



Frontispiece - View to North from Mt. Wharite where much of the collecting was carried out. Note the whiteness of the opening buds, a factor which makes associations of Olearia colensoi distinctive at considerable distances.

A STUDY OF THE ARTHROPODA ASSOCIATED
WITH OLEARIA COLENSOI HOOK. f.

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INTRODUCTION

The present study is an investigation of the Arthropoda associated with Olearia colensoi Hooker f. This is a subalpine scrub plant that occupies a narrow altitudinal belt between the treeline and the alpine grasslands on many of the wetter parts of the New Zealand mountains.

Reports in the literature indicate that this plant, important in erosion control, was and is suffering an unduly high level of damage. It has been considered by a number of authors that insects are at least partly responsible for this damage.

Consequently a survey was designed in order to discover the arthropods associated with Olearia colensoi at various localities throughout its range and elucidate their role. A secondary aim was to sample the general fauna of the subalpine areas visited and especially that of Olearia colensoi stands.

CHAPTER ONE

REVIEW OF LITERATURE

The literature concerning Olearia colensoi is not extensive. Several botanical papers have been published that contain information on this plant and the associations that it forms. Occasional comments on the animals associated with Olearia colensoi also appear in a few of these articles.

The information so far published is considered under the general headings of taxonomy, ecology, pathology and climatology.

TAXONOMY OF OLEARIA COLENZOI HOOK. f.THE GENUS OLEARIA MOENCH, 1802.

The genus Olearia consists of about 130 species distributed between Australia, New Zealand, Lord Howe Id. and New Guinea (Allan, 1961). This author states that 32 species, all endemic, occur in New Zealand, excluding the hybrids.

OLEARIA COLENZOI HOOK. f.

Olearia colensoi Hook. f. was described by Hooker in 1853 from Mt. Hikurangi. A description of the typical form and the varieties follows from Allan (1961).

Olearia colensoi Hook. f.

Shrub up to 3 m. tall; branchlets stout, clad in white to buff tomentum. Lvs 8-20 x 3-6 cm. including short petiole up to 5 mm. long, obovate to obovate-oblong, acute to subacute, coriaceous, irregularly serrate, glab. above when mature and \pm rugose, clad in dense white to

buff or fulvous appressed tomentum below. Racemes up to 20 cm. long, with lanceolate tomentose bracts subtending pedicels. Capitula 2-3 cm. diam., phyll. in 1-2 series linear, glab. or nearly so, up to 1 cm. long; florets all tubular, in one row; achenes compressed, pilose, 4 mm. long, grooved; pappus hairs up to 6 mm. long, dull white.

Type locality: Mt. Hikurangi.

Var. argentea Allan var. nov.

Tomentum appressed, silvery; racemes short.

COMMON AND MAORI NAMES

This plant is known under a variety of common and Maori names. The ones heard most frequently during the course of this study are "leatherwood" and, less commonly, "leatherleaf". These are the names by which the plant is known to the N.Z. Forest Service personnel, trampers, hunters and others who spend time where it grows. The fact that associations of this plant are highly impenetrable makes it distinctive to the above named groups and thus any common name tends to be both uniform and widely applied.

Allan (1961) gives, in a list of the Maori names of New Zealand plants, the following names as referring to Olearia colensoi:

kumarahou

kumararaunui

tupare

Andersen (1926 and 1927) gives the following list of common and Maori names for Olearia colensoi and makes recommendations as to those he considers should be used:

kumarahou

tupare

Colenso's daisy tree

common mountain tree daisy

Mountain tree daisy

large leaved tree daisy

musk tree

muttonbird scrub

muttonbird wood

mutton wood

Andersen recommends "tupare" and "mutton wood".

At present, however, none of the names mentioned in Allan's or Andersen's lists belong to common usage and will probably never do so. It seems that the common name "leatherwood" will be the enduring one.

THE STATUS OF OLEARIA COLENZOI VAR. GRANDIS

This variety of Olearia colensoi occurs from sea level to 920 m. on Stewart Island. The leaves on the coastal form are large, and Cockayne (1909) writes that he fails to see any difference between Olearia lyalli Hook., and the Stewart Island coastal form. The Stewart Island form is very variable but Cockayne states that there is only one species on the island whether it be Olearia colensoi var. grandis Simpson or Olearia lyalli Hook. f. In this work it will be referred to by the former name.

HYBRIDISATION

A plant described by Kirk (1884) as Olearia trailli is stated by Allan (1961) to be a hybrid between Olearia colensoi var. grandis and Olearia angustifolia Hook. f.

This is the only stable hybrid known to involve Olearia colensoi, but is not particularly common (Allan, 1961).

DISTRIBUTION OF OLEARIA COLENZOI HOOK. f.

Allan (1961) gives the range of Olearia colensoi as being the North Island, South Island, Stewart Island and Solander Island. In his words it occurs as "montane to subalpine scrub from latitude 38°

southwards, descending to sea level in the southernmost part of range".

Within this broad range, given for the whole species, the different varieties have fairly limited distributions. The variety grandis Simpson is limited to Stewart Island and a small area near the base of Bluff Hill. The variety argentea Allan occurs on the mountains of Fiordland above the tree line. The type locality of this latter variety is Dusky Sound. (Allan, 1961).

The typical form of the species occupies the rest of the range given by Allan (1961).

The altitudinal limits, and the factors setting them, are discussed more fully in the section on the ecology of the plant but are briefly as follows. The typical form of Olearia colensoi has a range of from 600 m. to 1200 m. (Wardle, 1960) but it has been recorded from as low as 488 m. (Zotov, et al., 1938) to as high as 1525 m. (Elder, 1965). Olearia colensoi var. grandis occurs from sea level to about 920 m. on Stewart Island.

There appears to be no information regarding the altitudinal range of Olearia colensoi var. argentea.

ECOLOGY OF OLEARIA COLENZOI HOOK. f.

THE GROWTH FORM OF OLEARIA COLENZOI HOOK. f.

Olearia colensoi is a very variable plant and its growth form is largely dependent on the environment in which it grows. A typical growth form on a sheltered, fairly level site is that of a shrub up to about 3m. tall. As the slopes become steeper and less sheltered the canopy height is progressively reduced to where it may be only a few centimetres tall on the most exposed boggy sites (Wardle, 1963).

On the steeper slopes the trunks of Olearia colensoi var. grandis are often prostrate and the horizontal spread may be greater than the vertical height of the canopy (Cockayne, 1909). This statement is

equally applicable to the other varieties.

The growth form of Olearia colensoi var. grandis resembles that of the typical form where it occurs above 600 m. (Cockayne, 1909). Below this level, however, it often differs considerably. Simpson (1945) calls it a small tree growing up to 4 m. high but the present author has seen larger specimens in the coastal areas of Paterson's Inlet. Its strong resemblance to Olearia lyalli has been mentioned in an earlier section and this extends to the growth form.

THE GROWTH CYCLE OF OLEARIA COLENZOI HOOK. f.

The New Zealand subalpine area has a distinctly seasonal climate leading to a well marked periodicity in the growth of the plants of this region. Olearia colensoi is no exception to this as Wardle (1963) has shown. In addition Olearia colensoi belongs to the group of sub-alpine shrubs that start their growth late and concentrate it into a short flush (Wardle, 1963).

No absolute data is available on the length of the growing season beyond an observation by Wardle (1963) that the buds of Olearia colensoi opened during December in 1958.

Allan (1961) states that the flowering period is from November to January and that the fruiting period is from December to February.

Growth rates are given by Wardle (1963) as follows:

annual shoot growth	4.0 to 10.0 cm.
growth rings per cm. radius	10 to 20

This data places Olearia colensoi among the faster growing subalpine plants.

Leaf Development.

When the vegetative buds burst the young leaves are initially soft and tomentose on both the upper and lower surfaces. They may still partially retain the folded shape they assumed in the bud. Finally, however, they mature and become hard, toothed round the edges and the

tomentum is lost from the upper surface leaving it quite smooth. The teeth around the edge of the leaves make associations of this plant quite painful to walk through. The final stages of leaf hardening probably represent the end of the growing season. Sometimes however, if the apical bud has been damaged, dormant laterals will produce buds which wholly or partly develop in the same season. These often produce small, aberrant leaves, a state possibly due to the action of frost. Where these buds do not open in the same season they may, if in a well sheltered position, open somewhat earlier than the main buds in the next season. Leaves persist for two years on Olearia colensoi (Wardle, 1963).

Longevity.

Olearia colensoi is a relatively short lived plant and persists only from sixty to one hundred years (Wardle, 1963). In the undisturbed situation, however, gaps due to death of individual plants, are rapidly filled by reproduction.

REPRODUCTION

In Olearia colensoi reproduction is both sexual and asexual.

Asexual Reproduction.

Wardle (1963) states that the layering habit is best developed, within a species, in areas of high altitude and rainfall, and Olearia colensoi is no exception to this. Young plants are bent by the weight of the winter snow and the trunks often run parallel to the ground for some distance downhill before growing vertically again. These trunks frequently produce adventitious roots as do other prostrate branches. Thus, in the most exposed situations vegetative reproduction is often more important than the sexual form.

The advantages of vegetative reproduction are, in this case, due to the risk of high seedling mortality in an area of poor soils, a harsh climate and a dense evergreen canopy (Wardle, 1963).

Sexual Reproduction.

The flowering and fruiting times have been given above.

Reproduction from seed is predominant on the gentler slopes and at lower altitudes in less exposed situations. Whenever a gap in the canopy occurs, in the undisturbed situation, there are normally a large number of seedlings present to make use of the increased light available. This leads to rapid formation of a new canopy and prevents loss of topsoil from exposed areas.

FACTORS CONTROLLING THE ALTITUDINAL RANGE OF OLEARIA COLENZOI

HOOK. f.

The normal range of Olearia colensoi is, as stated above, from approximately 600 m. to about 1200 m. This range is apparently not set by any inherent physiological properties of the plant but rather by competition from other plants that occur normally below and above the Olearia colensoi belt. The factors controlling this competition are not constant and thus Olearia colensoi occasionally occurs much above or below its normal range.

Factors Setting the Upper Limit.

With increasing height, greater exposure causes the canopy of Olearia colensoi to become depressed and increasingly discontinuous. Snow-tussocks, (Chionochloa spp.) which are better adapted to these higher altitudes, begin to occupy the gaps in the canopy of Olearia colensoi. So as one moves up through this region a gradual change occurs from the dense cover of the Olearia colensoi canopy through the lowering canopy to where it becomes discontinuous and a few snow-tussocks start to appear. After this point the snow-tussock begins to assume dominance except for isolated islands of scrub induced by some peculiarity of the local conditions. An example of the latter case is the occurrence of dwarfed Olearia colensoi shrubs at 1448 m. in the Tararua Ranges. Its occasional presence there is attributed to the

occurrence of stoney shallow soil that is less suitable for the snow-tussock which usually grows at this altitude (Wardle, 1962). In some cases Olearia colensoi may give way to a belt of Dracophyllum uniflorum Hook. f. as it does in the Hokitika catchment, before this in turn gives way to alpine grassland (Wardle, 1962).

Winter climate may directly set an upper altitudinal limit on Olearia colensoi and Wardle (1962) cites the presence of dried up terminal buds and shoots with malformed leaves occurring above 1200 m. in the Tararua Mountains. This was apparently due to an unusually light snowfall the preceeding winter which left the buds without a protective coating of snow at this time.

Factors Setting the Lower Limit.

The lower level of Olearia colensoi is normally set by the upper level of the tree line which is in turn limited in its upward growth by light levels. Zotov, et al. (1938) states that in the Tararua Ranges Nothofagus menziesii (Hook. f.) does not occur above the lower altitudinal level of the heavy fogs and Wardle (1962) states that a similar relationship appears to hold for other areas of New Zealand where frequent fogs occur. Thus it would seem that the lower limit of Olearia colensoi is normally set by the upper limit of Nothofagus spp., mostly Nothofagus menziesii, and Libocedrus bidwillii Hook. f. Olearia colensoi will grow well much lower than its normal 600 m. where lack of competition permits this. An example of this is its presence at 488 m. on Baber's Saddle in the Tararua Ranges (Zotov, et al., 1938). Olearia colensoi var. grandis occurs to sea level on Stewart Island and Cockayne (1958) ascribes its presence at this unusually low altitude to the modified subantarctic climate of this area.

Conclusion.

It would appear, that Olearia colensoi is limited in its local range, not by any innate physiological factors, but rather by competition. This is borne out by its occurrence at abnormally high

and low altitudes due to some ameliorating factor of the environment.

MAJOR TYPES OF ASSOCIATION INVOLVING OLEARIA COLENZOI HOOK. f.

Olearia colensoi occurs in a wide variety of situations and associations within its range. Its presence is usually climatically controlled but in some areas edaphic factors may be predominant.

Normally Olearia colensoi grows as part of a subalpine association but some lowland associations do occur.

Lowland Associations Involving Olearia colensoi Hook. f.

Two types of lowland association occur. The first is where it occurs as coastal scrub, the second is an edaphically induced association. They are both described below.

Coastal Scrub: On Stewart Island Olearia colensoi var. grandis descends to sea level as a member of Cockayne's (1958) "macrocephalous Olearia colensoi association". He attributes this presence at such a low level to the modified sub-antarctic climate of the area.

Other Lowland Associations: Cockayne (1958) states that Olearia colensoi was present as a member of a sere on the riverbed of the Franz Joseph, a short distance from the terminal wall of the glacier. This was in 1910 or 1911 and the situation has no doubt altered substantially in the intervening period. The presence of Olearia colensoi at this location is possibly induced both by climatic and edaphic factors.

Subalpine Associations Involving Olearia colensoi Hook. f.

The subalpine habitat is the more normal one for Olearia colensoi and large areas of it occur in the mountainous regions of the three main islands.

In the above areas Olearia colensoi typically occupies a belt above the tree line. In most of the associations of which it is a member it is usually one of the dominant species present. In the upper and

lower parts of its altitudinal range it often recedes into sub-dominance.

Stewart Island: The Mount Anglem Association. On Mount Anglem the Olearia colensoi var. grandis scrub attains its typical subalpine character at over 600 m. Here Olearia colensoi var. grandis is again dominant but with Dracophyllum longifolium (J.R. et G. Forst.) and Dacrydium bidwillii Hook. f. also assuming some importance. Cockayne (1909) gives a fuller list of the composition of the Mount Anglem association and cites its presence on Mount Rakeahua, Table Hill Range, the Thomson Range and some other localities.

South Island:

Lake Monk Area - Southern Fiordland: In most areas of Fiordland, a zone of subalpine scrub is interspersed between the upper level of the forest and the alpine grassland only where the tree line has become depressed. Such situations occur most often in the valley heads and it is here that the composite-rich subalpine scrub dominated by Olearia colensoi var. argentea is best developed.

The major species of the association are Olearia colensoi Hook. f., Dracophyllum uniflorum, Dracophyllum longifolium, Dracophyllum menziesii Hook. f., Phormium colensoi Hook. Of lesser importance are Coprosma pseudocuneata W.R.B. Oliver and Coprosma ciliata Hook. f. The most important species overall is, however, Olearia colensoi var. argentea (Riney, et al., 1959).

Hokitika Catchment: In the Hokitika catchment Olearia colensoi attains its fullest development on moderately sheltered slopes with a northerly aspect and where soil moisture is relatively high. Other sub-dominant species important in this association are Dracophyllum longifolium, Dracophyllum traversii Hook. f. and Olearia lacunosa Hook. f. (Wardle, 1960).

North Island:

Tararua Ranges: In the Tararua Ranges Olearia colensoi is by

far the most important subalpine scrub species present. In fact, Holloway et al. (1963) states that " --- the condition of the subalpine scrubland is virtually equivalent to the condition of Olearia colensoi ---".

In comparison with the situation described by Wardle (1960) for the Hokitika catchment, Olearia colensoi in the Tararua Ranges is important in three associations instead of only one (Wardle, 1962). They are as follows:

1. Olearia/Blechnum Scrub.

This is the most extensive type of subalpine scrub in the Tararua Ranges. It occurs from 920 m. to 1220 m. on well drained, stable and often stony soils that vary in slope from steep to nearly flat. The shrubs, mainly Olearia colensoi, form a dense canopy at from about 0.9 m. to 2.4 m. Some of the other shrubs present are, in order of decreasing importance, Neopanax simplex (Forst. f.), Coprosma foetidissima J.R. et G. Forst., Coprosma pseudocuneata W.R.B. Oliver and Dracophyllum filifolium Hook. f. There is a sparsely developed herbaceous understory of Blechnum minus (R. Br.) Allan.

2. Olearia Polystichum Scrub.

Tall Olearia colensoi, growing up to 2.4 m. high, is the dominant shrub species here. Other important shrub species are Senecio elaeagnifolius Hook. f., Coprosma pseudocuneata, Coprosma foetidissima, Aristotelia fruticosa Hook. f., Neopanax simplex and Myrsine divaricata A. Cunn. This association is found typically, from 1066 m. to 1250 m. on fairly sheltered sites where the soils are moist, well drained and somewhat unstable.

3. Olearia/Danthonia (Chionochloa) Scrub.

As the canopy of the Olearia/Blechnum association becomes lower and more discontinuous, the gaps are mainly occupied by tall snow-tussocks (Chionochloa spp.). A stunted form of Olearia colensoi

occurs as high as 1448 m. where the situation is sheltered and competition from Chionochloa spp. is reduced by the rockiness of the ground.

4. Less Important Associations.

Olearia colensoi occurs in a number of other associations in the Tararua Ranges. For example, as an understory to Nothofagus menziesii where the canopy of the latter is sufficiently open to permit it to grow. Yet another situation is where Olearia colensoi is codominant with stunted Nothofagus menziesii on high exposed places. This association has been noted near Pillan's Pass though it was Olearia colensoi var. argentea which was involved here.

Ruahine Ranges: Elder (1965) divides the Ruahine Ranges into four natural areas: the Central, Northern, Western and Southern Ruahines.

Olearia colensoi occurs up to approximately 1525 m. but at this height it is a sprawling shrub and only grows on South facing slopes. However, typical dense Olearia colensoi scrub occurs in limited areas such as in basins and on the broader spurs below approximately 1450 m. (Elder, 1965).

In the Western Ruahines the situation differs from North to South. In the North there are few peaks high enough to permit the growth of Olearia colensoi but isolated stands are present where conditions suit. In the Southern part of this area Olearia colensoi attains its more normal type of development and forms a belt above the timber line.

Elder (1965) states that perhaps as much as 20% of the Southern Ruahine Range is occupied by "leatherwood" scrub. This consists of Olearia colensoi and Senecio elaeagnifolius, with the former occupying the higher ground. Other species are present but are not important as they occur only as isolated plants. Possibly because of climatic conditions Olearia colensoi grows to below 900 m. in this area and forms an altitudinally deep belt in many places.

Raukumara Range: Olearia colensoi is present on Mount Hikurangi (1755 m.) but is not an important component of the shrub-composite scrub. It occurs on the steep slopes of the mountain, especially on the northern side. The dominant species here are Senecio bidwilli Hook. f. and Podocarpus nivalis Hook. (Cockayne, 1958).

PATHOLOGY OF OLEARIA COLENZOI HOOK. f.

The factors causing death of Olearia colensoi may be conveniently divided into biotic and abiotic.

BIOTIC FACTORS

To date a variety of organisms have been implicated in the causation of damage to Olearia colensoi. These will be discussed under the headings of browsing mammals, arthropods and fungi.

Browsing Mammals as Pathogens of Olearia colensoi Hook. f.

The introduction of a variety of browsing mammals into an environment which is not adapted to their presence, has had, and is still having, a profoundly deleterious effect on the alpine biota of New Zealand. One of the most obvious effects of these animals is the accelerated erosion that is occurring in our mountain lands.

The effect of browsing mammals on Olearia colensoi stands is no exception to the above statements, especially as the land it stabilises is usually steep. Thus, in terms of accelerated erosion, the consequences of its destruction can be more serious than that of many other plants. Wardle (1961) in support of this states that when the plant cover is removed, slips form, and, in the presence of browsing mammals, these are colonised by an open type of vegetation that is incapable of preventing erosion. In the absence of browsing mammals, slips were quickly stabilised by a number of plant species that have

proved to be palatable to these animals, such as Hoheria glabrata Sprague et Summerhayes.

Holloway, et al. (1963) have compiled an "elimination series" of the subalpine and alpine plants of the Tararua Ranges. In this the plants are grouped from species which are "subject to early eradication", such as Neopanax colensoi (Hook. f.), to those which are "Highly resistant to eradication" for example Pseudowintera colorata (Raoul). In this series Olearia colensoi comes under the grouping of those plants which are "moderately susceptible to elimination".

Browsing Mammals Present in Olearia colensoi Associations:

The following browsing mammals have been recorded as being regularly present in Olearia colensoi associations.

Red deer	<u>Cervus elaphus</u>
Chamois	<u>Rupicapra rupicapra</u>
Goats	<u>Capra aegagrus</u>
Pigs	<u>Sus scrofa</u>
Opossums	<u>Trichosurus vulpecula</u>
Hares	<u>Lepus europaeus</u>

(Holloway et al., 1963. Wardle, 1960 and 1961. Zotov et al., 1938. Riney, et al., 1959).

Japanese deer, Cervus nippon have been taken in the northern Ruahine Ranges and it appears that they are displacing Red deer from much of their range. (Kiddie, 1962.). Thus it is likely that Japanese deer may become more important in the pathology of Olearia colensoi in the future, at least in the Ruahine Ranges.

Damage to Olearia colensoi by Browsing Mammals: The damage that can be ascribed to the presence of browsing mammals in Olearia colensoi associations can conveniently be divided into direct and indirect damage.

Direct damage includes the direct feeding action of animals on Olearia colensoi taken at the level of the individual plant. A number of

mammals browse the foliage, that is the vegetative and flowering buds, the leaves, and the flowers themselves. The most important of these are deer, chamois and goats. (Holloway, et al. 1963 and Wardle, 1960). Opossums may heavily damage Olearia colensoi by browsing where it grows as an understory to Nothofagus menziesii (Hook. f.) (Holloway, et al. 1963). Associated with browsing is a form of damage where the buds are pulled off and not eaten but left scattered around a small area. (Holloway, et al., 1963).

Browsing on the buds of Olearia colensoi is stated by Holloway, et al. (1963) to occur mainly in the winter and this leads to death of the branch in question.

Holloway, et al. (1963) state that occasional feeding on the bark occurs. The present author considers that this probably occurs mainly in winter, and again will result in death of the branch if it is at all severe.

Indirect damage includes all browsing mammal damage not attributed to their eating action.

Where animals push their way through stands of Olearia colensoi, the thin bark is often damaged by trampling and this very often leads to death of the related sector of the canopy. (Holloway, et al. 1963). When one bears in mind the near horizontal nature of the trunks in many places it will be seen that this is of some significance.

When a portion of the canopy is killed, the bark becomes directly exposed to the sun. This may result in sun scald and the death of a further section of the canopy. (Holloway, et al. 1963).

Arthropods as Pathogens of Olearia colensoi Hook. f.

The literature concerning arthropods that cause damage to Olearia colensoi is not large. Much of it is in the form of incidental detail in botanical papers and host plant designations in taxonomic works. In only two cases are details of the life histories given.

The arthropods mentioned in the literature belong to two orders, the Lepidoptera and the Coleoptera.

Lepidoptera:

External leaf and bud feeders: In 1938, Zotov, et al. reported, in a study on the vegetation and flora of the Tararua Ranges, the occurrence of a "--- larva of a moth which feeds on the young leaves and buds of Olearia colensoi." These authors stated that epidemics leave the dead scrub with the appearance of having been burned over.

In 1961, Wardle stated that this, or a similar insect from the Tararua Ranges was identified by Dr. George Gibbs as Agriophara coricopa (Meyr., 1897).

Still more recently, Holloway, et al. (1963) reported the presence of the larva of a moth on the foliage of Olearia colensoi. They tentatively assigned it to the family Noctuidae. This insect was recorded as living in the winter buds where it was feeding on the inner parts and the upper surfaces of the outer folded leaves. A photograph is presented in the same paper of a larva feeding on the upper surface of an Olearia colensoi leaf. The larva in this photograph appears similar to a diagram of Agriophara coricopa (Meyrick) given by Hudson (1928).

In describing its effects, Holloway, et al. (1963) reported that where infestation was heavy, serious damage was occurring but that this was mainly confined to the taller denser stands. They claim that larval attack on the foliage is serious due to the very limited ability of Olearia colensoi to regenerate shoot apices from dormant laterals.

The most recent contribution to the literature of the pathology of Olearia colensoi is given by Kibblewhite (1964). His study was conducted in the Tararua Ranges and consisted of observations on the condition of Olearia colensoi stands throughout the area. A summary of presumed mortality factors is given and, among the Insecta present the author states that lepidopteran larvae feeding on the foliage are

causing heavy and widespread damage in some areas. He considers that two species of larvae are involved but that their effect is discontinuous as their numbers vary greatly between catchments.

Leaf miners: Two leaf miners have been reported as occurring on Olearia colensoi, they are Nepticula fulva Watt, 1921. (Watt, 1921) and Apatetris melanombra (Meyrick, 1888) (Watt, 1924). Watt (1921 and 1924) discusses their biology in some detail, though not their effect on this plant as it is in neither case the major host.

They appear to be of little significance in the pathology of Olearia colensoi as no other authors have recorded the occurrence of leaf miners.

Coleoptera: Only two known, and one unknown species of Coleoptera have been described from Olearia colensoi, both were described by Broun (1913).

The first of these is the curculionid Peristoreus oleariae (Broun, 1913) which was described on the basis of a single specimen collected from Mt. Quoin in the Tararua Ranges (Broun, 1913). This specimen was stated to be feeding on Olearia colensoi, however the author did not state what part of the plant was being attacked.

The other beetle described from Olearia colensoi is the chrysomelid Adoxia simmondsi (Broun, 1913). This species was again described on the basis of a single specimen collected from Mt. Quoin (Broun, 1913).

The unknown species is a large larva which bores the woody stems. This stem boring action is recorded by Holloway, et al. (1963) and Kibblewhite (1964). The former authors consider that attacked stems are prone to breakage. The latter author, however, considers that the overall effect is probably negligible, a statement with which the present author concurs. This species is presumed to belong to the Order Coleoptera and probably the family Cerambycidae.

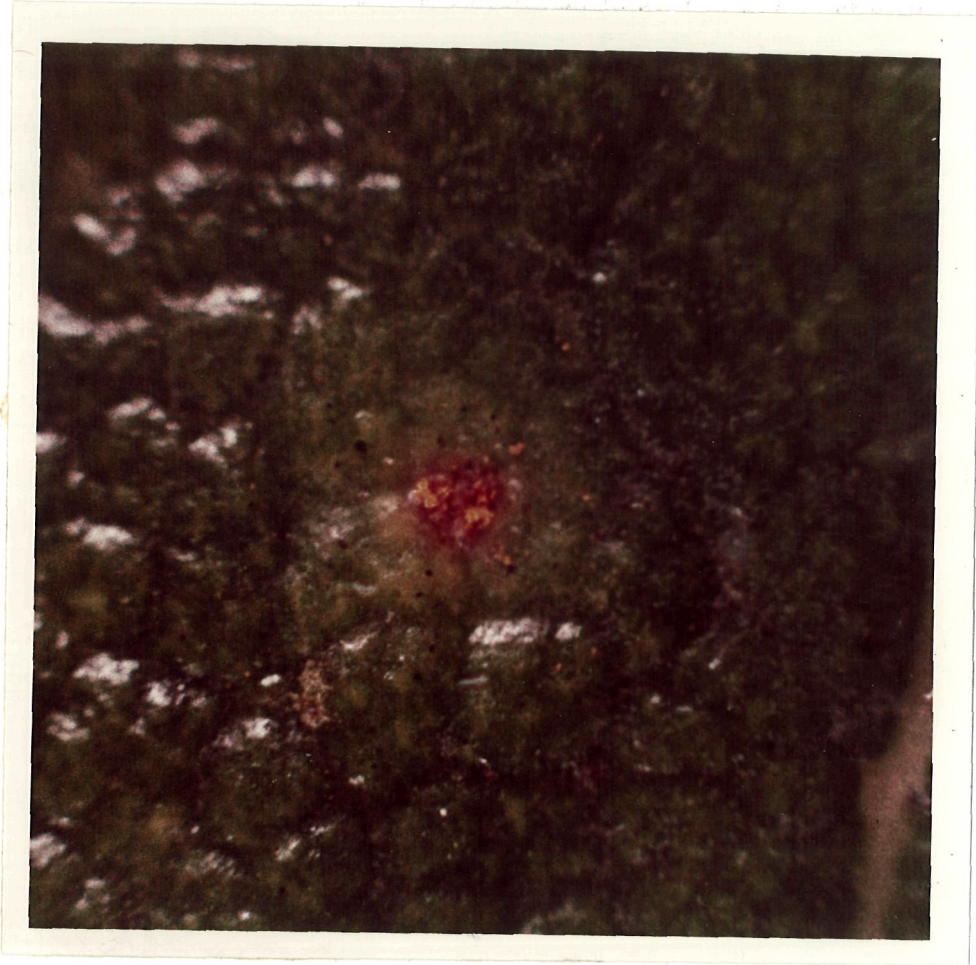


Plate 2 - Uredo tupare Cunningham, infection on upper leaf surface of Olearia colensoi. Note the large orange uredospores and discolouration of surrounding tissue. Photographed 11. viii. 1967.



Plate 3 - Uredo tupare Cunningham, uredospores on lower leaf surface of Olearia colensoi. Photographed 11. viii. 1967.

Other Arthropods: The only other arthropods reported are "aphid - like insects," and a few others which are characterized only as insects (Kibblewhite, 1964). This author states that a number of specimens were forwarded to the Entomology Laboratory at the Forest Research Institute in Rotorua for determination. No names are given to any specimens in the report and there appears to be no record of these specimens at the above laboratory, (R.H. Milligan, pers. comm.).

Conclusions: It would appear from the limited amount of literature on the subject that the main Arthropoda pathogenic on Olearia colensoi are lepidopteran larvae and that possibly more than one species is involved. The role of the other insects would appear to be quite minor. It further seems that insect damage to Olearia colensoi varies from area to area, one form of damage being predominant in one area and not in another.

The literature available does in fact lead one to believe that arthropods are not particularly important, except perhaps locally, in the pathology of Olearia colensoi stands.

Fungi as Pathogens of Olearia colensoi Hook. f.

Only two fungi have been reported from Olearia colensoi.

Cunningham (1924) described the basidiomycete Uredo tupare Cunningham, 1924 from the foliage of Olearia colensoi collected at several localities in the Tararua Ranges. He later (Cunningham, 1931) extended the verified range of this fungus to Alec's Knob in the Franz Josef area of Westland. No information about the pathological consequences to the host plant, if any, of the presence of this fungus was given.

More recently, Holloway et al. (1963) tentatively identified a fungus that caused spotting and death of leaves as Asterina sp. They stated, however, that badly diseased shrubs had apparently been previously weakened by larval attack. Thus this pathogen, being

secondary, is probably of minor importance.

Photographs of the uredospores of Uredo tupare are presented on Plates 2 and 3.

ABIOTIC FACTORS

Frost Damage.

In the higher areas, such as in the Olearia colensoi/Chionochloa associations, Olearia colensoi can be heavily frost damaged in years of low snowfall. Holloway, et al. (1963) state that the winter of 1958 was such a year, the damage appearing the next summer in the form of dried out buds, and shoots with malformed leaves.

Sun Scald.

Sun scalding of bark is an abiotic factor, but as it is normally a secondary consequence of canopy death due to some other factor it was treated with the biotic factors.

CONCLUSION

Various factors, biotic and abiotic, are involved in the destruction of Olearia colensoi. Undoubtedly the most important are browsing mammals with their disrupting effects on the mountain ecosystem. Secondary in importance are the several insect pathogens described, the most significant of these being the lepidopteran larvae that attack the foliage and buds. Fungi and the abiotic factors are probably minor in effect, or secondary.

CONDITION OF OLEARIA COLENZOI HOOK. f. ASSOCIATIONS IN SOME AREAS

Fiordland.

Lake Monk: As stated in the section on the major types of associations, the main subalpine scrub species in this area is

Olearia colensoi var. argentea and Riney et al. (1959) state that deer have caused widespread destruction of this plant.

This destruction of Olearia colensoi var. argentea is patchy. In some areas only bleached sticks remain while in others it is apparently abundant but little browsed (Riney, et al. 1959). No reason is offered to explain this apparent anomaly. It may, though, be a function of the slope of the land as it is in other regions.

It is considered that because of the limited importance of Olearia colensoi var. argentea in erosion control in Fiordland and because Dracophyllum uniflorum and Dracophyllum longifolium are little browsed here the consequences of the damage to Olearia colensoi var. argentea are not so serious as they are elsewhere.

Secretary Island: Deer have not yet reached Secretary Island, in Doubtful Sound, and although there is much dead or dying Olearia colensoi var. argentea the absence of deer permits plentiful regeneration (Wardle, 1961).

Westland.

Hokitika Catchment: In this area both red deer and chamois are present, and feed in the subalpine scrub zone that is largely dominated by Olearia colensoi.

Wardle (1960) states that the impenetrability and low palatability of the subalpine scrub species discourage deer and chamois from excessive utilization of this zone. Their effects are confined, largely, to the formation of tracks on the crests of ridges and spurs leading from the forest to the grassland above. With the death of the shrubs along these tracks, they may become erosion channels.

It is only along the scrub/grassland margin and on isolated bushes that browsing is severe, this occurs mainly in the winter.

Opossums are present in the area however Wardle (1960) considers that they are not generally important but cites one area where

they had been forced into the subalpine scrub by high population levels.

Hares are present in the area but their effects, if any, are not noted beyond the suggestion that they may feed on Olearia colensoi in the winter. (Wardle, 1960).

Overall, the condition of Olearia colensoi in this area is good. Palatable species occur only a short distance from the tracks and damage tends to be mainly confined to tracking on the spurs, ridges and other animal travel routes.

Tararua Ranges.

As stated above there are three types of association here in which Olearia colensoi is important. The effects of browsing mammals on each of these will be discussed in turn.

Tall Olearia colensoi scrubland.

The degree of damage to scrubland of this type is dependent largely on the slope of the land on which it grows. Where the slope of the land is greater than 30° - 35° little damage has occurred. The use of the association by deer, and goats, is light and only the most palatable species have suffered damage.

Generally, the condition of the steeper Olearia colensoi scrubland of this type is good except on spurs and ridges that are important animal travel routes. Here gullying and the development of erosion pavements may occur.

The situation is somewhat different on the gentler slopes. Here damage is severe and a consequence of heavy use by browsing mammals. Over large areas nothing of Olearia colensoi remains but bleached sticks, and Holloway, *et al.* (1963) estimate that up to a quarter of the total scrubland has been destroyed by these animals. The result of this destruction is the formation of an erosion pavement and, where soil remains, the development of a short, browse resistant turf.

Olearia colensoi / Chionochloa flavescens scrubland.

Damage to this type of scrubland is not pronounced. It is thought, though, that this association may have been induced by browsing, the Olearia colensoi that is killed off being replaced by Chionochloa flavescens. (Holloway, et al. 1963).

Olearia colensoi / Polystichum vestitum scrubland.

This association normally occurs on steep and unstable ground thus erosion in the form of slipping and gullying is, here, a normal state. Because of the steepness of the ground browsing mammal use is not heavy, but slips are utilised to penetrate the scrub and vegetation regrowth is slowed down.

Ruahine Ranges.

Elder (1965) considers that browsing mammals have as yet, caused little serious damage to Olearia colensoi stands in the Ruahine Ranges. The only specific mention of browsing mammals in relation to Olearia colensoi in this work states that hares have been noted as causing undercutting of bushes up to a height of approximately 60 cm. The effects are probably minor and Elder (1965) characterizes them as "interesting rather than serious".

CONCLUSIONS

From a study of the literature it would appear that Olearia colensoi was in a state of fairly fine equilibrium with the various destructive agents and elements in its environment prior to the introduction of browsing mammals. Since populations of these animals have become high, however, this equilibrium has been upset in favour of the destructive agents.

These agents, such as the lepidopteran larva whose depredations were described by Zotov, et al. (1938) have caused widespread death of Olearia colensoi and in the presence of browsing mammals the ill adapted plant has not been able to regenerate

successfully.

The most important factors in the destruction of Olearia colensoi, according to the authors mentioned, are browsing mammals and insects. The effect of the physical factors is probably minor and in the case of sun scald is a secondary consequence of the presence of these mammals or larval attack.

Very often the condition of the stands seems to be correlated with the steepness of the land. The heavy use of Olearia colensoi stands by browsing mammals is at present largely confined to the gentler slopes, though there is no guarantee that this situation will continue when the flatter land is grazed out.

CLIMATOLOGY OF OLEARIA COLENZOI HOOK. f.

There appears to be little direct information available on the climate of the region in which Olearia colensoi grows. Most accounts of the climate of the high mountains refer not only to that part of them which is occupied by Olearia colensoi but also to the entire alpine zone as well. In fact, the area in which Olearia colensoi grows, with the exception of Stewart Island, is characterized by McIntock (1959) as "High rainfall; mountain climate". The part of Stewart Island where most of the Olearia colensoi grows is classified as an area of "mild temperatures, high rainfall increasing rapidly inland with height. Minimum rainfall in winter especially in the South. Prevailing winds S.W. but gales not frequent at low levels in spite of exposed coastline" (McIntock, 1959). However, Cockayne (1909) claims that the climate of the southern part of Stewart Island, and its mountains, may be considered subantarctic, approaching that of the Auckland Islands.

Apart from the above general statements, various botanists have given some details of the climate of the alpine and subalpine

zones. Unfortunately most of this information is in the form of observations and extrapolations from known sea level conditions and little absolute data is available. Such detail as is known is presented below.

WIND

High average wind speeds seem to be characteristic of the areas in which Olearia colensoi grows.

Cockayne (1909) claims that wind is the major factor controlling plant distribution on Stewart Island. He ascribes the peculiarities of the subalpine scrub to among other factors, constant wind with frequent strong westerly gales.

Wardle (1962) in describing the climate of a subalpine area in the Hokitika catchment, states that winds are frequent and violent.

In the Tararua Ranges intense wind is also a major factor in controlling the growth form and distribution of plants. (Wardle, 1962). In fact, Holloway, et al. (1963) claim that wind is the outstanding climatic feature of the Tararua Ranges and that it largely determines the behaviour of all living organisms in the area. Gale force winds may blow for weeks on end (Holloway, et al., 1963) and of these the most important, ecologically, are the predominant North-Westers. (Wardle, 1962).

From the above statements it is adequately demonstrated that the area in which Olearia colensoi grows is subject to frequent strong winds, mainly from a westerly direction. It appears certain that these winds play an important part in determining both the growth form and distribution of Olearia colensoi.

PRECIPITATION

In the areas where Olearia colensoi grows precipitation is in the form of rain, snow, and less important, fog and low cloud. In all of

these areas precipitation is high and falls on a large percentage of days per year.

Cockayne (1909), in discussing the climate of the subalpine scrub zone of Stewart Island, states that rainfall here is "excessive" and that the number of rain days is high. No actual figures are given however.

In the Hokitika catchment Wardle (1960) estimates that the precipitation in the subalpine scrub belt is probably in excess of 760 cm. per annum.

For the Tararua Ranges, Zotov, et al. (1938) estimated the mean annual precipitation at 1200 m. as being at least 250 cm. falling on approximately 200 rain days. At 800 m. they estimated the mean annual rainfall as being 100 cm. These figures are probably an underestimation. Holloway, et al. (1963) give short term rainfall records for the years 1952 to 1954 for two points in the Tararua Ranges which were considerably greater. At "Mountain House" (694 m.) the rainfall for the period mentioned above was 462 cm. per annum, and on Mt. Holdsworth (at 1405 m.) it was 544 cm. In winter much of this precipitation falls as snow which has a protective effect on the vegetation through the cold of the winter months (Holloway, et al., 1963). Fog and low cloud probably make a small addition to the effective precipitation.

It seems that Olearia colensoi grows in regions of high precipitation and that, in winter at least, a good part of it falls as snow. Fog and low cloud probably do not increase the effective precipitation much. They are discussed in another context below.

TEMPERATURE

Little information has been published on actual temperature levels but there have been attempts to delimit belts of altitude on this basis (Cockayne, 1958 and Zotov, 1938). These belts have been characterised in a general way and Olearia colensoi grows in the "cold

temperate" and "lower warm subpolar" of Zotov, and the "subalpine" and the lower part of the "alpine" of Cockayne. In the Tararua Ranges these belts extend from 600 m. to 1500 m. (Zotov, 1938).

Temperature information for other subalpine areas is scanty or non-existent. However, Wardle, (1963) characterises the climate of a subalpine area in the Hokitika catchment as having summers and winters which are, respectively, relatively cool and relatively mild.

With regard to the effect of temperature on Olearia colensoi, Zotov (1938) claims that the timber line is controlled by the temperature regime of the summer growth period. However, Cockayne (1928) considers that the chief factor that delimits the vegetation belts is the average length of time that the winter snow remains on the ground. The present author considers that Zotov's thesis is probably the more correct one but that snow cover may play an important part at high altitudes by providing a degree of protection for the next season's buds.

It seems, then, that temperature levels, both in winter and summer, play an important part in controlling the distribution of Olearia colensoi. The means whereby this control is effected is, as yet, unclear.

LIGHT LEVELS

Throughout New Zealand the light levels in the subalpine scrub belt are generally low. This factor has been stressed by most of the authors who have studied this type of vegetation.

Cockayne (1909) states that on Stewart Island the high land receives little sunshine, due to the high number of rain days and the prevalence of much low cloud and fog.

Wardle (1963) writes that fog and cloud is frequent in the subalpine scrub zone of the Hokitika catchment. Although he does not comment on light levels as such, they must be low as the combination of a high rainfall and a high incidence of fog and low cloud means that the level of surface illumination is low for a good part of the year. To

corroborate these statements, the same author writes in an earlier paper (Wardle, 1960) that during three summer months of 1957-58 there were no more than ten fine, sunny days.

In their work on the vegetation of the Tararua Ranges Holloway, et al. (1963) state that cloud and fog is a feature of the entire area. Earlier, Zotov, et al. (1938) stated that the crests of the Ranges are fog bound for at least 200 days each year.

The effect of fog and low cloud is to reduce the amount of light reaching the plants by a factor of up to 1000 times (Zotov, et al., 1938). As explained earlier, the lower level of the fogs sets the upper limit of Nothofagus menziesii and thus the lower limit of Olearia colensoi. It is thus demonstrated that the level of illumination is an important factor in the ecological relationships of Olearia colensoi.

SEASONAL ASPECTS

The climate of the New Zealand mountains is distinctly seasonal as is shown by the periodicity of annual growth in the subalpine woody plants (Wardle, 1963). Only two seasons are recognised by this author and these are the summer, during which growth and reproductive activity occur, and the winter dormant period. The summer is relatively short compared with the lowland and both Olearia colensoi and its associated fauna must complete their major reproductive activity during this time.

CONCLUSION

The peculiarities of the Olearia colensoi association arise largely from those of the climatic regime. These are: almost constant wind with much of gale force, a very high rainfall spread over a large number of days, much fog and low cloud leading to low light levels and, finally, a marked seasonality.

Although little accurate data is available, the climate of the areas in which Olearia colensoi grows has been characterized in a general

way. This climate, as has been described, differs markedly from that of the surrounding lowland areas and it is to this singular climate that both Olearia colensoi and its associated fauna is adapted.

Approximate Locations of
Collecting Sites
Fig. 1

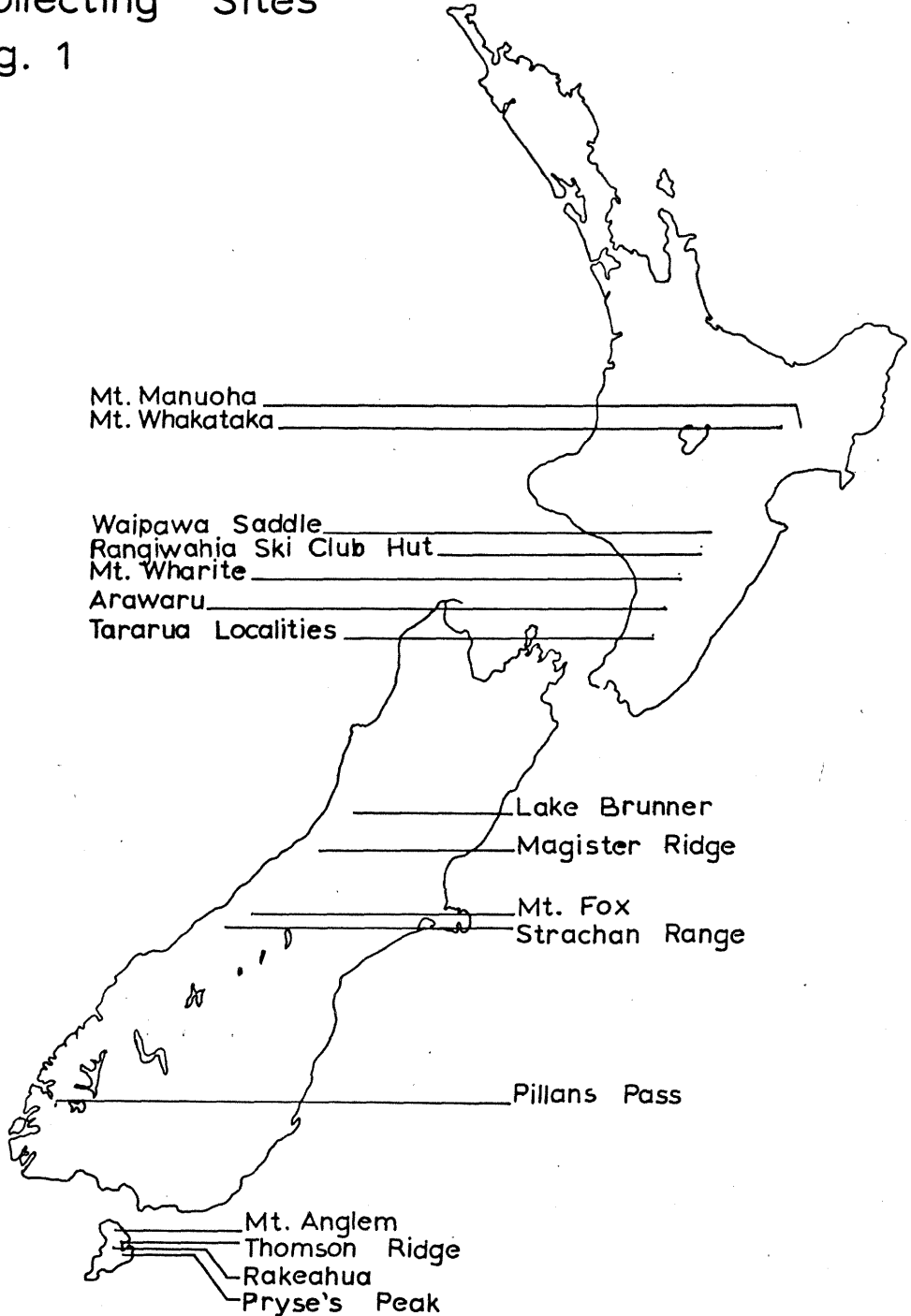


TABLE 1 - EXACT LOCATIONS OF STUDY AREAS

Area	N.Z.M.S. No.	Sheet Title	Sheet No.	Sheet Reference
STEWART ISLAND.				
Pryse's Peak	219	Stewart Id.		8D
Mt. Rakeahua	219	Stewart Id.		7D
Thomson Ridge	219	Stewart Id.		8C
SOUTH ISLAND.				
Upper Spey River	10A		30	167 8.6'E. 45 36.6'S.
Pillan's Pass	10A		30	167 10.7'E. 45 36.3'S.
Strachan Range	10A		24	169 38'E. 43 46.8'S.
Mt. Fox	180	Westland & Mt. Cook Nat. Pks.		170 E. 43 29.7'S.
Magister Ridge	177	Kaniere	558	171 7.7'E. 42 57.7'S.
Lake Brunner	1	Hokitika	50 + 51	89856270
NORTH ISLAND.				
Tararua Mountains.				
Blue Range	57	Tararua Mt. System		301182
Table Ridge	57	"		296184
Pinnacle Spur	57	"		295186
Arête Stream Basin	57	"		296187
Waingawa	57	"		298187
Arawaru	1	Eketahuna	N153	116164
Ruahine Ranges.				
Mt. Wharite	1	Palmerston Nth.	N149	33254740

Area	N.Z.M.S. No.	Sheet Title	Sheet No.	Sheet Reference
Ruahine Ranges (cont.)				
Rangiwahia	74	Ruahine		348292
Ski Club		Mt. System		
Waipawa	74	"		361302
Saddle				
Hinerua Ridge	74	"		297365
Huiarau Ranges.				
Mt. Manuoha	1	Maungapohatu	N96	544402
Mt. Whakataka	1	Maungapohatu	N96	413357

CHAPTER TWO

METHODS OF STUDY

INTRODUCTION

In order to achieve the aims of the study it was decided that the most appropriate way to pursue the investigation would be to conduct a survey of Olearia colensoi stands throughout the country.

