 2 f. 5.4.65; 22 m. PDB, PDC, PDD, PDE, PDF, PDI, PDJ,
PDL, PDN, PDQ, PDR, PDS, PDU, PDV, PDW, PDY, 17 f. 1-9.1.66; 43 m. 22.f. 6-20.2.66;
 37 m. 28 f. PDF, PDH, PDK, PDM, PDO, PDP, PDT, PDX, 6 - 18.3.66; GC, D.E. Gaskin.
 North Tararua Range, 1,600 ft.: 2 m. 19.1.66, GC, T. Crilly, D.E. Gaskin.
 Pouakai Range, 1,500 ft. Tar.: 1 m. 7.11.66, GC, D.E. Gaskin.
 Oban, Stewart Island: 2 m. Mar. 1961, DM, anon.
 Ohakune, 2,100 ft.: 1 m. 6.2.66, GC, D.E. Gaskin.
 Rotorua: 1 f. 20.10.64, FRI, W.A. Hollaway.
 Owen River: 1 m. 23.1.57, ED, E.S. Gourlay.
 Ribbonwood Fan, 2,200 ft. Cass, Cant.: 1 f. 12.3.62, LC, E.G. White.
 Riccarton: 1 m. 16.12.1864, CM, R.W. Fereday.
 Ruahine Range, 1,800 ft.: 4 m. 1 f. 16.1.66, GC, D.E. Gaskin.
 Sedgemere, 3,300 ft. Nel.: 1 m. 13.2.66, FRI, J.S. Dugdale.
 Sherry Valley, Nel.: 1 m. 4.2.42, ED, E.S. Gourlay.
 Reefton: 1 m. 17.12.62, FRI, J.S. Dugdale.
 Spreydon, Cant.: 4 m. Dec. 1919; 7 m. 11-15, 11.31; 3 m. 3.12.31; CM, S. Lindsay.
 Stephen's Island: 1 f. 14.1.33, ED, E.S. Gourlay.
 Sunnyside, Invercargill, Sthld.: 1 m. 20.12.14, ED, A. Philpott.
 Tinui, Wairarapa: 2 m. Jan. 1933, GC, D.E. Gaskin.
 Tisbury, Sthld.: 1 m. 2.12.12, ED, A. Philpott.
 Wainuiomata: 3 m. 3.2.63, GC, M.W. Cawthorn.
 Waiouru, 2,600 ft.: 5 m. 2 f. 3-4.2.66, GC, D.E. Gaskin.
 Wellington: 3 m. 12.1.09, ED, G.V. Hudson.
 Weraroa: 2 m. 15.4.17, ED, G.V. Hudson.
 West Plains, Sthld.: 1 m 1 f. no date, ED, A. Philpott.
 Westport: 2 m. 23.1.49, ED, "E.K."
 Winchmore, Cant.: 30 m. 15 f. Feb. 1966, GC, R. Lobb.

REMARKS: Phylogenetically O.flexuosellus is the sister species of O.horistes which is found only on the Chatham Islands, and I have no doubt that the two species shared a common ancestor. The relationship is further discussed in the section on O.horistes. On the other hand O.flexuosellus shows quite a close affinity to O.dicrenellus, which might be regarded as a derivative from the common stock which has radiated into the alpine habitat, and also to O.haplotomus. The numerical success of O.flexuosellus is due at least in part to the readiness with which the species has adapted to feeding on European grasses. I have no doubt that the list of host plant species will be extended when this species is studied more thoroughly.

The species is readily distinguished from any other on male or female genitalia characters, but externally worn specimens might be confused with O.vittellus or O.jansoni. However the former lacks the characteristic dark costa of the forewing, and the latter has no forewing subterminal markings.

Orocrambus fugitivellus (Hudson) comb.nov.

Crambus fugitivellus Hudson 1951, Fragments of New Zealand Entomology, Wellington, 1951, p. 99, Plate IV, Fig. 2.

Holotype m. in Hudson collection, Dominion Museum, Wellington, slide DM 160, labelled "McKenzie Country, Canterbury, Feb. 1939, R.D. Dick, Hudson coll. 1773," "Crambus fugitivellus holotype."

Three topotype m. in EDNZ with same label data but apparently not examined by Hudson for his diagnosis.

EXTERNAL CHARACTERS (Slide 7): Description by Hudson (1951), and coloured figure (see above). Wing span 18 - 19 mm (male.) This species superficially resembles O.aethonellus and O.melitastes but can be recognised by the very slender forewings with acute apices. Eye nocturnal type. Female unknown.

MALE GENITALIA (Fig. 48^{topotype}): As for generic and species group diagnosis except: Arms of vinculum $\frac{1}{3}$ uncus; saccus parallel-sided, with truncate apex, Costa of valve poorly developed with only small flange, dorsal margin about $\frac{2}{3}$ uncus. Sacculus not differentiated in comparison with most species, but a very small flange is present. Gnathos tapered, pointed, equal to uncus. Aedoeagus tapered apically, $1\frac{1}{2}x$ uncus, length to median breadth ration $6\frac{1}{2}:1$, with minute thorn dorso-

dextrad at 1/16 from apex.

LARVA: Not known

HOST PLANT: Not known, but probably a tussock grass species.

DISTRIBUTION; (Fig.231): Known only from the McKenzie Plains, adult flight period February.

MATERIAL EXAMINED: Holotype and 3 topotypes as above.

REMARKS: Phylogenetically this species is probably close to O.aethonellus, but also shows affinities to O.horistes and O.flexuosellus. The exact position of this species in the phylogenetic systematic scheme must remain provisional until the female is available for examination, but the male characters strongly support the present placing.

Orocrambus horistes (Meyrick) comb.nov.

Crambus horistes Meyrick, 1902, Trans. ent. Soc. Lond., 1902, p.276.

Lectotype m. (Dr. S. Bleszynski) and paralectotype in British Museum (Natural History) labelled "Chatham Islands F./OO".

Paratype m. in CMNZ labelled "^{lect.}Crambus horistes Meyrick", "Paratype det. E. Meyrick 1924".

EXTERNAL CHARACTERS (Slide 8): Detailed description by Meyrick (1902), abbreviated description by Hudson (1928). Female frenulum triple, eye nocturnal type.

Wingspan 25 - 29 mm (both sexes). Shares with O.flexuosellus and O.jansoni a dark costal stripe. The dark subterminal forewing markings of O.flexuosellus are absent in O.horistes, or occasionally present very faintly as smudges in the white fascia. Forewing apices less acute than in O.jansoni. Known only from the Chatham Islands where O.flexuosellus and O.jansoni do not occur.

MALE GENITALIA (Fig. 49): As for generic and species group diagnosis except: Arms of vinculum $\frac{2}{3}$ uncus; saccus turned dorsad, parallel-sided for most of its length with bluntly rounded or truncate apex. Costa of valve flanged, dorsal margin about $\frac{2}{3}$ uncus. Sacculus not differentiated. Gnathos tapered, pointed or very slightly clubbed, equal to uncus. Aedoeagus stout, truncate apically, 2 - $2\frac{1}{4}$ x uncus, length to median breadth ratio 6-7:1. Dorsal midline strong

from apex to $\frac{1}{2}$, with very large thorn subapical, dorsad.

FEMALE GENITALIA (Fig. 135): As for generic diagnosis except: Eighth abdominal tergite fusing dorso-laterally with ostium bursae, as wide at fusion as in dorsal midline. Eighth sternite a weak oval plate. Ductus bursae $3\frac{1}{2}$ - 4x length of anal papillae, strong to $\frac{1}{3}$, narrowing at $\frac{1}{3}$, joined by ductus seminalis at about $\frac{5}{8}$. Ostium bursae with swollen pouch, forming a simple calathiform funnel. Corpus bursae with two moderate oval signa, equal in size.

LARVA: Not known.

HOST PLANTS: Not known, but this species is so abundant on the Chatham Islands that it can probably fairly safely be assumed that it has adapted to feeding on a very similar range of European grasses to O.flexuosellus.

DISTRIBUTION: Grassy areas of the Chatham Islands only. Flight period December and January.

MATERIAL EXAMINED: 24 m. 10 f.

Mangere Island: 15 m. AGW, 5 f. BCA, 4-21.1.24, CM, ED (1 f.), C. Lindsay

Maunganui: 3 m. CM, 1 f. ED, 16.12.23, C. Lindsay.

Ngaio: 1 m. 24.1.24, CM, C. Lindsay.

Pitt Island: 2 m. ZFU, ZPV, no date, DM, Mitchell coll.

Wharekauri: 3 m. 4 f. 12. Dec. 1923 - 21 Jan. 1924, CM (3m. 2 f.), ED, (2 f.), C. Lindsay.

REMARKS: Sister species of O.flexuosellus but distinct on external and genitalia characters in both sexes, (see figs. 47 and 49 for males, and figs. 134 and 135 for females).

Orocrambus mylites Meyrick

Orocrambus mylites Meyrick, 1888, Trans. N.Z. Inst., 20, p. 67.

Lectotype m. (Dr. S. Bleszynski) in British Museum (Natural History) with 4 paralectotypes, labelled "Mt. Arthur New Zealand 4,800 ft. 17/1/86".

EXTERNAL CHARACTERS (Slide 9): Detailed description by Meyrick (1888); coloured figure by Hudson (1928, Plate XX, Fig. 23) and abbreviated description. Female frenulum triple, very rarely double. Eye diurnal type. Wing span 19 - 25 mm

(both sexes). The dark bluish brown forewings with obscure greyish fascia distinguish this species from any other yet known.

MALE GENITALIA (Fig. 50): As in generic and species group diagnosis except for following: Arms of vinculum about $\frac{3}{4}$ uncus; saccus tapering to rounded apex. Costa of valve flanged, dorsal margin about $\frac{3}{4}$ uncus. Aedoeagus slender, $4 - 4\frac{1}{2}x$ uncus, length to median breadth ratio 15-16:1, with long apical spur oval in cross-section arising ventrally and curving dorsad.

FEMALE GENITALIA (Fig. 136): As in generic description except for following: Eighth abdominal tergite fusing dorso-laterally with ostium bursae, about $1\frac{1}{2}x$ as wide at fusion as in dorsal midline. Anterior apophyses represented by very short triangular projections in lateral midlines of anterior margin of tergite. Eighth sternite a weak lunate plate. Ductus bursae about 5x length of anal papillae, strong to $\frac{3}{4}$, ductus seminalis joining at $\frac{3}{4}$. Ostiolar pouch not noticeably swollen, ostium bursae forming a wide, simple tapering funnel with flared mouth. Corpus bursae with a pair of unequal oval signa.

LARVA: Not known.

HOST PLANT: The restricted range of O. mylites to the mountain ranges of the Nelson Province is coincident with the range of Chionochloa australis (carpet grass) given by Burrows (1967). That this is a foodplant of this species has been recently confirmed by a pupa found in the base of a clump of carpet grass by Mr. J.S. Dugdale, from which a female of this species was obtained (pers. comm., specimen in EDNZ collection).

PUPA: Only the above specimen is available, in rather broken condition, on which to base a description. Pupa dull brown, about 10 mm in length, with dark slightly raised spiracles, abdominal setae small, unmodified. Duration of pupal stage not recorded.

DISTRIBUTION (Fig. 232): Alpine zone of the Nelson Province south to the St. Arnaud Range, and extending into northern Marlborough, 3,500 ft. to 6,500 ft. Flight period December to February.

MATERIAL EXAMINED: 78 m. 31 f.

Blue Creek, Mt. Owen, 3,500 ft.: 2 m. 12.1.65, FRI, J.S. Dugdale.

Cascade Creek, Angelus Basin, 5,000-7,000 ft.: 4 m. 1 f. CDM, 9.2.64, FRI, J.S. Dugdale.

Cobb Hut, 3,500 ft. Nel.: 2 m. 7.12.62, FRI, J.S. Dugdale.

Cuploa Basin, 4,650-5,200 ft.: 2 m. 1 f. 10.1.65, FRI, J.S. Dugdale.

Freehold Range, 4,000 ft.: 5 m. 3 f. 31.12.34, CM, S. Lindsay.

Howard Basin, 5,500 ft.: 1 f. (ex pupa) 5.2.64, FRI, J.S. Dugdale.

Iron Hill, 4,200 ft.: 13 m. 2 f. 8-9.2.66, FRI, J.S. Dugdale.

Island Lake, east ridge, 4,800 ft. Nel.: 2 m. CDE, CDF, 3 f. CDH, CDJ, CDK, 6.12.62, FRI, J.S. Dugdale.

Lake Sylvester, 4,300-5,300 ft.: 3 m. 1 f. 8.2.66, FRI, J.S. Dugdale.

Lake Sylvester Track, 3,900 ft.: 1 m. 1 f. 11.2.66, FRI, J.S. Dugdale.

Mt. Aorere, 5,000 ft.: 3 m. CDP, 3.12.62, FRI, J.S. Dugdale.

Mt. Arthur, 4-5,000 ft.: 1 f. CDB, no date, DM, A. Hamilton; 9 m. 3 f. 23.12.21, ED, A. Philpott; 1 f. AGH, 16.1.22, CM, 2 m. 1 f., 12.12.23, ED, 1 m. Jan. 1924, ED; A. Philpott; 1 m. 13.12.28, ED, 1 f. AM, E.S. Gourlay.

Mt. Arthur Tableland, 4,000 ft.: 1 m. 5.2.1898, DM, G.V. Hudson; 1 f. 3.2.10, ED, 1 m. 16.1.22, CM, A. Philpott; 1 f. AGI, 24.1.24, CM, 3 m. 28.1.24, CM, S. Lindsay.

Mt. Cedric: 2 m. 18.1.27, ED, E.S. Gourlay.

Mt. Crystal ridge, 4,500-5,900 ft.: 1 m. 1 f. 14.2.66, FRI, J.S. Dugdale.

Mt. Owen, 5,250 ft.: 4 m. 13.1.65, FRI, J.S. Dugdale.

Mt. Peel, Nel.: 3 m., ED, 2 f. CDC, CDD, DM, 28-31.12.12, A. Philpott and A. Hamilton.

Mt. St. Arnaud, 4,000 ft.: 2 m. 30.12.33, CM, S. Lindsay.

Nuggety Basin, Mt. Owen, 5,200 ft.: 1 m. 1 f. 13-14.1.65, FRI, J.S. Dugdale.

Travers Range, Speargrass Ck, 5,400-6,000 ft.: 8 m. GDL, CDN, CDO, 5 f. CDG, CDI, 4-6.2.64, FRI, J.S. Dugdale.

Wairou Mountains, Mt. Iris Ridge, 4,000-6,500 ft.: 2 m. 16.2.66, FRI, J.S. Dugdale.

REMARKS: Near horistes and aethonellus, but showing more relatively apomorphic characters in the male genitalia. Of all the species in this subgroup I find that O.mylites has most phylogenetic affinity to the species of subgroup 2b, where the slender apical spur of the aedoeagus has been developed in all 4 species.

Orocrambus haplotomus (Meyrick) comb.nov.

Crambus haplotomus Meyrick, 1882, New Zealand Journal of Science.

Crambus haplotomus Meyrick, 1883, Trans. N.Z. Inst., 15, p. 23.

Lectotype m. (Dr. S. Bleszynski) in British Museum (Natural History), labelled

"Lake Wakatipu New Zealand /1/81 RWF." (Abdomen missing).

EXTERNAL CHARACTERS (Slide 10): Detailed description by Meyrick (1883), coloured illustration by Hudson (1928, Plate XX, Fig. 7 m.), and abbreviated description. Frons conical, eye nocturnal type, female frenulum triple. Wing span 19 - 28 mm (male), 25 - 30 mm (female). This species has a distinctive yellowish ground colour which is easily recognised but difficult to describe. Lacks white median streak on the dorsal surface of the thorax common to most pale species of Orocrambus. Dorsum of forewing slightly concave.

MALE GENITALIA: (Fig. 51): As for generic and species group description except for the following: Arms of vinculum about $\frac{3}{4}$ uncus; saccus parallel-sided for proximal $\frac{1}{2}$, tapering to rounded apex, with "keel". Costa of valve flanged, dorsal margin $1\frac{1}{4}$ - $1\frac{1}{2}$ uncus. Sacculus not differentiated. Gnathos tapering, bluntly pointed, equal to uncus. Aedoeagus $3\frac{1}{4}$ - $3\frac{3}{4}$ x uncus, length to median breadth ratio 11-12:1, with simple strong subapical thorn 45° dextrad.

FEMALE GENITALIA (Fig. 137): As for generic description except for following: Eighth abdominal tergite fusing laterally and diagonally with ostium bursae, with ventral ends drawn into protrusions or "wings" fused with ventro-lateral walls of ostium below the line of the tergite. Eighth sternite a strong lunate plate. Ductus bursae 6x length of anal papillae, chitinised to $\frac{1}{2}$, spirally pleated from $\frac{1}{4}$ to $\frac{1}{2}$, with an asymmetrical pouch sinistrad at base of spiral, pigmented with a few sclerotised spots, ductus seminalis joining ductus bursae at $\frac{3}{4}$. Ostium a broad tapering funnel with exaggerated dorsal lip. Corpus bursae with two unequal oval signa.

LARVA: Not known.

HOST PLANT: Not known.

DISTRIBUTION (Fig. 233): Hudson (1928) claims that this species occurs in the Castle Hill area near Arthur's Pass, but these specimens cannot be traced and are assumed to be a misidentification. He did not state whether he had collected them there himself, or had been informed the species existed there. The species

on available evidence seems to be confined to grassy subalpine areas around Lakes Te Anau and Lake Wakatipu, extending to Milford Sound. I suspect that the specimens from Castle Hill were O.lectus, a species not seen by Hudson until after his 1928 work was published.

MATERIAL EXAMINED: 9 m. 6 f.

Homer, Fdld.: 3 m. XAA, XAC, XAD, 20-23.12.43, DM, G. Howes

Hunter Mountains: 2 m. 28.12.22, AM, C.E. Clarke.

Lake Wakatipu: 1 m. HDA, 20.2.03, ED, G.V. Hudson.

Milford Sound: 1 m. 4 f. CFC, CFG, CFO, LAH, LAI, 28-29.1.46, DM, J.T. Salmon.

Kinloch, Lake Wakatipu: 1 m. CFR, Jan. 1906, 1 f. CFQ, Jan. 1905, DM, G.V. Hudson.

Paradise, Lake Wakatipu: 1 m. CFS, 1 f. XAB, 15-28.2.03, DM, G.V. Hudson.

REMARKS: Shows affinities in male genitalia structures to O.flexuosellus, but the conical frons and the peculiar "wings" of the eighth tergite in the female are apomorphic structures not present in any other species in this group. Variation is largely in the size of specimens, but as in O.lectus there is a tendency for the horizontal median white streak to be obliterated.

Subgroup b.

Contains four species, O.heliotes, O.machaeristes, O.thymiastes and O.tritonellus, of which only O.heliotes occurs in the North Island, where it is largely restricted to boggy localities in the tussock grasslands of the central plateau. The remaining species are also essentially alpine or subalpine, although O.thymiastes occurs down to near sea level close to Invercargill.

Group 2b. KEY TO SPECIES: male genitalia

- | | | |
|---|--|---------------------|
| 1 | Saccus apically excavate | <u>heliotes</u> |
| - | Saccus apically rounded | 2 |
| 2 | Sacculus flanged | <u>thymiastes</u> |
| - | Sacculus without flange | 3 |
| 3 | Juxta strong, saccus apically narrowly rounded | <u>machaeristes</u> |
| - | Juxta weak, saccus apically broadly rounded | <u>tritonellus</u> |

Orocrambus heliotes (Meyrick)

Crambus heliotes Meyrick, 1888, Trans. N.Z. Inst., 20, p. 68.

Lectotype m. (Dr. S. Bleszynski) in British Museum (Natural History) with 8 paralectotypes, labelled "Mt. Arthur New Zealand 3,800 ft. 15/1/86".

Syntype m. in CMNZ labelled "Mt. Arthur, 15.1.86" in Meyrick's writing, author's genit prep AGO.

EXTERNAL CHARACTERS (Slide 11): Detailed description by Meyrick (1888); coloured illustration by Hudson (1928, Plate XIX, figs. 5 f, 6 m.) and abbreviated description. Female frenulum double or triple, eye diurnal type. This species is at once distinguished from any other by the bright orange hindwings. Wing span 14 - 17 mm (male), 15 - 20 mm (female),

MALE GENITALIA (Fig. 52 from CMNZ syntype): As for generic and species group description except for following: Arms of vinculum about $\frac{3}{4}$ uncus; saccus about $\frac{1}{2}$ uncus in profile, apically excavate. Juxta U-shaped. Costa of valve flanged, dorsal margin about $\frac{7}{8}$ uncus. Gnathos tapered, pointed, equal to or slightly longer than uncus. Aedoeagus 3x uncus, length to median breadth ratio 8-9:1, slender, apical spur present.

FEMALE GENITALIA (Fig. 138): As for generic description except for following: Eighth abdominal tergite fusing dorso-laterally with ostium bursae, $2\frac{1}{2}$ - 3x as wide at fusion as in dorsal midline. Eighth sternite a weak oval plate. Ductus bursae 4 - $4\frac{1}{2}$ x length of anal papillae, strong to and narrowing at $\frac{1}{3}$, ductus seminalis joining at $\frac{5}{8}$; dorsal margin of ostium slightly excavate; Corpus bursae with two equal oval signa.

EGG: Oblate, 20 - 26 vertical ribs, 0.39 -- 0.42 x 0.28 -- 0.29 mm, creamy white when first laid, turning orange after 24 - 36 hours, if fertilised. Duration of egg stage 11 - 13 days in November, 8 - 11 days in January, February. Gross embryological changes visible through the shell the same as for O. flexuosellus (pp. 100). Shell not consumed by larva.

HATCHING BEHAVIOUR: As for O. flexuosellus (p. 101), except that larva is active immediately after leaving shell, and crawls rapidly into any available debris, where it begins to construct a fragile silk shelter.

LARVA (Fig. 217): Length of final instar larva at rest 10 - 13 mm, stout, dull brown with darker brown pinacula. Head dark brown with paler brown frontal region.

Prothorax with strong shield, L2 dorso-cephaled to L1, SV2 cephalad to SV1.

On Mesothorax and Metathorax: L1 dorsad to L2, D2 longer than D1, SD1 longer than SD2. On abdominal segments: On A1, 2; SV2 caudad to SV1, SV3, SV3 cephalad to SV1, L1 dorsad to L2, SD2 very small. On A3-6; SV2 dorsad to SV1, SV3. L1 dorsad to L2. On A7; SV1 ventro-caudad to SV2, L1 dorso-caudad to L2. On A9 D1, SD1 on common pinaculum.

DURATION OF LARVAL INSTARS: All larvae maintained at room temperature in small containers, conditions not controlled, food changed every few days. First instar: 9 - 11 days (November); Second instar: 10 - 15 days (November-December); Third instar: 9 - 12 days (December); Fourth instar: 11 - 13 days (December); Fifth instar: 15 - 32 days (December-January); Sixth instar: 17 - 48 days (February - March, April).

LARVAL BEHAVIOUR: The larvae maintained in captivity in containers constructed horizontal tunnels through moss and soil debris, and ate little or no grass. Immediately prior to pupation a rough chamber of soil and moss debris held together by silk was constructed among the moss rhizoids, rarely more than about $\frac{1}{4}$ " below the surface. Feeding was carried out within the tunnels, which were extended from place to place as the moss was eaten. Only in one neglected culture were the larvae ever observed to leave the tunnels.

HOST PLANTS: Not known, but may be swamp mosses, Sphagnum sp., and Breutelia (?) sp. The captive larvae were fed largely on Funaria sp., but also ate Juncus bufonius L.

PUPA: Bright golden brown, about 8 mm in length, spiracles slightly raised, dark brown, abdominal setae microscopic, unmodified. Duration of pupal stage 31 - 56 days (March-May). Moths emerged in captivity at time of year when none have ever been recorded in the wild.

DISTRIBUTION (Fig. 234): A diurnal species associated with swamps and slow-moving streams in tussock grasslands, apparently more common in the South Island to the west of the main divide (see fig. 1 of Burrows, 1967). Taken at 4,900 ft. by Dr. K. Fox on Mt. Ruapehu (pers. comm.), at 3,500 ft. on Mt. Pureora (South Auckland) by

J.S. Dugdale. The distribution in the South Island may be discontinuous between Southland/Otago and Nelson, but this is such a local species that I would hesitate to be dogmatic on this point. Where it is found the species is usually abundant, at least at the peak of the flight period. I have collected this species three years running at Waiouru and National Park in the same localities at different times, and conclude that the species is protandrous, with the males on the wing for about a week before the main peak of the female flight. Eighty five specimens netted over a ditch at National Park in the first week of November 1967 were all males, and searching closely revealed no females sitting among the vegetation, so it is concluded that the imbalance was not caused by a behaviour difference. A week later males and females were flying together in almost equal numbers. The adult flight, which takes place only when the sun is shining, begins in early November and is finished by the end of the first week of February.

MATERIAL EXAMINED: 189 m. 34 f.

Burgoo Creek, 4,000 ft., Nel.: 1 f. IBA, 6.12.62, FRI, J.S. Dugdale.

Cobb Hut, 3,500 ft., Nel.: 1 f. IBC, 7.12.62, FRI, J.S. Dugdale.

Cobb Valley, Nel.; 7 m. 1 f., 9.12.22, ED, A. Philpott.

Gore Hill, Sthld: 1 m. DCE, 3.1.45, DM, G. Howes.

Gouland Downs, Nel.: 2 m. 7.2.22, ED, A. Philpott.

Lake Rotoiti, Nel.: 2 m. 28.11.31; 19 m. 3 f. 30-31.12.33; CM, S. Lindsay.

Mt. Arthur, Nel.: 1 m. AGO, 15.1.1886, CM, R.W. Fereday; 2 m. 27.1.24, 4 m. 16.2.27; ED, A. Philpott.

Mt. Ruapehu: 2 m. DCA, DCJ, 17.1.21, DM. A. Hamilton.

National Park Junction: 85 m. 7.11.67; 16 m. 11 f. 16.11.67, GC, D.E. Gaskin and K. Fox.

North Lake Mavora, Otago: 1 m. DCB, 1.1.41, DM, G. Howes.

Paradise, Lake Wakatipu: 2 f. DCH, 2.1.14; 3 m. DCC, DCF, DCK, 1 f., 4.1.16, DM, C.E. Fenwick.

Pureora, Sth. Ackld.: 2 m. IBB, IBD, 6.2.63, FRI, J.S. Dugdale.

Runanga, Westld.: 6 m. DCF, DCG, 6.1.09, CM(1), ED(2), DM(2), A. Hamilton.

Salisbury's Opening, Mt. Arthur Tableland; 4,000 ft. Nel.: 5 m. 1 f. 21.1.24, CM, S. Lindsay.

Taihape: 1 m. DCI, DM, 1 m. CM, 3 m. ED, 4.12.08, A. Hamilton.

Taupo: 1 m. 23.12.08, ED, G.V. Hudson.

Tokaanu: 3 m. DCD, DCL, 22.11.19, DM, A. Hamilton.

Waimarino (National Park Settlement): 2 m. 10.1.19, CM, ED, R.J. Tillyard; 21 m. 1 f. 18.1.19, AM, C.E. Clarke.

Waiouru: 2 m. 1 f. 12.12.08, CM, ED, G.V. Hudson; 12 m. 9 f. 7.12.66, GC, D.J. Greenwood and D.E. Gaskin; 3 m. 3 f. 8.2.68, D.E. Gaskin, P.J. Wigley.

REMARKS: According to Hudson (1928), the white forewing markings in this species are a male characteristic. This is not the case; both sexes show forewings varying from plain brown to brown with a set of curved pale markings which almost approach those of O.thymiastes.

Phylogenetically the four species of Group 2b form a very tight unit. Occasional retention of a double frenulum in some females of this species is regarded as a random feature, and I do not regard this as a very important character; Specimens are only rarely found where the number of frenulum units is variable. If the distribution of this species proves to be discontinuous in the South Island, then I would regard the presence of this species in the central North Island as the result of a spread northwards from the Nelson/Marlborough biotic refuge while Cook Strait was bridged.

Orocrambus machaeristes Meyrick

Orocrambus machaeristes Meyrick, 1905, Trans. ent. Soc. Lond., 1905, p. 224.

Lectotype f. (Dr. S. Bleszynski) and 1 paralectotype in British Museum (Natural History) slide BM pyral 5633, labelled "Mt. Earnslaw New Zealand GVH./03."

EXTERNAL CHARACTERS (Slide 12): Description by Meyrick (1905), coloured illustration by Hudson (1928, Plate XX, Fig. 22 f), with abbreviated description. Female frenulum triple, eye diurnal type. Wing span 19 - 25 mm (both sexes). The pale forewing fascia, edged posteriorly with black and ending abruptly in the outer disc, and the dotted subterminal line at once distinguish this species from any other species in the genus.

MALE GENITALIA (Fig. 53, topotypic specimen): As for generic and species group description except for following: Arms of vinculum about $\frac{2}{3}$ uncus; saccus short, tapered, apically rounded; juxta a concave plate; costa of valve flanged, dorsal margin about equal to uncus; sacculus not differentiated. Gnathos tapered, pointed, slightly longer than uncus. Aedoeagus tapering, $2\frac{1}{2}$ - 3x uncus, length to median breadth ratio 7-8:1, with strong apical spur curved ventrad.

FEMALE GENITALIA (Fig. 139 partly after damaged topotype): As for generic description except for following: Eighth abdominal tergite encircling ostium bursae, as wide ventrally as in dorsal midline. Anterior apophyses represented by very short triangular projections on anterior tergite margin in lateral midline. Eighth sternite a strong lunate plate. Ductus bursae 3x length of anal papillae, weak, with swollen ostiolar pouch, the latter bearing one or two characteristic very strong spots, and having well-defined pleats, ductus seminalis joining ductus bursae at $\frac{1}{2}$. Ostium narrow, weak. Corpus bursae with two unequal oval signa.

LARVA: Not known.

HOST PLANTS: Not known, however the restricted range of the records of this species is coincident with the range of Chionochloa pallens (midribbed snowgrass), on and to the west of the main divide, approximating the 50 inch isohyet (Burrows, 1967).

DISTRIBUTION (Fig. 235): Mt. Arthur Tableland southward along the main axis of the Southern Alps to the vicinity of Lake Wakatipu. Not recorded below 3,500 ft.

Flight period December to March.

MATERIAL EXAMINED: 33 m. 14 f.

Arthur's Pass, 4,500 ft.: 2 m. Dec. 1908, ED, G.V. Hudson; 1 m. 1 f. 23.1.28, ED, A. Philpott.

Ben Lomond: 1 m. EDC, 20.2.16, DM, C.E. Fenwick.

Bold Peak: 2 m. EDB, EDE, 1 f. DDJ, 25-6.12.12, DM, C.E. Fenwick; 7 m. 1 f. 9-10.1.20, AM, C.E. Clarke.

Commissioner's Creek, Otago: 2 m. 1 f. 3.2.13, ED, A. Philpott.

Minaret Peak: 3 m. 1 f. 29.12.23, AM, C.E. Clarke.

Mt. Arthur: 3 m. 2 f. 24-7.12.21, ED, A. Philpott.

Mt. Earnslaw, 5,200 ft.: 3 m. GFC, 1 f. GFA, 16-22.2.03, DM, G. Howes; 2 m. EDA, EDF, 3 f. EDG, EDI, EDK, 25.12.22, DM, C.E. Fenwick.

Mt. Luxmore, 3,500 ft.: 3 m. EDL, 2 f. EDM, 2.2.66, FRI, J.S. Dugdale.

Paradise: 1 m. EDD, 1.4.20, DM, C.E. Fenwick.

Remarkable Range, 5,200-7,000 ft.: 2 m. 15-16.1.66, FRI, J.S. Dugdale.

Tooth Peaks: 1 f. 25.12.18, ED, A. Philpott.

Vanguard Peak: 2 m. 8.1.09, ED, G.V. Hudson.

REMARKS: Sister species of O. tritonellus, and showing apparent affinity also with O. clarkei in Group 3a in the encirclement of the ostium, although I regard

O.machaeristes and O.tritonellus as sharing the encircled ostium as a relatively apomorphic character within a very tight monophyletic group, while in O.clarkei it is a case of parallelism. However at the larger "subgeneric" level Groups 2 and 3 appear to be themselves a monophyletic grouping (Fig. 2).

Orocrambus thymiastes Meyrick

Orocrambus thymiastes Meyrick, 1901, Trans. ent. Soc. Lond. 1901, p. 567.

Lectotype f (Dr. S. Bleszynski) in British Museum (Natural History), slide BM pyral 5632, labelled "Invercargill New Zealand P./OO."

EXTERNAL CHARACTERS (Slide 13): Full description by Meyrick (1901), coloured illustration by Hudson (1928, Plate XX, Fig. 21 m.) with abbreviated description. Female frenulum double, eye diurnal type, wing span 18 - 23 mm (both sexes).

MALE GENITALIA (Fig. 54 from topotype): As for generic and species group description except for following: Arms of vinculum $\frac{1}{2}$ uncus; Saccus tapered, with rounded apex. Juxta a concave quadrate plate. Costa of valve with small flange, dorsal margin about $\frac{2}{3}$ uncus; Sacculus flanged. Gnathos tapered, pointed, equal to uncus. Aedoeagus tapered, 3x uncus, length to median breadth ratio 10-11:1, with strong apical spur curved dorsad.

FEMALE GENITALIA: (Fig. 140 from topotype): As for generic description except for following: Eighth abdominal tergite fusing dorsally with ostium bursae, $\frac{3}{4}$ as wide in dorsal midline as at fusion. Eighth sternite a strong lunate plate. Ductus bursae $4\frac{1}{2}$ x length of anal papillae, strong to and narrowing at $\frac{1}{4}$, ductus seminalis joining at $\frac{5}{8}$. Ostium a lightly chitinised funnel, pouch not swollen, corpus bursae with two equal oval signa.

LARVA: Not known.

HOST PLANT: Not known, but the limited southern distribution of this species is coincident with the range given by Burrows (1967) for Chionochloa teretifolia (hairy snowgrass).

DISTRIBUTION (Fig. 236): Southland to the west of the Mataura River and parts of western Otago, confined to boggy areas. Flight period January and February.

MATERIAL EXAMINED: 8 m. 3 f.

Lake Mavora: 1 f. SCA, 1.1.41, DM, G. Howes.

Mt. Luxmore, 3,500 ft.: 3 m. SCB, SCC, 3.2.65, FRI, J.S. Dugdale

Seaward Moss, Invercargill, Sthld.: 1 m. no date, ED, 1 f. GFK, Jan. 1902, DM,

1 m. GFJ, Feb. 1903, DM, 1 m. GFI, 1 f. GFL, Jan. 1907, DM, 2 m 10.2.10, ED;

A. Philpott.

REMARKS: Close to O.heliotes, but with strong affinities with O.tritonellus and O.machaeristes. O.thymiastes is still rare in New Zealand collections.

Orocrambus tritonellus (Meyrick)

Crambus tritonellus Meyrick, 1885, Trans. N.Z. Inst., 17, p. 134.

Orocrambus tritonellus (Meyrick) Hudson, 1928, "The Butterflies and Moths of New Zealand, p. 160, Pl. XX, fig. 27."

Holotype f. in British Museum (Natural History), slide BM pyral 5635, labelled "Porters Pass New Zealand JDE./82".

EXTERNAL CHARACTERS (Slide 14): Detailed description by Meyrick (1885), coloured illustration by Hudson (1928, Plate XX, Fig. 27 m.), and abbreviated description. Female frenulum triple, eye diurnal type. Wing span 18 - 23 mm (both sexes).

MALE GENITALIA (Fig. 55): As for generic and species group description except for following: Arms of vinculum $\frac{3}{4}$ uncus. Saccus tapering with rounded apex. Juxta a weak plate curved ventrally around the aedoeagus. Costa of valve flanged, dorsal margin $\frac{3}{4}$ - $\frac{7}{8}$ uncus; Sacculus not differentiated. Gnathos tapered, pointed, equal to uncus. Aedoeagus tapered, $2\frac{3}{4}$ - 3x uncus, length to median breadth ratio 9:1, with lightly chitinised apical spur curved ventrad.

FEMALE GENITALIA (Fig. 141 compared with drawing of type genitalia by Dr. S. Bleszynski):

As for generic description except for following: Eighth abdominal tergite encircling the ostium bursae and about $1\frac{1}{2}$ - 2x as wide in ventral as in dorsal midline.

Anterior apophyses represented by very short triangular projections in lateral midlines of anterior margin of tergite. Eighth sternite a large, strong lunate plate. Ductus bursae 3 - $3\frac{1}{2}$ x length of anal papillae, strong to $\frac{1}{4}$ where there is a well-developed ostiolar pouch, ventrally pleated; ductus seminalis joining ductus bursae at $\frac{3}{8}$.

Ostium bursae a dorso-laterally compressed funnel; Corpus bursae with two equal oval signa.

LARVA: Not known.

HOST PLANT: Not known, distribution coincident with range of Chionocholea rubra shown by Burrows (1967).

DISTRIBUTION (Fig. 237): Subalpine and alpine regions of the central and eastern South Island, largely east of the main divide, although also occurring in the Tasman Mountains. Flight period late September to mid-January.

MATERIAL EXAMINED: 34 m. 13 f.

Broken River, Cant.: 4 m. no date, ED, S. Lindsay.

Castle Hill, Cant.: 1 f. AGM, 1878, CM, R.W. Fereday.

Cromwell: 1 f. 11.11.10, A.M. C.E. Clarke.

Freehold Range, 4,000 ft.: 2 m. CDA, DDB, 31.12.35, DM, S. Lindsay.

Jack's Pass, Hanmer: 1 m. 10.1.32, CM, S. Lindsay.

Mt. Grey, Cant.: 1 m. DDG, 1 f. DDE, DM, 1 m. CM, 1 f. 22.10.23, CM, 2 m. 13-15.11.23, CM, 1 m. 1 f. 30.9.28, CM, 1 m. DDA, DM, 2 m. 1 f. 20.10.29, CM; S. Lindsay.

Mt. Ida: 1 m. 22.10.23, AM, C.E. Clarke.

Mt. Oxford, Cant.: 1 m. no date, CM, 1 m. DDH, DM, 1 m. CM, 9.10.32, S. Lindsay.

Mt. Peel, 3,000 ft. Nel.: 1 m. 1 f. 17.1.30, CM, S. Lindsay.

Obelisk: 1 m. 1 f. 4.11.16. AM, C.E. Clarke.

Otarama: 7 m. 3 f. 17-22, 10.21, CM, G. Archey.

Queenstown: 2 m. DDC, DDF, 2.11.34, DM, G. Howes.

Taeri Gorge: 1 m. DDI, 1 f. DDD, 24.10.39, DM, G. Howes.

Whiterock, Cant.: 1 m. Nov. 1919, ED, S. Lindsay.

REMARKS: I found this species frequently confused with pale specimens of O.mylytes in New Zealand museum collections. Although the pale fuscous streaking of O.tritonellus is usually quite distinctive, separation by genitalia characters is decisive. The spur of the aedoeagus curves dorsad in O.mylytes, but ventrad in O.tritonellus, where it is always weakly chitinised. In the latter species of course, the juxta is absent. In the female of O.mylytes the ostium is not encircled.

Phylogenetically this is sister species to O.machaeristes, and seems to have diverged mainly into the sub-100 inch isohyet regions of the South Island while O.machaeristes has developed in the west of the island; however O.tritonellus in the Tasman mountains is of course within the 200 inch isohyet (Burrows, 1967, fig. 1).

Variation in this species is restricted to size (within limits given earlier)

and intensity of the fuscous streaking of the forewings.

SPECIES GROUP 3.

Frons smooth, planoconvex. Cornuti absent from aedoeagus. Saccus undeveloped. Juxta present in subgroup 3a, absent in subgroup 3b. (fig.3).

Subgroup a.

Contains four species, all restricted to the South Island of New Zealand.

O.melampetrus alone ranges the length of the main axis, and is also found in the Tasman Mountains. O.ventosus is restricted to the Tasman Mountains, and O.clarkei (two subspecies), is found from Franz Joseph southwards into Fiordland.

O.scoparioides is distributed only in the far south.

Group 3a. KEY TO SPECIES: male genitalia

- 1 Aedoeagus without ornamentation scoparioides
- Aedoeagus ornamented 2
- 2 Aedoeagus with apical spur turned dorsad 3
- Aedoeagus with apical spur turned ventrad ventosus
- 3 Apical thorn of aedoeagus a very characteristic recurved sickle shape melampetrus
- Apical thorn slightly curved, simple clarkei

Orocrambus clarkei clarkei Philpott

Orocrambus clarkei Philpott, 1930, Rec. Auckland Inst. Mus., 1, p.3.

Tauroscopa nebulosa Philpott, 1930, Rec. Auckland Inst. Mus., 1, p.3.

Holotype m. in Auckland Museum, together with paratype m. author's preps BMT, BMR, labelled "Mt. Moltke 5,000 ft. Franz Joseph Cl 20.1.25. Orocrambus clarkei Philp. Westland Co. South Island New Zealand. Auckland Museum".

Holotype m. in Auckland Museum, together with paratype m. author's prep BMS, labelled "Mineret Pk L. Wanaka 30.12.20. Tauroscopa nebulosa Philp. C.E. Clarke Collection."

EXTERNAL CHARACTERS (Slides 15, 16): Detailed description by Philpott (1930), coloured illustrations by Hudson (1939; Plate LVI, Fig. 5 m. *Tauroscopa nebulosa*, Fig. 6 m. *Orocrambus clarkei*), with abbreviated descriptions. Eye nocturnal type, wing span 20 - 25 mm. Female of this subspecies not known. Easily confused with several species of Tauroscopa on externals, but quite distinct on genitalia characters in both sexes. Differs from O.c.eximia externally in lacking the clear white hindwings. Venation (figs. 18, 19, 20).

MALE GENITALIA (Fig. 56, paratype clarkei): As for generic and species group description except for following: Arms of vinculum about $\frac{1}{2}$ uncus. Saccus not developed, arms of vinculum meeting with rounded apex. Juxta a broad lunate plate. Costa of valve flanged, dorsal margin about $\frac{7}{8}$ uncus. Sacculus flanged. Gnathos tapered, pointed, equal to uncus. Aedeagus tubular, $2\frac{3}{4}$ x uncus, length to median breadth ratio $7\frac{1}{2}:1$, apex broad, truncate, dorso-ventrally compressed. Large apical spur in dorsal midline curved dorsad.

LARVA: Not known.

HOST PLANT: Not known, but coincident with the range given for Chionochloa oreophila (snow patch grass) by Burrows (1967), which is not found below 3,800 ft.

DISTRIBUTION (Fig. 238): Main axis of the South Island ranges above 5,000 ft. from Franz Joseph ($43^{\circ}25'$ S) to Lake Wanaka ($44^{\circ}40'$ S). Flight period December and January.

MATERIAL EXAMINED: 4 m.

Mineret Peak, Lake Wanaka: 2 m. (holotype and paratype (BMS) T.nebulosa), 30.12.20, AM, C.E. Clarke.

Mt. Moltke, Franz Joseph, 5,000 ft.: 2 m. (holotype and paratype (BMR) C.clarkei) 20.1.25, AM, C.E. Clarke.

REMARKS: This species was quite sufficient to destroy any remaining faith I might have had in the value of venation as the final test of taxonomic and systematic relationships in the Crambinae. Within the one species O.clarkei, I found variation in both fore and hindwing venation. In the paratype of nebulosa, although the genitalia were identical in detail with those of the

paratype of clarkei, veins Sc and r_1 are free from rr (fig. 19). On Meyrick's criteria this specimen could find no place in the Crambinae. In both the nebulosa and clarkei paratypes r_5 is stalked with r_4 in the forewing (figs. 18, 19) but in both Humboldt Range and Homer saddle specimens of the other subspecies O.c.eximia forewing r_5 is completely free (fig. 20). The male genitalia in both subspecies are almost identical, except that the aedoeagus thorn in O.c.eximia is somewhat more massive and sharply hooked relative to the condition in O.c.clarkei.

I am almost at a loss to know how to treat this species, but I have made the subspecific split on the basis of the forewing venation differences, which are backed up by different geographical distributions. I regard the hindwing venation difference as of less importance than that in the forewing since one of the O.c.clarkei specimens (the holotype) shows attenuation of the link between Sc and r_1 , a transition to the total lack of a cross connection in the nebulosa paratype.

This species requires more study, but the difficulties of obtaining large quantities of specimens are considerable. The species is a fast flyer with excellent disruptive camouflage. The flash of white of ~~the~~ hind wings is easily following in flight, but this is lost when the species drops suddenly and closes its wings (Mr. J.S. Dugdale, pers. comm).

Orocrambus clarkei eximia (Salmon) comb.nov.

Tauroscopa eximia Salmon, 1946, Rec. Dom. Mus. Wellington, 1, p.6.

Holotype m. in Dominion Museum, Wellington, author's genit prep PCA, labelled "Homer, 1.1.45".

Allotype f. in EDNZ, author's genit prep GGV, labelled "Humboldt Range, peak between Lake Howden and Lake McRoberts, 5,000 ft. 10.1.66, J.S. Dugdale."

EXTERNAL CHARACTERS (Slide 17): Detailed description by Salmon (1946), coloured illustration by Hudson (1951, Plate VII, Fig. 4 m) with abbreviated description. Female frenulum sextuple, wing span 24 - 26 mm (both sexes), hind wings white, compared with muddy brown in O.c.clarkei.

MALE GENITALIA: As for O.c.clarkei (Fig. 56) except that thorn of aedoeagus is slightly more massive and hooked.

FEMALE GENITALIA (Fig. 142, allotype): As for generic description except for the following: Eighth abdominal tergite encircling ostium bursae, as wide ventrally as in dorsal midline, anterior apophyses represented by very short triangular projections in lateral midlines of anterior margin of tergite. Eighth sternite a strong lunate plate. Ductus bursae $3\frac{1}{2}$ x length of anal papillae, strong to and narrowing at $\frac{3}{8}$ ductus seminalis separating just after $\frac{3}{8}$. Ostium a broad dorso-ventrally flattened funnel; corpus bursae with two very unequal signa.

LARVA: Not known.

HOST PLANT: See remarks in this section under O.c.clarkei.

DISTRIBUTION (Fig. 238): Homer Saddle and Humboldt Range above 4,000 ft.

Flight period January.

MATERIAL EXAMINED: 3 m. 1 f.

Homer Saddle: 1 m. (holotype T.eximia) PCA, 1.1.45, DM, J.T. Salmon.

Humboldt Range, 5,000 ft. between Lake Howden and Lake McRoberts: 1 f. (allotype) GGV, 10.1.66, FRI (ED), J.S. Dugdale.

Mt. Gertrude, 4,700 ft.: 2 m. CGW, 18.1.63, FRI, J.S. Dugdale.

REMARKS: See this section under O.c.clarkei.

Orocrambus melampetrus Purdie

Orocrambus melampetrus Purdie, 1884, New Zealand Journal of Science (Dunedin) 2, p.168.

Orocrambus melampetrus Meyrick, 1885, New Zealand Journal of Science (Dunedin) 2, p.133.

Purdie's specimens appear to be lost. They have not been deposited in the British Museum or any New Zealand Museum. I therefore designate a neotype based on one of the specimens examined by Meyrick.

Neotype m. in CMNZ, author's prep AGC, labelled "Mt. Hutt Jan 1877, RWF."

EXTERNAL CHARACTERS (Slide 18): Full description by Meyrick (1885), coloured figure by Hudson (1928, Plate XX, Fig. 26 f.) with abbreviated description. Female frenulum triple, eye diurnal type. Wing span 24 - 28 mm (both sexes). This species is at once distinguished from any other known by the very dark brown forewings with obscure transverse markings.

MALE GENITALIA (Fig. 57): As for generic and species group description except for the following: Arms of vinculum about equal to uncus. Saccus undeveloped, arms of vinculum coming together at rounded apex. Juxta a weak U-shaped structure. Costa of valve flanged, dorsal margin almost equal to uncus. Sacculus flanged. Gnathos tapered, pointed, equal to uncus. Aedoeagus tubular, $3\frac{1}{2} - 3\frac{3}{4}x$ uncus, length to median breadth ratio about 8:1, with a characteristic recurved sickle-shaped apical thorn or spur.

FEMALE GENITALIA (Fig. 143, from Mt. Hutt specimen): As for generic description except for the following: Eighth abdominal tergite fusing dorso-laterally and diagonally with ostium bursae; anterior apophyses represented by short triangular projections in lateral midlines of anterior margin of tergite. Eighth sternite a strong lunate plate. Ductus bursae 6 - 7x length of anal papillae, very strong to and narrowing at $\frac{3}{8}$, osiolar pouch region deeply corrugated and pleated, ductus seminalis joining ductus bursae at $\frac{1}{2}$. Corpus bursae with two very unequal oval signa.

LARVA: Not known.

HOST PLANT: Not known, but the known distribution of this species is closely coincident with that given for Chionochloa flavescens (broad-leaved snow-grass) by Burrows (1967), and also Ch.pallens (mid-ribbed snow-grass).

DISTRIBUTION (Fig. 239): Alpine grasslands of the South Island main axis from 3,800 ft. to the edge of the permanent snow-line. The altitudes at which this species has been recorded by Mr. J.S. Dugdale in the Remarkables (5,700 - 7,000 ft.) and the Wairau Mountains (up to 6,500 ft.) casts some doubt on the possibility of Ch.flavescens as a food plant, as this species apparently reaches its limital altitude at about 5,000 ft. (Burrows, 1967). Flight period is from December to mid-February.

MATERIAL EXAMINED: 46 m. 10 f.

6 m. no date or locality, CM, R.W. Fereday, probably Mt. Hutt.

Arthur's Pass, 4,500-5,000 ft.: 1 f. 4.12.08, DM, G.V. Hudson; 1 m. ICA, 1 f. ICC, 1-4.12.22, DM, H. Hamilton; 3 m. 24.1.23, AM, C.E. Clarke; 2 m. 17-21.1.27, DM, G.V. Hudson.

"Black Butterfly Mountain", Cant.: 1 m. AGD, 1.1.1869, CM, R.W. Fereday.
 Craigieburn: 1 m. ICB, 30.12.44, DM, S. Lindsay.
 Franz Joseph Glacier, 5,600 ft.: 4 m. CM, 1 m. ICD, DM, 6 m. 2 f. AM, 20.1.25,
 C.E. Clarke.
 Freehold Range, 4,000 ft.: 2 m. 31.12.35, CM, S. Lindsay.
 Hooker: 1 m. 13.12.29, CM, A. Philpott
 Mt. Arthur, 5,000 ft.: 1 m. Jan. 1889, ED, G.V. Hudson.
 Mt. Cedric: 1 m. 18.1.27, ED, A. Philpott.
 Mt. Gertrude, 4,700-5,200 ft.: 1 m. 18.1.63, FRI, J.S. Dugdale.
 Mt. Hutt: 1 m. AGC, Jan. 1877, CM, R.W. Fereday; 6 m. AGG, 3 f. AGE, AGF,
 25.12.32, CM, S. Lindsay.
 Mt. Owen, 5,300 ft.: 1 m. CBA, 1 f. CBB, 16.1.65, FRI, J.S. Dugdale.
 Mt. Phipps, 3,800-4,800 ft.: 1 m. 1 f. Dec. 1959, FRI, J.S. Dugdale.
 Mt. Starvall: 1 m. 25.1.26, ED, A. Philpott.
 Mt. Torlesse: 1 m. no date, CM; 1 f. ICE, 20.12.36, DM, S. Lindsay.
 Nuggety Basin, Mt. Owen, 5-5,200 ft.: 1 m. TDB, 13.1.65, FRI, J.S. Dugdale.
 Remarkables, 5,700-7,000 ft.: 1 m. 15.1.66, FRI, J.S. Dugdale.
 Vanguard Peak: 1 m. 8.1.1909, ED, G.V. Hudson.
 Wairau Mountains, Mt. Iris Ridge, 4,000-6,500 ft.: 1 m. 16.2.66, FRI, J.S. Dugdale.

REMARKS: This is the type species of the genus, and although technically the species must be attributed to Purdie, it is evident that some unintentional pre-publication was involved (see pp. 61). Meyrick (1885), makes reference to the brief descriptive note by Purdie (1884) and suggests that there may be two similar species, one with pale fascia and the other with dark fascia. However I have found only one species with considerable variation in fascies from very dark brown to pale brownish yellow. Purdie's description is in fact so brief that any comparison is rather futile. However he does state clearly that he compared his own specimens with some labelled by Meyrick, and decided they were without doubt the same species.

O. melampetrus frequents broken fellfield at altitudes of more than 4,500 ft, and is highly adapted to these conditions, with a colour pattern suited to the fractured rock with its patches of black lichens. It has a number of other adaptations to life at high altitudes; the labial and maxillary palpi are excessively hairy, and the blackish brown colour of the

forewings is a character suited to rapid and efficient absorption of solar energy (Downes, 1965).

Phylogenetically this species is sister species to O. clarkei; the diagonal fusion of the eighth abdominal tergite with the ostium bursae suggests a tendency for encirclement of the ostium as in O. clarkei. However the greatly enlarged ostiolar pouch region of O. melampetrus is a peculiar feature paralleled by a similar development in O. tuhualis (Group 7b).

Orocrambus scoparioides Philpott.

Orocrambus scoparioides Philpott, 1914, Trans. N.Z. Inst. 46, p. 119.

Holotype m. in EDNZ, two paratype m. in EDNZ and six paratype m. in DMNZ, labelled "Ben Lomond 8.1.14, Orocrambus scoparioides Philpott"

EXTERNAL CHARACTERS (Slide 19): Detailed description by Philpott (1914), coloured illustration by Hudson (1928, Plate XLV, Fig. 1) with abbreviated description. Female frenulum triple, eye diurnal type. Wing Span 13 - 16 mm (male), 14 - 20 mm (female). The truncate termen of the brown forewings, the distinct subterminal line and other vertical markings, and especially the distinct reddish tinge found in most males, give this species a very strong superficial resemblance to some of the endemic Scoparia species of the ergatis group (Hudson, Plate XXII, Fig. 28), but at once distinguish it from any other Orocrambus so far known.

MALE GENITALIA (Fig. 58): As for generic and species group description except for following: Arms of vinculum about equal to uncus; Saccus not developed, apex where arms of vinculum join excavate or truncate. Juxta a curved plate. Costa

of valve flanged, dorsal margin equal to or slightly longer than uncus. Gnathos tapered, pointed, equal to uncus. Aedoeagus a simple unadorned tube, 3x uncus, length to median breadth ratio 7-8:1.

FEMALE GENITALIA (Fig. 144): As for generic description except for following: Eighth abdominal tergite fusing dorsally with ostium bursae, about twice as wide at fusion as in dorsal midline, anterior apophyses represented by short triangular projections in lateral midlines of anterior margin of tergite. Eighth sternite absent. Ductus bursae $3\frac{1}{2}$ - 4x length of anal papillae, strong to and narrowing at $\frac{1}{4}$, ductus seminalis joining at $\frac{1}{2}$. Ostium a broad dilate funnel. Corpus bursae with two very unequal oval signa.

LARVA: Not known.

HOST PLANTS: Not known.

DISTRIBUTION (Fig. 240): Ranges in Otago and Southland above altitudes of about 3,000 ft. Flight period December to April.

MATERIAL EXAMINED: 22 m. 2 f.

Ben Lomond, 3,500 ft.: 9 m. 8.1.14, ED (Holotype, 2 paratypes), DM, (6 paratypes), A. Philpott; 8 m. ADA, ADB, ADD, ADE, ADG, ADH, 14.1.16, DM. C.E. Fenwick; 1 m. AGN, CM, 1 m. DM, 22.12.22; 1 m. Jan. 1922, CM, A. Philpott.

Commissioner's Creek: 1 m. 3.2.13, ED, A. Philpott.

Mt. Burns: 1 m. 24.1.17, ED, A. Philpott.

Mt. Cleughearn, 3,500 ft.: 1 f. IGM, 21.1.14, DM, A. Philpott.

Paradise: 1 f. IGL, 15.4.13, DM, C.E. Fenwick.

REMARKS: Variation in the species is considerable, with one female specimen in the Dominion Museum collection as large as O.thymiastes, and with the markings so obscure it resembles a small specimen of O.ventosus. It was in fact in a series labelled ventosus. However the two species are abundantly distinct on genitalia characteristics. Variation in the males is largely confined to the distinctness or otherwise of the transverse markings.

O.scoparioides is, in male genitalia characters, the most distinct of this species subgroup, being the only species lacking all aedoeagal ornamentation.

However the female genitalia show no atypical features, except that the degree of fusion of the eighth tergite with the ostium bursae and the position of the fusion lines suggests that this is relatively at a more primitive stage than in any other species in the subgroup.

Orocrambus ventosus Meyrick

Orocrambus ventosus Meyrick 1920, Trans. N.Z. Inst., 52, p. 30.

Lectotype f. in Dominion Museum, Wellington, author's prep. GFD, labelled "Mt. Arthur, 4,300 ft., 7.1.19, S. Hudson" and 1 paralectotype with identical data. See also remarks section.

EXTERNAL CHARACTERS (Slide 20): Detailed description by Meyrick (1920), coloured illustration by Hudson (1928, Plate XLVIII, Fig. 15 m, 16 f.), with abbreviated description. Female frenulum triple, eye diurnal type. The plain dark brown forewings distinguish this species from all species except O.melampetrus, and it is distinct from the latter in lacking transverse markings. Wing span 25 - 31 mm (both sexes).

MALE GENITALIA (Fig. 59): As in generic and species group description except for following: Arms of vinculum about $\frac{1}{2}$ uncus; Saccus undeveloped, apex of arms of vinculum truncate or slightly excavate. Juxta a heart-shaped plate. Costa of valve flanged, about equal to uncus. Gnathos tapered, pointed, equal to or slightly longer than uncus. Aedoeagus tubular, apically dilate, $2\frac{1}{2} - 2\frac{3}{4}x$ uncus, length to median breadth ratio 6:1, ventrally chitinised from apex to $\frac{1}{2}$, with large apical thorn set ventro-sinistrad.

FEMALE GENITALIA (Fig. 145): As for generic description except for following: Eighth abdominal tergite fusing dorso-laterally with ostium bursae, nearly twice as wide at fusion as in dorsal midline, anterior apophyses represented by short triangular projections in lateral midlines of anterior margin of tergite. Eighth sternite a strong lunate plate. Ductus bursae $4\frac{1}{4} - 4\frac{1}{2}x$ length of anal papillae, strong to $\frac{1}{4}$, with ductus seminalis joining at $\frac{1}{2}$. Ostiolar pouch swollen, ostium a vase-shaped broad funnel slightly crimped laterally at mouth. Corpus bursae

with two oval nearly equal signa.

LARVA: Not known.

HOST PLANTS: Not known, but the restricted distribution of the species is closely coincident with that shown for Chionochloa australis (carpet grass) by Burrows (1967).

DISTRIBUTION (Fig. 241): Ranges of the Nelson Province above 4,000 ft. flying over open grassy slopes (Hudson, 1928). Flight period December to February.

MATERIAL EXAMINED: 12 m. 6 f.

Burgoo Creek, Cobb, Tasman Mts.: 2 m. 6.12.62, FRI, J.S. Dugdale.

Gordon's Pyramid, 4,000 ft. Nel.: 2 m. 1 f. ED, 1 f. AM, 16.1.22, A. Philpott, 1 m. AGL, 25.1.24, CM, S. Lindsay.

Mt. Arthur, 4,300 ft.: 1 m. 1 f. ED, 2 f. GFD, GFE, DM, 7.1.19, S. Hudson (lectotype and paralectotype).

Mt. Owen, 4,300-5,400 ft. Nel.: 2 m. 1 f. TDC, 16.1.65, FRI, J.S. Dugdale.

Nuggety Basin, Mt. Owen, 5,000 ft.: 3 m. TDD, 2 f. TDA, TDE, 13.1.65, FRI. J.S. Dugdale.

Speargrass Ck, 4,600 ft. Nel.: 1 m. 4.2.64, FRI, J.S. Dugdale.

REMARKS: Dr. S. Bleszynski (in litt.) tells me he has selected an MS lectotype from among British Museum syntypes for this species. However the label data for this specimen (and the paralectotype) read "Mt. Arthur New Zealand GVH. 4,200' 1.18". Now neither the captor (G.V. Hudson rather than S. Hudson), the altitude (4,200' compared with 4,300') or the year (1918 rather than 1919), conform with the information clearly given by Hudson himself (1928, p.159). Although this is probably merely an example of careless labelling by Meyrick, I cannot agree to using this specimen as a lectotype. I have therefore selected one of the syntypes of the Hudson collection for this role.

Phylogenetically this species is close to O.melampetrus, but does not show the extreme development of the ostiolar pouch region as in that species, and also has affinities in male genitalia structures with O.clarkei.

Variation in this species is generally in size, and in the amount of whitish streaking in the interneural spaces of the terminal third of the forewings.

Most specimens appear a rather drab brown, and the whitish streaking is apparent only when the specimen is examined closely. One or two extreme specimens approach the forewing pattern of O. tritonellus.

Subgroup 3b

Contains three species with planoconvex frons O. ephorus, O. oppositus and O. philpotti which are confined to the South Island, and a single species with a conical frons, O. angustipennis, which ranges throughout the North and South Island. O. ephorus and O. oppositus are alpine, P. philpotti alpine and subalpine, and O. angustipennis lowland. O. philpotti is anomalous in possession of a juxta, but is placed here because of affinities to oppositus. (fig.3).

Group 3b. KEY TO SPECIES: male genitalia

- | | | |
|---|--|----------------------|
| 1 | Juxta present, aedoeagus with single strong dorsal apical thorn | <u>philpotti</u> |
| - | Juxta absent, aedoeagus with apical spur | 2 |
| 2 | Lateral thorn on aedoeagus as well as spur | 3 |
| - | Flattened spur with asymmetrical apex, no extra lateral thorn | <u>oppositus</u> |
| 3 | Lateral thorn sinistrad at about $\frac{1}{3}$, ventral portion of valval costa flange not produced into a distinct "tooth" | <u>ephorus</u> |
| - | Lateral thorn dextrad at about $\frac{1}{2}$, ventral portion of valval costa produced into distinct "tooth" | <u>angustipennis</u> |

Orocrambus ephorus (Meyrick) comb.nov.

Crambus ephorus Meyrick, 1885, Trans. N.Z. Inst., 17, p. 135.

Crambus corylana Clarke, 1936, Trans. N.Z. Inst., 56, p. 417.

Holotype m. in British Museum (Natural History), slide BM pyral 7960, labelled "Arthurs Pass New Zealand 4800 ft. 29/1/83".

Holotype m and 7 m. paratypes of corylana in Auckland Museum labelled "Mt. Ida 19.2.22, C.E. Clarke".

EXTERNAL CHARACTERS (Slides 21, 22): Detailed description by Meyrick (1885), coloured illustration by Hudson (1928, Plate XLVIII, Fig. 17 m.) and abbreviated description, of ephorus; no illustration of corylanus (= corylana) but brief description by Hudson (1928), based upon the detailed type

description of corylana by Clarke (1926). Eye intermediate nocturnal/diurnal type, female frenulum quadruple. The only species in the genus with horizontal white and yellow-orange colouring. In form corylana tending pale lemon yellow. Wing span 31 - 39 mm (both sexes).

MALE GENITALIA (Fig. 60 topotype): As for generic and species group description except for following: Arms of vinculum about $\frac{3}{4}$ uncus; Saccus not developed. Costa of valve flanged, toothed dorsally, dorsal margin of costa slightly less than uncus. Sacculus not developed. Gnathos tapered, pointed, equal to uncus. Aedoeagus $2\frac{1}{4}$ x uncus, length to median breadth ratio about 7:1, tapered apically with aperture of ductus dilate and turned dextrad; lateral thorn sinistrad at about $\frac{1}{3}$; long apical spur accounting for about $\frac{1}{3}$ total length of aedoeagus.

FEMALE GENITALIA (Fig. 146 topotype): As for generic description except for following: Eighth abdominal tergite fusing dorso-laterally with ostium bursae, half as wide at fusion as in dorsal midline. Eighth sternite a strong lunate plate. Ductus bursae 6 - 7x length of anal papillae, strong to $\frac{1}{3}$, ductus seminalis joining at $\frac{1}{2}$. Ostium a poculiform funnel with exaggerated dorsal lip, opening ventrad. Corpus bursae with two equal oval signa.

LARVA: Not known.

HOST PLANTS: Not known. In view of the great similarity of forewing pattern between this species and O.angustipennis one might at once assume adaptation to a similar food plant. However the foodplants of O.angustipennis (Cortaderia spp) do not extend into the alpine zone (Zotov, 1963).

DISTRIBUTION (Fig. 24.2): Alpine tussock grasslands of the Nelson, Arthur's Pass and central Otago regions. Distribution apparently discontinuous, above 4,000 ft. Flight period November to February.

MATERIAL EXAMINED: 23 m. 2 f.

Arthur's Pass, 4,000 ft.: 1 m. ZAE, 21.1.22, DM, A. Hamilton; 1 m. ZAD, 7.2.22, DM, G.V. Hudson; 1 m. BGG, 24.1.23 DM, 1 m. ED, 1 f. CM, 9.2.26; S. Lindsay; 6 m. ZAB, ZAC, ZAF, FFK, FFL, FFM, 1 f. FFJ, 16-20.1.28, DM, G.V. Hudson; 6 m. 23.1.28, ED, S. Lindsay and A. Philpott; 2 m. ZAA, FFN, 14-24.1.33, DM, G.V. Hudson.

Cave Creek, Craigieburn, 4,000 ft.: 2 m. BGH, BGI, 27.12.34, CM, S. Lindsay.
 Lake Sylvester, 4,300 ft. Nel.: 1 m. 9.2.66, FRI, J.S. Dugdale.
 Mt. Arthur, 4,000 ft.: 2 m. 2.2.23, ED, A. Philpott.
 Mt. Ida: 8 m. (holotype and 7 paratypes), 19.2.22, AM, C.E. Clarke.

REMARKS: O. ephorus shares with O. angustipennis a number of apomorphic characters in the male genitalia, and apparently also in the unusual patterning of the forewings, although the latter could be the result of parallelism. It is largely the strong affinity between these two species, despite the different frons construction in both, which leads me to discard the latter as a character representing a basic anatomical schism within the genus.

Variation in the depth of the yellow colour of the forewings is considerable, possibly also depending on the amount of wear a specimen has had before capture. I have found all intermediate stages between typical ephorus and typical corylanus, both in the colour and also the extent of the yellow. Specimens from Craigieburn, Tasman Mountains and Mt. Ida were all of the corylanus form. Some differences in the shape and relative size of the apical spur of the aedoeagus were noted between specimens from Arthur's Pass and Craigieburn. I do not see a strong case for retention of O. corylanus as a valid subspecies, but this is a problem which should be examined again in the future when far more material is available for study.

Orocrambus oppositus (Philpott) comb.nov.

Crambus oppositus Philpott, 1915, Trans. N.Z. Inst., 47, p. 197.

Holotype m. and allotype f, 2 paratype m. and 3 paratype f. in EDNZ; 3 paratype m. in DMNZ, author's preps CAF, FFD, FFE, 3 paratype f. in DMNZ author's preps FFA, FFH, FFI; - all labelled "Cleughearn 22.1.14, 3,500' A. Philpott".

EXTERNAL CHARACTERS (Slide 23, 24): Detailed description by Philpott (1915), coloured illustration by Hudson (1928, Plate XLIV, Fig. 1m, Fig. 2 f.) with abbreviated description. Female frenulum quadruple, eye diurnal type. Wing span 29 - 31 mm (both sexes). The large size, dark bronze colour of the forewings and the sinuate termen make this species very distinctive.

MALE GENITALIA (Fig. 61, paratype): As for generic and species group description except for following: Arms of vinculum about $\frac{1}{2}$ - $\frac{2}{3}$ uncus; Saccus

not developed; Costa of valve flanged, dorsal margin equal to or slightly less than uncus. Sacculus not developed. Gnathos tapered, pointed, equal to uncus. Aedoeagus tubular, $2\frac{3}{4}$ - 3x uncus, length to median breadth ratio 7-8:1, with flattened apical spur.

FEMALE GENITALIA (Fig. 147, paratype): As for generic description except for following: Eighth abdominal tergite encircling ostium bursae, as wide in ventral as in dorsal midline, anterior apophyses represented by very short blunt triangular projections in lateral midlines of anterior margin of tergite. Eighth sternite a strong lunate plate. Ductus bursae 4 - 5 x length of anal papillae, lightly chitinised to $\frac{1}{3}$, narrowing at $\frac{1}{3}$, ductus seminalis joining at $\frac{5}{8}$. Ostium bursae a moderately broad funnel, ostiolar pouch region barely swollen in relation to mouth. Corpus bursae with two equal oval signa.

LARVA: Not known.

HOST PLANTS: Not known, but the limited southern distribution of this species is very closely coincident with that shown for Chionochloa teretifolia, hairy snow grass, by Zotov (1963) and Burrows (1967).

DISTRIBUTION (Fig. 243): Tussock grasslands of the ranges to the south of Lake Te Anau and Lake Manapouri, at about 3-4,000 ft. Flight period December to February.

MATERIAL EXAMINED: 34 m. 23 f.

The Hump Range: 5 m. FFF, CAA, 4 f. CAB, CAC, CAD, FFG, 23-25.12.15, DM (2 m. 4 f.) ED (3 m.), A. Philpott; 1 m. 28.2.19, ED, A. Philpott.

Hunter Mountains, 4,000 ft.: 1 m. FFC, DM; 2 m. CM, 1 f. ED, 31.12.22, A. Philpott; 8 m. 8 f. AM, 9 m. ED (1), CM, 2 f. FFB, DM; 5-6.1.23, A. Philpott and S. Lindsay.

Mt. Cleughearn, 3,500 ft.: 6 m. (holotype, ED, 5 paratypes, DM (2), CAF, FFD, FFE, ED (2),), 7 f. (allotype, ED, 5 paratypes, DM (2) FFA, FFH, FFI, ED, (3),), 22.1.14, A. Philpott; 1 f. CAE, 13.1.16, DM, G. Howes.

REMARKS: This is one of the few species of Orocrambus where a sexual colour difference is seen. The hindwings of the males are grey-brown, while those of the female are white. The frenulum of the female is quadruple, a feature only found

otherwise in O. ephorus. Only in the species of Group 3 is the female frenulum tending towards further division beyond 3 elements, (sextruple in O. clarkei).

It has been noted earlier that O. philpotti is indifferent to the subgrouping within species group 3, retaining the juxta, but there is such a close affinity phylogenetically between O. philpotti and O. oppositus that the former is placed, on balance of characters, in this subgroup. O. oppositus and O. philpotti share a very distinctive slightly sinuate termen in the forewing.

Orocrambus philpotti sp. nov.

Holotype m. in Entomology Division (Nelson), author's prep. DGJ, and allotype f, author's prep. EGA, both labelled "Iron Hill, 4,700-5,500 ft. 9.3.66 J.S.D.". All specimens apart from holotype and allotype in "Materials examined" section are paratypes.

EXTERNAL CHARACTERS (Slide 25): Forewings golden bronze-brown with white median streak from base to termen. Termen sinuate. Hindwings glossy, whitish. Palpi golden brown laterally, white medially, about three times as long as eye. Female frenulum composed of three elements of which one consists of two fused or partly fused elements. Eye nocturnal type, wing span 26 - 35 mm (both sexes).

MALE GENITALIA (Fig. 62): As for generic and species group description except for the following: Arms of vinculum about $\frac{2}{3}$ uncus; Saccus not developed, fusion point of arms of vinculum deeply excavate. Juxta a bent triangular plate with long sides concave. Costa of valve flanged, dorsal margin equal to uncus. Sacculus with small flange. Gnathos tapered, pointed, equal to uncus. Aedoeagus tubular, $2\frac{1}{2}x$ uncus, length to median breadth ratio 7-8:1, strong from apex to $\frac{1}{3}$ with subapical thorn dorsad.

FEMALE GENITALIA (Fig. 148): As for generic description except for following: Eighth abdominal tergite fusing dorso-laterally with ostium bursae, half as wide at fusion as in dorsal midline. Eighth sternite a weak lunate plate. Ductus bursae about 7x length of anal papillae, strong to $\frac{3}{8}$, ductus seminalis joining at $\frac{5}{8}$. Ostiolar pouch region hardly swollen relative to ostium, ostium bursae forming a broad even funnel. Corpus bursae with two very unequal oval signa.

LARVA: Not known.

HOST PLANTS: Not known. The broad range of the species is coincident with that given for Chionochloa rubra (red tussock) by Zotov (1963) and Burrows (1967). Altitudes for Ch.flavescens by Burrows (ibid) have their maximum too low for agreement with all records of O.philpotti, but this is also a possibility.

DISTRIBUTION (Fig. 244.): Alpine and subalpine tussock grasslands of the central South Island from Tasman Mountains to Tekapo region. Flight period December to February.

MATERIAL EXAMINED: 77 m. 24 f.

Arthur's Pass, 3,000 ft.: 1 m. JDE, 25.12.14, DM; 1 f. JDF, Jan 1916, DM; G.V. Hudson; 1 m. 3.f. 2.2.19, AM, C.E. Clarke; 1 m. 19.1.22, ED, A. Philpott; 2 m. 2 f. 27.1.22, AM, C.E. Clarke; 1 f. JDG, 24.1.23, DM, 1 f. AM, 1 m. JDA, 2 f. JDC, JDD, DM, 14-21.1.27, G.V. Hudson; 1 m. 1 f. 23.1.28, ED, A. Philpott; 1 m. 1.1.32, 1 m. 1.1.42, CM, S. Lindsay.

Burgoo Creek, 4,900 ft. Nel.: 1 m. UBJ, 6.12.62, FRI, J.S. Dugdale.

Blue Creek: 1 m. UBR, 14.1.65, FRI, J.S. Dugdale.

Broken River, Cant.: 2 m. 24-5.12.34, CM, S. Lindsay.

Cascade Creek, Angelus Basin, 4-7,000 ft.: 4 m. UBG, UBH, UBO, UBP, 1 f. XBA, 5-9.2.64, FRI, J.S. Dugdale.

Cupola Basin, 4,650 ft.: 5 m. UBF, UBI, UBL, UBT, UBT, 8-10.1.65, FRI, J.S. Dugdale.

Dun Mountain, 3,500 ft. Nel.: 1 m. 3.1.21, 1 m. 6.1.21, 1 m. 8.1.21, 3 m. 24.1.21; ED, A. Philpott.

Iron Hill, 4,700-5,500 ft.: 1 m. DGJ, 3 f. EGA, EGG, EGM, 9.3.66, FRI, J.S. Dugdale.

Jack's Pass, Hanmer: 5 m. AGZ, 1 f. 9.2.31, CM, S. Lindsay.

Lake Ohau: 2 m. 1 f. 25.12.35, 1 m. 2.1.36; CM, S. Lindsay.

Lake Peel, 4,600 ft. Nel.: 1 f. JDB, 3.2.10, DM, G.V. Hudson.

Lake Tekapo: 2 m. CM, 1 m. ED, 23-4.12.28, S. Lindsay.

Mt. Arthur, 4,500 ft.: 1 m. 23.12.21, ED, A. Philpott.

Mt. Cedric: 1 m. 18.1.27, ED, A. Philpott.

Mt. Cook: 3 m. BGD, 1.1.29, CM, S. Lindsay.

Mt. Grey, Cant.: 6 m. 27.12.25, ED, W. Heighway; 10 m. 1 f. 28.12.25, 2 m. 1 f. 22.1.28, CM, S. Lindsay.

Mt. Luxmore, 3,500 ft.: 1 m. XBB, 3 f. XBC, XBD, XBE, 2.2.65, FRI, J.S. Dugdale.

Mt. Owen, 5,250 ft.: 5 m. UBE, UBK, UBM, UBS, 1 f. UBD, 13-16.1.65, FRI, J.S. Dugdale.

Nuggety Peak, 5-5,200 ft.: 2 m. UBA, UBB, 13.1.65, FRI, J.S. Dugdale.

Speargrass Hut, Main Ridge, Howard, 5,400-6,000 ft.: 1 m. UBN, 5.2.64, FRI, J.S. Dugdale.

Springfield, Cant.: 2 m. no date, ED, G.V. Hudson.

Waiho Gorge, Cant.: 1 m. 6.1.44, CM, S. Lindsay.

REMARKS: That the Crambus dicrenellus of Meyrick (1883), Philpott (1929) and Hudson (1928, 1939) consisted of O.dicrenellus and this species has been discussed in the section on O.dicrenellus. The resemblance is superficial only. The drawing given by Philpott (1929, Fig. 35) labelled C.dicrenellus Meyr. shows the male genitalia of O.philpotti.

