



FRONTISPIECE. Grease cylinder.

A SURVEY AND INVESTIGATION
OF THE INSECT FAUNA ASSOCIATED WITH
SOME TUSSOCK GRASSLANDS

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CONTENTS

CHAPTER	PAGE
1. INTRODUCTION AND REVIEW OF LITERATURE	1
Introduction	1
Review of literature	1
2. SURVEY OUTLINE	3
Study areas	3
Materials and methods	8
Grease cylinders	8
Grease table	10
Wind nets	11
Hand net	14
Pitfalls	15
Damp sacks	15
Light traps	16
Berlese funnel	19
Sieved soil samples	19
Hand searching of plants and soil	20
Collection of tussock samples	
for insect emergence	20
Rearing of immature insects	21
Survey programme	21
1961-1962 season	21
1962-1963 season	27
Cattle interference	32
Weather	32
Mackenzie Country collecting	35

CONTENTS (Cont'd)

CHAPTER	PAGE
3. THE FAUNA	36
Introduction	36
Method of presentation	37
THYSANURA	45
COLLEMBOLA	46
EPHEMEROPTERA	47
ODONATA	48
ORTHOPTERA	49
DERMAPTERA	54
PLECOPTERA	55
PSOCOPTERA	56
THYSANOPTERA	59
HEMIPTERA	60
COLEOPTERA	88
HYMENOPTERA	123
NEUROPTERA	172
DIPTERA	174
TRICHOPTERA	175
LEPIDOPTERA	181
4. DISCUSSION	244
Introduction	244
The fauna	245
Species of economic importance	250
ACKNOWLEDGMENTS	260
REFERENCES	262
APPENDIX	268
INDEX	271

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CHAPTER 1

INTRODUCTION AND REVIEW OF LITERATURE

INTRODUCTION

Very little is known about the insect fauna associated with New Zealand tussock grasslands. A survey was therefore designed to discover the faunistic composition of some tussock areas and to investigate wherever possible the significance and economic status of species within their grassland habitat. To this end, attempts were made to detect the distribution, abundance and seasonal appearance of individual species, and where possible to study their ecology. Such information is not only basic to an understanding of the fauna but is also useful to tussock grassland management.

REVIEW OF LITERATURE

There are two papers directly concerned with tussock grassland insects in New Zealand.

The first paper (Dick, 1940) outlines a survey made in Canterbury of low-tussock grasslands bounded by the Waimakariri and Waitaki Rivers. During late summer 1939,

records were made of Lepidoptera collected with a light trap by night and a hand net by day, and in August of the same year, additional records were made of coleopterous larvae among the roots of two tussock species. Direct damage of tussock by four of the listed species was observed but overall damage by insects was assessed as being subsidiary to damage caused by other factors.

The second paper is that of Kelsey (1957). This paper lists 45 insect species that feed on roots or aerial portions of native tussocks and discusses their relative importance in so far as they affect tussock deterioration. Reference is also made to a small series of insecticide-treated and untreated plots in the Mackenzie Country.

Because much of the contents of these two papers relates directly to certain insect species dealt with in Chapter 3 and to an appraisal of insect importance in tussock grasslands presented in Chapter 4, they are cited more extensively in those chapters.

Other literature relevant to insects taken from tussock grasslands during the survey is both specific and incidental and therefore accorded mention only where appropriate.

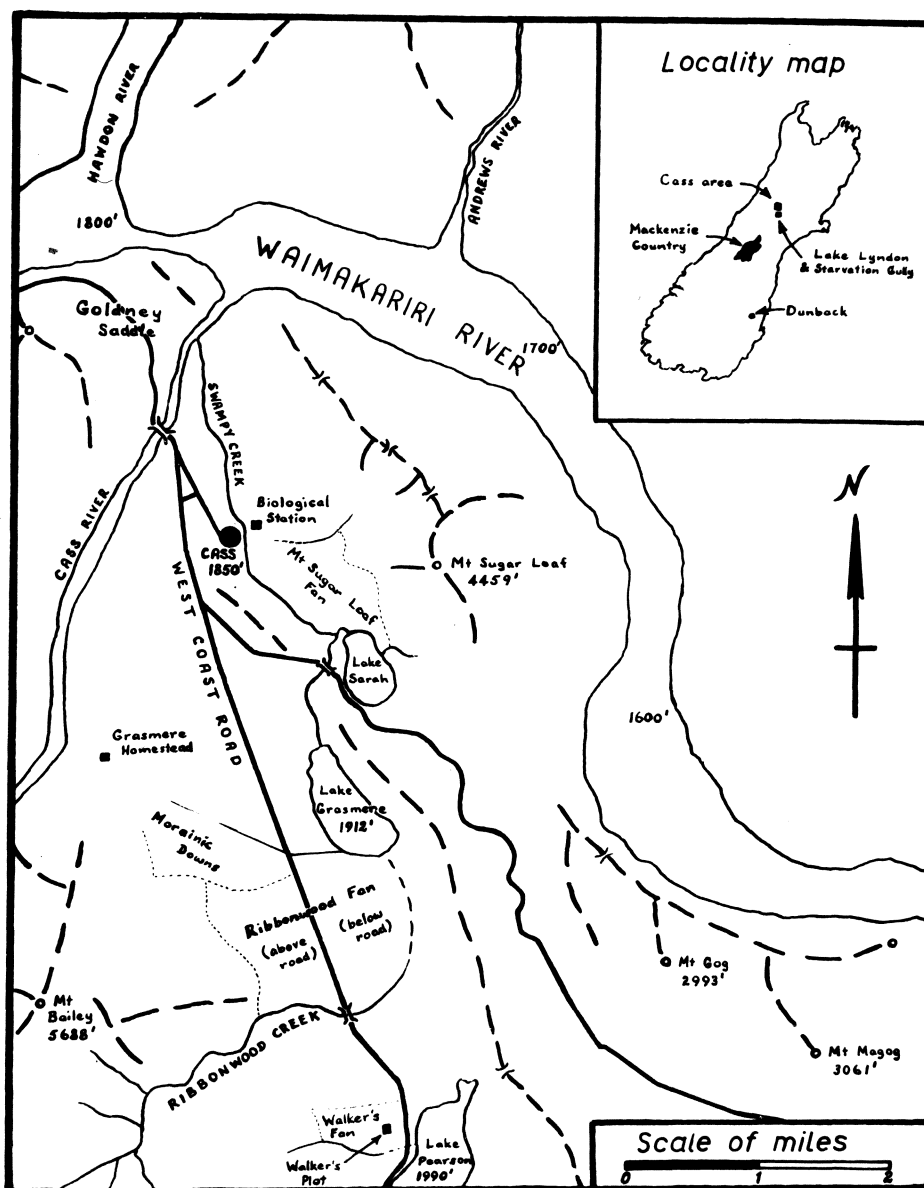
CHAPTER 2

SURVEY OUTLINE

STUDY AREAS

Insects were collected from several tussock grassland areas but to serve the purposes of the present study, one main area was considered necessary. This area had not only to be greatly restricted in size but as representative as possible if the survey was to be intensive and yet of widest application. The selection was therefore limited to those grasslands in high country and was further confined by the need to select an area not too distant from Lincoln College. Choice was thereby directed to places accessible from the Christchurch-Arthur's Pass West Coast Road.

All areas between Porter's Pass and Bealey were screened before selecting Cass, 73 miles from Lincoln. Besides the availability of Canterbury University's Biological Station here, there were within a 5-mile radius of the station several tussock grasslands away from forest and relatively free from scrub. These individual "sites" (see map of Cass area, page 4) not only possessed different floras, topography and altitudinal limits, but some had received experimental management. For the following reasons the Cass area was therefore considered representative of tussock grasslands generally and also potentially:



MAP OF CASS AREA
SHOWING SITES AND MAIN RIDGES

- (i) it was in a medium rainfall zone;
- (ii) it afforded continuous grassland cover over an altitude range from 1900' to 4500';
- (iii) both tall-tussock and low-tussock associations were present and represented four of the five most widely grazed tussock species;
- (iv) the low-tussock associations existed as both improved and unimproved grassland, the latter being in various stages of degradation.

The division of the tussock grasslands into tall-tussock and low-tussock associations is conventional. In the Cass area, a single snow tussock species (Chionocholea rigida (Raoul) Zotov) represented the tall-tussock grasslands while hard tussock (Festuca novae-zelandiae (Hack.) Cock.), silver tussock (Poa caespitosa Spreng.) and blue tussock (Poa colensoi Hook.) represented the low-tussock grasslands. Of the five most widely grazed tussock species, the one not present was Matthew's Fescue (Festuca matthewsii (Hack.) Cheesem.). This fescue is very similar to hard tussock and its associated insect fauna is probably very much the same.

Mt Sugar Loaf was the only site with a tall-tussock association. On the mountain's southern face the snow tussock extended as a continuous association down to about 2500' but on the western face its lower limit was nearer 3000'. On the sunny northern side it was replaced by an association of hard tussock and Celmisia spectabilis Hook.

All other sites were comprised solely of low-tussock associations. With the exception of the silver tussock found on the eastern slopes of Mt Bailey up to 3000' and also on parts of the morainic downs below, hard tussock was the dominant species. In all areas blue tussock was present with it, but this association was most marked on that portion of Ribbonwood Fan below the road. This same site, together

with Mt Sugar Loaf Fan and the flats at the base of Mt Gog and Mt Magog had tussock as the dominant grass. In contrast, Mt Gog, Mt Magog and Goldney Saddle had been subjected to a vigorous, ingression of sweet vernal (Anthoxanthum odoratum L.) and browntop (Agrostis tenuis Sibth.) which had tended to subordinate the tussock. On Walker's Fan, the ingression of these two exotic grasses had been so intense that very little tussock remained except at the fan's upper limits.

All sites had good inter-tussock cover, none being seriously depleted of plant growth. However, the composition of this vegetation varied considerably between some sites and was markedly different on those sites which are termed "improved". These were Mt Bailey, Ribbonwood Fan above the road and Walker's Plot. Their history is relevant to the survey.

In January 1956 an accidental fire swept the Mt Bailey and Ribbonwood Fan block of land but did not jump the road to the Ribbonwood Fan site below. The land damaged between 2000' and 4000' was topdressed and oversown in July of the same year. The oversowing mixture was white clover (Trifolium repens L.), alsike (T. hybridum L.) and Montgomery red clover (T. pratense L.) for the whole area, but cocksfoot (Dactylis glomerata L.) was also sown on the Mt Bailey slopes. This block of land therefore constituted an improved tussock area, parts of it receiving additional topdressings in subsequent years. Not only had the clovers and cocksfoot proved capable of healthy growth but the tussocks themselves had been rejuvenated. Though in some places they had formed a very open association with the inter-tussock vegetation dominant, their growth had still been vigorous. With this history, Ribbonwood Fan afforded an excellent opportunity to compare the insect fauna in the improved area above the road with that in the unimproved area below the road. Any striking differences may indicate changes that could be

anticipated with tussock grassland improvement on a wide scale.

Walker's Plot, an ungrazed trial area on Walker's Fan, also gave opportunity to compare improved with unimproved grassland. It was sown in 1956 with white clover, alsike and Montgomery red clover under different manurial treatments. Subsequently a small area of lucerne (Medicago sativa L.) was also planted in one corner. Because of the plot's small size (50 x 60 yards), only those insects distinctly influenced by the improvement were expected to reflect different concentrations from the outside area.

All sites were rather free of extraneous vegetation such as sedges and scrub. Their selection on this basis was purposeful, but where such vegetation was present it was accounted for as possibly including insect food plants.

Areas other than Cass which were visited during the survey were Starvation Gully, Lake Lyndon, Dunback and the Mackenzie Country.

Starvation Gully and Lake Lyndon are adjacent areas on the West Coast Road between Lincoln and Cass. Sites selected at the former ranged from 2800' to 3000' with a grazed hard tussock site adjoining an ungrazed association of the snow tussock Chionochloa flavescens Zotov. A single site selected in the Lake Lyndon area rose from 2800' at lake level to 3000' on Mt Lyndon. Only hard-tussock grassland was present but as with the same association at Starvation Gully, there was a considerable extent of scrub. Both areas were in a medium rainfall zone.

The area at Dunback in North Otago was at 400'. A rather open association of healthy hard and silver tussocks was present.

The Mackenzie Country area included sites at Burke's Pass, "Sawdon" station, "Holbrook" station, Tekapo, Mt John, Lake Alexandrina, "Godley Peaks" station, Lake Pukaki, Ohau River and "Ohau Downs" station. All were within the

altitudinal range 1600' to 2300' and all were predominantly hard-tussock associations free of scrub. Together they comprised a low rainfall zone.

MATERIALS AND METHODS

In order to make the survey comprehensive, diverse trapping procedures were employed. These had not only to account for aerial populations but also for insects inhabiting foliage, litter and the soil. Aquatic insects were sampled only as aerial populations penetrating tussock grassland.

The traps used were grease cylinders, a grease table, wind nets, a hand net, pitfalls, damp sacks, light traps and a Berlese funnel. Additional collecting procedures were sieving of soil samples, hand searching of plants and soil, collecting of tussock samples for insect emergence and rearing of immature insects.

Greasing of tussock foliage and of some pitfalls was also tried initially but proved unsatisfactory.

The methods employed are now described.

Grease Cylinders

The use of grease impaction traps has in the past been confined to the study of certain, small insect species. In New Zealand, grease cylinders have been used for trapping aphids (e.g. Close, 1959), and Pottinger (1961) used them to study the flight of the Argentine Stem Weevil, Hyperodes bonariensis Kusch. They have not previously been employed in New Zealand for general collecting such as in a survey.

The cylinders were galvanised-iron stove pipes, 4 inches in diameter and 12 inches tall, each screwed vertically to the top of an upright stake (see Frontispiece). Some were painted Waggon Yellow ("International" waggon and implement paint) and others were painted Mid Chrome Green ("Interlux" paint).

Cellulose acetate film 0.01 inch thick was held in place around the outside of the cylinder by clips of No.8 fencing wire (after the manner of Close, 1959). It was readily greased using a paint brush but the practice of detaching it and clipping its edges to a white-painted background for the removal of caught insects proved unsatisfactory. Insects were therefore removed from the film in situ by sliding a scalpel under the small areas of grease that held them. Removal of grease with the insect minimised damage.

To assist the counting of specimens, 12 equally spaced vertical lines were drawn around the trapping face. The multiple 12 was selected so that an abundant insect species could be sampled in each second, third or fourth sector. Vertical rather than horizontal divisions and sampling at regular intervals were made necessary by the differing insect densities on each trap face and within the height of each face.

The divisions were first made as grease-pencil lines on the back of the cellulose acetate film but since this has to be periodically replaced they were transferred to the cylinder, again using grease pencil. Black was satisfactory against both green and yellow backgrounds.

The grease used initially was "Shell Retinax P", a cup grease. As only a few very small insects were taken and much of the grease melted off in hot sunshine, "Shell Green Petrolatum" was then tried. This grease also tended to melt but soon formed a surface skin and lost all tackiness. Both of these greases were dissolved from insect specimens using the ethyl acetate/acetic acid washing procedure described by Close, 1959. As this method was not only time-consuming but unpleasant, some other procedure was considered desirable for the large insect numbers anticipated in the survey.

An I.C.I. tree-banding grease, "Ostico", proved capable of capturing all but the largest of insects such as bumble bees and dragonflies. Even the very active cicada was often taken and large moths and butterflies were no exception. The grease had the attributes of extreme tackiness, no tendency to melt even in the hottest sunshine, no tendency to form a surface skin and the ability to retain its tackiness for period upwards of two weeks, the maximum required by the survey. It may also have a scent, thereby explaining the attraction of considerable numbers of Lepidoptera. The only disadvantage was a tendency to cloud on those faces subjected to considerable rain. Though the grease still strongly resisted water droplets, the white emulsified areas obscured the trap colour but would disappear in rather hot sunshine. They remained during cool weather.

Chloroform was tested as a solvent of "Ostico" but was found inferior to Trichloroethylene. Insects were removed directly from the grease trap to a sample tube of this chemical. It was later drained off. If the quantity of grease removed from the trap had been excessive, a further quantity of solvent was sometimes necessary. After the final draining, 70% alcohol was added for preservation. This procedure was quick and convenient and did not require laboratory equipment. The grease actually dissolved in 10-15 minutes of jostling as experienced in the field, movement doing the insects no harm.

Grease Table

A table with an inset sheet of yellow perspex similar in shade to Waggon Yellow paint was used as a trapping procedure comparative with yellow grease cylinders (Fig.1). An area equivalent to the area of a cylinder was marked off with black grease pencil and sub-divided into 12 areas to facilitate counting. In distinction to a cylinder, the

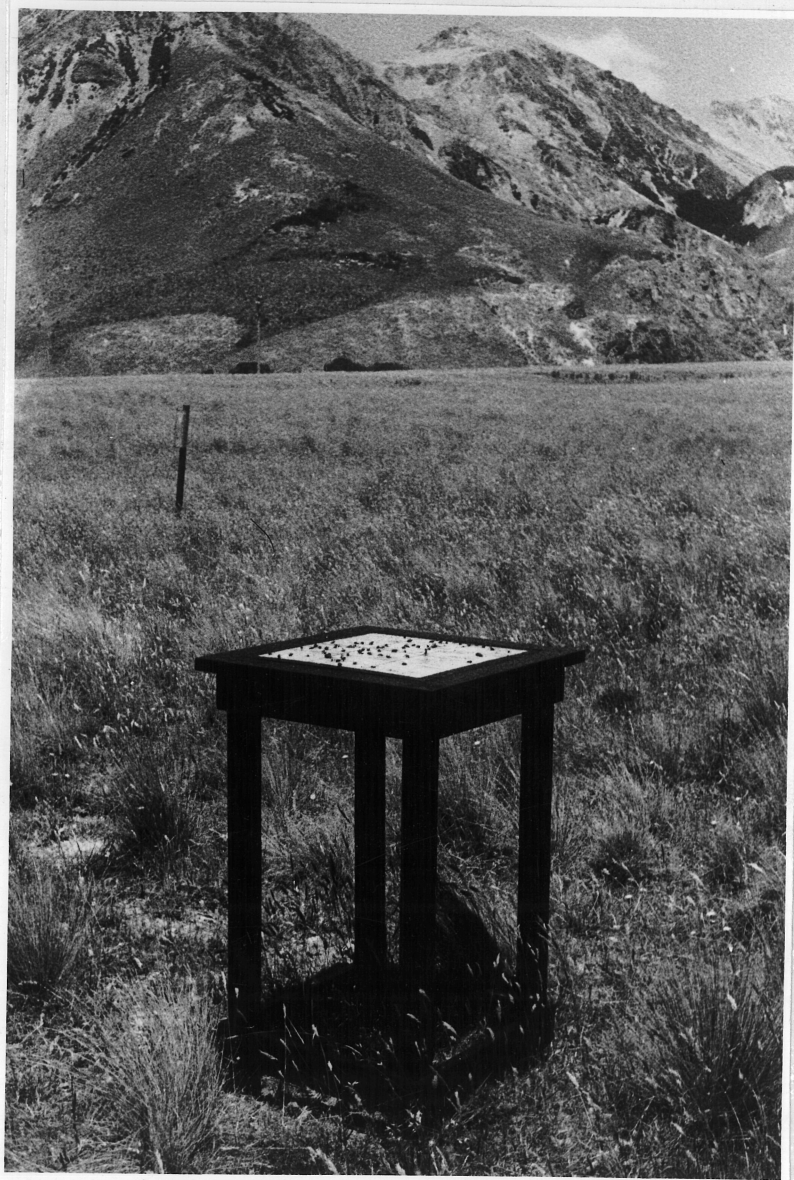


FIG. 1. Grease table, showing grease cylinder in background.

form of sub-division is irrelevant on a horizontal table.

The same grease and servicing procedure were used as for the cylinders except that a scalpel proved unsatisfactory for removing the insects. Since a flexible "blade" was necessary, good use was made of a plastic plant label.

Wind Nets

Wind nets have previously received most attention as aerial-borne and ship-borne traps. It was decided to try their use on land giving them freedom to rotate with the wind.

After testing their potential with a rather flimsy net, iron hoops of 1 meter diameter were used to frame a tapering nylon net about 6 feet long. The nylon selected was a strong and closely woven fabric. Some nets were sewn with a small detachable cone at the end but others with the net continuous to the point.

The hoop, directed by a wind vane (Fig.2) revolved on a vertical $1\frac{1}{4}$ -inch galvanised-iron pipe stoutly guyed to the ground from a point just below the hoop. With the net so large and winds experienced up to 90 m.p.h., it became necessary to strengthen the pipe with a central steel rod and add a cap to prevent the hoop being lifted over the top. These measures gave rigidity and transferred all strain to the guys and to the net fabric itself. However, further difficulties were encountered with the net entangling in the guys while hanging limp between winds and then, when wind resumed, sliding up a guy to become snagged between it and the upright. This not only disabled the net but often caused it to be torn. Adhesive insulation tape strung between guys where they converged kept the net from becoming wedged but did not prevent it being wrapped around a guy. Therefore it was permanently held out from the upright sufficiently distant to keep the end away from the guys when hanging. This was achieved by a supporting, horizontal rod attached to the top of the hoop so as to revolve with the net.



FIG. 2 Wind net.

Designing an apparatus to kill and preserve captured insects in the cone of the net was, however, the main problem encountered with wind net trapping. The demands of such an apparatus were very stringent:

- (i) weight had to be very light in order that the net stay buoyant even in gentle breezes;
- (ii) entry had to be easy no matter what way a stronger wind tossed the net;
- (iii) the smallest insects had to be held and yet rain discarded;
- (iv) the insects had to be kept from desiccation by sun and wind and from destruction by movement for as long as two weeks, no matter how extreme the weather;
- (v) the killing agent had to be kept dry for maximum efficiency;
- (vi) fungous growth had to be avoided.

All of these criteria stem from very real problems. To achieve perfection in all points is night impossible but an apparatus was evolved to answer all criteria satisfactorily and some perfectly. The final design emerged only towards the end of the survey and therefore much trapping was achieved with lesser efficiency.

The sequence of designs began with a small plastic bottle tied in the end of the net. The killing agent KCN (Potassium cyanide) was held in the bottom by Plaster of Paris. A wad of screwed-up tissue paper saturated with 76 ppi DDT dissolved in acetone solution was in turn placed in the net but disappeared. Baffle arrangements to reduce insect movement were then tried in the plastic bottle and in a small beaker tied and padded into the net. None was satisfactory and tying a container into the net by its mouth only formed folds that caught and damaged most of the insects. It was evident that the container must be conically shaped like the net.

A cone of cellulose acetate film was therefore devised and after many stages and modifications, that illustrated in Fig.3 was adopted and proved itself over the last three months of the survey.

The cone-shaped cellulose acetate film is 0.03 inch thick. Lighter film soon buckled and lost shape but this heavier film withstood weathering well during the last three months' trapping. Continued usage to test its lasting ability would have proved very interesting. The film is stapled into shape at a slightly greater angle than the wind net itself. Without this precaution the mouth of the cone may not press against the nylon net around its whole circumference and so allow insects to pass down the outside.

The cork, without any surface holes, is sand-papered at its edges to fit the cone perfectly. It serves as an excellent filter for rain-water. In earlier models its position was occupied by the killing agent, glass wool and certain baffle plates, none of them satisfactory.

The small central partition keeled into the cork is made of cellulose acetate film 0.03 inch thick but the other parts are of film which is 0.01 inch thick. Only the mouthpiece needs regular replacement, its lugs soon breaking with the opening and closing of the cone when removing catches. It is "cupped" in all directions towards the small opening so that no matter what position the wind net assumes, insects are directed into the cone.

The KCN killing agent is tied in cloth at the top. If desired, a strip of adhesive insulation tape can be attached across the mouth at its top edge to prevent entry of water near the killing agent. Being deliquescent, however, the KCN dissolves whether or not it is kept clear of rain-water. It usually lasts for two weeks or longer but this depends on weather. No satisfactory substitute could be found.

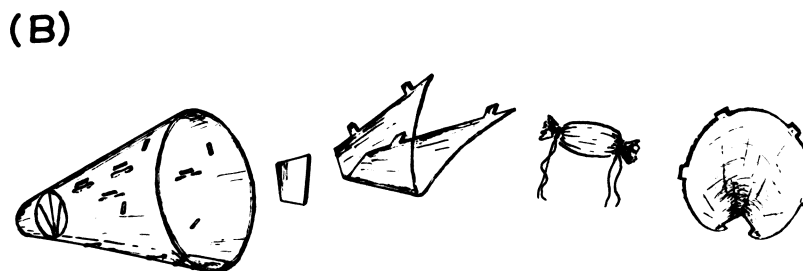
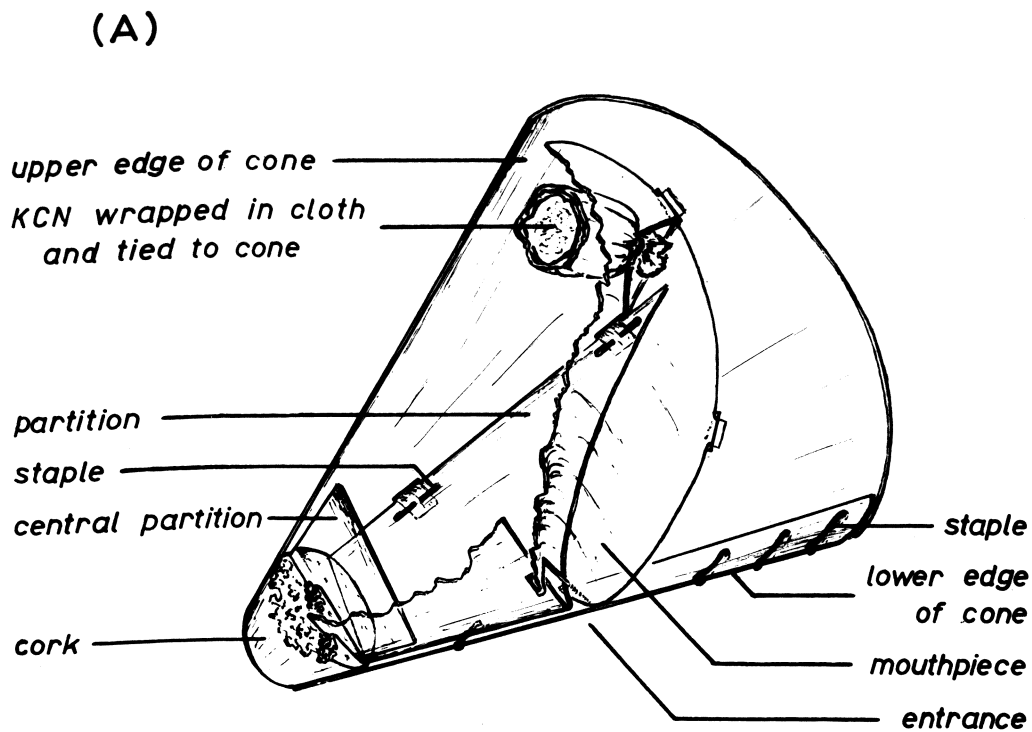


FIG 3. CONE OF CELLULOSE ACETATE
FILM FOR USE IN WIND NET (A) sectional
view (actual size) (B) exploded view

The mouthpiece, designed as it is, takes account of a behavioural pattern common to trapped insects. Unless the wind force is overwhelming, an insect flies towards the mouth in a bid to escape. Finding the mouthpiece obstructing, its tendency is always to climb. The slope of the mouthpiece is such that, inverse to trapping the insect in any wind net position, the trapped insect climbs by the same slope away from the entrance and towards the killing agent. Few insects find the entrance and those that do are likely to be blown back in. With this design, it is highly probable that many insects are captured even when the KCN has dissolved.

Damage to the catch is minimised by the partitions but overall condition does depend to a small extent on weather. Thus on several occasions rain kept a 12-14 days' catch in almost perfect condition by "matting" the dead insects together. Drainage kept them no more than slightly damp and wind kept this mass from being enveloped by fungus.

The cone is 4 inches long and weighs less than 1 ounce. It is fitted into the net with the entrance against the bottom seam. It needs no tying and does not swivel within the net. Earlier attempts to tie it by its narrower end only resulted in insects getting between the cone and the nylon.

Insects caught in the survey ranged in size from Fairy flies only 0.3 millimetre in length to grass-grub beetles and large moths. Even the largest moths were able to pass through the small entrance but wind nets are of no consequence in collecting the order Lepidoptera.

Hand Net

Methodical hand-sweeping of herbage was considered impracticable. Because the efficiency of sweeping rough herbage such as that in tussock grasslands is very low, an analytical study of this nature would necessitate a survey of its own. Therefore the hand net was used only for

casual (though considerable) sweeping and occasional flushing of larger insects.

Pitfalls

Pitfall traps were established for flightless ground-inhabiting insects but often were also a source of living larvae and of a few winged insects. They caught few specimens but these provided interesting records. Captured spiders were of nuisance value.

A 4-inch soil-sampler was used to remove cores of soil without disturbing the surrounds and 800-millilitre glass beakers of the same diameter were sunk with their edges slightly below the soil surface (Fig.4). They were each covered with a board or rock.

Though ground-surface hollows were avoided, some beakers collected water and so early attempts were made to drain it below a false bottom inside the beaker. However, advantages of the water in trapping insects normally able to climb out were soon realised and those beakers inclined to collect water were allowed to do so. They were emptied whenever attended.

Damp Sacks

Large sacks were pegged to the ground by their four corners (Fig.5) in an attempt to attract cryptic insects. Much of the grass herbage was first shortened by hand and below certain sacks some of the ground was also made bare to afford conditions that were initially different. A considerable quantity of scrap absorbent paper was crumpled into each sack to help retain moist conditions below but in spite of the paper, the area under some sacks tended to dry up in hot weather. Only below one sack did mildew ever become extensive.



FIG. 4. Pitfall viewed from above.



FIG. 5. Damp sack with one corner folded back.

Though these sacks never attracted great numbers of insects (and certainly few adults), they were a valuable source of certain larvae.

Light Traps

Light traps were used primarily to study the night-flying moth fauna though other insects were also taken. Apart from caddis-flies (Trichoptera), these other insects were only in small numbers.

The light traps used had the Robinson-type baffle arrangement and a $14\frac{3}{4}$ -inch diameter (Fig.6). Each of the two baffles had an effective cross-sectional trapping area of approximately 77 square inches. No roof was used over the trap in order that the light be seen from the greatest area.

Efforts were directed towards the simplest self-supporting construction possible for high-country conditions. Therefore the killing-tin of 5 inches diameter and $6\frac{1}{2}$ inches depth was matched with a close-fitting hole in the ground. This measure kept the trap upright and firm. The only additional support needed was an upright stake at each quarter to stop sideways stress and prevent wind from rotating the baffles within the trapping cone.

Due to weathering, chloroform-cementing of perspex around the lamp gave only temporary success, disintegrating every few weeks. Therefore metal clips were adopted to ensure an all-weather trap. The large quantities of rain caught were channelled through the bottom of the killing-tin by means of a centrally mounted plastic funnel. For this purpose, the hole in the ground was several inches deeper than the tin and satisfactorily disposed of all water. The insect baffle across the funnel mouth was first made of cloth draped over the sides and affixed below. In this arrangement, however, water was absorbed over the sides and in turn not only wet the collecting compartment but dissolved

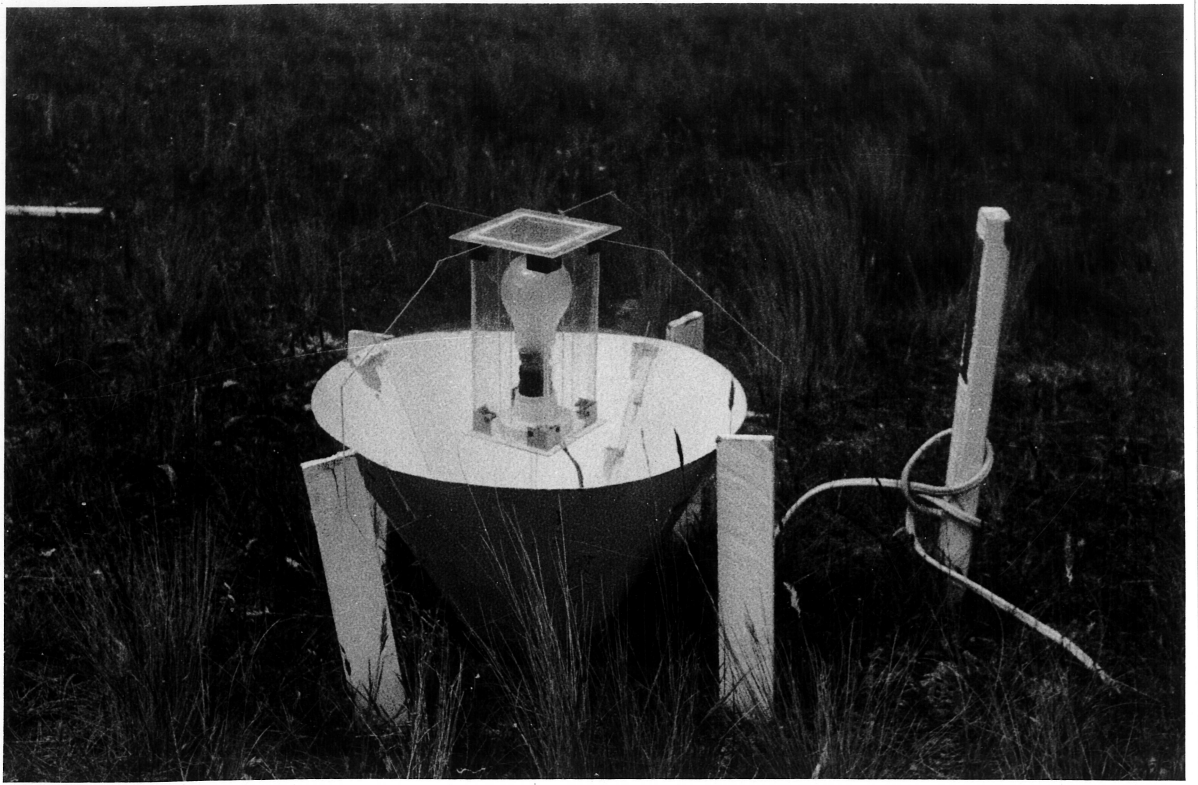


FIG. 6. Light trap.

crystals of the killing agent, KCN, set on the bottom in Plaster of Paris.

A sequence of modifications to keep the killing agent dry and the collecting area both clean and dry led to the compact design illustrated in Fig.7.

Two types of baffle arrangement were used across the mouth of the rain funnel. Use of cloth proved workable when strongly glued to the funnel around its whole circumference, the glue acting as a barrier to water absorption. Unfortunately, this function of the glue was nullified if the cloth became impregnated with moth scales and so once again water could seep over into the collecting compartment. This was avoided by keeping scale deposits clear but resort to a trial piece of 1/12-inch wire gauze proved a very interesting alternative. This mesh allowed nearly all micro-caddis (Hydroptilidae) to pass straight through. Only an occasional tinaeid moth and a few tiny aquatic Diptera were able to take the same passage. Because in one trap near a stream 10,000 micro-caddis and more were taken on some nights, the gauze saved sorting out these "nuisance-insects" from among the moths. Since they blocked the funnel rather than pouring through, they could still readily be retrieved if wanted. Hence instant sub-division of light-trap collections into broad size groupings could be quite simple without impairing insect condition. Gas diffusion ensures ready death in all compartments.

An inverted plastic bottle with the bottom removed served both to support the rain funnel and provide a concealed KCN chamber around it. Holes in the sides of the bottle had to be relatively large and numerous to allow a strong flow of HCN gas and were screened from the crystals by a layer of cotton wool. Because KCN is deliquescent, an attempt to absorb any moisture with silica gel crystals proved futile. The KCN had therefore to be periodically replaced, the interval depending on prevailing air humidities. Though exposed continuously to the open atmosphere,

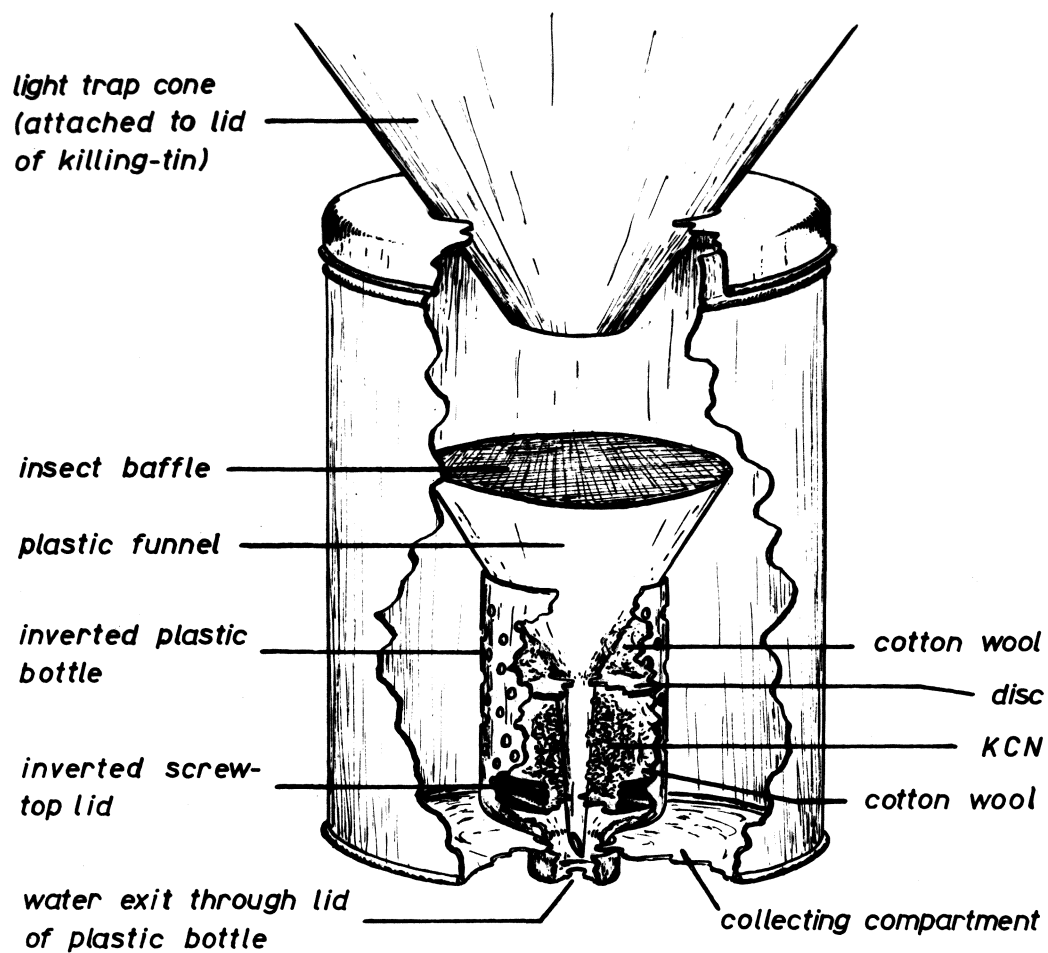


FIG 7. SECTIONAL VIEW OF LIGHT TRAP
KILLING-TIN (half actual size)

the quantity held by the trap always lasted at least two months.

Only one light trap was near a power supply. To position it well away from buildings on an extensive tussock fan, 400 yards of cable were laid out. Though the voltage from a transformer at the mains was 32 volts, cable resistance dropped it to 5 volts at the bulb when working. A 12-volt bulb was used.

Two other traps were run from batteries, one from a heavy duty 12-volt lead accumulator and the other from two 6-volt batteries. The latter were initially two electric fence batteries (dry cells) connected in series but these not only proved costly but were unable to maintain their power level for an unbroken three hours as required. Since batteries not too heavy for regular cartage up mountain sides were needed, 6-volt motor-cycle batteries (lead accumulators) were then tested and proved very successful. Two pairs, each connected in parallel, were operated in metal containers with handles for easy cartage. This now meant a 6-volt system in contrast to the other two 12-volt systems. The life of the batteries was two unbroken three-hour spells of fairly satisfactory performance using a 24-watt bulb. One pair of accumulators was recharged while the other was in use.

The only light colour used was white light but in contrast to the 24-watt, clear bulb used above, the other two traps were equipped with 60-watt, frosted bulbs. Gui et al. (1942), concluded from experiments that in the lower range of brilliance (15 watts to 75 watts), differences in wattage have only slight effects, thus suggesting little significant difference between the 24-watt and 60-watt traps. Nor is a very significant difference likely between the clear and frosted bulbs, a clear bulb in the present survey having taken a catch similar to that of a frosted bulb at the same site and under comparative conditions. Hence the three traps used were of themselves comparable, though as noted

on page 24 only the two identical traps were employed in strictly comparative situations.

Automatic timing equipment was used with two traps, for one a 24-hour clock and for the other a 7-day clock. The former was used following repeated failures with an adapted 12-hour clock. Timing of the third trap was manually controlled.

Light-trap catches other than with light were not uncommon, certain insects flying into the baffles by day and others occasionally climbing in. Cicadas and bees often flew into the baffles but some insects were almost certainly blown in, a surprising example being that of the oecophorid moth Atomotricha sordida (Butl.).

Berlese Funnel

A Berlese Funnel utilising the light and heat of an electric lamp was used to make extractions from tussock foliage and any soil that remained attached to the surface roots.

Sieved Soil Samples

A nest of three 5-inch diameter sieves ranging from a 1-millimetre mesh to a 5-millimetre mesh were used to sieve soil in workable condition. The soil samples were initially standardised 7-inch cubes with the vegetation removed but a later reduction to a 6-inch cube lessened the soil volume per sample by approximately one third without being of any consequence to sampling efficiency. A spade was machined to a width of 6 inches for cutting the samples. On a slope, they were cut vertically and calculated by average depth.

A sample was sieved in small quantities and each size-fraction spread by hand over a white-painted board 12 x 15 inches. The colour helped make insects obvious and these were simply removed by hand. Soil which passed through the sieve with a 1-millimetre mesh was discarded

since it demanded too much time to search visually.

When possible, sampling was done in the field in suitable weather conditions but otherwise samples were brought back to the laboratory.

Hand Searching of Plants and Soil

Hand searching of plants related chiefly to tussock though inter-tussock herbage and some scrub were on occasions also subjected to close scrutiny. Tussock bases were often searched meticulously and seed heads received considerable attention, especially while in flowering and early seeding stages.

Hand searching of soil refers to scraping through the surface soil (usually amongst plant roots) with the fingers in order to find any insects present.

Collection of Tussock Samples for Insect Emergence

In order to determine some of the insects that have definite ecological associations with the tussock plant, foliage was collected and stored in long and rather narrow calico bags to await emergence of adults from any immature forms present. In early sampling, the foliage was cut away from the plant just above ground level. This measure was not ideal, however, as the stem bases which constitute the most likely abode of any stem borers were left behind. Therefore in later sampling, segments of tussock were pulled from the plant, neatly shearing close to the juncture of stem and root.

A test-tube was tied into the neck of each bag to attract any emergent insects to the light and both tube and bag laid horizontal. Insects readily came to the tube but most appeared to return to the darkness to die unless removed. Therefore a few drops of 50% ppi DDT wettable powder dissolved in acetone were shaken in each tube and allowed to evaporate. This measure readily killed any emergents.

To avoid growth of mildew, samples collected wet needed good aeration while in storage.

Rearing of Immature Insects

Attempts were made to rear pupae, certain larvae and a few nymphs taken in the field. Early in the survey, eggs were also kept for hatching but as improper attention and only crude conditions could be provided in the time available, few other attempts were made. Even larvae and nymphs could only be allotted small jars given neither temperature nor humidity control. Food plants were often unknown and foliage acceptable in laboratory conditions difficult to find.

From approximately 500 immature specimens selected for rearing, 126 were successfully reared.

SURVEY PROGRAMME

The survey programme, though broadly defined at the outset, formulated its own pattern as it proceeded.

Field work commenced on 21 November 1961 and continued until 22 March 1963. An around-the-year collecting programme was designed with a second summer added not only to give a double opportunity during the main insect flight season but also to compensate for failures (technological or otherwise) during the first stages of the survey.

1961-1962 Season

The 1961-1962 season is taken as ending 30 June 1962.

In November 1961 several traps were established in the Starvation Gully and Lake Lyndon areas as follows:

Starvation Gully ----- At 2900', 1 damp sack.
At 3000', 1 wind net.
Lake Lyndon ----- At 2800', 1 yellow & 1
green grease cylinder, 1 damp sack, 5
pitfalls. At 3000', 1 yellow & 1
green grease cylinder.

Tussock sweeping was also commenced and the first tussock samples taken for Berlese Funnel extraction.

Collecting was continued until the fifth visit (29 December 1961), but progressive removal of the traps to the Cass area began on the third visit (6 December 1961).

The purpose for collecting in the Starvation Gully and Lake Lyndon areas before the main study area had been chosen was basically to provide for a trial of techniques and to gain competence for handling a large-scale survey.

On 7 December 1961 erection of the first traps in the Cass area was commenced and most were in position by the end of the month. The total of 41 traps included five yellow and seven green grease cylinders, one grease table, three wind nets, 14 pitfalls, eight damp sacks and three light traps. An outline of their locations and altitudes for the 1961-2 season follows:

Walker's Plot ----- At 2100', 1 yellow & 1
green grease cylinder, 1 damp sack, 2
pitfalls.

Walker's Fan ----- At 2100', 1 yellow & 1
green grease cylinder, 1 damp sack, 2
pitfalls.

Ribbonwood Fan (above road) --- At 2200', 1 light trap.
At 2300', 1 yellow & 1
green grease cylinder, 1 wind net, 1 damp
sack, 2 pitfalls.

- Ribbonwood Fan (below road) --- At 2300', 1 yellow & 1 green grease cylinder, 1 grease table, 1 damp sack, 2 pitfalls.
- Mt Bailey (East face) ----- At 3100', 1 green grease cylinder, 1 damp sack, 1 pitfall.
- Goldney Saddle (North face) --- At 2100', 1 yellow grease cylinder, 1 wind net, 1 damp sack, 1 pitfall.
- Mt Magog (North face) ----- At 2300', 1 pitfall.
At 2600', 1 green grease cylinder, 1 damp sack, 1 pitfall.
- Mt Gog (South face) ----- At 2900', but transferred 17/1/62 to 2300', 1 light trap.
- Mt Sugar Loaf (South face) ---- At 2800', but transferred 20/12/61 to 3200', 1 wind net.
At 3200', 1 damp sack, 2 pitfalls.
At 3500', 1 green grease cylinder.
- Mt Sugar Loaf Fan ----- At 1900', 1 light trap.

All other trapping methods outlined in the previous section, "Materials and Methods", were commenced within the same December-January period except soil sampling and tussock sampling for insect emergence. Berlese Funnel extraction could not be retained in the programme through lack of time and was discontinued after 31 December 1961.

Grease cylinders were erected with their bases 30 inches above the ground except for the two in Walker's Plot and the yellow one on Walker's Fan. The bases of these were only 1 inch above the ground in an effort to detect faunistic differences between the plot and the adjacent area

of Walker's Fan. A green grease cylinder on the same fan but much further removed from the plot was 30 inches above the ground to allow comparison of Walker's Fan with other sites. Where a comparison of trap heights is necessary, those traps with their bases at 30 inches are termed "high-set" cylinders while those erected near the ground are termed "low-set" cylinders.

On Ribbonwood Fan the four grease cylinders were paired with each other by colour and position. A yellow and a green trap on the improved fan above the road were placed opposite their own colour below. The yellow cylinders were each within 50 yards of the road but the green cylinders further down the fan were much more distant from each other. The proximity of the yellow traps was designed to relate any clear-cut differences between insect populations on the improved and unimproved portions of the fan. Wide-ranging flight of a species directly attracted to only one of the sites could of course annul positive results but any distinct differences obtained so close at hand should warrant a thorough examination. The two green cylinders placed much further apart should theoretically endorse any such trends, if not accentuate them.

Use of "Ostico" grease on all cylinders commenced in mid-January 1962.

The grease table, not established until 13 March 1962, was set 30 feet from the yellow grease cylinder on Ribbonwood Fan below the road. Its table surface was 30 inches above the ground, thus matching the base of the cylinder.

Wind nets were all erected with the base of the hoop $4\frac{1}{2}$ feet above the ground.

The light traps on Mt Sugar Loaf Fan and Ribbonwood Fan were in very similar types of position, each being visible from a large extent of fan and from a mountain slope about one-quarter of a mile distant. There was also

a small area of beech forest one-quarter of a mile from the Mt Sugar Loaf Fan trap. Since each was also lit with a 12-volt, 60-watt frosted bulb, collections from these two traps were considered good indices of faunas from improved versus unimproved tussock grasslands in the Cass area. Only the patch of beech forest and apparently different weather conditions between the two sites on some nights (see section on "Weather", Page 32) seemed to set them apart. These factors were accounted for.

In comparison, the Mt Gog light trap was first erected on a slope at 2900' not far below the mountain's peak (2993'). The light could not be seen 50 feet down the slope and the very few moths taken up until mid-January 1962 seemed to indicate a very small effective trapping area together with an unsatisfactory performance by the electric fence batteries. Therefore the trap was shifted down to a 2300' promontory overlooked by the mountain's southern face. It could not be seen from below and so in contrast to the other two traps could draw insects only from the mountain slopes (unless some from the extensive flats at 2000' ever flew within range). The northern face of Mt Magog one-quarter of a mile away was also overlooking the trap.

Persistence with the electric-fence batteries proved futile and on 28 February 1962 the trap was first equipped with motor-cycle batteries. It immediately proved capable of taking good catches though still drawing from a much smaller area than the other two traps. However, in subsequent use, good catches were more often the exception.

Reasons for the smaller and sometimes insignificant catches are difficult to give, though unsatisfactory weather probably accounted for many. Even those nights known to be good at Mt Sugar Loaf Fan may not have been so good at Mt Gog 5 miles away and subjected to different wind

currents. In addition, an elevated promontory cannot usually compete with a fan for shelter. For these reasons, Mt Gog catches were not considered comparable with those from the other two light traps and later in the survey few efforts were made to obtain them on the same nights. On occasions however, circumstances indicated that the smaller catches were in fact a function of elevation and site. If this be correct, then such catches are comparable with those from the other traps given similar and favourable weather conditions at each site.

All light traps were operated for the three-hour period after dusk, the time-limiting factor being battery life. The nights for trapping were selected. At least one evening of worthwhile collecting by each trap was desired for every fortnightly visit. To co-ordinate the three traps on a suitable evening meant anticipating the weather some hours before in order to set each trap. This achieved, the weather often changed and became unsatisfactory. Co-ordinated catches were therefore few and Mt Sugar Loaf Fan catches the most numerous since that trap alone could be reached when weather improved at the last minute.

Soil sampling for insects had to be limited in extent because it was so time-demanding. In order that it be representative and have opportunity to reveal seasonal trends from a minimum number of samples, a sequence of clumped sampling at intervals along a transect was designed for repetition on three occasions throughout the year.

A North Canterbury Catchment Board transect on Ribbonwood Fan above the road was projected on to the same fan below the road and also on to a spur on Mt Bailey at 3800'. This single transect therefore extended over improved and unimproved grassland, a fan, a broad mountain ridge and an altitudinal range of 1500'. Sampling along

the transect was designed to compare tussock and inter-tussock samples at each point, care being taken that the latter were from well vegetated areas. The points were at 120-yard intervals on the fan but 60-yard intervals on the spur since it was less extensive. Those on the fan both above and below were measured from near the road in order to detect any sudden transition from one area to the other.

In April 1962 the first series of samples were taken: three 7-inch cubes from each of four points on both sides of the fan and three from each of three points on the spur. At every one of the 11 transect points, the three samples were selected as close as possible while at the same time allowing for future sampling. One of the samples was cut in the inter-tussock zone well removed from any tussock plants and two of the samples were cut with the tussock plant in the centre. Most taken were hard tussocks but some were blue tussocks and at one point on the spur transect, silver tussock was sampled.

Until 17 May 1962, visits were nearly always fortnightly and each afforded (on average) six days of collecting. During this period, all field traps were serviced at least once. Other trapping procedures were used as time allowed but often little time was available for hand searching of tussock and observation of insect activities.

No further collecting was carried out in the remainder of May and nor was there any in June. Very little insect activity was apparent in the rigorous winter conditions.

1962-1963 Season

The season commenced with a one-day trip in mid-July but regular collecting was not resumed until 29 August

1962. It continued throughout the season in the pattern of fortnightly visits but until mid-November these visits were of no longer than two and three days' duration and only a restricted trapping programme was undertaken. This was limited to Ribbonwood Fan, Mt Bailey, Mt Sugar Loaf, Mt Sugar Loaf Fan, Walker's Fan and Walker's Plot.

From mid-November until the survey finished, the fortnightly visits were (on average) four to five days in length. All sites except Goldney Saddle were again regularly visited but the trapping programme was somewhat modified. Not only was trapping itself reduced but, with a concerted effort to study insect activities amongst tussock plants, the number of insects handled from the traps had to be lessened. Therefore, commencing in late November, all Diptera were discarded except species not taken previously and a few readily recorded ones.

Only six grease cylinders were employed in the August to mid-November period. These were the four yellow ones on Walker's Plot, Walker's Fan, Ribbonwood Fan above and below the road, plus the two green ones on Mt Bailey and Mt Sugar Loaf.

As from mid-November, the grease-cylinder trapping was re-organised. The 1961-2 season's trapping indicated slightly higher insect numbers on yellow traps comparable with green traps on the same sites. Without counts being made, this was the general impression for most species though green may have been the favoured colour of a few species. Therefore a complete switch to yellow trapping was decided and the six traps employed were those on Mt Bailey, Mt Sugar Loaf, Mt Magog, Ribbonwood Fan above the road and two on Ribbonwood Fan below the road. The second of these last two was a low-set cylinder erected only 3 inches above the ground and 30 feet from the grease table so as to form an equilateral triangle with it and the other cylinder. By

this arrangement, a ready comparison of trapping ability and potential could be gauged for each of the three traps. This would help interpret all other grease-trapping data obtained in the survey.

Because the number of traps already painted yellow was one short, the Mt Bailey trap was re-painted but the "Interlux" Zinc Chromate primer which was used is a very distinctive yellow from Waggon Yellow. Therefore, though very successful in itself, the Mt Bailey trap could not offer ideal comparisons with others.

Throughout the survey, no determined attention was paid to differing insect densities on opposing cylinder faces. Insect densities around the cylinder did vary markedly but without continuous data on air-currents and winds, there was no point in trying to interpret a species' distribution around the trap. For such analysis the behavioural pattern of each species had also to be known or deduced, some being seen to alight voluntarily in calm conditions.

The grease table was in service from mid-November until mid-February but caught comparatively few insects.

Only the one wind net on Ribbonwood Fan was utilised in the second season and its service period was limited to the three months commencing late November. A net damaged by high winds towards the end of the survey did not warrant replacement for the remaining period.

Pitfalls and damp sacks were serviced for the period over which each site was attended.

All three light traps received regular use, but whereas the Mt Sugar Loaf Fan and Ribbonwood Fan traps were operated from late August, the Mt Gog trap commenced operation in late November. As in the previous season, the Mt Sugar Loaf Fan trap was used more often than the others but a far greater number of catches were co-ordinated with the Ribbonwood Fan trap. The Mt Gog trap with its 7-day clock was most commonly used to collect in the

intervals between visits. No related weather conditions could therefore be determined but several significant catches were taken.