FIELD WORK

LOCATION OF FIELD STUDY AREAS

In the course of this study Olearia colensoi stands were visited throughout the three main islands of New Zealand and collections were made at each locality.

The approximate locations of the sites visited are shown on the accompanying map and their exact positions are indicated by way of reference to maps published by the New Zealand Department of Lands and Survey. This latter data is presented in Table 1.

DURATION OF FIELD WORK

The field work that this study is based on extended over the three summer seasons of 1964/65, 1965/66, and 1966/67. The time spent at each locality is given below.

In several cases samples of Olearia colensoi foliage were received from sites which were unable to be visited. The collectors are acknowledged in the text.

Stewart Island.

Three locations on Stewart Island were visited during a brief stay on the Island starting in late December, 1964. The dates and duration of these visits are presented below.

Pryse's Peak	28th December, 1964.
Mt. Rakeahua	28th December to 31st Dec., 1964.
Mt. Anglem	2nd January to 7th January, 1965.

Also a sample of Olearia colensoi foliage was received which was collected by Mr. J.C. McIlroy of Lincoln College on the 23rd February, 1967 from Thomson Ridge.

South Island.

Several sites in the South Island were visited, some a number of times during the course of the study. The number of visits and their duration are presented below.

Upper Spey River and Pillan's Pass.

31st January to 3rd February, 1965.

21st November, 1965.

2nd January to 3rd January, 1967.

Strachan Range.

31st September, 1965.

Magister Ridge.

20th March, 1964.

10th December to 12th December, 1964.

20th January to 22nd January, 1965.

17th February to 19th February, 1965.

4th February to 5th February, 1966.

25th September, 1966.

Lake Brunner.

16th March to 17th March, 1964.

In addition to the above, a sample of Olearia colensoi foliage

from Mt. Fox was received from Dr. P. Wardle of Botany Division, D.S.I.R. A number of specimens were taken from it.

North Island.

Olearia colensoi stands at a number of sites in the Tararua and Ruahine Mountains were examined. Details of the number and duration of each visit are given below.

Tararua Mountains.

Blue Range.

21st December, 1964.

25th February, 1965.

Table Ridge.

16th May, 1964.

19th May, 1964.

17th December, 1964.

20th December, 1964.

Pinnacle Spur.

10th December, 1965.

Arête Stream Basin.

17th May, 1964.

18th December to 20th December, 1964.

23rd February to 24th February, 1965.

6th December to 11th December, 1965.

Waingawa Ridge.

16th February, 1966.

Mt. Arawaru.

6th April, 1964.

Ruahine Mountains.

Mt. Wharite (includes Mt. Wharite Ridge).

26th February, 1965.

16th September to 17th September, 1965.

21st October to 9th November, 1965.
 13th December to 15th December, 1965.
 22nd December to 24th December, 1965.
 4th January to 6th January, 1966.
 11th January, 1966.
 14th February to 15th February, 1966.
 28th August, 1966.
 29th October, 1966.
 21st December, 1966.
 11th August, 1967.

Rangiwahia Ski Club Hut Area.

5th April, 1964.

Waipawa Saddle.

28th December, 1966.

A sample of Olearia colensoi foliage was received from Mr. P. Lewis of Napier who collected it from Hinerua Ridge on the 13th August, 1967.

In addition to the above samples of Olearia colensoi foliage from two localities in the Huiarau Ranges were received. Details of their collection are as follows.

Mt. Manuoha.

24th January, 1967.

collected by Mr. D. Prebble of Napier.

Mt. Whakataka.

14th February, 1967.

collected by Mr. F.P. Wallis of the New Zealand Forest Service.

COLLECTING METHODS

Two factors precluded the systematic use of many conventional

collecting methods. These were the type of association that this plant forms and the problem of inaccessibility. The type of association formed by this plant is typically that of a low growing, dense and almost impenetrable mat of plants. The branches are brittle, unyielding and considerable force is required to push them apart. Downhill layering of branches on the steeper sites produces trunks that run parallel to the ground and these, together with the vertical stems growing from them, greatly increase the branch density. All these factors make travel, even through a moderately dense association, very slow. Where present, access tracks cut by the New Zealand Forest Service or formed by animals, were used throughout the study.

The second factor was the remoteness of the study areas. To get to most of these areas some hours of walking were involved and thus transport of heavy collecting or trapping equipment was precluded.

METHODS OF COLLECTING ARTHROPODS SPECIFIC TO OLEARIA COLENSOI HOOK. f.

The methods included here are those which were designed to collect insects that were feeding on the tissue of Olearia colensoi or were otherwise closely associated with it.

Handpicking Directly from the Foliage.

This form of collection was found to be practicable with many of the common insects present, such as lepidopteran larvae, smaller beetles and weevils. Very small insects were collected by this means with the aid of a moistened brush. Examples of the arthropods collected in this way included various Thysanoptera, Hemiptera and some of the larger Acari.

Beating and Sweeping from the Foliage.

This method was one of the more important used to collect insects during the course of the study.

Initially, a conventional tray was used but it was soon discarded

as the winds, which blow fairly constantly in this region, caused an excessive loss of specimens in the interval between beating and collection. For the greater part of the study specimens were beaten on to a handnet. This proved most satisfactory as few insects could escape and no wind loss was experienced. A further advantage of using the handnet was that it permitted normal manipulation, thus insects flying away from the disturbed foliage could also be taken.

Insects taken in this manner were held in a small portion of the net end and thus collection could continue until a suitable opportunity arose to empty the contents into a killing jar.

Splitting of Stems and Branches.

When the presence of wood boring insects was indicated by a yellowing, or death, of part of the canopy of a particular bush, the stems were split with a machete or an axe to try to locate the agents responsible. Larvae collected in this manner were placed in phials of ethanol for killing and preservation.

Collection of Foliage in Plastic Bags.

At most of the areas visited foliage was collected in plastic bags for later examination. Leaves were examined with a hand lens and those bearing a large number of arthropods were placed in the bag. This proved to be the most important way of collecting mites.

The examination of leaves collected in this manner could be delayed up to three weeks without damage to the mites. Even longer times were possible where refrigeration was available but lepidopteran larvae could not be kept alive for much more than ten days.

On returning to the laboratory the foliage was examined under a binocular microscope, each leaf being studied individually and the arthropods transferred to ethanol for preservation or mounted immediately. The Cryptostigmata, however, were placed in 100% lactic acid for clearing according to Balogh's (1959) method.



Plate 4 - Light Trap: Erected in Arête Stream Basin, Tararua Mountains.
Note dead Olearia colensoi bushes in background.

METHODS FOR COLLECTING ARTHROPODS FROM THE GENERAL ENVIRONMENT OF ASSOCIATIONS OF OLEARIA COLENZOI HOOK. f.

The methods included in this section were intended to trap a sample of the arthropods found generally in the Olearia colensoi association, not just those directly associated with the plant. Some of these latter did, however, occur in a number of the samples. A combination of light trapping, wind and handnetting was used to sample the aerial fauna and leaf litter was collected in order to examine the fauna of this layer.

Light Trapping.

It was decided early in the study that a light trap should be used to sample the general fauna of the Olearia colensoi association. To meet the portability requirements imposed by the nature of the study it was considered that the light source could not be electric, due to the heaviness of batteries. Consequently, for ease of starting, the light source chosen was a pressure lantern operating on white spirit (unleaded petrol).

The main body of the trap was constructed of normal three-layered plywood reinforced with narrow boards. The baffle was built from similar materials. The collecting apparatus was a cake tin fitted with a gauze covered funnel for drainage. The killing agents will be discussed below. The trap was designed to be supported by locally obtained materials which usually consisted of a tripod of branches, of suitable length, carried up from the forest below.

Assembly of the Light Trap: The funnel of the trap was made from four trapezium-shaped pieces of plywood lashed tightly together to form a hollow, inverted, truncate pyramid. The lid of the cake tin was screwed to the bottom end of this structure and the joint made relatively gas tight by sealing it with putty. This apparatus, the funnel with the cake tin lid attached, was then lashed to the supporting tripod of branches.

The next stage was the attachment of the pressure lantern and baffle. The pressure lantern was suspended from the tripod nearly over the centre of the pyramid and at such a height that the bottom of the glass was just level with the top of the sides of the funnel. The baffle was then tied in position over the pressure lantern.

The final stage in assembly was the attachment of the cake tin containing the gauze covered drainage funnel and the killing apparatus. This was simply pushed on, giving a good seal between the lid and the tin, and supported underneath with stones to prevent it falling off.

A photograph of the assembled light trap is shown on Plate 4.

Killing Apparatuses: During the course of the study potassium cyanide was used as a killing agent in the light trap. Three sorts of killing apparatus were tried.

The first was a small plastic bottle perforated with many holes. Inside this bottle a bag consisting of a double layer of fine nylon mesh was placed and filled with potassium cyanide crystals. The bottle was then closed and the apparatus placed in a sealed plastic bag till required. In use, this apparatus functioned well except on wet nights when all the potassium cyanide would dissolve. Wet weather being quite common, other less wasteful methods were tried.

The second apparatus was a variation on the common cyanide killing bottle. Potassium cyanide crystals were placed in a small jar to within two centimetres of the top. Plaster of Paris was then run onto the top of the crystals and allowed to set. The jars were sealed with screw top lids and bound with adhesive tape to prevent breakage. When the trap was set up ready for use three of these jars were placed in the cake tin with the screw tops removed. This method proved inadequate and was later discontinued, as the bottle failed to produce enough hydrogen cyanide gas to kill the insects caught.

The most successful apparatus, and that used for the greater part of the study, was a few grammes of potassium cyanide crystals wrapped

in a double thickness of nylon mesh. This was then rolled up and tied with a string. A number of these rolls were made up before each field trip and were stored in a sealed plastic bag till required. Just prior to the pressure lantern being lit two rolls were briefly immersed in water giving a good initial concentration of gas while two more dry rolls were placed in the tin for a more lasting effect. The four rolls were discarded the next morning after one night's use. This arrangement was most successful as it was rare to find any insect capable of flight when the cake tin was opened the next morning for collection of the previous night's catch.



Plate 5 - Wind Net: Erected on Mt. Wharite.

Wind Netting.

For a further sample of the general fauna of the Olearia colensoi association a wind net containing a killing apparatus was erected on Mt. Wharite Ridge. This site was chosen mainly for its good road access as the heavy metal parts of the trap were able to be taken by vehicle to within 30 minutes walk of the projected erection site.

The trap was that used by White (1962) near Cass and details of its construction are available from this source. Its gross structure is shown in Plate 5.

The site selected for erection of the wind net was on top of Mt. Wharite Ridge, in the middle of a dense, pure association of Olearia colensoi growing, at this point, about two metres high. A circular area of about six metres diameter was cleared to ground level, this being sufficient to permit free all round movement of the net with changes in the wind direction. The apparatus was arranged so that the mouth of the net was just above the level of the canopy.

Little success was achieved with this method of trapping due to the high average wind speed in the area. During the first night the apparatus was insufficiently guyed and was blown over. Extra guy ropes held it upright for the next few days but on a subsequent night the main supporting pole was broken off at the base of the net and the nylon net itself torn by the force of the wind.

It was decided not to persevere with this method of collection due to its lack of success in this situation.

Hand Netting.

Specimens were collected with a hand net at all localities visited. Most of this netting was done along tracks; a common technique was to disturb the foliage and sweep rapidly over the top of the bush to catch the insects flying up. Individual insects were often taken with a hand net but they frequently evaded capture by flying off the track where they could seldom be followed.

Generally the highest number of insects taken by this method were caught at dusk and occasionally a torch was used to enable collecting to continue after dark.

Leaf Litter Collection.

Leaf litter was collected from various localities. The reasons for making these collections were twofold. The first was to try to ascertain whether the mites present on the foliage also occur in the litter and secondly, to note the range of arthropods present.

Leaf litter was collected from underneath pure stands of Olearia colensoi and placed in plastic bags which were then sealed. The samples collected in this manner were returned to the laboratory for extraction.

FIELD TREATMENT OF SPECIMENS COLLECTED

Cyanosed Specimens.

The insects collected by beating and hand netting were usually killed in a cyanide killing bottle. Exceptions to this were lepidopteran larvae and other soft bodied insects which were placed directly in phials of 70% ethanol. After being cyanosed, either in a killing jar or in the light trap, the specimens were packed between soft tissue in small plastic boxes containing a small quantity of naphthalene crystals for preservation.

Specimens Killed in Ethanol.

Homoptera, mites, tipulid flies and soft bodied larvae taken in the field were usually transferred immediately to small phials of 70% ethanol for killing and preservation. The phials were placed in a tin and packed with soft tissue to prevent damage in transit. They were not disturbed again in the field.

Specimens Collected in Plastic Bags.

It was found that specimens collected in leaf litter or on the foliage of Olearia colensoi would keep satisfactorily for some two or

three weeks, provided that temperatures did not become unduly high. The foliage did not succumb to fungal or bacterial breakdown to any extent during this period and, as long as the leaves remained green, the arthropods included in the sample did not appear to suffer any significant mortality. Fungal and bacterial action was, naturally, of little moment as far as the litter fauna was concerned. The foliage and litter samples were not disturbed again till the specimens were extracted.

CONCLUSIONS

The trapping methods used throughout this study were designed to give an accurate sample of the fauna of the various Olearia colensoi associations that were examined. This was done within the limitations imposed by portability and the nature of the plant association.

It is considered that the methods used for collecting the arthropods specific to Olearia colensoi probably gave a good sample of the fauna present. Sampling of the insects attacking the woody parts of the plant possibly did not give such an accurate reflection of the numbers present as attacked plants show little sign of damage till the winter season following attack. Thus it is felt that many newly attacked plants were not recognized as such.

The methods employed to sample the arthropods in the general environment of Olearia colensoi stands probably gave a less accurate sample of the insects present than those used for the more specific fauna. Light trapping success is not high in alpine regions because of climatic limitations and, in any case, gives a biased sample of the fauna of the area in which it is carried out. Windnetting, where successful, gives a fair sample of the smaller insects present but is biased against the larger, stronger flying types (White, 1962). The effectiveness of hand netting in scrub of this nature is low since one is essentially restricted to tracks and cannot follow individual insects. Systematic sweeping is precluded for the same reason, except along the track edges.

Due to their low extraction efficiency for arthropods from leaf litter, of the Berlese and Tullgren funnels used in the study, it is considered that an accurate sample of the litter fauna was probably not obtained.

PREPARATION METHODS FOR THE INSECTA

Mainly conventional methods were used in the preparation and mounting of the insects collected. Those used are briefly discussed below.

ORDER LEPIDOPTERA

Specimens of this order that were taken in the light trap, or hand netted, were relaxed, set with their wings outspread and left till the latter had hardened in position. They were then placed in insect boxes for storage, together with a little camphor for preservation.

ORDER DIPTERA

The larger specimens were pinned obliquely through the thorax and the smaller were double mounted on micro pins and pith. In some cases, for example the Tipulidae, specimens were transferred directly to small phials of 70% ethanol to prevent loss of the deciduous legs and other structures. It is considered that, in a study of this nature, most of the small flies should be treated in this way as they tend to dry out and their appendages fall off in the lengthy interval between collection and mounting.

ORDER COLEOPTERA

The larger specimens of this order taken were pinned through the anterior part of the right elytron and the left elytron and metathoracic wing set out. Smaller specimens were mounted on cards while others

were point mounted on cardboard triangles.

ORDER HEMIPTERA

The members of the superfamily Coccoidea were mounted on slides, either directly from the samples of foliage gathered, or from specimens preserved in ethanol. Most other members of this order taken were pinned through the scutellum and preserved dry. The soft bodied nymphs were preserved in phials of 70% ethanol.

ORDER HYMENOPTERA

Most specimens collected were point mounted on cardboard triangles.

MINOR ORDERS

The few specimens of the orders Odonata and Neuroptera taken were pinned and set with wings extended. The single cockroach nymph taken was pinned and preserved dry. Members of the orders Ephemeroptera, Plecoptera and Trichoptera taken were mostly preserved in phials of 70% ethanol. However, a few Trichoptera were set and mounted in a similar way to the Lepidoptera and preserved dry.

PREPARATION TECHNIQUES FOR THE ACARI

The Acari that were collected from the foliage of Olearia colensoi were divided, in the laboratory, into orders to permit the most appropriate method of mounting to be applied to each one.

ORDER PROSTIGMATA

The prostigmatic mites were treated in one of two ways. Either they were transferred to 70% ethanol or mounted directly from the foliage. In both cases the final mounting technique used was the same.

The mounting medium used was Hoyer's modification of Berlese's solution. The formula and instructions for its preparation are given from Baker and Wharton (1952).

50g. distilled water
30g. gum arabic
200g. chloral hydrate
20g. glycerine

The ingredients given in the list above are mixed in that sequence at room temperature.

The sequence of mounting the mites directly from the foliage, or from ethanol, is as follows:

1. The mite is transferred to a drop of the mountant which had previously been placed centrally on a standard size (7.62 by 2.54 cm.) glass slide.
2. The glass slide, with the drop of mounting solution containing the specimen, is warmed gently on a hotplate to clear the mite.
3. The cover slip (13 mm. diameter, "zero" thickness) is applied.
4. The specimen is orientated, under a dissecting microscope by careful movement of the cover slip.
5. The prepared mount is then placed in an oven at approximately 50° C. and left till the preparation is dry.
6. The dried mount is ringed by applying "Gurr's Microscope Cement", nail varnish or some other suitable sealing agent to prevent the deliquescent mounting medium from absorbing water from the atmosphere.

This medium and method of mounting proved most satisfactory and the mites cleared well enough, in nearly all cases, to permit phase contrast examination. In the case of some of the more heavily pigmented types it is considered that preliminary clearing in lactic acid

would be beneficial in facilitating observation.

It was found that mounts made by this method must be stored flat to prevent migration of the specimens underneath the cover slips.

ORDER MESOSTIGMATA

The method of mounting and the same mounting medium as used for the Prostigmata proved satisfactory for the arboreal Mesostigmata collected.

The relatively soft bodied forms, such as the Phytoseiidae and Ascidae, cleared well and did not crush with the weight of the coverslips used. The heavily chitinized forms, such as the Rhodacaridae, were treated in a similar manner to the Cryptostigmata.

ORDER CRYPTOSTIGMATA

The Cryptostigmata were treated in a number of ways.

Early in the study they were mounted in a similar manner to that described above for the Prostigmata but this proved unsuitable as the specimens were often crushed and did not clear sufficiently. After some experimentation the most satisfactory method was found to be a modification of that of Balogh's (1959) technique. In this method the mites are cleared and depigmented with a variety of chemicals and the treated specimens are examined in temporary mounts on cavity slides. When they are finished with, the specimens are stored in 70% ethanol.

The sequence of the chemical treatments is as follows:

1. The specimen is cleared by warming it in a small crucible of 100% lactic acid on a hotplate. The acid is heated till vapour rises and complete clearing takes approximately one hour at this temperature.

2. The specimen is transferred to another small crucible of 30% hydrogen peroxide and warmed till the desired degree of depigmentation is obtained.

3. The specimen is then dehydrated in 80% ethanol.

The treated specimen, almost vitreous and light yellow in colour, is now ready for examination and observation. The following method of observation follows that of Balogh (1959). The specimen is transferred to a cavity slide that holds a drop of glycerine sufficient to fill half the cavity when a cover slip is placed across. The specimen is introduced under the edge of the cover slip into the glycerine. Its orientation can be altered by careful movement of the cover slip under the microscope. After observation the specimens are permanently stored in phials of 70% ethanol.

The advantage of this method is that one specimen can be viewed from all angles. This permits observation of the taxonomically important lateral view of the propodosoma and allows examination of structures from various aspects. The result of the use of this method is increased accuracy of observation especially in chaetotaxy as the setae of one side of the specimens do not have to be viewed through the cuticle of the other. Also, specimens are not distorted by the weight of a cover slip and a more accurate measure of proportion is obtained. A further advantage is that specimens are not split or otherwise damaged, as so often happens with the standard method of mounting.

Balogh (1959) recommends the use of lactic acid as a temporary mounting medium but it has been found (Dr. G. Ramsay, pers. comm.) that the fumes of the acid damage the objective lenses of the microscope used. This is obviated by substituting glycerine in place of the lactic acid.

Another technique can be used to mount the Cryptostigmata on slides and yet avoid crushing. This is to mount the cleared and depigmented mites in Hoyer's solution surrounding the specimens with a ring of glass chips to prevent the cover slip from resting on the specimen. This technique is useful in that it provides a selection of specimens readily available for quick comparisons. For more critical work, however,

it suffers from the disadvantage that the specimens can only be viewed from one aspect.

For making diagrams of the mites further techniques were developed to ensure greater accuracy and ease of observation. In order to figure various structures these had to be dissected out. Sometimes, as with the chelicerae, genital and anal plates, these could be obtained by simply crushing a specimen with a cover slip and moving it to separate the required parts. However, to obtain an accurate knowledge of some structures these had to be dissected out. This dissection was greatly facilitated by prolonged (4 - 5 hours) heating in 100% lactic acid which weakened the membranous attachments. The notogaster could then be lifted off and its chaetotaxy and the arrangement of the areae porosae more easily determined. After this was done the chelicerae could be pushed out through the rostrum and the nature of both these structures more easily determined and figured.

The figures included in the descriptions of new taxa, described in Appendix A, were made from specimens, or parts of specimens, that had been prepared according to the above methods. In the case of whole specimens well cleared individuals were used and the outlines and principal structures drawn in with the aid of a Leitz "Dialux" projecting microscope. Fine detail was added later after further examination with an ordinary microscope. A similar process was followed with the various parts that were dissected out. The scale in each case was determined by projecting a micrometer slide at the same magnification as the specimen.

ATTEMPTS AT REARING ARTHROPODS ASSOCIATED WITH OLEARIA COLENZOI

Attempts were made to rear two of the arthropods associated with Olearia colensoi. These were the stenomid moth Agriophara coricopa (Meyrick) and the cryptostigmatic mite Tuparezetes christineae Spain.

ATTEMPTS AT REARING AGRIOPHARA CORICOPA (MEYRICK)

A number of Olearia colensoi seedlings were brought from the collecting site at Magister Ridge and planted in small pots. Larvae of Agriophara coricopa, collected at the same locality, were placed on these plants but failed to attack them. The reasons for this failure are unknown.

Dr. G. Gibbs, of Victoria University, Wellington, New Zealand, states (pers. comm.) that he has managed to rear two larvae through to adults from the prepupal stage but not from earlier instars.

Dr. P. Wardle, of Botany Division, D.S.I.R., Christchurch, New Zealand, states (pers. comm.) that Olearia colensoi is somewhat difficult to grow in lowland areas. It may well be that the seedlings were somewhat debilitated and this may have been the reason for the failure of the larvae to attack the foliage.

ATTEMPTS AT REARING TUPAREZETES CHRISTINEAE SPAIN

Attempts were made to rear this species with the aim of describing the immature stages. Accordingly several small breeding jars were prepared. These jars were half filled with a mixture of Plaster of Paris and activated charcoal in a ratio, by weight, of nine parts to one. After the mixture had set it was moistened with water and some adults of Tuparezetes christineae placed in the jars together with portions of Olearia colensoi foliage. The larvae fed freely on the fungi growing on the leaves and numerous faecal pellets were passed. No sign of mating was noted, nor were any eggs laid, but the mites lived for six weeks at which time the experiment was terminated.

Another attempt was made. This time a multiple choice of several types of fungi were offered in an attempt to discover a suitable food for the mites. Mites were placed in the jars mentioned above with a choice of several types of forest litter fungi, each growing on a small

piece of agar medium. No success was obtained with this approach as the fungi were not eaten and the mites became entangled in the cultures.

Further attempts at rearing this species with fungi cultured from gut smears of crushed, living individuals were discontinued due to lack of time. Travé (1963) states that arboreal Cryptostigmata are more difficult to culture than edaphic forms.

CHAPTER THREE

THE FAUNA

INTRODUCTION

A list of the fauna taken is presented. The Acari are divided into those taken from the foliage and those taken from the leaf litter of Olearia colensoi. The Insecta are, however, presented in a strictly taxonomic manner.

CLASS: ARACHNIDA

SUBCLASS: ACARI

INTRODUCTION

The history of acarology in New Zealand dates from 1896 when Smith recorded the cryptostigmatic mite Liacarus longipilis (Moniez) from ant nests in Canterbury. Lamb (1952) compiled the first comprehensive list of the Acari of New Zealand and recorded 93 species. Ten years later Dumbleton (1962) in a supplementary list added another 56 species to bring the total to 149. The present total stands in excess of 370 species, a figure which reflects the quickening interest in the study of the Acari of this country. Wood (1964) recorded a number of families and genera of the Prostigmata that were new to New Zealand but did not describe any species at this time, although some of these were described in subsequent publications.

The history of the study of the Acari associated with the foliage of native vegetation is much shorter and the number of species recorded

correspondingly lower. No survey of the complete mite fauna of any plant has been conducted and the New Zealand records consist, in the main, of fairly haphazard collections from various plants.

The first records of phytophagous mites from native New Zealand plants were those of Lamb (1951, 1953a, 1953b) who described 18 species of Eriophyidae. Pritchard and Baker (1955) described a new species of Tetranychidae from Elaeocarpus dentatus (J.R. et G. Forst.) and the same authors (Baker and Pritchard, 1956) described a new species of Tenuipalpidae from galls on a species of Hebe. Ramsay (1958) described another species of Eriophyidae and gave an account of its life cycle. Collyer (1964) described five new species of Tenuipalpidae and recorded one, already known in Australia, from native plants. Manson (1965) described three new species of Eriophyid mites from the foliage of native trees. Hammer (1966, 1967) recorded a total of ten species of Cryptostigmata, of which eight were new, present on the foliage of trees in this country. However, not all of these were from native trees as a number of collections were made in exotic forests (Hammer, 1967). More recently, Collyer (1967) described a new species of acaridid mite from a number of native trees but considered that it was probably a fungivore. Manson (1967) described a new species of Tetranychidae from Clianthus sp. and exotic hosts.

A number of predatory species have also been recorded from native plants in New Zealand. Most of these mites are found on a fairly wide range of plants and, as Chant (1959) has shown, for the Phytoseiidae at least, these mites can survive on plant as well as animal protoplasm and show little host specificity. For this reason the plants that these mites are recorded from can, most accurately, be regarded as finding places. Gonzalez (1963) described three species of the family Stigmaeidae from native plants and added another two years later (Gonzalez, 1965). Wood (1964a, 1966b, 1967) recorded a total of 16 species of Stigmaeidae from native plants. In the family Ascidae, the one arboreal

species known from this country was described by Wood (1966a). Collyer (1964a) recorded a cosmopolitan phytoseiid mite from a number of native and introduced plants. In the same year Collyer (1964c) described seven new species and recorded a number of cosmopolitan examples of this family, all from native trees.

CLASSIFICATION

The higher classification of the Acari used here is that of Evans, Sheals and MacFarlane (1961) which treats the group as a distinct subclass of the Class Arachnida. In this classification the subclass is divided into two superorders (on the basis of the presence or absence of actinochitin in the setae) and seven orders.

The classification of the individual orders varies. The Prostigmata are classified according to Cunliffe (1955), the Mesostigmata according to Evans (1957) and the Cryptostigmata according to Balogh (1965). Minor modifications to the classifications of these authors are acknowledged in the text under the various taxa.

ACARI ASSOCIATED WITH THE FOLIAGE OF OLEARIA COLENZOI HOOKER f.

The following is a list of the Acari collected from the foliage of Olearia colensoi over the course of the study:

Superorder: ACARI - ANACTINOAETA

Order: MESOSTIGMATA

Family: PHYTOSEIIDAE Berlese, 1916.

Remarks: The classification used for this family is that of Chant (1959) whose keys were used to identify the specimens to subgeneric level.

Subfamily: Phytoseiinae Berlese, 1916.

Genus: Typhlodromus Scheuten, 1857.

Subgenus: Typhlodromus Scheuten, 1857.

Typhlodromus (Typhlodromus) novaezealandiae Collyer, 1964.

Records: SOUTH ISLAND: Magister Ridge, 20. iii. 1964, 1 specimen, (A.V. Spain). STEWART ISLAND: Thomson Ridge, 23. ii. 1967, 1 specimen, (I.C. McIlroy).

Remarks: Dr. E. Collyer, of Entomology Division, D.S.I.R., Nelson, states (pers. comm.) that this is the basic New Zealand species of the genus and is common everywhere. She further states that she is not yet sure of the specific limits of this and the related species Typhlodromus (Typhlodromus) dachanti Collyer and Typhlodromus (Typhlodromus) manukae Collyer as these are all included in a range of very similar morphs.

Typhlodromus (Typhlodromus) sp. a.

Records: RUAHINE MOUNTAINS: Rangiwahia Ski Club Hut Area, 4. iv. 1964, 2 specimens, (A.V. Spain).

Remarks: Dr. Collyer states (pers. comm.) that this is a new species near Typhlodromus (Typhlodromus) aceri Collyer.

Typhlodromus (Typhlodromus) sp. b.

Records: RUAHINE MOUNTAINS: Rangiwahia Ski Club Hut Area, 4. iv. 1964, 3 specimens, (A.V. Spain). TARARUA MOUNTAINS: Arête Stream Basin, 23. ii. 1965, 1 specimen, (A.V. Spain). SOUTH ISLAND: Strachan Range, 31. viii. 1965, 4 specimens, (A.V. Spain).

Remarks: Dr. Collyer states (pers. comm.) that these specimens represent a new species near Typhlodromus (Typhlodromus) nesbitti Womersley, 1954.

Typhlodromus (Typhlodromus) sp. c.

Records: HUIARAU RANGE: Mt. Manuoha, 24. i. 1967, 2 ♀, 2 ♂, 1 nymph, (D. Prebble). RUAHINE MOUNTAINS: Rangiwahia Ski Club Hut Area, 4. iv. 1964, 2 ♀, (A.V. Spain).

Remarks: Dr. Collyer states (pers. comm.) that this is a new species and can be distinguished from the others recorded by the possession of 11 short lateral setae, 4 ventrianal setae, and a marked macroseta on leg IV.

Typhlodromus (Typhlodromus) sp. d.

Records: RUAHINE MOUNTAINS: Mt. Wharite, 29. x. 1966, 1 ♀, 1 nymph, (A.V. Spain). SOUTH ISLAND: Mt. Fox, 6. xi. 1966, 1 ♀, 1 nymph, (P. Wardle): Pillan's Pass, 2. i. 1967, 1 ♀, 1 ♂, 4 nymphs, (A.V. Spain). STEWART ISLAND: Thomson Ridge, 23. ii. 1967, 1 ♂, (I.C. McIlroy).

Remarks: Dr. Collyer states (pers. comm.) that this species is probably undescribed and is characterized by the possession of 11 long lateral setae similar to those of Typhlodromus (Typhlodromus) dachanti Collyer but of differing proportional length.

Family: ASCIDAE Voigts and Oudemans, 1905.

sensu Lindquist and Evans, 1965.

Subfamily: Ascinae Voigts and Oudemans, 1905.

sensu Lindquist and Evans, 1965.

Tribe: Ascini Voigts and Oudemans, 1905.

sensu Lindquist and Evans, 1965.

Genus: Asca v. Heyden, 1826.

Asca arboriensis Wood, 1966.

Records: HUIARAU RANGES: Mt. Whakataka, 14. iii. 1967, 1 ♀, (F.P. Wallis). RUAHINE MOUNTAINS: Hinerua Ridge, 12. viii. 1967, 1 ♂, (P. Lewis): Mt. Wharite, 28. viii. 1966, 1 specimen; 11. viii. 1967, 1 specimen, (A.V. Spain).

Remarks: This species appears to be truly arboreal in its habits and has been taken from a number of native plants in both the North and South

Islands. These are Coprosma pseudocuneata W.R.B. Oliver, Nothofagus sp., Podocarpus hallii Kirk, Libocedrus bidwilli Hook. f. and Podocarpus sp. (Wood, 1966a). The specimens were identified from Wood's (1966a) key to the New Zealand members of this genus.

Superorder: ACARI - ACTINOCHAETA

Order: PROSTIGMATA

Family: TROMBIDIIDAE Leach, 1815.

Subfamily: Microtrombidiinae Thor, 1935.

Genus: Microtrombidium Haller, 1882.

Microtrombidium sp.

Record: RUAHINE MOUNTAINS: Mt. Wharite, 15. ix. 1965, 1 specimen, (A.V. Spain).

Remarks: As shown by the single record above, this species is not common. It does not appear to be either of the those described by Womersley (1936) and is thus probably a new species. The specimen was identified to genus using Womersley's (1945) key.

Family: TETRANYCHIDAE Donnadieu, 1875.

Subfamily: Tetranychinae Berlese, 1913.

Tribe: Tetranychini Reck, 1950.

Genus: Tetranychus Dufour, 1832.

Tetranychus sp.

Records: SOUTH ISLAND: Magister Ridge, 25. ix. 1966, 5 ♀, (A.V. Spain).

Remarks: These specimens were taken during the subalpine winter dormant season, thus no males were found. It is therefore impossible to identify these mites further than generic level in the meantime.

Mr. D.C. Manson of Department of Agriculture, Levin, New Zealand

confirmed the generic determinations made from Pritchard and Baker (1955).

Family: STIGMAEIDAE Oudemans, 1931.

Remarks: The members of this family are small and often brightly coloured mites. They occur in a number of habitats ranging from the intertidal zone to moss and leaf litter in forests and include a number of arboreal species that occur on the foliage and branches of plants. Some species have a wide habitat range and are found in all of the latter three situations (Wood, 1967). Their food habits are somewhat obscure but they are generally assumed to be predatory. Some arboreal species are known to prey on phytophagous mites of the families Tetranychidae, Tydeidae, Tarsonemidae and Phytoptipalpidae (Wood, 1967 quoting various authors) and are thus of economic significance. At the present time 39 species of this family are known from New Zealand (Wood, 1967) and the new species mentioned below brings the total to 40. Most of the following species were identified by Dr. T.G. Wood, of C.S.I.R.O., Australia.

Genus: Pseudostigmaeus Wood, 1967.

Pseudostigmaeus collyerae Wood, 1967.

Record: SOUTH ISLAND: Pillan's Pass, from Olearia colensoi foliage, 1. ii. 1965, 2 specimens, (A.V. Spain).

Remarks: This species has been recorded from a wide range of indigenous host plants throughout both the North and South Islands. It has been previously been taken from sea level to approximately 1200 metres, on Mt. Egmont (Wood, 1967). The present records extend the known altitudinal range of this species to approximately 1400 metres.

Genus: Mecognatha Wood, 1967.

Mecognatha hirsuta Wood, 1967.

Records: STEWART ISLAND: Thomson Ridge, from Olearia colensoi foliage, 23. ii. 1967, 5 specimens, (I.C. McIlroy).

Remarks: This species has been recorded from a variety of indigenous and exotic plant species and also from moss and leaf litter (Wood, 1967). It is distributed throughout the North and South Islands (Wood, 1967) but the above is the first record of this species from Stewart Island.

Genus: Mediolata R. Canestrini, 1890.

Mediolata favulosa Wood, 1967.

Records: HUIARAU RANGE: Mt. Manuoha, from Olearia colensoi foliage, 24. i. 1967, 1 larva, 2 nymphs, 1 adult, (D. Prebble). RUAHINE MOUNTAINS: Mt. Wharite, from Olearia colensoi foliage, 11. viii. 1967, 2 ♀, 1 ♂, (A.V. Spain).

Remarks: This species has been previously recorded from the bark of unsprayed apple trees near Nelson and also from moss on boulders at 1000 metres near Queenstown (Wood, 1967).

Mediolata robusta Gonzalez, 1965.

Records: RUAHINE MOUNTAINS: Mt. Wharite, from Olearia colensoi foliage, 11. viii. 1967, 3 specimens, (A.V. Spain).

Remarks: This species has been taken from a number of native trees and from moss on rocks and tree trunks. It has been recorded from localities in both the North and South Islands (Wood, 1967).

Mediolata sp.

Record: STEWART ISLAND: Thomson Ridge, from Olearia colensoi foliage, 23. ii. 1967, 2 ♀, (I.C. McIlroy).

Remarks: Dr. T.G. Wood states (pers. comm.) that these specimens represent a new species.

Genus: Mullederia Wood, 1964.

Mullederia arborea Wood, 1964.

Records: RUAHINE MOUNTAINS: Mt. Wharite, from Olearia colensoi

foliage, 15. ix. 1965, 10 specimens; 28. viii. 1966, 3 specimens; 21. xii. 1966 2 specimens; 11. viii. 1967, 3 specimens, (A.V. Spain).

Remarks: This species has been recorded from the North, South and Kapiti Islands and taken from a wide range of indigenous host plants (Wood, 1964a). This author states that, although it is often associated with other mites such as Agistemus, Tydeus, Eupodes and Bdellodes spp., it has not been observed feeding on them and its principal food may be mite eggs. The specimens mentioned in the records differ from the typical form of Mullederia arborea in that setae li are somewhat longer than normal and greater in length than setae he, to which they are usually equivalent (T.G. Wood, pers. comm.). Mullederia arborea is an important constituent of the stigmatid fauna of Mt. Wharite and large numbers of these conspicuous red mites have been noted on the foliage of Olearia colensoi, during visits to this site.

Family: TYDEIDAE Kramer, 1877.

Remarks: No indigenous members of this family have yet been described from New Zealand although they appear to be quite common. There is however, a record of Tydeus caudatus (Duges, 1834) given in Lamb's (1952) list of the New Zealand Acarina although no details are given beyond the fact that it is a new record. Also, Collyer (1964a) reports the presence of Tydeus californicus (Banks) as numerous on apple foliage but makes no conclusions on its feeding habits. The specimens collected during the present study were identified from Baker's (1965) key.

Both the species of this family taken are extremely small and it is considered that the records probably do not truly reflect the abundance of these mites. They are both, undoubtedly new species.

Genus: Tydeus Koch, 1835.

Tydeus sp.

Records: RUAHINE MOUNTAINS: Waipawa Saddle, 28. xii. 1966, 1 specimen; Mt. Wharite, 29. x. 1966, 2 specimens; 11. viii. 1967, 13 specimens, (A.V. Spain).

Genus: Lasiotydaeus Berlese, 1908.

Lasiotydaeus sp.

Records: SOUTH ISLAND: Magister Ridge, 20. iii. 1964, 1 specimen; 25. ix. 1966, 25 specimens (A.V. Spain).

Superfamily: TARSONEMOIDEA

Family: TARSONEMIDAE Kramer, 1877.

Remarks: Species of economic importance, such as Steneotarsonemus fragariae (Zimmerman, 1905), Steneotarsonemus pallidus (Banks, 1901) and Hemitarsonemus latus (Banks, 1904) have been known to occur in New Zealand for several years (B.M. May, Plant Diseases Division, D.S.I.R., Auckland, New Zealand; pers. comm.) but have never been recorded in the literature. Mr. D.C.M. Manson of the Department of Agriculture, Levin, New Zealand, states (pers. comm.) that there are two collections which he considers to be Steneotarsonemus pallidus from Martinborough (on strawberry) and Palmerston North (on Cyclamen indicum Mill.). He also states that this species is recorded from Morrinsville (on Cyclamen indicum), New Plymouth (on Gloxinia sp.), Palmerston North (on Dizycotheca sp.) and at Blenheim (no host plant given). Apart from the species mentioned above no members of this family have previously been recorded from New Zealand.

Genus: Steneotarsonemus Beer, 1954.

Steneotarsonemus sp.

Records: RUAHINE MOUNTAINS: Hinerua Ridge, 12. viii. 1967, 1 ♀,

(P. Lewis): Mt. Wharite, 11. viii. 1967, 2 ♀, (A.V. Spain).

Remarks: As males are required for accurate determination of members of this family, this species can be characterized no further until some have been taken. In Beer's (1954) key to the females this species keys to Steneotarsonemus ananas (Tryon, 1858), a pineapple pest originally recorded from Australia.

Family: CUNAXIDAE Thor, 1902.

Remarks: Baker and Wharton (1952) state that the members of this family are predatory on other mites and small insects.

Cunaxid sp.

Record: SOUTH ISLAND: Magister Ridge, from Olearia colensoi foliage, 5. ii. 1966, 1 specimen, (A.V. Spain).

Remarks: The specimen was too badly damaged to permit any further determination.

Family: EUPODIDAE Koch, 1842.

Remarks: The members of this family are phytophagous and many are pests of agricultural and horticultural crops.

Genus: Eupodes C.L. Koch, 1836.

Eupodes sp.

Record: STEWART ISLAND: Thomson Ridge, from Olearia colensoi foliage, 23. ii. 1967, 1 specimen, (A.V. Spain).

Remarks: This specimen was determined by Dr. T.G. Wood of the C.S.I.R.O., Australia.

Eupodid sp.

Record: SOUTH ISLAND: Magister Ridge, from Olearia colensoi foliage,

5. ii. 1966, 1 specimen, (A.V. Spain).

Remarks: This specimen was too badly damaged to permit any further determination.

Order: CRYPTOSTIGMATA

Except where otherwise noted, the classification of this order follows that of Balogh (1965), from whose key most of the genera were identified.

ORIBATEI INFERIORES

Superfamily: NOTHROIDEA

Family: HOLONOTHRIDAE Wallwork, 1963.

Genus: Holonothrus Wallwork, 1963.

Holonothrus sp.

Records: RUAHINE MOUNTAINS: Mt. Wharite, 29. x. 1966, 1 specimen, (A.V. Spain).

Remarks: This family was described by Wallwork (1963) on the basis of a single species (Holonothrus foliatus) from Macquarie Island. Since then Hammer (1966) has described another species (Holonothrus pulcher) from Puketi and Waitakere in this country. This latter species was found in the leaf litter of Agathis australis Salisbury, 1807 in moss and among other low plants on the ground. Wallwork (1966b.) has also described another species (Holonothrus concavus), from moss, on Campbell Island. The specimen mentioned in the records above represents a new species as it differs slightly in chaetotaxy, and in several other characters, from the three species already known. The present record is also the first of the occurrence of members of this family on the foliage of higher plants.

ORIBATEI SUPERIORES

Superfamily: AMERONOTHROIDEA

Family: CYMBAEREMAEIDAE Sellnick, 1928.

Genus: ?Scapheremaeus Berlese, 1910.

?Scapheremaeus sp.

Records: HUIARAU RANGE: Mt. Whakataka, 14. iii. 1967, 1 specimen, (F.P. Wallis). RUAHINE MOUNTAINS: Rangiwahia Ski Club Hut Area, 4. iv. 1964, 4 specimens, (A.V. Spain). Mt. Wharite, 29. x. 1966, 2 specimens; 11. viii. 1967, many specimens, (A.V. Spain).

TARARUA MOUNTAINS: Arête Stream Basin, 23. ii. 1965, 1 specimen, (A.V. Spain). STEWART ISLAND: Thomson Ridge, 23. ii. 1967, 5 specimens, (J.C. McIlroy).

Remarks: Hammer (1966) described a cymbaeremaeid mite under the name ?Scapheremaeus emarginatus but commented that it was probably not a true Scapheremaeus as it did not possess a marginal zone. This was confirmed by Dr. M. Luxton of Soil Bureau, D.S.I.R., Taita, New Zealand, (pers. comm.) and thus Hammer's species must be considered as belonging to a new genus. The specimens collected as noted in the records given above strongly resemble ?Scapheremaeus in general facies and notogastral chaetotaxy. However, they differ in prodorsal structure and in that they possess rostral setae while ?Scapheremaeus emarginatus does not. It is considered that the specimens mentioned above are probably not congeneric with ?Scapheremaeus emarginatus but that they represent a new genus. They are, however, provisionally included in the same genus as ?Scapheremaeus emarginatus till further study can define their taxonomic position more accurately.

Superfamily: OPPIOIDEA

Family: TUPAREZETIDAE Spain, n. fam.

Genus: Tuparezetes Spain, n. gen.

Tuparezetes christineae n. sp.



Plate 6 - Magister Ridge: Cryptostigmatic mites, mainly Tuparezetes christineae Spain, on back of Olearia colensoi leaf.



Plate 7 - Magister Ridge: Tuparezetes christineae Spain
amongst tomentum on lower surface of Olearia colensoi leaf.
Note extent of white dorsal secretion.

Photographs of this species are presented in Plates 6 and 7.
(See appendix A for a description and details of these new taxa).

Superfamily: CERATOZETOIDEA

Family: MYCOBATIDAE Grandjean, 1954.

Genus: Mycozetes Spain n. gen.

Mycozetes oleariae n. sp.

(See appendix A for a description and details of these new taxa).

Genus: Anellozetes Hammer, 1962.

Anellozetes intermedius Hammer, 1967.

Records: RUAHINE MOUNTAINS: Rangiwahia Ski Club Hut Area, 4. iv. 1964, 3 specimens, (A.V. Spain). Mt. Wharite, 29. x. 1966, 1 specimen, (A.V. Spain).

Remarks: The members of this genus are conspicuous in that they possess no notogastral setae. These setae are, however, represented by their points of insertion. The prodorsum is conspicuous in that there is a semicircular chitinous ring encircling the lateral sides of the rostrum (Hammer, 1962b). The genus contains four species, one in Patagonia (Hammer, 1962b) and three in New Zealand (Hammer, 1967). Anellozetes intermedius has been collected from several localities in both the North and the South Islands and is apparently widespread. This is its first recorded occurrence on foliage as it has previously only been taken from wet areas on the ground and amongst moss on a tree trunk (Hammer, 1967).

Family: CERATOZETIDAE Jacot, 1935.

Genus: Campbellobates Wallwork, 1964.

Campbellobates occultus Hammer, 1967.

Record: RUAHINE MOUNTAINS: Mt. Wharite, 15. ix. 1965, 1 specimen, (A.V. Spain).

Remarks: The familial placing of this genus is uncertain. Wallwork (1964b) states that it has affinities with both the Scheloribatidae and the Ceratozetidae and it is tentatively included in the latter here. Four species of this genus are known, one from Campbell Island (Wallwork, 1964b) and three from New Zealand (Hammer, 1967). The known species of this genus have all been collected from moss on the ground, or on tree trunks.

Genus: ?Porozetes Hammer, 1962.

?Porozetes sp. a.

Records: HUIARAU RANGE: Mt. Manuoha, 24. i. 1967, 13 specimens, (D. Prebble). RUAHINE MOUNTAINS: Mt. Wharite, 29. x. 1965, 1 specimen, (A.V. Spain). SOUTH ISLAND: Mt. Fox, 6. xi. 1966, 31 specimens, (P. Wardle): Strachan Range, 31. viii. 1965, 10 specimens, (A.V. Spain): Pillan's Pass, 1. ii. 1965, 141 specimens, 24. xi. 1965, 15 specimens; 2. i. 1967, 18 specimens, (A.V. Spain): Upper Spey River, 3. i. 1967, 17 specimens, (A.V. Spain). STEWART ISLAND: Thomson Ridge, 23. ii. 1967, 1 specimen, (J.C. McIlroy).