This species is indifferent to the subgrouping within species group 3, and is placed with O.oppositus since they share the following apomorphic characters; the forewing termen is sinuate, an unusual feature in this genus, in exactly the same way in both species; the female frenulum in both species is composed of 4 elements, even though two are nearly always fused in O.philpotti the two parts of the composite are still easily recognisable and have their basal insertions distinct; and the male genitalia have all their features in common except that the dorsal chitinisation of the aedoeagus in O.oppositus has developed into a spur rather than a thorn and that the sacculus in O.philpotti has developed a small flange. (See fig.4).

Variation in O.philpotti is slight. Worn and faded specimens, especially those which have lost cilia so that the margin of the forewing termen is rather indistinct, are difficult to distinguish from O.dicrenellus except by an examination of the genitalia.

Orocrambus angustipennis (Zeller) comb.nov.

Chilo angustipennis Zeller, 1877, Horae Soc. ent. Ross., 13, p. 15.

Crambus angustipennis (Zeller) Meyrick, 1883, Trans. N.Z. Inst., 15, p. 22.

Holotype f. in British Museum (Natural History), Zeller collection, slide BM pyral 5579, labelled "Chilo angustipennis Neu Seeland Knaggs 11/69".

EXTERNAL CHARACTERS (Slides 26, 27): Brief description by Zeller (1877), detailed description by Meyrick (1883), coloured illustration by Hudson (1928, Plate XX, Fig. 38 f; 1939, Plate LXII, Fig. 9 m.), with abbreviated description (1928). Female frenulum triple, eye intermediate nocturnal/diurnal type, but tending

largely to nocturnal. Wing span 34 - 40 mm (male), 44-50 mm (female).

This species is at once separated from any other by its large size, acute forewing apices, and forewings marked horizontally with white anteriorly and brown posteriorly.

MALE GENITALIA (Fig. 63): As for generic and specific description except for following: Arms of vinculum $\frac{1}{2}$ uncus; Saccus not developed, apex where arms of vinculum join rounded or slightly excavate; Costa of valve flanged and the latter drawn into dorsal and ventral teeth, dorsal margin $\frac{3}{4}$ uncus. Sacculus not differentiated. Gnathos tapered, pointed, equal to uncus. Aedoeagus $2\frac{1}{2}$ - $2\frac{3}{4}$ uncus, length to median breadth ratio about 8:1, sharply tapering to long apical spur, with small thorn dextrad at about $\frac{1}{2}$.

FEMALE GENITALIA (Fig. 149, compared with type sketch by Dr. S. Bleszynski): As for generic description except for the following: Eighth abdominal tergite fusing dorso-laterally with ostium bursae, as wide at fusion as in dorsal midline, anterior apophyses represented by short triangular projections in lateral midlines of anterior margin of tergite. Eighth sternite a strong lunate plate. Ductus bursae $4\frac{1}{2}$ - 5x length of anal papillae, very swollen to $\frac{1}{2}$, strong to $\frac{1}{4}$ and laterally to $\frac{1}{2}$, slightly constricted at $\frac{3}{8}$ but ostiolar pouch region barely swollen in comparison to rest of ostiolar region, ductus seminalis joining at $\frac{3}{4}$. Ostium a broad funnel; corpus bursae with two unequal oval signa.

OVIPOSITION BEHAVIOUR: Although the larva is a stem-borer, the ovipositor of this species is not modified from the generalised generic pattern, and the anal papillae are not coalescent as in Chilo (Bleszynski, 1965). A captive gravid female of O.angustipennis was observed to drop 7 eggs while sitting on Cortaderia selloana, and crawling actively from leaf to leaf, shortly before dusk in February 1968. In each case the end of the abdomen was positioned so that the egg fell between one leaf blade and the next, coming to rest at the ligule.

EGG: Oblate, 36 - 41 vertical ribs, 1.02 - 1.04 x 0.52 - 0.58 mm. creamy white when first laid, turning orange after 24 - 36 hours. Duration of egg stage 10 - 11

days in December, 8 - 9 days in January, February. Gross embryological changes visible through shell as for O.flexuosellus (pp.100). Egg shell not consumed.

HATCHING BEHAVIOUR: As for O.flexuosellus (p.101) and O.heliostes. The egg hatches against the leaf base and the larva at once begins to spin a fragile chamber attached to the ligule. During the first instar the larva tunnels either upward, or more usually downward, through the tightly rolled leaf-bases.

LARVA (Fig. 218): Only reared through to the fourth instar. Length of fourth instar larva at rest 10 - 12 mm, dull pinkish brown above, dirty creamy white beneath. Head capsule and prothoracic shield brown mottled with darker blackish brown. On prothorax L2 slightly dorsocephalad of L1, SV2 slightly dorsocephalad of SV1. On Mesothorax and Metathorax: SD1 three or four times longer than SD2. On abdominal segments: On A1, 2; D1 longer than D2, SV2 closer to SV1 than SV3, SV1 slightly anterior to SV2, SV3. On A3-6; SV2 dorsad of SV1, SV3. On A7; SV1 ventro-caudad of SV2. On A9, 10; D2 very long, three to four times D1.

DURATION OF LARVAL INSTARS: Difficult to determine because of the boring habit. Frequent disturbance and the opening of the tunnels could have contributed to the considerable mortality of captive larvae. In one of the two colonies attempted, 32 first instar larvae hatched from 33 eggs, but only one was reared through the third instar, and this died a few days (found dead in burrow) after the fourth change. In the remaining two cultures all larvae were dead before the third instar was complete. No cause of death could be ascertained. Fungal hyphae in the walls of the tunnels were apparently saprophytic and were not attacking the larvae. Microscopic examination showed that internal organs were decomposed, but with no trace of fungal infection.

LARVAL BEHAVIOUR: The maximum tunnel length found for a third instar larva was one and a quarter inches. Pale yellowish frass expelled from the burrow entrance by the larva each evening piled within the circle of a leaf base is an indication

of the presence of a larva of this species.

HOST PLANTS: Cortaderia selloana (Schultes) Ascherson and Graebner, and Cortaderia toetoe Zotov. Attacks growing stems and blades.

DISTRIBUTION (Fig. 245): North and South Islands of New Zealand, in swampy areas and pastures where Cortaderia spp. are used as shelter breaks. Flight period November to March, two generations. As well as from localities below, also from Haumoana (Hawkes Bay), (T.H. Davies, pers. comm.) and the Chatham Islands (J.S. Dugdale, pers. comm.).

MATERIAL EXAMINED: 38 m. 15 f.

4 m. CCA, CCC, GFR, GFS, 1 f. GFT, no date or locality, DM, G.V. Hudson.

Appleby, Nel.: 1 m. 20.2.37, CM, S. Lindsay.

Brooklands, Cant.: 5 m. 20.2.37, CM, S. Lindsay.

Christchurch: 2 f. 1.1.1864, 1 f. 2.1.1869, CM, 1 m. CCA, DM, 1 f. GFU, 9.1.64, CM. R.W. Fereday.

Kaikoura: 1 f. CCB, 27.12.14, DM, C.E. Fenwick.

Mt. Ruapehu Chateau, 3,800 ft.: 1 m. QBB, 18.2.65, FRI, J.S. Dugdale.

Dargaville: 1 m. 1 f. Jan. 1936, CM, E. Fairburn.

Horseshoe Lake, Cant.: 1 m. 29.12.23, ED, S. Lindsay.

Lees Valley, Cant.: 3 m. 9-10.2.29, CM, S. Lindsay.

Morere: 1 f. 18.12.09, ED, G.V. Hudson.

Mt. Grey, Cant.: 2 m. 30.12.24, CM, S. Lindsay.

Mt. Maungatua: 1 f. 10.2.24, AM, C.E. Clarke.

Lincoln College, Cant.: 1 m. 28.11.66; 1 m. 12.12.66; 1 f. 17.12.66; 1 m. 21.12.66 LC. M. McPherson.

Oparara: 1 m. 19.11.59, ED, E.S. Gourlay.

Palmerston North: 1 f. 3.1.67, GC, D.E. Gaskin.

Picton: 1 f. 11.12.08, ED, G.V. Hudson.

Riccarton: 1 m. AGT, 30.3.1869, CM, R.W. Fereday.

Rotorua: 1 f. QBC, 27.2.60; 1 m. QBA, 31.3.65; FRI, J.S. Dugdale.

Stuart's Gully: 1 m. Nov. 1919, CM, S. Lindsay.

Waiho Gorge, Wesld.: 1 m. CCD, 2.2.24, DM, F.T. Richardson, 2 m. 13.1.25, AM, C.E. Clarke.

Wainuiomata: 4 m. CCC, CCE, GFR, GFS, 1 f. GFT, 12.1.44, DM, G.V. Hudson.

Waipukurau: 1 f. CCF, 20.10.22, DM, A.V. Wilson.

West Plains, Sthld.: 4 m. no date, ED, A. Philpott.

Waikupa: 1 m. 11.1.20, ED, A. Philpott.

REMARKS: The female of this species is the largest among any species of Orocrambus, measuring up to 5 cm in wing span, hardly deserving to be classified as microlepidoptera! Very large specimens are often nearly pure white, with just faint traces of brown in the basal posterior part of the forewings. The apex of the forewings is very acute in such specimens.

Phylogenetically this species is very close to O.ephorus on male genitalia, both having the same rather unusual form of apical spur and small lateral thorn. There is little variation in genitalia structure, except to a slight degree in the depth of sclerotisation of the apical spur, which is greater in large males.

This is a local species, found throughout New Zealand. There are no long series from single localities in any of the museums, indicating that where populations occur they are probably low density ones. Even in the swampy country near Paiaka Cumber (1951) took only 11 in a full year's trapping, although in my experience the species comes readily to light.

SPECIES GROUP 4.

Frons smooth, planoconvex. Cornuti retained in aedoeagus. Saccus undeveloped. Juxta absent. Very characteristic spiral pleating in ductus bursae.

Contains only two species, O.corruptus and O.melitastes, both confined to the South Island, with O.corruptus distributed in the eastern central areas and O.melitastes in the south.

Group 4.

KEY TO SPECIES: male genitalia

- 1 Costa of valve flanged, aedoeagus with row of 7-12 small rose thorn-shaped cornuti from apex to $\frac{1}{2}$ corruptus
 - Costa of valve drawn dorsally into uncurved prong; aedoeagus with about 20-25 small rose thorn-shaped cornuti scattered between $\frac{1}{4}$ and $\frac{1}{2}$ melitastes.

Orocrambus corruptus (Butler) comb. nov.

Hypochoalcia corrupta Butler, 1877, Proc. zool. Soc. Lond., 1877, p. 399

Crambus corruptus (Butler), Meyrick, 1883, Trans. N.Z. Inst., 15, p. 20.

Crambus luridus Hudson, 1923, Ent. mon. Mag., 59, p. 64.

Holotype m. in British Museum (Natural History), slide BM pyral 5567, labelled "Hypochalicia corrupta Butler type. N.Z. 77.34."

EXTERNAL CHARACTERS (Slide 28): Detailed description by Meyrick (1883), coloured illustration by Hudson (1928, Plate XX, Fig. 1 m.) with brief description. Female frenulum triple, eye diurnal type, wing span 15 - 20 mm (both sexes). Females on the whole have more slender forewings than the males. The mottled brown forewings with uneven white fascia distinguish this species from any other. There is frequently a yellowish tinge to the forewings (form luridus). Occasionally specimens are found with the forewings approaching an even grey-brown, and these have been confused in New Zealand museum series with O.aethonellus and O.melitastes.

MALE GENITALIA (Fig. 64, compared with type sketch by Dr. S. Bleszynski): As for generic and species group description except for the following: Arms of vinculum equal to uncus; saccus not developed, apex of arms of vinculum excavate. Costa of valve flanged, dorsal margin about equal to uncus. Gnathos tapered, pointed bluntly, equal to uncus. Aedoeagus tubular, truncate, $2\frac{3}{4}$ x uncus, with simple lateral thorn at $\frac{1}{3}$, and from 8 - 12 small rose thorn-shaped cornuti between apex and $\frac{1}{2}$.

FEMALE GENITALIA (Fig. 150): As for generic description except for the following: Eighth abdominal tergite fusing dorso-laterally with ostium bursae, as wide at fusion as in dorsal midline, anterior apophyses represented by triangular projections in lateral midlines of anterior margin of tergite. Eighth sternite a strong lunate plate. Ductus bursae about $4 - 4\frac{1}{2}$ x length of anal papillae, strong to $\frac{3}{8}$, spirally pleated from $\frac{3}{8}$ to $\frac{5}{8}$, ductus seminalis joining at $\frac{5}{8}$. Ostium a simple funnel flared at mouth, ostiolar pouch region not swollen. Corpus bursae with two large unequal oval signa.

EGG: Oblate, 17 - 23 vertical ribs, 0.41 - 0.42 x 0.27 - 0.30 mm, creamy white when first laid, turning orange after 24 - 36 hours. Duration of egg stage, 8 days in November. Gross embryological changes visible through the shell as for O.flexuosellus (pp. 100).

HATCHING BEHAVIOUR: The shell was not consumed by the larvae on emergence.

Immediately after hatching they sought shelter in moss provided in the container.

LARVA: Reared only to third instar, head dark brown with paler brown adfrontalia. Well-developed prothoracic shield present. Rest of body pale brown with dark brown pinacula. Chaetotaxy not studied.

DURATION OF LARVAL INSTARS: Larvae were reared in small containers maintained only at room temperature, not under controlled conditions, food changed every 3 days. First instar: 9 - 12 days (November); Second instar: 8 - 15 days (December); only one larva survived into third instar and died 2 days after ecdysis.

LARVAL BEHAVIOUR: The captive larvae, obtained from the Winchmore Irrigation Research Station were reared on Funaria, which they ate readily. Grasses (Poa annua and Bromus dactylis) and clover (Trifolium repens) were eaten but obviously not preferred. Horizontal tunnels running through the moss were constructed, built close against the soil.

HOST PLANTS: In view of the heavy mortality in captive larvae I doubt if any natural foodplant was being offered. Mr R.J. Wood of the Winchmore Irrigation Research Station informed me that the moths were flying in "considerable numbers in old pasture where sweet vernal and similar plants were common".

DISTRIBUTION (Fig. 246): Lowland grasslands of the eastern and subalpine grasslands of the central South Island of New Zealand, with a preference for poorly drained or boggy areas. Occurs up to 2,500 ft. (Hudson 1928). Adult flight period September to early December, and in some areas again in February.

MATERIAL EXAMINED: 62 m. 13 f.

2 m. no data, CM, R.W. Fereday.

1 m. 1862, no locality, CM, R.W. Fereday.

1 m. Oct. 1877, no locality, CM, R.W. Fereday.

Balcairn, Cant.: 1 f. 20.10.21; 1 f. 30.10.21; CM, S. Lindsay.

Ball Glacier: 2 m. NAD, 14.12.29, CM, DM, A. Philpott.

Cass, Cant.: 1 m. Nov. 1924, CM, A. Tonnoir.

Christchurch: 1 m. 1.11.1864, CM, R.W. Fereday; 3 m. NAA, NAB, 1 f. HFU, 28.9.22, DM, C.E. Fenwick.

Cooper's Nob, Cant.: 1 m. Nov. 1918, ED, S. Lindsay; 4 m. HFV, 1 f. HFV, 14-16.11.24, DM (1), ED (5), S. Lindsay.

Eyrewell: 2 m. HBB, HBC, 20.10.64, FRI, J.S. Dugdale.

Lumsden: 1 m. HFY, 1 f. NAH, 15.10.41, DM, G. Howes.

Mt. Grey, Cant.: 1 m. 20.11.24, CM, S. Lindsay.

Mt. Pleasant, Cant.: 3 m. 24.10.21; 1 m. 30.11.24; CM, S. Lindsay.

Porter River, Cant.: 4 m. 9-10.11.28; 2 m. 15.11.29; CM, S. Lindsay.

Port Hills, Cant.: 3 m. Oct. 1919, ED (1), CM (2); 3 m. Nov. 1919, ED, CM (2); 1 m. Dec. 1919, CM; 1 m. 27.10.24, ED; 1 m. HFX, 18.10.31, DM; S. Lindsay.

Puke Atua Bush, Cant.: 5 m. 3 f. 29.9.28, DM (1 m.), CM, S. Lindsay; 1 m. 6.10.28, ED, E.S. Gourlay.

Rangitata: 2 m. 3 f. 18.10.39, ED, S. Lindsay.

Taeri Gorge: 1 m. NAI, 1 f. NAG, 24.10.39, DM, G. Howes.

Taylor's Mistake; 1 m. 30.9.23, ED, S. Lindsay.

Temuka: 1 f. 1.11.08, ED, G.V. Hudson.

Waimakariri River: 1 m. 22.10.21, ED, S. Lindsay.

Waimate: 1 m. 1 f. 7.9.25, CM, S. Lindsay.

Waitaki, 2,000 ft.: 1 m. HBA, 11.2.63, FRI, J.S. Dugdale.

Wedderburn: 2 m. no date, ED, J.H. Lewis; 7 m. 3 f. 22.10.23, AM, C.E. Clarke.

Winchmore, Cant.: 12 m. 1 f. Oct. 1967, R.J. Wood.

REMARKS: A very clear and close phylogenetic affinity to O.melitastes, the two species forming a compact and sharply delimited group, not very close to any species in other species groups.

Variation in O.corruptus is considerable, where forewing pattern and colour is concerned. Hudson (1923) erected a new species for an extreme colour variety (luridus), but sank it as a synonym of corruptus in his later monograph (1928). However the pale forewing fascia are clear in almost all specimens, and the forewings are very slender in comparison to species such as melitastes and aethonellus.

Orocrambus melitastes (Meyrick) comb.nov.

Crambus melitastes Meyrick, 1909, Trans. N.Z. Inst., 41, p. 9.

Lectotype m. (Dr. S. Bleszynski) in British Museum (Natural History) with 1 paralectotype, labelled "Invercargill New Zealand 13.12.82, peltastes Meyrick".

The labelling of the name peltastes is assumed to be a lapsus calami by Meyrick.

EXTERNAL CHARACTERS (Slides 29, 30): Detailed description by Meyrick (1909); coloured illustration by Hudson (1928, Plate XIX, Fig. 8, 9.) and abbreviated description. Female frenulum triple, eye nocturnal type. Wing span 17 - 22 mm (both sexes). White subapical mark on forewing distinguishes it from aethonellus.

MALE GENITALIA (Fig. 65): As for generic and species group description except: Arms of vinculum about $\frac{1}{2}$ uncus; saccus with bluntly rounded or slightly excavate apex. Costa of valve flanged dorsally pronged, dorsal margin about equal to uncus. Sacculus not differentiated. Gnathos tapered, pointed. Aedoeagus tubular, truncate, $2 - 2\frac{1}{2}$ uncus, length to median breadth ratio 8-9:1, with small dorso-lateral thorn at about $\frac{1}{4} - \frac{1}{3}$ from apex; 20 - 25 small cornuti between $\frac{1}{4}$ and $\frac{1}{2}$.

FEMALE GENITALIA (Fig. 151): As for generic description except: Eighth abdominal tergite fusing dorso-laterally with ostium bursae, twice as wide at fusion as in dorsal midline. Eighth sternite a weak lunate plate. Ductus bursae $4 - 4\frac{1}{2}x$ length of anal papillae, strong to $\frac{1}{3}$, with characteristic diagonal pleating from $\frac{1}{4}$ to $\frac{1}{2}$, ductus seminalis joining at $\frac{1}{2}$. Ostium a simple tapering funnel. Corpus bursae with two very unequal oval signa.

LARVA: Not known.

HOST PLANTS: Not known.

DISTRIBUTION (Fig. 247): Southland, Otago and Westland, subalpine zone down to sea level at Invercargill. Flight period October to January.

MATERIAL EXAMINED: 29 m. 12 f.

1 m. BFA, no date, DM, C.E. Fenwick.

Bluff: 2 m. 15.12.14, ED, A. Philpott.

Catlins, Otago: 1 m. 18.12.14, ED, 3 m. OAE, OAI, OAJ, 4 f. OAB, OAC, OAL, NAF, 4.12.39, DM; G. Howes.

Greenhills, Sthld.: 1 m. 14.11.18, ED, A. Philpott.

Lake Manapouri: 1 m. OAG, 11.12.57, FRI, J.S. Dugdale.

Lindis Pass: 1 f. OAK, 14.10.41, DM, G. Howes.

Menzie's Ferry, Sthld.: 1 m. 20.1.10, CM, E. Meyrick.

Monowai: 3 m. 1 f. 13.11.19, ED, A. Philpott.

New River, Sthld.: 7 m. 1 f. no date, ED, 3 f. IFB, IFC, IFD, no date, DM:
 A. Philpott; 2 m. HFZ, QAA, no date, DM, G. Howes, 1 m. IFA, Dec. 1908, DM,
 3 m. 30.10.09, ED; A Philpott.
 Tawhai State Forest: 1 m. OAF, Jan. 1962, FRI, W.A. Holloway.
 Tisbury, Sthld.: 2 f. 26.1.16, CM, A. Philpott
 West Plains, Sthld.: 1 m. OAD, DM, 1 m. ED, no date, A. Philpott.

REMARKS: Hudson (1928), offered doubts concerning the specific status of this species, but this is the only one of the seven small brown and white species described by Meyrick which is clearly distinct from O.aethonellus. There are quite striking differences between the sexes of O.melitastes. The females usually have pale streaks on both costa and dorsum of the forewing, and are generally paler in colour, while the males are darker without such markings and with narrower white forewing fascia, superficially more like O.aethonellus than the females. However both sexes of O.melitastes possess a small white subapical patch on the costa of the forewing, which is never found in O.aethonellus. The two species are quite distinct in both male and female genitalia characters (Figs. 65, 151, melitastes, figs. 44, 132, aethonellus). Females of melitastes approach fugitivellus in external appearance, but the latter species has much narrower forewings and very acute apices. Phylogenetically O.melitastes has a close affinity with O.corruptus.

SPECIES GROUP 5.

Frons planoconvex or conical; cornuti present in aedoeagus; Saccus tapered. Juxta present in subgroup 5a, absent in subgroup 5b. An assemblage of relatively primitive species, not monophyletic as a unit.

Subgroup a.

Contains four species; O.cyclopicus, O.jansoni, O.lectus and O.ornatus. O.cyclopicus ranges from Hawkes Bay to the southern parts of the South Island; O.jansoni is confined to the tussock subalpine region of the central North Island plateau. O.lectus is a subalpine/alpine species in the central South Island, while O.ornatus is known only from the holotype from Golden Downs, Nelson.

GROUP 5a. KEY TO SPECIES: male genitalia

- 1 Aedoeagus without external ornamentation, cornuti
squat and rose-thorn shaped 2
- Aedoeagus with lateral or subapical thorn, cornuti
slender, splinter-shaped 3
- 2 Cornuti arranged in two parallel rows, costa of valve
flanged lectus
- Cornuti scattered, costa of valve drawn dorsally into a prong . . . ornatus
- 3 Sacculus with distinct flange, aedoeagal thorn dorsal and
subapical, cornuti grouped at $\frac{1}{2}$ when vescia not everted cyclopicus
- Sacculus not flanged, aedoeagal thorn ventral, at about
 $\frac{1}{4}$, cornuti linear between $\frac{1}{8}$ and $\frac{1}{2}$ when vescia not everted jansoni

Orocrambus cyclopicus (Meyrick) comb.nov.

Crambus cyclopicus Meyrick, 1882, New Zealand Journal of Science (Dunedin) 1, p.187.

Crambus cyclopicus Meyrick, 1883, Trans. N.Z. Inst., 15, p. 29.

Crambus sophistes Meyrick, 1905, Trans. ent. Soc. Lond., 1905, p.226 (N.Syn.)

Lectotype m. (Dr. S. Bleszynski) in British Museum (Natural History) slide BM pyral 7978, labelled "Christchurch New Zealand 10/3/82 Crambus cyclopicus".

Holotype m. in British Museum (Natural History), slide BM pyral 5628, labelled "Dunedin New Zealand JHL/O3. Crambus sophistes".

EXTERNAL CHARACTERS (Slide 31): Detailed description by Meyrick (1883) of typical form, and of form sophistes (1905), coloured illustration by Hudson (1928, Plate XX, Fig. 44 f.) and of form sophistes (Plate XIX, Fig. 24 m). The specimen on Plate XX, Fig. 43 labelled Crambus sophronellus m. is quite clearly a form of O.cyclopicus with the markings of the forewings obsolete. This is a form commonly met with. However the illustration given in a later work by Hudson (1951, Plate V, Fig. 2 f) is of a bona fide specimen of O.sophronellus. The eye of O.cyclopicus is nocturnal type, the female frenulum triple, and the wing span 22 - 30 mm (both sexes). There is a resemblance between this species and a number of Pyraustiniids and Phycitiniids, but the large eye-shaped stigma in this disc of the forewings is a good identification mark. Not easily confused with other Crambids.

MALE GENITALIA (Fig. 66, checked against lectotype sketch by Dr. S. Bleszynski):

As for generic and species group description except for following: Arms of vinculum about $\frac{3}{4}$ uncus; Saccus tapered with rounded apex; Juxta a U-shaped plate. Costa of valve flanged, dorsal margin about $\frac{3}{4}$ uncus. Sacculus flanged. Gnathos tapered, curved dorsad, with apical club, about equal to uncus.

Aedoeagus tubular, truncate, $2\frac{3}{4}$ - 3x uncus, length to median breadth ratio about 10:1, strong in dorsal midline from apex to about $\frac{2}{3}$, with simple thorn subapical, dorsad at about 1/16; group of 3 - 6 slender cornuti at about $\frac{1}{2}$.

FEMALE GENITALIA (Fig. 152): As for generic description except for following: Eighth abdominal tergite fusing diagonally with ostium bursae, anterior portion completely encircling ostium. Tergite about 4 - 5x as wide at fusion as in dorsal midline. Eighth sternite a weak lunate or oval plate. Ductus bursae 9 - 10x length of anal papillae, pleated to $\frac{3}{4}$, strong to $\frac{1}{4}$, ductus seminalis joining at $\frac{3}{4}$. Ostium bursae a dorso-ventrally flattened crateriform funnel with ostiolar pouch swollen. Corpus bursae with two unequal oval signa.

EGG: Oblate, 16 - 21 vertical ribs, 0.46 - 0.48 x 0.34 - 0.37 mm, light brown when first laid, turning orange-grey after 24 - 36 hours. Gross embryological changes visible through shell as for O.flexuosellus (pp.100). Duration of egg stage 15 days (March), 17 days (April).

HATCHING BEHAVIOUR: Similar to that of O.flexuosellus (p.101), shell not consumed.

LARVA (Fig. 219): Length of fully fed final instar larva 12 - 15 mm; stout, greyish brown with darker brown pinacula. Head capsule medium brown with darker brown markings (Fig. 208). Prothorax with well-developed shield, strong in 5th and 6th instars, L2 dorsad of L1, SV2 dorsad of SV1. Mesothorax and Metathorax: D2 longer than D1, SD1 longer than SD2, L1 dorsad of L2. On abdominal segments: On A1, A2; SD2 very small, D1 longer than D2, SV2 caudad of and longer than SV1, SV3. On A3-6; SV2 dorsad of SV1, SV3, L1 dorsocaudad of L2. On A7; SV1 ventro-caudad of SV2. In final instar dorsal pinacula are continuous over dorsal midline.

DURATION OF LARVAL INSTARS: First instar: 8 - 27 days (April); Second instar: 19 - 32 days (April-May); Third instar: 19 - 28 days (May); Fourth instar: 13 - 22 days (May-June); Fifth instar: 12 - 19 days (June); Sixth instar: 52 - 76 days (June-August). Larvae kept at room temperature, not under controlled conditions. Food changed every 2 - 3 days.

LARVAL BEHAVIOUR: Newly emerged larvae are sluggish for 1 - 2 hours, then begin to construct silk tunnels through soil debris. Vertical tunnels into the soil are constructed by fourth and following instars, these may be up to 2" in length, and are usually found between the roots of the foodplant. A pupal chamber is formed at the base of the tunnel, as in O.flexuosellus (p.102). Extensions of the tunnels, made of silk, frass and plant debris, are often made for 1 - 2" above the soil into the base of food plant clumps. The larvae eat longitudinal grooves in the leaves of the food plant, and differ in behaviour from O.flexuosellus in that they leave the burrows at night to feed; I have found them as far as a foot above ground on the leaves, and Mr P.J. Wigley of the Zoology Department, Massey University, took 4 larvae of this species while sweep-netting for weevils at dusk.

HOST PLANTS: Found in the wild on Bromus mollis L. and Arrhenatherum elatius L. Native hosts unknown.

PUPA: Medium brown, slightly glossy, about 11mm in length, spiracles dark, slightly raised, abdominal setae microscopic, unmodified. Duration of pupal instar 27 - 53 days. Moths emerged in captivity in months when no specimens have ever been recorded in the wild.

DISTRIBUTION (Fig. 248): Common in the lowland pastures of the eastern South Island and the southern North Island, becoming apparently scarce north of the Manawatu except in some places on Hawkes Bay coast (T.H. Davies, pers. comm.). The species also occurs in subalpine and alpine regions of the South Island, to about 4,000 ft. Specimens taken by Mr J.S. Dugdale at Craigieburn had all forewing markings obsolete, but had typical male genitalia. Flight period January

to May. This is strictly an autumnal species, with the peak of adult flight occurring in March-April in both the North and South Islands (Table 8). There is no winter diapause in this species, as is shown by the fact that the larvae bred in captivity in this study pupated in August and emerged in September and October at room temperature, a completely abnormal pattern when compared with the adult flight records given below.

Table 8

Flight records of <u>O.cyclopicus</u> obtained by light-trapping with 125 watt MV bulb.					
	Feb.	Mar.	Apr.	May	June
Massey University 1965-6	1	64	38	10	1
Massey University 1966-7	2	101	190	12	0
Massey University 1967-8	0	12	64	14	0
Lincoln College Canterbury, 1966-7	1	22	4	0	0
Winchmore, Canterbury 1966-7	73	174	10	0	0

MATERIAL EXAMINED: 101 m. 23 f.

Alexandra: 5 m. 4.4.20, AM, C.E. Clarke.

Ben Lomond: 2 m. 22.2.16, AM, C.E. Clarke.

Bottle Lake, Cant.: 3 m. 17.2.23; 3 m. 22.3.25; CM, S. Lindsay.

Castle Hill, Cant.: 1 m. 9.3.30, CM, S. Lindsay.

Christchurch: 3 m. no date; 2 m. 3-4.3.1864; 1 m. 10.3.1864; CM. R.W. Fereday;
2 m. 8.4.34, CM, S. Lindsay.

Craigieburn, 4,000 ft.: 4 m. AEA, AEB, AEC, AED, AEE, 18.3.65, FRI, J.S. Dugdale.

Dunedin: 1 m. 24.3.12, AM, C.E. Clarke.

Hinds: 1 m. 13.3.11, ED, C.E. Clarke.

Hoon Hay, Cant.: 1 m. Mar. 1921; 8.3.23; CM, S. Lindsay.

Horseshoe Lake, Cant.: 1 m. 23.3.23, ED, S. Lindsay.

Ida Valley, Otago: 2 m. RDA, RDB, summer 1902, DM, J.H. Lewis.

Kaituna: 2 m. 11.3.23, CM, S. Lindsay.

- Lake Guyon: 1 m. Mar. 1871, CM, R.W. Fereday.
- Lake Rotoroa: 1 m. 2 f. 14-15.3.31, CM, S. Lindsay.
- Mt. Grey, Cant.: 1 m. 6.4.28, 1 m. 16.3.30, CM, S. Lindsay.
- Mt. Sugarloaf, 2,000 ft. Cant.: 2 m. 28.2.62; 2 m. 16.3.62; 1 m. 12.2.63; LC, E.G. White.
- Nelson: 4 m. 4-29.4.21; 1 m. 3.5.21; 2 m. 17-23.3.23; 1 m. 7.4.23; 2 m. 23-28.3.25; 6 m. 16.4.25; 2 m. 7-14.5.25; 1 m. 9.4.26; 8 m. 8.4.27; ED, A. Philpott.
- Palmerston North: 17 m. MDA, MDB, MDC, MDE, MDF, MDG, MDH, MDI, MDJ, MDK, MDL, MDM, MDP, 12 f. MDN, MDO, 12-27.4.66; 8 m. 6 f. 9-18.4.66; 3 m. 3 f. 2-8.5.66; GC, D.E. Gaskin.
- Pokororo, Nel.: 1 m. 3.3.21, ED, S. Lindsay.
- Port Hills, Cant.: 1 m. April 1918, CM, S. Lindsay.
- Queenstown: 1 m. 22.2.12, AM, C.E. Clarke.
- Ribbonwood Fan, 2,100 ft. Cant.: 1 m. 13.3.62; 1 m. 26.3.62; LC, E.G. White.
- Spreydon, Cant.: 1 m. 16.3.18, CM, S. Lindsay.
- Tooth Peaks: 1 m. 24.11.18, ED, A. Philpott.
- Waitati: 1 m. RDC, 1.2.27, DM, G. Howes.
- Wedderburn: 2 m. no date, ED, C.E. Fenwick.
- Wellington: 1 m. Mar. 1963, GC, D.E. Gaskin.

REMARKS: Phylogenetically this species is unequivocally a Group 5 species; the male genitalia, especially in the structure of the aedoeagus, show a similar pattern of development to the species of subgroup 5b, such as O.harpophorus, although the retention of the juxta is regarded as a primitive feature. On the other hand the species shows the advanced feature of ostium encirclement by the eighth tergite in the female. The male genitalia structure is very close to O.jansoni, though O.jansoni has a conical frons, and shows a more conservative habitus than O.cyclopicus. What advantage is conveyed by the peculiar wing pattern is not known.

Orocrambus lectus (Philpott) comb.nov.

Crambus lectus Philpott, 1929, Trans. N.Z. Inst., 60, p. 301.

Holotype m, allotype f, 2 paratype m, in EDNZ, 1 paratype m, 1 paratype f, in CMNZ, labelled "L. Tekapo, 24.12.28, A. Philpott". Author's preps. of genitalia ACB (EDNZ m.); AGR (CMNZ m.); AGS (CMNZ f.).

EXTERNAL CHARACTERS (Slide 3); Detailed description by Philpott (1929), coloured illustration by Hudson (1939, Plate LVI, Fig. 17 f.), with abbreviated description. Eye nocturnal type, female frenulum triple. Difficult to separate by forewing pattern from some alpine specimens of O. ramosellus and O. callirrhous in particular, also when fairly worn from such species as O. ordishi and O. abditus. Easily distinguished by genitalia characteristic in both sexes. Wing span 21 - 29 mm (both sexes).

MALE GENITALIA (Fig. 67): As for generic and species group description except for the following: Arms of vinculum about $\frac{2}{3}$ uncus; Saccus tapered to rounded or very slightly excavate apex; Juxta a small subsellate plate. Costa of valve flanged, dorsal margin slightly less than uncus. Sacculus not developed. Gnathos straight, tapered, bluntly pointed, equal to uncus. Aedoeagus tubular, $2\frac{3}{4}$ x uncus, length to median breadth ratio 6-7:1, occasionally with very small thorn near apex; double row of rose-thorn shaped cornuti present, arranged sometimes alternately, sometimes in pairs.

FEMALE GENITALIA (Fig. 153): As for generic description except for following: Anal papillae with about 4 very coarse setae on anal margin of ventral lobe. Eighth abdominal tergite fusing dorso-laterally with ostium bursae, less than half as wide at fusion as in dorsal midline. Eighth sternite a weak lunate plate. Ductus bursae $3\frac{1}{2}$ - 4x length of anal papillae, strong and pleated to $\frac{5}{8}$, ductus seminalis joining at about $\frac{3}{4}$. Ostium a broad tapering funnel opening dorso-caudally. Corpus bursae with two very large unequal lanceolate signa, one about twice the other.

LARVA: Not known.

HOST PLANTS: Not known.

DISTRIBUTION (Fig. 249): Eastern subalpine and alpine regions of the South Island, and in the Mount Arthur-Lake Sylvester region of the Nelson high country. Flight period December to February. One stray taken near sea level at Lincoln College.

MATERIAL EXAMINED: 25 m. 4 f.

Cass, 1,990 ft. Cant.: 1 m. 8.12.61, LC, E.G. White.

Craigieburn, Cant.: 1 m. TAD, 31.12.44, DM, S. Lindsay.

Hammer: 1 m. Dec. 1919, CM, S. Lindsay.

Island Pass, 4,590 ft. Nel.: 2 m. DGT, EGK, 15.2.66, FRI, J.S. Dugdale.

Jack's Pass, Hammer: 6 m. 2 f. 29.12.30, DM (2 m.), CM. S. Lindsay.

Klondyke: 1 m. SBD, 19.12.59, FRI, J.S. Dugdale.

Lake Tekapo: 1 m. (holotype), ED, 3 m. (paratypes) AGR (CM), ACB (ED), 1 f. (allotype) ED, 1 f. (paratype) AGS, CM; 24.12.28, S. Lindsay.

Linccln College: 1 m. 23.12.66, GC, M. McPherson

Mt. Crystal Ridge, 4,500 ft. Nel.: 1 m. DGX, 14.2.66, FRI, J.S. Dugdale.

Mt. Luxmore, 3,500 ft.: 3 m. SAA, SAB, SAC, 2.2.65, FRI, J.S. Dugdale.

Mt. Sugar Loaf, Cant.: 2 m. 18.12.62, LC, E.G. White.

Sedgemere, 3,300 ft. Nel.: 2 m. DGI, DGL, 13.2.66, FRI, J.S. Dugdale.

REMARKS: I found this species frequently confused in New Zealand museum series with O. ramosellus, O. haplotomus, O. callirrhous, the simplex section of subgroup 5b, and a few other species. It is very variable, and difficult to pick by externals alone. However the two remarkable features of the genitalia - the huge lanceolate signa of the female corpus bursae, and the double row of cornuti in the aedoeagus of the male - are unmistakably distinctive.

Phylogenetically clearly in this subgroup, but without any really close relationships with any other species within the subgroup, which is a very divergent one.

Orocrambus ornatus (Philpott) ccmb.nov.

Crambus ornatus Philpott, 1927, Trans. N.Z. Inst., 58, p.82.

Holotype m. in EDNZ, ED (Philpott coll. slide, no number, but labelled "C. ornatus type." Specimen labelled "Golden Downs, 8.1.26, A. Philpott.")

EXTERNAL CHARACTERS (Slide 33): Detailed description by Philpott (1927), coloured illustration by Hudson (1939, Plate LVI, Fig. 28 m.) and abbreviated description. Eye nocturnal type. Wing span 20 mm. Female not known.

MALE GENITALIA (Fig. 68, Type): As for generic and species group description except for following: Arms of vinculum a little less than uncus; Saccus tapered,

with rounded apex; juxta a small plate concave dorsally, ventral margin convex, medially cleft. Costa of valve flanged, drawn dorsally into blunt in-curved prong, dorsal margin about $1\frac{1}{2}x$ uncus. Sacculus not differentiated. Gnathos parallel-sided for most of its length, half as wide as long, tapering to rounded apex, slightly longer than gnathos. Aedoeagus tubular, truncate, slightly dilate apically, $3x$ uncus, length to median breadth ratio $7\frac{1}{2}:1$, without external ornamentation. Four rose-thorn shaped cornuti between apex and $\frac{1}{2}$.

LARVA: Not known.

HOST PLANTS: Not known.

DISTRIBUTION (Fig. 250): Golden Downs, Nelson. Flight period January.

MATERIAL EXAMINED: 1 m.

Golden Downs, Nel.: 1 m. (holotype), 8.1.26, ED, A. Philpott.

REMARKS: The genitalia drawing in Fig. 68 may be proportionately inaccurate in some details, as it had to be reconstructed from the dissected fragments (broken) of the type slide, which was in very poor condition. The drawing by Philpott (1929, Fig. 27) does not seem to be by camera lucida, but there is broad agreement between Philpott and myself concerning the features. The strong development of the costa of the valve is interesting, but a parallelism of what has occurred in O.apicellus, O.tuhualis and O.aethonellus. Another interesting feature is the spatulate uncus, which approaches the condition found in Maoricrambus oncobolus. I hesitated to place this species with systematic exactitude, without a female; but by male genitalia characteristics it is clearly placed in this subgroup. I suspect that O.punctellus, only so far known from a worn female holotype, will prove to be the female of ornatus, since the placing of the central stigma of the forewing and some of the other obscure markings are strongly suggestive of the forewing pattern of the ornatus holotype. I will not alter the status of either on the limited material available. If O.punctellus is the female of this species, then its systematic position would be confirmed, rather than altered.

Orocrambus jansoni

sp.nov.

Holotype m. author's prep. of genitalia ZPX, allotype f, author's prep. of genitalia ZPY and 5 paratype m. in EDNZ, labelled "Waiouru, 4 Feb. 1966; 2,800 ft. D.E. Gaskin". 3 paratype m. in DMNZ, 2 paratype m. in AMNZ, 3 paratype m. in CMNZ, 1 paratype m. in MUNZ.

EXTERNAL CHARACTERS (Slide 34): Antennae dark brown, serrate in male, nearly filiform in female. Ocellus 0.05 - 0.07 mm in diameter, compound eye nocturnal type. Frons conical. Frenulum single in male, triple in female. Maxillary palp triangular, laterally brown, medially yellowish. Labial palp dark brown laterally, yellowish medially, porrected, ratio to head length about 2.4:1. Thorax and abdomen yellowish to silvery white. Forewings with brown costal streak from base to apex, similar paler streak on dorsum. Median area silvery white to yellowish from base to termen. Anterior end of this fascia touches apex. Apices acute. Cilia brown and white. Hindwings dark brown with lighter brown cilia. Foregoing description based on holotype and paratype males; allotype female very similar but with all markings very much paler and cilia of all wings white. Legs brown speckled with white in both sexes. Wing span, 18 - 22 mm (male), 22 mm (female).

MALE GENITALIA (Fig. 69, paratype): As for generic and species group description except for the following: Arms of vinculum about $\frac{1}{2}$ uncus; Saccus tapered with rounded apex. Juxta a thin U-shaped structure. Costa of valve flanged, dorsal margin about equal to uncus. Sacculus not differentiated. Gnathos curved dorsad, apically clubbed, equal to uncus. Aedoeagus tubular, truncate, $3x$ uncus, length to median breadth ratio about 13:1, strong ventrally from apex to $\frac{1}{2}$, with small thorn ventrad at $\frac{1}{4}$; 8 - 12 very slender cornuti linear from apex to $\frac{1}{2}$.

FEMALE GENITALIA (Fig. 154, allotype): As for generic description except for following: Eighth abdominal tergite fused dorso-laterally with ostium bursae, about $\frac{3}{4}$ as wide at fusion as in dorsal midline. Ductus bursae about $6x$ length of anal papillae, strong to $\frac{2}{3}$, with vertical pleats from $\frac{1}{3}$ to $\frac{2}{3}$, ductus seminalis joining at $\frac{3}{4}$. Ostiolar pouch slightly swollen, ostium a dorso-ventrally compressed funnel with slightly exaggerated dorsal lip. Corpus bursae with two equal oval signa.

LARVA: Not known

HOST PLANTS: Not known, possibly Chionochloa rubra, with which this species was found associated, but several species of European grasses were growing at the type locality.

DISTRIBUTION (Fig. 251): Waiouru. Flight period December to February.

MATERIAL EXAMINED: 31 m. 1 f.

Waiouru, 2,800 ft.: 26 m. 1 f. 4-5.2.66, 2 m. 7.12.66; 3 m. 7.1.68;
D.E. Gaskin, D.J. Greenwood and P.J. Wigley.

REMARKS: Male genitalia show a superficial resemblance to O.cyclopicus. There is a strong resemblance to a small worn specimen of O.flexuosellus, for which reason it may have been overlooked by Hudson and Clarke, both of whom collected at Waiouru. It has a close resemblance externally to O.fugitivellus. The type locality at Waiouru is an area by the side of the Ohakune road only 200 yards long by 50 yards wide. Extensive collecting all around the settlement did not reveal any more patches or colonies of O.jansoni. However the species will probably be found to occur in other tussock localities of the subalpine parts of the central plateau, which have not been extensively collected.

Subgroup 5b.

Contains 18 species, of which 7; O.abditus, O.crenaeus, O.heteraulus, O.isochoytus, O.ordishi, O.paraxenus and O.scutatus are confined to the South Island and the other eleven; O.callirrhous, O.enchophorus, O.harpophorus, O.lewisi, O.ramosellus, O.simplex, O.siriellus, O.tuhualis, O.vittellus, O.vulgaris and O.xanthogrammus are found in both the South and North Islands. However the group is definitely one with a southern bias, and of the eleven species in the second category only O.vittellus and O.ramosellus are ubiquitous in the North Island. O.lewisi has a small foothold on the west coast north of Wellington to about Titahi Bay, and O.callirrhous has only been taken at the old Miramar golf course. Because of much modern development in the area since it was reported there as O.schedias (Meyrick, 1911), the population may now be extinct. However I think

there is a strong likelihood that the species will also be found along the coast of Palliser Bay, where, to the best of my knowledge, no collecting has been carried out.

KEY TO SPECIES: male genitalia

Notes: Remarks were made with the species groups key about O. lewisi and O. crenaeus. However in the later species cornuti, although deciduous, are almost always present.

- 1 No cornuti lewisi
(or occasional specimen of crenaeus)
- Cornuti present 2
- 2 Single elongate cornutus in aedoeagus xanthogrammus
- 3 or more cornuti present 3
- 3 3 or 4 huge rose thorn-shaped cornuti in expanded aedoeagal apex; costa of valve developed into a prong tuhualis
- Cornuti not gigantic and bulging within aedoeagus; costa of valve flanged 4
- 4 Distal end of sacculus developed into short projection ramosellus
- Distal end of sacculus not developed into a projection, ventro-caudal margin of valve smoothly rounded 5
- 5 Small grit-like cornuti present ordishi
- Elongate cornuti 6
- 6 Aedoeagus without thorn 7
- Large or small thorn present 9
- 7 Aedoeagus unchitinised, apically expanded abditus
- Aedoeagus dorsally chitinised 8
- 8 Saccus very elongate, almost as long as valve siriellus
- Saccus short, less than length of uncus simplex
- 9 Gnathos clubbed 10
- Gnathos bluntly pointed 13
- 10 Thorn ventral on aedoeagus 11
- Thorn dorsal 12
- 11 Cluster of elongate cornuti at about $\frac{1}{2}$, cornuti about $\frac{1}{4}$ - $\frac{1}{2}$ uncus; sacculus strongly flanged enchophorus
- Small elongate cornuti linear between $\frac{1}{4}$ and $\frac{1}{2}$; sacculus not developed vulgaris

- 12 Aedoeagus with small second thorn lateral and sinistrad
at about $\frac{1}{2}$ harpophorus
- No lateral thorn present heteraulus
- 13 Aedoeagus with strong apex, developed into short spur
or large thorn 14
- Aedoeagus with weak apex 16
- 14 Short straight spur on aedoeagus, flat ventrally, with small
subapical thorn; sacculus not flanged isochytus
- Apical thorn, on aedoeagus; sacculus flanged 15
- 15 Aedoeagus with hooked curved thorn; saccus short, about
 $\frac{1}{4}$ uncus (cornuti deciduous) crenaeus
- Aedoeagal thorn not curved; saccus long, about $\frac{3}{4}$ uncus scutatus
- 16 Costa of valve weakly flanged; aedoeagus with small
thorn ventral at about $\frac{1}{4}$ paraxenus
- Costa of valve strongly flanged, aedoeagus with small thorn
lateral at $\frac{1}{2}$ or dorsal and subapical 17
- 17 Aedoeagal thorn subapical, dorsal callirrhous
- Aedoeagus with small lateral thorn at $\frac{1}{2}$ vittellus

Orocrambus abditus (Philpott) comb.nov.

Crambus abditus Philpott, 1924, Trans. N.Z. Inst., 55, p.212.

Holotype f. in Canterbury Museum, author's genit prep. AGA, 1 labelled "C.abditus A. Philpott, holotype female. Otarama (bred from larva) 20.10.21".

EXTERNAL CHARACTERS (Slides 35, 36): Detailed description of female externals by Philpott (1924). Coloured illustration by Hudson (1928, Plate L, Fig. 18 f.) with abbreviated description. Eye nocturnal type, female frenulum triple, wing span 24 - 28 mm (both sexes). As in the other species of the "simplex" complex of species, the apices of the forewings of the female are much more acute than those of the male. Cannot be separated from O.simplex, O.lewisi, O.ordishi or even small specimens of O.crenaeus without examination of the genitalia.

MALE GENITALIA (Fig. 70): As for generic and species group description except for the following: Arms of vinculum about $\frac{1}{2}$ uncus; Saccus tapered to truncate apex. Costa of valve flanged, dorsal margin about $\frac{3}{4}$ uncus. Sacculus flanged. Gnathos

tapered, bluntly pointed, slightly longer than uncus. Aedoeagus narrowly conical, to truncate apex, $2\frac{3}{4}x$ uncus, length to median breadth ratio 8:1, without external ornamentation. 18 - 22 cornuti between apex and $\frac{1}{2}$.

FEMALE GENITALIA (Fig. 155, holotype): As for generic description except for the following: Eighth abdominal tergite fusing dorso-laterally with ostium bursae, about as wide at fusion as in dorsal midline. Eighth sternite a weak lunate plate. Ductus bursae about 7x length of anal papillae, strong and pleated to and narrowing at $\frac{1}{3}$, with ductus seminalis joining at about $\frac{2}{3}$. Ostium a tapered funnel, ostiolar pouch region not swollen relative to ostium. Corpus bursae with two unequal oval signa.

LARVA: Not known.

HOST PLANTS: Not known.

DISTRIBUTION (Fig. 252): North Canterbury and Marlborough, and small area of South Canterbury around Birdling's Flat. Flight period October to March, apparently two generations. Light trap records for Lincoln College, Canterbury in 1966-67 are given in table 9. Judging from the figure given by Burrows (1967), this species is confined to the east of the 50 inch isohyet; and north of the Rakaia River according to distribution records presently available. This pattern of distribution may in part be attributed to O.abditus being a species which survived in the eastern part of the Nelson/Marlborough Biotic refuge during the Otiran Glaciation and has spread out from this area in recent times. Southward spread could now be limited by some (unknown) physical environmental factor, or by direct competition with the southern-biased sibling of the "simplex" species, O.ordishi.

Table 9

Results of MV light-trapping at Lincoln College, Canterbury, total operation, with 125 watt bulb.							
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1966-67	0	3	1	21	67	19	0

MATERIAL EXAMINED: 25 m. 1 f.

Birdling's Flat, Cant.: 1 m. FGO, 19.2.28, CM, S. Lindsay

Christchurch: 1 m. FGW, Nov. 1868, CM, R.W. Fereday.

Hoon Hay, Cant.: 1 m. GGD, ED, 1 m. CM, 8-15.11.22; S. Lindsay.

Kaikoura: 1 m. FGX, 9.2.1870, CM, R.W. Fereday.

Lewis Pass: 1 m. GGG, 8.2.57, ED, E.S. Gourlay.

Lincoln College, Cant.: 2 m. 28.11.66; 1 m. 12.12.66; 1 m. 17.12.66; 5 m. 10.3.67, GC, M. McPherson.

Otarama, Cant.: 1 f. (holotype) AGA, 20.10.21, CM, A. Philpott.

Springfield, Cant.: 3 m. VAE, VAH, VAI, 19.12.08; 2 m. CFE, WAE, 17.1.23, DM, G.V. Hudson.

Waiau, Marl.: 5 m. FGK, 18-20.11.29, CM, S. Lindsay.

REMARKS: See this section under O.simplex for a discussion of this sibling species. In his paper (1924) Philpott calls the holotype a male, which it is not.

Orocrambus crenaeus (Meyrick) comb.nov.

Crambus crenaeus Meyrick, 1885, Trans. N.Z. Inst., 17, p. 197.

Crambus diplorrhous Meyrick, 1885, Trans. N.Z. Inst., 17, p. 197.

Lectotype m. slightly worn, in Canterbury Museum, author's genit prep. BGJ, labelled C.crenaeus n.sp. 25.1.83".

Lectotype m. and 4 paralectotype m. (Dr. S. Bleszynski) in British Museum (Natural History), slide BM pyral 7956, labelled "Crambus diplorrhous, L. Wakatipu New Zealand. 17/12/82".

EXTERNAL CHARACTERS (Slide 37): Detailed descriptions by Meyrick (1885), coloured illustrations by Hudson (1928, Plate XX, Fig. 9 m. (not f. as stated) diplorrhous), with abbreviated descriptions. Eye nocturnal type, wing span 31 - 38 mm (male). Female not known, quite probably semi-apterous as never recorded coming to light. This species is best distinguished from externally similar species by examination of genitalia.

MALE GENITALIA (Fig. 71): As for generic and species group description except for following: Arms of vinculum about $\frac{3}{4}$ uncus; saccus short, apically rounded. Costa of valve flanged, dorsal margin as long as uncus. Sacculus flanged. Gnathos tapered apically, otherwise parallel-sided, slightly longer than uncus, bluntly

pointed. Aedoeagus apically dilate, $2\frac{1}{2}$ - $2\frac{3}{4}x$ uncus, length to median breadth ratio 8-9:1, apical breadth ratio 4:1; large, variable dorsal apical thorn present; 6 - 10 deciduous elongate cornuti between apex and $\frac{1}{2}$.

LARVA: Not known.

HOST PLANTS: Not known, but distribution is coincident with range of Chionochloa rubra (red tussock) shown by Burrows (1967).

DISTRIBUTION (Fig. 253): Alpine grasslands of the South Island. Flight period December to February.

MATERIAL EXAMINED: 88 m.

Arthur's Pass: 7 m. 20.1.23, AM, C.E. Clarke; 2 m. CM, 2 m. ED, 8-9.2.26; 9 m. 23.1.28, ED, A. Philpott.

Bold Peak: 4 m. 8.2.13, ED, A. Philpott.

Burgoo Creek, Nel.: 1 m. VBD, 6.12.62, FRI, J.S. Dugdale.

Gordon's Pyramid, Nel.: 1 m. 25.1.24, CM, S. Lindsay.

Humboldt Range; 5 m. VAA, VAB, VAC, VAD, VAK, 28.2.03, DM, G.V. Hudson.

Island Pass, 4,500 ft. Nel.: 1 m. 15.2.66, FRI, J.S. Dugdale.

Lake Sylvester, Nel.: 17 m. 4-8.2.66, FRI, J.S. Dugdale.

Minaret Peak: 5 m. 29.12.23, AM, C.E. Clarke.

Mt. Arthur, 4,000 ft.: 2 m. 26-27.2.21, 4 m. 14.1.22, ED, A. Philpott.

Mt. Arthur Tableland, 4-5,000 ft.: 2 m. 3.2.10, ED, A. Philpott; 6 m. CM, 5 m. ED, 25-28.1.24, A. Philpott and S. Lindsay; 1 m. BAB, 19.2.46, DM, J.T. Salmon.

Mt. Cedric: 6 m. 18.1.27, ED, A. Philpott.

Mt. Crystal Ridge, 4,500 ft.: 4 m. 14.2.66, FRI, J.S. Dugdale.

Mt. Earnslaw, 4-5,000 ft.: 7 m. UAA, UAD, UAE, UAG, UAI, UAK, VAG, 16-22.2.03, DM, G.V. Hudson; 1 m. DAC, CM, 2 m. AGU, AGV, DM, 3.1.14, C.E. Fenwick; 5 m. UAC, UAF, UAH, UAJ, VAB, 9-16.1.14, DM, G.V. Hudson.

Mt. Luxmore, 3,500 ft.: 9 m. RBA, RBB, RBL, RBM, RBN, RBO, RPB, VBA, VBE, 2.2.65, FRI, J.S. Dugdale.

Mt. Peel, Nel.: 2 m. BAD, BAE, DM, 1 m. ED, 31.12.12, A. Philpott.

Mt. St. Arnaud, Nel.: 7 m. 30.12.33, CM, S. Lindsay.

Old Man Range, 4,000 ft.: 1 m. VAJ, Feb. 1906, DM, J.H. Lewis.

Speargrass Creek, 4,600 ft. Nel.: 1 m. VBC, 4.2.64, FRI, J.S. Dugdale.

Wakatipu: 1 m. no date, ED, A. Philpott.

REMARKS: One of the most abundant members of the genus in the South Island alpine grasslands (J.S. Dugdale, pers. comm.). Female probably semi-apterous like that of O.ordishi in this species group, as it has never been taken at light.

Meyrick (1885) described O.diplorrhous from specimens of O.crenaeus with a distinct whitish streak on the subcosta of the forewings. These forms are identical to O.crenaeus on male genitalia structure. In the Museum collections of New Zealand can be found specimens to make up a series showing complete gradation from form diplorrhous to typical crenaeus. Thus on these grounds, although the female is not yet known, I have no hesitation in synonymising diplorrhous with crenaeus. Systematically this species is close to the "simplex" cluster of species, with a strong superficial resemblance to large specimens of O.ordishi, so that examination of genitalia is recommended for positive identification.

Concerning the genitalia of this species there is much confusion in the paper by Philpott (1929a). His Fig. 31, labelled C.heteraulus, shows male crenaeus. His Fig. 56 labelled C.crenaeus shows male heteraulus. His Fig. 58 labelled C.diplorrhous shows male isochytus.

Orocrambus harpophorus (Meyrick) comb.nov.

Crambus harpophorus Meyrick, 1882, New Zealand Journal of Science, Dunedin, 1, p.187

Crambus harpophorus Meyrick, 1883, Trans. N.Z. Inst. 15, p. 30.

Lectotype m. (Dr. S. Bleszynski) in British Museum (Natural History), slide BM pyral 7976, labelled "L. Wakatipu New Zealand /1/80 RWF".

EXTERNAL CHARACTERS (Slide 38): Detailed description by Meyrick (1883), coloured illustration by Hudson (1928, Plate XX, Fig. 36 m.), with abbreviated description. Eye nocturnal type, female frenulum triple, wing span 25 - 29 mm (both sexes), With the black and white basal streaks of the forewing this species bears a superficial resemblance to Tawhitia pentadactyla and Maoricrambus oncobolus. Best separated by examination of genitalia, especially when specimens are worn.

MALE GENITALIA (Fig. 72, compared with sketch of lectotype by Dr. S. Bleszynski): As for generic and species group description except for the following: Arms of vinculum about $\frac{2}{3}$ uncus; Saccus tapered, with truncate apex and "keel". Costa of valve flanged, dorsal margin as long as uncus. Sacculus flanged. Gnathos clubbed, equal to uncus. Aedoeagus tubular, truncate, $2\frac{1}{4}$ x uncus, length to median breadth ratio 9:1, with slightly dilate apex, simple thorn dorsal at $\frac{1}{8}$ and a smaller one lateral, sinistrad at about $\frac{1}{2}$ (sometimes absent); 10 - 15 elongate cornuti between apex and $\frac{1}{2}$.

FEMALE GENITALIA (Fig. 156): As for generic description except for the following: Eighth abdominal tergite fusing dorso-laterally with ostium bursae, about twice as wide at fusion as in dorsal midline. Eighth sternite strong. Ductus bursae 5 - 6 x length of anal papillae, strong to $\frac{1}{2}$, ductus seminalis joining at about $\frac{5}{8}$, ostium a tapered funnel with exaggerated dorsal lip, ostiolar pouch region slightly swollen. Corpus bursae with two unequal oval signa.

LARVA: Not known.

HOST PLANTS: Not known, distribution coincident with range of Chionochloa rubra (red tussock) shown by Zotov (1963) and Burrows (1967).

DISTRIBUTION (Fig. 254): Sea level to 5,000 ft. in North and South Islands of New Zealand. Appears to be locally common in some coastal localities, but probably basically an alpine/subalpine species. In the North Island recorded only from Levin, Paiaka and Mt. Tongariro. Possibly two generations per year in North Island as Cumber recorded a specimen at Paiaka in June.

MATERIAL EXAMINED: 50 m. 4 f.

Arthur's Pass: 2 m. HFJ, IAA, 16.1.22, DM, H. Hamilton; 11 m. 16-22.1.22, AM, C.E. Clarke; 3 m. 21-27.1.22, ED (1), CM (2); 1 m. HFF, 24.1.22, DM, 1 m. HFI, 14.1.27, DM; G.V. Hudson; 1 m. 24.12.31, CM; 2 m. 1 f. 30-31.12.40, CM, S. Lindsay.
Ben Lomond (Queenstown): 1 m. IAB, 13.1.16, DM, C.E. Fenwick.
Dunedin: 1 m. IAC, 22.3.14, DM, C.E. Fenwick.
Fever Creek, Sthld.: 1 m. 21.12.19, ED, A. Philpott.
Gordon's Pyramid, Nel.: 2 m. 24.2.24, ED, A. Philpott.

Humboldt Range, (Otago): 1 m. (310i), no date, DM, G.V. Hudson.
 Iron Hill Ridge, 4,700 ft. Nel.: 1 m. 10.2.66, FRI, J.S. Dugdale.
 Kinloch, Otago: 1 m. CGO, 3.1.1881, CM, R.W. Fereday.
 Levin: 1 m. 20.1.09, ED, G.V. Hudson.
 Lake Sylvester, 3,900 ft. Nel.: 3 m. CGK, CGL, CGN, 8-11.2.66, FRI, J.S. Dugdale.
 Mt. Cedric, Nel.: 1 m. 18.1.27, ED, A. Philpott.
 Mt. Earnslaw, 3,000 ft.: 1 m. HFG, 14.1.14, DM, G.V. Hudson.
 Mt. Greenland, Westl.: 1 m. 23.3.10, ED, A. Philpott.
 Mt. Arthur Tableland, 4,300 ft.: 1 m. HFH, 3.2.10, DM, G.V. Hudson.
 Mt. Arthur, 4,500 ft. Nel.: 8 m. 1 f. 24-28.2.21; 1 m. 14.1.22, ED; 3 m. 2 f. 24-27.1.24, ED (1 m.), CM (2 m., 2 f.), A. Philpott.
 Chateau, Tongariro, 3,800 ft.: 2 m. OBA, OBB, 18.2.65, FRI, J.S. Dugdale.

REMARKS: Lowland North Island specimens (Levin) much smaller and browner than other specimens, with forewing markings indistinct. Although the forewing pattern deviates from the more typical pattern found in the majority of this species group, the genitalia characters show that phylogenetically this species is close to O. ramosellus and O. heteraulus.

Orocrambus heteraulus (Meyrick) comb.nov.

Crambus heteraulus Meyrick, 1905, Trans. ent. Soc. Lond., 1905, p. 225.

Holotype m. in British Museum (Natural History), slide BM pyral 7957, labelled "Humboldt Mts. New Zealand GVH/03."

EXTERNAL CHARACTERS (Slide 39): Detailed description by Meyrick (1905), coloured illustration by Hudson (1928, Plate XX, Fig. 37 f.) with abbreviated description. Eye nocturnal type, female frenulum triple, wing span 28 - 35 mm (both sexes). Easily separated on externals from any other species by its golden lustrous forewings with basally originating white fascia branching beyond the central disc. Females tinged with whitish; dark interneurate streaks in a few specimens of this sex.

MALE GENITALIA: (Fig. 73, topotype): As for generic and species group description except for following: Arms of vinculum about $\frac{3}{4}$ uncus; Saccus tapered, with "keel". Costa of valve flanged, dorsal margin of costa about $\frac{3}{4}$

uncus. Sacculus flanged, Gnathos parallel-sided, apically clubbed, equal to uncus. Aedoeagus tubular, $2\frac{1}{4}x$ uncus, dorsally strong to $\frac{1}{2}$, simple thorn dextro-dorsad at about $\frac{1}{4}$, linear group of 9 - 16 elongate cornuti between apex and $\frac{1}{2}$.

FEMALE GENITALIA (Fig. 157, topotype nr): As for generic description except for the following: Eighth abdominal tergite fusing dorso-laterally with ostium bursae, tergite narrow, as wide at fusion as in dorsal midline. Eighth sternite a strong lunate plate. Ductus bursae about 5x length of anal papillae, strong to $\frac{1}{3}$, pleated from $\frac{1}{3}$ to $\frac{2}{3}$, ductus seminalis joining at $\frac{2}{3}$. Ostium a tapered funnel, ostiolar pouch region barely swollen. Corpus bursae with two unequal oval signa.

LARVA: Not known.

HOST PLANTS: Not known.

DISTRIBUTION (Fig. 255): Humboldt Range and Routeburn Valley - boundary of western Otago and Fiordland. Flight period December and February.

MATERIAL EXAMINED: 13 m. 2 f.

Bold Peak, 4,000 ft.: 1 m. GFQ, 16.2.11, DM, G.V. Hudson; 2 m. 11.12.13, ED, A. Philpott.

Humboldt Range, 4,000 ft.: 2 m. GAE, GFN, 2 f. GFC, GAA, 26-28.2.03, DM, G.V. Hudson.

Mt. Luxmore, 3,500 ft.: 1 m. VBF, 2.2.65, FRI, J.S. Dugdale.

Routeburn, 2,500 ft.: 5 m. GAB, GAD, GAF, GFO, GFP, DM, 2 m. CM, Feb. 1911, G.V. Hudson.

REMARKS: Phylogenetically close to O.harpophorus on genitalia structure. In his paper on the male genitalia of the New Zealand Crambidae, Philpott (1929a) confused this species with crenaeus. His Fig. 56 should read "C.heteraulus Meyr." and Fig. 31 should read "C.crenaeus Meyr." This is a peculiar mistake, best attributed to an error in slide labelling. The two species are quite distinct, and Meyrick's descriptions (1885, 1905) repeated by Hudson (1928), are quite unambiguous.

Orocrambus lewisi sp.nov.

Holotype m. in Dominion Museum Wellington, author's genit prep. WAA, and allotype f, author's prep. WAB, both labelled "Titahi Bay, 2.1.04, G.V. Hudson".

EXTERNAL CHARACTERS (Slide 40): Antennae serrate in male, nearly filiform in female, eye nocturnal type, ocelli 0.05 mm in diameter, frenulum single in male, triple in female. Maxillary palpi triangular, labial palpi porrected, brown laterally, whitish yellow medially. Thorax and abdomen dark yellowish brown. Forewings yellow-brown with median white streak bordered obscurely with dark brown. Tendency for dark interneural streaking, but not consistently so. Costa with a faint white streak to apex, and on dorsum to about $\frac{3}{4}$. Cilia white, basally brown. Legs brown, scaled with white. Hindwings shining brownish white with whitish cilia. Very similar to O.ordishi, n.sp but on average specimens of O.lewisi are slightly smaller and darker. Female very similar to male, but with much more acute forewing apices. Wing span 28 - 30 mm (both sexes).

MALE GENITALIA (Fig. 74, holotype): As for generic and species group description except for the following: Arms of vinculum about $\frac{5}{4}$ uncus; Saccus parallel-sided, apically truncate. Costa of valve flanged, dorsal margin about equal to uncus. Sacculus not developed. Gnathos straight, tapered, bluntly pointed, equal to uncus. Aedoeagus tubular, slightly curved dorsad, moderately dilate apically, $2\frac{1}{4}x$ uncus, length to median breadth ratio 8-9:1, with 160° sinistrad torsion of strong dorsal midline towards apex, with hooked subapical thorn nearly ventrad. Cornuti absent.

FEMALE GENITALIA (Fig. 158): As for generic description except for following: Eighth abdominal tergite fusing dorso-laterally with ostium bursae, a third wider at fusion than in dorsal midline. Eighth sternite a strong lunate plate. Ductus bursae 4 - 5x length of anal papillae, strong to and narrowing at $\frac{1}{2}$, with pleated area from $\frac{1}{4}$ to $\frac{1}{2}$, ductus seminalis joining at $\frac{5}{8}$. Ostium a broad dorso-ventrally compressed funnel, with slightly exaggerated ventral lip, ostiolar pouch region swollen. Corpus bursae with two very unequal oval signa.

LARVA: Not known for certain, although the description by Sunley (in Hudson,

1928, p. 166) was probably of O. lewisi.

HOST PLANTS: Poa caespitosa (silver tussock), White (1963), ^{who} ~~called~~ ^{his specimens} C. simplex.

~~However~~ O. lewisi only recorded from Cass.

DISTRIBUTION (Fig. 256): Central South Island of New Zealand, largely in the grasslands east of the main divide, up to about 2,000 ft. Also from Stephen's Island, Cook Strait, and the west coast of the North Island from the vicinity of Titahi Bay down to Wellington. In latter locality among sand dunes. Also coastal in Otago (Dunedin) and Southland (Bluff). Flight period October to March.

MATERIAL EXAMINED: 46 m. 5 f.

Alexandra: 1 m. HGB, no date, ED, A. Philpott.

Balcairn, Cant.: 1 m. FGZ, 30.10.21, CM, S. Lindsay.

Bluff: 1 m. GGP, 21.11.13, ED, A. Philpott.

Cass, 1,870 ft. Cant.: 1 f. AGB, Nov. 1924, A. Tonnoir, CM, 1 m. LAK, 3.2.36, DM, J.T. Salmon.

Castle Hill, 2,000 ft. Cant.: 1 m. AED, 7.1.1893, AI, G.V. Hudson.

Dunedin: 1 f. AEJ, 17.1.13, AM, C.E. Clarke.

Gordon's Nob, Nel.: 10 m. GGL, 9.1.26, ED, A. Philpott.

Lake Tekapo: 2 m. FGN, 23-24.12.28, CM, S. Lindsay; 3 m. HGC, 24.12.28, ED, A. Philpott.

Lumsden: 1 f. WAS, 28.1.05, G.V. Hudson.

Mt. Cook: 1 m. FGT, 2.1.29, CM, S. Lindsay; 2 m. HGE, 8.2.29, ED, A. Philpott.

Mt. Grey, Cant.: 1 m. FGM, 27.11.21, 1 m. 13.11.25, 3 m. FGV, 3-5.11.29; CM, S. Lindsay.

Mt. Sugarloaf, 2,000 ft. Cant.: 1 m. FGP, 16.2.62, LC, E.G. White.

New River, Sthld.: 1 m. no date, 1 m. GGR, 10.1.09, 2 m. GGQ, 20.12.16; ED, A. Philpott.

Stephen's Island: 1 m. HGF, 1 f. HGG, 14-28.1.33, ED, E.S. Gourlay.

Takitimo Range: 1 m. GGZ, 28.12.12, ED, A. Philpott.

Titahi Bay: 1 m. WAA (holotype), 1 f. WAB (allotype), 2.1.04, DM, G.V. Hudson.

Waiau, Marl.: 6 m. FGO, 18-20.11.29, CM, S. Lindsay.

Wanaka: 1 m. AEH, 20.12.23, AIM, C.E. Clarke.

Wedderburn: 1 m. HGA, no date, ED, A. Philpott.

Wellington: 1 f. Dec. 1963, GC, D.E. Gaskin.

Whitestone River: 1 m. GGO, 30.1.19, ED, A. Philpott.

Yaldhurst, Cant.: 1 m. CFM, 2.3.30, CM, S. Lindsay.

REMARKS: See this section on O.simplex, for a detailed discussion of this and the other sibling species of the "simplex" complex. Philpott's Fig. 52 (1929a) labelled "C.simplex" is O.lewisi.

Orocrambus ordishi sp.nov.

Holotype m. author's genit prep. ALZ, allotype f. author's prep. BLB, 3 paratype m. (AEG), 1 paratype f. labelled "Hinds 13.3.11, C.E. Clarke Collection", and 1 paratype f. labelled "Mt. Ida 17.2.24" author's prep. BLG, in Auckland Museum. Also in Auckland 1 paratype m. labelled "Cape Egmont 13.3.11" with my additional label pointing out the obvious lapsus calami. All labels of locality data in Clarke's handwriting.

EXTERNAL CHARACTERS (Slides 41, 42): Antennae serrate in male, nearly filiform in female. Compound eye nocturnal type, ocelli 0.05 mm in diameter. Frons planoconvex; frenulum single in male, triple in female. Maxillar palpi triangular, labial palpi porrected; brownish yellow laterally and whitish medially. Thorax and abdomen golden brown, central thorax whitish. Forewings golden brown with median white streak from base to termen, obscurely margined with dull brown posteriorly. Costa with a faint white streak to $\frac{3}{4}$. Cilia white, basally streaked with brown. Hindwings shining pale brown with white cilia. Legs brown, scaled with white. Foregoing description based on male. Female similar in colouration but semi-apterous; hindwings much reduced, forewings long and narrow, but venation not simplified. Wing span 30 - 34 mm (male), 28 - 32 mm (female). Not possible to separate this species from others in the "simplex" complex by external characters.

MALE GENITALIA (Fig. 75): As for generic and species group description except for following: Arms of vinculum about $\frac{2}{3}$ uncus; saccus tapering to rounded apex. Costa of valve flanged, dorsal margin about $\frac{3}{4}$ uncus. Sacculus flanged. Gnathos straight, tapered, bluntly pointed, slightly longer than uncus. Aedoeagus tubular, slightly dilate apically, $2\frac{1}{4}$ x uncus, length to median breadth ratio about 7:1, dorsally strong from apex to $\frac{1}{2}$, apical thorn dorsad, dorsal apical third before thorn arched dorsad, 6 - 10 very small rose thorn-shaped cornuti between $\frac{1}{4}$ and $\frac{1}{2}$.

FEMALE GENITALIA (Fig. 159): As for generic description except for the following: Eighth abdominal tergite encircling ostium bursae, about $\frac{1}{3}$ wider ventrally than in dorsal midline. Eighth sternite a strong lunate plate. Ductus bursae about 5x length of anal papillae, weak except in region of encirclement, ductus seminalis joining at $\frac{2}{3}$. Ostiolar pouch region slightly swollen, ostium bursae tubular with limen very slightly constricted. Corpus bursae with two very unequal oval signa.

LARVA: Not known.

HOST PLANTS: Not known.

DISTRIBUTION (Fig. 257): Central and eastern grasslands of the South Island of New Zealand from sea level to about 2,500 ft. Northern limit of distribution in the South Island appears to be the Waimakariri River. Flight period late December to April. Results of trapping for this species at Winchmore (Ashburton, Canterbury) and Lincoln College are given in table 10 .

Table 10

Results of MV Trapping with 125 watt bulb, total operation, at Winchmore Irrigation Research Station, and Lincoln College, Canterbury.				
	Jan.	Feb.	Mar.	Apr.
Results for 1966-67, Winchmore	0	69	47	2
Results for 1966-67, Lincoln College	0	1	6	0

MATERIAL EXAMINED: 43 m. 3 f.

Birdling's Flat, Cant.: 1 m. LAN, 1.3.31, DM, S. Lindsay.

Cass, Cant.: 1 m. AEE, 8.2.06, AM, C.E. Clarke.

Horseshoe Lake, Cant.: 1 m. GGX, 23.3.23, ED, W. Heighway.

Hinds, Otago: 4 m. ALZ (Holotype) AEG (Paratype), 2 f. BLB (Allotype), 13.3.11, AM, C.E. Clarke.

Lake Pukaki: 2 m. HGD, 29.12.28, ED, A. Philpott.

Middlemarch, Otago: 1 m. AFF, 20.2.27, AM, C.E. Clarke.

Mt. Ida, Otago: 3 m. AEB, AEC, AEI, 1 f. (Allotype), 17.2.24, AM, C.E. Clarke.

Mt. John, 2,500 ft. Cant.: 1 m. FGI, 26.4.63, LC, E.G. White.
 Pukeatua Bush, Port Hills, Cant.: 3 m. GGC (ED), (CM,2), 13.3.26, S. Lindsay.
 Stuart's Gully, Cant.: 2 m. FGL, 11.2.23, CM, S. Lindsay.
 Winchmore, Cant.: 20 m. 17-28.2.67, GC, W.R. Lobb.
 Yaldhurst, Cant.: 1 m. GGA, 25.3.28, 1 m. 2.3.30, CM, S. Lindsay.

REMARKS: This species is discussed in detail in the remarks section under
O.simplex.

Orocrambus ramosellus (Doubleday) comb.nov.

Crambus ramosellus Doubleday, 1843, in: Dieffenbach's Travels in New Zealand, 2,
 p. 288.

Crambus rangona Felder, 1875, Reise Nov. Lep, 5, pl. cxxxvii, f. 25.

Crambus leucanialis Butler, 1877; Chilo, Proc. zool, Soc. Lond., 1877, p. 401.

Crambus apselias Meyrick, 1907, Trans. N.Z. Inst., 39, p. 109.

Syntype m. ramosellus in British Museum (Natural History) labelled "New Zealand
 42-55", no abdomen.

Type f. rangona in British Museum (Natural History) labelled "R.Nov cxxxvii, f.25
 Crambus rangona N.seeld. f."

Syntype m. leucanialis in British Museum (Natural History) labelled "N.Zeal
 77.34 Chilo leucanialis Butler Type".

