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A TAXONOMIC REVISION OF THE
NEW ZEALAND SPECIES OF THE GENUS
PERSECTANIA (NOCTUIDAE: MADENINAE)
(SENSU HUDSON, 1928).

A thesis
submitted in partial fulfilment
of the requirements for the Degree
of
Master of Agricultural Science
in the
University of Canterbury

by
S. Goodwin

Lincoln College
1970
## CONTENTS

<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. <strong>INTRODUCTION</strong></td>
<td>1</td>
</tr>
<tr>
<td>II. <strong>REVIEW OF LITERATURE</strong></td>
<td>4</td>
</tr>
<tr>
<td>I. General</td>
<td>4</td>
</tr>
<tr>
<td>II. Flight Trap Records</td>
<td>12</td>
</tr>
<tr>
<td>III. Morphology and Nomenclature of</td>
<td></td>
</tr>
<tr>
<td>Lepidopterous Genitalia</td>
<td>13</td>
</tr>
<tr>
<td>1. Introduction</td>
<td>13</td>
</tr>
<tr>
<td>2. Historical</td>
<td>13</td>
</tr>
<tr>
<td>3. Nomenclature and Morphology</td>
<td>15</td>
</tr>
<tr>
<td>IV. Morphology of Lepidopterous Larvae</td>
<td>27</td>
</tr>
<tr>
<td>III. MATERIALS AND METHODS</td>
<td>35</td>
</tr>
<tr>
<td>I. Obtaining the Material</td>
<td>35</td>
</tr>
<tr>
<td>II. Preparation for Study</td>
<td>39</td>
</tr>
<tr>
<td>IV. TAXONOMY OF THE GENUS <strong>PERSECTANIA</strong> HAMPSON</td>
<td>42</td>
</tr>
<tr>
<td>(Sensu Hudson, 1928) IN NEW ZEALAND</td>
<td></td>
</tr>
<tr>
<td>I. Historical</td>
<td>42</td>
</tr>
<tr>
<td>II. Descriptions of the larvae of six species of Lepidoptera (Noctuidae: Badeninae)</td>
<td>47</td>
</tr>
<tr>
<td>1. Chaetotaxy</td>
<td>47</td>
</tr>
<tr>
<td>2. Pigmentation Patterns</td>
<td>61</td>
</tr>
</tbody>
</table>
III. Classification of the family Noctuidae 67

IV. Descriptions of some New Zealand noctuid genera (Noctuidae:Hadeninae), and of the species placed in Peraeaetania 72

V. DISCUSSION AND CONCLUSIONS 148

VI. SUMMARY 159

GLOSSARY 161

ACKNOWLEDGMENTS 162

REFERENCES 163
<table>
<thead>
<tr>
<th>FIGURE</th>
<th>DESCRIPTION</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Distribution of <em>Peroctania swungii</em> (Westw.) and <em>P. syrscita</em> Common in</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Australia based on adult records</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Lateral aspect of female abdomen, showing reproductive system and secondary</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>sexual structures used in taxonomy</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Schematic drawing of a male phallus</td>
<td>23</td>
</tr>
<tr>
<td>4.</td>
<td>Noctuid labium and maxillae</td>
<td>28</td>
</tr>
<tr>
<td>5.</td>
<td>Typical 3-segmented lepidopterous antenna</td>
<td>28</td>
</tr>
<tr>
<td>6.</td>
<td>Noctuid mandible</td>
<td>28</td>
</tr>
<tr>
<td>7.</td>
<td>Cranial sutures and areas of lepidopterous larvae</td>
<td>29</td>
</tr>
<tr>
<td>8.</td>
<td>Noctuid larval thoracic leg</td>
<td>29</td>
</tr>
<tr>
<td>9.</td>
<td>Noctuid larval crochet arrangement, (uniordinal, mesoseries)</td>
<td>29</td>
</tr>
<tr>
<td>10.</td>
<td>Larval cranial chaetotaxy of <em>G. disjungens</em>, <em>T. steropastia</em>, and *T.</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td>atristriga</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Larval cranial chaetotaxy of <em>T. propria</em>, <em>G. arcotis</em>, and <em>P. aversa</em></td>
<td>49</td>
</tr>
<tr>
<td>12.</td>
<td>Larval prothoracic chaetotaxy of <em>G. disjungens</em>, <em>T. steropastia</em>, *T.</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>atristriga, <em>T. propria</em>, <em>G. arcotis</em>, and <em>P. aversa</em></td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Larval meso/metathoracic chaetotaxy of <em>G. disjungens</em>, <em>T. steropastia</em>,</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>T. atristriga</em>, <em>T. propria</em>, <em>G. arcotis</em></td>
<td></td>
</tr>
</tbody>
</table>
and P.aversa . . . . . . . . . . 51
14. Larval abdominal chaetotaxy of G. disjungens,
    T. steropastis, T. atristriga, T. propria, G. arotis,
    and P.aversa . . . . . . . . . . 52
15. Typical noctuid larval cranial chaetotaxy . . 53
16. Typical noctuid larval pigmentation bands . . 53
17. Larval and shield chaetotaxy of G. disjungens,
    T. steropastis, T. atristriga, T. propria, G. arotis,
    and P.aversa . . . . . . . . . . 60
18. Diagrammatic sketch of the wing pattern of a
    noctuid . . . . . . . . . . . . 68
19. Apical fore tarsal segment, ventral view . . 68
20. Typical thoracic legs of a noctuid . . . . . 68
21. Typical noctuid wing venation . . . . . 69
22. Types of egg of P.aversa and the other species
    in the genus Persectania (sensu Hudson, 1928). 69
23. Male genitalia of Persectania aversa . . . 116
24. Female genitalia of Persectania aversa . . . 117
25. Male genitalia of Graphania disjungens . . . 118
26. Female genitalia of Graphania disjungens . . . 119
27. Male genitalia of Graphania arotis . . . . 120
28. Female genitalia of Graphania arotis . . . . 121
29. Male genitalia of Tmetolophota propria . . . 122
30. Female genitalia of Tmetolophota propria . . . 123
31. Male genitalia of Tmetolophota atristriga . . . 124
<table>
<thead>
<tr>
<th>FIGURE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>32.</td>
<td>Female genitalia of <em>Tmetolophota atristriga</em></td>
</tr>
<tr>
<td>33.</td>
<td>Male genitalia of <em>Tmetolophota steropastis</em></td>
</tr>
<tr>
<td>34.</td>
<td>Female genitalia of <em>Tmetolophota steropastis</em></td>
</tr>
<tr>
<td>35.</td>
<td>Male genitalia of <em>Tmetolophota similis</em></td>
</tr>
<tr>
<td>36.</td>
<td>Female genitalia of <em>Tmetolophota similis</em></td>
</tr>
<tr>
<td>37.</td>
<td>Distal half of forewing of <em>Persectania swingii</em> (Westwd.), <em>P. dyscrita</em> Common, <em>P. aversa</em> (Wlk.) and <em>T. similis</em> (Philpt.)</td>
</tr>
<tr>
<td>38.</td>
<td>Peniculi of male genitalia of the New Zealand species of <em>Persectania</em> (sensu Hudson, 1928).</td>
</tr>
<tr>
<td>39.</td>
<td>Male genitalia of <em>Maoria plena</em></td>
</tr>
<tr>
<td>40.</td>
<td>Female genitalia of <em>Maoria plena</em></td>
</tr>
<tr>
<td>41.</td>
<td>Male genitalia of <em>Dipauastica epiastra</em></td>
</tr>
<tr>
<td>42.</td>
<td>Female genitalia of <em>Dipauastica epiastra</em></td>
</tr>
<tr>
<td>43.</td>
<td>Male genitalia of <em>Phystetica caerulea</em></td>
</tr>
<tr>
<td>44.</td>
<td>Female genitalia of <em>Phystetica caerulea</em></td>
</tr>
<tr>
<td>45.</td>
<td>Male genitalia of <em>Erana graminosa</em></td>
</tr>
<tr>
<td>46.</td>
<td>Female genitalia of <em>Erana graminosa</em></td>
</tr>
<tr>
<td>47.</td>
<td>Male and female genitalia of <em>Ichneutica ceraunius</em></td>
</tr>
</tbody>
</table>
**LIST OF PLATES**

<table>
<thead>
<tr>
<th>PLATE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Frontispiece: A view of the University of Canterbury Research hut, Cass, with the surrounding vegetation host to many noctuid species</td>
<td>129</td>
</tr>
<tr>
<td>2. Typical marginal notching of flax (<em>Phormium tenax</em>) leaves caused by the larvae of <em>Persectania steropastis</em> (Meyrick)</td>
<td>129</td>
</tr>
<tr>
<td>3. The model of light trap used to catch live adults of the moth species under revision</td>
<td>129</td>
</tr>
<tr>
<td>4. The two types of cages which were used to contain ovipositing adults and subsequently developing larvae</td>
<td>129</td>
</tr>
<tr>
<td>5. <em>Persectania aversa</em> (Wlk.), male</td>
<td>129</td>
</tr>
<tr>
<td>7. <em>Graphania disjungens</em> (Wlk.), male</td>
<td>129</td>
</tr>
<tr>
<td>8. <em>Graphania disjungens</em> (Wlk.), female</td>
<td>129</td>
</tr>
<tr>
<td>9. <em>Graphania arotis</em> (Meyr.), male</td>
<td>129</td>
</tr>
<tr>
<td>10. <em>Graphania arotis</em> (Meyr.), female</td>
<td>129</td>
</tr>
<tr>
<td>11. <em>Tmetolophota propria</em> (Wlk.), male</td>
<td>130</td>
</tr>
<tr>
<td>12. <em>Tmetolophota propria</em> (Wlk.), female</td>
<td>130</td>
</tr>
<tr>
<td>13. <em>Tmetolophota atristiga</em> (Wlk.), male</td>
<td>130</td>
</tr>
<tr>
<td>14. <em>Tmetolophota atristiga</em> (Wlk.), female</td>
<td>130</td>
</tr>
<tr>
<td>15. <em>Tmetolophota steropastis</em> (Meyr.), male</td>
<td>130</td>
</tr>
<tr>
<td>16. <em>Tmetolophota steropastis</em> (Meyr.), female</td>
<td>130</td>
</tr>
</tbody>
</table>
17. Tmetolophota similis (Philpt.), male . . . 131a.
19. 1st Instar larva of Persectania aversa . . . 149
20. 1st Instar larva of Tmetolophota atristriga . . 150
21. 1st Instar larva of Melanchra mutans . . . 151
LIST OF TABLES

<table>
<thead>
<tr>
<th>TABLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The names of the cranial setae and associated punctures of Lepidopterous larvae, after Hinton (1946)</td>
<td>33</td>
</tr>
<tr>
<td>2. The names of the thoracic and abdominal setae of Lepidopterous larvae, after Hinton (1946)</td>
<td>34</td>
</tr>
<tr>
<td>3. Measurements in mm. between the cranial setae of six species of Lepidopterous larvae</td>
<td>55</td>
</tr>
<tr>
<td>4. Transformation into ratios of the measurements between the cranial setae of six species of Lepidopterous larvae</td>
<td>56</td>
</tr>
</tbody>
</table>
CHAPTER I

INTRODUCTION

It is commonly known that *Persectania aversa* (Walker), the native army caterpillar of New Zealand, is a pest of cultivated graminaceous plants especially those harvested for their seed. When this species is present in high populations it becomes gregarious and can cause considerable damage. Only the irregular nature of these outbreaks has prevented *P.aversa* from becoming a major pest in New Zealand agriculture on the scale of grass grub and porina.

The New Zealand Armyworm then, is an economic pest to a certain degree and for this reason a study of its biology and population dynamics was originally planned.

In a preliminary examination of the literature relating to *P.aversa* in particular, and to other members of the genus *Persectania* in general, some doubt was cast on the actual classification of this genus in New Zealand. This doubt was primarily caused by Common (Common, 1954), who stated that "...it seems desirable to restrict the genus *Persectania* to the two
Australian and the single New Zealand species." Since Common, this latter idea has also been suggested by J.S. Dugdale, D.S.I.R., Nelson (pers. comm.) and D.S. Fletcher, Brit. Mus. (Nat. Hist.) (pers. comm.).

These suspicions were then considered in the light of the last revision of the genus Persectania in 1928 (Hudson, 1928), which placed eight species in the genus. The seven other New Zealand species in Persectania (sensu Hudson, 1928) besides \textit{aversa}, all of which are solitary phytophagous defoliators of some importance in their own niches are, \textit{basifascia} Hampson, which has since been placed in the synonymy of \textit{propria} Walker (Fletcher in litt.), \textit{arotis} Heyrick, \textit{atristriga} Walker, \textit{disjungens} Walker, \textit{similis} Philpott and \textit{steropastis} Heyrick.

Although \textit{P.aversa} does not appear in Hudson (1928) as a species, it does figure, alongside of \textit{P.ewingii}, in the synonymy of \textit{P.composita}. Common (1954) separates the New Zealand and Australian species and used the names \textit{P.aversa} and \textit{P.ewingii} respectively. Future reference to Hudson, 1928 accepts \textit{P.composita} as \textit{P.aversa} and not \textit{P.ewingii} which would be technically correct.

As a result of the doubt which has arisen since 1954 (Common, 1954), it was considered essential that a prerequisite to any future biological work on the genus \textit{Persectania} must be a revision of the classification of this genus. This is the topic of this thesis.

This taxonomic revision has demanded an intensive examination of the morphological characters of the species in question and
also an examination of the nominal genera that have been pro-
posed for the New Zealand species in the subfamily Hadeninae
to which *Peraectania* belongs. Many of these generic names are
buried in synonymies.

It is hoped that this study will resolve the current
taxonomic problems in the genus *Peraectania* and provide a sound
basis for further study.

A number of problems have been encountered in the course of
this revision which are inherent to the approach adopted.
The most serious of these is that the phylogenetic trends within
the family are obscured, to a certain extent, by restricting the
revision to a single genus comprising only eight species. It
is therefore hoped that the limited conclusions presented here
represent an acceptable interpretation of the taxonomy of this
group within the context of the phylogeny of the family Noctuidae
in New Zealand.
CHAPTER II

REVIEW OF LITERATURE

I. GENERAL

The group of Noctuid moths placed in the genus *Persectania* Hampson have larvae that are commonly referred to as army caterpillars, although the use of this term for the whole genus is not strictly correct. The name army caterpillar is derived from the behaviour of the late instar larvae which, under certain climatic conditions, appear in vast numbers and cause widespread damage to pastures and crops (Wright, 1961).

Army caterpillars are a type of cutworm exhibiting gregarious tendencies which cause them to mass together and move across the countryside eating off the vegetation along a face (Wright, 1961). Towards the end of an army caterpillar plague, many of the caterpillars are affected by different natural enemies (Wright, 1961). In particular the high densities provide suitable conditions for infection by "granulosis" and "polyhedrosis" viruses (Lowe, 1958; Lower, 1954; Wright, 1961).
Fig 1: Distribution of *Persectania ovinii* (Westw.) and *P. dyscrita*. Common in Australia based on adult records.
In New Zealand there are two army caterpillar genera which together, are distributed over most of the country including Stewart Island (Bugdale pers. comm; Gaskin, 1966b; Hudson, 1928). The other genus is *Pseudoaletia* Franglemont. Its only New Zealand species, *Pseudoaletia separata* (Walker), (= *Cirphia unigemata* auck., nec), is widespread in the North Island (Atkinson et al., 1956).

For all their economic importance to New Zealand agriculture, the only modern reference to the damage of army caterpillars in New Zealand is Hamblyn (1959), which reports that in the autumns of 1956 and 1957 army caterpillars, probably *Pseudoaletia separata* and *Persectania avara*, were responsible for the defoliation of 120,000 acres of hill pasture on the east coast of the North Island, leaving the damaged areas bare and exposed to invasion by weeds. This apparent lack of information on this pest is difficult to comprehend when it is considered that the army caterpillar is one of the more familiar pests in New Zealand and also that it does occur in pest proportions more often than the single reference would suggest.

At present the genus *Persectania* contains seven endemic species in New Zealand (Hudson, 1928). There are two other species of *Persectania* which occur in Australia (Common, 1954). Both of these, *P. swinhii* Westwood and *P. dyscrita* Common are probably true army caterpillars, occurring in the southern regions of Australia and in Tasmania (Common, 1954; Miller et al., 1951) (Fig 1). Little is known of the ecology of *P. dyscrita*. It has a
distribution in Southern Australia, except Tasmania, similar to *P. ewingii*, but it appears to occur more commonly in inland areas where the summer rainfall is low (Common, 1954).

Only one of the *Persectania* species found in New Zealand, *P. aversa*, is a true army caterpillar. This species has been recorded as having the mass foraging tendencies referred to above, and is the only species which has transferred to any extent from its presumed original host range of native grass species to introduced grasses and cereal crops (Miller, 1919).

The reasons behind the population increases that lead to the mass outbreaks of *P. aversa* in New Zealand, and *P. ewingii* and *P. dyscrita* in Australia are not well known. Muggeridge (1934), believed that a disturbance in the host/parasite relationships permitted a rapid multiplication of the host with a consequent relative decrease of parasites. Wright (1961), suggested that areas most frequently troubled by caterpillar outbreaks in Australia are those where periodic floods occur and where heavy falls of rain are followed by vigorous growth of succulent grass and herbage.

*Persectania aversa* is commonly called the Native Armyworm Moth (Gaskin, 1966a), the Streaked Armyworm Moth (Gaskin, 1966a), and the New Zealand Armyworm Moth (Atkinson et al., 1956; Gaskin, 1966b; Miller, 1919; Muggeridge, 1934), although its standard common name is the Native Army Caterpillar (Anon., 1967). It
is recorded as attacking a large number of grasses and crops, including cereals, brassicas, solanums and maize (Atkinson et al., 1956; Hamblyn, 1959; Lewis, 1881; Lowe, 1958).

In Australia, the affinity of *P. ewingii* for barley over a number of outbreaks has led to it being called the Barley Grub (Dent, 1960), although its standard common name is the Southern Armyworm (Anon, 1955).

The adult moths of the true army caterpillar species of *Persectania* are active mainly at night in their functions of mating and oviposition and take flight on warm, humid nights in spring and summer (Wright, 1961), the females laying their eggs in the sheath or on the flag of various grasses. The eggs of the New Zealand species, *P. aversa* are creamy white when fresh, although the darker developing embryo soon becomes obvious. Incubation takes about three weeks. Young larvae are pale at eclosion, feed on the flag of the plants, and grow rapidly as a result of voracious feeding. Larvae in their final instar form a subsurface cell in the soil where they undergo their final moult, the old skin being pushed to the bottom and attached to the pupa. Pupation occurs at a depth of about 1 - 3".