Remarks: A description of this species is presented in Appendix A. See also under next species.

?Poroztes sp. b.

Records: HUIARAU RANGE: Mt. Manuoha, 24. i. 1967, 1 specimen, (D. Prebble). RUAHINE MOUNTAINS: Mt. Wharite, 15. ix. 1965, 1 specimen; 28. viii. 1966, 2 specimens; 29. x. 1966, 4 specimens; 21. xii. 1966, 2 specimens, (A.V. Spain). TARARUA MOUNTAINS: Arête Stream Basin, 23. ii. 1965, 2 specimens; 25. ii. 1965, 3 specimens, (A.V. Spain). SOUTH ISLAND: Magister Ridge, 25. ix. 1966, 9 specimens, (A.V. Spain).

Remarks: Because of their possession of *areae porosae dorsosejugales* ?Porozetes spp. a and b would key to Porozetes in Balogh's (1965) world key. Porozetes sensu stricto differs from ?Porozetes spp. a and b in a number of ways. The two species and one subspecies of the genus already described, all have the rostrum with a projecting, toothed central lobe and a pair of lateral teeth (Hammer, 1962a, b and Wallwork, 1966a) whereas the rostrum of ?Porozetes is rounded and smooth. Also, the distal tip of the turtorium is freely projecting in all the known species of Porozetes sensu stricto whereas that of ?Porozetes spp. a and b is closely adpressed to the prodorsum. Other differences in chaetotaxy and lamellar structure exist and it is considered that the sum of these differences probably warrant the creation of a new genus allied to Porozetes. The two species can be separated easily by the length of the lamellar cusps. Those of ?Porozetes sp. a are less than one eighth as long as the lamellae proper while those of ?Porozetes sp. b. are approximately one quarter as long as the lamellae.

Superfamily: ORIBATULOIDEA

Family: ORIBATULIDAE Thor, 1929.

Genus: Ingella Hammer, 1967.

Ingella bullager Hammer, 1967.

Records: RUAHINE MOUNTAINS: Rangiwahia Ski Club Hut Area, 4. iv. 1964, 2 specimens, (A.V. Spain). STEWART ISLAND: Thomson Ridge, 23. ii. 1967, 2 specimens, (I.C. McIlroy).

Remarks: This species is apparently widespread, having been previously taken at several localities in both the North and South Islands. It has been mainly collected from wet, mossy sites on the ground or on the trunks of trees but two of the records given by Hammer (1967) are from the foliage of living trees, so that it would appear that this species is facultatively arboreal. There appears to be some variation in the shape

of the rostrum of the specimens from Stewart Island when compared with that of the typical form.

Genus: Maculobates Hammer, 1962.

Maculobates longus Hammer, 1967.

Records: STEWART ISLAND: Thomson Ridge, 23. ii. 1967, 1 specimen, (J.C. McIlroy).

Remarks: This specimen differs from the diagram given by Hammer (1967) of this species in that A_3 is close to and just below r_1 , also ip is somewhat larger.

Maculobates sp.

Records: RUAHINE MOUNTAINS: Rangiwahia Ski Club Hut Area, 4. iv. 1964, 1 specimen, (A.V. Spain): Mt. Wharite, 26. ii. 1965, 1 specimen; 15 ix. 1965, 1 specimen, (A.V. Spain).

Remarks: The members of this genus appear to be facultatively arboreal as large numbers have been noted to be present in some of the litter samples collected. Maculobates longus has previously been recorded only from the ground in wet, mossy situations (Hammer, 1967). The other species of Maculobates mentioned in the records does not agree with any of the eight new species described by Hammer (1967) and thus probably represents a new species.

Genus: Calvoppia Jacot, 1934.

Calvoppia sp.

Records: SOUTH ISLAND: Mt. Fox 6. ii. 1966, 3 specimens, (P. Wardle).

Remarks: Members of this genus are known from Oceania (Balogh, 1965) although none have been recorded from this country. Thus these specimens probably represent a new species.

Genus: Cosmobates Balogh, 1959.

Cosmobates sp.

Records: HUIARAU RANGES: Mt. Whakataka, 14. iii. 1967, 1 specimen, (F.P. Wallis). RUAHINE MOUNTAINS: Mt. Wharite, 28. viii. 1966, 1 specimen; 29. x. 1966, 2 specimens, (A.V. Spain).

Remarks: This species keys to Cosmobates in Balogh's (1965) world key but appears to differ from it in some respects. It belongs, most probably, to a new genus related to Cosmobates.

Genus: Urubambates Hammer, 1961.

Urubambates sp.

Record: STEWART ISLAND: Thomson Ridge, 23. ii. 1967, 1 specimen, (J.C. McIlroy).

Remarks: This genus was described from Peru (Hammer, 1961) and the record above adds a second species to the genus. The type species was recorded from mossy and other wet sites on the ground.

Family: HAPLOZETIDAE Grandjean, 1954.

Genus: Totobates Hammer, 1961.

Remarks: Totobates was described by Hammer (1961) on the basis of specimens gathered in Peru and in this work she added another described earlier from the Argentine Totobates elegans (Hammer, 1958). The genus was poorly characterized when described and Wallwork (1964a) redefined it on the basis of a new species Totobates antarcticus (Wallwork, 1964) Wallwork (1966). Wallwork (1964a) also revised its familial placing and transferred it from the Oribatulidae, where it had been placed by Balogh (1961 and 1965) with the status of a genus inquirendum, to the family HAPLOZETIDAE Grandjean, 1954. Since 1961 a number of new species have been described bringing the total number in the genus to ten. As it now stands this very widely distributed genus

has five members from South America, four from New Zealand and one species whose range encompasses New Zealand and Campbell Island.

The species below, characterized only by figures, apparently represent new species within the genus Totobates as they do not agree with those already described by Hammer (1967) from this country. This genus and the related Maculobates Hammer, 1962 are badly in need of revision (Dr. M. Luxton, pers. comm.).

Totobates sp. a.

Records: HUIARAU RANGES: Mt. Whakataka, 14. iii. 1967, 1 specimen, (F.P. Wallis). RUAHINE MOUNTAINS: Rangiwahia Ski Club Hut Area, 4. iv. 1964, 10 specimens (A.V. Spain): Mt. Wharite, 15. ix. 1965, 1 specimen; 26. ii. 1965, 1 specimen, (A.V. Spain). SOUTH ISLAND: Magister Ridge, 20. iii. 1964, 2 specimens, (A.V. Spain): Mt. Fox, 6. xi. 1966, 1 specimen, (P. Wardle): Upper Seaforth River, 1. ii. 1965, 2 specimens, (A.V. Spain).

Tobates sp. b.

Records: RUAHINE MOUNTAINS: Mt. Wharite, 15. ix. 1965, 1 specimen; 29. x. 1966, (A.V. Spain).

Remarks: This species exhibits neotrichy of the ventral plate in that it possesses five pairs of long setae situated in a longitudinal row which runs lateral to, and anterior of, the anal aperture.

Totobates sp. c.

Records: RUAHINE MOUNTAINS: Mt. Wharite, 29. x. 1966, 1 specimen, (A.V. Spain). SOUTH ISLAND: Magister Ridge, 20. iii. 1964, 2 specimens, (A.V. Spain): Mt. Fox, 6. xi. 1966, 1 specimen, (P. Wardle): Upper Seaforth River, 1. ii. 1965, 2 specimens, (A.V. Spain).

Totobates sp. d.

Records: RUAHINE MOUNTAINS: Mt. Wharite, 29. x. 1966, 1 specimen, (A.V. Spain).

Remarks: This species appears to be near Totobates ovalis Hammer, 1967 in structure but differs slightly in chaetotaxy.

Immature Cryptostigmata.

Cryptostigmatic larvae and nymphs were noted to be present in large numbers on the foliage of Olearia colensoi at all localities where collections were made. Only in the case of Tuparezetes christineae were the immature Cryptostigmata able to be identified with any degree of certainty. For this reason no attempt was made to record these immature stages.

Biology of the Acari Associated with the Foliage of Olearia colensoi.

The food habits of many of the Acari are obscure, however, those of some groups are known with a reasonable degree of certainty. For convenience, the Acari that have been recorded from the foliage of Olearia colensoi are here divided into two groups, the phytophagous species and the predators, although these categories overlap to some extent.

The potential food sources for phytophagous mites present on the leaves of Olearia colensoi include fungi, algae (unicellular and filamentous), the tomentum of the leaf, its cellular contents, and even the small clumps of moss occasionally present.

The most numerous mites present on the foliage are usually the members of the Order Cryptostigmata. This group is normally fungivorous but its members may also feed on the algae that grows on the leaves and the bark. Fungal hyphae and spores were noted in the food boluses of most species of Cryptostigmata and in the case of Tupaezetes christineae, were able to be partially identified (Appendix A). The spores of Uredo tupare Cunningham, 1924 were also noted to be present and available to

be fed on but it is not known whether they were utilized. It is also possible that Cryptostigmatic mites sometimes feed on the fine strands of the tomentum, but this was never observed.

The second most numerous group of mites on the foliage of Olearia colensoi were the two genera of Tydeidae recorded. The food habits of this family are obscure and, as noted by Baker (1965), there is much to be learned. Baker (1965) in discussing the biology of tydeid mites states that the species Tydeus californicus (Banks) has been variously reported as a plant feeder and a predator, so it appears that some members of this group may be somewhat plastic in their food habits. The feeding habits of the two species found on Olearia colensoi are unknown.

The known plant feeders such as Tetranychus sp., Steneotarsonemus sp. and the Eupodid mites found were present only in very low numbers, as indicated in the records. For this reason it is considered that their effect on Olearia colensoi is probably minimal and, unless their numbers increase markedly, they can be discounted as playing any important part in the pathology of Olearia colensoi.

A number of predatory species representing a variety of families were found on the foliage of Olearia colensoi. The potential food sources for these include the eggs of the various mite and insect species present, the very numerous cryptostigmatic nymphs, the tydeid mites and, for the Phytoseiidae at least, plant tissues (Chant, 1959).

The most numerous predators taken from the plant proved to be members of the family Stigmaeidae. Some members of this family have been reported to be efficient predators on phytophagous mites in New Zealand orchards (Collyer, 1964a) but little is known of their role on native vegetation. Baker and Wharton (1952) consider these mites to be general predators and Evans, Sheals and MacFarlane (1961) report that a member of the genus Zetzellia Oudemans has been reported to feed on the immature stages of scale insects and eriophyid mites in North America.

It is not known whether the members of this family also feed on plant juices. The arboreal members of this family known from New Zealand all seem to be found on a range of trees (Wood, 1967) but on Olearia colensoi it is probable that they feed principally on the eggs of other mites and the numerous soft bodied cryptostigmatic nymphs present on the foliage.

Several new species of the genus Typhlodromus Scheuten occur on the foliage of Olearia colensoi throughout the country. They have been noted to be present only in moderate numbers and probably prey on a wide variety of other mites, nymphs and their eggs.

Asca arboriensis Wood was occasionally found on the foliage of Olearia colensoi. Lindquist and Evans (1965) comment that some Ascinae are found rather commonly on plant foliage in the tropics but that they are seldom present in temperate regions where these exposed habitats are often dominated by phytoseiid mites. These authors also state that, in this habitat, ascine mites are thought to be predatory but probably not completely so. It is considered that Asca arboriensis is predacious on essentially the same prey as the phytoseiid mites mentioned above and that they may even compete with them to some degree.

Only one member of the family Trombididae was taken during the entire course of the study. The larvae of this family parasitize arthropods and the adults are predatory on the immature stages of many of the members of this phylum (Evans, Sheals and MacFarlane, 1961).

As stated in the records given above one cunaxid mite was taken but was too damaged to allow further determination. The members of this family are stated to be predatory on other mites and small insects (Baker and Wharton, 1952).

The Foliage of Olearia colensoi as a Habitat for Acari.

The foliage of Olearia colensoi provides a very favourable microclimate for mites, the reasons for this are severalfold.

The most important factor is the presence of a deep diffuse

tomentum on the backs of the leaves. This tomentum provides conditions of high humidity for the mites living among it by slowing air movement in the proximity of the backs of the leaves. This is probably an important factor in the survival of the soft-bodied cryptostigmatic larvae and nymphs which would otherwise be subject to possible dessication. The tomentum also provides a high degree of mechanical protection for the mites present by preventing interference with them through the rubbing action of other leaves and twigs with the frequent high winds. By providing grip for the mites, and other arthropods, the tomentum also prevents them from being blown off, or falling from, the leaves.

Available food is plentiful for the fungivorous and algivorous Cryptostigmatic mites on the foliage of Olearia colensoi. This is presumably because the tomentum acts as a trap for wind borne organic matter as well as numerous fungal and algal spores. In support of this it is noted that the Cryptostigmata tend to be found more often on the older rather than the younger leaves. This is probably because the former have had more time to accumulate organic matter which could act as a substrate for fungal growth.

The nature of the host plant association also aids by creating a cool humid microclimate with little air movement under the canopy. This means that the mites present on the bark and lower part of the canopy are not exposed to the dessicating effects of wind and sun.

Finally the climate of the region where the plant grows, with its high rainfall and proportion of rain days together with the frequent occurrence of mist aids the mites by providing generally moist conditions.

A KEY TO THE GENERA OF CRYPTOSTIGMATA OCCURRING ON THE FOLIAGE
OF OLEARIA COLENSOI

- 1 Notogaster subdivided into a median notaspis and lateral pleuraspes Holonothus Wallwork, 1963.
Notogaster entire 2
- 2 Prodorsum with a pair of posteriorly directed spines Tuparezetes n. gen.
Prodorsum without such spines 3
- 3 Notogaster granulate 4
Notogaster smooth 5
- 4 Notogaster with lenticulus ? Scapheremaeus Berlese, 1910
Notogaster without lenticulus Cosmobates Balogh, 1959.
- 5 Without dorsosejugal suture, or this suture only indicated by a line 6
With dorsosejugal suture 8
- 6 With 2 pairs of genital setae Ingella Hammer, 1967.
With 3 pairs of genital setae 7
- 7 Pteromorphs partly hinged Totobates Hammer, 1961.
Pteromorphs not hinged Maculobates Hammer, 1962.
- 8 Notogaster without setae Anellozetes Hammer, 1962.
Notogaster with setae 9
- 9 Prodorsum with lamellae 10
Prodorsum without lamellae Calvoppia Jacot, 1934.
- 10 Notogaster with a pronounced tectum overhanging prodorsum and covering most of sensilli Mycozetes n. gen.
Notogaster with a small, or no tectum. 11
- 11 Pteromorphs well developed, downcurving n. gen. near Porozetes
..... Hammer, 1962.
Pteromorphs small, horizontal Urubambates Hammer, 1961.

LITTER ACARI FROM OLEARIA COLENSOI STANDS

The leaf litter was examined only very superficially with the main aim of finding out if the Cryptostigmata present on the foliage also occurred in the litter layer. No numerical factors were considered and only a few of the taxa in the samples were identified, due to lack of available time. The list of the taxa that were identified is presented below.

Superorder: ACARI - ANACTINOAETA

Order: MESOSTIGMATA

Superfamily: PARASITOIDEA

Family: DERMANYSSIDAE Kolenati, 1859 sensu
Evans and Till, 1966.

Subfamily: Laelaptinae Berlese, 1892.

Genus: Hypoaspis G. Canestrini, 1885.

Subgenus: Gaeolaelaps

Hypoaspis (Gaeolaelaps) sp.

Record: RUAHINE MOUNTAINS: Mt. Wharite, 29. x. 1966, 1 ♀,
(A.V. Spain).

Remarks: Mr. D.C. Lee, of the South Australian Museum, Adelaide, Australia, states (pers. comm.) that this is a new species.

Family: RHODACARIDAE Oudemans, 1902.

Genus: Ologamasus Berlese, 1888 nec Berlese, 1906.

Ologamasus validus Lee, 1966.

Record: RUAHINE MOUNTAINS: Mt. Wharite, 29. x. 1966, 1 ♀, 1 ♂,
5 deutonymphs, (A.V. Spain).

Remarks: This species belongs to the cymosus group and has only been recorded previously from Waimamaku in the North Island (Lee, 1966).

Ologamasus nucilus Lee, 1966.

Record: RUAHINE MOUNTAINS: Mt. Wharite, 29. x. 1966, 1 ♀,
(A.V. Spain).

Remarks: This species, a member of the cymosus group, has been previously recorded from leaf mould in Wellington, which is the type locality (Lee, 1966).

Ologamasus leptosceles Lee, 1966.

Record: RUAHINE MOUNTAINS: Mt. Wharite, 29. x. 1966, 2 ♀,
(A.V. Spain).

Remarks: This species, a member of the cymosus group, has been recorded from leaf mould in Wellington which is the type locality (Lee, 1966).

Ologamasus masoni Lee, 1966.

Record: RUAHINE MOUNTAINS: Mt. Wharite, 29. x. 1966, 1 ♀,
(A.V. Spain).

Remarks: This species, a member of the cymosus group, has been previously recorded only from leaf mould in Wellington which is the type locality (Lee, 1966).

Ologamasus sp. a.

Record: RUAHINE MOUNTAINS: Mt. Wharite, 29. x. 1966, 1 ♀,
(A.V. Spain).

Remarks: Mr. D.C. Lee states (pers. comm.) that this is a new species belonging to the cymosus group.

Ologamasus sp. b.

Record: RUAHINE MOUNTAINS: Mt. Wharite, 29. x. 1966, 2 ♀, 1 ♂,
(A.V. Spain).

Remarks: Mr. D.C. Lee states (pers. comm.) that this is a new species near Ologamasus simplicior Berlese, 1914.

Genus: Gamasiphis Berlese, 1903.

Gamasiphis (Neogamasiphis) novae-zealandiae Womersley, 1956.

Records: RUAHINE MOUNTAINS: Mt. Wharite, 26. ii. 1965, 1 specimen; 29 x. 1966, 2 specimens; 21. xii. 1966, 4 specimens, (A.V. Spain).

STEWART ISLAND: Mt. Anglem, 7. i. 1965, 1 specimen, (A.V. Spain).

Remarks: The specimen taken on 26. ii. 1965 from Mt. Wharite was collected from the foliage of Olearia colensoi, a somewhat unusual situation for this normally litter inhabiting species.

Gamsiphis sp. a.

Record: RUAHINE MOUNTAINS: Mt. Wharite, 29. x. 1966, 1 ♀, (A.V. Spain).

Remarks: Mr. D.C. Lee states (pers. comm.) that this is a new species.

Gamasiphis sp. b.

Record: RUAHINE MOUNTAINS: Mt. Wharite, 29. x. 1966, 1 ♀, (A.V. Spain).

Remarks: Mr. D.C. Lee states (pers. comm.) that this is a new species related to Gamasiphis fornicatus Lee.

Genus: Euepicrius Womersley, 1942.

Euepicrius sp.

Record: RUAHINE MOUNTAINS: Mt. Wharite, 29. x. 1966, 1 ♀, (A.V. Spain).

Remarks: Mr. D.C. Lee states (pers. comm.) that this is a new species.

Genus: Gamasellus Berlese, 1892.

Gamasellus sp. a.

Record: RUAHINE MOUNTAINS: Mt. Wharite, 29. x. 1966, 1 ♀, (A.V. Spain).

Remarks: Mr. D.C. Lee states (pers. comm.) that this is a new species

related to Hydrogamasus delameri Sheals, 1962.

Gamasellus sp. b.

Record: RUAHINE MOUNTAINS: Mt. Wharite, 29. x. 1966, 1 ♂,
(A.V. Spain).

Remarks: Mr. D.C. Lee states (pers. comm.) that this is a new species.

Superfamily: UROPODOIDEA

Remarks: The members of this superfamily that were collected have been forwarded to Dr. B. Ainscough, of the University of the West Indies, for determination and description.

Order: PROSTIGMATA

Family: PENTHALODIDAE Thor, 1933.

Genus: Tectopenthalodes Tragardh, 1907.

Tectopenthalodes sp.

Records: RUAHINE MOUNTAINS: Mt. Wharite, 29. x. 1966, many specimens, (A.V. Spain).

Family: SCUTACARIDAE Oudemans, 1916.

Genus: Scutacarus Gros, 1845.

Scutacarus sp.

Record: RUAHINE MOUNTAINS: Mt. Wharite, 29. x. 1966, 2 specimens, (A.V. Spain).

Order: CRYPTOSTIGMATA

ORIBATEI INFERIORES

Superfamily: NOTHROIDEA

Family: CAMISIIDAE Oudemans, 1900.

Genus: Acronothrus Berlese, 1916.

Acronothrus spp.

Records: RUAHINE MOUNTAINS: Waipawa Saddle, 28. xii. 1966, many specimens, (A.V. Spain): Mt. Wharite, 29. x. 1966, many specimens; 21 xii. 1966, many specimens, (A.V. Spain).

Remarks: The members of this genus appear to be very numerous in the litter of Olearia colensoi but were not taken from foliage.

ORIBATEI SUPERIORES

Superfamily: ORIBATULOIDEA

Family: ORIBATULIDAE Thor, 1929.

Genus: Maculobates Hammer, 1962.

Maculobates spp.

Records: STEWART ISLAND: Mt. Anglem, 7. i. 1965, 6 specimens, (A.V. Spain).

Remarks: No estimate of the number of species in the litter was made. However, in view of the remarks of Hammer (1967) on the widespread occurrence of the members of this genus, it is considered that they are probably more common in this situation than is indicated by the above records.

ACARI PRESENT IN THE LEAF LITTER AND ON THE FOLIAGE OF OLEARIA COLENZOI

Only a few mites were found to occur on both the foliage and in the leaf litter samples. Those involved are Gamasiphis (Neogamasiphis) novae-zelandiae and members of the genus Maculobates.

Information on the occurrence of other mites in leaf litter, on bark and on foliage is available for the family Stigmaeidae in New Zealand. Of the species found during the course of this study Wood (1967)

states that Mediolata favulosa and Mecognatha hirsuta, are found in all of the three habitats mentioned above.

It is considered that more intensive study of the litter fauna would probably reveal a greater number of species that occur in all of the three habitats mentioned above. This would seem to be most probable in the case of certain of the members of the order Cryptostigmata found on the foliage. Many, though, appear to be well adapted for an arboreal existence and would probably be absent from the litter layer.

In support of this viewpoint Evans, Sheals and MacFarlane (1961) state that several cryptostigmatic mites occur on the ground and on foliage and cite Minunthozetes semirufus (C.L.K.) as an example. But Trave (1963) in a very thorough analysis of arboreal and saxicolous Cryptostigmata, conducted in France, considered that "Les oribates saxico-arboricoles sont nettement separees des oribates du sol". His samples of edaphic and saxicolous/arboreal species showed the following proportions of each of these groups:

Edaphic species	68.4%
Saxicolous/arboreal species	24.4%
Species present in both situations	7.2%

Dr. G. Ramsay, of Entomology Division, D.S.I.R., New Zealand, states (pers. comm.) that he has beaten large numbers of the very common litter dwelling genus Acronothrus Berlese from the foliage of various species of plants in the Chatham Islands.

CONCLUSIONS

It is considered that the Acari present on the foliage of Olearia colensoi fall into two groups. The first consists of those that are fairly well adapted for an arboreal existence, such as Tuparezetes christineae and the various Mesostigmata recorded. The second group consists of those that are present only because of the singular

combination of factors that make the foliage of this plant such a suitable habitat for mites.

It is concluded that the Acari recorded from the foliage of Olearia colensoi only have a small influence on the well being of the plant. The food chain of the most numerous group present on the foliage, the Cryptostigmata, starts with the fungi and algae present on the back of the leaves. That of the predatory species with the larvae and nymphs of the Cryptostigmata and the eggs of the other arthropods present. The numbers of the species that are known to be phytophagous on higher plants are probably too low to have any marked effect on the plant. This is probably also true of the partially phytophagous, partially predatory Phytoseiidae, Ascidae and Stigmaeidae.

CLASS: INSECTA

ORDER: COLEOPTERA

Much of the collecting and trapping done during the course of the survey was aimed at sampling the beetle fauna of Olearia colensoi associations. Literature reports (Broun, 1913) had indicated the presence of phytophagous beetles on Olearia colensoi and it was considered desirable to discover those present and assess their role in the pathology of this plant. A secondary reason for sampling the beetle fauna of the area was the desire to gain an increased knowledge of members of this order that occur in subalpine situations.

Collection of the beetles recorded below was effected by light trapping, considerable beating of Olearia colensoi foliage, handnetting of flying individuals within associations of this plant, handpicking of individuals from foliage and also by extraction from leaf litter. It is considered that most of the commoner members of the order present in Olearia colensoi stands were taken by the above methods.

The specimens taken were identified to family level using Crowson's (1955 and 1956) works. Below this level, however, many of the determinations were made, perforce, by others. Dr. J.C. Watt, of Entomology Division, D.S.I.R., Nelson, New Zealand, determined most of the Helodidae and some others and Mr. J.S. Dugdale, of the same institution, identified the Chrysomelidae.

Suborder: ADEPHAGA

Superfamily: CARABOIDEA

Family: CARABIDAE

Remarks: The members of this family are, in both the adult and larval stages, essentially carnivorous and in temperate regions are almost entirely ground beetles. Many members of this family have their elytra fused together and thus cannot fly but others are active in this regard (Imms, 1960).

Specimens taken were identified from the works of Britton (1940), Moore (1963) and by Mr. P.M. Johns, of the University of Canterbury, who also confirmed the other determinations. The classification used below is that of Britton (1940).

Tribe: Pterostichini

Genus: Megadromus Motschulsky, 1865.

Megadromus turgidiceps (Broun, 1908).

Records: RUAHINE MOUNTAINS: Mt. Wharite, from Olearia colensoi leaf litter, 30. x. 1965, 1 ♂, 1 ♀, (A.V. Spain).

Genus: Plocamostethus Britton, 1940.

Plocamostethus planiusculus (White, 1846).

Records: RUAHINE MOUNTAINS: Mt. Wharite, from Olearia colensoi leaf litter, 30. x. 1965, 1 specimen; 15. xii. 1965, 1 specimen, (A.V. Spain).

Genus: Holcaspis Chaudoir, 1865.

Holcaspis oedicnema Bates, 1894.

Record: RUAHINE MOUNTAINS: Mt. Wharite, from Olearia colensoi leaf litter, 30. x. 1965, 1 specimen, (A.V. Spain).

Tribe: Nomini

Genus: Tarastethus Sharp, 1883.

Tarastethus sp.

Record: RUAHINE MOUNTAINS: Mt. Wharite, from Olearia colensoi leaf litter, 21. xii. 1966, 1 specimen, (A.V. Spain).

Tribe: Pericalini

Genus: Scopodes Erichson, 1842.

Scopodes elaphroides (White, 1846).

Record: RUAHINE MOUNTAINS: Mt. Wharite, beaten from Olearia colensoi foliage, 5. i. 1966, 1 specimen, (A.V. Spain).

Remarks: Hudson, (1934) states that the members of this genus are sunlovers and are to be found under stones or bark exposed to hot sunshine. Hudson (1934) states that Scopodes elaphroides is one of the commonest species of the genus and has been taken previously from Auckland and around Wellington.

Tribe: Migadopini

Genus: Amarotypus Bates, 1872.

Amarotypus edwardsi Bates, 1872.

Record: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 5. i. 1966, 1 specimen, (A.V. Spain).

Remarks: Hudson (1934) states that this species, unlike most members of this family, is not found on the ground but may be beaten out of trees and shrubs which are heavily covered with hanging moss. Its larva is also to be found in similar situations. This species is generally distributed throughout the North and South Islands (Hudson, 1934).

Immature Carabidae.

Record: RUAHINE MOUNTAINS: Mt. Wharite, beaten from Olearia colensoi foliage, 14. ii. 1966, 1 larva, (A.V. Spain).

Remarks: The larvae of this family are mostly ground dwellers although those of a few species are capable of climbing trees (Peterson, 1960) and some even breed in arboreal situations (Hudson, 1934). The larva taken may have been feeding on the Acari or other Arthropoda present on the foliage of Olearia colensoi. It appears to differ in several respects from the larva of Amarotypus edwardsi figured in Hudson's (1934) work and is probably not this known arboreal species.

Series: STAPHYLINIFORMIA

Superfamily: STAPHYLINOIDEA

Family: SILPHIDAE

Remarks: Tillyard (1926) states that the members of this family are scavengers and feed on carrion or decaying vegetable matter while a few are predacious.

Genus: Necrophilus Latreille, 1829.

Necrophilus prolongatus Sharp, 1881.

Records: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, ?. xi. 1965, 2 specimens; 29. x. 1966, 1 specimen, (A.V. Spain).

TARARUA MOUNTAINS: Arête Stream Basin, ex light trap, 9. xii. 1965, 5 specimens; 10. xii. 1965, 3 specimens, (A.V. Spain). SOUTH ISLAND: Magister Ridge, ex light trap, 19. ii. 1965, 1 specimen, (A.V. Spain).

Remarks: Hudson (1934) states that this species is probably generally distributed throughout New Zealand and this is borne out by the above

records. The larvae have been taken in carrion and the adults are probably to be taken throughout the year (Hudson, 1934). The adults of this species are evidently attracted to light.

Family: SCAPHIDIIDAE

Remarks: Hudson (1934) states that the members of this family are to be found living in fungi and in decaying tree stumps and Tillyard (1926) adds that they are also found on flowers and under bark.

Genus: Scaphisoma Leach, 1812.

Scaphisoma sp.

Record: SOUTH ISLAND: Magister Ridge, ex light trap, 11. xii. 1964, 1 specimen, (A.V. Spain).

Remarks: The single specimen collected was determined by Dr. J.C. Watt.

Family: STAPHYLINIDAE

Remarks: Many of the members of this family are found where there is decaying organic matter such as dung or carrion, whereas others are predacious. The members of this family were mostly determined by Dr. J.C. Watt.

Genus: Creophilus (Kirby M.S.) Samouelle, 1819.

Creophilus oculatus (Fabricius, 1794).

Record: RUAHINE MOUNTAINS: Pretender Ridge, from Olearia colensoi leaf litter, 25. x. 1965, 1 specimen, (A.V. Spain).

Remarks: Gourlay (1950) states that this species has been recorded from Australia, throughout New Zealand, from the Kermadec, Chatham and Auckland Islands. It is one of the commonest associates of carrion in this country and is predatory on the larvae of Calliphoridae.

Genus: Holotrochus Erichson, 1840.

Holotrochus gracilis Broun, 1910.

Records: RUAHINE MOUNTAINS: Waipawa Saddle, from Olearia colensoi leaf litter, 28. xii. 1966, 6 specimens, (A.V. Spain).

Remarks: This species was described from a single specimen taken in the Waitakere Range (Broun, 1910a).

Genus: Ischnoderus Fauvel, 1867.

Ischnoderus morosus Broun, 1873.

Record: RUAHINE MOUNTAINS: Mt. Wharite, from Olearia colensoi foliage, 21. xii. 1966, 1 specimen, (A.V. Spain).

Remarks: This species has been previously recorded from Howick (Broun, 1893). It is probably incidental on Olearia colensoi.

Genus: Ocalea Erichson, 1837.

Ocalea sp.

Record: SOUTH ISLAND: Pillan's Pass, beaten from Olearia colensoi foliage, 1. ii. 1965, 1 specimen, (A.V. Spain).

Remarks: Dr. J.C. Watt states (pers. comm.) that this species is near Ocalea suturalis Cameron.

Genus: Thamiaraea Thomson, 1858.

Thamiaraea sp.

Record: RUAHINE MOUNTAINS: Mt. Wharite, beaten from Olearia colensoi foliage, 21. xii. 1966, 2 specimens, (A.V. Spain).

Genus: Quedius Stephens, 1832.

Quedius sp.

Record: RUAHINE MOUNTAINS: Mt. Wharite, beaten from Olearia colensoi foliage, 24. xii. 1965, 1 specimen, (A.V. Spain).

Family: PSELAPHIDAE

Remarks: Many of the members of this family can be collected from leaf litter, moss and tussocks (Tillyard, 1926) while a large number of species are known to be myrmecophilous (Imms, 1960). Dr. Watt states (pers. comm.) that both the adults and larvae of this family are usually predatory.

Genus: Vidamus Raffray, 1898.

Vidamus sp.

Record: RUAHINE MOUNTAINS: Mt. Wharite, from Olearia colensoi leaf litter, 29. x. 1966, 2 specimens; 21. xii. 1966, 1 specimen, (A.V. Spain).

Remarks: The specimens collected were identified by Dr. Watt.

Genus: Sagola Sharp, 1874.

Sagola sp.

Records: RUAHINE MOUNTAINS: Mt. Wharite, beaten from Olearia colensoi foliage, 21. xii. 1966, 2 specimens, (A.V. Spain).

Remarks: This is a very large genus and Hudson (1934) records 130 species.

Series: SCARABAEIFORMIA

Superfamily: SCARABAEOIDEA

Family: SCARABAEIDAE

Remarks: This very large family contains more than 19,000 species, many of which are of considerable economic importance (Imms, 1960). In New

Zealand the subfamily Melolonthinae is the best represented with ten genera (Given, 1960), the subfamily Aphodiinae is next with four, the Coprinae has three and the Dynastinae only one (Hudson, 1934). Of these, only the subfamily Melolonthinae is represented in the collections of the present survey. The larvae of this subfamily feed among decaying vegetable matter or among the roots of plants (Imms, 1960) and many are economic pests in both the adult and larval stages. All specimens were identified using Given's (1960) keys.

Tribe: Colpochilini

Genus: Odontria White, 1846.

Odontria magnum Given, 1952.

Records: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 30. x. 1965, 3 ♂; 3. xi. 1965, 3 ♂; 29. x. 1966, 1 ♂, (A.V. Spain).

Remarks: This species, the largest in the genus, is apparently confined to the central region of the North Island (Given, 1952). The present records represent the southernmost known occurrence of this species.

Odontria marmorata Broun, 1893.

Records: RUAHINE MOUNTAINS: Mt. Wharite, handnetted at dusk in Olearia colensoi association, 4. i. 1966, 1 ♀; 21. xii. 1966, 2 ♀; ex light trap, 5. i. 1966, 1 ♀, (A.V. Spain). TARARUA MOUNTAINS: Arête Stream Basin, ex light trap, 18. xii. 1964, 1 ♀; 7. xii. 1965, 1 ♂, (A.V. Spain). SOUTH ISLAND: Magister Ridge, ex light trap, 20. i. 1965, 2 ♂, (A.V. Spain).

Remarks: In Given's (1952) work the specimens from Magister Ridge key to Odontria similis Broun which Given (1960) has synonymised with Odontria marmorata. Given (1952) states that this species is one of a group of alpine and forest forms that extends throughout the South Island and onto the North Island Ranges.

Tribe: Xylonychini

Genus: Pyronota Boisduval, 1835.

Pyronota festiva (Fabricius, 1792).

Records: RUAHINE MOUNTAINS: Mt. Wharite, beaten from Olearia colensoi foliage, 5. i. 1966, 40 specimens; 21. xii. 1966, 1 specimen, (A.V. Spain).

Remarks: This species appears to be generally distributed throughout New Zealand (Given, 1952). Its larvae generally feed on montane pasture and the adults are known to feed on Rosa rubiginosa Linnaeus and Leptospermum scoparium J.R. et G. Forst, (Brown, 1963). This species was noted to be present in great numbers on the Olearia colensoi bushes growing on the summit of Mt. Wharite, but not on the lower ridge top only a few hundred metres distant. Hudson (1950) states that he has noted swarms of this, or related species, on mountains and gives two specific instances. Pyronota festiva was not observed to be present at any time other than is shown in the records above. Thus, it is probably of little importance in Olearia colensoi stands.

Series: DASCILLIFORMIA

Superfamily: DASCILLOIDEA

Family: HELODIDAE

Remarks: This family is well represented in New Zealand with 12 genera (Hudson, 1934) and 121 species (Tillyard, 1926). However, many of these so called species are probably just colour variants and a full revision of the New Zealand members of this family is required (Dr. J.C. Watt, pers.

comm.). The habits, especially those connected with feeding, of this family are obscure. Tillyard (1926) states that the larvae are aquatic or terrestrial while Hudson (1934) considers that they live on the roots of plants although describing that of Cyphon genalis Sharp from the leaf bases of an asteliad. Dr. J.C. Watt states (pers. comm.) that the larvae live in water or very wet moss including that which gathers in the leaf axils of asteliads or flax. The adults are apparently predacious and are frequently found on flowers (Hudson, 1934). Most specimens were identified by Dr. J.C. Watt.

Genus: Cyphon Paykull, 1798.

Cyphon genalis Sharp, 1878.

Record: RUAHINE MOUNTAINS: Mt. Wharite, beaten from Olearia colensoi foliage, 4. i. 1966, 1 specimen, (A.V. Spain).

Remarks: Broun (1880) states that this species was collected in Auckland and Tairua while Hudson (1934) notes that it is often beaten from forest foliage during the summer months. The larvae has been recorded from the "slushy accumulations" between the leaves of Freycinetia banksii A. Cunn. and a brief description of it is given by Hudson (1934).

Cyphon brouni (Broun, 1893).

Records: RUAHINE MOUNTAINS: Mt. Wharite, beaten from Olearia colensoi foliage, 5. i. 1966, 1 specimen; 6. i. 1966, 2 specimens, (A.V. Spain).

Remarks: This species was described from four specimens taken on Mount Arthur (Broun, 1893).

Cyphon rectalis Broun, 1886.

Records: SOUTH ISLAND: Pillan's Pass, beaten from Olearia colensoi foliage, 2. i. 1967, 14 specimens, (A.V. Spain).

Remarks: Specimens sent to the Commonwealth Institute of Entomology

were determined as above. However, Dr. J.C. Watt of Entomology Division, D.S.I.R., Nelson, New Zealand states that they are probably not Cyphon rectalis but they are considered as such provisionally.

Cyphon sp. a.

Records: SOUTH ISLAND: Magister Ridge, beaten from foliage of Olearia colensoi, 20 i. 1965, 1 specimen; 19. ii. 1965, 2 specimens, (A.V. Spain).

Remarks: Dr. Watt states (pers. comm.) that this species is near Cyphon rectalis Broun, 1886.

Cyphon sp. b.

Records: RUAHINE MOUNTAINS: Mt. Wharite, beaten from Olearia colensoi foliage, 4. i. 1966, 2 specimens; 5. i. 1966, 8 specimens; 6. i. 1966, 17 specimens, (A.V. Spain).

Remarks: Dr. Watt considers (pers. comm.) that this species is near Cyphon aethiops Broun, 1886.

Cyphon sp. c.

Record: RUAHINE MOUNTAINS: Mt. Wharite, beaten from Olearia colensoi foliage, 6. i. 1966, 1 specimen, (A.V. Spain).

Cyphon sp. d.

Record: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 5. i. 1966, 1 specimen, (A.V. Spain).

Cyphon sp. e.

Records: RUAHINE MOUNTAINS: Mt. Wharite, beaten from Olearia colensoi foliage, 21. xii. 1966, 4 specimens, (A.V. Spain).

Remarks: Dr. Watt considers (pers. comm.) that this species is near Cyphon waikatoensis Broun, 1886.

Genus: Mesocyphon Sharp, 1878.

Mesocyphon divergens Sharp, 1878.

Records: SOUTH ISLAND: Magister Ridge, ex light trap, 20. i. 1965, 2 specimens, (A.V. Spain).

Mesocyphon granulata Broun, 1886.

Records: SOUTH ISLAND: Magister Ridge, beaten from Olearia colensoi foliage, 6. i. 1966, 1 specimen; 11. i. 1966, 2 specimens, (A.V. Spain).

Mesocyphon sp. a.

Records: TARARUA MOUNTAINS: Waingawa Ridge, handnetted in Olearia colensoi association, 17. ii. 1966, 3 specimens, (A.V. Spain).

SOUTH ISLAND: Magister Ridge, beaten from Olearia colensoi foliage, 12. xii. 1964, 1 specimen; 5. ii. 1966, 1 specimen, (A.V. Spain).

Remarks: Dr. Watt considers (pers. comm.) that this species is near Mesocyphon granulata Broun, 1886.

Mesocyphon sp. b.

Record: TARARUA MOUNTAINS: Waingawa Ridge, beaten from Olearia colensoi foliage, 17. ii. 1966, 1 specimen, (A.V. Spain).

Remarks: Dr. Watt considers (pers. comm.) that this species is close to Mesocyphon monticola Broun, 1886.

Mesocyphon sp. c.

Records: SOUTH ISLAND: Magister Ridge, beaten from Olearia colensoi foliage, 20. iii. 1964, 2 specimens, (A.V. Spain).

Mesocyphon sp. d.

Record: SOUTH ISLAND: Magister Ridge, beaten from Olearia colensoi foliage, 5. ii. 1966, 3 specimens, (A.V. Spain).

Mesocyphon sp. e.

Records: SOUTH ISLAND: Pillan's Pass, beaten from Olearia colensoi foliage, 2. i. 1967, 2 specimens, (A.V. Spain).

Mesocyphon sp. f.

Records: SOUTH ISLAND: Magister Ridge, ex light trap, 20. i. 1965, 72 specimens; from Olearia colensoi foliage, 20. i. 1965, 28 specimens; 5. ii. 1966, 1 specimen, (A.V. Spain).

Remarks: This species was observed to be present on the opening buds of Olearia colensoi in very large numbers. Up to 15 of these beetles per bud were noted and the presence of these beetles appeared to be correlated with a certain amount of damage to the very soft upper cuticle of the leaf. Later in the season the results of this damage were obvious in the form of shallow brown markings on the upper leaf surface. The effect of this damage to the leaves was probably slight as affected leaves appeared to remain quite healthy.

Genus: Veronatus Sharp, 1878.

Veronatus longicornis Sharp, 1878.

Records: RUAHINE MOUNTAINS: Mt. Wharite, handpicked from Olearia colensoi foliage, 15. ii. 1966, 1 specimen, (A.V. Spain).

Remarks: This specimen was identified at the Commonwealth Institute of Entomology. Hudson (1934) states that this is a rare species and records it from Tairua and Otira.

Superfamily: ELATEROIDEA

Family: ELATERIDAE

Remarks: The larval habits of the New Zealand elaterids appear to be

little known. Those that are, have a variety of habits; some are subterranean root feeders, others lignicolous and xylophagous yet others may be carnivorous (Imms, 1960). The following species were identified by Dr. Watt.

Genus: Protelater Sharp, 1877.

Protelater diversus Broun, 1911.

Records: RUAHINE MOUNTAINS: Mt. Wharite, beaten from Olearia colensoi foliage, 4. i. 1966, 1 specimen; 6. i. 1966, 1 specimen; 21. xii. 1966, 1 specimen, (A.V. Spain).

Remarks: Hudson (1934) states that this species is found in beech forests in both the North and South Islands and is usually taken at considerable elevations. Broun (1911) records it at 1250 metres on Nothofagus in the Tararua Mountains.

Genus: Sphaenelater Schwarz, 1902.

Sphaenelater lineicollis (White, 1877).

Record: RUAHINE MOUNTAINS: Mt. Wharite, handpicked from Olearia colensoi foliage, 21. xii. 1966, 1 specimen, (A.V. Spain).

Remarks: Broun (1880) states that this species has been recorded from Tairua and Christchurch and is probably widely distributed.

Genus: Corymbites Latreille, 1834.

Corymbites sp.

Record: RUAHINE MOUNTAINS: Mt. Wharite, beaten from Olearia colensoi foliage, 21. xii. 1966, 1 specimen, (A.V. Spain).

Remarks: Dr. Watt states (pers. comm.) that this species is near Corymbites myops White, 1877.

Genus: Elatichrosis Hyslop, 1921.

Elatichrosis barbata (Candeze, 1877).

Records: RUAHINE MOUNTAINS: Mt. Wharite, from Olearia colensoi leaf litter, 23. xii. 1965, 1 specimen; ex light trap, 21. xii. 1966, 1 specimen, (A.V. Spain).

Remarks: Hudson (1934) states that this species is widely distributed throughout New Zealand and is often found in the mountains. It is, apparently, often to be found under stones. Broun (1880) states that this species is extremely variable.

Genus: Oxylasma Broun, 1881.

Oxylasma basalis Broun, 1886.

Records: RUAHINE MOUNTAINS: Mt. Wharite, beaten from Olearia colensoi foliage, 22. xii. 1965, 1 specimen; 24. xii. 1965, 1 specimen; 4. i. 1966, 2 specimens; 5. i. 1966, 1 specimen; ex light trap, 5. i. 1966, 1 specimen, (A.V. Spain).

Remarks: This species was described from five specimens collected on Mt. Egmont (Broun, 1886).

Oxylasma sp.

Records: RUAHINE MOUNTAINS: Mt. Wharite, beaten from Olearia colensoi foliage, 4. i. 1966, 1 specimen; 5. i. 1966, 1 specimen, (A.V. Spain).

Remarks: Dr. Watt states (pers. comm.) that this species resembles Oxylasma basalis Broun.

Superfamily: CANTHAROIDEA

Family: LAMPYRIDAE *Cantharidae*

Remarks: This family, formerly known as the Malacodermidae, is represented in New Zealand by the subfamily Telephorinae which contains

a few species of the genus Asilis (Tillyard, 1926). None of these species emit light. Hudson (1934) states that most of the species live on flowers.

Genus: Asilis Broun, 1893.

Asilis sp.

Record: STEWART ISLAND: Mt. Rakeahua, beaten from Olearia colensoi foliage, 29. xii. 1964, 1 specimen, (A.V. Spain).

Remarks: The single specimen was determined by Dr. Watt.

Family: LYCIDAE

Remarks: Imms (1960) states that the adults of this family are diurnal and are found on leaves and flowers or under bark. New Zealand has no native members of this family which is represented here by the Australian species recorded below.

Genus: Metriorrhynchus Guerin, 1838.

Metriorrhynchus rufipennis Fabricius.

Records: RUAHINE MOUNTAINS: Mt. Wharite, beaten from Olearia colensoi foliage, 21. xii. 1965, 1 specimen; 5. i. 1966, 1 specimen, (A.V. Spain).

Remarks: Imms (1960) remarks on the family would appear to hold for this species. The larva is black and preys on other insect larvae and pupae (Tillyard, 1926).

Series: CUCUJIFORMIA

Superfamily: CUCUJOIDEA

Family: NITIDULIDAE

Remarks: Imms (1960) states that this is a large family of extremely variable form, structure and habits. Its members are found in decaying vegetable matter, on flowers, in ripe fruit or feeding in sap or on carrion (Tillyard, 1926).

Genus: Platipidia Broun, 1893.

Platipidia asperella Broun, 1893.

Records: TARARUA MOUNTAINS: Arête Stream Basin, ex light trap, 10. xii. 1965, 1 specimen; handpicked from Olearia colensoi leaf, 11. xii. 1965, 1 specimen, (A.V. Spain).

Remarks: These specimens were determined by Dr. Watt. Broun (1893) records this species only from Clevedon, the type locality.

Family: COCCINELLIDAE

Remarks: Both the adults and larvae of the members of this family prey on aphids, scale insects and other arthropods and are thus of considerable economic value. The phytophagous species of the subfamily Epilachninae are absent from New Zealand (Tillyard, 1926).

Genus: Coccinella Linnaeus, 1735.

Coccinella 11-punctata Linnaeus, 1735.

Records: RUAHINE MOUNTAINS: Mt. Wharite, beaten from Olearia colensoi foliage, 6. i. 1966, 2 specimens, (A.V. Spain).

Remarks: This European species is apparently widespread throughout New Zealand (Hudson, 1934). It has been recorded as a summit haunting species by Hudson (1934) and Taylor (1961) but as only a few individuals were noted besides those taken this was probably not part of a mating swarm.

Immature Coccinellidae

Genus: Scymnus Kugelann, 1794.