Particularly in the August to October period when very few moths were active, the Mt Sugar Loaf Fan trap was often used throughout the night in order to obtain a better sample than that from the three-hour period after dusk. The evening weather at this time of the year was seldom suitable for light-trapping before the early hours of the morning.

Later in the season the traps on both fans were used once or twice to take an early morning catch for comparison with standard evening catches but little was learnt from the comparisons.

Soil samples were taken from the same transect as last season but their size was reduced to a 6-inch cube. In late August samples were taken from all points sampled in April, two tussock samples remaining standard to each inter-tussock sample. Ribbonwood Fan below the road provided the only exceptions with one transect point not sampled but two inter-tussock samples taken at each of two other points.

Because of their wet condition, none of the above 32 samples could be sieved immediately. They had therefore to be sieved over the month's period from 10 September 1962. While drying in plastic bags at room temperature, all reasonable precautions were taken to stem the escape of any insects, though at this time of the year few were mature. The chances of insects dying were greatest in those samples sieved last. The records may therefore not be complete.

The transect was sampled for the third time in late January 1963, but only one tussock and one inter-tussock sample were taken at each alternate point, making a total of 12 samples. For the small number of sizeable insects present at this time of the year, no more sampling was

warranted in terms of the time demanded. The common species were mostly absent or, if present, then present as very early instars not readily detected.

The only additional soil sampling was in the Mackenzie Country in early February 1963. Since its chief purpose was to find wireworms (Elateridae), this period of the year was satisfactory. Tussock and inter-tussock samples were taken from the "Holbrook" and "Godley Peaks" stations near Lake Tekapo and also from near Lake Ohau. Further tussock samples were also taken from "Ohau Downs" station and from near Lake Pukaki.

Including these samples from the Mackenzie Country, the total number taken in the survey was 85. The April sampling gave the greatest number of insects.

Tussock samples collected for insect emergence were considered a measure most appropriate to the early spring period. Adults of few insects had emerged in the high country at this stage and any in tussock stems or foliage would most likely be in their final instars. A large number of samples were therefore taken in September 1962. The first had already been taken in mid-July and others were added in early January 1963.

Samples of all four tussock species were taken, some of the September ones being pulled from below the snow. Quite a number of insects emerged over a period.

In the 1962-3 season, two collecting procedures not used in the previous season were adopted. Collecting tussock samples for insect emergence has already received mention but reference to a single night spent with a torch looking for insect activity among tussock has so far been omitted. Though that one night was unsuccessful, such attempts could have proved very rewarding if they had been adopted as part of the survey programme.

Cattle Interference

Cattle interference with traps was very persistent and certainly did not aid the survey programming. Sheep caused no trouble even where delicate light-trap baffles were unprotected, but cattle not only broke light traps but also rubbed the grease off grease cylinders, uprooted damp sacks, uncovered pitfalls and ate the nylon of a wind net.

Because of this interference, certain traps accessible to cattle had to be strongly protected. Such measures were taken on Mt Gog and Ribbonwood Fan above the road but in no case was protective fencing considered a deterrent to the trap's trapping ability.

Weather

Weather recordings and observations were made in the Cass area throughout the survey. These consisted of rainfall and temperature readings together with daily observations during visits.

At the Canterbury University Biological Station, daily maximum and minimum temperatures were recorded on each visit with a dry bulb thermometer. Rainfall readings were also taken. Though rainfall records at the station extend back for many years and over recent years have indicated a mean annual precipitation near 50 inches, their value as indices for the whole Cass area was doubtful. Therefore readings were also taken on the most northerly, easterly and southerly sites in the survey. In late summer 1962, two rain gauges were set on the most northerly and easterly sites, the first on Goldney Saddle (at 1900') and the second on Mt Magog (at 2100'). The most southerly gauge used was at 2100' near Walker's Fan, readings being obtained by courtesy of B.P.J. Molloy. Readings from all three of these rain gauges were compared with those of the Cass gauge at 1900'. For the 52 weeks ending 15 March 1963 individual totals to the nearest half inch were as follows:

Cass	57.5 inches
Goldney Saddle	54.5 "
Walker's Fan	49.5 "
Mt Magog	43.5 "

Though the above figures extend over only 12 months, they indicate that Walker's Fan and Ribbonwood Fan probably receive a lesser annual rainfall than Cass and Goldney Saddle and that Mt Magog and Mt Gog almost certainly do. Since the Cass rainfall for the calendar year 1962 was 55.5 inches, the year was slightly wetter than usual. It therefore appears likely that as compared with a mean annual rainfall of 50 inches at Cass there may be only 40 inches at Mt Magog. This suggests that the survey of the Cass area was directly related to a rainfall zone of 40 to 50 inches.

An overall appreciation of seasonal weather throughout the survey was difficult to gain from observations made only during visits. Further, these observations gave no basis for comparison with other seasons. The appreciation and comparison given below were made possible by the weather records of the "Grasmere" station, Cass. The comments cover the whole Cass area.

Commencing with the weather immediately preceding the survey, D. McLeod (pers. comm.) makes the following broad assessments while drawing attention to salient points:

Winter	1961	mild, without much snow or heavy frosts, a wet June but dry August.
Spring	1961	mild, a dry October.
Summer	1961-2	fairly hot, a very dry December.
Autumn	1962	mild, a wet May.
Winter	1962	mild.
Spring	1962	a very wet October.
Summer	1962-3	a very dry December and January but conditions not so dry on account of cool temperatures.

He continues, "Neither of these seasons was notable for north-westerly wind conditions any more than usual. The winters were milder than the area is entitled to expect and growth was early in each spring. Generally speaking, the seasons were typical of the last 10 years or so as opposed to the more severe winters and springs characteristic of the late 1940s."

Though the weather was broadly similar for the two seasons, survey findings indicate certain peculiarities of the second season in comparison with the first. Each tussock species probably flowered later, fewer insects were trapped on grease cylinders in the 1963 summer and the Ribbonwood Fan light trap began collecting more moths than the Mt Sugar Loaf Fan light trap.

No records were made of tussock-flowering dates in the early stages of the survey but there are indications that the low-tussocks possibly flowered three to four weeks earlier than in the following 1962-3 season. If this was true, then the smaller numbers of insects trapped on grease cylinders in the 1963 summer may be in part a reflection of the later season. The survey finished a few weeks too soon to clinch this.

A second possible difference between the two seasons relates to winds at night. Whereas in the 1961-2 summer more moths were usually trapped by the Mt Sugar Loaf Fan light trap than by the Ribbonwood Fan light trap, in the 1962-3 summer the latter often recorded more specimens and on occasions caught considerable numbers when windy conditions badly hampered the Mt Sugar Loaf Fan trap. This indicated different wind conditions for each trap on the same evening and suggests that nightly wind patterns changed in the second season.

Though other noteworthy differences between the two seasons may have existed, the suggested lateness and different wind currents of the second season are foremost

explanations of the seasonal trapping tendencies. High winds in the late summer of 1963 certainly played a part in restricting insect activity towards the end of the survey.

Mackenzie Country Collecting

Three brief trips were made to the Mackenzie Country during the 1962-3 season. On 10 November 1962 tussock areas were swept at Ohau River, Lake Pukaki, "Sawdon" station and Burke's Pass. On 8 and 9 February 1963 a little tussock sweeping on "Sawdon" and "Ohau Downs" stations accompanied soil sampling, the main purpose of the trip. Then on 21 February 1963 a trip was made with the single purpose of taking a light-trap collection. It had appeared from earlier visits that the Mackenzie Country fauna was probably two or three weeks earlier in its seasonal appearance than that at Cass. A light-trap collection was considered the best way to detect this, certain moth species whose flight periods were known at Cass acting as indices. A light trap was therefore set among the downs to the west of Mt John. It collected for the eight hours after dusk.

The purpose of collecting in the Mackenzie Country was to gain an appreciation of diversity in the insect faunas of tussock grasslands. Together with the experience afforded in the Starvation Gully and Lake Lyndon areas this appreciation proved to be an asset in helping to interpret survey records from the Cass area.

CHAPTER 3

THE FAUNA

INTRODUCTION

The list of insect species given in this chapter is incomplete for the survey. A total of 805 species are presented but the three orders Collembola, Thysanoptera and Diptera have been omitted. The collections of these insects still await study, but with their inclusion the total will probably be between 1000 and 1100 species.

The final list could be considered comprehensive though still rather inexhaustive for the Cass tussock grasslands. The trapping programme ensured a very thorough survey of some insect groups but certain others would have responded better to selective trapping measures. Attention is drawn to these in the appropriate text as also to a few small groups given only casual coverage.

Most determinations were made by the writer but all assistance given by specialists is listed in the acknowledgements. As yet, only a few larval determinations have been made.

It is possible in a few instances that adult specimens belonging to a single unnamed species have been annotated as more than one species. On occasions this arises only from uncertain male and female relationships but wherever species rank is considered suspect, it is intimated.

Because the overall number of doubtful species is few, changes could alter the faunistic list only slightly.

Presentation of survey findings must remain incomplete for some of the listed species since their records have still to be analysed statistically. Because light traps and grease cylinders methodically sampled many species populations over a wide extent and throughout most of the year, their data for such species warrants analytical study. This has already been possible in the case of Lepidoptera taken at light but until the Diptera and Thysanoptera have been studied, none of the grease cylinder information can be analysed. Therefore the findings presented for such species are less specific than they might be. Statistical analysis has also been possible for soil-sampling data from the Mt Bailey - Ribbonwood Fan transect but the only records which warrant the analysis are those of the elaterid and scarabaeid larvae.

METHOD OF PRESENTATION

In an attempt to make the presentation of faunistic details both methodical and concise, a standard layout has been adopted.

Within each order the layout follows the classification system that is named, but within each family (or sub-family) the sequence of genera and species in some instances tends to be rather arbitrary. Where a standard text has been available (e.g. "New Zealand Beetles and their Larvae" by G.V. Hudson, "The Butterflies and Moths of New Zealand" by G.V. Hudson), this has been followed. Where there has been no such guide, species have been grouped next to those others which they most broadly resemble. Named species, however, precede those which are unnamed.

The convenience of this layout is that the most easily confused species are adjacent to each other. Such a presentation is most relevant to the long species lists of unnamed Hymenoptera.

The layout of information presented for individual species also follows a standard pattern. Some of the most relevant information arising from the survey is first listed in a concise though somewhat abbreviated form. Any explanation or expansion of this which may be necessary is then given below, along with any other survey findings that may be of some consequence. Reference is also made to literature that is applicable to the species in the context of the present survey, and finally an attempt is made to assess the insect's economic importance in tussock grasslands. It must be stressed that this assessment relates only to tussock grasslands and that it is relative to tussock grasslands generally rather than to just those in the Cass area. It is derived from an appreciation of the survey findings and where possible from an understanding of the species' distribution throughout New Zealand and its habits. For this reason parasites, predators and hosts or food plants are listed if they are known but only those are included which have been recorded from the Cass area. Hence, though 30 species of food plant are known for the aphid Aulacorthum solani (Kltb.), only three are listed because none of the others are known to occur locally. The main source of information concerning the local flora has been Philipson and Brownlie (1958) whereas mention of known parasites, predators or hosts has depended solely on their having been collected and determined from the present survey. In some of the recorded families all too little is known about the habits and distribution of the various species to make any assessments of their economic importance. Therefore broadly defined statements have been made to give a general coverage for each family as a whole.

The detailed though slightly abbreviated list that introduces each species states concisely the number of adult specimens that were trapped in the field, their sex ratio (if sexed), the number of trapping records, the years in which the species was recorded, the months in which the adults were trapped, the months in which nymphs were trapped or adults emerged from pupae, the range in altitude over which the species was found, the sites from which the species was recorded and the trapping methods by which specimens were caught. Though the layout of this list is simple and the abbreviations logical, certain exceptions cannot be avoided. Two sample lists are therefore given below and all possible exceptions explained together with the basic abbreviations.

Corymbites antipodus Cand. 10 (2:5) 8

1961-2, Dec, Apr & May/Nov, 2100'-2300', Rib. Fan (A & B), Gold. Sdle, Mt Magog & Mt Gog. Traps P, S & L/Ld.

Lissotrachelus maoricus (Walk.) 14. 10

1962-3, early Feb-mid Apr (11 nymphs, mid Jan-mid Feb), 1900'-2800'/3100', Sawdon Stn & all Cass sites except Mt Gog, Mt Sugar Lf & Mt Sugar Lf Fan. Traps N, P, G & Ld.

The Figures alongside the Name

These figures relate only to adults caught in the field. The first represents the number of specimens taken, the brackets (where present) include the female : male sex ratio of all specimens that were sexed and the final figure represents the number of trapping records. Even if two adults were taken on the same day but were from different traps, different sites or different altitudinal zones (see page 42), they were regarded as two separate records. The value of keeping these records separate and then numbering them is to indicate whether a species' appearance has been consistent or occasional. Such an appreciation helps to elucidate all other information present^{ed} in the introduction.

- Exceptions (i) a sex ratio with three components - such a ratio is applicable only to ants and represents alate females : alate males : other castes.
- (ii) omission of trapping records - this is applicable only to caddis-flies and is the result of grouping all specimens into monthly collections.
- (iii) omission of all figures - this is a logical case of no adults being trapped in the field, all specimens being either observed, reared or found only as immature forms.

The Years

The years listed are the calendar years in which the species was trapped or observed. A hyphen is used to denote specimens being trapped in consecutive years (e.g. 1961-3) and an ampersand to denote specimens being trapped in non-consecutive years (e.g. 1961 & 3).

- Exception (i) a bar used between two years (e.g. 1962/3) - this indicates that the year in which the species was collected is now uncertain.

The Months

The months listed are those in which adult specimens were trapped or observed in the field. Though for most species they relate directly to the flight period, there are several exceptions. These concern apterous and semi-apterous species, soil-inhabiting adults and the ants with their various castes. In the latter case the months listed do relate to the flight period and that alone since the apterous castes can be found throughout the entire year.

In most cases the months are designated as "early", "mid" or "late". However, these definitions are rather limited because many field traps could be attended only once a fortnight (on average). Therefore each fortnightly collection was allotted to the date mid-way through the collecting period and the three intervals within each month defined as follows:

"early" - 1st to 10th day of month (inclusive)
 "mid" - 11th to 20th " " " "
 "late" - 21st to last " " " "

Where a species was collected in both the early and late periods of the same month, it was considered to be present for the whole month. Therefore neither of the intervals is defined and the name of month stands alone - unless the insect's appearance extends into subsequent months. In such cases the earliest period is mentioned and a hyphen used to denote the consecutive intervals (e.g. early Feb-mid Apr).

Exceptions (i) a bar used between two months (e.g. July/Nov) - this indicates that a species was collected by a trap that was unattended between July and November (inclusive).

(ii) collection dates of soil-sampled specimens - the name of each month stands alone without further qualification.

The Nymphs and Reared Specimens

Information relating to nymphs and reared specimens is enclosed in brackets but concerns relatively few species. Its chief purpose is to define the months in which nymphs were collected in the field or reared adults emerged in the laboratory. The number of specimens is prefixed in each case and the months defined in the same manner as for adult specimens collected in the field.

The Altitudinal Range

The lowest and highest records of each species denote the altitudinal range over which it was found. The records of both adults and immature specimens are accounted for and the heights expressed in feet above sea level. In most cases each of the two expressions is stated to the nearest 100' (e.g. 1900'-3500'), but in some instances the definition has to be less accurate (e.g. 1900'-3500'/4000'). In this example, 1900' is the lowest height at which the species was recorded but its highest record was somewhere between 3500' and 4000' inclusive. The upper limit is not expressed accurately because herbage sweeping and general collecting in the survey were organised within several altitudinal zones, each extending several hundred feet.

The Sites

The sites listed are those on which the species was trapped or observed. Records of both adults and immature specimens are accounted for.

In detailing the various sites, four standard abbreviations are used:

Mt	Mount	Stn	Station
L.	Lake	Rvr	River

Further abbreviations that are used for some of the individual sites are as follows:

Walk. Plot	Walker's Plot
Walk. Fan	Walker's Fan
Rib. Fan (A)	Ribbonwood Fan (above the road)
Rib. Fan (B)	Ribbonwood Fan (below the road)
Rib. Fan (A & B)	both sites on Ribbonwood Fan
Gold. Sdle	Goldney Saddle
Mt Sugar Lf	Mt Sugar Loaf
Mt Sugar Lf Fan	Mt Sugar Loan Fan
Starv. Gully	Starvation Gully
L. Lynd.	L. Lyndon

For most species the sites are listed individually, but in cases where specimens have been collected from all or nearly all sites in the Cass area, the distribution is expressed as "all Cass sites" and any exceptions noted. These exceptions never include Cass since it is not a true tussock-grassland site. It is listed occasionally, however, to include those insects collected near the Cass settlement, or in the immediate vicinity of the Biological Station.

Exception (i) a bar used between two sites (e.g. Walk. Plot/Walk. Fan) - this indicates that the site from which a specimen came is now uncertain.

The Traps

The traps listed are those which caught adult specimens or nymphs. Where more than one type of trap or trapping method is concerned, the listing sequence is in descending order with the trap which caught most specimens appearing first. Where the advantages of one type of trap over others is of any great significance, attention is drawn to this in the text.

The abbreviations used for the various traps and trapping methods are as follows:

B	Berlese funnel
D	Damp sack
G	Grease trap
L	Light trap
Ld	Light trap - daylight catch
N	Hand net
P	Pitfall
S	Soil sample
W	Wind net

It is to be noted that no distinction is made between grease cylinders set at different heights above the ground or between grease cylinders and the grease table. Any

significant differences are mentioned in the text. It must also be noted that the list contains no references to general collecting (e.g. hand searching of tussocks), rearing of immature specimens or emergence of insects from tussock samples.

Exception (1) a bar used between L and Ld (e.g. L/Ld) - this indicates uncertainty as to whether a species was attracted to light or caught in the light trap at some time when the light was not operating.

THYSANURA

(Silverfish, Bristle tails)

Classification follows Tillyard (1926).

The collecting of insects in this order requires specially adapted trapping measures not used in the survey. Their abundance in tussock grasslands is not therefore indicated but they are probably present only in very small numbers.

ECTOTROPHICA

LEPISMATIDAE

Heterolepisma zelandica (Till.) 1 (1:0) 1

1962, early Mar, 3200', Mt Sugar Lf. Trap W.

M. Johns (pers. comm.) has recorded this species from amongst the litter of silver and fescue tussocks and has taken it at Cass but states that it is most common among other plants in coastal areas and river valleys. It is distributed throughout New Zealand but is of no economic importance.

As an instance of wind dispersal, the single record proves to be of considerable interest in the dispersal of silverfish generally.

COLLEMBOLA
(Spring-tails)

The Collembola have still to be studied. Not a great deal of attention was paid to this order but quite a range of species was taken.

EPHEMEROPTERA

(Mayflies)

Classification follows Tillyard (1926). This reference is also the source of general information.

Mayflies are aquatic insects, entirely beneficial and forming one of the best foods for freshwater fish. In the survey they were quite often caught in tussock grasslands but because of their aquatic associations they were given no special attention and in the 1962-3 season were largely overlooked. They are of no economic importance.

LEPTOPHLEBIIDAE

Deleatidium autumnale ? Phill. 34. 23

1962-3, early Jan-mid May, 1900'-3500', all Cass sites except Walk. Fan & Walk. Plot. Traps Ld, W, N, G & L.

J.G. Penniket (pers. comm.) indicates that this mayfly is the dominant species in the Cass area and so possibly explains why it was the only one recorded. It was taken from both hard and snow tussocks. On 4 January 1963 a fourth instar nymph of Nabis maoricus Walk. (Nabidae) was found preying on a male sub-imago specimen at 2200' on Mt Gog.

ODONATA

(Dragonflies, Damselflies)

Classification follows Tillyard (1926). This reference is also the source of general information.

Insects of this order are aquatic and wholly beneficial with both the larvae and adults preying on large numbers of insects, especially Diptera. Because aquatic, little attention was paid to them, but during the summer it was not uncommon to see them ranging over tussock areas. Though the records are fragmentary, the species list may be nearly complete for the Cass area. However, none of the species are of economic significance.

ZYGOPTERA

(Damselflies)

COENAGRIOIDEA

COENAGRIIDAE

Xanthocnemis zealandica (McL.) 5 (3:2) 4

1962, Nov & Jan, 2300'-2800'/3100', Mt Bailey & Burke's Pass. Trap N.

ANISOPTERA
(Dragonflies)

AESCHNOIDEA

PETALURIDAE

Uropetala chiltoni Till. 3 (1:2) 3

1961-3, Dec-Feb, 1900'-4000', Gold. Sdle, Mt Magog,
Mt Gog, Mt Sugar Lf & Cass. Trap N.

On 13 February 1963 a specimen was seen rapidly
devouring an adult Melampsalta sp. (Cicadidae) at 2400'
on Mt Magog.

LIBELLULOIDEA

CORDULIIDAE

Procordulia grayi (Selys.) 2 (2:0) 2

1962-3, mid Nov & early Jan, 2200'/3500'-3500'/4500',
Mt Sugar Lf. Trap N.

Procordulia smithii (White) 2 (1:1) 1

1962, mid Feb, 1900', Cass. Trap N.

This species is very common in New Zealand.

ORTHOPTERA

(Cockroaches, Stick insects, Grasshoppers, Crickets, Wetas)

Classification follows Tillyard (1926) but with minor alterations. The same reference is also the source of general information not otherwise acknowledged.

Insects in this order are chiefly vegetarian with some omnivorous forms such as the cockroaches. Hence they are injurious and can be of great economic importance.

BLATTOIDEA

BLATTIDAE (Cockroaches)

These insects are well known pests of buildings but the native New Zealand species seldom do any harm. None is of economic importance in grasslands.

Cutilla truncata (Brunn) 14. 12

1962, mid Oct-mid Mar, 1900'-3200'/4000', all Cass sites except Walk. Plot, Mt Magog & Mt Gog. Traps Ld, G & P.

Most specimens were taken by hand and were recorded from the bases of healthy hard tussock and both healthy and rotten snow tussock. An early instar nymph, probably the same species, was taken from the base of blue tussock. These records indicate a general occurrence amongst tussock but only in small numbers.

Blattid sp. 1 2. 2

1963, Jan, 2300', Rib. Fan(B). Traps G & S.

Blattid sp. 2 5. 4

1961-2, early Dec & late Feb, 1900'-3200', Mt Sugar Lf, Mt Sugar Lf Fan & L. Lynd. Trap P.

Most specimens were recorded from the bases of hard and snow tussock.

PHASMATOIDEA

PHASMATIDAE (Stick insects)

New Zealand species have never been known to do any damage.

Micrarchus ? sp.

1962, (1 nymph, mid Dec), 3300', Mt Sugar Lf.

The single specimen was taken from among dead snow tussock foliage.

ACRIDIOIDEA

TETTIGONIIDAE (Long-horned locusts)

Xiphidium semivittatum (Walk.) 1 (1:0) 1

1962-3, mid Mar (3 late instar nymphs, late Feb-mid Mar), 1900'-2300', Walk. Fan, Rib. Fan (A), Gold Sdle & Mt Sugar Lf Fan. Trap N.

Cumber (1959e) records this species ovipositing in the stems of tall fescue so it may also deposit in fescue tussock. Its small numbers in the Cass area and probably in most South Island areas make it of no consequence but in warmer areas it can be quite abundant. Its most southern record may be that of R.S. Bigelow who has noted it at 5600' on Foggy Peak (pers. comm.).

RHAPHIDOPHORIDAE (Cave wetas)

The three species listed belong to three undescribed genera (A.M. Richards, pers. comm.). They are of no economic importance.

Rhaphidophorid sp. 1

6. 4

1961-2, late Nov-mid Jan & early Apr (1 nymph, mid May), 2800'-3200', Mt Sugar Lf & L. Lynd. Trap P.

Rhaphidophorid sp. 2

3. 2

1962-3, early Dec & mid Feb, 1900'-3200', Mt Sugar Lf & Mt Sugar Lf Fan. Trap D.

Rhaphidophorid sp. 3

1. 1

1962, mid Mar, 2300', Mt Gog. Trap Ld.

STENOPELMATIDAE (Wetas)

Members of this family are of no economic importance.

Hemideina alterna Salmon

1. 1

1961, late Nov, 3000', Starv. Gully.

The single specimen was found beneath a rock on the hard-tussock site.

Hemiandrus sp.

1962-3, (8 nymphs, Aug, Jan, Feb & Apr), 2300'-3800', Mt Bailey & Rib. Fan (A). Traps S, Ld & P.

Most specimens were taken from soil sampling in August and April.

GRYLLIDAE (Crickets)

Lisotrachelus maoricus (Walk.)

14. 10

1962-3, early Feb-mid Apr (11 nymphs, mid Jan-mid Feb), 1900'-2800'/3100', Sawdon Stn & all Cass sites except Mt Gog, Mt Sugar Lf & Mt Sugar Lf Fan. Traps N, P, G & Ld.

Little attention was paid to this species. It is widely distributed throughout New Zealand but has received no detailed studies (Cumber, 1959e). Its economic importance cannot be gauged.

ACRIDIIDAE (Short-horned grasshoppers)

These insects are very abundant but they could be given only a casual coverage in the survey. They may be of considerable economic importance.

Phaulacridium marginale (Walk.) 17. 12

1961-3, mid Dec-mid Mar (15 nymphs, late Dec-mid Mar), 1900'-3100'/3800', all Cass sites except Rib. Fan, (B), Mt Magog & Mt Sugar Lf. Traps N & P.

Nearly all specimens were swept and most were taken on Mt Bailey. That none were taken in snow-tussock areas (cf. Paprides furcifer Hutton) may indicate a stronger attachment to low-tussock grasslands. Cumber (1959e) records the species as widespread throughout New Zealand and Kelsey (1957) found it wherever there was low tussock. Although he recorded the species eating tussock leaves, he states that "very little impression was made on tussock growth".

Paprides furcifer Hutton 16. 8

1961-3, late Aug-late Mar (25 nymphs, mid Sept-late Feb), 2300'-3500'/4500', Mt Bailey, Rib. Fan (A & B), Mt Sugar Lf, Sterv. Gully & L. Lynd. Trap N.

The collections indicate an apparent concentration in the snow-tussock sites (cf. Phaulacridium marginale (Walk.)) though the species can readily be found in low-tussock grasslands and was recorded from the base of hard tussock. It was probably this species which was seen eating an Aciphylla flower head, other heads having already suffered considerable damage.

R.S. Bigelow (pers. comm.) suggests that the species' southern limit is not much south of Cass though it is still undetermined.

Brachaspis nivalis (Hutton) 1 (1:0) 1

1962, early Mar (1 nymph, early Jan), 3300'-3500'/4500', Mt Sugar Lf. Trap N.

This species frequents screes on mountain sides.

Huttonacris sp.

1962, (1 nymph, mid Sept), 2300', Rib. Fan (B).

Trap N.

R.S. Bigelow (pers. comm.) mentions that this is a widely distributed species but that the small numbers in insect collections may indicate rarity. It is therefore unlikely to be of economic importance.

DERMAPTERA

(Earwigs)

Classification follows Tillyard (1926). This reference is also used as a source of general information.

Earwigs are omnivorous but the greater part of their food is vegetable matter.

FORFICULINA

FORFICULOIDEA

FORFICULIDAE

Forficula auricularia L.

20. 10

1962-3, early Sept, early Nov-mid Mar (2 nymphs, late Nov), 2000'-2700'/3100', Walk. Plot, Mt Bailey, Rib. Fan (A), Gold. Sdle & Mt Magog. Traps P, D & W.

This species is the European earwig.

Most specimens were found in the bases of tussocks on Mt Bailey. In the base of a single, vigorous silver tussock, between 20 and 30 specimens were sometimes estimated. Though also taken from the base of hard tussocks, plant size rather than plant species would seem to be the criterion for presence or absence. Large, healthy tussocks may be the only means of protection from predatory birds such as magpies.

It would appear that the adults overwinter. Following a September record, no trace of the species was found in October but by December nymphal ecdysal skins were abundant and adults again becoming common. They are of no economic importance.

The wind net record in early March 1962 is interesting because the species rarely flies (Imms, 1957).

PLECOPTERA
(Stoneflies)

Classification follows Tillyard (1926).

Stoneflies are aquatic but those recorded were taken in tussock grassland. They are of no economic importance.

LEPTOPERLOIDEA

LEPTOPERLIDAE

Zelandobius furcillatus Till. 11. 11

1962, mid Sept-mid Dec, early Feb & early Mar,
2100'-3800', all Cass sites except Gold. Sdle & Mt Sugar
Lf Fan. Traps G & N.

Tillyard (1923b) states that this species is common in many parts of New Zealand and probably generally distributed.

PSOCOPTERA
(Psocids, Booklice)

Classification follows Tillyard (1926). This reference is also the source of general information not otherwise acknowledged.

Wingless booklice are well known pests of stored goods and winged psocids feeding on fungal mycelia are often a means of spreading fungal infection. Cumber & Eyles (1961) remark that most foliage will yield psocids at some time of the year, and state, "Here they shelter and feed on algae, lichens, fungi and fragments of animal and vegetable matter". Cumber (1958 & 1959d) notes that they tend to be found in undisturbed situations, his sweeping of roadside areas being much more productive than in sown pastures. This would suggest that tussock grassland may provide a favourable habitat for these insects but since only one of the 14 species recorded was abundant, the order may be expected to lack strong associations. Its economic importance is probably nil.

PARAPSOCTIDA

ATROPIDAE

Atropos pulsatoria (Muller) 1. 1

1962, early Feb, 2300', Rib. Fan (A). Trap G.

This introduced species is common throughout New Zealand (Tillyard, 1923a).

TROCTIDAE

Troctes divinatorius (L.) 13. 8

1961-2, late Nov, early Dec, late Feb-early May,
2300'-3500', Mt Bailey, Rib. Fan (A & B), Mt Sugar Lf,
Starv. Gully & L. Lynd. Traps D, G, W & S.

This species is the small booklouse abundant throughout New Zealand. Tillyard (1923a) states that specimens can be obtained at almost any time of the year.

EUPSOCIDA

MESOPSOCIDAE

Mesopsocus stigmaticus Till. 2. 2

1962, late Feb, 2300'-3500', Rib. Fan (B) & Mt Sugar
Lf. Trap G.

Mesopsocid sp. 1 (1:0) 1

1962, late Mar, 2300', Rib. Fan (A). Trap G.

MYOPSOCIDAE

Myopsocus sp. 315 (142:122) 85

1962-3, late Dec-mid May, 1900'-3500'/4500', all
Cass sites. Traps G, W, Ld, N & P.

This undescribed species was trapped extensively by grease cylinders though wind nets took quite a few specimens. Nearly all were taken in the 1962 summer and autumn with high numbers from early February until early April. Though the species ranged over a wide area in considerable numbers, some definite attraction to Walker's Plot was evident.

CAECILIIDAE

Caecilius zelandicus Till. 3. 3

1962, late Feb-late Mar, 2100'-3200', Rib. Fan (A),
Gold. Sdle & Mt Sugar Lf. Trap W.

Tillyard (1923a) records this species as common in native bush in most parts of New Zealand.

Caecilius sp. 1. 1

1962, early May, 2300', Mt Gog. Trap L/Ld.

Maoripsocus semifuscatus Till. 2 (1:0) 2

1962, late Feb & late Mar, 3100', Mt Bailey. Trap G.

Tillyard (1923a) records this species from white pine.

Maoripsocus sp. 1 (1:0) 1

1962, late Mar, 2300', Rib. Fan (B). Trap G.

Ectopsocus congener Till. 11. 6

1962-3, early Feb-early Apr, 2100'-3500', Walk. Plot, Mt Bailey, Rib. Fan (A & B) & Mt Sugar Lf. Traps G & W.

Tillyard (1923a) records this species as abundant in many localities throughout New Zealand, both in the bush, in gardens and among orchard trees.

Peripsocopsis sp. 2 (2:0) 2

1962, early Mar & late Apr, 2100'-3200', Walk. Fan & Mt Sugar Lf. Traps G & W.

Peripsocopsis ? sp.1 1. 1

1963, early Jan, 3100', Mt Bailey. Trap G.

Peripsocopsis ? sp.2 1. 1

1962, late Oct, 3100', Mt Bailey. Trap G.

UNCERTAIN FAMILY POSITION

Eupsocida sp. 1. 1

1963, mid Jan, 2600', Mt Magog. Trap G.

THYSANOPTERA

(Thrips)

The Thysanoptera have still to be studied. Large numbers were taken and though the number of species involved cannot yet be appreciated, there is probably quite a range.

HEMIPTERA

(Cicadas, Leaf hoppers, Plant-lice, Scale insects, Bugs)

Classification follows Tillyard (1926) but with minor changes in the superfamilies Miroidea and Coccoidea to take account of more recent systematics.

The order was probably well sampled in the survey with records of 84 species.

HETEROPTERA

(GYMNOCERATA)

PENTATOMOIDEA

Insects in this superfamily are mostly plant feeders but a few are secondarily carnivorous forms (Tillyard, 1926).

LYGAEIDAE

Myers (1926) notes that all members of this family are apparently phytophagous. Those living amongst plants show a decided preference for low-growing vegetation but some species live among leaf mould. Of the former group, Eyles (1960) states that many are pests damaging agricultural crops.

In the list presented below, the economic status of infrequently recorded species does not receive comment; they are almost certainly insignificant.

Nysius huttoni Buch. White 641 (196:197) 84

1961-3, late Sept-late Apr (52 nymphs, late Nov & early Jan-mid Mar), 1600'-3100', Ohau Rvr, Sawdon Stn & all Cass sites except Mt Gog & Mt Sugar Lf. Traps W, G, N, Ld, S & P.

Most specimens were trapped by wind nets and nearly all were recorded from Ribbonwood Fan above the road. This strong association with Ribbonwood Fan cannot be directly related to improvement since few specimens were recorded from Walker's Plot and Mt Bailey. Therefore some secondary effect of improvement must have made the one site more preferable than the others. Eyles (1960) indicates that the species lives close to the ground surface, preferring where sunlight strikes through. Cumber (1959a) adds that it thrives where conditions are dry. These features characterise Ribbonwood Fan whereas the other two sites have a cover of more complete and vigorous vegetation that readily retains moisture. It would appear therefore that improvement of drier tussock areas could induce a build-up of this species.

Though it is well known that the insect damages wheat and crucifer seedlings (Cumber, 1959a), it has also been recorded feeding on tussock leaves and seed heads (Kelsey, 1957). Kelsey comments that it is not uncommon on developing seed heads but that its damage is difficult to assess. In the present survey it was further recorded from seeding browntop, large numbers being found in Kelsey's plot on "Sawdon" station (3 February 1963). It would therefore appear that in very dry tussock areas such as the Mackenzie Country where inter-tussock vegetation is often minimal or nearly nil, the species can occur in appreciable numbers even in unimproved grasslands. Should these be improved, it seems likely that the species might become still more abundant unless the vegetative cover could be kept complete and healthy.

The survey trapping revealed a high population level from late December until early February but provided no certain evidence of any peaks.

As intimated by Kelsey (1957), the species' economic importance is difficult to assess.

Hudsona anceps (Buch. White) 16 (12:4) 13

1962-3, mid Sept, mid Nov-early Feb (14 nymphs, mid Jan-late Mar), 1900'-3500'/4500', Rib. Fan (A), Mt Magog, Mt Gog, Mt Sugar Lf, Mt Sugar Lf Fan, Holbrook Stn & L. Pukaki. Traps N, Ld & S.

Most specimens were swept. The species was taken from the bases of hard and snow tussocks and also from a silver tussock area but is probably most common in hard-tussock areas. Its distribution within these areas does not appear uniform and is difficult to explain.

Kelsey (1957) records this species feeding on tussock leaves but states that its damage is difficult to assess since it is a sap feeder. He found no evidence to show that it was of primary importance, but where numbers are low (as in the Cass area), its importance must be considered negligible.

Rhyodes myersi Using. 7 (4:3) 5

1961-2, mid Nov-late Dec & early Mar, 2300'-3000'/3500', Rib. Fan (A), Mt Sugar Lf & Starv. Gully. Traps W, N & Ld.

This species was taken once from Celmisia and three nymphs that may be the same species were taken from the centre of seeded Celmisia flowers. Since little attention was paid to this plant, the species may be relatively more abundant than the few records suggest.

Rhyodes chinai Using. 6 (1:5) 3

1961-3, mid Dec-late Jan, 2200'/3200'-3500'/4500', Mt Sugar Lf. Traps W & N.

This species may be relatively more abundant than the records suggest.

Brentiscerus putoni (Buch. White) 2 (0:1) 2

1962, late Feb-early Mar, 2100', Walk. Plot & Gold. Sdle. Trap G.

Metagera obscura Buch. White 2 (2:0) 2

1962, early & mid Dec, 2000', Mt Sugar Lf Fan.

Both specimens were recorded from the base of hard tussock but at least one of them was taken not far from beech forest. Myers (1926) states, "It is rare for this little species to occur anywhere else than in the leaf mould of the forest floor where it is one of the most plentiful species". The survey records indicate that the species also ventures into the tussock areas bordering forest. It has cryptozoic habits.

CYDNIDAE (Burrower bugs)

Choerocydnus nigrosignatus Buch. White 21 (10:11) 13

1962-3, Aug, early Dec, Jan & Apr (2 nymphs late Jan & mid Feb), 2300'-3800', Mt Bailey, Rib. Fan (A & B) & Mt Magog. Traps S & P.

Nearly all specimens were taken from soil samples in January, April and August. No flight period can be gauged with certainty but the two adult records from pitfalls at least indicate activity above the ground in early December. The two nymphs recorded were fifth instars, possibly endorsing the evidence for a late spring-early summer dispersal by the adults.

The distribution of this species must be wider than indicated by Myers (1926) who states that it occurs in open country but is more or less attached to the sea coast. In the present survey it appeared to have a clumped distribution and possibly some association with the tussock root zone. Only once was it taken from an inter-tussock sample. Its importance cannot be gauged.

PENTATOMIDAE (Stink bugs, Shield-bugs)

Most species of this family suck plant juices but a few suck the blood of insect hosts (Tillyard, 1926).

Rhopalimorpha obscura Adam White 7 (7:0) 7

1962-3, mid Dec-late Jan & Mar (5 nymphs, Jan & mid Feb), 2100'-3800', Mt Bailey, Gold. Sdle & Mt Gog. Trap N.

Nearly all specimens (nymphs and adults) were taken from Mt Bailey. The reason for this concentration may be the presence of cocksfoot (Dactylis glomerata L.) oversown on the slopes in 1956. Pendergrast (1952) indicates that cocksfoot was the only pasture plant he examined which harboured this species though sedges were found to be the most favoured food plants. He observed both nymphs and adults feeding from the unripe seeds of their food plants and also recorded the adults feeding from the leaves, especially near their bases.

From the present survey, two further hosts are added: silver tussock and sweet vernal (Anthoxanthum odoratum L.). A fifth instar nymph was found feeding from silver tussock seed heads on 15 February 1962, and on 1 January 1963 an adult was seen drawing sap from a sweet vernal seed head. The stylet, after a slow, partial retraction with a series of rhythmic jerks, was inserted yet further in a recurring pattern. Both records were from Mt Bailey. The species was also recorded from the base of hard tussock and from the seed heads of browntop (Agrostis tenuis Sibth.).

Though the most favoured food plants (sedges) occur in one moist area on Mt Bailey, no insects were collected from them. Therefore the cocksfoot and silver tussock may account for the species' distribution. If sweet vernal is a regular food plant, the species would have been anticipated on other sites.

The species is present throughout New Zealand but not considered by Cumber (1959a) as important in sown pastures. This would also appear true for tussock areas.

Cermatulus nasalis hudsoni Wdwd 9 (6:3) 9

1962-3, mid Sept, mid Nov-late Jan & mid Mar (17 nymphs, mid Nov & mid Jan), 1900'-3500', L. Lynd. & all Cass sites except Walk. Plot, Rib. Fan (A & B) & Gold. Sdle.

Traps N & P.

Most specimens were taken by hand and records made from the bases of hard, silver and snow tussocks, the latter being an overwintering adult taken in mid-September. The insect may be relatively more abundant than the records suggest since the species nasalis appears to be partially nocturnal (Myers, 1926). Myers also notes that it is typically carnivorous.

The several predation records for the species nasalis can be considered typical if not factual for the high-country subspecies hudsoni. Myers (1921) calls the species a "butcher of noctuid larvae". Its host records include the larvae and pupae of Agrotis ypsilon (Rott.) and Persectania avera Walk. (Myers, 1922) and the larvae, pupae and adults of Vanessa gonerilla (Fab.) (Gourlay, 1930). These hosts are lepidopterous but Myers (1921) also records an attack on the genus Melampsalta (Cicadidae).

For the subspecies hudsoni, the present survey yielded two lepidopterous host records: at 2400' on Mt Magog, two fifth instar nymphs were found fighting over a single $\frac{1}{2}$ -inch larva (undetermined), the predators with their stylets inserted at opposite ends and pulling in a literal tug of war (17 January 1963); at 2300' on Mt Bailey, one fifth instar nymph was recorded with its stylet inserted through the thoracic dorsum of an adult Crambus vittellus Dbld. (18 January 1963).

The insect can be considered a useful predator though probably of small importance in controlling pest larvae.

Dictyotus caenosus (Wstwd) 6 (4:2) 6

1962-3, Aug, Nov, Dec, Mar & Apr, 2000'-3800',
Mt Bailey, Rib. Fan (A) & Mt Magog. Traps N & S.

The April and August records from a soil sample and the base of a hard tussock respectively may indicate overwintering habitats of the adult. No attention was paid to

dry dung pats under which Cumber (1959a) found considerable numbers of this species. It could therefore be relatively more abundant than the records indicate.

The species is widespread and probably feeds largely on developing seed embryos (Cumber, 1959a). Kelsey (1957) records it feeding on tussock leaves but as it is a sap feeder its damage is difficult to assess. Its small numbers suggest that it is of no importance in the Cass area.

ARADOIDEA

ARADIDAE (Flat bugs, Fungus bugs)

Members of this family are supposed to live on fungi but Myers (1926) indicates that their feeding habits have not been definitely ascertained. They can be of no economic importance.

Aradid sp.

1. 1

1962, mid Mar, 2100', Gold. Sdle. Trap D.

It is interesting that this specimen was taken in grassland which was nowhere near bush. Aradids are typically found under bark or dead wood (Tillyard, 1926).

REDUVIOIDEA

NABIDAE

These bugs are predacious and commonly found on herbage where they attack phytophagous insects (Cumber, 1959a). The current survey adds non-phytophagous hosts (see Nabis maoricus Walk.).

Nabis maoricus Walk.

22 (10:12) 17

1961-3, Aug, Sept, Nov & Jan-Apr (6 nymphs, mid Dec-late Jan), 1900'-3800'/4500', L. Lynd. & all Cass sites except Walk. Plot, Walk. Fan & Rib. Fan (B). Traps N, Ld, S & B.

The species was recorded from the bases of both hard and silver tussocks. Soil samples provided two specimens of interest, one a recently ecdysed fifth instar nymph and the other an adult taken in late April. These two records suggest that the species may retreat below the ground for both ecdysal and overwintering.

All nymphs taken were fourth and fifth instars. One of the fourth instar specimens was found preying on a male sub-imago specimen of Deleatidium autumnale ? Phill. (Ephemeroptera) at 2200' on Mt Gcg, 4 January 1963. The stylets were inserted in at least two different places on the thorax during feeding. An instance of attempted predation by an adult was also observed when a specimen held a medium-sized fly (possibly a tachinid) for some time before the intended victim escaped. The predator had only managed to grasp the fly by one tarsus but held on during all early attempts of the much larger insect to free itself.

Both host records outlined above indicate that this species (if not the family Nabidae) extends its host-range beyond phytophagous insects as delimited by Cumber (1959a).

Woodward (1954) states that the species is common and widespread. As its only injury to plants could be through oviposition in stems (Cumber, 1959a), the species must be regarded as useful though of no great importance in tussock areas.

Nabis capsiformis Germ.

3 (1:2) 3

1962, mid Mar-late Apr, 2300', Rib. Fan (A). Traps N, G & W.

Cumber (1959a) outlines the only possible injury of this species to plants as oviposition in stems. Its apparent small numbers however make it of no great significance.

MIROIDEA

Tillyard (1926) records members of this superfamily as possessing very varied feeding habits though mostly phytophagous.

MIRIDAE (Plant bugs, Leaf bugs)

This is a large family containing many pests that damage agricultural crops though a few beneficial predacious species are known (Eyles, 1960). The economic importance of none of the recorded species is known but those seldom caught can be safely regarded as insignificant in the Cass area.

Megaloceroea reuteriana Buch. White 255 (111:142) 53

1961-3, early Oct & late Nov-mid May (239 nymphs, mid Oct-early Apr), 1600'-3500'/4500', L. Lynd., Burke's Pass, L. Pukaki, Ohau Rvr & all Cass sites except Walk. Plot. Traps N, Ld & G.

Nearly all specimens were swept but often the large numbers taken in the hand net were a nuisance to other collecting. Many were therefore discarded.

An adult taken in early October and the sequence of nymphs from mid-October indicate overwintering in the imago state. Nymphal development progressed almost collectively from the first instar in mid-October to the fifth instar in mid-November and the imago in late November. Hereafter the pattern became confused with overlapping generations but a young nymph (possibly a second instar) was recorded as late as early April.

It is probable that the species is not so abundant on Mt Bailey with its more vigorous vegetation.

Woodward (1954) states that the species is common and widespread throughout New Zealand, but as no information is available on its feeding habits (Cumber, 1959a), its importance cannot be determined. Its abundance almost certainly indicates some significant role in the fauna.

Sthenarus myersi Wdwd

5 (2:3) 4

1962-3, late Dec-mid Jan, 2600'-3500'/4500', Mt Magog
& Mt Sugar Lf. Traps G & N.

Lygus sp.

2 (0:2) 2

1962-3, late Nov & mid Jan, 2000'/2600'-2600', Mt Magog.
Traps G & N.

Romna sp. 1

2 (0:1) 2

1962, Feb, 2300'-3500', Rib. Fan (A) & Mt Sugar Lf.
Traps G & L/Ld.

Romna sp. 2

1. 1

1963, mid Mar, 1900', Mt Sugar Lf Fan.

nr Macrotylus sp.

3 (1:1) 3

1962-3, early Dec & Feb, 2100'-3100', Walk. Fan, Mt
Bailey & Mt Magog. Trap G.

T.E. Woodward (pers. comm.) indicates that this is a
new species and possibly represents a new genus.

Mirid sp. 1

13 (4:8) 7

1962-3, early Dec-mid Jan, 2300', Rib. Fan (A & B).
Traps G & W.

T.E. Woodward (pers. comm.) indicates that this is a
new species and possibly represents a new genus.

Mirid sp. 2

1962, (1 nymph, mid Dec), 2300', Mt Gog.

This single nymph belongs to the sub-family
Orthotylinæ which is not otherwise represented in the
survey collection. It was found in the base of a hard
tussock.

Mirid sp. 3

1961, (1 nymph, late Nov), 2800', L. Lynd. Trap P.

This single nymph belongs to the sub-family Cylapinae
which is not otherwise represented in the survey collection.

CRYPTOSTEMMATIDAE

No New Zealand cryptostemmatids have yet been described. From their few records, the survey species can be safely regarded as of no economic significance.

Cryptostemmatid sp. 1 2. 2

1962, early Mar & early Apr, 1900'-2300', Rib. Fan(A) & Mt Sugar Lf Fan. Traps R & L/Ld.

Cryptostemmatid sp. 2 8. 8

1961-2, late Nov-late Feb, 2100'-2800', Rib. Fan (A & B) & L. Lynd. Traps G & W.

(CRYPTOCERATA)

CORIXOIDEA

CORIXIDAE (Waterboatmen)

Tillyard (1926) states that members of this aquatic family are beneficial, attacking mosquito and other insect larvae. However, they are of no consequence in tussock grasslands.

Sigara potamius Young 2 (1:1) 1

1962, early Apr, 2300', Rib. Fan (B). Trap G.

The pair were recorded together from the grease table.

This South Island species is found only in shingle river beds (Young, 1962). Therefore, unless Ribbonwood Creek one-quarter of a mile away provides a suitable habitat (it sometimes dries up), the two specimens caught must have flown from either the Cass River or the Waimakariri River, each more than two miles away.

HOMOPTERA

(AUCHENORRHYNCA)

CICADOIDEA

CICADIDAE (Cicadas)

Typical cicada food plants are trees and shrubs. The adults do damage by sucking the sap and further by slitting the bark when laying eggs; the nymphs also do damage by sucking the sap but are root feeders (Tillyard, 1926). It is possible that the nymphs are carnivorous as well, feeding on the juices of other subterranean animals (Hudson, 1950).

The regular occurrence of nymphs in tussock grass-land soils (as revealed by soil sampling and the frequency of ecdysal skins) indicates that they must subsist on other than woody food plants. Only three low-growing, woody species, Leucopogon fraseri A. Cunn., Coprosma petriei Cheesem. and Pimelea prostrata (J.R. et G. Forst.) Willd., occur in significant numbers, but in some areas even these species are infrequent. As nymphs were not uncommon in tussock and inter-tussock soil samples away from these plants, they may also feed from non-woody root systems.

In the survey, only casual attention was paid to the adults. The species list is not therefore complete and the records do not account for all specimens trapped. One such specimen was found being rapidly devoured by an adult of the dragonfly Uropetala chiltoni Till. The pair were observed on Mt Magog on 13 February 1963, and though the cicada cannot be identified it represents a species not otherwise found in the survey.

The first cicadas of the season were heard in mid-November.

Melampsalta muta (Fab.)

25 (7:18) 13

1962-3, early Jan-late Feb, 2100'-2600', Rib. Fan
(A & B), Gold. Sdle, Mt Magog & Mt Gog. Traps Ld, N & G.

This species is represented by the variety pallida.

Most of the specimens were caught by light traps, the cicada readily flying into the perspex baffles during daylight. Of those trapped in this way, the majority were taken on Mt Gog, possibly indicating some local concentration. On two occasions, specimens were discovered bound in grass seeds cemented around the body but no explanation of this fate is yet certain.

Hudson (1950) suggests that the variety pallida is probably fairly common and generally distributed in subalpine localities throughout New Zealand. Its economic importance in tussock areas is difficult to gauge but the records indicate that it can be the dominant cicada.

Melampsalta campbelli (Myers)

6 (0:6) 5

1961-2, early Dec-early Feb, 2300', Rib. Fan (A & B).
Traps G, W, N & Ld.

Hudson (1950) indicates that this species is found in fixed river beds in the South Island but seldom found in great numbers. The survey records show that it also ranges over tussock grassland but cannot indicate whether or not there is a direct association. Its economic importance must therefore remain unknown.

JASSIDAE (Leaf hoppers)

Because of the immense numbers in which many species occur, jassids do a great deal of damage even though their individual punctures on leaves are often not noticeable (Tillyard, 1926). Myers (1922) adds that damage consists not only of grass consumption but also the prevention of pollination and seed production as the result of sap extraction from the immature floral organs. Eyles (1960) lists further injurious effects as toxin production and the spread of virus diseases, and Smith (1958), in elaborating their

virus transmission, assesses the importance of leaf hopper vectors as only second to aphids. Unfortunately, little is known about the New Zealand species and their economic importance can seldom be given any definition.

In the survey, those species most readily trapped by herbage sweeping are probably sampled less efficiently than others. Their relative abundance is quite likely greater than their records indicate.

Batrachomorphus sp. 12 (10:2) 11

1962-3, early Jan-mid Mar, 1900'-2600'/3500', Walk. Fan, Rib. Fan (A & B), Mt Magog, Mt Sugar Lf & Mt Sugar Lf Fan. Traps G, N & W.

Most specimens were taken from grease cylinders.

J.W. Evans (pers. comm.) states that this species feeds more especially on trees and shrubs. Hence the records probably relate to dispersal across tussock areas rather than to association with them.

Deltocephalus sp. 1 1 (0:1) 1

1961, late Dec, 2000'/2900', Mt Gog. Trap N.

Deltocephalus sp. 2 2 (1:1) 2

1962, early Feb & mid Mar, 2100'-2300', Walk. Fan & Rib. Fan (B). Trap N.

Deltocephalus sp. 3 6 (0:6) 3

1962, early Jan-early Mar, 1900'-2300', Rib. Fan (B), Mt Gog & Mt Sugar Lf Fan. Trap N.

Deltocephalus sp. 4 69 (32:36) 37

1961-3, May/Dec & mid Dec-mid May, 2000'-3800', all Cass sites except Mt Sugar Lf & Mt Sugar Lf Fan. Traps N, G & Ld.

This species is without doubt the most abundant jassid. Most specimens were swept but low-set grease cylinders trapped a few and one was taken from a seed head of sweet vernal (Anthoxanthum odoratum L.). The species was also swept from an area of sweet vernal and browntop (Agrostis tenuis Sibth.). In early February 1962 one

dryinised female was taken from Walker's Plot but the dryinid sac was empty.

Since the genus Deltocephalus contains serious pasture pests (Cumber, 1959a), this species may be of considerable economic importance. Its great abundance as compared with other species could mean that its injury to grasses is extensive. Only with more intensive powers of toxin production or virus transmission could the less common species be as significant.

Xestoccephalus sp. 1 (1:0) 1

1963, late Jan, 2300', Mt Gog. Trap Ld.

The habits of the genus Xestoccephalus are unknown (Cumber, 1959a) but the single record of this species indicates that it is of no importance in the Cass area.

Divitiacus hospes (Kirk.) 12 (9:3) 7

1962-3, late Jan-late Feb, 2100'-2600', Walk. Plot, Walk. Fan, Rib. Fan (B) & Mt Magog. Traps G & N.

All but one specimen were recorded from grease traps. The economic importance of the species cannot be assessed as nothing is known of its habits.

? Typhlocyba froggatti Baker 4 (3:1) 3

1961, late Nov-late Dec, 2800'-3000', Starv. Gully & L. Lynd. Traps W & P.

If the identification of this species as the well known apple pest is correct, its record is surprising. Its presence in the Starvation Gully and Lake Lyndon areas but not in the Cass area may indicate that it has crossed the first mountain range from the Canterbury Plains but not managed to penetrate as far as Cass.

Jassid sp. 1 4 (1:3) 4

1962-3, mid Jan-late Feb, 2100'-2300', Rib. Fan (A & B). Traps G & W.

J.W. Evans (pers. comm.) comments that this species occurs commonly on the native beech tree, Nothofagus. Its records therefore probably relate to dispersal across tussock grassland rather than to an association with it.

Jassid sp. 2 1 (0:1) 1

1962, late Jan, 2100', Walk. Plot. Trap G.

Jassid sp. 3 8 (8:0) 5

1962, early Feb-late Mar, 2000'/2300'-2300'/2600',

Rib. Fan (B), Mt Magog & Mt Gog. Trap N.

Jassid sp. 4 2 (2:0) 2

1962, late Sept & late Jan, 2100', Walk. Plot.

Trap G.

FULGOROIDEA

CIXIIDAE

Oliarus oppositus (Walk.) 60 (38:22) 12

1962-3, late Dec-mid Jan, 400'-3500'/4500', Mt Bailey,
Mt Magog, Mt Gog, Mt Sugar Lf, Mt Sugar Lf Fan & Dunback.
Traps N, G & L/Ld.

Nearly all specimens of this species were swept from the snow-tussock areas of Mt Sugar Loaf. The majority were taken above 3500' and there may have been a marked concentration on the southern face. In both seasons there was a decided peak in numbers at the beginning of January.