Lectotype m. (Dr. S. Bleszynski) in British Museum (Natural History) slide BM pyral
 7975 and 4 paralectotypes, labelled "Crambus apselias Invercargill New Zealand
 GVH.06".

EXTERNAL CHARACTERS (Slide 43): Detailed description of typical forms and the
 variety named apselias in previous literature by Meyrick (1883, 1907). Eye
 nocturnal type, female frenulum triple. Wing span 20 - 27 mm (both sexes). This
 species can usually be recognised by the pale yellowish or straw-coloured fore-
 wings with dark basal streak ending in the disc. Form apselias has this streak
 frequently reaching the termen, usually spreading and becoming more attenuated.
 The principle forms of variation of the forewings in this species are shown in Fig.11.

MALE GENITALIA (Fig. 76): As for generic and species group description except
 for the following: Arms of vinculum about $\frac{2}{3}$ uncus; saccus tapered, longer than

uncus, with "keel". Costa of valve flanged, dorsal margin about $\frac{3}{4}$ uncus. Sacculus not flanged, but posterior extremity bears a short triangular projection breaking ventro-caudal margin of valve. Gnathos tapered, straight, bluntly pointed, slightly less than uncus. Aedoeagus tubular, $3\frac{1}{4} - 3\frac{1}{2}x$ uncus, length to median breadth ratio 9-10:1, original dorsal midline passing through 160° torsion sinistrad towards apex, frequently with small subapical thorn ventro-sinistrad. Irregular line of 3 - 7 variable rose thorn-shaped cornuti present, scattered.

FEMALE GENITALIA (Fig. 160): Eighth abdominal tergite fusing dorso-laterally with ostium bursae, tergite very narrow, 3 - 4x as wide at fusion as in dorsal midline. Eighth sternite a strong triangular plate. Ductus bursae about 8x length of anal papillae, strong to nearly $\frac{1}{2}$, pleated swelling at $\frac{1}{2}$, ductus seminalis joining at about $\frac{3}{4}$. Ostium bursae a tapering funnel, slightly narrowed at mouth, ostiolar pouch region not swollen, corpus bursae with two very unequal oval signa.

EGG: Oblate, 18 - 22 vertical ribs, 0.43 - 0.45 x 0.32 - 0.35 mm, creamy white when first laid, turning orange about 24 - 36 hours after being laid. Duration of egg stage observed (not under controlled conditions); 15 - 17 days in December, 16 - 18 days in February, March; 22 days in April. Gross embryological changes visible through the shell as in O.flexuosellus (pp.100).

HATCHING BEHAVIOUR: As for O.flexuosellus (pp.101), except that larvae are active immediately after leaving the shell, which is not consumed. Larvae search for a grass-stem and climb until reaching the first leaf-sheath separation. They crawl into the space between the inner and outer blades and build a fragile silk shelter against the ligule.

LARVA (Fig. 211, head capsule pattern, Fig. 221, final instar): Length of final instar larva 12 - 15 mm, moderately stout, brownish with darker pinacula giving the appearance of a dorsal and a pair of dorso-lateral stripes. Paler brown ventrally. On prothorax; L2 cephalad of L1, SV2 cephalad of SV1. Mesothorax

and Metathorax; L1 dorsad of L2, SD1 longer than SD2, D2 longer than D1. On abdominal segments; On A1, 2; L1 dorso-caudad of L2, SD2 very small, D1 longer than D2, SV2 caudad of and longer than SV1, SV3. On A3 - 6; L1 dorsad of L2, SV2 dorsad of SV1, SV3. On A7; L1 dorso-caudad of L2, SV1 ventro-caudad of SV2. On A9; D1, SD1 on common pinaculum.

DURATION OF LARVAL INSTARS: All larvae maintained at room temperature in small containers, conditions not controlled, food changed every two days. First instar: 8 - 11 days (December), 7 days (March); Second instar: 7 - 8 days (January), 9 days (March); Third instar: 7 - 10 days (January), 8 - 18 days (March-April); Fourth instar: 5 - 12 days (January), 11 - 17 days (April); Fifth instar: 6 - 15 days (January), 7 - 13 days (April); Sixth instar: 6 - 13 days (January-February), 9 - 17 days (April).

LARVAL FEEDING: After construction of the fragile silk shelter against the ligule as described earlier, the larva shortly begins to eat into the stem of the grass plant. There may be a resting period after construction of the initial shelter, but this was never more than an hour or two in my captive larvae. The larva retains this stem-boring habit until reaching the third or fourth instar, when it is usually too large to tunnel within the grass stems. At this time a vertical tunnel identical to that described for O.flexuosellus (pp.102) is constructed with 3 or 4 grass blades, usually dead ones, woven into the silk walls, which are further strengthened by frass particles. The larva pupates within this chamber above ground level (usually only 1 - 3 inches in my captive specimens), an observation first recorded by White (1963).

HOST PLANTS: Bred from pupae found in Poa caespitosa (silver tussock) and Festuca novaezealandia (hard tussock), White (1963). Some larvae sent to me via Mr J.S. Dugdale from a Wairarapa locality had been feeding on Agrostis tenuis (Brown Top). Captive larvae ate readily any common introduced grass given to them, of which identified species are: Poa annua L., Alopecurus pratensis L., (Meadow Foxtail), and Bromus catharticus L. (Prairie Grass).

PUPA: Dull medium brown with glossy head and abdomen. Spiracles dark, slightly raised. Abdominal setae microscopic, unmodified. Duration of pupal stage 22 - 47 days.

DISTRIBUTION (Fig. 258): Ubiquitous, North and South Islands of New Zealand, equally abundant at Cass, Canterbury in both improved and unimproved pastures (White, 1963). White noted that the apselias form was far more common than typical ramosellus in several tussock grassland areas of the South Island between 1,600 and 3,100 ft. He quoted Hilgendorf to show a change in apparent abundance of ramosellus over the last 50 years, but Hilgendorf's identifications were almost certainly approximate. The apselias form of O.ramosellus is associated with high country pastures and subalpine tussock grasslands in the eastern South Island and the central North Island. In the latter region the dark spotted form (Fig. 11) dominates, especially in wet areas near ditches and watercourses. In swamps at Waiouru it is replaced by O.simplex and in the dry well-drained areas where extensive thistle growth occurs, it is replaced by O.vittellus.

The flight period is from October to July. Records for Paiaka were given by Cumber (1951), for Cass by White (1963) and for Wellington by Gaskin (1964; a). Flight records for Massey University, Highbury (Palmerston North), Lincoln College and Winchmore Irrigation Research Station in Canterbury, are shown in table 11.

Table 11

Results of MV trapping for <u>O.ramosellus</u> , 125 watt bulbs, total operation, at three localities between 1965 and 1968, and 100 watt tungsten trapping at one (Highbury, Palmerston North)										
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.
Massey Univ. 1965-66	3	13	16	48	1	18	14	5	0	0
1966-67	10	26	72	20	0	31	33	3	1	1
1967-68	14	31	31	18	2	47	42	3	3	1
Highbury (P.N.)										
1965-66	0	0	16	5	1	6	1	0	0	0
1966-67	2	10	11	0	6	7	1	0	0	0
Lincoln, 1966-67	0	4	16	16	14	16	4	0	0	0
Winchmore, 1966-67	0	7	4	2	0	1	5	2	0	0

MATERIAL EXAMINED: 183 m. 45 f.

Akaroa: 2 m. Dec. 1924, CM, A. Tonnoir.

Aniseed Valley, Nel.: 1 m. 3.12.24, ED, A. Philpott.

Aorere River, Nel.: 1 m. 20.2.24, ED, A. Philpott.

Arthur's Pass: 1 m. 23.1.28, ED, A. Philpott.

Awapiri, Marl.: 1 m. WCE, 29.11.18, DM, J.A. Thompson.

Ball Glacier: 1 m. 14.12.29, ED, A. Philpott.

Belgrove, Nel.: 1 m. 1.12.55, ED, E.S. Gourlay.

Ben Lomond: 1 m. 19.12.13, ED, A. Philpott.

"Black Butterfly Mountain", Cant.: 1 m. 1.3.1869, CM, R.W. Fereday.

Bold Peak: 1 f. 3.2.13, ED, C.E. Fenwick.

Bottle Lake, Cant.: 1 m. 10.12.28; 1 m. 16.1.28; 1 m. 28.1.28; 1 m. 18.2.28;
CM, S. Lindsay.

Broad Bay, Otago: 3 m. 15.1.15, ED, C.E. Fenwick.

Cass, Cant.: 1 m. Nov. 1924, CM, A. Tonnoir; 1 m. Feb. 1962; 1 m. 14.3.62; LC,
E.G. White.

Castle Hill, Cant.: 1 f. QDs, 7.1.1893, DM, G.V. Hudson.

Christchurch: 5 m. 2 f. no date, CM, R.W. Fereday.

Cobb Valley Dam, 3,500 ft. Nel.: 2 m. DGO, DGW, 1 f. DGY, 7.2.66, FRI, J.S. Dugdale.

Cora Lynn, Cant.: 2 m. WCC, WCD, 15.1.27, DM, G.V. Hudson.

Day's Bay, Well.: 1 m. 28.12.37, CM, S. Lindsay.

Dunedin: 1 m. 7.12.13, QDO, DM, C.E. Fenwick; 1 m. 13.1.15, 1 m. 22.1.15, ED,
A. Philpott; 1 f. QDQ, 9.2.15, 1 f. QDX, 16.3.15, 1 m. QDt, 2.2.16; DM,
C.E. Fenwick.

Flagstaff, Dunedin: 1 m. 12.1.15, ED, A. Philpott.

Hikurangi, Nthld.: 1 m. Jan. 1936, CM, E. Fairburn.

Hoon Hay, Christchurch: 1 m. 27.11.28, ED, W. Heighway.

Horseshoe Lake, Cant.: 2 m. 7.2.25, CM, S. Lindsay.

Hurworth, Tar.: 2 m. 7.11.66, GC, D.E. Gaskin.

Invercargill: 1 m. WCB, 30.1.05, DM, 1 m. WCA, 1907, DM; A. Philpott.

Jack's Pass, Hanmer, Cant.: 1 m. 29.12.30, CM, S. Lindsay.

Kaitawa: 1 m. QDN, 8.11.23, DM, A. Hamilton.

Karori, Well.: 1 m. no date, (278b), ED, G.V. Hudson; 1 f. QDy, 18.12.35, DM,
J.T. Salmon; 17 m. QDb, QDe, QDf, QDg, QDh, QDi, QDl, QDk, QDm, 11 f. QDU, QDa,
QDc, Dec. 1964, GC, D.E. Gaskin.

Lake Rotorua: 3 m. 7.1.28, ED, A. Philpott.

Lake Sylvester, 5,300 ft. Nel.: 1 m. DGP, 8.2.66, FRI, J.S. Dugdale.

Lake Tennyson: 1 m. EGL, 16.2.65, FRI, J.S. Dugdale.

Little River, Cant.: 1 m. 1.4.23, CM, S. Lindsay.

Manaia, Tar.: 3 m. 3 f. 4.11.66, GC, D.E. Gaskin and K. Fox.

- Mt. Bailey, 2,200 ft. Cant.: 1 m. 6.1.62, LC, E.G. White.
- Mt. Cook: 1 m. 7.2.29, ED, A. Philpott; 1 m. QDY, 8.2.29, DM, A. Philpott; 1 m. 9.2.29, CM, A. Philpott.
- Mt. Cook Hermitage, 2,500 ft.: 1 m. MBA, 14.1.64, FRI, J.S. Dugdale.
- Mt. Hutt, Cant.: 1 m. Jan. 1878, CM, R.W. Fereday.
- Mount Maunganui: 1 m. DGU, 7.12.65, FRI, J.S. Dugdale.
- Mt. Sugar Loaf, 2,000 ft. Cant.: 1 m. 1 f. 28.2.62, 2 m. 3.12.62 (bred ex pupa); LC. E.G. White.
- Nelson Gorge: 1 m. 13.1.1870, CM, R.W. Fereday.
- Nelson: 1 m. 8.10.20, 1 m. 29.2.21, 1 m. 26.9.21, 1 m. 29.10.21, 3 m. 21-22.12.21 1 m. 21.12.27; ED. A. Philpott.
- New Brighton: 1 m. 19.12.26, CM, S. Lindsay.
- New River, Sthld.: 1 m. no date, CM, A. Philpott.
- Palmerston North: 25 m. QDC, QDD, QDE, QDG, QDI, QDL, QDN, QDO, QDP, QDR, QDV, QDW, QDY, 6 f. QDA, QDB, QDF, QDI, QDK, QDM, 10-19.12.65, 12 m. 2 f. QDS, QDT, 16-23.3.66, 4 m. 19-28.4.66, 9 m. 11 f. 8-20.3.67; GC, D.E. Gaskin.
- Pelorus River: 1 f. 2.4.25, ED, A. Philpott.
- Pleasant Point, Cant.: 3 m. Feb.-Mar. 1918, CM, S. Lindsay
- Porter River, Cant.: 1 m. 15.11.29, CM, S. Lindsay.
- Porter's Pass: 1 m. MBB, 17.3.65, FRI, J.S. Dugdale.
- Pouakai Range, 1,500 ft. Tar.: 1 m. 7.11.66, GC, D.E. Gaskin.
- Pui-pui Reserve, Marl.: 1 m. 6.12.57, ED, E.S. Gourlay.
- Puke Atua Bush, Cant.: 1 m. 12.1.30, CM, S. Lindsay.
- Queenstown: 1 m. 18.12.23, ED, A. Philpott.
- Remarkable Range, 3,000 ft.: 1 m. EGF, 15.1.66, FRI, J.S. Dugdale.
- Riccarton, Cant.: 1 m. 11.12.1864, CM, R.W. Fereday.
- Mt. Ruapehu: 1 m. QDP, 2.1.22, DM, H. Hamilton.
- Sandhill Point, Sthld.: 1 m. 1.1.17, ED, A. Philpott.
- Sedgemere, 3,300 ft. Nel.: 1 m. DGM, 13.2.66, FRI, J.S. Dugdale.
- Spreydon, Cant.: 1 m. Jan. 1919, 1 m. 29.1.32; CM, S. Lindsay.
- Stephen's Island: 3 m. 14-28.1.33, ED, E.S. Gourlay.
- Sullivan's Dam, Otago: 1 m. QDR, 24.10.40, DM, G. Howes.
- Tisbury, Sthld.: 1 m. 21.12.12, ED, A. Philpott.
- Upper Maitai, Nel.: 3 m. 10.2.24, ED, A. Philpott.
- Waihi Gorge, Cant.: 2 m. 25.12.43, CM, S. Lindsay.
- Waipori, Otago: 1 m. JAB, 2.1.46, DM, G. Howes.
- Waimakariri River, Cant.: 1 m. 1.1.23, ED, S. Lindsay.
- Wallacetown: 1 m. 22.12.09, ED, A. Philpott.
- Wellington: 2 m. no date (278L, 249a), ED, G.V. Hudson.
- West Plains, Sthld.: 7 m. 2 f. no date, ED, A. Philpott.
- Whitestone River, Sthld.: 1 m. 30.1.19, ED, A. Philpott.
- Winchmore, Cant.: 3 m. Nov. 1966, GC, W.R. Lobb.

REMARKS: Meyrick (1907) and Hudson (1928) distinguished Crambus apselias from ramosellus on forewing characters. C.apselias was stated to lack the row of terminal black dots on the forewings. Most lowland North Island female ramosellus lack these dots on the termen, but do not conform to the apselias description in any other respect.

Philpott (1929a) showed slight differences in the shape of the gnathos and the shape and size of cornuti in C.apselias and ramosellus. However these differences are not consistent in any long series of preparations; in fact few specimens of either form are exactly alike in the shape and size of their cornuti. It is possible to set up series of specimens showing complete gradation in forewing pattern from the apselias type to the typical ramosellus (Fig. 11), and from Philpott's apselias form to typical Philpott ramosellus in cornuti shape and number, but the two series are not consistent with one another. The two forms have identical female genitalia.

Orocrambus simplex (Butler) comb.nov.

Chilo simplex Butler, 1877, Proc. zool. Soc. Lond., 1877, p.400, pl. XLIII, Fig.12.

Crambus simplex (Butler) Meyrick, Trans. N.Z. Inst., 15, p. 24.

Syntype m. in British Museum (Natural History) labelled "N.Zeal. 77.34" and a specimen labelled "Chilo simplex Butler Type", slide BM pyral 5562 m.

EXTERNAL CHARACTERS (Slides 44, 45): The description of wings and body given by Butler (1877) and Meyrick (1883) is applicable to the males of all the "simplex" complex of sibling species; O.simplex, O.lewisi, O.ordishi and O.abditus. Eye nocturnal type, female frenulum triple. There is a trend among all the females of this complex towards the semi-apterous state, with much narrower forewings than the male, with very acute apices, and generally a weaker flight. This trend has reached its maximum present extent in O.ordishi, where the female might be mistaken for a Pterophorid by the casual observer or collector. Coloured illustrations by Hudson (1928, Plate XX, Fig. 14 m, 15 f.) may be taken from either O.simplex or O.lewisi specimens, which were mixed together

in the Hudson collection series (simplex from Waiouru and lewisii from Titahi Bay). Photograph of Waiouru simplex given by Gaskin (1966, Plate 18, Fig. 2 m.). Wing span 25 - 33 mm (both sexes).

MALE GENITALIA (Fig. 77, compared with type sketch by Dr. S. Bleszynski):

As for generic and species group description except for the following: Arms of vinculum about $\frac{3}{4}$ uncus; Saccus nearly parallel-sided, with excavate apex. Costa of valve flanged, dorsal margin equal to uncus. Sacculus flanged. Gnathos tapered, pointed, slightly longer than uncus. Aedoeagus tubular, truncate, $2\frac{1}{2} - 2\frac{3}{4}x$ uncus, length to median breadth ratio 8:1, strong dorsally from apex to $\frac{1}{2}$, with 4 - 7 elongate cornuti scattered from apex to $\frac{1}{2}$.

FEMALE GENITALIA (Fig. 161): As for generic description except for the following:

Eighth abdominal tergite fusing dorsally with ostium bursae, about $\frac{1}{2}$ as wide at fusion as in dorsal midline, tergite sharply angled in lateral midlines.

Eighth sternite a strong lunate plate. Ductus bursae about 6x length of anal papillae, strong to and narrowing at about $\frac{1}{4}$, ductus seminalis joining at $\frac{3}{4}$. Ostium bursae a flared funnel, ostiolar pouch region not swollen relative to ostium. Corpus bursae with two unequal signa.

EGG: Oblate, with 14 - 19 vertical ribs, 0.50 - 0.52 x 0.36 - 0.38 mm, pale yellow when first laid, turning orange after 24 - 36 hours. Duration of egg stage observed (not under controlled conditions); 12 - 13 days (February).

Gross embryological changes visible through the shell as in O.flexuosellus (pp.100).

HATCHING BEHAVIOUR: The larva does not consume the egg shell after hatching, and at once crawls into the nearest soil or plant debris or among matted grass roots.

LARVA: (Fig. 209, head capsule pattern): Length of final instar larva 12 - 14 mm.

stout, brownish green with dark brown pinacula giving appearance of dorsal and pair of dorso-lateral stripes. Greyish in spiracular region, paler brown ventrally. The larval description by Sunley (in Hudson, 1928, p. 166) probably applies to O.lewisii since Sunley largely collected on the Makara coast near

Wellington. However the specimens were not preserved in any museum collection and there is no way of being sure. The food-plant noted, Poa caespitosa is same noted for O.lewisi at Cass (White, 1963, under C.simplex).
 Chaetotaxy: Prothorax; L2 cephalad of L1, SV2 cephalad of SV1. Mesothorax and Metathorax: L1 slightly dorso-caudad of L2, SD1 longer than SD2, D2 longer than D1. Abdominal segments: On A1, 2; L1 dorso-caudad of L2, SD2 very small. D1 longer than D2. SV2 caudad of and longer than SV1, SV3. On A3-6; L1 dorsad of L2, SV2 dorsad of SV1, SV3. A7; L1 dorso-caudad of L2. SV1 ventro-caudad of SV2. On A9; D1, SD1 on common pinaculum.

DURATION OF LARVAL INSTARS: Larvae maintained in small containers at room temperature, conditions not controlled, food changed every two days. First instar: 8 - 11 days (February); Second instar: 9 - 13 days (February, March); Third instar: 7 - 14 days (March); Fourth instar: 9 - 16 days (March); Fifth instar: 13 - 17 days (March-April); Sixth instar: 188 days (April-October, 1 larva only). This protracted final instar gives a life cycle in close agreement to that described by Sunley (in Hudson, 1928, p. 166), who however did not distinguish instars or give any information on instar durations, and unless the range of simplex has been radically reduced, was describing O.lewisi.

LARVAL BEHAVIOUR: The captive larvae constructed irregular winding tunnels, largely horizontal ones, up to six inches long through the bases of clumps of Poa annua on which they were fed. Pupation occurred in a blind end of the tunnel in the soil litter among the matted food plant roots. Tunnels incorporate silk, frass and debris, with the latter predominating, and are very difficult to find in the wild state.

HOST PLANTS: Associated with P.caespitosa and C.rubra at Waiouru.

PUPA: Dull brown, with slightly raised dark spiracles, abdominal setae microscopic, unmodified. About 8 - 9 mm long. Duration of pupal period about 72 days (only 1 specimen reared through).

DISTRIBUTION (Fig. 259): Interior plateau of the North Island from north of Taihape to the southern Hawkes Bay coast but usually above about 2,000 ft. Nelson Province and west coast of the South Island, west of the main divide to Waiho River, near Franz Joseph. Flight period November to late February.

MATERIAL EXAMINED: 81 m. 12 f.

Arthur's Pass: 1 m. AEA, 27.1.22, AIM, C.E. Clarke; 2 m. GGT, GGU, 8.11.57, ED, E.S. Gourlay.

Beeby's Nob, Nel.: 1 m. 26.12.27, ED, A. Philpott.

Golden Downs, Nel.: 3 m. GGY, 8.1.26, ED, A. Philpott.

Haumoana, Hawkes Bay: 1 m. BMD, 2.1.67, DC, 1 m. BMC, 21.12.67, DC, T.H. Davies.

Lake Brunner: 3 m. LAD, LAJ, LAL, 20.2.40, DM, J.T. Salmon.

Lake Rotoiti: 1 m. FGY, 26.12.23, CM, S. Lindsay; 5 m. CFI, CFK, CFP, LAB, LAM, 11.2.40, DM, J.T. Salmon.

Maruia Springs: 1 m. FGJ, 27.12.38, CM, S. Lindsay.

Otirā: 2 m. CFA, CFH, Jan. 1916, DM, G.V. Hudson; 3 m. CFL, LAA, LAE, 21.2.40, DM, J.T. Salmon.

Puketitiri: 1 m. BMB, 30.1.66, DC, T.H. Davies.

Tophouse, Nel.: 3 m. CFB, CFD, CFE, 31.12.35, DM, G.V. Hudson.

Waiho, Westl.: 1 m. LAF, 18.2.27, DM, A. Castle; 1 m. WAI, 25.1.38, DM, G.V. Hudson

Waiouru: 2 m. WAC, WAD, Dec. 1928, DM, G.V. Hudson; 32 m. XTB, 4 f. KTD, FGO, FGR, 2-3.2.66, GC, D.E. Gaskin; 17 m. 8 f. 7.12.66, GC, D.E. Gaskin and D.J. Greenwood.

REMARKS: Orocrambus simplex, O.lewisi, O.ordishi and O.abditus form a tight sibling complex within this subgroup which are almost identical in habitus and best discussed together. Phylogenetically they are closely related and all show a trend towards development of a semi-apterous female. Most if not all of the New Zealand Museum series of Crambus simplex contained mixtures of some or all of these species; only in the Canterbury Museum is Crambus abditus holotype correctly labelled.

The description of Crambus abditus by Philpott is an interesting problem, since on external characters it is impossible to distinguish from the other species. The holotype is yellower than most specimens of the other three species, and in fact O.abditus in both sexes tends to be slightly more yellow

than the other species in forewing colour, but not consistently so. In his description Philpott (1924) makes specific reference to the acute forewing apices of abditus, yet must have known the same character occurred in the female of simplex. However he calls the holotype a male, which it is obviously not, and the abdomen is entire, the genitalia unexamined. Thus the original description of this species seems to have resulted from one or more mistakes on Philpott's part, but nevertheless O.abditus is a valid species.

Since this group are all tussock grassland species and appear to have in three cases discrete allopatric ranges within the South Island, they offer an interesting possibility for future ecological work in this genus. The factors limiting their distributions are not presently known.

The males of O.abditus are recognisable by the trumpet-shaped aedoeagus and the large group of elongate cornuti. The apex of the saccus is truncate. The arched aedoeagus with small grit-like cornuti and apical thorn at once separates O.ordishi from other males and in this species the female is semi-apterous. The excavate saccus, strong posterior dorsal midline (without thorn) and elongate cornuti of the aedoeagus of O.simplex are quite characteristic. There are also relatively small but consistent differences in the structure of the female genitalia of O.simplex, abditus and lewisi. The ostium in O.ordishi is encircled by the eighth tergite. Only in the males of O.lewisi are cornuti completely absent in the aedoeagus.

Orocrambus siriellus (Meyrick) comb. nov.

Crambus siriellus Meyrick, 1882, New Zealand Journal of Science, (Dunedin) 1, p.187.

Crambus siriellus Meyrick, 1883, Trans. N.Z. Inst., 15, p. 25.

Lectotype m. (Dr. S. Bleszynski) in British Museum (Natural History) labelled "Hamilton New Zealand 17/1/80."

EXTERNAL CHARACTERS (Slide 46): Detailed description by Meyrick (1883), coloured illustration by Hudson (1928, Plate XX, Fig. 28 m.) with abbreviated description. Eye nocturnal type, female frenulum triple, wing span 29 - 34 mm.

(both sexes). Most specimens have a distinct reddish tinge to their forewings. The pale band on the dorsum separates this species from all in the genus but O. scutatus, O. crenaeus and perhaps dark specimens in the "simplex" complex. Identification easily confirmed by examination of genitalia.

MALE GENITALIA (Fig. 78): As for generic and species group description except for the following: Arms of vinculum about $\frac{2}{3}$ uncus; saccus parallel-sided, tapering abruptly to blunt apex with "keel". Costa of valve flanged, dorsal margin $\frac{7}{8}$ uncus. Sacculus flanged. Gnathos straight, tapered, bluntly pointed, slightly longer than uncus. Aedoeagus tubular, curving dorsad, apically dilate, $2\frac{3}{4}$ - 3x uncus, length to median breadth ratio 9-10:1, dorsally strong from apex to $\frac{1}{2}$, terminating in long straight thorn. Ten to twelve rose-thorn shaped rather elongate cornuti between apex and $\frac{1}{2}$.

FEMALE GENITALIA (Fig. 162): As for generic description except for the following: Eighth abdominal tergite fusing dorso-laterally, diagonally with ostium bursae, about twice as wide at fusion as in dorsal midline. Eighth sternite a weak lunate plate. Ductus bursae 6 - 7x length of anal papillae, strong to $\frac{3}{8}$, plicated from $\frac{3}{8}$ - $\frac{7}{8}$, ductus seminalis joining at $\frac{7}{8}$. Ostium bursae a dorso-ventrally compressed tapering funnel, ostiolar pouch region swollen with a distinct ring of thickening. Corpus bursae two very unequal oval signa.

LARVA: Not known.

HOST PLANTS: Not known, but associated with Poa caespitosa, Carex spp. and Juncus spp. at National Park.

DISTRIBUTION (Fig. 260): Locally distributed in swampy areas from Northland to Southland, also on the Chatham Islands. As well as localities given below, also from Little Bush, Hawkes Bay (T.H. Davies, pers. comm.). Flight period December to February.

MATERIAL EXAMINED: 54 m. 6 f.

Broken River, Cant.: 1 m. 25.12.34, CM, S. Lindsay.

Cass, Cant., 2,500 ft.: 1 m. 4.2.26, DM, J.T. Salmon.

Cave Creek, Craigieburn, Cant.: 4 m. 2 f. BGS, BGT, 26.12.34 - 1.1.35,
 CM, S. Lindsay.

Golden Downs, Nel.: 12 m. 8.1.26, ED, A. Philpott.

Goulard Downs, Nel.: 1 m. 7.2.22, ED, A. Philpott.

Kaitoke: 1 m. DFG, 27.12.07, 1 m. DFC, 27.12.11, DM, G.V. Hudson.

Lake Brunner: 1 m. KAB, 20.2.40, DM, J.T. Salmon.

Manapouri: 5 m. 1 f. 29.12.22-4.1.23, ED (1), CM (5), S. Lindsay.

Mt. Arthur, 4,000 ft.: 1 f. 26.1.24, CM, S. Lindsay.

Mt. Arthur Tableland, 3,600 ft.: 3 m. DFA, DFB, DFE, 16.2.1888, DM, G.V. Hudson

Mt. Holdsworth, 2,000 ft.: 1 f. KAA, 15.2.31, DM, E. Plank.

National Park: 2 m. 7 Dec. 1967, GC, D.E. Gaskin.

Obelisk: 1 m. DAD, 1.1.40, DM, G. Howes.

Seaward Moss, Sthld.: 1 m. KAE, no date, DM, C.E. Fenwick, 2 m, no date, 2 m.
 27.1.15, 2 m. 31.12.19; ED, A. Philpott.

Titoki: 1 m. Jan. 1936, CM, E. Fairburn.

Waimarino: 1 m. DFD, Jan. 1930, DM, G.V. Hudson.

West Plains, Sthld.: 1 m. KAD, no date, DM, G. Howes; 4 m. no date, ED, A. Philpott

Wilderness: 1 f. DAE, 5.1.41, DM, G. Howes.

Wharekauri, Chatham Islands: 6 m. 12-14.12.23, CM. C. Lindsay.

Waiouru: 1 m. DFE, 2.2.12, DM, G.V. Hudson.

REMARKS: I found this species in close association at National Park with
O.apicellus. Phylogenetically close to O.harpophorus and O.ramosellus but more
 primitive in most respects.

Orocrambus callirrhous (Meyrick) comb.nov.

Crambus callirrhous Meyrick, 1882, New Zealand Journal of Science (Dunedin) 1, p.137

Crambus callirrhous Meyrick, 1883, Trans. N.Z. Inst., 15, p. 24.

Crambus schedias Meyrick, 1911, Trans. N.Z. Inst., 43, p. 60. (n.Syn.)

Crambus callirrhous Meyrick, Bleszynski and Collins, p. 258 in: A Short Catalogue
 of the World Species of the Family Crambidae (Lepidoptera),
 Acta zool. cracov, Kracow, 7, p. 197-389. (misspelling of
Crambus callirrhous).

Lectotype m. in Canterbury Museum author's genit prep. BGM, labelled "Lake Guyon,
 Feb.-Mar. 1871 R.W. Fereday coll."

Holotype m. in British Museum (Natural History) slide BM pyral 7980, labelled
 "Wellington New Zealand GVH. 3.08." "Crambus schedias Meyr."

EXTERNAL CHARACTERS (Slide 47): Detailed descriptions by Meyrick (1883, 1911), coloured illustration by Hudson (1928, Plate XX. Fig. 33 (schedias), Fig. 34 (callirrhous)), with abbreviated descriptions. Eye nocturnal type, female frenulum triple, wing span 24 - 32 mm (both sexes). Frons conical. Worn specimens in particular difficult to separate on externals from superficially similar O.lectus, O.haplotomus, O.enchophorus, O.paraxenus and O.vittellus. Identification easily checked by reference to genitalia structure of either sex.

MALE GENITALIA (Fig. 79, compared with lectotype): As for generic and species group description except for the following: Arus of vinculum about $\frac{1}{2}$ uncus; saccus elongate, tapered, with "keel". Costa of valve flanged, dorsal margin about $\frac{7}{8}$ uncus. Gnathos tapered, straight, bluntly pointed, equal to uncus. Sacculus flanged. Aedoeagus tubular, $2\frac{1}{4}x$ uncus, length to median breadth ratio 10-11:1, simple subapical thorn dorsad, about 10 elongate cornuti clustered at $\frac{1}{2}$.

FEMALE GENITALIA (Fig. 163); As for generic description except for the following: Eighth abdominal tergite fusing dorso-laterally with ostium bursae, about three times as wide at fusion as in dorsal midline. Eighth sternite a weak lunate plate. Ductus bursae 7 - 8x length of anal papillae, strong to $\frac{1}{3}$, ductus seminalis joining at $\frac{2}{3}$. Ostium bursae a simple funnel, curved ventrad, ostium opening ventro-caudad, ostiolar pouch region markedly swollen. Corpus bursae with two very unequal signa.

LARVA: Not known.

HOST PLANTS: Festuca novaezealandia (hard tussock), White (1963), possibly others in coastal North Island.

PUPA: One found by White (1963) and bred out, but not described.

DISTRIBUTION (Fig. 261): Eastern and central South Island up to about 3,500 ft. Distribution in North Island apparently limited to coast near Wellington and at Whangarei. Flight period December to April.

MATERIAL EXAMINED: 64 m. 6 f.

1 f. no date or locality, DM, G.V. Hudson.

Arthur's Pass: 1 m. MCA, 15.2.27, ED, A. Philpott.

Birdling's Flat, Cant.: 1 m. JAF, 19.3.33, DM, S. Lindsay.

Bottle Lake, Cant.: 1 m. 11.2.22, ED; 3 m. (HFB (763b), HFC (763c), HFA, (763d))
HC, 4 m. CM, 24.3.23; 4 m. 22.3.25, ED (1), CM (3); 1 m. 17.2.28, CM. S. Lindsay

Brooklands, Christchurch: 7 m. (JAC, DM), 1 f. 12.2.33, CM; S. Lindsay.

Christchurch: 1 m. 29.3.33, ED, S. Lindsay; 1 m. 16.12.67, 4 m. no data, CM,

R.W. Fereday.

Clarence Bridge, Marl.: 1 f. HFE, 24.1.30, DM, G.V. Hudson.

Lake Guyon: 1 f. BGM, Mar. 1871, CM, R.W. Fereday.

Lees Valley, Cant.: 2 m. 9.2.29, CM, S. Lindsay.

Miramar, Wellington: 12 m. (328p); ED (2), HC (10) IDA, IDB, IDC, IDD, IDE, IDF,
GFV, GFW, GFY, GFZ; April 1927, 1 m. GFY, 22.3.28, DM, G.V. Hudson.

Mt. Cook: 1 m. JAA, 8.1.29, DM, A. Philpott.

Mt. Grey, Cant.: 1 m. JAE, 22.1.28, DM; 1 m. 2.3.30, CM; S. Lindsay.

Mt. John, Cant.: 1 m. 21.2.63, LC, E.G. White.

Mt. Ida: 1 m. 17.2.24, AM, C.E. Clarke.

New River, Sthld.: 2 m. no date, ED, 1 m. HFD, no date, DM; A. Philpott.

Oakden's Bush, Cant.: 1 m. 7.3.1873, CM, F.W. Fereday.

Otira Gorge: 1 m. JAD, 21.2.40, DM, J.T. Salmon.

Sandymount, Sthld.: 1 m. 25.1.14, ED, A. Philpott.

Sandhill Point, Sthld.: 1 m. 1.1.17, ED, A. Philpott.

Sedgemere, 3,300 ft. Nel.: 2 f. CGY, CGZ, 13.2.66, FRI, J.S. Dugdale.

Stuart's Gully, Cant.: 1 m. 25.3.23, CM, S. Lindsay.

Waimate, Cant.: 1 m. 8.4.26, CM, S. Lindsay.

Whangarei: 1 m. Feb. 1935, CM, E. Fairburn.

Yaldhurst, Cant.: 6 m. 25.3.28, CM, S. Lindsay.

REMARKS: The minor forewing shape and colour differences which Meyrick (1911) used as justification for the description of C.schedias as a separate species are not constant. Philpott (1929a) showed an apparent difference in the position of entrance of the ductus ejaculatorius into the aedoeagus in schedias and callirrhous, but I could not find any difference when re-examining the preparations from which he took his drawings, and can only conclude that he misinterpreted what he saw. Dr. S. Bleszynski has examined the type of schedias and other specimens labelled callirrhous in the Meyrick collection in the British Museum and confirms

my view that the two forms are identical.

Sister species of O.enchophorus and O.vittellus.

Orocrambus enchophorus (Meyrick) comb.nov.

Crambus enchophorus Meyrick, 1885, Trans. N.Z. Inst., 17, p. 136.

Crambus pedias Meyrick, 1885, Trans. N.Z. Inst., 17, p. 137 (N.Syn.)

Crambus scitulus Philpott, 1925, Trans. N.Z. Inst., 56, p. 390. (N.Syn.)

Lectotype m. (Dr. S. Bleszynski) and 4 paralectotypes in British Museum (Natural History), lectotype slide BM pyral 5628, labelled "Castle Hill New Zealand 2,500 ft. 18/1/83, Crambus enchophorus".

Lectotype m. (Dr. S. Bleszynski) and 5 paralectotypes in British Museum (Natural History), lectotype slide BM pyral 7962, labelled "Wanganui New Zealand 3/3/83", Syntype f. in Canterbury Museum labelled "Crambus pedias n.sp. 3/3/83. Specimen ex abdomen."

Holotype m. in Canterbury Museum, author's genit. prep. BGK, labelled "Crambus scitulus holotype male Mt. Arthur 4,000 ft. 24.1.24, S. Lindsay".

EXTERNAL CHARACTERS (Slide 48): Full description of major forms by Meyrick (1885) and Philpott (1925), coloured illustrations by Hudson (1928, Plate XX, Fig. 16 f. (enchophorus), Fig. 32 m (pedias), Plate L1, Fig. 23 m. (scitulus)), with abbreviated descriptions. Eye Nocturnal type, female frenulum triple, wing span 24 - 40 mm (both sexes). Small pale specimens difficult to distinguish from O.callirrhous, large pale alpine specimens which have been worn and rubbed are almost impossible to tell apart from O.crenaeus without resorting to examination of the genitalia.

MALE GENITALIA (Fig. 80, compared with lectotype sketch by Dr. S. Bleszynski): As for generic and species group description except for the following: Arms of vinculum about $\frac{1}{2}$ uncus; Saccus tapered, elongate, curved dorsad, without "keel". Costa of valve flanged, dorsal margin slightly less than uncus. Sacculus flanged. Gnathos apically clubbed, equal to uncus. Aedoeagus tubular, truncate, $2\frac{3}{4}x$ uncus, length to median breadth ratio 10:1, original dorsal midline with 180° sinistrad torsion towards apex, with simple subapical thorn ventrad, and a second thorn frequently dextrad at $\frac{3}{8}$, especially in large dark specimens, 10 - 12 slender closely packed cornuti at about $\frac{1}{2}$.

FEMALE GENITALIA (Fig. 164): As for generic description except for the following:

Eight abdominal tergite fusing dorsally with ostium bursae, about half as wide at fusion as in dorsal midline. Tergite with fragile triangular projections in lateral midlines of anterior margin representing anterior apophyses. Eighth sternite a strong lunate plate. Ductus bursae about 8 - 9x length of anal papillae, ductus seminalis joining at about $\frac{7}{8}$. Ostium bursae a cupuliform funnel, ostiolar **pouch** region swollen. Corpus bursae with two nearly equal oval signa.

EGG: Oblate, 16 - 25 vertical ribs, 0.47 - 0.53 x 0.37 - 0.44 mm, pinkish white when first laid, turning orange-grey after 24 - 36 hours. Duration of egg stage at room temperature, not under controlled conditions, 12 - 14 days in March.

Gross embryological changes visible through the shell as for O.flexuosellus (p.100).

HATCHING BEHAVIOUR: The shell is not consumed, and the larva at once crawls into shelter after freeing itself. After 1 - 5 hours a fragile shelter has been constructed among soil debris at the base of the foodplant.

LARVA (Fig. 220, final instar; Fig. 210, head capsule pattern). Length of final instar larva 12 - 18 mm, stout, sluggish, glassy greyish green with brown pinacula giving appearance of interrupted dorsal and dorso-lateral striping. Greenish brown ventrally. On prothorax strong dorsal shield developed, L2 dorso-cephalad of L1, SV2 cephalad of SV1. Mesothorax and Metathorax: SD1 longer than SD2. Abdominal segments: On A1, 2: L1 very slightly dorso-caudad of L2, SV2 cephalad of SV1, SV3. On A3 - 6; SV2 dorsad of SV1, which is dorsad of SV3. On A7; SV1 caudad of SV2. On A9; D1, SD1 on common pinaculum.

DURATION OF LARVAL INSTARS: All larvae maintained at room temperature in small containers, not under controlled conditions. First instar: 10 - 30 days (March); Second instar: 13 - 29 days (April); Third instar: 12 - 35 days (April-May); Fourth instar: 13 - 58 days (April-May); Fifth instar: 9 - 57 days (May-June); Sixth instar: 48 - 175 days (May-January).

LARVAL BEHAVIOUR: Long horizontal chambers are constructed through the top half inch of the soil by the early instars, while the fifth and sixth instars make deep extensions into the topsoil of 1 - 4", the walls being composed of silk, frass

and soil particles. The larva pupates in the enlarged terminal portion of this vertical tunnel. Captive larvae were observed to come out of their tunnels to feed at night, eating strips from the leaf blades close to the tunnel entrance and sometimes pulling thin slivers of leaf back into the tunnel entrance and eating them inside.

HOST PLANTS: Native host not known, but associated with Poa caespitosa at Waiouru. In improved pastures found feeding on Bromus catharticus and Festuca arundinacea; will feed readily on Poa annua and Agrostis tenuis in captivity.

DISTRIBUTION (Fig. 262): In South Island of New Zealand mainly east of the main divide, up to 5,400 ft. in Tasman Mountains. In the North Island distributed in the south, especially on the west coast. Also found in alpine and subalpine grassland in the central plateau. Apart from localities given below also recorded from Haumoana and Little Bush, Hawkes Bay (T.H. Davies, pers. comm.) Flight period January to May. Light trap results for Massey University given in table 12.

Table 12

Results of light trapping for <u>O.enchophorus</u> at Massey University with 125 watt MV bulb, total operation.						
	Jan.	Feb.	Mar.	Apr.	May	Jun.
1965-66	0	0	4	1	0	0
1966-67	0	1	23	20	2	0
1967-68	0	0	16	13	3	0

PUPA: Medium to dark brown, about 10 - 15 mm long, with dark slightly raised spiracles, stout. Abdominal setae microscopic, unmodified. Duration of pupal stage 29 - 42 days.

MATERIAL EXAMINED: 105 m. 10 f.

Alberttown, Otago: 1 m. KDF, 10.3.41, DM, G. Howes.

Aorangi, East Cape: 1 m. 12.3.09, ED, G.V. Hudson.

Berwick, Otago: 1 f. AAA, 9.4.12; 2 m. EAB, EAC, 26.4.12; DM, C.E. Fenwick.

Cape Saunders, Otago: 2 m. (731g) FFW, DM, ED, 4 m. AM, 1.4.17; 1 m. (731e) EAD, 24.2.18, DM; 3 m. (731b) FFT, ED, (731 L) FFV, (731k) FFU, 2 f. (731c) EAE, (731i) EAF, DM, 4 m. AM; 11.4.20, C.E. Clarke; 2 m. 28.1.27, CM, S. Lindsay.

Castle Hill, Cant.: 1 m. no date, CM, R.W. Fereday; 1 m. 8.3.30, CM, S. Lindsay.
 Castlepoint, Wairarapa: 1 m. 28.12.63, GC, K.F. Maynard.
 Craigieburn, 4,000 ft. Cant.: 17 m. TBA, TBB, TBC, TBD, TBE, TBF, TBG, TBH, TBI,
TBJ, TBK, TBL, TBM, TBN, TBO, TBP, TBQ, 18.3.65, FRI, J.S. Dugdale.
 Iron Hill, Nel.: 1 m. 9.2.66, FRI, J.S. Dugdale.
 Island Pass, 4,590 ft. Nel.: 7 m. EGN, 15.2.66, FRI, J.S. Dugdale.
 Jack's Pass, Marl.: 1 m. BGN, 11.2.31, CM, S. Lindsay.
 Kaituna, Cant.: 1m. Feb. 1921, CM, S. Lindsay.
 Karori, Well.: 1 m. KDC, 10.4.28, DM, G.V. Hudson.
 Little River, Cant.: 3 m. 1.4.23, CM, S. Lindsay.
 Lowry Bay, Well.: 3 m. KDA, KDB, KDE, 12-13.3.29, DM, G.V. Hudson.
 Makara, Well.: 1 f. KDD, 20.4.08, DM, G.V. Hudson, 1 m. KDG, 26.4.45, DM, G. Howes.
 Mt. Arthur, 4,000 ft. Nel.: 1 m. BGK, 24.1.24, CM, S. Lindsay (Holotype of Crambus scitulus).
 Mt. Chrome, Nel.: 1 m. YBA, 9.2.64, FRI, J.S. Dugdale.
 Mt. Grey, Cant.: 5 m. 28.3.26; 6 m. 6-8.4.28; 5 m. 16.3.30; CM, S. Lindsay.
 Mt. Ida: 9 m. 19.2.22, AM, C.E. Clarke.
 Mt. Torlesse, 4,000 ft. Cant.: 3 m. 16.2.37, CM, S. Lindsay.
 Nelson: 1 f. 29.1.1870, CM, R.W. Fereday (possible syntype of Crambus enchophorus)
 1 m, 1.4.09, ED, G.V. Hudson.
 Palmerston North: 1 m. 2.3.66; 2 m. 3.3.66; 1 m. 7.9.66 (bred specimen); 1 m.
 5.4.66; 1 f. 10.4.66; 1 f. 22.4.66; GC, D.E. Gaskin.
 Mt. Crystal Ridge, 5,400 ft. Nel.: 1 f. 14.2.66, FRI, J.S. Dugdale.
 Mt. Ruapehu, Chateau Tongariro, 3,800 ft.: 1 m. ZBA, 18.2.65, FRI, J.S. Dugdale.
 Port Hills, Cant.: 1 m. 9.3.24, CM, S. Lindsay.
 Pui-pui Reserve, Kaikoura, Marl.: 1 m. 6.1.30, CM, S. Lindsay.
 Pukeatua Bush, Cant.: 1 m. 28.1.27, CM, S. Lindsay.
 Ribbonwood Fan, Cass, 2,100 ft. Cant.: 1 m. 26.3.62, LC, E.G. White.
 Rotorua: 1 f. WBA, 11.4.61, FRI, J.S. Dugdale.
 Waimate, Cant.: 2 m. 6.4.26; 1 m. 26.3.33; CM, S. Lindsay.
 Waiouru: 3 m. Dec. 1967, GC, P.J. Wigley and D.E. Gaskin.
 Wanaka: 1 f. 10.3.41, DM, G. Howes.

REMARKS: Philpott (1929a) showed drawings of male genitalia of enchophorus and scitulus, but not pedias. I examined the genitalia preparation of scitulus from which the drawing had been made and found it to be a specimen of callirrhous. Other specimens in the Philpott collection labelled Crambus scitulus were in fact very large dark specimens of callirrhous. However the holotype of scitulus in the Canterbury Museum collection has genitalia identical with those of any

large dark enchophorus, and I have no hesitation in synonymising it with that species. Dr. S. Bleszynski has checked the genitalia of the lectotypes of enchophorus and pedias in the British Museum (Meyrick collection) and agrees with my opinion, based on a study of material in New Zealand, that the two species are one and the same.

The major differences between specimens called enchophorus and those called pedias by Meyrick (1885) are size and locality. Specimens of pedias in New Zealand museum collections were all from North Island lowland localities. Specimens of enchophorus are almost all from the subalpine eastern South Island. Hudson (1928) remarked on the great similarity of the two species, giving size as the major difference.

In the Canterbury Museum there is a long series of enchophorus from several South Island localities. The specimens from the Otago peninsula are as small as those labelled pedias from the southern part of the North Island.

Variation in the male genitalia is confined to size and the degree of development of the ornamentation, which is more marked in large dark specimens. In the large females the ostium bursae is more heavily chitinised than in small specimens. There is variation in the intensity of the grey forewing colour, and in the degree to which terminal and subterminal rows of black dots are developed.

Very large worn specimens of O.enchophorus approach dark specimens of O.crenaeus, and small pale specimens resemble dark specimens of callirrhous. Examination of the genitalia easily confirms identifications in these cases.

Phylogenetically this species is sister species to O.callirrhous.

Orocrambus isochytus (Meyrick) comb.nov.

Crambus isochytus Meyrick, 1888, Trans. N.Z. Inst., 20, p. 68.

Lectotype m. and 1 paralectotype (Dr. S. Bleszynski) in British Museum (Natural History) labelled "Mt. Arthur New Zealand 4,300 ft. 16/1/86".

EXTERNAL CHARACTERS (Slide 49): Detailed description by Meyrick (1888), coloured illustration by Hudson (1928, Plate xx, Fig. 10 m.) with abbreviated description. Eye diurnal/nocturnal intermediate type, female frenulum triple, wing span 35 - 41 mm (both sexes). Externally very similar to O.crenaeus, but differs from it in the sharper delimitation of the fascia colour and the more acute forewing apices, and the conical frons.

MALE GENITALIA (Fig. 81, topotype): As for generic and species group description except for the following: Arms of vinculum about $\frac{3}{4}$ uncus; saccus tapered, with rounded apex. Costa of valve with relatively weak flange, dorsal margin about equal to uncus. Sacculus not differentiated. Gnathos tapered, straight, bluntly pointed, equal to uncus. Aedoeagus tubular, $2\frac{3}{4}$ x uncus, length to median breadth ratio 8-9:1, drawn apically into short flat spur, aperture of ductus ejaculatorius angled dextrad, simple thorn ventrad at $\frac{3}{4}$. Dense patch of small cornuti sinistrad, at about $\frac{1}{4}$.

FEMALE GENITALIA (Fig. 165, topotype): As for generic description except for the following: Eighth abdominal tergite fusing dorso-laterally with ostium bursae, about three times as wide at fusion as in dorsal midline. Eighth sternite a strong lunate plate. Ductus bursae about 6x length of anal papillae, strong to $\frac{1}{3}$, ductus seminalis joining at about $\frac{2}{3}$. Ostium bursae a broad pleated funnel, ostiolar pouch swollen. Corpus bursae with two very unequal oval signa.

LARVA: Not known.

HOST PLANTS: Not known, but the distribution of this alpine species is coincident with that given for Chionochloa australis (carpet grass) by Burrows (1967).

DISTRIBUTION (Fig. 263): Alpine tussock grasslands of the Nelson Province. Flight period December to February.

MATERIAL EXAMINED: 24 m. 6 f.

Burgoo Creek, 4-4,200 ft. Nel.: 1 m. RBE, 6.12.62, FRI, J.S. Dugdale.

Blue Creek, 3-5,000 ft. Nel.: 4 m. RBH, RBJ, RBC, RBS, 12.1.65, FRI, J.S. Dugdale

Cobb Valley, 3,500 ft. Nel.: 1 m. RBD, 7.12.62, FRI, J.S. Dugdale.

Gordon's Pyramid, 4,000 ft. Nel.: 2 m. 1 f. BGF, 25.1.24, CM, S. Lindsay.
 Mt. Arthur, 4,500-5,000 ft.: 2 m. FFO. FFP. no date, DM, G.V. Hudson; 1 m. HAC, 24.1.1889, DM, G.V. Hudson; 1 m. 1 f. 12-16.12.22, ED, A. Philpott; 1 m. 2.2.23, ED, 2 f. AM, A. Philpott; 1 m. FFO, 1 f. HAD, 9.1.24, DM, G.V. Hudson; 1 m. 27.1.24, ED, A. Philpott; 1 m. FFR, 16.1.32, DM, G.V. Hudson.
 Mt. Arthur Tableland: 1 f. HAA, 19.2.46, DM, J.T. Salmon.
 Mt. Owen, 5,000 ft.: 6 m. RBC, RBF, RBG, RBI, RBK, RBR, 14.1.65, FRI, J.S. Dugdale.
 Mt. Peel, Nel.: 1 m. HAB, 31.12.12, DM, A. Hamilton; 1 m. 21.1.43, ED, E.S. Gourlay.

REMARKS: There is little variation in genitalia in this species, and the dense patch of oval cornuti are a feature unique to this species. Sister species of O.scutatus, but very distinct.

Philpott (1929 gave the genitalia of this species correctly (Fig. 54.) but used another specimen of isochytus for the drawing of Crambus diplorrhous male genitalia (Fig. 58), but with the aedoeagus turned to the right. Since Philpott drew all his specimens with the aedoeagus in left lateral aspect this error is a direct result of drawing genitalia which have been squashed under a cover slip without prior examination. Specimens in his collection at Entomology Division are correctly labelled, so possibly the confusion was compounded by mistakes in slide labelling.

Orocrambus paraxenus (Meyrick) comb.nov.

Crambus paraxenus Meyrick, 1885, Trans. N.Z. Inst., 17, p. 137.

Lectotype m. and 4 paralectotypes (Dr. S. Bleszynski) in British Museum (Natural History), lectotype slide BM pyral 7982, labelled "Wakatipu New Zealand 17/12/82".

EXTERNAL CHARACTERS (Slide 50): Detailed description by Meyrick (1885), coloured illustration by Hudson (1928, Plate XX, Fig. 17 m.) with abbreviated description. Eye nocturnal type, wing span 30-33 mm (male). Female not known. Difficult to tell from forewings from O.dicrenellus, except that O.paraxenus has a conical frons. Also difficult to tell apart from large specimens of O.vittellus where the usual characteristic white fascia notch of that species is missing. However very fresh specimens of paraxenus usually have a slight greenish tinge to the forewings.

MALE GENITALIA (Fig. 82): As for generic and species group description except for following: Arms of vinculum about $\frac{1}{2}$ uncus; Saccus tapered, parallel-sided, apically rounded, with "keel". Costa of valve weakly flanged, dorsal margin about $\frac{1}{2}$ uncus, drawn dorsally into introrse tooth. Sacculus flanged. Gnathos tapered, straight, bluntly pointed, equal to uncus. Aedoeagus pistol-shaped, 2x uncus, length to median breadth ratio about 13:1, simple thorn ventro-sinistrad at about $\frac{1}{4}$, 4 - 7 elongate cornuti at $\frac{1}{2}$.

LARVA:: Not known.

HOST PLANTS: Not known.

DISTRIBUTION (Fig. 264): South Island, usually above about 2,000 ft. Hudson (1928) and White (1963) state that it is associated with dry tussock areas. Flies December-February.

MATERIAL EXAMINED: 25 m.

Ben Lomond: 2 m. 25.11.12, ED, 1 m. AM; 2 m. FFS, DM, 1 m. ED, 1 m. AM, 18-23.12.13; 1 m. BAA, 5.1.14, DM, C.E. Fenwick and A. Philpott; 1 m. 22.2.16, AM, C.E. Clarke.

Lake Luella: 3 m. 22.12.19, ED, A. Philpott.

Macetown, Otago: 2 m. FAC, FAD, DM, 1 m. ED, 22.12.08 - 10.1.09, A. Hamilton.

Mount Constitution, Makarora: 1 m. 6.11.23, AM, C.E. Clarke.

Mount Earnslaw: 2 m. VAF, VAL, 16-22.1.08, G.V. Hudson, 1 m. CM, 27.12.22, C.E. Fenwick.

Mt. John, MacKenzie Country, Cant.: 3 m. 21.2.63, LC, E.G. White.

Remarkable Range, 5,700-7,000 ft.: 2 m. CGX, DGA, 15.1.66, FRI, J.S. Dugdale.

REMARKS: Sister species of O.vittellus

Orocrambus scutatus (Philpott) comb.nov.

Crambus scutatus Philpott, 1917, Trans. N.Z. Inst., 49, p. 242.

Holotype m. and 2 paratype m. in Entomology Division collection, Nelson, 2 paratype m. in Dominion Museum, Wellington, labelled "Longwoods 26-29.12.15, A. Philpott", author's paratype prep. AAE.

EXTERNAL CHARACTERS (Slide 51): Detailed description by Philpott (1917), coloured illustration by Hudson (1928, Plate XLIV, Fig. 3 m.) with abbreviated

description. Eye nocturnal type, wing span 26 - 30 mm (male). Female not known. Externally this species can be separated by its fuscous hindwings from the superficially similar O.siriellus.

MALE GENITALIA (Fig. 83, paratype): As for generic and species group description except for the following: Arms of vinculum about $\frac{3}{4}$ uncus; Saccus very elongate, longer than uncus, tapered to rounded apex, with "keel". Costa of valve flanged, dorsal margin about equal to uncus. Sacculus flanged. Gnathos tapered, straight, bluntly pointed, equal to uncus. Aedoeagus tubular, curved dorsad, 3x uncus, length to median breadth ratio about 10-11:1, strong apically in dorsal midline, terminating in a short spur flattened ventrally; 5 - 8 elongate cornuti scattered between apex and $\frac{1}{2}$.

LARVA: Not known.

HOST PLANTS: Not know, but distribution records are partly coincident with that shown by Burrows (1967) for Chionochloa teretifolia (hairy snowgrass).

DISTRIBUTION (Fig. 265): Subalpine tussock in Southland. Flight period December and January.

MATERIAL EXAMINED: 12 m.

Gore Hill: 3 m. AAA, AAB, AAC, 11.12.44, DM, G. Howes; 4 m. AAD, EFE, EFF, EFG, 9.1.45, DM, J.T. Salmon.

Longwoods, 2,700 ft.: 5 m. AAE, 26-29.12.15, DM (2, incl. AAE, paratypes); ED (holotype and two paratypes), A. Philpott.

REMARKS: Sister species of O.isochytus.

Orocrambus tuhualis (Felder) comb.nov.

Crambus tuhualis Felder, 1875, Reis. Nov. Lep., 5, pl. cxxxvii, f. 18.

Crambus thrincodes Meyrick, 1910, Trans. N.Z. Inst., 42, p. 64. (Bleszynski and Collins syn. 1962.)

Holotype f. in British Museum (Natural History), slide BM pyral 5673, labelled "Novara cxxxvii f. 18 Crambus tuhualis N. Seeld. f."

Holotype m. in British Museum (Natural History) labelled *Crambus thrincodes* Kaitoke, New Zealand GVH.07".

EXTERNAL CHARACTERS (Slide 52): Detailed description by Meyrick (1910), coloured illustration by Hudson (1928, Plate XX, Fig. 8 m.) with abbreviated description. Rather difficult to separate on external characters from *O. vulgaris*, especially when rubbed, and very difficult to tell from *O. ornatus* or *O. punctellus* without examining genitalia. Eye nocturnal type, female frenulum triple, wing span 23 - 28 mm (both sexes).

MALE GENITALIA (Fig. 84): Arms of vinculum about $\frac{5}{4}$ uncus; Saccus very elongate, longer than uncus, tapering to rounded apex with "keel". Costa of valve flanged, drawn dorsally into prominent introse prong, apically truncate, dorsal margin about $1\frac{1}{2}$ x uncus. Sacculus not developed. Gnathos tapered, nearly straight, clubbed, about $1\frac{1}{4}$ x uncus. Aedoeagus very stout, length to median breadth ratio $6\frac{1}{2}:1$, apical $3\frac{1}{2}:1$, with blunt subapical thorn sinistrad at about $\frac{1}{8}$; 3 very large rose-thorn shaped cornuti between apex and $\frac{1}{2}$.

FEMALE GENITALIA (Fig. 156, compared with type sketch by Dr. S. Bleszynski): As for generic description except for the following: Eighth abdominal tergite fusing dorsally with ostium bursae, about $\frac{1}{3}$ as wide at fusion as in dorsal midline, tergite narrowing sharply just before point of fusion. Eighth sternite a strong lunate plate. Ductus bursae about 4x length of anal papillae, strong to $\frac{1}{2}$, ductus seminalis joining at $\frac{5}{8}$. Ostium bursae cupuliform, with ostiolar pouch region grossly swollen, narrowing sharply at about $\frac{1}{4}$, very strong, with the surface irregularly and deeply rugose, the pleats becoming vertical from $\frac{1}{4}$ to $\frac{1}{2}$ in ductus. Ostium opening dorso-caudad. Corpus bursae with two unequal oval signa.

LARVA: Not known.

HOST PLANTS: Not known, possibly *Juncus* spp., as recorded from swampy area at Kaitoke by Hudson (1928).

DISTRIBUTION (Fig. 266): A local species, found throughout the South Island and with a few footholds in the southern part of the North Island, in swampy areas.

Apparently never really common. Flight period November to December.

MATERIAL EXAMINED: 32 m. 5 f.

Cobb Hut, 3,500 ft. Nel.: 1 m. KBA, 7.12.62, FRI, J.S. Dugdale.

Day's Bay, Well.: 1 m. LDF, 21.12.12, DM, G.V. Hudson.

Dun Mountain, 3,000 ft. Nel.: 1 m. 8.1.22, 1 m. 3.2.24, ED, A. Philpott,

Gouland Downs, Nel.: 1 f. 7.2.22, CM, 3 m. ED, 2 f. CM, 7.2.22, A. Philpott.

Kaitoke: 3 m. ED, 1 m. HFL, 3.1.03; 1 m. LDD, 27.12.07, 1 m. HFM, 27.12.11;

3 m. LDB, LDC, LDE, 26.12.12; DM, G.V. Hudson.

Lake Rotoiti: 2 m. 25.12.33, CM, S. Lindsay.

Mt. Alexander, Marl.: 1 m. 30.12.29, CM, S. Lindsay.

Mt. Grey, Cant.: 2 m. 11-15.11.23; 2 m. 28.12.24; CM, S. Lindsay; 1 m. 23.12.25, ED, W. Heighway; 1 m. 9.1.29, CM, S. Lindsay.

Mt. Whekere, Marl.: 1 m. 4.1.30, CM, S. Lindsay.

Nelson: 2 m. 15.2.24, ED, A. Philpott.

Picton: 3 m. 2-5.12.31, CM, S. Lindsay.

Soldier's Creek, Reefton: 1 m. KBB, 17.12.62, FRI, J.S. Dugdale.

Waiho, Westld.: 1 f. LDA, 25.1.38, DM, G.V. Hudson.

Waihi, Cant.: 1 f. 26.12.39, CM, S. Lindsay.

REMARKS: The most distinctive genitalia in the genus. The small number of quite grotesque cornuti are accommodated in the swollen apical region of the aedoeagus, and the swollen ostiolar region of the female is a structure obviously associated with the corresponding peculiarity in the male aedoeagus.

Phylogenetically near O.vulgaris but this species has deviated considerably from the typical genitalic forms found in Orocrambus, and is not as close to vulgaris as vulgaris is to enchophorus.

Orocrambus vittellus (Doubleday) comb. nov.

Crambus vittellus Doubleday, 1843, in Dieffenbach's Travels in New Zealand, 2, p.289.

Crambus nexalis Walker, 1863, List of the Specimens of Lepidopterous Insects in the Collection of the British Museum, 27, p. 178.

Crambus transcissalis Walker, 1863, List of the Specimens of Lepidopterous Insects in the Collection of the British Museum, 27, p. 178.

Crambus sublicellus Zeller, 1863, Chilonidarum et Crambidarum genera et species. Berolinensis, p. 31.

Crambus bissectellus Zeller, 1863, Chilonidarum et Crambidarum genera et species, Berolinensis, p. 32.

Crambus incrassatellus Zeller, 1863, Chilonidarum et Crambidarum, genera et species, Berolinensis, p. 32.

Crambus vapidus Butler, 1877, Proc. zool. Soc. Lond. 1877, p. 399.

Crambus conopias Meyrick, 1907, Trans. N.Z. Inst., 39, p. 110. **Syn. nov.**

Neotype m. (Dr. S. Bleszynski) in British Museum (Natural History), slide BM pyral 7955, labelled "New Zeal. 54.4", Crambus vittellus.

Lectotype f. (Dr. S. Bleszynski) in British Museum (Natural History), slide BM pyral 5575, labelled "Auckland, N. Zeal. 60.73", Crambus nexalis.

Holotype m. in British Museum (Natural History) ex abdomen, labelled "New Zealand 4.5.61", Crambus transcissalis.

Neotype m. (Dr. S. Bleszynski) in British Museum (Natural History) of Crambus sublicellus, same specimen as used for neotype designation of Crambus vittellus, (slide BM pyral 7955).

Neotype m. (Dr. S. Bleszynski) in British Museum (Natural History), slide BM pyral 7950, labelled "Castle Hill New Zealand 2500 ft. 18.i.82," Crambus bisectellus.

Holotype f. in Naturhistorisches Museum, Vienna, ex abdomen, with labels "30.1871", "vidit ZII.871, Hugel 674", Crambus incrassatellus.

Syntype f. in British Museum (Natural History), slide BM pyral 5532, labelled "N.Zeal. 77.34 Crambus vapidus Type."

Holotype f. in British Museum (Natural History), slide BM pyral 5634, labelled "Dunedin New Zealand GVH.05," Crambus conopias.

EXTERNAL CHARACTERS (Slides 53, 54): Detailed descriptions of most varieties of this species (other than form conopias) by Meyrick (1883). Coloured illustrations by Hudson (1928, Plate XX, Figs. 2-4) with abbreviated description. Eye nocturnal type, female frenulum triple, wing span 19 - 28 (both sexes).

Venation shown in Fig. 17. Most specimens of all the varieties of O.vittellus bear the good specific character of a white notch or triangular projection on the anterior margin of the white forewing fascia

MALE GENITALIA (Fig. 85, compared with type sketches by Dr. S. Bleszynski):

As for generic and species group descriptions except for the following: Arms of vinculum about $\frac{1}{2}$ uncus; saccus parallel-sided for most of its length,

tapering abruptly to rounded apex with "keel". Costa of valve flanged, dorsal margin $\frac{2}{3}$ uncus. Sacculus flanged. Gnathos tapered, straight, pointed, slightly longer than uncus. Aedoeagus pistol-shaped, $2\frac{1}{2} - 2\frac{3}{4}$ x uncus, length to median breadth ratio about 14-15:1, original dorsal midline with 180° sinistrad torsion towards apex, with small thorn sinistrad at about $\frac{1}{2}$, sometimes a second small thorn subapical, ventrad; 10 - 16 slender cornuti between apex and $\frac{1}{2}$.

FEMALE GENITALIA (Fig. 167, compared with type sketches of conopias, vapidus and nexalis by Dr. S. Bleszynski): As for generic description except for the following: Eighth abdominal tergite fusing dorso-laterally with ostium bursae, about three times as wide at fusion as in dorsal midline. Eighth sternite not present, except possibly as a lip of thickening fused to lamellae postvaginalis. Ductus bursae 10-11x length of anal papillae, strong to about $\frac{1}{8}$, ductus seminalis joining at about $\frac{7}{8}$. Ostium bursae a slender funnel, ostiolar pouch region swollen. Corpus bursae with two unequal oval signa.

EGG: Oblate, 14 - 22 vertical ribs, 0.48 - 0.50 x 0.28 - 0.30, orange brown when first laid, turning brown after 24 - 36 hours. Duration of egg stage at room temperature, not under controlled conditions; 11 days in January, 12 days in February, 13 - 16 days in March. Gross embryological changes visible through shell as for O.flexuosellus, (p.100).

HATCHING BEHAVIOUR: Identical to that of O.enchophorus (p.191), shell not consumed after hatching.

LARVA (Fig. 222 fourth instar; Fig. 223 final instar; Fig. 212, head capsule): Length of final instar larva 10 - 13 mm, moderately stout, pale brown with darker greenish brown pinacula giving the appearance of a dorsal and pair of dorso-lateral stripes. Pale brown ventrally. Prothorax with well-developed dorsal shield, strong in 5th and final instars, L2 dorso-cephalad of L1, SV2 cephalad of SV1. Mesothorax and Metathorax: SD1 longer than SD2, D2 longer than D1. Abdominal segments: On A1, 2; L1 nearly dorsad to L2, SV1, SV3 cephalad of SV2. On A3-6; SV1, SV2, SV3 almost in horizontal line. On A7; L1 almost

dorsad of L2, SV1 ventro-caudad of SV2. On A9; D1, SD1 on common pinaculum.

DURATION OF LARVAL INSTARS: All larvae maintained at room temperature, not under controlled conditions, food changed every two days. First instar: 9 - 11 days (February), 10 - 14 days (March), 10 - 29 days (April); Second instar: 9 - 21 days (February-March), 9 - 16 days (March), 14 - 28 days (April); Third instar: 6 - 17 days (March), 27 - 50 days (March-April), 25 - 47 days (April-May); Fourth instar: 13 - 23 days (March), 15 - 30 days (March-April), 15 - 33 days (April-May), 21 - 45 days (May-July); Fifth instar: 7 - 22 days (March-April), 11 - 51 days (April-June), 17 - 32 days (June-August); Sixth instar: 36 - 88 days (March-July), 54 - 175 days (April-October).

LARVAL BEHAVIOUR: Almost identical with that observed for O. flexuosellus (pp. 102), especially in the construction of vertical feeding tunnels. Pupation occurred in the basal portion about 1" below soil level. Larvae were not observed to leave their tunnels. During the coldest weather, when night room temperatures dropped to perhaps 8-10°F above freezing the larvae ceased eating and aestivated, reviving and eating during the day if the containers were kept in shadow. Occasionally the head of the larva emerged from the end of the chamber to pull a fragment of grass into the tunnel to eat it.

HOST PLANTS: Native host not known. Found only on brown top Agrostis tenuis in the wild.

PUPA: Bright golden brown, about 6 - 9 mm in length, moderately stout. Spiracles dark, very slightly raised, abdominal setae microscopic, unmodified. Duration of pupal stage 62 - 122 days.

DISTRIBUTION (Fig. 267): North, South and Stewart Islands, associated with both native and European grasses, especially prominent in improved grasslands in the eastern South Island (White, 1963). Flight period November to April, in most of New Zealand, but in warm seasons flies in October in South Taranaki (pers. obs.). Light trapping results over the last few seasons show an

interesting difference in the apparent abundance of this species at Lincoln College and at Winchmore, further south, where it is without doubt the dominant Crambid in the catch, (Table 13). Also Auckland Islands.

Table 13

Results of total operation MV trapping with 125 watt bulbs at four localities, and with 100 watt tungsten at one (Highbury).							
		Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
Highbury (Palmerston North)	1965-66	0	3	69	88	2	0
	1966-67	0	0	5	55	36	1
	1967-68	0	4	7	80	12	0
Massey Univ.	1965-66	0	0	870	502	21	3
	1966-67	0	18	227	620	134	2
	1967-68	2	5	197	733	86	3
Manutuke, (Gisborne)	1966-67	17	18	144	115	75	0
Winchmore	1966-67	0	150	4776	7630	80	1
Lincoln	1966-67	0	11	379	719	177	0

MATERIAL EXAMINED: 271 m. 81 f.

Adams I (Auckland Is): 4 m. 31.1.66, Bishop Museum, Honolulu, K.A.J. Wise.
Akaroa, Cant.: 1 m. Dec. 1924, CM, A. Tonnoir.

Albertown, Otago: 2 m. UDA, 1 f. 15.3.43, DM, G. Howes.

Arapawa Island, Marl.: 4 m. 2 f. Feb-Mar 1963, GC, D.E. Gaskin.

Arthur's Pass: 1 m. 25.12.19, ED, A. Philpott.

Barrack Creek, Otira Gorge, 1,500 ft.: 1 f. UDF, no date, FRI, J.S. Dugdale.

Ben Lomond: 1 m. 19.12.13, ED, 1 m. UCF, 19.1.14, DM, A. Philpott.

Birdling's Flat, Cant.: 2 m. 30.11.29, CM, S. Lindsay.

Bluff, Sthld.: 1 m. 25.11.13, ED, A. Philpott.

Borland River: 2 m. 27.1.17, ED, A. Philpott.

Bottle Lake, Cant.: 1 m. 13.1.23, ED, W. Heighway; 2 m. 15.2.25, CM; 4 m. 2 f. 28.1.28, CM; S. Lindsay.

Cass, 1,870 ft. Cant.: 1 m. UDI, 3.2.36, DM, J.T. Salmon

Castlepoint, Wairarapa: 12 m. 5 f. Dec. 1963, GC, D.E. Gaskin.

Cave Creek, Craigieburn, Cant.: 1 m. 5.1.35, CM, S. Lindsay.

Cobb Dam ridge, 3,450 ft. Nel.: 1 m. DGZ, 7.2.66, FRI, J.S. Dugdale.
 Cupola 4,650 ft.: 1 m. 8.1.65, FRI, J.S. Dugdale.
 Christchurch: 1 m. 16.12.1867; 2 m. 1869; CM, R.W. Fereday.
 Drayton Station, Cant.: 1 m. 1.1.1879, CM, R.W. Fereday.
 Dun Mountain, Nel.: 2 m. 29.11.20; 4 m. 1 f. 14.12.20; 1 m. 6.1.21; 1 m. 17.1.21; ED, A. Philpott.
 Elfin Bay, Stewart Island: 1 m. 24.1.18, ED, A. Philpott.
 Fever Creek, Sthld.: 2 m. 21.12.19, ED, A. Philpott.
 Fortrose, Sthld.: 1 m. QDZ, 12.1.40, DM, J.T. Salmon.
 Gordon's Knob, Nel.: 2 m. 9.1.26, ED, A. Philpott.
 Greenhills, Sthld.: 2 m. 2.12.18, ED, A. Philpott.
 Island Pass, 4,590 ft. Nel.: 7 m. DGH, EGB, EGC, EGD, EGE, EGH, EGI, 15.2.66, FRI, J.S. Dugdale.
 Kaituna, Cant.: 1 m. 11.3.23, CM, S. Lindsay.
 Kapiti Island: 1 m. 2 f. 12.2.66, GC, D.E. Gaskin.
 Karori, Wellington: 7 m. 2 f. 6-10.3.64, GC, D.E. Gaskin.
 Kauaeranga: 1 m. 9.11.63, FRI, P. Crowhurst.
 Kinloch, Otago: 2 m. 8.2.43, ED, DM, G. Howes.
 Kowai Bush, Cant.: 1 m. 17.3.24, ED, W. Heighway.
 Lake Mavora: 1 m. UDI, 1 f. 1-2.1.41, DM, G. Howes.
 Lake Pukaki: 3 m. 29.12.28, ED, A. Philpott.
 Lake Rotiti: 3 m. UDL, 11.2.40, DM, J.T. Salmon.
 Lake Tekapo: 1 m. 24.12.28, CM, S. Lindsay.
 Lee's Valley: 1 m. 10.2.29, CM, S. Lindsay.
 Little River, Cant.: 3 m. 28-9.1.28, CM, S. Lindsay.
 Macetown: 1 m. no date, ED, A. Philpott.
 Manaia, Tar.: 3 m. 4.11.66, GC, K. Fox.
 Maungati, Waikate: 1 m. OAA, 21.12.25, DM, R.W. Tabè.
 Milford Sound: 1 m. 19.2.43, DM, J.T. Salmon.
 Monowai: 5 m. 11-21.12.14, ED, A. Philpott.
 Mt. Cook: 3 m. 3-5.1.29, CM (2), ED (1), A. Philpott.
 Mt. Creighton, Otago: 2 m. 20.12.19, ED, A. Philpott.
 Manatuke, Gisborne: 12 m. 6 f. Feb. 1967, GC, Dept. Agriculture.
 Mt. Crystal, 5,000 ft. Nel.: 1 m. DGN, 14.2.66, FRI, J.S. Dugdale.
 Mt. Gog, 2,450 ft. Cass, Cant.: 1 f. 28.2.62, LC, E.G. White.
 Mt. Sugar Loaf, 2,000 ft. Cass, Cant.: 1 m. 28.2.62, LC, E.G. White.
 Mt. Tarndale, 4,000 ft. Marl.: 3 m. DGK, DGS, EGJ, 13.2.66, FRI, J.S. Dugdale.
 Lincoln College, Cant.: 10 m. 8 f. 5-8.1.67, GC, M. McPherson.
 Nelson: 1 m. 4.4.21, ED, A. Philpott.