Scymnus flavihirtus Broun, 1880.

Record: RUAHINE MOUNTAINS: Waipawa Saddle, beaten from Olearia colensoi foliage, 28. xii. 1966, 1 larva, (A.V. Spain).

Remarks: Hudson (1934) describes and figures the larva of this species. He states that the species is probably generally distributed throughout the country and that it is commonly found on the foliage in beech forests and a number of subalpine scrub plants. Tillyard (1926) states that the species of this genus feed on larval psyllids and mites. On Olearia colensoi this species would no doubt be preying on the numerous Acari present on the foliage.

Family: LATHRIDIIDAE

Remarks: The members of this family occur mainly in moss, flowers and leaf litter (Tillyard, 1926). Imms (1960) states that apparently all feed, both in adult and larval stages, on fungi and on Mycetozoa. Dr. Watt states (pers. comm.) that they are frequently associated with decaying vegetation.

Genus: Melanopthalma Motschoulsky, 1866.

Melanopthalma sp.

Record: RUAHINE MOUNTAINS: Mt. Wharite, beaten from Olearia colensoi foliage, 21. xii. 1966, 1 specimen, (A.V. Spain).

Remarks: This specimen was identified by Dr. Watt.

Family: TENEBRIONIDAE

Remarks: The members of this very large family exhibit a good deal of

variability in their habits with species occurring on the ground, in wood and in stored products such as grain. Many are scavengers and occur in dung, in carrion, in fungi, under bark and similar places (Imms, 1960).

Genus: Chalcodrya Redtenbacher, 1868.

Chalcodrya variegata Redtenbacher, 1868.

Records: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 5. i. 1966, 3 specimens; 14. ii. 1966, 1 specimen, (A.V. Spain).

Remarks: Hudson (1934) states that this species occurs in forest and scrub, sometimes under bark, but is more often beaten from dead shrubs in hot sunshine. Gourlay (1960) records rearing this species from small diameter branches of Neopanax arboreum (Murr.) collected from Dun Mt. Tramway, Nelson. The larvae were noted to work the cambium and woody tissues and frequently pupate in the central wide pith cavity.

Family: SALPINGIDAE

Remarks: Little appears to be known of the habits of this group.

Genus: Salpingus Gyllenhal, 1810.

Salpingus sp.

Record: TARARUA MOUNTAINS: Arête Stream Basin, handpicked from Olearia colensoi leaf, 11. xii. 1965, 1 specimen, (A.V. Spain).

Remarks: Dr. J.C. Watt (pers. comm.) states that this species is probably a fungivore that feeds in a subcortical position in dead wood, during the larval stage.

Family: PYROCHROIDAE

Remarks: Imms (1960) states the larval life of members of this family is spent under bark and that the adults are found in this position and also

on leaves and flowers.

Genus: Exocalopus Broun, 1893.

Exocalopus pectinatus Broun, 1893.

Records: RUAHINE MOUNTAINS: Mt. Wharite, beaten from Olearia colensoi foliage, 5. i. 1966, 1 ♀; 6. i. 1966, 2 specimens; 11. i. 1966, 2 specimens, (A.V. Spain).

Remarks: These specimens were identified by Dr. J.C. Watt who states (pers. comm.) that this species probably feeds in a subcortical position in dead wood during the larval stage. It has previously been taken from between approximately 900 and 1200 metres on Mt. Egmont and Mt. Arthur (Hudson, 1934).

Family: OEDEMERIDAE

Remarks: Little appears to be known of the habits of the members of this family. The soft bodied larvae are usually found in wet, rotting wood while the adults feed on pollen or nectar (Dr. J.C. Watt, pers. comm.)

Genus: Selenopalpus White, 1846.

Selenopalpus aciphyllae Broun, 1886.

Records: TARARUA MOUNTAINS: Arête Stream Basin, handpicked from Olearia colensoi foliage, 18. xii. 1964, 1 specimen, (A.V. Spain).

Remarks: Broun (1886) described this species on the basis of a single specimen taken from Aciphylla lyalli Hook. f. at Taieri. Hudson (1934) records it from the Dart Valley where it was collected from under logs and White (1962) records it from two localities near Cass where, in one case, a specimen was found at the base of a hard tussock. It would thus appear that this species is generally distributed. The single specimen of this species was identified by Dr. J.C. Watt.

Genus: Thelyphassa Pascoe, 1876.

Thelyphassa longicornis (Broun, 1893).

Records: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 5. i. 1966, 6 specimens; 14. ii. 1966, 3 specimens, (A.V. Spain).

Remarks: Broun (1893) records this species from Caplestone in Westland. Dr. J.C. Watt identified the specimens.

Superfamily: CHRYSOMELOIDEA

Family: CERAMBYCIDAE

Remarks: This family includes species which attack living trees, those that attack dying and dead wood and those that attack seasoned to partially decayed timber (Morgan, 1960). The adults of this family were not common in Olearia colensoi stands and were all taken by light trap. Most specimens were identified from the works of Hudson (1934) and Breuning (1962) and confirmed by comparison with named specimens in the collection of the Canterbury Museum. The classification followed below is that of Blair (1937).

Subfamily: Prioniinae

Genus: Prionoplus White, 1846.

Prionoplus reticularis White, 1846.

Records: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 14. ii. 1966, 5 specimens, (A.V. Spain).

Remarks: This species is both common and generally distributed throughout New Zealand. It attacks a variety of dead softwood timber but has not been recorded from hardwood (Morgan, 1960). The larval period is spent within dead wood and its length, depending on the

moisture content of the breeding medium, is normally three years but may vary from two to more than three (Morgan, 1960). Pupation occurs in the wood. Hudson (1934) states that this species is strongly attracted to light and thus light trapping should give a good indication of its frequency. As only a few specimens were taken, it is considered that this species is not a common inhabitant of Olearia colensoi stands and that those recorded probably originated in the forest present a few hundred feet below the collecting site.

Subfamily: Cerambycinae

Tribe: Callidiopini

Genus: Oemona Newman, 1840.

Oemona hirta (Fabricius, 1775).

Records: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 14. ii. 1966, 6 specimens, (A.V. Spain).

Remarks: This species is common throughout New Zealand (Hudson, 1934) and the larvae are known to tunnel the stems of a large number of indigenous and exotic host plants (Hudson, 1934; Atkinson et al., 1956; Dumbleton, 1957). Oemona hirta is apparently uncommon in Olearia colensoi stands although light trapping probably gives a distorted idea of its frequency as this insect is apparently not attracted to light (Dye, 1950).

Tribe: Phlyctaenodini

Genus: Epheus Broun, 1886.

Epheus costifer Broun, 1886.

Records: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 14. ii. 1966, 4 specimens, (A.V. Spain).

Remarks: The host plants of this species are unknown but Mr. R.H. Milligan (pers. comm.) states that he has collected it, also at light, in the Northern Kaimanawa Forest where no Olearia colensoi occurs. Hudson (1934) states that it may be taken by beating forest growth in January and has recorded it from Wellington, Tuakau and Kaeo. It would seem that this species is only incidental in Olearia colensoi stands. The specimens were identified by Mr. R.H. Milligan of the Forest Research Institute, Rotorua, New Zealand.

Subfamily: Lamiinae

Tribe: Acanthocini

Genus: Tetrorea White, 1846.

Tetrorea cilipes White, 1846.

Records: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 14. ii. 1966, 3 specimens, (A.V. Spain). TARARUA MOUNTAINS: Arête Stream Basin, ex light trap, 18. xii. 1964, 1 specimen, (A.V. Spain).

Remarks: Hudson (1934) states that this species is probably generally distributed throughout both the North and South Islands. Morgan (1960) in discussing its biology states that although it has been reared from the trunks of lower canopy or secondary hardwoods such as Neopanax arboreum (Murr.) and Griselinia littoralis Raoul, it is apparently more common as a twig and small branch borer. This author gives further details of the biology of Tetrorea cilipes White, Dumbleton (1957) describes and figures the larvae and Breuning (1962) provides a redescription of the adult.

Unknown Stem Borer

In the Tararua Mountains, numbers of dead Olearia colensoi

bushes were observed that had obviously been bored by some insect, presumably of this family. In one case a live branch had been tunnelled causing yellowing of part of the canopy. A tipulid larva was found in this tunnel but was probably secondary (Dr. G. Kuschel, pers. comm.) the larva that made the tunnel having probably emerged previously. Kibblewhite (1964) indicates that this, or some other species with similar habits, may be locally important in attacking healthy, or debilitated, Olearia colensoi bushes.

Family: CHRYSOMELIDAE

Remarks: This very large family is divided into eleven subfamilies by Crowson (1955) but only one, the Galerucinae, is represented in the collections made during this study. The larval habits of this latter subfamily vary from those that feed openly on the parenchyma of leaves to those that mine leaves, while others live in roots (Imms, 1960). The members of this family that were collected during the course of this study were identified by Mr. J.S. Dugdale.

Subfamily: Galerucinae

Genus: Adoxia Broun, 1880.

Adoxia vulgaris Broun, 1880.

Records: RUAHINE MOUNTAINS: Mt. Wharite, beaten from Olearia colensoi foliage, 11. i. 1966, 1 specimen; 21. xii. 1966, 1 specimen, (A.V. Spain).

Remarks: Hudson (1934) states that this species is one of New Zealand's commonest beetles and is found in large numbers amongst many types of flowers in the spring and summer. Both Hudson (1934) and Broun (1880) state that it is very commonly found on the inflorescences of Brachyglottis repanda J.R. et G. Forst. The specimens taken were beaten from

flowering shrubs and were possibly feeding on the inflorescences.

Adoxia oleareae (Broun, 1893).

Records: TARARUA MOUNTAINS: Arête Stream Basin, handpicked from Olearia colensoi foliage, 19. xii. 1964, 8 specimens; 6. xii. 1965, 1 specimen; 12. xii. 1965, 3 specimens, (A.V. Spain). Pinnacle Spur, handpicked from Olearia colensoi foliage, 11. xii. 1965, 8 specimens, (A.V. Spain).

Remarks: This species was described from specimens taken from the inflorescences of Olearia arborescens (Forst. f.) on Mt. Egmont at 1150 metres (Broun, 1893). It has also been noted to be abundant on Cassinia sp. and tussock grasses at about 1200 metres on Mt. Arthur (Hudson, 1934). Adoxia oleareae was the most commonly noted species of this genus on the foliage of Olearia colensoi and was occasionally present in large numbers. Considerable numbers of this species were noted to be active on 11. xi. 1965 on Pinnacle Spur. The day was warm, humid and windless and numbers of this species were observed actively flying and aggregating on several Olearia colensoi bushes on the ridge top. The role of this species in the pathology of Olearia colensoi is probably minor.

Adoxia simmondsi (Broun, 1913).

Record: RUAHINE MOUNTAINS: Mt. Wharite, handpicked from Olearia colensoi foliage, 4. i. 1966, 1 ♀, (A.V. Spain).

Remarks: This species has previously been recorded from Mt. Quoin in the Tararua Mountains where it was taken from Olearia colensoi growing at approximately 1200 metres (Broun, 1913). The rarity of this species makes it unlikely to be a serious pathogen of Olearia colensoi.

Adoxia rugicollis (Broun, 1893).

Record: TARARUA MOUNTAINS: Arête Stream Basin, beaten from Olearia

colensoi foliage, 18. xii. 1964, 1 specimen; 19. xii. 1964, 5 specimens, (A.V. Spain).

Remarks: This species was described from specimens taken on Mt. Egmont at approximately 1100 metres (Broun, 1893). No host plant was mentioned.

Adoxia insolitus (Broun, 1910).

Records: SOUTH ISLAND: Pillan's Pass, beaten from Olearia colensoi foliage, 2. ii. 1965, 2 ♂, 2 ♀, (A.V. Spain).

Remarks: This species was described from Hump Ridge, near Invercargill, where it was taken at an altitude of approximately 1100 metres (Broun, 1910).

Adoxia sp. a.

Records: SOUTH ISLAND: Magister Ridge, beaten from Olearia colensoi foliage, 22. vi. 1965, 2 specimens; 5. ii. 1966, 1 specimen, (A.V. Spain). Pillan's Pass, beaten from Olearia colensoi foliage, 1. ii. 1965, 1 specimen, (A.V. Spain).

Adoxia sp. b.

Record: SOUTH ISLAND: Magister Ridge, beaten from Olearia colensoi foliage, 12. xii. 1964, 1 ♀; 5. ii. 1966, 1 ♂, (A.V. Spain).

Remarks: Mr. J.S. Dugdale states (pers. comm.) that this species has in the male, long hind tibiae and first tarsal segments. The female has simple terminalia.

Superfamily: CURCULIONOIDEA

Family: ANTHRIBIDAE

Remarks: This large family, with approximately 2,400 species, is mainly tropical. The larvae are usually found in dead wood. (Imms, 1960). New Zealand has a total of 83 species of which 57 belong to the genus Anthribus (Hudson, 1934).

Genus: Anthribus Geoffroy, 1762.

Anthribus inornatus Sharp, 1886.

Record: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 14. ii. 1966, 2 specimens, (A.V. Spain).

Remarks: Dr G. Kuschel (pers. comm.) states that the larvae of this species are found in dead wood of many types. It was described from specimens collected at Greymouth and Kumara (Broun, 1893).

Family: BRENTHIDAE

Remarks: This family contains about 1700 species (Imms, 1960), most of which are tropical. Sexual dimorphism is usual and the rostrum of the female is adapted for boring wood for purposes of oviposition. The larvae are dead wood feeders (Hudson, 1934)

Genus: Lasiorrhynchus Lacordaire, 1866.

Lasiorrhynchus barbicornis (Fabricius, 1775).

Records: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 14. ii. 1966, 2 ♂; in pool of water, 15. ii. 1966, 1 ♂, (A.V. Spain).

Remarks: This species is apparently generally distributed throughout New Zealand but is commonest in the North Island. The larvae bore the dead wood of a number of trees (Hudson, 1934). It is probably of little significance in Olearia colensoi stands.

Family: CURCULIONIDAE

Remarks: This large and economically important family is represented in the collections from Olearia colensoi associations by a number of species taken from foliage, leaf litter and in light traps. The classification of this family follows Crowson's (1955) system with the modifications proposed by Kuschel (1964). All the species taken were identified by Dr. G. Kuschel of Entomology Division, D.S.I.R., Nelson, New Zealand.

Subfamily: Erirehinae

Genus: Peristoreus Kirsch, 1877.

Peristoreus oleariae (Broun, 1913).

Records: RUAHINE MOUNTAINS: Waipawa Saddle, beaten from Olearia colensoi foliage, 28. xii. 1966, 2 specimens, (A.V. Spain). Mt. Wharite, ex light trap, 3. xi. 1965, 1 specimen, (A.V. Spain). SOUTH ISLAND: Magister Ridge, ex light trap, 11. xii. 1964, 1 specimen; handpicked from Olearia colensoi foliage, 5. ii. 1966, 2 specimens, (A.V. Spain).

Remarks: This species was originally described from a specimen obtained from Mt. Quoin in the Tararua Mountains where it was noted feeding on Olearia colensoi (Broun, 1913). Kuschel (1964) states that members of this genus are host specific and confined to a single genus or group of species within a genus of plants. The larvae live within the main rachides of the inflorescences or in the fruits. Adults are diurnal and feed on the foliage, flowers and pollen of the same plant species as the larvae. Results of the present study confirm these statements for Peristoreus oleariae with the exception that they may be stimulated to become active at night, as evidenced by the two records from light trappings. It is considered that this species is unlikely to be important in the pathology of Olearia colensoi. This is because populations appear to be generally low and also because the destruction of a few inflorescences is unlikely to have serious consequences for a host plant species in which vegetative reproduction is prevalent.

Genus: Baeosomus Broun, 1904.

Baeosomus sp.

Record: 1 specimen in care of Dr. Kuschel, collection data unavailable.

Remarks: The adults of this genus are diurnal foliage feeders and occur in damp and mossy situations; most species are restricted to alpine or subalpine habitats (Kuschel, 1964). The larvae feed on the bases of mosses (Dr. G. Kuschel, pers. comm.).

Genus: Etheophanus Broun, 1886.

Etheophanus pinguis Broun, 1893.

Record: RUAHINE MOUNTAINS: Waipawa Saddle, from leaf litter of Olearia colensoi, 28. xii. 1966, 1 specimen, (A.V. Spain).

Remarks: The adults of this species are commonly found on ferns but it is not known whether they feed regularly on them. The larvae are unknown but most probably occur in dead wood (Dr. G. Kuschel, pers. comm.).

Genus: Storeus Schoenherr, 1843.

Storeus albosignatus Blackburn, 1890.

Record: RUAHINE MOUNTAINS: Mt. Wharite, handpicked from foliage of Olearia colensoi, date unknown, 1 specimen, (A.V. Spain).

Remarks: The host plant of this Australian species is Acacia verticillata Willd. Dr. G. Kuschel (pers. comm.) states that this species is probably genus specific in regard to its host plants and therefore is incidental on Olearia colensoi.

Subfamily: Leptopiinae

Genus: Platyomida White, 1846.

Platyomida morosa Broun, 1913.

Record: SOUTH ISLAND: Magister Ridge, handpicked from foliage of Olearia colensoi, 5. ii. 1966, 1 specimen, (A.V. Spain).

Remarks: This species was described from a single individual from Mt. Greenland (Broun, 1913). Dr. G. Kuschel states (pers. comm.) that this species is polyphagous with a very wide host range.

Subfamily: Aterpinae

Genus: Anagotus Sharp, 1882.

Anagotus rugosus (Broun, 1886).

Record: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 21. xii. 1966, 1 specimen, (A.V. Spain).

Remarks: This species was described from two specimens taken on islands in Cook Strait known as "The Brothers" (Broun, 1886). The larvae of this species have been reared from Coprosma sp. and the adults are also commonly found on this plant (Dr. G. Kuschel, pers. comm.).

Anagotus helmsi Sharp, 1893.

Record: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 29. x. 1966, 1 specimen, (A.V. Spain).

Remarks: Hudson (1934) states that this species is found in beech forests in both the North and South Islands. It is however, polyphagous as both adults and larvae have been recorded attacking plants as diverse as Nothofagus spp. and Pinus radiata Don. (Dr. G. Kuschel, pers. comm.).

Subfamily: Rhyparosominae

Genus: Gromilus Blanchard, 1853.

Gromilus acuminatus (Broun, 1913).

Record: TARARUA MOUNTAINS: Arête Stream Basin, handpicked from Olearia colensoi foliage, 19. xii. 1964, 1 specimen, (A.V. Spain).

Remarks: This species was described from Bold Peak near Lake Wakatipu at an altitude of 1680 metres (Broun, 1913). Kuschel (1964) states that

the adults of this genus are nocturnal feeders and spend the day hidden under stones, logs, in leaf litter. The feeding habits of the alpine members of this genus are practically unknown. Their larvae are probably subterranean and feed on cushions or mats of dicotyledonous plants. The lowland species feed on ferns (Dr. G. Kuschel, pers. comm.).

Genus: Hyperodes Jekel, 1865.

Hyperodes bonariensis Kuschel, 1955.

Record: RUAHINE MOUNTAINS: Mt. Wharite, beaten from foliage of Olearia colensoi, 21. xii. 1966, 1 specimen, (A.V. Spain).

Remarks: Only one specimen of this well known pasture pest was taken from Olearia colensoi. It no doubt originated from the grasslands below the collection site and its occurrence on Olearia colensoi can only be regarded as incidental.

Subfamily: Otiorrhynchinae

Genus: Tigones Broun, 1881.

Tigones binodulus (Sharp, 1886).

Records: RUAHINE MOUNTAINS: Mt. Wharite, handpicked from Olearia colensoi foliage, 24. xii. 1965, 1 specimen; 4. i. 1966, 3 specimens; 5. i. 1966, 4 specimens; 6. i. 1966, 1 specimen; 21. xii. 1966, 2 specimens; ex light trap, 5. i. 1966, 1 specimen, (A.V. Spain).

Remarks: This species was described from specimens collected at Greymouth (Broun, 1893) and is stated by Hudson (1934) to be common at Newton's Flat on the Buller River. Dr. G. Kuschel states (pers. comm.) that the adults of this species are polyphagous leaf feeders and the larvae subterranean root feeders.

Genus: Brachyolus White, 1846.

Brachyolus sp.

Record: TARARUA MOUNTAINS: Arête Stream Basin, beaten from Olearia colensoi foliage, 19. xii. 1964, 1 specimen, (A.V. Spain).

Remarks: Dr. G. Kuschel (pers. comm.) considers that this species is most likely polyphagous on many flowering plants and that its larvae are most probably to be found feeding around grass roots. He states that this species can not be named until the whole complex is further studied.

Subfamily: Phrynixinae

Genus: Phrynixus Pascoe, 1875.

Phrynixus thoracicus (Broun, 1893).

Records: RUAHINE MOUNTAINS: Waipawa Saddle, from Olearia colensoi leaf litter, 28. xii. 1966, 1 specimen, (A.V. Spain): Mt. Wharite, from Olearia colensoi leaf litter, 29. x. 1966, 1 specimen, (A.V. Spain).

Remarks: This species is apparently restricted to the North Island of New Zealand below latitude 37°S., but a doubtful record exists from the Auckland Islands (Kuschel, 1964). The type locality is Mt. Pirongia (Broun, 1893). The larvae of this species live in decaying wood. The adults are nocturnal feeders and probably polyphagous although they are common in forest litter from sea level to 1000 m. (Kuschel, 1964). The record from Waipawa Saddle extends the altitudinal range to at least 1300 m.

Genus: Amphiskirra Broun, 1909.

Amphiskirra umbricola Broun, 1909.

Record: RUAHINE MOUNTAINS: Waipawa Saddle, from Olearia colensoi leaf litter, 28. xii. 1966, 1 specimen, (A.V. Spain).

Remarks: Dr. G. Kuschel states (pers. comm.) that this is a litter dwelling species and that the larvae are only found in dead material. It was described from a specimen taken at Otira Gorge (Broun, 1909).

Genus: Sosgenes Broun, 1893.

Sosgenes discalis Broun, 1917.

Records: RUAHINE MOUNTAINS: Waipawa Saddle, from Olearia colensoi leaf litter, 28. xii. 1966, 13 specimens, (A.V. Spain). Mt. Wharite, from Olearia colensoi leaf litter, 29. x. 1966, 3 specimens, (A.V. Spain).

Remarks: Dr. G. Kuschel states (pers. comm.) that the ecology of this species is unknown but that it probably breeds in rotting wood. Broun (1917) recorded this species from "cotton plants" at approximately 650 metres on Mt. Algidus.

Subfamily: Cryptorrhynchinae

Genus: Zeacalles Broun, 1893.

Zeacalles binodosus Broun, 1910.

Record: RUAHINE MOUNTAINS: Waipawa Saddle, from Olearia colensoi leaf litter, 28. xii. 1966, 1 specimen, (A.V. Spain).

Remarks: This species was described from species collected from leaf litter at Waimarino. Its ecology appears to be unknown.

Subfamily: Scolytinae

Genus: Hylastes Erichson, 1836.

Hylastes ater (Paykull, 1800).

Record: RUAHINE MOUNTAINS: Mt. Wharite, from Olearia colensoi foliage, date unknown, 1 specimen, (A.V. Spain).

Remarks: This cosmopolitan pest of exotic conifers has been known to occur in New Zealand since 1929 (Clark, 1932). The larvae breed in stumps and dead trees and the adults cause damage to young Pinus radiata Don. by feeding on the cambium (Clark, 1932). It is thus of no significance in Olearia colensoi stands.

Conclusions.

It is considered that the only Coleoptera of importance to the health of Olearia colensoi are members of the families Chrysomelidae and Curculionidae. However, the numbers taken indicate that population levels are too low at present for them to cause much damage to Olearia colensoi stands. The wood boring cerambycid may be locally important in the Tararua Mountains but signs of wood boring in living shrubs have not been observed elsewhere. The effects of the members of the family Helodidae on Olearia colensoi are somewhat obscure and the elucidation of their feeding habits must await the results of gut analyses of the various species taken.

ORDER: DIPTERA

During the course of the study a number of Diptera were collected. It was realised that the members of this order would probably not have much direct effect on the health of Olearia colensoi thus, little time was devoted to their collection and, most probably, only the more conspicuous were taken. It was, however, considered worthwhile to collect those that were noted for the following reasons.

Firstly, many Diptera are predatory or parasitic and may aid in the natural regulation of the arthropods occurring on Olearia colensoi. Secondly, the larvae of many families breed in decaying leaf litter and are partially responsible for breaking it down, thereby aiding nutrient recycling. Thirdly, it was considered desirable to increase the present records of subalpine Diptera, and for purposes of this study, those occurring in Olearia colensoi stands. The final reason for collecting was to ascertain whether there were any phytophagous species present. Most of the flies were collected by sweeping the foliage of Olearia colensoi with a hand net and others were taken by general sweeping within associations of this plant. A few larvae were collected from the foliage and one from a tunnel in a living branch.

The classification used is that of Imms (1960). However, some minor modifications have been made below the family level and these are acknowledged in the text.

Dr. R.A. Harrison, of Lincoln College, New Zealand, confirmed many of the determinations made in this order.

Suborder: NEMATOCERA

Family: TIPULIDAE

Remarks: Most tipulid larvae are terrestrial and live among grass, roots or in decaying vegetation. Others are aquatic and some occur in decaying wood (Imms, 1960). The adults of many New Zealand species have been described but their larval habits are poorly known. They were studied by Edwards (1923) who provided keys to the 160 tipuloid flies then known. This total has since increased markedly and Miller (1950) in his catalogue of The New Zealand Diptera was able to list a total of 538 species of Tipulidae. Tillyard (1926) stated that he considered the Tipulid fauna of New Zealand to be one of the most abundant in the world.

The classification of this family follows that of Edward (1923), with minor modifications that are acknowledged in the text.

Subfamily: Limnobiinae

Tribe: Limnobiini

Genus: Limonia Meigen, 1803.

Subgenus: Dicranomyia Stephens, 1829.

Limonia (Dicranomyia) sp. a.

Record: TARARUA MOUNTAINS: Arête Stream Basin, ex light trap, 7. xii. 1965, 1 specimen, (A.V. Spain).

Remarks: Mr. P. Johns, of the University of Canterbury, New Zealand considers (pers. comm.) that this is probably a new species related to Limonia (Dicranomyia) luteonitens Edwards, 1923. Imms (1960) states that the larvae of this subgenus are aquatic or semi aquatic.

Limonia (Dicranomyia) sp. b.

Records: TARARUA MOUNTAINS: Arête Stream Basin, ex light trap, 7. xii. 1965, 1 specimen, (A.V. Spain).

Remarks: This specimen appears to belong to an undescribed species.

Subgenus: Zelandoglochina Alexander, 1924.

Limonia (Zelandoglochina) huttoni (Hutton, 1900).

Records: RUAHINE MOUNTAINS: Mt. Wharite, swept from Olearia colensoi foliage, 21. xii. 1966, 1 specimen, (A.V. Spain).

Remarks: This species has previously been recorded from Wellington, Te Wairoa (Edwards, 1923), Ohakune, Kariot, Raetihi Hill and at 1000 to 1300 metres on Mt. Ruapehu (Alexander, 1929).

Limonia (Zelandoglochina) sp. a.

Records: TARARUA MOUNTAINS: Arête Stream Basin, ex light trap, 18. xii. 1964, 1 specimen, (A.V. Spain).

Remarks: Mr. P. Johns considers (pers. comm.) that this specimen is a member of a new species near Limonia (Zelandoglochina) melanogramma (Edwards, 1923).

Limonia (Zelandoglochina) sp. b.

Records: SOUTH ISLAND: Magister Ridge, ex light trap, 19. ii. 1965, 1 specimen, (A.V. Spain).

Remarks: Mr. P. Johns considers (pers. comm.) that this is probably a member of a new species.

Tribe: Eriopterini

Genus: Molophilus Curtis, 1831.

Molophilus sp. a.

Records: SOUTH ISLAND: Magister Ridge, ex light trap, 11. xii. 1964, 2 specimens, (A.V. Spain).

Molophilus sp. b.

Record: SOUTH ISLAND: Magister Ridge, ex light trap, 19. ii. 1965,

1 specimen, (A.V. Spain).

Molophilus sp. c.

Record: RUAHINE MOUNTAINS: Waipawa Saddle, swept from Olearia colensoi foliage, 28. xii. 1966, 1 ♀, (A.V. Spain).

Tribe: Limnophilini

Genus: Gynoplistia Westwood, 1835.

Gynoplistia sackeni Alexander, 1920.

Records: SOUTH ISLAND: Magister Ridge, ex light trap, 20. i. 1965, 3 ♂; swept from Olearia colensoi foliage, 22. i. 1965, 1 ♂, (A.V. Spain).

Remarks: Edwards (1923) gives only one record of this species from Wellington but Alexander (1929) records it from Ohakune, Karioi, and Raetihi Hill.

Gynoplistia cuprea Hutton, 1900.

Records: RUAHINE MOUNTAINS: Mt. Wharite, swept from Olearia colensoi foliage, 15. ii. 1966, 1 ♀, (A.V. Spain).

Remarks: Edwards (1923) records this species from Porirua (in forest), Wellington and Canterbury.

Gynoplistia sp. a.

Record: RUAHINE MOUNTAINS: Waipawa Saddle, swept from Olearia colensoi foliage, 28. xii. 1966, 1 ♂, (A.V. Spain).

Gynoplistia sp. b.

Record: RUAHINE MOUNTAINS: Mt. Wharite, handnetted in Olearia colensoi association, 5. i. 1966, 1 ♀, (A.V. Spain).

Genus: Limnophila Macquart, 1834.

Limnophila argus Hutton, 1900.

Record: RUAHINE MOUNTAINS: Mt. Wharite, handnetted in Olearia colensoi association, 4. i. 1966, 1 ♂, 1 ♀, (A.V. Spain).

Remarks: This species has previously been recorded from Wellington, Kennedy's Bush (Edwards, 1923), Ohakune, Karioi, Raetihi Hill and on Mt. Ruapehu from about 1000 to nearly 1500 metres, (Alexander, 1929).

Limnophila skusei Hutton, 1902.

Records: SOUTH ISLAND: Magister Ridge, ex light trap, 20. i. 1965, 1 ♂, (A.V. Spain).

Remarks: This appears to be a widespread species and is recorded by Edwards (1923) from various localities in the North and South Islands.

Genus: Orolimnophila Alexander, 1913.

Orolimnophila eluta Edwards, 1923.

Record: SOUTH ISLAND: Magister Ridge, swept from Olearia colensoi foliage, 5. ii. 1966, 1 ♂, (A.V. Spain).

Remarks: This species has been previously recorded from Mt. Arthur, Mt. Grey and Otira (Edwards, 1923) and appears to favour higher altitudes.

Orolimnophila sp.

Record: RUAHINE MOUNTAINS: Mt. Wharite, handpicked from Olearia colensoi foliage, 11. i. 1966, 1 ♀, (A.V. Spain).

Genus: Rhamphophila Edwards, 1923.

Rhamphophila obscuripennis (Hudson, 1895).

Record: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 21. xii. 1966, 1 ♀, (A.V. Spain).

Remarks: This species has been previously recorded from Auckland, the Wellington district, Te Wairoa and Papatotara (Edwards, 1923). The

larvae of this species inhabit fallen tree trunks in an advanced state of decay and form burrows between the soft decayed portions and the harder part of the wood (Hudson?, pers. comm. in Edwards, 1923).

Subfamily: Tipulinae

Genus: Holorusia Loew, 1863.

Holorusia novarae (Schiner, 1868).

Records: RUAHINE MOUNTAINS: Mt. Wharite, handpicked from Olearia colensoi foliage, 13. xii. 1965, 1 ♀; 15. xii. 1965, 1 ♂, (A.V. Spain).

Remarks: Hutton (1899) states that this species is common throughout New Zealand.

Genus: Macromastix Osten - Sacken, 1886.

Macromastix ferruginosa Edwards, 1923.

Records: RUAHINE MOUNTAINS: Mt. Wharite, swept from Olearia colensoi foliage, 14. ii. 1966, 8 specimens; ex light trap, 14. ii. 1966, 4 specimens; handnetted in Olearia colensoi association, 15. ii. 1966, 2 specimens, (A.V. Spain).

Remarks: This species was noted to be very common during mid February, 1966 in the Olearia colensoi associations on Mt. Wharite, Edwards (1923) records it from Wainuiomata where it was taken from glades in the forest.

Macromastix rufiventris Edwards, 1923.

Records: RUAHINE MOUNTAINS: Mt. Wharite, handnetted in Olearia colensoi association, 5. i. 1966, 1 specimen; 15. ii. 1966, 3 specimens, (A.V. Spain). TARARUA MOUNTAINS: Waingawa Ridge, handnetted in Olearia colensoi association, 17. ii. 1966, 7 specimens, (A.V. Spain).

Remarks: Edwards (1923) states that this species was "formerly extremely abundant on hilltops, now (1921) very rare".

Macromastix sp.

Records: RUAHINE MOUNTAINS: Mt. Wharite, swept from Olearia colensoi foliage, 21. xii. 1966, 6 specimens; ex light trap, 21. xii. 1966, 2 specimens, (A.V. Spain).

Larvae

Subfamily: Tipulinae

Genus: Macromastix Osten - Sacken, 1886.

Macromastix sp.

Record: TARARUA MOUNTAINS: Arête Stream Basin, from tunnel in Olearia colensoi branch, 17. 5. 1964, 1 specimen, (A.V. Spain).

Remarks: The presence of a stem borer of some sort was indicated by a yellowing of part of the canopy of an otherwise healthy plant. On splitting the affected branch the above larva was noted in the terminal part of a tunnel. Dr. G. Kuschel, of Entomology Division, D.S.I.R., Nelson, New Zealand, made the tentative generic determination of this larva and stated (pers. comm.) that it was probably secondary in this situation and utilizing the tunnel previously formed by another wood boring larva.

Family: PSYCHODIDAE

Remarks: The larvae of this family live in decaying vegetable matter, dung or water (Curran, 1965). The larvae of the species below were probably living in the leaf litter of Olearia colensoi.

Genus: Pericoma Walker, 1856.

Pericoma sp.

Record: SOUTH ISLAND: Pillan's Pass, beaten from Olearia colensoi foliage, 2. i. 1967, 1 ♂, (A.V. Spain).

Genus: Psychoda Latreille, 1796.

Psychoda sp.

Records: RUAHINE MOUNTAINS: Mt. Wharite, from leaf litter of Olearia colensoi, 29. x. 1966, 4 ♀; beaten from foliage of Olearia colensoi, 21. xii. 1966, 22 specimens, (A.V. Spain).

Remarks: The pupae of this species probably occur in the leaf litter as the records from this habitat were of specimens that appeared in the collecting tube of the Tullgren funnels being used to extract the fauna of this layer. It is probable that the warmth of the dessicating lamp caused their emergence from the pupae.

Family: TRICHOCERIDAE

Genus: Paracladura Brunetti, 1911.

Paracladura sp. a.

Record: RUAHINE MOUNTAINS: Mt. Wharite, handnetted in Olearia colensoi association, 28. viii. 1966, 7 specimens; ex light trap, 29. x. 1966, 8 specimens, (A.V. Spain).

Paracladura sp. b.

Record: TARARUA MOUNTAINS: Arête Stream Basin, ex light trap, 7. xii. 1965, 1 specimen, (A.V. Spain).

Family: MYCETOPHILIDAE

Remarks: This family is well represented in New Zealand and Miller (1950) was able to record 263 species. The larvae of this family live in moist soil, wood and decaying vegetable matter. The family derives its common name of fungus gnats from the fact that the larvae frequently feed on fungi (Curran, 1965; Imms, 1960). Tonnoir and Edwards (1927) studied the New Zealand members of the family and provided keys to the

adults of the species then recorded. These authors stated that very few of the larvae were known, a situation that has not yet changed.

Subfamily: Ditomylinae

Genus: Nerviuncta Marshall, 1896.

Nerviuncta hexachaeta Edwards, 1927.

Record: RUAHINE MOUNTAINS: Mt. Wharite, swept from Olearia colensoi foliage, 21. xii. 1966, 1 ♂, (A.V. Spain).

Remarks: Tonnoir and Edwards (1927) note that this species is widely distributed and that it shows some variation.

Subfamily: Macrocerinae

Genus: Macrocera Meigen, 1803.

Macrocera hudsoni Tonnoir, 1927.

Record: RUAHINE MOUNTAINS: Mt. Wharite, swept from Olearia colensoi foliage, 21. xii. 1966, 2 ♂, (A.V. Spain).

Remarks: Tonnoir and Edwards (1927) note that this species is widespread in both the North and South Islands.

Subfamily: Mycetophilinae

Genus: Mycetophila Meigen, 1803.

Mycetophila grandis Tonnoir, 1927.

Record: TARARUA MOUNTAINS: Arête Stream Basin, ex light trap, 7. xii. 1965, 1 specimen, (A.V. Spain).

Remarks: This species appears to be widespread in both the North and South Islands, to judge from the records given by Tonnoir and Edwards (1927).

Mycetophila griseofusca Tonnoir, 1927.

Record: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 29. x. 1966, 2 specimens, (A.V. Spain).

Remarks: This specimen has been recorded only from Mt. Arthur, the type locality, by Tonnoir and Edwards (1927).

Mycetophila grisescens Edwards, 1927.

Record: RUAHINE MOUNTAINS: Mt. Wharite, handnetted in Olearia colensoi association, 29. x. 1966, 1 ♂, (A.V. Spain).

Remarks: This species was recorded from Ohakune and Mt. Grey by Tonnoir and Edwards (1927).

Mycetophila subspinigera Tonnoir, 1927.

Record: RUAHINE MOUNTAINS: Mt. Wharite, swept from Olearia colensoi foliage, 5. i. 1966, 1 specimen, (A.V. Spain).

Remarks: Tonnoir and Edwards (1927) comment that this species is one of the most abundant of this family and record it from numerous localities all over New Zealand.

Family: BIBIONIDAE

Remarks: Hardy (1953) stated that this family is poorly represented in New Zealand with only two genera and seven species being known at that time. The larvae of this family feed on decaying vegetable matter and pupate in the soil (Curran, 1965).

Genus: Dilophus Meigen, 1803.

Dilophus nigrostigmata (Walker, 1848).

Records: RUAHINE MOUNTAINS: Mt. Wharite, handnetted from Olearia colensoi association, 4. i. 1966, 1 specimen; 5. i. 1966, 3 specimens, (A.V. Spain).

Remarks: This species appears to be widely distributed in the North Island (Hardy, 1953) and has been recorded swarming on mountain tops (Hudson, 1950).

Dilophus harrisoni (Hardy, 1953).

Record: RUAHINE MOUNTAINS: Mt. Wharite, handnetted from Olearia colensoi association, 13. xii. 1965, (A.V. Spain).

Remarks: This species appears to favour higher altitudes and is recorded by Hardy (1953) from Tongariro National Park, the type locality.

Family: CHIRONOMIDAE

Remarks: Freeman (1959) recorded a total of 41 described species of this family from New Zealand. He stated however, that about 50 species were known to him but some were unavailable for description as the specimens were either damaged or consisted only of females. In the same work, keys to the adults of the described species are presented. The larvae of this family are aquatic, or semi-aquatic while others occur in decaying vegetation. The records below indicate breeding in this latter habitat.

Subfamily: Orthocladiinae

Genus: Orthocladius Wulp, 1874.

Orthocladius sp. a.

Record: SOUTH ISLAND: Magister Ridge, handnetted from Olearia colensoi association, 25. ix. 1966, 6 specimens, (A.V. Spain).

Orthocladius sp. b.

Record: RUAHINE MOUNTAINS: Mt. Wharite, ex leaf litter of Olearia colensoi, 29. x. 1966, 1 ♂, (A.V. Spain).

Remarks: This specimen was found in the collecting tube of the Tullgren funnel that was being used to extract the fauna of the litter sample. Most probably the warmth of the dessicating lamp caused the adult to emerge from the pupa.

Genus: Anatopynia Johannsen, 1905.

Anatopynia antarctica (Hudson, 1892).

Record: RUAHINE MOUNTAINS: Waipawa Saddle, ex leaf litter of Olearia colensoi, 28. xii. 1966, 1 specimen, (A.V. Spain).

Remarks: See remarks under Orthocladus sp. b. which also apply to this species.

Genus: Smittia Holmgren, 1869.

Smittia sp.

Record: RUAHINE MOUNTAINS: Mt. Wharite, swept from Olearia colensoi foliage, 29. x. 1966, 1 ♂, (A.V. Spain).

Subfamily: Tanypodinae

Genus: Pentaneura Philippi, 1865.

Subgenus: Ablabesmyia Johannsen, 1905.

Pentaneura (Ablabesmyia) malus (Hutton, 1902).

Record: RUAHINE MOUNTAINS: Mt. Wharite, ex leaf litter of Olearia colensoi, 29. x. 1966, 1 ♀, (A.V. Spain).

Remarks: See remarks on Orthocladus sp. b. for details of extraction.

Genus: Metriocnemus Wulp, 1874.

Metriocnemus sp.

Record: RUAHINE MOUNTAINS: Mt. Wharite, handnetted in Olearia colensoi association, 5. i. 1966, 1 specimen, (A.V. Spain).

Subfamily: Chironominae

Tribe: Chironomini

Genus: Chironomus Meigen, 1803.

Subgenus: Chironomus Meigen, 1803.

Chironomus (Chironomus) zealandicus Hudson, 1892.

Record: RUAHINE MOUNTAINS: Mt. Wharite, ex leaf litter of Olearia colensoi, 29. x. 1966, 1 ♂, 14 ♀, (A.V. Spain).

Remarks: Freeman (1959) remarks that this species is both common and widely distributed. See remarks under Orthocladus sp. b. for details of extraction.

Family: CECIDOMYIIDAE

Remarks: Miller (1950) records 25 species of Cecidomyiidae from New Zealand. The taxonomy of the family in this country is somewhat confused as the type specimens of the 12 species described by Marshall are stated by Miller (1950) to be lost, thus extensive collecting at the type localities is needed to provide specimens for redescriptions. Since Miller's (1950) catalogue appeared three new gall forming species have been described by Lamb (1951 a, b; 1954) to bring the New Zealand total to 28.

Genus: Miastor Meinert, 1864.

Miastor sp.

Record: SOUTH ISLAND: Mt. Fox, handpicked from sample of Olearia colensoi foliage, 6. xi. 1966, 1 specimen, (P. Wardle).

Immature Cecidomyiidae.

Records: RUAHINE MOUNTAINS: Waipawa Saddle, handpicked from sample of Olearia colensoi foliage, 28. xii. 1966, 8 specimens, (A.V. Spain): Mt. Wharite, handpicked from sample of Olearia colensoi foliage, 29. x. 1966, 4 specimens, (A.V. Spain). SOUTH ISLAND: Magister Ridge, handpicked from sample of Olearia colensoi foliage, 29. ix. 1966, 5 specimens, (A.V. Spain).

Remarks: As indicated by the records cecidomyid larvae occur fairly widely, and commonly, on Olearia colensoi foliage. No galling or other plant damage was noted where these larvae were present and it is considered that they are probably predatory.

Suborder: BRACHYCERA

Family: STRATIOMYIIDAE

Remarks: This family is represented by 29 species in New Zealand (Miller, 1950). Curran (1965) states that the larvae of this family are predacious, live in decaying vegetation, under bark or are aquatic. The adults are known as soldier flies and often may be found on flowers, foliage or in long grass near water (Curran, 1965).

Subfamily: Beridinae

Genus: Benhamyia Miller, 1920.

Benhamyia straznitskii (Nowicki, 1875).

Records: RUAHINE MOUNTAINS: Mt. Wharite, handnetted in Olearia colensoi association, 5. i. 1966, 2 specimens; ex light trap, 5. i. 1966, 2 specimens; ex light trap, 14. ii. 1966, 6 specimens, (A.V. Spain).

Remarks: This species has been previously recorded from Auckland and

Southland (Miller, 1917).

Subfamily: Odontomyiinae

Genus: Eulalia Meigen, 1800.

Eulalia neodorsalis (Walker, 1849).

Record: RUAHINE MOUNTAINS: Mt. Wharite, handnetted in Olearia colensoi association, 5. 1. 1966, 1 specimen, (A.V. Spain).

Remarks: This species has previously been recorded from Auckland and Napier (Hutton, 1901).

Family: TABANIDAE

Remarks: The New Zealand tabanid fauna is a restricted one and possibly derived from an extensive Antarctic radiation (Mackerras, 1957). Miller (1950) lists the New Zealand tabanid fauna as 21 species but Mackerras (1957) reduced this to 16.

The female members of this family are well known bloodsuckers all over the world (Curran, 1965). The males however do not suck blood and those of some species feed on pollen and nectar (Curran, 1965). Tillyard (1926) records Scaptia (Pseudoscione) adrel (Walker, 1850) as visiting the flowers of Leptospermum scoparium, J.R. et G. Forst. The larvae are predacious, aquatic, or semi-aquatic and pupation takes place in the soil (Curran, 1965). The tabanids are pests of minor status in New Zealand and Miller (1939) says that members of this family sometimes worry cattle, but to no great extent. Tillyard (1926) states that Dasybasis (Protodasyommia) sarpa (Walker, 1850) and other species are found resting on river beds but seldom appear to bite.

Subfamily: Pangoniinae

Tribe: Scionini

Genus: Scaptia Walker, 1856.

Subgenus: Pseudoscione Lutz, Araujo and Fonseca, 1918.

Scaptia (Pseudoscione) brevipalpis Krober, 1931.

Record: RUAHINE MOUNTAINS: Mt. Wharite, handnetted in Olearia colensoi association, 5. i. 1966, 1 specimen, (A.V. Spain).

Remarks: This species has been recorded from Mt. Ruapehu in the North to Wallacetown in the South. It has previously been recorded from as high as 1300 metres on Mt. Ruapehu (Mackerras, 1957).

Subfamily: Tabaninae

Tribe: Diachlorini

Genus: Dasybasis Macquart, 1847.

Subgenus: Protodasyommia Enderlein, 1925.

Dasybasis (Protodasyommia) truncata (Walker, 1850).

Record: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 14. ii. 1966, 1 specimen, (A.V. Spain).

Remarks: This species has previously been recorded from several localities in both the North and South Islands. These localities range from Lake Taupo in the North to as far South as Nelson (Mackerras, 1957).

Family: DOLICHOPODIDAE

Remarks: The adults of this family are all predacious and Curran (1965) states that they feed on smaller insects and mites. Curran (1965) also states that little is known of the immature stages but considers that

those living in decaying vegetation are probably predacious. Parent (1933) states that New Zealand has a very rich dolichopodid fauna and records 107 species. He states that this total is the result of only a few years' collecting and that more remain to be discovered. In spite of this, few further members of the family have been described from this country. Parent (1933) also comments on the high level on endemism at the specific level.

Subfamily: Chrysosmatinae

Genus: Chrysosma Guérin, 1831.

Chrysosma dictaetum Parent, 1933.

Records: RUAHINE MOUNTAINS: Mt. Wharite, handnetted in Olearia colensoi association, 21. xii. 1966, 1 ♂, 1 ♀, (A.V. Spain).

Remarks: This species has been recorded from various places in both the North and South Islands ranging in latitude from Auckland to Dunedin (Parent, 1933).

Family: EMPIDIDAE

Remarks: This family is well represented in New Zealand and Miller (1950) recorded 108 species from this country. The adults of this family are all predacious and feed, for example, on small insects and mites. The immature stages are not well known but the larvae are found in decaying vegetation, under bark and in streams (Curran, 1965).

Subfamily: Empidinae

Genus: Empis Linnaeus, 1758.

Empis probata Collin, 1928.

Record: RUAHINE MOUNTAINS: Waipawa Saddle, handnetted in Olearia

colensoi association, 28. xii. 1966, 1 o, (A.V. Spain).

Remarks: Collin (1928) records this species only from Ohakune.

Subfamily: Homalocneminae

Genus: Homalocnemis Philippi, 1865.