Myers (1924) indicates that the species frequents grass and ground herbage but from the survey there appears to be some strong attachment to the tall-tussock association. This is endorsed by the finding of three nymphs, probably this species and also found on Mt Sugar Loaf. They were recorded in February, March and October from the bases of both healthy and rotten snow tussock and from an inter-tussock plant. The last-mentioned record concerns a nymph found sucking latex from a tap-root but as foliage was gone the food plant could not be identified. An adult was also recorded from hard tussock on one occasion.

Myers (1924) states that the species is widespread throughout New Zealand. Its economic importance is difficult to gauge.

Semo clypeatus Buch. White 10 (7:3) 6

1961-2, early Nov-late Dec, 2800'/3000'-3500', Mt Sugar Lf & Starv. Gully. Traps G & W.

Myers (1924) states that this species is present in both the North and South Islands and apparently confined to the sub-alpine and the undergrowth of the forest at its upper limit. In the survey there was a clear association with snow tussock areas but the little scrub present may explain why so few specimens were recorded.

The economic importance of the species is probably nil.

DELPHACIDAE

Many delphacid species are injurious to agricultural crops and are potential virus transmitters (Eyles, 1960).

Nilaparvata myersi Muir 5 (3:1) 3

1962-3, Jan, 2300', Rib. Fan (A). Trap W.

The habits of this species are unknown (Cumber, 1959a). Its small numbers indicate that it has no economic significance in the Cass area.

Delphacodes meridionalis Muir 9 (5:4) 9

1962-3, late Nov-early Feb (69 nymphs, late Aug-late Mar & May), 1900'-3500'/4500', all Cass sites except Walk. Fan & Gold. Sdle. Traps N, Ld, G & W.

The ratio of sexed nymphs was 20 females : 30 males.

The various trapping methods seem to indicate markedly different behavioural patterns between the adults and nymphs of this species. Only two of the adults were swept from herbage whereas the majority of the nymphs were taken in this way. Quite a number of nymphs were also taken as daylight catches in light traps but no adults were so recorded. However, the several grease trap and wind net records indicate that the adults are more readily trapped in flight but their overall small numbers when so many nymphs (mostly final instar) were recorded point strongly to some elusive habit. Sweeping would therefore seem to

be of little value in trapping adults but no other successful measure was found.

The distribution of this species is also difficult to explain. Nymphs were very abundant on Ribbonwood Fan below the road, Mt Gog and possibly Mt Sugar Loaf Fan but few were recorded elsewhere. In contrast, all but one of the adults were taken from the three sites with improved pasture. This adult distribution may not be significant but the species certainly warrants a closer study.

An individual nymph of particular interest was a dryinised female collected from Mt Bailey in late March 1962. It was in the final instar and the dryinid sac still in the early stages of development. No dryinised delphacids have previously been recorded in New Zealand.

The economic importance of the species is uncertain.

(STERNORRHYNCHA)

PSYLLOIDEA

PSYLLIDAE (Jumping plant lice, Lerp insects)

In New Zealand this family takes the place of the Aphididae, the larvae clustering in immense numbers on young foliage of certain plants. The larvae of many species secrete waxy scales or produce galls on leaves (Tillyard, 1926).

Trioza discariae Tut.

3019 (1283:1141) 180

1961-3, late Aug-mid May, 1900'-3800'/4500', all Cass sites, Starv. Gully & L. Lynd. Traps G, W, N & Ld.

Both grease traps and wind nets proved very efficient at catching this species. Each reflected a mid-January peak in numbers though the peak from wind net collections was more pronounced. High-set grease cylinders proved better than those set low.

Tuthill (1952) states that the species' food plant

is matagouri (Discaria toumatou Raoul). Since all sites were free or almost free of this weed, the extensive records must indicate wide-ranging flights by the adults. It would appear also that these flights are very general because the species' abundance was similar on all sites except above 3500'. The reason that few specimens were caught above this height could either be the relative sparseness of matagouri in the higher zones or a limited altitudinal range for the species. It seems more probable however that matagouri distribution is the governing factor.

It appears likely that the adult could be recorded throughout the entire year. Its economic importance must be relative to any measure of control that it may influence over matagouri.

Trioza falcata (Ferr. & Klyv.) 70 (27:28) 29

1961-3, early Dec-mid Jan & late Mar-mid May, 2100'-3500', Starv. Gully & all Cass sites except Mt Magog, Mt Gog & Mt Sugar Lf Fan. Traps G, W & N.

Grease traps and wind nets proved the most efficient trapping measures for this species. Each reflected two flight periods within the one season. Since the first period closely corresponded with the adult's seasonal appearance as recorded by Tuthill (1952), it doubtlessly represents a distinct generation. The second period must therefore indicate a second generation. It too must be very distinct for no specimens were recorded in the interim period between generations and when the species reappeared it was taken simultaneously on nearly all grease cylinders. Whether there was a peak in numbers for the first flight period is uncertain but a definite peak was observed for the second period in mid or late April.

Tuthill (1952) records the food plant as Aristotelia serrata (J.R. et G. Forst.) Oliv. As this bush plant does not occur within several miles of the collecting sites, the psyllid's records must either relate to long dispersal

flights or infer other food plants closer at hand. The only Aristotelia species known to occur locally are A. racemosa Hook.f. in forest and A. fruticosa Hook.f. amongst scrub.

Tuthill (1952) suggests that the species is always found in shade or partial shade but the grassland records negate this contention unless the species flies only during overcast weather. It can be of no economic importance.

Trioza bifida (Ferr. & Klyv.) 4 (3:1) 4

1962, early Dec, early Feb & Apr, 2300'-3100', Mt Bailey, Rib. Fan (A) & Mt Magog. Traps G & W.

Of the two food plants recorded for this species by Tuthill (1952), only Olearia avicenniaefolia (Raoul) Hook.f. is found near Cass. The insect is of no economic concern.

Trioza acuta (Ferr. & Klyv.) 6 (5:1) 2

1962, mid Sept & late Apr, 2300'-2300'/3000', Rib. Fan (A) & Mt Sugar Lf. Trap N.

Tuthill (1952) records the food plant of this species as Cassinia leptophylla A. Cunn. but this plant is not known to occur locally. Since five specimens recorded from Mt Sugar Loaf on the same day indicate that the insect has not flown into the Cass area from outside, the species may also feed on C. fulvida Hook.f. It is probably of no economic concern.

Trioza sp. 3 (0:3) 2

1962-3, early Dec & early Jan, 3100'-3500', Mt Bailey & Mt Sugar Lf. Trap G.

This insect is probably an undescribed species.

APHIDIDAE (Plant-lice)

These well known insects, many of which are of economic importance, have probably been sampled very thoroughly in the survey. The greatest number were caught in wind nets but these records were appreciably extended by the wide use of grease cylinder trapping. The latter method is extensively used in the study of aphids and in that some of the survey traps were painted yellow (the preferential colour as

defined by Broadbent, 1948), the records can be considered good indicators of abundance.

Those species which receive no comments relating to their economic importance are understood by their small numbers or food plants to be of no significance in the Cass area.

The source of general information not otherwise acknowledged in the text is Cottier (1953).

Brachycaudus helichrysi (Kltb.) 4. 4

1961-2, early Dec, mid Jan & mid Mar, 2300'-3000', Rib. Fan (A) & L. Lynd. Traps W & G.

This aphid is common and generally distributed in New Zealand. Its local food plants could be Celmisia glandulosa Hook.f. or several Senecio species but in that the three Cass records were from Ribbonwood Fan above the road, the insect may be feeding on red clover (Trifolium pratense L.).

Pentatrichopus tetrarhodus (Walk.) 5. 5

1961-2, late Nov-early Jan, 2100'-3000', Gold. Sdle, Mt Magog, Starv. Gully & L. Lynd. Traps W & G.

This species is found in scattered numbers on sweet briar (Rosa rubiginosa L.). Higher numbers might have been anticipated since briar was never very distant from any of the trapping sites.

Myzaphis rosarum (Kltb.) 1. 1

1962, early Dec, 2300', Rib. Fan (A). Trap W.

The recorded food plant of this species is Rosa multiflora Thunb. The single survey record may indicate an association with sweet briar (R. rubiginosa L.).

Cavariella aegopodii (Scop.) 3. 3

1961-2, late Nov-mid Jan, 2300'-3000', Rib. Fan (A) & L. Lynd. Traps G & W.

In New Zealand this species is common on willow and the Umbelliferae. Its local food plants may be Aciphylla species.

Rhopalosiphum padi (L.)

57. 19

1961-3, late Nov-late Apr, 2100'-3500'/4500', Starv. Gully & all Cass sites except Rib. Fan (B), Gold. Sdle, Mt Gog & Mt Sugar Lf Fan. Traps W, G & N.

Most specimens of this aphid were caught by wind net. A collection of 37 individuals at the beginning of December 1962 indicates a strong flight peak, but as no wind net was used throughout November, the inception of high numbers cannot be traced. These numbers represent the species' "spring flight" noted by Lowe (1961), but survey trapping did not afford ideal opportunity to detect the smaller "autumn flight" in April and May. During the spring flight, grease cylinders trapped only two specimens and thereby may reflect a lesser efficiency than wind nets for trapping the species. The only specimen swept from herbage was taken during the flight peak in early December.

As R. padi is the common aphid infesting the Gramineae in New Zealand, it is surprising that all catches except one were small and even incidental. This may indicate that the species is not locally abundant but that its high numbers at the beginning of December were a result of drift from the Canterbury Plains.

Cumber (1959a) showed that the species is widespread in the North Island and suspected it of being important in sown pastures. As it transmits viruses it warrants further study, but in the meantime its economic importance in tussock areas remains difficult to assess.

Rhopalosiphum splendens (Theo.)

1. 1

1962, early Mar, 2100', Gold. Sdle. Trap W.

This species is known from Gramineae but appears to be of little relevance in the Cass area.

Aphis nerii Fonsc.

1. 1

1963, early Feb, 2600', Mt Magog. Trap G.

None of the species' recorded food plants occur locally.

Aphis craccivora Koch 1. 1

1962, mid Jan, 2300', Rib. Fan (A). Trap W.

This is a common species infesting the Leguminosae in New Zealand. Local food plants may therefore be clovers or several Carmichaelia species.

Aphis gossypii Glov. 1. 1

1963, early Feb, 2600', Mt Magog. Trap G.

Local food plants of this aphid could be several Hebe species or white clover (Trifolium repens L.). The species is generally distributed throughout New Zealand.

Macrosiphum euphorbiae (Thom.) 3. 3

1961, late Nov, 2800'-3000', Walk. Fan, Mt Cog, Starv. Gully & L. Lynd. Traps W & G.

None of the many food plants recorded for this species is known to occur locally.

Macrosiphum rosae (L.) 2. 2

1961-2, early Dec, 2300'-3000', Rib. Fan (A) & Starv. Gully. Traps W & G.

This serious pest of cultivated roses may have come from sweet briar (Rosa rubiginosa L.) near the trapping sites.

Macrosiphum avenae (Fab.) 1. 1

1962, late Mar, 2300', Rib. Fan (A). Trap W.

This species is apparently rather common on Gramineae in open New Zealand forest.

Capitophorus elaeagni (Del Guer.) 24. 9

1962, early Jan-late Apr, 2100'-2300', Walk. Fan, Rib. Fan (A) & Gold. Sile. Traps W & G.

Nearly all specimens were caught in wind nets, so indicating a distinct advantage over grease cylinder trapping. Most were also recorded on Ribbonwood Fan above the road but this cannot be proved significant. Higher numbers in late March and late April agree with the acknowledged March/April flight period of this species (A.D. Lowe, pers.comm.).

The only recorded food plant which may be local is the Californian thistle, Cirsium arvense (L.). The aphid is of no economic concern.

Aulacorthum solani (Kltb.) 2. 2

1962, early Dec & early Mar, 2300', Rib. Fan (A).

Traps W & G.

Recorded food plants of this species which are known to occur locally are Cardamine heterophylla (Forst. f.) Schulz, Celmisia glandulosa Hook. f. and Phormium tenax Forst.

Hyperomyzus lactucae (L.) 1. 1

1962, early Mar, 2100', Gold. Sdle. Trap W.

Neither of the two recorded food plants (thistles) are known to occur locally. Cumber (1959a) indicates that the species is apparently widespread in the North Island.

Myzus persicae (Sulz.) 6. 6

1961-2, early Oct-late Dec & early Mar, 2100'-3500', Mt Bailey, Gold. Sdle, Mt Sugar Lf & Starv. Gully. Traps W, G & N.

This aphid is ubiquitous and a well known pest but none of its recorded food plants are known to occur locally. It is probably of no economic importance in tussock areas.

Myzus cerasi (Fab.) 1. 1

1962, early Dec, 2300', Rib. Fan (A). Trap W.

This pest of cherries is also recorded from Cardamine heterophylla (Forst. f.) Schulz, the only food plant known to occur locally.

Brevicoryne brassicae (L.) 141. 21

1961-3, late Nov-early Mar, 2100'-3500', Rib. Fan (A), Gold. Sdle, Mt Magog, Mt Sugar Lf, Starv. Gully & L. Lynd. Traps G, W & N.

Both grease traps and wind nets proved to be efficient at trapping this species. Nearly all specimens were recorded in the Starvation Gully and Lake Lyndon areas, their abundance suggesting a drift from the Canterbury Plains. A.D. Lowe (pers. comm.) indicates that the species has also been known

in considerable numbers at Broken River almost mid-way between the Canterbury Plains and Cass. The incidental nature of records in the Cass area may therefore indicate a distance normally too far from the Plains for any substantial drift. The species' food plants are almost entirely confined to the Brassicae and any of these which may occur locally could well support the few aphids present.

The species is widely distributed throughout New Zealand.

Lipaphis erysimi (Kltb.) 3. 3

1962, mid Jan, early Mar & late Apr, 2300'-3100', Mt Bailey & Rib. Fan (A). Traps W & G.

This aphid is recorded from cruciferous weeds which may also support it locally.

Thripsaphis sp. 1. 1

1963, early Jan, 3500', Mt Sugar Lf. Trap G.

This is an unknown but distinct species close to T. foxtonensis Cott. The genus comprises forms living free upon grasses and sedges in moist localities.

ERIOSOMATIDAE

Trifidaphis phaseoli (Pass.) 5. 4

1961-2, early Dec, early Mar & mid Apr, 2300'-3100', Mt Bailey, Rib. Fan (A) & Starv. Gully. Trap W.

None of this aphid's recorded food plants are known to occur locally.

Aploneura lentisci (Pass.) 4. 3

1961-2, early Dec, mid Mar & early Apr (39 nymphs, mid Mar & early Apr), 2100'-3000', Rib. Fan (A) & Starv. Gully. Traps D & W.

In mid-March and early April two colonies of this species were taken from below a damp sack. In the first colony all specimens were immature but two specimens had reached maturity in the second. Both records were from Ribbonwood Fan above the road.

The species colonises the roots of its food plants and though of no economic importance it has been recorded

from Gramineae.

COCCOIDEA (Scale insects, Mealy bugs)

In the survey, no specific attention was paid to the Coccoidea. The records pertain only to the general collecting procedures used and would certainly have been extended with a more intensive study.

Most of the species listed receive no comment on their economic importance as too little is known about them. Some, however, are directly associated with tussock grasslands and a few with individual tussock species. No records were made of the unidentified mealy bug recorded by Kelsey (1957) feeding on the roots of tussocks.

PSEUDOCOCCIDAE

<u>Pseudococcus</u> (sens. lat.) sp.1	1 (1:0)	1
1961, late Nov, 2800', L. Lynd.	Trap B.	
<u>Pseudococcus</u> (sens. lat.) sp.2	2 (2:0)	1
1961, mid Dec, 2800', L. Lynd.	Trap B.	
<u>Pseudococcus</u> (sens. lat.) sp.3	3 (3:0)	1
1961, late Nov, 3000', L. Lynd.		
<u>Pseudococcus</u> (sens. lat.) sp.4	4 (4:0)	1
1962, mid Jan, 2300', Rib. Fan (A).	Trap D.	
<u>Pseudococcus</u> (sens. lat.) sp.5	1 (1:0)	1
1962, mid Dec, 3100', Mt Bailey.		

This species was recorded from the base of silver tussock.

<u>Pseudococcus</u> (sens. lat.) sp.6	1 (1:0)	1
1962, Aug, 2300', Rib. Fan (B).	Trap S.	

This species was taken from an inter-tussock soil sample.

<u>Pseudococcus</u> (sens. lat.) sp.7	2 (1:0)	1
1963, early Feb, 2000', L. Ohau.	Trap S.	

This species was taken from a soil sample below tussock.

Rhizoecus sp.

9 (9:0) 5

1962-3, mid Dec & early Feb-late Mar, 3000'/3500'-
3500'/4500', Mt Sugar Lf. Trap N.

This species is almost certainly associated with snow tussock, its elongate form being adaptive to the inside of curled tussock leaves. One of the specimens was removed from the base of snow tussock.

ERIOCOCCIDAE

Eriococcus sp.

1 (1:0) 1

1961, late Dec, 2000', Mt Gog. Trap B.

COCCIDAE

Coccus sp.

1 (1:0) 1

1962, mid Oct, 2200'/3000', Mt Sugar Lf.

This species was removed from a leaf of Cassinia fulvida Hook. f.

MARGARODIDAE

Kelsey (1957) records a margarodid species feeding on the leaves of tussock but the same species was not found in the present survey.

Coelostomidia sp.

26 (26:0) 10

1962-3, mid Nov, early Jan-late Mar, 1900'-2600', Rib. Fan (B), Gold. Sdle, Mt Magog & Mt Sugar Lf Fan. Traps P & D.

Most specimens were taken from the bases of tussock which included hard tussock in healthy, dead and rotten conditions and also blue tussock. All recorded individuals were adult females but masses of early instar nymphs were found with some. Since no records were made of the actively feeding intermediate instars, J.M. Hoy (pers. comm.) suggests that they may feed on the roots of plants such as Leucopogon. The tussock would then serve only as protection during the period of regeneration. Since the species is almost certainly univoltine, this explanation implies the presence

of living specimens in tussock for only one period of the year. The survey collecting does not clinch this but those specimens taken from pitfall traps and from under damp sacks in late January and throughout February certainly establish a movement by adult females at that time of the year.

The species is probably of no economic concern.

? Ultracoelostoma assimile (Mask.) 14 (0:14) 8

1962-3, early Jan-early Feb, 1900'-3500'/4500', Rib. Fan (B), Mt Gog, Mt Sugar Lf & Mt Sugar Lf Fan. Traps G, Ld & N.

If the identification is correct, this insect is the scale causing sooty mould on beech (Nothofagus) and the records must therefore represent dispersal by the male. However, no reasons can be given as to why most specimens were recorded from Ribbonwood Fan below the road.

UNCERTAIN FAMILY POSITION

Coccoid sp. 1 35 (0:35) 16

1961-3, late Dec-late Mar, 2100'-3200', Walk. Plot, Rib. Fan (A), Gold. Sdle & Mt Sugar Lf. Traps W & G.

Most specimens were caught in wind nets.

The distribution of this species is difficult to explain, most being taken on Goldney Saddle and Mt Sugar Loaf. The insect could be the male of one of the species already recorded but represented only by females.

Coccoid sp. 2 1 (0:1) 1

1961, late Nov, 3000', Starv. Gully. Trap W.

This insect could be the male of one of the species already recorded but represented only by females.

COLEOPTERA
(Beetles, Weevils)

Classification follows Hudson (1934) except the Carabidae which follow Britton (1939). Hudson is also the source of all general information not otherwise acknowledged.

From the survey, a total of 162 species of Coleoptera were recorded. Although diverse trapping procedures were employed, it is difficult to assess the overall trapping efficiency for the order. Some species doubtlessly have habits that would help them to evade all of the various trapping methods, while others occupy habitats that were scarcely examined. Hence, because no time was spent looking below stones, dung pats and similar habitats, it is likely that ground-inhabiting forms received too little attention. Conversely, most flying forms received worthy attention, this being borne out by the very large proportion of trapped beetles which are small in size and, in general, more poorly represented in collections of New Zealand Coleoptera. Nocturnal species were probably trapped with the same efficiency as those with diurnal habits.

A noteworthy feature of the survey records is the entire absence or poor representation of some coleopteran groups. The only family found to have any considerable range of species present was the Staphylinidae.

The economic importance of individual species is mentioned in only a few instances because all too little is known about the habits of others to make any assessment.

ADEPHAGA

CARABOIDEA

CICINDELIDAE (Tiger beetles)

This family of beetles prey on other insects both as larvae and adults. They are commonly found where the soil is friable or sandy (Cumber, 1959b).

No specific measures were taken to collect these insects but in tussock areas where vegetative cover is good they can be safely assumed as incidental in their appearance. One larva dug from a clay bank on Mt Bailey in mid-February 1962 could well be the same species as the adult taken later at an adjacent spot.

<u>Neocicindela latecincta</u> (White)	1. 1
1963, late Jan, 3100', Mt Bailey.	Trap D.

CARABIDAE (Ground beetles, Carabs)

The majority of these insects live in the ground, in rotting wood, under stones, logs, bark or similar habitats. Most larvae and adults are carnivorous but a few are known to damage seeds and fruits (Cumber, 1959b).

In the survey these insects were not extensively sampled. Though the family is generally beneficial, the individual species are probably of little economic significance.

Harpalinae

<u>Mecodema constrictum</u> Broun	27. 23
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1961-3, late Sept-late Feb & late Apr, 2100'-3300', Starv. Gully, L. Lynd., & all Cass sites except Walk. Plot, Rib. Fan (A) & Mt Sugar Lf Fan. Traps P, D & N.

Most specimens were recorded from pitfalls and it may also be significant that nearly all were recorded from slopes rather than from fans.

<u>Oregus aereus</u> White	2. 2
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1961, late Nov-early Dec, 2800', L. Lynd. Trap P.

Megadromus enysi (Broun) 8. 7

1961-3, early Dec-mid Feb, 2300'-2800', Mt Magog, Mt Gog & L. Lynd. Traps P & Ld.

All specimens except one were trapped in pitfalls. Even more may have been collected in this way but the records lost.

Megadromus antarcticus (Chaud.) 1. 1

1963, mid Feb, 2200', Rib. Fan (A).

Though the abundance of this species cannot be gauged from the present study, it is certainly much less abundant than when Hilgendorf (1918) observed it in scores or in hundreds lying between the Cass railway lines.

Holcaspis hudsoni Brit. 3. 3

1962, early Nov-early Dec, 3100'-3200', Mt Bailey & Mt Sugar Lf. Trap P.

It is possible that specimens were collected on one or two further occasions but the records lost.

Anchomenus submetallicus (White) 2. 2

1961, late Nov, 2800', L. Lynd. Trap D.

This species may be generally distributed in the South Island.

Anchomenus sp. 1. 1

1961, late Nov, 2800', L. Lynd. Trap P.

Demetrida dieffenbachi White 1. 1

1962, early Dec, 2000', Mt Sugar Lf Fan.

The single specimen was taken from the base of hard tussock though Tillyard (1926) remarks that the genus Demetrida is associated especially with loose bark.

Scopodes sp. 1. 1

1963, early Jan, 2300', Rib. Fan (A). Trap W.

Whereas Hudson (1934) remarks that beetles in the genus Scopodes can be sought under stones or bark exposed to hot sunshine, Tillyard (1926) refers to them as swamp-haunting beetles. They are probably of no economic concern.

Hypharpax antarcticus (Cast.) 2. 1

1963, early Feb, 2200', Holbrook Stn. Trap S.

Both specimens were removed from an inter-tussock soil sample. The species is very active and probably generally distributed throughout New Zealand. Its record in the Mackenzie Country rather than in the Cass area reflects its liking for hot, dry, sandy places. Cumber (1959b) suggests that it may have a minor beneficial effect in sown pastures and this could also be true for hotter tussock areas.

Hypharpax abstrusus Bates 1. 1

1962, early Dec, 2300', Rib. Fan (A). Trap W.

This species is known from both the North and South Islands (Eyles, 1961) but is probably of no economic significance.

DYTISCIDAE (Water beetles)

The members of this family are more common in standing than in flowing water. Tillyard (1926) indicates that they are active predators.

Lancetes lanceolatus (Clark) 2. 1

1963, mid Jan, 1900', Mt Sugar Lf Fan. Trap L.

Both specimens were recorded at light between 8.30 pm. and 11.30 pm. The larvae are predatory on aquatic animals but the adults on either aquatic or terrestrial insects (E.S. Gourlay, pers. comm.). They are of no economic significance.

POLYPHAGA

BRACHELYTRA

STAPHYLINIDAE (Rove beetles)

Many members of this family are predacious but the majority of adults live on decaying vegetable matter and

are to be found near dung, rotting vegetation and dead animals (Cumber, 1959b). They are also known from beneath moss, bark and stones, and have been recorded in fungi and on flowers. Tillyard (1926) indicates that the larvae also are active ground-scavengers.

From the survey 29 species were recorded, some of them common or even abundant. They are undoubtedly beneficial though it is unlikely that any are of economic importance.

Because of the taxonomic difficulties encountered in this family, few attempts were made to identify any species.

Aleocharinae

Aleochara subaenea Fauv. 1. 1

1962, late Apr, 1900', Mt Sugar Lf Fan. Trap L/Ld.

Aleocharine sp. 1 1. 1

1962, late Mar, 3100', Mt Bailey. Trap G.

Aleocharine sp. 2 19. 3

1962-3, Jan & late Mar, 2100'-3800', Mt Bailey, Rib. Fan (A) & Gold Sdle. Traps S, W & L/Ld.

Nearly all specimens were taken from a soil sample below tussock at 3800' on Mt Bailey.

Aleocharine sp. 3 1. 1

1962, early Apr, 3200', Mt Sugar Lf. Trap W.

Aleocharine sp. 4 5. 3

1961 & 3, late Nov & Jan, 2300'-3000', Rib. Fan (A) & Starv. Gully. Trap W.

Aleocharine sp. 5 12. 8

1961-3, early Dec-late Feb, 2000'/2300'-3500', Mt Magog, Mt Gog & Mt Sugar Lf. Traps G & N.

On one occasion this species was recorded from flowering Hebe salicifolia (Forst. f.) Penn.

Aleocharine sp. 6 3. 3

1963, Jan, 2300', Rib. Fan (A). Traps W & G.

Aleocharine sp. 7

5. 4

1962-3, early Nov-early Feb, 3200'-3500', Mt Sugar Lf.

Traps G & W.

Aleocharine sp. 8

2. 2

1962-3, late Nov & late Feb, 3500', Mt Sugar Lf.

Trap G.

Aleocharine sp. 9

5. 5

1962-3, late Sept, early Dec, early Feb-late Mar,
2100'-2300', Walk. Plot & Rib. Fan (A & B). Traps G & W.Aleocharine sp. 10

4. 4

1962-3, early Jan-early Mar, 3500', Mt Sugar Lf.

Trap G.

Aleocharine sp. 11

1. 1

1962, early Nov, 3500', Mt Sugar Lf. Trap G.

Aleocharine sp. 12

1. 1

1963, late Dec, 2300', Rib. Fan (A). Trap G.

Aleocharine sp. 13

75. 14

1962-3, Jan, Feb & May, 2000'-3100', Walk. Plot, Walk.
Fan, Mt Bailey, Rib. Fan (A & B), Gold. Sdle, Godley Pks &
L. Chau. Traps S, W & G.

This species appears to have a very distinct flying season in January. Records in other months were from four soil samples taken below tussock. High numbers of specimens in two of these samples indicate a strongly clumped distribution at times.

Aleocharine sp. 14

10. 9

1962-3, early Dec-early Mar, 2100'-3100', Walk. Plot,
Mt Bailey, Rib. Fan (A & B) & Mt Magog. Traps G, W & L/Ld.Aleocharine sp. 15

27. 15

1962-3, Aug, early Oct, Nov, Jan, early Feb & Apr,
2300'-3500', Mt Bailey, Rib. Fan (A & B), Mt Sugar Lf &
L. Lynd. Traps W, G & S.

The flight records of this species are those from October to early February. Other records are from soil

samples but only relate to four specimens.

Aleocharine sp. 16 5. 4

1961-2, Aug & late Nov, 2300'-2800', Rib. Fan (A) & L. Lynd. Traps S & B.

Those specimens found in soil were from both tussock and inter-tussock samples.

Aleocharine sp. 17 1. 1

1961, late Nov, 3000', L. Lynd. Trap G.

Aleocharine sp. 18 2. 2

1961, late Nov & early Dec, 2800', L. Lynd. Trap G.

Aleocharine sp. 19 2. 2

1962-3, Aug & Jan, 2300'-3800', Mt Bailey & Rib. Fan (B). Trap S.

The specimens were taken from both tussock and inter-tussock soil samples.

Tachyporinae

Members of the genus Conosomus are very active beetles found in damp places under stones and logs.

Conosomus sp. 1 28. 13

1962-3, early Dec-early Feb, 2100'-3500', Mt Bailey, Rib. Fan (A), Gold. Sdle & Mt Sugar Lf. Traps W & G.

Most specimens were recorded from wind nets.

Conosomus sp. 2 7. 6

1962-3, Nov, Jan & Feb, 2600'-3500', Mt Magog & Mt Sugar Lf. Trap G.

Staphylininae

Staphylinine sp. 1 1. 1

1963, early Jan, 2300', Rib. Fan (A). Trap W.

Staphylinine sp. 2 2. 2

1963, early Jan & early Feb, 2300', Rib. Fan (A). Trap W.

Staphylinine sp. 3 1. 1

1962, mid Jan, 2300', Rib. Fan (A). Trap W.

Staphylinine sp. 4 1. 1

1962, late Nov, 3100', Mt Bailey. Trap G.

Staphylinine sp. 5

2. 2

1961, late Nov & early Dec. 2800', L. Lynd. Trap P.

Stephylinine sp. 6

1. 1

1962, late Mar, 1900', Cass.

This species was taken inside a building but may have come from the adjacent tussock grassland.

OxytelinaeOxyteline sp.

88. 4

1962-3, late Dec-late Jan, 3000'/3500'-3500', Mt Sugar Lf. Traps G & N.

This species has a distinct flying season with a very strong peak in the first half of January. It may well be restricted to snow-tussock areas.

PSELAPHIDAE

Members of this family are found under stones, among moss and among dead leaves. Tillyard (1926) records them from tussocks also. The survey would suggest however that they are incidental in tussock grassland.

Because of the taxonomic difficulties involved, no attempt was made to identify any species.

Pselaphid sp. 1

1. 1

1963, late Jan, 2300', Rib. Fan (A). Trap W.

Pselaphid sp. 2

2. 2

1962, Jan, 2100'-2300', Rib. Fan (A) & Gold. Sdle. Traps W & G.

Pselaphid sp. 3

3. 3

1961-2, early Dec, late Feb & early May, 2100'-2800', Rib. Fan (A), Gold. Sdle & L. Lynd. Trap G.

Pselaphid sp. 4

2. 2

1961-3, early Dec & early Mar, 2200'-2800', Rib. Fan (A) & L. Lynd. Traps G & Ld.

SILPHIDAE

Members of this family are feeders on carrion or decaying vegetable matter but more rarely they are predacious (Tillyard, 1926). The larvae of a few species are known to be predacious on lepidopterous larvae (Eyles, 1961). Though beneficial, the poor representation of both species and individuals makes the family of no economic significance in the Cass area.

<u>Choleva</u> sp. 1	1. 1
1962, late Jan, 2100', Gold. Sdle.	Trap W.
<u>Choleva</u> sp. 2	1. 1
1962, May/July, 1900', Mt Sugar Lf Fan.	Trap Ld.
<u>Silphid</u> sp. 1	9. 8
1961-3, early Nov-mid Feb, 2300'-3500', Mt Bailey, Rib. Fan (A), Mt Sugar Lf & Starv. Gully.	Traps G & W.
<u>Silphid</u> sp. 2	1. 1
1962, May/Nov, 2300', Mt Gog.	Trap Ld.

TRICHOPTERYGIDAE

<u>Trichopterygid</u> sp.	2. 2
1963, Jan, 2300'-2600', Rib. Fan (A) & Mt Magog.	
Traps W & G.	

HISTERIDAE

Members of this family are predacious or carrion feeders (Tillyard, 1926).

<u>Saprinus pseudocyaneus</u> White	4. 2
1962, Dec, 2300', Rib. Fan (A).	Trap W.

This species is occasionally found amongst dried-up carrion which is almost reduced to skin and bones. It is therefore beneficial but of no economic concern.

UNCERTAIN FAMILY POSITION

Staphylinoid sp.

18. 7

1962-3, early Sept, early Apr-early May & May/Nov,
2300'-3500', Mt Bailey, Rib. Fan (A & B), Mt Gog & Mt Sugar
Lf. Traps L/Ld, G & N.

Of the specimens caught in light traps, the majority
(if not all) were daylight catches.

CLAVICORNIA

TROGOSITIDAE

Members of this family are found under the bark of
trees and are therefore of no consequence in tussock grass-
lands. Tillyard (1926) states that the larvae are mostly
predacious.

Leperina nigrosparsa ? White

1963, (1 reared, early Feb), 2000', Mt Sugar Lf Fan.

The single specimen was reared from a larva taken in
December 1962 from a stem of matagouri (Discaria toumatou
Raoul).

Grynoma sp.

2. 1

1961, early Dec, 2800', L. Lynd. Trap G.

NITIDULIDAE

Members of this family have varied habits. They
are found in decaying vegetable matter, on flowers, in ripe
fruit or feeding on sap or on carcasses (Tillyard, 1926).
Eyles (1961) adds that some are found on fungi.

Though most are beneficial, none would appear to be
of any economic significance.

Epuraea antarctica White

1. 1

1962, early Oct, 2100', Walk. Plot. Trap G.

Omosita colon (L.)

1. 1

1962, early Dec, 2300', Rib. Fan (A). Trap W.

CUCUJIDAE

Members of this family are found under the bark of trees or in vegetable refuse but are usually rare. Eyles (1961) states that most are predatory, though grain infesting species are also known.

? Cucujid sp.

1. 1

1962, late Mar, 1900', Mt Sugar Lf Fan. Trap L/Ld.

LATHRIDIIDAE

Tillyard (1926) notes that members of this family are found chiefly in moss, flowers and fallen leaves. Cumber (1959b) adds that they are essentially fungus feeders though some apparently feed on mycetozoa. They are not regarded as being of any economic importance.

Melanophthalma sp. 1

142. 57

1961-3, late Sept-mid May, 2100'-3500', L. Lynd. & all Cass sites except Mt Sugar Lf Fan. Traps G, W, N & L/Ld.

Nearly all specimens were caught by grease traps and wind nets though the species may have shown a preference for the yellow grease cylinders. The beetle could possibly be trapped throughout the entire year.

A definite association with Walker's Plot and possibly with Ribbonwood Fan above the road was evident. The former association would suggest favourable fungus conditions among the rank, ungrazed clover, and but for the grazing Ribbonwood Fan might be expected to reflect a similar insect concentration. The Mt Bailey catches are difficult to interpret but it might be anticipated that oversowing with clovers will generally tend to induce a build-up in the numbers of this species.

Melanophthalma sp. 2

1. 1

1961, early Dec, 3000', Starv. Gully. Trap W.

Melanophthalma sp. 3

1. 1

1962, early Dec, 2300', Rib. Fan (A). Trap G.

- Melanophthalma sp. 4 1. 1
 1962, late Jan, 2300', Rib. Fan (A). Trap G.
Melanophthalma sp. 5 2. 2
 1962, Jan, 2100'-2300', Walk. Plot & Rib. Fan (A).

Trap G.

- Melanophthalma sp. 6 14. 14
 1962-3, Aug, late Sept, late Nov, mid Jan-early Mar,
 2300'-3100', Mt Bailey, Rib. Fan (A & B) & L. Lynd.
 Traps G, W & S.

The single soil-sample specimen was taken in August from below tussock and may indicate an overwintering habitat for the species.

- Lathridiid sp. 1. 1
 1962, late Mar, 3100', Mt Bailey. Trap G.

This insect belongs to either the genus Lathridius or Coninomus.

MYCETOPHAGIDAE

Most members of this family are associated with fungi and therefore not considered of any economic importance (Cumber, 1959b).

- ? Mycetophagid sp. 1 5. 5
 1962-3, late Jan-early Apr, 2100'-3500', Walk. Fan,
 Mt Bailey, Rib. Fan (A) & Mt Sugar Lf. Trap G.
 ? Mycetophagid sp. 2 1. 1
 1963, early Feb, 3500', Mt Sugar Lf. Trap G.
 ? Mycetophagid sp. 3 1. 1
 1962, early Mar, 2300', Rib. Fan (A). Trap G.

COLYDIIDAE

Members of this family are attached to primitive forests, living in leaf mould, decayed wood or under bark (Tillyard, 1926). Some are associated with fungi.

The survey records doubtlessly represent dispersal from beech forests.

ColydiinaeBitoma sp.

3. 3

1961-2, late Nov-mid Jan, 2300'-3200', Mt Bailey, Rib. Fan (A) & Mt Sugar Lf. Traps G & W.

BothriderinaePycnomerus sp.

1. 1

1962, early Dec, 2300', Rib. Fan (A). Trap W.

COCCINELLIDAE (Ladybirds)

Tillyard (1926) indicates that ladybirds feed on soft-bodied insects such as aphids and scales, the genus Scymnus also feeding on larval psyllids. Though in general these beetles are highly beneficial, Cumber (1959b) states that some species are phytophagous and include serious pests.

The survey records indicate that none are of any great consequence in tussock grassland.

Coccinella 11-punctata L.

1. 1

1962, early Jan, 3500'/4500', Mt Sugar Lf. Trap N.

This species is heavily parasitised in New Zealand (Tillyard, 1926). It is uncertain in its appearance but records of swarming on mountains may indicate that it is abundant in tussock areas on occasions. In a list of hosts, Gourlay (1930) includes the aphids Brevicoryne brassicae (L.), Aphis nerii Fonsc., Macrosiphum rosae (L.) and Myzus persicae (Sulz.).

Coccinella tasmanii White

23. 21

1961-3, late Nov-mid Mar, 2100'-3500'/4500', all Cass sites except Walk. Plot, Walk. Fan, Rib. Fan (B) & Mt Sugar Lf Fan. Traps W, G, N & L/Ld.

A single specimen was taken from the base of a hard tussock.

This native ladybird is generally distributed in New Zealand but is nowhere common. In a list of hosts, Gourlay (1930) includes the aphids Brevicoryne brassicae (L.),

Aphis nerii Fonsc., Macrosiphum rosae (L.) and Myzus persicae (Sulz.).

Scymnus sp. 1 5. 5

1962-3, early Jan-late Feb, 2000'/2300'-3100', Mt Bailey, Rib. Fan (B), Mt Magog & Mt Gog. Traps G & N.

Scymnus sp. 2 4. 4

1962, early Nov, early Dec, mid Feb & late Mar, 2300'/2600'-3500'/4500', Mt Bailey, Mt Magog & Mt Sugar Lf.

Traps N & G.

Scymnus sp. 3 1. 1

1963, early Jan, 2300', Mt Gog. Trap L/Ld.

Scymnus sp. 4 2. 2

1962-3, early Jan & late Mar, 2600', Mt Magog. Trap G.

Holopsis sp. 1. 1

1961, late Nov, 2800', L. Lynd. Trap B.

DERMESTIDAE (Bacon beetles)

Many members of this family frequent flowers, often in large numbers, and the larvae feed on dead animal substances. Tillyard (1926) notes that the larvae are often injurious.

Trogoderma sp. 31. 7

1961-2, early Nov-mid Dec, 1600'-3500', Mt Magog, Mt Sugar Lf, L. Lynd. & Ohau Rvr. Traps G & N.

All specimens except one were caught by grease cylinders, the majority being recorded from Mt Magog and Mt Sugar Loaf. The records indicate a very distinct though short flying season.

The species' economic significance is uncertain.

HYDROPHILIDAE

Members of this family are mostly aquatic or semi-aquatic (Tillyard, 1926). Many live in standing water.

Cercyon flavipes (Fab.) 8. 5

1962-3, early Jan-late Mar, 2300', Rib. Fan (A).

Trap W.

E.S. Gourlay (pers. comm.) indicates that this species is found in rather wet, decaying vegetable matter. It is probably of no economic significance.

HELODIDAE

Adult members of this family are found near water in which the larvae live (Imms, 1957).

In the survey, large numbers of adults of the genus Cyphon were found in tussock areas but until more is known about their habits, their economic importance is difficult to assess. They may be strongly attracted to flowers.

Cyphon sp. 1

6. 6

1961-3, early Oct, late Nov, early Dec, early Feb-early Apr, 1900'-3000', Gold. Sdle, Mt Magog, Mt Sugar Lf Fan & L. Lynd. Traps G & W.

Cyphon sp. 2

39. 11

1961-3, early Dec-mid May, 2200'-3100', Mt Bailey, Mt Magog & Mt Gog. Traps N & G.

A total of 27 specimens were swept from flowering Hebe salicifolia (Forst. f.) Penn. at Mt Gog on 30 December 1961.

Cyphon sp. 3

6. 4

1961-3, late Dec-early Mar, 2200'-2600', Mt Magog & Mt Gog. Traps G & N.

A single specimen was swept from flowering Hebe salicifolia (Forst. f.) Penn. at Mt Gog on 30 December 1961.

Cyphon sp. 4

3. 3

1962-3, late Jan-early Mar, 2100'-2600', Rib. Fan (A), Gold. Sdle & Mt Magog. Traps G & W.

Cyphon sp. 5

4. 4

1961-3, late Dec-late Mar, 1900'-2300', Rib. Fan (A), Mt Gog & Mt Sugar Lf Fan. Traps G, W, N & L/Ld.

A single specimen was swept from flowering Hebe salicifolia (Forst. f.) Penn. at Mt Gog on 30 December 1961.

Cyphon sp. 6

6. 4

1962-3, early Jan-late Feb, 2100'-2600', Walk. Plot,
Rib. Fan (A) & Mt Magog. Traps W & G.

Cyphon sp. 7

8. 8

1962-3, late Oct, late Nov, early Mar-late Apr, 1900'-
2600', Rib. Fan (A), Gold. Sdle, Mt Magog & Mt Sugar Lf Fan.
Traps G, W & L/Ld.

Cyphon sp. 8

7. 6

1962-3, late Sept-mid Dec & early Mar, 2100'-3500',
Walk. Fan, Mt Bailey, Rib. Fan (A & B) & Mt Sugar Lf.
Traps G & W.

Cyphon sp. 9

22. 12

1962-3, early Nov-early Mar, 1900'-2600', Walk. Plot,
Rib. Fan (B), Gold. Sdle, Mt Magog, Mt Gog, Mt Sugar Lf Fan,
Cass & L. Tekapo. Traps N, G, L & Ld.

This species was once recorded from the base of a hard
tussock and on 6 February 1962 was found abundant on a small
patch of silver tussock at Cass. The specimen attracted
to light was recorded between 8.30 p.m. and 11.30 p.m. on
4 January 1963.

Cyphon sp. 10

1. 1

1962, early Jan, 1900', Mt Sugar Lf Fan. Trap L/Ld.

Cyphon sp. 11

1. 1

1961, late Dec, 2200', Mt Gog. Trap N.

The single specimen was swept from flowering Hebe
salicifolia (Forst. f.) Penn.

MALACODERMIDAE = *Cantharidae*

Most adult members of this family live on flowers.
Tillyard (1926) states that the larvae subsist on various
foods though many forms are highly carnivorous.

It is improbable that any of the recorded species are
of economic importance.

Asilis sp. 1

22. 16

1961-2, early Nov-early Dec, 2100'-3500', Walk. Plot, Gold. Sdle, Mt Magog, Mt Gog, Mt Sugar Lf, Mt Sugar Lf Fan, Starv. Gully & L. Lynd. Traps G, N, P & L/Ld.

Asilis sp. 2

4. 3

1962-3, early Jan, 2200'/3500'-3500'/4500', Mt Sugar Lf. Traps N & G.

? Asilis sp.

20. 11

1961-2, late Nov-late Dec (2 reared, late Oct), 2300'-3200', Mt Bailey, Rib. Fan (A), Mt Sugar Lf, Starv. Gully & L. Lynd. Traps G & W.

This species is semi-brachypterous and undescribed.

From the survey, it appeared that the species was much more abundant in the Lake Lyndon area than in the Cass area. The larvae were found to be soil-inhabiting, 14 specimens being recorded from Ribbonwood Fan above the road. All were taken in August 1962 from a single soil sample below tussock and two adults emerged in the following October.

MELYRIDAE

Most members of this family frequent flowers. Their economic importance will therefore depend on larval habits but as yet nothing is known of these.

Dasytes minuta Fab.

82. 28

1961-3, late Nov-mid Feb, 2100'-3500'/4500', Mt Bailey, Rib. Fan (B), Gold. Sdle, Mt Magog, Mt Gog, Mt Sugar Lf & Starv. Gully. Traps N, G & Ld.

The distribution of this species is difficult to explain but nearly all specimens were taken from Mt Magog, Mt Gog, Mt Sugar Loaf and Starvation Gully. Highest numbers were present in December and January.

Flowers from which adults were recorded were Anisotome, Aciphylla, Hebe and Celmisia. The species was also swept from hard and snow tussock which was in flower and possibly from flowering silver tussock. On flowering snow tussock it was

quite abundant but on hard tussock (and probably on silver tussock) its records were incidental. This may appear to suggest selective pollen feeding but it is more likely that the species' abundance depends on the distribution and diversity of flowering dicotyledonous plants. In a tall-tussock association the range of such plants is much greater than in a low-tussock association and therefore there are more beetles present to invade the tussock when it flowers.

Dasytes sp. 1. 1

1962, early Nov, 1600', Ohau Rvr. Trap N.

CLERIDAE

The members of this family are mostly predacious, living among flowers or on leaves. Tillyard (1926) indicates that most larvae are also predacious.

Parnius sp. 2. 2

1962, early Dec, 2600'-3500', Mt Magog & Mt Sugar Lf. Trap G.

This species is probably of no economic significance.

ANOBIIDAE

Members of this family live in wood and dry vegetable and animal matter. They are of no economic importance in tussock areas.

Anobiinae

Anobium punctatum De Geer 2. 2

1963, Jan, 2300', Rib. Fan (A). Trap P.

This renowned wood borer is a surprising record for tussock grassland.

Xenogonus granulatus (Broun) 1. 1

1963, mid Jan, 2200', Rib. Fan (A). Trap L/Ld.

Xenogonus sp. 1. 1

1962, mid Jan, 2300', Rib. Fan (A). Trap G.

ELATERIDAE (Click-beetles, Skipjacks)

Though zoophagous species are known, most members of this family are root feeders in their larval or "wireworm" stages, some causing considerable damage to cereals and grasses (Cumber, 1959b). Apparently there is little known about adult habits.

In the survey, few adults were collected. None of the trapping methods proved capable of catching more than a few specimens and yet larval counts indicated that these insects were very abundant. The species records therefore remain fragmentary though they do indicate that Corymbites antipodus Cand. is probably the most abundant species.

The larval counts totalled 278 specimens, 233 of these being recorded from the Mt Bailey - Ribbonwood Fan soil-sampling transect. Along the transect from point to point the wireworm density varied considerably, but irrespective of density, all except two of the 77 soil samples taken had a greater concentration of larvae in the tussock than in the inter-tussock samples. Statistical analysis proved the greater incidence in tussock root zones to be highly significant at the 0.1% level. Since the same correlation was found where wireworms were present in Mackenzie Country soil samples, it would appear that they have a distinct and widespread preference for the tussock root zone. Evidence suggests that this preference is for the tussock roots themselves. Kelsey (1957) recorded three unidentified species of elaterid larvae feeding on tussock roots, and though no further feeding records were obtained in the present survey, larvae were readily found just below the plant crown where often no other roots were present. As many as five were found concentrated in this small pocket of soil $\frac{1}{2}$ inch deep and on occasions when the vegetation was wet, larvae were found in the tussock foliage itself. It would therefore appear that wireworms are widespread in

tussock areas, that they can be abundant and that they have a preference for tussock roots. Their damage remains difficult to assess but there is good reason to believe that on occasions they cause the death of individual tussocks. Their concentration under dying plants suggests that grass grub larvae (Scarabaeidae) are not the only root feeders contributing to tussock death.

Elaterid larvae were also on occasions recorded from pitfalls and from below damp sacks. Two survey records of special interest were a single fungus-infected larva taken dead from a soil sample in April 1962, with a Cordyceps fruiting-body projecting, and a healthy wireworm which apparently turned predator and partly ate a lepidopterous larva placed in the same sample tube.

Elaterinae

Corymbites antipodus Cand. 10 (2:5) 8

1961-2, Dec, Apr & May/Nov, 2100'-2300', Rib. Fan (A & B), Gold. Sdle, Mt Magog & Mt Gog. Traps P, S & L/Ld.

December was the only month in which flight was definitely recorded for this species though it may also take place in November. The April records were of two adults taken from soil samples below tussock.

Corymbites agriotoides Sharp 3. 3

1961-2, Dec, 2100'-3200'/3500', Gold. Sdle & Mt Sugar Lf. Traps W & N.

Corymbites sp. 1 1. 1

1962, late Sept, 2300', Rib. Fan (B). Trap P.

Corymbites sp. 2 1. 1

1962, early Dec, 2600', Mt Magog. Trap P.

Corymbites sp. 3 1. 1

1962/3, Nov/Feb, 2100', Gold. Sdle. Trap P.

Elatichrosis barbata (Cand.) 1. 1

1962, early Dec, 2300', Mt Gog. Trap L/Ld.

This species is often found in mountainous areas.

- ? Elatichrosis sp. 1. 1
1962/3, Nov/Feb, 2100', Gold. Sdle. Trap P.

HETEROMERA

TENEBRIONIDAE

Tillyard (1926) states that the majority of adults in this family are found either on the ground, under logs and stones or under bark. The larvae are known to feed on rotten wood, bark, fungi and vegetable debris. Eyles (1961) adds that some of the beetles live in dung.

No members are of any economic importance.

Cnodaloninae

- Artystona erichsoni (White) 3. 1
1962, early Dec, 2100', Mt Sugar Lf Fan.

All specimens were taken from crevices in the stems of matagouri (Discaria toumatou Raoul).

Adeliinae

- Pheloneis sericatum ? (Sharp) 1. 1
1962, late Apr, 3800', Mt Bailey. Trap S.

- Pheloneis zelandicum ? (Bates) 2. 2
1962-3, late Aug & Jan, 3800', Mt Bailey. Trap S.
A single specimen taken in August was found in the base of a hard tussock.

- Pheloneis sp. 1 1. 1
1961, late Dec, 2800', L. Lynd. Trap P.
Pheloneis sp. 2 1. 1
1962, mid Jan, 3200', Mt Sugar Lf. Trap P.

OEDEMERIDAE

The beetles of this family live on flowers and the larvae in old wood and in the stalks of plants.

- Selenopalpus rectipes Broun 9. 7
1961-3, mid Nov-early Jan, 2000'-3800', Mt Bailey, Rib. Fan (A), Mt Magog, Mt Sugar Lf, Starv. Gully & L. Lynd. Traps P, W & G.

This species was recorded from flowering Aciphylla and also from hard tussock in full bloom. It is doubtlessly a pollen feeder but is of no economic importance.

Selenopalpus aciphyllae Broun 2. 2

1962, Dec, 1900'-2600', Mt Magog & Mt Sugar Lf Fan.
Trap P.

One specimen was recorded from the base of a hard tussock.

MELANDRYIDAE

Some members of this family are found under the dead wood of trees or in fungi but most are found in foliage. Their economic significance cannot be assessed without knowing the habits of individual species.

Hylobia sp. 1 7. 3

1962-3, early Dec-early Jan, 3500', Mt Sugar Lf.
Trap G.

This species appears to have a very distinct flying season.

Hylobia sp. 2 14. 4

1962-3, early Nov-late Dec, 3100'-3500', Mt Bailey & Mt Sugar Lf. Trap G.

This species has a very distinct flying season.

Hylobia sp(p). 3 2. 2

1961, early Dec, 2800', L. Lynd. Trap G.

The two specimens entered as this species may possibly be distinct.

PHYTOPHAGA

CHRYSOMELIDAE (Leaf beetles)

Members of this family are phytophagous or xylophagous and include many serious agricultural pests (Cumber, 1959b). The economic importance of those species recorded in the survey is unknown.

Eumolpinae

Eucolaspis sculptus (Broun) 5. 2

1963, Jan, 2300', Mt Gog. Trap L/Ld.

This species may be attached to lawyer. It is known from Rubus australis Forst. f. though it is uncertain whether this is the lawyer occurring on Mt Gog.

Chrysomelinae

Allocharis marginata Sharp 2 (1:1) 2

1962, mid Mar & mid Sept, 2200'-3300', Walk. Fan & Mt Sugar Lf.

This species was recorded from the bases of both snow and hard tussocks. E.S. Gourlay (pers. comm.) indicates that it is an uncommon and very local species.

Galerucinae

Luperus aeneus (Broun) 8. 8

1961-2, early Nov-late Dec, 2300'-3500'/4500', Mt Bailey, Rib. Fan (A & B), Mt Magog, Mt Sugar Lf, Starv. Gully & L. Lynd. Traps G, N & W.

This species is probably generally distributed on mountains throughout New Zealand and is known to be common at Hebe blossoms.

Luperus scutellaris ? Broun 5. 4

1962, late Oct-late Nov, 2300'-2400', Rib. Fan (B), Mt Gog & Mt Sugar Lf. Traps G & Ld.

Luperus sp. 1 1. 1

1962, early Dec, 2300', Rib. Fan (A). Trap W.

Luperus sp. 2 2. 2

1961-2, late Nov & mid Dec, 2100'-2300', Rib. Fan (B) & Gold. Sdle. Traps W & G.

Luperus sp. 3 1. 1

1961, late Dec, 2300', Rib. Fan (A). Trap W.

Luperus sp. 4 1. 1

1962, mid Nov, 3500'/4500', Mt Sugar Lf. Trap N.

Luperus sp. 5

3. 2

1962-3, late Nov & early Jan, 2300'-3100', Mt Bailey
& Rib. Fan (B). Trap G.

Luperus sp. 6

50. 14

1961-2, early Nov-late Dec, 2800'-3500'/4500', Mt Bailey,
Mt Sugar Lf, Starv. Gully & L. Lynd. Traps G, N & W.

Most specimens were caught by grease traps and the
majority recorded from Mt Sugar Loaf. The species may
therefore be attached to snow-tussock associations. High
numbers were present in late November and early December.

Luperus sp. 7

1. 1

1962, early Dec, 2300', Mt Gog. Trap Ld.

Luperus sp. 8

35. 7

1962, early Nov-early Dec (1 reared, early Oct),
2200'/3000'-3500'/4500', Mt Sugar Lf. Traps G & N.

A larva of this species was found in the base of a
snow tussock in mid-September 1962. Although the adult
emerged in early October, no specimens were recorded in
the field until early November. High numbers were present
in late November and early December.

It appears that this species is attached to snow-
tussock associations.

Luperus sp. 9

2. 2

1961-2, mid Nov & mid Dec, 2100', Gold. Sdle.
Traps W & N.

Luperus sp. 10

1. 1

1962, early Nov, 2200', L. Tekapo. Trap N.

Galerucine sp.

1. 1

1962, late Dec, 3100', Mt Bailey. Trap G.