- New River, Sthld.: 6 m. no date; 1 m. 26.12.05; 2 m. 20.12.08; 1 m. 20.12.16; ED, A. Philpott.
- North Tararua Ranges, 1,650 ft.: 2 m. 1 f. 19.1.66, GC, T. Crilly.
- Ohakune: 2 m. 5.2.66, GC, D.E. Gaskin.
- Mt. Ruapehu, 2,300 ft.: 1 m. 5.2.66, GC, D.E. Gaskin.
- Palmerston North: 2 m. 1 f. 7-10.3.65; 10 m. 6 f. 10-15.1.66; 5 m. 5 f. 24-25.2.66; 8 m. 3 f. 7.3.66; GC, D.E. Gaskin.
- Paradise: 1 f. Feb. 1903, DM, G.V. Hudson.
- Pleasant Point, Cant.: 1 m. Feb. 1918, CM, S. Lindsay.
- Pouakai Range, 1,500 ft. Tar.: 4 m. 7.11.66, GC, P. Peckham.
- Port Hills, Cant.: 2 m. 14.1.28, CM, S. Lindsay.
- Rotorua: 1 f. 4.3.60, FRI, J.S. Dugdale.
- Mt. Ruapehu, Chateau Tongariro, 3,800 ft.: 1 m. 18.2.65, FRI, J.S. Dugdale.
- Queenstown, Otago: 1 m. 18.12.13, ED, A. Philpott.
- Ribbonwood Fan, Cass., 2,800 ft. Cant.: 3 m. 6.1.62; 1 f. 1.1.63; LC, E.G. White.
- Sedgemere, 3,300 ft. Nel.: 5 m. DGC, DGD, DGE, DGF, DGG, 13-15.2.66, FRI, J.S. Dugdale.
- Silverstream, Well.: 2 m. UDK, 8.1.16, DM, H.W. Simmonds
- Southbrook, Cant.: 1 m. 1.1.27, CM, S. Lindsay.
- Stuart's Gully, Cant.: 3 m. 11.2.23, CM, S. Lindsay.
- Sunnyside, Sthld.: 2 m. 15-18.1.14, ED, A. Philpott.
- Takitimu Range: 1 m. 28.12.12, ED, A. Philpott.
- Te Awaiti, Arapawa Island, Marl.: 1 m. 6.2.37, DM, J.T. Salmon.
- Tooth Peaks, Remarkable Range: 1 m. 26.12.18, ED, A. Philpott.
- Travers Range: 1 m. 25.4.64, ED, J.I. Townsend.
- Tuturau, Nel.: 1 m. 10.2.27, ED, A. Philpott.
- Unuwhac, North Cape: 3 m. 22-24.2.67, AM, K.A.J. Wise.
- Waiouru, 2,500 ft.: 2 m. 2 f. 2-3.2.66, GC, D.E. Gaskin.
- Waipapa: 2 m. Feb.-Mar. 1965, FRI, C. Hudson.
- Waipoua State Forest, Cathedral Grove: 1 m. 21.3.63, FRI, J.S. Dugdale.
- Wedderburn, Otago: 1 m. no date, ED, A. Philpott.
- Wellington: 1 m. 26.1.09; 1 m. 24.2.09; ED, G.V. Hudson.
- West Plains, Sthld.: 1 m. no date, ED, A. Philpott.
- Whangarei: 1 m. Feb. 1935, CM, E. Fairburn.
- Whitestone River, Otago: 4 m. 30.1.19, ED, A. Philpott.
- Wilderness, Fdld.: 1 m. 10.12.43, DM, G. Howes.
- Winchmore Research Station, Cant.: 40 m. 25 f. Feb. 1967, GC, W.R. Lobb.

REMARKS: Meyrick (1883) indicated by implication that he had examined the type material of C.vittellus, C.nexalis, C.transcissalis and C.vapidus, since he synonymised them under C.vittellus in that paper. He also stated quite clearly that he had seen unpublished drawings of Prof. Zeller's species C.sublicellus, C.bisectellus and C.incrassatellus, which he also sank under C.vittellus. I have examined a photograph of the type of C.conopias kindly supplied by Mr P.E.S. Whalley of the British Museum Entomology Department, and a drawing of the genitalia of the type made by Dr. S. Bleszynski, and I have no hesitation in synonymising this too with C.vittellus. C.conopias, as well as having quite typical vittellus female genitalia, also bears the characteristic white thorn or notch-mark on the anterior fascia margin of the forewing. The type of conopias differs from typical vittellus only in the heavy subterminal markings and other blackish clouding. I have in fact seen a more extreme forewing variety of vittellus than this from near Lake Tekapo, where all the markings but a faint trace of the white fascia were obliterated by smokey grey scales.

The welter of names attributed to forms of this species is not entirely due to the variable nature of the forewing pattern. Walker and Zeller worked at the same time in ignorance of one another, describing the same varieties from collections made in New Zealand and published their results in the same year (1863). Dr. Bleszynski informed me that the types of C.vittellus, C.sublicellus and C.bisectellus are lost, and he has consequently erected neotypes, the data for which are given in this paper. It is now not really possible to be sure which varieties of vittellus were described under which name, except that vittellus was applied to the form with submarginal breaks in the white forewing fascia, and C.vapidus and C.nexalis to the dark grey female form which is common in parts of the Wairarapa, and occurs sporadically in series from other parts of the North Island.

With abundant material on hand I have been able to study extensive series from all parts of New Zealand, and conclude that all forms of intermediates exist between the described forms. The major varieties in forewing

pattern are shown in Fig. 9. The two common forms, pale brown, with notched white forewing fascia and either with or without submarginal spotting, occur throughout the country. However a detailed analysis of the light trap results at Massey show that there the spotted form occurs as a percentage of the total which approaches, but never exceeds, 25% of the total catch, Table 14. Also some collecting I carried out on the Wairarapa coast produced all grey-form females with 5 of the males also tending towards the same dark greyish brown forewings. In the first case I think we may be dealing with a genetic variety, in the latter case with regionalism. In view of the abundance of this species and its possible importance in pastures, I think it would be a rewarding study for some future worker. However I would add the warning that the species in my experience is difficult to breed out on a casual basis, larval mortality in the final instar during the winter months was very high in my cultures.

Female genitalia show little variation from one form to another, such as there is being in the degree of sclerotisation of the ostiolar region. Male genitalia vary slightly in the number of cornuti present and the degree of aedoeagal sclerotisation and the size of the thorns.

Table 14

Percentage of spotted forewing <u>vittellus</u> to plain forewing <u>vittellus</u> in MV trap at Massey University.		Dec.	Jan.	Feb.	Mar.	Apr.
1966-67	total	18	227	620	134	2
	plain	17	198	484	104	2
	spotted	1	29	136	30	0
	%age spttd	5.5	12.8	21.9	22.3	0

Orocrambus vulgaris (Butler) comb.nov.

Crambus vulgaris Butler, 1877, Proc. zool. Soc. Lond., 1877, p. 400, pl. xliii, fig. 7.

Crambus tuhualis (nec Felder) Meyrick, 1883, Trans. N.Z. Inst., 15, p. 28.

Crambus obstructus Meyrick, 1911, Ent. mon. Mag., 47, p. 82. (New syn.).

Three syntype m. in British Museum (Natural History), two with abdomens missing, but third intact and bearing label "Crambus vulgaris Butler Type". All labelled "N.Zeal 77.34".

Lectotype m. (Dr. S. Bleszynski) in British Museum (Natural History), labelled "Crambus obstructus Lumsden New Zealand L.8.3.10". (L. standing for Longstaff).

EXTERNAL CHARACTERS (Slides 55, 56): Detailed descriptions of the major forms by Meyrick (1883; 1911). Coloured illustrations by Hudson (1928, Plate XX.

Fig. 5 m. (obstructus), Fig. 39 f. (vulgaris.) Face moderately conical, eye nocturnal type, female frenulum double but major element bifid apically, possibly indicating secondary fusion rather than a primitive condition, wing span 21 - 25 mm (both sexes). Range of forewing variation shown in Fig. 12. Difficult to separate when worn from ornatus, punctellus or small specimens of tuhualis.

MALE GENITALIA (Fig. 86): As for generic and species group description except for the following: Arms of vinculum about $\frac{1}{2}$ uncus; saccus elongate, tapered, without "keel". Costa of valve flanged, dorsal margin slightly longer than uncus. Sacculus not developed. Gnathos straight, tapered, equal to uncus, apically clubbed. Aedoeagus tubular, truncate, $3 - 3\frac{1}{4}x$ uncus, length to median breadth ratio 10-11:1, with slightly hooked thorn ventrad at about $\frac{1}{4}$; strong from apex to $\frac{1}{2}$ in ventral midline; 12 - 20 small elongate cornuti from $\frac{1}{4}$ to $\frac{1}{2}$.

FEMALE GENITALIA (Fig. 168): As for generic description except for the following: Eighth abdominal tergite fusing dorsally with ostium bursae, half as wide again at fusion as in dorsal midline. Eighth sternite a strong lunate plate. Ductus bursae about 5x length of analpapillae, strong to and vertically pleated to $\frac{3}{4}$, ductus seminalis joining at $\frac{7}{8}$. Ostium a broad tapered funnel,

ostiolar pouch region swollen, corpus bursae with two unequal oval signa.

LARVA: Not known.

HOST PLANTS: Not known, but probably on introduced as well as native grasses.

DISTRIBUTION (Fig. 268): Lowland and subalpine grasslands largely east of the main divide. In the west of the North Island the species is not common, but in the east Mr T.H. Davies (pers. comm.) has recorded it as far north as Haumoana, Hawkes Bay, and states that it is plentiful in the lowland tussock around Waipukurau. Flight period January to April, but with the peak in March; this is essentially an autumn species. In table 15 the results of MV trapping are given for Massey University; Lincoln College and Winchmore Irrigation Research Station; Canterbury.

Table 15

Results of 125 bulb MV light trapping for <u>O.vulgaris</u> , total operation.				
	Jan.	Feb.	Mar.	Apr.
Massey University, 1965-66	0	2	12	0
1966-67	0	0	12	0
1967-68	0	0	4	0
Lincoln College, 1966-67	0	226	508	9
Winchmore, 1966-67	0	75	1156	5

MATERIAL EXAMINED: 143 m. 15 f.

Alberttown: 1 m. HFS, 15.3.43, DM, G. Howes.

Arthur's Pass: 1 m. 9.2.26, CM, S. Lindsay.

Ben Lomond: 2 m. UCD, UCG, 19-20.1.14, DM, A. Philpott.

Berwick: 1 m. VCC, 9.4.12, DM, C.E. Fenwick.

Bold Peak: 2 m. 8.2.13, ED, A. Philpott.

Borland River: 2 m. 1 f. 27.1.17, ED, A. Philpott.

Bottle Lake, Cant.: 1 f. 22.3.25, CM, S. Lindsay.

Brooklands, Cant.: 2 m. 12.3.33, CM, S. Lindsay.

Castle Hill, Cant.: 1 m. no date, CM, R.W. Fereday.

Christchurch: 5 m. no date, 1 m. Feb. 1868, CM, R.W. Fereday; 1 m. 12.3.37, CM, S. Lindsay.

Dunedin: 1 m. UCK, 11.3.12, DM, A. Hamilton; 1 m. HFO, 12.3.15, 1 m. HFT, 27.2.16; DM, C.E. Ferwick.

Freestone Hill, Sthld.: 1 m. 12.2.20, ED, A. Philpott.

Goldney Saddle, 1,900 ft. Cant.: 2 f. 15.2.62, LC, E.G. White.

Hilltop, Cant.: 2 m. Jan. 1925, CM, A. Tonnoir.

Hoon Hay Valley, Cant.: 1 m. 8.2.23, CM, S. Lindsay.

Jack's Pass, Hanmer: 1 m. 10.2.31, CM, S. Lindsay.

Kaituna: 2 m. Feb. 1921, CM, S. Lindsay.

Karori, Well.: 1 m. HFO, April 1894, DM, 1 m. HFN, April 1909, DM; G.V. Hudson; 7 m. 2 f. 7-28, 3.64, GC, D.E. Gaskin.

Kekerangu, Marl.: 1 m. HFP, no date, DM, G.V. Hudson.

Kinloch: 1 m. UCI, 8.2.43, DM, G. Howes.

Kiwi Bush, Cant.: 1 m. 17.2.24, ED, W. Heighway.

Lowry Bay, Well.: 1 m. NDA, 12.3.29, DM, G.V. Hudson.

Mt. Cook: 10 m. UCJ, DM, CM (6), ED (3), 1 f. BGV, CM, 8-9.2.29, A. Philpott.

Mt. Grey, Cant.: 1 f. 18.1.25; 1 m. 10.1.29; 3 m. 2.3.30; CM, S. Lindsay.

Mt. Sugarloaf, 2,000 ft.: 1 m. 16.2.62, 2 m. 28.2.62, LC, E.G. White.

Mt. Tarndale; 3 m. DGO, DGR, DGV, 13.2.66, FRI, J.S. Dugdale.

Mt. Torlesse, Enys Plateau: 1 m. UCH, 10.2.36, DM, J.T. Salmon.

Nelson: 1 m. 26.2.23; 1 f. 7.3.24; 14 m. 7-23.3.25; 1 m. 16.4.25; ED, A. Philpott.

Palmerston North: 6 m. NDB, NDC, NDD, NDF, NDG, NDH, 6-15.3.65; 8 m. NDI, NDJ, NDK, NDL, HDM, NDN, NDO, NDP, 1 f. NDE, 7-9.3.66; 1 m. NDQ, 10.3.67; GC, D.E. Gaskin.

Porau: 1 m. Mar. 1920, CM, S. Lindsay.

Port Hills, Cant.: 1 m. 12.3.22, CM, S. Lindsay.

Price's Bush, Cant.: 1 m. 7.2.32, CM, S. Lindsay.

Pukeatua Bush, Cant.: 1 m. 18.2.28, CM, S. Lindsay.

Ribbonwood Fan, 2,100 ft.: 1 m. 31.1.63, LC, E.G. White.

Shirley: 1 m. 17.2.28, CM, S. Lindsay.

Spreydon, Cant.: 1 m. 4.3.32, CM, S. Lindsay.

Tuturau: 2 m. 10.2.07, ED, A. Philpott.

Waimakariri River, Cant.: 2 m. UCA, UCE, 1 f. UCB, 23.1.35, DM, G.V. Hudson.

Waitati: 1 m. HFR, 16.2.40, DM, G. Howes.

Waimate: 1 m. 6.2.35, CM, S. Lindsay.

Wellington: 1 m. 24.2.09, ED, G.V. Hudson; 1 m. 7.2.14.

West Plains, Sthld.: 1 m. no.date, ED, A. Philpott.

Winchmore, Cant.: 30 m. 4 f. 7-17.3.67, GC, W.R. Lobb.

Woodhaugh: 3 m. 20.2.17, AM, C.E. Clarke.

REMARKS: The extreme variability of this species is a result of white scales grouping around the median white forewing fascia in greater or lesser quantities.

When the scaling is profuse and linear the forewing fascia remains entire but becomes wide and diffuse, especially towards the termen, and the submarginal markings of typical vulgaris are partially or completely obliterated. This condition has been described as Crambus obstructus by Meyrick 1911.

My examination of nearly 160 specimens of this species from different parts of both main islands of New Zealand, suggests that the most clearly marked typical vulgaris form is from the southern Wairarapa and Wellington. In the South Island a mixture occurs, but the obstructus form is most frequently taken in the subalpine grasslands of Canterbury and Otago. An extreme obstructus form from the Cass area in the Lincoln College collection is almost white. Incidentally White (1963) working in this area noted that the flight period was in late February, earlier than for my records from Winchmore and Lincoln College.

There is some variation in genitalia structure in regard to the degree of sclerotisation in both sexes and the number of cornuti and the size of the subapical thorn on the aedoeagus, but this minor variation does not correlate with variation in forewing pattern between typical vulgaris and the obstructus form. Superficially this species does resemble O.vittellus, O.enchophorus and several other species in this subgroup, but is quite distinct on genitalia characteristics in both sexes.

Orocrambus xanthogrammus (Meyrick) comb.nov.

Crambus xanthogrammus Meyrick, 1882, New Zealand Journal of Science, Dunedin, 1, p. 187.

Crambus xanthogrammus Meyrick, 1883, Trans. N.Z. Inst., 15, p. 32-3.

Lectotype m. (author's) in Canterbury Museum labelled "Lake Coleridge New Zealand /3/73 R.W.F."

EXTERNAL CHARACTERS (Slide 57): Detailed description by Meyrick (1883), coloured illustration by Hudson (1928, Plate XX, fig. 6 m.) with abbreviated description. Eye nocturnal type, female frenulum triple, wing span 20 - 30 mm (both sexes), frons conical. The only member of the genus known to date with a lustrous pyraustine appearance.

MALE GENITALIA (Fig. 87): As for generic and species group description except for the following: Arms of vinculum about equal to uncus. Saccus tapered, with rounded apex. Costa of valve flanged, dorsal margin about $1\frac{1}{4}x$ uncus. Sacculus not differentiated. Gnathos straight, tapered, bluntly pointed, slightly longer than uncus. Aedeagus tubular, truncate, $2\frac{3}{4}x$ uncus, length to median breadth ratio 8-9:1; no external ornamentation, one slender curved cornutus present.

FEMALE GENITALIA (Fig. 169): As for generic description except for the following: Eighth abdominal tergite encircling ostium, about $\frac{3}{4}$ as wide at fusion as in dorsal midline. Eighth abdominal sternite absent. Ductus bursae $3\frac{1}{2}-4x$ length of anal papillae, strong to $\frac{1}{3}$, pleated from $\frac{1}{3}$ to $\frac{2}{3}$, ductus seminalis joining at about $\frac{3}{4}$. Ostium a simple funnel, ostiolar pouch region swollen. Corpus bursae with two large unequal signa.

LARVA: Not known.

HOST PLANTS: Pupa found among Raoulia sp. by S. Lindsay (Hudson, 1939) and adult reared. Tunnels around the chamber in which the pupa was found suggested that this was the actual foodplant.

DISTRIBUTION (Fig. 269): River beds in the eastern South Island, and eastern North Island in the Wairarapa (Hudson, 1928, though I have not been able to trace the specimen/s.), and at the Mohaka River, Hawkes Bay, (T.H. Davies, in litt., with specimens which he kindly allowed me to examine). Flight period December to March.

MATERIAL EXAMINED: 48 m. 8 f.

Birdling's Flat, Cant.: 1 f. ex pupa 19.2.28; 1 f. 3.3.29; 2 m. 25.1.30; 1 m. 1.1.31; 1 m. 25.2.34; CM, S. Lindsay.

Blackmillar, Marl.: 1 m. 12.1.27; CM, S. Lindsay.

Broken River, Cant.: 2 m. no date. ED, S. Lindsay.

Cooper's Creek, Cant.: 2 m. 15.2.31, CM; 1 m. 15.2.36, ECI, DM; S. Lindsay.

Hope Arm, Manapouri: 1 m. 3.1.23, AM, C.E. Clarke.

Kaikoura, Marl.: 1 m. ECJ, 2 f. ECG, ECK, 24.12.14; DM, Fenwick.

Lake Coleridge: 1 m. (lectotype) Mar. 1873, CM, R.W. Fereday.
 Milford Sound, Fiordland: 1 m. ECF, 2.1.42, DM, G. Howes; 2 m. ECC, ECE, 19.12.43, DM, J.T. Salmon.
 Makarora: 1 m. ECD, 1 f. ECA, 25.12.24; 1 m. 11.1.25; DM, Fenwick.
 Mohaka River, Hawkes Bay: 2 m. 17.12.63, DC, T.H. Davies.
 Mt. Cook Hermitage 2,500 ft.: 2 m. PBC, PBD, 14.1.64; FRI, J.S. Dugdale.
 Mt. Grey, Cant.: 1 m. Nov. 1917, ED; 1 m. 22.1.28, CM; S. Lindsay; 3 m. 15.12.29; 1 m. 1.1.30; CM, White.
 Mt. Ida: 1 m. 18.2.24, AM, C.E. Clarke.
 Oakden's Bush, Cant.: 1 m. 7.3.1873; CM, R.W. Fereday.
 Peel Forest, Cant.: 1 m. 30.12.17, CM, S. Lindsay.
 Puhi-puhi Bush, Kaikoura, Marl.: 6 m. 1 f. 22-27.12.29; CM, S. Lindsay.
 Speargrass Ck, Travers Range, Nel.: 1 m. PBB, 1 f. PBA, 6-7.2.64; FRI, J.S. Dugdale.
 Waihi, Cant.: 1 m. ECH, 18.2.24; DM, A. Castle.
 Whiterock, Cant.: 1 m. Nov. 1918, CM; 3 m. Dec. 1918, CM (2), ED (1); 1 m. Nov. 1919, CM; 1 m. Dec. 1919, ED; S. Lindsay.
 Worsley Arm, Te Anau; 6 m. 1 f. 28.12.27 - 30.1.28, AM, C.E. Clarke.

REMARKS: There is considerable variation in the reddish marks and the greenish background colour of the forewings. Some species appear quite chequered, others nearly silvery white. The forewing pattern is an adaptation to life among shifting rocks and shingle of river beds, where the mottled colours make it very hard to find, even though the flight is not particularly strong (T.H. Davies, in litt.). Not very close systematically to the other species in this group, but there has been greater deviation from the typical pattern in forewing colour than in genitalia structure.

SPECIES NOT GROUPED.

Orocrambus punctellus (Hudson) comb.nov.

Crambus punctellus Hudson, 1951, Fragments of New Zealand Entomology, Wellington, 1951, p. 99.

Holotype f. in Dominion Museum, author's genit prep. NCA, in poor condition (worn, labial palpi missing), labelled "Portobello 8.3.40" and Hudson coll. label "843a".

EXTERNAL CHARACTERS (Slide 58): Detailed description and coloured illustration given by Hudson (1951, Plate VII, fig.10). Eye nocturnal type, female

frenulum triple, wing span (female) 23 mm. frons planoconvex. Male not known.

FEMALE GENITALIA (Fig. 170, holotype): As for generic description except for the following: Eighth abdominal tergite fusing dorso-laterally with ostium bursae, 3 - 4 times as wide at fusion as in dorsal midline. Eighth sternite a strong lunate plate. Ductus bursae about 5x length of anal papillae, with narrow constriction at $\frac{1}{4}$, strong to $\frac{1}{2}$, ventrally pleated to just beyond $\frac{1}{4}$, ductus seminalis joining at $\frac{3}{4}$. Ostium bursae a simple funnel, ostiolar pouch region swollen, corpus bursae with two equal oval signa.

LARVA: Not known.

HOST PLANTS: Not known.

DISTRIBUTION (Fig. 270): Portobello, Otago Peninsula only. Flight period in March.

MATERIAL EXAMINED: 1 f.

Portobello, Otago Peninsula: 1 f. (holotype), 8.3.40, DM, G. Howes.

REMARKS: The unique holotype female was not catalogued in any of the museums of New Zealand, but I rediscovered it in the Hudson collection and made positive identification by the data label.

The female of O.ornatus has yet to be collected, and O.punctellus may prove to be it. On the other hand I do not completely discount the possibility that this is a very aberrant specimen of O.vulgaris, although there are a number of significant differences in the genitalia of the two species (Figs. 168 and 170), for example the equal size of the signa in punctellus and the ventral pleating in the ostiolar region of that species. In both species the anterior margin of the eighth tergite is rather indistinct and in many specimens of vulgaris where overall sclerotisation tends to be weak, blends into the lightly sclerotised intersegmental membrane. I would not therefore place undue emphasis on the fact that I have shown the shape of the tergite to be quite different.

The drawing of vulgaris was based on a specimen showing strong sclerotisation, whereas this is only moderate in the punctellus holotype. More material from the Otago Peninsula is required.

Orocrambus sophronellus (Meyrick) comb. nov.

Crambus sophronellus Meyrick, 1885, Trans. N.Z. Inst., 17, p. 138.

Holotype f. in British Museum (Natural History), slide BM pyral 5629, labelled "Christchurch? New Zealand RWF/82". The question mark is in the citation.

EXTERNAL CHARACTERS (Slide 59): Detailed description by Meyrick (1885), coloured illustration by Hudson (1951, Plate V, Fig. 2 f.). The figure given previously by Hudson as the male of the species (1928, Plate XX, Fig. 43) is of a form of O.cyclopicus, not this species. Eye diurnal type, female frenulum triple, wing span 18 mm (female), frons planoconvex. Male not known.

FEMALE GENITALIA (Fig. 171, from the specimen taken by Lewis and figured by Hudson (1951, Plate V, Fig. 2) and compared with type genitalia sketch by Dr. S. Bleszynski): As for generic diagnosis except for the following: Eighth abdominal tergite fusing dorso-laterally with ostium bursae, twice as wide at fusion as in dorsal midline, anterior margin of tergite produced in lateral midlines into projections representing anterior apophyses. Eighth sternite a weak oval plate. Ductus bursae about 4x length of anal papillae, strong to $\frac{1}{3}$, spirally pleated from $\frac{1}{2}$ to $\frac{3}{4}$, ductus seminalis joining at $\frac{3}{4}$. Ostium a simple tapering funnel. Corpus bursae with two large equal signa.

LARVA: Not known.

HOST PLANTS: Not known.

DISTRIBUTION (Fig. 271): Wedderburn, Central Otago and possibly Christchurch (holotype). Flight period March.

MATERIAL EXAMINED: 1 f.

Wedderburn: 1 f. FCA, 1900, Det. J.H. Lewis.

REMARKS: A form of O.melitastes with all the forewing markings obscured by grey scaling closely resembles O.sophronellus. However the two species differ

in eye shape (diurnal in sophroneilus) and female genitalia characters (two very large equal signa in sophroneilus, one very much reduced in melitastes). However on female genitalia structures I would tentatively place this species systematically close to melitastes, although its placing and status cannot be finally decided until a male is available for examination.

Orocrambus lindsayi sp.nov.

Holotype f. author's genit. prep BLI, and paratype f. in Auckland Museum, labelled "Mt. Ida 19.2.22, C.E. Clarke Collection".

EXTERNAL CHARACTERS (Slide 60): Following description based on holotype female, male not known. Forewings, thorax and abdomen grey faintly sprinkled with white and dark brown. Forewings very elongate with a few subterminal and discal dark markings, apices very acute. Hindwings very much reduced, greyish white. Antennae greyish, nearly filiform. Maxillary palpi grey, triangular. Labial palpi porrected, grey laterally and whitish medially. Legs grey sprinkled with white. Eye nocturnal type, female frenulum triple, wing span 22 mm. Venation (fig. 21).

FEMALE GENITALIA (Fig. 172, holotype): As for generic description except for the following: Eighth abdominal tergite fusing dorso-laterally with ostium bursae, as wide at fusion as in dorsal midline. Eighth sternite strong, fused to lamella postvaginalis as a projecting lip. Ductus bursae 7-8x length of anal papillae, strong to $\frac{1}{4}$, with reverse loop at $\frac{1}{2}$, ductus seminalis joining at $\frac{1}{2}$. Ostium bursae dorso-ventrally compressed funnel, ostiolar pouch region swollen. Corpus bursae with two large unequal oval signa.

LARVA: Not known.

HOST PLANTS: Not known.

DISTRIBUTION (Fig. 272): Presently known only from Mt. Ida, Otago. Flight period February.

MATERIAL EXAMINED: 2 f.

Mt. Ida, Otago: 2 f. (holotype and paratype), 19.2.22, AM, C.E. Clarke.

REMARKS: Tentatively I would place this species somewhere between O.harpophorus and the simplex cluster in the phylogenetic scheme of Group 5, but without the male genitalia being available for examination the pattern of characters is not complete enough for systematic analysis.

Orocrambus cultus Philpott

Orocrambus cultus Philpott, 1917, Trans. N.Z. Inst., 49, p. 242.

The holotype, allotype and paratypes were said to have been deposited in the Pasco collection (Philpott, 1917; Hudson 1928). I have not been able to trace this collection and no specimens from it have been deposited in the British Museum or any New Zealand museum.

EXTERNAL CHARACTERS: Full description by Philpott (1917), coloured illustration by Hudson (1928, Plate XLIV, Fig. 10 f.). General forewing pattern as follows: Wing span about 20 mm (both sexes), deep yellowish brown with dusky longitudinal black markings or shadings on the costa, below the middle disc and on the dorsum. A broad broken ochreous streak extends from base to $\frac{3}{4}$ below the middle, with two other marks above this, and a whitish ochreous line crosses the wing at $\frac{3}{4}$, sharply bent outwards below the costa, as a subterminal line.

MALE GENITALIA: Not known.

FEMALE GENITALIA: Not known.

LARVA: Not known.

HOST PLANTS: Not known.

DISTRIBUTION: Cecil Peak, Lake Wakitipu. Flies in January.

COMMENTS: From the descriptions given, and the locality, I suspect that if rediscovered, this species may prove to be a local form of O.scoparioides or O.thymiastes.

Maoricrambus gen.nov. (Monotypic)

Type species: Crambus oncobolus Meyrick, 1885, Trans. N.Z. Inst. 17, p. 138.

DIAGNOSIS: Labial palpi longer than head, porrected, smooth-scaled; maxillary palpi triangular, erect; ocelli small, compound eyes without nude peri-orbital

strip, nocturnal type. Frons with conical protuberance. Female frenulum triple. Fore and hindwing venation as in Orocrambus, forewing r_4 , r_5 stalked. In male genitalia vinculum almost a right-angled triangle in profile, saccus elongate with rounded apex. Costa of valve flanged and developed dorsally into a large strong prong curved introrse; uncus and gnathos very broad, gnathos spatulate with strong rim enclosing weak central region. Aedoeagus tubular, $2\frac{3}{4}x$ uncus, length to median breadth ratio 7:1, cornuti absent, but thick cusp-like thickening from about apex to $\frac{3}{8}$. In female genitalia eighth abdominal tergite fusing dorso-laterally with ostium bursae; ductus bursae about $3x$ length of anal papillae, strong to $\frac{1}{3}$, weakly pleated from $\frac{1}{3}$ to $\frac{2}{3}$, ductus seminalis joining at about $\frac{7}{8}$. Eighth sternite absent. Corpus bursae lacking signa.

COMMENTS: Differs from Orocrambus, from which it is a segregate, by the form of the spatulate gnathos in the male (tapered, slender and either pointed or clubbed in Orocrambus), and the asignate corpus bursae in the female (always two signa in Orocrambus). See table 2 for comparison with other "Crambus" line genera.

Maoricrambus oncobolus (Meyrick) comb.nov.

Crambus oncobolus Meyrick, 1885, Trans. N.Z. Inst., 17, p. 138.

Crambus oncolobus Hampson, 1896, Proc. Zool. Soc. Lond., 1896, p. 940.
(misspelling of oncobolus Meyrick)

Lectotype m. allolectotype f. (Dr. S. Bleszynski) in British Museum (Natural History), and syntype m. in Canterbury Museum, lectotype slide BM pyral 7984, allolectotype slide BM pyral 7977, syntype author's prep. CGT, labelled "Castle Hill New Zealand 2,300 ft. 20/1/83."

EXTERNAL CHARACTERS (Slide 61): Detailed description by Meyrick (1885), coloured illustration by Hudson (1928, Plate XX, Fig. 35) with abbreviated description. Eye nocturnal type, frons conical, female frenulum triple, wing span 23 - 25 mm (both sexes). Strong convergent resemblance to Orocrambus harpophorus but can be at once distinguished by the lack of subterminal spotting in oncobolus.

MALE GENITALIA (Fig. 88): See generic description

FEMALE GENITALIA (Fig. 173): See generic description.

LARVA: Not known.

HOST PLANTS: Not known.

DISTRIBUTION (Fig. 273): Unless it has been extensively overlooked this species has a restricted distribution in central Canterbury and Southland in the South Island of New Zealand. Flight period December to February.

MATERIAL EXAMINED: 3 m. 3 f.

Broken River, Cant.: 2 m. 1 f. CGR, 24-25.12.34, CM, S. Lindsay.

Castle Hill, Cant.: 1 m. CGJ (syntype), 20.1.1883, CM, R.W. Fereday.

Mt. Torlesse: 1 f. HFK, 10.2136, DM, J.F. Salmon.

New River, Sthld.: 1 f. (Philpott genit prep. no number), no date, ED, A. Philpott.

REMARKS: Because of their considerable forewing pattern similarity this species and O.harporhorus have been confused in New Zealand museum collections, although the two species show no resemblance in either male or female genitalia structure.

Genus Angustalius Marion

Angustalius Marion, 1954, Mem. Inst. Sci. Madagascar (E) 5, p. 50. Type species Angustalius ditaeniellus Marion, 1954. (monotypic).

Crambopsis de Lattin, 1952, Ent. Z. 62, p. 91. Type species Crambus malacellus Duponchel, 1836 (monotypic)
Praeoc. by Crambopsis, Walker, 1865.

Bleszynskia de Lattin, 1961, Ent. Z. 71, p. 115. Type species Crambus malacellus Duponchel, 1836, (monotypic).

DIAGNOSIS: See Marion (1954) and Bleszynski (1965).

COMMENTS: A genus hitherto in some confusion, represented in New Zealand by a single species A.malacelloides (Bleszynski), probably accidentally introduced into the country by human agency.

Angustalius malacelloides (Bleszynski)

Crambopsis malacelloides Bleszynski, 1955, Pol. Pis. ent. 25, p. 229, Fig. 3
(m. genit.) Fig 6 (f. genit.).

Angustalius malacelloides (Bleszynski) Bleszynski, Crambinae: Microlepidoptera
Palaeartica, Vienna, p. 230, Fig. 144 (m. genit.)

EXTERNAL CHARACTERS (Slide 62): Full description by Bleszynski (1955), drawing of venation of closely related A. malacellus Dup. by Bleszynski (1965). At once distinguished from any other New Zealand Crambinid by median white forewing fascia and the metallic subterminal line angled and cutting off apical triangular area. Coloured illustration by Hudson (1939, Plate LVI, Fig. 29 m.)

Venation, Fig. 22.

MALE GENITALIA: Bleszynski (1955, Fig. 3), and Bleszynski (1965, Plate 54, Fig. 144).

FEMALE GENITALIA: Bleszynski (1955, Fig. 6).

LARVA: Not known.

HOST PLANTS: Not known.

DISTRIBUTION: Himalayas, India, Ceylon, Kwangtung Province (mainland China), Malaya, Australia, Tasmania (type locality), and New Zealand (Bleszynski, 1965). Within New Zealand now common in Northland and Auckland, possibly still extending its range southwards (K.A.J. Wise, pers. comm.). Flight period November to April in eastern Australia, October and January (Hudson, 1939) in New Zealand.

MATERIAL EXAMINED: 6 m.

a) Australian

Brisbane, Qld.: 1 m. Nov. (no year), EDNZ, no captor.

Sandgate, Qld.: 1 m. Apr. (no year), EDNZ, no captor.

Stanthorpe, Qld.: 1 m. Feb. (no year), ANMC, no captor.

b) New Zealand

Waitangi, Nthld.: 2 m. 22.10.63, 1 m. 23.10.63, FRI, J.S. Dugdale.

REMARKS: The first record of this species in New Zealand was by Mr C.E. Clarke at Whangarei, Northland in 1927. In 1932 the same person noted that the species was abundant at Lake Takapuna, Auckland (Hudson, 1939).

Genus Kupea Philpott

(Monotypic)

DIAGNOSIS: Labial palpi longer than head, porrected, smooth-scaled; maxillary palpi triangular, erect; antennae serrate in male, shortly ciliate; frons with conical protuberance; forewings with veins r_3 and m_2 absent or vestigial, r_4 stalked with r_5 . Hindwings with vein m_2 absent, (venation Fig. 23). Male frenulum single. In male genitalia saccus short, with rounded apex, juxta a heart-shaped plate, costa of valve a well differentiated rectangular plate with flange on inner posterior margin. Sacculus flanged. Uncus and gnathos slender, tapered, but very large compared to rest of genitalia. Aedoeagus tubular, $1\frac{3}{4}$ x uncus, length to median breadth ratio about 8:1, group of 4 to 6 elongate cornuti at about $\frac{1}{2}$.

COMMENTS: Differs from Orocrambus and Maoricrambus by the reduced fore and hindwing venation. Otherwise male genitalia very like Orocrambus, although uncus and gnathos are proportionately much larger than in Orocrambus. Not given in the comparative table with other genera as only the male of the type species is known, and the placing of the genus may be provisional only.

Kupea electilis Philpott.

Kupea electilis Philpott, 1930, Rec. Cant. Mus., 3, p. 247.

Holotype m. in Canterbury Museum with 20 m. paratypes, also 1 m. paratype in Dominion Museum, Wellington, author's genit. prep. FGE, all labelled "Birdling's Flat, Cant. 3.3.29, S. Lindsay."

EXTERNAL CHARACTERS (Slide 63): As for generic diagnosis, but with addition of following details; forewings very elongate, brassy ochreous, suffused with grey in disc, brownish black mark in disc followed by oblique white bar, and a much larger patch beyond this containing two white oval blotches and a complete circular spot. There is a well-defined white subterminal band.

Hindwings brownish. Detailed description by Philpott (1930), coloured illustration by Hudson (1939, Plate LVI) and abbreviated description. Eye nocturnal type. Venation, fig. 23. Female not known.

MALE GENITALIA: As for generic diagnosis. See also fig. 89.

LARVA: Not known.

HOST PLANTS: Not known.

DISTRIBUTION: Fig. 274. Birdling's Flat, near Bank's Peninsula only.

Flight period March.

MATERIAL EXAMINED: 34 m.

Birdling's Flat, Cant.: 1 m. (holotype) CM, 20 m. (paratypes), 1 m. FGE, (paratype) DM, 3.3.29; 6 m. DM, 19.3.33; S. Lindsay.

REMARKS: The male genitalia of Kupea electilis show resemblances to both O. xanthogrammus and a number of other species of this genus in species group 5b (figs. 80-89). The female of K. electilis is not represented in any of the museum collections of New Zealand. The specimens taken by S. Lindsay were probably taken by light-trapping, and because of the absence of even a single female I suspect this sex may be semi-apterous. When the female has been obtained the systematic position of the genus will need to be re-assessed. At present Kupea is a genus of uncertain status, but I think ultimately it may require including in Orocrambus, despite the reduced venation.

Sub-tribe Corynophorina

Sub-tribal diagnosis: As for tribe Crambini but having the following features not found in sub-tribe Crambina:

Forewing r₅ free; In male genitalia saccus with ventral laminate posterior flap, pseudosaccus absent, juxta strongly developed, either plate-like or saddle-shaped; In female genitalia anal papillae fused into characteristic "dutch clog" shape, eighth tergite fused into a broad closed tube with ostium bursae a smaller flattened tube at its base.

Type of sub-tribe: Corynophora lativittalis (Walker, 1863, List.Spec.lep.B.M. 27:171 : Crambus)

Eastern Australia.

Genus Tawhitia Philpott

Tawhitia Philpott, 1931, Trans.N.Z.Inst., 62, p.26, Type species Tauroscopa glaucophanes Meyrick 1907.

Crambus sensu Zeller, 1863 (nec Fabricius, 1798, in: Supplementum Entomologiae Systematicae, type species Phalaena Tinea pascuella Linnaeus, 1758).

Tauroscopa sensu Meyrick 1907 (nec Meyrick, 1888, Trans.N.Z.Inst., 20, p.69, type species Tauroscopa gorgopis Meyrick, 1888).

Argyria sensu Meyrick, 1905 (nec Hübner, 1825, Verzeichniss bekannter Schmettlinge (sic), Augsburg, 432 pp., type species (designated by Fernald, 1896) Argyria nummulalis Hübner, 1818).

Velasquez Bleszynski, 1962, Polskie pismo entomologiczne, 32, p. 14. Type species Crambus pentadactylus Zeller, 1863.

DIAGNOSIS: Palpi, legs (except tibiae and tarsi) and thorax densely haired, less so in female (and pentadactyla). Antennae stout, filiform, pubescent. Forewings with r_3 and r_4 stalked, bases of r_4 , r_5 approximated at base, but r_5 still distinctly free. Hindwing discal cell open, as in Orocrambus, and all other hindwing venation as in Orocrambus. Venation, fig. 25. In male genitalia saccus having a very characteristic ventral leaf-like flattened projection. Costal lobe and sacculus lobes of male valve strongly separated and developed, pointed. Uncus curved ventrad, very broad in profile. Gnathos Y-shaped, separate at base, fusing to form tubular apex, curved dorsad. Aedoeagus tubular, without cornuti or ornamentation, juxta a complex folded plate, approximately anvil-shaped. In female genitalia anal papillae coalescent with long posterior apophyses. Eighth abdominal tergite forming a broad deep tube, eighth sternite either incorporated into this tube or lost. Ostium bursae a recessed tube at base of the tergite tube, partially shielded by the posterior margin of the seventh sternite. Ventral lip of the ostium (lamella antevaginalis) projecting further caudad than dorsal lip (lamella postvaginalis). At their margins the sclerites fuse with the lateral lobes of the eighth tergite. Signum present or absent on corpus bursae.

COMMENTS: Endemic to New Zealand, two known species. Not close to any other genus except Corynophora Berg (Australian). Tawhitia differs from Corynophora as follows: In Corynophora the costal lobe of the valve is barely developed, and the sacculus remains marginally fused with valvula for most of its length. The inner margin of the sacculus curves upwards, however, as in Tawhitia, although bearing a stiff cucullus of hair at its posterior extremity. In the female of Corynophora (fig. 174) the process of evagination of the ostiolar sclerites is not as advanced as in Tawhitia. Short anterior apophyses are retained, and the

corpus bursae bears a large oval signum of the type found in other genera of the "Crambus" line, compared with the U-shaped signum of glaucophanes and the asignate bursa of pentadactyla.

KEY TO THE KNOWN NEW ZEALAND SPECIES OF
Tawhitia

- 1 Forewings variable in colour; silvery grey, greenish grey, yellowish brown or dark brown, with blackish wedge-shaped stigma and first and second lines.
In male genitalia: saccus terminating in dorsal truncate process, gnathos about equal to uncus.
In female genitalia: ostium nearly circular, antero-ventral margin of eighth tergite cleft in midline glaucophanes
- Forewings grey with dark basal streak from base ending in disc.
In male genitalia: saccus tapered to a blunt point, gnathos about $\frac{3}{8}$ longer than uncus.
In female genitalia: ventral lip of ostium drawn into a flattened shield posteriad, antero-ventral margin of eighth sternite entire pentadactyla

Tawhitia glaucophanes (Meyrick)

Tauroscopa glaucophanes Meyrick, 1907, Trans. N.Z. Inst., 39, p. 110.

Tawhitia glaucophanes (Meyrick) Philpott, 1931, Trans. N.Z. Inst., 62, p. 26.

Tawhitia leonina Philpott, 1931, Trans. N.Z. Inst., 62, p. 28.

Lectotype m. and one syntype m. (Dr. S. Bleszynski) in British Museum (Natural History), labelled "Tauroscopa glaucophanes Meyrick," "L. Wakatipu New Zealand GVH.06."

Holotype m. and allotype f. in Entomology Division, Nelson, and paratype f. in Dominion Museum, Wellington, labelled "Tawhitia leonina Philpott, Takitimos 28.12.12."

EXTERNAL CHARACTERS (Slides 65, 66, 67): Detailed description given by Meyrick (1907), coloured illustrations by Hudson (1928, Plate XX, fig. 45 m; 46 f; Plate XLVIII fig. 5 f. variety; 1939, Plate LXI, fig. 15 m.), with abbreviated descriptions. Range of forewing pattern variation shown in fig. 10. Eye diurnal type, frons planoconvex, female frenulum triple. Wing span 21 - 32 mm

(both sexes). This species has a strong superficial resemblance to members of Tauroscopa, but can at once be separated from them by the open discal cell of the hindwing. Venation, fig. 25.

MALE GENITALIA (Fig. 91): As for generic description but including the following detail: Arms of vinculum broad in profile, only little shorter than uncus. Saccus elongate, terminating anteriorly in a dorsal truncate thumb-like process. Ventrally having a leaf-like flattened posterior extension. Juxta a complexly folded anvil or saddle-shaped plate. Costa of valve developed into a pointed elongate lobe curving first ventrad, then introrse, then dorsad, dorsal margin slightly more than 2x uncus. Valvula a slender relatively weak elongate lobe with rounded apex, twisting through 90° towards apex so that posterior extremity comes to lie below prongs of both costal lobe and sacculus. Total length of valve to tip of valvula equal to aedoeagus. Sacculus a strongly differentiated elongate pointed lobe, dorsal surface concave, turning introrse and dorsad under costal lobe. Uncus and gnathos tubular, equal in length. Aedoeagus tubular, about $3\frac{1}{2}$ x uncus, length to median breadth ratio about 8:1, cornuti and all other ornamentation absent.

FEMALE GENITALIA (Fig. 175): As for generic description but including following details: Anal papillae coalescent, having the shape of a dutch clog in profile. Posterior apophyses elongate, slightly longer than tube formed by eighth tergite, which encircles the ovipositor. Eighth sternite either absent or incorporated into tube. Paired ostiolar sclerites fuse laterally to form a projecting ostium or limen at base of the tergite tube, fusing with lobes of eighth tergite and protected ventrally by posterior margin of seventh sternite. Ventral lip of ostium projecting slightly further posteriorly than dorsal lip. Anterior margin of eighth tergite cleft ventrally, ventro-lateral margins curving introrse to fuse with sclerites. Ductus bursae about $2\frac{3}{4}$ x length of posterior apophyses, strong to and tapering sharply at about $\frac{1}{6}$, ductus seminalis joining at $\frac{1}{3}$. Ostium bursae a dorso-ventrally flattened funnel of complex origin as

detailed above. Ostiolar pouch region slightly swollen, corpus bursae with a very narrow U-shaped signum.

LARVA: Not known.

HOST PLANTS: Not known.

DISTRIBUTION (Fig. 275): Southern bias in distribution, but taken as far north as Mt. Cook. Confined to South Island of New Zealand, strictly alpine, found above about 3,500 ft. Flight period late December to February. Forewing patterns indicate some regionalism, although more material would be needed for study before definite conclusions could be drawn.

MATERIAL EXAMINED: 37 m. 39 f.

Advance Peak: 1 m. RCJ, 2.1.10, DM, C.E. Fenwick.

Arthur's Pass: 1 m. 23.1.28, ED, A. Philpott.

Ben Lomond, 4,000 ft.: 2 f. 25.1.12, 1 m. 1 f. 19.12.13, ED; 1 m. RCF, 5.1.14, 1 m. RCH 2 f. HGA, HGM, 11.1.21, DM; C.E. Fenwick; 1 m. Jan. 1922, ED, A. Philpott.

Bold Peak: 1 f. 2.12.10, 1 f. 26.12.12, C.E. Fenwick; 1 f. 11.2.13, CM, G. Howes; 1 f. 9.1.20, CM, A. Philpott; 1 m. 1 f. 5.1.21, DM, S. Hudson.

Mt. Gertrude, 4,700 ft.: 3 m. BLF, 2 f. BLG, 16-18.1.63, FRI, J.S. Dugdale.

Homer Tunnel: 1 m. 17.1.63, FRI, J.S. Dugdale.

Humboldt Range: 1 f. 31.1.06, DM, G.V. Hudson; 1 m. 1 f. 10.1.66, FRI, J.S. Dugdale.

Macetown: 3 m. 3 f. 1-6.2.09, ED, 1 m. 6.2.09, CM, 1 f. HCB, 29.12.09, DM, C.E. Fenwick.

Mt. Burns, 4,000 ft.: 2 f. 23.1.14, ED, 1 f. 14.1.16, DM, C.E. Fenwick.

Mt. Cleughearn: 4 m. 4 f. 22-3.1.14, ED, 1 f. 14.1.16, ED, 1 m. 8.1.19, ED, C.E. Fenwick.

Mt. Cook: 1 m. RCA, 8.2.29, DM, A. Philpott.

Mt. Luxmore, 3,500 ft.: 3 m. BLD, 5 f. BLE, 2.2.65, FRI, J.S. Dugdale.

Obelisk: 1 m. CM, 3 f. RCC, RCD, RCE, DM, 1.1.40, G. Howes.

Old Man Range: 1 m. 30.1.12, CM, 2 m. 1.2.12, ED, C.E. Fenwick, 5 m. RCB, RCG, RCI, RCK, RCL, 1.2.12, DM, A. Hamilton.

Remarkables, 5,400 ft.: 1 m. 3 f. 15.1.66, FRI, J.S. Dugdale.

Takitimos, 4,000 ft.: 1 m. (holotype of leonina) 1 f. (allotype of leonina) ED, 1 f. (paratype of leonina) OCA, DM; 28.2.12, A. Philpott.

Tooth Peaks: 1 m. 25.12.15, ED, A. Philpott.

REMARKS: A New Zealand endemic segregate of the Australian lowland Corynophora, with some regionalism apparent in forewing pattern. This species simulates an alpine relict (see Dumbleton, 1966), and would be an interesting species for further studies in regionalism in New Zealand Crambinae. Nothing is unfortunately known of the life history. Phylogenetically Tawhitia and Corynophora make up a very distinct sub-unit of the "Crambus" evolutionary line.

Tawhitia pentadactyla (Zeller) comb.nov.

Crambus pentadactylus Zeller, 1863, Chilonidarum et Crambidarum genera et species, Berolinensis 54, pp.

Aquita claviferella Walker, 1866, List of the specimens of Lepidopterous insects in the collection of the British Museum, pt. 5, London, p. 1546.

Crambus pentadactylus(Zeller) Meyrick, 1883, Trans. N.Z. Inst., 15, p. 31.

Aphomia strigosa Butler, 1887, Proc. zool. Soc. Lond., 1887, p. 368. pl. xliii, fig. 10.

Argyria pentadactyla (Zeller) Hudson, 1938, Butterflies and Moths of New Zealand, p. 170.

Velasquez pentadactylus (Zeller) Bleszynski, 1962, Polskie pismo entomologiczne, 32, p. 14.

Holotype m. in British Museum (Natural History), labelled "pentadactylus, Z.mon. 38 Neu Seeland Knaggs 11/69."

EXTERNAL CHARACTERS (Slide 64): Detailed description given by Meyrick (1883), coloured illustrations by Hudson (1928, Plate XX, fig. 48 m.; 1939, Plate LXII, fig. 15 f.) with abbreviated descriptions. Frons planoconvex, female frenulum triple, wing span 29 - 40 mm (male), 30 - 36 mm (female). The large size usually serves to distinguish this species at sight from the superficially similar Orocrambus harpophorus and Maoricrambus oncobolus, but the identity of small specimens of pentadactyla is best confirmed by examination of genitalia.

MALE GENITALIA (Fig. 92): As for generic description except for the following: Arms of vinculum very narrow in profile, only about $\frac{3}{8}$ as wide as uncus is long.

Saccus with leaf-like ventral caudad extension, and with rounded apex.

Juxta a saddle-shaped plate. Costal lobe of valve long and pointed, curved dorsad and introrse, dorsal margin of costa about $1\frac{1}{2}$ x uncus. Valvula an elongate relatively weak median lobe with rounded apex. Sacculus strongly developed as a broad prong curving introrse and dorsad. Total length of valve a little less than length of aedoeagus. Uncus sub-tubular, curved ventrad. Gnathos slightly longer than uncus, curved dorsad. Gnathos tongue fused for posterior $\frac{1}{2}$ only, with bluntly pointed apex. Aedoeagus tubular, truncate, without cornuti or ornamentation, 2x uncus, length to median breadth ratio about 8:1.

FEMALE GENITALIA (Fig. 176): As for generic description except for the following: Anal papillae coalescent, having shape of a dutch clog in profile. Posterior apophyses slightly curved, longer than tube of eighth tergite, which possibly incorporates the eighth sternite, which is not separately present. The lamellae ante and postvaginales fuse laterally to form ostium bursae and are themselves fused antero-laterally with lobes of the eighth tergite tube, the whole forming an external opening at the base of the tergite tube, shielded ventrally by the posterior margin of the seventh sternite. Lamella ante vaginalis lip projecting much further posteriorly than the dorsal postvagenalis lip, acutely triangular (fig. 176A). Anterior apophyses absent. Ductus bursae about 3x length of posterior apophyses, strong only to about $\frac{1}{6}$, ductus seminalis joining at $\frac{1}{3}$. Ostiolar pouch region swollen, corpus bursae asignate.

LARVA: Not known.

HOST PLANTS: Not known.

DISTRIBUTION (Fig. 276): Semi-ubiquitous in lowland to alpine swamps in South Island, in similar situations from Wellington northwards, to Taupo (T.H. Davies, in litt.). Flight period October, December to March.

MATERIAL EXAMINED: 32 m. 2 f.

Alberttown: 2 m. CGF, CGG, 10.3.41, DM; 2 m. CGH, 15.3.43, DM; G. Howes.

Alexandra: 1 f. no date, ED, G.V. Hudson.

Birdling's Flat: 2 m. 3.3.29, 1 m. 16.3.30, CM, S. Lindsay.

Bottle Lake, Cant.: 2 m. 12.2.25, 1 m. 22.3.25, ED, W. Heighway; 7 m. 22.2.25 - 28.3.25, CM, S. Lindsay.

Christchurch: 3 m. no date, CM, 1 m. Feb. 1868, CM; R.W. Fereday.

Clifton, Cant.: 1 m. 12.3.20, ED, S. Lindsay.

Horseshoe Lake, Cant.: 1 m. Mar. 1917, CM, S. Lindsay.

Lincoln College: 1 m. Mar. 1967, GC, M. McPherson.

Long Acre: 1 f. CGE, 3.12.18, DM, C. E. Fenwick.

Makarora: 1 m. CGD, 31.12.24, DM, C.E. Fenwick.

Mt. Tarndale: 1 m. 13.2.66, FRI, J.S. Dugdale.

Palmerston North: 2 m. Mar. 1966, GC, D.E. Gaskin.

Paraparaumu: 1 m. CGC, no date, DM, A. Hamilton.

Porirua: 1 m. 24.10.11, ED, G.V. Hudson.

Sedgemoor, 3,300 ft.: 1 m. CGB, 13.2.66, FRI, J.S. Dugdale.

Wellington: 1 m. no date, ED, G.V. Hudson.

REMARKS: This species was recently re-examined by Bleszynski (1962). He correctly removed it from Argyria on the strength of male genitalia characters (the female was not examined), and erected for it a new monotypic genus Velasquez. While concurring with the removal from Argyria, I do not agree that a new genus is necessary. The male and female genitalia structures of pentadactyla are very close to those of glaucophanes with many important characters in common, and I have no hesitation in moving pentadactyla to Tawhitia.

Genus Corynophora Berg

Corynophora Berg, 1898, Substitucion de nombres genericos, Comm. Mus. Buenos Aires, 1, p. 42. Type species Crambus lativittalis Walker, 1863.

Halterophora Meyrick, 1897, Trans. ent. Soc. Lond., 1897, p. 367
(praeoc. in Geometridae)

PROVISIONAL DIAGNOSIS (Based on re-examination of type species only): Labial palpi porrected, smooth-scaled, maxillary palpi triangular. Ocelli small, antennae serrate in male, nearly filiform in female. Female frenulum triple. Forewings with vein r_5 free; hindwings with m_2 present, discal cell open

(fig. 24). In male genitalia gnathos short, curved dorsad, socii present. Uncus sub-tubular, curved ventrad. Vinculum very narrow, apex with dorsal truncate thumb-like process. Saccus (apex of vinculum) not well differentiated, but with ventral leaf-like posterior extension or flange. Costa of valve only poorly differentiated, not separated from valvula. Sacculus well differentiated, with strong cucullus at inner posterior extremity, fused to valvula except at apex, folded introrse, trough-like. Juxta an oblate plate, concave dorsally. Aedoeagus apically dilate, without cornuti or external ornamentation. In female genitalia anal papillae coalescent, with long apophyses. Eighth tergite forming a tube fusing latero-anteriorly with lamellae ante and postvaginales, lobes curving introrse. Tergite with moderately long (half posteriors) apophyses, Eighth sternite not separately recognisable, either lost or incorporated into tergite tube. Posterior margin of seventh tergite folded introrse, otherwise not modified. Ductus seminalis at about $\frac{1}{2}$, ductus bursae only about twice length of anal papillae including posterior apophyses, strong to about $\frac{1}{2}$. Corpus bursae with one very large oval signum.

COMMENTS: A genus first erected by Meyrick (1897) to take lativittalis correctly out of Crambus F., and then renamed by Berg (1898) because of preoccupation, this is of particular interest since it appears to be the lowland Australian genus from which the New Zealand endemic Tawhitia Phil. segregated. I have not yet had the opportunity to examine either of the other species listed in this genus by Bleszynski and Collins (1962).

The retention of a large oval signum and anterior apophyses I regard as clearly plesiomorphic characters relative to the situation found in Tawhitia. The degree of fusion of the eighth tergite with the ostiolar sclerites and the position of the sclerites is of special interest. The sclerites are dorso-ventral in arrangement, and only partly evaginated at their posterior extremities. This species offers some evidence for arguing that the external dorso-ventral sclerite position in the "Crambus" line could have been derived

originally from a primitive intermediate position in the intersegmental membrane of the seventh and eighth sternites, as suggested in the earlier general discussion on this point (pp. 53). However I am not prepared to confirm this as a generalised theory without examining the other species of Corynophora. There is always the possibility that the condition in lativittalis has resulted from secondary invagination of sclerites.

Corynophora lativittalis (Walker)

Crambus lativittalis Walker, 1863, List of the specimens of Lepidopterous insects in the collection of the British Museum, 27: 171.

Crambus halterellus Zeller, 1863, Chilonidarum et Crambidarum genera et species, Berolinensis, p. 33.

(Synonymy from Bleszynski and Collins, 1962).

Type not examined. Following based on a specimen from the Australian National Museum Collection determined by I.F.B. Common (and other specimens compared with this by myself), labelled "Corynophora lativittalis (Walk) Jervis Bay N.S.W. 14 Oct. 66 I.F.B. Common and M.S. Upton."

EXTERNAL CHARACTERS (Slide 68): Detailed description given by Meyrick (1897).

The only variation I noted in the specimens examined was that the specimens from Warouna (Victoria) were darker than those from Tasmania and New South Wales.

Venation, fig. 24.

MALE GENITALIA (Fig. 90): See generic description.

FEMALE GENITALIA (Fig. 174) See generic description.

LARVA: Not known.

HOST PLANTS: Not known.

DISTRIBUTION: Given as East Australia (Bleszynski and Collins (1962).) I have examined specimens from New South Wales, Western Australia and Tasmania. Flight period October and November.

MATERIAL EXAMINED: 2 m. 2 f.

Beaconsfield, Tas.: 1 m. 28.10.08, EDNZ, no captor.

Jervis Bay, N.S.W.: 1 m. 14.10.66, ANMC, I.F.B. Common and M.S. Upton.

Waroona, W. A.: 2 f. 4.11.07, NMVC, G. Lyell.

REMARKS: See generic section comments. The placing of this genus in the Crambinae is also briefly considered by Bleszynski (1962a).

Tribe Diptychophorini

Type of the tribe: Diptychophora azanalis (Walker, 1859, List. Spec. Lep.

B.M. 19: 967 : ?Zebronia)

Guiana, Brazil, Peru.

Tribal diagnosis: Antennae filiform to serrate; maxillary palpi triangular with hair-like scales; labial palpi elongate, porrect, with hair-like scales; frons planoconvex; ocelli small; chaetosemae vestigial or absent; compound eye lacking nude peri-orbital margin; proboscis fully developed; forewing with r_5 free, Sc frequently running into r_1 ; forewings often bearing metallic markings, especially near termen; hindwing with discal cell closed, and moderate cubital hair-pecten developed on lower margin of cell; male frenulum single, female frenulum single, double or triple.

In MALE GENITALIA: Pseudosaccus absent; Arms of vinculum narrow; saccus usually broadly developed into a dorsal cup, especially in Pareromene; tegumen slender; uncus and gnathos well developed, apex of gnathos often elaborate; valve with sacculus undeveloped; costal lobe of valve usually having one or two prongs or lobes; valvula generally moderately broad with weak hair cucullus on inner surface; juxta plate-like or slightly crescentic, sometimes with short lobes or prongs; aedoeagus curved ventrad, slender, external ornamentation usually limited to one or **two** thorns; internally vesica of aedoeagus frequently equipped with cornuti.

In FEMALE GENITALIA: Ostiolar sclerites developed in dorsal and ventral positions, completely invaginated into ostium bursae, only very weakly fused in lateral midlines, this distinguishes this tribe from the other Crambine tribes; ductus bursae often with swollen pouch region which may be close to ostium bursae or as far anterior as three quarters of the way along the ductus bursae (these structures are thus probably not homologous); corpus bursae asiginate or with a single star-shaped or circular signum; anal papillae weakly fused, with long to very long posterior apophyses; eighth sternite absent; eighth tergite free, usually with long, sometimes with very long anterior apophyses.

Genus Pareromene Osthelder

- Pareromene Osthelder, 1941, Beitrag zur Kleinschmetterlings fauna Kretas. Mitt. Münch. ent. Ges. 31; 366. Type species Pareromene rebeli Osthelder 1941.
- Diptychophora sensu Zeller 1877 (nec Zeller, 1866, Beschreibung einiger amerikanischen Wickler und Crambiden. Ent. Ztg. Stettin 27: 153)
- Ditomoptera Hampson, 1893, The Macrolepidoptera of Ceylon (Heterocera), v. 182 pp. (p. 179). Type species Ditomoptera minutalis Hampson, 1893 (monotypic) (nomen praeoccupatum)
- Pagmania Amsel, 1961, Arkiv. f. zool. 13: 332. Type species Pagmania bilinealis Amsel, 1961 (monotypic).

DIAGNOSIS: Initial diagnosis by Osthelder (1941), redefined by Bleszynski (1965, p. 51)

COMMENTS: Pareromene differs from Diptychophora Zeller, 1866 in possessing a dorso-anteriorly cupped saccus, from Microcausta in lacking a translucent window in the vinculum, from Microchilo in not having the hindwing veins m_2 , m_3 stalked and from Tamsica in having forewing veins Sc and r_1 coincident (fig. 27) or concurrent (fig. 26). Relationships between Pareromene and the last two genera need further examination (Bleszynski, 1967).

THE SPECIES GROUPS OF Pareromene

Since Pareromene is not an endemic New Zealand genus, obviously any phylogenetic scheme must take into account foreign species. The genus ranges through the warmer parts of Eurasia (Bleszynski, 1965), central Africa (ibid, 1966) South America (ibid, 1967) and has also been recorded in New Guinea,

New Britain, Moluccas and Sumatra (Bleszynski, 1966). Records of Ditychophora Zeller from Fiji (Bleszynski and Collins, 1962) are probably also referable to the genus Pareromene. Species placed in Ditychophora by Meyrick described from Australia are probably all also referable to Pareremone, although at this date I have only been able to obtain material of P.ochracealis (Walker). Most of the structural details can be easily interpreted in the drawings made by Bleszynski in the above papers, and it is possible to construct a systematic phylogeny of the genus (fig. 5) based on 18 New Zealand species and 23 species from other parts of the world, the analysis of the latter being based on drawings.

Seven of the 23 foreign species examined and placed in the scheme have apomorphic characters in common with New Zealand species in 3 species groups. They include one from the Near East in Group 1; one from China in Group 4a; two from New Guinea in Group 4b; one from Japan and one from China in Group 5a; and one from Afghanistan in Group 5b. The single Australian species examined showed a remarkable plesiomorphic character, to the best of my knowledge, unique in the Crambinae, of having the ductus ejaculatorius enter the aedoeagus directly at the anterior end, rather than dorsally some distance from the anterior end. P.ochracealis shows no relationship with any New Zealand species, but shares with five species of group 9a from China and Amurland an apomorphic character which I call a "tooth-brush" gnathos apex (fig. 111).

The groups of species into which all the New Zealand species are placed, together with seven others mentioned earlier from New Guinea and Asia are among the most conservative in uncus and gnathos structure, show little or no tendency for deep division of the juxta, but do tend towards the development of an ostiolar pouchlike swelling of the ductus bursae and an apical aedoeagal thorn which appears to have arisen as the result of permanent eversion of the first part of the vesica. In one tight wholly New Zealand subgroup (5c) a permanent aedoeagal apical sac is present, as well as the thorn or cornutus, and

this structure is complemented in the female genitalia by a fully separate stalked ostiolar pouch.

In this genus there is considerable variation in the relationship between Sc and R₁ in the forewing. In a number of species the two veins are coincident, but I share the view of Bleszynski (1966, p. 463) that this character is of no generic importance in most Crambinae.

In this genus the sacculus of the male valve is never developed, but there is a great deal of variation in the shape of the costa of the valve, which is much prone to the development of rather exotic prongs, lobes and spines, which are in most cases, in my opinion, parallel developments not at all to be regarded as important systematic characters, although of some use at the species group level.

The swelling in the ductus bursae of several species and species groups differs in shape and position, and while there seems to be a common tendency for its development, I doubt if the stalked pouch derived from the ostium bursae and the globate swelling near the junction with the ductus seminalis, conditions which can be seen respectively in P.holanthes and P.gurri, can be considered homologous.

Except for the dorso-ventral position of the invaginated lamellar sclerites I find little variation in the female genitalia which appears to be of major systematic value. As a result the male genitalia, as in Orocrambus, are used very largely in the phylogenetic scheme. Only species group 5c can be directly separated on female as well as male genitalia. This is the group with a fully separated ostiolar sac arising from the ostium bursae. As a result of this situation a key to the female genitalia of all the New Zealand species is given as a single unit, while the male genitalia are sub-keyed within species groups.

SYNONYMIC LIST OF NEW ZEALAND SPECIES
OF THE GENUS Pareromene

SPECIES GROUP 1.

1. Pareromene chrysochyta (Meyrick, 1882: Diptychophora)
N.comb.

chrysoclyta (Hampson, 1895: Diptychophora. Misspelling
of chrysochyta Meyrick)

SPECIES GROUP 2.

2. Pareromene selenaea (Meyrick, 1885: Diptychophora) N.comb.

SPECIES GROUP 4a.

3. Pareromene gurri sp.nov.

4. Pareromene leucoxantha (Meyrick, 1882: Diptychophora)
N.comb.

SPECIES GROUP 4b.

5. Pareromene auriscriptella (Walker, 1864: Eromene) N.comb.

6. Pareromene bipunctella (Walker, 1866: Eromene) N.comb.

7. Pareromene harmonica (Meyrick, 1888: Diptychophora) N.comb.

SPECIES GROUP 5a.

8. Pareromene elaina (Meyrick, 1882: Diptychophora) N.comb.

9. Pareromene helioctypa (Meyrick, 1882: Diptychophora) N.comb.

10. Pareromene interrupta (Felder, 1875: Crambus) N.comb.

astrosema (Meyrick, 1883: Diptychophora)

11. Pareromene lepidella (Walker, 1866: Eromene) N.comb.

gracilis (Felder, 1875: Crambus)

SPECIES GROUP 5b.

12. Pareromene metallifera (Butler, 1877: Eromene)

13. Pareromene microdora (Meyrick, 1905: Diptychophora)
N.comb.

14. Pareromene planetopa (Meyrick, 1923: Diptychophora)
N. comb.

SPECIES GROUP 5c.

15. Pareromene epiphaea (Meyrick, 1885: Diptychophora)
N. comb.
16. Pareromene holanthes (Meyrick, 1885: Diptychophora)
N. comb.
17. Pareromene parorma (Meyrick, 1925: Diptychophora)
N. comb.
18. Pareromene pyrsophanes (Meyrick, 1882: Diptychophora)

SYSTEMATIC LIST OF FOREIGN SPECIES OF Pareromene
(ie. not known from New Zealand) BASED ON MY
INTERPRETATIONS OF DRAWINGS BY S. Bleszynski (1965, 1966)

SPECIES GROUP 1.

1. Pareromene euchromiellus (Ragonot, 1895).
Near East. See Bleszynski (1965, p. 53)

SPECIES GROUP 3a. (No New Zealand representatives)

2. Pareromene tripunctata (Moore, 1888)
Assam. See Bleszynski (1965, p. 62)

SPECIES GROUP 3b. (No New Zealand representatives)

3. Pareromene omeishani Bleszynski, 1965.
Japan. See Bleszynski (1965, p. 63)

SPECIES GROUP 4a.

4. Pareromene parthenie Bleszynski, 1965.
China. See Bleszynski (1965, p. 63)

SPECIES GROUP 4b.

5. Pareromene ajaxella Bleszynski, 1966.
New Guinea.
6. Pareromene morobella Bleszynski, 1966.
New Guinea.
see Bleszynski (1966, p. 461-2)

SPECIES GROUP 5a.

7. Pareromene copernici Bleszynski, 1965.
China. See Bleszynski (1965, p. 58)
8. Pareromene minutalis (Hampson, 1893).
Assam. See Bleszynski (1965, p. 58)
9. Pareromene moriokensis (Okano, 1962).
Japan. See Bleszynski (1965, p. 59)
10. Pareromene vermeeri Bleszynski, 1965.
Japan. See Bleszynski (1965, p. 60)

SPECIES GROUP 5b.

11. Pareromene bilinealis (Amsel, 1961).
Afghanistan. See Bleszynski (1965, p. 60)

SPECIES GROUP 6. (No New Zealand representatives)

12. Pareromene ramona Bleszynski, 1965.
China. See Bleszynski (1965, p. 61)

SPECIES GROUP 7. (No New Zealand representatives)

13. Pareromene albilinealis (Hampson, 1893).
Assam. See Bleszynski (1965, p. 61)
14. Pareromene paradisella Bleszynski, 1966.
Congo. See Bleszynski (1966, p. 462)
15. Pareromene subalbilinealis Bleszynski, 1965.
China. See Bleszynski (1965, p. 61)

SPECIES GROUP 8. (No New Zealand representatives)

16. Pareromene lathonia Bleszynski, 1966.
New Britain. See Bleszynski (1966, p. 459)

SPECIES GROUP 9a. (No New Zealand representatives)

17. Pareromene electra Bleszynski, 1965.
China. See Bleszynski (1965, p. 56)
18. Pareromene exsectella (Christoph, 1881).
Amurland, Japan. See Bleszynski (1965, p. 57)
19. Pareromene melistoma (Meyrick, 1931).
China. See Bleszynski (1965, p. 57)

20. Pareromene rosanna Bleszynski, 1965.
China. See Bleszynski (1965, p. 58)

21. Pareromene rosannoides Bleszynski, 1965.
China. See Bleszynski (1965, p. 58)

SPECIES GROUP 9b. (No New Zealand representatives)

22. Pareromene ochracealis (Walker, 1866)[Ⓜ]
Australia. [Ⓜ] male genitalia figured in this
work, fig. 111.

SPECIES GROUP 10. (No New Zealand representatives)

23. Pareromene mutuurella Bleszynski, 1965
Japan. See Bleszynski (1965, p. 452)

KEY TO SPECIES GROUPS OF Pareromene BY MALE GENITALIA

- 1 Apex of vinculum junction dorsally cupped, rounded 2
 - Apex of vinculum truncate, bilobate GROUP 10.
- 2 Uncus and gnathos simple, straight or curved, tapered and pointed, gnathos apex sometimes dorsally cupped but not elaborated. Juxta platelike, sometimes with dorsal margin concave to take aedoeagus, but juxta not deeply cleft or crescentic, and lacking any annular structures 3
 - Uncus and gnathos frequently complex, especially the gnathos apex, which may be dolabrate, or of "tooth-brush" form. Either independent of or associated with these conditions the juxta may be deeply cleft or crescentic, or platelike and oblate with annular bristles or horns 11
- 3 All cornuti appearing to be lost from aedoeagus (although under stereo high power 50 -70 tiny transparent cornuti are visible) no apical thorn, costa of valve barely elaborated . . . GROUP 1 ☒
 - Cornutus or cornuti and/or apical thorn found in or on aedoeagus, Costa almost always showing some degree of elaboration 4
- 4 Aedoeagus with small cornuti only, from 2 to several, often linearly arranged 5
 - One large cornutus or thorn present if small cornuti retained, or large or small everted apical thorn or thorns on aedoeagus 6
- 5 Valval costa barely elaborated, just separated at apex from valvula GROUP 2 ☒
 - Valval costa developed into huge prong 10
- 6 One large thorn/cornutus present in aedoeagus, but always internal in inverted condition 7
 - Thorn or thorns permanently everted dorsally or ventrally at aedoeagus apex 8
- 7 Uncus long, about or greater than $\frac{1}{2}$ aedoeagus GROUP 4a ☒
 - Uncus short, much less than $\frac{1}{2}$ aedoeagus GROUP 4b ☒
- 8 Uncus long, about $\frac{1}{2}$ aedoeagus GROUP 5a ☒
 - Uncus short, much less than $\frac{1}{2}$ aedoeagus 9

- 9 No aedoeagal sac present GROUP 5b ⌘
- Distinct ventral apical aedoeagal sac present GROUP 5c ⌘
- 10 Valval costa strongly asymmetrical, prong developed
on one valve only GROUP 3a
- Valval costae symmetrical, huge prong on each GROUP 3b
- 11 Juxta bilobate 12
- Juxta a single plate 13
- 12 Juxta apically setulose, gnathos strongly "fish-hooked" . . GROUP 6
- Juxta not apically setulose, gnathos dolabrate GROUP 7
- 13 Juxta with pair of anellar lobes, gnathos without
"toothbrush" apex GROUP 8
- Juxta a cleft or whole plate, without anellar lobes,
gnathos with "toothbrush" structured apex 14
- 14 Costa elaborate, but without deeply infolded margin GROUP 9a
- Costa elaborate, with deeply infolded inner margin,
"toothbrush" dorsal as well as ventral GROUP 9b

⌘ Indicates groups with New Zealand representatives.

KEY TO THE FEMALE GENITALIA OF NEW ZEALAND SPECIES OF THE GENUS

Pareromene

- 1 Stalked ostiolar pouch present 2
- Ostiolar swelling present or absent, if present never
stalked from ostium bursae 5
- 2 Ductus seminalis joining ductus bursae at about $\frac{1}{3}$ epiphaea
- Ductus seminalis joining ductus bursae at $\frac{1}{2}$ or beyond 3
- 3 Ductus bursae strong to about $\frac{1}{3}$ holanthes
- Ductus weak or lightly chitinised at ostium only 4
- 4 Ductus bursae about 3x length of anterior apophyses pyrsophanes
- About 6x length of anterior apophyses parorma
- 5 Large star-shaped signum on corpus bursae interrupta
- No signum present on corpus bursae 6
- 6 Apophyses extremely elongate, posteriors at least 4x length
of 8th sternite elaina
- Posterior apophyses "normal", i.e. no more than about twice
length of 8th sternite 7
- 7 Ductus bursae with an abruptly swollen region 8
- Ductus bursae without such an area; either tapering very
gradually to corpus bursae or with very slight elongate swelling . . 15
- 8 Ventral lip of ostium bursae with median cleft, lamella ante-
vaginalis almost heart-shaped posteriorly microdora
- Ostium with no such median cleft 9
- 9 Ductus bursae unchitinised or weakly chitinised only to
about $\frac{1}{8}$ from mouth 10
- Ductus bursae strong to at least $\frac{1}{3}$ 11
- 10 Ductus seminalis joining ductus bursae at about $\frac{3}{8}$ harmonica
- Ductus seminalis joining ductus bursae at about $\frac{3}{4}$ selenaea
- 11 Swelling in ductus closer to ostium than $\frac{1}{2}$ 12
- Swelling at $\frac{1}{2}$ or further from ostium 13
- 12 Ostiolar swelling large, lateral, at $\frac{1}{4}$, anterior apophyses about
equal to posteriors metallifera
- Ostiolar swelling at $\frac{1}{3}$, small, not lateral, anterior
apophyses $\frac{3}{4}$ posteriors auriscriptella

- 13 Anterior apophyses about equal to posterior apophyses heliotypa
 - Anterior apophyses $\frac{3}{4}$ posteriors 14
- 14 Ostium bursae a flattened convex funnel, ductus bursae with
 reverse loop at $\frac{5}{8}$, ductus bursae about 3x anterior apophyses. . gurri
 - Ostium bursae a flattened funnel with nearly straight sides;
 without reverse loop in ductus bursae, ductus about 5x length
 of anterior apophyses lepidella
- 15 Ductus bursae with chitinised region from ostium mouth to
 about $\frac{1}{8}$, then weak to $\frac{1}{4}$, chitinised again from $\frac{1}{4}$ to $\frac{1}{2}$ leucoxantha
 - Ductus bursae with single region of chitination from mouth
 of ostium to $\frac{1}{4}$ or a little less 16
- 16 Ductus seminalis joining ductus bursae at $\frac{1}{2}$ bipunctella
 - Ductus seminalis joining ductus bursae at $\frac{7}{8}$ chrysochyta

NB: Female of P.planetopa not yet collected; not keyed.

SPECIES GROUP 1.

Frons planoconvex. Apex of vinculum junction dorsally cupped, rounded. Uncus and gnathos simple. Juxta an elongate plate. Very small microscopic cornuti, nearly transparent, compared with larger linear cornuti, easily visible under low power stereo microscope (c.20x), in Group 2. No apical thorn, costa of valve with single straight prong, barely separated from the valvula.

Contains one New Zealand species P.chrysochyta which ranges through dense bush in the central and western South Island and the central bush-covered spine of the North Island to Auckland, and one species P.euchromiella from the Near East.

Pareromene chrysochyta (Meyrick) comb.nov.

Diptychophora chrysochyta Meyrick, 1882 New Zealand Journal of Science (Dunedin), 1, p. 186.

Diptychophora chrysochyta Meyrick, 1883 Trans. N.Z. Inst., 15, p. 12.

Diptychophora chrysoclyta Hampson, 1896, Proc. zool. Soc. Lond. 1895, p. 942. (misspelling of chrysochyta)

Lectotype m. (Dr. S. Bleszynski) in British Museum (Natural History) labelled "Auckland, New Zealand, 20/1/80".