In Australia, Dent (1960) recorded that although the larvae of *P. ewingii* feed on the green leaves of the young barley plants, their most economically significant damage is to the ripening crop. At this stage, the caterpillars have to climb higher to find green parts of the stem to feed on. By the time they reach the top of the stem, just below the ear, the caterpillars have reached
Plate 2: Typical marginal notching of flax (Phormium tenax) leaves caused by the larvae of Persectania Steropastis (Meyrick).
maturity and greatest feeding power (Dent, 1960). This feeding habit is typical of *P. averse* as well as *P.ewingii*.

The remaining six species play a varying role in the ecology of a number of habitats ranging through flax stands, bush, high country, hill country and improved pasture.

Two of these species *P.steropastis* Heyrick and *P.arotis* Heyrick develop on native flax (*Phormium tenax*) (Gaskin, 1966a; Hudson, 1950; Miller, 1916; 1917 a,b,c; Yeates, 1938), the latter species has also been recorded on toe-toe (*Cortaderia spp.*) (Dugdale, *pers. comm.*). Injury by the larvae has been called notching on account of the marginal "U" or "V" shaped pieces eaten from the leaf in typical noctuid fashion (Cumber, 1954) (Plate 2). Adults of *P. steropastis* have been found throughout the year with greatest numbers in Sept. - March, April. Female moths oviposit on the leaves of flax bushes and the newly hatched larvae quickly move to rolled leaves for shelter. Damage occurs throughout the year and seems to become more prevalent between Jan. - Feb. and May - July, suggesting that there may be two generations per year. Pupation occurs within the dead leaf sheaths or in the dry soil about the plant. (Cumber, 1954).

Four other species, *P.atristriga* Walker, *P.disjungens* Walker, *P.proprisa* Walker and *P.similia* Philpott, are commonly found at higher altitudes on native grasses and in bush areas, although they are not confined to this area. The damage to this habitat by *Peraectania* larvae is probably very significant.
Although not observed in high densities defoliating large areas in a manner typical of the army caterpillars, they do play an important part in the destruction of vital tussock cover. Dick (1940), believed that insects, of which lepidopterous larvae were the most significant, form a strong secondary cause of tussock grassland depletion causing damage of economic proportions in low and medium rainfall areas. He also noted that an examination of tussock plants showed that in almost every case the crown exhibited strong evidence of excreted frass from leaf-eating caterpillars. This was also observed at Cass in 1969 and 1970 (pers. obs.). In 1945/1946, investigations on the influence of insects on the deterioration of tussock grassland, showed that *P. averse* was the most significant insect species (Anon., 1946). White (1962) and (pers. obs., 1969, 1970) have recorded *P. atristriga*, *P. disjungens* and *P. propria* in large numbers in the tussock grasslands at Cass. Dr Fox (pers. comm.) has recorded *P. similis* as being very common on Mt Ruapehu at 4000'.

In New Zealand, *P. averse* is the most economically significant species in this genus (*sensu* Hudson, 1928) and attracts a wide range of cultivated graminaceous plants. *P. steropastis* and *P. srotis* have a minor pest status in a declining flax industry. The remaining species, *P. atristriga*, *P. disjungens*, *P. propria* and *P. similis* play a varying role of suspected but unconfirmed importance in feeding on native tussock grasses.
II. FLIGHT TRAP RECORDS

Flight trap records are inadequate for the construction of emergence patterns of *Persecotania* species throughout New Zealand. However, White's results (White, 1962), and records obtained from a light trap at Lincoln College during 1963 - 68 provide a guide for the pattern of emergence of most species of *Persecotania* in Canterbury. White (1962) operated light traps from the Canterbury University Biological Research hut at Cass, just off the Christchurch - Arthur's Pass Road, for two seasons.

Records from both Lincoln College and Cass illustrate the bivoltine emergence of *P. atristriga* (mean peaks in October and February), and *P. aversa* (mean peaks in November and February). For *P. atristriga* the main flight at both Lincoln College and Cass is in February, while for *P. aversa* the main flight is not so obvious. White's figures from Cass are inconclusive but indicate the February flight as being larger, while the data collected at Lincoln College suggests that the main flight occurs in late October - November.

Four of the remaining six species have a single peaked emergence period which appears to be relatively constant for each species, and can occur at any time during the summer months.

(a) *P. arrotia* - range October - November, single peak October.

(b) *P. disjungens* - range November - late January, single peak November - December.
(c) \textit{P. propria} - range January - April, single peak March.

(d) \textit{P. similis} - range December - February, single peak December.

(e) \textit{P. stereopastis} - range December - January, no peak evident.

(f) \textit{P. basifascia} - there are no records for this species.

III. MORPHOLOGY AND NOMENCLATURE OF LEPIDOPTEROUS GENITALIA

(1) \textbf{Introduction}

The morphology and nomenclature of lepidopterous genitalia is reviewed very fully in this chapter for two reasons. Firstly, the resolution of the classification of the genus \textit{Persectania} in Chapter V has been achieved to a large extent through the use of the male and female genitalia, and secondly, over the years, the terminology associated with this subject has become very confusing and misleading in some parts. The names of structures mentioned in this study therefore, are clearly defined and the derivations of these names are indicated.

(2) \textbf{Historical}

For 150 years the study of the sclerotized insect genitalia of cuticular origin has been recognised as having a 

\textbf{Footnote:}

* The records for \textit{P. similis} were provided by Dr Fox, Manaia, Taranaki.
certain relevance in taxonomy. Their value has been enhanced where other characters, imaginal and stational, have proved inadequate.

This subject has received much publicity and support recently for its application to the taxonomy and phylogeny of the lepidoptera (Beirne, 1942/43; Diakonoff, 1954a,b; Forbes, 1939, 1954; Francélemont, 1951; Klots, 1970; Ogata et al., 1957; Okagake et al., 1955; Sibatani et al., 1954; Stekol'nikov, 1965; Viette, 1962).

Hudson (1950) believed however, that while descriptions and figures of genitalia are characteristic for the species involved, the perspective can be altered by applying pressure to various parts and by viewing at different angles which, he suggested, diminished their value in entomological taxonomy.

For many years after the recognition of the importance of the sclerotized genitalia (Rambur, 1842); their use was restricted to classificatory studies and their morphology escaped detailed analysis. Pierce (1909, 1914) initiated the study of genitalic morphology along modern lines, and he acquired a good general knowledge of these structures throughout the order. Prior to Pierce (1909), incomplete morphological studies were responsible for much of the confusion that existed in this subject. Even now the functional importance of some structures in the copulatory apparatus is unclear (Stekol'nikov, 1965). Without this knowledge it is difficult
to reach an understanding of the interrelation of the various structures or the assessment of their adaptive importance in either sex.

The confusion that exists in this subject is due largely to our vast ignorance of the morphology and homologies of the structures in practically all groups (Klots, 1970). A number of causes on which this confusion can be blamed have become obvious, they are as follows:

(i) Often the first name applied to a particular structure is unknown to many and hence it is not used and substitute names or name are in common usage.

(ii) Incorrect identification of some structures and the misapplication of old names to such structures can lead to misplaced homologies, e.g. harpe (sensu Pierce 1909, and now Sibatani et al., 1954).

(iii) Failure to discriminate between parts of structural importance and minor structures of limited significance (Diakonoff, 1954a).

Diakonoff (1954a), began an upsurge in interest by several workers (Forbes, 1954; Diakonoff, 1954b; Ogata et al., 1957; Okagaki et al., 1955; Sibatani et al., 1954, 1957; Stekol'nikov, 1965), who have attempted to unify the terminology of this subject. The proposals and criticisms of these authors are adequately dealt with in the respective papers.

(3) **Nomenclature and Morphology**

The nomenclature required to describe the characteristic
features of the male and female genitalia of the genus _Pereclisia_, is basically straight-forward and agrees with the generalised system originally proposed by Pierce (1909) for noctuidae.

In adopting a system of nomenclature in this section, the strict application of priority has been avoided. Clarity and accuracy have been achieved by following recent usage which is based on Pierce (1909), and some of the ideas of Diakonoff (1954a) on morphological nomenclature, while not being deliberately pursued, have never-the-less been adhered to. A point worth noting is that some names are being employed in a different sense to that which they were originally intended. Pierce's system forms the basis of the modern nomenclature, the modifications having arisen as a result of one or more of the conflicts mentioned previously.

The genitalic structures used in the taxonomy of the lepidoptera are derivatives of the integument of the VII - X abdominal segments, mostly the tergites and sternites. Some arise from the intersegmental integument and some from the transformed segmental appendages (gonopods) (Klots, 1970).

The majority of the taxonomically significant structures in the male genitalia are derived from the IX and X abdominal segments.

The following structures are defined and the names quoted in parenthesis after the name of the structure refer to the first person(s) to use the name in the sense of the description given
The abdominal:

A part of the abdominal segment forms a complete transverse ring. This is the basic site of attachment for other parts of the male genitalia.

The components of the ring are the following:

**Tegumen** (Pierce, 1909)
The dorsal part of the ring.

**Vinculum** (Pierce, 1909)
The ventral part of the ring, usually U or V shaped.

**Pedunculi** (Pierce, 1909)
The lateral points of articulation between the tegumen and vinculum.

**Appendices angulares** (Petersen, 1904)
The points at which the valvae articulate with the transverse ring in the region of the pedunculi.

**Saccus** (Bander, 1903)
A mid ventral, blind trough shaped process.

The remainder of the abdominal segment consists of the following:

**Valva** (Burmeister, 1832)
= Harpago-Harpigines (White, 1876 and Snodgrass, 1935).
= Harpe (Pierce, 1909).
Refers to the chief paired claspers organ of the male genitalia which is derived from the IX abdominal segment. It is typically, a flattened sac, open proximally. It contains a number of fundamental regions (sensu Sibatani et al., 1954), some of which bear armatures significant to the taxonomy of the genus Persectania. It articulates with the transverse ring formed by the tegumen, vinculum and saccus.

Regions of the Valva (Klots, 1970; Pierce, 1909, 1914; Sibatani et al., 1954).


The ventro-proximal region of the valva, investing the base of it.

2. Clavus (Pierce, 1909).

= Innerlobe (Klots, 1929).

A rounded or peaked process of the dorsal margin of the saccus, often hairy.

3. Costa (Pierce, 1914)

A variously sclerotized portion of the dorso-proximal margin of the valva. The ventral limitation of this sclerite lying on the outer wall of the valva is frequently margined by a more or less strongly sclerotized thickening.


The central and medio-dorsal region of the valva. This term was first used by Pierce (1909) to indicate a process situated dorso-proximally to the harpe (Gosse, 1882) in the Noctuidae, but Sibatani et al., (1954) showed that this name in the Noctuidae
must represent a distinct region dorsal to the harpe and ventro-proximally to the cucullus.

5. Harpe (Gosse, 1882)

= Cuiller (Reverdin, 1910).

This term is now understood and accepted as referring to a distinct region of the valva, which bears Gosse's harpe, a secondary clasping process. It is synonymous with the region and process that was called "clasper" by Pierce (1909) in the Noctuidae.


Usually the dorso-distal region of the lepidopterous valva, except in Rhopalocera, where both this and the valvula (Pierce, 1914) are absent. The dorso-distal region then becomes the ampulla.

Present on the cucullus are a number of conspicuous spines of taxonomic importance, called the corona. Pierce (1909), defined the corona as the marginal row of incurved spines. The remaining inner spines of the mesal surface of the cucullus he called the "marginal spines". Franclemont (1951), used both sets of spines in his interpretation of the corona, qualifying the term by referring to "a diffuse corona of large stout spines" and "a marginal corona of slender spines". Common (pers. comm.), stated that not all groups of noctuids have the clearly defined marginal row and the stouter, inner set of diffuse spines that occur in the genus *Persectania*. The *Gosse*, therefore, is interpreted in the sense of Franclemont (1951).
Franclemont (1951) used the form of the corona to
differentiate three groups of armyworms as follows:

1. Those possessing a cucullus of the valve with a
diffuse corona of large stout spines.

2. Those possessing a cucullus of the valve with only
a marginal corona of slender spines.

3. Those lacking a corona.

Franclemont (1951), placed Persectania in the first
group and suggested that they represented a primitive element
of this group.

Two other features present in the cucullar region are the
anal spine, which is attached to the ventral angle of the cucullus,
and the anal angle, which is that angle immediately anterior to
the cucullus and in front of the spine.

7. Valvula (Pierce, 1914).

Defined as the ventro-distal region (Sibatani et al.,
1954) although not always obvious as distinct from the cucullus.
Species of the genus Persectania (sensu Hudson, 1928), exemplify
this point, although homologous structures occur in some noctuids.
This structure is more common and obvious in the family Geometridae
(Sibatani et al., 1954).

X Abdominal Segment

Scaphium (Ogata et al., 1957)

The dorsal appendages of the Xth segment can be collectively
called the scaphium. The scaphium can be developed into a median
uncus and lateral socii, although in some instances the recognition of these is difficult.

The supports for the anal tube, often dorsal and ventral sclerotizations, have been designated "ligula" and "subligula" respectively. (Ogata et al., 1957). The anal sclerotizations are the "scaphium" and "subscaphium" of Pierce (1909).

**Uncus** (Gosse, 1883)

The dorsal hooklike process which occurs just posterior to the tegumen being fused or articulated with the median portion of the latter.

**Socii** (Pierce, 1914)

Paired lateral processes, often absent in this family (vide Franclemont, 1951; Hardwick, 1965).

**Gnathos** (Pierce, 1914)

The ventral process which arises from the posterior margin of the tegumen and below the base of the uncus. It extends ventrad and posterior (Torres-Bueno, 1962). This structure is sometimes absent in the family Noctuidae. The gnathos can develop a median process, the cochlear, and the lateral arms, the brachia (Ogata et al., 1957).

**Membranous and Secondary Sclerotizations**

**Diaphragma** (Chaladowsky, 1886)

This is a transverse sheet of membrane which encloses the posterior end of the abdomen. It extends from the tegumen to
the vinculum, and is derived from the \( II - X \) intersegmental integument.

**Anellus** (Pierce, 1914)

Where the aedeagus perforates it, the diaphragma is doubly folded around the organ to form an eversible cone, which bears the juxta ventrally.

**Manica** (Pierce, 1914)

The base of the anellus.

**Aedeagus** (Pierce, 1909) (Fig. 3)

= penis

Comprised of the anellus and manica and can be extruded.

**Vesica** (Pierce, 1909)

A membranous invagination of the aedeagus which connects cephalad to the ductus ejaculatorius.

**Cornuti** (Pierce, 1909)

Sclerotized spines often borne by the vesica. They are of taxonomic importance in some groups particularly Noctuidae. Both the vesica and cornuti penetrate the bursa copulatrix of the female at copulation (Klots, 1970).

**Juxta** (Pierce, 1909)

A sclerotization of the diaphragma with some taxonomic significance. This process can often be distinguished as a shield shaped sclerite in the ventral region of the anellus between the cephalic areas of the valvae.

**Canaliculus** (Pierce, 1914)

The upper edge of the juxta which is produced centrally
Fig 2: Lateral aspect of female abdomen, showing reproductive system and secondary sexual structures used in taxonomy

Fig 3: Schematic drawing of male phallus
in the form of a long lip or spout acting as a guide to the
aedeagus.

**Transtilla** (Pierce, 1914)

The dorsal transverse, band-like sclerotized structure
of the diaphragma.

FEMALE

The sclerotized female genitalia of ectodermal origin
are concerned with copulation, reception and storage of sperm,
fertilisation of the ova and oviposition (Klots, 1970). (Fig.2).

Although the morphology and homologies of the female
genitalia have been less frequently studied than the male
genitalia, they have a significant role in taxonomic studies
at various levels. The taxonomic significance of female
lepidopterous genitalia is most noticeable at the subordinal
level in the presence, position and interconnections of the
genital ducts (Klots, 1970). The use of these characters at this
level can be found in most modern lepidopterous keys and does
not require further elaboration (Common, 1970; Hardwick, 1965;
Imms, 1964).

The female genitalia are basically modified for oviposition
and copulation, with the structures for these two functions
occupying the IV - X abdominal segments although the origins of
these structures are located in segments VIII - X (Beirne, 1942).

In the suborder Ditrysia, to which the family Noctuidae belongs,
there are separate external openings for both of the above
mentioned functions (Klots, 1970).

The osium buraseae (Petersen, 1900), is the copulatory entrance and lies in the ventral wall of either abdominal segments VIII or VIII, usually the latter, and leads into a narrow duct, the ductus buraseae (Petersen, 1900), which joins the external opening to the corpus buraseae (Stitz, 1901), an enlarged sac-like structure (Klots, 1970).

The osium eoviductis (Petersen, 1900), is the ovipositional exit and lies in the region of the IX abdominal segment presumably between the papillae anales.

Sclerotized structures frequently occur in the wall of the corpus buraseae. These are the signa (Pierce, 1914), which can assume various shapes that are given appropriate names e.g. lamina dentata, a toothed plate (Beirne, 1942).

The bursa copulatrix, (von Siebold, 1837), includes the corpus buraeae, the ductus buraseae, and the various regions of the bursae copulatrix which have names, referring either to a specific site or to abnormalities peculiar to particular areas, e.g. cervix buraseae (Stitz, 1901), a differentiated region between the corpus and ductus buraseae; fundus buraseae (Petersen, 1902), the cephalad extremity of the corpus buraseae; atrium (Higgins, 1941), part of the ductus buraseae nearest the osium buraseae; appendix buraseae (Kusnezov, 1915), any lobed or shouldered area; colliculum, (Biakanoff, 1939), any sclerotization of the ductus buraseae.

The corpus buraseae is often incorrectly referred to as the bursa copulatrix (Klots, 1970).
An interesting point is that taxonomically the *ostium bursae* is the opening into the *sinus vaginalis* (Kusnezov, 1912), while morphologically it lies at the point of separation of the *ductus seminalis* and *ductus bursae* (Klots, 1970).

At some point along the *bursa copulatrix* the *ductus seminalis* (Petersen, 1900), opens out and joins the *corpus bursae* to the spermatheca and vagina. The released sperm travels from the *corpus bursae* via the *ductus seminalis* to the oviduct and into the *receptaculum seminum* (spermatheca), or the *bulla seminalis* (Petersen, 1901).

**VIII Abdominal Segment** (Beirne, 1942; Stekol'nikov, 1965).

This segment is reduced in the more primitive noctuids, such as the genus *Persectania*, with the sternum usually being unsclerotized, while the tergum is often fused to the *papillae anales*. From the lateral sides of this segment also, run a pair of *anterior apophyses* (Kusnezov, 1915), which extend anteriorly. The *ostium bursae* lies in the ventral wall of this segment and from this extends the *bursa copulatrix*, often through to segment **IV**.

The *genital plate* (Pierce, 1909), is a modification of the sternum unattached to the tergum, which occurs in some taxa.