HalticinaePhyllotreta nitida ? Broun

3. 3

1961-2, late Nov, early Dec & mid Mar, 2800'-3500'/
4500', Mt Bailey, Mt Sugar Lf & L. Lynd. Trap N.

LONGICORNIA

CERAMBYCIDAE (Longicorns)

The adult members of this family are found on flowers or amongst bark and wood. The larvae are mostly wood borers and therefore of no economic importance in tussock grasslands.

Zorion castum Broun

2. 2

1962, late Oct & early Jan (1 reared, late Oct), 2000'-4000', Mt Magog & Mt Sugar Lf.

One adult and a pupa of this species were found in a stem of matagouri (Discaria toumatou Raoul) at the foot of Mt Magog in late October. An adult emerged from the pupa in the same month.

Gastrosarus nigricollis Bates

2 (1:1) 2

1962, late Oct, mid Nov & early Jan, 2000'-4000', Mt Magog & Mt Sugar Lf.

A single specimen taken in late October was found in a stem of matagouri (Discaria toumatou Raoul) at the foot of Mt Magog.

RHYNCOPHORA

CURCULIONIDAE (Weevils)

The larvae of this family can be extremely destructive. The vast majority are internal or subterranean plant feeders but Cumber (1959b) notes that no parts of the plant are entirely free from their attacks. Kelsey (1957) records the larvae of an unidentified species feeding on tussock roots and comments that they sometimes occurred in relatively large numbers. In the present survey, however, only a few larvae were found in the soil.

The list of species recorded may be rather fragmentary for tussock areas. The adults of many species are probably

elusive, so requiring special trapping attention.

The economic importance of some species cannot be readily assessed.

Otiorrhynchinae

The larvae of this subfamily are free-living in the soil and polyphagous as a rule though they are mainly root feeders (G. Kuschel, pers. comm.).

Nicaeana sp. 1

2. 2

1962-3, early Dec & late Jan, 1900'-2300', Rib. Fan (A) & Mt Sugar Lf Fan.

One specimen was recorded from the base of a hard tussock.

Nicaeana sp. 2

2. 2

1962, mid-Feb & Apr (2 reared, Nov), 2300'-2300'/3100', Mt Bailey & Rib. Fan (B). Traps N & S.

The soil-sampled specimens were all from the same point on the Ribbonwood Fan transect, an adult being recorded in April and two larvae in August. Though the larvae were taken from both tussock and inter-tussock samples, the species clearly has a clumped distribution. Adults emerged in mid- and late November.

Nicaeana sp. 3

2. 2

1962-3, mid Jan & early Feb (1 reared, mid Feb), 2300'-3800', Mt Bailey, Rib. Fan (B) & Mt Gog. Traps G & Ld.

Two pupae of this species were taken from an inter-tussock soil sample on Mt Bailey but only one adult emerged. The adult record from a high-set grease cylinder is rather surprising as this genus is wingless.

Nonnotus griseolus Sharp

3. 1

1962, late Dec, 400', Dunback.

This species was found to be abundant on the seed heads of both hard and silver tussocks. It is not certain whether either of the tussock species was in flower but the adults may have been feeding on pollen.

- Tigones humeralis Broun 2. 2
1962-3, late Nov & early Feb, 2300', Mt Gog. Trap Ld.
Catoptes obliquesignatus Bohem 1. 1
1961, late Nov, 2800', L. Lynd.

The single specimen was beaten from matagouri
(Discaria toumatou Raoul).

This is the commonest species of Catoptes in New Zealand and recorded by Eyles (1961) as widely distributed in the North Island.

- Catoptes sp. 1 2. 1
1963, mid Feb, 2000', L. Ohau. Trap S.

The two specimens were both recorded from a soil sample below tussock.

- Catoptes sp. 2 2. 2
1963, late Jan, 2300'-3800', Mt Bailey & Rib. Fan (A).
Trap N.

- Catoptes sp. 3 1. 1
1962, late Dec, 2200', Rib. Fan (A). Trap Ld.
Inophloeus rhesus Pasc. 1. 1
1962, mid Nov, 3200', Mt Sugar Lf. Trap D.

Rhyparosominae

- Dryopais variabilis Broun 2. 2
1961, late Nov & late Dec, 2800', L. Lynd. Trap P.

G. Kuschel (pers. comm.) states that this species is found in marshy places, its larvae inhabiting the stems of Myriophyllum. It is therefore of no economic significance in tussock grasslands.

- Hyperodes bonariensis Kusch. 6. 6
1962, late Nov-late Dec & late Mar-early Apr, 2100'-2300', Rib. Fan (A & B) & Gold. Sdle. Traps W & G.

All specimens except one were caught in wind nets.

This species is the well known Argentine Stem Weevil. Cumber (1959b) indicates that it feeds on most grasses and Kelsey (1957) has recorded it feeding on tussock leaves. However, it is apparently of no economic significance in the Cass area.

Erirrhinae

G. Kuschel (pers. comm.) indicates that members of this subfamily are host-specific as larvae in soft dicotyledonous tissues (including flowers and fruits).

Peristoreus veronicae Broun 18. 17

1961-3, early Dec-late Mar, 2100'-3500'/4500', Walk. Plot, Walk. Fan, Rib. Fan (A & B), Gold. Sdle & Mt Sugar Lf. Traps N, W & G.

G. Kuschel (pers. comm.) indicates that this species probably feeds on Cassinia, Olearia and other Compositae but not likely on Hebe. In the survey one specimen was swept from a hard tussock and Celmisia association and it is almost certain that another was taken from Cassinia.

Euprocas scitulus Broun 9. 5

1961-2, Dec & early Feb, 2100'-3500'/4500', Rib. Fan (A), Gold. Sdle & Mt Sugar Lf. Traps W, N & Ld.

Most specimens were recorded from wind nets.

Alloprocas niger Broun 1. 1

1963, mid Mar, 1900', Mt Sugar Lf Fan.

The single specimen was probably collected from a hard tussock area though G. Kuschel (pers. comm.) notes that the species is apparently confined to beech (Nothofagus). The collecting site was not far from beech forest.

Eugnominae

G. Kuschel (pers. comm.) indicates that the larvae of this subfamily are host-specific and that the adults are pollen feeders.

Colabotelus sp. 8. 3

1962-3, mid Dec, mid Jan & mid Feb, 2300'-2300'/3100', Mt Bailey & Rib. Fan (A). Trap N.

This species is relatively more abundant than the records indicate. In 1963 the hard tussock was in full bloom in early January but on 18 January when all or most pollen had probably fallen, many of these weevils were noted among the seed heads in one area of Ribbonwood Fan above the road. One specimen examined in the field appeared to be

chewing the young seed awns. On the same day a specimen was also noted on a sweet vernal seed head and it was possibly the same species that was noted on rather dead, silver-tussock foliage. Later in the day all specimens had disappeared.

Apioninae

Members of this subfamily are often associated with weeds, roots or stems and some are injurious to leguminous crops (Cumber, 1959b).

Apion ulicis (Forst.)

11. 9

1962, mid Oct-early Dec & early Feb-late Mar, 2300'-3500'/4500', Mt Bailey, Rib. Fan (A), Mt Magog & Mt Sugar Lf. Traps N, G & W.

This insect is the introduced gorse weevil.

Most specimens were swept and the majority were recorded from Mt Sugar Loaf, often above 3500'. The species was recorded from flowering Dracophyllum and from snow tussock, but Cumber (1959b) states that as far as is known it is host-specific. An occasional patch of gorse (Ulex europaeus L.) probably occurred within one or two miles of all sites from which the weevil was recorded.

Rhinomacerinae

Rhinorrhynchus rufulus (Broun)

1. 1

1962, late Feb, 2100', Gold. Sdle. Trap W.

G. Kuschel (pers. comm.) suggests that members of this genus may possibly feed on monocotyledons.

Cryptorrhynchinae

Cryptorrhynchine sp.

1. 1

1961, late Nov, 2800', L. Lynd. Trap P.

LAMELLICORNIA

SCARABAEIDAE (Chafers)

Tillyard (1926) states that the larvae in this family feed on roots, vegetable matter, dung, or in rotten wood. The adults of many species are nocturnal or crepuscular though some are diurnal (Eyles, 1961).

Melolonthinae

The larvae of this subfamily are root feeders and the adults live on plants and flowers. Many species appear occasionally in very large numbers and may then do a considerable amount of damage to trees and other plants.

Kelsey (1957) observed that the feeding of melolonthine larvae on tussock roots can cause sufficient damage in some localised areas to permit grazing stock to pull up whole tussock plants. In summarising his survey work he states, "Populations as high as 47 larvae under a single tussock plant were recorded....and counts of 3 to 8 per plant were not uncommon averages. The main effect of these insects' activities is to reduce length and number of roots.... The shortened effective root system would not be important in a season of adequate rainfall, but such plants were occasionally adversely affected under local dry conditions". From his 10-year period of study he concluded that these larvae undoubtedly reduced the vigour of tussock.

In the present survey, little attention was paid to the larvae apart from the systematic soil sampling of the Mt Bailey - Ribbonwood Fan transect. This revealed a surprisingly low concentration on Ribbonwood Fan of the genera Pyronota and Costelytra and a strong concentration on Mt Bailey of only the genus Pyronota. In total, 148 larvae were taken from the transect, 111 of them being Pyronota species. Numbers in the April sampling were considerably greater than in the August sampling, this probably indicating a winter mortality together with a

possible larval migration to deeper soil in the intervening period. The January sampling revealed very little since most specimens had emerged as adults and those present were only very early instar stages of the next generation. No significant differences in density were detected between tussock and inter-tussock soil samples.

The highest densities recorded under tussock were a total of 26 Pyronota larvae under two tussocks in April and 12 larvae of Costelytra zealandica (White) under a single hard tussock on Mt Bailey in February. The latter record was not from the soil transect and was a count from only the top two to three inches of soil.

In the survey the adults of Pyronota also received little attention since the genus was being studied concurrently by J.G. Brown of Lincoln College. A local concentration of these insects on Mt Bailey was strongly evident from both soil-sampled larvae and observations of adults. On 15 December 1962 the adults were so abundant that while climbing between 12 noon and 1.0 p.m. there were probably three or four seen on every hard tussock - and on one small and lone snow tussock at least 13 were counted. Their abundance doubtless affords a ready food supply for birds and on several occasions Pyronota elytra were noticed in bird droppings.

Pyronota festiva (Fab.) 11 (5:2) 11

1961-2, late Nov-early Jan, 2100'-3200'/3500', Mt Bailey, Rib. Fan (A & B), Gold. Sdle, Mt Gog, Mt Sugar Lf, Starv. Gully & L. Lynd. Traps W, N & Ld.

J.G. Brown (pers. comm.) indicates that this species is widespread throughout New Zealand but much less abundant on Mt Bailey than P. edwardsi Sharp and P. laeta (Fab.). The larvae feed generally on montane pasture and can therefore be of economic significance. The adults are known to feed on sweet briar (Rosa rubiginosa L.) and manuka (Leptospermum scoparium J.R. et G. Forst.).

An interesting record of predation concerns a male specimen of the asilid fly Neoitamus varius (Walk.). It was found on 29 November 1962 preying on an adult male of Pronota festiva on Ribbonwood Fan below the road. Its stylets were inserted dorsally between the beetle's head and prothorax.

Pyronota edwardsi Sharp 14 (5:3) 6

1961-3, late Nov-mid Jan, 2300'-2800'/3000', Rib. Fan (A), Mt Magog, Mt Gog & Starv. Gully. Traps Ld, N, G & W.

J.G. Brown (pers. comm.) indicates that this species is widespread throughout New Zealand and as common on Mt Bailey as P. laeta (Fab.). He adds that the adults are known to feed on matagouri (Discaria toumatou Raoul).

The abundance of this species on Mt Bailey undoubtedly makes the larvae of economic importance on that site. The species may also be quite common on Mt Gog and Mt Magog.

On two occasions, records were made of the asilid fly Neoitamus varius (Walk.) preying on female specimens. At Mt Magog on 16 December 1962 a male N. varius was found with its stylets inserted through the beetle's thoracic ventrum, and on 5 January 1963 a female N. varius was recorded on Ribbonwood Fan above the road with a further specimen.

A possible instance of phoresy was also recorded for Pyronota edwardsi. A female specimen swept at Starvation Gully on 23 November 1961 had a scale attached to the thorax but loss of the individual prevented a determination being made.

Pyronota laeta (Fab.) 7 (1:1) 5

1962-3, late Dec-mid Jan (5 reared, Oct), 2100'-3500'/4000', Mt Bailey, Rib. Fan (A), Mt Gog & Mt Sugar Lf. Traps W, Ld, N & G.

The reared specimens (4 females and 1 male) emerged in mid- and late October. They had been reared from larvae found on Mt Bailey.

J.G. Brown (pers. comm.) indicates that this species is widespread throughout New Zealand and is as common on Mt Bailey as P. edwardsi Sharp. Its larvae feed on montane pasture and by their abundance on Mt Bailey must be of considerable economic importance on that site. The adults are known to feed on sweet briar (Rosa rubiginosa L.) and manuka (Leptospermum scoparium J.R. et G. Forst.).

Costelytra zealandica (White) 257. 51

1961-3, early Dec-mid Feb, 1900'-3100', all Cass sites except Walk. Fan & Mt Sugar Lf. Traps L, W, P, D & G.

This insect is the common grass grub.

Most specimens were recorded from light traps though wind nets also caught considerable numbers. The peak adult flight period was in mid-December though numbers were still high in late December.

Light trap collections indicated a local concentration of this species on Ribbonwood Fan above the road. A considerable number of specimens were also caught on Mt Gog but surprisingly few (only 13) were taken on Mt Sugar Loaf Fan. The Mt Gog and Mt Sugar Loaf Fan catches were probably indicative of the species' abundance on those sites but it is most likely that a large number of specimens recorded on Ribbonwood Fan above the road had come from adjoining sites. Only on one occasion were larvae of this species recorded from the soil-sampling transect above the road whereas on the same fan below the road larvae were found at all points along the transect. On Mt Bailey no larvae were found on the transect but general collecting had indicated that the species was probably very abundant on the slopes. It would seem therefore that many specimens caught by the Ribbonwood Fan light trap (and wind net) were attracted into that area. Most probably came from the Mt Bailey slopes.

It is evident that local concentrations of this species vary markedly from site to site. The low numbers on Mt Sugar Loaf Fan and on Ribbonwood Fan (especially above the road) are

very interesting as is also the apparently high concentration on the Mt Bailey slopes. But though there were large numbers on Mt Bailey at 3100', not one of the 103 melolonthine larvae recorded from the soil sampling transect at 3800' was this species. Therefore the upper limit of the insect is somewhere between 3100' and 3800' on this site.

Kelsey (1957) recorded the larvae feeding on tussock roots and also the adults feeding on young tussock leaves after a burn. He assessed the overall importance of the insect's leaf feeding as negligible but found the larvae responsible for most of the damage occurring to tussock root systems. He recorded them in fairly high numbers even at 4500'. In a personal communication, he adds that grass grub was present in all tussock grassland inspected during the survey presented in his 1957 paper. In reference to the inter-tussock vegetation, he states that the grubs are probably responsible for the non-establishment of seedling plants and primarily responsible for a great deal of the overall loss of vegetation. A secondary effect of their presence is the making of topsoil friable, so permitting the entry of water. This can then be followed by frost-lift. Once dry, the soil is readily lost by wind erosion and the bared areas become unfavourable for supporting new plant growth.

The economic importance of this insect is unquestionable but the survey would indicate that in some areas its incidence and therefore importance can be surprisingly low.

Odontria aurantia Given 1 (1:0) 1

1962, early Jan, 2900', Mt Gog. Trap L/Ld.

It is probable that this species is relatively more abundant than the single record suggests. B.B. Given (pers. comm.) indicates that the species is a tussock inhabitant in relatively high grasslands but that it is not widely distributed. It is probably therefore of little economic importance.

Odontria smithii Broun 3 (1:2) 3

1962-3, early Jan & early Mar, 2300', Rib. Fan (A) & Mt Gog. L/Ld & W.

B.B. Given (pers. comm.) indicates that this species is known in both the North and South Islands. It is usually found in improved country but occasionally penetrates into other areas such as tussock grasslands. J.M. Kelsey (pers. comm.) mentions that it can sometimes cause severe local damage to inter-tussock vegetation.

Odontria marmorata Broun 3 (3:0) 2

1962-3, late Jan & early Feb, 2600'-3200', Mt Magog & Mt Sugar Lf. Trap P.

It is probable that this species is relatively more abundant than the records suggest.

B.B. Given (pers. comm.) states that it is found in both the North and South Islands but that it is usually associated with typical subalpine country. Its economic significance is uncertain.

Odontria occiputale Broun 1 (1:0) 1

1962, late Dec, 3200', Mt Sugar Lf. Trap P.

It is probable that this species is relatively more abundant than the records suggest. B.B. Given (pers. comm.) indicates that it is an alpine species occurring only in the South Island. Its economic significance is uncertain.

Aphodiinae

Members of this subfamily live in dung.

Saprosites brouni (Sharp) 1. 1

1963, early Feb, 2200', Godley Pks. Trap S.

The single specimen was found in an inter-tussock soil sample. Richards (1959) records the species as widely distributed in New Zealand and a useful dung feeding scavenger. Its value in tussock areas is probably slight.

HYMENOPTERA

(Ichneumon flies, Wasps, Ants, Bees)

Classification follows Tillyard (1926). The same reference is the source of all general information not otherwise acknowledged.

The members belonging to this order are highly beneficial except for a few gall-forming chalcids. The benefit afforded by most species is their parasitic control of other insects, many of which are (or otherwise would be) pests. Some hymenopteran species can hyperparasitise others and so decrease the overall benefit of the order but this group is in a minority.

The population level necessary for a beneficial species to effectively control an insect pest is summed up by Cumber (1959c) who states, "It should be emphasised that the numerical strength of a species bears no relationship to its potential, for in host/parasite associations the balance is often maintained at low population levels". Species which have occurred in the present survey in only small numbers are therefore not necessarily unimportant. Many may be, but without a knowledge of their habits and hosts little can be said to evaluate their economic significance.

In the survey it is probable that the order has been sampled very extensively. A total of 270 species were recorded and though a few of these may have defied methodical trapping, it is thought that most have been representatively collected. Grease cylinders afforded such large and extensive collections that the catches of many species warrant statistical analysis, but this analysis will not be possible until the Thysanoptera and Diptera have been studied. All other methods of trapping were considered complementary to the grease cylinder collecting.

Because so little is known about the habits and hosts of many species, evaluations of economic importance are in most cases omitted. Several successes in rearing species have provided host associations not previously known but in total such records still remain fragmentary. Some are barely informative since the species concerned (like the majority of others collected) remain undescribed. This non-description, together with inadequate description of some known species, accounts for the long lists of unnamed species recorded from the survey.

CLISTOGASTRA

ICHNEUMONOIDEA

The larvae of this superfamily are internal parasites of living, active hosts or their eggs. A large proportion of the hosts are lepidopterous and dipterous larvae which live in the open.

ICHNEUMONIDAE (Ichneumon flies)

Most members of this family parasitise larval and pupal stages of Lepidoptera but some are known to parasitise Coleoptera, Diptera, Hemiptera, Hymenoptera and Neuroptera. Many of them are highly beneficial (Cumber, 1959c).

Ichneumoninae

Large-bodied species belonging to this subfamily are not readily caught on grease cylinders and so may not have been representatively sampled. Their abundance relative to species readily caught on cylinders is probably underrated but attention is drawn to this where appropriate.

Degithina ? sp.

8 (2:6) 6

1962-3, late Nov-late Feb, 2100'-3500'/4500', Walk.

Plot, Mt Bailey, Rib. Fan (A) & Mt Sugar Lf. Traps N & P.

This species may be relatively more abundant than the records suggest. It possibly frequents slopes in preference to rather flat areas.

Ichneumon promissorius Erichs. 7 (0:7) 7

1962-3, early Jan-late Apr, 2100'-2800'/3200',
Walk. Fan, Mt Bailey & Rib. Fan (A). Trap N.

This species may be relatively more abundant than the records indicate.

Parrott (1953) states that the hosts of this *Ichneumon* fly are usually noctuid larvae and that it must be considered a valuable agent in the control of army worms and cutworms. However, since only one specimen is likely to emerge from a host, the species' abundance must relate directly to the number of hosts parasitised. The survey indicates therefore that in the Cass area the insect can only be of minor importance in the control of noctuid larvae.

Ichneumon sollicitorius ? (Fab.) 15 (5:10) 11

1962-3, mid Sept, mid Nov & early Jan-mid Mar, 2100'-3200', Walk. Fan, Mt Bailey, Rib. Fan (A), Mt Magog, Mt Gog & Mt Sugar Lf. Traps N & W.

This species is relatively more abundant than the records indicate. It was observed in the bases of hard tussocks with a frequency that suggests it was searching for noctuid larvae and was also once recorded from the base of snow tussock. Nearly all specimens were caught on slopes.

Ichneumon machimia ? Cam. 44 (17:23) 27

1961-3, mid Sept & late Nov-late Mar, 1900'-3500', all Cass sites except Mt Magog. Traps G, N & W.

The only specimen recorded in September was from the base of snow tussock and may have been overwintering in that position. The active flying season is no doubt indicated by the November to March catches. An interesting record from among these was the presence in late November of 10

specimens (possibly all females) in the base of one hard tussock. Their being together may indicate recent emergence from a single host but only a large host could contain 10 such individuals. The species may therefore parasitise noctuid larvae or pupae.

Ichneumon utetes ? Cam. 4 (4:0) 4

1962, mid Nov, early Jan & Feb, 2100'-3100'/3500', Mt Bailey, Gold. Sdle & Mt Sugar Lf. Traps W, G & N.

Ichneumonine sp. 1 4 (2:2) 4

1962-3, mid Oct, late Nov, early Jan & late Feb, 2100'-3100'/3500', Walk. Fan, Mt Bailey, Rib. Fan (A) & Mt Sugar Lf. Traps G & N.

Ichneumonine sp. 2 3 (3:0) 3

1963, mid Jan & early Feb, 2300'-3100', Mt Bailey & Rib. Fan (A). Traps G & W.

Ichneumonine sp. 3 1 (0:1) 1

1963, early Feb, 2300', Rib. Fan (A). Trap W.

Ichneumonine sp. 4 4 (1:3) 3

1962-3, late Dec & Jan, 2300'-3500'/4000', Mt Bailey, Rib. Fan (A) & Mt Sugar Lf. Traps G & N.

Ichneumonine sp. 5 2 (1:1) 2

1962, late Oct & early Feb, 3100'-3100'/3500', Mt Bailey & Mt Sugar Lf. Traps G & N.

Ichneumonine sp. 6 5 (0:5) 5

1962-3, early Dec-mid Jan & early Mar, 2100'-3800', Walk. Fan & Mt Bailey. Traps G & N.

Ichneumonine sp. 7 5 (1:4) 4

1962, Nov & late Mar, 1600'-3000'/3500', Mt Gog, Mt Sugar Lf, Mt Sugar Lf Fan & Lake Pukaki. Trap N.

Ichneumonine sp. 8 2 (0:2) 2

1962, late Mar & early Apr, 3500'-3500'/4500', Mt Sugar Lf. Traps G & N.

Ichneumonine sp. 9

1 (1:0) 1

1962, mid Dec, 2300', Mt Gog.

The single specimen was recorded from the base of hard tussock.

Ichneumonine sp. 10

1963, (1 reared, Jan), 2400', Mt Bailey.

The single male specimen emerged on 12 January 1963 from a Crambus pupa found in the base of a silver tussock in mid-December 1962.

Ichneumonine sp. 11

1 (1:0) 1

1962, early Mar, 2300', Rib. Fan (A). Trap W.

Ichneumonine sp. 12

1 (0:1) 1

1962, late Apr, 2100', Gold. Sdle, Trap W.

Ichneumonine sp. 13

1 (1:0) 1

1962, mid Nov, 3000'/3500', Mt Sugar Lf. Trap N.

Ichneumonine sp. 14

1 (1:0) 1

1962, May/Nov, 2300', Mt Gog. Trap Ld.

Ichneumonine sp. 15

1 (1:0) 1

1962, late Mar, 2200'/3100', Mt Bailey. Trap N.

Ichneumonine sp. 16

4 (4:0) 4

1962-3, early Feb & Mar, 3100'-3500', Mt Bailey & Mt Sugar Lf. Trap G.

Ichneumonine sp. 17

1 (0:1) 1

1962, late Jan, 3100', Mt Bailey. Trap G.

CryptinaeCryptine sp. 1

92 (9:29) 16

1962-3, mid Sept-mid Nov, late Jan & early Mar-early Apr, 2100'-3500', Walk. Plot, Walk. Fan, Rib. Fan (A & B), Mt Magog & Mt Sugar Lf. Traps G, N & W.

Nearly all specimens were recorded from grease cylinders, the majority being caught on the low-set traps. Because so few of these were used, the insect must be relatively more abundant than the records suggest. It is interesting however that this abundance does not relate to all sites. Whereas only five specimens were trapped inside Walker's Plot, 80 specimens were trapped outside. Such a

clear-cut difference is surprising for a hymenopteran species, even if it indicates that the host or hosts were poorly represented in the improved site.

The species was most abundant in October. Having first appeared in small numbers in March and April, it apparently ceased activity during the winter but emerged in greatly increased numbers for the spring. A single specimen taken in January was incidental to the main flight period.

Cryptine sp. 2 3 (2:1) 2
1963, late Jan & early Feb, 2600'-3800', Mt Bailey & Mt Magog. Traps N & G.

Cryptine sp. 3 1 (1:0) 1
1963, early Jan, 2300', Rib. Fan (A). Trap W.

Cryptine sp. 4 1 (1:0) 1
1963, early Jan, 2300', Rib. Fan (B). Trap G.

Cryptine sp. 5 2 (2:0) 2
1962, late Sept & late Mar, 2100'-3100', Walk. Fan & Mt Bailey. Trap G.

Cryptine sp(p). 6 78 (13:65) 41
1962-3, late Oct & late Nov-early May, 2100'-3500'/4500', all Cass sites except Mt Sugar Lf Fan. Traps G, N, W & Ld.

All specimens recorded here are probably the same species but it is very variable.

Many specimens were caught on grease traps and quite a number were swept. No decided peak in numbers was evident but rather a continuous low level that may have been cut short in May when trapping was discontinued for the winter.

Several factors indicated that this species may have a strong attachment to the snow-tussock association on Mt Sugar Loaf.

Tryphoninae

Netelia ephippiatus (Smith) 14 (13:1) 7
1962-3, mid Jan-mid Mar, 1900'-2300', Rib. Fan (A), Mt Gog & Mt Sugar Lf Fan. Trap L.

All but two specimens were caught by the light trap on Ribbonwood Fan above the road.

Parrott (1951) indicates that this species is probably distributed throughout New Zealand. He also states that it is known to attack lepidopterous larvae.

Homotropus sp. 1 (0:1) 1

1962, early Jan, 3500'/4500', Mt Sugar Lf. Trap N.

The genus Homotropus has not previously been recorded in New Zealand.

Ashmead (1900) states that the known host records of species belonging to the same tribe as Homotropus are all confined to the larvae and pupae of Diptera and almost without exception to the family Syrphidae. It is interesting that the specimen of Homotropus recorded from the survey was taken at an altitude where syrphids are common.

Tryphonine sp. 1 3 (3:0) 3

1962-3, early Dec, early Feb & early May, 2300'-3100', Mt Bailey & Rib. Fan (A & B). Traps G & W.

Tryphonine sp. 2 4 (0:4) 4

1962, Nov & early Dec, 3000'-3500', Mt Bailey & Mt Sugar Lf. Traps G & N.

Tryphonine sp. 3 9 (6:3) 8

1962-3, early Nov & early Jan-late Feb, 2100'-3500', Mt Bailey, Gold. Sdle & Mt Sugar Lf. Traps G & W.

All specimens except one were taken above 3000' and most were recorded by the grease cylinder on Mt Sugar Loaf.

Tryphonine sp. 4 2 (2:0) 2

1962-3, late Jan & late Mar, 2100'-3500', Walk. Fan & Mt Sugar Lf. Trap G.

Tryphonine sp. 5 1 (0:1) 1

1962, late Feb, 2300', Rib. Fan (B). Trap G.

Tryphonine sp. 6 10 (0:9) 8

1962, late Oct & late Mar-mid May, 2100'-3000'/3500', Walk. Plot, Mt Bailey, Mt Magog & Mt Sugar Lf. Traps G & N.
Most specimens were recorded from Mt Bailey.

Tryphonine sp. 7

17 (14:2) 16

1962-3, early Dec-late Mar, 2300'-3100'/3500', all Cass sites except Walk. Plot, Walk. Fan & Mt Sugar Lf Fan. Traps W, G, N & L.

Tryphonine sp. 8

1 (0:1) 1

1961, late Nov, 2800'/3000', Starv. Gully. Trap N.

Tryphonine sp. 9

1 (0:1) 1

1962, early Dec, 3500', Mt Sugar Lf. Trap G.

PimplinaePimpline sp. 1

81 (29:52) 36

1961-3, early Dec-early Apr, 1900'-3500', all Cass sites except Mt Magog & Mt Gog. Traps G, N, W & L.

This species was readily caught by grease traps, wind nets and sweeping, but whereas the first and last methods trapped mostly males, wind net specimens were nearly all females. These records therefore indicate differing behavioural patterns in the two sexes. The predominance of males on grease cylinders may be a reflection of their swarming habits observed on two occasions, once in mid-December flying around two silver tussocks at the foot of Mt Bailey and once in early January swarming on a single Cassinia plant. On the former occasion, probably 30 individuals were present but only 10 of these were collected.

The records indicated no period of peak numbers but revealed a concentration of the species on Walker's Fan, Mt Bailey and Ribbonwood Fan above the road. This distribution is difficult to explain.

Pimpline sp. 2

1 (0:1) 1

1962, late Mar, 3100', Mt Bailey. Trap G.

Pimpline sp. 3

1 (1:0) 1

1963, late Jan, 2300', Rib. Fan (A). Trap W.

OphioninaeAustralophion peregrinus (Smith)

2 (1:1) 2

1962, late Nov & early Jan, 2300'/3100', Mt Bailey. Trap N.

Parrott (1954a) states that this species appears to be generally distributed in both the North and South Islands.

Ophion oculatus Parr.

6 (1:5) 4

1962-3, mid Jan-late Feb, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

Parrott (1954a) indicates that this species probably occurs throughout New Zealand.

Ophion inutilis Smith

4 (0:4) 4

1962, mid Sept-mid Oct & mid Jan, 2200'-3000'/3500', Mt Sugar Lf. Trap N.

Parrott (1954a) indicates that this species is generally distributed throughout New Zealand.

Ophionine sp. 1

1 (0:1) 1

1962, early Jan, 2200'/3500', Mt Sugar Lf. Trap N.

Ophionine sp. 2

115 (19:64) 44

1961-3, early Oct-early May, 2100'-3500'/4500', Walk. Plot, Walk. Fan, Mt Bailey, Rib. Fan (A & B), Gold. Sdle, Mt Sugar Lf & Starv. Gully. Traps G, N & W.

Nearly all specimens were recorded from grease cylinders, their records indicating a strong concentration on Mt Bailey. Considerable numbers were also recorded from Walker's Plot and Walker's Fan but these numbers may have been a reflection of trap height rather than of site preference. Only a single specimen was recorded from Goldney Saddle but several were taken from Mt Sugar Loaf. Hence the species' overall distribution and relative abundance between sites is difficult to explain.

The main flight periods were from March to April and November to December but no peak numbers were apparent at any stage. It would therefore seem likely that adults which emerged in the autumn became inactive during winter but again made their appearance in spring, probably along with further new emergents. During summer, only occasional specimens were recorded.

Ophionine sp. 3

3 (0:3) 2

1962, early Nov & early Dec, 3500', Mt Sugar Lf.

Trap G.

Ophionine sp. 4

1 (1:0) 1

1962, late Jan, 3100', Mt Bailey. Trap G.

Ophionine sp. 5

146 (26:47) 31

1962-3, late Sept-early Dec & early Feb-early May,
2100'-3100', Walk. Plot, Walk. Fan, Mt Bailey, Rib. Fan (A
& B) & Gold. Sdle. Traps G, N & W.

Nearly all specimens were recorded from grease cylinders, the majority being caught on the low-set traps. Because so few of these were used, the insect must be relatively more abundant than the records suggest. It is interesting however that this abundance does not relate to all sites. Whereas only eight specimens were trapped inside Walker's Plot, 118 specimens were trapped outside. Such a clear-cut difference is surprising for a hymenopteran species, even if it indicates that the host or hosts were poorly represented in the improved site.

The species' main flight periods were from March to April and October to November with a strong peak in numbers during October. This would seem to indicate an adult emergence in the autumn with further specimens emerging in the spring to complement the overwintering population. Records between November and March were incidental.

Ophionine sp. 6

1 (1:0) 1

1963, early Jan, 2300', Rib. Fan (A). Trap W.

Ophionine sp. 7

2 (2:0) 1

1962, mid Dec, 3000', Mt Sugar Lf. Trap N.

Ophionine sp. 8

7 (3:3) 7

1961-3, late Oct-early Jan, 2300'-3100', Mt Bailey,
Rib. Fan (A), Mt Gog, Starv. Gully & Burke's Pass. Traps
W, N, G & L/Ld.

Ophionine sp. 9

2 (2:0) 2

1962, early Dec & early Jan, 3100'-3100'/3500', Mt Bailey & Mt Sugar Lf. Traps G & N.

Ophionine sp. 10

2 (0:2) 2

1962-3, late Jan & late Mar, 3000'/3500'-3500', Mt Sugar Lf. Traps G & N.

Ophionine sp. 11

25 (21:3) 20

1962-3, mid Nov-early May, 1900'-3500', all Cass sites except Walk. Plot & Mt Gog. Traps G, W & N.

The species was recorded consistently between the dates mentioned and might have been recorded later than early May if trapping had been continued. No peak in numbers was evident.

Ophionine sp. 12

15 (7:7) 9

1962-3, early Dec-late Mar (1 reared, early Jan), 2000'-3500', Walk. Plot, Mt Bailey, Rib. Fan (A), Mt Magog & Mt Sugar Lf. Traps G, W & N.

Because of an apparent morphological gradation between this species and the next, all intermediate specimens have been recorded as Ophionine sp(p). 13. Some of these specimens doubtlessly belong to Ophionine sp. 12 and therefore the present records remain incomplete.

A single male specimen was reared as a larval parasite from the gelechiid moth Megacraspedus calamogonus Meyr. It emerged on 5 January 1963.

Ophionine sp(p). 13

608 (120:351) 110

1961-3, early Oct-mid May (1 reared, late Nov), 1600'-3500'/4500', Starv. Gully, L. Pukaki, Burke's Pass & all Cass sites except Mt Sugar Lf Fan. Traps G, N & W.

The majority of specimens recorded here are the one species but there exists an apparent morphological gradation between this and other species. The confusion probably relates only to male specimens and possibly concerns no other species than the similar Ophionine sp. 12 and Ophionine sp. 14. The records of these two species doubtlessly suffer from the confusion but since a large number

of the listed records relate to a distinct species (Ophionine sp. 13), the information presented can still be considered reliable. The doubtful records are too few to be upsetting.

Nearly all specimens were recorded from grease traps but a large number of these were caught by the yellow grease cylinder on Ribbonwood Fan above the road. Considerable numbers were also taken from Walker's Fan and Goldney Saddle but only a few were collected from Mt Bailey and Mt Sugar Loaf and very low numbers from other sites. This distribution is difficult to explain but is suggestive of strong site preferences and possibly a distinct attraction to yellow grease cylinders. The species had a very definite concentration below 2500' and was seldom found above 3500'.

Specimens trapped in wind nets were nearly all females whereas those taken from other traps were predominantly males. The species must therefore have behavioural patterns that differ for the two sexes. It may also have a dislike for warm weather since most of the specimens swept from herbage were recorded in cool and overcast weather and sometimes in cold and even showery conditions. In addition, many were taken in the late afternoon when temperatures were becoming cooler.

In the 1961-2 season, peak numbers were present in March though a high incidence was maintained from mid-February until late April.

A single female specimen was reared from the larva of the pyraustid moth Scoparia submarginalis (Walk.). The larva was taken in April 1962 from a soil sample on Ribbonwood Fan above the road and the parasite emerged 28 November 1962. The species may be an important parasite of this abundant moth.

Ophionine sp. 14 2 (1:1) 1

1962, late Apr, 2200', Rib. Fan (A). Trap N.

The male of this species may have been confused with Ophionine sp(p). 13 but because only one female was recorded, it is unlikely that many males were captured.

Ophionine sp. 15 3 (2:1) 3

1962-3, Jan & early May, 2100'-3100', Walk. Fan & Mt Bailey. Trap G.

Ophionine sp. 16 7 (6:1) 3

1962-3, Dec & early Jan, 3000'-3000'/3500', Mt Bailey & Mt Sugar Lf. Traps N & G.

Ophionine sp. 17 1 (1:0) 1

1963, early Jan, 3500', Mt Sugar Lf. Trap G.

Ophionine sp. 18 1 (0:1) 1

1962, late Apr, 3100', Mt Bailey. Trap G.

Ophionine sp. 19 156 (32:112) 65

1962-3, early Nov-late Apr, 1600'-3100', L. Pukaki & all Cass sites except Mt Gog & Mt Sugar Lf. Traps G, N, W & Ld.

The majority of specimens were trapped on grease cylinders but slightly higher numbers were recorded from the low-set traps. The species was most abundant in February and March and most commonly found below 2500'. Early season specimens were smaller and darker.

Ophionine sp. 20 704 (62:280) 83

1961-3, mid Sept-early May, 2100'-3500', Starv. Gully & all Cass sites except Mt Gog & Mt Sugar Lf Fan. Traps G, W & N.

Nearly all specimens were trapped by grease cylinders, the majority being recorded from the low-set traps. Because so few of these were used, the species must be relatively more abundant than the records indicate. Its relative abundance between sites, however, is difficult to interpret though it appeared generally to be more common below 3000'.

Specimens trapped in wind nets were nearly all females

whereas those taken from grease cylinders were mostly males. The species must therefore have behavioural patterns that differ for the two sexes.

The main flight periods were early March to early April and early October to early November with peak numbers in the second period. This suggests that adults emerge in the autumn and after their inactivity during the winter, reappear in the spring together with further emergents.

Ophionine sp. 21 1 (1:0) 1

1962, early Feb, 3000'-3500', Mt Sugar Lf. Trap N.

Ophionine sp. 22 4 (3:1) 1

1962-3, late Dec-mid Jan, 3000'/3500'-3700'/4000',
Mt Sugar Lf. Traps G & N.

Ophionine sp. 23 4 (3:1) 1

1962-3, late Jan-late Feb, 2300'-3100', Mt Bailey &
Rib. Fan (A & B). Traps G & W.

Ophionine sp. 24 3 (2:1) 1

1962, early Dec & Jan, Rib. Fan (A & B) & Mt Sugar Lf.
Traps W & G.

Ophionine sp. 25 1 (1:0) 1

1962, late Dec, 2300', Rib. Fan (A). Trap G.

BRACONIDAE

Classification within this family follows Ashmead (1900).

Braconids are mostly beneficial, the larvae being parasitic chiefly on lepidopterous caterpillars. Many species lay a number of eggs in a single host. Some small species parasitise aphids and scale insects, and Cumber (1959c) adds that some are parasites of Coleoptera.

Macrocentrinae

Phogra rubromaculata Cam. 222 (76:143) 108

1961-3, early Nov-early May (107 reared, Apr), 1900'-3800'/4500', all Cass sites, Starv. Gully & L. Lynd.
Traps G, W & N.

Most specimens were recorded from grease cylinders but much better trapping was achieved with the low-set traps. Because so few of these were used, the species must be relatively more abundant than the records indicate. No peak in numbers was evident at any stage of the season though in 1962 numbers were slightly higher from mid-February until mid-April.

Whereas males were predominant in grease cylinder catches, females were considerably more abundant in wind net collections. The species must therefore have behavioural patterns that differ for the two sexes. The actual sex ratio may not necessarily be consistent but it is interesting to note the following two records for comparison with field collections: of 73 specimens which were reared from a larva of the noctuid moth Ariathisa comma (Walk.), only eight of the 66 sexed individuals were males; of 34 adults which were reared from an unidentified noctuid larva, only nine of the emergents were males. In the latter case at least 46 larvae emerged from the host but some died in pupation. The pupation period ranged from 25 to 28 days but most adults emerged on the 25th day. All males appeared on the earliest emergence date.

Other noctuid hosts have also been recorded. Parrott (1954b) states that the species is parasitic on Persectania aversa (Walk.) and P. steropastis (Meyr.), and both Gourlay (1930) and Hudson (1950) note larval parasitism in the noctuid genus Melanchra. The species may hence exert a worthwhile controlling influence on many noctuid moths. Cumber (1959c) suggests that it probably plays an important part in controlling outbreaks of army worm and cutworm.

The species is probably generally distributed throughout New Zealand (Parrott, 1954b).

Macrocentrine sp. 1

1 (0:1) 1

1962, late Dec, 2600', Mt Magog. Trap G.

Macrocentrine sp. 2

6 (4:2) 4

1962-3, mid Dec-early Jan, 3000'-3700'/4000', Mt Sugar Lf. Traps G & N.

IchneutinaeIchneutine sp.

1 (1:0) 1

1962, late Nov, 3100', Mt Bailey. Trap G.

MeteorinaeMeteorus sp. 1

7 (1:6) 7

1962, early Oct, Nov & Feb (1 reared, early Mar), 1900'-2700', Walk. Fan, Mt Bailey, Gold. Sdle, Mt Gog, Mt Sugar Lf, Mt Sugar Lf Fan & Burke's Pass. Traps N, W, G & L.

A single female specimen was reared from an unknown pupa found in the soil below a hard tussock.

Meteorus sp. 2

2 (2:0) 2

1962, early Dec & late Apr, 2200'-3100', Walk. Fan & Mt Bailey. Trap G.

Meteorus sp. 3

11 (5:6) 10

1962, Oct, early Dec & late Jan-early Apr, 1900'-3100', all Cass sites except Gold. Sdle & Mt Gog. Traps G & N.

Meteorus sp. 4

18 (4:14) 12

1962-3, early Nov-late Mar, 2100'-3100', Walk. Plot, Walk. Fan, Mt Bailey, Rib. Fan (A & B) & Mt Sugar Lf Fan. Traps G & N.

All specimens except one were recorded from grease cylinders.

Meteorus sp. 5

11 (0:11) 5

1962-3, mid Feb-late Apr (1 reared, late Jan), 1900'-2300'/3100', Mt Bailey, Rib. Fan (A) & Mt Sugar Lf. Trap L.

Only males of this species were attracted to light but a single female was reared from an unknown pupa found on Mt Bailey.

BlacinaeBlacine sp.

1 (1:0) 1

1962, late Dec, 3100', Mt Bailey. Trap G.

EuphorinaeEuphorine sp.

6 (6:0) 6

1962, late Nov & late Jan-early Mar, 2100'-2300',
Rib. Fan (A & B). Traps G, W & N.

MicrogasterinaeApanteles demeter Wilk.

49 (26:22) 32

1961-3, early Nov-early May, 2100'-3100'/3500', all
Cass sites except Mt Gog & Mt Sugar Lf Fan. Traps G, W & N.

Both grease traps and wind nets readily caught this
species. No peak in numbers was evident but rather a
consistent level throughout the recorded flight period.

Parrott (1954b) indicates that the species has been
reared from a species of Tortrix.

Apanteles sp. 1

4 (0:4) 3

1962-3, late Dec, early Feb & mid Mar, 2300', Rib.
Fan (A). Trap W.

Apanteles sp. 2

14 (6:8) 7

1962-3, mid Nov-late Mar, 1900'-3100', Walk. Fan, Mt
Bailey, Rib. Fan (B) & Mt Sugar Lf Fan. Traps G & N.

All specimens except one were collected from grease
traps.

Apanteles sp. 3

6 (4:2) 4

1962, late Mar & late Apr, 2100'-3100', Mt Bailey &
Gold. Sdle. Traps G & N.

Apanteles sp. 4

1 (1:0) 1

1962, late Dec, 3100', Mt Bailey. Trap G.

Apanteles sp. 5

4 (3:1) 4

1962, late Nov, mid Dec, early Jan & mid Feb, 2300'-
3500'/4500', Rib. Fan (A), Mt Sugar Lf & Starv. Gully.
Traps W & N.

Apanteles sp. 6

128 (40:86) 76

1961-3, late Sept-mid May (2 reared, early Dec & mid Mar), 1600'-3500'/4500', all Cass sites, Starv. Gully, L. Lynd. & L. Pukaki. Traps G, N, W & L/Ld.

Most specimens were trapped by grease cylinders but distinctly higher numbers were recorded from those which were set low. Herbage sweeping also caught considerable numbers.

The records indicate no peak in numbers but rather a consistent level throughout the September to May period. If trapping had continued after mid-May it is quite likely that specimens would still have been caught.

Two specimens were reared, one from an unknown lepidopterous pupa and the other from its own pupa found on a blade of hard tussock. The latter had doubtlessly emerged from its host to pupate.

Apanteles sp. 7

2 (1:1) 2

1961-2, late Oct & late Nov, 2800'/3000'-3500', Mt Sugar Lf & Starv. Gully. Traps G & N.

The pairing of these two specimens remains in slight doubt.

Apanteles sp. 8

7 (4:3) 6

1962-3, early Jan-mid Apr, 2100'-3100', Walk. Fan, Mt Bailey & Rib. Fan (A & B). Traps G & W.

Apanteles sp. 9

1 (1:0) 1

1962, early Nov, 3500', Mt Sugar Lf. Trap G.

Apanteles sp. 10

6 (5:1) 5

1962-3, mid Mar-early Apr, 2100'-3100', Walk. Plot, Walk. Fan, Mt Bailey, Rib. Fan (A) & Gold. Sdle. Traps G & N.

Apanteles sp. 11

18 (9:8) 18

1961-3, mid Dec-early Apr, 2100'-3100', Walk. Plot, Mt Bailey, Rib. Fan (A & B), Gold. Sdle & Mt Magog. Traps G & W.

Apanteles sp. 12

47 (26:20) 37

1962-3, Oct & early Dec-early May, 2100'-3500', all Cass sites except Mt Magog & Mt Sugar Lf Fan. Traps G, W & N.

Most specimens were caught by grease cylinders. The species may possibly have been more abundant inside Walker's Plot than outside.

Apanteles sp. 13 32 (26:5) 16

1962, late Feb-late Apr, 2100'-2300', Walk. Plot, Walk. Fan & Rib. Fan (A & B). Traps G, W & N.

Most specimens were trapped by grease cylinders and the majority recorded from Ribbonwood Fan. The records indicated a decided peak in numbers during March.

Cheloninae

Ascogaster sp. 7 (6:0) 7

1961-2, early Nov-late Feb, 2300'-3100', Walk. Fan, Mt Bailey & Rib. Fan (A & B). Traps G & W.

Chelonine sp. 1 (1:0) 1

1963, early Feb, 2300', Rib. Fan (A). Trap G.

Aphidiinae

Aphidiine sp. 18 (4:8) 14

1961-2, mid Nov-late Mar, 2100'-3200'/3500', Mt Bailey, Rib. Fan (A), Gold. Sdle, Mt Sugar Lf, Starv. Gully & L. Lynd. Traps W, G & N.

Opiinae

Opiine sp. 1 1 (0:1) 1

1962, late Mar, 3500'/4500', Mt Sugar Lf. Trap N.

Opiine sp. 2 8 (7:1) 6

1962-3, early Jan-mid Mar, 2100'-3300', Rib. Fan (A), Gold. Sdle & Mt Sugar Lf. Traps W & G.

Opiine sp. 3 1 (1:0) 1

1962, late Mar, 2100', Gold. Sdle. Trap W.

The single specimen could possibly be the female of Opiine sp. 4.

Opiine sp. 4 1 (0:1) 1

1962, late Dec, 3500', Mt Sugar Lf. Trap G.

The single specimen could possibly be the male of Opiine sp. 3.

RhogadinaeRhogas sp(p).

45 (15:27) 32

1961-3, late Sept-early Apr, 1900'-3100'/3500', all Cass sites except Mt Magog & Mt Gog. Traps G, N, W & L.

It is uncertain whether all specimens recorded here are the same species. They are rather variable.

Low-set grease cylinders proved to be the best traps for this species and yellow cylinders were possibly the more attractive. Since few of these were used, the species must be relatively more abundant than the records indicate. Its distribution is general but it appears significant that all specimens swept from herbage were collected from the snow-tussock association on Mt Sugar Loaf. It is surprising that none was ever swept from low-tussock associations.

Cumber (1959c) states that parasitism of early stage noctuid larvae is typical of Rhogas attack and in this capacity species may be important in the control of army worms and cutworms.

SpathiinaeSpathiine sp. 1

2 (1:1) 1

1962, early Mar, 3000'/3500', Mt Sugar Lf. Trap N.

Spathiine sp. 2

5 (4:1) 5

1962, late Sept, late Nov, late Dec, late Feb & late Mar, 3100'-3500', Mt Bailey & Mt Sugar Lf. Traps G & W.

ALYSIIDAE

Ashmead (1900) states that members of this family attack dipterous larvae almost exclusively.

Dacnusa areolaris Nees

3 (3:0) 3

1962-3, late Dec, mid Jan & mid Apr, 2300', Rib. Fan (A). Trap W.

Aspilota sp.

45 (40:2) 35

1961-3, late Oct & early Dec-mid May, 2100'-3500', all Cass sites except Mt Gog & Mt Sugar Lf Fan. Traps G, W, N & P.

Most specimens were trapped by grease cylinders and wind nets. The records revealed no certain peak in numbers.

EVANIIDAE

The larvae of this family are parasitic on the larvae of longicorn beetles and also in the egg capsules of cockroaches.

Gasteruption crassipes (Smith) 1. 1

1962, early Dec, 2300', Rib. Fan (B). Trap G.

It was probably this species which Hilgendorf (1918) recorded at Cass as G. flavipes. If so, the species has certainly declined in numbers over the last 50 years.

CYNIPOIDEA

Most members of the superfamily are gall-forming parasites on leaves, stems or buds of plants but some are either parasitic on the gall-formers or else inquillines living inside the galls made by others.

CYNIPIDAE

Members of this family not only include gall-formers and inquillines in galls but also parasites of Diptera and hyperparasites of aphids and coccids (Cumber, 1959c).

Aulax hypochaeridis Kieff. 4 (4:0) 4

1961-2, late Nov & early Dec, 2300'-2800'/3000', Rib. Fan (B), Starv. Gully & L. Lynd. Traps G, W & N.

This species is almost certainly more abundant in the Starvation Gully and Lake Lyndon areas than in the Cass area. It forms galls in the stems of catsear (Hypochaeris radicata L.) and is of no economic importance.

Cynipid sp. 1 13 (9:1) 10

1961-3, early Dec-early Mar, 2300'-3000', Walk. Plot, Rib. Fan (A & B) & Starv. Gully. Traps W & G.

Most specimens were collected by wind nets.

Cynipid sp. 2

3 (2:0) 2

1961-2, early Dec & late Mar, 2300'-2800', Rib. Fan
(A) & L. Lynd. Traps W & G.

FIGITIDAE

Most species in this family parasitise aphids and scales though Cumber (1959c) indicates that some are parasites of Diptera and Neuroptera.

Figitid sp.

3. 3

1962-3, early Dec, mid Jan & early Feb, 2300'-3100',
Mt Bailey, Rib. Fan (A) & Mt Magog. Traps G & W.

CHALCIDOIDEA

The great majority of species in this superfamily are parasitic though some are secondary parasites. Some parasitise insect eggs and a considerable number live in galls where they parasitise the gall-makers or live as inquillines but a few are gall-makers themselves. The group as a whole is highly beneficial.

PTEROMALIDAE

Imms (1957) states that the members of this family "affect almost all orders of insects either as parasites or hyperparasites".

Pteromalus puparum (L.)

1 (0:1) 1

1962, early Mar (85 reared, early Mar), 1900'-2300',
Rib. Fan (A) & Cass. Trap W.

The female of this species may have been determined as Pteromalid sp. 1 in one or two instances but the number of specimens concerned is too few to significantly alter the records of either species.

The 85 reared specimens were 29 females and 56 males which emerged from a pupa of Pieris rapae L. attached to a building at Cass. Two other pupal cases from which the parasites had emerged were also found in the same vicinity.

It appears significant that the parasite was readily found near habitation and yet only a single individual was caught in the surrounding tussock grassland.

Pteromalid sp. 1

304 (47:227) 70

1961-3, early Oct & early Dec-late Apr, 2100'-3100'/3800', all Cass sites except Mt Sugar Lf & Mt Sugar Lf Fan. Traps G, W & N.

In one or two instances females entered as this species may be Pteromalus puparum (L.) but if any confusion exists, the number of specimens concerned is too few to significantly alter the records of either species.

Most specimens were recorded from grease traps though the high-set cylinders proved to be much better than those set low. Their records indicated a strong concentration of the species on Ribbonwood Fan below the road and considerable numbers on Walker's Fan and Mt Magog, possibly indicating some association with unimproved low-tussock grasslands. The species may also be concentrated below 3000'. Males were recorded from grease traps far more often than females but wind net collections were predominantly females. This indicates differing behaviour in the two sexes.

Pteromalid sp. 2

8 (8:0) 7

1961-3, early Dec-early Mar, 2100'-3100', Mt Bailey, Rib. Fan (A), Gold. Sdle & Starv. Gully. Traps G & W.

Pteromalid sp. 3

2 (0:2) 2

1962-3, late Jan & late Feb, 3100'-3500', Mt Bailey & Mt Sugar Lf. Trap G.

Pteromalid sp. 4

20 (20:0) 15

1962-3, late Dec-late Mar, 2100'-3100', Walk. Plot, Walk. Fan, Mt Bailey & Rib. Fan (A). Traps W, G & N.

Pteromalid sp. 5

9 (7:1) 9

1961-3, late Sept, early Nov & mid Jan-late Mar, 2200'-3500', Walk. Fan, Mt Bailey, Rib. Fan (A & B), Mt Sugar Lf & Starv. Gully. Traps G & W.

Pteromalid sp. 6

1 (1:0) 1

1962, mid Jan, 2300', Rib. Fan (A). Trap W.

Pteromalid sp. 7

58 (30:24) 35

1961-3, late Nov-late Apr (1 reared, mid Apr), 2100'-3200'/3500', Starv. Gully, L. Lynd. & all Cass sites except Mt Gog & Mt Sugar Lf Fan. Traps G, N, W & B.

Most specimens were trapped on grease cylinders but the low-set cylinders proved considerably better than those which were set high. Because few low-set cylinders were used, the species must be relatively more abundant than the records indicate. No peak in numbers was apparent but rather a low continuous level from November until April.

A reared female specimen probably emerged from a small unidentified lepidopterous larva.

Pteromalid sp. 8

1 (1:0) 1

1962, mid Feb, 2200'/3200', Mt Bailey. Trap N.

This species is brachypterous.

Pteromalid sp. 9

5 (5:0) 4

1962, mid Jan-late Mar, 2100'-3000'/3500', Walk. Plot, Walk. Fan & Mt Sugar Lf. Traps G & N.

Pteromalid sp. 10

229 (151:75) 35

1962-3, early Jan-mid Mar, 2100'-3500'/4500', all Cass sites except Mt Bailey, Mt Gog & Mt Sugar Lf Fan. Traps G, N & W.