EXTERNAL CHARACTERS (Slide 69): Detailed description by Meyrick (1883), coloured illustration by Hudson (1928, Plate XIX, fig. 10) with abbreviated description. Eye nocturnal type, frenulum single in male, triple in female, wing span 13 - 17 mm (both sexes). Usually distinguishable from other species in New Zealand by yellow outer discal region of forewing being crossed with silvery lines on the veins.

MALE GENITALIA (Fig. 93): As for generic and species group description, and with the following: Arms of vinculum slightly less than uncus; Saccus slightly longer than uncus. Juxta an oblong plate more than twice as long as wide, slightly concave on anterior surface. Costa of valve fused to valve for most of its length, slightly separated apically, dorsal margin about 3x uncus.

Uncus about quarter longer than gnathos, tapered, pointed, curved ventrad. Aedoeagus tubular, tapered, 4x uncus, length to median breadth ratio about 14:1; with row of microscopic cornuti (50 - 70) from near apex to about $\frac{3}{4}$, not visible under low power of stereo-microscope, and nearly transparent.

FEMALE GENITALIA (Fig. 177): As for generic description except for the following: Anterior apophyses about $\frac{5}{4}$ posteriors. Ductus bursae about 5 - 6x length of anterior apophyses, lightly chitinised to about 1/6, smoothly tapering from the flattened ostium, no swelling or pouch, ductus seminalis joining at about $\frac{7}{8}$.

LARVA: Not known.

HOST PLANTS: Not known, but probably a moss.

DISTRIBUTION (Fig. 277): Central and western South Island, central districts of the North Island, especially around the central plateau; I have an unconfirmed but probably reliable report of the species from Trounson's Park, Northland, (T.H. Davies, in litt.). Flight period December, January, in deep bush, where it is best taken by sweep netting along paths at dusk.

MATERIAL EXAMINED: 23 m. 9 f.

Aniseed Valley, Nel.: 1 m. 8.12.25, ED, A. Philpott.

Aratiatia Rapids: 1 m. 30.12.16, CM, S. Lindsay.

Claverley, Marl.: 1 m. 24.12.22, CM, S. Lindsay.

Greenhills: 1 m. 7.1.20, ED, A. Philpott.

Karori, Well.: 1 m. Dec. 1900, ED, G.V. Hudson.

Lake Rotoroa: 1 m. 18.1.27, 1 m. 26.1.28, ED, A. Philpott.

Longwoods: 1 m. 24.12.15, DM, C.E. Fenwick.

Mt. Greenland, 2,900 ft.: 1 f. 6.1.43, ED, E.S. Gourlay.

Mt. Ruapehu, 2,700 ft.: 4 m. 1 f. 18.1.67, GC, D.J. Greenwood, D.E. Gaskin.

Okere: 1 m. 27.12.16, CM, S. Lindsay.

Pelorus Bay: 2 m. 28.1.28, ED, 1 f. 16.3.31, CM; A. Philpott.

Price's Bush, Cant.: 1 m. 27.12.42, CM, S. Lindsay.

Puhi-puhi River, Marl.: 1 m. 2 f. 26.12.29 - 4.1.30, CM, S. Lindsay

Punakaiki: 1 f. 13.3.31, CM, S. Lindsay.

Queenstown: 1 f. 4.1.20, AM, C.E. Clarke.

Tautapere: 2 m. CM, 1 f. BLH, AM, 18.12.17, C.E. Clarke.

Wellington: 1 m. no date, CM, G.V. Hudson; 1 m. ALU, no date, DM, G.V. Hudson.

West Plains: 2 m. 1 f. no date, ED, A. Philpott.

REMARKS: A primitive species relative to most other New Zealand members of the genus as far as the development of the costa of the valve and the simple structure of the ductus bursae are concerned. On the other hand cornuti in the aedoeagus are greatly reduced and transparent, and can in fact only be seen under the highest power of a stereo microscope.

SPECIES GROUP 2.

Frons planoconvex. Apex of vinculum junction dorsally cupped, rounded. Uncus and gnathos simple. Juxta an elongate plate. Small lineat cornuti, easily visible under low power stereo microscope (c. 20x). No apical thorn.

Contains one New Zealand species P.selenaea, common in both lowland and subalpine bush through the North and South Islands, although found on the two Barrier Islands in the Hauraki Gulf and on Great Island in the Three Kings group north of Cape Reinga.

Pareromene selenaea (Meyrick) comb.nov.

Diptychophora selenaea Meyrick, 1885, Trans. N.Z. Inst., 17, p. 131.

Lectotype m. (D.E. Gaskin, on advice from P.E.S. Whalley) in British Museum (Natural History), labelled "Dunedin, New Zealand, AP./82".

EXTERNAL CHARACTERS (Slide 70): Detailed description by Meyrick (1885), coloured illustration by Hudson (1929, Plate XIX, fig. 30 m.) with abbreviated description. Eye nocturnal type, female frenulum triple, wing span 15 - 18 mm (both sexes). Usually separable from other species by its white circular reniform stigma and the black-marked veins in the subterminal portion of the forewings.

MALE GENITALIA (Fig. 94): As for generic and species group description, but with the following details: Arms of vinculum about $1\frac{1}{4}x$ uncus; saccus about $1\frac{3}{4}x$ uncus. Juxta an oval plate a little less than half as wide as long. Costa of valve with prong, reduced, contact with valve less than half total length of valve.

Dorsal margin of costa including prong about twice uncus. Total length of valve about $\frac{3}{4}$ aedoeagus. Uncus and gnathos tapering, pointed, uncus slightly curved ventrad, gnathos nearly straight. Aedoeagus tubular, tapering to apex, about 5 - 6x uncus, length to median breadth ratio 14:1, with row of very small elongate cornuti between apex and $\frac{1}{2}$, visible under low power stereo microscope.

FEMALE GENITALIA (Fig. 178): As for generic description but with the following details: Anterior apophyses about $\frac{3}{4}$ posteriors. Ductus bursae about $4 - 4\frac{1}{2}x$ length of anterior apophyses, weakly chitinised to about $\frac{1}{8}$, pleated from $\frac{1}{8}$ to $\frac{3}{4}$, with swollen saclike region at $\frac{1}{4}$ representing slightly developed ostiolar pouch, with swollen reverse loop at $\frac{3}{4}$, ductus seminalis joining at $\frac{3}{4}$. Ostium bursae a flattened funnel.

LARVA: Not known.

HOST PLANT: Not known, but probably a moss.

DISTRIBUTION (Fig. 278): Lowland and subalpine bush of New Zealand from Three Kings Islands to Southland, also on Little Barrier and Great Barrier Islands. As well as the localities listed below, I have unconfirmed but probably reliable records from Clifton and Little Bush, Hawke Bay (T.H. Davies, in litt.). Flight period September to February, probably two generations.

MATERIAL EXAMINED: 48 m. 22 f.

Aniseed Valley, Nel.: 1 f. 3.12.24, ED, A. Philpott.

Blackmillar, Kaikoura: 1 f. 28.12.29, CM, S. Lindsay.

Bluecliff, Otago: 2 m. 1 f. 17.12.17, ED, E. Meyrick (?).

Claverley: 4 m. 1 f. 28.12.32 - 3.1.33, CM, S. Lindsay.

Day's Bay, Well.: 1 f. IFW, 21.10.27, DM, W.T. Mist.

Dun Mountain, 3,000 ft. Nel.: 1 m. 8.1.22, 1 m. 24.12.27, ED, A. Philpott.

Ferthumb Track, Little Barrier I: 1 m. 23.11.54, PDD, K.A.J. Wise.

Flora River: 1 f. 15.1.22, ED, A. Philpott.

Great Barrier Island: 1 m. 22.11.40, PDD, D. Spiller.

Great Island, 3 Kings Is.: 1 m. 3.5.46, AM, A.G. Turbott.

Karori, Well.: 1 m. no date, ED, G.V. Hudson.

Knife and Steel Peaks, Otago: 1 f. 11.12.17, AM, C.E. Clarke.

Lake Moana: 1 f. 16-21.12.35, CM, A. Tonnoir.
 Lake Rotoiti: 1 m. 27.12.33, CM, S. Lindsay.
 Lake Rotoroa: 2 m. 18.1.27, 3 m. 7.1.28, ED, A. Philpott.
 Longwoods: 5 m. IFY, IFZ, 25-29.12.15, ED, A. Philpott.
 Manapouri: 4 m. 5 f. 27-29.12.22, CM, S. Lindsay.
 Maruia: 1 f. no date, CM, S. Lindsay.
 Milford Track: 2 m. IFX, JFC, 30.2.20, DM, C.E. Fenwick.
 Mt. Grey: 1 m. Dec. 1924, ED, W. Heighway; 1 f. 28.12.24, CM, S. Lindsay,
 2 m. 7-8.1.29, CM, W. Heighway.
 Mt. Ruapehu, 3,300 ft.: 5 m. 2 f. 18.1.67, GC, D.J. Greenwood, D.E. Gaskin.
 Nelson: 1 m. 22.1.22, CM, 1 m. 26.12.23, 1 m. 3.1.29, ED, A. Philpott.
 Puhi-puhi, Kaikoura: 1 f. 27.12.29, CM, S. Lindsay.
 Rowallan: 1 m. 26.12.15, ED, A. Philpott.
 Sandhill Plain, Sthld.: 1 m. 8.12.17, ED, E. Meyrick.
 Taieri: 1 f. 16.12.23, AM, C.E. Clarke.
 Tisbury: 1 m. JFB, no date, DM, G. Howes.
 Wellington: 1 f. IFV, no date, DM, G.V. Hudson.
 West Plains: 2 m. 1 f. no date, ED, A. Philpott.
 Whakarewarewa, Rotorua: 1 m. 28.10.60, 1 m. 1 f. IGE, 13.9.62, FRI, J.S. Dugdale.

REMARKS: In the paper by Philpott (1929a) the captions for figs. 13 and 14 have become reversed. Fig. 13 shows the male genitalia of P.selenaea and fig. 14 the male genitalia of P.interrupta, not vice versa as shown by Philpott. This species shows considerable variation in forewing ground colour, but little or no variation in genitalia except in size.

SPECIES GROUP 3.

No New Zealand representatives. One species P.tripunctata in subgroup 3a from Assam, and one from Japan in subgroup 3b, P.omeishani.

SPECIES GROUP 4.

Frons planoconvex. Apex of vinculum (saccus) junction dorsally cupped and rounded. Uncus and gnathos simple. Juxta an elongate plate. Small cornuti present or absent, but always one large cornutus present, much larger than the others. This is not produced from the apex of the aedoeagus in the unevverted condition.

Group 4a.

Swelling on ductus bursae absent. Uncus very long, about equal to or more than $\frac{1}{2}$ aedoeagus.

Group 4b.

Swelling on ductus bursae present. Uncus short, much less than $\frac{1}{2}$ aedoeagus.

KEY TO MALE GENITALIA OF GROUP 4: (N.Z. spp.)

- 1 Uncus equal to or more than $\frac{1}{2}$ aedoeagus (4a) . . . 2
 - Uncus less than $\frac{1}{2}$ aedoeagus (4b) . . . 3
- 2 Valvula much longer than costal prong leucoxantha
 - Costal prong projecting well beyond tip of valvula gurri
- 3 Costa of valve with single prong 4
 - Costa of valve with prong and also dorsal projection harmonica
- 4 Costal prong ending well anterior to tip of valvula, juxta subhastate, cornutus complex, with apical hook auriscriptella
 - Costal prong equal to valvula, juxta oblong, cornutus simple, not hooked hipunctella

Pareromene gurri sp.nov.

Holotype m., author's genit prep. JFU, allotype f., author's prep. HGY, paratype m., f., in Entomology Division DSIR, Nelson, labelled "Tapu - Coroglen Road, 1,200 ft. 16.11.64 JSD."

EXTERNAL CHARACTERS (Slide 71): Antennae nearly smooth in both sexes. Eye without nude periorbital strip (nocturnal type). Frons planconvex. Maxillary palpi triangular, brown. Labial palpi porrect, brown flecked with white distally, white at base, about equal to length of head. Thorax and abdomen dull brown. Forewings dull greenish brown, reniform stigma pale grey towards base and red-brown towards termen. First, second and third lines single, dark brown and angled sharply at centre. Subterminal region dull yellowish brown. Termen sinuate in male, slightly incised, nearly straight in female. Cilia greyish brown with dark brown bases. Hindwings dark brown with cilia similar to those of forewings.

Undersides of all wings dull greyish brown with some obscure markings in subterminal region of forewings. Frenulum single in male, triple in female. Wing span 11 - 15 mm (both sexes).

MALE GENITALIA (Fig. 95, holotype): As for generic and species group descriptions but with following detail: Arms of vinculum about $\frac{1}{2}$ uncus; saccus about $\frac{5}{8}$ uncus. Juxta a roughly oblong plate tapering slightly dorsally. Costa of valve with large prong extending beyond valvula tip, dorsal margin of costa twice uncus. Total length of valve about equal to aedoeagus. Uncus and gnathos slender, parallel-sided for most of their length, apically swollen and sharply pointed. Uncus curved slightly ventrad, gnathos slightly dorsad. Aedoeagus tubular, slightly tapering apically, $1\frac{3}{4}$ x uncus, length to median breadth ratio about 10:1, long straight cornutus rooted near $\frac{1}{2}$ and reaching to apex, and row of about 20 microscopic rose-thorn shaped cornuti also present anterior to base of large cornutus.

FEMALE GENITALIA (Fig. 179, allotype): As for generic description except for the following: Anterior apophyses about $\frac{3}{4}$ posteriors. Ductus bursae about 3x length of anterior apophyses, strong to $\frac{1}{2}$, with swelling and reverse loop at $\frac{5}{8}$, ductus seminalis joining at $\frac{3}{4} - \frac{7}{8}$. Ostium bursae a flattened funnel, tapering sharply at a little beyond $\frac{1}{8}$.

LARVA: Not known.

HOST PLANT: Not known, but probably a moss.

DISTRIBUTION (Fig. 279): Presently known only from Coromandel and South Auckland. Flight period November.

MATERIAL EXAMINED: 7 m. 2 f.

Tapu-Coroglen Road, 1,200 ft., Coromandel: 2 m. JFU (Holotype), 2 f. HGY, (Allotype), 16.11.64, FRI, J.S. Dugdale.

Te Aroha Summit ,3,200ft: 5 m. 23.10.67,ED,J.S.Dugdale.

REMARKS: Shares apomorphic characters with P.leucoxantha, and the Chinese species P.parthenie Blesz.

Superficially quite like P.ephiphaea, an alpine species found in both the North and South Islands of New Zealand, and is further discussed in the remarks section on that species. Easily distinguished on the genitalia characters in both sexes. Externally the species are hard to separate, although the forewing tornus is very obtuse in P.ephiphaea and nearly a right angle in P.gurri.

Pareromene leucoxantha (Meyrick) comb.nov.

Diptychophora leucoxantha Meyrick, 1882, New Zealand Journal of Science, Dunedin, 1, p. 186.

Diptychophora leucoxantha Meyrick, 1883, Trans. N.Z. Inst., 15, p. 15.

Holotype m. in British Museum (Natural History) labelled "L. Wakatipu New Zealand, 2/1/81, RWF."

EXTERNAL CHARACTERS (Slide 72): Full description by Meyrick (1883), coloured illustrations by Hudson (1928, Plate XIX, figs. 16, 17 m.) with abbreviated description. Eye nocturnal type, female frenulum triple, wing span 12 - 19 mm (both sexes). The forewing colour is very variable, but it can usually be distinguished from other species by its heart or kidney-shaped reniform stigma and the silvery veins in the subterminal region.

MALE GENITALIA (Fig. 96): As for generic and species group descriptions except for following details: Arms of vinculum about $\frac{3}{4}$ uncus; saccus about $\frac{2}{3}$ uncus. Juxta a diamond-shaped plate less than half as wide as long, tapering more sharply posteriorly. Costa of valve with prong, but considerably anterior to tip of valvula. Total length of valve slightly more than aedoeagus. Uncus about $\frac{1}{4}$ longer than gnathos, tapering, pointed, curved ventrad. Gnathos tapering, curved slightly dorsad apically. Aedoeagus tubular, tapering slightly apically, about 2x uncus, length to median breadth ratio about 9:1, with a long cornutus rooted at about $\frac{3}{4}$ reaching to near apex; 8 elongate small cornuti also present.

FEMALE GENITALIA (Fig. 180): As for generic description except for following details: Anterior apophyses about $\frac{3}{4}$ posteriors. Ductus bursae about 4x length of anterior apophyses, weakly chitinised to $\frac{1}{8}$ and again from $\frac{1}{4}$ to $\frac{1}{2}$, ductus seminalis joining at $\frac{3}{4}$. Ostium bursae a flattened funnel, No trace of a swelling in ductus bursae.

LARVA: Not known.

HOST PLANT: Not known, probably a moss.

DISTRIBUTION (Fig. 280): A common species in lowland and subalpine bush throughout the South Island of New Zealand, and in the North Island it has been taken in the Wellington district, on Mt. Ruapehu, and also on Mt. Egmont (T.H. Davies, in litt.). I have not examined these specimens but regard the record as reliable. I have taken the species in the Pouakai Range north of Egmont. Flight period November to early February.

MATERIAL EXAMINED: 60 m. 16 f.

Arthur's Pass: 13 m. 2 f. 2-9.2.26, CM, S. Lindsay; 1 m. 23.1.28, ED, A. Philpott; 1 m. 28.12.31, CM, 2 f. 30-31.12.40, CM, S. Lindsay.

Cass, Cant.: 1 m. November 1924, CM, A. Tonnoir.

Cawthron Park, Nel.: 1 m. 6.11.26, ED, A. Philpott.

Dun Mt. Nel.: 1 m. 1.1.21, 3 m. 2 f. 8.1.22, 2 m. 1 f. 8-29.12.25, 1 m. 24.12.27, ED, A. Philpott.

Forest Hill, Sthld.: 1 m. 29.11.15, ED, A. Philpott.

Greenhill, Sthld.: 1 m. 16.12.13, CM, G.V. Hudson.

Hump: 1 m. 1 f. 24.12.15, DM, C.E. Fenwick.

Karori, Well.: 1 m. no date, ED, G.V. Hudson.

Lake Rotoiti: 2 m. 25.12.33 - 2.1.34, CM, S. Lindsay.

Lake Rotoroa: 1 m. 1 f. 7.1.28, ED, A. Philpott.

Longwoods: 3 m. 5.12.13, ED, 1 m. 29.12.15, ED, A. Philpott.

Manapouri: 1 m. 30.12.22, CM, S. Lindsay.

Marion, Otago: 1 f. 20.12.42, DM, G. Howes.

Maruia Springs: 1 m. 3.1.40, CM, S. Lindsay.

Milford Track: 4 m. ALL, ALM, 2 f., 26-30.12.20, DM, C.E. Fenwick.

Mt. Greenland, Westld.: 1 m. 12.1.31, ED, E.S. Gourlay.

Mt. Grey, Cant.: 2 m. 28-29.12.35, CM, S. Lindsay.

Mt. Ruapehu: 1 m. 1.f. 18.1.67, GC, D.J. Greenwood and D.E. Gaskin.

Nelson: 3 m. 6-9.12.20, ED, A. Philpott.
 Otira: 1 m. Dec. 1914, DM, G.V. Hudson.
 Porirua: 1 m. 25.11.11, CM, W. Heighway.
 Pouakai Range, Tar.: 2 m. 6.11.66, GC, D.E. Gaskin.
 Table Hill, Sthld.: 1 m. 29.12.03, ED, G.V. Hudson.
 Waitati: 1 m. 12.12.16, DM, C.E. Fenwick, 1 f. 18.12.16, AM, 1 f. 16.12.18, AM,
 C.E. Clarke.
 Wellington: 1 m. 1 f. HGP, no date, DM, G.V. Hudson.
 West Plains: 4 m. no date, ED, A. Philpott.
 Whiterock, Cant.: 1 m. 26.11.22, CM, S. Lindsay.

REMARKS: Shares apomorphic characters with P.gurri, and the Chinese species P.parthenie Blesz.

The forewing pattern is very variable in this species, although I have not detected any regionalism. A rather remarkable form has the forewings bright sulphur yellow with the reniform stigma still typically heart-shaped, but purplish black. Yellow-orange and brown and the most common forewing ground colours, although greyish is not unknown and there are one or two specimens in New Zealand collections with a strong reddish tinge. The reniform stigma varies in colour from white to purplish brown. I would suggest that this species might provide useful material for a long-term genetics experiment. The variation may be random, genetically controlled, or related to strains or discrete populations adapted to different foodplant species in different habitats.

Pareromene auriscriptella (Walker) comb.nov.

Eromene auriscriptella Walker 1864, List of the Species of Lepidopterous insects in the collection of the British Museum, 30, p. 976.

Diptychophora auriscriptella Meyrick, 1883, Trans. N.Z. Inst., 15, p. 16.

Lectotype m. (Dr. S. Bleszynski) in British Museum (Natural History) labelled "New Zeal. 54.4."

EXTERNAL CHARACTERS (Slide 73): Detailed description by Meyrick (1883), coloured illustration by Hudson (1928, Plate XIX, fig. 37 f.) with abbreviated description; photograph by Gaskin (1966, Plate 18, fig. 5) and brief notes (p. 161). Eye

nocturnal type, female frenulum triple, wing span 14 - 18 mm (both sexes).

MALE GENITALIA (Fig. 97): As for generic and species group descriptions except for following details: Arms of vinculum about equal to uncus; saccus longer than uncus. Juxta a subhastate, spear-shaped plate. Costa of valve with prong reaching tip of valvula. Dorsal margin of costa including prong about $2\frac{1}{2}$ x uncus. Total length of valve about equal to aedoeagus. Uncus longer than gnathos, tapered, pointed. Aedoeagus tubular, about 4x uncus, length to median breadth ratio about 13:1, apically truncate, with hooked rose-thorn shaped cornutus below apex.

FEMALE GENITALIA (Fig. 181): As for generic description except for following details: Anterior apophyses about $\frac{3}{4}$ posteriors. Ductus bursae about $3\frac{1}{2}$ x length of anterior apophyses, strong to $\frac{1}{3}$, with pouched sac-like pleated swelling at base of this zone, ductus seminalis joining at $\frac{1}{2}$. Ostium bursae a flattened funnel.

LARVA: Not known.

HOST PLANT: Not known, but probably a moss.

DISTRIBUTION (Fig. 280): A common species in lowland and subalpine bush throughout the North and South Islands of New Zealand from Southland north to Te Aroha, also recorded from Great Barrier Island. As well as the localities given below, I have been given records from Burgess Park (New Plymouth), White Pine Bush and Little Bush (both in Hawke Bay), (T.H. Davies, in litt.). Flight period November to March, with most specimens taken in November to early January, so possibly only one generation in most of the country per year.

MATERIAL EXAMINED: 58 m. 18 f.

Akaroa: 2 m. Dec. 1924, CM, A. Tonnoir.

Aniseed Valley, Nel.: 1 m. 3.12.24, 2 m. 8.12.25, ED, A. Philpott.

Blackmillar, Marl.: 1 m. 3 f. 26-29.12.29, CM, S. Lindsay.

Bluecliff, Sthld.: 1 f. 17.12.17, ED, A. Philpott.

Campbell's Hill, Well.: 1 f. IGA, 7.12.13, DM, G.V. Hudson.

Christchurch: 6 m. no date, CM, R.W. Fereday.

Claverley, Marl.: 2 m. 1 f. 27-29.12.32, CM, S. Lindsay.

Dun Mountain, Nel.: 3 m. 29.12.25, ED, A. Philpott.
 Hoon Hay, Cant.: 2 m. Jan. 1920, 1 m. Mar. 1920, CM, S. Lindsay.
 Karori, Well.: 1 m. ALY, 3.1.1897, DM, G.V. Hudson.
 Longwoods: 2 m. 1 f. 29.12.15, ED, A. Philpott.
Monowai: 1 m. 21.12.14, ED, A. Philpott.
 Mount Grey, Cant.: 1 m. Jan. 1921, CM, S. Lindsay.
 Mount Ruapehu, 3,000 ft.: 1 m. 1 f. 18.1.67, GC, D.E. Gaskin.
 Mount Te Aroha: 1 m. 16.11.64, FRI, J.S. Dugdale.
 Nelson: 6 m. 2 f. 14-29.12.20, 1 m. 22.12.22, 1 m. 1 f. 24.11.25, 1 m. 9.12.27, ED, W. Heighway and A. Philpott.
 Palmerston North: 1 m. 26.11.65, GC, D.E. Gaskin.
 Price's Bush, Cant.: 1 m. 7.12.30, CM, S. Lindsay.
 Puhi-puhi, Marl.: 2 m. 1 f. 26-28.12.29, CM, S. Lindsay.
 Pukeatua Bush, Port Hills: 1 m. 28.1.27, CM, S. Lindsay.
 Sunnyside, Sthld.: 2 m. 1f. ED, 1 m. ALQ, DM, 20.12.14, C.E. Fenwick.
 Takitimu Mountains: 1 m. 28.12.12, ED, A. Philpott.
 Tautapere: 2 f. 18.12.17, AM, C.E. Clarke.
 Tisbury: 1 m. 1 f. 3-11.1.12, ED, A. Philpott.
 Upper Maitai, Nel.: 2 m. 26.11.23, ED, E.S. Gourlay.
 Wadestown, Well.: 1 m. 24.11.1895, DM, G.V. Hudson.
 Wainuiomata: 1 m. 30.12.1900, DM, G.V. Hudson.
 Wellington: 2 m. ALX, Dec. 1888, DM, G.V. Hudson.
 West Plains: 2 m. 1 f. no date, DM, C.E. Fenwick.
 Whakarerwarewa, Rotorua: 1 m. 14.11.60, FRI, J.S. Dugdale.
 Whangaparapara, Great Barrier Island: 3 m. 1 f. 15-16.11.50, PDD, K.A.J. Wise.

REMARKS: This species has also been discussed briefly in the section on P.lepidelia. P.auriscriptella can be distinguished by its clear white crescentic stigma in the forewing disc. There is considerable variation in the strength of the silvery cross-lines in P.auriscriptella, but it can always be separated from the very similar P.holanthes by its white stigma; in P.holanthes the stigma is represented by a pair of small black dots.

The male genitalia labelled Diptychophora auriscriptella Walk. by Philpott (1929, fig. 5) are those of P.harmonica, while those shown as Diptychophora harmonica Meyr. (1929, fig. 17) are those of P.auriscriptella.

Pareromene bipunctella (Walker) comb.nov.

Eromene bipunctella Walker, 1866, List of the Species of Lepidopterous insects in the collection of the British Museum, 35, p. 1761.

Diptychophora bipunctella (Walker) Meyrick, 1885, Trans. N.Z. Inst., p. 17, p. 132.

Holotype m. in British Museum (Natural History) labelled "New Zeal. 54.4."

EXTERNAL CHARACTERS (Slide 74): Detailed description by Meyrick (1885), coloured illustration by Hudson (1939, Plate LVI, fig. 32 m.) with abbreviated description.

Eye nocturnal type, female frenulum triple, wing span 15 - 17 mm (both sexes).

Can be separated from the externally very similar and closely related P.harmonica by lacking metallic subterminal costa markings on the forewings and not having veins in subterminal forewing region marked with silver.

MALE GENITALIA (Fig. 98): As for generic and species group descriptions except for the following: Arms of vinculum about $\frac{3}{4}$ uncus; saccus slightly less than uncus. Juxta an oblongate plate, less than half as wide as long. Costa of valve with prong terminating well anterior of valvula tip, dorsal margin of costa a little less than twice uncus. Total length of valve about equal to aedoeagus. Uncus and gnathos tapered, pointed, equal in length. Gnathos curved slightly dorsad. Aedoeagus about $3\frac{1}{4}$ x uncus, tubular, truncate, length to median breadth ratio about 9-10:1, with single stout cornutus behind apex.

FEMALE GENITALIA (Fig. 182): As for generic description except for the following: Anterior apophyses about $\frac{3}{4}$ posteriors. Ductus bursae about 3 - $3\frac{1}{2}$ x length of anterior apophyses, strong to $\frac{1}{4}$, with pleated swelling from $\frac{1}{4}$ to $\frac{1}{2}$, narrowing at $\frac{1}{2}$, and widening slightly again towards corpus bursae, ductus seminalis joining at $\frac{1}{2}$. Ostium bursae a flattened funnel.

LARVA: Not known.

HOST PLANT: Not known, but probably a moss.

DISTRIBUTION (Fig. 281): Confined to Nelson Province and southern part of the North Island to Palmerston North and the Pohangina Valley (Ruahines). Frequent

dense native scrub, apparently not a common species. Flight period November, December.

MATERIAL EXAMINED: 5 m. 1 f.

Gollans Valley, Nel.: 1 m. ALJ, 7.11.34, DM, E.S. Gourlay.

Palmerston North: 1 m. 6.12.66, GC, D.E. Gaskin.

Pohangina Valley: 2 m. ALH, 1 f. IGG, 4.12.29, DM, G.V. Hudson.

Upper Maitai, Nel.: 1 m. 26.11.23, ED, E.S. Gourlay.

Wainuiomata: 1 f. ALI, 31.12.05, DM, G.V. Hudson.

REMARKS: The exact identity of this species has been in considerable confusion in the past. Hudson (1928) was not able to recognise the species from the descriptions by Walker (1866) and Meyrick (1885), but his catalogue numbers related to the specimens in the Hudson collection show that he did not have any specimens of the true bipunctella at that time. In his later work (1939) he was able to give a re-description and an illustration from specimens taken in the Pohangina Valley.

The male genitalia shown by Philpott (1929a, fig. 10) as bipunctella are those of P.elaina, while those shown for elaina (fig. 7) are unidentifiable. Philpott does not actually figure the genitalia of P.bipunctella.

Pareromene harmonica (Meyrick) comb.nov.

Diptychophora harmonica Meyrick, 1888, Trans. N.Z. Inst., 20, p. 71.

Lectotype m. (Dr. S. Bleszynski) in British Museum (Natural History), labelled "Auckland New Zealand 22/12/85."

EXTERNAL CHARACTERS (Slide 75): Detailed description by Meyrick (1888), coloured illustrations by Hudson (1928, Plate XIX, fig. 38 f, and Plate LII, fig. 30 f. (as bipunctella)), with abbreviated description. Eye nocturnal type, female frenulum triple, wing span 13 - 18 mm (both sexes). Can be separated from P.bipunctella by having metallic markings on the subterminal costa of the forewing, and silvery markings on the veins in the subterminal region of the forewings.

MALE GENITALIA (Fig. 99): As for generic and species group description except for the following: Arms of vinculum about equal to or slightly longer than uncus; saccus slightly longer than uncus. Juxta a quadrate plate tapering posteriorly,

dorsally concave. Costa of valve with slender prong terminating anterior to tip of valvula, and also with dorsal projection at about $\frac{1}{2}$; dorsal margin of costa including prong about $2\frac{1}{2}$ x uncus. Total length of valve about equal to aedoeagus. Uncus and gnathos tapered, pointed, equal in length. Aedoeagus tubular, truncate apically, about 4x uncus, length to median breadth ratio about 8:1, with single large cornutus below apex.

FEMALE GENITALIA (Fig. 183): As for generic description except for the following: Anterior apophyses about $\frac{3}{4}$ posteriors. Ductus bursae weak, about 4x length of anterior apophyses, with swollen pleated pouch at about $\frac{3}{8}$, ductus seminalis joining at about $\frac{3}{8}$. Ostium bursae a very slender funnel with a slightly strengthened constriction at about $\frac{1}{8}$, only slightly flared at mouth.

LARVA: Not known.

HOST PLANT: Not known, probably a moss.

DISTRIBUTION (Fig. 282): Probably throughout the North and South Islands of New Zealand from Auckland to Southland in native lowland and subalpine bush. Flight period October to February, possibly two complete generations per year.

MATERIAL EXAMINED: 38 m. 3 f.

Arthur's Pass: 1 m. 25.12.40, CM, S. Lindsay.

Claverley: 2 m. 28.12.32 - 3.1.33, CM, S. Lindsay.

Dun Mt. Nelson: 1 f. 8.1.22, ED, 1 m. 31.12.27, ED, A. Philpott.

Gollans Valley, Nel.: 1 m. 11.11.19, DM, 1 m. 7.11.34, DM, G.V. Hudson.

Hump Range: 1 m. 23.12.13, DM, C.E. Fenwick.

Karori, Well.: 1 m. no date, ED, 1 m. IGD, 7.2.1891, DM, G.V. Hudson.

Lake Rotoroa: 4 m. 7.1.28, ED, A. Philpott.

Longwoods: 1 m. DM, 1 m. ED, 5.12.13, C.E. Fenwick.

Manapouri: 4 m. 25-29.12.22, CM, S. Lindsay.

Milford Track: 2 m. 29-31.12.30, DM, C.E. Fenwick.

Mt. Grey, Cant.: 1 f. 8.1.29, CM, W. Heighway.

Mt. Ruapehu: 2 m. 10.1.41, DM, G.V. Hudson.

Nelson: 2 m. 9-29.12.20, ED, 1 m. 15.12.21, ED, A. Philpott.

Pelorus Bay: 5 m. 1 f. 28.11.28, ED, E.S. Gourlay.

Pukeatua Bush, Cant.: 1 m. 12.1.30, CM, 1 m. 29.11.32, CM, S. Lindsay.

Waimarino: 1 f. BLQ, 19.2.22, AM, C.E. Clarke.

Wainuiomata, Well.: 1 m. 25.12.15, 1 m. 10.12.31, DM, G.V. Hudson.

Waioeka Gorge: 1 m. 9.10.64, FRI, J.S. Dugdale.

West Plains: 1 m. ALS, DM, 1 m. ED, no date, C.E. Fenwick.

Whiterock, Cant.: 1 m. 26.11.22, CM, S. Lindsay.

Wilton's Bush, Well.: 1 m. 21.11.28, DM, G.V. Hudson.

REMARKS: P.bipunctella shares apomorphic characters with P.auriscriptella.

It is worth noting again in this section that the drawing of the male genitalia of this species in Philpott's paper (1929^a, fig. 5) is labelled D.auriscriptella, and the genitalia drawing of the latter species is labelled D.harmonica (fig. 17).

SPECIES GROUP 5.

Frons planoconvex. Apex of vinculum junction (saccus) dorsally cupped and rounded. Uncus and gnathos simple. Juxta an elongate plate. Uncus long (about $\frac{1}{2}$ aedoeagus) or short (much less than $\frac{1}{2}$ aedoeagus), a cornutus or thorn permanently everted at apex of aedoeagus, either dorsal or ventral.

Group 5a.

Long uncus. Signum present on corpus bursae of P.interrupta. No aedoeagal apical sac. Ductus bursae with or without pouched sac.

Group 5b.

Short uncus. No aedoeagal apical sac. Ductus bursae with pouched sac.

Group 5c.

Short uncus. Aedoeagal apical sac present. Ostiolar stalked pouch present.

KEY TO MALE GENITALIA OF GROUP 5: (N.Z. Spp.)

- | | | |
|---|--|-------------------------------|
| 1 | Uncus long, equal to or more than $\frac{1}{2}$ aedoeagus | (<u>5a</u>) 2 |
| - | Uncus short, much less than $\frac{1}{2}$ aedoeagus | (<u>5b, 5c</u>) 5 |
| 2 | Costa of valve pronged, no dorsal projection on margin anterior to prong | <u>interrupta</u> |

- Such a dorsal projection present 3
- 3 Dorsal projection on costa of valve large, at about $\frac{2}{3}$
of dorsal margin from tip of prong, juxta hastate elaina
- Dorsal projection on costa of valve a small bump or spur
right at base of prong before $\frac{1}{2}$ from tip of prong,
juxta oblongate or sub-triangular 4
- 4 Juxta oblongate lepidella
- Juxta sub-triangular, almost dolabrate helioclypa
- 5 Aedoeagal sac absent (5b) 6
- Aedoeagal sac present (5c) 8
- 6 Aedoeagus with pair of small dorsal apical thorns planetopa
- Aedoeagus with single ventral apical thorn 7
- 7 Juxta elongate, oblongate microdora
- Juxta short and broad, shield-shaped, with posterior
margin concave metallifera
- 8 Costa of valve with apical prong, dorsal projection also
present, aedoeagal spur ventral parorma
- Costa with some form of apical prong, often very short and
blunt, aedoeagal thorn dorsal 9
- 9 Costal prong elongate, arising from position about $\frac{1}{2}$ from
tip of valvula epiphaea
- Prong short or very short, close to valve apex 10
- 10 Costa developed only into a very short spur at about $\frac{1}{3}$
from valve apex, aedoeagal sac elongate pyrsophanes
- Costa spur easily visible at about $\frac{1}{5}$ from valve apex,
aedoeagal sac subglobular holanthes

Pareromene elaina (Meyrick) comb.nov.

Diptychophora elaina Meyrick, 1882, New Zealand Journal of Science (Dunedin),
1, p. 187.

Diptychophora elaina Meyrick, 1883, Trans. N.Z. Inst., 15, p. 17.

Lectotype m. (Dr. S. Bleszynski) in British Museum (Natural History) labelled
"Wellington, New Zealand 31/12/59".

EXTERNAL CHARACTERS (Slide 76): Detailed description by Meyrick (1883),
coloured illustration by Hudson (1928, Plate XIX, fig. 31 f.) with abbreviated

description, photograph and brief details by Gaskin (1966, Plate 18, fig. 4 and p. 161). Eye nocturnal type, female frenulum triple, wing span 12 - 16 mm (both sexes). At once separable from the superficially very similar P. parorma by lacking the line of terminal black dots characteristic of the forewing of the latter species.

MALE GENITALIA (Fig. 100): As for generic and species group description except for following detail: Arms of vinculum about $\frac{1}{2}$ uncus; saccus about $\frac{3}{4}$ uncus. Juxta a hastate plate less than half as wide as long. Costa of valve produced posteriorly into a long prong extending just beyond tip of valvula, and with second projection dorsal at about $\frac{1}{3}$ from base. Total length of valve about equal to length of aedoeagus. Uncus nearly straight, parallel-sided for most of its length, with rounded apex, slightly longer than gnathos. Gnathos curved dorsad, parallel-sided for most of its length, apically swollen and sharply pointed. Aedoeagus tubular, about 2x uncus, curved slightly ventrad, length to median breadth ratio about 9-10:1, dorsal apex with straight spur and cluster of 6 - 9 cornuti of graduated size about its base. In the body of the aedoeagus are about 18 - 20 microscopic elongate cornuti, between $\frac{1}{4}$ and $\frac{1}{2}$ in uneverted condition.

FEMALE GENITALIA (Fig. 184): As for generic description except for the following: Both anterior and posterior apophyses very elongate compared with other members of the genus in New Zealand. Posterior apophyses almost as long as ductus bursae. Anterior apophyses about $\frac{3}{4}$ posteriors. Ductus bursae very slender, weak, with no trace of ostiolar swelling, ductus seminalis joining at about $\frac{3}{8}$.

EGG: Flattened ovoid, no ribs, with a microscopic hexagonal pattern, 0.32 - 0.34 x 0.19 - 0.20 mm. Greenish white when first laid, turning orange after 24 - 36 hours. Duration of egg stage at room temperature, not under controlled conditions; 17 days (October-November), 20 days (November-December).

LARVA (Fig. 224, final instar): Final instar larva slender, 10 - 12 mm, greenish grey with series of wedge-shaped marks between segments five and nine running dorsally down the back, the wedges cleft apically and facing caudad. Head dark brown with pale central streak. First described by Fereday (in Meyrick, 1883).

On prothorax: L2 dorso-cephalad of L1, SV2 slightly dorso-cephalad of SV1. Mesothorax and Metathorax: D2 longer than D1, SD1 longer than SD2, L1 dorso-caudad of L2. Abdominal segments: On A1, 2; SV2 dorsad of SV1, SV3, L1 dorso-caudad of L2, SD2 very small, D1 longer than D2. On A3 - 6; SV3 dorso-cephalad of SV2, SV1. L1 dorso-caudad of L2. On A7; L1 dorso-caudad of L2, SV1 ventro-caudad of SV2. On A9; D1, SD1 on separate pinacula.

DURATION OF LARVAL INSTARS: All larvae maintained on growing moss (Funaria hygrometrica (?)) in small containers, foodplant changed when necessary, few drops of water added every 2 days, at room temperature, conditions not controlled. Duration of instars as follows: First instar: 9 - 11 days (December), 6 - 7 days (January); Second instar: 5 - 6 days (December), 5 - 8 days (January); Third instar: 5 - 9 days (December), 7 - 8 days (January); Fourth instar: 7 - 8 days (December-January), 6 - 7 days (January-February); Fifth instar: 5 - 8 days (January), 8 - 10 days (February); Sixth instar: 4 - 8 days (January), 6 days (February).

LARVAL BEHAVIOUR: Makes fragile horizontal tunnels through moss on logs and the soil, and was noted by Fereday (in Meyrick, 1883) in moss on walls. The larva can easily be seen through the thin walls of the tunnels; it is sluggish during the day but feeds quite actively at night. When ready for pupation it constructs a rough cocoon of debris and soil particles held together by silk among the roots of the foodplant. The final instar larva seals itself in this cocoon, which is oval and about 0.8 cm long by 0.5 cm wide, and enters a non-feeding quiescent prepupal stage which lasts from 1 - 4 days before the final ecdysis.

HOST PLANTS: Not identified by Fereday (in Meyrick, 1883) beyond "moss".

I have not found the larva during the course of this study in the wild, but previously found it at Karori in 1963 feeding in moss on two fallen logs and the soil around them, which was also thickly covered with moss. Unfortunately at that time I did not ascertain the species. In captivity the larva feeds readily on Funaria hygrometrica, and a number of other species which I have not been able to identify.

PUPA: Shining golden brown, slender, about 6 mm long. Spiracles dark, abdominal setae microscopic except on cremaster, where they are long and relatively thick. Duration of pupal stage 8 - 22 days.

DISTRIBUTION (Fig. 283): This species has a northern biased distribution in the South Island of New Zealand, being absent from Southland, and I know of only one record south of about the latitude of Mt. Cook and Christchurch, a single specimen taken in Dunedin. In the North Island it is the most common species of Pareromene in lowland bush, although not yet recorded from Hawke Bay district (T.H. Davies, pers. comm.). Records in the North Island extend to Waitangi in the north and Rotorua. Flight period October to March, two complete generations per year.

MATERIAL EXAMINED: 40 m. 30 f.

Alford Forest: 1 m. 4.2.28, CM, S. Lindsay.

Auckland: 1 m. 1929, ED, D.A. Milligan.

Blackmillar, Marl.: 1 f. 28.12.27, CM, S. Lindsay.

Christchurch: 6 m. 3 f. no date, 1 m. Jan. 1875, CM, R.W. Fereday.

Claverley: 1 m. 27.12.32, CM, S. Lindsay.

Dunedin: 1 m. 30.3.1902, ED, G.V. Hudson.

Dun Mt., Nel.: 1 f. 14.1.26, ED, A. Philpott.

Eglinton Valley: 1 m. 31.12.20, DM, C.E. Fenwick.

Flora Camp, Mt. Arthur, Nel.: 1 m. 24.1.24, CM, S. Lindsay.

Governor's Bay, Christchurch: 1 m. 1 f. 18-19.11.22, CM, S. Lindsay.

Hoon Hay, Cant.: 1 m. 1.12.23, CM, S. Lindsay.

Karori, Well.: 2 m. ALB, 1 f. Jan. 1884, 1 f. Dec. 1909, 1 f. ALE, Jan. 1915, DM, G.V. Hudson.

Lake Rotoroa: 1 f. 15.3.31, CM, W. Heighway.
 Lees Valley, Cant.: 1 m. 9.2.29, CM, S. Lindsay.
 Makara: 1 f. 5.12.23, DM, G.V. Hudson.
 Maruia Springs: 1 f. 5.1.40, CM, S. Lindsay.
 Mt. Cook: 1 m. 4.1.29, ED, A. Philpott.
 Mt. Grey, Cant.: 1 f. 12.11.23, 1 f. 23.2.24, 1 m. 17.11.29, CM, S. Lindsay.
 Mt. Ruapehu: 1 m. ALC, 4.1.22, DM, C.E. Fenwick; 1 m. 18.1.67, GC, D.J. Greenwood.
 Nelson: 2 m. 8 f. 5-8.12.20, 1 m. 29.11.21, 1 m. 1.3.24, 1 f. 23.12.25, ED,
 A. Philpott.
 New Creek, Mt. Cook: 1 m. 4.1.29, ED, A. Philpott.
 Palmerston North: 2 m. 1 f. 1-3.11.66, 1 m. 1 f. 15.11.66, GC, D.E. Gaskin.
 Price's Bush, Cant.: 1 f. 25.12.42, CM, S. Lindsay.
 Puhi-puhi River, Marl.: 6 m. 1 f. 26.12.29 - 6.1.30, CM, S. Lindsay.
 Wainuiomata: 1 m. ALA, 28.12.25, DM, G.V. Hudson.
 Waitangi: 1 m. 23.10.63, FRI, J.S. Dugdale.
 Wellington: 1 m. 15.2.1868, CM, R.W. Fereday; 1 f. Nov. 1898, DM, 2 m. Dec.
 1904 - Jan. 1905, ED, 1 f. 9.1.24, DM, G.V. Hudson.
 Whakarewarewa, Rotorua: 1 f. ALF, 31.10.63, FRI, "R.H.M."
 Wilton's Bush, Well.: 1 m. 21.12.28, DM, G.V. Hudson; 1 f. 30.12.37, CM,
 S. Lindsay.

REMARKS: Perhaps the most divergent member of Group 5a, especially in the great elongation of the apophyses in the female genitalia. Although superficially very similar to P.parorma, P.elaina is not closely related to it, and the forewing pattern similarity is clearly a case of convergence. The two species can be easily separated by the very distinct differences in the genitalia of both sexes (see figs. 109, 192 parorma; figs. 100, 184, elaina).

Philpott (1929a) shows a series of drawings of the male genitalia of this genus, but the species are hopelessly confused, as in Orocrambus/Crambus in the same paper. His fig. 10 labelled D.bipunctella shows the male genitalia of Pareromene elaina, clearly recognisable by the hastate juxta. His fig. 17 of D.harmonica actually shows the male genitalia of P.auriscriptella; the genitalia of the real P.harmonica are in fact labelled P.auriscriptella (fig. 5). He does not actually figure the genitalia of the rare P.bipunctella. What is represented by fig. 7 labelled D.elaina, I cannot tell, possibly it was a specimen of

P.chrysochyta, although the juxta is the wrong shape. The slide in the Philpott collection on which the drawing was presumably based has nothing on it.

Pareromene helioctypa (Meyrick) comb.nov.

Diptychophora helioctypa Meyrick, 1882, New Zealand Journal of Science (Dunedin), 1, p. 187.

Diptychophora helioctypa Meyrick, 1883, Trans. N.Z. Inst., 15, p. 17.

Lectotype m. (Dr. S. Bleszynski) in British Museum (Natural History) labelled "L. Wakatipu New Zealand /1/81 RWF". and "N. Zealand, 96.182".

EXTERNAL CHARACTERS (Slide 77): Detailed description by Meyrick (1883), coloured illustration by Hudson (1928, Plate XIX, fig. 39 f.) with abbreviated description. Eye nocturnal type, female frenulum triple, wing span 12 - 16 mm (both sexes). Forewings relatively more narrow than in any other New Zealand member of the genus, usually with white comma-shaped reniform. Distinguishable from the externally similar P.chrysochyta by the shape of the second line, which is single and serrate in helioctypa, double and waved in chrysochyta.

MALE GENITALIA (Fig.101): As for generic and species group description except for the following: Arms of vinculum about $\frac{1}{2}$ uncus; saccus also about $\frac{1}{2}$ uncus. Juxta a sub-triangular, almost dolabrate plate, dorsal surface concave. Costa of valve with strong prong and a short spur at the base of the prong on the dorsal margin, latter about $1\frac{1}{4}$ x uncus. Total length of valve about equal to aedoeagus. Uncus slightly longer than gnathos, both tapering, nearly parallel-sided for most of their length, pointed, uncus curved ventrad, gnathos dorsad. Aedoeagus tubular, apically tapered, about $1\frac{2}{3}$ uncus, length to median breadth ratio about 10-11:1, line of about 60 small cornuti present, and also straight ventro-apical thorn directed antero-ventrad.

FEMALE GENITALIA (Fig. 185): As for generic description except for the following: Anterior apophyses about equal to posteriors. Ductus bursae strong to $\frac{1}{2}$, about $2\frac{1}{2}$ x length of anterior apophyses, with pleated swelling at $\frac{1}{2}$, ductus seminalis

joining at $\frac{3}{4}$. Ostium bursae a flattened funnel.

LARVA: Not known.

HOST PLANT: Not known, probably a moss.

DISTRIBUTION (Fig. 284): Throughout the South Island of New Zealand in native lowland and subalpine forest, from Tasman Mountains to Southland. No North Island records. Flight period late November to mid-February.

MATERIAL EXAMINED: 69 m. 9 f.

Arthur's Pass: 1 f. 31.12.40, CM, S. Lindsay.

Bold Peak: 1 f. 24.12.13, DM, C.E. Fenwick.

Central Otago: 1 m. no date, ED, A. Philpott.

Claverley, Cant.: 2 f. 25.12.32 - 1.1.33, CM, S. Lindsay.

Cobb Valley, Nel.: 5 m. 1 f. 9.12.22, ED, A. Philpott.

Drayton Station, Cant.: 1 m. Jan. 1877, CM, R.W. Fereday.

Eglinton: 1 m. 11.12.44, DM, G. Howes.

Franz Josef: 1 m. 3.12.64, FRI, J.S. Dugdale.

Glen Tui: 4 m. 1 f. 28-30.12.21, CM, S. Lindsay.

Greenhills, Dunedin: 1 m. 3.12.16, ED, C.E. Fenwick.

Homer: 3 m. 23.12.41, DM, J.T. Salmon.

Horseshoe Lake, Cant.: 2 m. 29.11.24, ED, CM, 1 m. 7.1.28, CM, Lindsay.

Kinloch: 1 m. 2.1.1881, CM, R.W. Fereday.

Lake Moana: 1 m. 16.12.35, CM, A. Tonnoir.

Lake Tekapo: 8 m. 23.12.28, ED (4), CM (4), S. Lindsay.

Marion: 1 m. 1.1.43, DM, G. Howes.

Maruia: 2 m. 5.1.40, CM, S. Lindsay.

Milford Sound: 4 m. ALV, 20.12.43, DM, J.T. Salmon

Milford Track: 1 m. 30.12.20, DM, C.E. Fenwick.

Mt. Cook: 2 m. ED, 1 m. DM, 1 f. CM, 3-9.2.29, A. Philpott.

Mt. Greenland, 2,500 ft.: 12 m. 6.1.43, ED, E.S. Gourlay.

Mt. Grey: 2 m. Jan. 1921, CM, S. Lindsay.

New River; 1 m. no date, ED, A. Philpott.

North Lake Mavora: 2 m. 1.1.40, DM, G. Howes.

Paradise: 5 m. ALW, 4.1.16, DM, C.E. Fenwick.

Queenstown: 1 f. HGZ, 18.2.13, DM, G. Howes; 1 f. 4.1.20, AM, C.E. Clarke; 5 m. 2.f. 18-20.12.23, ED, G. Howes.

Seaward Moss: 1 m. DM, 1 m. ED, no date, A. Philpott.

Traill's, Otago: 2 m. 29.12.13, ED, G. Howes.

West Plains: 1 m. no date, ED, A. Philpott.

Whiterock, Cant.: 1 m. 1 f. 26-28.11.22, CM, S. Lindsay.

Wyndham: 1 m. 5.12.14, ED, G. Howes.

REMARKS: Shares apomorphic genitalial characters with P.lepidella and P.elaina.

Although the wing shape is very characteristic once one knows the genus, this species is extremely variable in forewing pattern, in fact it might be true to say that no two specimens are exactly alike. In fact the colour can range from almost uniform dark brown to a smudgy reddish yellow, with all discrete markings lost in both these conditions. The white comma-shaped reniform stigma is a good character in 90% of all specimens, but if there is any doubt then examination of genitalia will quickly confirm the identity.

Pareromene interrupta (Felder) comb.nov.

Crambus interruptus Felder, 1875, ^{Felder and Rogenhofer,} Reise der Novara, Lepidoptera, 5, pl. cxxxv, fig. 15

Diptychophora astrosema Meyrick, 1883, Trans. N.Z. Inst., 15, p. 13.

Diptychophora interrupta (Felder), Meyrick, 1885, Trans. N.Z. Inst. 17, p. 130.

Holotype m. in British Museum (Natural History) labelled "Novara cxxxv f. 15
Crambus interruptus, N.Seeld. m."

Holotype m. in British Museum (Natural History) labelled "Christchurch, R.W.F.,
27.1.1873", "Diptychophora atrosema Meyr."

EXTERNAL CHARACTERS (Slide 78): Detailed description by Meyrick (1883, as D.astrosema, a designation later altered by the same author in 1885), coloured illustration by Hudson (1928, Plate XIX, fig. 13 m.) with abbreviated description. Eye nocturnal type, female frenulum triple, wing span 16 - 22 mm (both sexes). Easily separated from all other New Zealand members of the genus by the Y-shaped reniform.

MALE GENITALIA (Fig. 102): As for generic and species group description except for the following: Arms of vinculum about $\frac{1}{2}$ uncus; saccus about $\frac{3}{4}$ uncus.

Juxta a quadrate plate medially less than half as wide as long. Costa of valve developed into a prong, dorsal margin including prong $1\frac{1}{3}$ x uncus. Total length

of valve slightly less than aedoeagus. Uncus parallel-sided for most of its

length, curved

ventrad, pointed, slightly longer than gnathos. Latter tapered, pointed, curved slightly dorsad. Aedoeagus tubular, twice unicus, length to median breadth ratio 7-8:1, 80 - 100 microscopic cornuti from $\frac{1}{4}$ to $\frac{1}{2}$, ventral lip of aedoeagus with a straight thorn directed antero-ventrad.

FEMALE GENITALIA (Fig. 186): As for generic description except for the following: Anterior apophyses about $\frac{3}{4}$ posteriors, ductus bursae about 5x length of anterior apophyses, lightly chitinised to $\frac{1}{2}$, with narrow weak band at about $\frac{1}{4}$, ductus seminalis joining at about $\frac{7}{8}$. Single large star-shaped signum on corpus bursae.

LARVA: Not known.

HOST PLANT: Not known, probably a moss.

DISTRIBUTION (Fig. 285): Lowland and subalpine native bush throughout the South Island of New Zealand from the Tasman Mountains to Southland, in the North Island so far only known from Mt. Ruapehu and the Wellington area. Flight period October to March, probably two generations per year.

MATERIAL EXAMINED: 51 m. 13 f.

Akaroa: 1 m. Dec. 1924, CM, A. Tonnoir.

Aniseed Valley, Nel.: 1 m. 8.12.25, ED, E.S. Gourlay.

Arthur's Pass: 1 m. 9.2.26, CM, S. Lindsay, 1 m. 2 f. 23.1.28, ED, A. Philpott.

Cawthron Park; Nel.: 1 f. 6.11.25, ED, E.S. Gourlay.

Flora Range: 1 m. 22.2.24, ED, A. Philpott.

Homer: 1 m. IFU, 1 f. IFT, 1.1.43, DM, 1 m. IFR, IFS, 23.12.43 - 1.1.44, DM, G. Howes.

Hoon Hay, Cant.: 1 m. 10.1.25, CM, S. Lindsay.

Lake Rotoiti: 1 m. 31.12.35, CM, S. Lindsay.

Lake Wanaka: 1 m. no date, ED, A. Philpott.

Leihfield: 2 m. IFO, IFP, 1 f. IFN, 3.12.15 - 1.1.16, DM, C.E. Fenwick, 1 m. 17.1.16, ED, A. Philpott; 1 f. 20.1.16, AM, C.E. Clarke.

Mt. Arthur: 1 m. no date, ED, G.V. Hudson.

Mt. Cook: 12 m. ED, 5 m. CM, 21.4.28. - 3.1.29, A. Philpott; 1 f. IFQ, 8.2.29, DM, C.E. Fenwick.

Mt. Ruapehu: 1 f. 18.1.67, GC, D.E. Gaskin.

Nelson: 1 f. 28.1.1870, CM, R.W. Fereday, 1 m. 17.3.22, ED, A. Philpott.

Okuti Valley; 1 f. 28.1.33, CM, S. Lindsay.

Otira: 1 m. IFL, Dec. 1908, DM, G.V. Hudson; 1 m. 20.2.27, CM, S. Lindsay.
 Pelorus Bay: 5 m. 28.11.28, ED, S. Lindsay.
 Price's Bush, Cant.: 1 f. 18.12.32, 1 m. 27.12.42, CM, S. Lindsay.
 Sentinel Rock, Franz Josef: 2 m. 1 f. IGF, 3.12.64, FRI, J.S. Dugdale.
 Sleepy Bay, Banks Pénin: 1 m. 26.11.38, CM, S. Lindsay.
 Table Hill, Sthld.: 1 m. 29.12.13, ED, A. Philpott.
 Upper Maitai, Nel.: 3 m. 26.10.25, ED, E.S. Gourlay.
 Waiho R, West.: 1 m. 27.12.39, CM, S. Lindsay.
 Wainuiomata: 1 m. IFM, 5.12.1898, DM, G.V. Hudson.
 Waitati: 1 m. 25.12.15, ED, A. Philpott; 1 m. 30.1.18, CM, S. Lindsay, 1 f. 18.12.19, AM, C.E. Clarke.

REMARKS: Not as variable as many other New Zealand members of the genus, and always recognisable by the Y-shaped reniform. Moderately close to P.lepidella and P.heliotypa, but shares apomorphic characters with the related Asiatic species P.vermeeri and P.copernici.

The genitalia labelled D.interrupta in Philpott's paper (1929 fig. 13) are those of P.selenaea, while those labelled D.selenaea (fig. 14) are those of interrupta.

Pareromene lepidella (Walker) comb.nov.

Eromene lepidella Walker, 1866, List of the species of Lepidopterous insects in the collection of the British Museum, 35, p. 1761.

Crambus gracilis ^{Felder and Rogenhöfer, Lepidoptera,} ~~Felder,~~ ¹⁸⁷⁵ Reise der Novara, 5, pl. cxxxvii, fig. 26.

Diptychophora lepidella (Walker) Meyrick, 1883, Trans. N.Z. Inst., 15, p. 14.

Lectotype m. (Dr. S. Bleszynski) in British Museum (Natural History) labelled "Auckland N. Zeal. 60.73." (ex abdomen).

Holotype m. in British Museum (Natural History) labelled "Novara CXXXVII, f. 26."

Crambus gracilis m. N. Seeld. F. & R."

EXTERNAL CHARACTERS (Slide 79): Detailed description by Meyrick (1883), coloured illustrations by Hudson (1928, Plate XIX, figs. 14, 15 f.) with abbreviated description. Eye nocturnal type, female frenulum triple, wing span 14 - 18 mm. (both sexes); Usually easily separated from P.holanthes by the silver reniform (two black dots in holanthes) and from auriscriptella by the single brown serrate

first line (double and waved in auriscriptella)

MALE GENITALIA (Fig. 103): As for generic and species group description except for the following: Arms of vinculum about $\frac{1}{2}$ uncus; saccus slightly less than $\frac{1}{2}$ uncus. Juxta an oblongate plate about third as wide as long. Costa of valve drawn into strong prong, with short dorsal spur at base of prong, dorsal margin of costa about $1\frac{1}{4}$ x uncus. Total length of valve about $\frac{7}{8}$ aedoeagus. Uncus and gnathos equal in length, parallel-sided for most of their length, uncus curved slightly ventrad, gnathos straight but curved sharply dorsad at apex, pointed. Aedoeagus tubular, tapering to apex, curved ventrad, $1\frac{7}{8}$ x uncus, length to median breadth ratio about 11-12:1, with group of 7 - 10 small elongate cornuti between apex and $\frac{3}{4}$, ventral lip of aedoeagus with straight thorn directed antero-ventrad.

FEMALE GENITALIA (Fig. 187): As for generic description except for the following: Anterior apophyses about $\frac{3}{4}$ posteriors, ductus bursae about 5x length of anterior apophyses, strong to $\frac{2}{3}$, with swollen and horizontally pleated pouch at $\frac{2}{3}$, ductus seminalis joining at $\frac{3}{4}$. Ostium bursae a flattened funnel.

LARVA: Not known.

HOST PLANT: Not known, probably a moss.

DISTRIBUTION (Fig. 286): Common in lowland and subalpine native bush in the South Island of New Zealand, less common in the North Island; recorded from Auckland and Castlepoint on the Wairarapa coast. Flight period November to February.

MATERIAL EXAMINED: 49 m. 14 f.

A' Bay, Dunedin: 5 m. ALP, 1 f. 30.11.-16.12.13, DM, C.E. Fenwick.

Capleston: 1 f. 22.1.57, ED, E.S. Gourlay.

Castlepoint, Wair.: 3 m. 25.12.63, GC, K. Maynard, D.E. Gaskin.

Christchurch: 5 m. no date, CM, R.W. Fereday.

Claverley, Cant.: 1 f. 31.12.32, CM, S. Lindsay.

Dunedin: 1 m. 3.12.13, 1 m. ALK, 28.11.14, 1 m. 20.12.16, DM, C.E. Fenwick, 1 f. 21.1.20, AM, C.E. Clarke.

Evansdale, Otago: 1 f. 1.1.16, AM, C.E. Clarke.

- Glen Tui: 1 m. 28.12.21, CM, S. Lindsay.
 Hermitage, Mt. Cook: 1 m. Feb. 1888, CM, R.W. Fereday.
 Hokitika: 1 m. 1.12.29, CM, S. Lindsay.
 Homer: 1 m. 23.12.41, DM, G. Howes.
 Kaikoura: 1 m. no date, ED, A. Philpott.
 Kamaeranga State Forest: 1 m. 9.11.63, FRI, P. Crowhurst.
 Kinloch: 1 m. 3.1.1881, CM, R.W. Fereday.
 Lake Rotoroa: 1 m. 7.1.28, ED, A. Philpott.
 Lloyd Cottage, Christchurch: 1 f. 9.1.1865, 1 m. 10.12.1866, CM, R.W. Fereday.
 Maruia: 1 m. 3.1.40, CM, S. Lindsay.
 Mt. Cook: 1 f. 31.12.25, CM, S. Lindsay.
 Mt. Grey: 3 m. Jan. 1921, CM, S. Lindsay; 1 f. 6.12.24, ED, W. Heighway; 2 m. 28.11.24, 2 m. 1 f. 15.12.29, CM, S. Lindsay.
 New Creek: 1 m. 24.1.29, ED, A. Philpott.
 Paradise Bay, Bank's Penin.: 1 f. Dec. 1933, CM, S. Lindsay.
 Puhi-puhi, Kaikoura: 1 f. 25.12.29, CM, S. Lindsay.
 Riwaka: 1 f. 15.11.28, ED, A. Philpott.
 Stuart's Gully: 1 m. Nov. 1919, 1 m. Dec. 1920, CM, S. Lindsay.
 Sunnyside, Sthld.: 1 m. 20.12.11, ED, A. Philpott.
 Tisbury: 1 f. no date, ED, A. Philpott (?), 1 m. 22.12.12, 1 m. 16.1.22, ED, A. Philpott.
 Traill's Sthld.: 2 m. 29.12.13, ED, C.E. Fenwick.
 Upper Maitai, Nel.: 5 m. 26.11.23, ED, E.S. Gourlay.
 Upper Marawhaiti, Maimai: 1 m. 30.11.64, FRI, J.S. Dugdale.
 Waihi Gorge: 1 m. 3.1.44, CM, S. Lindsay.
 West Plains: 2 m. ED, 1 f. HGL, DM, no date, A. Philpott, G. Howes.

REMARKS: Variation in the forewing pattern of P.lepidella is generally limited to greater or lesser amounts of blackish or brown clouding between the first and subterminal lines. This clouding never obscures the reniform stigma, although this may be very indistinct in very pale specimens.

Pareromene metallifera (Butler) comb. nov.

Eromene metallifera Butler, 1877, Proc. zool. Soc. Lond., 1877, p. 401, pl. xliii, fig. 11.

Diptychophora metallifera (Butler), Meyrick, 1883, Trans. N.Z. Inst., 15, p. 15.

Lectotype m. (Dr. S. Bleszynski) in British Museum (Natural History), labelled "N. Zeal. 77.34; Eromene metallifera Butler Type."

EXTERNAL CHARACTERS (Slide 80): Detailed description by Meyrick (1883), coloured illustrations by Hudson (1928, Plate XIX, figs. 32, 33 f.) with abbreviated description. Eye nocturnal type, female frenulum triple, wing span 18 - 24 mm (both sexes). Venation, fig. 26. Most specimens at once recognisable by silver kidney-shaped reniform and the bright orange ground colour of the forewings, although the disc is often clouded with blackish. A larger species than most New Zealand members of the genus.

MALE GENITALIA (Fig. 104): As for generic and species group description with the exception of the following: Arms of vinculum equal to uncus; saccus slightly longer than uncus. Juxta a concave shield-shaped plate. Costa of valve drawn into a prong, dorsal margin including prong 2x uncus. Total length of valve a little less than aedoeagus. Uncus slightly longer than gnathos, tapered, pointed, curved ventrad. Gnathos tapered, pointed, curved dorsad. Aedoeagus tubular, curved strongly ventrad, about $3\frac{1}{2}$ x uncus, length to median breadth ratio about 7-8:1, without cornuti, ventral lip of apex with large straight spur directed antero-ventrad.

FEMALE GENITALIA (Fig. 188): As for generic description except for the following: Anterior apophyses almost equal to posteriors, ductus bursae strong to $\frac{1}{3}$, with ostiolar pouched swelling at about $\frac{1}{4}$, ductus seminalis joining at about $\frac{1}{2}$. Ostium bursae a flattened funnel.

EGG: Not described by Hudson (1928).

LARVA: Figured in colour by Hudson (1928, Plate III, fig. 1). Described by that author as stout, shiny and glassy-looking, dull brownish green with head and prothorax brownish black, with a double series of brownish tubercles with a black bristle on each segment. Length given in illustration is 15 mm.

HOST PLANT: Moss (Hudson, 1938), species not given. Larva described as feeding actively in tunnels through wet moss on logs and stones in forest.

PUPA: Not described by Hudson (1928).

DISTRIBUTION (Fig. 287): Lowland and subalpine native bush in the northern part of the South Island, with the most southerly records about the latitude of Christchurch ($43\frac{1}{2}^{\circ}\text{S}$). In the North Island found from Wellington north to at least Mt. Ruapehu. Hudson (1928) gives records for Auckland and Waimarino (National Park settlement), although I could not find the specimens, and I have reliable records from Mt. Egmont, and Little and White Pine Bushes, in Hawke Bay (T.H. Davies, in litt.). Hudson (1928) states that this species is associated with forested valleys and is found right on the banks of streams. I have netted the species at dusk close to the Mangawhero Stream on Ruapehu. Flight period October to January, possibly only one generation per year.

MATERIAL EXAMINED: 42 m. 22 f.

Aniseed Valley, Nel.: 1 m. 8.1.25, ED, A. Philpott.

Cawthron Park, Nel.: 1 m. 6.1.25, ED, A. Philpott.

Christchurch: 7 m. no date, CM, R.W. Fereday.

Campbell's Gully, Well.: 2 m. JFF, JFH, 14.12.13, DM, 1 f. AM, G.V. Hudson.

Claverley: 1 m. 26.12.32, CM, S. Lindsay.

Crow's Nest Hill, Well.: 1 m. JFI, 9.11.1892, DM, G.V. Hudson.

Day's Bay, Well.: 1 f. 8.11.25, ED, A. Philpott.

Dun Mountain, Nel.: 1 m. 8.1.22, 1 m. 31.2.22, 1 m. 3 f. 8-29.12.25, 1 m. 24.2.27, ED, A. Philpott.

Glen Tui: 2 m. 1 f. 29-30.12.21, CM, S. Lindsay.

Golland's Valley, Nel.: 1 f. JFL, 3.12.27, DM, G.V. Hudson.

Kaka Head, Well.: 1 m. JFN, 16.11.90, DM, G.V. Hudson.

Karori, Well.: 1 m. 1 f. Dec. 1913, ED, G.V. Hudson.

Lake Rotoroa: 5 m. 6 f. 7.1.28, ED, A. Philpott.

Mt. Grey: 3 m. 1 f. 28.12.25, CM, S. Lindsay, 1 m. 2.1.29, CM, W. Heighway.

Mt. Ruapehu: 1 m. 18.1.67, GC, D.J. Greenwood and D.E. Gaskin.

Nelson: 1 m. 29.12.20, 1 m. 25.11.27, ED, A. Philpott.

Pelorus Bay: 1 f. 28.11.28, ED, A. Philpott.

Upper Maitai, Nel.: 2 m. 26.11.23, 1 m. 2 f. 27.11.25, ED, E.S. Gourlay.

Wadestown, Well.: 2 m. JFK, JFO, 4.11.1894, 3 f. JFG, JFL, JFM, 6.12.1914, DM, G.V. Hudson.

Waioeka Gorge: 1 f. HGQ, 9.10.64, FRI, J.S. Dugdale.

Wellington: 2 m. JFD, JFE, no date DM, A. Hamilton; 2 m. no date, ED, G.V. Hudson, 2 f. 5.12.27, ED, A. Philpott.

Wilton's Bush, Well.: 1 f. Nov. 1924, CM, S. Lindsay.

REMARKS: Shares one apomorphic character with P.microdora (New Zealand), and P.bilinealis (Afghanistan). P.planetopa is probably also close to P.metallifera but the female has not yet been collected and final confirmation of the position of that species must be reserved.

Pareromene microdora (Meyrick) comb.nov.

Diptychophora microdora Meyrick, 1905, Trans. ent. Soc. Lond., 1915, p. 227.

Lectotype m. (Dr. S. Bleszynski) in British Museum (Natural History), labelled "Mt. Arthur New Zealand, 3,000 ft. 19/1/86."

EXTERNAL CHARACTERS (Slide 81): Detailed description by Meyrick (1905), coloured illustration by Hudson (1928, Plate XIX, fig. 12 m.) with abbreviated description. Eye nocturnal type, female frenulum triple, wing span 10 - 13 mm (both sexes). Can be separated from the externally similar P.planetopa by lacking a silvery circular reniform present in planetopa; and from P.pyrsophanes by the yellow sigma shape of the posterior part of the first line of the forewing, which bears only a small yellow comma-shaped mark in pyrsophanes. The wing span in the latter species is 13 - 18 mm.

MALE GENITALIA (Fig. 105): As for generic and species group description except for the following: Arms of vinculum about equal to uncus; saccus a little longer than uncus. Juxta an oblate plate, dorsally concave, less than half as wide as long. Costa of valve with a prong, dorsal margin including prong about twice uncus. Total length of valve equal to aedoeagus. Uncus slightly longer than gnathos, tapered, pointed, curved ventrad. Gnathos tapered, pointed, almost an isocetes triangle in ventral aspect. Aedoeagus tubular, $2\frac{3}{4}$ - $3x$ uncus, length to median breadth ratio about 9:1; no cornuti, but ventral lip of apex with straight thorn directed antero-ventrad.

FEMALE GENITALIA (Fig. 189): As for generic description except for the following detail: anterior apophyses about $\frac{3}{4}$ posteriors, ductus bursae barely twice length of anterior apophyses, strong to and with swollen pouch at $\frac{1}{3}$, ductus seminalis

joining at $\frac{2}{3}$. Ostium bursae a flattened funnel, with anterior margin beneath 7th sternite medially cleft.

EGG: Not described by Hudson (1928).

LARVA: Described by Hudson (1928) as follows: "very slender, dull brownish-green; the head and second segment are horny, shining brownish black; there is a double series of obscure tubercles on each segment, each tubercle emitting a black bristle. Feeds on dry moss on fallen logs."

HOST PLANT: Given only as "dry moss" (Hudson, 1928), species not named.

PUPA: Not described by Hudson.

DISTRIBUTION (Fig. 288): In lowland and subalpine native bush in South Island of New Zealand from Nelson Province to central South Canterbury. Only from Wellington district of the North Island. Flight period November to February.

MATERIAL EXAMINED: 44 m. 5 f.

Arthur's Pass: 1 m. IFK, 19.1.20, C.E. Fenwick; 1 m. CM, 1 f. AM, 14.1.23, C.E. Clarke; 10 m. 2 f. 19-24.1.23, AM, C.E. Clarke; 1 m. 8.2.26, CM, S. Lindsay. 1 m. 23.1.28, ED, A. Philpott.

Campbell's Bush, Well.: 1 m. IFI, 28.12.07, 2 m. IFE, IFH, 18.12.10, 1 m. IFF, 17.1.15, DM, G.V. Hudson.

Dun Mountain, Nel.: 1 m. 31.12.23, ED, A. Philpott; 2 m. 24.12.27, CM, ED, A. Philpott.

Gouland Downs, Nel.: 1 m. 7.2.22, ED, A. Philpott.

Karori, Well.: 2 m. IFG, IFJ, 17.11.06, DM, G.V. Hudson.

Lake Rotoroa: 9 m. 7.1.28, ED, A. Philpott.

Maruia Springs: 2 m. 3-5.1.40, CM, S. Lindsay.

Mt. Arthur, 4,000 ft.: 1 m. 23.12.21, 1 m. 27.1.24, ED, A. Philpott.

Otira: 4 m. 1 f. 30.1.22, AM, C.E. Clarke.

Waiho Gorge, Cant.: 3 m. 1 f. 16.1.25, AM, C.E. Clarke.

REMARKS: This diminutive species shares one apomorphic genitalial character with P.metallifera, and with the central Asiatic species P.bilinealis.

Pareromene planetopa (Meyrick) comb.nov.

Diptychophora planetopa Meyrick, 1923, Trans. N.Z. Inst., 54, p. 162.

Holotype m. in British Museum (Natural History) labelled "L. Wakatipu New Zealand GVH.10.2.11."

EXTERNAL CHARACTERS (Slide 82): Detailed description by Meyrick (1923), coloured illustration by Hudson (1928, Plate XLIX, fig. 19 m.), with abbreviated description. Eye nocturnal type, wing span 9 - 10 mm (male). Female not known. This species is distinguishable from the similar P.microdora and P.pyrsophanes by its silvery circular reniform.

MALE GENITALIA (Fig. 106): As for generic and species group description except for the following: Arms of vinculum about $\frac{7}{8}$ uncus; saccus slightly longer than uncus. Juxta an oblate plate, less than half as wide as long. Cost of valve with very long prong developed, dorsal margin of costa including prong $2\frac{3}{4}$ x uncus. Total length of valve about equal to aedoeagus. Uncus slightly longer than gnathos, tapered, pointed, nearly straight, gnathos tapered, pointed, curved slightly dorsad. Aedoeagus tubular, tapering apically, about 3x uncus, length to median breadth ratio 7-8:1, no cornuti, but with a pair of short dorso-apical thorns directed antero-dorsad.

LARVA: Not known.

HOST PLANT: Not known, probably a moss.

DISTRIBUTION (Fig. 289): Confirmed from Arthur's Pass and Lake Wakatipu (type locality) only. Hudson (1939) gave Lake Te Anau and Lake Manapouri as well. Although this species is so distinctive and there is little chance of error in identification, I have not been able to locate these specimens. Flies in January, February.

MATERIAL EXAMINED: 3 m.

Arthur's Pass: 3 m. BLO, BLP, 14.1.23, AM, C.E. Clarke.

REMARKS: On male genitalia characters alone this species seems to belong to this subgroup. However since the female has not yet been collected the exact position remains to be confirmed.

Pareromene epiphaea (Meyrick) comb.nov.

Diptychophora epiphaea Meyrick, 1885, Trans. N.Z. Inst., 17, p. 132.

Lectotype m. (Dr. S. Bleszynski) in British Museum (Natural History), labelled "Arthur's Pass New Zealand, 3,000 ft. 25/1/83."

EXTERNAL CHARACTERS (Slide 83): Full description by Meyrick (1885), coloured illustration by Hudson (1928, Plate XIX, fig. 40 m.) with abbreviated description. Eye intermediate type, female frenulum triple, wing span 13 - 17 mm (both sexes). Venation, fig. 27. P.epiphaea has a metallic apical mark on the forewing which is absent in the very dark form of P.helioctypa with which this species could just possibly be confused, though not by anyone familiar with the genus, as the wing shape in the two species is different, being much narrower in helioctypa. Could be confused with P.gurri, sp.nov., although in the latter species the forewing tornus is nearly a right angle while in P.epiphaea it is obtuse, and epiphaea lacks the greenish tinge of gurri.