**IX Abdominal Segment** (Beirne, 1942; Stekol'nikov, 1965).

This segment is reduced in the more primitive noctuids, such as the genus *Persectania*, with the sternum usually being unsclerotized, while the tergum is often fused to the *papillae*
anesae. From the lateral sides of this segment also, run a pair of posterior apophyses (Kusnezov, 1915), which extend anteriorly.

The apophyses of the VII and IX segments serve for muscle attachment and for support for the abdomen during periods of elongation in copulation.

**X Abdominal Segment** (Beirne, 1942; Stekol'nikov, 1965).

This consists of paired, hairy lobes, the papillae anales (Kusnezov, 1915), representing the Xth tergum, occurring one on either side of the anal and oviducal openings, but separated anteroventrally by the papillae genitaliae.

The papillae genitaliae (Kusnezov, 1915), are a pair of small membranous or slightly sclerotized lobes situated immediately ventral to the ostium oviductus (Petersen, 1900), and are usually underdeveloped (Beirne, 1942).

**IV MORPHOLOGY OF LEPIDOPTEROUS LARVAE**

The value of immature stages in particular the larvae, in the systematics of lepidoptera, has been recognised for less than half a century (Pant and Chatterjee, 1949; Ripley, 1923). During the past twenty-five years much has been written on the
Fig 4: Noctuid labium and maxillae

Fig 5: Typical 3-segmented lepidopterous antenna

Fig 6: A Noctuid mandible
Fig 7: Cranial sutures and areas of lepidopterous larvae.

Fig 8: Noctuid larval thoracic leg.

Fig 9: Noctuid larval crochet arrangements (uniordinal, meso series).

Mackay (1964b, 1968a) in particular, has expounded this topic extensively in many papers. The value of larval morphology to systematics in general has been recognised in this study and larval characters have been used where possible. Even though the larvae of the lepidoptera resemble each other more closely than the larvae of the other major orders of holometabolous insects (Peterson, 1959), there is no comprehensive description for them which covers all families. The following serves to illustrate some of the main morphological features which are common to the order. All lepidopterous larvae possess a distinct head with chewing mouthparts including opposing mandibles. Most species possess several ocelli, adfrontal areas, antennae and a protruding labial spinneret. The thorax has three distinct segments, each bearing true segmented legs and the prothorax bears a pair of spiracles. There are ten abdominal segments; prolegs, bearing crochets, are usually present on segments three to six, and ten, and spiracles on the first eight segments (Peterson, 1959). (Figs. 4, 5, 6, 7, 8 & 9).

The general morphology is dealt with fully by Common (1970), Imms (1964) and Peterson (1959).

Noctuid larvae may show variation in the crochet
arrangement, some head structures, skin sculpturing and colour patterns, although the value of these characters in systematics is limited. Another set of characters, the setae, offer the most useful information. These can be mapped for each segment including the cranium, and the variation which occurs either in shape, size or position (Peterson, 1959) can be used to distinguish between various groups (Mutiura, 1956).

The arrangement of setae and their value in the classification of caterpillars was first noted by Muller (1886). Since then Dyar (1894), Forbes (1910, 1916, 1923), Fracker (1915), Gerasimov (1935, 1937, 1952) and Heinrich (1916), have all contributed to systems of setal nomenclature.

Hinton's (1946) system of Arabic numerals and letters was the first universally accepted plan for mapping setae and has since been used extensively by most workers in this field. Since Hinton's original work, some modifications and alternative systems have been proposed (Mackay, 1963; Mutuura, 1956; Singh, 1950).

Hinton recognizes three types of setae, primary, subprimary and secondary; the first two having a definite distribution over the body area within a particular group and these have been named. Primary setae are present from the first instar while subprimary setae first appear on later instars. Secondary setae are unusually fine and hairlike and are distributed randomly.

Opinions have varied regarding the relative importance of the setae on various parts of the body. Peterson (1959) disregarded
the cephalic setae while Hinton (1946) ignored the setae on the X abdominal segment. The latter omission was due to his failure to resolve the homology of all of the setae and also because he regarded them as having little taxonomic value. Singh (1950) refuted Hinton's latter claim.

Hinton categorized the setae on the following: cranium (Table 1), thorax and abdomen (Table 2).

On the cranium there are 12 long and 4 (rarely 5) minute setae with eight punctures which occur generally throughout Lepidoptera. The general preservation of the primitive pattern throughout the lepidoptera is thought to be due to the fact that in the most primitive forms there was a moderately even distribution of tactile setae on the exposed parts of the head. Changes in response to different environmental needs were chiefly reflected in slight changes in position and relative lengths rather than the addition of new setae (Hinton, 1946).

The thoracic and abdominal setae are not so well known and understood. A number of different systems were proposed during the first half of this century but most have been superseded by Hinton's system. Hinton described two types of setae, microscopic and tactile. The microscopic setae are denoted by the prefix M.
<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>a</th>
<th>b</th>
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<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td><strong>CCELLAR</strong></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td><strong>SUBCCELLAR</strong></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
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<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td><strong>POSTERODORSAL</strong></td>
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<td>+</td>
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<td>-</td>
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<td>+</td>
<td>-</td>
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Table 2:

THE NAMES OF THE THORACIC AND ABDOMINAL SETAE
OF LEPIDOPTEROUS LARVAE, AFTER HINTON (1946).

<table>
<thead>
<tr>
<th>GROUP</th>
<th>THORAX I</th>
<th>THORAX II-III</th>
<th>ABD. I-IX</th>
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<tbody>
<tr>
<td>EXTRA DORSAL</td>
<td>XD1, XD2.</td>
<td>-</td>
<td>-</td>
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<td>MXD1.</td>
<td>-</td>
<td>-</td>
</tr>
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<td>D1, D2.</td>
<td>D1, D2.</td>
<td>D1, D2.</td>
</tr>
<tr>
<td>MICRO DORSAL</td>
<td>-</td>
<td>MD1, MD2.</td>
<td>MD1, MD2.</td>
</tr>
<tr>
<td>SUBDORSAL</td>
<td>SD1, SD2.</td>
<td>SD1, SD2.</td>
<td>SD1, SD2.</td>
</tr>
<tr>
<td>MICRO SUB DORSAL</td>
<td>-</td>
<td>HSD1, HSD2.</td>
<td>-</td>
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<td>LATERAL</td>
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<td>L1, L2, L3.</td>
<td>L1, L2, L3.</td>
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<tr>
<td>MICRO VENTRAL</td>
<td>NV2, NV3.</td>
<td>NV1, NV2, NV3.</td>
<td>NV3.</td>
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<td>SUBVENTRAL</td>
<td>SV1, SV2.</td>
<td>SV1, SV2.</td>
<td>SV1, SV2, SV3.</td>
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</table>
CHAPTER III

MATERIALS AND METHODS

I. OBTAINING THE MATERIAL

Both fresh and preserved material of most species of the genus Persectania (sensu Hudson, 1928), has been studied. The fresh material was in the form of live adults caught by light trap at Cass and Lincoln College (Plate 3).

The light trapping of adults of P. propria and P. disjungens at Cass during the summer of 1969 - 1970, was only partially successful. Only very small numbers of females were caught relative to the numbers of males, which made it difficult to obtain sufficient eggs for rearing where mating shyness occurred. This difficulty made the larval-rearing problems mentioned previously even more critical. The unbalanced sex ratio for these two species has also been noted by White (1962).

No adults of P. similis have been trapped locally, and no live adults have been available from other sources, so it has not been possible to obtain eggs or larvae for study. The conclusions drawn on this species rest solely on the adult characters,
Plate 3: The model of light trap used to catch live adults of the moth species under revision.
Plate 4: The two types of cages which were used to contain ovipositing adults and subsequently developing larvae.
The females were allowed to lay eggs in oviposition cages (Plate 4), and larvae were subsequently reared from these eggs. The female moths, under these conditions oviposited freely on any surface, although the majority of the eggs were layed down the midrib and sometimes between two or more lamina of the grass plants provided, either in unilayer rows, in multilayer rows or in multilayer clumps.

The larvae were reared on ryegrass plants (Lolium perenne and Lolium perenne x L. multiflorum), which has been grown from seed and then transplanted into pots after tillering had occurred. Two types of rearing cages were used, a plastic cylinder which had nylon gauze sock suspended by a piece of hooked wire which was stuck into soil in the pot (Plate 4).

Several problems were encountered during the rearing programme. Aphids accumulated in high numbers and may have had an adverse affect on the fitness of the larvae. Heavy north west weather caused high temperatures (up to 120°F at times). This temperature effect and the high humidities, aggravated by standing the pots in trays of water to prevent drying out, caused moulds to become a problem. These factors contributed to an overall decrease in vigour and in some cases, the death of some larvae. Both P. arrotis and P. disjungens suffered heavily.

The temperature increase was reduced to a certain extent by spraying lime onto the glasshouse as soon as it was first noticed.
II. PREPARATION FOR STUDY

Larvae were preserved firstly in Carney's Solution* and then in 70% Alcohol + Glycerine. The condition of such specimens has not deteriorated seriously except in some instances where a dark discolouration has appeared, locally or over the whole surface of the larvae.

Larval characters of six species have been studied in an attempt to substantiate or refute the ideas derived from the study of adults. From a number of larval characters, the cranial and body setae held the most potential from a taxonomic viewpoint, although even these have not been outstanding.

Hinton (1946), investigated the chaetotaxy of the Agrotidae, a family closely related to the Noctuidae, and the observations in the current study have illustrated the lack of any chaetotactic differences between the two families.

The setae were studied by microscopic observation of the specimen in alcohol. The heat dissipated by the microscope light often caused the larvae to relax from the fixed position the specimen had assumed in the alcoholic preservative. Setal maps were constructed in two dimensional diagrams to illustrate the relative positions and sizes of setae and punctures. These were drawn on transparent "Permatrace" and have been photocopied.

From the adult specimens of seven species, (no material

Footnote: *Glacial Acetic Acid 5 ml; 95% Alcohol 30 ml; Chloroform 15 ml.
of *E. basifascia* was available), male and female genitalia were extracted by removing the abdomen and heating it in 10% KOH over a water bath. The abdominal tissues were loosened periodically under the microscope with fine forceps (Watchmakers No. 5), until the sclerotized genitalia plus ducts could be removed. The extracted genitalia were stored in glycerine in microvials and placed with the adult, with the pin stuck through the cork.

When required for study, the genitalic specimen was removed from the microvial and placed in a cavity slide in glycerine and cover slip. These temporary preparations were preferred to the permanent preparations because they can be manoeuvred into as many positions as are required for the interpretation of the structures and their illustration.

For taxonomic purposes the male genitalia had the vesica extruded to expose the cornuti. Particular difficulty in exposing the cornuti was encountered with old specimens taken from museum collections. Where possible, a fine No. 283 x 1/2 hypodermic needle was inserted into the cephalic portion of the aedeagus, and dilute alcohol and water was injected to effect the initial eversion. Rarely did the hypodermic technique cause the vesica to evert completely. The reasons for this were due to its delicate, membranous nature and the difficulty in releasing it from the interior of the aedeagus. Usually the vesica was partially released with the hypodermic and then manually drawn
out with fine forceps. The final step was a syringing of the
vesica with 95% or absolute alcohol which dehydrated it,
causing it to harden in an inflated condition. Prior to
being drawn, the male genitalia were spread out to enable the
finer details to be clearly identified in their correct
perspectives.

The male and female genitalia of the *Persectania* species
were described and then drawn ventrally and laterally with the
aid of a Zeiss camera lucida on a Leitz binocular microscope
(16x magnification). The drawings were done on heavy bond
drawing paper, and Xerox copies made.

Finally, external morphological features of the adults
were examined under the binocular microscope and described
for inclusion into species descriptions. These features
included antennae, legs and spines, frons, wing patterns and
body colour.
CHAPTER IV

TAXONOMY OF THE GENUS PERSECTANIA
HAMPSON (SENSU HUDSON, 1928) IN
NEW ZEALAND.

I. HISTORICAL

The family Noctuidae is an extensive one in New Zealand consisting of about 140 species representing 30 genera (Gaskin, 1966a; Hudson, 1928), and forms a large portion of our endemic lepidopterous fauna. The members of this family are large and most exhibit a drabness of colour. This latter character is probably an adaptation to their nocturnal habits and to the need for camouflage during the daytime.

Although the taxonomic history of this family of New Zealand Lepidoptera is not very old, the species concerned have been studied extensively. Their classification was made difficult, firstly by the interspecific similarity in some groups, and secondly by the intraspecific variation that occurs within others. Broadly speaking the present problems can be blamed on the reliance on external morphological characters for the classification of this family. The monotonous similarity of many of these structures combined with a superficial understanding
of their use, resulted in many questionable decisions being taken during the early classificatory period in the late nineteenth and early twentieth centuries. Furthermore lengthy synonymies testify to the inability of such adult structures in the definition of stable taxa.

Over the past 20 years a better understanding of intra and interspecific variation among characters, has led to sounder taxonomic studies.

The use of genitalic characters in the adult immature morphology (egg, larval and pupal), serology and precipitin testing, chromosomal studies, comparative morphology of protein molecules, and other recent advances in the field of numerical taxonomy are all helping to make this subject less arbitrary.

Previously taxonomists had two alternatives, either taxa could be broken down into a number of small groups on the basis of minor differences or similar taxa could be consolidated into broader categories.

Hampson (1905) seemed to favour the former approach. Meyrick (1911) criticized Hampson for erecting too many generic groups on relatively trivial and unimportant differences. He pointed out that *Sideritis* Hübner differed from *Cirphis* Walker/ *Hyasina* Guenée complex only in having the thorax clothed entirely with hair. This criterion is obviously trivial and open to doubt by present day standards.

It is difficult to take one line or the other when discussing the family as a whole. Broad groups covering a number of species
or narrower groups often applying to one or two species. Either
is acceptable where the biological facts justify their use.
A large number of New Zealand species in the family Noctuidae, while
being apparently morphologically similar in many respects, have
been placed into convenient genera more so I think through an
inability to separate them on some sound morphological basis,
rather than on their phylogenetic similarity.

As a result, some of the available generic names have
been extensively misused. Earlier *Mamestra* Treitschke suffered
from this, and more recently *Melanchra* Hubner.

The inaccurate use of such broad groupings is exemplified
in particular by *Melanchra*, a Palearctic genus which has contained
up to 52 species in New Zealand, misrepresenting much of the
fauna in question.

Hampson (1905) erected the genus *Persectania* to contain
four Australian and New Zealand species, *Leucania atristriata* Walker,
*Leucania sulacii* Meyrick, *Noctua* (? *Xylophasia*) *wingii* Westwood
and *Mamestra streptopastis* Meyrick, and distinguished them from
*Leucania* and *Aletia* by the form of the frons. Later Meyrick (1911)
followed Hampson (1905) in this conclusion and also considered
*Cirphis* and *Sideridia* as synonyms of *Aletia*.

Although the determination of genera by the form of the
frons has proved unsatisfactory in some cases, Hampson's decision
has since been verified by the structures of the male and female
genitalia (Franclemont, 1951). It seems then that the separation
of *Persectania wingii* and related species from other armyworm and
cutworm genera was justified.

Since Hampson (1905), several changes have been made to the species composition of the genus Persectania.

1. In Hampson (1905), *L.aretia* Meyrick, 1886 was placed in the synonymy of *P.aulacas* Meyrick, 1886. However, Hudson (1898) acting as the first reviser had already synonymized *aretia* and *aulacas*, and in his subsequent revision in 1928 he reaffirmed this decision.

2. *P. boscifascia* was described by Hampson (1913).

3. *P. similis* was described by Philpott (1923).

4. *Marmorata* was described in *Persectania* Hudson (1924), and later transferred to *Ichneutica* Hudson (1928). *Eutetolophota* Hampson and *Graphania* Hampson, with their type species *propria* Walker and *disjungens* Walker were synonymized with *Persectania* Hudson (1928).

5. The species *E. ewingii*, used by Hampson for specimens found in New Zealand and Australia was resolved into two species by Common (1954) on the basis of the male and female genitalia. Common used the name *E. ewingii* for the Australian species and *E. aversa* for the New Zealand species, placing *Chloantha composita* Gœnne in the synonymy of *E. ewingii*, and *Manestra maori* Felder, *Morrisonia peracuta* Morrison and *Leucania dentigera* Butler in the synonymy of *E. aversa*. Common also described *E. dyscrita* during this revision of the *ewingii* material in Australia.

6. *P. boscifascia* has been placed in the synonymy of *P. propria* Fletcher *(in litt.)*.
Neither *P. swingii* or *P. dyscrita* occurs in New Zealand and *P. aversa* is restricted to this country (Common, 1954).
II. DESCRIPTIONS OF THE LARVAE OF SIX SPECIES OF LEPIDOPTERA (NOCTUIDAE: HADENINAE).

1. Chaetotaxy

The larval setae are drawn and described for the cranial (Figs 10 & 11), prothoracic (Fig 12), meso/metathoracic (Fig 13) and abdominal (Fig 14) segments of the six species.

In the case of the cranial setae (Fig 15), reliable measurements could be taken for distances between setae owing to the chitinous nature of the head capsule. This was not possible with the body setae (Table 3). Because the larvae examined were comprised of a mixture of instars, the measurements were made more meaningful by the comparison of ratios of distances (Table 4).

(a) Cranial Chaetotaxy

$C_1^1, C_2^2, C_3^3, C_4^4$ and $C_5^5, C_6^6$ refer to the ocelli which are arranged in two groups. They are numbered dorsoventrally.

Vertical group – V3, V4 and V2 in a straight line and approximately equidistant overall except for V1 which is at a greater distance from V2 than it is to F2. P.aversa is the exception with all setae and puncture approximately equidistant and V1 nearer to V2 than it is to F2. The setae in the first group are not all the same distances apart, however the similarities that do exist are illustrated in a number of critical ratios which are indicated in Table 4 by an asterisk.
Fig 10: Larval cranial chaetotaxy of (a) G. disjungens, (b) T. steropastis and (c) T. atristriga
Fig 11: Larval cranial chaetotaxy of (a) *T. propria*
(b) *G. arotia*  (c) *P. aversea.*
Fig 12: Larval prothoracic chaetotaxy of

(a) *G. disjungens*, (b) *T. steropastis*,

(c) *T. triastriga*, (d) *T. propria* (e) *G. erotis*,

(f) *E. versal*. 
Fig 13: Larval meso/metathoracic chaetotaxy of
(a) G. disjungens, (b) T. steropastis,
(c) T. atristrixa, (d) T. propria (e) G. aratis,
(f) P. aversa.
Fig 14: Larval abdominal chaetotaxy of
(a) *G. disjungens*, (b) *T. steropastis*,
(c) *T. atristira*, (d) *T. propria* (e) *G. arotic*,
(f) *P. aversa*. 
Fig 15: Typical noctuid larval cranial chaetotaxy.