Considerable numbers of this species were collected by herbage sweeping but most specimens were trapped by low-set grease cylinders. Because few of these were used, the species must be relatively more abundant than the records indicate. Its abundance, however, differs markedly between sites. Hence, whereas no specimens were caught on the low-set cylinder on Walker's Fan, 150 specimens were trapped by the same cylinder set on Ribbonwood Fan below the road. The species' distribution may therefore be random or else related to certain types of tussock grassland.

In 1963 a strong peak in numbers was evident in early February.

Pteromalid sp. 11

3 (3:0) 3

1962-3, early Jan & early Mar, 2100'-3500', Walk. Fan & Mt Sugar Lf. Trap G.

Pteromalid sp. 12

4 (4:0) 4

1961-2, Nov, 2300'-3500', Mt Bailey, Rib. Fan (A), Mt Sugar Lf & L. Lynd. Trap G.

The single specimen taken at Lake Lyndon is probably this species.

CALLIMOMIDAE

Some members of this family are gall-formers and others are parasitic in galls.

Callimomid sp.

1 (1:0) 1

1963, late Jan, 2600', Mt Magog. Trap G.

EURYTOMIDAE

Cumber (1959c) states that members of this family exhibit widely diverse habits. Some are egg parasites of orthopterous insects, others are associated with the nests of bees and wasps, many are gall-formers or associated with galls formed by Diptera and Hymenoptera and some attack seeds. Those attacking seeds of legumes are of considerable economic importance.

Eurytomid sp. 1

33 (28:5) 16

1962-3, early Dec-mid Feb, 2300'-3500'/4500', Mt Bailey, Rib. Fan (A & B), Gold. Sdle, Mt Magog & Mt Sugar Lf. Traps G, W & N.

Most specimens were recorded from grease cylinders but the majority of these were from the low-set cylinder on Ribbonwood Fan below the road. This indicates more efficient trapping by the low-set cylinders but the absence of records from Walker's Fan and Walker's Plot may indicate that the species has a restricted distribution.

Eurytomid sp. 2

1 (0:1) 1

1962, early Dec, 2600', Mt Magog. Trap G.

Eurytomid sp. 3

1 (1:0) 1

1962, early Dec (9 reared, early Nov), 2000'-2600',
Mt Magog. Trap G.

Nine specimens, five females and four males, emerged on 10 November 1962 from pupae found in the centre of a stem of matagouri (Discaria toumatou Raoul) in late October of the same year. Wood boring is apparently unusual for a eurytomid.

Eurytomid sp. 4

4 (2:2) 4

1962, late Jan-early Feb & early Apr, 2100'-2300',
Walk. Plot, Walk. Fan & Rib. Fan (B). Trap G.

Eurytomid sp. 5

1. 1

1962, mid Jan, 2500', Mt Sugar Lf.

The single specimen was taken from a gall on Cassinia fulvida Hook. f.

PERILAMPIDAE

Some members of this family are gall-formers but many are parasitic on lepidopterous and neuropteran larvae.

Perilampid sp.

23 (14:9) 12

1962-3, late Jan-late Mar, 2100'-2300', Walk. Plot & Rib. Fan (A). Traps G & W.

This species had a distinct association with Walker's Plot, 22 specimens being taken on 11 occasions. A very small specimen recorded from Ribbonwood Fan above the road is probably the same species.

EULOPHIDAE

Some members of this family are gall-formers and others parasites. Cumber (1959c) states that the family affects almost all orders of insects either as primary or secondary parasites.

Aphelinus sp.

5 (5:0) 4

1962, late Feb-late Mar, 2100'-2300', Walk. Plot & Rib. Fan (A). Trap G.

Species belonging to the genus Aphelinus are aphid parasites (Valentine, 1963). Hence, since four specimens of the present species were recorded from Walker's Plot, the species may parasitise clover-feeding aphids.

Coccophagus sp. 20 (12:8) 19

1962-3, late Nov-early Apr, 2100'-3500', Walk. Fan, Mt Bailey, Rib. Fan (A & B), Mt Magog & Mt Sugar Lf. Traps G & W.

Members of the genus Coccophagus are parasites of lecaniine scales and mealy bugs (Valentine, 1963).

nr Coccophagus sp. 3 (3:0) 3

1962, mid Feb, late Mar & late Apr, 2100', Walk. Fan. Trap W.

All specimens were recorded from a low-set grease cylinder.

Eulophid sp. 1 3 (3:0) 3

1962-3, Jan, 3100'-3500', Mt Bailey & Mt Sugar Lf. Trap G.

Eulophid sp. 2 2 (2:0) 2

1962, late Jan & late Feb, 2100', Walk. Plot. Trap G.

Eulophid sp. 3 1 (1:0) 1

1963, early Jan, 3100', Mt Bailey. Trap G.

Eulophid sp. 4 6 (4:2) 6

1961-2, late Sept, early Dec, mid Feb & Apr, 2100'-3500', Walk. Plot, Walk. Fan, Mt Bailey, Mt Sugar Lf & Starv. Gully. Traps G & W.

Eulophid sp. 5 3 (3:0) 3

1962, early Nov, late Feb & late Mar, 2100'-3500', Walk. Fan & Mt Sugar Lf. Trap G.

Eulophid sp. 6 6 (6:0) 6

1961-2, late Nov-late Feb, 2300'-3500', Rib. Fan (A & B), Mt Sugar Lf & Starv. Gully. Traps G & W.

Eulophid sp. 7 5 (4:1) 5

1962-3, late Nov-late Feb, 3100'-3500', Mt Bailey & Mt Sugar Lf. Trap G.

Four of the specimens were recorded from Mt Sugar Loaf.

Eulophid sp. 8

2 (1:1) 2

1961-2, late Nov & mid Dec, 2300'-3000', Rib. Fan (A) & Starv. Gully. Traps W & N.

Eulophid sp. 9

3 (1:2) 3

1962, late Mar, 2100'-3100', Mt Bailey, Rib. Fan (A) & Gold. Sdle. Traps W & G.

Eulophid sp. 10

22 (13:8) 20

1962-3, early Sept & early Nov-late Mar, 2100'-3500', Mt Bailey, Rib. Fan (B), Gold. Sdle, Mt Magog & Mt Sugar Lf. Traps G & W.

Most specimens were recorded from grease cylinders. The species may possibly be associated with higher mountain slopes.

Eulophid sp. 11

1 (1:0) 1

1962, mid Jan, 2300', Rib. Fan (A). Trap W.

Eulophid sp. 12

3 (3:0) 1

1962-3, late Dec, late Jan & early Feb, 2300'-3100', Mt Bailey & Rib. Fan (A & B). Traps G & W.

Eulophid sp. 13

12 (12:0) 11

1962-3, late Dec-early Mar, 2100'-3100', Walk. Plot, Walk. Fan, Mt Bailey, Rib. Fan (A) & Starv. Gully. Traps G & W.

The specimens recorded here are possibly the females of Eulophid sp. 14.

Eulophid sp. 14

12 (0:12) 11

1962-3, early Dec-late Mar, 2100'-3500'/4500', Walk. Plot, Walk. Fan, Mt Bailey, Rib. Fan (A & B) & Mt Sugar Lf. Traps G, N & W.

The specimens recorded here are possibly the males of Eulophid sp. 13. Most were recorded from low-set grease cylinders.

Eulophid sp. 15

4 (3:0) 4

1962, late Nov, late Dec & Feb, 2600'-3500', Mt Magog & Mt Sugar Lf. Trap G.

Eulophid sp. 16

26 (18:7) 19

1962-3, mid July, mid Sept & early Nov-late Feb
(1 reared, mid Feb), 1600'-3500', Ohau Rvr & all Cass sites
except Walk. Plot, Walk. Fan & Mt Sugar Lf Fan. Traps G & N.

The single reared specimen emerged as a pupal parasite
from an undetermined host.

Eulophid sp. 17

3 (2:0) 3

1961-2, early Dec, late Dec & late Jan, 2300'-3500',
Rib. Fan (A), Mt Sugar Lf & Starv. Gully. Traps W & G.

Eulophid sp. 18

1 (1:0) 1

1961, late Nov, 2800', L. Lynd. Trap G.

Eulophid sp. 19

2 (1:1) 2

1962-3, late Jan & late Feb, 2100'-2300', Rib. Fan (B)
& Gold. Sdle. Trap G.

Eulophid sp. 20

1 (1:0) 1

1962, early Jan, 2100', Gold. Sdle. Trap W.

Eulophid sp. 21

2 (1:1) 2

1961 & 3, late Nov & early Feb, 2600'-3000', Mt Magog
& Starv. Gully. Traps G & W.

Eulophid sp. 22

19 (19:0) 13

1961-3, late Nov-early Feb, 2300'-3500', Mt Bailey,
Rib. Fan (A), Mt Magog, Mt Sugar Lf & Starv. Gully.
Traps W, G & N.

Eulophid sp. 23

1 (1:0) 1

1963, early Feb, 3100', Mt Bailey. Trap G.

ENCYRTIDAE

Members of this family are parasites of the eggs,
larvae and pupae of many insect orders but more especially
of the Homoptera and Lepidoptera (Cumber, 1959c).

The listed records remain incomplete for the survey.

Microterys flavus How.

1 (1:0) 1

1962, late Apr, 2600', Mt Magog. Trap G.

Eusemion cornigerum (Walk.) 1 (1:0) 1

1962, late Feb, 2600', Mt Magog. Trap G.

The host list of this species includes Microterys flavus How. (Peck, 1963).

Hungariella sp. 4 (2:2) 4

1962, early Feb-late Mar, 2000'-2600', Gold. Sdle & Mt Magog. Traps G & N.

E.W. Valentine (pers. comm.) indicates that members of the genus Hungariella are mealy bug parasites.

nr Paranusia sp. 21 (19:0) 19

1962-3, Nov & early Jan-late Mar, 2100'-3500'/4500', all Cass sites except Mt Gog & Mt Sugar Lf Fan. Traps G, W & N.

E.W. Valentine (pers. comm.) indicates that members of the genus Paranusia are mealy bug parasites.

Encyrtid sp. 1 1 (1:0) 1

1962, early Mar, 3500', Mt Sugar Lf. Trap G.

This species is brachypterous. The record from a high-set grease cylinder must therefore indicate wind dispersal.

Encyrtid sp. 2 1 (1:0) 1

1962, late Mar, 3200', Mt Sugar Lf. Trap W.

This species is brachypterous. The wind net record must therefore indicate wind dispersal.

Encyrtid sp. 3 4 (3:1) 4

1962-3, early Jan-early Apr, 2100'-3500', Mt Bailey, Rib. Fan (A), Gold. Sdle & Mt Sugar Lf. Traps G & W.

Encyrtid sp. 4 3 (2:1) 3

1962-3, early Dec-early Feb, 2300'-3100', Mt Bailey, Rib. Fan (B) & Mt Magog. Trap G.

Encyrtid sp. 5 3 (2:1) 3

1962, mid Nov, mid Feb & late Mar, 2300'-3500'/4500', Rib. Fan (B) & Mt Sugar Lf. Traps N & G.

Encyrtid sp. 6

3 (3:0) 3

1962, early Feb & late Mar, 2100'-3200', Walk. Fan,
Rib. Fan (A) & Mt Sugar Lf. Traps G & W.

Encyrtid sp. 7

5 (4:1) 4

1962-3, early Dec-early Feb, 2300'-3500', Rib. Fan (B),
Mt Magog & Mt Sugar Lf. Trap G.

Encyrtid sp. 8

12 (9:3) 9

1962-3, mid Nov-mid Jan & Mar, 1900'-3500'/4500', Rib.
Fan (A & B), Mt Sugar Lf & Mt Sugar Lf Fan. Traps N & G.

All specimens except one were swept from herbage.

E.W. Valentine (pers. comm.) indicates that this
species is a mealy bug parasite.

ELASMIDAE

Members of this family parasitise Diptera, Hemiptera,
and Lepidoptera (Cumber, 1959c). Hyperparasites are also
known.

Elasmus sp. 1

4 (1:3) 4

1962-3, early Nov & early Jan-late Feb, 1600'-2300',
Walk. Plot, Rib. Fan (A & B) & L. Pukaki. Traps G, W & N.

Elasmus sp. 2

3 (3:0) 3

1962, early Mar-early Apr, 2100', Walk. Plot. Trap G.

TRICHOGRAMMATIDAE

Members of this family are mainly egg parasites of
Lepidoptera, Hemiptera and Odonata (Cumber, 1959c) but they
are also known to parasitise thrips and leaf hoppers.

Trichogrammatid sp. 1

54 (47:7) 28

1962-3, early Oct-late Apr (8 reared, mid Jan), 2100'-
3500', all Cass sites except Mt Gog & Mt Sugar Lf Fan.
Traps G & W.

All but two specimens were recorded from grease
cylinders but the majority were taken from the low-set
cylinders. The species may therefore be relatively more
abundant than the records indicate. It may also have

strong site preferences as only two specimens were recorded from the low-set cylinder on Ribbonwood Fan below the road whereas considerable numbers were taken from Walker's Plot and Walker's Fan. This could however be a seasonal effect.

The eight reared specimens (five females and three males) emerged from unidentified host eggs found inside a rolled snow-tussock leaf.

Trichogrammatid sp. 2 5 (4:1) 2

1963, early Feb, 2300'-2600', Rib. Fan (B) & Mt Magog.
Trap G.

MYMARIDAE (Fairy flies)

Members of this family are egg parasites, Hemiptera apparently being the main hosts though Coleoptera and Lepidoptera are also parasitised (Cumber, 1959c).

Mymarid sp. 1 1 (1:0) 1

1962, mid Mar, 2300', Rib. Fan (A). Trap W.

Mymarid sp. 2 2 (1:0) 2

1962, early Sept & late Mar, 2100', Walk. Fan. Trap G.

Mymarid sp. 3 2 (1:1) 2

1962, late Dec & early Mar, 2100'-2300', Walk. Plot
& Rib. Fan (A). Trap G.

Mymarid sp. 4 2 (2:0) 2

1962, late Feb, 2100'-3500', Gold. Sdle & Mt Sugar
Lf. Traps W & G.

Mymarid sp. 5 2 (1:0) 2

1962, early Dec & late Apr, 2100'-3500', Walk. Plot
& Mt Sugar Lf. Trap G.

Mymarid sp. 6 1 (1:0) 1

1962, late Mar, 2100', Walk. Plot/Walk Fan. Trap G.

Mymarid sp. 7 1 (1:0) 1

1962, late Feb, 3500', Mt Sugar Lf. Trap G.

Mymarid sp. 8 1 (1:0) 1

1962, late Feb, 3500', Mt Sugar Lf. Trap G.

Mymarid sp. 9 2 (2:0) 2

1962, late Dec & mid Mar, Rib. Fan (A & B). Traps G & W.

Mymarid sp. 10 2. 1

1963, early Feb, 2300', Rib. Fan (A). Trap W.

Mymarid sp. 11 3 (2:0) 2

1962-3, early Feb & early Mar, 2300', Rib. Fan (A).
Trap W.

PROCTOTRUPOIDEA

Members of this superfamily are all parasitic, the great majority parasitising the eggs or larvae of other insects. The host list includes Orthoptera, Hemiptera, Coleoptera, Lepidoptera and Diptera.

PROCTOTRUPIDAE

Ashmead (1902) indicates that members of this family are parasitic on the larvae of Coleoptera.

Proctotrupes intrudens Smith 14 (8:6) 14

1961-3, late Nov-late Apr, 2100'-3100', Walk. Plot, Walk. Fan, Mt Bailey, Rib. Fan (A) & Mt Magog. Traps G & W.

Proctotrupes sp. 16 (13:3) 15

1961-3, late Nov-late Mar, 2100'-3500', Walk. Plot, Mt Bailey, Rib. Fan (A), Gold. Sdle, Mt Magog & Mt Sugar Lf. Traps G, W & N.

PLATYGASTERIDAE

Ashmead (1903) indicates that members of this family are parasitic in dipterous larvae, principally the Cecidomyiidae and Tipulidae. Gall and fungus-inhabiting flies are especially subject to platygasterid attack.

Platygasterid sp. 1 1. 1

1962, late Jan, 2100', Walk. Plot. Trap G.

Platygasterid sp. 2

30. 19

1962-3, late Sept-late Jan, 2100'-3500'/4500', Walk. Fan, Mt Bailey, Rib. Fan (A & B), Mt Sugar Lf & Starv. Gully. Traps G, N & W.

Most specimens were recorded from grease cylinders. It is possible that the species is attached to snow-tussock associations.

Platygasterid sp. 3

1. 1

1961, early Dec, 2800', L. Lynd. Trap G.

Platygasterid sp. 4

19 (4:15) 14

1961-3, late Nov-early Mar, 2100'-3500', Walk. Plot, Mt Bailey, Rib. Fan (B), Mt Magog, Mt Sugar Lf & L. Lynd. Trap G.

Platygasterid sp. 5

10 (7:1) 9

1961-3, early Dec-early Apr, 2100'-3500', Rib. Fan (B), Gold. Sdle, Mt Magog, Mt Sugar Lf & L. Lynd. Traps G & W.

All specimens except one were recorded from grease cylinders.

Platygasterid sp. 6

1 (0:1) 1

1962, late Dec, 3200', Mt Sugar Lf. Trap W.

This insect may possibly be the male of *Platygasterid* sp. 7.

Platygasterid sp. 7

1 (1:0) 1

1962, mid Feb, 3200', Mt Sugar Lf. Trap W.

This insect may possibly be the female of *Platygasterid* sp. 6.

Platygasterid sp. 8

1. 1

1963, mid Jan, 2300', Rib. Fan (A). Trap W.

Platygasterid sp. 9

7. 6

1961-3, late Nov-late Jan, 2300'-3000'/3500', Rib. Fan (B), Mt Magog, Mt Sugar Lf & L. Lynd. Traps G & N.

Platygasterid sp. 10

21. 17

1961-3, late Nov-early Feb, 2300'-3500', Mt Bailey, Rib. Fan (A & B), Gold. Sdle, Mt Magog, Mt Sugar Lf, Starv. Gully & L. Lynd. Traps W & G.

Platygasterid sp. 11 3 (3:0) 3

1962, late Nov, early Dec & mid Feb, 2100'-3100',
Mt Bailey, Rib. Fan (B) & Gold. Sdle. Traps G & W.

Platygasterid sp. 12 9. 9

1961-3, early Nov-late Dec & Feb, 2100'-3500', Mt
Bailey, Rib. Fan (A & B), Gold. Sdle & Mt Sugar Lf.
Traps G & W.

Platygasterid sp. 13 5 (3:1) 5

1961-2, late Sept & early Dec-late Feb, 2100'-3500',
Rib. Fan (A & B), Gold. Sdle, Mt Sugar Lf & Starv. Gully.
Traps G & W.

Platygasterid sp. 14 1 (1:0) 1

1962, late Mar, 3100', Mt Bailey. Trap G.

Platygasterid sp. 15 2 (1:0) 1

1963, early Jan, 3500', Mt Sugar Lf. Trap G.

CERAPHRONIDAE

Members of this family are parasitic on insects of
several orders but are probably most generally secondary
parasites of aphids or coccids through various braconid
and chalcid primaries (Imms, 1957). Most species are
therefore harmful.

Lygocerus niger ? How. 33 (27:3) 26

1961-3, late Nov-early Mar, 2100'-3100', Walk. Plot,
Walk. Fan, Mt Bailey, Rib. Fan (A & B), Mt Magog, Starv.
Gully & L. Lynd. Traps G & W.

This species is known to parasitise the aphid

Brevicoryne brassicae (L.).Lygocerus sp. 1 1 (1:0) 1

1962, early Dec, 2600', Mt Magog. Trap G.

Lygocerus sp. 2 1 (0:1) 1

1962, late Mar, 3000'/3500', Mt Sugar Lf. Trap N.

Lygocerus sp. 3 3 (1:2) 3

1962, Jan, 2100'-3500', Rib. Fan (A) & Mt Sugar Lf.
Trap W.

Ceraphronid sp. 1

15 (12:3) 11

1962-3, early Jan-late Mar, 2100'-3500', all Cass sites except Mt Gog & Mt Sugar Lf Fan. Traps G, W & N.

Nearly all specimens were recorded from grease cylinders.

Ceraphronid sp. 2

14 (9:3) 12

1961-3, late Nov-late Dec & early Feb-late Mar, 2100'-3000', Walk. Plot, Walk. Fan, Rib. Fan (A), Mt Magog & Starv. Gully. Traps G & W.

Ceraphronid sp. 3

4 (0:3) 4

1962, Feb & late Apr, 2300'-2600', Rib. Fan (A & B) & Mt Magog. Trap G.

Ceraphronid sp. 4

5 (2:3) 4

1962, late Dec-late Feb & late Apr, 2100'-2600', Walk. Plot, Rib. Fan (A) & Mt Magog. Trap G.

Ceraphronid sp. 5

4 (1:0) 4

1961-2, late Nov, early Dec & early Feb, 2300'-3000', Rib. Fan (A) & L. Lynd. Traps G & W.

This species was possibly more abundant in the Lake Lyndon area than in the Cass area.

Ceraphronid sp. 6

1. 1

1962, mid Feb, 2000'/2600', Mt Magog. Trap N.

This species is brachypterous.

Ceraphronid sp. 7

1 (1:0) 1

1962, mid Sept, 3000'/3500', Mt Sugar Lf. Trap N.

This species is brachypterous.

SCELIONIDAE

Ashmead (1903) states that all members of this family without exception are egg parasites of other insects. The Lepidoptera, Hemiptera, Orthoptera and Neuroptera are the orders most frequently attacked.

Scelionid sp. 1

12 (3:3) 10

1962-3, early Dec-late Mar (27 reared, early Jan-early Feb), 2100'-3500', Walk. Plot, Mt Bailey, Rib. Fan (A), Mt

Magog & Mt Sugar Lf. Trap G.

This species was twice reared from lepidopterous eggs, eight females and eight males emerging from eggs found on a snow-tussock leaf and 11 specimens, all females, emerging from eggs taken from the side of a pitfall trap. In both egg batches, further parasites were fully developed but failed to emerge. Apparently no eggs escaped parasitism.

Scelionid sp. 2 1. 1

1961, mid Dec, 2100', Gold. Sdle. Trap W.

Scelionid sp. 3 5. 5

1962-3, early Jan-early Apr, 2300'-3500', Mt Bailey, Rib. Fan (A) & Mt Sugar Lf. Traps G & P.

Scelionid sp. 4 5. 5

1962-3, late Jan-late Mar, 2100'-3100', Walk. Fan, Mt Bailey, Rib. Fan (B) & Mt Magog. Trap G.

Scelionid sp. 5 1. 1

1962, early Feb, 2300', Mt Gog. Trap Ld.

Scelionid sp. 6 4 (0:2) 3

1962-3, late Dec & early Feb, 2100'-2600', Rib. Fan (A), Gold. Sdle & Mt Magog. Trap G.

DIAPRIIDAE

Members of this family are mainly parasites of Diptera (Cumber, 1959c).

Diapriid sp. 1 2. 1

1962, early Dec, 3200', Mt Sugar Lf. Trap D.

This species is brachypterous.

Diapriid sp. 2 2 (1.1) 2

1962-3, early Jan & early May, 2300', Rib. Fan (A). Traps N & P.

Diapriid sp. 3 28 (25:3) 17

1961-3, late Nov-late Feb, 2100'-3500'/4500', Walk. Plot, Mt Bailey, Rib. Fan (A & B), Mt Sugar Lf., Mt Sugar Lf Fan, Starv. Gully & L. Lynd. Traps W, G & N.

Diapriid sp. 4

287 (98:152) 78

1961-3, early Oct-late Apr, 2100'-3500'/4500', all
Cass sites except Mt Sugar Lf Fan. Traps G, W, N, Ld & P.

Most specimens were caught by wind nets and grease
traps. Although wind nets were probably the most efficient
trapping method used, low-set grease cylinders also appeared
to be quite successful.

The species was widely distributed in the Cass area but
through its host or hosts may have been strongly associated
with improved sites. High numbers were recorded from
January to March.

Diapriid sp. 5

1 (1:0) 1

1962, mid Feb, 3500', Mt Sugar Lf. Trap G.

Diapriid sp. 6

1 (0:1) 1

1962, late Mar, 3500'/4500', Mt Sugar Lf. Trap N.

Diapriid sp. 7

13 (6:7) 10

1962-3, early Jan-early Apr, 3000'/3500'-3500', Mt
Sugar Lf. Traps G & N.

All specimens except one were recorded from the Mt
Sugar Loaf grease cylinder. The species' distribution
may be restricted to snow-tussock associations.

Diapriid sp. 8

3 (1:2) 3

1962-3, Jan, 2200'-3100', Mt Bailey & Rib. Fan (A & B).
Traps G & Ld.

Diapriid sp. 9

1 (1:0) 1

1962, early Dec, 3500'/4500', Mt Sugar Lf. Trap N.

Diapriid sp. 10

3 (1:1) 3

1962-3, Jan, 2100'-3100', Mt Bailey, Gold. Sdle & Mt
Magog. Traps G & W.

? Aberrant diapriid sp.

An apparently "aberrant" species having both diapriid
and belytid features is entered as "? Belytid sp.".

BELYTIDAE

Members of this family are mostly found at high altitudes. Ashmead (1902) states that they are supposed to be parasitic on dipterous larvae inhabiting fungi.

Belytid sp. 1 1 (0:1) 1

1962, early Mar, 2100', Walk. Fan. Trap G.

Belytid sp. 2 43 (28:14) 20

1961-3, early Nov-early Apr, 2100'-3500'/4500', Walk. Plot, Mt Bailey, Rib. Fan (A & B), Gold. Sdle, Mt Magog, Mt Sugar Lf, Starv. Gully & L. Lynd. Traps N, G & W.

The high numbers of this species swept on one occasion in early December may indicate peak numbers at that time of the year. The insect is probably most common on slopes and possibly most concentrated in snow-tussock associations.

Belytid sp. 3 4 (3:1) 4

1962-3, early Jan-late Feb, 2100'-2300', Rib. Fan (A) & Gold. Sdle. Trap W.

? Belytid sp. 1. 1

1962, ?Nov, 2300', Mt Gog. Trap Ld.

This species is apparently an "aberrant" form having both diapruid and belytid features. It is closer to the family Belytidae.

BETHYLOIDEA

BETHYLIDAE

The larvae of insects in this family are parasitic in the larvae of Lepidoptera, Diptera and Coleoptera.

Bethylid sp. 1 1. 1

1962, early Dec, 2600', Mt Magog. Trap G.

Bethylid sp. 2 20 (0:20) 17

1962-3, late Nov-late Feb, 2100'-3500', Walk. Plot, Walk. Fan, Rib. Fan (A & B), Mt Magog & Mt Sugar Lf. Traps G & N.

All specimens except one were caught by grease traps.

Bethylid sp. 3

50. 29

1962-3, late Jan-early Apr, 1900'-3100'/3800', Walk. Plot, Walk. Fan, Rib. Fan (A & B), Gold. Sdle & Cass. Traps G, N, W & Ld.

A large number of specimens were recorded from grease cylinders, most being from those which were set low. Since few of these were used, the species must be relatively more abundant than the records indicate. No peak in numbers was evident.

Bethylid sp. 4

11 (3:6) 10

1962-3, late Dec-late Feb, 2100'-3500', Walk. Fan, Mt Bailey, Rib. Fan (A), Mt Magog & Mt Sugar Lf. Traps G & W.

All specimens except one were recorded from grease cylinders. The species is possibly more abundant on slopes.

Bethylid sp. 5

1 (1:0) 1

1962, early Mar, 2100', Walk. Fan. Trap G.

Bethylid sp. 6

1 (1:0) 1

1962, late Jan, 2300', Rib. Fan (B). Trap G.

DRYINIDAE

The larvae of this family are parasites of Homoptera, chiefly leaf hoppers (Jassidae) and plant hoppers (Fulgoroidea). Because any parasitised homopteran is unable to produce eggs, dryinids can be of economic value.

Adult dryinids have only once been recorded in New Zealand though there are three records of dryinised leaf hoppers (Gourlay, 1954). In the present survey an adult was reared and two more dryinised homopterans recorded. The first was an adult of Deltocephalus sp. 4 (Jassidae) recorded in early February 1962 and the second a dryinised nymph of Delphacodes meridionalis Muir (Delphacidae) found in late March of the same year.

Dryinid sp.

1962, (1 reared, late Dec), 2300', Rib. Fan (B).

This species is undescribed. The single specimen emerged on 31 December 1962 from its own pupal case found in the base of a blue tussock.

FORMICOIDEA

FORMICIDAE (Ants)

Ants are highly beneficial in removing and destroying animal and vegetable debris, though some foster care on aphids and scales. All species are social insects with three castes. Their nests are made in the ground, under stones, rocks and other similar places.

In the present survey, little attention was paid to nests though these were often found when soil sampling. The records therefore relate chiefly to winged specimens caught in flight.

Amblyopone saundersi Forel

240 (10:224:6) 59

1962-3, late Jan-late Mar, 1900'-3500', all Cass sites except Mt Gog. Traps G, W, P, L/Ld, N & S.

Nearly all winged specimens were recorded from grease cylinders.

Brown (1958) states of this species, "It is found chiefly in forests, in the soil and soil cover, in rotten logs, under rocks, and so on. The colonies are usually quite small, consisting of 10-30 workers and females".

In the present survey, six workers were recorded, two from a soil sample from Ribbonwood Fan below the road and four from a pitfall on Mt Bailey. The presence of these in tussock grassland, together with the large number of male specimens recorded, may indicate a distinct and relatively strong association. It is possible that the male records represent dispersal flights from forest areas but an association with tussock grassland seems more likely.

The main flight period for the species commenced in mid-February and was very closely followed by the peak flights. Apart from a single straggler taken in late March 1962, the flight period was distinctly finished by mid-March.

It is interesting that only a single male of this species has previously been recorded (recorded by Cumber, 1959f).

Discothyrea antarctica Emery 1 (1:0:0) 1
1962, early Mar, 2300', Mt Gog. Trap Ld.

This species forms minute colonies in leaf litter, rotten wood and similar habitats. It is mainly found in wooded areas (Brown, 1958).

Huberia striata (Smith) 4 (1:2:1) 3
1961-2, mid & late Nov, 2100'-2100'/2300', Gold.Sdle & Mt Magog. Traps N & P.

Brown (1958) indicates that this species is very widely distributed in New Zealand. It nests in the soil, often under stones in cooler areas. In its nests which are very populous and without colony limits, it tends homopterans.

Monomorium antarcticum (White) 27308 (53:26573:40) 170
1961-3, late Dec-early May, 1900'-3500'/4500', L. Lynd., Sawdon Stn, Godley Pks & all Cass sites. Traps G, W, L/Ld, S, N, D, P & B.

Nearly all winged specimens were trapped by grease cylinders. Their greatest abundance was on Ribbonwood Fan (both above and below the road) and on Goldney Saddle. The Mt Magog records proved to be intermediate between these and the low levels found on Mt Bailey, Walker's Fan and Mt Sugar Loaf. The lowest incidence recorded for any site was on Walker's Plot.

Since the Mt Bailey and Mt Sugar Loaf catches were consistent throughout the flight period, their relatively

low numbers may be a reflection of altitude. However, this may not be the only explanation. Consideration should also be given to the possibility that as the ants fly higher, they may at the same time fly further above the ground. Many would therefore escape trapping at these altitudes.

The inception of the main flight period of this species proved to be very distinct. Grease-trapping supported the observation of Hudson (1950) that the winged male and female ants are ejected by the workers over very extended areas at the same time. In 1962, the "ejection" was between 17 and 19 February inclusive but probably occurred on 18 February. Prior to this, occasional males had been recorded since late December, but no females. Then, between the dates mentioned, grease cylinders on some sites and probably on all sites caught large numbers of the ant simultaneously. Winged females were present with the males but only in small numbers.

The initial peak in male numbers fell off sharply at first and from early April onwards only a few remained in flight. This tailing off probably reflects a "loitering" habit after the initial flight and up until death. A single male which was found in a nest in late August and had lost its wings may indicate that a few do not die but rather return to colonies. Although females were recorded from the flight inception until late March, the largest number were trapped in early March. Their relatively small numbers during the peak flight period of the males possibly reflects a "soaring" habit that eludes trapping. The subsequent increase in numbers suggests their return for searching out suitable places to colonise. In the newly formed colonies they could again be found but with their wings detached.

In 1963, it was probably unfavourable weather with high winds that hampered flight and disrupted the main

flight period. The numbers caught were far fewer than in 1962 and the flight inception less sharply defined though it may possibly have occurred several days earlier. An apparent peak in early March may have indicated a return to more favourable weather conditions.

Worker ants were readily recorded from nests discovered in soil sampling and small numbers were also recorded from pitfalls, damp sacks, herbage sweeping and Berlese funnel extractions.

Brown (1958) indicates that the species occurs throughout New Zealand and tolerates a wide variety of ecological situations. He states, "The ants are general feeders, preying on small insects, scavenging, and tending homopterans", but adds that feeding on plant tissues must also be suspected. Their abundance in tussock grasslands as indicated by the present survey must make them of some economic consequence but making an assessment is difficult. It is probable that they are largely beneficial.

Prolasius advena (Smith) 591 (7:178:46) 50

1961-3, late Jan-late Apr, 2100'-3100', Walk. Fan, Mt Bailey, Rib. Fan (A & B), Gold. Sdle, Mt Magog, Starv. Gully & L. Lynd. Traps G, S, L/Ld, D & P.

Nearly all specimens were recorded from grease cylinders but it is somewhat surprising that none was trapped by wind nets.

In 1962 the first alates appeared in late January. Records did not indicate any sudden mass flight as with Monomorium antarcticum (White) but there was a peak flight in late February. This was followed by low numbers until late April. Few winged females were recorded.

In 1963 there were few alates trapped, possibly reflecting unfavourable weather with high winds. The first records were not until early February and numbers remained too low to indicate a main flight period.

Brown (1958) states that the species is widespread in New Zealand and nests primarily in bush country. The survey indicates, however, that its association with tussock grasslands may be quite pronounced. Since workers were collected from Mt Bailey, Ribbonwood Fan above and below the road, Starvation Gully and Lake Lyndon, it is probable that the flights recorded on grease cylinders were largely or even solely from grassland populations rather than from those in forested areas. Not all grassland sites are necessarily acceptable to the species, some sites apparently being more preferable than others. This is evident by the species' greater concentration on Mt Bailey than on other sites and by the complete absence of records from Mt Sugar Loaf.

Of the species' habits, Brown (1958) states, "I should expect that the workers tend plant lice, including subterranean types, and that they are general predators and scavengers of small arthropods on the ground and in the foliage above the ground. The colonies are often populous".

VESPOIDEA (Wasps)

PSAMMOCHARIDAE (Sand-wasps, Spider-hunters)

Members of this family are active predators which search for spiders. They are of no economic importance in tussock grasslands.

Salix wakefieldi Kirby 1 (0:1) 1

1963, early Jan, 1900', Gold. Sdle.

The single specimen was found in clay below a rain-gauge. Hudson (1934) states that the species is "common and ferocious".

Salix marginatus Smith 1 (1:0) 1

1962, early Jan, 2400', Mt Sugar Lf.

The single specimen was taken from Celmisia.

Salix diligens Smith 1 (0:1) 1

1963, early Mar, 1900', Mt Sugar Lf Fan. Trap Ld.

Salix carbonarius ? Smith

11. 10

1962-3, early Dec-late Feb, 2100'-3500'/4500', Walk.
Plot, Mt Bailey, Rib. Fan (A), Mt Magog & Mt Sugar Lf.
Traps P, N, W & L/Ld.

It is possible that more than one species is included here.

VESPIDAE (Social wasps)

Members of this family live in nests, each with males, females and workers present.

Vespula germanica Fab.

This species, known as the European wasp, was once observed at the "Grasmere" station homestead. It is likely that occasional specimens do range over tussock grasslands in the Cass area but their capture would be difficult with the trapping procedures used in the survey.

UNCERTAIN FAMILY POSITION

Vespoid sp.

14 (0:14) 9

1962-3, late Nov-late Jan & early Mar, 2300'-3500', Mt Bailey, Rib. Fan (A), Mt Magog & Mt Sugar Lf. Traps G & W.

Though the family to which this wasp belongs has not yet been determined, it has certainly had no previous records in New Zealand. The species belongs to none of the families listed by Tillyard, 1926.

All specimens except one were recorded from grease cylinders. The species is possibly associated with higher slopes.

SPHEGOIDEA (Wasps)

TRYPOXYLIDAE

Pison spinolae Shuck

2. 2

1962-3, early Dec & late Jan, 1900', Cass.

Both specimens were found in a building but in all likelihood had entered from the surrounding grassland.

The species is a well known intruder of houses, blocking keyholes with clay nests or building behind bookshelves and similar places.

CRABRONIDAE

E.S. Gourlay (pers. comm.) indicates that members of the genus Rhopalum burrow holes in the ground and provender their nests with cockroaches.

- Rhopalum sp. nr R. carbonarium Smith 1 (1:0) 1
1962, early Jan, 3500'/4500', Mt Sugar Lf. Trap N.
- Rhopalum sp. nr R. cora Cam. 1 (0:1) 1
1962, mid Dec, 3800', Mt Bailey. Trap N.
- Rhopalum sp. 1 1 (1:0) 1
1962, early Dec, 3500'/4500', Mt Sugar Lf. Trap N.
- Rhopalum sp. 2 4 (0:3) 3
1962, early Dec-early Jan, 3500'-3500'/4500', Mt Sugar Lf. Traps G & N.

APOIDEA (Bees)

All except the parasitic groups of bees are of great economic value because of their pollination of plant blossoms.

COLLETIDAE

Members of this family burrow in the ground, especially in clayey soils. Because little attention was paid to these bees in the survey, the records are fragmentary.

- Paracolletes fulvescens (Smith) 10. 5
1961-3, early Dec & late Feb, 1900'-2300', Rib. Fan (A), Mt Gog & Mt Sugar Lf. Traps W & Ld.
- Paracolletes hirticeps (Smith) 13. 10
1961-3, late Dec-late Mar, 1900'-2200'/3500', Rib. Fan (A), Mt Gog, Mt Sugar Lf & Mt Sugar Lf Fan. Traps Ld, N & W.

Most specimens were recorded as daylight catches from light traps.

Hilgendorf (1918) recorded this species as common at Cass.

Paracolletes boltoni Ckll 3. 2

1962, early Jan, 2300', Rib. Fan (A) & Mt Gog.

Traps Ld & W.

Paracolletes maorium Ckll 1. 1

1963, early Jan, 2300', Rib. Fan (A). Trap W.

Paracolletes obscurus (Smith) 17. 12

1961-3, early Dec-early Feb, 1900'-2300', Fib. Fan (A), Gold. Sdle, Mt Gog & Mt Sugar Lf Fan. Traps Ld, W & N.

Most specimens were recorded as daylight catches in light traps. One was swept from flowering Hebe salicifolia (Forst. f.) on Mt Gog.

This species is common throughout New Zealand.

Paracolletes vestitus (Smith) 4. 4

1962-3, late Dec-mid Feb, 1900'-2300', Rib. Fan (A), Mt Gog & Mt Sugar Lf Fan. Traps Ld & W.

Paracolletes hudsoni ? Ckll. 1. 1

1961, late Dec, 2900', Mt Gog. Trap Ld.

HYLAEIDAE

Members of this family are flower-haunting. It is not certain if they have been representatively sampled in the survey or not.

Prosopis sp. 1 3. 3

1962, late Nov, late Dec & late Jan, 2300'-3100', Mt Bailey & Rib. Fan (A & B). Trap G.

Prosopis sp. 2 1. 1

1962, early Jan, 2900', Mt Gog. Trap Ld.

ANDRENIDAE

The members of this family are burrowing bees.

Halictus huttoni Cam. 167. 19

1962-3, early Jan-late Apr, 2300'-3100', Mt Bailey,

Rib. Fan (A & B) & Mt Gog. Traps G, Ld, N & W.

Nearly all specimens were recorded from grease traps but 130 were taken on one occasion (late January 1963) from the low-set cylinder on Ribbonwood Fan below the road. Because in the same period only four specimens were recorded from the high-set cylinder ten yards away, the large numbers may have been due to either swarming or the preferable trap height. No conclusive answer can be offered but whether the large numbers were a result of swarming or peak abundance, the species must certainly have been present in considerable numbers at that time of the year.

Halictus sp. 1 4. 4

1962-3, late Jan-early Mar, 2200'/3500'-3500', Mt Sugar Lf. Traps G & N.

One specimen was recorded from flowering Hebe.

Halictus sp. 2 40. 26

1961-3, late Sept-early May & May/July, 1600'-3500', Rib. Fan (A & B), Mt Gog, Mt Sugar Lf, Mt Sugar Lf Fan, Starv. Gully, L. Lynd. & Ohau Rvr. Traps G, Ld, W & N.

A single specimen was recorded from flowering Hebe.

This species may have been more abundant in the Starvation Gully and Lake Lyndon areas than in the Cass area.

APIDAE (Social bees, Honey bees, Bumble bees)

The bees in this family form large social colonies.

Bombus terrestris (L.) 31 (24:7) 12

1962, early Nov & early Jan-early Apr, 1900'-3200', Rib. Fan (A), Mt Gog, Mt Sugar Lf & Mt Sugar Lf Fan. Traps Ld & P.

All specimens except one were recorded as daylight catches from light traps. Though few specimens were collected, this species was often observed in tussock grassland.

Bombus ruderatus (Fab.) 1. 1

1962, mid Mar, 2100', Walk. Plot.

NEUROPTERA
(Lacewings)

Classification follows Tillyard (1926). This reference is also the source of general information not otherwise acknowledged.

Members of this order are almost entirely beneficial. Their larvae are active and predatory, most being terrestrial or arboreal though a few are aquatic or semi-aquatic.

It is difficult to know how well the order has been sampled in the survey.

MEGALOPTERA

SIALOIDEA

CORYDALIDAE (Dobson flies)

Archichauliodes diversus Walk. 1. 1

1961, late Nov, 3000', Starv. Gully. Trap N.

This species is abundant on all running rivers in New Zealand and its larva is fiercely carnivorous. It is of no consequence in tussock grasslands.

PLANIPENNIA

HEMEROBIOIDEA

HEMEROBIIDAE (Brown lacewings)

Members of this family are of great economic value in checking the spread of aphids, psyllids and scales. They feed ravenously on these, especially on aphids and psyllids.

Micromus tasmaniae (Walk.)

52 (23:17) 28

1961-3, late Nov-late Mar & early May, 2100'-3500'/
4500', Starv. Gully & all Cass sites except Rib. Fan (B) &
Mt Sugar Lf Fan. Traps W, G, L/Ld & N.

Most specimens were trapped by wind nets though a considerable number were recorded from grease cylinders. But whereas the latter trapping method collected mostly males, wind net collections largely consisted of females. This probably indicates differing behaviour in the two sexes.

The species apparently had a distinct association with Walker's Plot and therefore its hosts may well have been clover-feeding aphids. Because of such predation against aphids and also against scales, Tillyard (1926) states that it is the most useful and abundant lacewing in New Zealand.

DIPTERA
(Flies)

The Diptera have still to be studied. Their only reference in the present thesis concerns specimens recorded preying on or parasitising hosts from orders other than Diptera. The species concerned are:

Asilidae - Neoitamus varius (Walk.)

Tachinidae - Gracilicera monticola Mall.

Gracilicera politiventris Mall.

A large number of species was collected in the survey.

TRICHOPTERA
(Caddis-flies)

Classification follows Tillyard (1926). This reference is also the source of general information not otherwise acknowledged.

Caddis-fly larvae are aquatic and entirely beneficial, not only acting as good food for fish but also controlling the growth of water weeds. The adults are nearly all crepuscular or nocturnal and readily attracted to light.

In the survey, no direct attention was paid to the Trichoptera because of their aquatic associations. However, large numbers (and sometimes phenomenal numbers) of adults were caught in tussock grassland by the light traps. In the 1961-2 season most of these were kept, but in the following season nearly all were discarded. They are of no economic importance in tussock areas.

Those retained and identified have not been kept separate by individual dates but grouped as monthly collections. They relate only to the months October and January to April, though September might be legitimately included as a month of no catches. Most are records from the light traps on Mt Sugar Loaf Fan and Ribbonwood Fan. Whereas large catches were anticipated at the former trap which was only one-quarter of a mile from a slow-running stream (Swampy Creek), it is interesting that large catches were also obtained by the Ribbonwood Fan trap which was neither visible from nor close to any water. The nearest water was Lake Grasmere three-quarters of a mile away but running water was no closer than Cass River more than one and one-half miles away (Ribbonwood Creek three-quarters of a mile distant was often dry).

AEQUIPALPIA

RHYACOPHILOIDEA

RHYACOPHILIDAE

Hydrobiosis frater McL. 21 (11:10)

1962, Oct & Jan-Apr, 1900'-2200', Rib. Fan (A) &
Mt Sugar Lf Fan. Trap L.

Hydrobiosis umbripennis McL. 79 (76:2)

1962, Oct & Jan-Apr, 1900'-2200', Rib. Fan (A) & Mt
Sugar Lf Fan. Trap L.

A considerable number of the specimens caught were
taken in October.

This species is fairly common in New Zealand.

Hydrobiosis parumbripennis McF. 33 (22:10)

1962, Oct & Jan-Apr, 1900'-2300', Rib. Fan (A), Mt Gog
& Mt Sugar Lf Fan. Trap L.

Hydrobiosis clavigera McF. 57 (51:6)

1962, Oct & Feb-Apr, 1900'-2200', Rib. Fan (A) & Mt
Sugar Lf Fan. Trap L.

Most specimens were recorded in October.

This species is widely distributed in New Zealand
from sea level to a little over 2000' (Mosely & Kimmins,
1953).

Hydrobiosis harpidiosa McF. 37 (22:15)

1962, Oct, Mar & Apr, 1900'-2200', Rib. Fan (A) &
Mt Sugar Lf Fan. Trap L.

Most specimens were recorded in October.

This species is present in the Waimakariri River from
the foothills upwards (Mosely & Kimmins, 1953).

Psilochorema leptoharpax McF. 29 (14:15)

1962, Oct & Jan-Apr, 1900'-2200', Rib. Fan (A) &
Mt Sugar Lf Fan. Trap L.

This species is plentiful in the bed of the
Waimakariri River from sea level to 2500' (Mosely & Kimmins,
1953).

Psilochorema bidens McF. 2 (0:2)

1962, Jan & Mar, 2200', Rib. Fan (A). Trap L.

This species is found in slow-running streams (Mosely & Kimmins, 1953).

Psilochorema spp. 25 (25:0)

1962, Jan, 2200', Rib. Fan (A). Trap L.

Costachorema psaroptera McF.

One or two specimens of this caddis-fly were recorded but the records were lost.

The species is present in the upper Waimakariri River watershed. It is plentiful in fast, stony, cold streams in open tussock country 1000' to 2600' (Mosely & Kimmins, 1953). A.G. McFarlane (pers. comm.) indicates that the adult first appears in February.

Costachorema xanthoptera McF. 24 (16:8)

1962, Oct, Mar & Apr, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

Most specimens were recorded in October.

This species is known from both the North and South Islands (Mosely & Kimmins, 1953).

Neurochorema confusum (McL.) 2 (0:2)

1962, Feb, 1900', Mt Sugar Lf Fan. Trap L.

The adult is known from November until March but is commonest in midsummer (Mosely & Kimmins, 1953).

Synchorema zygoneura Till. 5 (3:2)

1962, Feb & Mar, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

Mosely & Kimmins (1953) state that this South Island species is rare.

Synchorema sp. 1 (0:1)

1962, Oct, 1900', Mt Sugar Lf Fan. Trap L.

A.G. McFarlane (pers. comm.) indicates that this specimen may possibly represent a new species.

POLYCENTROPIDAE

The larvae of this family live in either running or

stagnant water and are mostly carnivorous.

Plectrocnemia maclachlani Mos. 1 (0:1)

1962, Mar, 2200', Rib. Fan (A). Trap L.

HYDROPSYCHIDAE

The larvae from this family are carnivorous. The genus Hydropsyche is usually abundant near fast rivers.

Hydropsyche colonica McL. 1(0:1)

1962, Feb, 2300', Mt Gog. Trap L.

This species is the commonest caddis-fly in New Zealand. Mosely & Kimmins (1953) indicate that the adults appear in December and January.

Hydropsyche tepoka Mos. 2 (0:2)

1962, Feb & Mar, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

This species is known from Lake Tekapo (Mosely & Kimmins, 1953).

Hydropsyche catherinae McF. 2 (0:2)

1962, Feb, 1900', Mt Sugar Lf Fan. Trap L.

LEPTOCERIDAE (Long-horned caddises)

The larvae of this family are vegetarian.

Triplectides cephalotes (Walk.) 252 (248:4)

1962, Jan-Apr, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

Most of the recorded specimens were taken in February and may indicate a peak in flight at that period.

Oecetis unicolor (McL.) 158 (14:4)

1962, Jan-Mar, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

Most specimens were recorded in February and may indicate the peak flight period.

The larvae of this species live in lakes.

Oecetis sp. 1.

1962, Jan, 2200', Rib. Fan (A). Trap L.

A.G. McFarlane (pers. comm.) states that this is a new species.

Hudsonema amabilis (McL.)

13 (8:2)

1962, Jan, Mar & Apr, 2200', Rib. Fan (A). Trap L.

Mosely & Kimmins (1953) indicate that this species is very abundant with the adult flying from mid-November until the end of December.

HYDROPTILOIDEA

HYDROPTILIDAE (Micro-caddises)

The larvae of this family live on slime algae.

On some occasions during the survey, adults belonging to this family were caught in enormous numbers by light traps. These catches were not identified, however, apart from determining the presence of the two listed species. Therefore no counts are given.

Oxyethira albiceps (McL.)

1962, Oct, Jan & Mar, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

A.G. McFarlane (pers. comm.) indicates that adults of this species can be obtained throughout the entire year.

Paroxyethira hendersoni Mos.

1962, Oct & Jan-Mar, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

Mosely & Kimmins (1953) give only South Island records for this species. A.G. McFarlane (pers. comm.) indicates that adults can be obtained throughout the entire year.

INAEQUIPALPIA

SERICOSTOMATOIDEA

SERICOSTOMATIDAE

The larvae of this family are vegetarian and mostly live in running water.

Pycnocentria evecta McL. 106.

1962, Oct & Feb-Apr, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

Mosely & Kimmins (1953) indicate that this species is very common, the adults being taken from November until February.

Pycnocentria funerea McL. 17 (16:1)

1962, Jan & Feb, 1900', Mt Sugar Lf Fan. Trap L.

Mosely & Kimmins (1953) indicate that this species usually frequents the margins of streams in open country and is often fairly common. The adults are found from October until March.

Pycnocentrodes aurecla McL. 9 (3:3)

1962, Jan, Feb & Apr, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

Mosely & Kimmins (1953) record this species from both the North and South Islands. The adult occurs between November and March.

Pycnocentrodes aeris Wise 2.

1961, Dec, 1900', Mt Sugar Lf Fan. Trap L.

Olinga feredayi (McL.) 2 (0:2)

1962, Feb, 1900', Mt Sugar Lf Fan. Trap L.

This species is common throughout New Zealand. Mosely & Kimmins (1953) indicate that the adults are found from November until February.

Sericostomatid sp. 2 (2:0)

1962, Dec, 1900', Mt Sugar Lf Fan. Trap L.

LEPIDOPTERA

(Moths, Butterflies)

Classification follows Imms (1957) but with minor alterations. The source of general information not otherwise acknowledged is Hudson (1928 & 1939).

The insects in this order are generally harmful, many doing great damage. The larvae of nearly all species feed on vegetable matter and mostly on plant leaves though a considerable number bore into the stems and trunks of plants or tunnel in the ground amongst their roots (Tillyard, 1926.) In relation to their feeding on tussock leaves, Kelsey (1957) concluded after a period of 10 years' observations that they were the most damaging insect order.

From the present survey a total of 222 species is listed. This list probably represents the order fairly well for the Cass area but since light traps were the only means of sampling night-flying species, those not attracted to light will probably have been missed and the abundance of those which are poorly attracted to light will have been misrepresented. Day-flying forms were mostly swept from herbage and are probably well represented except for species frequenting the higher mountain slopes. Though none of these diurnal species were quantitatively sampled, the more abundant nocturnal species were regularly sampled throughout the entire trapping season. Hence it was possible to quantitatively analyse the light trap collections and several of the graphs which were constructed are included in the text. The method of analysis is outlined in Appendix 1.

Since most of the larvae which were collected have not yet been studied, the recorded observations are confined almost entirely to the adults. With one exception, the extending of this information has so far been possible only for those species whose larvae or pupae have been reared. Other information has still to be related to definite species but two records of particular interest are included here. The first is of a single larva diseased with an unidentified Cordyceps species. Cunningham (1921) indicates that the only New

Zealand records of Cordyceps in lepidopterous larvae are from the hepialid genus Porina (=Wiseana), but as the present larva does not belong to the family Hepialidae the record is of considerable interest. The second record relates to larvae which appear in large numbers on the developing seed heads of silver tussock. It is probable that these larvae not only chew the young awns but also the ovary and developing seed since they have been seen to burrow inside the awns. Because of their abundance they may be important in limiting the seed production of silver tussock. It is quite likely that they are the larvae of one of the more common species of moth.

The economic importance of many species is difficult to assess but where their distribution, abundance and food plants are known, soundly based estimations can be given.

MONOTRYZIA

HEPIALOIDEA

HEPIALIDAE

Wiseana cervinata (Walk.) 36 (5:28) 6

1962, early Oct-mid Nov, 1900'-3100', Mt Bailey, Rib. Fan (A) & Mt Sugar Lf Fan. Traps L & G.

This species is relatively more abundant than the records indicate. A very large catch of damaged moths taken from the Mt Sugar Loaf Fan light trap in late October 1962 contained specimens of Wiseana that were doubtlessly this species. Though unrecognisable, considerable numbers were present and probably represented the species' peak flight numbers for this season. This suggestion corresponds fairly closely with the peak flight period observed by Dick (1945) and with the pattern of other catches in the present survey.

Though the only light trap being operated during the flight period of this moth was the one on Mt Sugar Loaf Fan, the many pupal cases present on the slopes of Mt Bailey in mid-October indicated that the species would also have been readily trapped by the light trap on Ribbonwood Fan. It is therefore probable that the moth shows little discrimination between improved and unimproved tussock grasslands

(cf. Wiseana despecta (Walk.)) though its relative abundance in each has not been studied.

The species is generally distributed in New Zealand but is largely replaced by other species in the south of the South Island. Since the larvae feed on grasses, they may be of considerable economic importance.

Wiseana despecta (Walk.) 113 (97:16) 17

1962-3, mid Dec-mid Feb, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

It is very interesting to note for this species that whereas considerable numbers of specimens were trapped by the Ribbonwood Fan light trap, only occasional ones were taken by the Mt Sugar Loaf Fan light trap. This may indicate that the species is of little importance in unimproved tussock grasslands (cf. Wiseana cervinata (Walk.)) but shows a strong preference for the improved areas. In such areas it could possibly be of considerable economic importance.

The species occurs in both the North and South Islands.

Wiseana jocosa (Meyr.) 4 (1:3) 2

1962-3, early Jan & early Feb, 2100'-2200', Walk. Fan & Rib. Fan (A). Traps L & G.

This species generally frequents forest country and is probably of no economic significance.

