A New Species of *Eriococcus* Targ. (Hemiptera, Coccidae) Attacking *Leptospermum* in New Zealand.

By J. M. Hoy,
Entomological Research Station, Palmerston North

[*Read before Canterbury Branch, July 1, 1953; received by the Editor, November 2, 1953.*]

Summary

Eriococcus orariensis, a new species of *Coccidae* attacking *Leptospermum* is described, and its life-history under Canterbury conditions outlined.

E. orariensis is apparently naturally distributed in Canterbury from Cave to the Waipara River. The insect has been artificially established at a large number of points in both main islands.

Control by chemicals is possible but would be expensive on a large scale.

The origin of the insect is unknown, and it is considered that if the present rate of increase and spread is maintained, ultimately all the larger stands of *Leptospermum scoparium* Forst. will be destroyed.

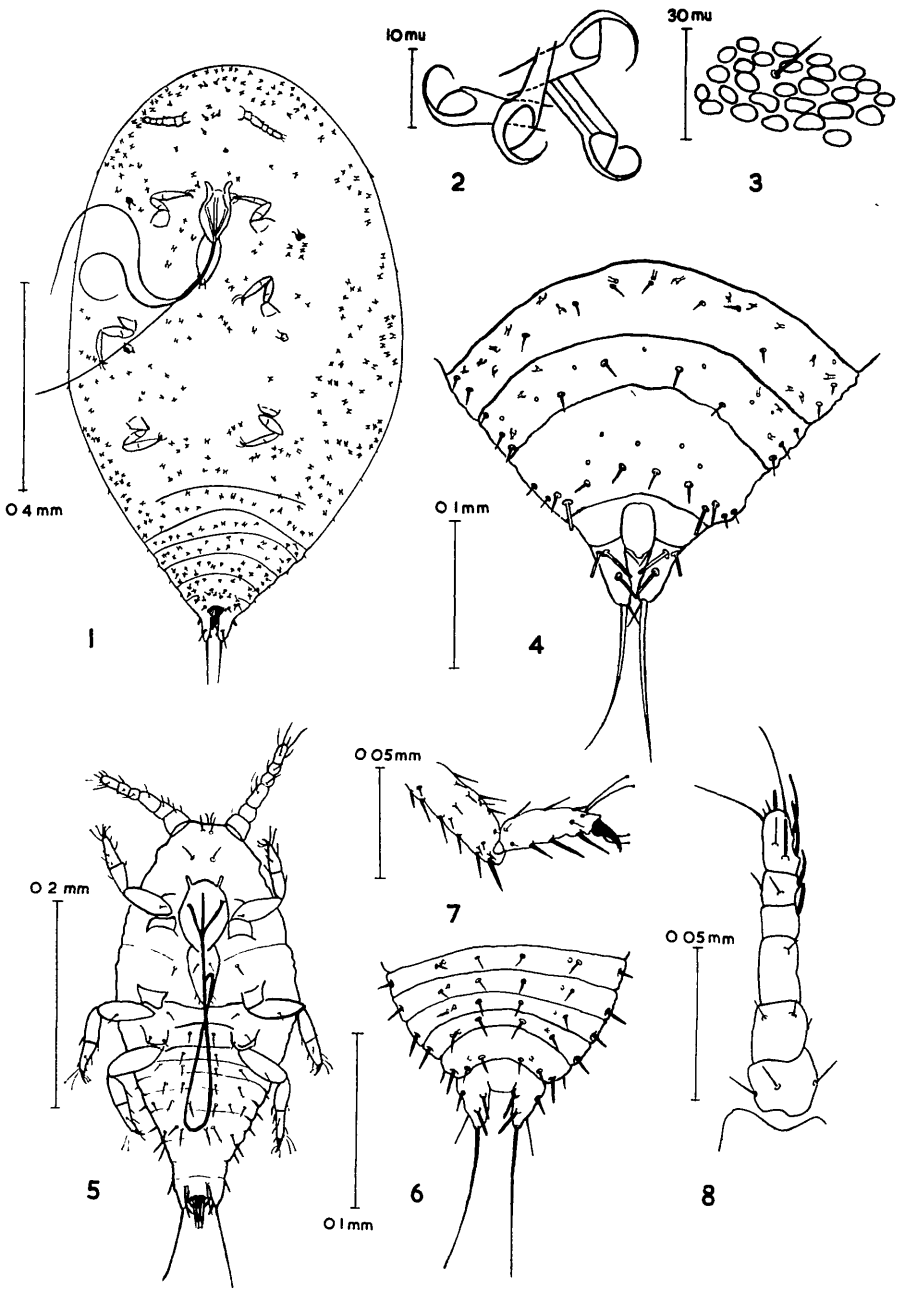
Introduction

A considerable amount of publicity has been given to the effects of an eriococcid on *Leptospermum scoparium* Forst. over the last eight years The insect was first reported to be associated with the death of large areas of *L. scoparium* in the Geraldine district during 1945. A survey made in 1948 showed that the insect was present throughout most of the Plains-Foothills area of Canterbury and that a considerable number of stands of *L scoparium* were dead or dying. Regrowth *L. scoparium,* mostly under eighteen inches in height, was heavily infested. Plants of *L. ericoides* A. Rich. in mixed stands were carrying large numbers of coccids apparently without detrimental effects. *Ulex europaeus* Linn., *Pteridium esculentum* (Hook.) and *Rubus fruticosus* Linn. were encroaching on the dying stands of *L. scoparium,* and in a number of places native grasses were establishing.

Since 1948, there has been a large-scale distribution of eriococcid infested plant material both by farmers and commercial interests. The insect has been established over the greater portion of the country, and *L. scoparium* is dying in many of these areas.

Infested plants of both *L. scoparium* and *L. ericoides* are heavily coated with a black fungal growth, particularly on the lower portions. This fungal growth gives an infested stand of manuka a typical fire blackened appearance, especially when viewed from a distance White cottony sacs of the male puparia are scattered over the surface of the sooty mould and bark. The earlier stages of the insect and sacs of the adult female are sheltered under exfoliated bark of the host plant