MALE GENITALIA (Fig. 107): As for generic and species group description except for the following: Arms of vinculum about equal to uncus; saccus about $\frac{3}{4}$ uncus. Juxta an oblate plate, slightly constricted medially and rounded ventrally, dorsally concave. Costa of valve with prong, dorsal margin including prong about $1\frac{3}{4}$ x uncus. Total length of valve slightly more than length of aedoeagus. Uncus tapered, pointed, curved slightly ventrad, about equal to gnathos. Gnathos tapered, pointed, curved dorsad. Aedoeagus tubular, with ventral apical sac and short dorsal spur, about 3x uncus, length to median breadth ratio 9:1, without cornuti.

FEMALE GENITALIA (Fig. 190): As for generic description except for the following: Posterior and anterior apophyses about equal, ductus bursae weakly chitinised near mouth, with distinct stalked ostiolar pouch, ductus bursae about $3\frac{1}{2}$ x length of anterior apophyses, ductus seminalis joining at $\frac{1}{3}$.

LARVA: Not known.

HOST PLANT: Not known, probably a moss.

DISTRIBUTION (Fig. 290): Donatia - Oreobolus alpine moss swamp of the South Island of New Zealand (Mr. J.S. Dugdale, in litt.). Also from the central plateau of the North Island. Not confirmed from Mount Egmont. Flight period September to March, diurnal.

MATERIAL EXAMINED: 44 m. 6 f.

Arthur's Pass: 1 f. 8.12.17, 3 m. 2 f. 2-4.2.26, CM, S. Lindsay; 7 m. 9.12.26, 5 m. 1 f. 23.1.28, ED, A. Philpott; 4 m. 27.12.31 - 1.1.32, 1 m. 30.12.40, CM, S. Lindsay.

Castle Hill, 2,000 ft., Cant.: 1 m. Jan. 1893, ED, G.V. Hudson.

Chateau Tongariro, 3,600 ft.: 1 m. 21.2.65, ED, G. Kuschel.

Cleddau: 2 m. ALR, HGW, 20.12.44, DM, J.T. Salmon.

Eglinton Valley: 1 m. 11.12.45, DM, G. Howes.

Flagstaff, Dunedin: 1 m. 1.2.16, DM, C.E. Fenwick.

Glenorchy: 1 m. 2.1.11, DM, G. Howes.

Homer: 3 m. ALP, 26.12.44, DM, J.T. Salmon.

Longwoods: 1 f. 29.12.15, ED, A. Philpott.

Milford Track: 2 m. 1 f. 24-29.12.20, DM, C.E. Fenwick.

Mt. Arthur: 1 m. 12.12.22, 1 m. 2.3.22, 1 m. 1.12.24, ED, A. Philpott.

Mt. Cleaghearn: 1 f. 1.1.15, 3 f. 13.1.16, ED, A. Philpott.

Mt. Cook: 3 m. 1 f. 5.1.29, CM, A. Philpott.

Mt. Ruapehu: 1 m. 2.1.22, DM, C.E. Fenwick.

Mt. Torlesse, 4,000 ft.: 2 m. 6.2.37, CM, S. Lindsay.

Old Man Range, 4,200 ft.: 2 m. 18.1.63, FRI, J.S. Dugdale.

Waitati: 1 m. 3.9.16, CM, C.E. Clarke.

REMARKS: Although P.epiphaea and P.gurri are externally very similar and could easily be confused by someone not familiar with the genus, they are quite distinct on the genitalia characters of both sexes and are not closely related. While P.epiphaea has been recorded from both the North and South Islands, almost always above the bush line, P.gurri is presently known only in the form of a short type series from the Coromandel Peninsula.

Pareromene holanthes (Meyrick) comb.nov.

Diptychophora holanthes Meyrick, 1885, Trans. N.Z. Inst., 17, p. 131.

Lectotype m. (Dr. S. Bleszynski) in British Museum (Natural History) labelled "Otira Gorge New Zealand 1,600 ft. 24/1/83."

EXTERNAL CHARACTERS (Slide 84): Detailed description by Meyrick (1885), coloured illustration by Hudson (1928, Plate XIX, fig. 36 f.) with abbreviated description. Eye nocturnal type, female frenulum triple, wing span 14 - 18 mm (both sexes). Distinguishable from pale specimens of P.auriscriptella with weak cross lines by the reniform stigma, which is white in P.auriscriptella and composed of a pair of small black dots in P.holanthes.

MALE GENITALIA (Fig. 108): As for generic and species group description except for the following: Arms of vinculum and saccus about equal to uncus. Juxta an oblate plate with convex ventral margin, about half as wide as long and dorsally concave. Costa of valve with short spur near posterior extremity, dorsal margin of costa about $2\frac{1}{2}$ x uncus. Total length of valve equal to aedoeagus. Uncus and gnathos equal in length, tapering, pointed, uncus curved ventrad, gnathos dorsad. Aedoeagus tubular, curved strongly ventrad with ventral apical sac and short dorsal apical curved spur or thorn, nearly 4x uncus, length to median breadth ratio 11:1, no cornuti.

FEMALE GENITALIA (Fig. 191): As for generic description except for the following: Anterior apophyses about $\frac{3}{4}$ posteriors. Ductus bursae with stalked ostiolar pouch, about $4\frac{1}{2}$ - 5x length of anterior apophyses, strong to $\frac{1}{3}$, ostium bursae a very wide flattened funnel with sinuate ventral margin below posterior margin of 7th sternite.

LARVA: Not known.

HOST PLANT: Not known, probably a moss.

DISTRIBUTION (Fig. 291): Northern part of the South Island (north of about latitude 44° S), and two areas of the North Island; around Wellington and in the subalpine bush of the central plateau. Flight period late November to early February.

MATERIAL EXAMINED: 37 m. 14 f.

Christchurch: 1 m. 26.1.83 (syntype ?), CM, R.W. Fereday.

Dun Mountain, Nel.: 5 m. 8.1.22, 2 m. 3.2.24, 1 m. 27.12.27, ED, A. Philpott.

Glen Tui: 3 m. 26.12.21, CM, S. Lindsay.
 Golden Downs: 8 m. 3 f. 8.1.26, ED, E.S. Gourlay.
 Jack's Pass: 1 m. 29.12.30, CM, S. Lindsay.
 Lake Rotoroa: 1 f. 18.1.27, ED, E.S. Gourlay.
 Mt. Grey, Cant.: 2 m. CM, 2 f, ED, Jan. 1921, 1 m. CM, 2 m. ED, 28.12.24,
 S. Lindsay and W. Heighway.
 Mt. Ruapehu: 2 m. 1 f. 18.1.67, GC, D.E. Gaskin and D.J. Greenwood.
 Pelorus Bay; 1 f. 20.11.28, ED, E.S. Gourlay.
 Port Hills, Cant.: 1 m. 15.1.30, CM, W. Heighway.
 Ross: 2 m. 1 f. 24.12.39, CM, S. Lindsay.
 Waimarino: 1 m. 26.12.21, DM, C.E. Fenwick.
 Wainuiomata: 1 m. 1 f. 23.12.1900, 6 m. ALG, 3 f. HGN, 29-31.12.26, 1 f.
 9.12.31, DM, G.V. Hudson.

REMARKS: See comments on external characters, and the remarks section under P.auriscriptella.

This species together with P.epiphaea, P.parorma, and P.pyrsophanes, forms part of a closely related subgroup restricted to New Zealand, which is characterised by the apical aedoeagal sac of the male and the stalked ostiolar pouch of the female. An ostiolar pouch is present in P.mutuurella, a Japanese species, but I regard this as a parallelism. In mutuurella the male genitalia not only show no relationship to this New Zealand subgroup, but also deviate considerably, especially in the shape of the vinculum/saccus, from the form found in the rest of the genus, including this subgroup.

Pareromene parorma (Meyrick) comb. nov.

Diptychophora parorma Meyrick, 1925, Trans. N.Z. Inst., 55, p. 202.

Lectotype m. (Dr. S. Bleszynski) in British Museum (Natural History) labelled "Mt. Ruapehu New Zealand GVH. 2800'. 1.22."

EXTERNAL CHARACTERS (Slide 85): Detailed description by Meyrick (1925), with abbreviated description by Hudson (1928, p. 176). Eye nocturnal type, female frenulum triple, wing span 14 - 16 mm (both sexes). Distinguishable from the very similar P.elaina with which it has been confused in New Zealand collections by the row of terminal black dots on the forewings, which are completely absent in P.elaina.

MALE GENITALIA (Fig. 109): As for generic and species group description except for the following: Arms of vinculum about $\frac{7}{8}$ uncus; saccus slightly longer than uncus. Juxta an oblate plate, about half as wide as long, ventrally convex and dorsally concave. Costa of valve with short triangular projection at about $\frac{1}{2}$, and also with short spur or prong at posterior extremity, dorsal margin of costa $2\frac{1}{2}x$ uncus. Total length of valve a little less than aedoeagus. Uncus slightly longer than gnathos, tapered, pointed, curved slightly ventrad. Gnathos tapered, pointed, curved slightly dorsad. Aedoeagus tubular, curved slightly dextrad, $3 - 3\frac{1}{4}x$ uncus, length to median breadth ratio 9:1, ventral lip of apex with small thorn directed antero-ventrad, apical sac present posterior to this thorn.

FEMALE GENITALIA (Fig. 192): As for generic description except for the following: Anterior apophyses about $\frac{3}{4}$ posteriors, ductus bursae weak, about 6x length of anterior apophyses, ductus seminalis joining at about $\frac{1}{2}$, and with stalked elongated ostiolar pouch. Ostium bursae a weak flattened funnel.

LARVA: Not known.

HOST PLANT: Not known, probably a moss.

DISTRIBUTION (Fig. 292): Wellington area and central plateau of the North Island only, associated with lowland and subalpine bush. Hudson (1928) also gave Whangarei as a locality, but I have not been able to locate any specimen with such a label. Flight period December, January.

MATERIAL EXAMINED: 13 m. 11 f.

Ohakune: 2 m. 5 f. 18-24.12.16, AM, C.E. Clarke.

Waimarino: 1 m. 2 f. 24.1.19, AM, C.E. Clarke, 1 m. Jan. 1922, DM, G.V. Hudson.

Wainuiomata, Well.: 1 m. 2 f. 31.12.05, 1 m. HGX, 28-31.12.25, 4 m. ALC, 2 f. HGV, 25.12.26, G.V. Hudson, 3 m. 10.12.31, CM, G.V. Hudson.

REMARKS: See remarks section under P.holanthes and Pelaina.

Pareromene pyrsophanes (Meyrick) comb.nov.

Diptychophora pyrsophanes Meyrick, 1882, New Zealand Journal of Science, Dunedin 1, p. 186.

Diptychophora pyrsophanes Meyrick, 1883, Trans. N.Z. Inst., 15, p. 11.

Lectotype m. (Dr. S. Bleszynski) in British Museum (Natural History) labelled "Wellington New Zealand, 9/1/80."

EXTERNAL CHARACTERS (Slide 86): Detailed description by Meyrick (1883), coloured illustration by Hudson (1928, Plate XIX, fig. 11 m.) with abbreviated description. Eye nocturnal type, female frenulum triple, wing span 13 - 18 mm (both sexes). Lacks the oval silvery reniform of P.planetopa, and the large yellow sigma shape of the first forewing line of P.microdora. In p.pyrsophanes this is reduced to a small yellow comma-shaped mark. P.pyrsophanes is also a considerably larger species, 13 - 18 mm compared with 10 - 13 mm of microdora.

MALE GENITALIA (Fig. 110): As for generic and species group description except for the following: Arms of vinculum about $\frac{3}{4}$ uncus; saccus $\frac{3}{4}$ uncus. Juxta an oblongate plate about half as wide as long, ventrally convex with slight median cleft, dorsally concave. Costa of valve with very short spur close to costal posterior extremity, dorsal margin of costa about $1\frac{1}{2}$ x uncus. Total length of valve about equal to aedoeagus. Uncus slightly longer than gnathos, tapered, pointed, nearly straight. Gnathos tapered, pointed, curved dorsad. Aedoeagus tubular, curved ventrad, with elongate apical sac ventro-caudad, short spur dorso-caudad; about $2\frac{1}{2}$ x uncus, length to median breadth ratio about 10:1, no cornuti.

FEMALE GENITALIA (Fig. 193): As for generic description except for the following: Anterior apophyses slightly shorter than posteriors, ductus bursae weak except for slight chitinisation near mouth of ostium, about 3x length of anterior apophyses, ductus seminalis joining at $\frac{2}{3}$, stalked ostiolar pouch present at $\frac{1}{5}$.

LARVA: Not known.

HOST PLANT: Not known, probably a moss.

DISTRIBUTION (Fig. 293): In lowland and subalpine bush probably throughout New Zealand. Apart from localities given below, Hudson (1928) gave Stewart Island,

and I have unconfirmed but probably reliable records from Little Bush and White Pine Bush, Hawke Bay (T.H. Davies, in litt.). Flight period late October to mid-February.

MATERIAL EXAMINED: 54 m. 18 f.

Arthur's Pass: 1 f. 8.11.57, ED, E.S. Gourlay.

Blackmillar, Cant.: 2 m. 27-28.12.27, CM, S. Lindsay.

Cass: 1 m. Nov. 1924, CM, S. Lindsay.

Castlepoint: 1 m. Dec. 1963, GC, D.E. Gaskin.

Christchurch: 4 m. no date, CM, R.W. Fereday.

Claverley, Kaikoura: 1 m. 1 f. 25.12.32 - 1.1.33, CM, S. Lindsay.

Drayton Station, Cant.: 1 m. 1.1.1879, CM, R.W. Fereday.

Dun Mt., 2,000 ft., Nel.: 2 m. 1 f. 20-24.1.21, 1 m. 8.1.22, 1 f. 7.1.26, ED, A. Philpott.

Evansdale, Otago: 1 f. 1.1.16, AM, C.E. Clarke.

Flagstaff, Dunedin: 1 m. 15.1.15, ED, A. Philpott.

Glen Tui: 5 m. 1 f. 28-29.12.21, CM, S. Lindsay.

Golden Downs, Nel.: 1 m. 8.1.26, ED, A. Philpott.

Hokitika: 1 m. 1.12.29, CM, S. Lindsay.

Homer: 1 f. 28.12.44, DM, G. Howes.

The Hump: 1 f. 24.12.15, DM, C.E. Fenwick.

Kinloch: 1 m. 2.1.1881, DM, R.W. Fereday.

Lake Moana: 1 f. 16.12.25, CM, A. Tonnoir.

Lake Rotoiti: 1 m. 27.12.33, CM, S. Lindsay.

Lake Rotorua: 2 m. 7.1.28, ED, A. Philpott.

Longwoods: 3 m. 1 f. 26-29.12.15, DM, C.E. Fenwick.

Manapouri: 1 m. 27.12.22, CM, S. Lindsay.

Marion, Otago: 1 m. 20.12.42, DM, G. Howes.

Maruia: 1 m. 24.12.38, CM, S. Lindsay.

Milford Track: 1 f. 27.12.20, DM, C.E. Fenwick.

Mt. Cook: 1 m. 31.12.28, CM, S. Lindsay; 3 m. 3-8.2.29, ED, 1 m. DM, A. Philpott.

Mt. Grey, Cant.: 1 m. 8.11.29, 3 m. 15.12.29, CM, S. Lindsay.

Mt. Ruapehu, 3,300 ft.: 4 m. 2 f. 18.1.67, D.J. Greenwood and D.E. Gaskin.

Nelson: 1 m. 9.12.20, 1 m. 1 f. 15.12.21, ED, A. Philpott.

Peter's Pool, Franz Josef: 1 m. 5.12.64, FRI, J.S. Dugdale.

Pouakai Range, Tar.: 1 m. 6.11.66, GC, D.E. Gaskin.

Puhi-puhi River, Kaikoura: 1 m. 28.12.29, CM, S. Lindsay.

Queenstown: 1 m. 7.1.14, DM, G. Howes.

Rowallan: 1 m. 1 f. 26.12.15, ED, A. Philpott.

Tararuas: 1 m. Nov. 1967, GC, D.E. Gaskin.
 Tarawera: 1 m. 14.11.29, ED, A. Philpott.
 Traill's, Sthld.: 1 f. 29.12.13, ED, A. Philpott.
 Upper Maitai: 1 m. 26.11.23, ED, E.S. Gourlay; 1 m. 1 f. 27.11.25, ED,
 A. Philpott.
 Upper Marawhaiti, Maimai: 1 m. 30.11.64, FRI, J.S. Dugdale.
 Waitai: 1 f. 27.1.18, AM, C.E. Clarke.
 West Plains: 1 m. 3 f. no date, ED, A. Philpott.
 Whakarewarewa, Rotorua: 1 f. 24.10.59, FRI, J.S. Dugdale.

REMARKS: See this section under P.holanthes. There is little variation in this species except in size of specimens.

SPECIES GROUP 9b.

Costa with deep setulose median fold on membrana interna (inner wall of valve); juxta a long narrow plate, not cleft, gnathos with apex of "tooth-brush" form.

I include in this species subgroup the single revised Australian species ~~Pareromene~~[†], all of which were previously placed in Diptychophora Zeller. The other Australian species have been summarised by Bleszynski and Collins (1962) in their useful catalogue of the Crambidae of the World under the latter genus pending revision.

The genitalia of P.ochracealis have not previously been figured by any other author. I have not examined the female, but three males were available for study.

Pareromene ochracealis (Walker) comb.nov.

Cataclysta ochracealis Walker, 1866, List of the species of Lepidopterous Insects in the collection of the British Museum, 35, p. 1338.

Note: Bleszynski and Collins (1962) give Eromene dilatella Meyrick 1879, and E.praematurella Meyrick 1879, as synonyms of ochracealis, apparently only on the basis of the revision by Turner (1904), in which genitalia were not used. Since I am not attempting a revision of Australian Diptychophora but only dealing with this one species because of its interesting characters in the male genitalia, I

do not repeat this synonymy here. The species concerned need to be re-examined in the light of modern systematic methods.

For the dissection I used a specimen of P. ochracealis on loan from the Australian National Insect Collection of CSIRO, Canberra, determined by Mr. I.F.B. Common of the Entomology Division of CSIRO (Slide 87). The type has not been checked.

MALE GENITALIA (Fig. 111): As for generic and the subgroup 9b description, with the following additional details. Arms of vinculum almost forming a right angle in lateral view. Saccus very short, rounded, with dorsal cleft. Juxta an elongate dolabrate plate. Costa of valve elaborate, dorsal margin including posterior prong about $1\frac{1}{2}x$ uncus. Costa developed into a large incurved prong at about $\frac{1}{2}$, a second posterior prong at posterior extremity, and there is a third very short spur at the base of this. The costa has a long setulose median fold on the inner margin of the valvula/costa fusion. Uncus a little shorter than gnathos, shaped rather like an elongate parrot beak in lateral view, narrowing sharply at $\frac{1}{3}$ from apex, and very deep from $\frac{1}{3}$ to base. Gnathos curved ventrad, apically swollen, apex with "toothbrush"-like serrations dorsally and ventrally. Aedoeagus 2x uncus, tubular, tapering to apex, with about 40 small elongate cornuti, no apical spur. The ductus ejaculatorius enters the aedoeagus directly at the anterior end rather than dorso-anteriorly.

FEMALE GENITALIA: Not available for study.

LARVA: Not known.

HOST PLANT: Not known.

DISTRIBUTION: Eastern states of Australia (Turner, 1904). Flight period November.

MATERIAL EXAMINED: 3 m.

Macedon, Vic.: 2 m. 27-28.11.07, MWC, G. Lyell coll.

Sydney, N.S.W.: 1 m. 16.11.27, AMIC, (no captor).

REMARKS: I regard the anterior entry point of the ductus ejaculatorius as a

very interesting primitive character of this species, while the very elaborate costa is an apomorphic character. Possibly further examinations of Australian Pareromene species genitalia will show that the unusual point of ductus entry is the rule rather than the exception, in which case perhaps serious consideration will have to be given to removing this and any similar species from Pareromene to a new genus. Certainly P.ochracealis shows little relationship in male genitalia characters to any New Zealand species.

I have considered its position in the generic phylogenetic scheme in an earlier section (p. 236). The apomorphic character of the "toothbrush" gnathos is found in no less than five Asiatic species of Pareromene, yet the two species known from New Guinea, morobella and ajaxella, show a direct relationship to New Zealand species, and none to ochracealis. In view of later discussions on general biota relationships in the region (p. 374), this is not surprising, especially since P.ochracealis, which extends well south of Sydney (Turner, 1904), is not a rain forest species, and the only direct relationships between the insects of New Guinea and those of northern Australia appear to be in the rain forest region of Queensland (Gressitt, 1961), where some exchange apparently took place during the time of extensive land connections in the Pleistocene (Gressitt, *ibid*). I think it very likely that Pareromene was established in Australia well before this time, and probably isolated long before the Pleistocene. The retention of the primitive ductus position in an Australian species could lend some support to this idea.

Tribe Acigonini

Type of the tribe: Acigona cicatricella (Hübner, 1824, Samml.eur.Schmett.Tineae, pl.lxviii, ff.454 and 455: Tinea)

Tribal Diagnosis: Antennae filiform to dentate; maxillary palpi triangular, erect, covered with hair-like scales; labial palpi elongate, porrect, covered with hair-like scales; proboscis developed, or atrophied (in Calamotropha); ocelli present or absent (in Calamotropha); chaetosemae present; frons planoconvex or conical; forewing with r_5 free or stalked with r_4 ; hindwing discal cell open; male frenulum single, female frenulum single, double or triple.

In MALE GENITALIA: Pseudosaccus present or absent; saccus moderately developed, usually rounded; tegumen moderate to broad; uncus and gnathos well developed, often swollen and elaborate; sacculus of valve not developed (except in a few species of Calamotropha); valvula broad or narrow but usually oblongate; costal region of valve either undeveloped, or pronged, or lobed; juxta present and plate-like, often medially cleft, or absent; left and right valvae are strongly asymmetrical in some genera; aedoeagus generally short and sometimes with elaborate external ornamentation; cornuti present or absent; if present either linear and small, or reduced to one very large cornutus.

In FEMALE GENITALIA: Ostiolar sclerites developed in lateral positions, relative to ostium bursae, partially or completely fused in dorsal and ventral midlines, and evaginated into projecting tube or two-pronged fork, these conditions distinguishing this tribe from other Crambine tribes; eighth sternite lost; eighth tergite broad or narrow, fused with ostium bursae directly or via sclerites; tergite with medium to long anterior apophyses; anal papillae coalescent, with relatively short posterior apophyses, little longer than papillae are wide; corpus bursae asignate or having a single oval, diamond-shaped or irregular signum.

COMMENTS: None of the genera in this tribe are represented in New Zealand. Classeya, Pseudoclasseya, Pseudocatharylla, Ancylolomia and Calamotropha are most strongly developed in the Ethiopian and Oriental regions, and not in Australia or America. Bleszynski (1961) listed only three species of Calamotropha from Australia. No representatives of the other genera were listed for Australia by Bleszynski and Collins (1962).

The partially revised Acigona/Haimbachia complex occurs in the Americas, with a few representatives in the Palaearctic (Bleszynski, 1965, Capps, 1965).

Tribe Chiloini

Type of the tribe: Chilo phragmitella (Hübner, 1805, Samml. eur. Schmett. Tineae, pl. xliii, ff. 297, 298: Tinea)

Tribal diagnosis: Antennae filiform to strongly ciliate or dentate; maxillary palpi triangular, with dense short hair-like scales; labial palpi very elongate, porrect, covered with short hair-like scales; proboscis well developed; frons planoconvex or conical; ocelli and chaetosemae present (except in Eschata); forewing r_5 free; hindwing discal cell closed (except in Euchromius); hindwing discal cell with poorly developed cubital hair pecten on lower margin of discal cell; male frenulum single, female frenulum single or double.

In MALE GENITALIA: Pseudosaccus present or absent; saccus developed, rounded in most genera; tegumen moderate to broad; uncus and gnathos well developed, sometimes apically elaborate; valve with sacculus undeveloped except in Euchromius; valvula usually broad (narrow in Euchromius); costal lobe of valve undeveloped, or moderately to strongly pronged or lobed within each genus; cucullus generally weak; juxta plate-like, often with some median cleavage, or developed into deeply cleft V or U-shaped structure, which becomes very complex in some species of Gadira and Hednota; aedoeagus usually short, frequently with elaborate cornuti and external ornamentation.

In FEMALE GENITALIA: Ostiolar sclerites developed in lateral positions, and invaginated into ostium bursae, this distinguishes this from the other Crambine tribes; the sclerites are either strong and fused dorsally and ventrally to form a sclerotised layer within the upper part of the ductus bursae (as in Chilo), or they remain unfused, separate and tend to become weak and functionless (as in Gadira and Tauroscopa); eighth sternite vestigial or absent; eighth tergite free or lightly fused via sclerites to ostiolar region; sometimes forming a closed tube above ostium bursae; medium to long anterior and posterior apophyses present; anal papillae fused at least dorsally; corpus bursae with none, one or two signa.

Genus Tauroscopa Meyrick

Tauroscopa Meyrick, 1888, Trans. N.Z. Inst. 20, p. 69. Type species
Tauroscopa gorgopis Meyrick 1888.

DIAGNOSIS: Labial palpi, maxillary palpi, thorax and coxae clothed with rough hair-like scales. Labial palpi porrected, maxillary palpi triangular. Forewings with vein r_5 free, r_4 stalked with r_3 . Hindwings with closed discal cell, m_2 present (fig. 28). In male genitalia anellus (or juxta) characteristically V-shaped with pair of anellar horns, serrate or smooth. Valve with little differentiation of costa and no differentiation of sacculus, although a trans-tilla is present. Cucullus of valvae weak. In the female genitalia the ostiolar sclerites are internal, lateral, strong or weak. Eighth tergite free, not fused directly with ostium bursae (indirectly through ostiolar sclerites in T.lachnea and T.callixutha). In the last two named species only part of the sclerites are invaginated into the ostium bursae. Ostium shielded ventrally by posterior margin of seventh abdominal sternite. Corpus bursae with or without pair of signa.

COMMENTS: Between the bases of the valvae in T.gorgopis is a minute sclerotised plate, which, as Philpott (1929a) suggested, could be the remains of the true juxta, in which case all the other structures present are presumably derived from the anellus. The ostiolar sclerites are very weak and difficult to see in T.notabilis.

I recognise three species groups in this genus. In the first are the two Australian species T.lachnea and T.callixutha (the latter with a quadrilobate juxta/anellus). Both have only part of the pair of ostiolar sclerites invaginated into the ostium bursae. The New Zealand T.notabilis is alone in the second, with the juxta/anellar lobes smooth instead of serrate as in the other two New Zealand species, and with the ostiolar sclerites practically lost within the lateral walls of the ostium bursae. The sclerites have also become functionless in T.trapezitis and T.gorgopis, which I place in

the third group characterised by serrate juxta/anellar lobes and relatively strong ostiolar sclerites.

Tauroscopa shows very close relationships with the dominant Australian lowland Gadira/Hednota complex. I regard Tauroscopa as an alpine cool-climate segregate of Gadira/Hednota.

Tauroscopa differs from Gadira/Hednota in having diurnal-type compound eyes; the palpi, thorax and coxae covered with dense hair-like scales ventrally; the hindwing veins m_2 , m_3 being distant at their bases; a trans-tilla present in the male genitalia, and having the ostium bursae characteristically flattened and bell-shaped.

The status of Tauroscopa will need to be carefully re-examined when the whole Gadira/Hednota complex in Australia has been revised. I suspect that the concept of Tauroscopa as a discrete genus may not be tenable when more information is available on the large genus or genera. That a quadrilobate juxta/anellus has developed simultaneously in Tauroscopa and some species of Gadira is a coincidence of a major order. Although I have interpreted Tauroscopa as monophyletic in fig. 7, the arrangement given there may be illusory, although I feel sure that the three New Zealand species are a monophyletic group at the generic level.

A complete revision of Gadira/Hednota is the most urgent single need in the systematic study of Australasian Crambinae.

KEY TO KNOWN NEW ZEALAND SPECIES OF

Tauroscopa

- 1 First line of forewings waved.
 In male genitalia: costal lobe fused to valvula, juxta V-shaped but with each anellar apical lobe with single prong.
 In female genitalia corpus bursae asignate 2
- First line of forewings obsolete, trapezoidal mark present instead.
 In male genitalia: costal lobe separated from valvula. Juxta V-shaped, each anellar apical lobe having two prongs.
 In female genitalia: corpus bursae with two signa trapezitis

2 Second forewing line scalloped.

In male genitalia: Inner margin of juxta lobes serrate.

In female genitalia: Ostiolar sclerites strong, apophyses about 6x length of anal papillae gorgopis

- Second line of forewings not scalloped.

In male genitalia: cornutus present. Inner margin of juxtal lobes smooth.

In female genitalia: Ostiolar sclerites weak. Apophyses only about 3x length of anal papillae notabilis

Species Group 1.

Characterised by a very weak lateral strip in the eighth abdominal tergite of the female, the relatively poor development of the transtilla and the presence of part of the paired ostiolar sclerites outside the ostium bursae in the intersegmental membrane.

Two species known, both from the ranges of south-eastern Australia, T.lachnea and T.callixutha.

Tauroscopa lachnea (Turner)

Oressaula lachnea Turner, 1913, Proc. roy. Soc. Queensl., 24. p. 163.

Tauroscopa lachnea (Turner) Bleszynski and Collins, 1962, Acta zool. cracov., 7, p. 355.

Holotype m. in National Museum of Victoria, Melbourne, labelled "Mt. Hotham Vic. 11.2.08", "G. Lyell Coll. Pres. 31.7.32", "Oressaula lachnea Turn. Type".

National Mus. Insect Type registration No. "T-3744". Syntype f. in Entomology Division, Nelson, author's genit prep., labelled "Mt. Hotham Vic. 4,200 ft., 11.2.08."

EXTERNAL CHARACTERS: Detailed description by Turner (1913). Compound eye diurnal type, ocelli large, female frenulum triple, frons planoconvex, wing span 18 - 22 mm (both sexes). Differs from the New Zealand species by having plain brown forewings, and pale brown hindwings with a dark narrow border. (Slide 88).

MALE GENITALIA: (Fig. 115): As for generic description except for the following: Arms of vinculum narrow, only about $\frac{1}{4}$ as wide in profile as uncus is long.

Saccus rounded, barely developed. Juxta (or anellus) a deeply cleft V-shaped plate, with strong, serrate bifurcate lateral horns. Transtilla present, weaker than in other species examined, otherwise costa of valve barely differentiated. Valve about $\frac{1}{8}$ longer than aedoeagus. Uncus and gnathos tapered, pointed. Aedoeagus about twice uncus, length to median breadth ratio about 4:1, without cornuti, but with strong dorsal area of thickening, and a small ventral narrow flange.

FEMALE GENITALIA (Fig. 197): As for generic description except for the following: Anal papillae nearly free, with slight dorsal coalescence, posterior apophyses about $\frac{1}{4}$ longer than anteriors. Eighth sternite possibly present as a minute strong plate posterior to ostium. Eighth tergite showing nearly complete ventral fusion into a collar, but very weak in lateral midlines. Fused ventro-laterally to pair of ostiolar sclerites which curve dorsad and introrse into lateral extremities of mouth of ostium bursae. Posterior margin of seventh sternite with complex ventral median lodicular series of folds. Ductus bursae about $3\frac{1}{2}x$ anterior apophyses, very broad with a constriction at $\frac{1}{2}$, ductus seminalis joining at $\frac{1}{2}$. Ostium bursae flattened, bell-shaped. Corpus bursae asiguate.

LARVA: Not known.

HOST PLANT: Not known.

DISTRIBUTION: South eastern Australia; . . . Victoria and New South Wales, above about 4,000 ft. Flight period December to February.

MATERIAL EXAMINED: 2 m. 1 f.

Mt. Hotham, Vic.: 1 m. NMVC, 1 f. 4,200 ft., EDNZ, 11.2.08, Lyell coll.

Mt. Kosciusko, N.S.W.: 1 m., slide P.39, 7.12.22, ANMC, Goldfinch.

REMARKS: See pp. 37-38 and p. 292.

Tauroscopa callixutha Turner

Tauroscopa callixutha Turner, 1925, Trans. roy. Soc. S. Austral., 49: 43.

Holotype m. in Australian Museum, Sydney, labelled "Kosciusko, 7.12.1922, GM, G.M. Goldfinch," with paratypic series of 5 m. with same label data.

EXTERNAL CHARACTERS: Detailed description by Turner (1925). Compound eye diurnal type, ocelli large, female frenulum triple, frons planoconvex, wing span 17 - 24 mm (both sexes). Differs from all other species by yellow chequering of hindwings.

MALE GENITALIA (Fig. 204a): As for generic description except for the following: Arms of vinculum narrow, only about $\frac{1}{4}$ as wide in profile as uncus is long. Saccus rounded, slightly cupped ventrally. Juxta (or anellus) a deeply cleft V-shaped plate with a pair of prongs curved ventrad, lying dorso-laterally to aedoeagus. A secondary lobe from the base of each extends posteriorly for about half the length of the lobes, with apices setulose. A pair of shorter juxta/anellar prongs lie ventro-lateral to the aedoeagus, but curve introrse below the aedoeagus, where their apices fuse. Transtilla present, but only weakly developed. Uncus and gnathos tapered, gnathos slightly clubbed. Aedoeagus about twice uncus, length to median breadth ratio about 6:1, with single moderate elongate cornutus, and the ventro-anterior extremity strongly sclerotised.

FEMALE GENITALIA (Fig. 204b): As for generic description except for the following: Anal papillae nearly free ventrally but with dorsal coalescence, posterior apophyses about $\frac{3}{4}$ anterior. Eighth sternite absent. Eighth tergite almost completely fused to form a collar, but very weak in lateral midlines. Fused ventro-laterally to pair of ostiolar sclerites which curve strongly dorsad and introrse into lateral extremities of mouth of ostium bursae. Posterior margin of seventh sternite with slight lodicular fold. Ductus bursae about 3 - 4 x anterior apophyses, very broad with loop at $\frac{1}{4}$, ductus seminalis joining at $\frac{1}{3}$. Ostium bursae flattened, bell-shaped, laterally and posteriorly heavily

sclerotised. Corpus bursae massive, asignate.

LARVA: Not known.

HOST PLANT: Not known.

DISTRIBUTION: South eastern Australia; Snowy Range above 3,000 ft. in New South Wales. Flight period December-January.

MATERIAL EXAMINED: 13 m. 2 f.

Mt. Kosciusko c. 5,000 ft., N.S.W.: 5 m. (paratypes) 7 Dec. 1922; 6 m. 3-10 Dec. 1921; 1 m. 27 Dec. 1924; 1 m. 5 Jan. 1925; G.M. Goldfinch.

REMARKS: See pp. 37-38 and p. 292.

Species Group 2.

Characterised by a thorn in the aedoeagus, smooth evenly tapered juxtal (or anellar) lobes; very weak ostiolar sclerites. The latter are usually not visible but may be seen in some females under a high power of a stereo-microscope, as a faint pair of marks in the lateral ostiolar walls.

Contains a single species, T. notabilis, confined to Nelson and Marlborough.

Tauroscopa notabilis Philpott.

Tauroscopa notabilis Philpott, 1923, Trans. N.Z. Inst., 54, p. 149.

Holotype m. and allotype f. in Entomology Division, Nelson, labelled "Mt. Peel (Nelson) 31/12/12" and "Mt. Arthur 4,500 ft. 20.2.23, A. Philpott", respectively.

EXTERNAL CHARACTERS: Detailed description by Philpott (1923), coloured illustration by Hudson (1928, Plate L. fig. 19 f.), eye diurnal type, frons with blunt conical projection, ocelli large, frenulum single in male, triple in female, wing span 18 - 20 mm (both sexes). (Slide 89).

MALE GENITALIA (Fig. 114): As for generic description but including the following: Arms of vinculum narrow in profile, less than $\frac{1}{2}$ uncus. Saccus poorly developed, cupped ventrally, apex with slight antero-lateral excavations.

Juxta (or anellus) with smooth pair of horns curving ventrad and extrorse. Transtilla present. Costal lobe of valve with a slight dorsal marginal protuberance at $\frac{1}{2}$, otherwise valve entire. Uncus tapered, 2 - 3x gnathos, curved ventrad, with laterally flattened apex. Gnathos curved dorsad, fused only for apical $\frac{1}{4}$, tapered and pointed, Aedoeagus tubular, with anterior medial cleft, strong from $\frac{1}{2}$ to anterior extremity, about $2\frac{1}{2}$ x uncus, length to median breadth ratio 5:1, apical thorn or cornutus present.

FEMALE GENITALIA (Fig. 196): As for generic description but with the following: Anal papillae coalescent, posterior apophyses relatively short, barely half anterior. Eighth sternite absent, eighth tergite free ventrally, three times wider dorsally than ventrally. Ductus bursae about 2x anterior apophyses, ductus seminalis joining at about $\frac{3}{8}$ to $\frac{1}{2}$, ostiolar sclerites very weak, lateral, internal, ostium bursae flattened, bell-shaped, shielded ventrally by posterior margin of seventh sternite. Corpus bursae asiginate.

LARVA: Not known.

HOST PLANT: Not known.

DISTRIBUTION (Fig. 295): An alpine species, largely confined to the Nelson and Marlborough Provinces, although a few specimens have been taken at Arthur's Pass, ~~and one further south at Mt. Wakefield.~~
Pass, Flight period December to February.

MATERIAL EXAMINED: 18 m. 7 f.

Arthur's Pass; 2 m. 14.1.33, DM, G.V. Hudson.

Burgoo Creek, Nel.: 2 m. EGS, 6.12.62, FRI, J.S. Dugdale.

Cascade Creek, Angelus Basin, Nel.: 1 f. HGR, 9.2.64, FRI, J.S. Dugdale.

Dun Mt. Nel., 3,000 ft.: 1 m. 8.1.22, ED, A. Philpott.

Iron Hill, 4,700 ft.: 1 m. EGZ, 4 f. HGU, BMI, 9.2.66, FRI, J.S. Dugdale.

Lake Sylvester: 3 m. EGP, BMH, 8-11.2.66, FRI, J.S. Dugdale.

Mt. Arthur: 1 m. 9.1.1891, DM, G.V. Hudson; 1 m. 2.2.23, ED, 1 m. KCA, 1 f. 23.2.24, ED; A. Philpott; 1 m. 16.1.32, DM, S. Hudson.

Mt. Crystal, 4,500 ft.: 1 m. EGX, 14.2.66, FRI, J.S. Dugdale.

Mt. Iris Ridge, Wairau Mts: 1 m. 16.2.66, FRI, J.S. Dugdale.

Mt. Peel, Nel.: 1 m. 23.1.1889, DM, G.V. Hudson.

Mt. Wakefield: 1 m. EGW, 1 f. 14.1.64, FRI, J.S. Dugdale.

Nuggety Peak, Mt. Owen: 1 m. 13.1.65, FRI, J.S. Dugdale.

REMARKS: There is very little variation in this distinctive species except for intensity of forewing markings. The presence of the species at Arthur's Pass, where it overlaps the range of T. trapezitis, as well as in the alpine regions of Nelson and Marlborough, can be explained by post-glacial colonisation or recolonisation along the Taramakau valley.

Distinct on several good characters from the other species I have examined, but not at the generic level.

Species Group 3.

Characterised by an unornamented aedoeagus, serrate juxtal (or anellar) lobes, strong ostiolar sclerites.

Contains two species, T. gorgopis and T. trapezitis in the South Island of New Zealand.

Tauroscopa gorgopis Meyrick

Tauroscopa gorgopis Meyrick, 1888, Trans. N.Z. Inst., 20, p. 69.

Tauroscopa howesi Philpott, 1930, Rec. Auckland Mus., 1. p. 3.

Holotype m. in British Museum (Natural History) labelled "Mt. Arthur New Zealand GVH./1/89," "Tauroscopa gorgopis".

Holotype m. in Entomology Division, Nelson labelled "Tauroscopa howesi Philpott holotype male and "Obelisk 1.2.12".

EXTERNAL CHARACTERS: Detailed descriptions given by Meyrick (1888) and Philpott (1930), coloured illustrations by Hudson (1928, Plate XIX, fig. 42 f, 1939, Plate LXII, fig. 21 m.). Eye diurnal type, with nude peri-orbital strip, ocelli large, frons with conical protuberance, frenulum single in male, triple in female. Wing span 18 - 24 mm (both sexes). Venation, fig. 28. (Slide 90).

MALE GENITALIA (Fig. 112): As for generic description but with the following: Arms of vinculum very narrow in profile, barely $\frac{1}{4}$ as wide as uncus is long.

Saccus poorly developed, with rounded apex, and fragile ventro-posterior flange. Juxta strongly developed as a deeply cleft V-shaped plate with sclerotised anellar apical horns. Each horn flattened, sharply angled extrorse at $\frac{1}{2}$, inner margin characteristically serrate. Transtilla present, otherwise costal lobe of valve poorly differentiated. Uncus and gnathos tubular, bluntly pointed, curved ventrad and dorsad respectively. Gnathos fused only apically. Aedoeagus unornamented, without cornuti, with ring of thickening at point of juxtal attachment, about 3x uncus, length to median breadth ratio about 8:1.

FEMALE GENITALIA (Fig. 194): As for generic description, but with the following: Anal papillae coalescent, posterior apophyses equal to anteriors. Eighth abdominal sternite absent. Eighth tergite not fused to ostium. Ostiolar sclerites lateral, clearly visible, isolated in walls of ostium bursae. Ductus bursae about equal to length of apophyses, ductus seminalis joining at $\frac{1}{2}$, corpus bursae asignate.

LARVA: Not known.

HOST PLANT: Not known.

FUPA (Fig. 36a): Length 20 mm, dull brown, with abdominal setae short, thickened, set in chitin pits, abdomen salebrose. Cremaster with strong setae. Pupa in rough cocoon of soil particles under stone.

DISTRIBUTION (Fig. 294): Alpine regions of the South Island, flying in rock-strewn grassland above 4,000 ft, and on fellfield and ridges up to about 5,500 ft. (Mr. J.S. Dugdale, pers. comm.). Flight period December to February.

MATERIAL EXAMINED: 54 m. 18 f.

Advance Peak: 4 m. FDA, FDG, FDH, 2 f. HGO, 1-2.1.10, DM, C.E. Fenwick.

Commissioner's Creek: 7 m. FDB, FDC, FDD, FDE, FDF, 2-3.2.13, DM, G. Howes.

Freehold Range: 2 m. 1 f. 31.12.35, CM, S. Lindsay.

Macetown: 1 m. 1.2.09, ED, C.E. Fenwick.

Mt. Arthur: 3 m. 24-8.1.24, CM, S. Lindsay.
 Mt. Cook: 5 m. 12.12.28 - 4.1.29, CM, S. Lindsay.
 Mt. Hutt: 1 m. Dec. 1933, CM, S. Lindsay.
 Mt. Peel Range: 1 m. 27.1.1889, DM, G.V. Hudson.
 Obelisk: 2 m. GDA, GDB, 1.1.40, DM, G.V. Hudson; 1 f. 2.12.63, FRI, J.S. Dugdale.
 Old Man Range: 1 m. 1.2.12, DM, A. Hamilton; 11 m. BMF, FGA, EGR, EGT, 2.12.63, FRI, J.S. Dugdale.
 Remarkables: 1 f. 15.1.66, FRI, J.S. Dugdale; 14 m. JFT, EGQ, EGV, EGY, 13 f. BMG, CGU, FGB, EGU, 15.1.66, FRI, J.S. Dugdale.
 Vanguard Peak: 2 m. 8.1.09, ED, G.V. Hudson.

REMARKS: The most wide-ranging of the New Zealand species, being found throughout the length of the main ranges of the South Island. The howesi form, with its distinct white patterning, does not appear to be worthy of subspecific rank as I have found many intermediates. In general this form is more common in the southern part of the South Island among the specimens I have examined, but the distinct howesi patterning is almost always associated with small dark male specimens. I can find no differences in the genitalia of either sex in gorgopis and howesi specimens.

Phylogenetically the sister species of the New Zealand T. trapezitis.

Tauroscopa trapezitis Meyrick 1905.

Tauroscopa trapezitis, 1905, Trans. ent. Soc. Lond., 1905, p. 227.

Holotype m. in British Museum (Natural History), slide BM pyral 3968, labelled "Mt. Earnslaw New Zealand GVH/03."

EXTERNAL CHARACTERS: Detailed description by Meyrick (1905), coloured illustration by Hudson (1928, Plate XIX, fig. 41 m.), with abbreviated description. Eye diurnal type, frons with blunt conical protuberance, ocelli large, frenulum single in male, triple in female. Wing span 18 - 22 mm (both sexes). (Slide 91).

MALE GENITALIA (Fig. 113): As for generic description except for the following: Arms of vinculum narrow, about $\frac{1}{2}$ uncus in profile. Saccus moderately developed, cupped ventrally below valvae bases, with antero-lateral excavations. Juxta (or anellus) with pair of large serrate lateral horns, each apically bifid.

Transtilla present, costal lobe separated from rest of valve at apex as a slight prong. Uncus slightly curved ventrad, a little shorter than gnathos. Gnathos curved dorsad, fused only apically, tapered, with blunt point. Aedoeagus tubular, strong from about $\frac{1}{2}$ to anterior extremity, with ring of thickening at attachment point of juxta/anellus, about 5 - 6x uncus, length to median breadth ratio about 6 - 7:1. No cornuti or other ornamentation.

FEMALE GENITALIA (Fig. 195): As for generic description except for the following: Anal papillae coalescent, posterior apophyses about $\frac{3}{4}$ anterior. Eighth sternite absent, eighth tergite margins free in ventral midline. Ostiolar sclerites clearly visible as strong areas isolated in lateral walls of ostium bursae. Ductus bursae about 4x length of anterior apophyses, with ductus seminalis joining at $\frac{3}{8}$, ostium bursae characteristically bell shaped, shielded ventrally by posterior margin of seventh sternite. Corpus bursae with two large unequal oval signa.

LARVA: Not known.

HOST PLANT: Not known.

DISTRIBUTION (Fig. 296): Alpine regions of the South Island of New Zealand south of Arthur's Pass. Flight period November to January.

MATERIAL EXAMINED: 10 m. 4 f.

Arthur's Pass: 1 m. 8.11.57, ED, E.S. Gourlay.

Ben Lomond: 1 m. 25.1.12, ED; 1 m. JCG, 1.1.22, DM, C.E. Fenwick.

Bold Peak: 2 m. JCD, JCE, 29.12.10, 1 f. JCC, 26.12.13, DM, C.E. Fenwick.

Hunter Mountains: 1 f. BMK, 6.1.22, CM, S. Lindsay.

Lake Luella: 1 m. 23.12.19, ED, C.E. Fenwick.

Mt. Earnslaw: 1 m. 20.2.03, G.V. Hudson; 1 m. JCF, 5.1.16, DM, C.E. Fenwick.

Paradise: 1 f. JCH, 29.12.12, 1 f. JCA, 1.1.20, DM, C.E. Fenwick.

Takitimos: 1 m. 28.12.12, ED, A. Philpott.

Vanguard Peak: 1 m. BMJ, 8.1.09, DM, G.V. Hudson.

REMARKS: Phylogenetically the sister species of T.gorgopis, but showing a relatively plesiomorphic character of retention of signa on the corpus bursae

not found in any other species in the genus.

Variation in this species is restricted to the intension of colour and pattern on the forewings.

Genus Hednota Meyrick

Hednota Meyrick, 1886, Trans. ent. Soc. Lond., 1886, p. 270. Type species (auct. Zimmerman, 1958) Crambus bifractellus Walker, 1863.

Thinasotia sensu Meyrick, 1879 (misspelling of Thisanotia Hübner), (nec Thisanotia Hübner, 1825, Verzeichniss bekannter Schmettlinge sic), type species Tinea chrysonuchella Scopali, 1763).

COMMENTS: This is an unrevised genus requiring urgent attention. The diagnosis of Meyrick (1886), based only on external characters, is inadequate. A brief diagnosis by Koch (1965) is of no use for systematic purposes. While it covers the species he describes it is not exclusive, and could apply to several other Crambine genera. I have examined the male genitalia of the type species (fig. 125), and at the present time the only male genitalial characters separating Hednota from Gadira Walker are the dorsal anellus shield in the former, lacking in Gadira, and the distinctly cupped saccus of Gadira species, lacking in Hednota bifractella but also poorly developed in G.vittella. In H.bifractella the tegumen is not characteristically narrowed basally as in the species I have transferred from Hednota to Gadira. I have retained, of the 10 species examined here, only the type species bifractella in Hednota. I have transferred the other species examined; crypsichroa Lower, gramella (Zeller), haplotype (Turner), leucophthalma (Meyrick), longipalpella (Meyrick), panselenella (Meyrick), pedionoma (Meyrick), pleniferella (Walker) and vittella (Suederus), to the genus Gadira, Walker. The position of (?) Hednota empheres Koch, 1965, which has a peculiar "thorny ampulla" on each male valve and similar swellings on the lateral angles of the female eighth abdominal tergite, is very problematical, and not further considered in the present work.

Hednota bifractella (Walker)
(type species)

Crambus bifractellus Walker, 1863, List of the Specimens of lepidopterous Insects in the collection of the British Museum, London, 27, p. 174.

Hednota bifractellus (Walker) Bleszynski and Collins, 1962, Acta zool. cracov. 7, p. 314.

Type not checked. Examination based on a male from the Australian National Museum Collection, Canberra, determined by I.F.B. Common, labelled "Black Mt. A.C.T. light trap, 30 Oct. 1959 I.F.B. Common." (Slide 92).

EXTERNAL CHARACTERS: Brief description by Walker (1863); recognisable by the paired inner and outer tear-drop shaped subcostal and median white markings. Eye nocturnal type, ocelli small, frons with conical protuberance, wing span 23 mm (male). Venation, fig.32. Female not examined.

MALE GENITALIA (Fig. 125): Arms of vinculum about $\frac{1}{2}$ as wide in profile as uncus is long. Saccus developed anteriorly, elongate (about $\frac{1}{2}$ uncus), apically rounded, not cupped ventrally below bases of valvae. Juxta (or anellus) a V-shaped plate bifurcating ventro-laterally to aedoeagus into pair of slender slightly curved horns. Dorsally and basal region of the structure has a moderately sclerotised strap-like shield arching over the aedoeagus and fusing with each side of the basal portion of the juxta/anellus. Costa of valve strongly developed, separated for apical $\frac{1}{2}$ into long narrow setulose lobe with truncate apex. Ventral margin of valve curving introrse, but sacculus not developed. Valve slightly longer than aedoeagus. Uncus tapered, pointed, arched sharply ventrad with pointed apex. Gnathos tapered, pointed, curved dorsad, a little shorter than uncus. Aedoeagus tubular, truncate, with single gigantic projecting cornutus more than $\frac{1}{2}$ total length of aedoeagus.

FEMALE GENITALIA: Not examined.

LARVA: Not known.

HOST PLANT: Not known.

DISTRIBUTION: Canberra, also South Australia (Bleszynski and Collins, 1962).

Flight period October, probably in other months also.

MATERIAL EXAMINED: 1 m.

Black Mountain, A.C.T.: 1 m. 30.10.1959, ANIC, I.F.B. Common.

REMARKS: Since H.bifractella is regarded as the type species of the genus (Zimmerman, 1958; Bleszynski and Collins, 1962; Bleszynski, 1963a), its

stability is desirable until the relationships of Chilo, Hednota and Gadira have been thoroughly explored and the assemblage of species presently in Hednota (Bleszynski and Collins, 1962, pp. 314-7) re-examined.

Genus Gadira Walker

Gadira Walker, 1866, List of the Specimens of lepidopterous Insects in the collection of the British Museum, London, 35, p. 1742. Type species Gadira acerella Walker, 1866. (monotypic).

Botys Felder, 1875, Reis, Nov. Lep., pl. cxxxvii, fig. 27. Type species Botys mehanga Felder, 1875 - Gadira acerella Walker, 1866. (monotypic)

Thinasotia sensu Meyrick, 1882 (misspelling of Thisanotia Hübner) (nec Hübner, 1825, Verzeichniss bekannter Schmettlinge (sic), Augsburg, p. 366, Type species Tinea chrysonuchella Scopoli, 1763).

Scenoploca Meyrick, 1882, New Zealand Journal of Science (Dunedin), 1, p. 186 Type species Scenoploca petraula Meyrick, 1882. (monotypic)

Cryptomima Meyrick, 1883, Trans. N.Z. Inst. 15, p. 8. Type species Gadira acerella Walker, 1866. (monotypic).

Thinasotia sensu Meyrick, 1883 (misspelling of Thisanotia Hübner) (nec Hübner 1825, Verzeichniss bekannter Schmettlinge (sic), Augsburg, p. 366. Type species Tinea chrysonuchella Scopoli, 1763).

Scenoploca Meyrick, 1883, Trans. N.Z. Inst. 15, p. 9. Type species Scenoploca petraula Meyrick, 1882. (monotypic).

Talis sensu Meyrick, 1912 (nec Guenee, 1845, Essai sur une nouvelle classification des Microlepidopteres Ann. Soc. ent. Fr., Paris, 3, pp. 324. (monotypic).

Hednota Meyrick, 1886 (partim) Trans. ent. Soc. Lond. 1886, p. 270. Type species Crambus bifractellus Walker, 1863.

PROVISIONAL DIAGNOSIS: Labial palpi longer than head, porrected, maxillary palpi triangular. Frons with or without conical protuberance. Frenulum single in male, double or triple in female. In venation: Forewings with r_5 free, r_1 not concurrent with Sc. Hindwings with discal cell primitively closed, but partially open in a number of species, m_2 and m_3 stalked, or with bases very closely approximated (figs. 29, 30, 31). In male genitalia: vinculum typically narrow, almost strap-like, in profile; saccus with rounded rarely elongate apex anteriorly, characteristically cupped ventrally below bases of valvae; costal region of valve poorly to strongly developed, with or without a prong or lobe. Sacculus not developed (unless Hednota asterias Meyr. should prove to belong to

this genus, see Bleszynski, 1962b, fig. 16). Juxta basically a U or V-shaped plate, with one or two pairs of horns developed, directed caudad, part or all of this structure possibly being anellar rather than juxtal in origin.

Aedoeagus stout, sclerotised or weak, with or without cornuti. In female genitalia: Eighth sternite absent; eighth tergite not directly fused with ostium bursae, ostiolar sclerites lateral and internal (partially so in pleniferella Meyr.), anterior apophyses present, usually long, corpus bursae asiguate (scobinate in pleniferella).

COMMENTS: At the present stage of our knowledge of the Australian Crambinae fauna this diagnosis can only be considered provisional. It may be necessary to widen the concept of this genus, or narrow it down to even fewer species than I have included here.

In a recent paper Bleszynski (1962b) has correctly removed about 19 species of Australian origin from Talis, and transferred them, with some reservations, to Hednota. Bleszynski and Collins (1962) removed the remaining Australian species formerly in Talis to Hednota. Bleszynski removed panteucha from Talis to the small genus Surattha, but Koch (1965) transferred the same species from Surattha to Hednota.

In the same paper Koch has made a useful contribution to our knowledge of the genus, but until all known species have been re-examined and the range of structure in all the important characters systematically analysed no one will be in a position to effectively revise this assemblage. However the type species of Gadira, acerella, is undoubtedly congeneric with petraula and leucophthalma, and also under the present generic definition with a number of endemic Australian species I have examined; cryptichroa, haplotypa, longipalpella, panselenella, pedionoma, gramella, pleniferella and vittella; and two of the species described by Koch (1965), ancylosticha and panteucha. Possibly other species figured by Koch in the same paper should also be transferred to Gadira, for example peripuces. However I had considerable difficulty interpreting his drawings in some cases, and found his genitalic descriptions quite inadequate for systematic analysis.

However the range of structure, especially in the female genitalia, is very wide, although not so wide that any particular condition cannot be derived from another. Should Hednota prove to be a genus distinct from Chilo, and even this has not yet been satisfactorily demonstrated (Bleszynski, 1963), then the Meyrick genus Hednota may need to be sunk as a synonym of Walker's much earlier Gadira. I have only examined the male genitalia of the type species of Hednota, H.bifractella (Walker). Here there is a broad dorsal shield linking the right and left arms of the juxta and completely surrounding the aedoeagus. In this species the characteristic cupping of the saccus below the bases of the valvae in species of Gadira such as acerella, petraula and pedionoma is not present. Since this appears to be a somewhat different line of development from Gadira I leave bifractella in Hednota. This is particularly important at this stage of revision as bifractella is after all the designated type species of the genus (Zimmerman, 1958).

The species crypsichroa Lower and haplotypa (Turner), show a very special complexity of juxta/anellus structure, though even this is more akin to the condition in leucophthalma than that in bifractella.

In this work the species under consideration are provisionally assembled into four species groups. (fig.8).

As presently defined Gadira differs from Tauroscopa by lacking a transtilla in the male genitalia, not having a broad flattened bell-shaped ostium bursae in the female, and by having hindwing veins m_2 and m_3 stalked.

The genus as presently defined differs from the type species of Hednota in lacking a dorsal shield over the aedoeagus between the lateral juxtal (or anellar) lobes. However there is a weak membranous connection in all species in Gadira, and closer intermediate conditions may be found when more species are examined. A more satisfactory distinction cannot at present be made.

Gadira and Hednota females so far examined by me or figured by Koch (1965) lack the strong dorso-ventrally fused completely internal ostiolar sclerites or the single diamond-shaped signum characteristic or revised Chilo

species (Bleszynski 1963, 1965) (although not the type species C.phragmitellus (Hübner), Bleszynski (1965, Plate 93, fig. 55)). The distinctions between these partially revised genera are very unsatisfactory and much more work is needed.

Several of the species described by Koch (1965), notably G.panteucha (Meyrick), G.longipalpella (Meyrick), G.crypsichroa (Meyrick), and G.pedionoma (Meyrick) are of great economic importance in Western Australia as "webworm", destructive in pastures. G.panteucha is the dominant species ^{according to} Koch, 1965; while Wallace and Mahon, (1952) considered G.pedionoma to be the dominant species in the Katanning area.

SYSTEMATIC LIST OF SPECIES OF Gadira EXAMINED
 IN THIS WORK OR WHOSE SYSTEMATIC POSITION IS
 INTERPRETABLE AMONG THOSE FIGURED BY KOCH (1965).
 ALL SPECIES AUSTRALIAN UNLESS OTHERWISE INDICATED

SPECIES GROUP 1.

1. Gadira vittella (Suederus, 1787: Tinea) N.comb.
2. Gadira gramella (Zeller, 1863: Crambus) N.comb.
3. Gadira panselenella (Meyrick, 1882: Thinasotia(sic)).
N.comb.

SPECIES GROUP 2a.

4. Gadira petraula (Meyrick, 1882: Scenoploca) N.comb.
New Zealand

SPECIES GROUP 2b.

5. Gadira acerella Walker, 1866. New Zealand
6. Gadira pedionoma (Meyrick, 1885: Thinasotia (sic)).
N.comb.

SPECIES GROUP 3.

7. Gadira panteucha (Meyrick, 1885: Thinasotia (sic)).
N.comb.
8. Gadira ancylosticha (Koch, 1965: Hednota) N.comb.
9. Gadira pleniferella (Walker, 1863: Crambus) N.comb.
10. Gadira longipalpella (Meyrick, 1879: ?Eromene) N.comb.

SPECIES GROUP 4.

11. Gadira crypsichroa (Lower, 1893: Hednota) N.comb.
12. Gadira haplotypa (Turner, 1904: Talis) N.comb.
13. Gadira leucophthalma (Meyrick, 1882: Thinasotia (sic))
N.comb. Australia and
New Zealand

KEY TO THE NEW ZEALAND SPECIES OF
THE GENUS Gadira.

1. Male genitalia; Aedoeagus with large cornuti (about 12), juxta (or anellus) with single pair of setulose horns curving extrorse.

Female genitalia; Distinct ostiolar pouch or swelling between ostium bursae and junction of ductus bursae with ductus seminalis. Internal lightly sclerotised lateral ostiolar sclerites visible in walls of ostium bursae.

Forewings: Blue scales present in disc. Reniform stigma clear with and oval, outlined with black.

. acerella

- Male genitalia: Aedoeagus either without cornuti or with microscopic cornuti. Juxta (or anellus) either with 4 horns, or one pair only curving introrse, each having a medial swelling.

Female genitalia: Long narrow swelling anterior to junction of ductus seminalis with ductus bursae. Sclerites not visible as above.

Forewings: Without blue scales in disc. Reniform elongate, oblique.

. 2

- 2 Male genitalia: Juxta (or anellus) with two pairs of horns. Costa of valve with triangular spur at $\frac{1}{2}$.

Female genitalia: Distinct stalked ostiolar pouch not present.

Forewings: Pale grey brown with distinct double subterminal line.

. leucophthalma

- Male genitalia: Juxta with one pair of horns. Costa of valve not differentiated, without spur.

Female genitalia: distinct stalked ostiolar pouch present.

Forewings: Whitish with black markings, without distinct doubled subterminal line. Female with narrow wings, all markings obscure.

. petraula

Species Group 1.

Saccus not strongly constricted from arms of vinculum or formed into a ventral cup (figs. 120-122). Juxta/anellus still largely plate like, though with pair of horns developed.

Contains three Australian species G.gramella, G.panselenella, and G.wittella, which differs from the other in having the apex of the gnathos very strongly developed into a "fish hook" form (fig. 122).

Gadira gramella (Zeller) comb.nov.

Crambus gramella Zeller, 1863, Chilonidarum et Crambidarum genera et species, p. 46.

* Crambus enneagrammos Meyrick, 1879, Proc. linn. Soc. N.S. Wales, 3, p. 184.

Hednota gramellus (Zeller) Bleszynski and Collins, 1962, Acta zool.cracov. 7, p. 315.

* Synonymy from Bleszynski and Collins, 1962.

Type not checked. Examination based on two males from the National Museum of Victoria Collection, Melbourne, determined by A. Neboiss, labelled "Macedon 29.10.05" and "Macedon 17.3.07, G. Lyell coll." (Slide 93).

EXTERNAL CHARACTERS: Detailed description by Meyrick (1879). Very similar forewing pattern to G.panselenella, but much paler, ground colour very light brown. Eye nocturnal type, ocelli small, frons with blunt conical protuberance, wing span about 27 mm. Female not examined.

MALE GENITALIA (Fig. 120): As for generic description and description of panselenella genitalia except for the following: Prong of costal region reaching tip of valve, gnathos about $\frac{1}{4}$ longer than uncus, and much more sharply curved dorsad than in panselenella.

FEMALE GENITALIA: Not examined.

LARVA: Not known.

HOST PLANT: Not known.

DISTRIBUTION: New South Wales, Victoria and Tasmania (Bleszynski and Collins 1962). Flight period October, March, and probably also in intervening months.

MATERIAL EXAMINED: 2 m.

Macedon, Vic.: 1 m. 29.10.05, 1 m. 17.3.07, NMVC, G. Lyell.

REMARKS: Very close to G.panselenella. See remarks on that species.

Gadira panselenella (Meyrick) comb.nov.

Thinasotia (sic) panselenella Meyrick, 1882, Proc. linn. Soc. N.S. Wales, 1882, p. 165.

Hednota panselenella (Meyrick), Bleszynski and Collins, 1962, Acta zool. cracov. 7, p. 316.

Type not checked. Examination based on two m. from the National Museum of Victoria Collection determined by A. Neboiss, labelled "Wandin W.Q." and "Beaconsfield. 19.12.03". (Slide 94).

EXTERNAL CHARACTERS: Detailed description by Meyrick (1882b). Recognisable by the rich orange-brown colour of the forewings with median fascia, and pale marked veins. Eye nocturnal type, ocelli small, frons with conical protuberance, wing span 25 - 27 mm. (male). Female not examined.

MALE GENITALIA (Fig. 121): As for generic description except for the following: Arms of vinculum narrow, about $\frac{1}{3}$ as wide in profile as uncus is long. Saccus poorly developed, anteriorly rounded, ventrally cupped below bases of valvae. Juxta (or anellus) a folded V-shaped plate bifurcating into two setulose lobes directed dorso-caudad and lying lateral to aedoeagus. Costal region of valve developed into large prong from near $\frac{1}{2}$, directed caudad, tip of prong ending well before apex of valve. Valve $1\frac{1}{2}x$ aedoeagus. Ventral margin of valve curved introrse, but sacculus not developed. Uncus and gnathos tapered, curved, equal in length. Aedoeagus stout, sigmoid, about twice uncus, apically dilate, length to median breadth ratio about 4:1, strong except in apical region, cornuti absent but a small "cusp" near $\frac{1}{2}$.

FEMALE GENITALIA: Not examined.

LARVA: Not known.

HOST PLANT: Not known.

DISTRIBUTION: New South Wales, Victoria, South Australia and Tasmania (Bleszynski and Collins, 1962: Turner, 1904). Flight period December and probably also in other summer months.

MATERIAL EXAMINED: 2 m.

Beaconsfield, Tas.: 1 m. 19.12.03, NMVC, no captor.

Wandin, W.Q. (locality not established as in West Queensland): 1 m. no date, captor not given, NMVC.

REMARKS: This species shows a very close relationship in male genitalial characters with G.gramella. After further examination of long series of both gramella and panselenella from as many localities as possible, consideration should be given to dropping panselenella to subspecific rank.

Gadira vittella (Suederus) comb.nov.

Tinea vittella Suederus, 1787, Act. Holm., p. 227.

Tinea bivittella Donovan, 1805, Ept. N. H. Ms. New Holland.

Crambus trivittatus Zeller, 1863, Chilonidarum et Crambidarum genera et species, p. 34.

Talis trivittalis Hampson, 1896, Proc. zool. Soc. Lond., 1895, p. 968.
(misspelling of trivittatus Zeller).

Hednota vittella (Suederus) Bleszynski and Collins, 1962, Acta zool. cracov. 7, p. 317.

All synonymy from Bleszynski and Collins, 1962.

Type not checked. Examination based on a male from the Australian National Museum Collection, Canberra, determined by I.F.B. Common, labelled "Black Mt. A.C.T. light trap 30 Nov. 1959 I.F.B. Common and M.S. Upton" and two males from the collection of the Entomology Division, Nelson compared with the first specimen.

EXTERNAL CHARACTERS: Brief description by Turner (1904), figured by Common (1963, fig. 185). Easily distinguished by the two clear white forewing fascia, one median and the other subcostal. Eye nocturnal type, ocelli small, frons planoconvex, wing span 25 - 30 mm (male). Female not examined. (Slide 95).

MALE GENITALIA (Fig. 122): As for generic description except for the following: Arms of vinculum slightly broader in profile than uncus is long. Saccus hardly developed, apically rounded, but extending ventrally below bases of valvae. Juxta (or anellus) a hastate plate with V-shaped bifurcation caudally into pair of horns lateral to aedoeagus and curving first introrse, then extrorse and ventrad. Costa of valve strongly developed into large truncate lobe. Ventral margin of valve strongly curved introrse, but sacculus not developed. Valve half as long again as aedoeagus. Uncus tapered, bluntly pointed, strongly arched ventrad, a little longer than gnathos. Gnathos broad in profile with sharply arched apex. Aedoeagus tubular, apically truncate, twice uncus, length to median breadth ratio about 7:1, without cornuti.

FEMALE GENITALIA: Not examined.

LARVA: Not known.

HOST PLANT: Not known.

DISTRIBUTION: Queensland, New South Wales, Victoria, South Australia and Tasmania (Bleszynski and Collins, 1962). Flight period November, December and April, and probably the intervening months also.

MATERIAL EXAMINED: 3 m.

Black Mountain, A.C.T.: 1 m. 30.11.1959, ANIC, I.F.B. Common.

Riverina, N.S.W.: 1 m. 1.12.02, EDNZ, no captor.

Stradbroke, N.S.W.: 1 m. 1.12.02, EDNZ, no captor.

REMARKS: No variation in forewing pattern in the specimens examined. The vinculum-saccus is less elaborate and without noticeable lateral constriction in comparison with the other species examined.

Koch (1965) has demonstrated satisfactorily the distinctness of this species from Hednota recurvella (Walker).

Species Group 2.

Includes three species in two subgroups. The saccus is

constricted from arms of vinculum. The juxta/anellus is a deeply cleft V-shaped or U-shaped structure with a pair of elaborate horns. Cornuti present and simple or absent. Subgroup 2a contains a single species, G.petraula from New Zealand. Subgroup 2b contains two species at present, G.acerella from New Zealand and G.pedionoma from eastern Australia. See fig.8.

Gadira petraula (Meyrick) comb.nov.

Scenoploca petraula Meyrick, 1882, New Zealand Journal of Science (Dunedin) 1, p. 186.

Scenoploca petraula Meyrick, 1883, Trans. N.Z. Inst., 15, p. 9.

Lectotype m. in Dominion Museum, Wellington; 6 ^{paralecto}~~synt~~types m. in British Museum (Natural History); 1 ^{paralecto}~~synt~~type m. in Canterbury Museum labelled "Scenoploca petraula Meyr. Christchurch New Zealand 10/3/82", and one ^{paralecto}~~synt~~type m. in British Museum dated 25/3/82.

EXTERNAL CHARACTERS: Detailed description by Meyrick (1883), coloured illustration by Hudson (1928, Plate XIX, fig. 34 m.) with abbreviated description.

Labial palpi having second joint bearing an oblique tuft of scales ventrally.

Eye nocturnal type, ocelli small, female frenulum double, frons planoconvex, wing span 14 - 18 mm (both sexes). Venation fig. 30. Female semi-apterous. (Slide 96)

MALE GENITALIA (Fig. 119): As for generic description except for the following:

Arms of vinculum narrow, only $\frac{1}{2}$ as wide in profile as uncus is long. Saccus bluntly rounded apically, ventrally cupped below bases of valvae. Juxta (or anellus) a V-shaped plate bifurcating into a pair of horns lateral to aedoeagus, strong, curving dorsad and introrse, then extrorse beyond a medial swollen region. Costa of valve poorly developed, dorsal margin about 3x uncus. Valve about $\frac{1}{4}$ longer than aedoeagus. Uncus parallel-sided, fingerlike, curved ventrad with blunt apex. Gnathos elements fused only for apical $\frac{1}{2}$, tongue fingerlike, curved dorsad, slightly shorter than uncus. Aedoeagus sigmoid, about $2\frac{1}{2}$ - 3x uncus, length to median breadth ratio 6-7:1, strong in ventral midline for apical $\frac{1}{4}$ and terminating in short flattened spur, cornuti absent.

FEMALE GENITALIA (Fig. 200): As for generic description except for the following: Anal papillae coalescent, posterior apophyses longer than eighth tergite. Tergite not fused to ostium bursae, anterior apophyses $\frac{3}{4}$ posteriors. Eighth sternite absent. Ostiolar sclerites lateral, internal, but very weak. Ductus bursae $1\frac{3}{4}$ x anterior apophyses, weak, with lateral ostiolar sac at $\frac{1}{4}$ and smaller complementary swelling on opposite side of ductus; tapering abruptly at $\frac{1}{2}$, ductus seminalis joining at $\frac{1}{2}$. Corpus bursae asignate.

LARVA: Described by Hudson (1928) as follows: "moderately stout, cylindrical, wrinkled, very sluggish; rather greyish brown on the back, much lighter on the sides; the spots are minute blackish and obscure; the head brown."

HOST PLANTS: Lichens. Hudson (ibid) stated "It feeds beneath a light shelter of silk on lichen dust on rocks, living in a crevice, and issuing forth beneath its shelter to feed".

PUPA: Not described by Hudson.

DISTRIBUTION (Fig. 299): Known only from Stephen's Island and the Christchurch-Banks Peninsula area of the South Island of New Zealand. Adult flight period October to March, probably with two generations each year.

MATERIAL EXAMINED: 29 m. 2 f.

Christchurch: 1 m. (lectotype) DM; 1 m. (syntype) CM, 10.3.82, E. Meyrick.
Port Hills, Cant.: 1 m. 12.3.22, 1 m. 24.11.23, 4 m. 17.2.24; CM, S. Lindsay;
1 f. BLV, 2 m. 27.10.24, AM; 2 m. 31.1.25, DM; 14 m. IGB, 1 f. 30.11.30, CM;
1 m. 18.10.31, CM; S. Lindsay.

Stephen's I, Cook Strait: 2 m. 14-28.1.33, ED, E.S. Gourlay.

REMARKS: Shares with G.leucophthalma the ostiolar sac or pouch in the female ductus, but the juxta is more like that found in G.acerella or G.pedionoma.

Little variation in the specimens I have examined, except that the semi-apterous females have all the markings obscured to a dull smudgy greyish white on a darker ground colour. Meyrick (1883) noted that the female ran and jumped, but seemed incapable of flight.

Gadira acerella Walker

Gadira acerella Walker, 1866, List of the Specimens of lepidopterous Insects in the collection of the British Museum, London, 35, p. 1742.

* Botys mehanga Felder, 1875, ^{Felder and Kugenhofers} Reise ^{des} Novara, Lepidoptera, 5, pl. cxxxvii, fig. 27.

Cryptomima acerella Meyrick, 1883, Trans. N.Z. Inst., 15, p. 8.

* Synonymy from Bleszynski and Collins (1962).

Holotype m. in British Museum (Natural History), labelled "Auckland, N. Zeal. 60.73."

EXTERNAL CHARACTERS: Detailed specific description given by Meyrick (1883), coloured illustration by Hudson (1928, Plate XXII, fig. 29 f.) with abbreviated description. Eye nocturnal type, ocelli small, female frenulum triple, wing span 15 - 21 mm (both sexes). Venation, fig. 29. Easily separated from the other New Zealand species by its bright blue forewing markings. (Slide 97).

MALE GENITALIA (Fig. 116): As for generic and species group description except for the following: Arms of vinculum narrow, about $\frac{1}{2}$ as wide in profile as uncus is long. Saccus poorly developed, apically rounded, ventrally cupped below valve bases. Juxta (or anellus) a V-shaped plate bifurcating into pair of strongly differentiated setulose prongs curving extrorse and ventrad. Costa of valve poorly differentiated. Dorsal margin of costa about 3x uncus. Valve $\frac{1}{4}$ longer than aedoeagus. Uncus parallel-sided, fingerlike, sharply curved ventrad near apex. Gnathos tapered, pointed, about $\frac{3}{4}$ uncus, curved sharply dorsad. Aedoeagus tubular, with dilate apex, about $2\frac{3}{4}$ x uncus, length of median breadthratio about 8:1, strong from $\frac{1}{2}$ to anterior extremity, 10 - 12 rose thorn-shaped cornuti between apex and $\frac{1}{2}$.

FEMALE GENITALIA (Fig. 198): As for generic description except for the following: Anal papillae coalescent, posterior apophyses slightly curved, about $\frac{3}{4}$ anterior. Eighth tergite not fusing with ostium bursae. Eighth sternite absent. Pair or internal weak ostiolar sclerites visible in lateral walls of ostium bursae. Ductus bursae $4\frac{1}{2}$ x length of anterior apophyses, ductus seminalis joining at $\frac{1}{3}$,

ductus bursae swollen and pleated from $\frac{1}{3}$ to $\frac{2}{3}$. Ostium bursae a weak flattened funnel. Corpus bursae asignate.

LARVA: Not known, but probably a forest moss feeder.

HOST PLANT: Not known.

DISTRIBUTION (Fig. 297): Throughout bush and forest in the South Island of New Zealand, and in the North Island northwards to Auckland, and eastwards into Hawke Bay (at Puketitiri, T.H. Davies, in litt.). Recorded up to 3,600 ft. by Mr. J.S. Dugdale, but the majority of records indicate this to be essentially a lowland-subalpine forest species. Flight period October to February.

MATERIAL EXAMINED: 41 m. 5 f.

Dunedin: 1 m. FGC, 4.2.43, DM, G. Howes.

Dun Mountain, 2,000 ft.: 1 m. 1.1.24, ED, A. Philpott.

Flora Range, 3,000 ft.: 3 m. 14-24.1.22, ED, A. Philpott, 1 m. FGD, 22.2.46, DM, J.T. Salmon.

Governor's Bay, Cant.: 1 m. 15.10.22, CM, S. Lindsay.

Hoon Hay, Cant.: 2 m. 8.11.22, CM, 1 m. 21.11.23, ED, S. Lindsay.

Kaitawa: 2 m. 6.12.22, DM, E.F. Richardson.

Karori, Well.: 1 m. no date, ED, G.V. Hudson.

Kiwi Bush, Cant.: 3 m. 27.12.24, ED, W. Heighway.

Lake Luella: 1 f. 23.12.19, ED, G.V. Hudson.

Lake Rotoroa: 1 m. 7.1.28, ED, A. Philpott.

Mokoia Island, Lake Rotorua: 1 f. BMM, 18.2.64, FRI, J.S. Dugdale.

Mt. Cook: 1 m. 3.1.29, ED, A. Philpott.