Wiseana umbraculata (Guen.) 13 (2:11) 8

1962-3, late Nov-mid Jan, 1900'-2300', Rib. Fan (A), Mt Gog & Mt Sugar Lf Fan. Trap L.

Though this species is common and generally distributed throughout New Zealand, it is apparently of little significance in the Cass area.

Wiseana ascendens (Meyr.) 6 (3:0) 1

1962, mid Dec, 3000'-3500', Mt Sugar Loaf.

All specimens were found in the bases of snow tussocks, though three were dead when taken. The species probably has a restricted distribution and occurs only at higher altitudes. Its economic significance amongst snow tussock is uncertain.

Wiseana sp.

1 (0:1) 1

1962, mid Feb, 2200', Rib. Fan (A). Trap L.

This very small species is undescribed. A second specimen has been seen in the collection of the Canterbury Museum.

DITRYZIA

TINAEOLIDEA

Larval habits in this superfamily are variable but all adopt some mode of concealment - tunnelling, mining, spinning leaves together or constructing portable cases (Tillyard, 1926). The range of food includes a great variety of animal and vegetable products (Cumber, 1960).

GELECHIIDAE

The larvae of this family usually feed among spun leaves or shoots (Tillyard, 1926).

Megacraspedus calamogonus Meyr. 7. 2

1962, late Aug & mid Oct (10 reared, Jan/July), 2300'/3000'-4000', Mt Bailey & Mt Sugar Lf. Trap N.

This species is relatively much more abundant than the records indicate since the adults have very elusive habits. Only in mid-October were specimens ever swept (two individuals on one occasion) and the species was never caught by light traps. However, the larvae were found in great numbers on the developing seeds of snow tussock. They were not only observed eating the young awns but where a specimen was seen burrowing inside the awns, a close examination revealed the absence of the flower ovary. This was observed while the anthers were still showing and suggests that the species' main damage may be the destruction of floral organs. Since this destruction prevents the setting of seed, the moth's abundance may make it of primary importance as an insect pest in snow-tussock grasslands.

In the 1962-3 season, larvae were swept from seed heads in considerable numbers both in mid-December and in early January but by mid-January none could be found. The species' life cycle must therefore be closely adapted to its food plant though it is also flexible since larvae have been recorded in March and mid-winter feeding in the seed heads of Arundo conspicua Forst. In tussock grasslands the adult probably overwinters, five specimens being recorded in late August from the base of silver tussock on Mt Bailey.

Along with several larvae which were reared, a single parasite emerged. It was a male specimen of Ophionine sp. 12.

The moth occurs in both the North and South Islands, being commonly recorded from Arundo conspicua.

Gelechia schematica Meyr. 12. 8

1961-3, late Dec-mid Mar, 1900'-2500', Rib. Fan (A), Mt Sugar Lf Fan & Mt John. Trap L.

This species is widely distributed in the South Island but is probably of little economic importance.

Gelechia parapleura Meyr. 27. 9

1962-3, mid Dec-late Feb, 1900'-2500', Rib. Fan (A), Mt Sugar Lf Fan & Mt John. Trap L.

This species is known only from the South Island and is probably of no economic significance.

Gelechia monophragma Meyr. 9. 6

1962-3, mid Nov-early Jan, 1900'-2300', Rib. Fan (A), Mt Gog & Mt Sugar Lf Fan. Trap L.

This species is generally distributed throughout New Zealand but is probably rather uncommon and therefore of no economic significance.

Gelechia pumila Philp. 3. 1

1963, late Feb, 2500', Mt John. Trap L.

This species has been recorded only from the South Island. It is probably a local species and of no economic concern.

Gelechia lithodes Meyr. 26. 6

1962-3, mid Oct & mid Jan-mid Feb, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

This species was most abundant in mid- and late January. It has been recorded from both the North and South Islands and frequents stony situations, usually in riverbeds or on mountains. It is of no economic importance.

Anisoplaca ptyoptera Meyr. 7. 4

1962-3, late Jan-late Feb, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

This species is known only from the South Island and is of no economic concern.

Gelechiid sp. 1. 1

1962, mid Feb, 1900', Mt Sugar Lf Fan. Trap L.

This is probably an undescribed species.

COSMOPTERYGIDAE

? Bactrachedra tristica Meyr. 1. 1

1962, mid Jan, 2300', Rib. Fan (A). Trap W.

This species is apparently rare, only three specimens receiving mention by Hudson (1928, 1939).

OECOPHORIDAE

The larvae of this family have variable habits, spinning leaves together or constructing various forms of cases (Tillyard, 1926).

Endrosis lactella Schiff. 1. 1

1963, late Feb, 2200', Rib. Fan (A). Trap L.

This is an introduced and well known domestic species common in houses and gardens throughout New Zealand. Its larva feeds on seeds, dry refuse and pollard. Its record in tussock grasslands is therefore incidental but possibly explained by the finding of two further specimens in a building at Cass.

Borkhausenia terrena Philp. 1. 1

1961, early Dec, 1900', Cass. Trap L.

This species is of no economic importance.

Borkhausenia grata Philp. 3. 3

1963, early Jan & mid Feb, 1900'-2300', Rib. Fan (A)
& Mt Sugar Lf Fan. Traps L & N.

This species is of no economic concern.

Borkhausenia marcida Philp. 1. 1

1962, early Oct, 2800', Mt Sugar Lf. Trap N.

The single specimen was swept from Cassinia. It has been recorded only in the South Island and is of no economic importance.

Borkhausenia sp. nr B. armigerella (Walk.) 2. 1

1962, late Feb, 1900', Mt Sugar Lf Fan. Trap L.

This may possibly be an undescribed species. It is of no economic importance.

Borkhausenia sp(p). 12. 6

1961-3, mid Nov-late Jan (1 reared, mid Dec), 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

This grouping may possibly represent a species complex. The specimens are close to B. anaema (Meyr.) and B. horaea (Meyr.) and may even include both species. Neither are likely to be of economic importance though a pupa was found in the base of a hard tussock. It was taken from Mt Sugar Loaf Fan in early December 1962 and the adult emerged several days later.

Trachypepla conspicuella (Walk.) 1. 1

1963, late Jan, 1900', Mt Sugar Lf Fan. Trap L.

Members of the genus Trachypepla live in forests and are therefore of no consequence in tussock areas. The single specimen was probably attracted from beech forest. The species is known in both the North and South Islands.

Atomotricha ommatias Meyr. 4. 1

1962, late Feb, 2300', Mt Gog. Trap L.

This species has been recorded in the South Island but probably has a restricted distribution. It is probably of

no economic importance.

Atomotricha sordida (Butl.)

318 (260:58) 5

1962-3, early Mar-mid July & July/Nov (4 reared, early May), 1900'-2300', Walk. Plot, Walk. Fan, Mt Bailey, Rib. Fan (A), Mt Gog & Mt Sugar Lf Fan. Traps Ld & G.

Nearly all specimens were caught as "daylight" catches in the Mt Sugar Loaf Fan light trap, apparently being blown in by wind. In this way, 312 specimens were collected between mid-May and mid-July 1962. When the small cross-sectional area of the light trap baffles is considered, a catch of this size must indicate an extremely dense population. Since also the females are semi-apterous and cannot fly, the presence of 258 female specimens is quite remarkable. Not only must the species be abundant but it must be widely dispersed by wind for the females could not have entered the trap in any other way. Further evidence for wind dispersal was gained from a high-set grease cylinder left standing throughout the winter. It was not greased but some months later, 28 specimens (almost certainly this species) were found clustered in a trace of grease that remained around the wire pin. The species' abundance is also indicated by the presence of the larvae which were not uncommon under damp sacks.

The first adult specimens were caught on grease cylinders in March 1962 but until mid-May specimens were incidental. Large numbers appeared sometime between mid-May and mid-July but were probably most common in June. Only a few remained alive in the Mt Sugar Loaf Fan light trap in mid-July (no KCN was present) and few were taken after this date. Four specimens reared in the laboratory from larvae emerged 7 May 1962, one individual having pupated on 19 March 1962. Hence, though the adults appear in winter, it is probably the next generation larvae which survive the severest weather. Under damp sacks these larvae lived in silken galleries tunnelled through the soil but their natural habitat may be the bases of tussocks. It is likely that they were

the larvae often seen in the bases of silver tussocks, as many as 10 or 12 individuals being estimated in the base of a large individual plant.

The species is known only from the South Island but the survey indicates that it is much more abundant than earlier records suggest. Its economic importance is difficult to estimate.

Oxythecta austrina (Meyr.) 1. 1

1962, mid Nov, 2100', Walk. Fan.

This species is known from both the North and South Islands but is of no economic concern.

Proteodes carnifex (Butl.) 6. 5

1962-3, early Feb-late Mar, 1900'-2300', Rib. Fan (A & B), Mt Gog & Mt Sugar Lf Fan. Traps L & G.

The larva of this species feeds on the beech Nothofagus solandri (Hook. f.) Oerst., webbing among the leaves. It is therefore of no consequence in tussock areas.

Cryptolechia apocrypta (Meyr.) 1. 1

1962, mid Jan, 1900', Mt Sugar Lf Fan. Trap L.

This species has been recorded from the South Island and is very common among forest. It is of no concern in tussock areas.

Oecophorid sp. 1. 1

1962, early May, 2100', Walk. Plot. Trap G.

ELACHISTIDAE

The larvae in this family are usually leaf miners or else live in seeds or stems (Tillyard, 1926). All known species of the genus Elachista mine in the leaves of grasses or sedges (Meyrick, 1888).

In the survey these tiny moths may not have been representatively sampled.

Elachista ombrodoca Meyr. 8. 5

1961-3, early Oct-late Nov & mid Jan, 2100'-2800'/3100', Walk. Fan, Mt Bailey, Mt Gog & L. Lynd. Traps N, B & L.

This species is known only from the South Island but in open grassy places it is often very common. Whether or not it is associated with tussock is unknown. Hence its economic importance cannot be gauged though at the most it is probably slight.

Elachista helonoma Meyr. 21. 12

1962-3, early Jan-mid Apr (1 reared, late Mar), 1900'-3500'/4500', Walk. Fan, Mt Bailey, Rib. Fan (A & B), Mt Sugar Lf & Mt Sugar Lf Fan. Traps N, W & L.

Most specimens were swept, the species being recorded from both hard tussock and snow tussock sites. It is probably quite common to both. A single specimen was recorded from the base of a hard tussock and in mid-March 1962 two pupae were found in the base of the same tussock species. Hence the survey findings support the statement of Hudson (1928) that the species is "abundant amongst tussock grass to which it appears attached." Its economic significance is uncertain.

Elachista gerasmia Meyr. 1. 1

1963, late Mar, 2200', Rib. Fan (A). Trap L.

This species has been recorded from both the North and South Islands and is known to be common in swampy places. It may therefore be attached to sedges and of no consequence in tussock grasslands.

Elachista ochroleuca ? Meyr. 1. 1

1962, late Mar, 2200'/3500', Mt Sugar Lf. Trap N.

This species is known only from the South Island. Hudson (1928) states that it is "found amongst tussock grass." It is probably of little economic significance.

Elachista sp. 1. 1

1962, mid Sept, 1900', Cass.

The single specimen recorded was very active on the surface of melting snow.

Elachista ? sp. 1. 1

1963, late Jan, 2300', Rib. Fan (A). Trap W.

COLEOPHORIDAE

The larvae of this family are usually miners during their earliest stages, afterwards constructing and inhabiting portable cases which they attach to a leaf or seed-vessel (Imms, 1957).

The species recorded from the survey are the well known clover case-bearer moths.

Coleophora spissicornis Haw. 6. 4

1963, early & mid Jan, 1900'-2300', Rib. Fan (A) & Mt Sugar Lf Fan. Traps L & W.

The food plants of this species include white clover (Trifolium repens L.) and red clover (T. pratense L.) (Cumber, 1960). Though the species was doubtlessly more abundant on the oversown sites than on the unimproved sites in the Cass area, the few specimens caught indicate that its presence was only incidental.

The species probably occurs throughout New Zealand (Dumbleton, 1952).

Coleophora alcyonipennella Kollar 276. 27

1962-3, mid Nov-mid Mar, 1900'-2300'/3100', Walk. Plot, Mt Bailey, Rib. Fan (A), Mt Gog, Mt Sugar Lf Fan & Sawdon Stn. Traps L, W, N & G.

Most specimens were caught by light traps. Though a considerable number were recorded from Mt Sugar Loaf Fan, the species was largely concentrated on the improved Ribbonwood Fan site where white clover (Trifolium repens L.) and red clover (T. pratense L.) had been oversown. In 1963 both the light trap on this site and general observations indicated two peak flight periods, one in mid-January and another in mid- and late February. These probably reflect the second and partial third generations indicated by Dumbleton (1963). Since the peak in mid-January corresponds closely with the appearance of the second generation on the Canterbury Plains, the appearance of the first generation in the high country may also be closely synchronised. It could therefore be expected in late November or early December.

The species is probably of little economic importance in clover areas that are grazed but would doubtlessly establish wherever clover was used in the improvement of tussock grasslands.

GRACILARIIDAE

The larvae of this family are leaf miners (Tillyard, 1926.)

Gracilaria linearis Butl. 15. 2

1962-3, early Oct & mid Feb, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

Nearly all specimens were trapped by the Mt Sugar Loaf Fan light trap in early October. Since the species frequents forests, those which were caught probably came from Nothofagus bush one-quarter of a mile away. The insect is of no consequence in tussock areas.

Gracilaria elaeas Meyr. 7 (1:6) 2

1962, early Oct & late Feb, 1900', Mt Sugar Lf Fan. Trap L.

The larva of this species feeds between the spun leaves or shoots of Tutu (Coriaria.) It is therefore of no consequence in tussock grasslands.

PLUTELLIDAE

The larvae of this family feed on leaves (Tillyard, 1926.)

Plutella sera Meyr. 1. 1

1962, late Feb, 1900', Mt Sugar Lf Fan. Trap L.

This species is of no economic importance.

Plutella psammochroa Meyr. 40.11

1962-3, mid July/late Aug & early Oct-mid Feb, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

This species is probably most abundant in early Spring though considerable numbers are still present in November. It may possibly have been more abundant on Ribbonwood Fan.

It is known from both the North and South Islands and

frequents open country. It is probably of no economic concern.

Plutella maculipennis Curt.

1962, (1 reared, mid Dec), 2000', Mt Sugar Lf Fan.

This species is the well known diamond-back moth.

The single specimen was reared from a pupa found in the base of a hard tussock on Mt Sugar Loaf Fan. Since the larva feeds on Cruciferae, the species is incidental in tussock areas.

GLYPHIPTERYGIDAE

The members of this family may not have been representatively sampled in the survey.

The larvae of the genus Glyphipteryx feed on pith inside the stems of rushes and sedges (Tillyard, 1926.)

Simaethis microlitha Meyr. 2. 2

1962-3, early & mid Feb, 2300'-2300'/3500', Rib. Fan (A) & Mt Sugar Lf. Traps N & W.

This species is known from both the North and South Islands and is stated by Hudson (1928) to frequent hebes and rank herbage on the mountain sides. It is of no economic concern.

Glyphipteryx cionophora (Meyr.) 7 (1:3) 6

1962-3, early Feb-mid Mar, 1900'-2300'/3500', Mt Bailey, Mt Magog, Mt Gog, Mt Sugar Lf & Mt Sugar Lf Fan. Trap N.

This species is known from both the North and South Islands and frequents open grassy country. Its economic importance is not known.

Glyphipteryx oxymachaera (Meyr.) 15. 11

1961-3, late Nov-late Feb, 1900'-3500'/4500', Mt Magog, Mt Gog, Mt Sugar Lf, Mt Sugar Lf Fan & L. Lynd. Traps N & L.

Nearly all specimens were swept. The species is generally distributed throughout New Zealand and frequents dry grassy places where it can be fairly common. Its economic importance is not known.

Glyphipteryx iocheaera Meyr. 1. 1

1962, late Dec, 2200', Mt Gog. Trap N.

The single specimen was taken from flowering Hebe. Since the larva of this species lives in the stems of the rush Juncus, the insect is of no consequence in tussock areas.

Glyphipteryx acrothecta Meyr. 51. 28

1962-3, mid Dec-late Mar, 1900'-2300'/3500', all Cass sites except Walk. Plot. Traps N & L.

Nearly all specimens were swept. Though not sexed, male specimens were predominant. This moth is known only from the South Island and may be a very local species. It frequents open grassy hillsides but its economic importance is uncertain.

Glyphipteryx triselena Meyr. 1. 1

1962, mid Feb, 2100', Gold. Sdle. Trap N.

This species is known only from the South Island and is very local. It is found in open grassy places but is of no economic importance.

Glyphipteryx barbata Philp 6. 2

1962, mid Nov & early Dec, 2200'/3500', Mt Sugar Lf. Trap N.

This species is known only from the South Island and is very local. It is attached to tussocks but is of no economic importance.

TINAEIDAE

The larvae in this family have variable habits, often living in portable cases and feeding on leaves, lichens and dried vegetable refuse (Tillyard, 1926) They may also feed on dead wood.

Archyala terranea (Butl.) 1. 1

1963, late Jan, 2200', Rib. Fan (A). Trap L.

The larva of this species feeds in moss on rocks and is therefore of no economic importance.

Monopis ethelella (Newm.) 13.11

1962-3, mid Jan-late Mar, 1900'-3200', Rib. Fan (A) Mt Sugar Lf & Mt Sugar Lf Fan. Traps L, W & P.

Nearly all specimens were trapped by light traps. The larva of this species feeds on soiled wool and is often found among the wool adhering to the bones of dead sheep in the last stages of decomposition. The insect appears to be common and generally distributed throughout the country but is of no economic importance, though beneficial.

UNCERTAIN FAMILY POSITION

<u>Tinaeoid sp. 1</u>	1. 1
1962, mid Jan, 2300', Rib. Fan (A).	Trap W.
<u>Tinaeoid sp. 2</u>	2. 2
1962, mid Jan & late Feb, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan.	Trap L.
<u>Tinaeoid sp. 3</u>	3. 2
1962-3, late Dec & early Jan, 2300', Mt Gog.	Trap L.

PSYCHOIDEA

PSYCHIDAE (Case moths, Bag moths)

The larvae of this family construct cases or bags of strong silk and either twigs or leaves. The adult females are apterous (Tillyard, 1926.)

<u>Oeceticus omnivorus</u> (Fereday)	1. 1
1962, mid Feb, 2300', Mt Gog.	

A single case was taken from Olearia virgata Hook. f. The moth is of no consequence in tussock areas.

TORTRICOIDEA

Many species in this superfamily are injurious to the leaves and stems of dicotyledonous plants (Cumber, 1960.) The larvae live concealed in the rolled or joined leaves or in the stems. Since their food plants are dicotyledonous, they are of no economic importance in unimproved tussock grasslands.

TORTRICIDAE (Leaf rollers)

The larvae in this family are leaf rollers (Tillyard, 1926.)

Capua semiferana (Walk.) 624. 39

1961-3, mid Nov-mid Apr, 1900'-2500', Rib. Fan (A),
Mt Gog, Mt Sugar Lf Fan & Mt John. Traps L, W, N & Ld.

Most specimens were caught by light trap, the majority being recorded from Ribbonwood Fan above the road. The distinct abundance on that site may indicate the species' preference for improved grasslands though it is generally found in any open grassy areas. A graph of its seasonal abundance indicates high numbers in February and March, probably with a peak in late February. It is likely that this peak represents a second generation, but since the Ribbonwood Fan light trap was not operated during spring, nothing is known of a first generation.

From mid-February until late March a distinct form of this species appeared, a total of 22 specimens being taken during the two collecting seasons. It has a characteristic wing pattern, no specimens being found with patterns intermediate between it and the common (though variable) form. It was recorded from both Mt Sugar Loaf Fan and Ribbonwood Fan above the road and most specimens were taken late in the season.

The species is apparently common and generally distributed throughout New Zealand. Its economic significance is not certain but it may be of some consequence in improved tussock areas.

Eurythecta leucothrinca Meyr. 1. 1

1962, mid May, 2300', Rib. Fan (B).

Only two specimens of this rare species have ever been recorded. Both have been taken in the South Island.

Tortrix pictoriana Feld. 13. 7

1962-3, late Feb, late Mar & early Apr, 1900'-2500',
Rib. Fan (A), Mt Sugar Lf Fan & Mt John. Traps L & W.

Nearly all specimens were caught by light traps, the single record in February being from Mt John. The species is

usually found in beech forests.

Tortrix leucaniana (Walk.) 31.11

1962-3, Jan & mid Mar-early Apr, 1900'-2300', Walk. Plot, Walk. Fan, Rib. Fan (A), Mt Gog & Mt Sugar Lf Fan. Traps L, G & N.

In the 1961-2 season all specimens were recorded in March and April while in the following season considerable numbers were recorded in January with an apparent concentration late in the month. This concentration corresponds with the peak numbers recorded in January by Cumber (1951). Whereas all of the survey specimens taken in January 1963 were caught by light traps, most of the previous season's records were from grease cylinders in Walker's Plot.

The species is generally distributed throughout New Zealand and frequents grassy places where it is often common.

Tortrix demiana Meyr. 41. 1

1963, late Feb, 2500', Mt John. Trap L.

Only two specimens of this species have ever been recorded, both being from the South Island. Hudson (1928) states, "It seems to be a very rare and local species." He is probably correct in stating it to be local but the collection from Mt John does not indicate that it is rare.

Tortrix conditana Walk. 1. 1

1963, late Mar, 1900', Mt Sugar Lf Fan. Trap L.

This species is known from both the North and South Islands. It usually frequents gardens and other cultivated places.

Gelophaula siraea (Meyr.) 10 (1:9) 4

1962, mid Nov & early Dec, 2200'/3500'-3500'/4500', Mt Sugar Lf. Trap N.

In mid-November 1962 quite a few male specimens of this moth were seen flying over snow tussock and in early December it was rather abundant, but by mid-December none could be found. The single female specimen recorded was taken from the base of a snow tussock. The species typically frequents open grassy slopes high up on the mountains and the female

is characteristically secretive in her habits.

Epichorista hemionana (Meyr.) 3. 2

1962-3, late Mar, 1900', Mt Sugar Lf Fan. Trap L.

This species is known only from the South Island and is apparently very local.

Epichorista aspistana (Meyr.) 1. 1

1963, late Feb, 2200', Rib. Fan (A). Trap L.

This species has been recorded only from the South Island. It frequents damp grassy places but seems to be very local.

Harmoloba oblongana (Walk.) 27 (2:6) 14

1961-3, late Nov-late Apr, 1900'-2600', Rib. Fan (A), Mt Magog, Mt Gog & Mt Sugar Lf Fan. Traps L & G.

Specimens recorded as this species may have possibly included specimens of Harmoloba sisyrana ? Meyr. but only a few determinations are likely to have been wrong.

Nearly all specimens were caught by light traps. The species is known from both the North and South Islands, the larva feeding on matagouri (Discaria toumatou Raoul).

Harmoloba sisyrana ? Meyr. 5 (0:4) 5

1961 & 3, early Dec-late Feb, 1900'-2600'/3500', Rib. Fan (A), Mt Magog, Mt Sugar Lf & Mt Sugar Lf Fan. Traps L & G.

It is possible that a few specimens of this species have been confused with Harmoloba oblongana.

The larva of the species is known to feed on Cassinia leptophylla (Forst. f.) Br. but since C. fulvida Hook. f. is the only Cassinia species in the Cass area, the insect may also feed on it. The species has been recorded from both the North and South Islands.

Acroclita discariana Philp. 3. 2

1962, late Oct & mid Nov, 2000'-2200', Rib. Fan (A) & Mt Magog. Trap L.

Two specimens were taken from the larval food plant, matagouri (Discaria toumatou Raoul). The species has been recorded only from the South Island.

Tortricid sp.

4. 2

1962-3, late Jan & mid Feb, 2200'/3500', Mt Sugar Lf.

Trap N.

This species is near both Cnephasia ochnosema Meyr. and Epichorista mimica Philp.

CARPOSINOIDEA

CARPOSINIDAE

The larvae of this family mostly feed on fruit but sometimes in galls, bark, shoots or inside leaves (Tillyard, 1926.)

Carposina canescens Philp.

4. 3

1962, late Nov, late Feb & late Mar, 1900', Mt Sugar Lf

Fan. Trap L.

This species has been recorded only from the South Island. It is of no economic importance.

PYRALIDOIDEA

The larvae of this superfamily are of very variable habits, mostly living concealed in leaves, making cases, burrowing in stems or twigs or feeding in lichens. A number feed on dried animal or vegetable refuse while a few are aquatic (Tillyard, 1926.)

CRAMBIDAE

Tillyard (1926) states that most New Zealand species in this family are attached to native grasses. His term "native grasses" apparently includes tussocks.

The genus Crambus is very well represented in tussock areas and in the survey was extensively sampled. Although some species of these "tussock moths" are extremely abundant, surprisingly little is known about their biology. From the survey, one significant feature relating to this may have been established, namely, the larval habits probably fall

into two distinct categories. The evidence for this is indirect but strong: the records of reared specimens indicate that there are two types of pupal cocoon, one being found generally in the bases of tussocks and the other below the surface of soil. Since all but one of the successfully reared pupae were taken from the bases of tussocks, the emergence of some species and not of others provided additional evidence for there being two categories. Hence, although C. vittellus Dbld., C. cyclopicus Meyr., C. flexuosellus Dbld. and C. vulgaris Butl. were all abundant in the Cass area, none were reared from pupae found in the bases of tussocks whereas six specimens of the less abundant C. apselias Meyr. successfully emerged. It would therefore appear likely that the first four species may pupate in the soil and this was in fact proven for the extremely abundant species, C. vittellus.

A comparison of pupal cocoons in the two categories is strongly suggestive of two types of larval habit. The cocoons of C. apselias (as also of C. callirrhous Meyr.) are constructed of large quantities of chewed tussock foliage and by both their construction and location indicate that the larvae probably live amongst the foliage in the bases of tussocks. In contrast, the cocoons of C. vittellus are constructed inside larval tunnels in the soil and are apparently made of silk impregnated with a little extraneous material taken from above the soil surface. Both their construction and location indicate that the larvae tunnel in the soil and this was in fact observed for C. vittellus and is recorded for C. flexuosellus by Cumber & Eyles (1961).

It is anticipated that the species list for each of these two categories could be expanded considerably but the present list is as follows:

(i) Pupae constructed in the bases of tussocks -

C. apselias Meyr.

C. callirrhous Meyr.

(ii) Pupae constructed in the soil -

C. vittellus Dbld.

C. flexuosellus Dbld.

It is considered likely that more species pupate in the soil than in vegetation.

Two pupae which were recorded from the bases of tussocks during the survey were found to be parasitised. From the first a single specimen of Ichneumonine sp. 10 (Ichneumonidae) emerged on 12 January 1963, and from the second a single specimen of the tachinid fly Gracilicera politiventris Mall. emerged in mid-March 1963. Because the pupae were taken from the bases of tussocks, the hosts must have both belonged to the Crambus apselias group of species.

Orocrambus mylites Meyr.

6. 2

1962, late Nov & early Dec, 2000'/2300'-3500'/4500', Mt Gog & Mt Sugar Lf. Trap N.

This species is found only in the South Island and is extremely abundant where found. It usually frequents swampy hollows on the mountain sides where blue tussock is present. The larva probably feeds on this but its economic significance is uncertain.

Crambus corruptus (Butl.)

3. 2

1962, mid Nov, 1600', Ohau Rvr & L. Pukaki. Trap N.

This species is known only from the South Island. It is probably of no economic importance.

Crambus antimorus Meyr.

1. 1

1962, mid Nov, 2200', Sawdon Stn. Trap N.

This species is known only from the South Island. It is probably of no economic importance.

Crambus aethonellus Meyr.

2. 2

1962, early & mid Dec, 3200'/3500'-3500'/4500', Mt Sugar Lf. Trap N.

This species is known only from the South Island. It is probably of no economic importance.

Crambus apselias Meyr.

328. 41

1961-3, mid Nov-late Mar (6 reared, Dec & Jan), 1600'-3100', Mt Bailey, Rib. Fan (A), Mt Magog, Mt Gog, Mt Sugar Lf Fan, Sawdon Stn, L. Pukaki & Mt John. Traps L & N.

Nearly all specimens were caught by light traps, the collections from Ribbonwood Fan and Mt Sugar Loaf Fan indicating a similar incidence of the species on both improved and unimproved sites. The moth was apparently most abundant in late January and February.

The larva almost certainly feeds on tussock leaves for the pupal cocoons are largely constructed of tussock foliage. They were readily found in the bases of hard and silver tussocks, six being successfully reared. It was possibly a specimen of this moth (though more likely of Crambus simplex (Butl.)) that was found on 17 January 1963 being preyed on by a male specimen of the asilid fly Neocitamus varius (Walk.). The pair were taken at 2000' from Mt Gog.

The species is known only from the South Island. Its economic importance is uncertain but it probably does some damage in low-tussock grasslands.

Crambus ramosellus Dbld.

6. 5

1962-3, mid Feb-late Mar, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

Although this species is now incidental in the Cass area, it was quite abundant when recorded by Hilgendorf (1918). Hence it has declined in numbers over the last 50 years.

The species is generally distributed throughout New Zealand and is usually very common in open grassy places.

Crambus corylanus Clarke

1. 1

1963, early Jan, 3000', Mt Sugar Lf. Trap N.

This species is known only from the South Island but is uncommon. It is of no economic significance.

Crambus dicrenellus Meyr.

14. 3

1962-3, mid Dec-early Jan, 1900'-2300', Mt Gog & Mt Sugar Lf Fan. Trap L.

Nearly all specimens were recorded from Mt Gog.

The species is rather local and known only from the South Island. It is probably of no economic importance.

Crambus enchophorus Meyr. 34.15

1962-3, mid Jan-early Apr, 1900'-2800'/3500', Rib. Fan (A), Mt Gog, Mt Sugar Lf & Mt Sugar Lf Fan. Traps L & N.

It is possible that an occasional specimen recorded here was in fact Crambus callirrhous Meyr. but any errors would make no difference to the apparent abundance of C. enchophorus in the Cass area.

All specimens except one were caught by light traps. The species is known only from the South Island but is not by any means common or generally distributed. It is probably of no economic importance.

Crambus callirrhous Meyr. 4. 2

1963, late Feb (1 reared, early Mar), 1900'-2500', Mt Sugar Lf Fan, Mt John & L. Alexandrina. Trap L.

It is possible that an occasional specimen of this species was recorded as Crambus enchophorus Meyr. but any wrong identifications would not alter its status as an incidental species in the Cass area. It was probably more abundant in the vicinity of Lake Tekapo.

A specimen reared from a pupa found in the base of a hard tussock at Lake Alexandrina emerged 4 March 1963. Since the pupal cocoon was largely constructed of tussock foliage, the larva almost certainly feeds on tussock leaves.

The species is known only from the South Island but is probably of no economic concern.

Crambus simplex (Butl.) 539. 17

1961-3, early Nov-late Feb, 1600'-2500', Rib. Fan (A), Mt Gog, Mt Sugar Lf Fan, L. Pukaki, Ohau Downs Stn, Sawdon Stn & Mt John. Traps L & N.

Nearly all specimens were caught by light traps, the majority being recorded from Mt John. In contrast to the species' abundance in the Mackenzie Country, only 74 specimens were collected in the Cass area. This indicates

that the species is little more than incidental, but in his 1939 survey, Dick (1940) recorded it at Cass as frequent. Hilgendorf (1918) also listed the species at Cass as quite common. Hence the present survey indicates that the species' abundance has markedly declined over the last 25 years if not over the last 50 years. Its place has probably been usurped by Crambus vittellus Dbld.

During the survey, an adult specimen (probably Crambus simplex) was found being preyed on by a male of the asilid fly Neoitamus varius (Walk.). The predator's stylet was inserted through the moth's thoracic dorsum. The pair were found at 2000' on Mt Gog on 17 January 1963.

The species is common and generally distributed throughout the South Island though also known from the North Island. It usually frequents tussock areas, the larva feeding on silver tussock. In the Cass area it is now of no economic significance.

Crambus lectus Philp.

4. 3

1961-2, early & mid Dec & mid Feb?, 1900', Mt Sugar Lf Fan. Trap L.

This species is known only from the South Island. It is probably of no economic significance.

Crambus paraxenus Meyr.

31. 1

1963, late Feb, 2500', Mt John. Trap L.

It is probable that more than 31 specimens (possibly up to 100) were recorded from Mt John but the count was lost. It is a local species frequenting dry areas. Its economic significance is probably slight.

Crambus obstructus Meyr.

331. 22

1962-3, mid Jan-late Feb, 1600'-2200', Rib. Fan (A & B), Gold. Sdle, Mt Gog, Mt Sugar Lf Fan & L. Pukaki. Traps L & N.

Nearly all specimens were caught by light traps. Graphs of the species' seasonal abundance indicate that the main flight period is in February with the greatest numbers present in mid- and late February.

The species is known only from the South Island and

frequents open tussock country. Its economic significance is uncertain.

Crambus vittellus Dbld. 12525. 61

1961-3, late Nov-late Mar (1 reared, Dec/Mar), 1600'-2300', Walk. Fan, Rib. Fan (A & B), Gold. Sdle, Mt Gog, Mt Sugar Lf Fan, Ohau Downs Stn, L. Pukaki & Mt John. Traps L, N, & W.

Nearly all specimens were caught by light traps, the collections indicating a considerably greater abundance on Ribbonwood Fan than on Mt Sugar Loaf Fan (Fig. 8). Although the species was common generally, this concentration may reflect a liking for the conditions in improved grasslands. The graph of seasonal abundance indicates high numbers in January and February with a peak level in late February but a sharp decline in March.

It is interesting that whereas this species is by far the most abundant crambid in the Cass area, it has not been so for long. From his 1939 survey, Dick (1940) termed the species to be "abundant" at Cass (rather than "very abundant") but not long before, Hilgendorf (1918) had not even mentioned the moth as present at Cass, stating that Crambus flexuosellus Dbld. was the chief tussock moth in the area. Hence in the last 50 years C. vittellus has surpassed several other species to become the most abundant species in the Cass area. In the Mackenzie Country it is apparently much less abundant though not uncommon.

A single specimen was reared, a larva having been found below a damp sack on Ribbonwood Fan above the road. The larva had tunnelled into the soil and lined the tunnel with sacking to form a cocoon.

The species is generally distributed throughout New Zealand. It usually frequents dry grassy situations where it is often very abundant and may quite likely be of economic importance.

Crambus flexuosellus Dbld. 481. 36

1961-3, late Nov-late Apr, 1900'-2300', Rib. Fan (A), Mt Magog, Mt Gog & Mt Sugar Lf Fan. Traps L & N.

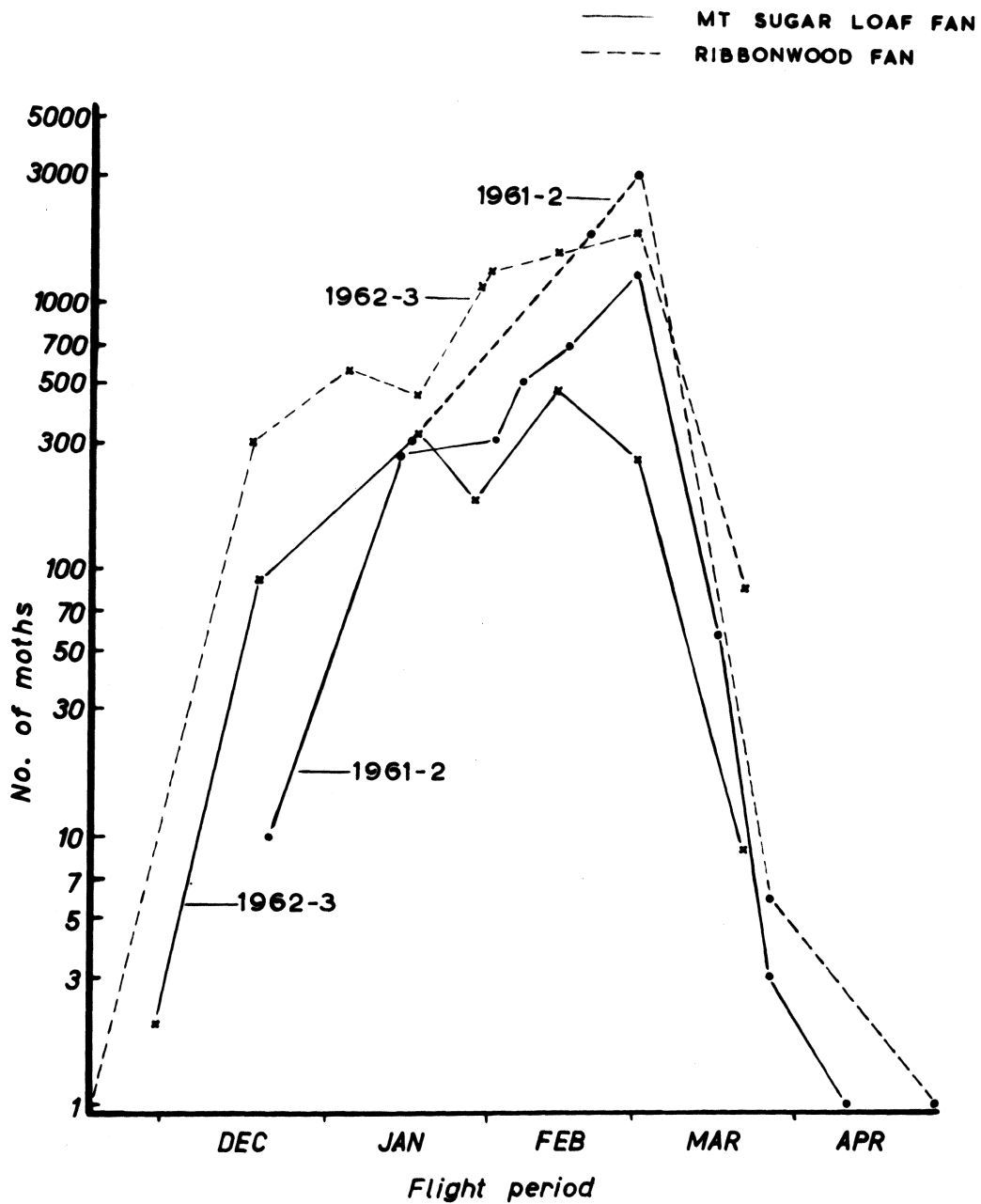


FIG 8. SEASONAL ABUNDANCE OF *CRAMBUS* *VITELLUS* AS INDICATED BY LIGHT TRAP COLLECTIONS

Nearly all specimens were caught by light traps, the records indicating that highest numbers were present in late February. Apparently, however, the species is no longer as abundant at Cass as it used to be. Fifty years ago it was the chief tussock moth in the Cass area (Hilgendorf, 1918) and only 25 years ago was still abundant (Dick, 1940.) Now it remains quite common but several other species are just as common and some more so.

The larvae of this species tunnel in silken galleries in the soil (Cumber and Eyles, 1961) and have been recorded by Kelsey (1957) eating tussock leaves.

The species is generally distributed throughout New Zealand, being one of the commonest species of the genus and found almost everywhere. It may be of economic importance.

Crambus vulgaris Butl.

576. 33

1962-3, mid Jan-mid Mar, 1600'-2300'/3500', Mt Bailey, Rib. Fan (A), Gold. Sdle, Mt Gog, Mt Sugar Lf, Mt Sugar Lf Fan & L. Pukaki. Traps L & N.

Nearly all specimens were caught by light traps, the collections indicating rather high numbers in February and probably a peak level in mid- or late February.

The species is known from both the North and South Islands. Its economic significance is uncertain.

Crambus cyclopicus Meyr.

1071. 21

1962-3, early Feb-late Apr, 1600'-2300'/3500', Rib. Fan (A), Mt Gog, Mt Sugar Lf, Mt Sugar Lf Fan, L. Pukaki, Sawdon Stn & Mt John. Traps L & N.

Nearly all specimens were caught by light traps, the collections indicating high numbers in late February and March with a peak level in mid- or late March. Though the species was recorded in the Mackenzie Country in early February, it was not recorded in the Cass area until late February.

The species is known from both the North and South Islands. Its economic significance is uncertain.

Crambus xanthogrammus Meyr. 31. 7

1962-3, mid Nov-late Feb, 1900'-2200', Rib. Fan (A),
Mt Sugar Lf Fan & Tekapo. Trap L.

Most of the specimens were caught in late November,
none being trapped later than mid-February in the Cass area.

The pupa of this species has been recorded from among
the roots of Raoulia lutescens Beauv., the larva probably
feeding on that plant. The moth is therefore of no
economic importance. It frequents river beds and is known
from both the North and South Islands.

Crambus sp. 1 2. 2

1962, mid Dec & early Feb, 2200'/3100', Rib. Fan (A)
& Mt Bailey. Traps L & N.

Crambus sp. 2 1. 1

1963, mid Jan, 1900', Mt Sugar Lf Fan. Trap L.

Crambus ? sp. 1. 1

1962, late Feb, 2200', Rib. Fan (A). Trap L.

Argyria pentadactyla Zell. 178. 4

1962-3, late Feb & late Mar, 2200'-2500', Rib. Fan (A)
& Mt John. Trap L.

Only five specimens were recorded from the Cass area,
the remainder being from Mt John. This may therefore be a
local species though apparently generally distributed
throughout New Zealand. Its economic significance is
uncertain but it is of no consequence in the Cass area.

Diptychophora epiphaea Meyr. 4. 2

1962-3, mid Dec & early Jan, 2200'/3500'-3500'/4000',
Mt Sugar Lf. Trap N.

The larvae of the genus Diptychophora feed on moss.
The species is therefore of no economic importance. It
frequents very damp spots on mountains, usually near or just
above the upper limits of forests.

Gadira acerella Walk. 3. 3

1962-3, mid Jan & mid Feb, 1900'-2200', Rib. Fan (A)
& Mt Sugar Lf Fan. Trap L.

This species is generally distributed throughout

New Zealand, often frequenting lichen-covered rocks and fences. It is of no economic importance.

PHYCITIDAE

Crocydopora cinigerella (Walk.) 2. 1

1962, late Feb, Mt John, 2500'. Trap L.

This species is known in both the North and South Islands. It is probably of no economic concern.

PYRAUSTIDAE

Members of this family were probably representatively sampled in the survey.

Species belonging to the abundant genus Scoparia are often forest-inhabiting insects whose larvae feed on mosses and lichens but it is possible that many of the New Zealand species feed on the roots of grasses. Some may therefore be just as important in grasslands as several species of Crambus.

Nymphula nitens (Butl.) 13. 8

1961-3, late Dec-late Feb, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

The larva of this species is aquatic. The insect is therefore of no economic concern.

Diasemia grammalis Dbld. 28. 14

1962-3, early Nov-mid Feb, 1600'-2300', Rib. Fan (A & B), Mt Sugar Lf Fan, L. Pukaki & Sawdon Stn. Traps N, L & W.

This species is probably distributed throughout New Zealand. It frequents dry open localities and although usually very local, it is often abundant where found. It is unlikely that it has any economic significance.

Mecyna adversa Philp. 3. 3

1963, late Feb-late Mar, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

This species is known only from the South Island and frequents the edge of forest. It is probably of no economic concern.

Mecyna flavidalis (Dbld.)

53. 22

1962-3, mid Jan-early Apr (1 reared, mid Feb), 1900'-3500'/4500', Rib. Fan (A), Gold. Sdle, Mt Gog, Mt Sugar Lf, Mt Sugar Lf Fan, Holbrook Stn & Mt John. Traps L & N.

Most specimens were caught by light traps.

Two forms of this species were found. One was typical of the Cass area and the other apparently typical of the Mackenzie Country area. However, in each area one specimen typical of the other area was taken.

One specimen was reared from a pupa found at the soil surface in the base of a hard tussock. It was taken from "Holbrook" station. This is perhaps a surprising record since the larva has been recorded to feed on Muehlenbeckia and the pupa has been found enclosed in a folded leaf of that plant. It is also known however that the species frequents rank grass and other herbage which grows in damp places. In the survey this habit was again noted, a few specimens being attracted to an outcrop of Schoenus growing on a damp slope on Mt Bailey (29 January 1963). The present evidence therefore indicates that the species may have more than one food plant but until further details are known, its economic significance cannot be gauged.

The species is very common and generally distributed throughout New Zealand.

Proteroeca comastis Meyr.

1. 1

1963, early Jan, 2300', Rib. Fan (A). Trap W.

This species is known only from the South Island. It frequents open country but is a rare species and of no economic concern.

Heliothela erebopsis Meyr.

5. 4

1962-3, mid Jan-mid Mar & early May, 2300', Rib. Fan (A & B) & Mt Gog. Traps N & Ld.

This species is known from both the North and South Islands. It frequents open grassy or rocky places on mountains and is probably of no economic significance.

Scoparia philerga Meyr.

61. 23

1962-3, mid Nov-late Mar, 1900'-2300', Rib. Fan (A),
Mt Gog & Mt Sugar Lf Fan. Trap L.

This species was probably most abundant from late January until late March. Its larva is known to feed in moss, the adult frequenting forest. It is of no economic importance.

Scoparia minusculalis Walk.

120. 11

1962-3, mid Jan-late Apr, 1900'-2200', Rib. Fan (A)
& Mt Sugar Lf Fan. Trap L.

Most specimens were recorded from Mt Sugar Loaf Fan. The species was apparently most abundant in March but this peak may possibly represent a second generation. A graph of the moth's seasonal appearance indicates that there may be an earlier generation.

The species frequents forests where its larva feeds in moss. It is therefore of no consequence in tussock areas.

Scoparia melanaegis Meyr.

5. 3

1962-3, mid Jan & early Feb, 1900', Mt Sugar Lf Fan.
Trap L.

This species is known from both the North and South Islands. It frequents forests or sheltered spots close to them and is therefore unlikely to be of any concern in tussock areas.

Scoparia trapezophora Meyr.

1. 1

1963, late Feb, 2200', Rib. Fan (A). Trap L.

This species is known only from the South Island but is apparently a very rare species.

Scoparia submarginalis (Walk.)

4447. 39

1961-3, late Nov-late Mar (1 reared, early Nov), 1900'-3500'/4500', Mt Bailey, Rib. Fan (A), Gold Sdle, Mt Gog, Mt Sugar Lf & Mt Sugar Lf Fan. Traps L, W & N.

Nearly all specimens were recorded from light traps, the collections indicating a greater concentration on Mt Sugar Loaf Fan than on Ribbonwood Fan. Graphs of the species' seasonal abundance indicate that greater numbers

were present in the second collecting season. In both seasons, however, the species was common from late December until early February, peak numbers being present in mid-January.

One adult moth and a parasite emerged from two larvae taken together from an inter-tussock soil sample on Ribbonwood Fan above the road (31 August 1962). The moth emerged on 10 November 1962 and a female specimen of Ophionine sp. 13 emerged from the other larva on 28 November 1962. The finding of these larvae indicates that the species has a definite association with grasslands though it is also known to frequent forests. It may therefore have diverse habits but its abundance in tussock areas indicates that its association with grasslands may be quite strong.

The species is generally distributed throughout New Zealand and can be very common. It may be of economic importance.

Scoparia cataxesta Meyr. 327. 35

1961-3, mid Nov-late Apr, 1900'-2500', Rib. Fan (A), Mt Gog, Mt Sugar Lf Fan & Mt John. Trap L.

Graphs of seasonal abundance indicate that this species has two distinct generations. Little is known about the first but it may be the more abundant. The second generation was found to have highest numbers in February and March.

Since the larva of this species feeds on cushion plants, the moth is of no consequence in tussock areas. It frequents streams and rocky mountain sides.

Scoparia asaleuta Meyr. 2. 2

1963, mid Jan, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

The species is known only from the South Island and frequents shingle areas. It is of no consequence in tussock grassland.

Scoparia indistinctalis (Walk.) 1. 1

1963, early Jan, 2200', Rib. Fan (A). Trap L.

This species is probably generally distributed through-

out New Zealand. It is not likely to be of any economic importance.

Scoparia leptalea Meyr.

159. 24

1961-3, late Nov-late Mar, 1900'-2300', Rib. Fan (A), Mt Gog & Mt Sugar Lf Fan. Trap L.

This species was most common in February and much more abundant on Ribbonwood Fan above the road than on Mt Sugar Loaf Fan.

The species is probably fairly common and generally distributed throughout New Zealand. It frequents dry grassy places but its economic significance is uncertain.

Scoparia feredayi Knaggs

222. 30

1961-3, mid Nov-mid Apr, 1900'-2300', Rib. Fan (A), Mt Gog & Mt Sugar Lf Fan. Trap L.

This species was distinctly more abundant on Mt Sugar Loaf Fan than on Ribbonwood Fan above the road. Graphs of its seasonal abundance indicate two overlapping generations. Highest numbers were present in January and February but lower numbers in late January on all four graphs suggest that the decline is significant. The peaks were in mid-January and early to mid-February.

The species is generally distributed in New Zealand but is not common. It frequents the outskirts of forests and is probably of no concern in tussock areas.

Scoparia cyrtastis Meyr.

5. 2

1962-3, mid Dec & early Jan, 3000'-3500'/4000', Mt Sugar Lf. Trap N.

This species is known from both the North and South Islands. It is probably of no economic significance.

Scoparia crypsinoa Meyr.

23. 3

1962, mid & late Nov, 1600'-2300', Mt Gog & Ohau Rvr. Traps L & N.

Nearly all specimens were trapped on Mt Gog in late November. The species may therefore be a local one. It is known from both the North and South Islands and frequents open country. It is probably of no economic concern.

Scoparia exilis Knaggs 112. 10

1961-3, mid Nov-late Dec & mid Jan, 1900'-3500'/4500', Mt Bailey, Rib. Fan (A & B), Mt Sugar Lf & Mt Sugar Lf Fan. Traps L & N.

Nearly all specimens were caught in November, most by light traps. The species is known from both the North and South Islands and frequents dry grassy slopes. Its economic significance is uncertain.

Scoparia turneri Philp. 77. 12

1962-3, late Nov-late Mar, 1900'-2300', Rib. Fan (A), Mt Gog & Mt Sugar Lf Fan. Traps L & N.

Nearly all specimens were caught by light traps, the collections indicating that the species was probably more abundant on Mt Gog and Ribbonwood Fan above the road than it was on Mt Sugar Loaf Fan. Graphs of the species' seasonal abundance indicate two widely separated generations, the first being most evident in November and the second in March.

The species is probably a local one in the South Island. It is unlikely to be of any economic significance.

Scoparia steropaea Meyr. 194. 17

1961-3, late Dec-late Feb, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

Most specimens were recorded from Mt Sugar Loaf Fan. Graphs of the species' seasonal abundance give no indication of a second brood suggested by Hudson (1939). Rather, there appears to be one generation with peak numbers from mid- to late January.

The species is probably generally distributed throughout New Zealand. It can sometimes be fairly common in restricted localities but is probably of no economic concern.

Scoparia elaphra Meyr. 2. 2

1962-3, mid & late Feb, 1900', Mt Sugar Lf Fan. Trap L.

This species is known from both the North and South Islands but is probably of no economic concern.

Scoparia paltomacha Meyr.

1. 1

1962, early Dec, 3500'/4500', Mt Sugar Lf. Trap N.

This species is known from both the North and South Islands but is probably of no economic significance.

Scoparia sabulosella (Walk.)

707. 51

1961-3, early Nov-late Apr (6 reared, mid July-early Aug), 1600'-3500'/4500', Walk. Plot, Rib. Fan (A & B), Gold. Saddle, Mt Gog, Mt Sugar Lf, Mt Sugar Lf Fan, L. Lynd, & Ohau Downs Stn. Traps L, W & N.

Nearly all specimens were caught by light traps, the collections indicating a greater abundance on Mt Sugar Loaf Fan than on Ribbonwood Fan above the road. High numbers were present from mid-November until late January with a peak level in mid-December

The larvae of this species were quite readily obtained from pitfalls and damp sacks in late March and April and several were also taken from soil samples in early May. In the laboratory they readily fed on clover leaves, pulling them down into tunnels in the soil. The last of them had stopped feeding by 17 June 1962 and the adults all emerged between 11 July and 6 August 1962. This early emergence may have been forced by favourable laboratory temperatures since graphs of seasonal abundance give no hint that an early-season generation is to be expected.

A considerable number of larvae taken from Walker's Plot and Ribbonwood Fan above the road may indicate a preference for improved grassland with clovers as food plants. However, a larva was also recorded from unimproved grassland and adults were abundant on these areas too. As the species is also known to feed in moss, it apparently has diverse food plants.

The moth is extremely common and generally distributed throughout New Zealand. It is often very common in dry grassy localities but can also be frequent in cultivated areas. It may well be of economic importance.

Scoparia trivirgata (Feld.)

60. 8

1961-3, mid Nov-mid Jan, 1900'-3500'/4500', Rib. Fan (A), Mt Sugar Lf, Mt Sugar Lf Fan & L. Lynd. Traps L & N.

Nearly all specimens were caught by light traps. A single individual swept from Mt Sugar Loaf was taken from a scree.

The species is generally distributed throughout New Zealand. It usually frequents open grassy slopes and can often be locally abundant. Its economic significance is not known.

Scoparia monochroma Salm.

8. 4

1962-3, late Jan-late Feb, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

This species is probably of no economic concern.

Scoparia cyaneuta (Meyr.)

1. 1

1963, mid Jan, 2200', Rib. Fan (A). Trap L.

This species is known from both the North and South Islands. It can often be abundant but is probably of no economic consequence.

Scoparia rotuella (Feld.)

2. 2

1962-3, late Feb & late Mar, 2200', Rib. Fan (A). Trap L.

This species is probably generally distributed throughout New Zealand. It is unlikely that it has any economic significance.

Scoparia scripta Philp.

3. 3

1962-3, late Feb-late Apr, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

This species is known only from the South Island and frequents damp gullies. It is of no economic importance.

Scoparia ejuncida Knaggs

615. 36

1961-3, mid Nov-late Mar, 1900'-3500'/4500', Rib. Fan (A), Mt Cog, Mt Sugar Lf, Mt Sugar Lf Fan & Mt John. Traps L & N.

Most specimens were caught by light traps, the majority being collected from the Mt Sugar Loaf Fan trap.

Graphs drawn from the collections indicate two very distinct generations, the first being most abundant from late November to early December and the second in mid-February.

The species was not uncommon on Mt Sugar Loaf or at Mt John. It is known only from the South Island and is generally found on the outskirts of beech forests. It is probably therefore of no economic importance.

Scoparia niphospora (Meyr.) 8. 3

1962-3, late Dec, mid Jan & early Feb, 1900'-2300', Rib. Fan (A), Mt Gog & Mt Sugar Lf Fan. Trap L.

This species is probably distributed throughout New Zealand. It frequents dry grassy situations on the mountain sides but is probably of no economic importance.

Scoparia aspidota (Meyr.) 5. 3

1962-3, Feb, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

This species is generally distributed throughout New Zealand, chiefly frequenting forest. It is of no economic importance.

Scoparia oculata Philp. 81. 20

1961-3, mid Nov-late Mar, 1900'-2500', Rib. Fan (A), Mt Gog, Mt Sugar Lf Fan & Mt John. Trap L.

Most specimens were trapped on Mt Sugar Loaf Fan, the collections possibly indicating two generations. A first peak in numbers was evident in November and a second in February.

The species is known only from the South Island. Its economic significance is uncertain.

Scoparia sp. 1. 1

1963, late Feb, 2200', Rib. Fan (A). Trap L.

The single specimen may possibly be a very small and extreme form of Scoparia scripta Philp but is best kept separate in the meantime.