Homalocnemis inexpletus Collin, 1928.

Record: RUAHINE MOUNTAINS: Mt. Wharite, handnetted in Olearia colensoi association, 5. i. 1966, 1 specimen, (A.V. Spain).

Remarks: This species is recorded from Blackball and Kumara (Malloch, 1932) and from Lake Manapouri at approximately 1300 metres (Collin, 1928).

Subfamily: Hemerodrominae

Genus: Chelipoda Macquart, 1823.

Chelipoda longicornis Collin, 1928.

Record: RUAHINE MOUNTAINS: Mt. Wharite, handnetted in Olearia colensoi association, 5. i. 1966, 1 specimen, (A.V. Spain).

Remarks: Collin (1928) records this species only from Ohakune.

Genus: Cladromia Bezzi, 1905.

Cladromia soleata Collin, 1928.

Record: SOUTH ISLAND: Pillan's Pass, swept from Olearia colensoi foliage, 1. ii. 1965, 1 specimen, (A.V. Spain).

Remarks: Collin (1928) records this species from Glenorchy and Queenstown.

Subfamily: Ocydrominae

Genus: Scelolabes Philippi, 1865.

Scelolabes sp.

Record: TARARUA MOUNTAINS: Arête Stream Basin, ex light trap, 7. xii. 1965, 1 specimen, (A.V. Spain).

Remarks: This specimen keys to the above genus in Collin's (1928) work but it is not Scelolabes fulvescens (Miller, 1923).

Suborder: CYCLORRHAPHA

Section: ASCHIZA

Family: SYRPHIDAE

Remarks: This family is well represented in New Zealand and Miller (1950) records 44 species. The larval habits of this family are varied, with species of phytophagous, predacious and saprophagous habits known (Imms, 1960).

Subfamily: Syrphinae

Genus: Syrphus Fabricius, 1775.

Syrphus novae-zealandiae Macquart, 1885.

Records: RUAHINE MOUNTAINS: Mt. Wharite, handnetted in Olearia colensoi association, 5. i. 1966, 2 specimens; 15. ii. 1966, 1 specimen, (A.V. Spain). TARARUA MOUNTAINS: Waingawa Ridge, swept from Olearia colensoi foliage, 17. ii. 1966, 1 specimen, (A.V. Spain).

Remarks: The larvae of this species are important predators on aphids and caterpillars. (Miller, 1918 and 1921). Miller (1921) stated that this species is abundant throughout New Zealand, the Kermadec and

Chatham Islands and is active for most of the year.

Subfamily: Eristalinae

Genus: Helophilus Meigen, 1822.

Helophilus antipodus Schiner, 1868.

Record: RUAHINE MOUNTAINS: Mt. Wharite, handnetted in Olearia colensoi association, 5. 1. 1966, 1 specimen, (A.V. Spain).

Remarks: Imms (1960) states that the larvae of this genus are saphrophagous and live in decaying organic matter such as dung, liquid mud or dirty water. Tillyard (1926) recorded that the adult of this species is a flower visitor.

Family: PHORIDAE

Remarks: This family is represented by 29 species in New Zealand (Miller, 1950). The larval habits are diverse with some species being parasitic while others are scavengers, (Curran, 1965).

Genus: Megaselia Rondani, 1856.

Subgenus: Aphiochaeta Brues, 1903.

Megaselia (Aphiochaeta) comparabilis Schmitz, 1929.

Record: RUAHINE MOUNTAINS: Mt. Wharite, swept from Olearia colensoi foliage, 21. xii. 1966, 1 specimen, (A.V. Spain).

Remarks: This species has been previously recorded from Nelson (Bridarolli, 1937).

Family: LONCHOPTERIDAE

Remarks: This is a small family of less than two dozen species (Curran, 1965) of which only the one recorded below is present in New Zealand (Harrison, 1950). Curran (1965) states that the adults are found in moist places, especially near streams and that the larvae are found under leaves and decaying vegetation.

Genus: Lonchoptera Meigen, 1803.

Lonchoptera dubia Curran, 1934.

Record: RUAHINE MOUNTAINS: Mt. Wharite, swept from foliage of Olearia colensoi, 21. xii. 1966, 1 ♀, (A.V. Spain).

Remarks: This species has previously been recorded as being distributed throughout the North Island (Cumber and Harrison, 1959).

Section: SCHIZOPHORA

Group I: ACALYPTRATAE

Family: SPHAEROCERIDAE

Remarks: These flies are small, usually black bodied and mostly breed in decaying plant materials or excrement. They appear to be widespread (Imms, 1960) and are represented in New Zealand by four general and 19 species.

Genus: Leptocera Olivier, 1913.

Subgenus: Limosina Macquart, 1835.

Leptocera (Limosina) luteilabris (Rondani, 1880).

Record: RUAHINE MOUNTAINS: Mt. Wharite, swept from Olearia colensoi

foliage, 5. i. 1966, 1 specimen, (A.V. Spain).

Remarks: A European species previously recorded in New Zealand from Auckland and Christchurch (Harrison, 1959).

Leptocera (Limosina) sp.

Record: RUAHINE MOUNTAINS: Mt. Wharite, handnetted in Olearia colensoi association, 5. i. 1966, 1 specimen, (A.V. Spain).

Remarks: This species was too damaged to permit further determination.

Family: EPHYDRIDAE

Remarks: This family is represented in New Zealand by 11 genera and 24 species (Harrison, 1959). Larval habits vary and phytophagous, saprophagous and parasitic species are known (Imms, 1960).

Subfamily: Hydrelliinae

Genus: Hydrellia Robineau - Desvoidy, 1830.

Hydrellia tritici Coquillett, 1903.

Records: RUAHINE MOUNTAINS: Mt. Wharite, handnetted in Olearia colensoi association, 5. i. 1966, 5 specimens; swept from Olearia colensoi foliage, 21. xii. 1966, 3 specimens, (A.V. Spain).

Remarks: This very common phytophagous pasture species is endemic to Australia and has been spread to New Zealand through the agency of man. It is widely distributed throughout this country and the adults have been recorded as present from July to April (Harrison, 1959).

Cumber and Harrison (1959) consider it probable that this species causes some damage to pastures.

Family: DROSOPHILIDAE

Remarks: This well known family is represented in New Zealand by two genera and 12 species (Harrison, 1959). The larval habits of this group vary and include saprophagous, phytophagous and predacious species (Imms, 1960).

Genus: Scaptomyza Hardy, 1849.

Scaptomyza fuscitarsis Harrison, 1959.

Record: RUAHINE MOUNTAINS: Mt. Wharite, swept from Olearia colensoi foliage, 21. xii. 1966, 1 specimen, (A.V. Spain).

Remarks: Harrison (1959) states that this possibly endemic species is regarded, along with the other New Zealand species of the genus, as a leaf miner in grasses.

Family: CALLIPHORIDAE

Remarks: The members of this family are important in the reduction of carrion and will also breed in decaying vegetation. They are important economically as they cause myiasis of stock and also because of their house entering habits. There are 19 members of this family recorded from this country, some of which are introduced (Miller, 1950).

Subfamily: Calliphorinae

Tribe: Calliphorini

Genus: Calliphora Robineau - Desvoidy, 1830.

Calliphora quadrimaculata (Svederus, 1787).

Records: RUAHINE MOUNTAINS: Waipawa Saddle, handnetted in Olearia

colensoi association, 28. xii. 1966, 2 specimens, (A.V. Spain): Mt. Wharite, in building, 23. xii. 1965, 5 specimens; handnetted in Olearia colensoi association, 15. ii. 1966, 4 specimens; 29. x. 1966, 1 specimen; 21. xii. 1966, 1 specimen, (A.V. Spain). TARARUA MOUNTAINS: Waingawa Ridge, handnetted in Olearia colensoi association, 17. ii. 1966, 1 specimen, (A.V. Spain). SOUTH ISLAND: Pillan's Pass, handnetted in Olearia colensoi association, 2. i. 1967, 2 specimens, (A.V. Spain).

Remarks: Miller (1939) states that this species is common throughout New Zealand, the Auckland and Campbell Islands. It is well known as a sheep blowfly that causes secondary external myiases.

Calliphora laemica (White, 1843).

Record: RUAHINE MOUNTAINS: Mt. Wharite, handnetted in Olearia colensoi association, 21. xii. 1966, 1 ♀, (A.V. Spain).

Remarks: Miller (1939) states that this species occurs throughout New Zealand and adjacent islands. It is a primary sheep blowfly and when the weather is hot may produce living larvae.

Family: TACHINIDAE

Remarks: This family, of which the larvae are uniformly parasitic, is represented in New Zealand by 131 species (Miller, 1950) but Mr. J. Dugdale, of Entomology Division, D.S.I.R., New Zealand, states (pers. comm.) that he knows of at least 160 distinct morphs and that, for 40 of these, the hosts and mode of attack are known. The habits of the adults are very much alike and, in this stage, they are mainly found among vegetation and particularly on flowers (Imms, 1960). Tachinid flies normally oviposit on the host insect but this is not invariable (Curran, 1965). Common hosts are lepidopterous larvae, coleopterous larvae and adults and, less commonly, members of the orders Orthoptera,

Hemiptera, Hymenoptera and other Diptera (Imms, 1960). As Curran (1965) states, this group is in a hopeless state taxonomically. Malloch (1938) describes a large number of new species and provides a useful key to genera.

Subfamily: Tachininae

Genus: Campylia Malloch, 1938.

Campylia temerarium (Hutton, 1901).

Record: RUAHINE MOUNTAINS: Mt. Wharite, swept from Olearia colensoi foliage, 4. i. 1965, 1 ♀, (A.V. Spain).

Remarks: Malloch (1938) records this species from Christchurch, Cass, Weraroa, Mt. Cargill, Nelson and Aniseed Valley.

Genus: Perrissina Malloch, 1938.

Perrissina bruniceps Malloch, 1938.

Record: RUAHINE MOUNTAINS: Mt. Wharite, handnetted in Olearia colensoi association, 11. i. 1966, 1 ♂, (A.V. Spain).

Remarks: Malloch (1938) records this species only from Auckland.

Genus: Medinella Malloch, 1938.

Medinella flavofemorata Malloch, 1938.

Record: TARARUA MOUNTAINS: Waingawa Ridge, swept from Olearia colensoi foliage, 17. ii. 1966, 1 ♀, (A.V. Spain).

Remarks: Malloch (1938) records this species from Cass, Flagstaff Hill and Nelson.

Genus: Phaoniella Malloch, 1938.

Phaoniella bifida Malloch, 1938.

Records: RUAHINE MOUNTAINS: Mt. Wharite, swept from Olearia colensoi foliage, 4. i. 1966, 1 ♂; handnetted in Olearia colensoi

association, 5. i. 1966, 1 ♂; 10. i. 1966, 1 ♂; 11. i. 1966, 1 ♂,
(A.V. Spain).

Remarks: Malloch (1938) records this species from a number of localities in the South Island (Mt. Arthur, Lake Peel, Mt. Peel). Most of these records were at high altitudes and this can probably be considered an alpine species.

Family: MUSCIDAE

Remarks: A number of specimens were taken that belonged to this family but no attempt was made to identify them further.

Conclusions.

It is considered that the Diptera taken probably have little direct effect on the health of Olearia colensoi. However, the members of the predatory and parasitic families present probably play a small part in helping to control the arthropods that occur on the foliage. Also, the larvae of many families breed in the decaying leaf litter and are partially responsible for breaking it down, thereby aiding nutrient recycling.

Thus, the members of this order can probably be regarded as generally beneficial to the health of Olearia colensoi stands.

ORDER LEPIDOPTERA

Because they were considered to be potentially the most important pathogens of Olearia colensoi, the Lepidoptera were sampled in both the adult and immature stages. The principal aim of sampling the adult Lepidoptera was to gather information on the flight periods of those species whose larvae feed on Olearia colensoi. However, apart from investigating the pathology of this plant, it was considered desirable to gain some knowledge of the adult Lepidoptera occurring in subalpine areas and particularly in Olearia colensoi stands.

The imagines were sampled with a light trap operated at most collecting sites and many were handnetted. This would not have given an accurate sample of the lepidopterous fauna but, probably, many of the commoner species were taken. Those imagines taken were identified as far as possible using Hudson's (1928, 1939, 1950) works. Confirmation of these identifications was carried out by comparison with named specimens in the collection of the Canterbury Museum. Mr. J.S. Dugdale of Entomology Division, D.S.I.R., Nelson, New Zealand confirmed the identifications made as above and determined many that were, at that stage, unidentified.

The foliage of Olearia colensoi was, at each locality visited, sampled intensively for lepidopterous larvae by extensive beating, examination of foliage and by the dissection of large numbers of damaged, and undamaged buds. This procedure was carried out in an effort to collect the larvae present and note their effects.

Identification of the larvae of New Zealand Lepidoptera is somewhat difficult due to the lack of relevant literature. Besides this factor, many of the earlier workers in the subject tended to base their descriptions on colouration alone. Since this is a very variable factor, between individuals of the one species, most of these descriptions are inadequate for identification purposes and, except for several species

of economic importance, few full descriptions of New Zealand lepidopterous larvae are available.

The larvae collected during the course of this study were identified to family level using Peterson's (1959) key. The Geometridae were identified to subfamily, and in the case of the Ennominae, to generic level using the keys in Dugdale's (1961) work on the latter group. All specimens were identified at the species level by Mr. J.S. Dugdale.

The terminology used is basically that of Peterson (1959). However, the nomenclature of the body setae follows the modified Hinton system used by Dugdale (1961).

Imagines.

Suborder: MONOTRYZIA

Superfamily: HEPIALOIDEA

Family: HEPIALIDAE

Subfamily: Hepialinae

Genus: Aenetus Herrick - Schaeffer, 1855.

Aenetus virescens (Doubleday, 1843) Dumbleton, 1966.

Record: RUAHINE MOUNTAINS: Mt. Wharite, found sheltering under board, 15. xii. 1965, 1 specimen, (A.V. Spain).

Remarks: This species is distributed throughout the North Island and occurs up to a height of approximately 1300 m. (Dumbleton, 1966). The larvae of this insect live within, and tunnel, the trunks of living trees. They are extremely polyphagous and Atkinson *et al.* (1956) record 14 indigenous and ten exotic host plants for this species. The adult moths were occasionally common in Olearia colensoi associations. On the 4th January, 1966 large numbers of this moth were noted to be extremely active on the summit of Mt. Wharite for the period 7.30 p.m. to 8.15 p.m. and the foliage could be heard rustling with their movement. However, no sign of larval attack on Olearia colensoi was ever noted.

Subfamily: Oxycaninae

Genus: Wiseana Viette, 1961.

Wiseana cervinata ? (Walker, 1865).

Record: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 5. i. 1966, 3 specimens, (A.V. Spain).

Remarks: This species is one of the major pasture pests in New Zealand. The larvae live in subterranean tunnels in the soil and emerge from these at night to feed on the foliage of adjacent grasses, clovers and lucerne (Atkinson, *et al.*, 1956). This species is distributed throughout the North and South Islands and its flight period is from September to November with an October peak (Dumbleton, 1966). Thus, although the specimens described in the record above resemble Wiseana cervinata, they may actually belong to one of the other species of this genus on the basis of flight period. Dumbleton (1966) states that the genitalia are very uniform within the genus, and variable within the species. This, coupled with the variability of the wing markings, (Gaskin, 1964 in Dumbleton, 1966), makes the separation of the species somewhat difficult. The specimens mentioned in the records given above probably came from the grassland which is present several hundred feet below the

summit of Mt. Wharite.

Suborder: DITRYZIA

Superfamily: PAPILIONOIDEA

Family: PIERIDAE

Genus: Pieris Schranck, 1801.

Pieris rapae Linnaeus, 1758.

Record: TARARUA MOUNTAINS: Waingawa Ridge, handnetted in very open Olearia colensoi association, 17. ii. 1966, 2 specimens, (A.V. Spain).

Remarks: This cosmopolitan pest of cruciferous plants is distributed throughout New Zealand (Atkinson, et al., 1956). The specimens mentioned in the records above were only some of many noted feeding on the flowers of Celmisia sp. that were growing between the scattered clumps of Olearia colensoi at approximately 1350 m. Previous records of this species occurring at high altitudes in New Zealand are from the Kaimanawa, Kaweka, Ruahine and Tararua Mountains (Elder, 1960; Gibbs and Ramsay, 1960) and the Southern Alps at Arthur's Pass, from Mt. Cook and the Arrowsmith Range (Burrows, 1961). No evidence of breeding on alpine plants has been forthcoming and Gibbs and Ramsay (1960) concluded that the source of the specimens observed in the Tararua Mountains was the Horowhenua or Wairarapa Plains.

Family: NYMPHALIDAE

Genus: Vanessa Fabricius, 1807.

Vanessa conerilla (Fabricius, 1775).

Record: RUAHINE MOUNTAINS: Mt. Wharite, in Olearia colensoi association, 29. x. 1965, 2 specimens, (A.V. Spain).

Remarks: This species was occasionally noted near the summit of Mt. Wharite although only two specimens were taken. Hudson (1928) states that it is generally distributed throughout the country and that the larvae feed on the foliage of Urtica spp. It has previously been recorded from high altitudes in the Tararua Mountains (Gibbs and Ramsay, 1960 and Hudson, 1905). Hudson (1928) states of this species that "it appears to have a singular liking for hill tops" and also that he has frequently observed it on high mountains between approximately 1300 m. and 1650 m.

Family: LYCAENIDAE

Genus: Lycaena Fabricius, 1807.

Lycaena sallustius (Fabricius, 1793).

Record: RUAHINE MOUNTAINS: Mt. Wharite, handnetted in Olearia colensoi association, 15. ii. 1966, 2 specimens, (A.V. Spain).

Remarks: Hudson (1928) states that this somewhat variable species is common and generally distributed throughout New Zealand. Its host plant is Muehlenbeckia sp. (Hudson, 1928). It was only seen rarely in Olearia colensoi associations.

Superfamily: PYRALIDOIDEA

Family: PYRALIDAE

Remarks: This family has an extremely disharmonic representation in New Zealand where only five of the ten subfamilies are recorded. It makes up for this, numerically at least, in the large number of species of the genera Scoparia and Crambus so that the Pyralidae as a whole form almost 18 per cent of the entire lepidopterous fauna (Hudson, 1928). The classification used here follows that of Hudson (1928).

Genus: Scoparia Haworth, 1811.

Scoparia spp.

Records: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 6. i. 1966, 2 specimens; 14. ii. 1966, 6 specimens, (A.V. Spain). SOUTH ISLAND: Magister Ridge, ex light trap, 11. xii. 1964, 6 specimens; 20. i. 1965, 7 specimens, (A.V. Spain).

Remarks: Hudson (1928 and 1939) records 112 species of this genus from New Zealand. The larvae of this genus feed mostly on moss and lichens and possibly on the roots of grasses (Hudson, 1928).

Genus: Crambus Fabricius, 1798.

Crambus flexuosellus Doubleday, 1843.

Record: RUAHINE MOUNTAINS: Mt. Wharite, handnetted at dusk in Olearia colensoi association, 4. i. 1966, 2 specimens; ex light trap, 6. i. 1966, 1 specimen, (A.V. Spain).

Remarks: Hudson (1928) states that the members of this genus probably nearly all feed amongst the stems or roots of grasses, or occasionally on moss. Cumber and Eyles (1961) however, record that the larvae of this species tunnel in the soil and Kelsey (1957) records them feeding on the foliage of tussocks. This species is thus of no significance in the

pathology of Olearia colensoi.

Superfamily: GEOMETROIDEA

Family: GEOMETRIDAE

Remarks: The members of this family are fairly well represented in the collections that were made during the course of this study. Most of the specimens were taken by light trapping. The larvae of this family are known as "loopers" because of their mode of progression and at least some of the host plants of many of the species are known.

The classification followed here is that of Brues et al. (1954) and at the lower levels follows that used by Dugdale (1961).

Subfamily: Ennominae

Genus: Selidosema Hubner, 1823.

Selidosema leucelaea Meyrick, 1909.

Record: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 29. x. 1966, 2 specimens, (A.V. Spain).

Remarks: This species appears to be generally distributed throughout New Zealand (Hudson, 1928 and 1939). The larvae feed on the foliage of the following podocarps: Podocarpus ferrugineus, G. Benn., Podocarpus totara G. Benn., Podocarpus hallii Kirk and Dacrydium spp. (Hudson, 1928 and J.S. Dugdale, pers. comm.). Thus this species is probably incidental in Olearia colensoi associations.

Selidosema pelurgata (Walker, 1862).

Record: RUAHINE MOUNTAINS: Mt. Wharite, handnetted at dusk in Olearia colensoi association, 4. 1. 1966, 1 specimen, (A.V. Spain).

Remarks: This species appears to be generally distributed throughout New Zealand (Hudson, 1928 and 1939). The larvae feed on the following ferns: Todea hymenophylloides A. Rich., Todea sp., Alsophila sp., Cyathea sp. (Hudson, 1928 and J.S. Dugdale, pers. comm.) and thus have no association with Olearia colensoi.

Selidosema suavis (Butler, 1879).

Record: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 14. ii. 1966, 2 specimens, (A.V. Spain).

Remarks: This insect is distributed throughout the three main islands of New Zealand from sea level to approximately 1000 m. (Dugdale, 1958). This species is highly polyphagous and Dugdale (1958) records 16 indigenous and 23 exotic host plants for this species. This species can be an important defoliator, however, Olearia colensoi usually grows somewhat higher altitudinally than most other host plants and it may well be that populations do not build up on it to any great extent.

Genus: Declana Walker, 1858.

Declana atronivea (Walker, 1865).

Record: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 28. x. 1965, 3 specimens; 5. i. 1966, 5 specimens; 29. x. 1966, 2 specimens; handnetted at dusk in Olearia colensoi association, 4. i. 1966, 1 specimen, (A.V. Spain).

Remarks: This species is confined to the North Island. The host plants of the larvae are Neopanax arboreum (Murr.) and Pseudopanax crassifolium (Sol. ex A. Cunn.) (Hudson, 1928 and 1939).

Declana junctilinea Walker, 1865.

Records: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 14. ii. 1966, 1 specimen, (A.V. Spain). SOUTH ISLAND: Magister Ridge, ex light trap, 20. i. 1965, 5 specimens; 19. ii. 1965, 1 specimen,

(A.V. Spain).

Remarks: This species has been recorded from both the North and South Islands. The larvae feed on Leptospermum ericoides A. Rich, and Leptospermum scoparium J.R. et G. Forst. (Hudson, 1928). Myrsine sp. and Aristotelia fruticosa Hook. f. (J.S. Dugdale, pers. comm.).

Declana floccosa Walker, 1858.

Record: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 5. i. 1966, 1 specimen, (A.V. Spain).

Remarks: This common and somewhat variable species is widely distributed throughout New Zealand (Hudson, 1928). It is high polyphagous and 12 indigenous and three exotic host plants are recorded (Hudson, 1928 and 1939; Rawlings, 1953; Anon., 1957).

Declana leptomera (Walker, 1858).

Record: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 14. ii. 1966, 1 specimen, (A.V. Spain).

Remarks: This species has been recorded from the North and South Islands and also from Pitt Island (Chatham Islands). The host plants of the larvae are Leptospermum ericoides A. Rich., Leptospermum scoparium J.R. et G. Forst. (Hudson, 1928) and Rubus sp. (J.S. Dugdale, pers. comm.).

Genus: Sestra Walker, 1862.

Sestra flexata (Walker, 1862).

Record: RUAHINE MOUNTAINS: Mt. Wharite, handnetted at dusk in Olearia colensoi association, 4. i. 1966, 1 specimen, (A.V. Spain).

Remarks: This species occurs throughout New Zealand and on the Chatham Islands. Its larvae feed on Histiopteris incisa (Thunb.) and Pteris macilenta A. Rich. (Hudson, 1928).

Subfamily: Larentiinae

Genus: Microdes Guénée, 1857.

Microdes epicryptis Meyrick, 1897.

Record: TARARUA MOUNTAINS: Arête Stream Basin, ex light trap, 7. xii. 1965, 1 specimen, (A.V. Spain).

Remarks: This species has been recorded from several localities in the North and South Islands. Its larvae feed on the foliage of the rushes Leptocarpus spp. (Hudson, 1928 and 1939) and Juncus spp. (J.S. Dugdale, pers. comm.).

Genus: Orthoclydon Warren, 1894.

Orthoclydon praefectata (Walker, 1894).

Records: TARARUA MOUNTAINS: Arête Stream Basin, ex light trap, 11. xii. 1964, 1 specimen, (A.V. Spain). SOUTH ISLAND: Magister Ridge, ex light trap, 8. xii. 1965, 1 specimen, (A.V. Spain).

Remarks: This species occurs throughout New Zealand. Its host plant is Phormium tenax (J.R. et G. Forst.) (Hudson, 1928). It is active at dusk and has been noted several times in Olearia colensoi stands in addition to the above records.

Genus: Chloroclystis Hübner, 1825.

Chloroclystis melochlora Meyrick, 1911.

Record: SOUTH ISLAND: Magister Ridge, ex light trap, 20. i. 1965, 3 specimens, (A.V. Spain).

Remarks: This species has previously been recorded from Eketahuna in the North Island and several localities in the South Island. The larvae of this species feed on Carmichaelia sp. (Hudson, 1928 and 1939).

Chloroclystis sandycias Meyrick, 1905.

Record: SOUTH ISLAND: Magister Ridge, ex light trap, 20. i. 1965,

1 specimen, (A.V. Spain).

Remarks: This species has previously been recorded from several localities in both the North and South Islands. Its larval host plants are Coprosma areolata Cheesem., Coprosma rhamnoides A. Cunn. and Coprosma rotundifolia A. Cunn. (Hudson, 1928 and 1939).

Chloroclystis sp.

Record: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 14. ii. 1966, 1 specimen, (A.V. Spain).

Remarks: This specimen represents a species unknown to Mr. J.S. Dugdale.

Genus: Xanthorhoe Hübner, 1825.

Xanthorhoe cedrinodes Meyrick, 1911.

Record: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 5. i. 1966, 1 specimen; 14. ii. 1966, 1 specimen, (A.V. Spain).

Remarks: This species has been recorded from the three main islands of New Zealand, sometimes at high altitudes (Hudson, 1928 and 1939). The host plants of the larvae are members of the genus Coprosma, especially Coprosma pseudocuneata W.R.B. Oliver (J.S. Dugdale, pers. comm.).

Xanthorhoe semifissata (Walker, 1862).

Record: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 5. i. 1966, 1 specimen, (A.V. Spain).

Remarks: This species occurs throughout New Zealand and in the Chatham Islands (Hudson, 1928 and 1939). The host plants of the larvae are Nasturtium officinale R. Br. (Hudson, 1939) and low herbs (J.S. Dugdale, pers. comm.).

Xanthorhoe clarata (Walker, 1862).

Records: TARARUA MOUNTAINS: Waingawa Ridge, handnetted in Olearia

colensoi association, 17. ii. 1966, 1 specimen, (A.V. Spain). SOUTH ISLAND: Magister Ridge, ex light trap, 20. i. 1965, 4 specimens, (A.V. Spain).

Remarks: This common species has been recorded from a number of localities in both the North and South Islands and also from the Chatham Islands (Hudson, 1928 and 1939). The host plants of its larvae are Chionocholea spp. (J.S. Dugdale, pers. comm.).

Xanthorhoe occulta Philpott, 1903.

Record: SOUTH ISLAND: Magister Ridge, ex light trap, 20. i. 1965, 1 specimen, (A.V. Spain).

Remarks: This species occurs on the three main islands of New Zealand and frequents forest glades between approximately 1000 m. and 1300 m. (Hudson, 1928). Its larvae feed on low herbs (J.S. Dugdale, pers. comm.).

Xanthorhoe cinerearia (Doubleday, 1843).

Record: SOUTH ISLAND: Magister Ridge, ex light trap, 20. i. 1965, 2 specimens, (A.V. Spain).

Remarks: This species is distributed throughout New Zealand and is stated to be common (Hudson, 1928). An alpine form exists which has been described as Xanthorhoe eupitheciaria (Guénée, 1868) which may, or may not, be conspecific with Xanthorhoe cinerearia. Host plants of the larvae are unknown.

Xanthorhoe chionogramma (Meyrick, 1884).

Record: TARARUA MOUNTAINS: Arête Stream Basin, ex light trap, 7. xii. 1965, 1 specimen, (A.V. Spain).

Remarks: This species occurs in both the North and South Islands, often at quite high altitudes (Hudson, 1928 and 1939). The larvae feed on low herbs (J.S. Dugdale, pers. comm.).

Genus: Epiphryne Meyrick, 1884.

Epiphryne verriculata (Felder, 1867).

Record: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 29. x. 1966, 1 specimen, (A.V. Spain).

Remarks: Hudson (1928) states that this insect is common and generally distributed throughout New Zealand. The larvae feed on the foliage of Cordyline australis Hook. f.

Epiphryne autocharis (Meyrick, 1924).

Records: TARARUA MOUNTAINS: Arête Stream Basin, ex light trap, 7. xii. 1965, 5 specimens; 8. xii. 1965, 1 specimen; 9. xii. 1965, 1 specimen, (A.V. Spain).

Remarks: This species occurs in the North Island and has been previously recorded from Mt. Ruapehu (Hudson, 1928) and Day's Bay, Wellington Harbour (Hudson, 1939). There is apparently a close relationship between Epiphryne autocharis and Epiphryne charidema (Meyrick, 1909) which has been recorded from the South, Campbell and Auckland Islands (Dugdale, 1964). The larval host plant of Epiphryne autocharis is Dracophyllum longifolium (J.R. et G. Forst.) (Hudson, 1939).

Epiphryne undosata (Felder, 1867).

Record: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 29. x. 1966, 1 specimen (A.V. Spain).

Remarks: Hudson (1928) states that this species appears to be generally distributed throughout New Zealand. The host plants of its larvae are Hoheria lyalli Hook. f. and Plagianthus betulinus A. Cunn. (Hudson, 1928).

Genus: Hydriomena Hübner, 1825.

Hydriomena lithurga Meyrick, 1910.

Record: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 14. ii. 1966,

1 specimen, (A.V. Spain).

Remarks: This species has been recorded by Hudson (1928) from two localities near Wellington. The food plant is probably Muehlenbeckia sp. as the pupa of this insect was found attached to this plant (Hudson, 1928).

Subfamily: Oenochromatinae

Genus: Epirrhanthis Hübner, 1823.

Epirrhanthis ustaria (Walker, 1862).

Records: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 5. i. 1966, 2 specimens; 29. x. 1966, 19 specimens, (A.V. Spain). STEWART ISLAND: Mt. Rakeahua, handpicked from Olearia colensoi leaf, 31. xii. 1964, 1 specimen, (A.V. Spain).

Remarks: Hudson (1928) states that this species is probably generally distributed throughout New Zealand and (1939) that it also occurs on the Chatham Islands. The larvae feed on the foliage of Pittosporum eugenioides A. Cunn. and Pittosporum tenuifolium Sol. ex Gaertn. (Hudson, 1928).

Epirrhanthis alectoraria (Walker, 1860).

Records: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 5. i. 1966, 1 specimen; 29. x. 1966, 2 specimens, (A.V. Spain).

Remarks: This somewhat variable species occurs in both the North and South Islands. Its larvae feed on the foliage of Neopanax arboreum (Murr.) and Carmichaelia sp. (Hudson, 1928 and 1939).

Superfamily: GELECHIOIDEA

Family: STENOMIDAE

Remarks: This family is represented in New Zealand by one species with, presumably, Australian affinities.

Genus: Agriophara Rosenstock, 1885.

Remarks: This genus, as originally defined, was very widespread with representatives in the Oriental, Neotropical and Australian Realms. However most of the Neotropical species were referred to the genus Chlamydastis Meyrick, 1916 by Busck (1934). Mr. W.D. Duckworth of the Smithsonian Institution, United States National Museum, states (pers. comm.) that all the species presently assigned to the genus Agriophara occur in Australia and New Guinea.

Agriophara coricopa (Meyrick, 1897).

Record: TARARUA MOUNTAINS: Table Top, reared from larvae ex foliage of Olearia colensoi, summer, 1959, 2 specimens, (G.W. Gibbs).

Remarks: This species has previously been recorded from the Wellington District, Otira, Dunedin, (Hudson, 1928) Waiho Gorge, Milford Track, (Hudson, 1939) and the Tararua Ranges (Wardle, 1962). Its known host plants are Olearia colensoi Hook. f. (Wardle, 1962), Olearia paniculata J.R. et G. Forst., Olearia rani (A. Cunn.) and Olearia solandri Hook. f. Details of its life history are discussed later in the section on immature Lepidoptera. It was never taken in the light traps that were operated in Olearia colensoi stands and is possibly not attracted to light.

Superfamily: TORTRICOIDEA

Family: TORTRICIDAE

Subfamily: Eucosminae

Genus: Acharneodes Meyrick, 1926.

Acharneodes guerula (Meyrick, 1912).

Record: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 29. x. 1966, 1 ♂, 1 ♀, (A.V. Spain).

Remarks: This species has been recorded from Australia (Meyrick, ? pers. comm. in Hudson, 1928) and the North and South Islands of New Zealand (Hudson, 1928 and 1939). The larval foodplants are apparently unknown.

Superfamily: NOCTUOIDEA

Family: NOCTUIDAE

Genus: Ichneutica Meyrick, 1886.

Ichneutica ceraunias Meyrick, 1886.

(a) dark form

Records: TARARUA MOUNTAINS: Arête Stream Basin, ex light trap, 7. xii. 1965, 1 specimen, (A.V. Spain). SOUTH ISLAND: Magister Ridge, ex light trap, 11. xii. 1964, 1 specimen, (A.V. Spain).

(b) pale form

Records: TARARUA MOUNTAINS: Arête Stream Basin, ex light trap, 8. xii. 1965, 1 specimen, (A.V. Spain). SOUTH ISLAND: Magister Ridge, ex light trap, 20. i. 1965, 1 specimen, (A.V. Spain).

Remarks: This species occurs in both the North and South Islands (Hudson, 1928) and is, apparently, often found at high altitudes. As noted above, dark and pale forms occur sympatrically. The larvae are unknown.

Genus: Persectania Hampson, 1905.

Persectania atristriga (Walker, 1866).

Record: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 14. ii. 1966, 2 specimens, (A.V. Spain).

Remarks: Hudson (1939) states that this species is apparently generally distributed throughout New Zealand. Its known larval foodplants are grasses of the genera Bromus and Festuca (Gaskin, 1967).

Persectania aversa (Walker, 1856).

Record: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 14. ii. 1966, 1 specimen, (A.V. Spain).

Remarks: Hudson (1928) states that this species is one of the most abundant of our night flying moths and occurs in great profusion throughout the country. Its distribution includes the three main islands of New Zealand and also the Chatham Islands. Meyrick (? pers. comm. in Hudson, 1928) states that it also occurs in parts of Australia. The larval foodplants of this species include Poa annua L., Festuca novaezealandiae Cockayne and most graminaceous crops (Gaskin, 1967).

Genus: Melanchra Hübner, 1820.

Melanchra mutans (Walker, 1857).

Record: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 14. ii. 1966, 7 specimens, (A.V. Spain).

Remarks: Hudson (1928) states that this species is extremely abundant and is found throughout New Zealand. The larvae of this insect feed on lucerne (Pottinger and MacFarlane, 1967), grasses, Plantago triandra Bergg., Pyrus malus L. and other low plants (Gaskin, 1967 quoting various authors).

Melanchra rubescens (Butler, 1879).

Record: SOUTH ISLAND: Magister Ridge, ex light trap, 20. i. 1965,

8 specimens, (A.V. Spain).

Remarks: This species occurs throughout the three main islands of New Zealand (Hudson, 1928). Its larvae feed on the foliage of Nothofagus spp. (J.S. Dugdale, pers. comm.).

Melanchra ustistriga (Walker, 1857).

Records: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 20. x. 1965, 2 specimens; 14. ii. 1966, 1 specimen, (A.V. Spain).

Remarks: This species is stated by Hudson (1928 and 1939) to occur throughout New Zealand and also on the Chatham Islands. Its larvae feed on Muehlenbeckia spp., Lonicera japonica L., Veronica persica L., Pyrus malus L., Dahlia spp. and Trifolium repens L. (Gaskin, 1967 quoting various authors).

Melanchra plena (Walker, 1856).

Record: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 29. x. 1966, 1 specimen, (A.V. Spain).

Remarks: This species occurs on the three main islands of New Zealand (Hudson, 1928). The larval foodplants are Fuschia excorticata (J.R. et G. Forst.) and low plants (Hudson, 1928). However, Gaskin (1967) states that other species of the genus Fuschia and various ornamental plants are also attacked.

Genus: Ariathisa Walker, 1865.

Ariathisa comma (Walker, 1856).

Record: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 5. i. 1966, 2 specimens, (A.V. Spain).

Remarks: This species occurs throughout New Zealand and also on the Chatham Islands (Hudson, 1928). The larval foodplants include Plantago spp., Pinus spp. seedlings, Apium graveolens L. and other low plants (Gaskin, 1967 quoting various authors).

Genus: Leucania Ochsenheimer, 1816.

Leucania sulcana Fereday, 1880.

Record: SOUTH ISLAND: Magister Ridge, ex light trap, 19. ii. 1965, 2 specimens, (A.V. Spain).

Remarks: This species occurs in the three main islands of New Zealand (Hudson, 1928 and 1939). The larval foodplants are Microlaena avenacea Hook. f. (Hudson, 1928), Gahnia setifolia Hook. f. (Hudson, 1939), Carex spp. and Chionochloa spp. (J.S. Dugdale, pers. comm.).

Leucania unica Walker, 1856.

Records: TARARUA MOUNTAINS: Arête Stream Basin, ex light trap, 23. ii. 1965, 6 specimens, (A.V. Spain). SOUTH ISLAND: Magister Ridge, ex light trap, 20. i. 1965, 1 specimen, (A.V. Spain).

Remarks: This species has been recorded from the North and South Islands and is apparently generally distributed throughout the latter (Hudson, 1928 and 1939). The larvae apparently feed on Chionochloa spp. (J.S. Dugdale, pers. comm.).

Genus: Agrotis Hübner, 1813.

Agrotis ypsilon Rottemburg.

Record: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 14. ii. 1966, 1 specimen,; 29. x. 1966, 1 specimen, (A.V. Spain).

Remarks: This cosmopolitan species occurs throughout New Zealand and in the Chatham Islands (Hudson, 1928). The larvae are subterranean and feed on the roots of many plants. Kelsey (1957) records it as feeding on tussock leaves and Dick (1940) states that it occasionally occurs on upland grassland in the Rakaiā. Gaskin also records it from a variety of cultivated plants (Gaskin, 1967 quoting various authors).



Plate 8 - Mt. Wharite: Noctuid caterpillar (Melanchra sp.)
feeding on Olearia colensoi leaf. Note fecal pellets.

LARVAE

Superfamily: GEOMETROIDEA

Family: GEOMETRIDAE

Subfamily: Ennominae

Tribe: Boarmini

Genus: Selidosema Hübner, 1823.

Selidosema suavis (Butler, 1879).

Record: SOUTH ISLAND: Magister Ridge, handpicked from leaves of Olearia colensoi, 5. II. 1966, 1 specimen, in 3rd instar, (A.V. Spain).

Remarks: As only one specimen was taken during the course of the study this species is probably not an important defoliator of Olearia colensoi. Dugdale (1958) has given detailed descriptions of the larval instars of this species.

Tribe: Ennomini

Genus: Declana Walker, 1858.

Declana floccosa (Walker, 1858).

Records: SOUTH ISLAND: Magister Ridge, handpicked from Olearia colensoi foliage, 5. II. 1966, 1 specimen, (A.V. Spain): Upper Spey River, handpicked from Olearia colensoi foliage, 3. I. 1967, 1 specimen, (A.V. Spain).

Remarks: As only two examples of this species were taken during the course of the study this species is probably not an important defoliator

of Olearia colensoi.

Subfamily: Larentiinae

Genus: Chloroclystis Hübner, 1825.

Remarks: The larvae of two species of this genus were collected from Pillan's Pass and Magister Ridge.

Chloroclystis sp. a.

Record: SOUTH ISLAND: Pillan's Pass, handpicked from Olearia colensoi foliage, 2. 1. 1967, 1 specimen, (A.V. Spain).

Remarks: Mr. J.S. Dugdale was unable to identify this species. A brief description is presented together with diagrams of the chaetotaxy of the prothorax, mesothorax and segment A_6 .

Head Capsule: Bearing 6 stemmata. Front high, adfrontals meeting at point of cervical triangle. Epicranium with obscure brown markings superimposed on a lighter background.

Thorax: Prothoracic saddle lightly sclerotized, mottled brown in colour. Mesothoracic dorsum brown, pleural area of prothorax and mesothorax light brown. Metathorax similar except for a large lighter area including setae L_1 , L_2 , and L_3 .

Abdomen: Darkly pigmented dorsally except for lighter areas surrounding setae D_2 on segments A_1 to A_3 . These lighter areas also occur on A_4 , A_5 and to a lesser degree on A_6 and A_7 . On A_6 and A_7 they are larger and less marked. Pleuron much lighter above and below spiracles. Venter mottled brown in colour. All segments posterior to A_7 are dark brown in colour. Pigmentation generally lighter on right side of this individual.

Crotchets: Crotchets arranged in biordinal mesoserries.

Size: body length = 8700 μ
 Head capsule width = 900 μ

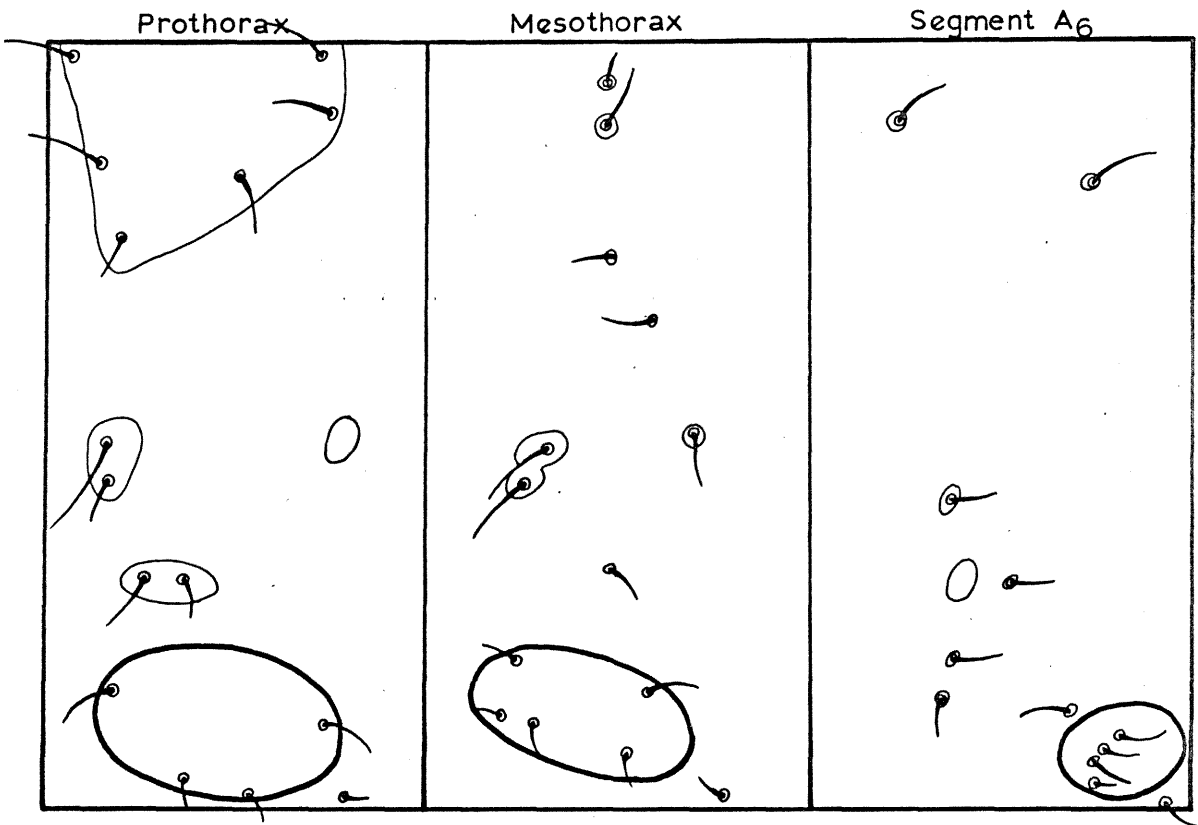
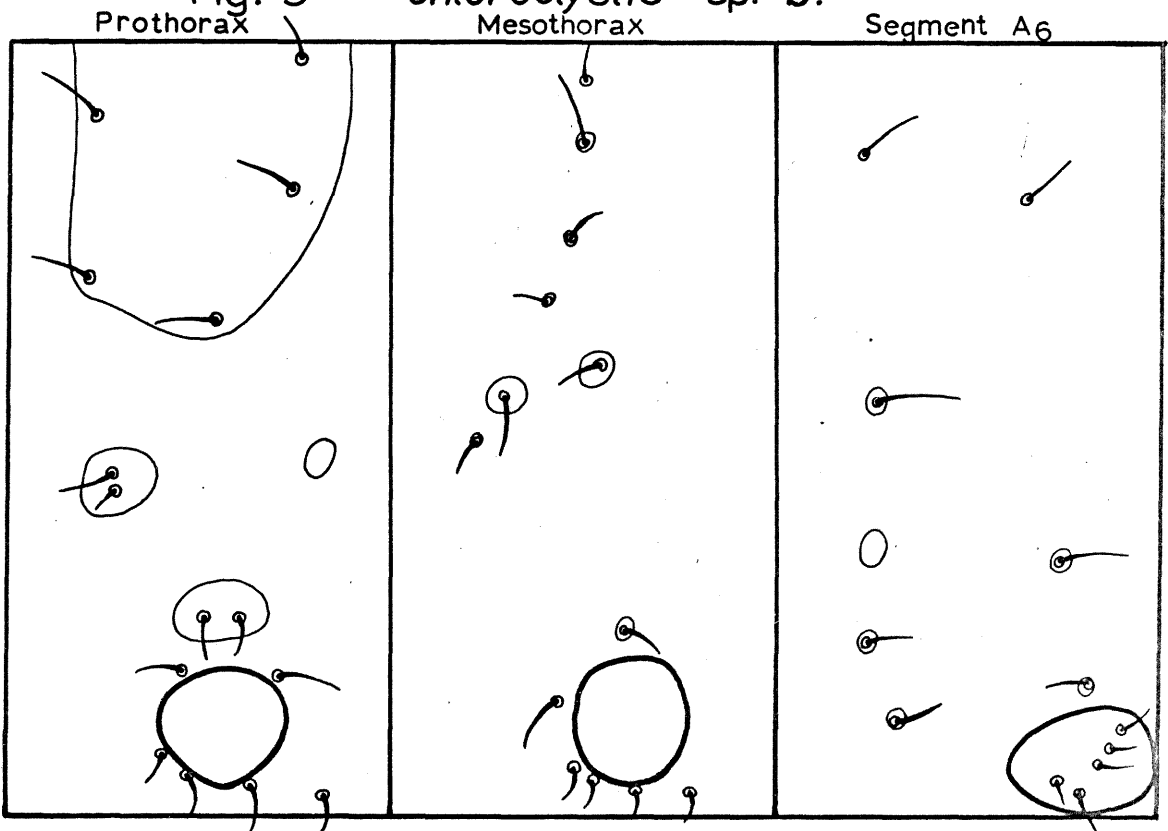


Fig. 3 - *Chloroclystis* sp. b.



Chloroclystis sp. b.

Records: SOUTH ISLAND: Magister Ridge, beaten from Olearia colensoi foliage, 5. ii. 1966, 1 specimen, (A.V. Spain): Pillan's Pass, beaten from Olearia colensoi foliage, 2. i. 1967, 8 specimens, (A.V. Spain).