Fig 16: Typical noctuid larval pigmentation bands.
Posterior group - P2 and Pb in a straight line with V1 and approximately equidistant, except *P. averra* which has V1 at a greater distance to P2 than P2 is to Pb. P1 and Pa, and P2 and Pb are the same distances apart. Pb slightly posteroventral to P2, Pa anteroventral to P1. P1 is two to four times longer than P2 in all species except *Taeolephota steropastia* where P2 is small.

Lateral group - L1 approximately central, being ventral to V1 and posterior to P1, La slightly posterodorsal to L1, although more dorsal in *Graphania disjunxena* and *P. averra*.

Anterodorsal group - A3, Aa and A2 form an approximate equilateral triangle, while A1 forms a straight line with A2 and Pa. A2, A3 and O1 also form a straight line, with Aa dorsal and between A3 and A2. A3 longer than A1, both being much longer than A2.

Subocellar group - S01, S02 and S03 form an approximately equilateral triangle, S01 near base of antenna and ventral to S02 which is alongside O6. S03 posterodorsal to S01 and posteroventral to S02, with S0a closest to S03.

Ocellar group - 01 slightly posterior to O4, 02 posterodorsal to O1 and O3 posteroventral to O2; this group forming an equilateral triangle. Oa close to O5 and often slightly ventral to line O3 - O1. *G. disjunxena* and *Taeolephota propria* have Oa closest to O3, *Graphania artoia* with Oa closest to O1 and more between O4 - O3 than equal to or slightly ventral to O4 as in other species.

Genal group - *T. steropastia* with G1 very close to edge of cranium, Ga slightly anterodorsal forming an approximately
straight line with O3 - Ca and an equilateral triangle with O3 and G1. T. arctic and T. diisjungens with Ga slightly ventral to line O3 - Ca. T. metulophora striatriga with G1 more ventral than normal and directly ventral to Ga. Ga in straight line with O3 - Ca. T. propria with Ga more dorsal to line O3 - Ca than T. steropastia and G1 ventral to Ga. E. averra with Ga ventral to Line O3 - Ca.

Table 3: MEASUREMENTS IN MM. BETWEEN THE CRANIAL SETAE OF SIX SPECIES OF LEPIDOPTEROUS LARVAE

<table>
<thead>
<tr>
<th>DISTANCES</th>
<th>T. steropastia</th>
<th>T. diisjungens</th>
<th>T. striatriga</th>
<th>T. propria</th>
<th>G. arctic</th>
<th>E. averra</th>
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</thead>
<tbody>
<tr>
<td>V3 - Va</td>
<td>0.17</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td>0.13</td>
<td>0.27</td>
</tr>
<tr>
<td>Va - V2</td>
<td>0.17</td>
<td>0.13</td>
<td>0.17</td>
<td>0.20</td>
<td>0.06</td>
<td>0.20</td>
</tr>
<tr>
<td>V2 - V1</td>
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<td>0.27</td>
<td>0.43</td>
<td>0.40</td>
<td>0.36</td>
<td>0.27</td>
</tr>
<tr>
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<td>0.33</td>
<td>0.43</td>
<td>0.40</td>
<td>0.30</td>
<td>0.60</td>
</tr>
<tr>
<td>P2 - Pb</td>
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<td>0.33</td>
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<td>0.20</td>
<td>0.27</td>
</tr>
<tr>
<td>P1 - Pa</td>
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<td>0.53</td>
<td>0.20</td>
<td>0.30</td>
</tr>
<tr>
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<td>0.17</td>
<td>0.17</td>
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<td>0.13</td>
<td>0.33</td>
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<td>L1 - P1</td>
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<td>1.23</td>
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<td>0.50</td>
<td>0.50</td>
<td>0.30</td>
<td>0.40</td>
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<tr>
<td>A3 - Aa</td>
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<td>0.40</td>
<td>0.46</td>
<td>0.10</td>
<td>0.27</td>
</tr>
<tr>
<td>A3 - A1</td>
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<td>0.43</td>
<td>0.50</td>
<td>0.67</td>
<td>0.33</td>
<td>0.67</td>
</tr>
<tr>
<td>A2 - Aa</td>
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<td>0.17</td>
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<td>0.27</td>
</tr>
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<td>0.30</td>
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<td>0.40</td>
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<td>0.50</td>
<td>0.63</td>
<td>0.33</td>
<td>0.67</td>
</tr>
<tr>
<td>O2 - O3</td>
<td>0.25</td>
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<td>0.57</td>
<td>0.46</td>
<td>0.46</td>
<td>0.67</td>
</tr>
<tr>
<td>O1 - O3</td>
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<td>0.67</td>
<td>0.60</td>
<td>0.46</td>
<td>0.83</td>
</tr>
<tr>
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<td>0.25</td>
<td>0.40</td>
</tr>
<tr>
<td>S01 - S02</td>
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<td>0.37</td>
<td>0.37</td>
<td>0.25</td>
<td>0.33</td>
</tr>
<tr>
<td>S02 - S03</td>
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<td>0.20</td>
<td>0.30</td>
<td>0.20</td>
<td>0.13</td>
<td>0.27</td>
</tr>
<tr>
<td>S03 - S0a</td>
<td>0.60</td>
<td>0.06</td>
<td>0.10</td>
<td>0.03</td>
<td>0.06</td>
<td>0.10</td>
</tr>
<tr>
<td>G1 - Ga</td>
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<td>0.17</td>
<td>0.27</td>
<td>0.27</td>
<td>0.25</td>
<td>0.27</td>
</tr>
<tr>
<td>Ga - O3</td>
<td>0.27</td>
<td>0.43</td>
<td>0.27</td>
<td>0.27</td>
<td>0.13</td>
<td>0.30</td>
</tr>
<tr>
<td>G1 - O3</td>
<td>0.40</td>
<td>0.25</td>
<td>0.40</td>
<td>0.27</td>
<td>0.25</td>
<td>0.37</td>
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Table 4: TRANSFORMATION INTO RATIOS OF THE MEASUREMENTS BETWEEN THE CRANIAL SETAE OF SIX SPECIES OF LEPIDOPTERIDAE LARVAE

<table>
<thead>
<tr>
<th>RATIOS</th>
<th>T. stereoptia</th>
<th>G. disjungens</th>
<th>T. striata</th>
<th>T. proprius</th>
<th>G. erotes</th>
<th>P. averse</th>
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<tbody>
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<td>V2 - V1</td>
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<td>2.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.23</td>
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<td>0.39</td>
<td>0.50</td>
<td>0.17</td>
<td>0.75</td>
</tr>
<tr>
<td>V2 - V1</td>
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<td>1.85</td>
<td>2.00</td>
<td>1.87</td>
<td>1.22</td>
</tr>
<tr>
<td>V3 - V1</td>
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<td>0.75</td>
<td>0.46</td>
<td>0.50</td>
<td>0.36</td>
<td>1.00</td>
</tr>
<tr>
<td>V3 - Va</td>
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<td>1.31</td>
<td>0.92</td>
<td>1.50</td>
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</tr>
<tr>
<td>V3 - V2</td>
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<td>0.53</td>
<td>1.76</td>
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<td>0.97</td>
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<td>0.50</td>
<td>1.00</td>
</tr>
<tr>
<td>A2 - Aa</td>
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<td>1.67</td>
<td>1.54</td>
<td>1.69</td>
<td>1.67</td>
</tr>
<tr>
<td>A3 - A1</td>
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<td>1.18</td>
<td>0.85</td>
<td>1.37</td>
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<td>0.85</td>
<td>0.77</td>
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<td>0.81</td>
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<td>O1 - O2</td>
<td>2.26</td>
<td>2.78</td>
<td>2.24</td>
<td>3.00</td>
<td>1.83</td>
<td>2.08</td>
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<tr>
<td>O3 - O1</td>
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<td>1.33</td>
<td>1.22</td>
<td>1.83</td>
<td>1.91</td>
<td>1.24</td>
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<td>S01 - S02</td>
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<td>0.79</td>
<td>1.00</td>
<td>0.61</td>
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<td>S03 - S01</td>
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<td>0.67</td>
<td>1.00</td>
<td>1.00</td>
<td>0.73</td>
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</table>
(b) Body Chaetotaxy:

Apart from the cranial setae there appears to be little variation of any significance in the position or size of any of the remaining setae.

The following is an account of the generalised pattern of the prothoracic, meso/metathoracic and VI abdominal segments. (vide Hinton, 1946).

(1) Prothoracic Setae:

All species have a pronotal shield of approximately the same shape, with P.aversa, G. disjungens, T. atristoga and T. propria having a more pronounced sclerotization.

XD group - G. disjungens with XD1 dorsal to XD2, G. aroris, T. atristoga, T. propria and T. steropastis with XD1 slightly posterodorsal to XD2, P.aversa with XD1 more posterodorsal to XD2.

Dorsal group T. steropastis with D1 slightly posterodorsal to D2, G. aroris, T. atristoga, G. disjungens and T. propria with D1 slightly anterodorsal to D2, P.aversa with D1 dorsal to D2.

On average XD1 and XD2 about twice as long as D1 and D2 in all species. MXD1 is midway between D1 - D2 and posterior of and slightly ventral to XD1, varying between species in its position with relation to the pronotal shield. G. aroris, P.aversa and T. steropastis with MXD1 inside shield, T. atristoga with MXD1 on margin, G. disjungens and T. propria with MXD1 outside shield.

Subdorsal group - The position of this group is the same in all species, midway between the XD and D groups, outside the
pronotal shield and anterodorsal to the spiracle. SD2 fine with a prominent puncture and two to three times longer than SD1 and antero and slightly ventral to it.

Lateral group - The position of this group is the same in all species, anterior to the spiracle. L1 slightly anterodorsal to L2 and one to two times longer, L1 fine with a prominent puncture.

Subventral group - The position of this group is the same in all species, above the coxa. SV1 postero and slightly ventral to SV2 and about three times longer.

Ventral group - V1 on the midventral line, very small and posterior to the coxa. It is longest in T.atristriga, P.aversa and T.proprina with G.disjunquensa similar and G.arotis and T.asteropastis noticeably smaller.

Microventral group - G.arotis and T.asteropastis with MV2 slightly anterodorsal to MV3, others have MV2 more anterior. MV3 is on the midventral line and anterior to the coxa.

(ii) Meso/Metathoracic Setae:-

Dorsal and Subdorsal Groups - Both groups form an approximately vertical straight line equidistant and middle of the segment. T.proprina with SD1 slightly anterior to the other species. SD1 and SD2 have two punctures associated with each seta, the second puncture being ventral to the setal bearer. SD1 fine in G.arotis, P.aversa, G.disjunquensa and T.asteropastis.

Micro dorsal group - MD1 near the anterior margin of the
segment and slightly ventral of mid D1 - D2.

Micro subdorsal group - Near the anterior margin of the segment, ventral to MD1 and approximately anterior to SD2.

G. arotie with MSD1 posterodorsal to MSD2, T. atristriga with MSD1 posterior to MSD2, P. aversa, G. disjunagens and T. steropastis with MSD1 posteroventral to MSD2.

Lateral group - Members of this group are the same in all species and basically triangulated on either side of the line formed by D - SD groups. L3 short and posteroventral to SD1, L1 about one to two times longer than L3, L2 fine and slightly anteroventral to L1 and closest to the anterior margin, smaller than L1, bigger than L3.

Subventral group - SV1 long, dorsal to the coxa and ventral to D - SD groups in most species. T. steropastis with SV1 ventral to L3.

Microventral group - Members of this group are triangulated and anterior to the coxa with MV1 and MV2 sometimes forming an approximate horizontal plane. MV3 mid and mostly ventral, MV2 posterodorsal to MV3, MV1 anterior to both and slightly dorsal or equal to MV2, the group being the same in all species except P. aversa where MV1 is distinctly dorsal to MV2.

Ventral group - V1 more dorsal to the midventral line than in the prothorax and about the same length in all species except P. aversa where it is longer.
Fig 17: The larval anal shield chaetotaxy of (a) G. disjungens, (b) T. steropastis, (c) T. atristriga, (d) T. propriia, (e) G. aronis (f) P. averaa
(iii) **Abdominal Setae:**

Dorsal group - D1 antero and slightly dorsal to D2 in most species. *P.aversa* and *T.propria* with D1 more dorsal to D2. D1 same length as D2 in all species.

Microdorsal group - MD1 near the anterior margin and mid D1 - D2 in all species.

Proleg setae - A group of four setae in a quadrilateral shape, with V1 most ventral and SV1, SV2 and SV3 dorsal. The same in all species.

(c) **Anal Shield Chaetotaxy:**

The chaetotaxy and pigmentation patterns of the six species have been studied and drawn, there being no noticeable variation in the former. This observation supports Hinton's conclusion (Hinton, 1946), that the setae of the tenth abdominal segment were of little taxonomic value. Fig 17 illustrates this.

The terminology of the various setae is given in Singh (1950) and will not be discussed any further here.

2. **Pigmentation Patterns**

The larvae of many noctuid species have their body segments subdivided longitudinally by bands of colour. These bands often extend onto the pronotal shield and head capsule anteriorly, and the anal shield posteriorly. They are particularly noticeable in some species e.g. *T.atristriga*, *P.aversa*, and *T.propria*, and less apparent in others. They are useful in the positioning of setae when drawing, and in the subsequent discussion. The most
obvious significance of these colour patterns in the larvae is in allowing for easy field identifications. Mackay (1968a) pointed out the necessity of easy identification for those involved in ecological and life table studies.

Fig. 16 subdivides the body segments of noctuid larvae into bands which appear to be consistent for most species. Where banding is inconspicuous e.g. _G. arctis_ and _T. steropastia_, the equivalent regions are often indicated by slight differences in general colour intensity.

The following are the descriptions of the pigmentation patterns of six of the seven noctuid species in this taxonomic revision.

(a) **Graphania arctis**;

Cranial area overall deep ochreous with a barely noticeable honeycomb mottling underlying the ground colour, conspicuous black setal punctures. The only discernable patterning over the rest of the body is a pair of distinct narrow subdorsal stripes running very close together on either side of the middorsum for the full length of the body. These are only obvious in fresh larvae. The colour varies from a rich ochreous to grass green depending on the host plant: Pronotal and anal shields barely noticeable, with little colour and no patterning.

(b) **Tmetolophota atristrix**;

Cranial area ochreofuscous with honeycomb mottling on the transitional areas where the darker colour changes to pale
ochreous, the distinct areas of ochreofuscos and pale ochreous running anteroposteriorly, with the amount of light colouration variable between specimens. The remainder of the body with a distinct narrow middorsum bordered by a darker, broad subdorsal area, the latter area darker than the remainder of the body and subdivided into a solid, narrow fuscosus band nearest the middorsum then laterally followed by a wide region of variegated colour clearly formed by fine fuscosus streaks aligned into longitudinal rows with a peler colour, followed by another narrow, solid fuscosus band. The supraspiracular region is a broad white band and the spiracular band is also of variegated pale brown and whitish similar to the subdorsal. The subspiracular is a broad white band; whilst the coxal region is basically pale brown variegated with whitish, fading to very pale ventrally. Dark lunulate sclerites are present above the proleg on each abdominal segment. The thoracic segments have very pale coxal regions.

The following setae have fuscosus pinacula: Prothorax, L group; Mesothorax, D, group; Metathorax, D group, SD2; Abdominal I - IX, D group, SD1, L3.

The pronotal and anal shields are typically ochreofuscos divided by pale middorsal and supraspiracular stripes with the sclerotized shields extending down into the spiracular region. The anal shield differs from the pronotal shield in having a narrow subdorsal stripe nearest the middorsum.

(c) *Persectania auresa*:-

Cranial area with three dark fuscosus stripes extending
anteroposteriorly with the remainder of the cranial surface a uniform fuscous honeycomb mottling over an ochreofuscous ground colour. The remainder of the body with a pale, narrow middorsum; subdorsal region with a dark fuscous band dorsally and a paler region below this to the margin of the supra-spiracular, the latter plain with no colouration. The spiracular band is broad with a dark fuscous streak dorsally and another dark streak ventrally, some vague colouration between; subspiracular band white and two thirds width of previous. Genal region very lightly marked with fuscous, darker in the thoracic segments, the abdominal segments bearing prolegs with distinct fuscous, lunulate sclerites, while the thoracic legs also have sclerotized patches covering most of each leg segment.

The following setae have fuscous pinacula: Prothorax, L and 3V groups; Meso/Metathorax, SD2, L1, L3, 3V1; Abdominal I - IX, SD1, L1, L3.

The pronotal and anal shields have the same pigmentation pattern which is common to many armyworm species with pale middorsal and supraspiracular stripes subdividing the solid fuscous sclerotized shields, the actual sclerotized areas representing the subdorsal and spiracular bands. In this species the subdorsal band is quite broad on the anal shield.

(d) Graphania disjungens:

Cranial area varies from broadly solid fuscous interrupted by sharply defined white areas extending anteroposteriorly to pale fuscous usually similar to ground colour and broadly interrupted
by a pale honeycomb mottling and some pale regions extending anteroposteriorly. The remainder of the body with subdorsal and spiracular bands amalgamated into one continuous region of variegated pale fuscous and pale to the subspiracular band.

No middorsal stripe. The supraspiracular band is represented by a broken fuscous line which is reduced on the thoracic segments to fragments. The subspiracular band is white tapering at the prothorax, with the coxal band similar to the subdorsal.

The following setae have fuscous pinacula: Meso/Metathorax, SD group, part D2; Abdominal I - IX, SD1, D group, L2, L3.

The pronotal and anal shields do not have any bands except for a very fine middorsal stripe on the former, instead an intensely coloured splotchy fuscous is uniform over the surface of both shields.

(e) *Imetolophota propria*:

Granal area fuscous basically, interrupted by pale areas running anteroposteriorly, the transitional areas a honeycomb mottling. The remainder of the body with a pale middorsum, abroad subdorsal band with a very intense fuscous stripe nearest to the middorsum, then an area to the supraspiracular band which changes from variegated fuscous and pale uniform over the surface anteriorly, through a gradation of intermediary changes antero posteriorly to the abdominal segments. Posteriorly this latter area virtually consists of dark fuscous bands dorsal and ventral, being quite broad in the latter. The supraspiracular band is a narrow pale ochreous stripe, with the spiracular band changing
anteroposteriorly from a continuously variegated to a
pale ochreous region with some variegated areas of fuscous and
pale ochreous. The subspiracular band is basically pale with
one or two fuscous spots about midband on abdominal segments.
Coxal region variegated pale fuscous with pale ochreous anteriorly,
to slightly variegated towards the top of L3 in abdominal segments,
below this a plain pale ochreous.

The following setae have fuscous pinacula: Meso/metathorax,
D group, SD1; Abdominal I - IX, D group, SD1 and L3 where prolegs
present.

Pronotal and anal shields similar and typically with two
whitish stripes, the middorsum and supra spiracular, with the
intervening sclerotization ochreofuscous and representing the
subdorsal and spiracular regions. The anal shield differs from
the pronotal shield in having an intense fuscous, subdorsal stripe
nearest the middorsum, also with a distinct area over this shield
more coloured than the rest.

