INSECTS ATTACKING TUSSOCK

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Summary

A list is given of 45 insects that feed on roots or aerial portions of native tussock species, and the relative importance of those insects is discussed in so far as they affect tussock deterioration.

INTRODUCTION

In this paper the tussocks referred to are *Festuca novae-zelandiae* Cockayne, *Poa caespitosa* Forst., and *P. colensoi* Hook. f. at altitudes ranging from 1,500 to 4,500 feet. Data are confined strictly to tussock itself, and do not include inter-tussock vegetation. Insect terminology is that of Hudson or Tillyard (1926).

Hudson (1928, 1934, 1939, 1950) shows that at the dates of publication of his work there were only nine insects—all larvae of Lepidoptera—known to feed on tussock; in addition, 22 further species of adult Lepidoptera were recorded as being common on tussock, and a further 47 species from native grasses in tussock-dominant zones. The term "native grasses" has been used apparently in some cases as a general name to include the above three tussock species also. Dick (1940) extended the list of insects definitely attacking tussock to include a species of *Odontria* feeding on roots, and the caterpillars of the three moths *Persectania ewingi* Westwd., *Leucania toroneura* Meyr., and *L. acontistis* Meyr. Healy (1945) recorded grass grubs and *P. ewingi* larvae as damaging tussock. Given (1952) lists 19 species of melolonthids as being found in "subalpine scrub and tussock" or "usually under grass or tussock".

The presence of adult Lepidoptera (which are usually nectar-feeders) or other insects on tussock does not necessarily mean that they or their leaf- or root-eating larvae feed on tussock, so there are authentic records of only 13 species of insects that definitely eat one or more of the three tussock species mentioned above, and a large number of tussock-zone moths and smaller numbers of Coleoptera whose larvae may be able to eat tussock.

INSECTS RECORDED ON TUSSOCK

The following records and notes refer only to insects that were actually seen by the writer to feed on tussock, or which contained tussock leaf fragments on dissection. The list of insects is as follows:

I. Leaf-eating species:

Agrotis ypsilon Rott.	(Noctuidae)
Argyrophenga antipodum Dbld.	(Nymphalidae)
Crambus flexuosellus Dbld.	(Pyralidae)
C. simplex Butl.	,,
C. spp. (2: larvae only)	,,
Leucania acontistis Meyr.	(Noctuidae)
L. phaula Meyr.	,,
L. semivittata Walk.	,,

Oxycanus spp. (2: larvae only)	(Hepialidae)
Orophora unicolor Butl.	(Psychidae)
Persectania atristriga Walk.	(Noctuidae)
P. disjungens Walk.	,,
P. ewingi Westwd.	,,
Brachaspis collinus Hutt.	(Acridiinae)
Locusta migratoria Reich.	(Oedipodinae)
Phaulacridium marginale Walk.	(Acridinae)
Mealybug (1 sp.)	(Margarodinae)
Dictyotus caenosus Westwd.	(Hemiptera)
Hudsona anceps White	,,
Nysius huttoni White	,,
Thrips (2 spp.)	(Thysanoptera)
Costelytra zealandica (White)	(Melolonthinae)
Odontria sp.	,,
Hyperodes griseus Hust.	(Curculionidae)

II. Root feeders:

Chlorochiton convexa Given	(Melolonthinae)
Costelytra zealandica (White)	,,
Odontria spp. (5: larvae & adults)	,,
O. striata White	,,
Pyronota inconstans Brookes	,,
Weevil sp. (larvae only)	(Curculionidae)
Elaterids (3 spp. larvae only)	(Elateridae)
Tipulids, (3 spp. larvae only)	(Tipulidae)
Oxycanus spp. (2: larvae only)	(Hepialidae)
Mealybug (1 sp.)	(Hemiptera)

EXTENT OF DAMAGE BY THE DIFFERENT ORDERS

Lepidoptera. This order occurred in greatest numbers in tussock, and also caused most damage to leaves over the ten-year period of observations. Of the 14 species involved, most damage was done by members of the genera *Crambus, Persectania,* and *Leucania,* but of these it was not possible to state that any one species was causing more damage than the others. Popular belief among tussock-zone farmers is that larvae of this order play a major part in tussock deterioration, but the present observations did not confirm this. There is, however, evidence in the form of frass deposits to indicate that high populations of the noctuids sometimes occur, and it is quite possible that under those circumstances severe damage could result.