Remarks: Mr. J.S. Dugdale did not recognize this species. A brief description is presented together with diagrams of the chaetotaxy of the prothorax, mesothorax and segment A_6 .

Head Capsule: Bearing 6 stemmata. Front high. Adfrontals extending to cervical triangle, narrowing abruptly below seta Adf₁. Epicranium with dark brown markings superimposed on a light brown background. Area of stemmata less heavily pigmented than surrounds. Mouth-parts normal; labium well developed, protruding.

Thorax: Prothoracic saddle with same colour and markings as epicranium, rest of segment light brown. Dorsum of meso and metathoracic segments brown, this colouration extending on to pleural areas. Transverse lines of lighter colour running across body. Pleuron and venter of meso and metathoracic segments light coloured except for pale areas surrounding bases of setae L_1 , L_2 and L_3 .

Abdomen: Dorsum with three darker stripes; mid dorsal widest, extending posteriorly from prothorax for whole length of body. The two lateral stripes strongest from A_2 to A_5 inclusive, extending anteriorly to prothorax though weaker in this region. These stripes present as mid segmental markings only on A_6 , A_7 and A_8 ; absent from posterior segments. Pleuron with a lighter stripe covering the spiracular area from prothorax to A_6 . A_{10} with a sclerotized suranal plate.

Crotchets: triordinal, interrupted mesoseries. Interruption of mesoseries complete on anal prolegs, on other prolegs mesoseries only partially interrupted.

Size:	Specimen	Body Length	Head Capsule Width
1	Pillan's Pass	10250 μ	880 μ
2	Pillan's Pass	9400 μ	890 μ

Specimen	Body Length	Head Capsule Width
3 Pillan's Pass	9000 μ	910 μ
4 Pillan's Pass	5980 μ	640 μ
5 Pillan's Pass	8220 μ	650 μ
6 Pillan's Pass	7300 μ	870 μ
7 Pillan's Pass	8300 μ	920 μ
8 Pillan's Pass	8500 μ	680 μ
9 Magister Ridge	12300 μ	910 μ

Agriophara coricopa (Meyr) — Chaetotaxy

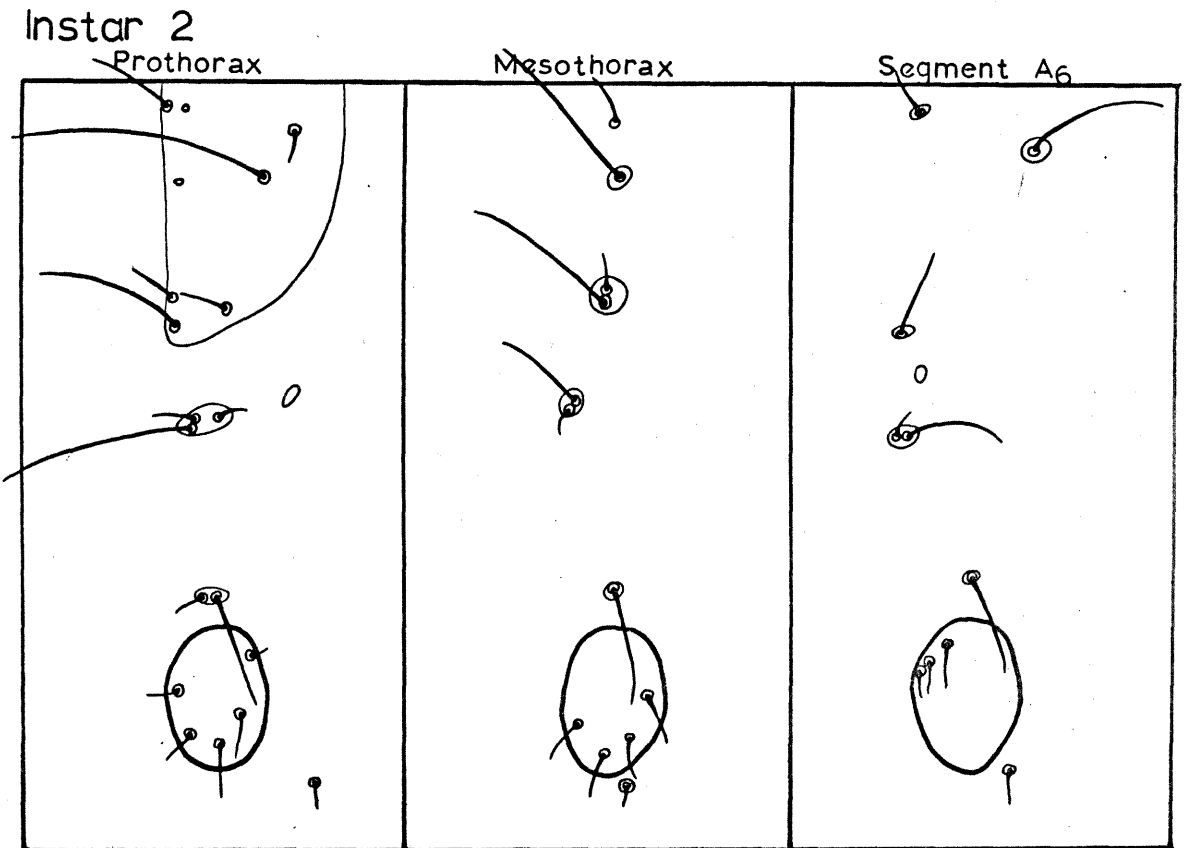
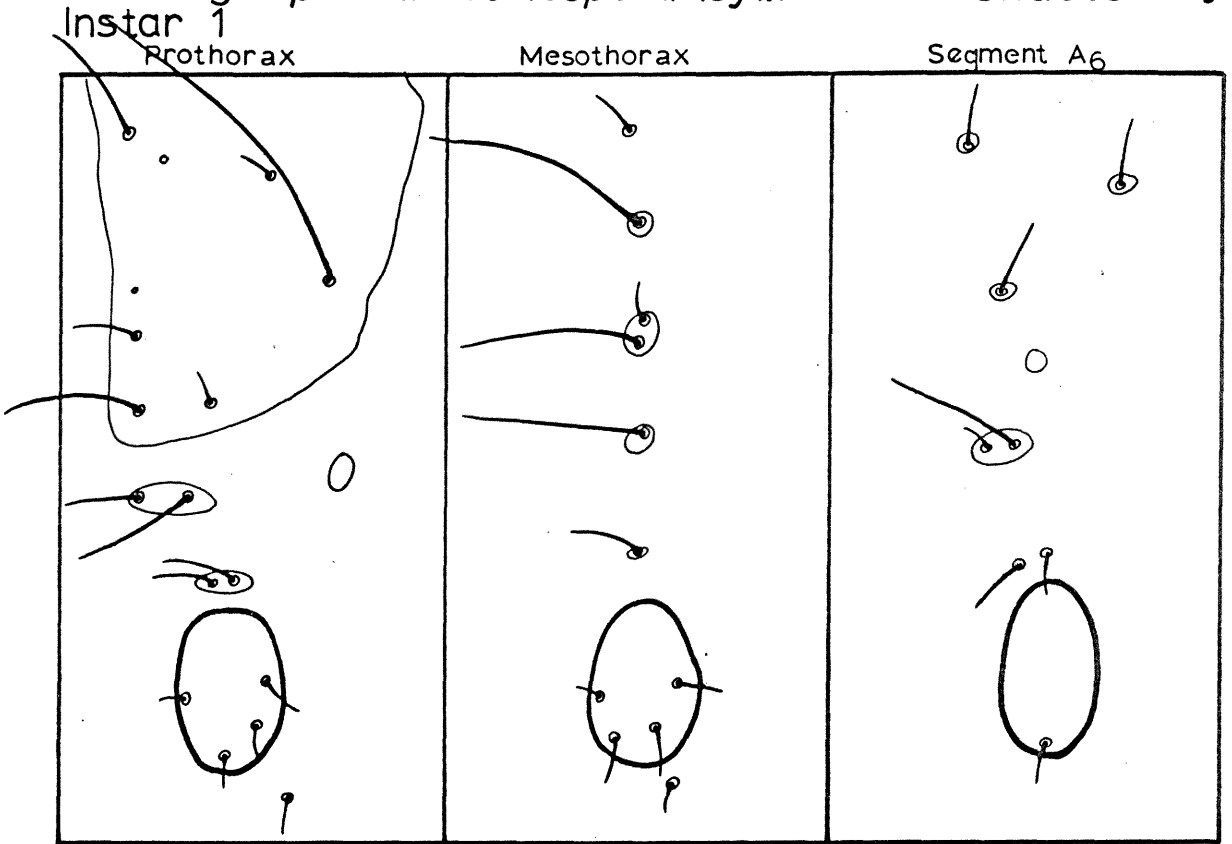


Fig. 4 & 5

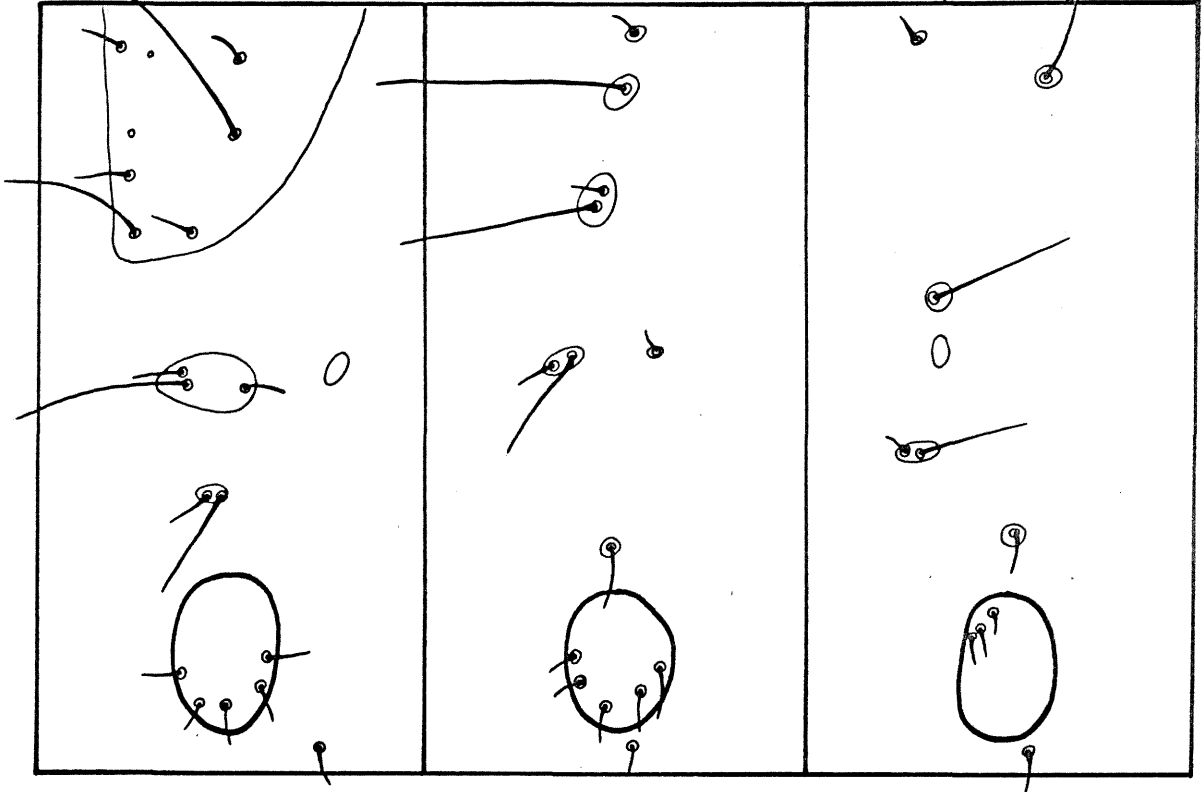
Agriophara coricopa (Meyr.) — Chaetotaxy

Instar 3

Prothorax

Mesothorax

Segment A6



Instar 4

Prothorax

Mesothorax

Segment A6

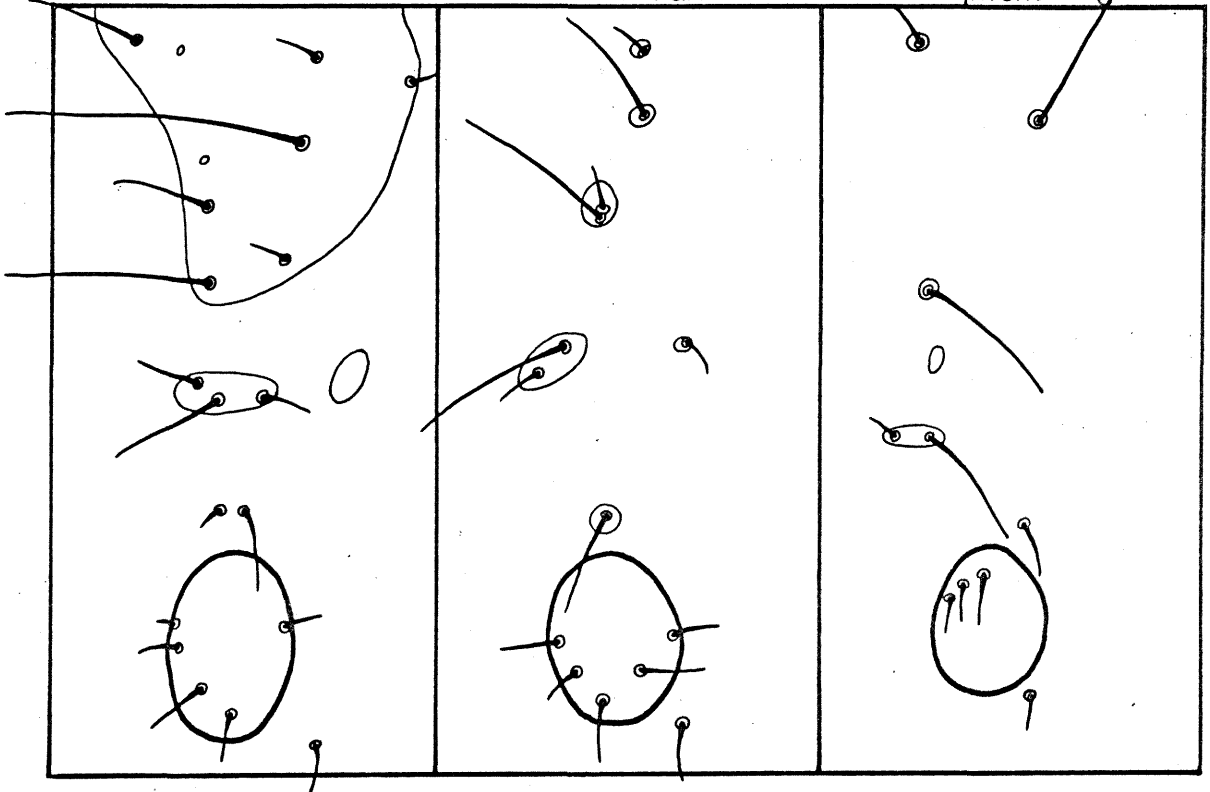


Fig. 6 & 7

Agriophara coricopa (Meyr) — Chaetotaxy

Instar 5

Prothorax

Mesothorax

Segment A6

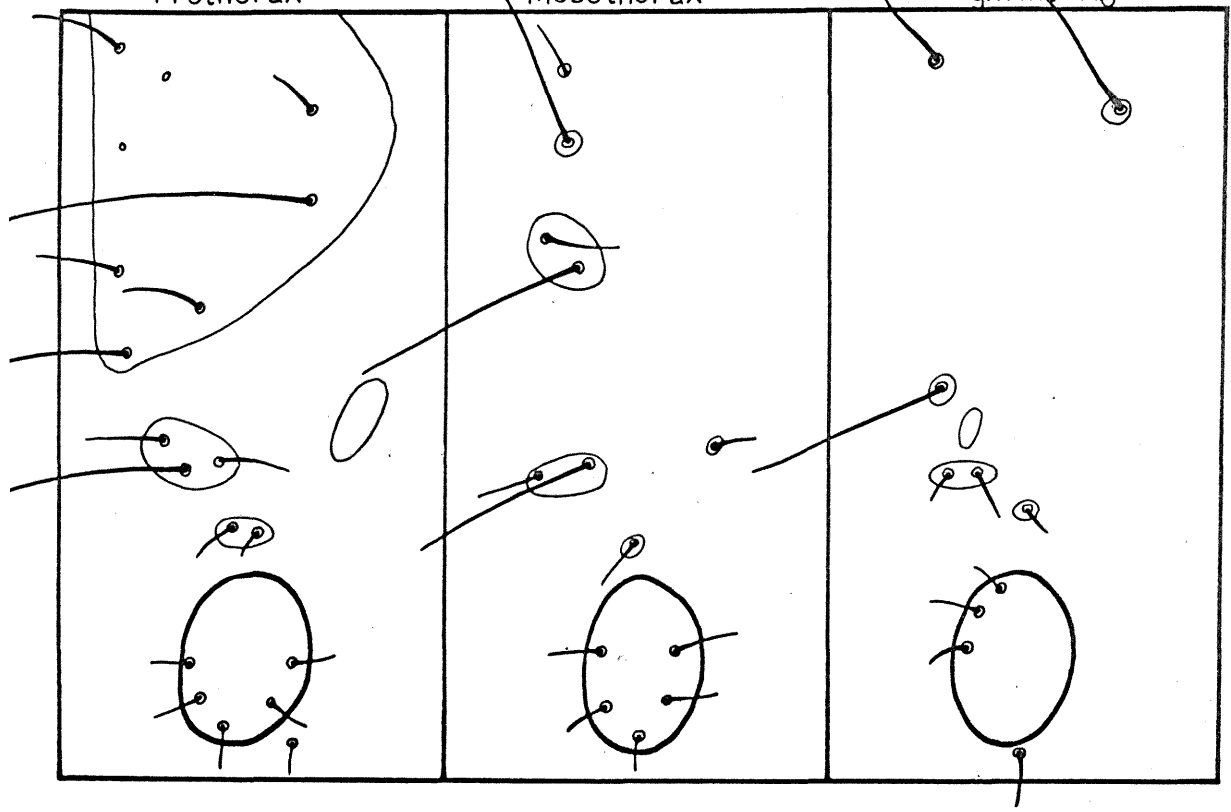


Fig. 8

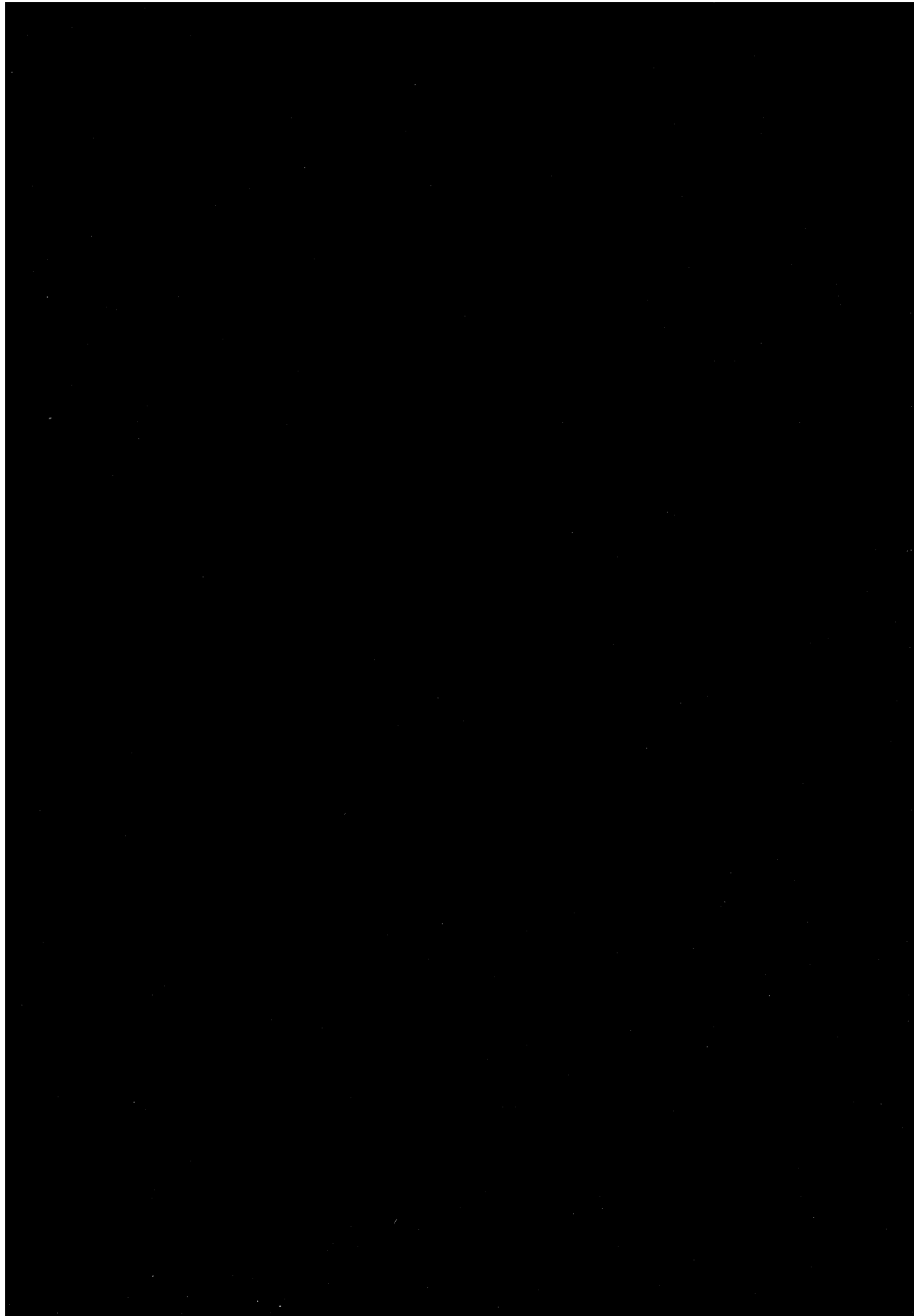
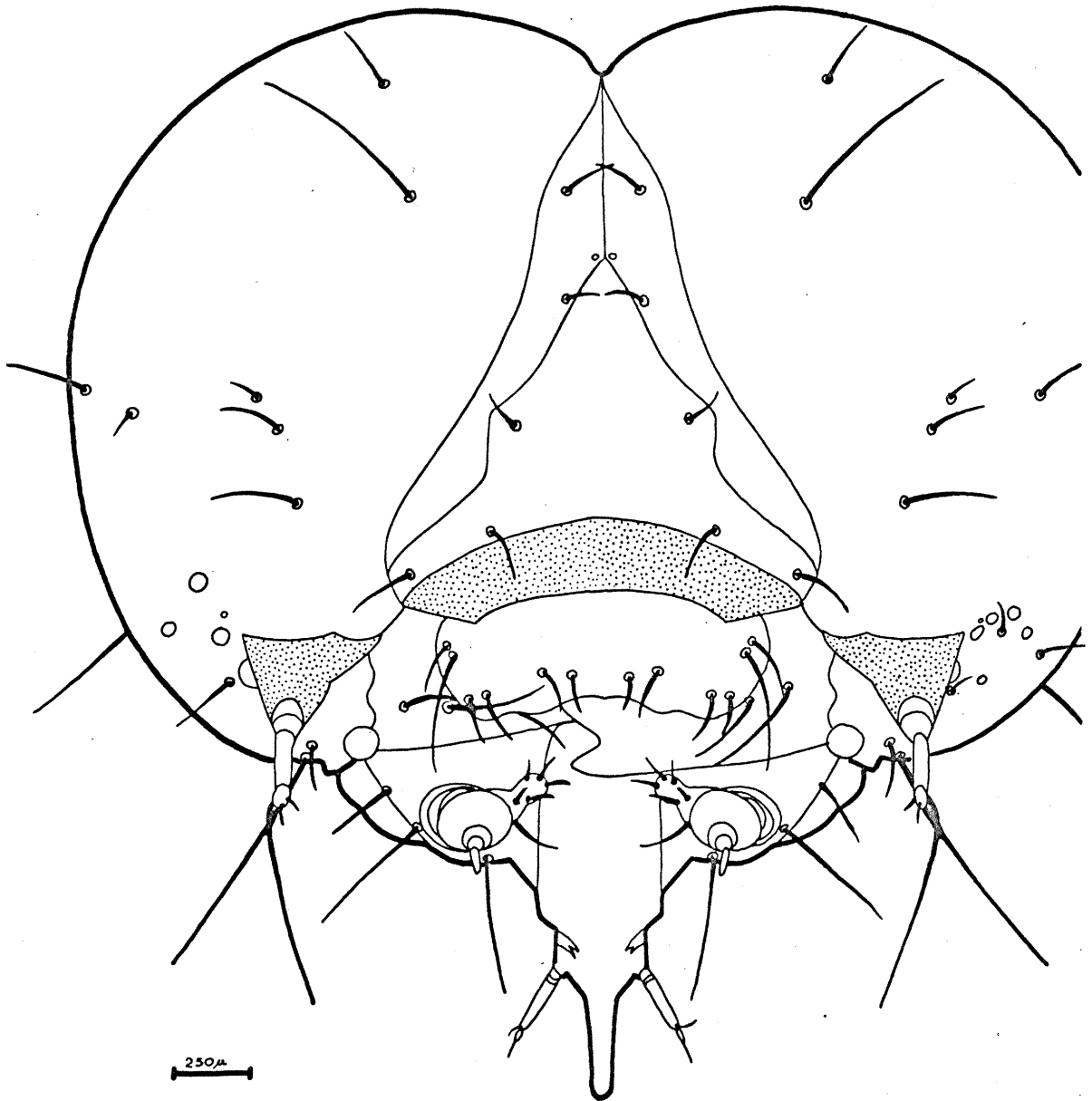


Fig. 10 — *Agriophara coricopa* (Meyr.)

Cephalic Aspect of Fifth Instar Head Capsule



Superfamily: GELECHIOIDEA

Family: STENOMIDAE

Genus: Agriophara Rosenstock, 1885.

Agriophara coricopa (Meyrick, 1897).

Records: TARARUA MOUNTAINS: Arête Stream Basin, handpicked from Olearia colensoi foliage, 10. xii. 1965, 13 specimens; 11. xii. 1965, 11 specimens, (A.V. Spain). SOUTH ISLAND: Magister Ridge, hand-picked from Olearia colensoi foliage, 5. ii. 1966, 19 specimens, (A.V. Spain).

Remarks: This was one of the most commonly found species of lepidopteran larvae at both the localities mentioned in the records and has previously been linked with damage to the foliage of Olearia colensoi by Wardle (1961).

The larva was figured by Hudson (1928) but this figure is of little use for recognition purposes. Therefore it is considered desirable to briefly describe the various instars and their salient characteristics. Specimens examined: the 43 larvae of all instars mentioned in the records above together with four unlabelled, late instar larvae from the Forest Research Institute, New Zealand.

Chaetotaxy: The chaetotaxy of the prothorax, mesothorax and segment A_6 of all instars is presented diagrammatically in Figs. 4 to 8.

Size: The body length and head capsule sizes are presented in Table 2 and the latter in the form of a histogram in Fig. 9.

First Instar: Head capsule dark brown; setae long, translucent.

Prothorax with cervical shield dark brown, slightly lighter than head capsule. Remainder of body cream in colour, setae light brown, inserted on minute brown pinacula. Suranal plate very lightly sclerotized. Crotchets of ventral prolegs forming a unioordinal ellipse, those of anal

prolegs a uniordinal, transverse, cephalic line.

Second Instar: Head capsule pigmented as in first instar. Prothorax with cervical shield pigmented as in first instar, setae of SV and L groups on lightly sclerotized pinacula. Mesothorax with setae D_2 , SD_1 and SD_2 and those of the L group inserted on lightly sclerotized pinacula.

Abdomen with setae D_1 , D_2 , SD_1 , L_1 and L_2 inserted on lightly sclerotized pinacula. Suranal plate lightly sclerotized. Crotchets of ventral prolegs arranged in a uniordinal, lateral penellipse; those of anal prolegs in a uniordinal, interrupted, cephalic, transverse series.

Third Instar: Head capsule dark brown with small areas of lighter pigmentation also present. Prothorax with cervical shield dark brown; some individuals with lighter coloured areas similar to head capsule. Setae of L and SV groups on sclerotized pinacula, the pinaculum of the SV group smaller and lighter in colour than that of L group. Mesothorax with setae D_1 , D_2 , SD_1 , SD_2 , L_1 , L_2 , and those of SV group on sclerotized pinacula darker than those of second instar. Metathorax similarly pigmented to mesothorax. Abdomen with setae D_1 , D_2 and SD_1 on sclerotized pinacula. Setae L_1 and L_2 on pinacula that are only slightly darker than surrounds. Suranal plate, brown, sclerotized. Crotchets of ventral prolegs arranged in a biordinal, lateral penellipse; those of anal prolegs in a biordinal, interrupted, cephalic series.

Fourth Instar: Head capsule pigmented as in third instar. Prothorax with cervical shield less heavily pigmented than in third instar; with dark brown markings. Setae of L and SV groups inserted on sclerotized pinacula. Mesothorax with setae D_1 , D_2 , SD_1 , SD_2 , L_1 , L_2 and L_3 inserted on sclerotized pinacula. The pinaculum on which seta L_3 is inserted is only lightly sclerotized. Metathorax sclerotized as mesothorax. Abdomen with setae D_1 , D_2 , and SD_1 inserted on sclerotized pinacula. Setae L_1 and L_2 inserted on a lightly sclerotized pinaculum. The suranal plate is lightly sclerotized with dark brown markings. An obscure dark stripe runs from mesothorax to segment A_9 in

the region of setae D_2 . Crotchets of ventral prolegs arranged in a triordinal, lateral penellipse; those of anal prolegs in a triordinal, interrupted, cephalic meseries.

Fifth Instar: Head capsule with light ground colour and darker pigmented markings. Prothorax, mesothorax and metathorax pigmented as in fourth instar. Abdomen with setae D_1 , D_2 , SD_1 , L_1 , L_2 and L_3 inserted on pinacula, all except the last being sclerotized. Obscure stripes run along the body in the region of setae D_2 and also mid dorsally. The suranal plate is pigmented as in the fourth instar. Crotchets of anal and ventral prolegs as in fourth instar. A diagram of the head capsule of this instar is presented as Fig. 10. It will be noted that there was some assymetry in the specimen in the number of stemmata and the setae of this region. The normal situation with six stemmata and the full complement of setae is shown on the left side of the head capsule.

Separation of Instars: The five instars of this species can be separated on the basis of the width of the head capsule as shown in Fig. 9. The separation of the instars on the basis of these size classes is supported by the development of the crotchets. There is little correlation between body length and instar as is shown in Table 2.

Recognition features: As this species is the only member of the family Stenomidae thus far recorded from New Zealand (J.S. Dugdale, pers. comm.) the familial recognition feature of the three setae of the L group being inserted on the same pinaculum on segment A_9 , is useful. Also conspicuous are the three dorsal stripes and the pinacula described above.

Ecology: Little is known of the ecology of this species. Hudson (1928) states that the larva of Agriophara coricopa feeds in November and December on the flowers, upper leaf surfaces and between the joined leaves of its various host plants. Observations made on Olearia colensoi during the present study indicate feeding in the latter two situations but not in the first. More important, however, is the habit of feeding internally on the unopened or partly opened buds. Consequences of

larval feeding in this situation are serious as the apical meristem is usually destroyed. This is an important factor in the pathology of Olearia colensoi which exhibits only a limited ability to regenerate shoot apices from dormant laterals. Buds that have been attacked by more mature larvae of Agriophara coricopa are easily recognized as such due to deformation, their failure to open, the presence of a dark brown staining that occurs at their bases and the occurrence of multiple brownish holes that are often visible externally. When the buds have been recently attacked by early instar larvae, the external signs of the larvae present within are not so obvious and may be indicated only by a small, brown edged entry hole or, merely by a slight browning at the edge of one of the folded leaves of the bud. The life cycle of this species is not well known. Hudson (1928) indicates larval feeding in November and December and probably this also occurs on Olearia colensoi as indicated by finding a late instar larva in early December. Feeding continues however, till at least middle February on late opening buds, between leaves that have been stuck together and also under their folded edges. It is considered that the unfavourable climatic conditions found in areas where Olearia colensoi grows, would not often permit more than one generation per year. A tentative life cycle on Olearia colensoi probably starts with eggs being laid on the buds by the adult female. The first instar larva hatches and bores into the bud where the larval stadia are passed. Pupation probably occurs within its buds or between leaves that have been stuck together. Hudson (1928) states that the imagines are the overwintering forms. This is borne out by the absence of larvae, or pupae, on the foliage of Olearia colensoi during the winter months. The length of the life cycle of this insect is probably quite variable due to the frequent occurrence of cold weather in the region where its host plant grows. On other host plants and in warmer areas, also possibly in sheltered positions in the subalpine region, this species may well have more than one generation per year.

TABLE 2 - AGRIOPHARA CORICOPA - SIZES OF INSTARS

First Instar

Specimens examined	=	20
Width of head capsule	- mean =	335 μ
" " " "	- range =	270 μ - 375 μ
Length of body	- mean =	2780 μ
" " "	- range =	1400 μ - 5500 μ

Second Instar

Specimens examined	=	5
Width of head capsule	- mean =	524 μ
" " " "	- range =	462 μ - 580 μ
Length of body	- mean =	4450 μ
" " "	- range =	4100 μ - 5400 μ

Third Instar

Specimens examined	=	9
Width of head capsule	- mean =	1405 μ
" " " "	- range =	800 μ - 1150 μ
Length of body	- mean =	9030 μ
" " "	- range =	7000 μ - 10500 μ

Fourth Instar

Specimens examined	=	6
Width of head capsule	- mean =	1380 μ
" " " "	- range =	1280 μ - 1500 μ
Length of body	- mean =	9890 μ
" " "	- range =	7200 μ - 11300 μ

Fifth Instar

Specimens examined	=	7
Width of head capsule	- mean =	2046 μ
" " " "	- range =	1800 μ - 2300 μ
Length of body	- mean =	10630 μ
" " "	- range =	7150 μ - 12000 μ

Superfamily: TORTRICOIDEA

Family: TORTRICIDAE

Genus: Ctenopseustis Meyrick, 1885.

Ctenopseustis obliquana (Walker, 1863).

Record: SOUTH ISLAND: Magister Ridge, handpicked from Olearia colensoi leaf, 5. 1. 1966, 2 specimens, (A.V. Spain).

Remarks: This very variable species is stated to be both common and generally distributed throughout New Zealand (Hudson, 1928). The larvae, also variable, are extremely polyphagous and have been recorded from a total of 12 indigenous and 26 exotic hosts (Hudson, 1928 and 1939; Anon., 1955; Wise, 1956a, 1956b). The two specimens recorded above were tentatively identified as Ctenopseustis obliquana by Mr. J.S. Dugdale.

Genus: unknown

Tortricid, species unknown

Record: SOUTH ISLAND: Mt. Fox, from sample of Olearia colensoi foliage, 6. xi. 1966, 1 specimen, (P. Wardle).

Remarks: Mr. J.S. Dugdale was unable to recognize this specimen.

Superfamily: NOCTUOIDEA

Family: NOCTUIDAE

Genus: Melanchra Hübner, 1820.

Melanchra ochthistis Meyrick, 1887.

Records: RUAHINE MOUNTAINS: Mt. Wharite, beaten from Olearia colensoi foliage, 22. xii. 1965, 4 specimens; 23. xii. 1965, 1 specimen; 4. i. 1966, 1 specimen; 5. i. 1966, 3 specimens; 11. i. 1966, 2 specimens; 21. xii. 1966, 4 specimens, (A.V. Spain).

Remarks: A number of the above specimens were tentatively determined as Melanchra ochthistis by Mr. J.S. Dugdale. Gaskin (1967) states that the host plants of this species are Carpodetus serratus J.R. et G. Forst and Rubus australis Forst. f. This species does not appear to be common on Olearia colensoi. It seems to feed largely on the upper leaf surfaces of the partly opened buds and, although causing damage to the leaves attacked, does not appear to harm the apical meristem. Thus its effect on the plant is not so significant as that of the species that feed on the unopened buds. A photograph of a larva of this species feeding on Olearia colensoi is shown in Plate 8.

Melanchra sp.

Records: SOUTH ISLAND: Pillan's Pass, beaten from Olearia colensoi foliage, 2. i. 1967, 4 specimens, (A.V. Spain).

Remarks: Mr. J.S. Dugdale determined these specimens to genus but did not recognize the species. The larvae recorded were noted to be feeding on the leaf surfaces of the nearly fully open buds and the effect of this species on Olearia colensoi is probably similar to that of Melanchra ochthistis. A brief description is presented.

Head Capsule: Ground colour light brown, some darker areas on

epicranium. Dark brown areas extending posteriorly from just above stemmata. Sub stemmatal region also dark brown.

Colouration of Body: Dorsomeson with a white strip. Dorsal area light brown mesially, bounded by an obscure darker area. Subdorsal area white, bounded dorsally by the obscure darker area of the dorsum.

Supraspiracular area brown. Subspiracular area with superficial, bright white colouration extending from prothorax to anal proleg. This colouration is very obvious in life but being superficial, disappears after the specimen has been immersed in alcohol for some time. Venter below subspiracular area uniformly pale brown except for the numerous areas of sclerotization on the legs, prolegs and pinacula.

Crotchets: arranged in a homoideous, unordinal mesoseries on ventral prolegs. On anal prolegs they form a transverse, homoideous mesoseries.

Spiracles: Elliptical, larges on prothorax and A_8 .

Prolegs: Present on segments A_3 , A_4 , A_5 , A_6 and A_{10} . A sclerotized plate covers most of lateral side and bears the setae of the SV group.

Setae V_1 occur mesad of the base of the proleg.

Size:	Head capsule width	Body length
Specimen 1	1353 μ	9500 μ
Specimen 2	1450 μ	15000 μ
Specimen 3	1500 μ	15000 μ
Specimen 4	1550 μ	13500 μ

The larvae of this species can be separated from those of Melanchnra ochthistis by the possession of terminal tarsal setae that are shorter than the claws.

KEY TO LEPIDOPTERAN LARVAE FOUND ON FOLIAGE OF OLEARIA COLENSOI

1. With less than 4 pairs of ventral prolegs (Geometridae) ..
 2
 With 4 pairs of ventral prolegs 5
2. Seta SV_3 present on $A_1 - A_5$ 4
 Seta SV_3 absent on $A_1 - A_5$ 3
3. With a single spatulate tarsal seta extending past
 claws Chloroclystis sp. a.
 With two spatulate tarsal setae extending past
 claws Chloroclystis sp. b.
4. Prolegs present on A_5 , seta CD_2 slightly below level
 of L_2 on anal prolegs Declana floccosa
 Prolegs absent on A_5 Selidosema suavis
5. With anal fork (Tortricidae) 6
 Without anal fork 7
6. Anal fork with base not well developed, 6 teeth; body
 surface apparently granulate at 100 x magnification.....
 Ctenopseustis obliquana
 Anal fork with base well developed; 9 teeth; body surface
 apparently smooth at 100 x magnification
 Tortricid sp.
7. Crotchets of ventral prolegs arranged in an ellipse or
 penellipse Agriophara coricopa
 Crotchets of ventral prolegs arranged in a
 mesoseris 8

8. Terminal setae of tarsi shorter than claws ... Melanchra sp.
 Terminal setae of tarsi longer than claws ... Melanchra ochthistis

Conclusions.

The imagines taken can be divided into six somewhat overlapping groups on the basis of the feeding habits of their larvae.

The largest category is that containing those species known to feed mainly on woody angiosperms. This group contains many species which breed on forest trees and scrub plants that may be found above, below or associated with Olearia colensoi stands. They are as follows:

- Aenetus virescens (Doubleday, 1843).
Vanessa gonerilla (Fabricius, 1775).
Lycaena sallustius (Fabricius, 1793).
Selidosema leucelaea Meyrick, 1909.
Declana atronivea (Walker, 1865).
Declana junctilinea Walker, 1865.
Declana leptomera (Walker, 1858).
Orthoclydon praefectata (Walker, 1858).
Chloroclystis melochlora Meyrick, 1911.
Chloroclystis sandycias Meyrick, 1905.
Xanthorhoe cedrinodes Meyrick, 1911.
Epiphryne verriculata (Felder, 1867).
Epiphryne autocharis (Meyrick, 1924).
Epiphryne undosata (Felder, 1867).
Hydriomena lithurga Meyrick, 1910.
Epirrhanthis ustaria (Walker, 1862).
Epirrhanthis alectoraria (Walker, 1860).
Melanchra rubescens (Butler, 1879).
Melanchra plena (Walker, 1866).

The next group is that whose larvae feed on grasses or sedges, either in the alpine grass-land above the scrub zone or below the forests in

cultivated grassland. They are as follows:

- Wiseana cervinata (Walker, 1865).
Crambus flexuosellus Doubleday, 1843.
Scoparia spp. ?
Xanthorhoe clarata (Walker, 1862).
Microdes epicryptis Meyrick, 1897.
Persectania atristriga (Walker, 1866).
Persectania aversa (Walker, 1856).
Leucania unica Walker, 1856.
Leucania sulcana Fereday, 1880.
Agrotis ypsilon Rottemburg.

The next group is that whose larvae feed on low herbaceous plants. They are as follows:

- Xanthorhoe semifissata (Walker, 1862).
Xanthorhoe occulta Philpott, 1903.
Xanthorhoe chionogramma (Meyrick, 1884).
Melanchnra mutans (Walker, 1857).
Ariathisa comma (Walker, 1856).

The next group consists of three species, the larvae of which are pests of cultivated crops. They are:

- Pieris rapae Linnaeus, 1758.
Persectania aversa (Walker, 1856).
Agrotis ypsilon Rottemburg.

The fifth group consists of two species whose larvae are known to feed on ferns. They are:

- Selidosema pelurgata (Walker, 1862).
Sestra flexata (Walker, 1862).

The sixth group consists of two species whose very polyphagous larvae also feed on the foliage of Olearia colensoi. They are:

- Selidosema suavis (Butler, 1879).
Declana floccosa (Walker, 1858).

The final group is comprised of three species whose larval habits are unknown. They are:

Xanthorhoe cinerearia (Doubleday, 1843).

Acharneodes querula (Meyrick, 1912).

Ichneutica ceraunias Meyrick, 1886.

As seen from the list given, little information on the flight periods of the principal species directly associated with Olearia colensoi was obtained. However, some information on the occurrence of various Lepidoptera in the subalpine zone was gathered.

A higher level of success was obtained with efforts to discover the lepidopterous larvae present and note their effects.

At least nine species of lepidopterous larvae feed on the foliage of Olearia colensoi. However, these are not distributed uniformly throughout the country and each region seems to have its dominant species as noted below.

TABLE 3 - DISTRIBUTION OF LEPIDOPTEROUS LARVAE ON OLEARIA COLENZOI

Ruahine Mountains: Melanchnra ochthistis Meyrick, 1887.

Tararua Mountains: Agriophara coricopa (Meyrick, 1897).

Magister Ridge: Agriophara coricopa (Meyrick, 1897).

Selidosema suavis (Butler, 1879).

Declana floccosa (Walker, 1858).

Chloroclystis sp. b.

Ctenopseustis obliquana (Walker, 1863).

Mt. Fox: Tortricid sp.

Pillan's Pass

Melanchra sp.

Chloroclystis sp. a.

Chloroclystis sp. b.

From the point of view of the pathology of Olearia colensoi The most important of the lepidopterous larvae present on the foliage is undoubtedly Agriophara coricopa because of its habit of attacking the unopened buds and destroying the apical meristem. Any other larvae with these habits would be similarly important. However, most of the other species have been taken from the partly opened buds where they were noted feeding on the soft green cuticle of the upper surface of the leaf bearing the veins. The effects of this latter feeding action are not nearly so important as the former, as many apparently healthy leaves have been noted with holes right through them, caused by feeding the previous season. Concentrated feeding may, however, destroy all the leaves derived from one bud and kill the growing point.

During the course of this study, population levels of lepidopterous larvae on Olearia colensoi were probably too low to cause a significant level of mortality. However, there are indications that populations of lepidopterous larvae, probably Agriophara coricopa, do reach higher levels than those noted and possibly cause a significant level of damage to stands of this plant (Zotov et al., 1938 and Dr. P. Wardle, pers. comm.).

Of the known species of Lepidoptera that attack Olearia colensoi none are confined to this plant alone. The most restricted in its host plant range is Agriophara coricopa which appears to be confined to four species of the genus Olearia. Melanchra octhisticis is known to feed on the foliage of members of three families viz: Compositae, Escalloniaceae and Rosaceae. The other known species Declana floccosa, Selidosema suavis and Ctenopseustis obliquana are all extremely polyphagous and feed on a wide range of indigenous and exotic host plants.

It is concluded that lepidopterous larvae are of prime importance

in the pathology of Olearia colensoi and that, of these, the most important is Agriophara coricopa due to its habit of attacking the unopened buds.

ORDER: HEMIPTERA

Remarks: The members of this order have varied feeding habits but the great majority are phytophagous and many are serious economic pests. All are suctorial feeders with the exception of a few adult male Coccoidea which have atrophied mouthparts (Imms, 1960). A range of families of both suborders was taken during the present study but no one species was noted to occur in especially large numbers. The classification adopted here is that of Imms (1960) however, the family name Eriococcidae is used in the sense of Hoy (1962).

Suborder: HOMOPTERA

Series: AUCHENORRHYNCHA

Superfamily: CICADOIDEA

Family: CERCOPIDAE

Cercopid sp. a.

Records: RUAHINE MOUNTAINS: Mt. Wharite, beaten from Olearia colensoi foliage, 15. ii. 1966, 2 specimens, (A.V. Spain).

Cercopid sp. b.

Record: STEWART ISLAND: Mt. Rakeahua, handpicked from Olearia colensoi foliage, 31. xii. 1964, (A.V. Spain).

Family: JASSIDAE

Jassid sp. a.

Record: SOUTH ISLAND: Pillan's Pass, beaten from Olearia colensoi foliage, 1. ii. 1965, 1 specimen, (A.V. Spain).

Remarks: Tillyard (1926) states that the members of this phytophagous family are normally important only when present in large numbers. However, Eyles (1960) states that some species are vectors of virus diseases.

Superfamily: FULGOROIDEA

Family: DERBIDAE

Derbid sp.

Records: SOUTH ISLAND: Magister Ridge, beaten from Olearia colensoi foliage, 20. i. 1965, 1 specimen, (A.V. Spain).

Family: ACHILIDAE

Genus: Agandecca White, 1879.Agandecca annectans White, 1879.

Records: RUAHINE MOUNTAINS: Mt. Wharite, beaten from Olearia colensoi foliage, 11. i. 1966, 1 specimen, (A.V. Spain).

TARARUA MOUNTAINS: Waingawa Ridge, beaten from Olearia colensoi foliage, 17. ii. 1966, 1 specimen, (A.V. Spain).

Remarks: Imms (1960) states that the nymphs of the members of this family live under bark or in cavities in dead wood.

Series: STERNORRHYNCHA

Superfamily: COCCOIDEA

Family: ERIOCOCCIDAE

Genus: Eriococcus Targioni-Tozzetti, 1869.

Eriococcus parabilis Hoy, 1962.

Records: TARARUA MOUNTAINS: Arête Stream Basin, handpicked from Olearia colensoi foliage, 23. ii. 1965, 12 specimens; 25. ii. 1965, 21 specimens, (A.V. Spain).

Remarks: Hoy (1962) states that this species is probably the most common endemic eriococcid in New Zealand, and lists 21 host plants. The present records are the first from this host plant. Hoy (1962) states that this insect is usually accompanied by a large amount of "sooty mould" and it is probably this species that is responsible for the sooty mould sometimes seen on Olearia colensoi.

Family: PSEUDOCOCCIDAE

Pseudococcid spp.

Records: RUAHINE MOUNTAINS: Mt. Wharite, handpicked from Olearia colensoi foliage, 15. ix. 1965, 4 specimens, (A.V. Spain). SOUTH ISLAND: Magister Ridge, handpicked from foliage of Olearia colensoi, 20. iii. 1964, 3 specimens, (A.V. Spain).