(f) Tmetolophota steropastis:

Cranial area ochreous with the underlying honeycomb
mottling more noticeable than in G. aerotis. Functures and setal
punctures black, often with an associated black patch. The
remainder of the body is ochreous with no pattern except for
the intersegmental areas of some segments which often have a
salmon pink colour which sometimes appears through the body
in narrow longitudinal stripes, however these are irregular and
disappear with the preservation in Carnoy's Solution or 70%
Alcohol.

Promontal and anal shields slightly more noticeable than *G. areolis* with distinct middorsal and supraspiracular pale stripes subdividing the moderately sclerotized shields.

### III CLASSIFICATION OF THE FAMILY NOCTUIDAE

The classification of the Noctuidae used here follows Common (1970), and Viette (1962), two of the most recent reviews defining the family and its subfamilies.

The last comprehensive works on the New Zealand noctuid genera are Seitz (1912) and Hudson (1928). Since then taxonomic methods have advanced and the recent reviews by Common (1970) Viette (1962) Franclemont (1951) and others have culminated in a better understanding of the contents and categorization of the genera within the family Noctuidae.

Description of the Family Noctuidae (after Common, 1970).

Adults small to large; ocelli usually present; antennae pectinate, dentate or simple; haustellum usually strong; maxillary palpi 1-segmented; labial palpi prorect or ascending; epiphysis present, tibial spurs 0-2-4, tibial and tarsi sometimes spined; forewing usually with areole, 1A + 2A forming basal fork; hindwing with Sc + R, shortly fused with R5 near base, rarely fused to about one-half of discal cell, M2 weak and arising nearer to M1 than to M3 (trifid), or strong and arising
Fig 18: Diagrammatic sketch of the wing pattern of a noctuid

Fig 19: Apical Fore tarsal segment, ventral view.

Fig 20: Typical thoracic legs of a noctuid.
Fig 21: Typical noctuid wing venation.

Fig 22: Types of egg *P. aversa* and of the other species in the genus *Persectania* (sensu Hudson, 1928).
nearer to M3 than to M1 (quadrifid); abdomen with postspiracular counter tympanal hood (Figs 18,19,20,21 & 22).

Eggs usually domed, with vertical ribs, laid singly or in clusters. Larvae usually without secondary setae, rarely with dense secondary setae on verrucae, crochets uniordinal, rarely biordinal, not abruptly shorter at ends of meso series; mostly phytophagous, sometimes stem-boring or predaceous on Coccidae. Pupae in cell in soil or in silken cocoon not incorporating larval hairs.

Common (1970) differentiates the subfamilies on the basis of external adult characters, while Viette (1962) also incorporates genitalic morphology. A composite key is presented here to differentiate the subfamily Hadeneinæ from its closest relatives.

Key of some Closely Related Subfamilies in the Family Noctuidæ

1. Hindwing trifid ........................................... 2

   Hindwing quadrifid or M2 equidistant from
   M1 and M2 ........................................... some other subfamilies

2. Tibiae on meso- and metathorax spined, where
   only one then usually the latter .................. 3
   Tibiae on meso- and metathorax not spined ...... 4

3. Prothoracic tibiae with a curved claw on apex -
   Absent in genus Adisura ................................ Helicycletriinæ
   Prothoracic tibia without terminal claw ........ Noctuinæ
Eye naked. Valva in male genitalia with poorly developed, often indistinct cucullus . . . . Helicthidinae and some other subfamilies.

Description of the Subfamily Hadenaiae (after Viette, 1962).

Eyes hairy; frons with a prominence, often rounded or subtruncate; erect tufts on thorax and abdomen often with dorsal or medial crests; male abdomen often has long lateral crests at case lying in a fold, other ventral tufts are external with coresema on VIII segment; female genitalia with ductus bursae sclerotized entirely and ovipositor lobes characteristically very large, protruding at apicodorsal angle and showing transverse striations on mediocentral line; male genitalia having a characteristic valve with typical cucullus and simple or diffuse corona.

The following is a list of the nominal genera available in New Zealand in the subfamily Hadenaiae.

- Aletia Hubner type
- Alysiad Gueene
- Cirohia Walker type
- Dipaustica Meyrick type
- Erata Walker type
- Graphania Hampson type
- Ichneutica Meyrick type
- Leucania Schesheimer type
- Conisera Schiffermüller
- Nullifera
- Costalis Walker
- Episera Meyrick
- Graminosa Walker
- Disjungens Walker
- Ceramia Meyrick
- Pallens Linnaeus
Macaria Warren type
Melanchra Hubner type
Matera Butler type
Persectania Hampson type
Physsetica Heyrick type
Sideridia Hubner type
Tmetolophota Hampson type

plea Walker.
persicariae Linnaeus.
pictula White (rhodopleura Heyrick).
emnii Westwood.
saerulae Guenee.
evinda Hubner.
propria Walker.

Many New Zealand species in the subfamily Hadeninae have
in the past been placed in the Palearctic genus Melanchra
Dugdale (in litt.) has reassigned them to other genera, mainly on
the form of the genitalic structures.

IV DESCRIPTIONS OF SOME NEW ZEALAND NOCTUID GENERA (NOCTUIDAE:
HADENINAE), AND OF THE SPECIES PREVIOUSLY PLACED IN PERSECTANIA.

The following are the descriptions of some of the genera in the
subfamily Hadeninae and of the species previously found in Persectania
(Hudson, 1928). All of the genera mentioned below are fairly
closely related, and those names which have been considered and
discounted are discussed briefly and the reasons for this decision
given.

Key to some genera in the subfamily Hadeninae (Lepidoptera: Noctuidae).

1. Bursa copulatrix with ductus bursae shorter than corpus bursae,
   the latter long and straight with the ductus seminalis arising
   from its wall; valva with the cucullus rounded and no anal
spinae; juxta with canaliculus absent; cornuti a simple
bunch of long stout spines on the apex of the vesica Perssectania.
Bursa copulatrix with ductus bursae longer than corpus
bursae and often kinked, the latter bulbous with a pronounced
appendix bursae, the ductus seminalis arising from the apex
of the appendix bursae; valva with the cucullus wedge shaped,
anal spine present; juxta with canaliculus present; cornuti
a band of stout spines along vesica. ....... 2

2. Valva with sides almost parallel and anal angle poorly
developed, forming a slightly wedge shaped cucullus;
asdeagus with the cornuti a uniform band of stout spines
extending along the vesica. ............ Graphania.
Valva with sides curved to form a prominent lobe of the
sacculus and anal angle prominent, forming a distinctly
wedge shaped cucullus; asdeagus with the cornuti a band of very
strong spines slightly twisting along two thirds of the vesica
and forking apically, or spines reduced centrally giving a
forked appearance ......... Tmetolephota.

Genus Perssectania Hampson.


Type species: Noctua (Xylophasia?) ewingii Westwood, 1839.

In Ewing, 1839. Trans. ent. Soc. London. 2 (Proc.): v. pl.20,
fig.1.

Proboscis fully developed; labial palpi curved obliquely
upwards, apical segment porrect; frons smooth, rounded or subtruncate
projecting scales on frons and vertex form rounded prominences. Antennae of female with very short pubescence and bristles, of male fasciculate - ciliated; eyes rounded and hairy.

Thorax with patagia forming transverse dorsal ridge; prominent medial divided crest on prothorax and a less prominent medial spreading crest on metathorax.

Abdomen with dorsal crest of scales on basal segment and lateral tufts of hair.

Male genitalia with ventral margin of valva in a pronounced lobe producing a prominent anal angle and a rounded cucullus, costa curved gradually; anal spine absent; corona a diffuse group of stout spines and a marginal row of shorter incurved spines on cucullus; harpe sigmoid; ampulla extending lateroventrally from harpe; clavus simple, and peaked; aedeagus with the cornuti a terminal bunch of three or four straight, stout spines on the apex of the vesica.

Female genitalia with bursa copulatrix having ductus bursae straight and strongly sclerotized and a simple large membranous sac without signa; ductus seminalis arising directly from the wall of the corpus bursae sac; papillae anales large and pointed.

Remarks: The diagnostic features of this genus are: the "reniform" mark on the forewing: the overall pattern of the forewings which is peculiar to all three species in this genus; the shape of the male valvae: the juxta with no canaliculus: the simple corpus bursae with the ductus seminalis arising from its wall and the short ductus bursae and long pointed papillae anales.
The conspicuous fuscous, dorsal stripes running longitudinally and onto the shields of the prothoracic and anal segments of the larva.

The ovoid shape of the egg which has its long axis running vertically through the micropyle, and little reticulation on the surface

Key to the Australian and New Zealand species

1. Forewing with reniform and orbicular separate; male genitalia with clavus produced into a bilobed process with a narrow neck; juxta broad at base, becoming rapidly narrower towards upper end, sides concave .......... P. dyasrita

2. Forewing with reniform and orbicular confluent; male genitalia with clavus rounded; juxta with nearly parallel sides, tapering abruptly to point above ................. 2

2. Thorax with transverse band on patagia white, black, white; underside of hindwing with clearly defined fascia, terminal series of black dots obscured; white reniform mark with orbicular elongate and continuous with reniform obvious only as a slight bulge, transverse posterior line broadly dentate to mark; male genitalia with clavus prominently rounded; female genitalia with ductus seminalis leaving bursa copulatrix at anterior end .................. P. oewingii

Thorax with transverse band on patagia black and white; underside of hindwing with poorly defined fascia, terminal series of black dots visible; white reniform mark with
Ovibicular elongate and continuous with reniform which is broken and more distinct, transverse posterior line sharply dentate to mark; male genitalia with clavus gently rounded; female genitalia with ductus seminalis leaving bursa copulatrix near the middle ... ... ... ... ... ... P.aversa.

Prestectania aversa (Walker). (Figs 23, 24 & 38; Plates 5 & 6).


Mus. 2113.


Leucania dentigera Butler, 1880. Cistula Entomologia, sive Insectorum novorum diagnoses. 2:542.


2:86-100

ADULT

Ground colour: Fuscofumate sometimes paled by rufous or ochreous.

Head and labial palpi with projecting scales ground colour; frons with transverse fuscous to dark fuscous bar; crown of vertex fuscous. Antennae of female, simple, cylindrical and few cilia, of male, strongly serrate and fasciculate although reduced distally to near cylindrical.
Thorax ground colour with olivaceous; patagia with black transverse band edged with white above; tegulae basically ground colour margined with fuscous, dark fuscous streak submesally with a whitish streak between this and the mesal margin on some specimens. Legs ochreofumate tinged with fuscous and black.

Abdomen pale ground colour, sublateral line of black dots more prominent in female, often merging into a line.

Forewing ground colour, white at the anterior base; two black basal streaks often indistinct, one below the cell, the other near the dorsum; subbasal line reduced, represented by a short dark outwardly oblique line from costa near base; transverse anterior line indistinct with large dentations; transverse posterior line from just beyond half costa, bent outwards to R4, then strongly dentate, but indistinct below Cu2; subterminal line white, black edged often tinged with rufous extending from apex obliquely inwards to M3 and Cu1, and then obliquely to dorsum where dentation to termen on 2d + 3dA; area between subterminal line and termen fuscous, sometimes with rufous; orbicular and reniform white, defined by black, the former elongate and in most specimens confluent with the latter to form the white streak peculiar to this species and the genus; reniform extended to transverse posterior line on M1 and M2; a series of black dots sometimes extended to streaks on termen between veins.

Hindwing fuscous, paler on proximal half; cilia white
with fuscous subbasal line.

Undersides of wings ground colour irrorated with fuscous and sometimes rufous; terminal row of black dots between veins; hindwing with black discoidal spot, paler in proximal half.

Male genitalia having juxta with nearly parallel sides tapering sharply posteriorly; canaliculus absent; peniculus a tuft of strong lengthy bristles; cornuti a small bunch of long spines at apex of vesica; clavus slightly rounded and peaked.

Female genitalia with ductus bursae short and corpus bursae broader anteriorly and narrow towards the ductus bursae; signa absent; ductus seminalis arising from mid corpus bursae; both pair of apophyses about same length (1.06 - 1.13mm) and thickness.

Wing expanse: Mean 36mm, Range 32 - 40mm, (77 specimens).

LARVAE

Chaetotaxy: Cranial - V3, Va, V2 and V1 approximately equidistant, with V1 a greater distance from P2 than from V2; P2 and Pb a smaller distance apart than V1 to P2; La more dorsal to L1 than it is in the other species with the exception of G.disjungens; Oa equal with or slightly ventral to O4; Ga ventral to line O3 - Oa.

Prothoracic - XD1 more posterodorsal to XD2 than in the other species; D1 dorsal to D2; NXD1 positioned inside the shield; V1 longer in P.aversa than in G.disjungens, G.arotis and T.stereopastis, MV2 more anterior to MV3 than G.arotis and
T. stercopastis.

Meso/Metathoracic - SD1 fine; MSD1 posterodorsal to MSD2.

Abdominal - D1 more dorsal to D2 than in other species with the exception of T. propria.

Pigmentation pattern: Cranial - consists of fuscous and pale areas with a honeycomb mottling in the transitional areas.

Body - conspicuous and consists of three dark stripes running longitudinally down either side of the middorsum. These stripes occur in the subdorsal and spiracular regions and there is also a white band in the subspiracular region. The pronotal and anal shields have three fuscous stripes also, with the subdorsal band being thicker on the anal shield than it is along the body.

EGG

Shape: Ovoid with vertical axis longest and slightly compressed sides; micropyle at upper pole, long axis 0.60 - 0.66mm, (9 specimens); widest diameter 0.51 - 0.57mm, (10 specimens).

Sculpture: Slight reticulation, no ribbing, random 4 - 6 sided cellular pattern on micropylar cap extending to halfway down egg and elongate towards micropyle, ending in squat cells immediately surrounding this structure.

Colour: Creamy white when fresh changing to buff orange. Developing embryo not visible as black colouration common in many noctuid eggs. Colour change first noticable at 2 days, becoming more noticeable at 4 days.
Type locality: is♀; type ♀

Location of type: British Museum (Natural History), London.
Specimens examined: 58 ♂♂, 54♀♀; 50 larvae.

NORTH ISLAND


SOUTH ISLAND


Distribution: This species is very widespread and commonly found throughout the North and South Islands, Stewart Island.
and the Chatham Islands (Hudson, 1928). It has been mistaken for *P. ewingii* in New Zealand but there have been no reports of the latter species since Common's (1954) paper.

*P. versus* is also common in the montane tussock grassland areas.

**Remarks:** The white "reniform mark" on the forewing is characteristic of the three species *P. versus*, *P. dyscrita* and *P. ewingii* in the genus *Persectaria*.

*P. versus* is very similar to the Australian *P. ewingii*. The most obvious external difference is that the transverse band on the patagia in *P. versus* is white and black, while *P. ewingii* has a white-black-white band.

Also Common (1954) pointed out that *P. versus* has a poorly defined terminal fascia on the underside of the hindwing. A series of black terminal dots is visible because of this, and obscure in *P. ewingii* for the opposite reason.

The male genitalia are very similar with the clavus being more prominent in *P. ewingii*. The juxta is not as distinguishable between the two species as Common (1954) points out. In *P. versus* it tapers posteriorly in a manner similar to *P. ewingii* although probably not quite so pinched in the sides just prior to the tip.

In the females, *P. ewingii* has the ductus seminalis leaving the bursa copulatrix at its anterior end and in *P. versus* near the middle. *P. ewingii* also has a lobe protruding from the side of the bursa copulatrix and anterior of the middle.
Genus *Graphania* Hampson.


Type species: *Heliophobus disjungens* Walker, 1858.


Proboscis fully developed; labial palpi obliquely upturned, apical segment correct; frons truncate conical with corneous plate below it; eyes rounded and hairy. Antennae of female simple cylindrical and only slightly ciliated; of male strongly bipectinate tapering apically to serrate.

Thorax with patagia forming transverse dorsal ridge; prominent medial spreading crest on prothorax with another less prominent crest on the metathorax.

Abdomen with dorsal crest on basal segment, dorsally clothed with rough hair and lateral tufts.

Apex of forewing slightly pointed, the termen obliquely curved; costa straight.

Male genitalia with sides of valva almost parallel, anal angle poorly developed forming a slightly wedge shaped cucullus, anal spine present; corona a diffuse group of stout spines and a row of slightly incurved spines extending all or most of the way along the margin; clavus with two distinct regions, posteriorly knoblike with a stippled surface, anteriorly twice as large with a smooth surface and a patch of scattered bristles; fine hooked uncus; juxta shield shaped with a distinct canaliculus; aedeagus with the cornuti a uniform band of stout spines extending
along the vesica to the apex.

Female genitalia with bursa copulatrix having a strongly sclerotized ductus bursae, a bulbous corpus bursae and a prominent appendix bursae with a ductus seminalis arising from its apex; papillae anales short and stout.

Remarks: The diagnostic features of this genus are the shape of the male valvae which have nearly parallel sides resulting in little or no anal angle and the cucullus slightly wedge shaped. The shape of the cornuti on the vesica in the form of a narrow band of uniform, stout spines extending from the apex of the vesica along most of its length.

Larval and egg characters have also been considered but they do not have any significance at the generic level.

Key to some of the New Zealand Species

1. Overall colour dark brown and white, most obvious on thorax and forewings; orbicular, reniform and clariform obvious on forewing which also has a distinct short dark basal streak; male genitalia with costa gently curved; marginal corona only extending half-way along margin; harpe broadly rounded; female genitalia with posterior end of ductus bursae slightly concave centrally . . . . . . . . . . . . G.disjungens (P.).

Overall colour uniform, but varies from ochreous tinged with rufous, testaceous or fulvous, to fuscous; forewing with veins defined by fine whitish streaks on dark specimens; whitish spot present at the junction of M3, Cu1 in some specimens;
orbicular, reniform and clariform absent; basal streak absent; transverse lines absent or represented by double striae or series of black dots; male genitalia with costa sharply elbowed; marginal corona extending right along margin; harpe sharply pointed with some small protruherences along mesal margin; female genitalia with posterior end of ductus bursae convex . . . . . . . . . . . . . . . . . . . . . . . . . . C. eroticus (F. &.)

Graphania disjungens (Walker). (Figs. 25, 26 & 38, Plates 7 & 8).


Namostreis disjungens (Walker); Heyrick, 1895. Trans. N.Z. Inst. 19:15.

Melanchra disjungens (Walker); Hudson, 1898. N.Z. Moths and Butterflies (Macrolepidoptera) p. 15, pl. v, fig. 43.

Graphania disjungens (Walker); Hampson, 1905. Cat. Lep. Phaenocerae Brit. Mus. 5:469.

Perseactania disjungens (Walker); Hudson, 1928. The Butterflies and Moths of N.Z. p. 66, pl. vii, fig. 23.