Coleoptera. Though eight species of melolonthid adults were collected within tussock by the writer or members of the Ashburton staff, only two were actually proved to be eating leaves, and then only new growth resulting from a burn; their overall influence as leaf-feeders was negligible. On the other hand melolonthid larvae feeding on roots caused sufficient damage in some localized areas to permit grazing stock to pull up whole tussock plants. Elaterid larvae were not numerous, but those of weevils sometimes occurred in relatively large numbers; their influence would be difficult to separate from that of melolonthids. Larvae of *Chlorochiton convexa* Given caused serious damage and tussock loss in small patches up to ¾ acre in extent over fairly extensive areas of the Mt. Highfield Station at Waiau. This is the same insect reported by Lowe (1954) as causing death of the noxious weed nassella tussock.

Costelytra zealandica larvae were responsible for most damage to root systems and they occurred in fairly high numbers even at altitudes of over 4,500 ft. above sea level.

Orthoptera. All three members of this order occurred wherever there was tussock, and, though they fed on leaves, very little impression was made on tussock growth.

Hemiptera. As these insects are sap-feeders, it is difficult to assess their damage, but no definite evidence was collected to show that they were of primary importance. A root-feeding mealybug was sometimes present in large numbers (over 150 per tussock plant), and a large mealybug within the rolled leaves sometimes resulted in a silvery appearance of leaves where high populations were present. *Nysius huttoni* was not uncommon on developing seed heads where feeding was observed to occur.

Thysanoptera. The two species of thrips came into the same category as the Hemiptera so far as assessing damage was concerned; they too, caused a silvering of leaves harbouring large populations, and they also fed on developing tussock seed.

Diptera. In areas of high soil moisture or organic matter, three species of tipulid larvae were sometimes relatively common, and one of them could be found almost anywhere that sampling was carried out. Though it may not be their main item of food, all three species were seen to feed on roots of tussock. The commonest species belonged to the genus *Macromastix.*

GENERAL DISCUSSION ON OVERALL DAMAGE

It can be seen from the above that no extensive conspicuous damage could be attributed to any particular insect. Their combined influence, however, is another matter, and it is hardly necessary to point out that 45 different species of insects, often all occurring in the same area, must reduce the vigour of the tussock to some extent at certain stages of growth. Over the period of observation there was no indication that any of the insects was more plentiful than past records or opinions of high-country farmers showed.

Of the insects that caused most damage, not one was free from parasites, predators, or diseases either above or below the ground surface, and it is considered that this factor was responsible for maintaining insect populations at a level where influence on tussock was not of major concern. In relatively small localized areas there were occasional seasons of severe damage till the parasite–host relationship reached what is apparently the normal balance. Another factor that reduces chances of damage to tussock is that melolonthid larvae are cannibalistic; this in the case of plants with poor root systems would assist in keeping populations per tussock at a more or less constant maximum of 6–8 larvae.

Taking a broad view of the tussock insect situation, and ignoring the sporadic occurrence of localized damage, it is considered that the leaf-eating insects observed were beneficial rather than harmful over the period of observation. Individual tussock plants tended to die out in the centre; this had the effect of "pushing" the growing portion outwards in a ring, leaving dead and decaying leafage in the centre. Most

insect damage to leaves occurred to centres of plants, and the accumulation here of frass and its attendant moulds speeded up the decaying process. Whether or not the tendency to die out in the centre is a natural feature of tussock development, the final effect was to produce a central decaying portion of leaf mould which formed an excellent seed-bed for germination of seed from the parent plant—a seed-bed moreover, that was not unduly affected by wind or frost action. Tussock seed was seen to be germinating in this central frass and decay zone in tussock.