PTEROPHORIDAE (Five-plume moths)

The larvae of this family are often associated with

composites, feeding on the flowers, leaves and stems. They are not therefore of any economic importance (Cumber, 1960).

These moths may be relatively more abundant than the survey records indicate. On several occasions they were possibly seen in flight during daytime but not recognised as moths.

Platyptilia falcatalis Walk. 9. 5

1962-3, Feb, 1900'-2200', Rib. Fan (A). Trap L.

All specimens caught were very small individuals for this species.

The moth is probably generally distributed throughout New Zealand, the larva feeding in the opening leaf and flower buds of Hebe salicifolia (Forst. f.) Penn.

Stenoptilia celidota (Meyr.) 3. 1

1962, late Feb, 2500', Mt John. Trap L.

This species is known from only the South Island and is rarely found.

Stenoptilia orites Meyr. 1. 1

1962, early Feb, 1900', Mt Sugar Lf Fan. Trap L.

This species is known only from the South Island and is rare. It frequents open tussock country.

PAPILIONOIDEA (Butterflies)

In the survey, little attention was paid to the butterflies though all species seen were recorded. In tussock areas some of these species are quite abundant but the number of specimens recorded for each is incidental.

NYMPHALIDAE

Argyrophenga antipodum Dbld. 28. 18

1962-3, early Nov-late Feb, 1600'-3500'/4000',
L. Pukaki & all Cass sites except Walk. Plot. Traps N, G & P.

Only at Lake Pukaki was the species recorded in early November.

In the Cass area it was significant that few specimens of this butterfly were ever seen in the improved grassland on Ribbonwood Fan whereas the species was quite common on the unimproved site. This distribution no doubt reflects the abundance of native flowers on each site and indicates that with widespread improvement the species would probably show a marked decline in numbers. It was observed at several flowers. A single specimen was also found being preyed on by a female specimen of the asilid fly Neoitamus varius (Walk.) The pair were recorded from a matagouri bush on 4 January 1963 at 2100' on Mt Gog. Whether by chance or design the predator had the butterfly half-wedged between matagouri thorns while it fed.

The larva is known to feed on silver tussock but it almost certainly feeds on other species too. In the survey three specimens were found, one being taken from hard tussock, another from snow tussock and a third from a hard tussock association with no silver tussock in the vicinity. It may therefore feed on most tussock species.

The butterfly occurs only in the South Island and is common in most tussock grasslands. It is probably of no economic importance.

Erebia pluto Fereday

2. 2

1962-3, early Jan, 4000'-4500', Mt Sugar Lf. Trap N.

This species frequents shingle slopes, quite a number being seen on the screes of Mt Sugar Loaf on 2 January 1963. It is most abundant near blue tussock on which the larvae are presumed to feed.

The butterfly occurs only in the South Island and is probably of no economic importance.

Vanessa gonerilla (Fab.)

1963, mid Feb, 2300', Mt Gog.

A single specimen of this butterfly was observed in flight. The species is generally distributed throughout New Zealand but not often recorded in mountainous areas. It is of no economic consequence.

LYCAENIDAE

The larvae of this family have very varied habits, some species being carnivorous. The family is of no importance in agriculture (Cumber, 1960).

Chrysophanus salustius Fab. 5. 4

1962-3, early Jan-mid Feb, 2000'-3100', Mt Bailey, Mt Magog & Mt Gog. Trap N.

A single specimen of this butterfly was seen at a Wahlenbergia flower, another on a flower head of white clover (Trifolium repens L.) and in mid-January 1963 many were noticed at the flowers of scotch thistle (Cirsium lanceolatum (L.)) occurring in a patch at the foot of Mt Magog.

The species is generally distributed throughout New Zealand and frequents open situations. It lays its eggs on the leaves of Muehlenbeckia.

Chrysophanus boldenarum (White) 11. 8

1961-2, mid & late Nov & early Feb-early Mar, 2000'-2800'/3500', Mt Bailey, Rib. Fan (A & B), Mt Sugar Lf & L. Lynd. Traps N, G & L/Ld.

This species is very common in most South Island localities and is also generally distributed in the North Island. The larva feeds on a small-leaved Muehlenbeckia species.

Lycaena labradus (Godt.) 3. 2

1962, early Nov & mid Feb, 1600'-2300', Rib. Fan (B) & L. Pukaki. Trap N.

The single specimen taken in early November was from Lake Pukaki.

This species frequents waste land. It is extremely abundant in some parts of New Zealand, especially where there is a very dry, hot climate.

PIERIDAE

The larvae of the genus Pieris feed on Cruciferae (Cumber, 1960) and are therefore of no economic importance in tussock grasslands.

Pieris rapae L.

2 (1:1) 2

1962-3, late Oct, mid Nov & Jan, 1900'-2000', Mt. Magog,
Mt Sugar Lf Fan & Cass. Trap N.

This species is the common White Butterfly.

In late January 1963 quite a few specimens of this butterfly were noticed at Swampy Creek, apparently being attracted to the watercress which was then in flower. In the vicinity of Cass also, the butterfly was often noticed, probably being attracted to local gardens. A pupa found on a house door there was parasitised by Pteromalus puparum (L.) and others which were found in the same vicinity had almost certainly suffered from the same parasite.

The species occurs throughout New Zealand.

GEOMETROIDEA

GEOMETRIDAE

Chloroclystis bilineolata (Walk.) 1. 1

1963, late Mar, 2200', Rib. Fan (A). Trap L.

This species is known only from the South Island and has been found feeding on Carmichaelia. It is of no economic importance.

Chloroclystis rubella Philp. 1. 1

1962, late Apr, 1900', Mt Sugar Lf Fan. Trap L.

This species is known only from the South Island, being found at the upper edges of forest. It is of no economic importance.

Hydriomena rixata (Feld.) 4. 4

1962-3, mid Jan-late Feb, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

This species is common and generally distributed throughout New Zealand and frequents overhanging banks of streams in wooded areas. The larva feeds on Plantago and probably other low plants but is of no economic importance.

Hydriomena deltoidata (Walk.) 98. 13

1962-3, mid Jan-mid Feb, 1900'-2200'/2600', Rib. Fan (A), Mt Magog, Mt Gog & Mt Sugar Lf Fan. Traps L & N.

Nearly all specimens were caught by light traps, the records indicating a much greater abundance on Mt Sugar Loaf Fan than on Ribbonwood Fan above the road. The species was most abundant in mid-January.

This species is abundant throughout New Zealand but is most common at the edges of forest or among open scrub. Its larva feeds on Plantago and probably also on other low plants. The moth is of no economic importance.

Hydriomena prionota (Meyr.) 1. 1

1962, early Oct, 1900', Mt Sugar Lf Fan. Trap L.

This species is known only from the South Island. It is probably of no economic significance.

Hydriomena subochraria (Dbld.) 7. 4

1962-3, late Jan-late Feb & early Apr, 1900', Mt Sugar Lf Fan. Trap L.

This species is generally distributed throughout New Zealand. It is fairly common and chiefly frequents tussock country and swampy situations. Its economic significance is uncertain.

Asthena sp. 2. 1

1963, early Jan, 2300', Mt Gog. Trap L.

Euchoeca rubropunctaria (Dbld.) 2. 2

1963, early & late Jan, 2300', Mt Gog. Trap L.

This species is generally distributed throughout New Zealand, usually being found in open situations near the sea coast. Its larva feeds on Haloragis erecta (Banks ex Murr.) Eichl. but this plant is not known to occur locally. The larva may therefore feed on one or more of the other Haloragis species present in the Cass area.

The moth is of no economic importance.

Orthoclydon chlorias (Meyr.) 1. 1

1963, late Mar, 2200', Rib. Fan (A). Trap L.

This moth is known from both the North and South

Islands but is a rare species. It is of no economic importance.

Asaphodes abrogata (Walk.) 74.11

1962-3, mid Feb-late Mar, 1900'-3500', Rib. Fan (A), Mt Magog, Mt Gog, Mt Sugar Lf, Mt Sugar Lf Fan & Mt John. Traps L, N & W.

Nearly all specimens were caught by light traps, the majority being recorded from Mt Gog. The species frequents open tussock country in both the North and South Islands but is probably a local species. Its economic significance is uncertain.

Xanthorhoe chlamydota (Meyr.) 1 (0:1) 1

1963, mid Jan, 2200', Rib. Fan (A). Trap L.

This species is known from both the North and South Islands. It chiefly frequents light forest or scrub but is not a common species. It is of no economic concern.

Xanthorhoe orophyla (Meyr.) 2 (1:1) 2

1962-3, mid & late Feb, 1900'-2500', Mt Sugar Lf Fan & Mt John. Trap L.

This species is known only from the South Island. It frequents open country on the mountain sides but is probably of no economic importance.

Xanthorhoe semifissata (Walk.) 10 (7:3) 6

1962-3, late Nov & early Feb-late Apr, 1900'-2200'/3500', Mt Sugar Lf & Mt Sugar Lf Fan. Traps L & N.

The larva of this species is known to feed on watercress (Nasturtium officinale R. Br.) The presence of this plant in Swampy Creek may explain why nearly all specimens were recorded from Mt Sugar Loaf Fan.

The species is generally distributed throughout New Zealand but is of no economic importance.

Xanthorhoe rosearia (Dbld.) 27 (18:9) 16

1962-3, Oct, Nov & Jan-Mar, 1900'-2300', Rib. Fan (A), Mt Gog & Mt Sugar Lf Fan. Trap L.

The larva of this species feeds on watercress (Nasturtium officinale R. Br.) and is therefore of no economic importance in tussock areas. The species is generally

distributed throughout New Zealand.

Xanthorhoe cinerearia (Dblld.) 6 (1:5) 4

1962, late Feb-early Apr, 1900'-2200', Rib. Fan (A)
& Mt Sugar Lf Fan. Trap L.

This species is generally distributed throughout New Zealand. Its economic significance is uncertain.

Xanthorhoe semisignata (Walk.) 365 (162:203) 30

1962-3, mid & late Nov & early Jan-late Apr, 1900'-
2500', Rib. Fan (A), Mt Gog, Mt Sugar Lf Fan & Mt John.
Trap L.

It is possible that specimens of Xanthorhoe plumbea Philp. have been recorded as this species.

Of the specimens recorded, 141 were caught at Mt John. The species may therefore have been much more abundant at that site than in the whole of the Cass area. However, it was quite common on Mt Sugar Loaf Fan and Ribbonwood Fan above the road, the light trap collections indicating two generations. The first was represented by relatively high numbers in November and the second by similar numbers in February. Only low numbers were present in mid-January.

The species is generally distributed throughout New Zealand. It is usually found in dry stony places and can often be abundant in river beds. Hudson (1950) suggests that its food plant may be a species of native daisy but its economic significance must for the meantime remain uncertain.

Xanthorhoe subobscurata (Walk.) 1. 1

1962, late Feb, 1900', Mt Sugar Lf Fan. Trap L.

This species is known only from the South Island. Its larva feeds on Angelica montana (J.R. et G. Forst.) Ckn. and is of no economic importance. The moth is rarely found.

Xanthorhoe clarata (Walk.) 76 (2:65) 23

1962-3, mid Dec-late Feb, 1900'-3500'/4000', Rib. Fan (A), Mt Gog, Mt Sugar Lf, Mt Sugar Lf Fan & Mt John. Traps L & N.

Nearly all specimens were caught by light traps but

only males were trapped in this way. The majority of specimens were recorded from Mt Sugar Loaf Fan, the records indicating high numbers in mid- and late January.

The species is generally distributed throughout the South Island and is also known from the North Island. It frequents open grassy places but its habits are unknown. Its economic significance is therefore uncertain.

Notoreas paradelpha (Meyr.) 2. 2

1961-2, late Nov & mid Dec, 2200'/3500', Mt Sugar Lf & L. Lynd. Trap N.

This species is known only from the South Island and frequents grassy mountain sides. It can often be abundant but its economic significance is uncertain.

Notoreas brephos (Feld.) 7. 5

1962, late Nov, early Jan & early Feb-late Mar, 2300'-3500'/4000', Rib. Fan (A) & Mt Sugar Lf. Trap N.

This species is generally distributed throughout New Zealand. It is common on mountains, often settling on bare ground in the hot sunshine (in the present survey it was observed on screes). It is probably of no economic significance.

Dasyuris anceps (Butl.) 7. 3

1962-3, early Dec-mid Feb, 2200'/3500', Mt Sugar Lf. Trap N.

Though few specimens were collected, this species appeared to be quite abundant on Mt Sugar Loaf in mid-February 1962. It frequents bare rocky situations on mountains where it can sometimes be abundant. Most records are from the South Island though it is also known from the North Island. It is probably of no economic concern.

Dasyuris partheniata Guen. 2. 2

1962, late Feb & late Mar, 2300'-2600', Rib. Fan (A) & Mt Magog. Trap G.

This species is known from both the North and South Islands. It frequents open grassy situations, the larva feeding on the leaves of Aciphylla squarrosa J.R. et G. Forst.

As this species of Aciphylla is not known to occur locally, other species may also serve as food plants. The moth is of no economic concern.

Lythria perornata (Walk.) 6. 6

1962-3, early Jan-mid Mar, 1600'-3500'/4500', Walk. Fan, Mt Magog, Mt Sugar Lf & L. Pukaki. Traps G & N.

This species is not uncommon in the North Island and is generally distributed throughout the South Island, sometimes being locally abundant. The larva feeds on Pimelea prostrata (J.R. et G. Forst.) Willd. and is therefore of no economic significance.

Lythria catapyrrha (Butl.) 5. 4

1962-3, early Jan-early Feb & late Mar, 2300', Rib. Fan (A). Traps N & W.

This species is known only from the South Island and frequents dry, open, sunny places. It tends to be a local species and is probably of little economic concern.

Leptomeris rubraria (Dbl.) 51 (13:37) 16

1961-3, mid Nov-late Mar, 1900'-2300'/3100', Mt Bailey, Rib. Fan (A), Mt Gog & Mt Sugar Lf Fan. Traps L, N & W.

Nearly all specimens were recorded from Ribbonwood Fan above the road, collections from the light trap on that site indicating a peak in numbers during February.

This species is generally distributed throughout New Zealand. The larva feeds on Plantago and other low plants and is therefore unlikely to be of any economic importance. However, the species' abundance on the improved portion of Ribbonwood Fan indicates that the improvement has provided conditions that are more favourable than previously.

Dichromodes sphaeriata (Feld.) 4. 4

1961-3, late Dec-late Mar, 1900'-2300', Rib. Fan (A), Mt Gog & Mt Sugar Lf Fan. Trap L.

This species is known from both the North and South Islands and frequents dry, open, sunny situations. It is probably of no economic concern.

Dichromodes gypsotis Meyr. 1. 1

1962, mid Dec, 2200'/3500', Mt Sugar Lf. Trap N.

This species is known only from the South Island but is rarely found. Its larva feeds on lichens and is therefore of no economic importance.

Selidosema leucelaea Meyr. 1. 1

1962, late Sept, 1900', Cass.

This species is known from both the North and South Islands, the larva feeding on totara (Podocarpus totara G. Benn ex D. Don) and miro (P. ferrugineus G. Benn ex D. Don). The moth is of no concern in tussock areas.

Selidosema colpogramma Meyr. 1. 1

1962, late Feb, 1900', Mt Sugar Lf Fan. Trap L.

This species has been recorded from Arthur's Pass. The larva is known to feed on Cassinia vauvilliersii (Homb. et Jacq.) Hook. but since the only Cassinia species known in the Cass area is C. fulvida Hook. f., the larva may also feed on that. The species is of no economic importance.

Hybernia indocilis Walk. 59 (0:59) 13

1961-3, early Oct & mid Dec-late Feb, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

Only male specimens were caught by light traps since the females are semi-apterous and cannot fly.

Clark (1935) states that this species has three generations each year. In the present survey, graphs of light trap records reflected at least two of these generations and possibly the third. A considerable number of specimens trapped in early October represented the first generation and a distinct peak in numbers between late January and mid-February represented a further generation. It is possible that another peak was evident in late December but few specimens were trapped.

The species occurs in both the North and South Islands. Clark (1935) indicates that its food plants include manuka (Leptospermum scoparium J.R. et G. Forst.), matagouri (Discaria toumatou Baoul) and sweet briar (Rosa rubiginosa L.),

but states that matagouri is the preferred food. The moth is probably of no economic concern.

Declana junctilinea Walk. 23 (0:23) 12

1961-3, mid Dec-late Feb, 1900'-2300', Rib. Fan (A),
Mt Gog & Mt Sugar Lf Fan. Trap L.

Most specimens were recorded from Mt Sugar Loaf Fan.

This species occurs in both the North and South Islands, the larva feeding on manuka (Leptospermum scoparium J.R. et G. Forst.) It is probably of no economic importance.

NOCTUOIDEA

ARCTIIDAE

Metacrias strategica (Huds.) 5 (0:5) 3

1962-3, mid Dec, early Jan & early Feb, 1900'-2300',
Mt Gog & Mt Sugar Lf Fan. Trap L.

At least four of the specimens caught by light traps were trapped between 11.30 p.m. and 6.0 a.m. This may indicate that the moth flies in the late evening and early morning hours but as the female is semi-apterous, only males are caught by light traps. A single larva was taken from a pitfall on Mt Magog in mid-December 1962.

This species occurs only in the South Island. Gibbs (1962) indicates that it does frequent tussock grassland but in the southern half of the South Island it is predominant in pasture land near the coast. Because the adult female is immobile, the species forms colonies in small localised areas. It is probably of little economic concern though the larval food plants include European grasses, clover and Plantago.

Metacrias erichrysa Meyr.

1963, 2200', Godley Peaks Stn.

This species was recorded from a single larva found in early February. The larva was probably a second instar when taken but in mid-February it underwent a further ecdysis. It was found in a soil sample below a hard tussock.

This species is known from both the North and South

Islands but since the adult female is immobile, it is confined to certain small areas. Gibbs (1962) outlines all known records of the moth and states that it is a mountainous species that prefers areas with a mean annual rainfall of over 100 inches. It is normally found close to the main dividing ranges among snow tussock, herbs and shrubs, and has only once been found in an area with a mean annual rainfall of less than 60 inches. Hence the record from the present survey is interesting since it was from the Mackenzie Country (the species has not previously been recorded from any part of the Mackenzie Country) and was from a hard tussock area receiving a mean annual rainfall of only 30 inches. The species may well be relatively abundant in this area. However, it is of little economic concern though Hudson (1950) states that the female sometimes makes her nest of tussock stems.

NOCTUIDAE

Many larvae in this family are serious pests (Tillyard, 1926).

Two instances of larval parasitism were recorded in the survey, one relating to an unidentified noctuid larva parasitised by the braconid Phogra rubromaculata Cam. In an instance of pupal parasitism by the tachinid fly Gracilicera monticola Mall., the host was almost certainly a species of Persectania. Again, it was almost certainly a larva belonging to the same genus which was found infected by the fungal mycosis Metarrhizium anisopliae (Metch.)

The seasonal abundance of noctuid moths in the Cass area (and probably of noctuid moths in New Zealand generally) proved to be very interesting. Graphs of light trap collections proved to be strongly bimodal with the first peak probably in late October and the second in late February (Fig. 9). Between these there was a sharp decline in numbers, very few moths being present in mid-January. An examination of the species composition of these graphs reveals that there are

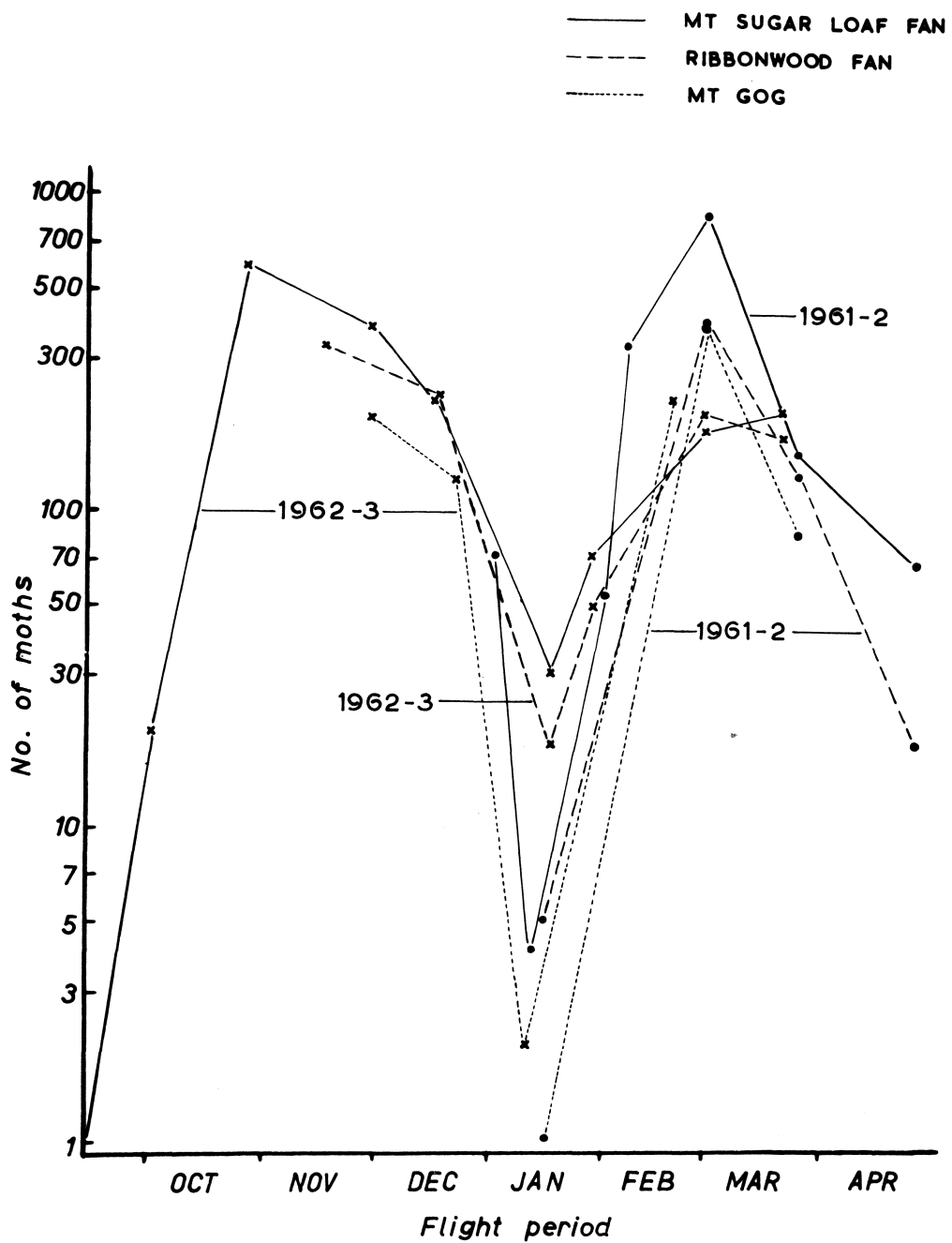


FIG 9. SEASONAL ABUNDANCE OF NOCTUID SPECIES AS INDICATED BY LIGHT TRAP COLLECTIONS

both early season and late season species of noctuid moths and that those which appear throughout the season have two generations, their lowest numbers coinciding with the virtual absence of other species in mid-January. There are evidently no mid-season species.

Euxoa admirationis (Guen.) 54 (8:46) 16

1961-3, mid Nov-late Jan & late Feb, 1900'-2500', Rib. Fan (A), Mt Gog, Mt Sugar Lf Fan & Mt John. Trap L.

The single record in late February was from Mt John.

Light trap catches in the Cass area indicate that this species is possibly more abundant on Ribbonwood Fan above the road than on Mt Sugar Loaf Fan. Graphs of the species' seasonal abundance on these sites reveal that peak numbers are probably present in late November and early December.

The species appears to be generally distributed throughout New Zealand but its economic significance is uncertain.

Agrotis ypsilon (Rott.) 2 (0:2) 2

1962-3, late Feb & late Apr, 1900'-2500', Cass & Mt John. Trap L.

This species is widely distributed in New Zealand, the larva being known as the "greasy cutworm" (Cumber & Eyles, 1961). It feeds on the roots of many plants and is recorded by Kelsey (1957) feeding on tussock leaves. However, it is incidental and therefore of no economic importance in the Cass area though it may well appear in considerable numbers in other tussock areas. When recorded at Cass by Hilgendorf (1918), the species was considerably more abundant than it is now and when recorded by Dick (1940) as "occasional", it was still apparently more common than at the present. It seems likely, therefore, that the species has declined in abundance over the last 25 years, if not over the last 50 years.

Austramathes ? sp. 1 (1:0) 1

1963, late Jan, 2300', Rib. Fan (A). Trap G.

J.D. Bradley (pers. comm.) states that this is "a new species probably belonging in the genus Austramathes and very near A. fortis Butler". It is possible that a moth taken in

late March 1962 from Ribbonwood Fan below the road is a further specimen of the same species.

Andesia pessota (Meyr.) 7 (4:3) 6

1962-3, late Jan-late Mar, 1900'-3100', Mt Bailey, Rib. Fan (A), Gold. Sdle & Mt Sugar Lf Fan. Traps L & G.

All specimens except one were taken in the 1961-2 season.

This species is known from both the North and South Islands but is rare. The number of records from grease cylinders may indicate that it is not readily attracted to light and is therefore more abundant than it appears. However, it is too uncommon to be of any economic significance.

Ichneutica marmorata (Huds.) 2 (2:0) 2

1962, mid Nov, 1900', Mt Sugar Lf Fan. Trap L.

This species is known from both the North and South Islands. It is probably of no economic importance.

Leucania acoustis Meyr. 405 (0:88) 14

1962, early Oct-late Dec (2 reared, Nov), 1900'-2300'/3100', Mt Bailey, Rib. Fan (A), Mt Magog, Mt Gog & Mt Sugar Lf Fan. Trap L.

Light trap collections revealed that this species was apparently more abundant on Mt Gog than on Ribbonwood Fan above the road and that it was least abundant on Mt Sugar Loaf Fan. Graphs drawn from the same collections indicate a very distinct season with peak numbers during mid- and late November but probably highest in late November.

Two specimens were reared from pupae, one of the pupae and also an adult having been found in the base of hard tussock. Since the larva has been recorded feeding on the same tussock (Dick, 1940), that plant may be the insect's main food. The species may therefore be of economic importance for it frequents open grassy country and is known from both the North and South Islands.

Leucania unica Walk. 129 (27:102) 14

1961-3, late Nov-early Jan, 1900'-2300', Rib. Fan (A), Mt Gog & Mt Sugar Lf Fan. Trap L.

Light trap collections revealed that this moth was apparently more abundant on Mt Gog than on Ribbonwood Fan above the road and Mt Sugar Loaf Fan. Since the species is found generally in open tussock country and its relative abundance between each of the three sites mentioned is similar to that of Leucania acontistis Meyr., it is quite likely that it also feeds on hard tussock. Its habitat must certainly be similar to that species.

Graphs of the species' seasonal abundance indicate that it has a very distinct season with a peak in numbers during mid- and late December. It is known in both the North and South Islands and may possibly be of some economic concern.

Leucania alopa Meyr.

5 (0:5) 4

1962-3, late Feb-mid Mar, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

This species is known from both the North and South Islands but is probably of little economic concern.

Leucania semivittata Walk.

29 (10:19) 10

1962-3, mid Nov & late Jan-late Mar, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

All specimens except one were recorded from Mt Sugar Loaf Fan.

The species is distributed throughout New Zealand and frequents open grassy country or grassy glades in forest. The larva feeds on native grasses (possibly including tussock) but in the Cass area the species is probably of no economic significance.

Aletia nullifera (Walk.)

7 (4:3) 6

1961-3, mid Dec-late Mar, 1900'-2500', Mt Gog, Mt Sugar Lf Fan & Mt John. Trap L.

This species is known from both the North and South Islands, the larva feeding on Aciphylla squarrosa J.R. et G. Forst. Since this species of Aciphylla is not known to occur locally, the larva probably feeds on other species also. It is of no economic importance.

Aletia moderata (Walk.)

365 (177:103) 43

1961-3, early Oct-late Apr, 1900'-2500', Rib. Fan (A), Mt Gog, Mt Sugar Lf Fan & Mt John. Trap L.

Light trap collections of this species indicated that its incidence on Mt Sugar Loaf Fan and Ribbonwood Fan above the road was similar. The same collections revealed two generations, peak numbers occurring in November and February (Fig. 10).

The species is generally distributed throughout New Zealand and Hudson (1950) has found the larvae to feed on Raoulia in river beds. The species is of no economic importance.

Aletia griseipennis (Feld.)

2 (1:1) 2

1962-3, early Feb & mid Mar, 1900', Mt Sugar Lf Fan. Trap L.

This species is known from both the North and South Islands and frequents open grassy country and river beds. The larva possibly feeds on tussocks as well as other native grasses. Its economic significance is uncertain but it is of no importance in the Cass area.

Aletia cuneata Philp.

16 (11:5) 6

1962, late Nov, Feb, late Mar & late Apr, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

This species was trapped only on those nights which were good or ideal for collecting. It is known from both the North and South Islands and frequents open country but its economic significance is uncertain.

Aletia mitis (Butl.)

421 (23:395) 21

1962-3, mid Feb-mid Apr, 1900'-2300', Walk. Plot, Rib. Fan (A), Mt Gog & Mt Sugar Lf Fan. Traps L & G.

All specimens except two were caught by light traps, the collections indicating high numbers throughout March with a peak in mid-March. The species was slightly more abundant on Mt Sugar Loaf Fan than on Ribbonwood Fan above the road and may have been more abundant in 1962 than in 1963.

Hudson (1939) indicates that this is a local species

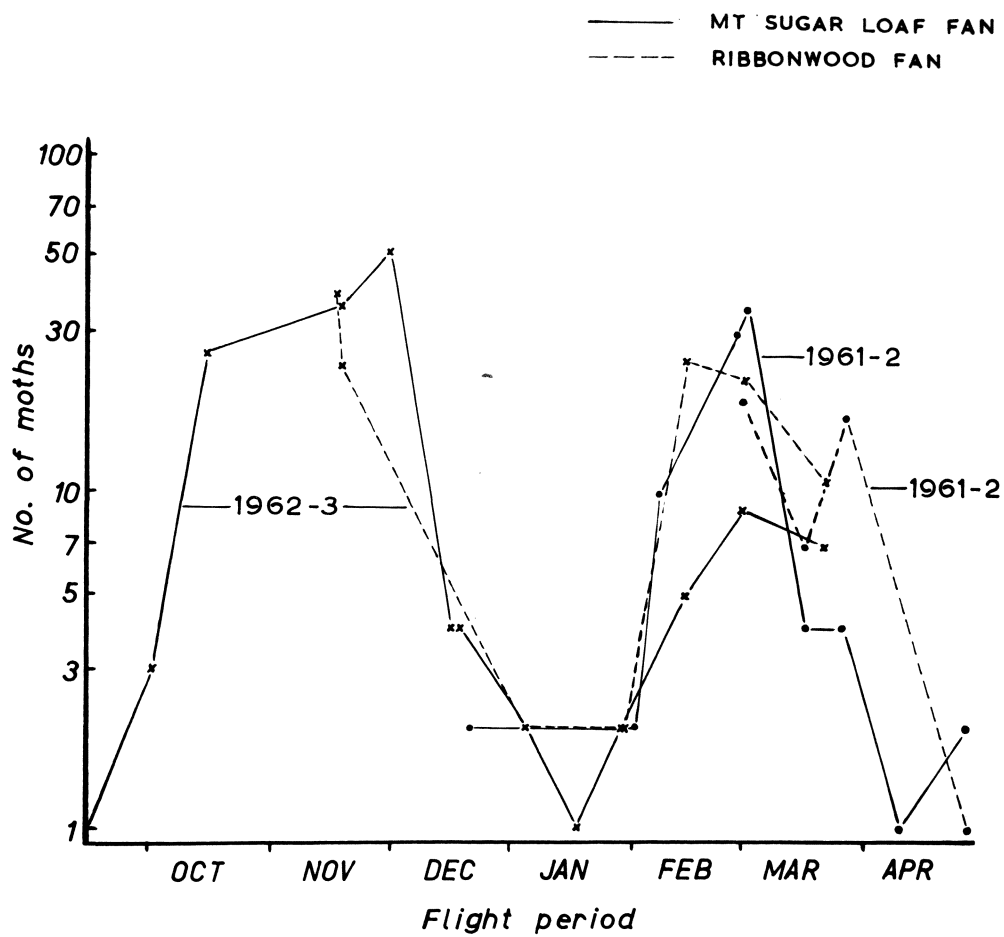


FIG 10. SEASONAL ABUNDANCE OF *ALETIA MODERATA* AS INDICATED BY LIGHT TRAP COLLECTIONS

occurring in February but apparently rare. However, records from the present survey show that it is incidental until late February and that it is by no means rare though it may possibly be local. It is known only from the South Island. Its economic importance is not certain.

Aletia longstaffi (Howes)

4 (3:1) 3

1962-3, late Feb & late Mar, 1900', Mt Sugar Lf Fan.

Trap L.

This species is known from both the North and South Islands but is probably of no economic concern.

Aletia obsecrata Meyr.

309 (157:94) 8

1962-3, mid Nov-mid Dec & mid Jan, 1900'-2300', Rib. Fan (A), Mt Gog & Mt Sugar Lf Fan. Trap L.

This species was apparently incidental on Mt Gog but was abundant on Mt Sugar Loaf Fan and Ribbonwood Fan above the road. It was not recorded before mid-November but its first appearance was probably in late October or early November. High numbers were present in mid- and late November but fell off sharply in early December. A single specimen taken in mid-January was a straggler.

This moth is known only from the South Island. Its economic significance is uncertain.

Physetica caerulea (Guen.)

108 (36:54) 33

1961-3, mid Oct-late Mar, 1900'-2300', Rib. Fan (A), Mt Gog & Mt Sugar Lf Fan. Trap L.

This species was trapped in consistently small numbers but the collections may have possibly indicated a peak in December. If it shares a similar biology to other noctuid species, its appearance over a period of several months may be expected to indicate two generations. It was much more abundant on Mt Sugar Loaf Fan than on Mt Gog and Ribbonwood Fan above the road.

This moth is known from both the North and South Islands but is a local species. It is probably of no economic concern.

Persectania disjungens (Walk.) 1444 (29:782) 28
1961-2, mid Nov-late Jan, 1900'-2900', Rib. Fan (A),
Mt Gog, Mt Sugar Lf & Mt Sugar Lf Fan. Traps L & W.

All specimens except one were caught by light traps, the collections indicating a similar incidence on Mt Sugar Loaf Fan and Ribbonwood Fan above the road but probably a lesser abundance on Mt Gog. Though the species was not recorded before mid-November, its first appearance was probably in late October or early November. High numbers were present from mid-November until late December but there were no strong peaks (Fig. 11). A slight peak may have been evident between late November and mid-December.

Since nearly all specimens caught by light traps were males, the relative abundance of the species may be much greater than the records indicate. Three interesting records were made of three males collected on separate occasions and each with a strongly distended abdomen. The abnormality may have been due to a disease.

This species is generally distributed throughout New Zealand except north of the central plateau in the North Island. Its larva has been recorded by Kelsey (1957) eating tussock leaves and may well be of some economic concern.

Persectania steropastis (Meyr.) 2 (1:0) 2
1962-3, mid Dec & early Jan, 1900', Mt Sugar Lf Fan.
Trap L.

This species is generally distributed throughout New Zealand but is nowhere common. Its larva feeds on Phormium tenax Forst. and is therefore of no concern in tussock areas.

The species is known to be parasitised by the braconid Phogra rubromaculata Cam. (Parrott, 1954b).

Persectania avera Walk. 470 (270:139) 49
1962-3, mid Oct-late Apr (3 reared, early Jan & early Mar), 1900'-2500'/3200', Mt Bailey, Rib. Fan (A), Mt Gog, Mt Magog, Mt Sugar Lf Fan & Mt John. Traps L, W & N.

This moth is one of the noctuid species whose larvae are known as "army worms".

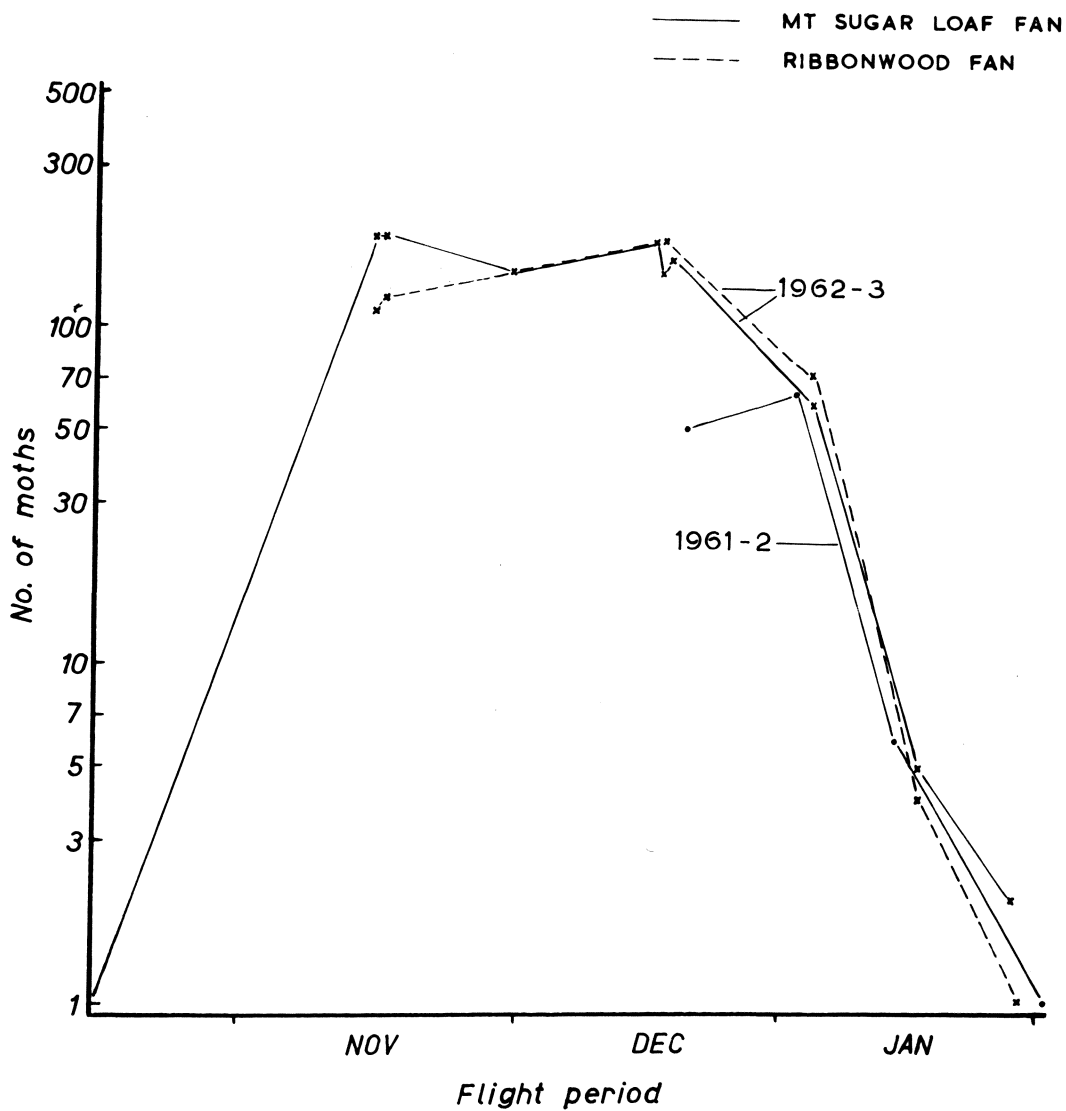


FIG 11. SEASONAL ABUNDANCE OF *PERSECTANIA DISJUNGENS* AS INDICATED BY LIGHT TRAP COLLECTIONS

All specimens except two were caught by light traps, the collections indicating similar levels on the three trapping sites. Graphs drawn from these collections reflected two generations, the first peak probably occurring between early and mid-November and the second peak occurring in late February (Fig. 12). The second generation was probably more abundant.

The three pupae which were reared were each taken from the bases of hard tussocks, one of the plants being dead. The larva has been recorded by Dick (1940) feeding on this tussock and is also known to feed on other grasses. Hence it can be of economic importance, occurring in great numbers throughout New Zealand.

Parrott (1954b) records the braconid Fhogra rubromaculata Cam. as parasitising this species.

Persectania arotis (Meyr.) 2 (0:2) 1

1962, early Oct, 1900', Mt Sugar Lf Fan. Trap L.

This species is known from both the North and South Islands. The larva feeds on Phormium tenax Forst. and is therefore of no concern in tussock areas.

Persectania atristriga (Walk.) 486 (219:128) 34

1962-3, mid Nov, early Jan-late Mar & late Apr, 1900'-2300', Rib. Fan (A), Mt Gog & Mt Sugar Lf Fan. Trap L.

Only single specimens were taken in November and April. The species was most abundant in February but there was no strong peak in numbers (Fig. 13). However, there may have been a slight peak in mid-February. In 1963, the moth was considerably less abundant than in 1962.

This species is generally distributed throughout New Zealand and the larva has been recorded by Kelsey (1957) feeding on tussock leaves. It may be of some economic importance.

Persectania propria (Walk.) 1875 (76:1057) 46

1962-3, late Dec-late Apr, early May & mid May/mid July, 1900'-2500', Rib. Fan (A), Mt Gog, Mt Sugar Lf Fan & Mt John. Trap L.

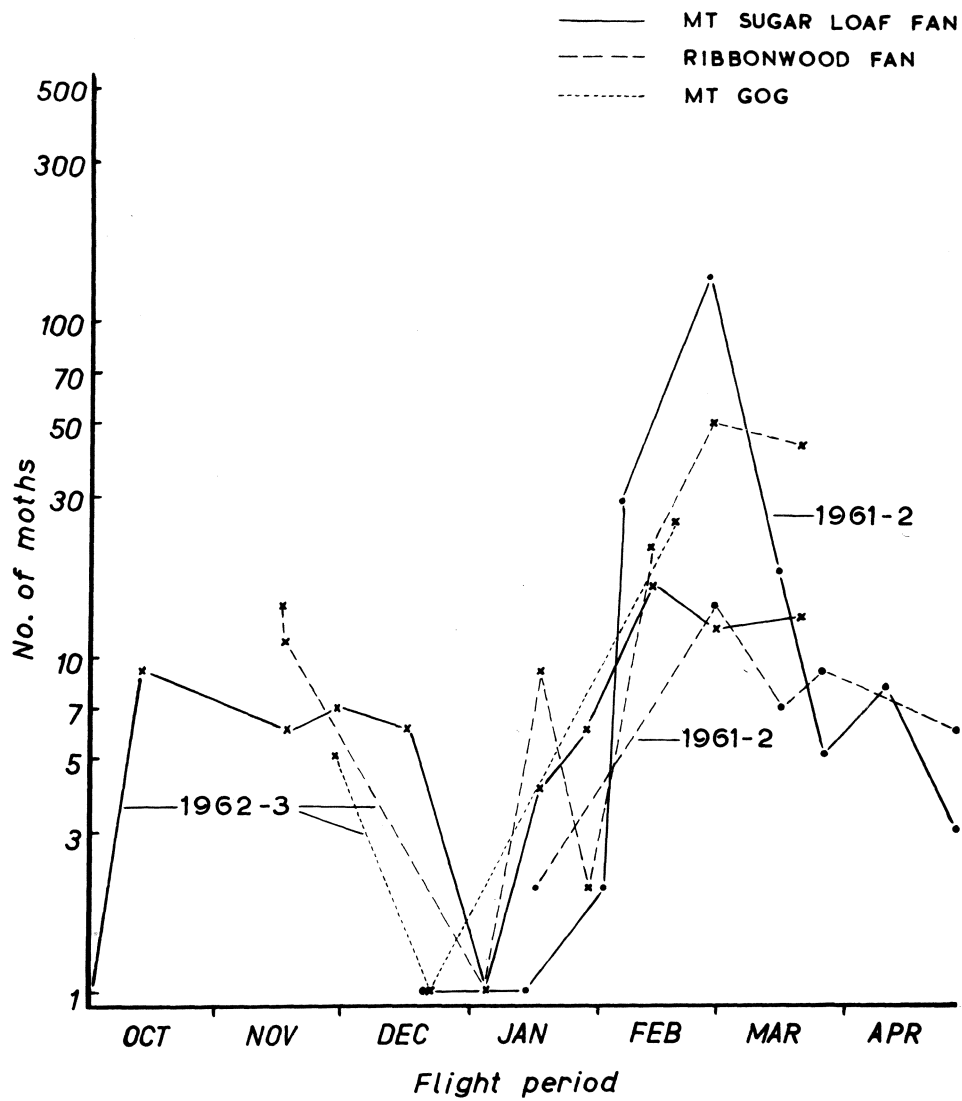


FIG 12. SEASONAL ABUNDANCE OF *PERSECTANIA*
AVERSA AS INDICATED BY LIGHT TRAP COLLECTIONS

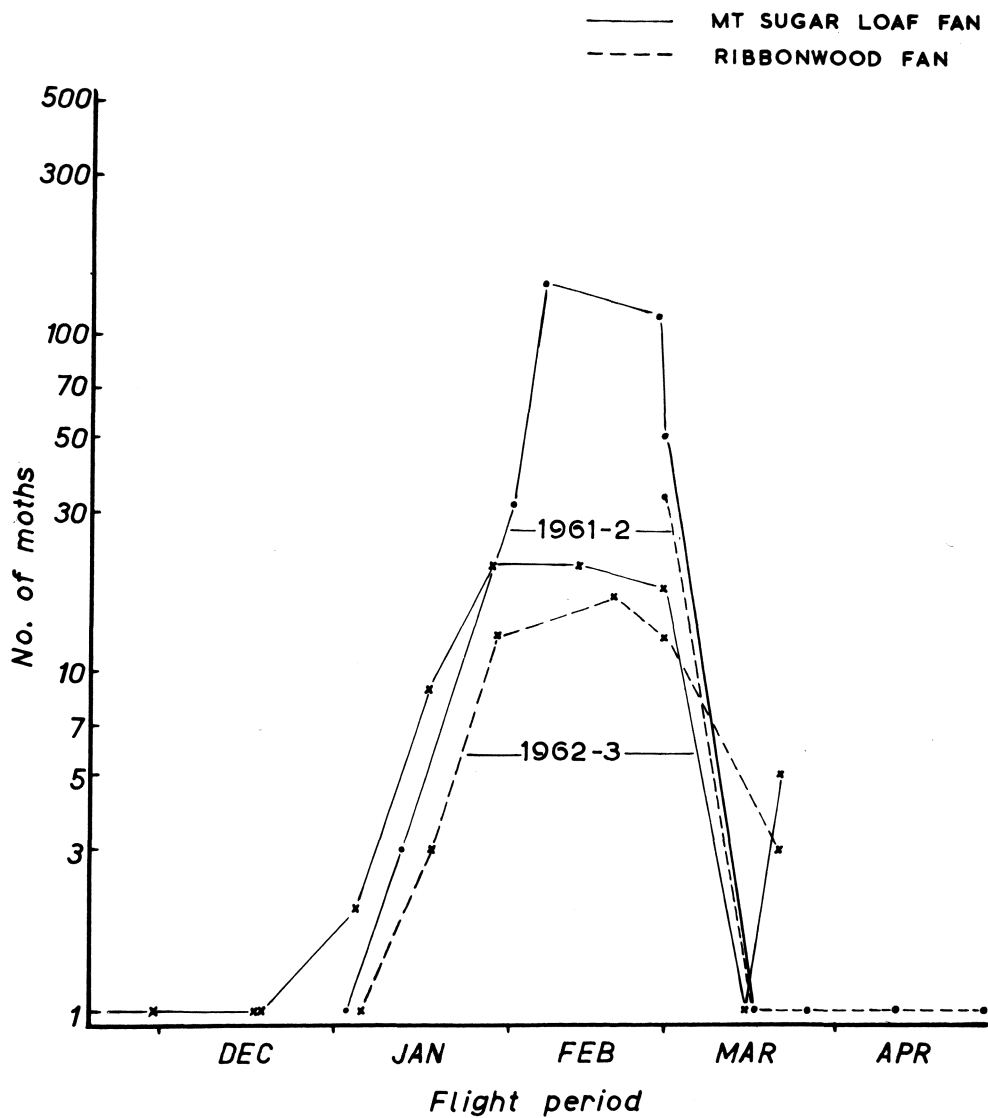


FIG 13. SEASONAL ABUNDANCE OF *PERSECTANIA*
ATRISTRIGA AS INDICATED BY LIGHT TRAP COLLECTIONS

Light trap collections indicated that this species was incidental until late January and again after March but very high numbers were present in February and March with peak numbers in late February (see Fig. 14). Since it appears that only males are readily attracted to light, the species may be relatively more abundant than the records indicate. On Mt Gog it proved to be more abundant than on Mt Sugar Loaf Fan and Ribbonwood Fan above the road and therefore almost certainly has a grassland association. Hence it is quite likely that it feeds on hard tussock and may be of considerable economic importance. It is generally distributed in the South Island but has seldom been recorded in the North Island. At Mt John, 37 specimens were trapped.

Melanchra pictula (White) 4 (3:0) 4

1962, early Mar, Apr & early May (1 reared, early Jan), 1900'-3500', Walk. Fan, Gold. Sdile, Mt Sugar Lf & Mt Sugar Lf Fan. Traps G & L.

Only one specimen was caught by a light trap.

A single larva of this species was found on 14 October 1962 on Walker's Fan. In the laboratory it burrowed down into the soil on 16 October and had pupated by 18 October. The adult probably emerged 1 or 2 January 1963.

The species is known only from the South Island but is rare. It is of no economic importance.

Melanchra insignis (Walk.) 22 (2:20) 8

1962, early Oct & late Mar-mid May, 1900'-2300', Rib. Fan (A), Mt Gog & Mt Sugar Lf Fan. Trap L.

This species is possibly most abundant in late April and the adult probably overwinters. It is common and generally distributed throughout New Zealand, the larvae feeding on a variety of low plants. It is probably of little economic significance.

Melanchra xanthogramma Meyr. 1 (0:1) 1

1962, late Nov, 1900', Mt Sugar Lf Fan. Trap L.

This species is known from both the North and South Islands, the larva feeding on Muehlenbeckia and probably

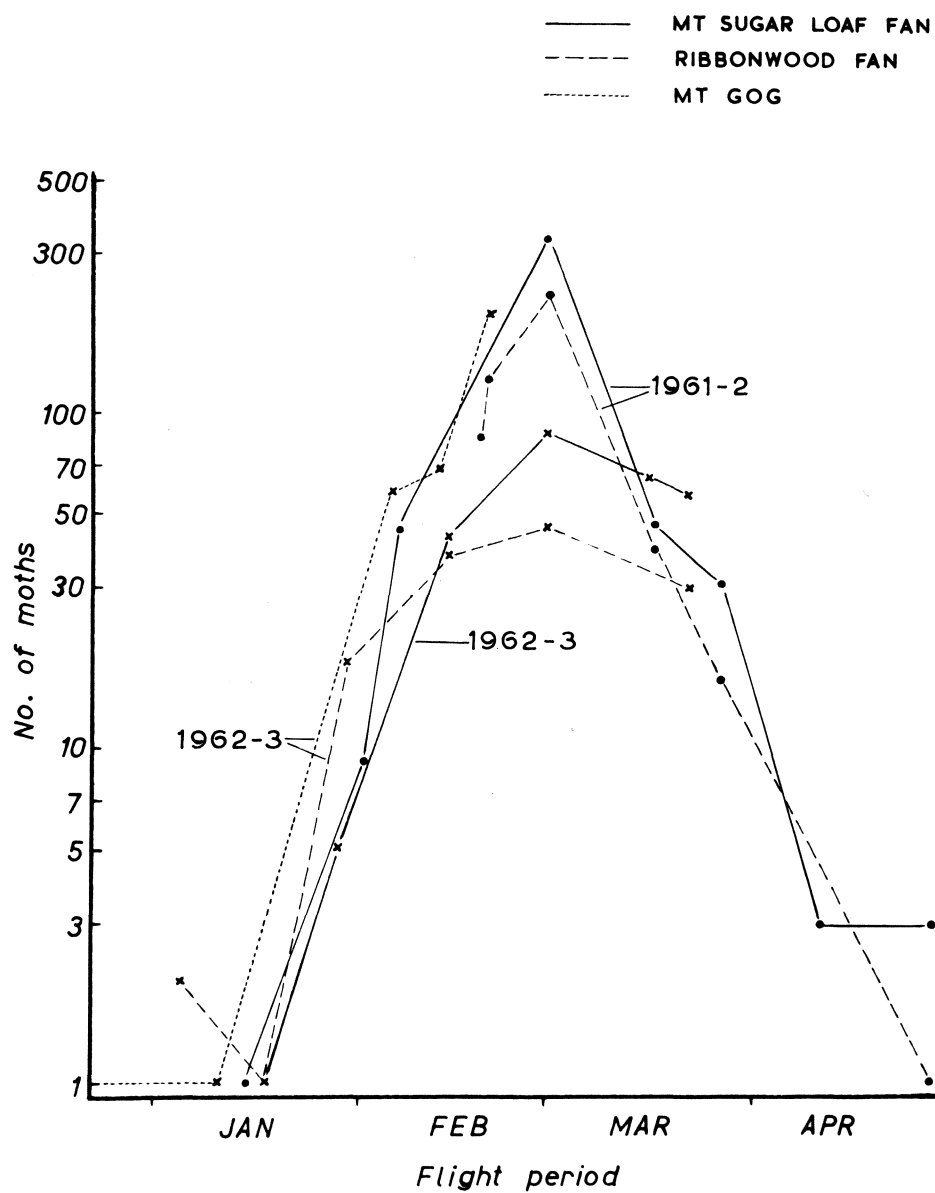


FIG 14. SEASONAL ABUNDANCE OF *PERSECTANIA PROPRIA* AS INDICATED BY LIGHT TRAP COLLECTIONS

many low plants. It is unlikely to be of any economic concern and is certainly incidental in the Cass area.

Melanchra plena (Walk.) 4 (2:2) 3

1962, early Oct & late Feb, 1900', Mt Sugar Lf Fan.

Trap L.

This species is apparently common and generally distributed throughout New Zealand. The larva feeds on Fuchsia excorticata (J.R. et G. Forst.) Linn. f. and also on low plants but is probably of no economic concern.

Melanchra mutans (Walk.) 772 (273:317) 53

1962-3, early Oct-late Apr, 1900'-2500', Rib. Fan (A), Mt Gog, Mt Sugar Lf Fan & Mt John. Trap L.

It is possible that a few female specimens of Melanchra furtiva Philp. have been recorded as this species but the effect of any confusion on the records of M. mutans can only be insignificant.

The adult of this species could probably have been trapped throughout the entire year. Light trap catches reflected two generations, the first with a peak in numbers probably in November and the second with a peak in late February (Fig. 15). The moth's greatest abundance was in February.

This species is extremely abundant throughout the whole of New Zealand. The larva feeds on low plants including Plantago. Its economic significance is uncertain.

Melanchra furtiva Philp. 6 (3:3) 4

1962, late Nov & Feb, 1900'-2300', Rib. Fan (A), Mt Gog & Mt Sugar Lf Fan. Trap L.