ADULT

Ground colour: Fuscous and pale ochreous.

Head and labial palpi with projecting scales, white and fuscous; frons ground colour with dark fuscous transverse bar and pale below. Antennae of female simple, cylindrical and ciliated; of male, strongly bipectinate and reduced at base and apex.
Thorax various shades of ground colour; patagia ground colour with transverse bands of black and white, fuscous above; tegulae white centrally, margined with fuscous and submarginal bands of fuscous and white; spreading crest on prothorax ground colour and white.

Abdomen fuliginous.

Forewing ground colour basically, patterned by whitish veins; subbasal line represented by oblique black striate from costa and cell, the latter followed by a slight black basal streak; transverse anterior line ground colour edged with black interrupted at the veins; claviform small defined by black anteriorly and situated between Cu stem and 2d + 3d A against transverse anterior line; orbicular and reniform small and white, pale fuscous centrally, edged with black; a median line obliquely from costa to below Cu2; transverse posterior line pale fumose excurved below costa towards M3, obliquely angled inwards below Cu2, then parallel with dorsum to transverse anterior line; subterminal line white with a pair of distinct dentate marks at Cu1 and M3 to termen; a terminal series of dark fuscous lunules; cilia pale ground colour.

Hindwing fuscofumace, pale basally with a dark terminal line; cilia pale basally, darker, then pale tips.

Undersides of wings pale irroration with fuscous, dark transverse posterior line plus discal spot on forewing; hindwing with discoidal spot and fuscous streak from spot towards base; fuscous transverse posterior line, terminal series of fuscous lunules.
Male genitalia with costa only slightly rounded, nearly straight; cucullus broad with little or no waist at anal angle; diffuse corona with spines very fine and lightly covering most of the surface of cucullus to above harpe, marginal corona extending part way long margin of cucullus; harpe broad and slightly rounded distally; ampulla slender, smaller than harpe and curving dorsally; peniculus a sparse tuft of fine hair.

Female genitalia with ductus bursae straight and moderately sclerotized; corpus bursae bulbous and slightly sclerotized, with a pair of leaf shaped sigmas; appendix bursae larger than corpus bursae, well rounded; striations at base of appendix bursae and along anterior half of ductus bursae; apophyses with posterior pair (1.44mm) longer and more slender than anterior pair (1.04mm).

**LARVAE**

Chaetotaxy: Cranial - V3, V4 and V2 approximately equidistant and nearer to each other than V2 is to V1, which is closer to P2 than V2; P2 and Pb are in a straight line with V1 and approximately equidistant; La more dorsal than in other species with the exception of **P.aversa**; Ga closest to O3; Ga slightly ventral to O3 - Oa.

Prothoracic - XD1 dorsal to XD2; D1 slightly anterodorsal to D2; MXD1 positioned outside the shield; V1 longer than **G. arorita** and **T. steropastis** and about the same length as the other species; MV2 more anterior to MV3 than **T. arorita** and **T. steropastis**.

Meso/Metathoracic - SD1 fine; MSD1 posteroverentral to MSD2.
Abdominal - SD2 anterior to spiracle.

Pigmentation pattern: Cranial - consists of fuscous and pale areas with some honeycomb mottling in the transitional areas.

Body - consists of a continuous subdorsal and spiracular region of variegated pale fuscous and pale broken only by a disjointed fuscous supraspiracular band which is reduced in the thoracic segments; middorsal band is absent; subspiracular region is white. The pronotal and anal shields have no stripes except for a fine middorsum on the former, the surface being covered with an intensely coloured splotchy fuscous.

EGG

Shape: Large and subspherical, flattened through the vertical axis and having a rather plump appearance; curvatures less pronounced; widest diameter 0.30-0.37mm, (10 specimens).

Sculpture: Prominent wavy ribbing, 36-40 ribs, (8 specimens), ending at lower curve, smooth base; ribs subdivided into rectangular cell forms by faint cross ribs arranged in concentric rings about the micropyle.

Colour: White when fresh, a brown subsurface mottling intensifying with maturity giving the egg a brown appearance after 2 days, finally turning grey at maturity; typical brown markings forming on the micropyle and also in a ring about it and some distance out.

Type locality: New Zealand: (Walker, Emys, Mathew), 48\textsuperscript{2}, 18\textsuperscript{4} type.
Location of type: British Museum (Natural History), London.
Specimens examined: 27 ♂, 8♀, 20 larvae.

NORTH ISLAND

Waimarie: -.i.1931, 1♂, 1♀, (G.V. Hudson), Canterbury Museum.

SOUTH ISLAND


Distribution: Found in both islands although records indicate that it is more common in the South Island. Occur in Wellington province, in particular lower central North Island and Mt. Ruapehu (up to 4000'); Canterbury; Central Otago and Southland. This species has been recorded up to 5500' in Canterbury and is in fact most common throughout New Zealand in the montane tussock grassland of this province, lower central N.I. and parts of Central Otago.
Remarks:

This species is quite unlike any of the other species in the genus *Persectania* (*Sensu* Hudson, 1928). Its basic wing pattern is a dark brown and white reticulation with the three marks quite prominent. The thorax and head are also comprised of dark brown and white scales and the patagia carries an obvious black and white transverse band. The antennae of the male are strongly bipectinate, much more so than any of the other species.

There is no prominent black basal streak as in *T. steropastis* *T. propria* and *T. atriatriiga*, likewise the white "reniform mark" typical of *P. averse*, *P. dyscrita* and *P. swingii* is absent.

*Graphania arotis* (*Meyrick*) (*Figs. 27, 28 & 38; Plates 9 & 10*).


**ADULT**

Ground colour: Ochreous, tinged with rufous, testaceous or fulvous; to fuscous.

Head, labial palpi and thorax ground colour; sides of palpi, and frons, with some black scales. Antennae in female
simple, cylindrical, pubescent; in male, errate and ciliated.

Thorax with patagia ground colour, sometimes with faint black transverse band on darker specimens; tegulae ground colour; sometimes with a darker line near the medial margin and another at lateral margin of darker specimens. Legs pale with darkish marks.

Abdomen ochreous irroration with fuscous.

Forewing ground colour; veins fuscous defined by fine whitish streaks on dark specimens between transverse posterior line and terminal margin; transverse anterior line arising sometimes as double striae on 2d + 3dA and M/Cu stem in dark specimens; transverse posterior line represented by a series of black dots curving basally on veins from M2, and joined by an oblique streak in darker specimens running basally and curving towards M/Cu stem; a pair of fine dark lines between transverse anterior striae and the dot on 2d + 3dA, the dot being part of the series forming the transverse posterior line; a whitish spot present at the junction of M3, Cu1 in some specimens; cilia ground colour; no black basal streak.

Hindwing pale fuscous, fuscorufous or fuscous; cilia pale.

Undersides of wings pale ochreous, irroration and partly suffused with rufous in dark specimens; discal area of forewing pale fuscous to fuscous; hindwing with a slight discoidal spot and an indistinct transverse posterior line.

Male genitalia with valva sides nearly parallel, costa sharply elbowed; cucullus slightly wedge shaped with a broad
waist, anal angle absent; diffuse corona large, extending down
the valva to about top of harpe, marginal corona extending
along margin of cucullus; harpe slightly sigmoid with some
protruberances on mesal margin, curving at distal tip to fine
point; ampulla slender and about same length; clavus slightly
wavy and curved obliquely; penisculus a tuft of long bristles
with other shorter bristles extending in a fan basally.

Female genitalia with ductus bursae rounded posteriorly,
well sclerotized and a prominent kink about half way long its
length, sometimes kink reduced; corpus bursae bulbous, slightly
sclerotized with a pair of leaf shaped or elongate signa; appendix
bursae strongly sclerotized, elongate rounded; striations near
base and on hump of appendix bursae along anterior half of ductus
bursae and running diagonally around the corpus bursae less
prominently than in Tsteropastis; apophyses with posterior pair
(1.40mm) longer than anterior pair (0.87mm).

Wing expanse: Mean 38mm, Range 33 – 44mm, (24 specimens).

LARVAE

Chaetotaxy: Cranial - V3, Vα and V2 roughly equidistant
and nearer to each other than V2 is to V1, which is closer to
P2 than V2; P2 and Pb in a straight line with V1 and approximately
equidistant; Oa closest to O1 and more between O^4 - O^5; Ga
slightly ventral to O3 - Oa.

Prothoracic - XD1 slightly posterodorsal to XD2; D1
slightly anterodorsal to D2; MXD1 situated outside the shield;
V1 noticeably smaller than in the other species with
the exception of T. ateropastis; MV2 slightly anterodorsal to
MV3.

Meso/Heterothoracic - SD1 fine; HSD1 posterodorsal to
HSD2.

F pigmentation pattern: Cranial - overall consists of ochreous with
conspicuous black setal punctures.

Body - has little pattern except for a distinct pale
narrow subdorsal stripe on either side of the middorsum
running the full length of the body. The pronotal and anal shields
are barely noticeable.

Egg

Shape: Subspherical, flattened through the vertical axis with
a flattened base; widest diameter 0.77-0.82mm, (10 specimens).

Sculpture: Prominent wavy ribbing clearly defined, 31-34
ribs, (10 specimens); with alternate ribs originating at micropyle,
ending at lower curve, smooth base; ribs subdivided into rectangular
cell forms by cross ribs arranged in concentric rings about the
micropyle.

Colour: White when fresh, changing to silvery grey and then
darker at maturity; typical brown markings forming on the micropyle
after 5 days and also in a ring about it and some distance out.

Type locality: New Zealand: (Walker), 1c.

Location of Type: British Museum (Natural History), London.

Specimens examined: 21♂♂, 6♀♀; 18 larvae.
NORTH ISLAND.


SOUTH ISLAND


Distribution: This species is not common although found in both the North and South Islands up to 3000' a.s.l. Ranges from Taranaki, including Mt. Egmont; Wellington province including Mt. Ruapehu; Marlborough, Canterbury, Otago and Southland.

Remarks: Dark forms of this species can be distinguished from T. ceteropastis most easily by the form of the genitalia, males having a valva with almost parallel sides and the anal angle reduced; cornuti a uniform band of stout spines; no fork. Females with the signa leaf shaped and the ductus bursae rounded posteriorly.

Externally, there is no basal streak and the transverse band on the patagia is reduced or obsolete.
Genus *Tmetolophota* Hampson.


Probo
cis fully developed, labial palpi curved obliquely upwards, apical segment correct; frons smooth; rounded or subtruncated; projecting scales on vertex extend towards a medial projection. Antennae of female simple, cylindrical with few cilia, of male serrate and fasciculate; eyes rounded and hairy.

Thorax with patagia forming transverse dorsal ridge; prominent divided crest on prothorax.

Abdomen with dorsal crest at basal segment, clothed with rough hair and lateral tufts.

Forewing with costa slightly bowed near base; the termen curved obliquely.

Male genitalia with valva sides curved to form a prominent sweeping lobe of the sacculus, costa curved obliquely, anal angle prominent forming a distinct wedge shaped cucullus; anal spine present; a diffuse corona of stout spines and a marginal row of incurved often stoutish spines; clavus with two distinct regions, posteriorly knoblike with a stippled surface, anteriorly about twice as large with a smooth surface and a patch of bristles; harpe stout pointing posteriorly along valva; ampulla narrow, angled mesally from base of harpe and often invested with some scattered short bristles; a small lobe at base of harpe and ampulla;
uncus fine or spatulate hooked; juxta broadly shield shaped with a distinct canalculus; aedeagus with a prominent spine on one of its distal forks and the cornuti a band of very strong spines twisting along two thirds of the vesica, the band forked apically or spines reduced centrally giving a forked appearance.

Female genitalia with bursa copulatrix having a well sclerotized ductua bursae, a bulbous corpus bursae, and a prominent appendix bursae with ductus seminalis arising from apex of appendix bursae.

Remarks: The diagnostic features of this genus are the shape of the male valvae which have a very pronounced sweeping lobe of the sacculus resulting in a deep, prominent anal angle and a strongly wedge shaped cucullus. The shape of the cornuti on the vesica is the form of a narrow band of stout spines extending from the apex of the vesica along most of its length, with those at the apex either absent or reduced centrally giving the cornutal band a forked appearance.

Key to some of the New Zealand Species.

1. Forewing with a single, prominent, black basal streak; overall colour pattern uniform and simple . . . . . . . . 2.

   Forewing with one or two short, indistinct, black basal streak(s); overall colour pattern complex . . . . . . . . . . . . 3.

2. Patagia with prominent black and white transverse band; black basal streak bluntly tipped; male genitalia with cornutal band forked, central spines absent; uncus broadly spatulate; costa
smoothly elbowed; female genitalia with signum leaf-shaped . . . . . . . . . . . . . . . . . . . . . . . T. propria. (P.).

Patagia with a dark transverse band faint or absent; black basal streak sharply tipped, male genitalia with cornutal band forked, central spines reduced, uncus uniformly slender, costa sharply elbowed; female genitalia with signum absent . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . T. atristriga. (P.).

3. Forewing with complex dullish colour pattern of ferruginous and black; whitish spot at junction of M3, Cu1; two black basal streaks; male genitalia with costa smoothly elbowed; harpe slender, sigmoid and pointed, ampulla very slender and same length; cucullus prominently wedge-shaped; female genitalia with posterior end of ductus bursae concave; signum slash shaped; corpus bursae strongly striated . . . T. steropastis. (P.).

Forewing with complex contrasting colour pattern of ferruginous, black and white; whitish spot absent at junction of M3, Cu1; single black basal streak; male genitalia with costa sharply elbowed; harpe broad and sharply pointed, ampulla more slender and shorter; cucullus moderately wedge-shaped but not prominent, female genitalia with posterior end of ductus bursae convex; signum diamond shaped; corpus bursae not strongly striated . . . . T. similis. (P.).
Tastolophota propria (Walker). (Figs. 29, 30 & 38; Plates 11 & 12).


Fersectania propria (Walker); Hudson, 1923. The Butterflies and Moths of N.Z. p.62, pl.vii, fig.29.


ADULT

Ground colour: Fulvid - fuscofulvid - rufofulvid - ferruginofulvid.

Head and labial palpi with projecting scales, ground colour; some darker scales on side of palpi, frons pale along side. Antennae of female simple, cylindrical with few cilia; of male, strongly serrate and fasciculate, reduced apically to simple cylindrical and ciliated.

Thorax colour uniform although in some specimens the strongly ferruginous contrasts with paler ground colour; patagia ground colour in pale specimens but same colour as rest of thorax in ferruginous and rufosfulvid specimens, prominent black and white transverse bands. Legs with fore and mid tibiae pale, blackish dorso anteriorly.

Abdomen ochreous with a row of sublateral dots often
with black.

Forewing ground colour in fulvid specimens, often where thorax more ferruginofulvid wings paler; prominent black basal streak with blunt tip, extending from below base of cell to below origin of Cu2; where fulvid winged, specimens have plain basal streak, where fusco, rufo or ferrugino tinged, basal streak pale anteriorly; posterior edge of cell from end of basal streak to M2, M3 diffuse fuscous; reniform small and fumate with black margin; orbicular and claviform often obsolete, when present reduced to a slight black streak with some fumate scales; transverse posterior line a series of black dots on veins; a series of terminal black lunules between veins.

Hindwings fuscous or ochreous tinged with fuscous; cilia ochreous basally then paler; dark, diffuse terminal lunules.

Undersides of wings; forewings ochreous irrorated with fuscous to fuscous, terminal black lunules present; hindwings ochreous with a discoidal spot and terminal black lunules.

Male genitalia with costa strongly bowed; diffuse corona with spines slightly larger than marginal corona, the latter not touching the margin in the centre; uncus with spatulate tip; harpe curved distally with some protruberances over surface bearing hairs; ampulla shorter with uniform sides, some hairs; clavus slightly wavy and slightly curved obliquely; aedeagus with a prominent spine near distal margin; peniculus a narrow dense tuft of shortish bristles with a few very small bristles scattered at base.

Female genitalia with ductus bursae slightly kinked to
straight, lightly sclerotized; corpus bursae membranous and bulbous with a pair of leaf shaped signa; appendix bursae larger than corpus bursae and elongate rounded, well sclerotized; striations at base of appendix bursae and along anterior half of ductus bursae; apophyses with posterior pair (1.37 mm) much longer than anterior pair (0.63 mm).

Wing expanse; Mean 33 mm, Range 29-38 mm, (86 specimens).

**LARVAE**

Chaetotaxy: **Cranial** - V3, Va and V2 approximately equidistant and nearer to each other than V2 is to V1, which is closer to P2 than V2; P2 and Pb in a straight line with V1 and approximately equidistant; Oa closest to O3; Ga more dorsal to O3-Oa.

**Prothoracic** - XD1 slightly postero-dorsal to XD2; D1 slightly antero-dorsal to D2; MXD1 positioned outside the shield; V1 longer than G. arctis and T. steropastis, and approximately the same length as the other species; MV2 more anterior to MV3 than G. arctis and T. steropastis.

**Meso/Metathoracic** - SD1 slightly anterior to others.

**Abdominal** - D1 more dorsal to D2; SD2 more dorsal to spiracle.

Pigmentation pattern: **Cranial** - consists of fuscous and pale areas with some honeycomb mottling in the transitional areas.

**Body** - conspicuous with two fuscous stripes on the subdorsal region on either side of the middorsum, the dorsal stripe being intensely coloured while the ventral one is broader. There are two pale bands in the supraspiracular and subspiracular regions
with the spiracular region changing anteroposteriorly from a continuously variegated area of fuscosus and pale ochreous anteriorly to a pale ochreous posteriorly. The pronotal and anal shields are similar with three fuscosus bands representing the subdorsal and spiracular areas on either side of a pale middorsum, also pale between the stripes. The anal shield differs in that there is a narrow, intense fuscosus subdorsal stripe nearest the middorsum and also an area over this shield which is more coloured than the remainder.

EGG

Shape: Subspherical, flattened through the vertical axis and a flattened base; widest diameter 0.70-0.76mm, (10 specimens).

Sculpturing: Prominent wavy ribbing clearly defined, 33-36 ribs, (10 specimens); with alternate ribs originating at micropyle, ending at lower curve, smooth base; ribs subdivided into rectangular cell forms by cross ribs arranged in concentric circles about the micropyle.

Colour: Off white when fresh, changing to a dark brownish at maturity; typical brown markings forming on the micropyle and also in a ring about it and approximately 0.5mm from the micropyle.

Type locality: New Zealand: (Earl), 16° type.

Location of type: British Museum (Natural History), London.

Specimens examined: 716°, 74°; 15 larvae.

NORTH ISLAND

Egmont: 23.1.1916, 1°, (Watt Collection), (Dominion Museum).

SOUTH ISLAND.


Distribution: Found in both the North and South Islands and in particular at high altitudes where it occurs in great abundance. This species has been recorded up to 5500' a.s.l. in Canterbury. Occurs in Taranaki, Canterbury and Otago although it is bound to be more widespread than the records suggest.