When it comes to consideration of the root-eating insects (particularly the melolonthid larvae) there is no doubt that they reduced vigour of tussock over the period of study. Populations as high as 47 larvae under a single tussock were recorded in the present survey, 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 so that tussock cannot utilize plant nutrients at a depth greater than 2–4 in. instead of the 18 in. to over 3 ft. common for the above three species of tussock. 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 at which times they showed noticeably poorer leaf growth than did plants with undamaged root systems.

The movement of ground-inhabiting insects—both plant-feeders and insect parasites and predators—through the soil tended to make the top 3 in. open and crumbly. This permitted frost action to lift root-damaged tussock plants in those relatively small areas where high populations of melolonthids built up to damaging levels. It was responsible also for accelerated wind erosion round margins of tussocks, and, of course, in inter-tussock areas where root-feeding insects caused more damage than under tussock themselves.

Tussock cannot apparently recover quickly from excessive injury, and it is important to recognize this fact when assessing impact of insect or any other type of damage. For exampe, at Waiau where *Chlorochiton convexa* larvae were destroying native tussock in more or less isolated patches, these tussock-free areas are likely to be apparent for over ten years even if this grass grub is eliminated from the area. The reason for this, it is considered, is that whereas native tussock (merely from the fact of its continued existence) must have been able successfully to withstand feeding by this native insect, it does not have the ability also to withstand effects of grazing stock, and feeding and scratching by rabbits. A true assessment of the relative effects of all types of physical injury to tussock could be achieved only after many years of careful checking, but the writer is convinced, as a result of the past ten years' casual observations, that insects could be responsible for some of the clear-cut lines on one side of which there is tussock and on the other no tussock at all, even though there may not be any insects present at subsequent inspections. It is thought, however, that insect larvae "put the finishing touches" to tussock injured by the complex of human, grazing, and other physical disturbances caused by animals.

It is stressed that over the 10-year period of the present studies, there has been no heavy infestation by any of the insects recorded here, so it would not be correct to state that insects are never of major importance

over large areas. All that can be said, is that there are many insects that fed on tussock, a few did periodic, severe, local damage over the period of observation, and that the overall damage was not severe over that period. A small series of insecticide-treated and untreated plots in the Mackenzie Country, however, showed that there is a definite difference between the treated and untreated; this indicates that the overall effect of insects cannot be ignored in making a true survey of tussock deterioration.

APPENDIX

PREVIOUS RECORDS OF INSECTS EATING TUSSOCK

I. Recorded by Hudson (1928, 1934, 1939, 1950):
Aletia griseipennis Feld. on native grasses.
A. temenaula Meyr. on *Poa caespitosa.*
Argyrophenga antipodum Dbld. on *P. caespitosa.*
Crambus simplex Butl. on *P. caespitosa.*
Leucania phaula Meyr. on *P. caespitosa.*
L. semivittata Walk. on native grasses.
Metacrias erichrysa Meyr. on tussock.
Orocrambus mylites Meyr. probably on *P. colensoi.*
Orophora unicolor Butl. probably on tussock.

II. Recorded by Dick (1940):
Leucania acontistis Meyr.
L. toroneura Meyr.
Persectania ewingi Westwd.
Odontria sp. larvae eating roots of *P. caespitosa* and *Festuca novae-zelandiae.*

III. Recorded by Healy (1945):
Odontria spp.
Persectania ewingi Westwd.

IV. Recorded by Given (1952):
Chlorochiton discoidea Broun
C. intermediata Given
C. pulcher Broun
C. simmondsi Broun
Costelytra zealandica (White)
Odontria macrothoracica Given
O. occiputale Broun
O. variegata Given
Mycernus elegans Broun
M. intermediatus Given
Prodontria bicolorata Given
P. capito Broun
P. lewisii Broun
P. modesta Broun
P. pinguis Given
Psilodontria viridescens Broun
Pyronota inconstans Brookes
P. rubra Given
Scythrodes squalidus Broun

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