Several species of mites are associated with the infestation, some feeding on honey dew, but at least one species is predacious on the active nymphal stages of the eriococcid.



TEXT-FIG. 1.—FIG. 1—Female, ventral view. FIG. 2—Female, body pores. FIG. 3—Female, scales on dorsal abdominal surface FIG. 4—Female, abdominal segments, dorsal view, anal ring and setae omitted. FIG. 5—Nymph, ventral view. FIG. 6—Nymph, dorsal view of abdominal segments, anal ring and setae omitted. FIG. 7—Male, leg, tibia, tarsus. FIG. 8—Female, antenna, ventral view.

Eriococcus orariensis n.sp.

ADULT FEMALE (Figs. 1, 2, 3, 4, 8.) The sac is greyish white, closely felted, open only at anal end; mean length 1 4 mm., mean breadth 1·0 mm.

Body light brown, oval, tapering towards prominent anal lobes Average length of twelve specimens 1·25 mm. (range 0 9 to 1 57 mm.); mean breadth 0·84 mm. (range 0·65 to 1 0 mm.).

Antennae (Fig. 8) six segmented, the third segment longest, mean lengths of segments in six specimens being as follows:—First 22μ (range 21–24μ); second 20μ (17–21μ); third 28μ (24–31μ); fourth 10μ (10–10μ); fifth 11μ (10–14μ); sixth 21μ (21–21μ), giving an antennal formula 3, 1, 6, 2, 5, 4. First segment with a single seta of moderate length on each lateral margin and a similar seta on mid-ventral surface; second with one moderate length seta towards each lateral margin, two-thirds distance from base to apex, and a short seta on posterior lateral margin mid-way from base to apex; third with one seta of moderate length towards posterior margin two-thirds distance from base to apex; fourth with one stout seta on posterior lateral margin; fifth with one stout seta on posterior margin, one moderately long seta on each of dorsal and ventral surfaces and a moderate length seta on anterior margin; sixth with two stout setae towards posterior margin placed approximately one-third and two-thirds distance respectively from base to apex, one stout seta on dorsal surface near mid-point with a shorter seta on either side, also one moderate length seta towards the apex. On the ventral surface two moderate length setae placed one-third and half distance from base to apex respectively, two long setae one at each of the posterior and anterior margins of the apex of the segment. Stout setae on posterior margin of sixth segment longer than those on fourth and fifth segments.