Remarks: Tillyard (1926) states that more than 30 species of "mealy bugs" are known from New Zealand. None appear to have been described from Olearia colensoi.

Suborder: HETEROPTERA

Family: ACANTHOSOMATIDAE

Genus: Oncacontias Breddin, 1903.

Oncacontias vittatus (Fabricius, 1881).

Records: RUAHINE MOUNTAINS: Mt. Wharite, beaten from Olearia colensoi foliage, 5. i. 1966, 1 specimen; 21. xii. 1966, 2 specimens, (A.V. Spain).

Remarks: This species is probably generally distributed throughout both the North and South Islands from sea level to approximately 1200 metres (Myers, 1926). It was however, taken at 2500 metres on a glacier on Mt. Ruapehu (Hudson, 1922) but Myers (1926) considers that it was blown up from the forest below. Myers (1926) states that this species is solely phytophagous and records it from a variety of host plant. He states that it is especially common in secondary growth and subalpine scrub. Olearia colensoi grows at, or above, the upper altitudinal limit for this species and it is considered, for this reason, Oncacontias vittatus would probably not build up high populations on this plant. Thus the effect of this insect on Olearia colensoi is, most probably, insignificant.

Family: MIRIDAE

Mirid sp.

Records: RUAHINE MOUNTAINS: Mt. Wharite, beaten from Olearia colensoi foliage, 26. xii. 1965, 1 specimen; 5. i. 1966, 1 specimen; 11. i. 1966, 1 specimen; 14. ii. 1966, 2 specimens; 15. ii. 1966, 3 specimens, (A.V. Spain).

Remarks: Miller (1956) states that the members of this family are mainly phytophagous although predacious, and partly predacious species are known. The feeding habits of this species are not known.

Immature Miridae

Records: RUAHINE MOUNTAINS: Mt. Wharite, beaten from Olearia colensoi foliage, 4. i. 1966, 2 specimens; 11. i. 1966, 6 specimens; 14. ii. 1966, 3 specimens; 29. x. 1966, 1 specimen; 21. xii. 1966, 1 specimen, (A.V. Spain).

Remarks: The specimens mentioned in these records are probably the immature forms of the species recorded above.

Family: LYGAEIDAE

Lygaeid sp.

Records: RUAHINE MOUNTAINS: Mt. Wharite, beaten from Olearia colensoi foliage, 5. i. 1966, 1 specimen, (A.V. Spain).

Remarks: Both phytophagous and predacious species occur in this family (Imms, 1960). The feeding habits of this species were not observed.

Conclusions.

It is considered that the Hemiptera associated with Olearia

colensoi play only a small part in the pathology of this plant. The most significant are probably Eriococcus parabilis and members of the families Pseudococcidae and Miridae. Most other families are represented by only a few specimens and their effect can only be insignificant.

Order: THYSANOPTERA

Remarks: The members of this order are somewhat variable in their habits. Most are phytophagous on higher plants, others occur in sub-cortical situations and in decaying vegetation where they possibly feed on fungi. Further species yet are at least partly predacious and feed on the body fluids of aphids, mites and various other small arthropods (Imms, 1960). Up to the present time 37 species of this order have been described or recorded from New Zealand. However, the biology of only four of these has been studied (Ward, unpublished revision of the New Zealand Thysanoptera).

Suborder: TEREBRANTIA

Superfamily: THRIPOIDEA

Family: THRIPIDAE

Genus: Taeniothrips Amyot et Serville, 1843.

Taeniothrips sp.

Records: RUAHINE MOUNTAINS: Waipawa Saddle, from Olearia colensoi foliage, 28. xii. 1966, 5 specimens, (A.V. Spain): Mt. Wharite, from Olearia colensoi foliage, 15. ix. 1965, 1 nymph; 21. xii. 1966, 5 adults, 25 nymphs; from Olearia colensoi buds, 29. x. 1966, 28 adults, (A.V. Spain). TARARUA MOUNTAINS: Arête Stream Basin, from Olearia

colensoi foliage, 25. ii. 1965, 1 nymph, (A.V. Spain). Blue Range, from Olearia colensoi foliage, 25. ii. 1965, 1 nymph, (A.V. Spain). SOUTH ISLAND: Strachan Range, from Olearia colensoi foliage, 31. viii. 1965, 4 adults, (A.V. Spain).

Remarks: The above species keys to Taeniothrips kellyanus (Bagnall, 1916) in Wards (unpublished) revision of the New Zealand Thysanoptera. However, Ward (pers. comm.) states that this species differs from Taeniothrips kellyanus in that the latter possess a yellow tip to the third antennal segment while the present species does not. It appears that the present species is new, but related to Taeniothrips kellyanus. The adults of this species were noted to appear in large numbers on the foliage of Olearia colensoi in the early Spring when the buds of the host plant are still virtually in their Winter dormant state. Both adults and nymphs were taken throughout the Summer. Overwintering probably occurs in the adult stage as evidenced by the August records from Strachan Range. Oviposition probably occurs, in the Spring at least, into the buds and later in the season into the tissue of the opening leaves. Little damage was noted as a result of the presence of these thrips but it is considered that they may well be responsible for part of the superficial discolouration that can frequently be observed on the upper leaf surfaces of Olearia colensoi.

Order: ORTHOPTERA

Remarks: Few members of this order were taken during the course of the study and, although they are known to be phytophagous, it is considered that they are relatively unimportant in the pathology of Olearia colensoi stands.

Family: ACRIDIDAE

Acridid sp.

Record: TARARUA MOUNTAINS: Arête Stream Basin, handpicked from Olearia colensoi bud, 19. xii. 1964, 1 nymph (A.V. Spain).

Remarks: Occasional damage to the buds of Olearia colensoi was noted at the top of its altitudinal range where it was growing to approximately the same height as the surrounding tussocks. This damage may well have been caused by the feeding action of these insects. It was, in no case severe.

Family: RHAPHIDOPHORIDAE

Subfamily: Macropathinae

Genus: Pachyramma Brunner, 1888.Pachyramma delli (Richards, 1954).

Record: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 21. xii. 1966, 1 ♂, (A.V. Spain).

Remarks: The members of this family are omnivorous in their feeding habits but apparently prefer animal food (Imms, 1960). The members of the presently recorded subfamily are known popularly as "cave wetas" however, many are not cavernicolous. This species was identified using Richards (1958) key, it has previously been recorded from two localities in the South Island where it was collected from rotten wood.

Order: BLATTARIAE

Suborder: BLABEROIDEA

Family: CHORISNEURIDAE

Genus: Celeriblattina Johns, 1966.

Celeriblattina sp.

Record: RUAHINE MOUNTAINS: Mt. Wharite, beaten from Olearia colensoi foliage, 5. i. 1966, 1 nymph, (A.V. Spain).

Remarks: Only one specimen of this order was taken during the course of the study and this was identified from Johns' (1966) work. The feeding habits of these species do not appear to be well known. Imms (1960, quoting various authors) states that the domestic species are omnivorous but prefer foods that are high in carbohydrate while the food of most wild species is mainly dead animal matter. However, some species possess symbiotic bacteria and Protozoa which permits them to feed on dead wood. Johns (1966) states that the members of this genus are small, fast running insects. This latter author has recorded them from underneath the bark of a number of trees and from the bases of Phormium tenax J.R. et G. Forst. and Freycinetia banksi A. Cunn.. The feeding habits of the species recorded above are unknown but it is probably incidental on Olearia colensoi.

Order: ODONATA

Remarks: The members of this order are predacious insects with aquatic nymphs. The food of the adult insects is captured on the wing and most orders of alate insects are preyed upon (Imms, 1960).

Suborder: ZYGOPTERA

Family: LESTIDAE

Genus: Lestes Leach, 1817.

Subgenus: Indolestes Fraser, 1922.

Lestes (Indolestes) colenonis (White, 1846).

Record: RUAHINE MOUNTAINS: Mt. Wharite, handnetted in Olearia colensoi association, 15. 11. 1966, 1 ♂, (A.V. Spain).

Remarks: Hudson (1904) states that this species is very common throughout the country and Tillyard (1926) adds that it is most plentiful in swampy situations. Dragonflies were rarely seen in Olearia colensoi associations and the only one taken is that mentioned in the records. It is considered that, because of their infrequent occurrence the members of this order play little part in the control of insects in Olearia colensoi associations. The specimen recorded above was identified using Penniket's (1966) key.

Order: EPHEMEROPTERA

Remarks: The nymphs of this order are aquatic in habit and may be either phytophagous or predacious. There are two winged instars, the subimago and imago, both of which are normally short lived. Neither of these instars feed as the mouthparts are non functional (Tillyard, 1926).

Family: LEPTOPHLEBIIDAE

Genus: Deleatidium Eaton, 1899.

Deleatidium vernale Phillips, 1930.

Record: SOUTH ISLAND: Pillan's Pass, swept from Olearia colensoi foliage, 2. 1. 1967, 1 specimen, (A.V. Spain).

Remarks: Phillips (1930b) states that individuals of the various species of this genus are possibly the most abundant of the New Zealand Ephemeroptera. The larvae are feeble swimmers and cling to the

bottom of stones in both slow and fast running water. They also are found buried in the sand and shingle of river beds, and, especially in winter, among submerged moss and waterside vegetation of many kinds (Phillips, 1930a., b).

Order: PLECOPTERA

Remarks: The nymphs of this order are exclusively aquatic and live beneath stones in clear water. They apparently require well aerated water and are rarely found in standing pools or contaminated streams, (Imms, 1960).

Family: GRIPOPTERYGIDAE

Genus: Zelandoperla Tillyard, 1923.

Zelandoperla sp.

Records: RUAHINE MOUNTAINS: Mt. Wharite, ex light trap, 5. i. 1966, 1 specimen; 5. ix. 1966, 1 specimen; handnetted in Olearia colensoi association, 15. ii. 1966, 1 specimen, (A.V. Spain).

Remarks: This specimen does not seem to belong to any of the species mentioned by Tillyard (1923).

Order: NEUROPTERA

Remarks: Imms (1960) classification of the order is used here.

Suborder: PLANIPENNIA

Superfamily: HEMEROBIOIDEA

Family: OSMYLIDAE

Subfamily: Kalosmylinae

Genus: Kempynus Navas, 1912.

Kempynus incisus (McLachlan, 1863).

Record: TARARUA MOUNTAINS: Arête Stream Basin, ex light trap, 23. ii. 1965, 1 specimen, (A.V. Spain).

Remarks: Only one specimen of this order was taken during the study and was identified from Kimmins' (1940) work. Hudson (1904) states that the carnivorous larvae of this species live under stones close to stream edges in densely wooded valleys. It is, apparently, to be found in wet places though not those that are submerged for long periods. The imagines occur from approximately November to the middle of March (Hudson, 1904). This species is stated to be common in the forests of the North Island and has also been recorded from Nelson and the Otago districts. It probably occurs in wooded areas throughout New Zealand. (Hudson, 1904).

Order: COLLEMBOLA

Remarks: A few members of this order were taken from the foliage of Olearia colensoi but were not determined. All belong to the suborder Arthropleona.

Collembolan sp. a.

Record: RUAHINE MOUNTAINS: Rangiwahia Ski Club Hut Area, hand-picked from Olearia colensoi foliage, 4. iv. 1964, 1 specimen, (A.V. Spain).

Collembolan sp. b.

Record: RUAHINE MOUNTAINS: Mt. Wharite, handpicked from Olearia colensoi foliage, 15. ix. 1965, 1 specimen, (A.V. Spain).

Collembolan sp. c.

Record: SOUTH ISLAND: Magister Ridge, handpicked from Olearia colensoi foliage, 20. iii. 1964, 3 specimens, (A.V. Spain).

Order: TRICHOPTERA

Remarks: The members of this order were not studied as the larvae are aquatic and not associated with plants. Most were collected in light traps and members of the following families were noted:

Hydroptilidae

Polycentropodidae

Rhyacophilidae

All specimens have been forwarded to Mr. A. G. McFarlane, of the Canterbury Museum (New Zealand) for study and determination.

Order: HYMENOPTERA

Remarks: The members of this order were not well represented in the collections. Those taken have not been determined.

CHAPTER FOUR

DISCUSSION

INTRODUCTION

The results of the survey indicate that a wide range of Arthropods of various habits live on, and in the general environment of Olearia colensoi.

The principal orders of the Acari represented in the collections from Olearia colensoi itself are the Cryptostigmata, Mesostigmata and Prostigmata. The orders Coleoptera and Lepidoptera were the most predominant of the Insecta taken from the plant.

In the collections from the general environment of Olearia colensoi the orders Coleoptera, Diptera and Lepidoptera were the best represented of the aerial fauna. The ground litter was dominated by Acari of the orders Cryptostigmata, Mesostigmata and, to a somewhat lesser extent, the Prostigmata. Insects predominant in this layer were members of the orders Coleoptera, Collembola and larval Diptera.

ANALYSIS OF THE FAUNA

For purposes of analysis, the fauna collected from Olearia colensoi may be separated into two groups. The first group consists of that part of the fauna actually taken from Olearia colensoi, the second of that occurring generally in associations of this plant but not necessarily directly associated with it.

SPECIES OCCURRING ON OLEARIA COLENZOI

The species of this first group may be divided, on the basis of their presumed feeding niches, into those with phytophagous and those with zoophagous habits.

Phytophagous Species. The species of this group were taken from the foliage, flowers, bark and branches of Olearia colensoi. A list of these species is presented in Table 4 together with details of their niches and the stage of the life history at which they are parasitic on this plant.

Table 4 - Phytophagous Species Collected from Olearia colensoi

Species	Foliage Feeders	Fungivores Algivores	Xylophagous Species	Remarks
Lepidoptera:				
<u>Selidosema suavis</u>	+			larva
<u>Declana floccosa</u>	+			larva
<u>Chloroclystis</u> sp. a.	+			larva
<u>Chloroclystis</u> sp. b.	+			larva
<u>Agriophara coricopa</u>	+			larva
<u>Ctenopseustis obliquana</u>	+			larva
Tortricid sp.	+			larva
<u>Melanchra ochthistis</u>	+			larva
<u>Melanchra</u> sp.	+			larva
Coleoptera:				
Cerambycid sp.			+	larva
<u>Adoxia vulgaris</u>	+			adult
<u>Adoxia oleareae</u>	+			adult
<u>Adoxia simmondsi</u>	+			adult
<u>Adoxia rugicollis</u>	+			adult

Species	Foliage Feeders	Fungivores Algivores	Xylophagous Species	Remarks
<u>Adoxia insolitus</u>	+			adult
<u>Adoxia</u> sp. a.	+			adult
<u>Adoxia</u> sp. b.	+			adult
<u>Peristoreus oleariae</u>	+			adults and larvae
<u>Baeosomus</u> sp.	+			adults only
<u>Platyomida morosa</u>	+			adults
<u>Gromilus acuminatus</u>	+			adults
<u>Tigones binodulus</u>	+			adults
<u>Brachyolus</u> sp.	+			adults
<u>Asilis</u> sp.	+			adult
<u>Selenopalpus aciphyllae</u>	+			adults only
<u>Protelater diversus</u>	?+			adults only
<u>Corymbites</u> sp.	?+			adults only
<u>Oxylasma basalis</u>	?+			adults only
<u>Oxylasma</u> sp.	?+			adults only
<u>Sphaenelater lineicollis</u> ?	+			adults only
Diptera:				
<u>Macromastix</u> sp.			? +	larva only
Hemiptera:				
Cercopid sp. a.	+			nymphs and adults
Cercopid sp. b.	+			nymphs and adults
Jassid sp.	+			nymphs and adults
<u>Agandecca annectans</u>	+			nymphs and adults
<u>Eriococcus parabilis</u>	+			nymphs and adults

Species	Foliage Feeders	Fungivores Algivores	Xylophagous Species	Remarks
Pseudococcid sp.	+			nymphs and adults
<u>Oncacontias vittatus</u>	+			nymphs and adults
Mirid sp.	+			nymphs and adults
Lygaeid sp.	+			nymphs and adults
Thysanoptera:				
<u>Taeniothrips</u> sp.	+			nymphs and adults
Orthoptera:				
Acridid sp.	+			nymphs and adults
Blattariae:				
<u>Celeriblattina</u> sp.		+		nymphs and adults
Collembola:				
Collembolan sp. a.		+		nymphs and adults
Collembolan sp. b.		+		nymphs and adults
Collembolan sp. c.		+		nymphs and adults
Collembolan sp. d.		+		nymphs and adults
Acari:				

A B 130 C D E F G H I

10

9

510

8

7

6

5

4

3

450

2

Noted

H.P.

Kawhia R.

R.

Marokopa R.

Kiwhakōwhiri R.

Waipa R.

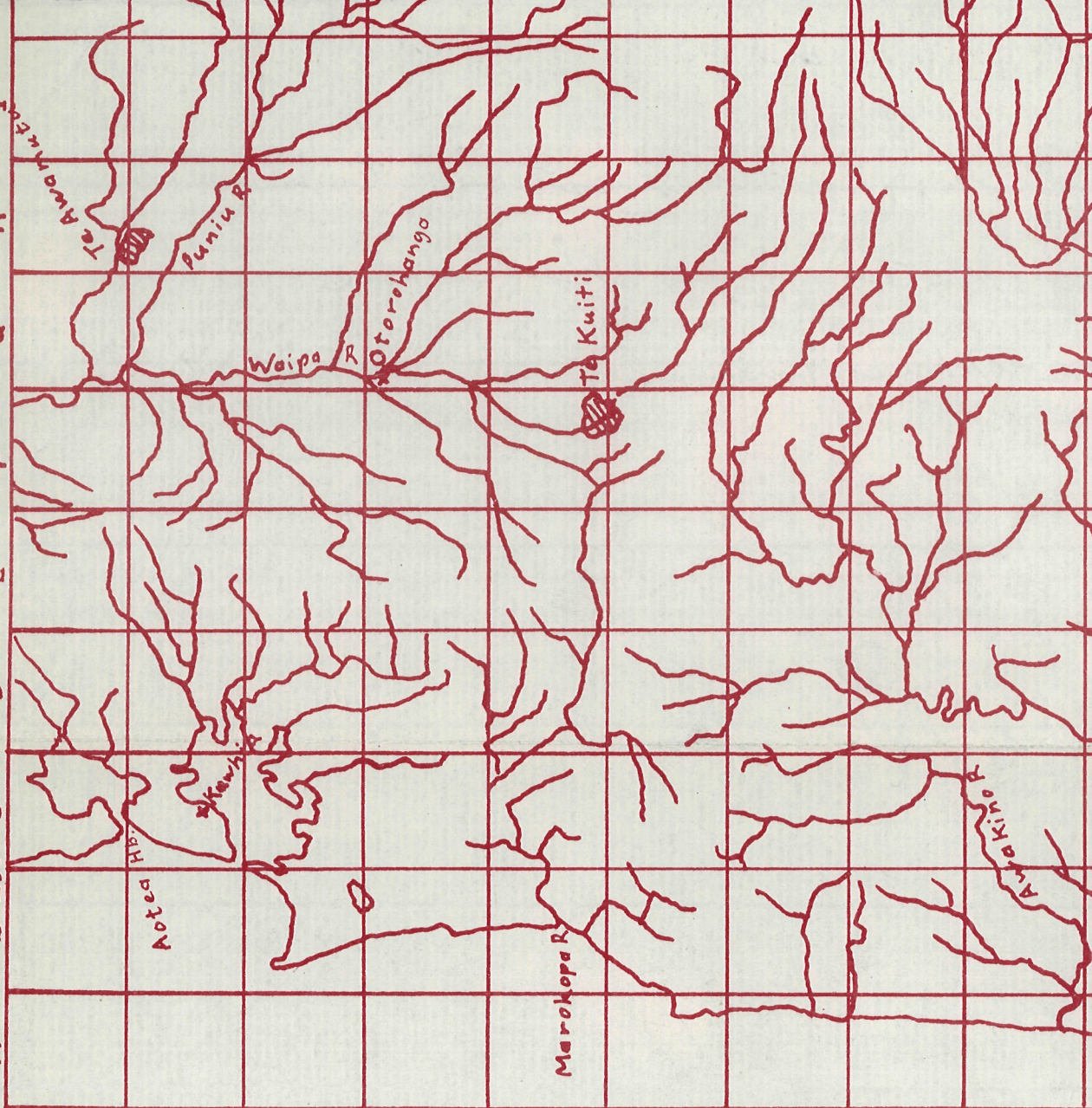
R.

Otorehanga

To Kuiti

Puniu R.

Te Awamōke



Species	Foliage Feeders	Fungivores Algivores	Xylophagous Species	Remarks
Prostigmata:				
<u>Tetranychus</u> sp.	+			all stages
<u>Tydeus</u> sp.	? +			all stages
<u>Lasiotydaeus</u> sp.	? +			all stages
<u>Steneotarsonemus</u> sp.	? +	? +		all stages
<u>Eupodes</u> sp.	+			all stages
<u>Eupodid</u> sp.	+			all stages
Cryptostigmata:				
<u>Holonothus</u> sp.		+		all stages
? <u>Scapheremaeus</u> sp.		+		all stages
<u>Tuparezetes christineae</u>		+		all stages
<u>Mycozetes oleariae</u>		+		all stages
<u>Anellozetes intermedius</u>		+		all stages
<u>Campbellobates occultus</u>		+		all stages
? <u>Porozetes</u> sp. a.		+		all stages
? <u>Porozetes</u> sp. b.		+		all stages
<u>Ingella bullager</u>		+		all stages
<u>Maculobates longus</u>		+		all stages
<u>Maculobates</u> sp.		+		all stages
<u>Calvoppia</u> sp.		+		all stages
<u>Cosmobates</u> sp.		+		all stages
<u>Urubambates</u> sp.		+		all stages
<u>Totobates</u> sp. a.		+		all stages
<u>Totobates</u> sp. b.		+		all stages
<u>Totobates</u> sp. c.		+		all stages
<u>Totobates</u> sp. d.		+		all stages

Species	Foliage Feeders	Fungivores Algivores	Xylophagous Species	Remarks
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Species Incidental on Olearia colensoi

<u>Storeus albosignatus</u>	+			host: <u>Acacia</u> spp.
<u>Hyperodes bonariensis</u>	+			host: grasses
<u>Exocalopus pectinatus</u>		+		sub cortical feeder
<u>Hylastes ater</u>			+	dead wood feeder
<u>Salpingus</u> sp.		+		fungivore
<u>Metriorrhynchus rufipennis</u>				possibly a pollenivore
<u>Melanophthalma</u> sp.		+		possibly a fungivore

Analysis of this table shows that 65% of the phytophagous species occurring on Olearia colensoi feed on the foliage and flowers, while 33% are fungivorous or algivorous and 2% are xylophagous.

These figures, while demonstrating the ratio of species with various feeding habits, give no information on the numbers of individuals of each type present. This plant, for reasons described above, supports a large population of fungivorous cryptostigmatic mites, the various species of which are the most numerous arthropods present. However, their role in the pathology of this plant can only be insignificant.

Less numerous in terms of individuals, but more important to the health of the plant, are the members of the coleopterous families Chrysomelidae and Curculionidae. These leaf and flower feeders are responsible for a small amount of damage and probably rarely, if ever, reach sufficiently high population levels to have any serious effect on the plant.

In terms of their deleterious effects on the plant lepidopterous larvae are, without doubt, the most important of the plant parasites present on Olearia colensoi, in spite of comprising only 19.5% of the species of this latter group.

The other leaf feeding species normally present in low numbers, are most probably unimportant, as are the species of the other fungivorous groups.

A regional analysis of the distribution of the species feeding on the tissues of Olearia colensoi at four of the principal collecting sites is presented in Table 5 below.

Table 5 - Regional Analysis of Plant Parasitic Arthropods Associated with Olearia colensoi at Four Localities.

Species	Pillan's Pass	Magister Ridge	Tararua Mountains	Ruahine Mountains
Lepidoptera:				
<u>Selidosema suavis</u>		+		
<u>Declana floccosa</u>	+	+		
<u>Chloroclystis</u> sp. a.	+			
<u>Chloroclystis</u> sp. b.	+	+		
<u>Agriophara coricopa</u>		+	+	
<u>Ctenopseustis obliquana</u>		+		
<u>Melanchra ochthistis</u>				+
<u>Melanchra</u> sp.	+			
Coleoptera:				
Cerambycid sp.			+	
<u>Adoxia vulgaris</u>				+
<u>Adoxia oleareae</u>			+	
<u>Adoxia simmondsi</u>				+

Species	Pillan's Pass	Magister Ridge	Tararua Mountains	Ruahine Mountains
<u>Adoxia rugicollis</u>			+	
<u>Adoxia insolitus</u>	+			
<u>Adoxia</u> sp. a.	+	+		
<u>Adoxia</u> sp. b.		+		
<u>Peristoreus oleariae</u>		+		+
<u>Platyomida morosa</u>		+		
<u>Gromilus acuminatus</u>			+	
<u>Tigones binodulus</u>				+
<u>Brachyolus</u> sp.			+	
<u>Asilis</u> sp.				
<u>Selenopalpus aciphylliae</u>			+	
<u>Protelater diversus</u>				+
<u>Corymbites</u> sp.				+
<u>Oxylasma basalis</u>				+
<u>Oxylasma</u> sp.				+
<u>Sphaenelater lineicollis</u>				+
Hemiptera:				
Cercopid sp. a.				+
Jassid sp. a.	+			
Derbid sp.		+		
<u>Agandecca annectans</u>			+	+
<u>Eriococcus parabilis</u>			+	
Pseudococcid spp.		+		+
<u>Oncacontias vittatus</u>			+	+
Mirid sp.				
Lygaeid sp.				

Species	Pillan's Pass	Magister Ridge	Tararua Mountains	Ruahine Mountains
Thysanoptera:				
<u>Taeniothrips</u> sp.			+	+
Orthoptera:				
Acriddid sp.			+	
Acari:				
Prostigmata:				
<u>Tetranychus</u> sp.		+		
<u>Tydeus</u> sp.				+
<u>Lasiotydaeus</u> sp.		+		
<u>Steneotarsonemus</u> sp.				+
Eupodid sp.		+		

This regional analysis shows that very few of the arthropods parasitic on Olearia colensoi have a wide distribution. Only two species, Agriophara coricopa and Peristoreus oleariae, are shown to have an inter island distribution, however Taeniothrips sp. has been taken at one South Island locality. Neither of the latter species appear to be serious pathogens but Agriophara coricopa frequently kills the apical meristems when it attacks buds that are at an early stage of development.

As stated earlier, the condition of Olearia colensoi stands is often related to the steepness of the ground on which they grow and it appears unlikely that this would be correlated with arthropod activity. Consideration of the associations growing on the steeper slopes of, for example, Westland and the Tararua Mountains should reflect the amount of damage that can be ascribed to arthropods. In each of these situations though, with the exception of animal travel routes, damage

does not appear to be unduly serious. It would thus appear that damage to Olearia colensoi would tend to be associated with some factor other than arthropods.

Zoophagous Species.

A number of zoophagous species were collected from the foliage of Olearia colensoi and a list of these is presented in Table 6 below.

Table 6 - Zoophagous Species Collected from Olearia colensoi.

Species	Predators	Parasites	Remarks
Coleoptera:			
<u>Scopodes elaphroides</u>	+		adult
Carabid sp.	+		larva
<u>Ischnoderus morosus</u>	+		
<u>Ocalea</u> sp.	+		
<u>Thamiaraea</u> sp.	+		
<u>Quedius</u> sp.	+		
<u>Cyphon genalis</u>	+		
<u>Cyphon flavescens</u>	+		
<u>Cyphon rectalis</u>	+		
<u>Cyphon</u> sp. a.	+		
<u>Cyphon</u> sp. b.	+		
<u>Cyphon</u> sp. c.	+		
<u>Cyphon</u> sp. d.	+		
<u>Mesocyphon granulata</u>	+		
<u>Mesocyphon</u> sp. a.	+		
<u>Mesocyphon</u> sp. b.	+		
<u>Mesocyphon</u> sp. c.	+		
<u>Mesocyphon</u> sp. d.	+		
<u>Mesocyphon</u> sp. e.	+		

Species	Predators	Parasites	Remarks
<u>Mesocyphon</u> sp. f.	+		
<u>Veronatus longicornis</u>	+		
<u>Sagola</u> sp.	+		
<u>Coccinella</u> <u>11-punctata</u>	+		adults
<u>Scymnus flavihirtus</u>	+		larvae
Diptera:			
Cecidomyiid sp.	+		larvae
Acari:			
Prostigmata:			
<u>Microtrombidium</u> sp.	+	+	both habits occur
<u>Mecognatha hirsuta</u>	+		
<u>Mediolata favulosa</u>	+		
<u>Mediolata robusta</u>	+		
<u>Mediolata</u> sp.			
<u>Mullederia arborea</u>	+		
<u>Pseudostigmaeus collyerae</u>	+		
Cunaxid sp.	+		
Mesostigmata:			
<u>Asca arboriensis</u>	+		
<u>Typhlodromus</u> sp. a.	+		
<u>Typhlodromus</u> sp. b.	+		
<u>Typhlodromus</u> sp. c.	+		

As shown in Table 6 no exclusively parasitic species were taken. There are, no doubt, a number of hymenopterous, and possibly dipterous, species which are parasitic on the lepidopterous larvae

attacking Olearia colensoi. However, none of these were noted.

The predatory species of Coleoptera noted in Table 6 were not present regularly or, except in the case of the species of Cyphon or Mesocyphon, in large numbers. The predatory Acari were, however, present regularly and in the case of Mullederia arborea, in quite large numbers. The species of both groups are probably general predators on the eggs and other stages of many of the mites and other arthropods present.

SPECIES COLLECTED IN THE GENERAL ENVIRONMENT OF OLEARIA COLENZOI

The species of this group were taken by general trapping methods such as light trapping and general sweeping. They are thus, in a number of cases, not associated with Olearia colensoi and can be considered incidental in associations of this plant.

A list of the species taken is presented in Table 7. Table 8 contains a number of zoophagous species collected by general trapping methods and should be considered together with Table 7. These species have been separated out because they are potentially predatory or parasitic on the arthropods associated more directly with Olearia colensoi.

Table 7 - Species Collected from the General Environment of Olearia colensoi.

Species	Litter breeding		Others	Remarks
	Species	Feeders		
Lepidoptera:				
<u>Aenetus virescens</u>			+	
<u>Wiseana cervinata</u>			+	
<u>Pieris rapae</u>			+	
<u>Vanessa gonerilla</u>			+	
<u>Lycaena sallustius</u>			+	

Species	Litter breeding	Dead wood		Remarks
	Species	Feeders	Others	
<u>Scoparia</u> spp.			+	
<u>Crambus flexuosellus</u>			+	
<u>Selidosema leucelæa</u>			+	
<u>Selidosema pelurgata</u>			+	
<u>Declana atronivea</u>			+	
<u>Declana junctilinea</u>			+	
<u>Declana leptomera</u>			+	
<u>Sestra flexata</u>			+	
<u>Microdes epicryptis</u>			+	
<u>Orthoclydon praelectata</u>			+	
<u>Chloroclystis melochlora</u>			+	
<u>Chloroclystis sandycias</u>			+	
<u>Chloroclystis</u> sp.			+	
<u>Xanthorhoe cedrinodes</u>			+	
<u>Xanthorhoe semifissata</u>			+	
<u>Xanthorhoe clarata</u>			+	
<u>Xanthorhoe occulta</u>			+	
<u>Xanthorhoe cinerearia</u>			+	
<u>Xanthorhoe chionogramma</u>			+	
<u>Epiphryne verriculata</u>			+	
<u>Epiphryne autocharis</u>			+	
<u>Epiphryne undosata</u>			+	
<u>Hydriomena lithurga</u>			+	
<u>Epirrhanthis ustaria</u>			+	
<u>Epirrhanthis alectoraria</u>			+	
<u>Ichneutica ceraunias</u>			+	larvae unknown
<u>Persectania atristriga</u>			+	
<u>Persectania aversa</u>			+	
<u>Melanchnra mutans</u>			+	

	Litter breeding	Dead Wood		
Species	Species	Feeders	Others	Remarks
<u>Melanchra rubescens</u>			+	
<u>Melanchra ustistriga</u>			+	
<u>Melanchra plena</u>			+	
<u>Ariathisa comma</u>			+	
<u>Leucania sulcana</u>			+	
<u>Leucania unica</u>			+	
<u>Agrotis ypsilon</u>			+	
<u>Acharneodes guerula</u>			+	
Diptera:				
<u>Limonia (Dicranomyia)</u> sp. a.	+			
<u>Limonia (Dicranomyia)</u> sp. b.	+			
<u>Limonia huttoni</u>	+			
<u>Limonia (Zelandoglochina)</u> sp. a.	+			
<u>Limonia (Zelandoglochina)</u> sp. b.	+			
<u>Molophilus</u> sp. a.	+			
<u>Molophilus</u> sp. b.	+			
<u>Molophilus</u> sp. c.	+			
<u>Gynoplistia sackeni</u>	+			
<u>Gynoplistia cuprea</u>	+			
<u>Gynoplistia</u> sp. a.	+			
<u>Gynoplistia</u> sp. b.	+			
<u>Limnophila argus</u>	+			
<u>Limnophila skusei</u>	+			
<u>Orolimnophila eluta</u>	+			
<u>Orolimnophila</u> sp.	+			

Species	Litter breeding		Dead wood		Remarks
	Species		Feeders	Others	
<u>Rhamphophila obscuripennis</u>	+				
<u>Holorusia novarae</u>	+				
<u>Macromastix ferruginosa</u>	+				
<u>Macromastix rufiventris</u>	+				
<u>Macromastix</u> sp.	+				
<u>Pericoma</u> sp.	+				
<u>Psychoda</u> sp.	+				
<u>Paracladura</u> sp. a.	+				
<u>Paracladura</u> sp. b.	+				
<u>Nerviuncta hexachaeta</u>	+				
<u>Mycetophila grandis</u>	+				
<u>Mycetophila griseofusca</u>	+				
<u>Mycetophila grisescens</u>	+				
<u>Mycetophila subspinigera</u>	+				
<u>Dilophus nigrostigmata</u>	+				
<u>Dilophus harrisoni</u>	+				
<u>Orthocladus</u> sp. a.	+				
<u>Orthocladus</u> sp. b.	+				
<u>Anatopynia antarctica</u>	+				
<u>Smittia</u> sp.	+				
<u>Pentaneura malus</u>	+				
<u>Metriocnemus</u> sp.	+				
<u>Chironomus zealandicus</u>	+				
<u>Miastor</u> sp.				+	see records
<u>Benhamyia straznitskii</u>	+				
<u>Eulalia neodorsalis</u>	+				
<u>Scaptia brevipalpis</u>	+				see records
<u>Dasybasis truncata</u>	+				see records
<u>Helophilus antipodus</u>	+				

Species	Litter breeding		Dead wood		Remarks
	Species		Feeders	Others	
<u>Megaseiia comparabilis</u>	+				
<u>Lonchoptera dubia</u>	+				
<u>Leptocera luteilabris</u>	+				
<u>Leptocera (Limosina) sp.</u>	+				
<u>Hydrellia tritici</u>				+	
<u>Scaptomyza fuscitarsis</u>				+	
<u>Calliphora quadrimaculata</u>	+				
<u>Calliphora laemica</u>	+				
Coleoptera:					
<u>Megadromus turgidiceps</u>	+				
<u>Plocamostethus planiusculus</u>	+				
<u>Holcaspis oedicephala</u>	+				
<u>Tarastethus sp.</u>	+				
<u>Creophilus oculatus</u>	+				
<u>Holotrochus gracilis</u>	+				
<u>Prionoplus reticularis</u>			+		
<u>Oemona hirta</u>				+	live wood feeder
<u>Epheus costifer</u>			+		
<u>Tetrorea cilipes</u>			+		
<u>Odontria magnum</u>				+	subterranean larva
<u>Odontria marmorata</u>				+	subterranean larva
<u>Pyronota festiva</u>				+	subterranean larva, Montane grassland species
<u>Etheophanus pinguis</u>			? +		adults fern feeders
<u>Anagotus rugosus</u>				+	host plant <u>Coprosma</u> sp.
<u>Anagotus helmsi</u>				+	polyphagous leaf feeder

Species	Litter breeding		Dead wood		Remarks
	Species	Species	Feeders	Others	
<u>Amphiskirra umbricola</u>		+			
<u>Sosgenes discalis</u>			+		
<u>Anthribus inornatus</u>			+		
<u>Lasiorrhynchus barbicornis</u>			+		
<u>Scaphisoma</u> sp.				+	
<u>Necrophilus prolongatus</u>		+			
<u>Vidamus</u> sp.		+			
<u>Chalcodrya variegata</u>			+		
<u>Elatichrosis barbata</u>		+			
<u>Thelyphassa barbicornis</u>			+		
Orthoptera:					
<u>Pachyramma delli</u>			?	+	
Plecoptera:					
<u>Zelandoperla</u> sp.				+	nymphs aquatic
Ephemeroptera:					
<u>Deleatidium vernale</u>				+	nymphs aquatic
Neuroptera:					
<u>Kempynus incisus</u>				+	larvae semi-aquatic
Trichoptera:					
many species				+	nymphs aquatic

Table 8 - Zoophagous Species from the General Environment of
Olearia colensoi.

Species	Predator	Parasite	Stage Taken
Coleoptera:			
<u>Amarotypus edwardsi</u>	+		adult
<u>Cyphon</u> sp. d.	+		adult
<u>Mesocyphon divergens</u>	+		adult
Diptera:			
<u>Chrysosma dictaetum</u>	+		adult
<u>Empis probata</u>	+		adult
<u>Homalocnemis inexpletus</u>	+		adult
<u>Chelipoda longicornis</u>	+		adult
<u>Cladromia soleata</u>	+		adult
<u>Scelolabes</u> sp.	+		adult
<u>Syrphus novae-zealandiae</u>	+		adult
<u>Campylia temerarium</u>		+	adult
<u>Perrissina bruniceps</u>		+	adult
<u>Medinella flavofemorata</u>		+	adult
<u>Phaoniella bifida</u>		+	adult
Odonata:			
<u>Lestes colensois</u>	+		adult

The species recorded in Tables 7 and 8 may be separated on the basis of their origins and breeding habits, into a number of categories.

The first category consists of those species that occur in, or whose larvae occur in leaf litter. This grouping encompasses most of the Diptera recorded in Table 7 and a number of predatory Coleoptera of the families Carabidae and Staphylinidae. A few scavengers, such as

Necrophilus prolongatus, also belong here.

The species that live in dead wood constitute the next category. This group consists of a variety of Coleoptera of various families and includes such species as Prionoplus reticularis and Lasiorrhynchus barbicornis.

Another major element consists of the phytophagous species that feed on living plants. Included here are most of the Lepidoptera and a few Coleoptera, as well as a number of Scarabaeidae which are subterranean root feeders in their larval stages.

The zoophagous species constitute a further element and these are presented in Table 8.

The final group consists of those species with aquatic immature stages namely, the Ephemeroptera, Plecoptera and Trichoptera. The species belonging to these orders can have no effect on Olearia colensoi.

It will be noted that species occurring in Olearia colensoi associations are derived from many situations both above and below the level of associations of this plant. This situation was not altogether unexpected as Olearia colensoi occupies a rather limited altitudinal zone. Also, reports in the literature (Gibbs and Ramsay, 1960; Hudson, 1950; Taylor, 1961) indicated the relatively frequent occurrence of lowland insects at higher altitudes.

PATHOLOGY OF OLEARIA COLENZOI

Olearia colensoi is attacked by a variety of phytophagous arthropods. However, few of these ever attain pest status. Another factor to be considered is that, as far as is known, only three species have more than a local distribution. These species are Agriophara coricopa, Peristoreus oleariae and Taeniothrips sp. all of which occur on Olearia colensoi in both the North and South Islands. Of these, the only serious pest is Agriophara coricopa which is, in the Tararua Mountains, at least, the major arthropodan mortality factor. This species though,

has so far been recorded on Olearia colensoi only from Magister Ridge and the Tararua Mountains localities mentioned above. Thus it is unlikely that Agriophara coricopa is the only major pathogen, as evidenced by Wardle's (1961) statement that there is much dead and dying Olearia colensoi on Secretary Island where no deer are present.

No large scale death of Olearia colensoi due to arthropods has been observed during the course of the present study. However, evidence exists to show that this sometimes occurs. (Zotov, et al. 1938 and Wardle, pers. comm.) and it is probable that the agent involved is, in the Tararua Mountains at least, Agriophara coricopa.

It is considered that factors other than arthropods must be taken into account if a full explanation of the pathology of Olearia colensoi is to be made. Fungal diseases appear to be minor in importance as do the abiotic factors, such as sun scald and frost damage.

Based on the statements of such authors as Holloway, et al. (1963), Riney, et al. (1959), Wardle (1960 and 1961) and Zotov, et al. (1938) and limited personal observations made during the present study it would appear that browsing mammals must take responsibility for a major portion of the damage that occurs to Olearia colensoi stands. Of these, apparently only a few are seriously involved, either because of their habits or distribution. These include deer, chamois, goats, pigs and possibly feral cattle in a few of the lower areas. Opossums and hares, although present in some Olearia colensoi associations, appear to be relatively unimportant as mortality factors (Elder, 1965 and Wardle, 1960).

Browsing mammals are a generally accepted cause of serious damage to New Zealand's indigenous vegetation, and it is easy to accept the hypothesis that these mammals are the sole factor involved. However, the role of natural mortality factors affecting indigenous plants under the altered environment induced by the presence of mammals has rarely been studied.

The situation with regard to Olearia colensoi associations is a

complex one. A number of plant parasites are present whose action on Olearia colensoi is imperfectly understood or unknown. These factors, and the importance of each, vary from area to area within the range of this plant. At least one of these arthropods is known to undergo population fluctuations of such amplitude that large scale death of Olearia colensoi results. The role of the predatory and parasitic species associated with the phytophagous species is almost completely unknown and a long term study of the population levels of the various arthropods present in Olearia colensoi stands would be required to show how these factors act and which are the key ones.

In pre-European times the population levels of the "key" phytophagous species on Olearia colensoi fluctuated at a level that was presumably generally below a "threshold" at which death occurred. This threshold level is somewhat difficult to define absolutely but may be considered as that level of damage (whether it be to the bark, buds, or roots) which in total, is sufficient to cause death of an individual plant. Occasionally fluctuations apparently exceed the threshold level over considerable areas causing widespread mortality. As this occurred in the absence of browsing mammals regeneration was no doubt rapid. But in the presence of these animals, regeneration is delayed with consequent soil loss and erosion which in turn reduces the probability of successful seedling establishment.

At the present time these fluctuations continue to occur. On these fluctuations are superimposed the added "tax" of animal browsing of buds together with root and stem damage, all of which are heaviest on the gentler slopes. This has extremely serious consequences for Olearia colensoi and may eventually result in its exclusion from all but the steeper slopes, and its replacement by other species.

CHAPTER FIVE

SUMMARY

A survey of Olearia colensoi was conducted at a number of points throughout its range with the primary aim of discovering the major phytophagous and zoophagous arthropods associated with this plant and elucidating their role. A secondary aim was to characterize the general fauna of the area in which Olearia colensoi grows.

These aims were achieved by a collecting and trapping programme conducted at a number of localities on Stewart Island, the West Coast of the South Island and at points in the Tararua and Ruahine Mountains. Also, samples of Olearia colensoi foliage were received from a number of localities that were not able to be visited personally, notable the Huiarau Range.

The fauna specific to Olearia colensoi was sampled by hand picking, beating and sweeping of foliage, collection of foliage for later examination in the laboratory and splitting of branches and stems. The more general fauna was collected by light trapping, general sweeping within Olearia colensoi associations and also by the extraction from leaf litter, with Tullgren apparatus, of the fauna of this layer.

The results of the survey revealed that a range of species with a wide variety of feeding habits occur on Olearia colensoi. A total of 78 phytophagous species was collected from the foliage, flowers and stems of this plant. The following major taxa are represented:

Coleoptera	28 species
Cryptostigmata	18 species

Lepidoptera	9 species
Hemiptera	9 species
Prostigmata	6 species
Collembola	4 species
Diptera	1 species
Thysanoptera	1 species
Orthoptera	1 species
Blattariae	1 species

Of these, seven species of Coleoptera are known to be associated with other plants and are not included in further analyses. Of the remainder, 65% feed on the foliage or flowers, 33% are fungivorous and 2% are xylophagous.

Thirty six zoophagous species were taken and members of the following major taxa are represented in the collections:

Coleoptera	24 species
Prostigmata	7 species
Mesostigmata	4 species
Diptera	1 species

All the zoophagous arthropods taken, with the exception of the immature stages of a species of Microtrombidium, are predatory. It is considered that there are probably a number of species that parasitize the various lepidopteran larvae present on the foliage of Olearia colensoi but they were not taken.

A large number of species was taken from the general environment of Olearia colensoi and the major taxa represented are as follows:

Diptera	64 species
Lepidoptera	42 species

Coleoptera	29 species
Orthoptera	1 species
Plecoptera	1 species
Ephemeroptera	1 species
Neuroptera	1 species
Odonata	1 species

Most of the Diptera are species that breed in the leaf litter, either of Olearia colensoi or the vegetation found above or below stands of this plant. The Lepidoptera are derived from a number of situations. Some are, in the larval stage, lowland crop or pasture pests, others defoliate woody angiosperms. Yet others feed on low plants and grasses while one species, in the larval stage, bores the stems of living trees. The Coleoptera taken have diverse habits with dead wood feeders, fungivores, and a variety of predators represented. A number of ground beetles and some whose larvae are subterranean also occur in the collections. The order Orthoptera is represented by one, probably omnivorous, species. All other species taken have aquatic or semi-aquatic larvae. Numerous Trichoptera were taken but not identified.

Of the species collected from the general environment of Olearia colensoi, a number of zoophagous species of Diptera may be involved in control of species more intimately associated with the plant. These are the parasitic species of the family Tachinidae and a number of predatory Empididae.

It is considered that arthropods play a significant part in the pathology of Olearia colensoi in certain areas and at certain, probably irregular, intervals. The most important arthropodan pathogens are, without doubt, the various Lepidopteran larvae that occur on the foliage. However, the various species attacking Olearia colensoi are not widely spread, and with the exception of a few, are apparently limited in their distribution to particular regions. The main exception is Agriophara

coricopa (Meyrick) which occurs in the Tararua Mountains and also in the Southern Alps near Hokitika. This species is probably the most important arthropod associated with Olearia colensoi as it has the habit of attacking and destroying the buds before they open, thereby destroying the apical meristem. This is especially important in the case of a plant like Olearia colensoi that has a very limited ability to regenerate shoot apices from dormant laterals. Evidence exists that this species occasionally occurs in epidemic proportions and does considerable damage to Olearia colensoi stands which possibly helps open them up, thus facilitating attack by browsing mammals. Other arthropods generally appear to be minor in their effects on the plant.

Various other factors are involved in the pathology of Olearia colensoi. The first of these is a fungus disease caused by Uredo tupare Cunningham which is responsible for a small amount of leaf spotting, its effects are apparently minor. The most important agents causing widespread death of Olearia colensoi in a number of localities are browsing mammals. These animals have, no doubt, constituted the overbalancing force in many areas.

Two new species of Cryptostigmata (Acari) were described from specimens collected from Olearia colensoi. One of the new species represents a new family within the superfamily Opilioidea and possesses a number of adaptations for an arboreal existence. The other species represents a new genus within the family Mycobatidae.

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I should also like to thank the following persons for collecting samples of the foliage of Olearia colensoi from which arthropods were taken:

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Mr. J.C. McIlroy, of Lincoln College, New Zealand.

Mr. D.L. Prebble, of Napier, New Zealand.

Mr. F.P. Wallis, of the New Zealand Forest Service.

Dr. P. Wardle, of Botany Division, D.S.I.R., Lincoln. I should also like to thank Dr.