It is possible that a few female specimens of this species have been recorded as Melanchra mutans (Walk.) but the number of instances must at the most be few.

This species is known only from the South Island. Hudson (1950) states that the larva feeds on Plantago and so the species is probably of no economic significance.

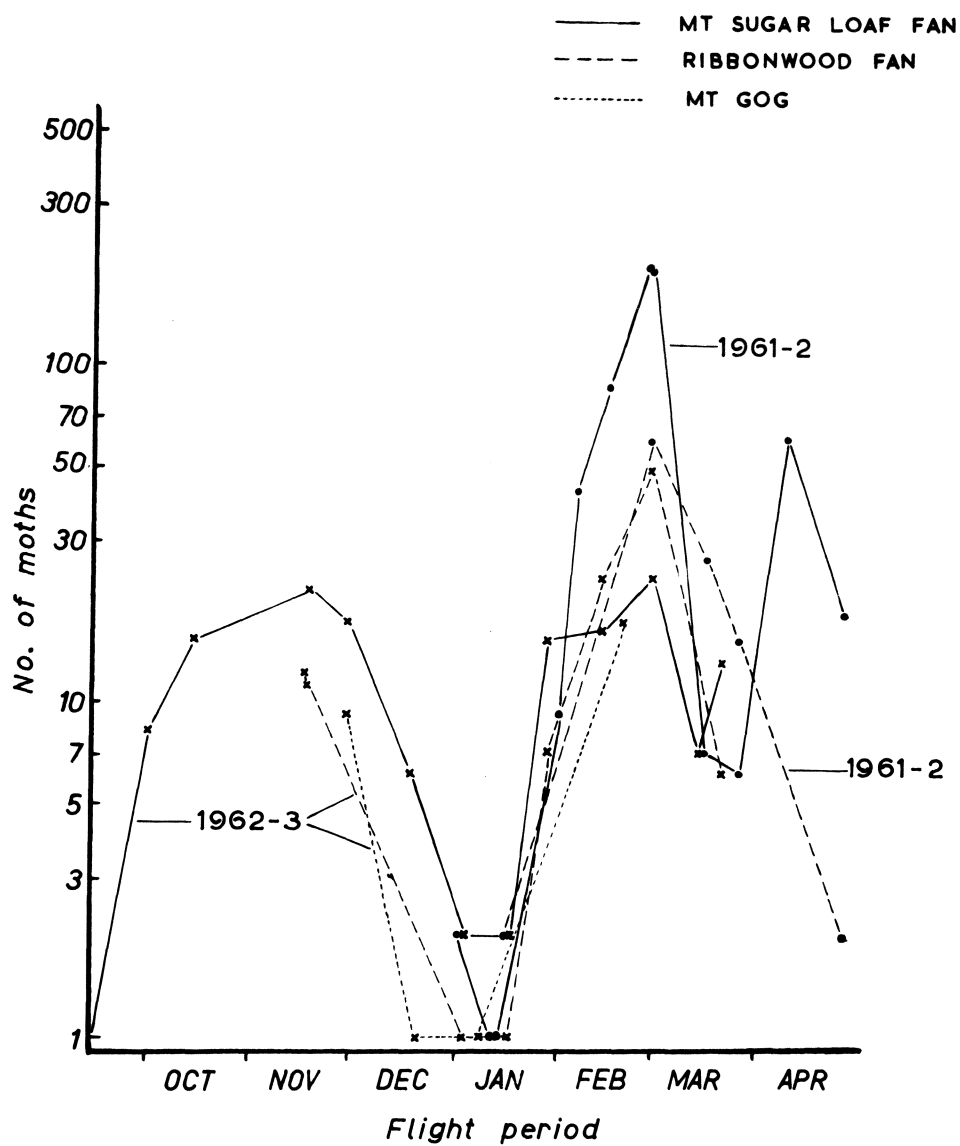


FIG 15. SEASONAL ABUNDANCE OF *MELANCHRA* *MUTANS* AS INDICATED BY LIGHT TRAP COLLECTIONS

Melanchra ustistriga (Walk.) 6 (2:4) 5

1962, early Oct, mid Nov & Apr, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

This species is apparently common and generally distributed throughout New Zealand. The larva feeds on Muehlenbeckia and is probably of no economic concern.

Melanchra paracausta (Meyr.) 7 (2:5) 3

1962, mid Oct & mid Nov, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

This species is generally distributed in the South Island but has seldom been recorded in the North Island. It is not often abundant and is probably of no economic concern.

Melanchra infensa (Walk.) 1 (0:1) 1

1962, mid Dec, 1900', Mt Sugar Lf Fan. Trap L.

This species is known from both the North and South Islands but is rarely found. The larval food plants probably include grasses but the species is of no economic significance.

Melanchra omoplaca (Meyr.) 8 (5:3) 6

1962-3, mid Dec-late Jan, 1900'-2300', Rib. Fan (A), Mt Gog & Mt Sugar Lf Fan. Trap L.

This species has been recorded from the North Island and is apparently widely distributed throughout the South Island. The larva feeds on Plantago and probably other low plants but it is unlikely to be of any economic concern.

Melanchra rubescens (Butl.) 24 (5:19) 9

1962-3, late Jan-late Feb, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

This species has been recorded from the North Island and is apparently widely distributed throughout the South Island. It is usually found in open situations. Its economic significance is uncertain.

Melanchra lignana (Walk.) 145 (118:21) 19

1962-3, early Feb-late Apr, 1900'-2300', Rib. Fan (A & B), Mt Gog & Mt Sugar Lf Fan. Traps L & G.

It is probable that a few specimens recorded here were Melanchra morosa (Butl.) but any confusion could not substantially alter the records of M. lignana.

All specimens except one were caught by light traps, the records indicating a greater abundance on Mt Sugar Loaf Fan than on Mt Gog and Ribbonwood Fan above the road. Highest numbers were present in late February and in March.

The species is generally distributed throughout New Zealand but its economic significance is uncertain.

Melanchra dotata (Walk.) 13 (9:4) 8

1962-3, late Jan-late Mar, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

This species is known from both the North and South Islands but is not often found. It is probably of no economic concern.

Melanchra tartarea (Butl.) 3 (1:2) 3

1962, late Mar-late Apr, 1900', Mt Sugar Lf Fan. Trap L.

This species is generally distributed only in the far south of New Zealand, being rare elsewhere. It is of no economic importance.

Melanchra agorastis Meyr. 89 (2:87) 20

1962-3, late Jan-early Apr, 1900'-2300', Rib. Fan (A), Mt Gog & Mt Sugar Lf Fan. Trap L.

The appearance of this species was incidental until mid-February, highest numbers occurring in late February and in March.

The species is known from both the North and South Islands. It appears to frequent open country but is rare in most localities. It is probably of little economic significance.

Melanchra morosa (Butl.) 8 (4:4) 6

1962-3, early Feb-late Mar, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

It is probable that a few specimens of this species were recorded as Melanchra lignana (Walk.) and so the number

of records listed is minimal.

The species is known from both the North and South Islands. Its economic importance is uncertain.

Melanchra lithias (Meyr.) 179 (9:167) 24

1962-3, late Dec & early Feb-late Apr, 1900'-2300',
Rib. Fan (A), Mt Gog & Mt Sugar Lf Fan. Trap L.

The appearance of this species was incidental until late February but rather high numbers were present until late March. Since only males seem to be readily attracted to light, the moth may be relatively more abundant than the records indicate.

The species has been recorded only from the South Island and is evidently local. It is probably of little economic concern.

Melanchra homoscia (Meyr.) 34 (22:9) 12

1962-3, early Oct-mid Dec & early Feb-late Apr, 1900'-2200', Rib. Fan (A) & Mt Sugar Lf Fan. Trap L.

All specimens except one were recorded from Mt Sugar Loaf Fan, the two largest catches being in early October and late April. It seems probable, therefore, that the moth could also be found between April and October.

The species is known from both the North and South Islands but is most common in the South Island. The larva feeds on Cassinia leptophylla (Forst. f.) R. Br. but as this species of Cassinia is not known to occur locally, the larva may also feed on C. fulvida Hook. f. The species is of no economic importance.

Melanchra prionistis (Meyr.) 1 (0:1) 1

1963, late Feb, 1900', Mt Sugar Lf Fan. Trap L.

This species is known from both the North and South Islands but is distributed generally only in the latter. Its economic significance is uncertain but it is of no consequence in the Cass area.

Melanchra phricias (Meyr.)

99 (85:11) 27

1962-3, mid Nov-late Apr, 1900'-2600', Rib. Fan (A),
Mt Magog, Mt Gog & Mt Sugar Lf Fan. Traps L & G.

All specimens except one were caught by light traps but the species' appearance was incidental before late January. Peak numbers probably occurred in February.

The moth is known from both the North and South Islands but is not a common species. Its economic importance is uncertain.

Melanchra omicron Huds.

7 (2:5) 6

1962-3, mid Nov-early Jan, 1900'-2300', Rib. Fan (A),
Mt Gog & Mt Sugar Lf Fan. Trap L.

This species has been recorded only once from each the North and South Island. It is therefore apparently very local and of no economic significance.

Melanchra sp.

1 (0:1) 1

1963, late Jan, 2200', Rib. Fan (A). Trap L.

Bityla defigurata (Walk.)

3 (3:0) 3

1962, late Sept, late Mar & mid May, 1900'-3200', Mt Sugar Lf, Mt Sugar Lf Fan & Cass. Traps L & W.

This species is generally distributed throughout New Zealand but is nowhere abundant. The larva feeds on Muehlenbeckia and is of no economic significance.

Bityla sericea Butl.

1 (0:1) 1

1963, late Mar, 1900', Mt Sugar Lf Fan. Trap L.

This species is known from both the North and South Islands but is seldom found. It is of no economic concern.

Ariathisa comma (Walk.)

16 (10:5) 9

1961-2, mid Nov-late Dec (4 reared, mid July-early Aug), 1900'-2500'/3100', Walk. Plot, Mt Bailey, Rib. Fan (A), Gold. Sdle, Mt Magog, Mt Gog & Mt Sugar Lf Fan. Trap L.

This species is relatively much more abundant than the records indicate. Late instar larvae could very readily be found amongst herbage in late summer and in autumn but were nowhere apparent in the spring (a single record in late November was incidental). Since only a few moths were

trapped in late spring and early summer, it appears that the adults may emerge and fly during the winter and early spring. This suggested flight period is supported both by the emergence dates of reared specimens and by the paucity of light trap records as compared with the abundance of larvae. If this explanation is true, those specimens caught by light traps in late spring and early summer were incidental to the moth's main flight period.

Those larvae which were reared were fed on the leaves of dandelion (Taraxacum officinale Weber) and a single specimen provided with only the leaves of cocksfoot (Dactylis glomerata L.) ate a small portion of a leaf sheath. In the field the larvae probably feed on a range of low plants. However, their economic importance is uncertain though the species is common and generally distributed throughout New Zealand.

The pupation period of reared specimens ranged from two to three months and one larva was found to be parasitised by the braconid Fhogra rubromaculata Cam. In the field the larvae were also found to be subject to a species of Entomophthera, a fungal mycosis. Infected specimens typically climbed as high as possible on the herbage (usually grasses) and died there. In those larvae which had only recently died, the symptoms were a shrivelling and darkening of the thorax. Particularly in late autumn when conditions were rather wet, these dead specimens were not uncommon in the grasslands and even in the following spring, some were still present. It appears therefore that larval numbers can be considerably reduced by this disease and that it may range over quite wide areas.

Noctuid sp.

1 (1:0) 1

1963, late Jan, 2200', Rib. Fan (A). Trap L.

HYPSIDAE

Nyctemera annulata (Boisd.) 1. 1

1962-3, late Nov, early Jan & late Apr, 1900'-2300',
Rib. Fan (A), Mt Magog & Cass. Trap N.

Only one specimen of this moth was ever caught but two others were seen in flight.

The species occurs in great abundance throughout New Zealand, breeding on composites. It is of no economic importance.

CHAPTER 4

DISCUSSION

INTRODUCTION

The results of the survey indicate that the insect fauna associated with tussock grasslands is both diverse and extensive. Not only are most orders present but most are well represented by a range of species. Although some of these species have only an indirect association with the grasslands, the majority are in effect directly associated either as plant and carrion feeders or as parasites and predators. Whether this association is with tussock or inter-tussock vegetation is of secondary significance for the fauna would be a different one if either of those components was absent.

The chief value of the faunistic list given is not as a list of individual species but as a list which reveals the overall composition of a fauna. This composition might well be considered typical of the fauna associated with tussock grasslands generally. Although the range of species may differ from one grassland to another, it is likely that the same orders and families (and even certain genera) which were a feature of the Cass fauna also characterise the fauna belonging to other tussock grasslands. Hence it is deserving that attention should first be paid to the relative importance of each individual order - its overall abundance, family composition and ecological significance. Similarly,

each of the dominant families and genera deserve a structural analysis and then a comparison with others. Individual species, however, demand a more critical appraisal. Some which have a wide distribution do in fact characterise the fauna of tussock grasslands generally, but others can be rather atypical, even though in the Cass area they proved to be abundant. Care should therefore be taken not to assert that any of the recorded species are necessarily typical of a tussock grassland fauna unless there is good evidence for doing so.

THE FAUNA

Three orders are dominant in tussock grassland - Hymenoptera, Lepidoptera and Diptera. Each of these is well represented both in species and individuals. The Lepidoptera are doubtlessly the most conspicuous and have consequently attracted most attention in the past but the other two orders are equally abundant. The Coleoptera are also represented by a considerable number of species but few appear to be abundant. The order is therefore much less conspicuous than the Hemiptera, although that order is represented by far fewer species.

Whereas only those orders mentioned above are dominant in tussock grassland, there are within many orders several components which can be considered a feature of the tussock grassland fauna. These components are now listed:

COLLEMBOLA - this order has still to be studied.

ORTHOPTERA - the Acridioidea are well represented, the Acridiidae being very conspicuous.

PSOCOPTERA - the Eupsocida are well represented though not abundant.

THYSANOPTERA - this order has still to be studied.

HEMIPTERA - the Homoptera are better represented than the Heteroptera but the latter are more conspicuous. The Pentatomoidea, Miroidea and Psylloidea are each well represented. No families or genera have a particularly good representation but some species are abundant.

COLEOPTERA - this order is poorly represented, no families being of any great significance other than the Carabidae, Staphylinidae, Elateridae and Scarabaeidae. The Curculionidae might also be included. Certain genera are rather well represented, namely Cyphon (Helodidae), Corymbites (Elateridae), Luperus (Chrysomelidae), Pyronota and Odontria (Scarabaeidae).

HYMENOPTERA - the Ichneumonoidea, Chalcidoidea and Proctotrupoidea are very abundant and well represented. The best represented family is the Ichneumonidae but others which are also well represented are the Braconidae, Pteromalidae, Eulophidae, Encyrtidae, Platygasteridae, Ceraphronidae and Diapriidae. The Formicidae and Colletidae are very abundant and conspicuous although represented by few species. Very few genera can be mentioned since not many have been determined but Apanteles (Braconidae) and Paracolletes (Colletidae) are each well represented.

DIPTERA - this order has still to be studied.

LEPIDOPTERA - the Pyralidoidea and Noctuoidea are very abundant and well represented. The best represented and most abundant families are the Crambidae, Pyraustidae and Noctuidae. Other conspicuous elements in the fauna are the Tinaeidea, Papilionoidea and Geometridae but these are not well represented.

Certain genera are abundant and well represented, namely Glyphipteryx (Glyphipterygidae), Elachista (Elachistidae), Crambus (Crambidae), Scoparia (Pyraustidae), Xanthorhoe (Geometridae), Leucania, Persectania and Melanchra (Noctuidae) and Wiseana (Hepialidae).

Individual species which were particularly characteristic of the fauna in the Cass area are as follows:

ORTHOPTERA - Phaulacridium marginale.

PSOCOPTERA - Myopsocus sp.

HEMIPTERA - Megaloceroea reuteriana, Deltoccephalus sp. 4 and Trioza discariae.

COLEOPTERA - Mecodema constrictum, Melanophthalma sp. 1, Pyronota edwardsi, P. laeta and Costelytra zealandica.

HYMENOPTERA - Cryptine sp. 1, Pimpline sp. 1, Ophionine sp. 13, Ophionine sp. 19, Ophionine sp. 20, Phogra rubromaculata, Apanteles sp. 6, Pteromalid sp. 1, Pteromalid sp. 10, Diapriid sp. 4, Monomorium antarcticum and Prolasius advena.

LEPIDOPTERA - Atomotricha sordida, Crambus vittellus, Scoparia submarginalis, S. sabulosella, Argyrophenax antipodum, Xanthorhoe semisignata, Persectania disjungens, P. propria, Melanchra mutans and Wiseana cervinata.

It is difficult to assess which species were conspicuous by either their absence or relatively low incidence but attention can be drawn to some. It is indeed interesting that the common grass-infesting aphid Rhopalosiphum padi was not abundant, that the hepialid moth Wiseana umbraculata was incidental and that the noctuid moth Agrotis ypsilon was

virtually absent. It is also significant that the army worm Pseudaletia separata (Walk.) was absent and that the honey bee Apis mellifera L., the lygaeid Rhyphodes clavicornis (Fab.) and the stigmellid moth genus Nepticula were never recorded. In addition, it is somewhat surprising that no records were made of the sweet briar seed-inhabiting chalcid Megastigmus aculeatus Swed. which B.P.J. Molloy (pers. comm.) states to be abundant amongst briar in the Cass area. The adult must therefore be very evasive or else not venture far from its food plant.

Certain species which were quite abundant in the Cass area showed distinct site preferences, some of the preferences being rather significant. Those which were most interesting were the ones which concerned improved versus unimproved grasslands. This response of certain species to improvement in tussock areas must not be overlooked since the faunistic changes that accompany the improvement can be quite marked. Those which are referred to below were all significant but doubtlessly there were others which could not be proven or else were not detected.

Species which were recorded as much more abundant on improved areas were Myopsocus sp. (PSOCOPTERA), Nysius huttoni (HEMIPTERA), Melanophthalma sp. 1 (COLEOPTERA), Perilampid sp. and Diapriid sp. 4 (HYMENOPTERA), Coleophora alcyonipennella, Capua semiferana, Leptomeris rubraria and Wiseana despecta (LEPIDOPTERA). The tussock moths (Crambidae) also appeared to be more abundant on improved grassland but this does not necessarily apply to all species. Species which were less abundant on improved areas were Cryptine sp. 1 and Ophionine sp. 5 (HYMENOPTERA) and Argyrophenga antipodum (LEPIDOPTERA). It is possible also that the tiny moths belonging to the genus Glyphipteryx were less abundant and likewise the lycaenid butterflies.

Species which had a restricted distribution irrespective of improvement included the following: Trogoderma sp.,

Dasytes minuta and probably Pyronota spp. (COLEOPTERA),
Pimpline sp. 1, Ophionine sp. 2, Ophionine sp. 13, Pteromalid sp. 1, Pteromalid sp. 10 and Eurytomid sp. 1 (HYMENOPTERA). Others which were distinctly associated with snow-tussock associations included Oliarus oppositus (HEMIPTERA), Diapriid sp. 7 and possibly Belytid sp. 2 (HYMENOPTERA), Megacraspedus calamogonus, Gelophaula siraea, Wiseana ascendens, Dasyuris spp. and Notoreas spp. (LEPIDOPTERA).

It is interesting to note wherever possible the long-term changes that have occurred within the fauna belonging to the Cass area. This has been possible for some of the species that were recorded at Cass by Hilgendorf (1918) and Dick (1940). Since the records of Dick were mid-way between those of Hilgendorf and those from the present survey, some significant trends could be noted. Species which have declined in numbers over the last 50 years include Megadromus antarcticus (COLEOPTERA), Gasteruption crassipes (HYMENOPTERA), Crambus flexuosellus, C. simplex, C. ramosellus and Agrotis ypsilon (LEPIDOPTERA). During the same period the tussock moth Crambus vittellus has greatly increased in numbers and there are indications that this increase may yet be continuing over wide areas of tussock grassland.

During the survey, the hosts of several parasites, predators and diseases were also recorded. Most of these associations are new records but unfortunately some of the insects still await identification. Since determinations may yet be made, all records except those of dipterous hosts are included in the following list (hosts are in second position):

PARASITISM -

- | | | |
|----------------------------------|---|----------------------------|
| <u>Gracilicera monticola</u> | - | <u>Persectania</u> sp. (?) |
| <u>Gracilicera politiventris</u> | - | <u>Crambus</u> sp. |

Ichneumonine sp. 10	- <u>Crambus</u> sp.
Ophionine sp. 12	- <u>Megacraspedus calamogonus</u>
Ophionine sp. 13	- <u>Scoparia submarginalis</u>
<u>Phogra rubromaculata</u>	- <u>Ariathisa comma</u>
" "	- unknown noctuid larva
<u>Meteorus</u> sp. 1	- unknown pupa
<u>Meteorus</u> sp. 5	- unknown pupa
<u>Apanteles</u> sp. 6	- unknown lepidopterous pupa
Pteromalid sp. 7	- unknown lepidopterous larva
Eulophid sp. 16	- unknown pupa
Trichogrammatid sp. 1	- unknown eggs
Scelionid sp. 1	- unknown lepidopterous eggs
unknown dryinid sp.	- <u>Deltocephalus</u> sp. 4
unknown dryinid sp.	- <u>Delphacodes meridionalis</u>

PREDATION -

<u>Uropetala chiltoni</u>	- <u>Melampsalta</u> sp.
<u>Cermatulus nasalis hudsoni</u>	- <u>Crambus vittellus</u>
" " "	- unknown lepidopterous larva
<u>Nabis maoricus</u>	- <u>Deleatidium autumnale</u> ?
<u>Neoitamus varius</u>	- <u>Pyronota festiva</u>
" "	- <u>Pyronota edwardsi</u>
" "	- <u>Argyrophenaga antipodum</u>
" "	- <u>Crambus simplex</u> (?)

DISEASE -

<u>Metarrhizium anisopliae</u>	- <u>Persectania</u> sp. (?)
<u>Entomophthera</u> sp.	- <u>Ariathisa comma</u>
<u>Cordyceps</u> sp.	- unknown lepidopterous larva
<u>Cordyceps</u> sp.	- unknown elaterid larva

SPECIES OF ECONOMIC IMPORTANCE

Since little is known about the precise habits of many insect species occurring in tussock grasslands, their likely

economic importance is difficult to estimate. Even when habits are known, their significance may not be appreciated and nor may the species' distribution and relative abundance be understood. As a result of the present survey, little new information has been added about the habits and general distribution of grassland-inhabiting species but much has been learned about the relative abundance of many. Hence, by taking account of previous information relating to habits and distribution, attempts have been made to evaluate the economic significance of some of the more important species.

Kelsey (1957) lists 45 species that have been recorded feeding on tussock. From the present survey, the following species have also been recorded as tussock feeders: Rhopalimorpha obscura (HEMIPTERA), Megacraspedus calamogonus, Crambus anselias and C. callirrhous (LEPIDOPTERA). In addition, unidentified lepidopterous larvae were recorded feeding on tussock and Dasytes minuta and a Colabotelus sp. (COLEOPTERA) were recorded as probable tussock feeders. There is strong evidence that the following insects may also feed on tussocks but no records of such feeding have yet been made. The insects are: Choerocydnus nigrosignatus, Melampusalta spp., a Rhizoecus sp. (HEMIPTERA), Selenopalpus rectipes, Nonnotus griseolus, Pyronota festiva, P. edwardsi, P. laeta (COLEOPTERA), Elachista helonoma, Scoparia submarginalis, S. sabulosella, Leucania unica and Persectania propria (LEPIDOPTERA). In addition, it is anticipated that the larvae of the tussock butterfly Argyrophenga antipodum feed on tussocks generally rather than confine their feeding to silver tussock.

Those insects which are considered most likely to do damage in tussock grasslands are now reviewed. Account is taken both of tussock-feeding species and of those which are known to feed on inter-tussock vegetation. Reference is

also made to certain species whose precise food plants are unknown but whose abundance may possibly make them of some consequence.

LEAF- AND STEM-FEEDING INSECTS

Those which may be of some concern are Phaulacridium marginale, Paprides furcifer (ORTHOPTERA), Megaloceroea reuteriana, Deltoccephalus sp. 4, Delphacodes meridionalis (HEMIPTERA), Atomotricha sordida, Glyphipteryx spp., Crambus spp., Scoparia submarginalis, S. sabulosella, Leucania spp., Persectania spp., Wiseana cervinata and W. despecta (LEPIDOPTERA).

The relative importance of the species listed is difficult to assess but undoubtedly the most damaging belong to the Lepidoptera. In order to evaluate which of these are the most important, the terms of the damage must be defined. This is necessary since the range of food plants is not the same for all genera.

In reference to damage of inter-tussock vegetation, J.M. Kelsey (pers. comm.) states that the genera Wiseana, Persectania and Crambus are the most important. He states also that the damage done by Wiseana is of an annual nature over extensive areas whereas that of the other two genera tends to be localised and serious only about once in 10 - 14 years. He further indicates that although all three genera prefer to feed on grasses, Wiseana and to a lesser extent Persectania will also eat legumes and plants in general. It would appear therefore that Wiseana damage is the most important in the inter-tussock zone. Its relative importance, however, depends on the comparative abundance of the genus, the composition of the inter-tussock vegetation and the species of Wiseana concerned. These considerations are now each dealt with in turn.

Firstly, it was evident from the survey that Wiseana can be many times less abundant than both Persectania and Crambus. It might therefore be questioned whether or not the higher and more consistent numbers of those genera actually cause more overall damage than is often anticipated. It is feasible that their higher numbers may possibly offset the greater damaging capacity of individual Wiseana larvae, although J.M. Kelsey (pers. comm.) indicates that Wiseana often destroy plant crowns whereas Persectania and Crambus do not. Secondly, if the inter-tussock vegetation is composed largely of grasses, then the feeding preferences of Persectania and Crambus will permit them to do more damage than if the vegetation was composed mainly of non-grasses. Hence it is possible that Wiseana damage will be comparatively less where grasses are more abundant. Thirdly, the species of Wiseana that is most important will probably depend on the vegetation. This was evident from the survey finding that W. despecta apparently has a strong preference for improved tussock grasslands whereas W. cervinata is generally distributed. It appears therefore that W. despecta may prefer non-graminaceous plants. Such a preference may make it possible to assess the most important species of Wiseana in a particular area by the composition of the vegetation.

Having once determined the relative importance of Wiseana, little more can be done to compare Persectania and Crambus. Not enough is known about the extent of their damage in inter-tussock vegetation but it would appear from the range of their food plants that Persectania is the more important. The likely importance of individual species is discussed below in reference to tussock feeders.

Kelsey (1957) states that the genera which do most damage to tussock are Crambus, Persectania and Leucania. Little is known about the larval habits of Crambus but it

is certainly known that they do not sever large amounts of tussock foliage at the base as can the larvae of both Persectania and Leucania. Since the damage of these last two genera appears to be similar, their relative importance would seem to be directly related to their abundance. Therefore, because Leucania was found in the survey to be much less abundant than either of the other two genera, its damage must be subsidiary at least to that of Persectania.

The extent of Persectania damage compared with that of Crambus is difficult to assess because although Crambus is much more abundant, the damage of its individual larvae is much less severe. It is generally considered, however, that Persectania is the more damaging, and it can certainly destroy entire plants whereas Crambus is not known to. Whether or not Crambus is more important than Leucania remains uncertain.

The relative importance of individual species of Crambus cannot be assessed since little is known about their larval habits and there is evidence that these may differ between species. For the genus Persectania, however, accurate assessments may be possible. The three species P. disjungens, P. aversa and P. atristriga are recorded by Kelsey (1957) as feeding on tussock, and from the present survey there is evidence that P. propria may also feed on tussock. As these are the only Persectania species which are common in tussock grasslands, their relative importance may closely approximate their comparative abundance. Hence, P. propria and P. disjungens are probably by far the most important species whereas P. aversa and P. atristriga are probably much less significant. This may be surprising since the army worm P. aversa is generally considered to be the only Persectania species of any real consequence. However, its comparatively low incidence is probably true for most tussock grasslands for not only was this evident in

the Cass area but also at Mt John in the Mackenzie Country.

(In assessing the relative importance of insects damaging foliage, it must be remembered that in the north of the South Island and in those tussock grasslands in the North Island, account has also be taken of the army worm Pseudaletia separata.)

SEED-FEEDING INSECTS

Those which may be of some concern are Megacraspedus calamogonus and certain unidentified larvae (LEPIDOPTERA).

The unidentified larvae (probably one species) have been recorded in considerable numbers from silver tussock while the larvae of M. calamogonus are known in large numbers from snow tussock. In both species the larvae chew the developing awns and it is likely that both also feed on the developing ovary. As yet, only M. calamogonus has been proved to damage the ovary but it is this damage which makes the species of some concern. Hence, since the two species occur in considerable numbers (especially M. calamogonus), their damage can be widespread and may greatly impair the setting of seed. Both may therefore be of economic concern for their damage ultimately limits the regeneration of tussock.

ROOT-FEEDING INSECTS

Those which may be of some concern are the Elateridae, Curculionidae, Costelytra zealandica, Pyronota spp., Odontria spp. (COLEOPTERA) and Wiseana spp. (LEPIDOPTERA).

The most damaging root feeders are undoubtedly the scarabaeid genera (Costelytra, Pyronota and Odontria), although in making the assessment no account can be taken of the extent to which Wiseana may damage roots. This genus is recorded by Kelsey (1957) as feeding on tussock roots but the extent of its damage is unlikely to compare with that of

the root-feeding scarabaeids. The weevils (Curculionidae) are included since they are able to do damage in some localised areas (Kelsey, 1957) although no such damage was recorded during the survey. The wireworms (Elateridae) also receive mention and may be more important as tussock feeders than has previously been realised. Kelsey (1957) records them feeding on tussock roots, and in the present survey they were proven to be much more abundant in the tussock root zone than in the inter-tussock root zone. It appears therefore that they may concentrate their feeding on the roots of tussock. Hence, on sites where root-feeding scarabs and curculionids are virtually absent (in the present survey this was found to be true for Ribbonwood Fan above the road), elaterids may actually be the most damaging root feeders. Generally, however, scarabs are much more important although it is considered that the damage of elaterids is possibly of some concern.

In assessing the relative importance of scarabaeid species, Kelsey (1957) indicates that Costelytra zealandica is widespread in tussock grasslands and is responsible for most damage to the roots of tussock. In a personal communication he adds that the same species is also responsible for most coleopteran damage in the inter-tussock root zone, although severe local damage is also known for two Odontria species and a single species of Chlorochiton. Hence, because of its widespread distribution and general feeding habits, Costelytra zealandica is undoubtedly the most important root-feeding species. The relative importance of species belonging to other genera cannot be assessed but it is likely that their damage tends always to be localised. (An instance of such a concentration was recorded in the present survey for species of Pyronota). Since all of these species are probably general feeders, there is no need to make accurate distinctions between feeding in tussock and inter-tussock root zones.

In comparing the influence of root-feeding and leaf-feeding insects on tussock, Kelsey (1957) considered that only the former were damaging if no account was taken of localised and sporadic damage. He states that leaf-feeding insects do most damage to leaves in the centre of tussock plants, but since the tussock tends to die in the centre and spread its growth outwards, the accumulation here of frass and its attendant moulds speeds up decay and provides an excellent seedbed for germination of seed from the parent plant. Hence leaf-feeding insects are beneficial whereas root feeders reduce the vigour of tussock by shortening the effective root system and thereby exposing the tussock to damage during periods of inadequate rainfall.

From the present survey, the conclusions drawn are somewhat different. Since Cass is in a medium-rainfall zone, the grasslands do not suffer from the extreme conditions experienced in low-rainfall areas. Hence it is improbable that any root-damaged tussocks have been exposed to periods of inadequate rainfall. In spite of this, many hard-tussock sites showed evidence of widespread damage by insects, and the same deterioration was equally true although more pronounced in low-rainfall areas. The evidence for this widespread damage was the complete or partial death of tussock plants, not in concentrated areas of local damage but as individual tussocks scattered over wide areas in many grasslands. In the field these tussocks were evident by their grey or grey-brown foliage - a foliage which was either flagging or had already fallen. Where only part of the tussock had died, the dead portion was often to one side - not necessarily in the centre.

An examination of some of these tussocks revealed that insect damage was the apparent cause of death in many cases. By lightly pulling the foliage it either sheared away just

above the soil surface or pulled out with only the basal half inch of its rooting system. Damage by noctuid larvae (mostly Persectania) is the logical explanation for foliage that is severed just above the soil surface while damage by root-feeding scarabaeids and/or elaterids probably accounts for most of the broken rooting systems. Hence it appears that leaf-feeding species are not all beneficial and that root feeders, under general conditions, can do the same damage to individual tussocks as they do to concentrated areas of tussock in sporadic outbreaks. The reason for being concerned about such damage is that there appears in fact to be little tussock regeneration. Instead, exotic grasses are often replacing the dead tussocks, or otherwise the ground may become bare as is quite possible in low-rainfall areas. It must be emphasised however that this is not a rapid deterioration but a slow, cumulative one that in time may greatly change the floristic composition of New Zealand's tussock grasslands. Their composition has already altered since the advent of the European but this change is continuing - and partly as a result of insect damage.

The full extent of the change at any point in time might be most expected in low-rainfall areas. Dick (1940), in reference to low-tussock grasslands, states that insect activity seems to aid the rapidity of deterioration in low-rainfall areas as also in a few medium-rainfall areas. From the survey, however, it appears that the deterioration of low-tussock grasslands in areas receiving a medium rainfall might be just as progressive. Whereas the nature of deterioration in low-rainfall areas stems from a lack of vigour (stunted tussock growth with degraded vegetation in the dry inter-tussock zone), it tends rather to result from increased vigour in medium-rainfall areas (vigorous exotic grasses regenerating more successfully than tussock). Hence, deterioration does not necessarily imply poor tussock growth but

can also indicate a replacement of dying tussocks by other vegetation. Whether or not the same criteria apply to silver-tussock and snow-tussock associations is uncertain, but it can be safely assumed that insect activity is still influencing the changing face of tussock grasslands generally.

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APPENDIX I

ANALYSIS OF LEPIDOPTERA COLLECTIONS
FROM LIGHT TRAPS

The sizes of light trap collections of Lepidoptera are markedly affected by weather conditions. A method of analysis was therefore devised to determine the seasonal abundance of species while accounting for the influence of local weather conditions on their flight activity. Since wind had the greatest influence on the flight of moths collected during the survey, the analysis is chiefly designed to minimise fluctuations in numbers caused by windy conditions. However it also accounts for any pronounced fluctuations that have been induced by other factors.

The effect of wind on the flight of an individual moth seems to depend largely on its body size. The greater its size, the greater its power of flight. Therefore, in order to analyse the significance of light trap collections taken on windy nights, it is necessary to know the extent to which the wind has affected the flight of different species. Moths might therefore be grouped according to their flying ability in windy conditions. From the survey records this appeared quite feasible as there seemed to be naturally three broad groupings. The strongest fliers were without doubt the Noctuidae and Hepialidae and as a group these were the most distinct. Typical of a second group were the Pyralidae and some of the smaller Geometridae (all with intermediate powers of flight) while the third group was comprised basically of the Tineidae, most being small in size and weak fliers. Each of these groups was distinct because the

moths mentioned were the most abundant of the Lepidoptera present in tussock grasslands and their sizes intergraded only slightly. However, there were also moths present whose sizes were intermediate to the three groups already defined but it is significant that none of these were abundant enough to constitute separate groupings. Therefore they were included in one of the major groups, although their size sometimes made this separation rather arbitrary. It must be emphasised however that their numbers were too small to upset later analyses of the three groups and yet their inclusion was necessary for an accurate analysis of collection totals.

Within each group, the number of moths caught were totalled for each individual light trap collection. Graphs of these totals were then plotted for the different light traps and the fluctuations studied carefully. By taking account of weather observations made in the field and by comparing the graphs for different light traps and different seasons, some of the stronger fluctuations could be readily explained. However, it was necessary to compare graphs from each of the three major size-groupings to evaluate what the effect of wind had been on each collection.

Where small-sized moths were few or virtually absent from a collection, it was clear that wind had been limiting their flight activity. Where they were plentiful, however, it was considered that wind had played no part in limiting their flight. Hence by making these and similar comparisons between the other size-groupings, an assessment could be made as to whether wind had appreciably influenced the size of a collection or not. Those collections which had been least affected were then isolated and plotted as separate graphs, one for each light trap and size-group. These graphs were without strong fluctuations and were taken to represent seasonal abundance much more ideally than the original graphs.

It could therefore be assumed that between each of the plotted points they showed the number of moths that would have been caught on other trapping dates if wind conditions had been favourable. By comparing these numbers with the numbers of moths actually caught, conversion factors could be readily calculated. These factors were then closely studied and any which were likely to introduce significant errors when used for individual species were rejected and the collections overlooked. All other factors were used to convert collection totals of individual species, and the new totals, together with those which remained unchanged, were plotted as a graph of the species' seasonal abundance. Several of the graphs are included in this thesis.

INDEX TO FAUNISTIC LIST
(excluding species)

	Page		Page
<u>Acridiidae</u>	52	<u>Aphodiinae</u>	122
<u>Acridioidea</u>	50	<u>Apidae</u>	171
<u>Acroclita</u>	198	<u>Apion</u>	116
<u>Adeliinae</u>	108	<u>Apioninae</u>	116
<u>Adephaga</u>	89	<u>Apis</u>	248
<u>Aequipalpia</u>	176	<u>Aploneura</u>	84
<u>Aeschnoidea</u>	48a	<u>Apoidea</u>	169
<u>Agrotis</u>	229	<u>Aradidae</u>	66
<u>Aleochara</u>	92	<u>Aradoidea</u>	66
<u>Aleocharinae</u>	92	<u>Archichauliodes</u>	172
<u>Aletia</u>	231	<u>Archyala</u>	194
<u>Allocharis</u>	110	<u>Arctiidae</u>	227
<u>Alloprocas</u>	115	<u>Argentine stem weevil</u>	114
<u>Alysiidae</u>	142	<u>Argyria</u>	207
<u>Amblyopone</u>	163	<u>Argyrophenga</u>	217
<u>Anchomenus</u>	90	<u>Ariathisa</u>	241
<u>Andesia</u>	230	<u>army worms</u>	234, 248
<u>Andrenidae</u>	170	<u>Artystona</u>	108
<u>Anisoplaca</u>	186	<u>Asaphodes</u>	222
<u>Anisoptera</u>	48a	<u>Ascogaster</u>	141
<u>Anobiidae</u>	105	<u>Asilis</u>	104
<u>Anobiinae</u>	105	<u>Aspilota</u>	142
<u>Anobium</u>	105	<u>Asthena</u>	221
<u>ants</u>	163	<u>Atomotricha</u>	187
<u>Apanteles</u>	139	<u>Atropidae</u>	56
<u>Aphelinus</u>	148	<u>Atropos</u>	56
<u>Aphididae</u>	79	<u>Auchenorrhyncha</u>	71
<u>Aphidiinae</u>	141	<u>Aulacorthum</u>	83
<u>Aphis</u>	81	<u>Aulax</u>	143

<u>Australophion</u>	130	<u>Caecilius</u>	57
<u>Austramathes</u>	229	Callimomidae	147
<u>Aylax</u> (see <u>Aulax</u>)		<u>Capitophorus</u>	82
bacon beetles	101	<u>Capua</u>	196
<u>Bactrachamorphus</u>	73	Carabidae	89
<u>Bactrachedra</u>	186	Caraboidea	89
bag moths	195	carabs	89
bees	169	<u>Carposina</u>	199
beetles	88	Carposinidae	199
Belytidae	161	Carposinoidea	199
Bethylidae	161	case moths	195
Bethyloidea	161	<u>Catoptes</u>	114
<u>Bitoma</u>	100	<u>Cavariella</u>	80
<u>Bityla</u>	241	cave wetas	50
Blacinae	139	Cerambycidae	112
Blattidae	49	Ceraphronidae	157
Blattoidea	49	<u>Cercyon</u>	101
<u>Bombus</u>	171	<u>Cermatulus</u>	64
booklice	56	chafers	117
<u>Borkhausenia</u>	187	Chalcidoidea	144
Bothriderinae	100	Cheloninae	141
<u>Brachaspis</u>	52	<u>Chlorochiton</u>	256
Brachelytra	91	<u>Chloroclystis</u>	220
<u>Brachycaudus</u>	80	<u>Choerocydnus</u>	63
Braconidae	136	<u>Choleva</u>	96
<u>Brentiscerus</u>	62	Chrysomelidae	109
<u>Brevicoryne</u>	83	Chrysomelinae	110
bristle tails	45	<u>Chrysophanus</u>	219
brown lacewings	172	cicadas	71
bugs	60	Cicadidae	71
bumble bees	171	Cicadoidea	71
burrower bugs	63	<u>Cicindela</u> (see <u>Neocicindela</u>)	
butterflies	217	Cicindelidae	89
caddis-flies	175	Cixiidae	75
Caeciliidae	57	Clavicornia	97

Cleridae	105	crickets	51
click beetles	106	<u>Crocodyopora</u>	208
Clistogastra	124	Cryptinae	127
clover case-bearers	191	Cryptocerata	70
<u>Cnephasia</u>	199	<u>Cryptolechia</u>	189
Cnodaloninae	108	Cryptorrhynchinae	116
Coccidae	86	Cryptostemmatidae	70
<u>Coccinella</u>	100	Cucujidae	98
Coccinellidae	100	Curculionidae	112
Coccoidea	85	<u>Cutilia</u>	49
<u>Coccophagus</u>	149	cutworm (greasy)	229
<u>Coccus</u>	86	Cydnidae	63
cockroaches	49	Cynipidae	143
<u>Coelostomidia</u>	86	Cynipoidea	143
Coenagriidae	48	<u>Cyphon</u>	102
Coenagrioidae	48	<u>Dacnusa</u>	142
<u>Colabotelus</u>	115	damselflies	48
<u>Coleophora</u>	191	<u>Dasytes</u>	104
Coleophoridae	191	<u>Dasyuris</u>	224
COLEOPTERA	88	<u>Declana</u>	227
COLLEMBOLA	46	<u>Degithina</u>	124
Colletidae	169	<u>Deleatidium</u>	47
Colydiidae	99	Delphacidae	76
Colydiinae	100	<u>Delphacodes</u>	76
<u>Conosomus</u>	94	<u>Deltocephalus</u>	73
Corduliidae	48a	<u>Demetriza</u>	90
Corixidae	70	DERMAPTERA	54
Corixoidea	70	Dermestidae	101
Corydalidae	172	diamond-back moth	193
<u>Corymbites</u>	107	Diapriidae	159
Cosmopterygidae	186	<u>Diasemia</u>	208
<u>Costachorema</u>	177	<u>Dichromodes</u>	225
<u>Costelytra</u>	120	<u>Dictyotus</u>	65
Crabronidae	169	DIPTERA	174
Crambidae	199	<u>Diptychophora</u>	207
<u>Crambus</u>	201	<u>Discothyrea</u>	164

Ditrysia	184	European earwig	54
<u>Divitiacus</u>	74	European wasp	168
dobson flies	172	<u>Eurythecta</u>	196
dragonflies	48a	Eurytomidae	147
Dryinidae	162	<u>Eusemion</u>	152
<u>Dryopais</u>	114	<u>Euxoa</u>	229
<u>Dytiscidae</u>	91	Evanidae	143
earwigs	54	fairy flies	154
<u>Ectopsocus</u>	58	<u>Phogra</u>	136
Ectotrophica	45	Figitidae	144
<u>Elachista</u>	189	five-plume moths	216
Elachistidae	189	flat bugs	66
Elasmidae	153	<u>Forficula</u>	54
<u>Elasmus</u>	153	Forficulidae	54
Elateridae	106	Forficuloidea	54
Elaterinae	107	Formicidae	163
<u>Elatichrosis</u>	107	Formicoidea	163
Encyrtidae	151	Fulgoroidea	75
<u>Endrosis</u>	186	fungus bugs	66
EPHEMEROPTERA	47	<u>Gadira</u>	207
<u>Epichorista</u>	198, 199	Galerucinae	110
<u>Epuraea</u>	97	<u>Gasteruption</u>	143
<u>Erebia</u>	218	<u>Gastrosarus</u>	112
Eriococcidae	86	<u>Gelechia</u>	185
<u>Eriococcus</u>	86	Gelechiidae	184
Eriosomatidae	84	<u>Gelophaula</u>	197
Erirrhinae	115	Geometridae	220
<u>Euchoeca</u>	221	Geometroidea	220
<u>Eucolaspis</u>	110	Glyphipterygidae	193
Eugnominae	115	<u>Glyphipteryx</u>	193
Eulophidae	148	gorse weevil	116
Eumolpinae	110	<u>Gracilaria</u>	192
Euphorinae	139	Gracilariidae	192
<u>Euprocas</u>	115	<u>Gracilicera</u>	201, 228
Eupsocida	57	grass grub	120

grasshoppers	49	<u>Hydropsyche</u>	178
ground beetles	89	<u>Hydropsychidae</u>	178
Gryllidae	51	Hydroptilidae	179
<u>Gryonoma</u>	97	Hydroptiloidea	179
<u>Gymnocerata</u>	60	Hylaeidae	170
<u>Halictus</u>	170	<u>Hylobia</u>	109
Halticinae	111	HYMENOPTERA	123
<u>Harmologa</u>	198	<u>Hyperodes</u>	114
Harpalinae	89	<u>Hyperomyzus</u>	83
<u>Heliothela</u>	209	<u>Hypharpax</u>	91
Helodidae	102	Hypsidae	243
Hemerobiidae	172	<u>Ichneumon</u>	125
Hemerobioidae	172	ichneumon flies	124
<u>Hemianthus</u>	51	Ichneumonidae	124
<u>Hemideina</u>	51	Ichneumoninae	124
HEMIPTERA	60	Ichneumonoidea	124
Hepialidae	182	<u>Ichneutica</u>	230
Hepialoidea	182	Ichneutinae	138
<u>Heterolepisma</u>	45	Inaequipalpia	179
Heteromera	108	<u>Inophloeus</u>	114
Heteroptera	60	Jassidae	72
Histeridae	96	jumping plant lice	77
<u>Holcaspis</u>	90	lacewings	172
<u>Holopsis</u>	101	ladybirds	100
Homoptera	71	Lamellicornia	117
<u>Homotropus</u>	129	Lampyridae (see Malacodermidae)	
honey bee	248	<u>Lancetes</u>	91
<u>Huberia</u>	164	Lathridiidae	98
<u>Hudsona</u>	62	leaf beetles	109
<u>Hudsonema</u>	179	leaf bugs	68
<u>Hungariella</u>	152	leaf hoppers	72
<u>Huttonacris</u>	53	leaf rollers	196
<u>Hybernia</u>	226	<u>Leperina</u>	97
<u>Hydriomena</u>	220	LEPIDOPTERA	181
<u>Hydrobiosis</u>	176	Lepismatidae	45
Hydrophilidae	101	<u>Leptomeris</u>	225

<u>Leptoceridae</u>	178	<u>Melanchra</u>	236
<u>Leptoperlidae</u>	55	<u>Melandryidae</u>	109
<u>Leptoperloidea</u>	55	<u>Melanophthalma</u>	98
<u>Leptophlebiidae</u>	47	<u>Melolonthinae</u>	117
lerp insects	77	<u>Melyridae</u>	104
<u>Leucania</u>	230	<u>Mesopsocidae</u>	57
<u>Libelluloidea</u>	48a	<u>Mesopsocus</u>	57
<u>Lipaphis</u>	84	<u>Metacrias</u>	227
<u>Lissotrachelus</u>	51	<u>Metagerra</u>	63
long-horned caddises	178	<u>Meteorinae</u>	138
long-horned locusts	50	<u>Meteorus</u>	138
<u>Longicornia</u>	112	<u>Michrarchus</u>	50
longicorns	112	micro-caddises	179
<u>Luperus</u>	110	<u>Microgasterinae</u>	139
<u>Lycaena</u>	219	<u>Micromus</u>	173
<u>Lycaenidae</u>	219	<u>Microterys</u>	151
<u>Lygaeidae</u>	60	<u>Miridae</u>	68
<u>Lygocerus</u>	157	<u>Miroidea</u>	68
<u>Lygus</u>	69	<u>Monomorium</u>	164
<u>Lythria</u>	225	<u>Monopis</u>	194
<u>Macrocentrinae</u>	136	<u>Monotrysia</u>	182
<u>Macrosiphum</u>	82	moths	181
<u>Macrotylus</u>	69	<u>Mycetophagidae</u>	99
<u>Malacodermidae</u>	103	<u>Mymaridae</u>	154
<u>Maoripsocus</u>	58	<u>Myopsocidae</u>	57
<u>Margarodidae</u>	86	<u>Myopsocus</u>	57
mayflies	47	<u>Myzaphis</u>	80
mealy bugs	85	<u>Myzus</u>	83
<u>Mecodema</u>	89	<u>Nabidae</u>	66
<u>Mecyna</u>	208	<u>Nabis</u>	66
<u>Megacraspedus</u>	184	<u>Neocicindela</u>	89
<u>Megadromus</u>	90	<u>Neoitamus</u>	119, 204, 218
<u>Megaloceroea</u>	68	<u>Nepticula</u>	248
<u>Megaloptera</u>	172	<u>Netelia</u>	128
<u>Megastigmus</u>	248	<u>Neurochorema</u>	177
<u>Melampsalta</u>	72	NEUROPTERA	172

<u>Nicaeana</u>	113	<u>Paranusia</u>	152
<u>Nilaparvata</u>	76	Parapsocida	56
Nitidulidae	97	<u>Parmius</u>	105
Noctuidae	228	<u>Paroxyethira</u>	179
Noctuoidae	227	Pentatomidae	63
<u>Nonnotus</u>	113	Pentatomoidae	60
<u>Notoreas</u>	224	<u>Pentatrichopus</u>	80
<u>Nyctemera</u>	243	Perilampidae	148
Nymphalidae	217	<u>Peripsocopsis</u>	58
<u>Nymphula</u>	208	<u>Peristoreus</u>	115
<u>Nysius</u>	60	<u>Persectania</u>	234
ODONATA	48	Petaluridae	48a
<u>Odontria</u>	121	Phasmatidae	50
<u>Oeceticus</u>	195	Phasmatoidea	50
<u>Oecetis</u>	178	<u>Phaulacridium</u>	52
Oecophoridae	186	<u>Pheloneis</u>	108
Cedemeridae	108	Phycitidae	208
<u>Oliarus</u>	75	<u>Phyllotreta</u>	111
<u>Olinga</u>	180	<u>Physetica</u>	233
<u>Omosita</u>	97	Phytophaga	109
<u>Ophion</u>	131	Pieridae	219
Ophioninae	130	<u>Pieris</u>	220
Opiinae	141	Pimplinae	130
<u>Oregus</u>	89	<u>Pison</u>	168
<u>Orocrambus</u>	201	Planipennia	172
<u>Orthoclydon</u>	221	plant bugs	68
ORTHOPTERA	49	plant-lice	79
Otiorrhynchinae	113	Platygasteridae	155
<u>Oxycanus</u> (see <u>Wiseana</u>)		<u>Platyptilia</u>	217
<u>Oxyethira</u>	179	PLECOPTERA	55
Oxytelinae	95	<u>Plectrocnemia</u>	178
<u>Oxythecta</u>	189	<u>Plutella</u>	192
Papilionoidea	217	Plutellidae	192
<u>Paprides</u>	52	Polycentropidae	177
<u>Paracolletes</u>	169	Polyphaga	91

<u>Porina</u> (see <u>Wiseana</u>)		<u>Rhogadinae</u>	142
<u>Procordulia</u>	48a	<u>Rhogas</u>	142
<u>Proctotrupes</u>	155	<u>Rhopalimorpha</u>	64
Proctotrupidae	155	<u>Rhopalosiphum</u>	81
Proctotrupoidea	155	<u>Rhopalum</u>	169
<u>Prolasius</u>	166	Rhyacophilidae	176
<u>Prosopis</u>	170	Rhyacophiloidea	176
<u>Proteodes</u>	189	Rhyncophora	112
<u>Proteroeca</u>	209	Rhyparsominae	114
Psammocharidae	167	<u>Rhypodes</u>	62
Pselaphidae	95	<u>Romna</u>	69
<u>Pseudaletia</u>	248, 255	rove beetles	91
Pseudococcidae	85	<u>Salius</u>	167
<u>Pseudococcus</u>	85	sand-wasps	167
<u>Psilochorema</u>	176	<u>Saprinus</u>	96
psocids	56	<u>Saprosites</u>	122
PSOCOPTERA	56	scale insects	85
Psychidae	195	Scarabaeidae	117
Psychoidea	195	Scelionidae	158
Psyllidae	77	<u>Scoparia</u>	210
Psylloidea	77	<u>Scopodes</u>	90
Pteromalidae	144	<u>Scymnus</u>	101
<u>Pteromalus</u>	144	<u>Selidosema</u>	226
Pterophoridae	216	<u>Selenopalpus</u>	108
<u>Pycnocentria</u>	180	<u>Semo</u>	76
<u>Pycnocentrodes</u>	180	Sericostomatidae	179
<u>Pycnomerus</u>	100	Sericostomatoidea	179
Pyralidoidea	199	shield-bugs	63
Pyraustidae	208	short-horned grasshoppers	52
<u>Pyronota</u>	118	Sialoidea	172
Reduvioidae	66	<u>Sigara</u>	70
Rhaphidophoridae	50	Silphidae	96
Rhinomacerinae	116	silverfish	45
<u>Rhinorhynchus</u>	116	<u>Simaethis</u>	193
<u>Rhizoecus</u>	86	skipjacks	106

social bees	171	<u>Trifidaphis</u>	84
social wasps	168	<u>Trioza</u>	77
Spathiinae	142	<u>Triplectides</u>	178
Sphecoidea	168	<u>Troctes</u>	57
spider-hunters	167	Troctidae	57
spring-tails	46	<u>Trogoderma</u>	101
Staphylinidae	91	Trogositidae	97
Staphylininae	94	Tryphoninae	128
Stenopelmatidae	51	Trypoxylidae	168
<u>Stenoptilia</u>	217	tussock moths	199
Sternorrhyncha	77	<u>Typhlocyba</u>	74
<u>Sthenarus</u>	69	<u>Ultracoelostoma</u>	87
stick insects	50	<u>Uropetala</u>	48a
stink bugs	63	<u>Vanessa</u>	218
stoneflies	55	Vespidae	168
<u>Synchorema</u>	177	Vespoidea	167
Tachyporinae	94	<u>Vespula</u>	168
Tenebrionidae	108	wasps	167, 168
Tettigoniidae	50	water beetles	91
thrips	59	waterboatmen	70
<u>Thripsaphis</u>	84	weevils	112
THYSANOPTERA	59	wetas	51
THYSANURA	45	white butterfly	220
<u>Tigones</u>	114	wireworms	106
Tinaeidae	194	<u>Wiseana</u>	182
Tinaeidea	184	<u>Xanthocnemis</u>	48
Tortricidae	196	<u>Xanthorhoe</u>	222
Tortricoidea	195	<u>Xenogonus</u>	105
<u>Tortrix</u>	196	<u>Xestocephalus</u>	74
<u>Trachypepla</u>	187	<u>Xiphidium</u>	50
Trichgrammatidae	153	<u>Zelandobius</u>	55
TRICHOPTERA	175	<u>Zorion</u>	112
Trichopterygidae	96	Zygoptera	48