Nelson: 1 m. 19.11.22, 1 m. 17.11.24, 1 m. 5.1.25, ED; 1 m. Feb. 1943, ED, E.E. Walker; 1 m. 1 f. 24.11.43, ED, E.S. Gourlay.

Palmerston North: 1 m. 5.1.67, GC, 1 m. 28.11.67, GC; D.E. Gaskin.

Pelorus Bridge: 1 m. Nov. 1967, GC, D.E. Gaskin.

Port Hills, Cant.: 1 m. Nov. 1919, CM, S. Lindsay; 1 m. 17.2.24, ED, S. Lindsay; 1 m. 1 f. 27.10.24, ED, S. Lindsay.

Portobello: 1 f. IGH, 20.11.39, DM, G. Howes.

Pukeatua: 2 m. 7-14.1.28, CM, S. Lindsay.

Speargrass Creek, 3,600 ft. Nel.: 1 m. BML, 6.2.64, FRI, J.S. Dugdale.

Thompson's Bush, Invercargill: 1 m. 21.1.08, ED, G.V. Hudson.

Tisbury: 1 m. 16.1.12, ED, A. Philpott.

Waiho Gorge: 2 m. 22-29.1.27, DM, E.F. Richardson.

Wellington: 1 m. no date, ED, G.V. Hudson.

West Plains: 1 m. no date, DM, G. Howes; 2 m. no date, ED, A. Philpott.

Whiterock, Cant.: 1 m. Nov. 1919, CM, S. Lindsay.

REMARKS: Fairly close on male characters to the Australian G.pedionoma (Meyrick). I have not personally examined a female pedionoma, but the figure by Koch (1965, 7c) shows the ostium bursae more sclerotized and the ductus bursae shorter than in acerella. The two species share the same simple bifurcate juxta/anellus. These two species are in turn fairly close to G.grammella (Zeller) and G.panselenella (Meyrick). I am not yet entirely satisfied with the arrangement of these species relative to one another, and the present species group scheme must be regarded as provisional only.

G.acerella shows little consistent variation. The intensity of the blue markings vary from specimen to specimen, and there is similar variation in the strength of the white stigma.

Gadira pedionoma (Meyrick) comb.nov.

Thinasotia (sic) pedionoma Meyrick, 1885, Trans. ent. Soc. Lond., 1885, p. 453.

Hednota pedionoma (Meyrick) Bleszynski and Collins, 1962, Acta zool. cracov. 7, p. 316.

Lectotype m. (L.E. Koch) and 7 syntypes in British Museum (Natural History), labelled "Thinasotia pedionoma Meyrick, Bathurst N.S. Wales, grass, 15/4/79". Slide BM pyral 3971.

Type not checked. Examination based on a male from the Australian National Museum Collection at Entomology Division CSIRO, Canberra, labelled "Black Mt A.C.T. light trap, 6 Apr. 1965, I.F.B. Common", determined by I.F.B. Common.

EXTERNAL CHARACTERS: Detailed description by Meyrick (1885). Eye nocturnal type, ocelli small, frons with a bluntly conical protuberance, wing span about 24 mm (male). Female not examined. (Slide 98).

MALE GENITALIA (Fig. 118): As for generic description except for the following: Arms of vinculum narrow, about one third as wide in profile as uncus is long. Saccus poorly developed, apically rounded, ventrally cupped. Juxta (or anellus) a V-shaped plate with pair of slender tapering lateral horns each side of

aedoeagus, with outer faces setulose, curving extrorse. Costa of valve poorly differentiated, ventral margin of valve curved introrse, sacculus not developed. Uncus and gnathos equal in length, tapering, bluntly pointed, uncus curved ventrad, gnathos dorsad. Aedoeagus tubular, $2 - 2\frac{1}{2}x$ uncus, length to median breadth ratio 6-7:1, with large number (c.50) rose thorn-shaped elongate cornuti between apex and $\frac{1}{2}$.

FEMALE GENITALIA: Not examined. Brief description by Koch (1965), also figured by same author (fig. 7c).

LARVA: See Koch (1965).

PUPA: Cremaster figured by Koch (1965).

HOST PLANT: See Koch (1965).

DISTRIBUTION: Canberra, also New South Wales, Victoria, South Australia and Tasmania (Turner, 1904; Bleszynski and Collins, 1962). Western Australia (Koch, 1965). Flight period only confirmed from specimen examined as April, but probably throughout summer.

MATERIAL EXAMINED: 1 m.

Black Mountain, Canberra A.C.T.: 1 m. 6.4.65, ANIC, I.F.B. Common.

REMARKS: Fairly close to G.acerella, but shows greater elaboration and organisation of the cornuti in the aedoeagus.

Species Group 3.

Includes at present four apparently closely related Australian species, G.ancylosticha, G.longipalpella, G.panteucha and G.pleniferella. The saccus is constricted from the arms of the vinculum as in Group 2, but Group 3 species are characterised by the presence of a single huge compound polyfurcate cornutus in the aedoeagus. Juxta/anellus a V-shaped structure with one pair of horns as in Group 2. G.ancylosticha and G.panteucha are described and figured by Koch (1965), and are not further considered in this study.

Gadira longipalpella (Meyrick) comb.nov.

? Eromene longipalpella Meyrick, 1879, Proc. linn. Soc. N.S. Wales, 3, p. 196.

Hednota longipalpella (Meyrick) Bleszynski and Collins, 1962, Acta zool. cracov. 7, p. 315.

Lectotype f. (L.E. Koch) in British Museum (Natural History), labelled "Eromene longipalpella Meyrick f. Melbourne, Victoria G.H.R. 178".

Type not checked, Examination based on a specimen from the Australian National Museum Collection, Canberra, determined by I.F.B. Common, labelled "Black Mt. A.C.T. light trap, 1 Apr. 1960, I.F.B. Common." (Slide 99).

EXTERNAL CHARACTERS: Detailed description by Meyrick (1879). This species bears a remarkable superficial resemblance to the genus Euchromius Gn (formerly Eromene Hbn praeoc.), but shares with G.pleniferella the peculiar polyfurcate cornutus of this species group. Eye nocturnal type, ocelli small, frons with conical protuberance, wing span about 23 mm. Female not examined.

MALE GENITALIA (Fig. 123): As for generic description except for the following: Arms of vinculum narrow, only about $\frac{1}{2}$ as wide in profile as uncus is long. Saccus slightly developed anteriorly, apically rounded, ventrally cupped below bases of valvae. Juxta (or anellus) a deeply cleft V-shaped plate bifurcating into a pair of strong slender elongate horns ventro-lateral to aedoeagus. Costa of valve developed apically into a prong about $\frac{3}{4}$ uncus. Ventral margin of valve curved weakly introrse, sacculus not developed. Uncus and gnathos equal in length, tapered and pointed, slightly curved. Aedoeagus strongly curved ventrad, about 3x uncus, length to median breadth ratio $8\frac{1}{2}:1$, with single huge apically polyfurcate cornutus.

FEMALE GENITALIA: Not examined. Described briefly and figured by Koch (1965, fig. 78).

LARVA: See Koch (1965).

PUPA: See Koch (1965).

HOST PLANTS: Hordeum spp., Vulpina spp., Bromus spp.

DISTRIBUTION: Canberra, also Queensland and Victoria (Bleszynski and Collins, 1962). New South Wales, South Australia and Western Australia (Koch, 1965). Flight period April and probably throughout the summer months.

MATERIAL EXAMINED: 1 m.

Black Mountain, A.C.T.: 1 m, 1.4.60, ANIC, I.F.B. Common.

REMARKS: Very close to G.pleniferella on male genitalial characters. The following life history is summarised from Koch (1965). This species, in company with G.panteucha (Meyr.) makes large bare patches in pasture in south western Australia by feeding on fresh blades of grass from late autumn to early spring, attacking the species listed above. There is only one generation per year. Moths fly and lay eggs in the autumn, mostly in April. Larvae feed from within individual vertical tubes and burrows. Between August and early October the final instar larvae deepen their burrows in the soil and remain until March of the next year. They pupate and emerge in a few weeks. G.panteucha is the predominant species.

Gadira pleniferella (Walker) comb.nov.

Crambus pleniferellus Walker, 1863, List of the Specimens of lepidopterous Insects in the collection of the British Museum, London, 27, p. 173.

* Crambus aurosus Felder, 1875, Reise Nov. Lep., pl. cxxxvii, fig. 31.

* Synonymy from Bleszynski and Collins (1962).

Type not checked. Examinations based on a male and a female from the National Museum of Victoria Collection, Melbourne, labelled "Ringwood V.28.2.20 L.B.T." determined by A.Neboiss, and a further male compared with these from the collection of the Entomology Division, Nelson, New Zealand.

EXTERNAL CHARACTERS: Short description by Walker, 1863. The species is easily recognised by brownish forewings with bright metallic yellowish markings, without continuous median fascia. Figured by Common (1963, fig. 186). Eye nocturnal type, ocelli small, frons planoconvex, male frenulum single, female frenulum triple, wing span 25 - 30 mm (both sexes). (Slide 100).

MALE GENITALIA (Fig. 124): As for generic description except for the following: Arms of vinculum with constriction at $\frac{1}{2}$, at costal margin about $\frac{3}{4}$ as wide as uncus is long. Saccus moderately developed apically, rounded, ventrally cupped below bases of valvae. Juxta (or anellus) a V-shaped plate bifurcating into pair of horns lateral to aedoeagus and directed dorso-caudad. Costa of valve developed posteriorly into apical prong longer than uncus. Ventral margin of valve curved strongly introrse, but sacculus not developed. Uncus and gnathos slightly curved ventrad and dorsad respectively. Aedoeagus apically dilate, $3\frac{1}{2}$ - 4x uncus, length to median breadth ratio about 8:1, with one very large polyfurcate cornutus.

FEMALE GENITALIA (Fig. 201): As for generic description except for the following: Anal papillae coalescent, posterior apophyses straight, about equal to length of eighth tergite. Eighth tergite margins free ventrally but not antero-ventrally, anterior apophyses $\frac{3}{4}$ posteriors. Antero-ventrally the eighth tergite fuses with pair of ventro-lateral ostiolar sclerites which curve introrse into mouth of ostium bursae to lie partly internally in walls. Ventral lip of ostium is formed by a strong lodicular fold of the posterior margin of the seventh sternite. Eighth sternite absent. Ductus bursae very short, barely equal to length of anterior apophyses, ductus seminalis joining very close to mouth of ostium just anterior to sclerite fusion, but ventrally. Corpus bursae relatively huge, elongate, with walls scobinate, asignate.

LARVA: Not known.

HOST PLANT: Not known.

DISTRIBUTION: Queensland, New South Wales, Victoria, Tasmania (Bleszynski and Collins, 1962). Flight period February and March.

MATERIAL EXAMINED: 2 m. 1 f.

Ringwood, Vic.: 1 m. 1 f. 28.2.20, NMVC, L.B.T.

Sydney, N.S.W.: 1 m. 9.3.12, "173", no captor, EDNZ.

REMARKS: Shares with G.longipalpella the extraordinary polyfurcate cornutus in the aedoeagus. No very close relationship with any other species so far examined, except G.ancylosticha (Koch), and G.panteucha (Meyrick).

Species Group 4.

Contains three species, G.crypsichroa, and G.haplotypa from Australia, and G.leucophthalma found in eastern Australia and eastern New Zealand.

Characterised by 4 lobed juxta/anellus. (See fig.8).

Gadira crypsichroa Lower comb.nov.

Hednota crypsichroa Lower, 1893, Trans. roy. Soc. S. Austral. 17, p. 166.

* Prosmixis discilunalis Hampson, 1919, Ann. Mag. nat. Hist., 3, p. 147.

* Synonymy from Bleszynski and Collins, 1962.

Lectotype (L.E. Koch) in South Australian Museum, labelled "Parkside", "Type", "Lower Coll."

Type not checked. Examination based on a male from the Australian National Museum Collection, Canberra, determined by I.F.B. Common, labelled "Black Mt. A.C.T. light trap, 12 Mar. 1965, I.F.B. Common".

EXTERNAL DESCRIPTION: Detailed description given by Lower (1893). Similar in general appearance to pedionoma, but nearly plain brown. Eye nocturnal type, ocelli small, frons with conical protuberance, wing span about 25 mm (male), female not examined.

MALE GENITALIA (Fig. 126): Arms of vinculum very narrow, barely $\frac{1}{8}$ as wide in profile as uncus is long. Saccus poorly developed, apically rounded, ventrally cupped below bases of valvae. Juxta/anellus a very complex structure; having a strong curved basal "stalk" (possibly modified juxta) bifurcating into pair of huge sickle-shaped horns curving caudad lateral to aedoeagus. From their fused bases arise a second pair, ventro-lateral to aedoeagus, which are elongate, setulose and apically truncate. Costa of valve poorly differentiated, ventral margin of valve curving deeply introrse but sacculus not developed. Valve $\frac{1}{4}$ longer than aedoeagus. Uncus equal to gnathos, tapered, slightly curved

ventrad, bluntly pointed. Gnathos tapered, straight from base to $\frac{1}{2}$, with apical $\frac{1}{2}$ angled sharply dorsad, apically truncate. Aedoeagus about $2\frac{1}{2}x$ uncus, length to median breadth ratio about 6:1, curved ventrad, with single simple cornutus.

FEMALE GENITALIA: Not examined. Described and figured by Koch (1965, fig. 7D).

LARVA: See Koch (1965).

PUPA: Cremaster figured by Koch (1965).

HOST PLANT: See Koch (1965).

DISTRIBUTION: Victoria and South Australia (Bleszynski and Collins, 1962). Western Australia, New South Wales, A.C.T. (Koch, 1965). Flight period March, probably other months also.

MATERIAL EXAMINED: 1 m.

Black Mountain, A.C.T.: 1 m. 12.3.65, ANIC, I.F.B. Common.

REMARKS: See remarks section on H.haplotypa.

Gadira haplotypa. (Turner) comb.nov.

Talis haplotypa Turner, 1904, Proc. roy. Soc. Queensl. 18, p. 177.

Hednota haplotypa (Turner), Bleszynski and Collins, 1962, Acta zool. cracov. 7, p. 315.

Type not checked. Examination based on a male from the Entomology Division Collection, Nelson N.Z. compared with Turner's description, labelled "Glen Innes N.S.W. 23.3.13, 145." (Slide 101).

EXTERNAL CHARACTERS: Short description by Turner (1904). Superficially very like a specimen of Orocrambus horistes (Meyr.) and even more like a very large specimen of O.jansoni sp.nov., with a yellowish tinge to the median forewing fascia, and a dark costa and subcosta on the forewings. Eye nocturnal type, ocelli small, frons planoconvex, wing span about 27 mm (male). Female not examined.

MALE GENITALIA (Fig. 127): Vinculum narrow, about $\frac{1}{2}$ as wide in profile as uncus is long. Saccus slightly developed, apically rounded, ventrally cupped below

bases of valvae. Juxta/anellus a complex structure, composed of a small basal "stalk" (possibly the juxta) constricted from a V-shaped area posterior to it which bifurcates dorso-caudally into a pair of huge sickle-shaped horns curving caudad each side of the aedoeagus. Also from the V-shaped region, but ventro-lateral to aedoeagus, arise a second pair of horns, these slightly curved, apically truncate, and thinly setulose. Costa of valve hardly differentiated, ventral margin of valve curved deeply introrse, sacculus not developed. Valve about $\frac{7}{8}$ aedoeagus. Uncus slightly longer than gnathos, tapered, pointed, curved ventrad. Gnathos tapered, pointed, curved dorsad. Aedoeagus curved strongly ventrad, 4x uncus, length to median breadth ratio 9-10:1, with single elongate cornutus.

FEMALE GENITALIA: Not examined.

LARVA: Not known.

HOST PLANT: Not known.

DISTRIBUTION: New South Wales (Turner, 1904). Flies in March and probably other months also.

MATERIAL EXAMINED: 1 m.

Glen Innes, N.S.W.: 1 m. 23.3.13, EDNZ, "145", no captor.

REMARKS: Has very complex juxta/anellus structure. However in other male genitalial characters, for example the structure of the vinculum/saccus, this species closely resembles others such as leucophthalma and pedionoma which I have transferred to Gadira. I consider the elaborate juxta/anellus to be a development from the simple quadri-horned form seen in leucophthalma, but I have not yet examined a species showing a condition exactly intermediate between haplotypa and leucophthalma.

The complexity of juxta/anellus is also found in H.crypsichroa.

Gadira leucophthalma (Meyrick) comb.nov.

Thinasotia leucophthalma Meyrick, 1882, New Zealand Journal of Science (Dunedin), 1, p. 186.

(misspelling of Thisanotia Hübner)

Thinasotia leucophthalma Meyrick, 1883, Trans. N.Z. Inst., 15, p. 7.

(misspelling of Thisanotia Hübner)

Talis leucophthalma (Meyrick), Meyrick, 1912, Trans. N.Z. Inst., 45, p. 35.

Hednota leucophthalma (Meyrick), Bleszynski and Collins, 1962, Acta zool. cracov. 7, p. 315.

Lectotype m. (Dr. S. Bleszynski) in British Museum (Natural History), labelled "Christchurch New Zealand 10/3/82."

EXTERNAL CHARACTERS: Detailed description by Meyrick (1883) coloured illustration by Hudson (1928, Plate XXI, fig. 35 m.) with abbreviated description.

Eye nocturnal type, ocelli small, frons planoconvex, female frenulum triple, wing span 23 - 26 mm (both sexes). Venation, fig. 31. (Slide 102).

MALE GENITALIA (Fig. 117): As for generic and species group description except for the following: Arms of vinculum narrow, about $\frac{1}{2}$ as wide in profile as uncus is long. Saccus poorly developed, apically rounded, cupped ventrally below bases of valvae. Juxta a V-shaped plate doubly bifurcate into pair of long dorso-lateral horns and a pair of shorter ventro-lateral horns around the aedoeagus, strong, and curving slightly extrorse. Costa of valve moderately developed, with sharp triangular dorsal projection at $\frac{1}{2}$, but without apical separation from rest of valve. Valve about $\frac{1}{8}$ longer than aedoeagus. Uncus tapered, pointed, curved ventrad. Gnathos tapered, pointed, curved dorsad, with elements fused for apical $\frac{1}{2}$ only, nearly equal to uncus. Aedoeagus tubular, apically dilate, about $3\frac{1}{2}$ x uncus, length to median breadth ratio about 7-8:1, moderately strong from $\frac{2}{3}$ to anterior extremity with ring of thickening at $\frac{2}{3}$, with group of minute cornuti near apex.

FEMALE GENITALIA (Fig. 199): As for generic description except for the following: Anal papillae coalescent, posterior apophyses slightly curved.

Eighth tergite not fused to ostium bursae, margins free in ventral midline, anterior apophyses sigmoid, with swelling near $\frac{1}{2}$, $\frac{3}{4}$ posteriors. Ostiolar sclerites ~~internal~~, lateral, very weak. Ductus bursae weak, $2\frac{1}{2}$ x length of anterior apophyses, with ostiolar pouch or swelling at $\frac{1}{4}$, ductus seminalis joining at $\frac{1}{2}$. Ostium bursae a very weakly sclerotised flattened funnel, corpus bursae asignate.

LARVA: Not known.

HOST PLANT: Not known.

DISTRIBUTION (Fig. 298): In New Zealand restricted to eastern central regions of the South Island. In Australia in Queensland and Victoria (Bleszynski and Collins, 1962). Flight period in New Zealand November to April.

MATERIAL EXAMINED: 26 m. 1 f.

Birdling's Flat, Cant.: 6 m. 3.3.29, CM, 4 m. IGK, IGJ, 1 f. FGH, DM, 5 m. CM, 25.2.34, S. Lindsay.

Christchurch: 3 m. no date, CM, R.W. Fereday.

Claverley: 1 m. 3.1.33, CM, S. Lindsay.

Hoon Hay, Cant.: 1 m. Mar. 1918, DM, S. Lindsay; 1 m. 8.3.23, CM, S. Lindsay.

Mt. Grey, Cant.: 1 m. Nov. 1917, 2 m. 7-9.4.28, CM, S. Lindsay.

Port Hills, Cant.: 1 m. Mar. 1919, CM, S. Lindsay.

Waiau: 1 m. 20.11.29, CM, S. Lindsay.

REMARKS: This species is congeneric with G.acerella, sharing with it the same ventrally cupped saccus and bifurcate juxta. However in leucophthalma the juxta shows somewhat greater elaboration with both dorso-lateral and ventro-lateral horns present. This particular development has reached a much greater degree of elaboration in the Australian species crypsichroa and haplotypa.

Paragadira gen.nov.

(monotypic)

Type species: Argyria strophea Meyrick, 1905, Trans. ent. Soc. Lond., 1905, p. 226.

DIAGNOSIS: Labial palpi elongate, porrected, maxillary palpi triangular.

Antennae ciliate in male. Forewings with r_5 free, r_4 stalked with r_3 , r_1 not coincident with Sc. Frenulum single in male, double in female. Hindwings with m_2 , m_3 having bases approximated, hindwing discal cell closed (fig. 33).

In male genitalia: the arms of the vinculum are narrow in profile, the saccus developed anteriorly into a short blunt fingerlike elongation, the juxta is an elongate plate tapering dorsally. The costa of the valve is hardly differentiated, but bears about a dozen very strong setae. The valve is rounded, oblate, with no strong cocullus development, and without differentiation of the sacculus. Basal pseudosaccus not developed. Uncus tapered, pointed, straight. Gnathos $\frac{3}{4}$ uncus, very broad and quadrate, with the pair of posterior angles each pairing three strong broad spines. Aedoeagus sigmoid, $1\frac{3}{4}$ x uncus, length to median breadth ratio about 4-5:1, without cornuti, and with the apical region deeply bifurcate into a pair of horns extending beyond caudal aperture of ductus, having sclerotised short spines at their tips. In female genitalia: Anal papillae coalescent, posterior apophyses very elongate, slightly curved, slightly longer than anteriors. Eighth tergite not fused to ostium bursae. Eighth sternite absent. Pair of lateral ostiolar sclerites present, each large, oval densely and shortly setulose, partially fused in midline to form a heart shaped plate lying in intersegmental membrane caudad to ostium. Their antero-lateral margins curve introrse to lie partially within the mouth of the ostium bursae. Ventral lip of ostium strong, crescentic, derived either from lodicular modification of posterior margin of seventh sternite or from extensions of ostiolar sclerite extremities. Ductus bursae weak, 3x length of anterior apophyses, ostiolar pouch region swelling not present, ductus seminalis joining at $\frac{1}{2}$. Corpus bursae with single long narrow transverse crescentic signum.

COMMENTS: Paragadira differs from Gadira and Hednota in having a quadrate

spined gnathos and very thick strong costal spines on the valvae in the male, and a heart-shaped pair of very large ostiolar sclerites, densely and shortly setulose, in the female. One species only, P.strophea. The position of this unusual monotypic genus may be clarified further when more of the lesser known tropical Australian and Pacific Island Crambinae are revised. Within New Zealand the single species has a strong northern bias not indicative of over-water dispersal from eastern Australia, as in the case of Gadira leucophthalma, but more suggestive of Melanesian Arc origin.

Paragadira strophea (Meyrick) comb.nov.

Argyria strophea Meyrick, 1905, Trans. ent. Soc. Lond., 1905, p. 226.

Lectotype m. (author's selected on advice of P.E.S. Whalley) and two syntypes in British Museum (Natural History) labelled "Wellington New Zealand GVH. 1904", also 1 syntype labelled as above but "1896" and 3 labelled "1903".

EXTERNAL CHARACTERS: Detailed description by Meyrick (1905), coloured illustration by Hudson (1928, Plate XIX, fig. 19 f.) with abbreviated description. Eye nocturnal type, ocelli small, frons planoconvex, female frenulum double, wing span 12 - 16 mm (both sexes). Venation, fig. 33. Recognisable by the lustrous greenish yellow forewing colour with whitish transverse lines. (Slide 103).

MALE GENITALIA (Fig. 128): As for generic description.

FEMALE GENITALIA (Fig. 202): As for generic description.

LARVA: Not known.

HOST PLANT: Not known.

DISTRIBUTION (Fig. 300): North Island of New Zealand, and at one South Island locality in the Nelson Province. Apart from the localities given below it has been taken at Haruru Falls (Bay of Islands), Lake Taupo, Bluff Hill (Napier) and is common at Lake Rotorua; (T.H. Davies, in litt.). Flight period December to February.

MATERIAL EXAMINED: 4 m. 5 f.

Coromandel: 1 f. BME, 16.2.34, AM, C.E. Clarke

Hikurangi: 1 f. Jan. 1936, CM, E. Fairburn.

Karori, Well.: 1 f. Jan. 1884, DM, G.V. Hudson.

Matakitaki Valley, Westl.: 1 f. 29.12.38, CM, S. Lindsay.

New Lynn: 1 m. 13.11.54, DM, no captor rec.

Raurimu: 1 f. BLY, 16.1.19, AM, C.E. Clarke.

Silverstream: 1 m. 29.1.02, DM, G.V. Hudson.

Wainuiomata: 1 m. Dec. 1912, 1 m. FGF, 25.12.13, DM, G.V. Hudson.

REMARKS: See comments section below generic diagnosis.

Genus Protyparcha Meyrick.

(monotypic)

Protyparcha Meyrick, 1909, Subantarctic Islands of New Zealand, p. 71.Type species: Protyparcha scaphodes Meyrick, 1909.Exsilirarcha Salmon and Bradley, 1956, Rec. Dom. Mus. Wellington, 3: p. 73.

(monotypic)

Type species: Exsilirarcha graminea Salmon and Bradley, 1956.

DIAGNOSIS: Antennae in male unpectinated. Thorax, coxae with longer hair-like scales ventrally. Forewings with r_5 free, r_4 stalked with r_3 . Male frenulum single. In hindwings m_2 , m_3 with bases very closely approximated, hindwing discal cell partially closed (fig. 34). Fore and hindwing venation greatly reduced in P.graminea (fig. 35.). Frons planoconvex, labial palpi elongate, with long hair-like scales ventrally, maxillary palpi triangular, erect. Eye nocturnal type, ocelli small. In male genitalia: Arms of vinculum narrow, about third as wide in profile as uncus is long. Saccus apically rounded, developed ventrally into a flange. Juxta long, tapering. Tegumen having translucent "window" immediately anterior to gnathos base, most pronounced in graminea. Posterior margin of tegumen strongly developed, separate from rest of tergite medially but fusing at junction with vinculum and near base of gnathos. Valve oblate, rounded, with costa barely differentiated, and sacculus not differentiated. Valve about equal in length to aedoeagus. Uncus fingerlike, tapered slightly, curved ventrad, with rounded apex. Gnathos equal to uncus, curved slightly dorsad, apically pointed. Aedoeagus strong with elongate tube-like anellar ring of thickening in scaphodes, weak apical area in graminea, total aedoeagal length about 2 - 3x uncus, length to median breadth ratio 8-9:1. No cornuti. In female genitalia: Anal papillae coalescent, posterior apophyses about $\frac{3}{4}$ anterior, slightly curved. Eighth abdominal tergite not fused with ostium bursae, anterior apophyses with swelling in posterior $\frac{1}{3}$. Eighth abdominal sternite absent. Ductus bursae weak, with slight trace of lateral ostiolar sclerites in scaphodes, no trace in graminea,

about twice anterior apophyses, with ductus seminalis joining at about $\frac{1}{3}$.

Corpus bursae asignate.

COMMENTS: I synonymise Exsilirarcha with Protyparcha on the strength of the shared characters in both male and female genitalia. The female is apterous in both species.

Protyparcha scaphodes Meyrick.

Protyparcha scaphodes Meyrick, 1909, in: The Subantarctic Islands of New Zealand, p. 71.

Lectotype m. in Canterbury Museum, author's genit. prep. IGI, labelled "Auckland Is. C.P.I. Sub. Ant. Exped. 1907, Protyparcha scaphodes. Hudson. Paratype. 7"

EXTERNAL CHARACTERS: Detailed description by Meyrick (1909), coloured illustration by Hudson (1928, Plate XX, fig. 40 m.) with abbreviated description. Venation, fig. 34. Other characters as in generic diagnosis. Female apterous. (Slide 104).

MALE GENITALIA: (Fig. 129): As for generic diagnosis.

FEMALE GENITALIA (Fig. 203): As for generic diagnosis.

LARVA: Not known.

HOST PLANT: Not known.

DISTRIBUTION: Auckland Islands, in tussock grass areas (Hudson, 1928).

Flies in November, during hot sunshine (Hudson, *ibid.*)

MATERIAL EXAMINED: 1 m. 1 f.

Auckland Island: 1 m. (lectotype) CM, C.P.I. Sub. Ant. Exped. Nov. 1907;
1 f. (Ranui Cove) 30 Dec. 1962, J.L. Gressitt.

REMARKS: I have selected a Canterbury Museum specimen as the lectotype, as 3 specimens in the British Museum collection, obviously from the original series, have been mislabelled "Kermadec Is. GVH.08" by Meyrick. Mr, P.E.S. Whalley informs me that Meyrick made the same mistake with Scoparia parmifera Meyr. also described from the Auckland Islands.

COMMENTS: For a detailed discussion on the systematic position of this genus see pp. 39-41 .

Protyparcha graminea (Salmon and Bradley) comb.nov.

Exsilirarcha graminea, Salmon and Bradley, 1956, Rec. Dom. Mus., Wellington, pp. 61-81.

Holotype m. and allotype f, together with a series of paratypes in the Dominion Museum, Wellington; a series of 4 paratypes in the Canterbury Museum, Christchurch; and a series of 14 paratypes in the British Museum (Natural History). Wings and genitalia of four male paratypes and female allotype on slides 5/104, 5/105, 5/106 (genitalia), 5/108 (wings and genitalia) and 5/107 (female genitalia) in Dominion Museum. Campbell Island.

EXTERNAL CHARACTERS: Detailed description by Salmon and Bradley (1956), male holotype and female paratype figured by these authors (figs. 24, 27). Wing span 18 - 20 mm (male) 12 mm (female). Other characters from Salmon and Bradley, 1956: "Branchypterous forms with the forewings long and narrow, pointed and tufted apically; the hindwings broad near the base, attenuated towards the apex; head loosely haired, a prominent tuft behind each antenna; face rounded, lateral ocellus well developed; tongue present; labial palpi porrected, entirely clothed with long projecting hairs which obscure the segments; maxillary palpi short, porrected and clothed with projecting scale-like hairs; antennae, in male, finely uniserrate and clothed with short, fine projecting, silvery hairs; in the female, filiform and heavily clothed with short, fine golden hairs; thorax with both hairs and scales, patagium well developed; femur broadened, clothed with both hairs and scales; middle tibia with a pair of apical and subapical spurs, the inner spur always the longer; fore tibia without spurs; wing venation unstable and of little diagnostic use, the forewings with M_2 , M_3 and Cu_1 probably coincident, r_3 and r_4 stalked, r_5 and m_1 stalked or separate, others variable or missing; hindwings similarly with m_2 , m_3 and Cu_1 coincident, m_1 free, Rs to costa and anastomosing with $Sc + r_1$, others missing." In the above diagnosis venation terminology has been adapted from the English System used by Salmon and Bradley, which has since fallen into disuse. Venation figured of paratype male (fig. 35). (Slide 105).

MALE GENITALIA (Fig. 130): Also figured in photograph by Salmon and Bradley

(1956, fig. 25), and a drawing by Munroe (1964). Vinculum very narrow, only about $\frac{1}{3}$ as wide in profile as uncus is long. Saccus barely developed, with rounded apex. Juxta a tapering elongate plate, slightly bifurcate dorsally. Costa of valve barely differentiated. Sacculus not developed. Valve slightly longer than aedoeagus. Tegumen with dorso-lateral windowed areas immediately anterior to gnathos base. Uncus and gnathos equal in length, tapering, nearly straight, with rounded apices. Aedoeagus curved slightly ventrad, about 3x uncus, length to median breadth ratio 8-9:1; strong except for weak subapical area, without cornuti.

FEMALE GENITALIA (Fig. 204): Also shown in photograph by Salmon and Bradley (1956) and in drawing by Munroe (1964). As in generic diagnosis.

LARVA: Not described, but bred out at least to prepupal stage (Munroe, 1964).

HOST PLANT: Poa litorosa, subantarctic tussock (Salmon and Bradley, 1956).

DISTRIBUTION: Campbell and Auckland Islands (Salmon and Bradley, *ibid.*)

Flight period August to October.

MATERIAL EXAMINED: 1 m. 1 f. and type slides.

Campbell Island: 1 m. 1 f. (paratypes), Sept. 1942, J.H. Sorensen.

REMARKS: For comments on the systematics, see pp. 39-41. Mr. J.H. Sorensen (in Salmon and Bradley) noted that the moths leap with great agility among the tussock grass, and in September are present literally in swarms. When touched they at once fall to earth and feign death for a few minutes.

WESTERN SOUTH PACIFIC BIOGEOGRAPHY,
WITH SPECIAL REFERENCE TO NEW ZEALAND.

INTRODUCTION

The systematics of New Zealand taxa can only be meaningfully discussed within a biogeographical framework. A study of the origins and relationships of any section of the New Zealand biota must include two basic considerations: Firstly, real floristic and faunistic affinities must be distinguished from those which are merely apparent. Secondly, even when these affinities have been established it is still necessary to demonstrate how the taxa in question came to be assembled in New Zealand. Postulated dispersal routes must not be at odds with the best available geological evidence, and suggested dispersal mechanisms and patterns must be compatible with the known biological characteristics of the organisms.

The search for true evolutionary relationships within a group should be guided by the scheme of phylogenetic reasoning devised by Hennig (1957; 1960; 1965). This method is of such basic importance in systematic work that Brundin (1965) proposed that it should be called "Hennig's Principle". Hennig stated that unassailable reconstruction of the history of phyletic groups could only be carried out through a detailed study of apomorphic (derived) and plesiomorphic (relatively primitive) characters, and that only a pattern of apomorphic characters indicating a true line of descent could be used to link sister species. In essence, Hennig's methods are relative; so that species A is shown to be more closely

related to species B than to species C. The same principle is just as valid when applied to higher phyletic units. Hennig clearly demonstrated that common possession of generalised primitiveness in two groups cannot be cited as evidence of common ancestry. In fact he also showed that no phyletic unit of any size can be regarded as completely primitive. Even relatively primitive species or groups always have at least one apomorphic character.*

Where dispersal routes are concerned it is very important to realise that the present New Zealand flora and fauna cannot be attributed to any single source (Fleming, 1962). Within the limits of our present knowledge of the New Zealand biota, and much of it remains to be examined with modern systematic methods, we can roughly divide the taxa into five loose groupings. There is a strong Malayo-Pacific element, a relatively small archaic endemic element, some holarctic/cosmopolitan elements, a strong Australian element, though a disharmonic one often over-estimated in importance (Thorne, 1963), and a large heterogeneous southern element. Taxa in the latter category have arrived in New Zealand over a long period of geological time. Fleming (1963) has applied the term Palaeonotian to the archaic pre-Cretaceous arrivals and Neonotian to those which have arrived more recently. "Neonotian" is not a completely satisfactory term since it would be useful to distinguish between pre and post-Pleistocene arrivals in some groups. I suggest "Recent Element" as a suitable name for the latter.

Whether one considers one or several of these elements, serious problems are encountered when possible routes to New Zealand are studied. Movement of some taxa

* A full explanation of the method of operation of this scheme accompanies the phylogenetic figures (1-8) in vol. II

across large expanses of open ocean appear incompatible with the structure of their reproductive stages and the mechanisms of dispersal (van Steenis, 1963).

At present there are two main viewpoints on the processes of dispersal in the geological past which have led to the distributions of plants and animals we observe today. Some specialists, notably Gressitt (1961), Zimmerman (1963) and Thorne (1963) believe that present distribution patterns are largely explicable as the results of over-water dispersal. This is presumed to have taken place both directly by point to point drift in air and water currents and indirectly by movement along decaying island chains. However others working on taxa poorly adapted to such dispersal assert that direct land connections must have existed at some time in the past between continental land masses now widely separated. For example some botanists have stressed that land connections are necessary to explain the present distribution of angiosperm genera in the tropics (van Steenis, 1963) and in the southern temperate regions (Cranwell, 1963).

Rejection of one view is not really a necessary prerequisite for acceptance of the other. In some parts of the world there is evidence (Fleming, 1962, 1963) that both kinds of dispersal have taken place, with early pre-Tertiary land connections and later over-water dispersal.

While there are very real difficulties associated with explaining the dispersal of some tropical rain forest angiosperm groups across open sea, the pyralid fauna of Hawaii, for example is strongly disharmonic. It was apparently accumulated from both east and west (Zimmerman, 1958),

and this author assumed that ancestors of present forms had speciated on islands now lost beneath the sea. Conditions of change and flux were presumably suitable for rapid evolution leading to the remarkable degree of endemism now prevailing in the Hawaiian fauna. Gressitt (1961) noted that the flora and fauna of Micronesia became increasingly disharmonic as one moved from west to east away from the Asian land mass. This would be the expected pattern if the biota of the islands had been assembled through the random agency of over-water dispersal throughout a long period of geological time.

Van Steenis (1963) was reluctant to accept the idea of biotic dispersal along decaying island chains in the tropical Pacific. He argued that archipelagic links, broken and re-established from time to time, with the links of varying duration and efficacy, were much less sure postulatory vessels for animal and plant dispersal than direct and relatively enduring land connections. He suggested that a large land bridge must have existed from the "fractured continental area of Melanesia" eastward into the central Pacific, and with connections to Hawaii and Micronesia, to explain certain angiosperm distributions.

But regardless of the "necessities" for land bridges to help biogeographers out of their difficulties, modern palaeogeography has placed definite limitations on just what can and cannot be postulated for the central Pacific region (Menard and Hamilton, 1963). These authors regard the presence of large continental land masses in the area as quite out of the question since the middle Mesozoic and highly improbable even before this time.

These views are based on studies of a wide-spread planktonic flora and fauna which has left good fossil records (Durham, 1965; Menard and Hamilton, 1963). However they also point out that modern geological exploration in the region does support a history of decaying island chains since the Cretaceous, even though the general form of the whole Pacific basin appears to have been much the same in that period as it is today.

These considerations are all pertinent to a discussion of New Zealand biogeography, since this country is, after all, an archipelago now remote from any other major land mass. In the rest of this chapter I will discuss the evidence for dispersal routes which are implied by the apparent relationships of the major elements in the New Zealand biota listed earlier. In the following chapter I will then examine the relationships within the Crambinae to see whether they support or conflict with the ideas and evidence put forward.

AUSTRALIAN ELEMENTS IN THE NEW ZEALAND BIOTA

The present biota of Australia and New Zealand are very dissimilar; New Zealand and New Caledonia totally lack land snakes, marsupials and fossil records of land dinosaurs, which argues for complete separation from Australia at least back to the Jurassic. However the lepidosaurian Sphenodon has survived in New Zealand and nowhere else, and presumably must have fossil remains waiting to be discovered. It is interesting that Sphenodon has retained many of the primitive diapsid characters of the Upper Permian fossils in an almost unchanged condition. Since this seems to have

been the only reptile line to reach New Zealand, the separation of New Zealand and the proto-Australian land mass could have taken place as early as the Lower Triassic or Upper Permian.

In the New Zealand Upper Jurassic strata a very strong Tethyan element is present (Fleming, 1962), in contrast to endemic Triassic biota and austral affinities of the Cretaceous. The New Zealand geosyncline became progressively reduced from the Cretaceous onwards (Fleming, *ibid*), and this period must mark the very latest time at which direct southern or eastern Australia-New Zealand links could have existed.

In fact even a link in the lower Cretaceous must be doubted. Darlington (1965) thought that such a connection existed probably no later than the Carboniferous Period, if at all. With due allowance for theories of sial drift due to changes in the convection currents in the earth's mantle (Dearnley, 1965), there is really no evidence for a direct connection between southern Australia and southern New Zealand at any time. The floor of the southern Tasman Sea consists of a thin sediment layer over oceanic crust *sima* (Fleming, 1962), and it is very doubtful if any of it was ever above the surface of the sea. Burbidge (1960) pointed out anomalous monotypic angiosperm groups which could indicate post-Cretaceous links between Tasmania and New Zealand, but these must surely be classified as late or Neotian elements resulting from floatation or aerial over-Tasman dispersal by the West Wind Drift. Fleming (1962), concluded that elements in the New Zealand biota which clearly have close affinities with groups in southern and eastern Australia are almost always Neotian or Recent arrivals. McDowall (1964, 1966) found

that although fresh water Galaxiidae in New Zealand have close affinities with the Australian, found, a number of species now isolated in New Zealand have marine larvae and juveniles. **This suggests** that the family has had potential for trans-Oceanic dispersal for a long time.

Interestingly enough, although Brundin (1965, 1967) found strong indirect evidence for austral land connections through his studies of the Chironomid midges using Hennig's phylogenetic reasoning, his results gave no indication that Australia and New Zealand were ever joined. Similary Caughley (1964) in a review of the New Zealand vertebrate fauna concluded that it was the result of over-water dispersal from several sources to what has for a very long time been a large oceanic archipelago.

Thorne (1963) summarised work up to that time on relationships between the Australian and New Zealand biota. He concluded that the importance of Australian influence in the New Zealand biota had been exaggerated by some previous workers, since although eighty percent of New Zealand angiosperm and gymnosperm genera are also common to Australia, ninety percent of these also occur in regions beyond the two countries. Consequently the real size of the endemic Australia-New Zealand element is quite small. The absence in New Zealand of the dominant and characteristic Australian genera Eucalyptus and Acacia is obviously just as important a factor in any biogeographical discussion as the taxa which the countries have in common.

The bulk of the shared flora (and presumable the fauna) could have entered both Australia and New Zealand

through mutual northern links (van Balgooy, 1960). Obviously the next step in this discussion is to consider evidence for such migration from the north.

DISPERSAL OF INDO-MALAYAN ELEMENTS, THE
MELANESIAN ARCS, AND THE RELATIONSHIP OF
AUSTRALIA AND NEW GUINEA

There is reasonable geological evidence to suggest that island archipelagoes, and possibly complete land links, once existed between New Guinea and New Caledonia (Fleming, 1949). There is also good evidence (Gill, 1952) for the existence of substantial land mass which included Norfolk and Lord Howe Islands, parts of present-day New Caledonia and New Zealand, the Campbell Plateau, and that part of the Chatham Rise which is now the system of oceanic banks to the south of the Chatham Islands. This structure, which was actually the New Zealand Geanticline, and for which the name Tasmantis is in common use, is estimated to have existed at least 200 million years ago, perhaps reaching its maximum extent in the Triassic.

With due allowance for the difference in latitude there are notable similarities in the seed-plant floras of New Caledonia and New Zealand (van Balgooy, 1960; Dawson, 1963), with relict groups preserved in both islands.

Such biotic affinities as New Caledonia shares with Australia are with the coast of Queensland, and there are strong affinities between the flora and fauna of New Caledonia and those of New Guinea (Gressitt, 1956; 1961; Good, 1950; Thorne, 1963). A study of the angiosperm flora of the whole area (Burbidge, 1960) showed strong links between New Guinea,

New Caledonia and northern Queensland.

Nakata (1961), working on the Phasmatodea (Orthoptera), found that the New Guinea genera were related to those of the Indo-Malayan region, but not to those of Australia. He also found relationships between the New Caledonian and New Zealand groups, both also initially derived from the Indo-Malayan region. However Common (1960) found considerable affinities between the Schoenobine stem borers (Lepidoptera: Pyralidae) of New Guinea and those of Northern Territory and northern Queensland. It is thus pertinent to examine in more detail what is known of the relationship between New Guinea and Australia.

Like New Zealand, New Guinea went through considerable geological activity during the Tertiary. While the alpine biota of New Zealand is extensive, although young (Fleming, 1963a), the alpine fauna of New Guinea is negligible (Gressitt, 1961), indicating an even more youthful state. The present fauna of subalpine New Guinea can largely be assumed to have been derived from tropical lowland groups (Gressitt, *ibid.*), though probably not from the regions which are now the lowlands of Papua-New Guinea. Mayr (1932) considered that the archipelagic nature of Tertiary New Guinea, of which part remains as the old and distinct Solomon Islands, played an important part in the development of endemic species and genera.

Durham (1963, fig.1) and Menard and Hamilton (1963, fig.3) give maps showing large areas of land in the vicinity of parts of modern New Guinea during the Cretaceous.

Mayr (1963) stressed the great importance of New Guinea as the evolutionary centre of the present Polynesian biota; although there are no endemic families there are large

numbers of endemic genera and species. However this view has been attacked by Durham (1963) and Ladd (1960), since the Tertiary must have been the period in which this development took place, and they both pointed out that although there was a considerable land area in the Cretaceous, during the Tertiary this was limited to a relatively small archipelago (called the Cyclopean Islands by Cheesman (1951)). Ladd suggested that the evolutionary centre lay further east towards the central Pacific. This may have been true for Molluscs, with which this author was particularly concerned, but otherwise the case for families originating beyond Indonesia is rather weak (Gressitt, 1961).

New Guinea and its outlying islands are presently regarded as an integral part of the Australian-Papuan continental land mass in geological terms (Stanley, 1958). Similarly, Thorne (1963) cited formidable biotic evidence which indicates the close relationship of the two regions in both Cretaceous and Tertiary times.

Recently Good (1963) has challenged this generally accepted view, pointing to certain dissimilarities in the biota despite the present proximity of the two land masses, and the fact that pre-Tertiary Australian stratification is strongly discordant with that of New Guinea. To explain this he suggested that Australia may have moved northward towards New Guinea during the Cretaceous or Tertiary. However such a theory is not supported by the best palaeomagnetic data currently available (Menard and Hamilton, 1963).

It is necessary to consider the total fauna of the Australia-New Guinea region rather than single taxa or groups of taxa, since the insect and vertebrate distribution patterns are very different (Gressitt, 1961). The mammals, birds

and reptiles of both land masses are very similar, and both regions appear to have been cut off from the north long enough ago to prevent an influx of higher placentals which superseded the marsupials in the north, including Europe, leaving a few relict groups in North and South America (Young, 1950).

Although this insularity prevented placentals reaching Australia and New Guinea, the invasion of insects from the Oriental and Indo-Malayan regions continued, since these were able to move from island to island across distances too great for vertebrate dispersal. Apart from the Phasmatodea mentioned earlier other groups of New Guinea insects have affinities with Indo-Malayan groups. These include several Orthopteran genera (Marshall, 1956), weevils (Marshall, *ibid*), Carabidae (Karny, 1929) and several families of Lepidoptera (Toxopeus, 1948; Diakonoff, 1955).

On the other hand, while Australian mammals were presumably able to invade New Guinea while extensive land connections existed during the Pleistocene (Gressitt, 1961), and where they found little competition, Australian insects were only successful in the savanna of southern New Guinea. This was despite a change in climatic conditions which might be supposed to favour the Australian groups. Thus it seems very likely that remaining differences in the flora and invertebrate fauna can be associated with the very marked climatic differences and difference in latitude (Gressitt, 1961).

Where the flora is concerned, living and fossil evidence shows that the east coast of Australia has been a migration route to and from the Malayan region for a very

long time. at least as far back as the Cretaceous (Burbidge, 1961). Dacrydium and Phyllocladus (Gymnospermae), and Drapetes (Thymelaeaceae) are examples of plants which are found from southern and eastern Asia through New Guinea to New Zealand and South America. The first two genera are known as fossils on the Australian main land, but all three are lacking in the present day Australian flora. Burbidge thought that this might have resulted from extinction in arid Pleistocene climates.

In northeast Queensland Burbidge found two quite distinct elements, one with strong affinities with New Caledonia, the other with very close ties to New Guinea, both islands containing derivatives of probable Malaysian origins. Some confused Malaysian elements are even present in the Tasmanian flora, although there is a high degree of endemism on that island, so the present tropical-temperate MacPherson-Macleay overlap in northern New South Wales does not represent the limit of this Malaysian influence.

The presence of Nothofagus species in the subalpine forests of New Guinea and New Caledonia is of great biogeographical interest (Fleming, 1962, Dawson, 1966). The fossil record of Nothofagus (Cranwell, 1963) shows that the distribution of the genus in the Tertiary was, with the exception of the above two islands, in large part the same as it is today. Positive records are confined to the southern hemisphere.

Southern Nothofagus and northern Fagus are assumed to have had a common tropical ancestor in the Cretaceous

(Fleming, 1963). The brassi group of the former genus appear to have spread aggressively on the outer side of the Samfrau Geosyncline (Cranwell, 1963), extending in western Australia alone to the inner side.

The brassi group apparently reached New Caledonia and New Guinea after the Miocene cooling, since there is no fossil record in either island going back further than the Pliocene. Fleming (1963a) concluded that the Pliocene was the period in which conditions were most suitable for the spread of the brassi group into the northern islands. Cranwell (1963) concluded that at the same period Nothofagus became extinct on the Antarctic continent as conditions became more and more rigorous. Couper (1960) reported evidence of extension of range of a number of Podocarp genera during the Tertiary in South and Central America.

Cranwell (1963) favoured the Melanesian arc from New Zealand to the New Guinea through New Caledonia as the Pliocene dispersal route of Nothofagus. However she described the western Australian members of the genus as brassi type, so the New Guinea Nothofagus may have been obtained via northern Australia. Durham (1963, fig2,3,4.) showed land connections between Australia and New Guinea in the Tertiary, extensive even in the Eocene, and increasing to maximum extent in the Pleistocene. However this still leaves the anomaly of Nothofagus on New Caledonia with no evidence of post-Cretaceous land connections with Australia or New Zealand (Dawson, 1966). There is no evidence of a continuous land connection as late as the Pliocene between

New Caledonia and New Zealand. While Durham (1963) and Menard and Hamilton (1963) showed maps which suggested scope for island-hopping along this route, especially in earlier times, the distances between land would still be extreme for the over-sea dispersal abilities of Nothofagus as presently understood.

Studies by Holloway (1954) on New Zealand Nothofagus strongly suggested that the species requires a seed source to be able to spread. He cited as evidence of this the failure of the species to recolonise parts of Westland, Mount Egmont, and Stewart Island after the destruction of the original forests during the Pliocene-Pleistocene glaciations. His detailed studies showed that the species tended to disperse along moist ridges and watercourses, abutting on the standing forest areas.

Preest (1963) carried out some work which showed that the seed of Nothofagus travelled only a relatively short distance from the parent tree when blown by wind, and was too heavy for aerial transport over more than a few kilometers. He also found that surface-wetted seed sank at once when put into sea water. He admitted that fruit-eating birds were a possible vector for distribution over longer distances, but pointed out that there was now great specificity in Nothofagus populations, a clear indication that successful dispersal over long distances was now no longer taking place, and that the postulated mechanisms for over-water dispersal of the seed must be regarded with scepticism.

Despite these problems, there can be little doubt that the melanesian arc or arcs played an important part in the spread of invertebrate taxa into the southern parts of the western Pacific. Solem (1958) showed that the land snails

of the New Hebrides had greater affinities with those of New Guinea than did those of New Caledonia. Thus we have to consider the probable existence of two arcs, an inner one passing through what is now New Caledonia (probably then part of Tasmantis), and an outer one taking in the New Hebrides and Fiji. Mackerras (1961) thought that the Tabanidae (Diptera) of Fiji were most closely related to those of the New Hebrides. His studies showed a break in the arc between the New Hebrides and the west, and continuation of the arc beyond this break to the Admiralty Islands.

He suggested that the western Pacific had been colonised by a "stream" of Tabanidae of Oriental-Ethiopian origin which passed through New Guinea into the outer Melanesian arc. This stream was supplemented, presumably at a later date, by more oriental elements and some Australian groups which moved outward into the Pacific. However he found no continuation of this spread through New Caledonia into New Zealand. A few New Zealand affinities with New Caledonia were found, but all the New Zealand Tabanidae (16 species), appeared to have their closest relatives in South America. The last finding conflicts to some degree with the apparent spread of taxa along the Melanesian arc to New Zealand found by other workers. Of course the link between New Guinea and New Caledonia may have been broken at the time of the spread of the Tabanidae and not at some other times, but the possibility of austral relationships introduces an entirely new element into the discussion.

THE CASE FOR AUSTRAL BIOTIC RELATIONSHIPS
AND SOUTHERN CONTINENTAL LINKS THROUGH
ANTARCTICA

The major problem occupying southern hemisphere biogeographers remains the question of trans-Antarctic links along the Samfrau Geosyncline. Adie (1963) summarised the basic geological evidence. His studies, and those of others, strongly suggest a connection between South America and Antarctica through the "Scotia Arc". The remains of this chain are the present-day islands of South Georgia, the South Shetlands, the South Sandwich group, the South Orkneys, and the Antarctic Peninsula, all bounding the Scotia Sea. The arc was probably never complete later than the Carboniferous (Darlington, 1965), but Adie regarded the Cretaceous and lower Tertiary as the most probable period in which faunal migrations could have taken place.

The same worker noted that geological evidence for New Zealand/Australia -Antarctic connections was much weaker, despite the existence of the Campbell Plateau and a number of sea mounts such as the Hjort. Studies of shelf fauna give no indication of a link between southern continents in the Tertiary. Allan (1963) examined the Brachiopods and Fell (1961) the Ophiuroids of Antarctic, and found them very distinctive and characteristic. If any links had existed from Antarctica to New Zealand Fell found it inconceivable that the shelf Ophiuroids would not have extended their range along the shores.

Fleming (1962) commented on the strongly cosmopolitan nature of the New Zealand Jurassic Trigoniidae (Mollusca) which he explained by coastwise dispersal and migration along the shores of connected land masses. The same group from Cretaceous strata show much more limited affinities, strongly suggesting that land connections were coming to an end in the Cretaceous.

Even though van Steenis (1963) concluded that a number of tropical land connections of great size and considerable duration in geological time were theoretically necessary to explain present angiosperm distribution patterns, especially of species poorly adapted for over-water dispersal his ideas are not necessarily at variance with actual geological evidence. Axelrod (1960) and van Steenis point out that since angiosperms were very widely distributed by the Cretaceous, they must have originated at least as far back as the Jurassic. Fleming (1962) indicated that massive tropical land connections probably existed during the Permian and the Jurassic.

King (1958) decided that palaeomagnetic evidence in the southern hemisphere pointed to a much closer relationship between the southern continents than exists today. In a later review King (1962) postulated the disruption of the old Gondwanaland through the process of continental drift as beginning in the Jurassic, with South Africa separating first, then New Zealand in the Lower Cretaceous, and finally Australia in the Middle Cretaceous. The final separation of Patagonia from Antarctic could have been delayed later than this, and taken place through a slow decay of the Scotia arc, island chain. This is compatible with the picture given by

Fleming (1962) and Adie (1963). However more recently Darlington (1965) has warned that the interpretation of palaeomagnetic data on which this time-table is based is suspect, and the case for Gondwanaland is not nearly as clear as other authors have made it appear.

In some respects one might try to associate changes of this magnitude with polar wandering. However the Palaeomagnetic evidence has been summarised by Gutenberg (1951), Durham (1959) and Menard and Hamilton (1963). The north pole was only about 20° from its present position in the Jurassic, 18° in the Middle Cretaceous, and very close to its present position right through the Tertiary.

It is tempting for geologists to use biological evidence to support geological timetables such as those discussed above, and the distribution of Nothofagus is surely one of the corner-stones in the arguments for austral trans-Antarctic links in the Jurassic and Cretaceous. As well as New Guinea and New Caledonia and New Zealand the southern beeches of this genus are found in Australia, Tasmania and the southern part of South America. Fossil records have been confirmed from the edge of the Ross Sea and the Antarctic Peninsula (Cranwell, 1963) and from some subantarctic islands, though those from Kerguelen were dismissed as laboratory contaminants (Cookson, 1947).

A formidable number of papers have been presented to show "on indisputable grounds" that Antarctica served as an effective dispersal centre and migration route for plants and animals during the Cretaceous and that part of the

Tertiary when it possessed a temperate climate. Among authors putting forward this view may be mentioned Britton (1957), Darlington (1952), Evans (1958), Jeannel (1938), Mackerras (1925; 1950; 1961), Mackerras and Fuller (1942), Paramonov (1955; 1959), Cranwell (1963) and Thorne (1963). The recent discovery of pre-Tertiary amphibian remains (Anon. "New Scientist", 1968, p.530) on the Antarctic mainland confirms that some vertebrates inhabited Antarctica as well as invertebrates.

Actually few invertebrate links have been confirmed by fossil finds on Antarctica, and trans-Antarctic links have been assumed on the basis of the similarities between forms in South America and other southern regions. Fleming (1962) remarked that certain trans-Antarctic links seemed to be demanded more through "biogeographical necessity" than through any geological evidence.

Hennig (1957; 1960; 1965) challenged the value of the phylogenetic arguments of a large number of insect biogeographers. Although the Diptera had been used by many workers, for example Mackerras, (1950), to demonstrate trans-Antarctic links, Hennig concluded that in no case had the studies been based on true synapomorphic lines of descent, and were therefore not phylogenetically valid.

Illies (1960a; 1960b; 1965) and Brundin (1965; 1967) have respectively demonstrated trans-Antarctic links for the Plecoptera, a group very poorly adapted for over-water dispersal, and the midge family Chironomidae (Diptera), using Hennig's methods of phylogenetic reasoning. Kuschel (1963) also considered that his studies on the southern hemisphere

weevils suggested trans-Antarctic connections. We may never see a careful phylogenetic re-examination of angiosperm taxa using Hennig's Principle, however. The higher plants, with their relatively simple construction and excessive parallelism are not suitable objects for such analysis, (Brundin, 1967).

Wardle (1963) studied taxa in the New Zealand alpine flora poorly adapted to over-water dispersal, and decided that there had been an influx as late as the Pliocene. There is no geological evidence for any land connections at this late date (Fleming, 1962; 1963). The latter author examined the build-up of the New Zealand flora in the fossil record by strict time sequence (1963,fig.2). The result is such, with elements like Astelia and Fuchsia entering (perhaps from a temperate Antarctica) in the Oligocene and Miocene, that if one demands land connections to account for their presence, then these must have been present through much of the Tertiary. Fleming argued that West Wind Drift airmasses have made notable contributions to the New Zealand fauna and flora in very recent times, and can safely be assumed to have done so in the geological past, with no requirement for Tertiary land connections.

S U M M A R Y

The New Zealand biota is disharmonic, and many taxa have been isolated in the archipelago for long periods of geological time. The major elements of many important groups were apparently established in the country by the Cretaceous at the latest (Dumbleton, 1963).

Three major dispersal routes to New Zealand have been considered; across the Tasman Sea from eastern Australia, along the Melanesian arc through what is now New Caledonia, and from Antarctica or South America through former trans-Antarctic land connections.

There is no evidence for direct land links through the Tasman Sea between Australia and New Zealand. Anomalous distribution patterns of some angiosperms (Burbidge, 1960; Wardle, 1963), can probably be explained by over-water dispersal through the West Wind Drift air masses, possibly by birds (Fleming, 1963). Australian elements in the New Zealand fauna are generally very disharmonic (Fleming, 1962; Dugdale, 1966). These elements appear to have been gradually assembled in New Zealand since Jurassic and Cretaceous times.

Geological and biological evidence suggest that both an outer Melanesian arc from the Admiralty Islands to Fiji and an inner arc from New Guinea through New Caledonia to New Zealand existed at some time. These links may never have been in the form of a complete archipelago in either case. A large land mass called Tasmantis taking in much of this area may have already begun to decay before the Cretaceous.

One worker (Good, 1963) has disputed the generally

assumed close geological relationship which appears to have existed between Australia and New Guinea since at least the Cretaceous (Menard and Hamilton, 1963). Biological evidence supports the latter view (Thorne, 1963; Gressitt, 1961). New Guinea appears to have many Indo-Malayan elements, especially among the invertebrate fauna and the flora. Some oriental and Malayan taxa have penetrated as far south as Tasmania (Burbidge, 1960) and the east coast of Australia has been a migration route since the Cretaceous. Australian invertebrates have not been very successful in re-invading New Guinea when land connections were re-established in the Pleistocene, (Gressitt, 1961). Only Queensland shows very close affinities with both New Guinea and New Caledonia, and some common Australian and New Zealand elements were apparently received through New Guinea. However the link between New Guinea and New Caledonia appears to have been broken at the time of a major invasion of Tabanidae at some time in the Tertiary.

There is some geological and biological evidence for a large proto-continent (Gondwanaland) which included the southern part of South America, New Zealand and Australia, Antarctica and South Africa, (King, 1958; 1962). However although such continental drift is favoured by a number of geologists (Durham, 1963; Menard and Hamilton, 1963), the actual evidence for past connections between New Zealand and Antarctica is weak (Fleming, 1963). If such direct connections did exist, then the break-up apparently began in the Jurassic with South Africa, and was complete for Australia and New Zealand before the end of the Cretaceous. Recently the palaeomagnetic data on which the concept of Gondwanaland is based has been seriously challenged (Darlington, 1965).

However some recent zoogeographical studies by Brundin (1965) based on the phylogenetic scheme of reasoning proposed by Hennig (1957; 1960; 1965) gave evidence not only of trans-Antarctic faunistic links, but also close agreement with the chronological sequence for the break-up of Gondwanaland given by King.

All the three dispersal routes discussed appeared to have played a part in the processes which have produced the present day and fossil biota of New Zealand. Possibly in terms of numbers of taxa the Australian element is weaker than the others, but conjecture on these lines is hardly profitable. However this is the one route for which there is no evidence of direct land connections at any time.

Even before the Cretaceous, connections to New Zealand through the Melanesian Arc or Antarctica may not have been complete, but in the form of transient island chains. For, as Fleming asked (1963), if land bridges were so substantial that Nothofagus could use them, what kept the Jurassic and Cretaceous land dinosaurs and early mammals from reaching New Caledonia and New Zealand? Questions like this still remain to be answered to everyone's satisfaction.

Despite the many problematical points in southern hemisphere biogeography, some of which may never be completely solved, a general picture of the history of New Zealand emerges from these studies. It is one of an island archipelago, far enough removed from the nearest large land mass to be considered oceanic, but with a large enough surface area to allow prolific speciation and evolution in isolation at least to the generic level. While a number of ancient endemic elements of uncertain relationships exist, the majority of

precursors of present taxa came from elsewhere, either by very early (pre-Cretaceous) land connections or archipelagic links, or by trans-oceanic dispersal.

GEOGRAPHICAL DISTRIBUTION OF THE
CRAMBINAE: ORIGINS OF THE NEW ZEALAND
CRAMBINE FAUNA

INTRODUCTION

During the earlier systematic discussion I examined relationships within the Crambinae through apomorphic characters which indicate true lines of descent. In the foregoing biogeographical chapter I reviewed data relevant to dispersal routes by which taxa have become assembled in New Zealand, and some of the physical problems involved with such movements.

Based on this information I will now review the conclusions of these sections which relate directly to the origins of the New Zealand crambine fauna, the probable times of arrival of the various genera or their precursors in this country, and also any apparent discontinuities in the availability to taxa of the various postulated dispersal routes to New Zealand at different times.

To facilitate this discussion I have summarised information in table 16 on the relationships of New Zealand crambine genera. In the rest of this chapter these are considered in more detail.

Table 16

SUMMARY OF RELATIONSHIPS OF NEW ZEALAND CRAMBINE TAXA				
GENUS	NZ spp	NOT NZ	SISTER sp. OR GENUS; AND LOCATION BEYOND NZ	PROBABLE DISPERSAL ROUTE TO NZ
<u>Orocrambus</u>	48	0	<u>Agriphila</u> , Palaeartic (Next nearest to <u>Orocrambus</u> + <u>Maoricrambus</u>)	Melanesian Arc, by "island-hopping"
<u>Maoricrambus</u>	1	0	<u>Orocrambus</u> , New Zealand	Endemic
<u>Angustalius</u>	1	1	<u>Angustalius</u> , Palaeartic	Introduced? Recent.
<u>Tawhitia</u>	2	0	<u>Corynophora</u> , E. Australia	Trans-Tasman aerial dispersal
<u>Pareromene</u>	18	23	<u>Pareromene</u> , New Guinea, eastern Palaeartic	Melanesian Arc, by "island-hopping"
<u>Tauroscopa</u>	3	2	<u>Gadira</u> , Australia	Trans-Tasman aerial dispersal
<u>Gadira</u>	3	10 +	<u>Chilo</u> , N. Australia, Old World tropics (Next nearest to <u>Gadira</u> + <u>Tauroscopa</u> complex)	Trans-Tasman aerial dispersal
<u>Paragadira</u>	1	0	Not known. New Caledonia or New Hebrides?	Not known
<u>Protyparcha</u>	2	0	Not known. Australia?	On subantarctic islands only. Aerial dispersal from southern Australia?

AFFINITIES AND DISTRIBUTIONS OF ELEMENTS
RELATED TO NEW ZEALAND CRAMBINE TAXA

Orocrambus and Maoricrambus

Orocrambus does not occur in Australia, nor does any genus with which it might conceivably have shared a common ancestor. In New Zealand it has speciated prolifically in isolation, and now has 48 or 49 known species, many of them alpine or subalpine.

In localities outside Australia and New Zealand in the western South Pacific Bleszynski and Collins (1962) listed only the following unrevised species; Crambus cinereus Hampson (New Guinea), Crambus fulvinotellus Hampson (Louisiades), and Crambus paralyticus Meyrick (Fiji). A few unrevised Australian species also remain in Crambus, but in every case where species formerly placed in this genus by Meyrick and Turner have been re-examined and the genitalial characters studied, it has been necessary to transfer them to other genera, usually Gadira (= Hednota). This is the dominant crambine genus (or complex) in Australia (Koch, 1965).

Under these conditions it is natural to look to South America for the "sister groups" of Orocrambus in the sense of Hennig (1957), since relatives of the genus do not exist in Australia and possibly not in the islands of the Melanesian Arc.

The tribal type genus Crambus F. reaches its maximum development in numbers of species in the Holarctic and more especially in North America (Bleszynski, 1965). It also occurs in South America, but appears to be limited to the Brazilian

shield region (Bleszynski,1966). Further south Fernandocrambus is strongly speciated, especially west of the Andes and on Juan Fernandez Island. Both Crambus and Fernandocrambus share a markedly apomorphic character (strongly lobed sacculus) with the Palaearctic Flavocrambus and Angustalius, but not Orocrambus.

Three other important genera in the Crambini are restricted to the Americas. These are Fissicrambus, Microcrambus and Parapediasia, which show a number of peculiar morphological features (Bleszynski,1963; Klots,1968). However these genera, which are still in need of much revision, appear closer to the Holarctic Pediasia than any other major genus (Bleszynski,1963).

My own preliminary study, admittedly based only on Dr.S.Bleszynski's drawings, suggests (fig.1.lines 34-37) that this similarity is only symplesiomorphic, and therefore not indicative of direct sister genus relationships. However even considering these genera one at a time, none shows sister genus relationships with Orocrambus or Maoricrambus.

Unless one is prepared to speculate on total extinction of relatively unspecialised genera of Crambini (ie. Orocrambus-Agriphila like) in South America and Australia, there is no evidence at all that Orocrambus in New Zealand ever had relatives on either land-mass or austral relationships of any kind. Munroe (1958) put forward the suggestion that Scoparia had become extinct in South America, but frankly, while I think extinction of taxa in Lepidoptera a good possibility on isolated islands, I find it hard to consider extinction of complete lines in huge land areas as a realistic explanation to account for discontinuous distributions.

Three other genera of Crambina show strong spinose development of the valval sacculus. These are Chrysoteuchia, Xanthocrambus and Catoptria; all occur in the Palaearctic. These genera are quite closely linked through apomorphic characters (fig.1), but none are sister genera of Orocrambus or Maoricrambus.

If in fact any genus can be called the sister genus of these two in the sense of Hennig, it is the Palaearctic Agriphila (fig.1). While this genus shares two apomorphic characters with Orocrambus, it is somewhat less specialised in female genitalial structure.

Angustalius

Angustalius malacelloides (Bleszynski) is distributed from India through Ceylon and Malaya, the Louisiades, Northern Australia and into the Northland Province of New Zealand. More intensive collecting will almost certainly reveal its presence in intermediate areas.

This species is a recent arrival in New Zealand (Hudson, 1939), and the distributions of this and the other important species of the genus, A. malacellus (Duponchel), are so cosmopolitan that the migrations of man may have helped indirectly to facilitate their spread. Bleszynski (1961) discussed the distribution of the cosmopolitan Calamotropha paludella (Hübner) in similar terms.

Tawhitia

One of the two known species of Tawhitia is found both in eastern Australia and New Zealand. This is T. pentadactyla,

an inhabitant of marshy areas in lowland and subalpine habitats. I have examined Tasmanian and New Zealand specimens, and they are conspecific. T.pentadactyla is clearly a Recent Element (in the sense used on p.339) in the New Zealand crambine fauna, resulting from trans-Tasman over-water dispersal from west to via the West Wind Drift.

The New Zealand endemic T.glaucophanes is entirely alpine in distribution. Its ancestor presumably came to New Zealand by over-water dispersal from south-eastern Australia, but at a much earlier date than T.pentadactyla. Further collecting in the generally poorly worked mountains of Tasmania may yet reveal other members of the genus. Anomalous disjunctive distribution of alpine Tasmanian elements in the New Zealand alpine zone has been noted in a number of taxa (Burbidge, 1960; Fleming, 1963a). This paradox has been discussed on p. 343 in the present work.

The relatively primitive sister genus of Tawhitia, Corynophora Berg, is distributed in lowland eastern Australia. Two or three species of this genus are known (Bleszynski and Collins, 1962; Bleszynski, 1962; Bleszynski, 1963a), but I have not found a close relative of this genus or Tawhitia among revised crambine genera described by other authors. A search among unrevised tropical genera was not possible because the amount of material held in New Zealand Museums from foreign countries is negligible. Further study is required of this specialised and archaic sub-tribe of the Crambini.

Tauroscopa

The genus Tauroscopa is an alpine segregate of the Gadira/Hednota complex. The two Australian species, T.lachnea and T.callixutha, show the least specialisation in genitalial characters. Both are found in the alpine zone of south-eastern Australia. The other three known species occur in the alpine zone of New Zealand, so here again the "alpine paradox" (Fleming, 1963a) is displayed. The three New Zealand species, T. gorgopis, T. trapezitis and T. notabilis show a number of apomorphic characters not possessed by the Australian species, though not in my opinion to such an extent that generic separation is deserved (see fig.7).

While T. trapezitis has a southern-biased distribution within the South Island of New Zealand (fig. 296), and T. notabilis a northern one (fig. 295), the distribution records for T. gorgopis overlap both (fig. 294). T. notabilis shows a number of marked differences in genitalial characters from the other two species, so this genus may have derived its representation in New Zealand from one or more probably two relatively ancient Tertiary invasions of this country via the West Wind Drift.

Gadira/Hednota

Meyrick (1883) considered that Australian and New Zealand specimens of Gadira leucophthalma were conspecific. I have not examined Australian specimens, but am prepared to accept this statement at face value. If Meyrick is correct then this is another example of recent trans-Tasman dispersal. Both G. leucophthalma and the New Zealand endemic

G.acerella have sister species in Australia, respectively G.haplotypa and G.pedionoma (fig.8).

The grasslands of the Holarctic, parts of Africa, South America and those of New Zealand are dominated by Crambini. However the equivalent Australian ecological niches have been colonised by species of the Gadira/Hednota complex (Common, 1963; Koch, 1965).

As well as Gadira/Hednota other Chiloini include the Palaearctic-Oriental Eschata and the Australian-New Zealand endemic Tauroscopa. Gadira/Hednota and Tauroscopa shared common ancestry with the cosmopolitan warm-climate Old World genus Chilo (fig.8). This genus occurs throughout the tropics of Africa, Asia and Australasia. Chilo has not been recorded from New Zealand, and is very poorly represented in South America (Bleszynski, 1962). Its presence there is probably the result of chance over-water dispersal via the North-East Trades from tropical West Africa where a number of species are known (Bleszynski and Collins, 1962).

Paragadira

This genus occupies a rather isolated position in the present phylogenetic scheme (fig.1). Its distribution within New Zealand has a strong northern bias (fig.300). Further revision of tropical crambine genera will probably help to clarify its position.

Protyparcha

The relationships of this geographically isolated and highly adapted genus cannot be very clearly defined at present, and even its placing in the Chiloini has an element of doubt. However bearing in mind earlier discussion (p. 39),

I doubt if this genus has a sister group (still to be found) outside the southern part of New Zealand, or more probably, Australia.

Pareromene

This is largely a Palaearctic-Oriental genus, with many species still listed in partially revised Diptychophora Zeller (Bleszynski and Collins, 1962). Since publication of that catalogue the Palaearctic species have been transferred to Pareromene (Bleszynski, 1965).

Even more recently Bleszynski (1967) has established Diptychophora as an endemic Central/South American genus, but also noted that 9 listed tropical American species do in fact belong to Pareromene in his opinion. The presence of Pareromene in tropical America is not anomalous, since its presence in tropical Africa has also recently been confirmed (Bleszynski, 1966). Direct dispersal of taxa from Africa to South America by the North East Trades seems very likely.

Bleszynski and Collins (1962) listed 6 species from Fiji and 3 from Samoa under Diptychophora. These species have not been re-examined at the time of writing, and their affinities are unknown. However these will probably prove to belong to Pareromene.

About 12 species of Pareromene are distributed in Australia (Mr I.F.B. Common in litt., Dr S. Bleszynski, in litt.), 8 of them in Queensland. Considering the close relationship found by Common (1960) between the stem-boring Schoenobiinae of Queensland/North Australia and New Guinea, we might expect to find a similar relationship between

Pareromene species when the Queensland species have been revised.

However I have examined one of the Pareromene species, P.ochracealis, which is widely distributed in the regions south of the tropical-temperate MacPherson-Macleay overlap in eastern Australia. The male genitalial characters of this species show a relationship with the eastern Palaearctic electra-rosanna cluster of species (fig.5), but no relationship at all to the New Guinea-New Britain species such as P.ajaxella, figured by Bleszynski (1966) or to the New Zealand species figured in the present work.

The New Guinea species P.ajaxella and P.morobella have sister species among the New Zealand members of species group 4b (figs 4 and 5). This gives some of the clearest evidence within the Crambinae of a link from New Guinea to New Zealand through the Melanesian Arc. More collecting in New Caledonia and the New Hebrides is needed, and Fijian and Samoan species of this genus need to be re-examined.

The Palaearctic species P.parthenie has New Zealand sister species in group 4a (fig.5); Palaearctic P.moriokensis, P.minutalis, P.copernici and P.vermeeri have New Zealand sister species in group 5a, and Palaearctic P.bilinealis has New Zealand sister species in group 5b (fig.5).

THE ARRIVAL OF CRAMBINE TAXA IN NEW ZEALAND

It is evident from previous discussion that our present crambine taxa did not arrive in a single invasion, and that the powers of over-water dispersal of these insects are sufficient for the problem of direct land connections

to New Zealand at any time to be irrelevant.

The structure of the New Zealand crambine fauna can be summarised as follows. There are no archaic endemic elements suggesting New Zealand as a centre of crambine evolution, nor any species with South American affinities. There is a very small disharmonic Australian element of 8 species presumably assembled in New Zealand by the influence of the West Wind Drift air masses.

Based on the assessments of average time needed for generic and specific evolution discussed elsewhere (p.394), we can make approximate estimates of the times of arrival of these Australian taxa. Two species are conspecific on each side of the Tasman Sea, so these probably arrived during the Late Pleistocene or even more recently, but in any case certainly during Quaternary time. The remaining species show considerable divergence from their closest Australian relatives, but not yet at the generic level. Thus we could gauge their probable time of arrival as middle to late Tertiary or possibly early Pleistocene.

Ignoring the two small genera Protyparcha and Paragadira, of uncertain affinities and the cosmopolitan Angustalius, a post-European time colonist, the remaining New Zealand crambine units are the largest, Orocrambus and Pareromene, with 66 known species between them. Neither Orocrambus as a genus or the New Zealand representatives of Pareromene have relatives in South America or the southern part of Australia. Orocrambus has no relatives in Australia at all. It is thus natural to assume by a process of elimination that both reached New Zealand by the "island-hopping" route of the Melanesian Arc.

Since a crambine fossil record is totally lacking (Bleszynski,1965) we can only guess at the age of these genera. With a few exceptions Orocrambus species are grass feeders while Pareromene species are forest moss feeders, so the two genera were not necessarily dispersed identically.

The differences in genitalial characters between most genera of Crambina are not great in absolute terms, and those between Orocrambus and Agriphila are much less marked than those between say, Agriphila and Crambus.

However we cannot safely assume that a big difference in structure necessarily always reflects a big time scale and a small difference a small time scale (Rensch,1959), as rates of evolution are frequently not the same in different genera.