Remarks: There are two basic colour types. Those with the thorax consisting of the same colour as the ground colour on the forewings, and those with the thorax more ferruginous than the paler ground colouring of the forewings.

The basal streak has a blunt apex and the male genitalia have a cornuti consisting of a band of stout spines twisted along the vesica and forked apically with the anal angle deep in the valva margin.

Fletcher (in litt.), states that P. basifascia Hampson is conspecific with P. propria Walker and has given permission for this information to be quoted here.
**Tmetolophota atristriga** (Walker) (Figs. 31, 32 & 38; Plates 13 & 14);


**Mamestra antipoda** Felder, 1874. "Novara." Reise der österreich ischen Fregatte Novara um die Erde in den Jahren, pl.109, fig.23.


**ADULT**

Ground colour: Fuscous - ferruginous - ochreoferruginous.

Head, labial palpi and thorax ground colour, often paled by an irroration of white tipped scales; this usually corresponding to the wing colour although some have paler wings. Antennae of female simple, cylindrical few cilia; of male serrate and fasciculate reduced to cylindrical and ciliate distally.

Thorax with patagia ground colour rarely with a faint dark transverse band; tegulae ground colour. Legs pale suffused with ferruginous, some fuscous also; anterior of femur and fibia, and last 2 - 3 tarsi blackish.

Abdomen fuscofumate; anal tuft more ochreous in darker specimens.

Forewing ground colour in most specimens, predominantly
ochreo ferruginous; prominent black basal streak extending from below base of cell to below the origin of Cu2, having a slender pointed apex; costal area often clouded with fumate to near apex, claviform small and fumate, sometimes nearly obsolete; orbicular and reniform small and fumate, margined by pale and black laterally; the former elongate, the latter angled basally on median nervure and with some fuscous in lower part; an ochreous patch between M1, M2 near reniform; sub-basal line sometimes represented by slight striae from costa and cell, very reduced, mostly obsolete; transverse anterior line arising as double striae from costa and cell, mostly obsolete or very reduced although more obvious in darker specimens; transverse posterior line visible as double striae arising from costa then indistinct, dark or light in fuscous - ferruginous range of specimens; subterminal line usually indistinct and represented by a series of small ochreous and fuscous dentations sometimes visible as much at Cu1 and M3 in fuscous specimens; a terminal series of black lunules in some specimens; cilia ground colour.

Hindwing fuscous to pale fuscous, paled basally; cilia fulvid, also sometimes pale basally.

Undersides of wings pale, irrorated with fuscous and sometimes rufous; forewing with fuscous discal area; hindwing with black terminal lunules.

Male genitalia with costa rounded to elbowed; cucullus strongly wedge shaped, narrow waist; spines of diffuse corona
and marginal corona about same size with former extending part way down dorsal margin, then proceeded by lengthy hairs; harpe short, slightly sigmoid and rounded distally; ampulla slightly more slender than harpe, rounded distally and curved dorsally; clavus with two regions very distinct, margin slightly wavy curving obliquely; peniculus consisting of a strong tuft of long, stoutish bristles, a shorter denser tuft of stoutish bristles and a basal fan of short fine bristles which extend out from the base mesally.

Female genitalia with ductus bursae sclerotized and corpus bursae membranous; signa absent from the latter; appendix bursae well sclerotized and rounded with striations at base of appendix bursae and in front of prominent kink which is about half way along ductus bursae; apophyses prominent, posterior pair (1.13mm) much longer than anterior pair (0.64mm).

Wing expanse: Mean 35mm, Range 31-40mm, (69 specimens).

**LARVAE**

Chaetotaxy: **Granal** - V3, Va and V2 approximately equidistant and nearer to each other than V2 is to V1, which is closer to P2 than V2; P2 and Pb are in a straight line with V1 and approximately equidistant; G1 more ventral than normal and directly ventral to Ga; Ga in straight line with O3 - Oa.

**Prothoracic** - XD1 slightly posterodorsal to XD2; D1 slightly anterodorsal to D2; MxD1 on margin of shield and between D1 - D2; NV2 more anterior to NV3 than G. arrotis and T. steropastis SD group on a pinaculum; V1 larger than in G. arrotis and T. steropastis
Meso/Metathoracic - MSD1 posterior to MSD2.

Pigmentation pattern: Cranial - consists of ochreofuscous and pale ochreous with some pale honeycomb mottling in the transitional areas.

Body - conspicuous and consists of two distinct dark stripes running longitudinally in the subdorsal region, but also between these there is an equally distinct variegated area consisting of a number of fine fuscous streaks aligned longitudinally. Also in this species there are two broad, white bands in the supraspiracular and subspiracular regions. The pronotal and anal shields are conspicuous and consist of the dark subdorsal stripes with the subdorsal stripe nearest the middorsum narrow on the latter shield.

EGG

Shape: Subspherical, flattened through the vertical axis; widest diameter 0.70-0.72mm, (10 specimens).

Sculpture: Prominent ribbing, 28-31 ribs, (10 specimens), ending at lower curve, smooth base; ribs subdivided into rectangular cell forms by cross ribs arranged about the micropyle.

Colour: White when fresh, changing to a dark brown at maturity; forming typical brown markings on the micropyle and in a ring about it and some distance away.

Type locality: Auckland: (Oxley), 2♂♂ type.

Location of Type: British Museum (Natural History), London.

Specimens examined: 5♀♀, 3♂♂; 3 larvae.
NORTH ISLAND


SOUTH ISLAND


Distribution: Very common throughout both islands of New Zealand ranging from sea level to montane regions. Occurs in Auckland; Taranaki; including Mt. Egmont; Hawke's Bay; Wellington province, including Mt. Ruapehu; Marlborough; Nelson; Canterbury; Otago; Southland; Westland and Stewart Island (Hudson, 1928). This species occurs very frequently throughout Canterbury, on the plain and in the tussock grasslands of the Southern Alps (Cass).
Remarks: Can be distinguished from *T. propria* by the sharp pointed basal streak which led to it being called the "Dagger-marked Cutworm Moth" (Gaskin, 1966a). The colours of this species also tend to be more drab than *T. propria* with a strong tendency towards a fuscous based ferruginous. Transverse band on the patagia is reduced or obsolete. The male genitalia has the cornutal band slightly twisted along the vesica and forked apically with the centre spines very much reduced. The female genitalia has a *corpus bursae* with no signa.

*Tmetolophota steropastia* (Meyrick). (Figs. 33, 34 & 38; Plates 15 & 16)


*Melanchra steropastis* (Meyrick); Hudson, 1898. N.Z. Moths and Butterflies (*Macrolepidoptera*) p.23, pl.iii, fig.7, pl.v, figs.10,11.


**ADULT**

Ground colour: Fuscoferruginous – fuscotestaceous; often mellowed by a fulvid colour, markings not so clear in latter specimens.

Head, labial palpi and frons ground colour with some white tipped scales; sides of palpi, and frons, blackish, vertex consisting of projecting scales of ground colour. Antennae of female and male simple, cylindrical and lightly ciliated base to apex, although in male ridged ventrally and slightly fasciculate.
Thorax with patagia ground colour, pale tips and black and white transverse bands midway, divided prothoracic crest ground colour, tipped with white, the medial part of the thorax between tegulae the same; tegulae ground colour with a black and white longitudinal band near medial margin and laterally a further curved white line, between the curve and wing base is a patch of deep fuscous. Legs rufous and fuscous dorso anteriorly, pale underneath.

Abdomen fumice tinged with fuscouscent and rufous, often a sublateral row of black dots.

Forewing fuscoferruginous; veins with dark streaks; black basal streak pointed distally pale along anterior margin, running from wing base below cell, along M/Cu stem to halfway to Cu2 base; second black streak running in cell to base of M2; transverse anterior line often obsolete although in fuscorufous, fuscotestaceuse specimens a tricolour line of black pale black, probably the remnants of this line, begins at wing base to 2d + 3dA; similarly for transverse posterior line with some remnants originating after 2d + 3dA vein in long streak, crossing Cu2, and dentate subterminally and terminally at Cu1, M3, and to a lesser extent at M5, the last mentioned being obsolete in falivid specimens; terminal line reduced to a pale line extended at vein tips between.

Minding fuscous to pale fuscous paler towards the base; cilia pale.

Underside of wings pale, forewing with fuscous discal area.

Male genitalia with costa obliquely elbowed; cucullus
strongly wedge shaped with a narrow waist; diffuse corona of stout spines longer than marginal corona; harpe simple, slightly sigmoid and tapering distally; ampulla slightly longer than harpe, slender with even sides; clavus with margin wavy, curving gradually; aedeagus with prominent spine near distal margin; peniculus a tuft of very long bristles with other shorter, finer bristles forming the main tuft and a bunch of short bristles at the base fanning out medi ally.

Female genitalia with ductus bursae bent under centrally at posterior end, a very prominent kink about a third way along its length and strongly sclerotized; corpus bursae rounded and skewed, slightly sclerotized with a pair of slash shaped signa; appendix bursae strongly sclerotized, elongate rounded and very large extending to top of ductus bursae; prominent striations down posterior third of ductus bursae, at base of appendix bursae and on corpus bursae about the signa; apophyses with posterior pair (1.36mm) longer than anterior pair (0.80mm).

Wing expanse: Mean 41mm, Range 37-45mm, (15 specimens).

LARVAE

Chaetotaxy: Cranial - V3, V4 and V2 approximately equidistant and nearer to each other than V2 is to V1, which is closer to P2 than V2; P2 and Pb in a straight line with V1 and approximately equidistant; P2 smaller than in the other species; C1 very close to the edge of the cranium, Ga slightly anterodorsal forming an approximately straight line with O3 - Oa.
Prothorax - XD1 slightly posterodorsal to XD2; D1 slightly posterodorsal to D2; MXD1 positioned inside the shield; V1 smaller than the other species with the exception of G. arctis; MV2 slightly anterodorsal to MV3.

Meso/Elastathorax - SD1 fine; MSD1 posteroveentral to MSD2; SV1 ventral to L3.

Pigmentation pattern: Cranial - consists of ochreous with an underlying honeycomb motting more noticeable in this species than in G. arctis. Also the punctures and setal punctures are black often with an associated black patch.

Body - consists of pale ochreous with no other patterning except for the intersegmental areas of some segments which are characteristically salmon pink. This colour sometimes appears in the body in narrow longitudinal lines, however, this usually disappears after having been stored in alcoholic preservative for a period of time. The pronotal and anal shields are slightly more noticeable than G. arctis with distinct middorsal and supraspiracular pale stripes subdividing the moderately sclerotized shields.

EGG

Shape: Subspherical, flattened through the vertical axis with a flattened base; widest diameter 0.72-0.78mm, (10 specimens).

Sculpture: Prominent ribbing clearly defined, 27-31 ribs, (10 specimens); extending from pole to pole although fading near flattened base; ribs subdivided into rectangular cell forms by cross ribs which are arranged irregularly, the cross ribs characteristically ending a distance from the micropyle in a V
notch between each pair or ribs, fainter normal cross ribbing occurring after this to the micropyle.

Colour: Offwhite when fresh turning brown at maturity; typical brown markings forming on the micropyle and in a circle about it and some distance away; brown circle often broken for a distance of 0.21-0.33mm, (10 specimens).

Type locality: New Zealand.

Location of Type: British Museum (Natural History), London.

Specimens examined: 9♂♂, 1♀; 2 larvae.

NORTH ISLAND

Taranaki: Manaia; 10.ix.1964, 1♂; 11.x.1966, 1♀, (K. Fox);
Chalot, Mt. Egmont, 2.ii.1969, 1♀, (T.H. Davies). Wairarapa: ----,
1♀, (Anon.), (Otago Museum). Fuketitiri: Little Bush, 15.xii.1962,
1♀, (Anon.), (Dominion Museum).

SOUTH ISLAND

Mt. Grey: reared from larvae, -.i.1920, 1♂, (Anon.), (Canterbury
Museum). Lees Valley: 10.ii/1929, 1♀, (Anon.), (Canterbury
Museum). ----: ----, 1♂, (Feraday Collection), (Canterbury Museum).
Spreydon: -.ii.1914, 1♂, (Anon.), (Canterbury Museum). Puke Atua
Bush: -.i.1920, 1♀, (Anon.), (Canterbury Museum). Kaituna: 17.ii.1929,
1♂, (S. Lindsay), (Canterbury Museum). Price's Bush: 14.1.1933, 1♀:
31.xii.1942, 1♀, (S. Lindsay), (Canterbury Museum). Kennedy's Bush:
6.1.1945, 1♀, (T. Salmon), (Canterbury Museum). Akaroa: Rowe's Bush,
5.ii.1878, 1♀, (Anon.), (Canterbury Museum). Dunedin: 6.xii.1919,
2♂♂, (Anon.), (Canterbury Museum): Waverly, 9.xii.1919, 1♂, (Anon.),
(Otago Museum): 6.xii.1919, 1♀; 10.xii.1919, 1♂ (C.E. Clarke),
(Auckland War Memorial Museum).

Distribution: This species occurs in both the North and South Island; and also on Stewart Island. Although it is not a common species it occurs over most of the country wherever there is flax. Also recorded at altitude. Occurs in Thames; Hawke's Bay; Taranaki, including Mt. Egmont (2000'-3500') Maata, New Plymouth, Wanganui; Wellington province including lower Central R.I.; Nelson, Canterbury; Otago, Southland and Stewart Island.

Remarks: The darker forms of *T. steropastis* and *C. arotis* can be distinguished by an examination of the male and female genitalia. The *T. steropastis* male has a valva with the anal angle deep and a strong cucullus with the cornuti a forked band which twists along the vesica. The females of the two species are very similar with the exception of the slash shaped signa and posterior end of the ductus bursae.

Normally *T. steropastis* is a large species and usually the bold ferruginous colour and strong thoracic crests and transverse band on the patagia are very distinctive as is the black basal streak on the forewing which is absent in *C. arotis*.

*Taetelophota similis* (Philpott) (Figs. 35, 37 & 38; Plates 17 & 18)


ADULT

Ground colour: Fuscous - fuscorufous - fuscoferruginous.
Head, labial palpi and frons basic ground colour, the intensity of which is governed by the number of whitish scales and white tips present, can vary from pale rufous to fuscous; vertex consists of projecting scales of ground colour with a white flash showing up in ferruginous specimens along the side. Antennae basally white merging gradually to ground colour; of female, simple, cylindrical with short cilia; of male, strongly serrate fasciculate tapering to cylindrical and ciliated in last few distal segments.

Thorax with patagia fuscous at base sprinkled with white and ferruginous distally with a heavy diffusion of white also, transverse bands of black and white midway; prothoracic crest white with rufous, medially between tegulae the thorax is white to buff sometimes with rufous tinge with dark streak middorsally; tegulae white to buff with a black to fuscous streak near mesal margin in female, lighter and less distinct in male, and a ferruginous streak on lateral margin. Legs basically whitish with darkened areas of ground colour sometimes coloured heavily.

Abdomen fuliginous in male, fuscate in female, often heavily suffused with black with sublateral black dots often merging into streaks.

Forewing narrow, costa almost straight, apex bluntly pointed, termen rounded oblique, bright ferruginous to fuscotestaceous and sometimes dark fuscous streaked with white; fine blackish basal streak from base to one third, margined with dark fuscotestaceous beneath and white above; second black streak running between 2d + 3dA
and dorsum from near base; transverse anterior and transverse posterior lines reduced or nearly obsolete, the former where present, indicated by inconspicuous dentations more obvious in the male than in the female, the latter at least by a series of black dots on some veins, although in some fuscous specimens it is a line or part line with dentations at some veins, being most obvious as a fuscous V between Cu2 and 2d + 3dA which is part of the transverse posterior line, forming an elliptoid shape with a fuscate centre, more obvious in the male; M/Cu stem produced to Cu1 and M3, dentated and white, fuscous V between veins; Cu2 dark, R5 and M1 dentated and white, more conspicuous in the female, also with black marks between veins; M2 ground colour and inconspicuous; a band of ground colour irrorated with white along costa; reniform and claviform mostly obsolete although sometimes represented by ground colour margined with white; cilia fuscorufous to fuscous, tips whitish sometimes, black terminal lunules sometimes occur between veins.

Hindwing fuscous paler towards the base; cilia with bands of buff, fuscous and white.

Undersides of wings buff irrorated with fuscofumate; forewings with discal area fuliginous, hindwings with discoidal spot.

Male genitalia with costa curved acutely; harpe broad tapering to a curved tip distally, some protruberances bearing small hairs; ampulla slender, uniform sides and clubbed distally with some very short hairs; a diffuse corona of strong spines extending down the dorsal margin of valva only briefly and not reaching top of harpe, the marginal corona uniform but not on
margin centrally; clavus with margin slightly wavy, curved acutely; peniculus a dense bunch of stoutish bristles with a further tuft of shorter bristles dispersed through an arc becoming less dense medially.

Female genitalia with ductus bursae rounded posteriorly and no kink along its length or only slightly; corpus bursae membranous with a pair of diamond shaped signa; appendix bursae smaller than corpus bursae, rounded and lightly sclerotized; striations along anterior half of ductus bursae; apophyses with posterior pair (1.27mm) longer than anterior pair (0.87mm).

Wing expanse: Mean 32mm, Range 28-37mm, (11 specimens).

Type locality: Goulant Downs, New Zealand: (A. Philpott), 1♂ holotype, 1♀ allotype.

Location of type: D.S.I.R., Entomology Division, Nelson, New Zealand.

Specimens examined: 9♂♂, 10♀♀.

NORTH ISLAND


SOUTH ISLAND

Lateral and Ventral View

Fig 23: Male genitalia of *Persectania aversa*

Fig 24: Female genitalia of *Persectania aversa*

Fig 25: Male genitalia of *Graphania disjungens*

Fig 26: Female genitalia of *Graphania disjungens*

Fig 27: Male genitalia of *Graphania arctis*

Fig 28: Female genitalia of *Graphania arctis*

Fig 29: Male genitalia of *Tmetolophota propria*

Fig 30: Female genitalia of *Tmetolophota propria*

Fig 31: Male genitalia of *Tmetolophota atristriga*

Fig 32: Female genitalia of *Tmetolophota atristriga*

Fig 33: Male genitalia of *Tmetolophota steropastis*

Fig 34: Female genitalia of *Tmetolophota steropastis*

Fig 35: Male genitalia of *Tmetolophota similis*

Fig 36: Female genitalia of *Tmetolophota similis*
Fig. 24.

- Papillae anales
- Posterior apophyses
- Anterior apophyses
- Ductus bursae
- Corpus bursae
- Ductus seminalis
Appendix bursae
Plate 5: *Persectania aversa* (Wlk.), male.

Plate 6: *P. aversa* (Wlk.), female.

Plate 7: *Graphania disjungens* (Wlk.), male.