Dorsal and ventral body surface lightly clothed with irregularly placed short setae, except for abdominal segments where placement is more regular. Without a marked marginal fringe of setae except on abdominal segments (Fig. 4). The posterior six abdominal segments show a scaled effect on dorsum (Fig. 3). Two types of pore are present. A small tubular type with a circular orifice, few in number and mainly confined to penultimate abdominal segments. Also, a larger cup-shaped pore with a whip-lash like extension from the margin (Fig. 2), these pores numerous, scattered on both dorsal and ventral surfaces with some concentration towards lateral margins.

Legs well developed Measurements of the segments in microns are given in Table I.

TABLE I.

Average Length (μ) of Leg Segments (6 specimens) in Adult Females of E. orariensis.*

	Coxa	Trochanter-Femur	Tibia	Tarsus	Claw
First Leg	34 (28–41)	66 (59–69)	32 (28–35)	56 (55–59)	18 (17–21)
Second Leg	36 (31–41)	67 (55–76)	35 (31–38)	57 (55–59)	17 (17–17)
Third Leg	34 (28–38)	69 (59–76)	36 (35–38)	59 (55–62)	18 (17–21)

* The range of measurements is given in parentheses.

Claw moderately falcate with a minute denticle near apex. Tarsal and ungual digitules weakly knobbed. Tarsal digitules approximately one and one-half times length of claw; ungual digitules same length as claw. Legs carry a very small number of setae.

Anal lobes (Fig. 4) strongly chitinized, cylindrical for three-quarters of their length and then tapering towards base of caudal setae which are two to three times the length of the lobes. On dorsal surface of each lobe there are two strong setae towards the base, and a strong seta two-thirds the distance from base to apex—towards inner margin. One longer seta on ventral surface towards base of caudal seta. Anal ring well developed, with eight setae. A moderately long seta situated on either side of anal ring on ventral surface. With one stout blunt seta and a shorter one on posterior extremities of dorsum of penultimate abdominal segment

THE 1ST INSTAR NYMPH. (Figs. 5, 6), light brown to pale pink, ovate, average length from frons to tip of anal lobes (128 specimens) 0 37 mm (range 0 26 to 0·73 mm.), mean breadth (128 specimens) 0 17 mm. (range 0 13 to 0.37 mm.).

Antennae six-segmented, relative lengths of segments being similar to those of adult female. There is a wide range of antennal length in the nymph, the average of 125 specimens being 94 5 microns and the range 73μ to 114μ

TABLE II.

Frequency Distribution of Antennal Length in 1st Instar Nymphs of E. ornatensis

Length (μ)	73–78	79–84	85–90	91–96	97–102	102–108	109–114
No. of Specimens	2	9	27	44	26	14	3

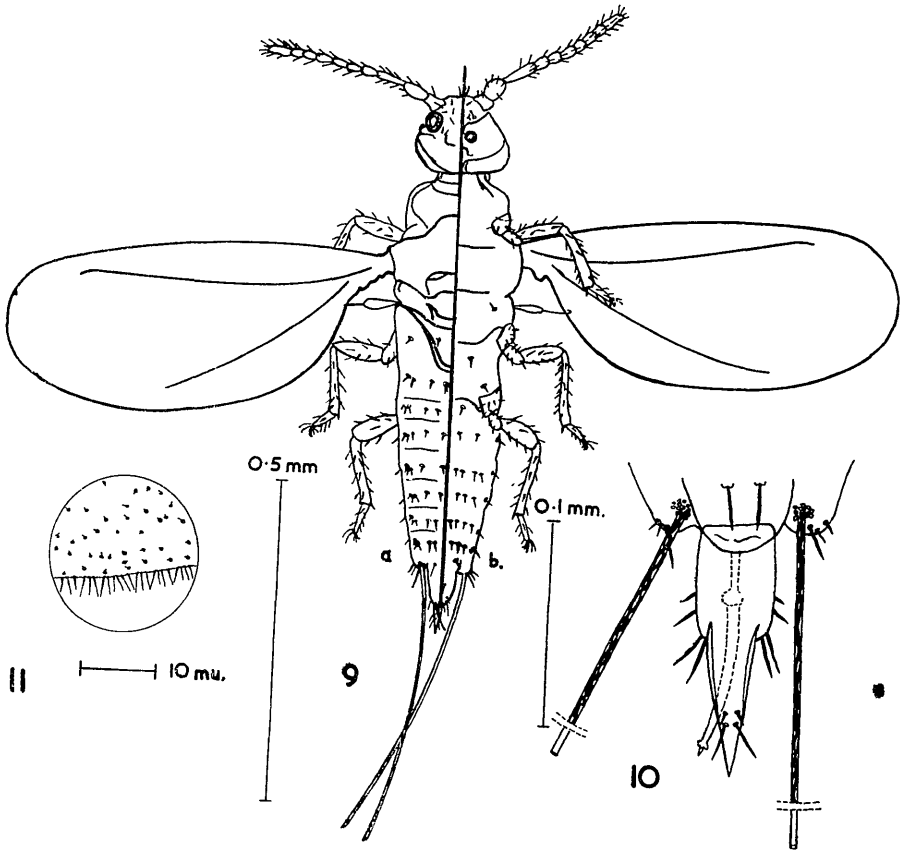
Setae of dorsum arranged in a more orderly fashion than in adult female Dorsal abdominal setae arranged in longitudinal rows, those on lateral margins more spine-like than those of adult female Setae sparse on dorsum of thoracic segments, but more numerous towards head and lateral margins of thorax. On ventral surface abdominal setae longer but finer than those on dorsum