Almost all genera of Crambina show great similarities in forewing pattern. Since most appear to be grass, rush or sedge feeders this may be attributed to natural selection tending to prevent deviation from the adaptive mean. The genitalia (like other internal organs), can evolve morphological differences while the external characters are held to a pattern by environmental pressures (Bigelow,1967). We cannot generalise about time scales for changes in genitalial structures as we know little or nothing about the factors which bring about such changes (Bigelow,ibid.). However they provide characters of great taxonomic value directly associated with the organs carrying and transmitting the sum total of genetic information in a species, and our uncertainty regarding causative factors should not prevent us from using these characters in taxonomy and systematics.

We can probably set a reasonable upper limit for the invasion time of Orocrambus. The success of the tribe Crambini, and more especially the sub-tribe Crambina seems to be tied very closely with the ability of the genera to exploit grasses as food plants, even though they are not necessarily obligate grass feeders. One exception is the New Zealand species Orocrambus xanthogrammus, which feeds on Raoulia sp.).

Assuming that the spread of the subtribe was associated with this ability, we can turn to the fossil record of the grasses and their relatives for some clue. This record is scanty, but the grasses did not appear to show signs of successful spread until the late Cretaceous, even if they were in existence as early as the Jurassic (Bews, 1927; 1929). The first grasses to appear in the New Zealand fossil record do so in the Eocene (Fleming, 1962). Successful dispersal of Orocrambus to New Zealand could have taken place at this time but probably no earlier.

According to Fleming the Lower Oligocene was a relatively cool period in New Zealand history, somewhat drier than at most other times. A savanna climate appeared to extend over much of the country. Probably under such conditions Orocrambus could successfully extend its range throughout New Zealand. Extensive speciation might not have occurred until later when rigorous climatic changes took place, changes in relief were considerable, and areas were periodically isolated by the sea.

The time of arrival of Pareromene is even more conjectural, although the genus must depend on extensive forest conditions for survival. The presence of two very

different species groups of Pareromene in New Guinea (and presumably Queensland), and southern Australia respectively lend credence to the idea of two invasions of this genus into the region. The systematics discussed earlier (pp. 236 and 237) show that both probably came from the Palaearctic.

During the Lower Miocene in New Zealand there was increased relief and higher topography, probably associated with higher rainfall (Fleming, 1962). In the Middle and Upper Miocene conditions were cooler, but Fleming noted that elements of Malayo-Pacific origin were continuing to arrive. This was also the time when conditions favoured the spread of Nothofagus (brassi species) into New Guinea and New Caledonia (Cranwell, 1963). I would thus postulate the Middle or Upper Miocene as the most likely period for the successful dispersal of Pareromene through the region to New Zealand. The first Australian "invasion" was presumably established somewhat earlier, perhaps in the early Middle Miocene or Lower Miocene. After the Middle Miocene average summer temperatures, and maximum temperatures, declined relatively steeply and steadily if the marine coral fauna are taken as a guide (Keyes, 1968), or the planktonic Foraminiferida (Jenkins, 1968), or the marine molluscs (Beu and Maxwell, 1968). These biological observations are broadly supported by oxygen isotope determinations of palaeotemperatures (Devereux, 1968) within New Zealand, and similar work carried out in Victoria (Gill, 1968).

One very interesting (and presently unanswerable) question remains concerning the dispersal of Orocrambus. We might reasonably explain the failure of a postulated

second invasion of Pareromene to colonise the southern part of Australia by the suitable ecological niches being already occupied by a different successful species group of the same genus.

However this is irrelevant to the surprising absence of all Crambina from Australia (let alone just Orocrambus), with the exception of the cosmopolitan Angustalius malacelloides.

There are a number of possibilities, all conjectural, which might explain this absence. One; Orocrambus or a related genus might have colonised Australia and later become extinct when conditions changed. This seems very unlikely seeing that Crambina ~~genera~~ tolerate grassland conditions ranging from desert conditions in Algeria and Arizona and alpine scree and fellfield country in New Zealand and Europe. Two; possibly Crambina could not compete in the Australian grasslands with species of the endemic Gadira/Hednota complex. On the whole the Australian endemic fauna has not competed very successfully with invading taxa, but it would be foolish to accept this as a generalisation for all cases. Three; some kind of biotic barrier may have prevented the spread of suitable foodplants and thus Crambina. The studies by Burbidge (1960) on plant distribution patterns in Australia indicate that such a theory can be discounted, and that the east Australian coast has been a migration route for Indo-Malayan floristic elements since the Cretaceous. Four; Possibly a physical barrier, such as a wide stretch of open sea prevented the spread of Orocrambus into Australia. Most of New Guinea was under water from the Cretaceous to the early Pliocene, and even such as remained above the

surface was probably covered with lowland forest (Gressitt, 1961).

However conditions for "island-hopping" from eastern Asia to New Zealand were probably never more suitable than during the Eocene (see Durham, 1963, fig. 3, and Menard and Hamilton, 1963, fig. 4). This is the period I suggested earlier for the dispersal of Orocrambus. North westerlies have presumably always been the prevailing summer winds in the western South Pacific, with January Monsoon winds sweeping from Asia into northern Indonesia where they converge with the north equatorial Trades from Micronesia. The cyclonic storm centre in the Coral Sea could play an important part in carrying biotic elements parallel to the Australian coast along the line of the Melanesian Arc as often as towards the coast of Queensland.

At the present time I regard hypotheses two and four of those given above as the most likely alternative (or combined) explanations for the absence of the sub-tribe Crambina from Australia. However in conclusion I can only stress again that these are purely conjectural, and that the reason is not known.

COMMENTS ON MAJOR BIOTIC MIGRATION
ROUTES BEYOND THE AUSTRALASIAN REGION

In the foregoing discussion I showed that evidence for relationships between Crambinae of South America and Australia-New Zealand is lacking, and also mentioned that according to Bleszynski (1965) important genera such as Pediasia, Crambus and Agriphila are distributed throughout the Holarctic. Both imply that other migration routes than trans-Antarctic ones have been important in the spread of Crambinae. In consequence I think a few brief comments on such dispersal routes are relevant.

There is good geological evidence to show that Bering Strait was closed periodically during the Cretaceous and Tertiary (Durham, 1963) and again during the Pleistocene (Lindroth, 1963). Ball (1963) suggested that "Bering Land", at 60 - 70°N, had tundra-type vegetation in the Tertiary. This presumably is unlikely to have been a barrier to cool-climate adapted species of Crambus, Pediasia and Agriphila.

Munroe (1965), studying the Scopariinae, found that the Davis Strait barrier had functioned as a strong check to Holarctic dispersal, but that the Bering Strait barrier had functioned only as a weak one.

The crambine genus Calamotropha is not found in the New World (Bleszynski, 1961). Most species are distributed in the Old World tropics. Certain characters of adults in this genus, such as loss of ocelli and the atrophied proboscis are highly apomorphic relative to other crambine genera, indicating that Calamotropha is a relatively recent generic segregate. Even though the Cretaceous climate of Bering

Land could have been temperate or even sub-tropical at its southernmost extremity (Ball,1963), conditions in the Tertiary (the period when I assume this genus to have arisen) were apparently not suitable for the spread of Calamotropha from its Old World evolutionary centre into North America.

Strong evidence exists in the Acigonini for former biotic links between eastern Africa and Oriental Region. The distributions of the genera Classeya, Pseudoclasseya and Pseudocatharylla are presently bisected by the deserts of Arabia (Bleszynski,1964). However the geological evidence for a direct physical connection between Africa and India is virtually nil (Darlington,1965).

The disharmonic distributions of such genera as Chilo (Bleszynski,1963) indicate that direct land connections are not necessary to explain crambine dispersal patterns between tropical western Africa and tropical southern America. In fact any connection between the two continents was almost certainly broken before the Triassic (Darlington,1965). This is probably too early to be of any relevance to distribution patterns of existing crambine genera which show disjunction.

Taking the above evidence into consideration, I can see little objection to major dispersals of crambine taxa across Bering Strait. Not all genera were apparently adapted to the conditions prevailing in the completely or partially closed Strait region at times critical to the development of their particular dispersal patterns. Similarly, Ethiopian-Oriental dispersal routes were apparently open to use by crambine taxa before the full development of the present arid zones. Prevailing Atlantic Trade winds would facilitate dispersal from tropical Africa to tropical America.

DISTRIBUTION OF CRAMBINAE WITHIN NEW ZEALAND

SUMMARY OF NEW ZEALAND
CRAMBINE DISTRIBUTIONS

Within the limits of available information five basic patterns of distribution can be recognised among the New Zealand Crambinae. Some of these categories are subdivided further on a provisional basis in the list given below. In this I give 78 of the 80 species described in this revision. Excluded are the probably introduced Angustalius malacelloides (first New Zealand record 1927, Hudson, 1939), which appears to be still extending its range southward out of Northland (K.A.J. Wise, pers. comm.), and the enigmatic Orocrambus cultus of which no specimens exist.

1) SUBANTARCTIC ISLANDS ONLY

a) Auckland Island only

Protyparcha scaphodes

b) Campbell Island

Protyparcha graminea

2) CHATHAM ISLANDS ONLY

Orocrambus horistes

3) NORTH ISLAND ONLY

Orocrambus jansoni

Pareromene gurri

Pareromene parorma

4) SOUTH ISLAND ONLY

a) Otago-Southland only

Orocrambus clarkei eximia O. haplotomus

O. heteraulus O. lindsayi

O. melitastes O. oppositus

O. scoparioides O. scutatus

O. sophronellus O. thymiastes

- b) Nelson-Marlborough only (in a few cases with southward extension to Arthur's Pass)

<u>Orocrambus isochytus</u>	<u>O.mylites</u>
<u>O.ornatus</u>	<u>O.ventosus</u>
<u>Tauroscopa notabilis</u>	

- c) Banks Peninsula-East Canterbury only

<u>Orocrambus abditus</u>	<u>O.corruptus</u>
<u>O.ordishi</u>	<u>Kupea electilis</u>
<u>Gadira leucophthalma</u> (also in E.Australia)	

- d) Central Canterbury only

Orocrambus fugitivellus

- e) Southern-biassed distribution (ie.excluding Nelson-Marlborough)

<u>Orocrambus clarkei clarkei</u> (Westland only)	
<u>O.paraxenus</u>	<u>Maoricrambus oncobolus</u>
<u>Pareromene planetopa</u>	<u>Tawhitia glaucophanes</u>
<u>Tauroscopa trapezitis</u>	

- f) Northern-biassed distribution (ie.excluding Otago-Southland)

<u>Orocrambus dicrenellus</u>	<u>Gadira petraula</u>
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- g) Throughout South Island length

- i) Forest mosses

Pareromene helioctypa

- ii) Alpine grasslands

<u>Orocrambus aethonellus</u>	<u>O.catacaustus</u>
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<u>O.crenaeus</u>	<u>O.ephorus</u>
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<u>O.lectus</u>	<u>O.machaeristes</u>
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<u>O.melampetrus</u>	<u>O.philpotti</u>
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<u>O.tritonellus</u>	<u>Tauroscopa gorgopis</u>
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5) NORTH AND SOUTH ISLANDS

a) Auckland-South Island distribution

i) Alpine swamps only

Pareromene epiphaea

ii) Lowland-alpine swamps

Orocrambus apicellus^x O.heliotes (not
lowland)O.siriellus^x

iii) Lowland swamps only

O.angustipennis^x

iv) Native and exotic grasslands

Orocrambus flexuosellus O.ramosellus^xO.vittellus^{x,xx}

v) Forest mosses

Gadira acerellaPareromene auri-
scriptellaP.chrysochytaP.harmonicaP.interruptaP.lepidellaP.leucoxanthaP.pyrsophanesP.selenaea

b) Northern-biassed distribution

i) North Island, Nelson, only

Paragadira strophea

ii) Excluding Otago-Southland

Orocrambus simplexPareromene elainaP.holanthosP.metalliferac) Centre-biassed distribution (South to about
Banks Peninsula, north only to Wellington)Orocrambus tuhualisPareromene bipunctellaP.microdora^xAlso Chatham Islands ^{xx}Also Auckland Island

- d) Southern-biased distribution (wide ranges in South Island but not apparently into Auckland/Northland Provinces to any extent)

<u>Orocrambus callirrhous</u>	<u>O.cyclopicus</u>
<u>O.harpophorus</u>	<u>O.lewisi</u>
<u>O.vulgaris</u>	<u>O.xanthogrammus</u>
<u>O.enchophorus</u>	<u>Tawhitia pentadactyla</u> ^x

^xAlso E.Australia

RELIABILITY OF APPARENT DISTRIBUTION PATTERNS IN THE NEW ZEALAND CRAMBINAE

Many of these distribution patterns must be treated with caution. Some no doubt approximately represent the real ranges of the species concerned. However when species appear to have very discontinuous distributions within one or both main islands the patterns are probably often spurious, resulting from under-collecting. There are a number of large mountain ranges in both islands from which Crambinae have never been collected. Inland Marlborough, coastal Westland, southern Fiordland and Stewart Island are examples of large regions for which records are so sparse that the crambine fauna must be regarded as unknown.

It is difficult to accurately assess the relative merits of some patterns. Categories 1 (Subantarctic) and 2 (Chatham Islands) are probably reliable because of isolation. Category 3 (North Island only) is more suspect, but if these species did occur in the South Island I would have expected at least a few specimens to have been taken by now, since a number of localities around the main cities have been relatively well-worked by local entomologists.

Within category 4 (South Island only) the species distributions for Otago-Southland and Nelson-Marlborough are probably reliable, at least to the extent of being mutually exclusive. However some species in these categories may prove to have more extensive ranges.

South Island centre-biassed distributions are more suspect, and possibly the result of under-collecting. Orocrambus fugitivellus could frequently have been taken for the abundant O. flexuosellus and O. vittellus and not collected. This is also true of O. jansoni in category 3. Gadira leucophthalma has dark cryptic colouration and Kupea electilis appears to be restricted a specialised dune-estuarine habitat. Both may therefore have been extensively under-collected. The three Orocrambus species with centre-biassed distributions in the South Island inhabit relatively well-collected lowland and subalpine grasslands. The distributions of the closely related O. abditus and O. ordishi appear to be mutually exclusive in eastern Canterbury (fig. 252, fig. 257).

Distributions of species in the broader South Island-restricted categories are probably fairly reliable. Although the tussock grasslands and swamps of the central plateau of the North Island have been only lightly collected, the occurrence of yet uncollected species now believed to be distributed only in the South Island is not very likely.

Collections have been made at Waiouru and the National Park tussock in all the spring and summer months (October to April), producing long series of Orocrambus simplex, O. heliotes and O. siriellus. If other subalpine species were present they would probably have been taken

at the same time, since the range of habitats appears suitable. With the exception of Pareromene epiphaea, the alpine zone of the Tongariro Plateau appears to lack a crambine fauna.

The ranges of all species in the Auckland-Southland distribution category are almost certainly more extensive than points on distribution maps in this work indicate.

I conclude in fact that the ranges of many species, especially those inhabiting forests, are likely to have been under-estimated in the above summary. However I do not think it unreasonable to discuss crambine patterns of distribution as if the major categories and the apparently reliable sub-sections were substantially valid approximations to the real distributions.

THE QUATERNARY IN NEW ZEALAND

Fleming (1963a) estimated that the result of the Pleistocene glaciations was to shift the southern limit of biotic zones in New Zealand northward through 11° of latitude. This assessment is in fairly close agreement with one made independently by Willett (1950) concerning climatic conditions during the glacial periods.

Willett calculated the mean reduction of mid-summer temperature to be about 6°C during the glacial periods in the South Island. The result of this was a depression of the snowline to about 3,500 ft below the present level. According to Willett this would have been sufficient to drive the temperate forest from almost all the South Island and from all but the northern part of the North Island. The exceptions would have been areas below 500ft and with rainfall in excess of 30 inches per annum.

Canterbury and parts of Westland suffered severely during the Pleistocene glaciations (Gage, 1958). However Gage (1965) also suggested that conditions were in fact not generally as severe as Willett proposed, and that permafrost did not form in the peri-glacial regions. He thought that on the whole, during the glaciations the climate in New Zealand was somewhat warmer and wetter than in glaciated regions of the northern hemisphere.

The sequence of climatic changes in New Zealand during the Pleistocene is still incompletely known, and studies of North Island and South Island deposits do not show exactly the same picture (Okehuan not known from the South Island according to Fleming, 1962, p.86).

There is evidence that alpine-subalpine conditions of varying degrees of severity have in fact extended over the whole South Island and much of the North Island at least a dozen times during the Pleistocene (Fleming, 1962). The amount of superimposition in the fossil record is so great that detailed interpretation is very difficult. However in the table below I have attempted to summarise the broad sequence of events in the New Zealand Pleistocene and match the South Island interpretations (Speight, 1938; Gage, 1958) against the North Island sequence (Fleming, 1962) and a postulated absolute time scale (Fleming, *ibid.*; Flint, 1957).

The extent of ice formation in the South Island during the late Pleistocene is not accurately known, although at one time the ice discharge gap of the glacier in the Waimakariri Valley reached at least to the present site of Sheffield (Speight, 1938). The penultimate (or possibly

Table 17

APPROXIMATE SEQUENCE OF PLEISTOCENE EVENTS IN NEW ZEALAND (Largely from Fleming,1962)			
International sequence	Local sequence	Details	Approximate dating
HOLOCENE			
LATE PLEISTOCENE	HAWERA SERIES (At least 4 glacials, 3 interglac.)	Last glaciation (Otiran)	c.20,000 years ago
		Last interglacial	c.70-150,000 years ago
		Penultimate glac. (Avocan)	
EARLY PLEISTOCENE	UPPER WANGANUI SERIES	2nd interglacial (Castlecliffian)	
		2nd glacial (Okehuan: not known from the South Island)	
		1st interglacial (Nukumaruan)	
		1st glacial (Hautawan and Waitotaran)	c.300,000 to 600,000 years ago
PLIOCENE	LOWER WANGANUI SERIES		

antepenultimate) glaciation, called the Avoca by Gage (1958), filled the Castle Hill Basin in Canterbury with ice. This same area seems to have partly escaped during the following Otiran glaciation (Gage, *ibid.*). There was a smaller ice advance (Younger Dryas) after the Otiran (Fleming, 1962). This occurred about 10,000 years ago, and was minor only, and a temporary reversal of a trend towards a warmer climate. There has been a reduction in the amplitudes of the fluctuations, but the Thermal Maximum, perhaps 5,000 years ago, had temperatures substantially warmer than now (Fleming, 1962).

EFFECTS OF PLEISTOCENE CLIMATES
ON THE NEW ZEALAND FAUNA, FLORA

The present distributions of species within New Zealand will be quite unlike those of the Tertiary (Dumbleton, 1966), since the Pleistocene glaciations brought about vast modifications in the terrestrial life zones of this country (Willett, 1950).

Willett postulated that biotic refuges permitted many taxa to survive the glacial epoch in New Zealand. Evidence for these areas is still largely botanical, but there is also some for a number of invertebrate taxa (Dumbleton, 1963). Willett listed the probable refuge areas as southeast Otago, Stewart Island, northern Westland, coastal Nelson and Marlborough, Bank's Peninsula, and the Auckland area.

Wardle (1963) presented some evidence for further refugia on the Chatham Islands and on the subantarctic islands. Fleming (1963) was unhappy with this idea. He stressed the severity of Pleistocene climates in the subantarctic; although Auckland Island was only partially glaciated (Flint, 1957). If evidence presented by Gage (1958) on ice formation in eastern Canterbury is any guide, Auckland Island may have been scoured of life in the penultimate glaciation, but been less severely treated by the Otiran.

Wardle (1963) described probable conditions in Canterbury peri-glacial regions in the following terms; "...probably exposed land surfaces in these mountains (ie. of Canterbury and Westland) consisted mainly of unstable scree supporting only sparse vegetation. There would have

been dry grassland on the Canterbury foothills, but barren, unstable braided river beds probably extended over the greater part of the plains."

Considerable difficulties are encountered in trying to relate changes in distribution to successive events in New Zealand Pleistocene history. For various reasons documented by Fleming (1962, pp.87-8) the climates of interglacials are harder to judge than those of glacial periods. The extent of biotic recolonisation during interstadials and interglacials is really not known. However increase in rainfall during sub-glacial conditions could have facilitated forest formation -- forest later decimated by the following glacial period, so that discontinuous pockets survived with associated faunistic taxa.

Basically the effects of the glacial periods would have been to restrict the distributions of species of animals by destruction of food plants in extreme cases, and possibly by steady reduction of conditions below those in which the reproductive life of the species could proceed, even in areas where the food plants survived.

It is hard to estimate the chances of survival of taxa in the peri-glacial regions of Canterbury. Dumbleton (1966) found no evidence of Hepialine survival, but did encounter local endemism in some Simuliidae (australense group, 1963) which strongly indicated survival through the Pleistocene.

The case for peri-glacial survival of a few Orocrambus species is also good. Distribution patterns of O.abditus, O.ordishi, and O.corruptus, together with a tendency towards an apterous female which is noticeable in all three but very pronounced in O.ordishi, suggest survival in the eastern

lowland and subalpine grasslands of Canterbury.

Other species of the genus, for example O. paraxenus, are distributed in dry alpine-subalpine grasslands, and O. xanthogrammus has become adapted to life in unstable river beds of the east coasts of both the North and South Islands. The latter species probably also was able to survive in peri-glacial conditions.

The distributions of 15 species of New Zealand Crambinae show close correlation with areas proposed by Willett as biotic refugia in Otago-Southland and Nelson-Marlborough. These are very probably coincident with relict food plant distributions. For example, the distributions of Orocrambus isochytus and O. ventosus are strongly correlated in the Tasman Mountains with the restricted range of the alpine carpet grass Chionochloa australis by Burrows (1967).

It is tempting to try to correlate some of the category 4c (Bank's Peninsula) distributions with the Bank's Peninsula biotic refuge suggested by Willett. However I have already indicated that some may be peri-glacial survivors and that the records for the others may be incomplete.

Further more, Dumbleton (1963) pointed out that this region is regarded as a volcanic dome of only Pliocene-Pleistocene age, in which case it is not likely to have functioned as a biotic refuge.

At the time of the last Pleistocene glaciation (Fleming, 1962, fig. 11) Mernoo and Veryan were islands instead of the banks they are today. This was probably the period, some 20,000 years ago, when Orocrambus angustipennis, O. apicellus, O. ramosellus, O. siriellus and O. vittellus reached the Chatham Islands along the island chain of the Chatham Rise.

At the same time O.vittellus reached the Auckland Islands, and in neither case is there detectable subspeciation.

However the dominant Chatham Island grassland crambine is Orocrambus horistes, which I regard as a good species which shared common ancestry with O.flexuosellus presently distributed throughout the New Zealand mainland. I would suggest that O.horistes reached the Chathams in a much earlier invasion, perhaps towards the beginning of the Last Glaciation, perhaps 100-150,000 years ago.

Since we have little idea of the length of time needed for production of full species in the Crambinae, it could be argued that the five species listed above are recent post-glacial colonists, perhaps even introduced with European grasses, and that O.horistes reached the Chathams during the last glacial period.

I prefer the longer time scale of these two, for the reason that 8 southern-biassed Crambinae have apparently crossed Cook Strait at a time when the sea level was lower and the Strait bridged (Te Punga, 1958) and become isolated in the North Island from the South Island populations. Here again no detectable subspeciation has occurred, and geological evidence suggests that the Strait was bridged during the last glaciation and that the link was broken again about 10,000 years ago (Te Punga, 1958; Fleming, 1962).

The abundance of these species, 7 Orocrambus and Tawhitia pentadactyla, appears to decay northwards. The swamp-dwelling O.heliotes and O.siriellus may also have crossed Cook Strait at the same time, later becoming isolated in the central plateau of the North Island when conditions changed. Alternatively they may have survived in the

Auckland region biotic refuge during the worst of the final glacial period, spread southwards as conditions improved, and been restricted in the central plateau and wiped out everywhere else by the warm period of the Thermal Maximum.

The southern part of the North Island apparently had a very severe climate in the Otiran, judging by certain plant fossils (Fleming, 1962; Wardle, 1963), although glaciation was restricted to the Tararuas. Conditions certainly may not have suited O. heliotes then. There was very considerable restriction of alpine habitats in the North Island during the Thermal Maximum, according to Wardle, possibly to the extent that only unstable Ruapehu and Egmont were high enough to retain alpine zones. Consequent volcanic activity has undoubtedly brought about much disruption of these zones, possibly causing the extinction of some taxa. Mt Egmont does not appear to have an alpine crambine fauna (Dr K. Fox, pers. comm.). A single expedition that I made with Mr P. J. Wigley on to the crest of the northern Ruahines in very favourable conditions in 1967 produced no alpine crambines.

However Pareromene is well represented in the subalpine bush in the central North Island, and around and on Mt Egmont. This genus still shows a distinct northern bias in its distribution. The Auckland region biotic refuge may be assumed to have played a large part in the survival of this genus in the North Island. Only two species out of 18 are completely confined to the South Island (P. helioctypa and P. planetopa) while two are confined to the North Island, eight range throughout the country, and five are not represented in Otago-Southland.

The peri-Cook Strait distribution of Pareromene microdora and P.bipunctella may reflect survival in the Nelson-Marlborough biotic refuge only, but the pattern may be spurious, as suggested earlier, resulting from under-collecting.

As well as Pareromene, the monotypic genus Paragadira also has a largely northern distribution, with only one record from the Nelson Province of the South Island. Like Pareromene, this genus is probably a moss feeder.

Allowing for possible under-collecting, Orocrambus jansoni may have a relict pre-glacial distribution unique in the genus. Orocrambus simplex also has a northern-biased distribution, but is also found along the west coast of the South Island while the closely related species O.ordishi and O.abditus occur in the drier grasslands east of the main axis. Consequently this may reflect a preference in O.simplex for relatively high rainfall conditions, as well as survival and spread from the Nelson-Marlborough refuge which lay somewhere near the middle of the present extended range.

Sixteen New Zealand Crambinae have very wide ranges throughout the country in either grassland or forest. Some may have survived in peri-glacial regions, but Pareromene species are and presumably always have been forest moss feeders.

The success of a few species, notably O.vittellus and O.flexuosellus, must be due in part at least to the readiness with which they have adapted to feeding on exotic grasses which Europeans have planted over much of the New Zealand lowlands. Bearing in mind the invasion history of Pieris rapae L. in this country (Hudson, 1939), we need have

no illusions that nation-wide spread of a species invading an empty ecological niche is a phenomenon requiring time on the geological scale.

THE PROBLEM OF SPECIATION

A great number of authors (summarised by Rensch, 1959) have made estimates of absolute speed of evolution in different animal taxa. Little has yet resulted from this work on which one might speculate with any safety, as we know little or nothing about the speed with which adaptations are adopted by a species during evolutionary changes. The rate of change may depend on population size and the density pattern for example, and thus vary from taxon to taxon, and as much within a single taxon. Independently of, or in combination with population size and density, the rate of change may be accelerated by the severity of environmental conditions (Rensch, 1959). In islands and archipelagoes isolation combined with topographic decay, land emergence, and dispersal of taxa to these emergent land areas appear to facilitate "explosive" evolution (Zimmerman, 1958; 1963).

Factors which could have lead to rapid evolution in Protyparcha on the subantarctic islands were discussed in the earlier tribal relationships section (p. 39). Similar factors, but in larger populations, could have operated to produce the semi-apterous condition in the females of apparent peri-glacial survivors of Orocrambus in eastern Canterbury. The reduction of venation and wing size is not nearly so extreme in these species as in Protyparcha.

The speed of evolution is undoubtedly controlled

by a complex of factors of which we know little or nothing. Rensch suggested that evidence from various taxa indicated that a species could evolve in about ten times the length of time required for a sub-species, and a genus in about ten times the time needed for a species to evolve.

Sylvester-Bradley (1963) estimated that one half to one million years is a reasonable time scale for evolution of a full species under most circumstances, but it is hard to accept this as a useful generality. For example, marine molluscan genera and species frequently show exceptional stability (Rensch, 1959). Schindewolf (1950) estimated the average age of Foraminiferan genera as 71 million years.

At the other end of the scale most existing mammalian genera have evolved within only 1-8 million years (Ekman, 1940), with some appearing barely 800,000 years ago. This would, using Rensch's scale, mean species evolving in about 80,000 years. Hamilton and Rubinoff (1963) showed statistically that isolation exerts a dominant effect on rate of evolution, and that in this respect island populations do not necessarily evolve at a faster rate than those on larger land masses but still with effective isolation. For example Lönnberg (1929) described a distinct race of the freshwater fish Cottus quadricornis L. which could not be older than 8,500 years, while Berg (1933) reported others with ages between 10,000 and 30,000 years.

The Pleistocene history of New Zealand, as summarised by Fleming (1962), suggests many changes in sea level and relief, with regions successively isolated

and re-linked. Species radiating into alpine zones have become effectively isolated from lowland forms. Yet I cannot find any evidence of sub-speciation in New Zealand Crambinae which might suggest evolution in isolation in the North and South Island since the Cook Strait bridge was broken about 10,000 years ago. Great variation in size and intensity of colour in species such as Orocrambus enchophorus may indicate the beginnings of sub-speciation, but this is found between alpine and lowland populations, not North Island and South Island, and intermediates are still plentiful.

Structurally Orocrambus horistes and O. flexuosellus show closer relationships than any other pair of New Zealand Crambinae. On the assumption that they diverged at the end of the penultimate glaciation, about 150,000 years ago, then we might estimate a tentative time scale for full species evolution in the genus as a whole as perhaps 250,000 - 300,000 years. I have already suggested that Orocrambus reached New Zealand in the Eocene-Oligocene (p.373). Separation of the related genera Maoricrambus and Kupea could have occurred during Miocene cooling, or during the first glaciation at the very end of the Pliocene.

Within the genus the monophyletic species groups of Orocrambus may reflect the original number of species which colonised the country and began to radiate in the Oligocene (fig.2), with Maoricrambus and Kupea reflecting perhaps two more somewhat initially divergent members.

During the Pleistocene glaciations species would have been driven down to low levels by the very extreme conditions in the present subalpine zone. Fleming (1963a)

stressed the youth of the New Zealand alpine biota. He noted that there was little or no evidence of relict pre-glacial distributions in the alpine sector, reflecting the climatic severity.

In support of this view Dumbleton (1966) argued that a number of postulated relict forms are in fact only simulates. Such could appear when only a single species of a large genus or the species of a monotypic genus was successful in invading or re-invading the alpine sector.

In the Crambini (Corynophorina) Tawhitia glaucophanes simulates a relict distribution in the alpine zone; its only other relatives are lowland and subalpine in Australia.

Authors discussing the New Zealand alpine biota have emphasised the importance of considering the age of adaptations within New Zealand taxa to cold-climate conditions, (Fleming, 1963a; Dumbleton, 1966; Bigelow, 1967). They argued that taxa could have become adapted to cold climate conditions much earlier than the Pleistocene. Bigelow noted Palaeonotian affinities among the Acridine grasshoppers of New Zealand, and speculated that they became cold-adapted on Antarctica. Conditions on this continent finally became too severe for all but a very few taxa in the Miocene (Cranwell, 1963). However this would presumably be too late for the Acrididae to experience these conditions and still reach New Zealand. Palaeonotian affinities suggest land connections, and these were broken (if they ever existed), before the end of the Cretaceous (p. 354).

However I regard these discussions as probably fruitless at the present stage of genetic knowledge. It could

be that physiological mechanisms which evolved to cope with arid or even just relatively dry savanna climates (such as apparently existed in New Zealand during the Oligocene), later proved by chance to be equally suitable to facilitate survival in subalpine-alpine conditions, and permitted successful recolonisation of the alpine sector after the Pleistocene glaciations.

However a number of Orocrambus species do show some of the morphological adaptations to cold-climate conditions recently listed by Downes (1965). At least some of these are unlikely to be previous adaptations to semi-arid conditions. In the adults the sensory areas, such as palpi, are covered with dense hair-like scales; there is a marked tendency to melanism coupled with a basking habit to make the most of radiant heat in periods of sunlight; the compound eyes of many species have a nude peri-orbital strip which is an adaptation to diurnal flight (Dugdale, 1966); the adults show "opportunism" in emerging early in the alpine summer season as soon as conditions are favourable; there is only one complete generation per year, and the larvae are long lived.

If one accepts the time period for species evolution in this genus as about 250-300,000 years, as suggested earlier, then it is possible to postulate that species already able to cope with conditions of physiological drought (which applies equally to very dry and very cold climates) were able to adapt to the conditions produced in New Zealand by the first glaciation at the very end of the Pliocene, perhaps half a million years ago. In the period following it would not be unreasonable to expect

very considerable selection pressure towards mutations which "reinforced" this existing physiological adaptation with advantageous morphological ones, such as those listed above. The distribution of any given Orocrambus species and the severity of any one glacial period would to some extent determine how much selection pressure existed, in the habitat of the species. Most of the really severe effects in life zone changes appear to have been brought about in New Zealand by the late Pleistocene glaciations (Darlington, 1965), and I have already indicated that these, especially the Otiran, were too recent to account for crambine speciation.

We can assume that if the early Pleistocene glaciations were relatively less severe, then species with ranges close to the margins of affected life zones might be expected to show greater degrees of change than others further from the margins. I regard this as the probable reason why not all Orocrambus are as morphologically adapted as others, such as O. clarkei and O. mylites, to name two extreme cases of "Downes-type" modifications.

Dumbleton (1966) discussed the problem of the more extensive speciation in the South Island relative to the North Island. This relationship is a phenomenon found in almost every family of Lepidoptera in New Zealand (Hudson, 1939, p. 472).

It has been attributed (Dumbleton, 1966) in part to the greater land surface area of the South Island, and also to the possibility that the South Island was once in a more favourable position to receive taxa than the North Island. Thermal Maximum extinction of alpine habitats in

the North Island (Wardle, 1963) probably also played a part in the imbalance. Whatever the reasons, to which could be added the much greater diversity of present alpine habitats in the South Island, the disparity is very marked in the New Zealand grassland Crambinae. There are 29 species of Orocrambus endemic to the South Island and only 1 to the North Island. Six of the 8 Crambinae recognisable as Australian elements are confined to the South Island among other genera. Only in Pareromene does the pattern show slight reversal.

CONCLUSIONS

Crambine distribution patterns in New Zealand are very diverse, but in broad terms the grassland species have southern biased distributions and the forest species a northern one. Some show restricted distributions which are apparently relict Pleistocene patterns. The reliability of other distributions is suspect because of poor collecting in most of New Zealand.

There is no evidence for sub-speciation resulting from isolation brought about by changes in sea level and the bridging of Cook Strait during the last or Otiran glaciation. An average age of 250,000 to 300,000 years for species evolution in Orocrambus is postulated, although in the Chiloinid Protyparcha in the subantarctic the period may have been shorter than this.

Success of Orocrambus in radiating into the alpine zone following the glaciations is attributed to pre-existing physiological adaptation in at least some species, reinforced by selection for morphological adaptations during the early Pleistocene. -----

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SYSTEMATICS OF NEW ZEALAND CRAMBINAE:

APPENDIX:

CATALOGUE OF GENITALIAL PREPARATIONS.

NOTE: 1) Preparations are catalogued as follows:

400/CDA/DM/M/O tritonellus.

The first number indicates the catalogue preparation number; the group of 3 letters the preparation key label under the specimen; the next batch of letters gives the collection (see Introduction); M or F indicates male or female.

2) Preparations are arrayed in large overall sequences, in alphabetical order by the middle letter of the first group. Each middle letter is in turn arrayed in sequence by the first letter. Each first letter is in turn arrayed in sequence by the last letter.

1/AAA/DM/M/0.scutatus	41/GAD/DM/M/0.heteraulus
2/AAB/DM/M/ "	42/GAE/DM/M/ "
3/AAC/DM/M/ "	43/GAF/DM/F/ "
4/AAD/DM/M/ "	44/HAA/DM/F/0.isochoytus
5/AAE/DM/M/ "	45/HAB/DM/M/ "
6/AAF/DM/M/ "	46/HAC/DM/M/ "
7/BAA/DM/M/0.paraxenus	47/HAD/DM/F/ "
8/BAB/DM/M/0.creñaeus	48/IAA/DM/M/0.harpophorus
9/BAC/DM/M/ "	49/IAB/DM/M/ "
10/BAD/DM/M/ "	50/IAC/DM/M/ "
11/BAE/DM/M/ "	51/JAA/DM/M/0.callirrhous
12/CAA/DM/M/0.oppositus	52/JAB/DM/M/0.ramosellus
13/CAB/DM/F/ "	53/JAC/DM/M/0.callirrhous
14/CAC/DM/F/ "	54/JAD/DM/M/ "
15/CAD/DM/F/ "	55/JAE/DM/M/ "
16/CAE/DM/F/ "	56/JAF/DM/M/ "
17/CAF/DM/M/ "	57/KAA/DM/F/0.siriellus
18/DAA/DM/M/0.crenaesus	58/KAB/DM/M/ "
19/DAB/DM/M/ "	59/KAC/DM/M/ "
20/DAC/DM/M/ "	60/KAD/DM/M/ "
21/DAD/DM/M/0.dicrenellus	61/KAE/DM/M/ "
22/DAE/DM/M/ "	62/KAF/DM/M/0.philpotti
23/DAF/DM/M/0.crenaesus	63/LAA/DM/M/0.crenaesus
24/EAA/DM/F/0.enchophorus	64/LAB/DM/M/0.simplex
25/EAB/DM/M/ "	65/LAC/DM/M/0.crenaesus
26/EAC/DM/M/ "	66/LAD/DM/M/0.simplex
27/EAD/DM/M/ "	67/LAE/DM/M/ "
28/EAE/DM/F/ "	68/LAF/DM/M/ "
29/EAF/DM/F/ "	69/LAG/DM/M/ "
30/EAG/GC/F/ "	70/LAH/DM/F/0.haplotomus
31/EAH/GC/M/ "	71/LAI/DM/F/ "
32/EAI/GC/M/ "	72/LAJ/DM/M/0.simplex
33/EAJ/GC/M/ "	73/LAK/DM/M/0.lewisi
34/FAA/DM/M/0.parexenus	74/LAL/DM/M/0.simplex
35/FAB/DM/M/ "	75/LAM/DM/M/ "
36/FAC/DM/M/ "	76/LAN/DM/M/0.abditus
37/FAD/DM/M/ "	77/MAA/DM/M/0.aethonellus
38/GAA/DM/F/0.heteraulus	78/MAB/DM/F/ "
39/GAB/DM/M/ "	79/MAC/DM/M/ "
40/GAC/DM/F/ "	80/MAD/DM/M/ "

81/MAE/DM/M/0.aethonellus	121/TAD/DM/M/0.lectus
82/MAF/DM/M/ "	122/UAA/DM/M/0.crenaeus
83/MAG/DM/M/ "	123/UAB/DM/M/ "
84/MAH/DM/M/ "	124/UAC/DM/M/ "
85/NAA/DM/M/0.corruptus	125/UAD/DM/M/ "
86/NAB/DM/M/ "	126/UAE/DM/M/ "
87/NAC/DM/F/ "	127/UAF/DM/M/ "
88/NAD/DM/F/ "	128/UAG/DM/M/ "
89/NAE/DM/F/ "	129/UAH/DM/M/ "
90/NAF/DM/M/0.melitastes	130/UAI/DM/M/ "
91/NAG/DM/F/0.corruptus	131/UAJ/DM/M/ "
92/NAH/DM/F/ "	132/UAK/DM/M/ "
93/NAI/DM/M/ "	133/VAA/DM/M/ "
94/OAA/DM/M/0.vittellus	134/VAB/DM/M/ "
95/OAB/DM/F/0.melitastes	135/VAC/DM/M/ "
96/OAC/DM/F/ "	136/VAD/DM/M/ "
97/OAD/DM/M/ "	137/VAE/DM/M/0.abditus
98/OAE/DM/M/ "	138/VAF/DM/M/0.paraxenus
99/OAF/FRI/M/ "	139/VAG/DM/M/0.crenaeus
100/OAG/FRI/M/ "	140/VAH/DM/M/0.abditus
101/OAH/ED/F/ "	141/VAI/DM/M/ "
102/OAI/DM/M/ "	142/VAJ/DM/M/0.crenaeus
103/OAJ/DM/M/ "	143/VAK/DM/M/ "
104/OAK/DM/M/ "	144/VAL/DM/M/0.paraxenus
105/OAL/DM/F/ "	145/WAA/DM/M/0.lewisi
106/PAA/DM/F/ "	146/WAB/DM/F/ "
107/PAB/DM/F/ "	147/WAC/DM/M/0.simplex
108/PAC/DM/F/ "	148/WAD/DM/M/ "
109/QAA/DM/M/ "	149/WAE/DM/M/0.abditus
110/QAB/DM/M/0.aethonellus	150/WAF/DM/M/ "
111/RAA/DM/F/ "	151/WAG/DM/M/ "
112/RAB/DM/M/ "	152/WAH/DM/M/ "
113/RAC/DM/M/ "	153/WAI/DM/M/0.simplex
114/SAA/DM/M/ "	154/XAA/DM/M/0.haplotomus
115/SAB/DM/F/ "	155/XAB/DM/F/ "
116/SAC/DM/M/ "	156/XAC/DM/M/ "
117/SAD/DM/M/ "	157/XAD/DM/M/ "
118/TAA/DM/M/0.lectus	158/YAA/DM/M/0.ephorus
119/TAB/DM/M/ "	159/ZAA/DM/M/ "
120/TAC/FRI/M/ "	160/ZAB/DM/M/ "

161/ZAC/DM/F/0.ephorus	201/OBA/FRI/M/0.harpophorus
162/ZAD/DM/F/ "	202/OBB/FRI/M/ "
163/ZAE/DM/M/ "	203/PBA/FRI/F/0.xanthogrammus
164/ZAF/DM/M/ "	204/PBB/FRI/M/ "
165/ABA/DM/M/0.dicrenellus	205/PBC/FRI/M/ "
166/ABB/DM/F/0.philpotti	206/PBD/FRI/F/ "
167/ABC/DM/F/ "	207/QBA/FRI/M/0.angustipennis
168/BBA/FRI/M/0.ramosellus	208/QBB/FRI/M/ "
169/BBB/FRI/M/ "	209/QBC/FRI/F/ "
170/CBA/FRI/M/0.melampetrus	210/RBA/FRI/M/0.crenaeus
171/CBB/FRI/M/ "	211/RBB/FRI/M/ "
172/HBA/FRI/M/0.corruptus	212/RBC/FRI/M/0.isochoytus
173/HBB/FRI/F/ "	213/RBD/FRI/M/ "
174/HBC/FRI/M/ "	214/RBE/FRI/M/ "
175/IBA/FRI/F/0.heliotes	215/RBF/FRI/M/ "
176/IBB/FRI/M/ "	216/RBG/FRI/M/ "
177/IBC/FRI/F/ "	217/RBH/FRI/M/ "
178/IBD/FRI/M/ "	218/RBI/FRI/M/ "
179/JBA/FRI/F/0.aethonellus	219/RBJ/FRI/M/ "
180/KBA/FRI/M/0.tuhualis	220/RBK/FRI/M/ "
181/KBB/FRI/F/ "	221/RBL/FRI/M/0.crenaeus
182/LBA/FRI/M/0.apicellus	222/RBM/FRI/M/ "
183/LBB/FRI/M/ "	223/RBN/FRI/M/ "
184/LBC/FRI/M/ "	224/RBO/FRI/M/ "
185/LBD/FRI/F/ "	225/RBP/FRI/M/ "
186/LBE/FRI/M/ "	226/RBQ/FRI/M/0.isochoytus
187/MBA/FRI/M/0.cyclopicus	227/RBR/FRI/M/ "
188/MBB/FRI/M/ "	228/RBS/FRI/M/ "
189/MBC/FRI/M/ "	229/SBA/FRI/M/0.lectus
190/MBD/FRI/M/ "	230/SBB/FRI/M/ "
191/NBA/FRI/F/0.aethonellus	231/SBC/FRI/M/ "
192/NBB/FRI/F/ "	232/SBD/FRI/M/ "
193/NBC/FRI/F/ "	233/TBA/FRI/M/0.enchophorus
194/NBD/FRI/F/ "	234/TBB/FRI/M/ "
195/NBE/FRI/M/ "	235/TBC/FRI/M/ "
196/NBF/FRI/M/ "	236/TBD/FRI/M/ "
197/NBG/FRI/M/ "	237/TBE/FRI/M/ "
198/NBH/FRI/M/ "	238/TBF/FRI/M/ "
199/NBI/FRI/F/ "	239/TBG/FRI/M/ "
200/NBJ/FRI/F/ "	240/TBH/FRI/M/ "

241/TBI/FRI/M/0.enchophorus		281/XBE/FRI/F/0.philpotti	
242/TBJ/FRI/M/	"	282/YBA/FRI/M/0.enchophorus	
243/TBK/FRI/M/	"	283/ZBA/FRI/M/	"
244/TBL/FRI/M/	"	284/ACA/ED/M/0.haplotomus	
245/TBM/FRI/M/	"	285/ACB/ED/M/0.lectus	
246/TBN/FRI/M/	"	286/BCA/ED/F/0.horistes	
247/TBO/FRI/M/	"	287/CCA/DM/M/0.angustipennis	
248/TBP/FRI/M/	"	288/CCB/DM/F/	"
249/TBQ/FRI/M/	"	289/CCC/DM/M/	"
250/UBA/FRI/M/0.philpotti		290/CCD/DM/F/	"
251/UBB/FRI/F/	"	291/CCE/DM/M/	"
252/UBC/FRI/F/	"	292/CCF/DM/M/	"
253/UBD/FRI/F/	"	293/DCA/DM/M/0.heliotes	
254/UBE/FRI/M/	"	294/DCB/DM/M/	"
255/UBF/FRI/M/	"	295/DCC/DM/M/	"
256/UBG/FRI/M/	"	296/DCD/DM/M/	"
257/UBH/FRI/M/	"	297/DCE/DM/M/	"
258/UBI/FRI/M/	"	298/DCF/DM/M/	"
259/UBJ/FRI/M/	"	299/DCG/DM/M/	"
260/UBK/FRI/M/	"	300/DCH/DM/F/	"
261/UBL/FRI/M/	"	301/DCI/DM/M/	"
262/UBM/FRI/M/	"	302/DCJ/DM/M/	"
263/UBN/FRI/M/	"	303/DCK/DM/M/	"
264/UBO/FRI/M/	"	304/DCL/DM/M/	"
265/UBP/FRI/M/	"	305/ECA/DM/M/0.xanthogrammus	
266/UBQ/FRI/M/	"	306/ECB/DM/M/	"
267/UBR/FRI/M/	"	307/ECC/DM/M/	"
268/UBS/FRI/M/	"	308/ECD/DM/M/	"
269/UBT/FRI/M/	"	309/ECE/DM/F/	"
270/VBA/FRI/M/0.crenaeus		310/ECF/DM/M/	"
271/VBB/FRI/M/	"	311/ECG/DM/F/	"
272/VBC/FRI/M/	"	312/ECH/DM/M/	"
273/VBD/FRI/M/	"	313/ECI/DM/F/	"
274/VBE/FRI/M/	"	314/ECJ/DM/F/	"
275/VBF/FRI/M/	"	315/ECK/DM/F/	"
276/WBA/FRI/F/0.enchophorus		316/FCA/DM/F/0.sophonellus	
277/XBA/FRI/F/0.philpotti		317/FCB/DM/M/0.cyclopicus	
278/XBB/FRI/F/	"	318/FCC/DM/M/	"
279/XBC/FRI/F/	"	319/GCA/DM/F/	"
280/XBD/FRI/F/	"	320/HCA/DM/F/T.glaucophanes	

321/HCB/DM/F/T.glaucophanes	361/UCC/DM/M/O.vulgaris
322/ICA/DM/M/O.melampetrus	362/UCD/DM/M/ "
323/ICB/DM/M/ "	363/UCE/DM/M/ "
324/ICC/DM/F/ "	364/UCF/DM/M/O.vittellus
325/ICD/DM/M/ "	365/UCG/DM/M/O.vulgaris
326/ICE/DM/F/ "	366/UCH/DM/M/ "
327/JCA/DM/F/T.trapezitis	367/UCI/DM/M/ "
328/JCB/DM/F/Scoparia sp.	368/UCJ/DM/M/ "
329/JCC/DM/M/T.trapezitis	369/UCK/DM/M/ "
330/JCD/DM/M/ "	370/VCA/ED/M/O.aethonellus
331/JCE/DM/M/ "	371/WCA/DM/M/O.ramosellus
332/JCF/DM/M/ "	372/WCB/DM/M/ "
333/JCG/DM/F/ "	373/WCC/DM/M/ "
334/JCH/DM/F/ "	374/WCD/DM/M/ "
335/KCA/ED/M/T.notabilis	375/WCE/DM/M/ "
336/LCA/DM/M/S.caesia	376/XCA/ED/M/O.aethonellus
337/MCA/ED/M/O.callirrhous	377/ZCA/DM/M/T.notabilis
338/NCA/HC/F/O.punctellus	378/ADA/DM/M/O.scoparioides
339/OCA/HC/F/T.leonina	379/ADB/DM/M/ "
340/PCA/DM/M/O.eximius	380/ADC/DM/M/ "
341/QCA/DM/M/Unident.tin.	381/ADD/DM/M/ "
342/RCA/DM/M/T.glaucophanes	382/ADE/DM/M/ "
343/RCB/DM/M/ "	383/ADF/DM/M/ "
344/RCC/DM/F/ "	384/ADG/DM/M/ "
345/RCD/DM/F/ "	385/ADH/DM/M/ "
346/RCE/DM/F/ "	386/BDA/DM/M/O.catacaustus
347/RCF/DM/M/ "	387/BDB/DM/M/ "
348/RCG/DM/M/ "	388/BDC/DM/F/ "
349/RCH/DM/M/ "	389/BDD/DM/M/ "
350/RCI/DM/M/ "	390/BDE/DM/F/ "
351/RCJ/DM/M/ "	391/BDF/DM/F/ "
352/RCK/DM/M/ "	292/BDG/DM/M/ "
353/RCL/DM/M/ "	393/BDH/DM/M/ "
354/SCA/DM/F/O.thymiastes	394/BDI/DM/F/ "
355/SCB/DM/F/ "	395/BDJ/DM/M/ "
356/SCC/DM/F/ "	396/BDK/DM/M/ "
357/TCA/DM/M/Unid.tin	397/BDL/DM/M/ "
358/TCB/DM/M/ "	398/BDM/DM/M/ "
359/UCA/DM/M/O.vulgaris	399/BDN/DM/M/ "
360/UCB/DM/F/ "	400/CDA/DM/M/O.tritonellus

401/CDB/DM/F/0.mylites		441/FDG/DM/M/T.gorgopis
402/CDC/DM/F/	"	442/FDH/DM/M/
403/CDD/DM/F/	"	443/GDA/DM/M/
404/CDE/FRI/M/	"	444/GDB/DM/M/
405/CDF/FRI/M/	"	445/IDA/DM/M/0.callirrhous
406/CDG/FRI/F/	"	446/EDB/DM/M/
407/CDH/FRI/F/	"	447/IDC/DM/M/
408/CDI/FRI/F/	"	448/EDD/DM/M/
409/CDJ/FRI/F/	"	449/IDE/DM/M/
410/CDK/FRI/F/	"	450/IDF/DM/M/
411/CDL/FRI/M/	"	451/JDA/DM/M/0.philpotti
412/CDM/FRI/F/	"	452/JDB/DM/F/
413/CDN/FRI/M/	"	453/JDC/DM/F/
414/CDO/FRI/M/	"	454/JDD/DM/F/
415/CDP/FRI/M/	"	455/JDE/DM/M/
416/DDA/DM/M/0.tritonellus		456/JDF/DM/F/
417/DDB/DM/M/	"	457/JDG/DM/F/
418/DDC/DM/M/	"	458/JDH/DM/F/
419/DDD/DM/F/	"	459/KDA/DM/M/0.enchophorus
420/DDE/DM/F/	"	460/KDB/DM/M/
421/DDF/DM/M/	"	461/KDC/DM/M/
422/DDG/DM/M/	"	462/KDD/DM/F/
423/DDH/DM/M/	"	463/KDE/DM/M/
424/DDI/DM/M/	"	464/KDF/DM/M/
425/DDJ/DM/F/0.machaeristes		465/KDG/DM/M/
426/EDA/DM/M/	"	466/LDA/DM/F/0.tuhualis
427/EDB/DM/M/	"	467/LDB/DM/M/
428/EDC/DM/M/	"	468/LDC/DM/M/
429/EDD/DM/M/	"	469/LDD/DM/M/
430/EDE/DM/M/	"	470/LDE/DM/M/
431/EDF/DM/M/	"	471/LDF/DM/M/
432/EDG/DM/F/	"	472/MDA/GC/M/0.cyclopicus
433/EDH/DM/M/	"	473/MDB/GC/M/
434/EDI/DM/F/	"	474/MDC/GC/M/
435/FDA/DM/M/T.gorgopis		475/MDD/GC/M/
436/FDB/DM/M/	"	476/MDE/GC/M/
437/FDC/DM/M/	"	477/MDF/GC/M/
438/FDD/DM/M/	"	478/MDG/GC/M/
439/FDE/DM/M/	"	479/MDH/GC/M/
440/FDF/DM/M/	"	480/MDI/GC/M/

481/MDJ/GC/M/0.cyclopicus	521/PDG/GC/M/0.flexuosellus
482/MDK/GC/M/ "	522/PDH/GC/F/ "
483/MDL/GC/M/ "	523/PDI/GC/M/ "
484/MDM/GC/M/ "	524/PDJ/GC/M/ "
485/MDN/GC/F/ "	525/PDK/GC/F/ "
486/MDO/GC/F/ "	526/PDL/GC/M/ "
487/MDP/GC/F/ "	527/PDM/GC/F/ "
488/NDA/DM/M/0.vulgaris	528/PDN/GC/M/ "
489/NDB/GC/M/ "	529/PDO/GC/F/ "
490/NDC/GC/M/ "	530/PDP/GC/F/ "
491/NDD/GC/M/ "	531/PDQ/GC/M/ "
492/NDE/GC/F/ "	532/PDR/GC/M/ "
493/NDF/GC/M/ "	533/PDS/GC/M/ "
494/NDG/GC/M/ "	534/PDT/GC/F/ "
495/NDH/GC/M/ "	535/PDU/GC/M/ "
496/NDI/GC/M/ "	536/PDV/GC/M/ ""
497/NDJ/GC/M/ "	537/PDW/GC/M/ "
498/NDK/GC/M/ "	538/PDX/GC/F/ "
499/NDL/GC/M/ "	539/PDY/GC/M/ "
500/NDM/GC/M/ "	540/QDA/GC/F/0.ramosellus
501/NDN/GC/M/ "	541/QDB/GC/F/ "
502/NDO/GC/M/ "	542/QDC/GC/M/ "
503/NDP/GC/M/ "	543/QDD/GC/M/ "
504/NDQ/GC/M/ "	544/QDE/GC/M/ "
505/ODA/GC/M/0.apicellus	545/QDF/GC/F/ "
506/ODB/GC/M/ "	546/QDG/GC/M/ "
507/ODC/GC/M/ "	547/QDH/GC/F/ "
508/ODD/GC/F/ "	548/QDI/GC/M/ "
509/ODE/GC/M/ "	549/QDJ/GC/F/ "
510/ODF/GC/M/ "	550/QDK/GC/F/ "
511/ODG/GC/M/ "	551/QDL/GC/M/ "
512/ODH/GC/F/ "	552/QDM/GC/F/ "
513/ODI/GC/M/ "	553/QDN/GC/M/ "
514/ODJ/GC/M/ "	554/QDO/GC/M/ "
515/PDA/GC/F/0.flexuosellus	555/QDP/GC/M/ "
516/PDB/GC/M/ "	556/QDQ/GC/F/ "
517/PDC/GC/M/ "	557/QDR/GC/M/ "
518/PDD/GC/M/ "	558/QDS/GC/F/ "
519/PDE/GC/M/ "	559/QDT/GC/F/ "
520/PDF/GC/F/ "	560/QDU/GC/F/ "

561/QDV/GC/M/O.ramosellus	601/AEC/AM/M/O.ordishi
562/QDW/GC/M/ "	602/AED/AM/M/O.lewisi
563/QDX/GC/F/ "	603/AEE/AM/M/O.ordishi
564/QDY/GC/M/ "	604/AEF/AM/M/ "
565/QDZ/GC/M/O.vittellus	605/AEG/AM/M/ "
566/QDa/GC/F/O.ramosellus	606/AEH/AM/M/O.lewisi
567/QDb/GC/M/ "	607/AEI/AM/M/O.ordishi
568/QDc/GC/F/ "	608/AEJ/AM/F/O.lewisi
569/QDd/GC/M/O.vittellus	609/AFA/DM/M/S.(?)caesia
570/QDe/GC/M/O.ramosellus	610/BFA/DM/M/O.melitastes
571/QDf/GC/M/ "	611/BFB/DM/M/ "
572/QDg/GC/M/ "	612/CFA/DM/M/O.simplex
573/QDh/GC/M/ "	613/CFB/DM/M/ "
574/QDi/GC/M/ "	614/CFC/DM/M/O.haplotomus
575/QDj/GC/M/ "	615/CFD/DM/M/O.simplex
576/QDk/GC/M/ "	616/CFE/DM/M/O.abditus
577/QDm/GC/M/ "	617/CFF/DM/M/O.simplex
578/RDA/DM/M/O.cyclopicus	618/CFG/DM/F/O.haplotomus
579/RDB/DM/M/ "	619/CFH/DM/M/O.simplex
580/RDC/DM/M/ "	620/CFI/DM/M/ "
580a/SDA/DM/M/O.sophonellus	621/CFJ/DM/M/O.crenaeus
581/TDA/FRI/M/O.ventosus	622/CFK/DM/M/O.simplex
582/TDB/FRI/M/O.melampetrus	623/CFL/DM/M/ "
583/TDC/FRI/F/O.ventosus	624/CFM/DM/M/O.lewisi
584/TDD/FRI/F/ "	625/CFN/DM/M/ "
585/TDE/FRI/F/ "	626/CFO/DM/F/O.haplotomus
586/UDA/GC/M/O.vittellus	627/CFP/DM/M/O.simplex
587/UBD/GC/M/ "	628/CFQ/DM/F/O.haplotomus
588/UDC/GC/M/ "	629/CFR/DM/M/ "
589/UDD/GC/M/ "	630/CFS/DM/M/ "
590/UDE/GC/M/ "	631/CFT/DM/M/O.dicrenellus
591/UDF/FRI/M/ "	632/DFA/DM/M/O.siriellus
592/UDG/DM/F/ "	633/DFB/DM/M/ "
593/UDH/DM/F/ "	634/DFC/DM/M/ "
594/UDI/DM/M/ "	635/DFD/DM/M/ "
595/UDJ/DM/M/ "	636/DFE/DM/M/ "
596/UDK/DM/M/ "	637/DFE/DM/M/ "
597/UDL/DM/M/ "	638/DFG/DM/M/ "
598/UDM/DM/M/ "	639/EFA/DM/M/O.crenaeus
599/AEA/AM/M/O.simplex	640/EFB/DM/M/ "
600/AEB/AM/M/O.ordishi	

641/EFC/DM/M/0.crenaeus	681/GFM/DM/M/0.aethonellus
642/EFD/DM/M/ "	682/GFN/DM/M/0.heteraulus
643/EFE/DM/M/0.scutatus	683/GFO/DM/M/ "
644/EFF/DM/M/ "	684/GFP/DM/M/ "
645/EFG/DM/M/ "	685/GFQ/DM/M/ "
646/FFA/DM/F/0.oppositus	686/GFR/DM/M/0.angustipennis
647/FFB/DM/F/ "	687/GFS/DM/M/ "
648/FFC/DM/M/ "	688/GFT/DM/F/ "
649/FFD/DM/M/ "	689/GFU/DM/F/ "
650/FFE/DM/M/ "	690/GFV/DM/M/0.callirrhous
651/FFF/DM/M/0 "	691/GFW/DM/M/ "
652/FFG/DM/F/ "	692/GFX/DM/M/ "
653/FFH/DM/F/ "	693/GFY/DM/M/ "
654/FFI/DM/F/ "	694/GFZ/DM/M/ "
655/FFJ/DM/F/0.ephorus	695/HFA/DM/M/ "
656/FFK/DM/M/ "	696/HFB/DM/M/ "
657/FFL/DM/M/ "	697/HFC/DM/F/ "
658/FFM/DM/M/ "	698/HFD/DM/M/ "
659/FFN/DM/M/ "	699/HFE/DM/F/ "
660/FFO/DM/M/0.isoehytus	700/HFF/DM/M/0.harpophorus
661/FFP/DM/M/ "	701/HFG/DM/M/ "
662/FFQ/DM/M/ "	702/HFH/DM/M/ "
663/FFR/DM/M/ "	703/HFI/DM/M/ "
664/FFS/DM/M/0.paraxenus	704/HFJ/DM/M/ "
665/FFT/DM/M/0.enchophorus	705/HFK/DM/F/M.oncobolus
666/FFU/DM/M/ "	706/HFL/DM/M/0.tuhualis
667/FFV/DM/M/ "	707/HFM/DM/M/ "
668/FFV/DM/M/ "	708/HFN/DM/M/0.vulgaris
669/GFA/DM/M/0.machaeristes	709/HFO/DM/F/ "
670/GFB/DM/M/ "	710/HFP/DM/M/ "
671/GFC/DM/F/ "	711/HFQ/DM/M/ "
672/GFD/DM/F/0.ventosus	712/HFR/DM/M/ "
673/GFE/DM/F/ "	713/HFS/DM/M/ "
674/GFF/DM/M/0.aethonellus	714/HFT/DM/M/ "
675/GFG/DM/M/ "	715/HFU/DM/F/0.corruptus
676/GFH/DM/M/ "	716/HFV/DM/M/ "
677/GFI/DM/M/0.thymiastes	717/FHW/DM/F/ "
678/GFJ/DM/M/ "	718/HFX/DM/M/ "
679/GFK/DM/M/ "	719/HFY/DM/M/ "
680/GFL/DM/F/ "	720/HFZ/DM/M/0.melitastes.

721/IFA/DM/M/O.melitastes	761/JFO/DM/M/P.metallifera
722/IFB/DM/F/ "	762/JFP/FRI/ /Pyralid
723/IFC/DM/F/ "	763/JFQ/FRI/ / "
724/IFD/DM/F/ "	764/JFR/FRI/ / "
725/IFE/DM/F/P.microdora	765/JFS/FRI/ / "
726/IFF/DM/M/ "	766/JFT/FRI/M/T.gorgopis
727/IFG/DM/M/ "	767/JFU/FRI/M/P.gurri
728/IFH/DM/M/ "	768/FJV/FRI/M/P.epiphaea
729/IFI/DM/M/ "	769/AGA/CM/F/O.abditus
730/IFJ/DM/M/ "	770/AGB/CM/F/ "
731/IFK/DM/M/ "	771/AGC/CM/M/O.melampetrus
732/IFL/DM/M/P.interrupta	772/AGD/CM/M/ "
733/IFM/DM/M/ "	773/AGE/CM/F/ "
734/IFN/DM/F/ "	774/AGF/CM/F/ "
735/IFO/DM/F/ "	775/AGG/CM/M/ "
736/IFP/DM/M/ "	776/AGH/CM/F/O.mylites
737/IFQ/DM/M/ "	777/AGI/CM/F/ "
738/IFR/DM/F/ "	778/AGJ/CM/M/O.catacaustus
739/IFS/DM/F/ "	779/AGK/CM/M/ "
740/IFT/DM/F/ "	780/AGL/CM/M/O.ventosus
741/IFU/DM/M/ "	781/AGM/CM/M/O.tritonellus
742/IFV/DM/F/P.selenaea	782/AGN/CM/M/O.scoparioides
743/IFW/DM/F/ "	783/AGO/CM/F/O.heliotes
744/IFX/DM/M/ "	784/AGP/CM/M/O.aethonellus
745/IFY/DM/M/ "	785/AGQ/CM/F/ "
746/IFZ/DM/M/ "	786/AGR/CM/M/O.lectus
747/JFA/DM/ /Pyralid.	787/AGS/CM/F/ "
748/JFB/DM/M/P.selenaea	788/AGT/CM/M/O.angustipennis
749/JFC/DM/M/ "	789/AGU/CM/M/O.crenaesus
750/JFD/DM/M/P.metallifera	790/AGV/CM/M/ "
751/JFE/DM/M/Pyralid	791/AVW/CM/M/O.horistes
752/JFF/DM/M/P.metallifera	792/AGX/CM/M/O.dicrenellus
753/JFG/DM/F/ "	793/AGY/CM/M/ "
754/JFH/DM/M/ "	794/AGZ/CM/M/O.philpotti
755/JFI/DM/M/ "	795/BGA/CM/M/O.dicrenellus
756/JFJ/DM/F/ "	796/BGB/CM/M/ "
757/JFK/DM/F/ "	797/BGC/CM/M/ "
758/JFL/DM/F/ "	798/BGD/CM/M/O.philpotti
759/JFM/DM/F/ "	799/BGE/CM/M/O.dicrenellus
760/JFN/DM/F/ "	800/BGF/CM/F/O.isochoytus.

801/BGG/CM/M/0.ephorus	841/CGX/FRI/M/0.paraxenus
802/BGH/CM/M/ "	842/CGY/FRI/F/0.callirrhous
803/BGI/CM/M/ "	843/CGZ/FRI/F/ "
804/BGJ/CM/M/0.crenaeus	844/DGA/FRI/M/0.paraxenus
805/BGK/CM/M/0.enchophorus	845/DGB/FRI/M/0.dicrenellus
806/BGL/CM/M/ "	846/DGC/FRI/M/0.vittellus
807/BGM/CM/F/0.callirrhous	847/DGD/FRI/M/ "
808/BGN/CM/M/0.enchophorus	848/DGE/FRI/M/ "
809/BGO/CM/F/ "	849/DGF/FRI/M/ "
810/BGP/CM/M/0.haplotomus	850/DGG/FRI/M/ "
811/BGQ/CM/M/ "	851/DGH/FRI/M/ "
812/BGR/CM/M/0.lewisi	852/DGI/FRI/F/0.lectus
813/BGS/CM/F/0.siriellus	853/DGJ/FRI/M/0.philpotti
814/BGT/CM/F/ "	854/DGK/FRI/M/0.vittellus
815/BGU/CM/M/ "	855/DGL/FRI/M/0.lectus
816/BGV/CM/ /0.vulgaris	856/DGM/FRI/M/0.ramosellus
817/BGW/CM/ / "	857/DGM/FRI/M/0.vittellus
818/CGA/FRI/M/T.pentadactyla	858/DGO/FRI/F/0.ramosellus
819/CGB/FRI/M/ "	859/DGP/FRI/M/ "
820/CGC/DM/M/ "	860/DGQ/FRI/M/0.vulgaris
821/CGD/DM/M/ "	861/DGR/FRI/M/ "
822/CGE/DM/F/ "	862/DGS/FRI/M/0.vittellus
823/CGF/DM/M/ "	863/DGT/FRI/M/0.lectus
824/CGG/DM/M/ "	864/DGU/FRI/M/0.ramosellus
825/CGH/DM/M/ "	865/DGV/FRI/F/0.vulgaris
826/CGI/DM/M/ "	866/DGW/FRI/M/0.ramosellus
827/CGJ/CM/M/M.oncobolus	867/DGX/FRI/M/0.lectus
828/CGL/FRI/M/0.harpophorus	868/DGY/FRI/M/0.ramosellus
829/CGL/FRI/M/ "	869/DGZ/FRI/M/0.vittellus
830/CGM/FRI/M/ "	870/EGA/FRI/F/0.philpotti
831/CGN/FRI/M/ "	871/EGB/FRI/M/0.vittellus
832/CGO/CM/F/ "	872/EGC/FRI/M/ "
833/CGP/CM/F/ "	873/EGD/FRI/F/0.enchophorus
834/CGQ/CM/F/ "	874/EGE/FRI/M/ "
835/CGR/CM/F/M.oncobolus	875/EGF/FRI/M/0.ramosellus
836/CGS/CM/M/ "	876/EGG/FRI/F/0.philpotti
837/CGT/CM/F/ "	877/EGH/FRI/M/0.vittellus
838/CGU/FRI/F/T.trapezitis	878/EGI/FRI/M/ "
839/CGV/FRI/F/0.eximia	879/EGJ/FRI/M/ "
840/CGW/FRI/M/ "	880/EGK/FRI/M/0.lectus

881/EGL/FRI/M/O.ramosellus	921/FGZ/CM/M/O.lewisi
882/EGM/FRI/F/O.philpotti	922/GGA/ED/M/O.ordishi
883/EGN/FRI/M/O.enchophorus	923/GGB/ED/M/ "
884/EGO/FRI/M/O.crenaeus	924/GGC/ED/M/ "
885/EGP/FRI/M/T.notabilis	925/GGD/ED/M/O.abditus
886/EGQ/FRI/M/T.gorgopis	926/GGE/ED/M/ "
887/EGR/FRI/M/ "	927/GGF/ED/M/ "
888/EGS/FRI/M/T.notabilis	928/GGG/ED/F/O.melitastes
889/EGT/FRI/M/T.gorgopis	929/GGH/ED/M/O.crenaeus
890/EGU/FRI/M/ "	930/GGI/ED/M/ "
891/EGV/FRI/M/ "	931/GGJ/ED/M/ "
892/EGW/FRI/M/T.notabilis	932/GGK/ED/M/ "
893/EGX/FRI/M/ "	933/GGL/ED/M/O.lewisi
894/EGY/FRI/M/T.gorgopis	934/GGM/ED/M/O.simplex
895/EGZ/FRI/M/T.notabilis	935/GGN/ED/M/O.heteraulus
896/FGA/FRI/M/T.gorgopis	936/GGO/ED/M/O.lewisi
897/FGB/FRI/M/ "	937/GGP/ED/M/ "
898/FGC/DM/F/G.acerella	938/GGQ/ED/M/ "
899/FGD/DM/M/ "	939/GGR/ED/M/ "
900/FGE/DM/M/K.electilis.	940/GGS/ED/M/O.abditus
901/FGF/DM/F/P.strophea	941/GGT/ED/M/O.simplex
902/FGG/DM/M/G.petraula	942/GGU/ED/M/ "
903/FGH/DM/F/G.leucophthalma	943/GGV/ED/M/ "
904/FGI/LC/M/O.abditus	944/GGW/ED/M/ "
905/FGJ/CM/M/O.simplex	945/GGX/ED/M/O.ordishi
906.FGK/CM/M/O.abditus	946/GGY/ED/M/O.simplex
907/FGL/CM/M/O.ordishi	947/GGZ/ED/M/O.lewisi
908/FGM/CM/M/O.lewisi	948/HGA/ED/M/ "
909/FGN/CM/M/ "	949/HGB/ED/M/ "
910/FGO/CM/M/ "	950/HGC/ED/M/ "
911/FGP/LC/M/ "	951/HGD/ED/M/O.ordishi
912/FGQ/GC/F/O.simplex	952/HGE/ED/M/O.lewisi
913/FGR/GC/F/ "	953/HGF/ED/M/ "
914/FGS/FRI/M/A.malacelloides	954/HGG/ED/F/ "
915/FGT/CM/M/O.lewisi	955/HGH/ED/M/T.glaucophanes
916/FGU/CM/M/O.abditus	956/GHI/ED/ /Pyraustine
917/FGV/CM/M/O.lewisi	957/HGJ/ED/M/O.aethonellus
918/FGW/CM/M/O.abditus	958/HGK/ED/M/O.catacaustus
919/FVX/CM/M/ "	959/HGL/DM/F/P.lepidella
920/FGY/CM/M/O.simplex	960/HGM/DM/F/T.glaucophanes

961/HGN/DM/F/P.holanthes	1001/ALO/DM/M/P.epiphaea
962/HGO/DM/F/T.gorgopis	1002/ALP/DM/F/P.lepidella
963/HGP/DM/F/P.leucoxantha	1003/ALQ/DM/M/P.auriscriptella
964/HGQ/FRI/F/P.metallifera	1004/ALR/DM/F/P.epiphaea
965/HGR/FRI/F/T.notabilis	1005/ALS/ED/M/P.harmonica
966/HGS/FRI/F/P.pyrsophanes	1006/ALT/DM/M/P.pyrsophanes
967/HGT/FRI/F/T.gorgopis	1007/ALU/DM/M/P.chrysochyta
968/HGU/FRI/F/T.notabilis	1008/ALV/DM/M/P.helioctypa
969/HGV/DM/F/P.parorma	1009/ALW/DM/F/ "
970/HGW/DM/F/P.epiphaea	1010/ALX/DM/M/P.auriscriptella
971/HGX/DM/F/P.elaina	1011/ALY/DM/M/ "
972/HGY/FRI/F/P.gurri	1012/ALZ/AM/M/O.ordishi
973/HGZ/DM/F/P.helioctypa	1013/BLA/AM/F/ "
974/IGA/DM/F/P.auriscriptella	1014/BLB/AM/F/ "
975/IGB/DM/M/G.petraula	1015/BLC/DM/M/P.harmonica
976/IGC/DM/F/P.harmonica	1016/BLD/FRI/M/T.glaucophanes
977/IGD/DM/F/ "	1017/BLE/FRI/F/ "
978/IGE/FRI/F/P.selenaea	1018/BLF/FRI/M/ "
979/IGF/FRI/F/P.interrupta	1019/BLG/FRI/F/ "
980/IGG/DM/F/P.bipunctella	1020/BLH/AM/F/P.selenaea
981/IGH/DM/F/G.acerella	1021/BLI/AM/F/P.parorma
982/IGI/CM/M/P.scaphodes	1022/BLJ/AM/F/P.pyrsophanes
983/IGJ/DM/F/G.leucophthalma	1023/BLK/AM/F/P.interrupta
984/IGK/DM/M/ "	1024/BLL/AM/F/P.metallifera
985/IGL/DM/F/O.scoparioides	1025/BLM/AM/F/P.microdora
986/IGM/DM/F/ "	1026/BLN/AM/F/P.chrysochyta
987/ALA/DM/M/P.elaina	1027/BLO/AM/M/P.planetopa
988/ALB/DM/M/ "	1028/BLP/AM/M/ "
989/ALC/DM/M/ "	1029/BLQ/AM/F/P.harmonica
990/ALD/DM/F/ "	1030/BLR/AM/F/P.leucoxantha
991/ALE/DM/F/ "	1031/BLS/DM/F/P.ephiphaea
992/ALF/FRI/F/ "	1032/BLT/DM/F/P.elaina
993/ALG/DM/F/P.holanthes	1033/BLU/DM/F/ "
994/ALH/DM/M/P.bipunctella	1034/BLV/AM/F/G.petraula
995/ALI/DM/F/ "	1035/BLW/DM/M/ "
996/ALJ/DM/M/ "	1036/BLX/DM/M/P.strophea
997/ALK/DM/F/P.lepidella	1037/BLY/AM/F/ "
998/ALL/DM/M/P.leucoxantha	1038/BLZ/DM/F/P.elaina
999/ALM/DM/M/ "	1039/BMA/FRI/F/P.selenaea
1000/ALN/DM/M/P.holanthes	1040/BMB/DC/M/O.simplex

1041/BMC/DC/M/O.simplex
1042/BMD/DC/M/ "
1043/BME/AM/F/P.strophea
1044/BMF/FRI/M/T.gorgopis
1045/BMG/FRI/F/ "
1046/BMH/FRI/M/T.notabilis
1047/BMI/FRI/F/ "
1048/BMJ/DM/M/T.trapezitis
1049/BMK/CM/F/ "
1050/BML/FRI/M/G.acerella
1051/BMM/FRI/F/ "
1052/BMN/ANC/M/P.ochracealis
1053/BMO/ANC/ /Pyralid
1054/BMP/ANC/M/T.pentadactyla
1055/BMQ/ANC/M/H.pedionoma
1056/BMR/ANC/M/E.ocelleus
1057/BMS/ANC/M/Anaclustis
1058/BMT/ANC/M/A.malecelloides
1059/BMU/ANC/F/ culladia
1060/BMV/BMH/F/P.scaphodes
1061/BMW/NMV/M/G.graminella
1062/BMX/NMV/F/G.pleniferella
1063/BMY/NMV/F/C.lativittalis
1064/BMZ/NMV/M/G.panselenella
1065/BNA/AMS/F/G.cuneiferellus
1066/BNB/AMS/M/T.callixutha
1067/BNC/AMS/F/ "
1068/BND/AMS/F/ "
1069/BNE/DC/M/O.crenaeus
1070/BNF/DC/M/O.simplex
1071/BNG/DC/M/T.crenaeus
1072/AQA/FRI/F/T.gorgopis
1073/AQB/FRI/F/ "
1074/AQC/FRI/F/T.glaucophanes
1075/AQD/FRI/F/T.gorgopis
1076/AQE/MC/F/O.angustipennis
1077/AQF/MC/F/O.flexuosellus
1078/AQG/MC/F/O.enchophorus
1079/AQH/DM/F/P.lepidella
1080/AQI/MC/F/S.philerga