Plate 8: *G. disjungens* (Wlk.), female.

Plate 9: *Graphania arotis* (Meyr.), male.

Plate 10: *G. arotis* (Meyr.), female.
Plate 11: *Tmetolophota propria* (Wlk.), male

Plate 12: *T. propria* (Wlk.), female.

Plate 13: *Tmetolophota atristriga* (Wlk.), male

Plate 14: *T. atristriga* (Wlk.), female.

Plate 15: *Tmetolophota steropastis* (Meyr.), male

Plate 16: *T. steropastis* (Meyr.), female.
Plate 17: *Tmetolophota similis* (Philpt.), male.

Plate 18: *T. similis* (Philpt.), female.
Fig 37: Distal half of forewing of *Pereoctania ewingii* (Getwd.), *P. dyscrita* Common, *P. aversa* (Vlk.) and *P. meteolophota similis* (Hilpt.).
Fig 38: Peniculi of male genitalia of the New Zealand species of *Teraectania* Hampson.

(a) *T. aversea*, (b) *C. disjuncta*, (c) *C. arctia*,
(d) *T. propria*, (e) *T. atristiga* (f) *T. similis*,
(g) *T. steroptista*. 
Distribution: This species has not been recorded very often although records do extend to both the North and South Islands. Basically, it seems as though the distribution of this species is governed by similar condition to those which affect *T. atristrica, G. diadymens and T. propria*. Records of this species are restricted to areas with a tussock grassland vegetation, often at altitude. Occurs on Mt. Ruapehu (4000'); Nelson, Westport and Stewart Island, in particular Mt. Rakahua (2700'). This last record is one of the few areas of tussock vegetation on this island.

Remarks: In general appearance this species is like *E. avera, P. dextrita* and *P. ewingii*, but with narrower wings and without the "reniform mark" peculiar to these species (Fig. 37). The general colouring is brighter and the genitalia are quite different in the male and female.

The following genera have been discounted from this study after careful consideration of the characters that were available.

*Genus Naoria* Warren. (Figs. 39 & 40).


The generic description of the external morphology can be
found in Seitz, 1912.

Male genitalia with valva sides curved to form a sweeping lobe of sacculus; costa curved obliquely; anal angle prominent forming a distinct wedge shaped sacculus; anal spine present; a diffuse corona of stout spines and a marginal row of shorter, incurved spines; clavus with wavy margin angled acutely; harpe simple, tapering posteriorly; ampulla shorter and slender; a small lobe at base of harpe and ampulla; juxta basically shield shaped with little side before extending into canaliculus; uncus fine hook; aedeagus with cornuti a uniform band of stout spines extending most way along vesica to apex.

Female genitalia with a ductus bursae with a distinct kink and striations along anterior part; a bulbous corpus bursae and a pronounced appendix bursae which has a ductus seminalis arising at its apex; pair of slash shaped signa; anterior apophyses thicker than posterior pair. This genus has been discounted because the male genitalia exhibited characters which have been used to distinguish the genera Graphania and Tactelophota. A decision on the classification of this genus was therefore suspended pending further information.

Dugdale (in litt.) however, has subsequently seen fit to place Macria in the synonymy of Graphania.

Genus Dipaustica Meyrick. (Figs. 41 & 42).

Dipaustica Meyrick, 1911. Trans. N.Z. Inst. 44:98

The generic description of the external morphology can be found in Meyrick, 1910.

Male genitalia with valva sides curved to form a pronounced sweeping lobe of sacculus; costa curved obliquely; anal angle prominent; cucullus distinctly wedge shaped; anal spine present; a diffuse corona of stoutish spines and a marginal row of incurved stoutish spines; harpe sigmoid, pointing posteriorly; ampulla narrow, angled mesally from base of harpe; juxta shield shaped, aedeagus with cornuti a band of stout spines along vesica.

Female genitalia with bursa copulatrix a well sclerotized ductus bursae, bulbous corpus bursae and a prominent appendix bursae; ductus seminalis arising from apex of appendix bursae. This genus has been discounted on the basis of anatypical bifurcate frons, even though the genitalia of both sexes are very similar to the Tmesolophota species.

Genus Phisetica Meyrick. (Figs. 43 & 44).


Type species: Agrotia caerulea Guèneé, 1868. Entomologist's mon. Mag. 5:38.

The generic description of the external morphology can be found in Guèneé, 1863.

Male genitalia with valva in pronounced lobe curving acutely into anal angle; cucullus distinctly wedge shaped; anal spine present; a diffuse corona of fine spines and a marginal row of stouter incurved spines; harpe long and slender pointing
posteriorly; ampulla short and atrophied; juxta bell shaped; adeagus with cornuti a narrow band of stout spines along vesica to apex.

Female genitalia with bursa copulatrix a short sclerotized ductus bursae and a bulbous corpus bursae with a posterior lobe extending out to one side; ductus seminalis arising from apex of lobe. This genus has been discounted on the basis of the peculiarly shaped male genitalia and also on the atypical apical segment of the labial palpi of the male.

Genus Erama Walker. (Fig. 45 & 46).


Type species: Erama graminosa Walker, 1857.

The generic description of the external morphology can be found in Walker, 1857.

Male genitalia with valva having a pronounced lobe; costa rounded; anal angle prominent; cucullus wedge shaped; anal spine present; a diffuse corona of stout spines extending across the cucullus in a band and a row of incurved spines along most of the margin; sigmoid harpe with apex pointing ventrally, ampulla lance shaped; juxta diamond shaped; adeagus with cornuti a very long band of strongly sclerotized spines.

Female genitalia with bursa copulatrix a partly sclerotized ductus bursae, a membranous bulbous corpus bursae and a coiled tube off it and partly sclerotized, extending alongside and for the length of the corpus bursae; signa absent.
This genus has been discounted on the basis of the peculiar coiled tube of the female genitalia which is typical of this genus.

Genus *Ichneutica* Meyrick. (Fig. 47).


Type species: *Ichneutica ceraunius* Meyrick, 1886.

The generic description of the external morphology can be found in Meyrick, 1886.

Male genitalia with valva sides approximately parallel; anal angle absent; anal spine absent; cucullus barely wedge shaped; a diffuse corona consisting solely of small, fine spines; harpe well sclerotized and stout with some transverse rings, pointed distally; ampulla reduced to a straight, stout structure alongside the harpe; aedeagus with cornuti consisting of 9-10 very small spines in a linear group near apex of vesica; uncus spatulate at tip and covered in short strong bristles; peniculus almost non-existant.

Female genitalia with bursa copulatrix consisting of a well sclerotized ductus bursae with a small, membranous corpus bursae and smaller reduced appendix bursae.

Both male and female genitalia are very small for noctuid species. This genus has been discounted on the basis of both the male and female genitalia which are so unlike any of the other genera discussed in this chapter.
Lateral and Ventral View

Fig 39: Male genitalia of *Haoria plena*

Fig 40: Female genitalia of *Haoria plena*

Fig 41: Male genitalia of *Dipauistica epiastra*

Fig 42: Female genitalia of *Dipauistica epiastra*

Fig 43: Male genitalia of *Physetica caerulea*

Fig 44: Female genitalia of *Physetica caerulea*

Fig 45: Male genitalia of *Erana graminosa*

Fig 46: Female genitalia of *Erana graminosa.*

Fig 47: Male and Female genitalia of *Ichneutica ceraunius*
In revising the Australian species of the genus *P. wingii* Common (1954) concluded that there were two species, *P. wingii* Westwood and *P. dyscrita* Common, not one as had been supposed. During the course of his study Common examined specimens from New Zealand which had previously been regarded as *P. wingii*, and found that the genitalic characters particularly of the female, showed the New Zealand species to be distinct from *P. wingii*. He chose the name *P. aversa* Walker which had previously been placed in the synonymy of *P. wingii*, for the New Zealand species.

Of the remaining seven species mentioned in Hudson (1928), six have been examined in this study. The other one, *P. basifascia* Hampson, has proved impossible to locate either in Museum collections or in the field in New Zealand. The conspecificity of *P. basifascia* Hampson, with *T. propria* Walker, has already been mentioned in the synonymy of the latter species.

The remaining six species, *G. arctica* Meyrick, *T. atristriga* Walker, *G. disjungens* Walker, *T. propria* Walker, *T. similis* Philpott and *T. steropastis* Meyrick have been examined and it is obvious that they are not congeneric with *P. aversa*. Unfortunately no immature
Plate 19: 1st Instar larva of Persectania aversa
Plate 20: 1st Instar larva of *Tmetolophota atristriga*. 
material was available for *T. similis*, however for the other five species and *P. aversa*, this conclusion was based on a comparison of egg, larval and adult material.

*P. aversa* has a distinctively shaped egg quite different in shape and surface sculpturing from that of the other five species (Fig. 22). The latter type of egg is very typical of a large number of noctuid species.

First instar larvae provided some evidence for the above conclusion. Plate 19 illustrates the features of the group containing *P. atristriga*, *Melanchris mutana* (Walker) and the other species of *Persectania* (sensu Hudson, 1928), and their differences from *P. aversa*. The first instar of *P. aversa* is uniformly spiculated over its surface giving the appearance of a faint dark colouration and has very indistinct, fine setae, while the "atristriga type" has very prominent, large black setae mounted on obvious pinacula and a complete lack of colour over the remainder of the body apart from the pronotal shield. A brief examination of the setae visible under low power showed SD2 (micro.) on abdominal segments to be absent in *P. aversa* and present in *T. atristriga* and *M. mutana*.

The morphological characters of later instars offered little assistance to this study. For the most part they showed strong interspecific similarity, the only significant differences being in the chaetotaxy, although even these characters provided little useful information at the generic level. The distribution of the vertical group of cranial setae proved to be the only factor of any value. In *G. arotis*, *T. atristriga*, *G. disjungens*, *T. propri
and *T. steropantis*, V3, Va and V2 are in a straight line and approximately equidistant, with V1 a greater distance from V2 than it is to P2 (Figs. 10 & 11), while in *P. aversa* V3, Va, V2 and V1 are in a staggered line and all approximately equidistant, with V1 closer to V2 than it is to P2.

The following sets of ratios illustrate these observations:

1. V2 - V1 *P. aversa*: 0.455
   V1 - P2 Others: Range 1.0 - 2.0, Mean 1.5.
2. Va - V2 *P. aversa*: 0.75
   V2 - V1 Others: Range 0.165 - 0.5, Mean 0.332.
3. V3 - V1 *P. aversa*: 1.22
   V1 - P2 Others: Range 1.82 - 2.22, Mean 2.02.
4. V1 - P2 *P. aversa*: 2.26
   P2 - Pb Others: Range 0.924 - 1.5, Mean 1.21.
5. V3 - V2 *P. aversa*: 1.755
   V2 - V1 Others: Range 0.525 - 1.25, Mean 0.887.
6. V3 - Va *P. aversa* and *P. ewingii*: 1.0
   V2 - V1 Others: Range 0.362 - 0.75, Mean 0.56.

The last ratio was the only one which was consistent for *P. aversa* and *P. ewingii* and may prove to be a generic character of *Persectania* when checked against *P. dyscrita* Common.

This group apart, none of the other setal groups either on the head capsule or on the body segments were of any help, neither in showing that the five species *G. arctis*, *T. strigata*, *G. disjungens*,
T. propria and T. steropastia do not belong in Persectania, nor in the resolution of the subsequent generic identity of these species.

Finally an examination of the adult genitalia did show quite conclusively that, P. aversa is the only New Zealand species at present recorded that belongs in the genus Persectania. In the male the shape of the valva with its rounded cucullus, the sigmoid harpe, the cornuti a simple bunch of long stout spines on the apex of the vesica and the peculiar juxta with no canaliculus are quite diagnostic. In the female the bursa copulatrix consisting of a large simple membranous corpus bursae with ductus seminalis arising directly from its wall, and the large papillae anales, are also typical of Persectania species represented by P. aversa in New Zealand, and P. dysscrita and P. swingii in Australia.

The other six species were represented by typical genitalic characters entirely different from Persectania (Figs. 25-36 inc.). In the male the cucullus has a diffuse corona of stout spines extending across the cucullus and down the dorsal margin of the valva; and a marginal row of uncurved spines; anal spine present; harpe linear and extending posteriorly with ampulla angled from the base of the harpe and generally narrower; juxta shield shaped with a distinct canaliculus; clavus with two distinct regions and a basically simple, sometimes wavy margin. In the female a much greater degree of similarity occurs with the bursa copulatrix having a strongly sclerotized ductus bursae often with a kink
part way along its length, a bulbous corpus bursae and a prominent moderately sclerotized appendix bursae with the ductus seminalis arising from its apex.

For all these similarities however, it has become obvious that there are two distinct generic groupings which can be differentiated on the basis of male genitalic characters. These two groups are G. arctis and G. disjungens, and T. atristriga, T. propria, T. similis and T. stereopastis. The generic determination of these groups required an examination of the nominal genera in the sub-family Hadeninae. The majority of the available names have been considered, although restrictions were placed on some genera through the lack of specimens of the type species. Those names that are found in the subfamily Hadeninae which have not been discussed in this chapter are either obviously unrelated to the species under revision or else they have been sufficiently doubted on the basis of the limited material available, where the above restrictions applied, to be omitted from further study.

Of the names considered a number were readily discounted on the basis of genitalic and external morphological characters. Examples are: Dipaustica Meyrick type epiastra Meyrick, which has an atypical bifurcate frons, although the genitalia of both sexes are very similar to the generalised description given earlier for the whole group of species in question: Erana Walker type graminosa Walker, with the obvious coiled tube extending off the bulbous corpus bursae in the female genitalia (Fig.44)
which is typical of another group of species (Dugdale in litt.); likewise the male genitalia has a very long cornutal band along the vesica which is not typical of any of the species in question, this feature not being figured because of the difficulty the author experienced in extracting the vesica from the few male specimens that were available: Ichneutica Meyrick type ceramium Meyrick, for the very distinctive genitalia in both sexes, quite unlike any other group of species (Fig. 45). This genus appears by its wing structure to be a development of Leucania Oschenheimer and by its genitalia to be a distinct endemic taxon: Physetica Meyrick type caerulea Guèneé, with the peculiar shaped appendix bursae on the female genitalia, the shape of the valva, the form of the diffuse corona and the sizes of the ampulla and harpe in the male genitalia. Also the apical segment of the labial palpi of the male is distended and has an orifice laterodistally.

These characters then, preclude the use of these generic names for the species considered here.

Of the available generic names that are left, the type species of two of them are in the genus Persectania (sensu Hudson, 1928).

These are Graphania Hampson type disjungens Walker, and Tmetolophota Hampson type propria Walker.

Therefore, the name Graphania has been used for the species disjungens and arotis, and Tmetolophota for propria, atristriga, similis and steropastis. Graphania is distinguished by the shape of the male valva, which has nearly parallel sides, little or
no anal angle and a short blunt anal spine and by the cornuti, a uniform band of stout spines extending along the vesica to the apex. *Tmetolophota* has the valva with a pronounced sacculus lobe, a deep anal angle, strongly wedge shaped cucullus and a prominent, curved anal spine. The cornuti in *Tmetolophota* are a band of stout spines twisting along the vesica and forked apically where the spines are either reduced or absent centrally. Sometimes one of the branches may appear separate from the remainder of the band.

A further generic name was looked at and although it was not considered in the final analysis, it could be readily discounted. *Maoria* Warren type *plena* Walker is closely related to the two genera mentioned above with both male and female genitalia showing strong likenesses to the general outline. However, it is not intended to make any decision on generic synonymies at this stage without more information.

As mentioned in the introduction it is hoped that the conclusions reached here represent an acceptable interpretation of the phylogeny of these species, although this decision suffers from studying the group in isolation.

The value of genitalic characters in noctuid taxonomy cannot be emphasised too strongly. While the disparities between groups based on these characters are not always large, they are usually obvious enough to be readily discernible, and consistent enough within species to be relied upon.

Hudson (1898, 1928) and his contemporaries, relied solely
on external characters and it was this factor which led to the misplacement of numerous endemic species of New Zealand's noctuid fauna. Most of the descriptions of species of the Hadeninae relied on the variation in the form of the frons and the presence or absence of crests on the thorax and abdomen, there being little noticeable variation in most other characters. The subsequent taxa tended to be vague and large caused by the lumping together of many similar species under convenient names that existed at that time. Hampson's (1905) world wide revision of the Noctuidae contained a broad recognition of the existence of endemic groups in New Zealand, *Graphania* and *Teetolophota* being two of these. It is these names I have had to fall back on in this study, which had been submerged in the synonymy of *Persectania* for the past 42 years.
The aims of this study have been to investigate the New Zealand species of the genus *Persectania* Hampson (sensu Hudson, 1928) (Lepidoptera: Noctuidae), to establish how many of the eight included species are congenereic with the Australian *P. ewingii* the type of the genus, and to establish the generic identity of the remaining species.

Egg, larval and adult material has been examined with a heavy reliance on adult genitalic characters.

*P. aversa* is shown to be the only New Zealand species belonging to *Persectania*, joining the Australian species *P. dyscrita* and *P. ewingii*.

Of the remaining species, two distinct generic groups have become obvious on the basis of male genitalic characters. The groupings are *arotis* and *disjungens* which have been placed into the genus *Graphania* Hampson, type *disjungens*, and *atristriga*, *propria*, *similis* and *steropastis* which have been placed into the genus *Tmeclophota* Hampson, type *propria*.

The diagnostic characters distinguishing these two genera are the form of both the male valva and the cornutal band on the vesica. The differences have been explained in
full in the text and are illustrated in figures.

During the course of the second part of this study, a number of other related nominal genera in the same subfamily were examined and precluded from the final analysis on the basis of external and genitalic characters. The generic names considered were Dipaustica, type spiastra; Erana, type graminosa; Ichneutica, type cremonius; Physetica, type caerulea and Maoria, type plena.

The last mentioned genus is a special case. It was found to be fairly closely related to both Graphania and Tmetolophota, although the specific nature of this relationship has not been resolved in this text.
A GLOSSARY OF COLOUR TERMS

All definitions are taken from Torre-Bueno (1962).

Ferruginofulvid: yellowy red brown.

Ferruginous: rusty red-brown.

Fuliginous: Smokey brown.

Fulvid, fulvous: tawny, brownish yellow.

Fumate: Smokey gray.

Fuscescent: becoming brown.

Fuscoferruginous: brownish rust red.

Fuscofulvid: darker brownish yellow.

Fuscofumate: blackish smokey gray.

Fuscorufous: red brown.

Fuscotestaceous: dull reddish brown.

Fuscos: dark brown, approaching black.

Ochreoferruginous: pale rust brown.

Ochreofumate: pale yellowy gray.

Ochreofuscous: pale fuscos.

Ochreseous: yellow with a slight brown tinge.

Olivaceous: olive green.

Rufofulvid: pale reddy yellow.

Rufous: pale red.

Testaceous: brownish yellow.
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