Wardle for providing much useful information on the botanical aspects of this study and for advice on suitable study locations.

Finally, I should like to thank my wife, Christine, for considerable help in the preparation of the figures.

APPENDICES

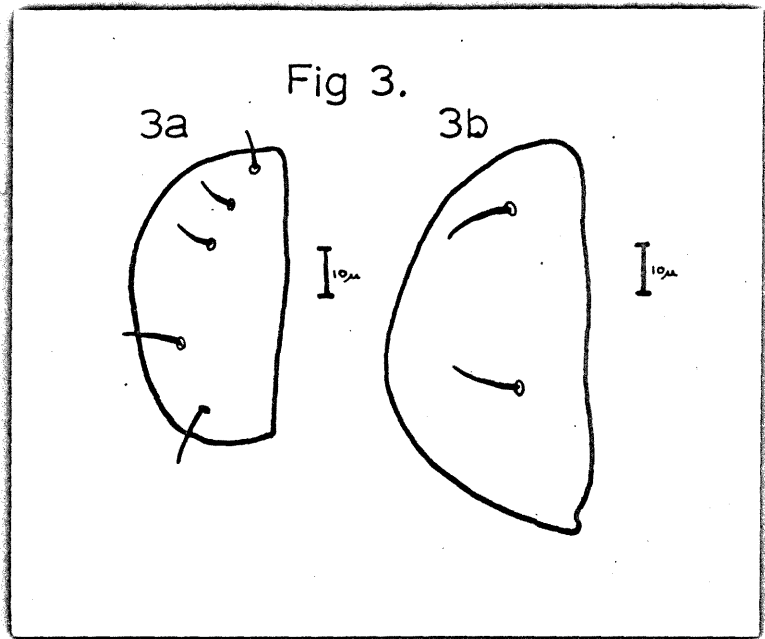
APPENDIX A - DESCRIPTIONS OF NEW TAXA

The descriptions of two new species, and a number of higher taxa resulting from these, are appended below.

The first paper is a description of a new species and genus of the family Mycobatidae (Acari: Cryptostigmata). This paper is to be published in *Acarologia* 10 (3) which will appear on the 1st July, 1968.

The second paper is a description of a new species and genus of a new family within the superfamily Oppioidea (Acari: Cryptostigmata). This paper has been submitted for publication in the journal "Pacific Insects".

The third paper is an unpublished description of a new species of the genus Porozetes Hammer.



Thesis figure 13 Mycozetes oleariae
(a) Genital plate
(b) Anal plate

A NEW GENUS OF ARBOREAL MYCOBATIDAE FROM
NEW ZEALAND (ACARI: CRYPTOSTIGMATA)

A.V. Spain, Agricultural Zoology Department, Lincoln College,
Canterbury, New Zealand.

The specimens on which this description is based were collected during the course of a study of the arthropods associated with Olearia colensoi Hooker f. This plant grows up to three metres high and forms dense stands, just above the timber line, in many of the wetter parts of the country. It occurs on the three main islands of New Zealand below 38°S latitude and descends to sea level in Stewart Island (Allan, 1961).

Superfamily: CERATOZETOIDEA Balogh, 1961

Family: MYCOBATIDAE Grandjean, 1954

Genus: Mycozetes Spain, n. gen.

Generic characters: Rostrum trilobate; lobes rounded, the median projecting furthest anteriorly. Tutoria adpressed to lateral sides of prodorsum. Lamellae with blade-like vertical extensions; cusps short, translamella complete. Sensilli almost completely covered by notogastral tectum. Notogaster pronotic, bearing nine pairs of setae. Pteromorphs partly hinged, strongly curved ventrad. A broad tectum extends from anterior border of notogaster covering posterior of prodorsum almost to bases of setae il. Five pairs of notogastral fissures. Coxisternal setal formula (3-1-2-2). Five pairs of genital setae. All tarsi monodactylous. Ventral keels on all femora and trochanters III and IV.

Type species: Mycozetes oleariae Spain, n.sp.

Remarks: Mycozetes keys to the genus Mycobates Hull, 1916 in Balogh's (1965) world key, largely because it possesses a notogastral tectum. However, Mycozetes is excluded from this latter genus on the basis of its lamellar structure and dorsal chaetotaxy. The relationships of Mycozetes appear to be closest to two genera described from Macquarie Island by Wallwork (1963), namely Cryptobothria Wallwork, 1963 and Neomycobates Wallwork, 1963. Neither of these genera are included in Balogh's (1965) world key, however, using this work, Cryptobothria keys out to Mycobates and Neomycobates does not key out at all. Mycozetes is perhaps most closely related to Neomycobates by virtue of its almost identical chaetotaxy which differs from that of this latter genus only by the absence of setae P_3 and one pair of genital setae. The structure of the pteromorphs and the degree of development of the notogastral tectum also closely approximate that of Neomycobates. Mycozetes more closely resembles Cryptobothria in its monodactylous tarsi and short lamellar cusps, however, the blade-like extensions of the lamellae are not striated and thus resemble more closely those of Neomycobates. Points which distinguish Mycozetes from both Cryptobothria and Neomycobates are the rounded lobes of the rostral tip, the tutoria being closely adpressed to the prodorsum and the absence of setae P_3 .

Mycozetes oleariae Spain, n.sp.

Prodorsum: Rostrum trilobate; lobes blunt, rounded, median lobe projecting furthest anteriorly. Lamellae narrow, thickening slightly mesially approximately half way between translamella and bothridium; possessing blade-like vertical extensions which are apparently not ornamented. Cusps short, translamella narrow; narrow canals run from bases of setae I to bases of cusps where they enter the prodorsum. Tutoria narrow ridges curving anteroventrad terminating posteroventrad

of insertions of setae ro, closely adpressed to prodorsal surface throughout their lengths; distal tips sharp, with ventral barbs. Pedotecta I and II well developed, toothed. Narrow ridges run from bothridia to pedotecta I. Bothridia concealed under notogastral tectum. Setae ro inserted dorsolaterally on rostrum, placed on small apophyses; slightly longer than mutual distance of bases, unilaterally barbed. Setae l inserted terminally on lamellar cusps, directed anteriorly; approximately two and one half times as long as mutual distance of bases, finely and unilaterally barbed. Setae il inserted anteromesad of bothridia between basal halves of lamellae; moderately heavily barbed, directed obliquely forwards, approximately twice as long as mutual distance of bases. Sensilli clavate, stalk short; distal tip only of sensilli protruding from beneath notogastral tectum. Setae ex short, smooth tapering distally; inserted lateral to bothridia, concealed under notogastral tectum.

Notogaster: Markedly convex, sides and posterior strongly curved. Anteriorly with a chitinous tectum joining bases of pteromorphs, overhanging posterior part of prodorsum almost to bases of setae il, concealing most of sensilli. Pteromorphs well developed, partly hinged, strongly downcurving; broadly based, narrowing to a rounded tip. In specimens cleared using Balogh's (1959) method they are seen to be striated (fig. 1). Four pairs of areae porosae present. Aa round, situated mesad of basal half of pteromorphs and posterior to setae ta. A₁ round, situated posterolaterad of setae ms and anterior to setae r₃. A₂ oval, inserted on the line between setae r₂ and r₃. A₃ largest, oval; inserted on line between setae r₁ and r₂. Five pairs of notogastral fissures present. Fissure ia placed posterior to setae ta, im anterolaterad of A₁, ip posterior of A₃, ips posterolaterad of A₂, ih laterad of setae r₃. Opening of lateral abdominal gland small, rounded; placed posterolaterad of A₁. Nine pairs of notogastral setae present; all short, smooth, tapering distally, distributed as shown in fig. 1.

Infracapitulum: Diarthral, labio-genal articulation complete. Setae h, m, a smooth, fine, tapering distally; h longest, a shortest. Palp five segmented; setal formula (0-2-1-3-9).

Ventral Region of Podosoma: Coxisternal ridges conspicuous. Coxisternal ridge I continuous with border of camerostome. Coxisternal ridges II and the sejugal moderate in length, not meeting at midventral line. Coxisternal ridges III short. Coxisternal ridges IV less heavily chitinized than others, extending forwards to join anterior to genital aperture. Coxisternal setal formula (3-1-2-2). Setae longer than those of genito-anal region, smooth, tapering distally; positioned as in fig. 2. Circumpedal ridge well developed, joins the pointed custodium which is continuous with discidium.

Genito-Anal Region: Anal aperture widest posteriorly. Anal plates bear two short, smooth, setae; positioned as in figure 3b. Genital aperture widest anteriorly. Genital plates bear five small, smooth setae arranged in an anterior group of three and a posterior group of two, as in fig. 3a. Adanal setae smooth, tapering distally, slightly shorter than anal setae. Setae Ad₁ and Ad₂ inserted lateral to mid ventral line behind anal aperture, Ad₃ inserted lateral to anterior half of anal aperture. The single pair of aggenital setae are short, smooth, taper distally; inserted posterolaterad of genital aperture. Fissures lad are present immediately anterior to setae Ad₃; run slightly oblique to edge of anal aperture.

Legs: Moderate in length, all tarsi monodactylous. Ventral keels present on all femora and trochanters III and IV. Chaetotaxy not studied.

Size: The mean length of 20 specimens from all localities was 364 μ , ranging from 335 μ to 410 μ . The mean width, taken at the widest part of the notogaster, of the above specimens was 247 μ , ranging from 209 μ to 278 μ . The holotype (female) is 340 μ long and 209 μ wide.

TYPE SPECIMENS

All specimens were collected from the foliage of Olearia colensoi. Unless otherwise indicated, types are deposited in the collection of the Entomology Division, D.S.I.R., Nelson, New Zealand.

- Holotype: Waipawa Saddle, Ruahine Mountains,
New Zealand. 28. xii. 1966, female, (A.V. Spain).
- Paratypes: Waipawa Saddle, Ruahine Mountains,
New Zealand, 28. xii. 1966, 2 specimens, (A.V. Spain)
Waipawa Saddle, Ruahine Mountains, New Zealand,
28. xii. 1966, 6 specimens, (A.V. Spain),
(Bernice P. Bishop Museum, Honolulu, Hawaii)
Rangiwahia Ski Club Hut Area, Ruahine Mountains,
New Zealand, 4. iv. 1964, 8 specimens. (A.V. Spain).
Mt. Manuoha, Huiarau Ranges, New Zealand,
24. i. 1967, 12 specimens. (D. Prebble).
Mt. Wharite, Ruahine Mountains, New Zealand,
28. viii. 1966, 1 specimen. (A.V. Spain).
Mt. Whakataka, Huiarau Ranges, New Zealand,
14. iii. 1967, 7 specimens. (F.P. Wallis).

Other Records: Mt. Fox, New Zealand, 6. xi. 1966, (P. Wardle).
Magister Ridge, New Zealand, 29. ix. 1966.
(A.V. Spain).

Only damaged specimens were available from these last two localities.

Ecology: This species has, so far, only been found on the foliage of Olearia colensoi. The diffuse tomentum occurring on the backs of the leaves of this plant presumably provides a favourable level of humidity and mechanical protection.

Acknowledgment: I should like to acknowledge the help of Dr. R.A. Harrison of Lincoln College, New Zealand, who supervised this work which was done as part of the requirement for a M.Agr.Sc. degree. I should also like to thank the following people for collecting samples of the foliage of Olearia colensoi from which specimens were obtained:

Mr. D. Prebble of Napier, New Zealand.

Mr. F.P. Wallis of the New Zealand Forest Service.

Dr. P. Wardle of the Botany Division, D.S.I.R.,
New Zealand.

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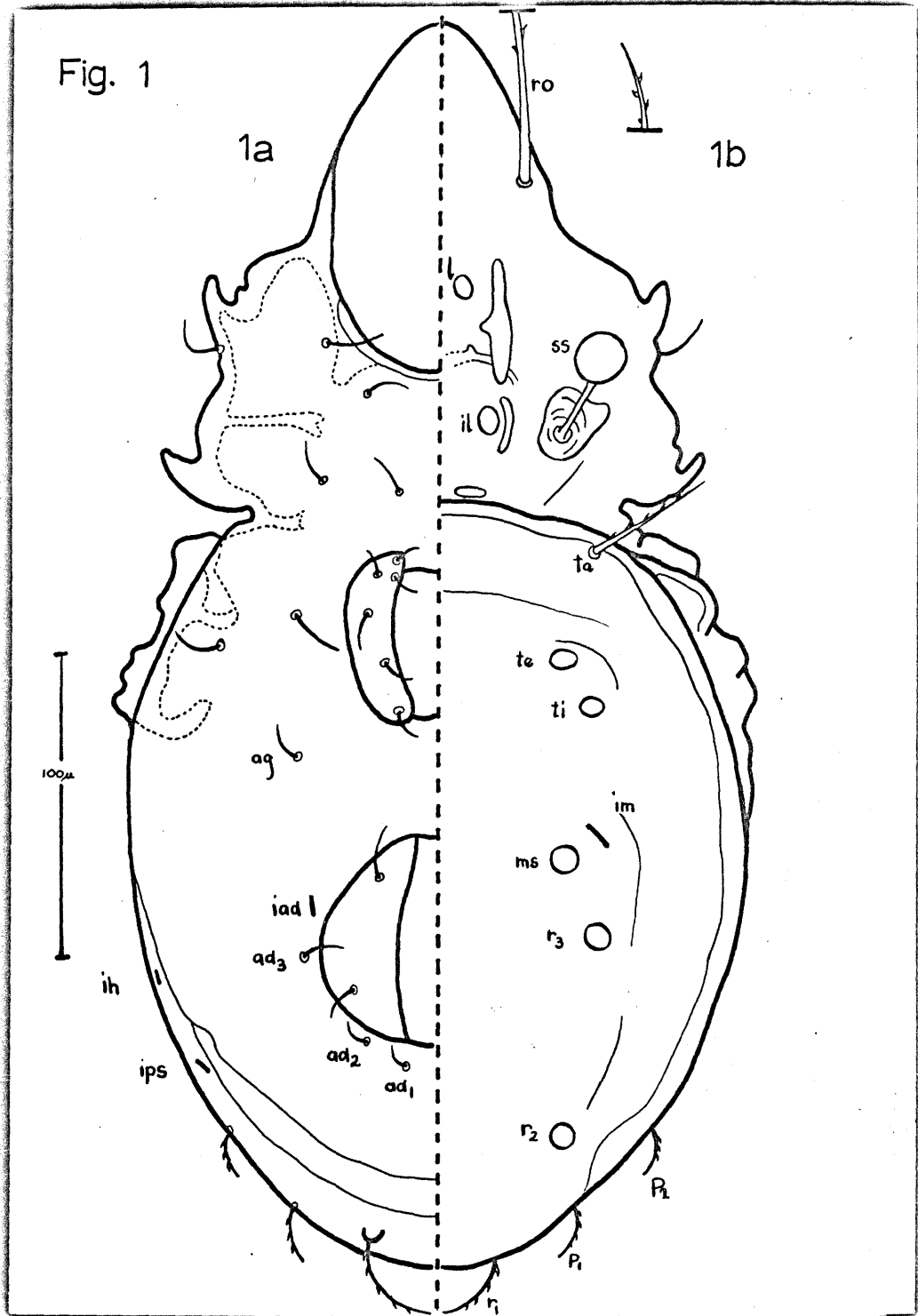
Captions for Plates

1. Mycozetes oleariae - dorsum
2. Mycozetes oleariae - venter
- 3a Mycozetes oleariae - genital plate
- 3b Mycozetes oleariae - anal plate

ABSTRACT

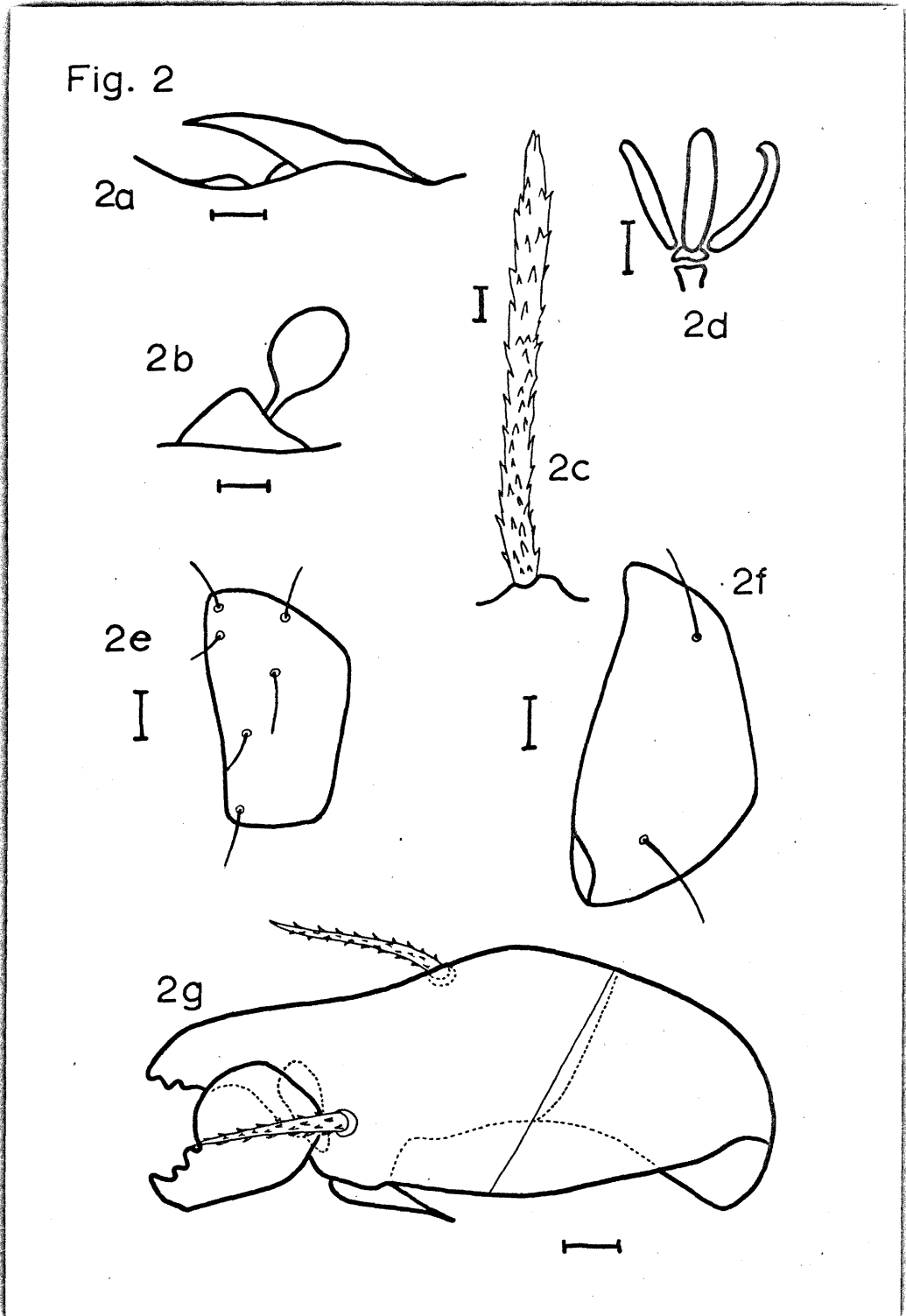
Mycozetes oleariae n.gen. n.sp. of the family Mycobatidae

Grandjean, 1954 is described from the foliage of Olearia colensoi Hooker f. a sub-alpine scrub plant occurring in the wetter areas of New Zealand.



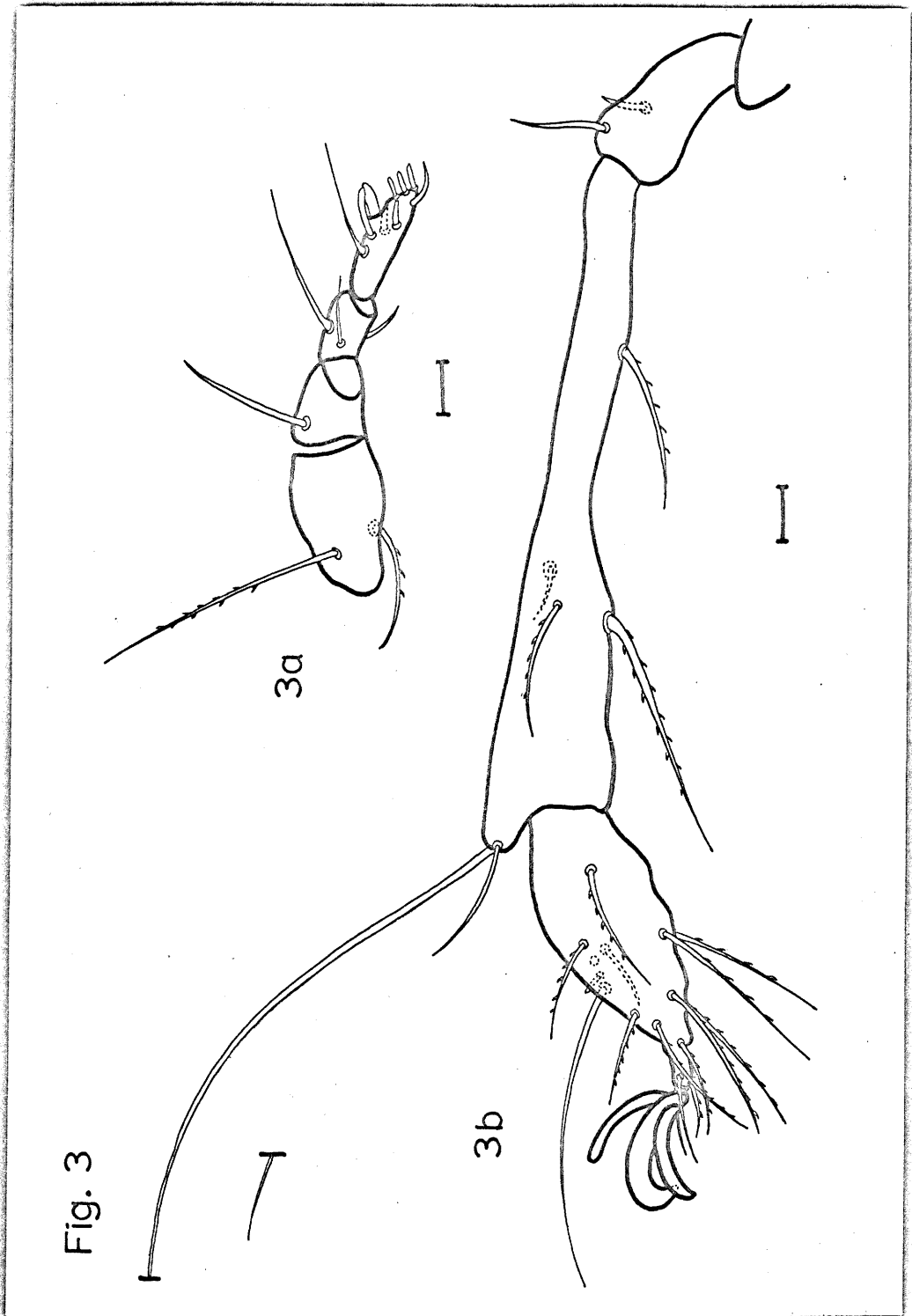
Thesis figure 14 - Tuparezetes christineae

- (a) Venter
(b) Dorsum



Thesis figure 15 - Tuparezetes christineae

- (a) Prodorsal spine - right lateral view; (b) Bothridium & Sensillus;
 (c) Seta il; (d) Claws - Leg I; (e) Genital Plate; (f) Anal plate;
 (g) Chelicera



Thesis figure 16 - *Tuparezetes christineae*

(a) Palp;

(b) Leg I

A NEW FAMILY OF ARBOREAL OPPIOIDEA FROM NEW ZEALAND

(Acari: Cryptostigmata)

A.V. Spain, Agricultural Zoology Department, Lincoln College, Canterbury,
New Zealand.

The specimens on which this work is based were collected during the course of a study of the arthropods associated with Olearia colensoi Hooker f. This is a composite shrub that grows up to three metres high and forms dense stands in the sub-alpine areas of New Zealand. It is found below 38°S., normally where the annual rainfall is greater than approximately 250 cm.

The foliage of this plant supports a varied acarine fauna which is, as far as is known, almost completely undescribed.

Superfamily: OPPIOIDEA Balogh, 1961.

Family: TUPAREZETIDAE Spain, n. fam.

Arboreal mites with long legs and tridactylous tarsi. Prodorsum with ridges and paired prodorsal spines. Bothridia prominent, sensilli spheroidal. Setae l and il well developed. Notogaster oval in outline, convex; integument finely granulate. In life posterior part of prodorsum and notogaster covered with a deep white substance. Nine pairs of notogastral setae inserted in a dorsolateral position, te, ti, ms, r₃ and r₂ well developed. Venter normal, six pairs of genital setae, coxisternal setal formula (3-2-0-2).

Type genus: TUPAREZETES Spain, n.gen.

Remarks: Balogh (1965) in his world key lists eight families that

Three notogastral fissures (im, ips and ih) present. Venter with weakly developed coxisternal ridges. Setae of genito-anal region and coxisternal rows a and b fine, smooth, tapering. Ad₁ and Ad₂ behind anal aperture. Pedotecta I and II toothed.

Type species: Tuparezetes christineae Spain, n. sp.

The genus is named for the host plant of the type species, (Olearia colensoi) whose maori name is "tupare".

Tuparezetes christineae Spain, n. sp.

Prodorsum: Rostrum rounded, setae ro smooth to finely barbed at the tips, inserted on slight prominences in a dorso-lateral position; nearly twice as long as the mutual distance of their bases, curving broadly forward of the rostrum by approximately one third of their length.

Prodorsal ridges present; indistinct and interrupted in parts, visible lateral to bases of setae il. Anteriorly interrupted for a short distance and reappearing as mesially curving ridges extending to bases of small, forward projecting cusps, these latter partially joined by a weak, medianly interrupted ridge. A large pair of sharp, posteriorly directed spines on prodorsum (Figs, 1b and 2a). In dorsal view bases of spines lateral to bases of setae L, points of former directed posteriorly over the mesially curving portions of prodorsal ridges, from which spines are quite separate. Posterior portions of bases of spines forming small, mesially directed projections. Tutorium apparently absent. Setae il thick, long, heavily barbed all round (Fig. 1c); inserted lateral to mid-dorsal line opposite the approximate middle of Pedotectum I. Setae il similar to l; inserted between bothridia. Posterior portion of lamellar region bordered by a mesially interrupted ridge which may be incurving extensions of posterior parts of prodorsal ridges. Bothridia prominent, directed obliquely forward (Fig. 2b). Sensilli large, spherical with a narrow stalk (Fig. 2b). No exobothridial setae noted. Pedotecta I and

II well developed.

Notogaster: Oval in shape, convex, somewhat truncate anteriorly. In life this and the prodorsum are covered with a deep, white to whitish-grey substance which may extend as high as half way up the major notogastral setae ti and ms. Nine pairs of notogastral setae. Setae ta finely barbed, situated on front corners of notogaster; directed obliquely forward at approximately 45 degrees to mid-dorsal axis of body. Setae ta, te, ms, r₃ and r₂ similar in structure to tl and l and directed vertically upwards; inserted as shown in fig. 1b (only the bases of these setae are shown to avoid obscuring the figure). Setae r₁ barbed, smaller than r₂ and r₃; often inserted on small apophyses, and curve horizontally mesad. Setae p₁ and p₂ smaller but similar in structure and curvature to r₁. Three pairs of notogastral fissures noted, (im, ips and ih) positioned as shown in figures 1a and 1b.

Infracapitulum: Diarthral, labio/genal articulation complete. Setae h, m and a broadly curved, tapering, finely barbed. Palp five segmented, chaetotaxy as in fig. 3a; setal formula (0-2-1-3-9).

Ventral Region of Podosoma: Coxisternal ridges not well developed. Ridges one, two and the sejugal present; three and four absent. A weakly chitinized sternal ridge is present and joined to ridges one, two and the sejugal. Coxisternal setae fine, smooth, similar in length to the genital setae. Coxisternal setal formula (3-2-0-2). Apodemata I and II moderate in length; III, IV and the sejugal short and heavily chitinized (fig. 1a).

Genito-Anal Region: (fig. 1a) Anal aperture widest posteriorly. Anal plates bear two small, smooth setae (fig. 2f). Adanal setae similar in structure to anals; Ad₁ located immediately behind anal aperture and just lateral to mid-ventral line, Ad₂ located lateral to Ad₁, Ad₃ lateral to and inserted approximately half-way along anal aperture. Anal fissure (iad) runs parallel to edge of anal aperture lateral to its anterior half. One pair of aggenital setae posterior of and lateral to

genital aperture. Genital aperture narrowest posteriorly. Genital plates bear six, small, smooth setae arranged as in fig. 2e; the positions of the most anterior seem to be slightly variable.

Legs: Legs long; the order of increasing size is II, I, III, IV. All tarsi tridactylous; claws finely barbed dorsally under high (1750X) magnification, the median somewhat longer and twice as thick as laterals (fig. 2d). The chaetotaxy of the first genu, tibia and tarsus is shown in fig. 3b. The long tactile solenidion ($\phi 1$) is inserted on a conspicuous projection. The "touffe du premier tarse" of Grandjean (1935) is raised on a small prominence and contains the famulus, two solenidia and seta tf. Chaetotaxy of other legs not studied.

Size: Mean body length of 20 specimens from all localities was 407 μ , range 371 μ to 451 μ . The mean body width, at the widest part of the notogaster, was 214 μ , range 190 μ to 232 μ .

The holotype is 425 μ long, 220 μ wide and 210 μ deep.

The lengths of the legs of 12 specimens from all localities are as follows:

Leg I	mean 362 μ ,	range 315 μ to	405 μ
Leg II	" 332 μ ,	" 303 μ to	357 μ
Leg III	" 374 μ ,	" 339 μ to	423 μ
Leg IV	" 459 μ ,	" 435 μ to	514 μ

The lengths of the major dorsal setae of 12 specimens from all localities are as follows:

seta	mean	range	seta	mean	range
<u>ro</u>	103 μ	92-116 μ	<u>l</u>	132 μ	122-146 μ
<u>il</u>	132 μ	122-158 μ	<u>te</u>	127 μ	103-146 μ
<u>ti</u>	132 μ	92-158 μ	<u>ms</u>	122 μ	97-140 μ

TYPE SPECIMENS

Holotype: Mt. Wharite, 29. x. 1966, ♀, (A.V. Spain). Taken from foliage of Olearia colensoi Hooker at 1025 m.

- Paratypes:** All collected from the foliage of Olearia colensoi
- Ruahine Ranges:**
- Hinerua Ridge, 13. viii. 1967, 5 specimens,
(P. Lewis).
- Waipawa Saddle, 28. xii. 1966, 8 specimens,
(A.V. Spain).
- Mt. Wharite, 28. viii. 1966, 2 specimens;
29. x. 1966, 23 specimens, (A.V. Spain).
- Tararua Ranges:**
- Arête Stream Basin, 23. ii. 1965, 2 specimens,
(A.V. Spain).
- South Island:**
- Magister Ridge, 25. ix. 1966, 4 specimens,
(A.V. Spain).
- Mt. Fox, 6. xi. 1966, 14 specimens,
(P. Wardle).
- Strachan Range, 31. viii. 1965, 1 specimen,
(A.V. Spain).
- Pillan's Pass, 3. i. 1967, 2 specimens,
(A.V. Spain).
- Stewart Island:**
- Thomson Ridge, 23. ii. 1967, 13 specimens,
(J.C. McIlroy).

The holotype and all paratypes with the exception of those collected from Mt. Wharite on 28. viii. 1966 are lodged in the collection of the Entomology Division, D.S.I.R., Nelson, New Zealand. The paratypes collected from Mt. Wharite on 28. viii. 1966 are lodged in the collection of the Bernice P. Bishop Museum, Hawaii.

Other Records: Rangiwahia Ski Club Hut Area, Ruahine Ranges, 4. iv. 1964, (A.V. Spain). Blue Range, Tararua Ranges, 23. ii. 1965,

(A.V. Spain). Only damaged specimens were available from these localities.

Ecology: The only host plant so far known for Tuparezetes christineae is Olearia colensoi. Tuparezetes christineae is undoubtedly a fungivore as masses of fungal hyphae and spores were noted in squash preparations of food boluses. One such preparation was sent to the Commonwealth Mycological Institute and the following identifications of the fungi present were made:

Conidia of Clasterosporium sp. or Sporidesmium sp.

Conidia of Cladosporium sp.

Groups of setae which may belong to Colletotrichum sp.

Other fungi known from Olearia colensoi are Uredo tupare Cunningham, 1924, (Cunningham, 1931) and another tentatively identified as Asterina sp. (Holloway, et al., 1963). It may well be that either or both of these latter are also utilized by Tuparezetes christineae. During the course of this study the large orange uredospores of Uredo tupare were observed to be present on both the upper and lower leaf surfaces of the host plant and thus readily available for consumption by Tuparezetes christineae. It is not known, however, whether they are utilized as they may be too large for the relatively small mouth parts of Tuparezetes christineae.

Tuparezetes christineae is normally found on the backs of the leaves of the host plant, on and amongst the deep, diffuse tomentum. This presumably provides it with a favourable level of humidity and mechanical protection. Tuparezetes christineae appears to be adapted to an arboreal existence in that it possesses long legs and well developed claws, with which it can cling most tenaciously to the leaves. It also possesses, in life, a white substance that covers the posterior part of the prodorsum and notogaster to some depth and this probably aids in water conservation. The origin and nature of this substance is unknown.

Tuparezetes christineae probably spends at least some of its nymphal stadia on the foliage as oppioid nymphs were noted to be present on the foliage. This mite is the only member of the Oppioidea present in this habitat thus it is considered that these nymphs are probably those of Tuparezetes christineae. These facts, together with the absence of Tuparezetes christineae from litter samples collected underneath stands of the host plant, suggest that this mite is truly arboreal in its habits.

Dr. E. Collyer of Entomology Division, D.S.I.R., Nelson, New Zealand, considers (pers. comm.) that tuparezetid mites are quite common on the foliage of the native trees of this country. Her collection of slides contains two Tuparezetidae, one from Nothofagus solandri (Hook.f.) and the other from "a low plant with coltsfoot-like leaves". The specimens on these slides are not suitable for taxonomic use and appear to differ in some respects from Tuparezetes christineae. Also, a new species of Tuparezetidae has recently been taken from the foliage of Nothofagus solandri growing in the Hundalee Hills, Marlborough, New Zealand, so that it would appear that a number of new species of this family remain to be described.

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ABSTRACT

A new family of arboreal opploid mites is described on the basis of Tuparezetes christineae n. sp. which was collected from the foliage

of a sub-alpine shrub growing in the wetter parts of New Zealand. Its affinities are discussed and it is concluded that the new family is most closely related to the Oppiidae Grandjean, 1954. Some ecological factors are discussed briefly.

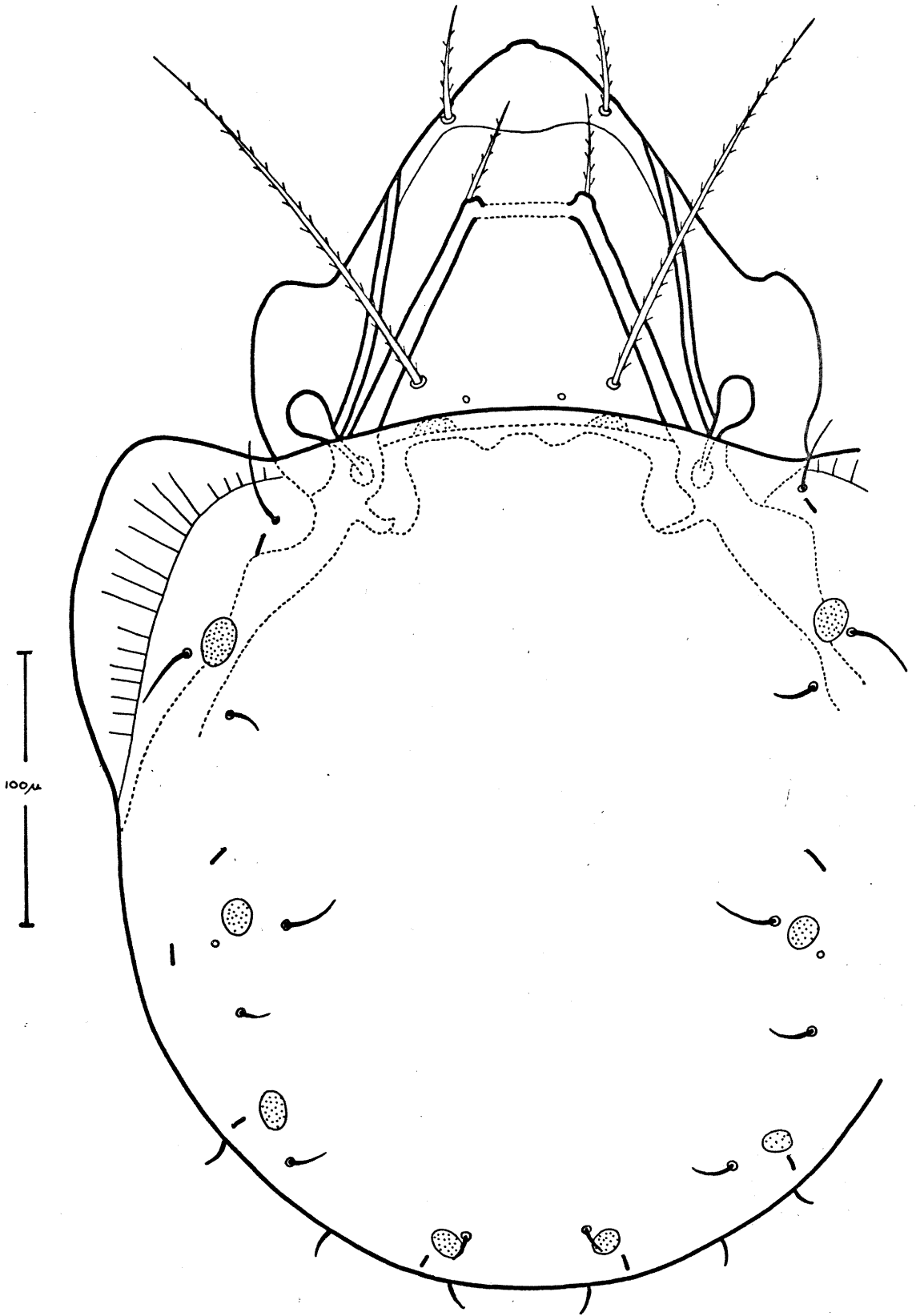


Figure 17 - Porozetes sp. a.
Dorsum

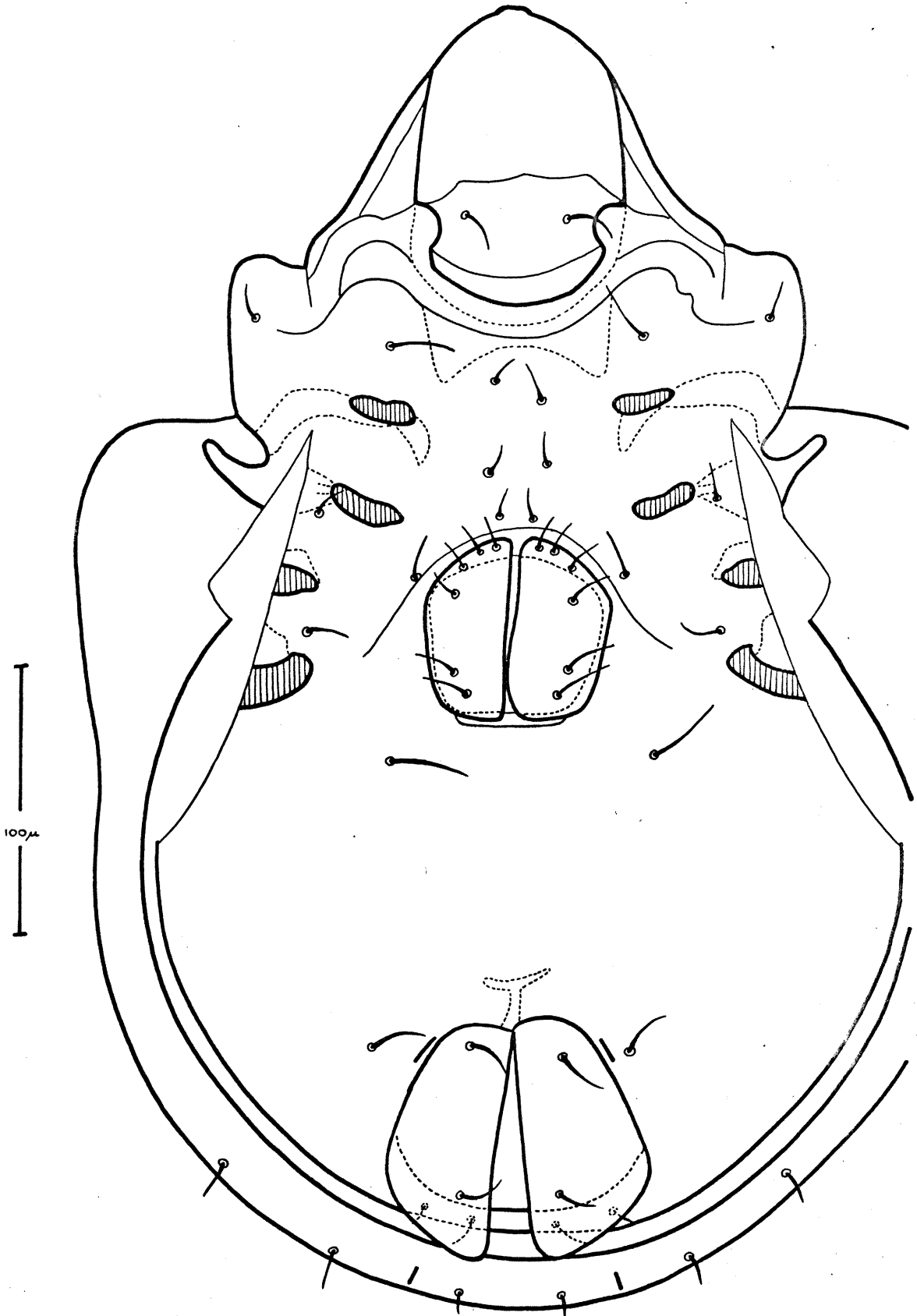


Figure 18 - Porozetes sp. a.
Venter

DESCRIPTION OF POROZETES SP. a.

Superfamily: CERATOZETOIDEA

Family: CERATOZETIDAE

Genus: Porozetes Hammer, 1962.

Porozetes sp. a.

Prodorsum: Rostrum rounded with a small round median lobe projecting anteriorly. From a dorsal aspect the area from the tip of the rostrum to approximately half way to the lamellar cusps consists of a more heavily chitinized sclerite that runs latero-ventrad round the rostrum. Lamellae long, thin, with short cusps; translamella weak, interrupted mesially. Tutoria narrow laths, S shaped from lateral aspect, closely appressed to propodosoma. A small pair of area porosae dorsosejugales present posterior to setae 11. Two small glandular openings present just posterior to line joining setae 11. Setae ro very finely barbed, directed straight forward, slightly converging; approximately one and one third times as long as the mutual distance of their bases, inserted dorsolaterally on rostrum. Setae 11 very finely barbed; more than twice as long as the mutual distance of their bases. Sensilli clavate, with narrow stalk. Bothridia hidden under anterior of notogaster. Setae ex small, smooth; inserted lateral to sensilli near bases of tutoria.

Notogaster: Well rounded laterally and posteriorly, less so anteriorly, moderately convex; integument smooth. With a narrow tectum projecting anteriorly over base of prodorsum and joining pteromorphs. Pteromorphs well developed, strongly downcurving with rounded apices, not hinged; striated from a line running anteriorly from posterior junction of pteromorphs with notogaster. Four pairs of areae porosae positioned as

in Fig. 17. Five pairs of notogastral fissures present (ia, im, ip, ips, ih) positioned as in Fig. 17. All notogastral setae fine, smooth, tapering. Setae ta inserted on front corners of notogaster postero-laterad of bothridia; directed outwards over pteromorphs. Setae te inserted lateral to Aa, directed upwards; directed outwards over pteromorphs. Setae ti inserted postero-mesad of Aa, directed upwards. Setae ms inserted antero-mesad of A₁, directed upwards; longest of notogastral setae. Setae r₃ inserted approximately equidistant from A₁ and A₂, directed upwards. Setae r₂ situated postero-mesad of A₂, directed upwards. Setae r₁ inserted anterior to A₃, directed obliquely rearwards, short. Setae P₁ postero-mesad of A₃; longest of posterior setae. Setae P₂ inserted lateral to A₃, directed obliquely rearward. Setae P₃ inserted postero-laterad of A₂, directed obliquely rearward; longest of posterior setae.

Infracapitulum: Palp 5 segmented, setal formula (0-2-1-3-9). "Corne double" not fused for whole length. Hysterostome U shaped, diarthral; labio/genal articulation complete. Setae h, m and a fine smooth and tapering.

Ventral Region of Podosoma: Coxisternal setal formula (3-1-2-2), setae arranged as in Fig. 18. Coxisternal ridge I associated with the border of the camerostome, ridge II longest. Sejugal long, ridges III and IV short. No sternal ridge noted. Custodium pointed, continuous with circumpedial ridge and discidium.

Genito-Anal Region: Anal aperture widest posteriorly, edges rounded. Anal plates with 2 pairs of setae arranged as in Fig. 19. Genital aperture widest anteriorly with rounded sides. Genital plates as in Fig. 19, with 6 pairs of setae arranged in an anterior group of 4 and a posterior group of 2. Preanal organ present but not conspicuous. Setae all fine smooth and tapering. Setae Ad₁ and Ad₂ posterior to anal aperture. Setae Ad₃ lateral to anterior end of anal aperture. One pair of aggenital setae inserted postero-laterad of genital aperture. Fissures

lad situated between setae Ad₃ and anterior part of anal aperture.

Opening of lateral abdominal gland (gla) situated postero-laterad of A₁.

Legs: Moderate in length. Tarsi tridactylous, median claw more heavily constructed than the 2 laterals, all claws finely barbed dorsally (as seen under 1750 x magnification). Famulus short, peg like, with a truncate top. All femora and trochanters III and IV with large ventral keels, much flattened. Tarsal solenidia with slight expansions distally.

Size: The length and width of 25 specimens from all localities are as follows:

Mean length	=	479 μ
Range	=	440 μ to 505 μ
Mean width	=	325 μ
Range	=	289 μ to 368 μ .

APPENDIX B - VEGETATIVE AND FLOWERING ACTIVITY IN OLEARIA COLENS

RUAHINE MOUNTAINS

Mt. Wharite

25. x. 1965. - All buds closed except a few seedlings.
 6. xi. 1965. - Some buds starting to open.
 13. xii. 1965. - All buds at least partly open, flowering.
 22. xii. 1965. - Most buds open.
 28. viii. 1966. - Plant apparently dormant.
 29. x. 1966. - Canopy buds closed, a few seedling buds partly open.

Waipawa Saddle

28. xii. 1966. - Most buds almost fully open, flowering.

TARARUA MOUNTAINS

17. xii. 1964. - Buds at least partly open, many fully so, flowering.
 6. xii. 1965. - Buds at least partly open, some fully so, Some flowers.
 20. ii. 1966. - A number of buds produced as a result of damage to the main apex are noted to be nearly fully open.

SOUTH ISLAND

Magister Ridge

10. xii. 1964. - Most buds closed. Some partly open in more sheltered areas.
 25. ix. 1966. - Plant apparently dormant.

Pillan's Pass

1. ii. 1965. - Buds open.
 21. xi. 1965. - Buds just starting to open, heavy snowfall locally.

2. i. 1967. - Buds nearly fully open in all cases.

STEWART ISLAND

Mt. Rakeahua

31. xii. 1964. - Most buds open.

Pryse Peak

28. xii. 1964. - Most buds open.

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