Legs well developed, details of claw and digitules similar to those of adult female, but digitule knobs more pronounced Anal lobes (Fig 6) more subconical than those of adult female; arrangement of anal lobe setae as for adult female. Anal ring well developed, with six anal ring setae.

ADULT MALE. (Figs. 7, 9, 10, 11.) Sac of puparium oval, white, cottony, not so closely felted as that of female, mean length 0 8 mm., mean breadth 0 3 mm. Male fulvous, wings iridescent, with filaments of penultimate abdominal segment conspicuous. Average length (12 specimens) from frons to extremity of abdominal spike 0·84 mm. (range 0 74 to 0 98 mm.).

Antennae with 10 segments, the third being longest. Antennal formula 3, (2, 10), (9, 6), 8, (4, 7), (1, 5). All segments except the first very setose Rudimentary eyes small, on lateral margins; ocelli four, large, prominent, reddish, two on lateral margins, two close together on mid-ventral surface Mouth parts wanting. Wings iridescent, clothed with a very large number of short, fine hairs each on a raised base; wing margin fringed with longer hairs (Fig. 11) Haltere with a single hamulus without an expanded tip.

With few setae on ventral aspect of head, these more numerous on dorsal surface Thoracic setae sparse. In dorsal aspect abdominal segments one to six with three setae in groups towards each lateral margin and a transverse series of four setae to each segment. Penultimate abdominal segment (Fig. 10), with a group of one long and two moderate setae at the junction of the posterior and lateral margins on each side, two moderate setae, one on either side of the median line. This segment also carries two pairs of extremely long setae, each pair being



TEXT-FIG 2—FIG 9—Male, (a) dorsal and (b) ventral view. FIG. 10—Male, abdominal spike and portion of penultimate abdominal segment, dorsal view FIG 11—Male. portion of wing showing hairs.

set in a group of 14 circular pores and supporting a waxen filament. Ventral aspect of first abdominal segment with a seta on each lateral margin and another on either side of the median line; segments two to six with one moderate length seta towards each lateral margin and an irregular transverse series of four to eight setae to each segment; penultimate segment with two setae, one near each basal extremity of abdominal spike

Legs setose, extremity of tibia with a spine-like seta, three similar setae on tarsus (Fig. 7). Claw moderately falcate with a small apical denticle; tarsal digitules, which end in a fine cone-shaped expansion, one and a-half times length of claw. Ungual digitules approximately equal in length to claw

Abdominal spike (Fig. 10) well developed, prominent In ventral view there is one seta on either side of base of genital sheath and one seta towards each lateral margin, also a pair of longer setae on each lateral margin at the point where the spike constricts In dorsal aspect, two pairs of setae towards the apex of spike The aedeagus exhibits no unusual features.

This species was described from mounts cleared in 10% caustic potash, stained in acid fuchsin and mounted in Euparal; also from mounts in Berlese's Fluid. All specimens in the collection of the Entomological Research Station, Palmerston North.

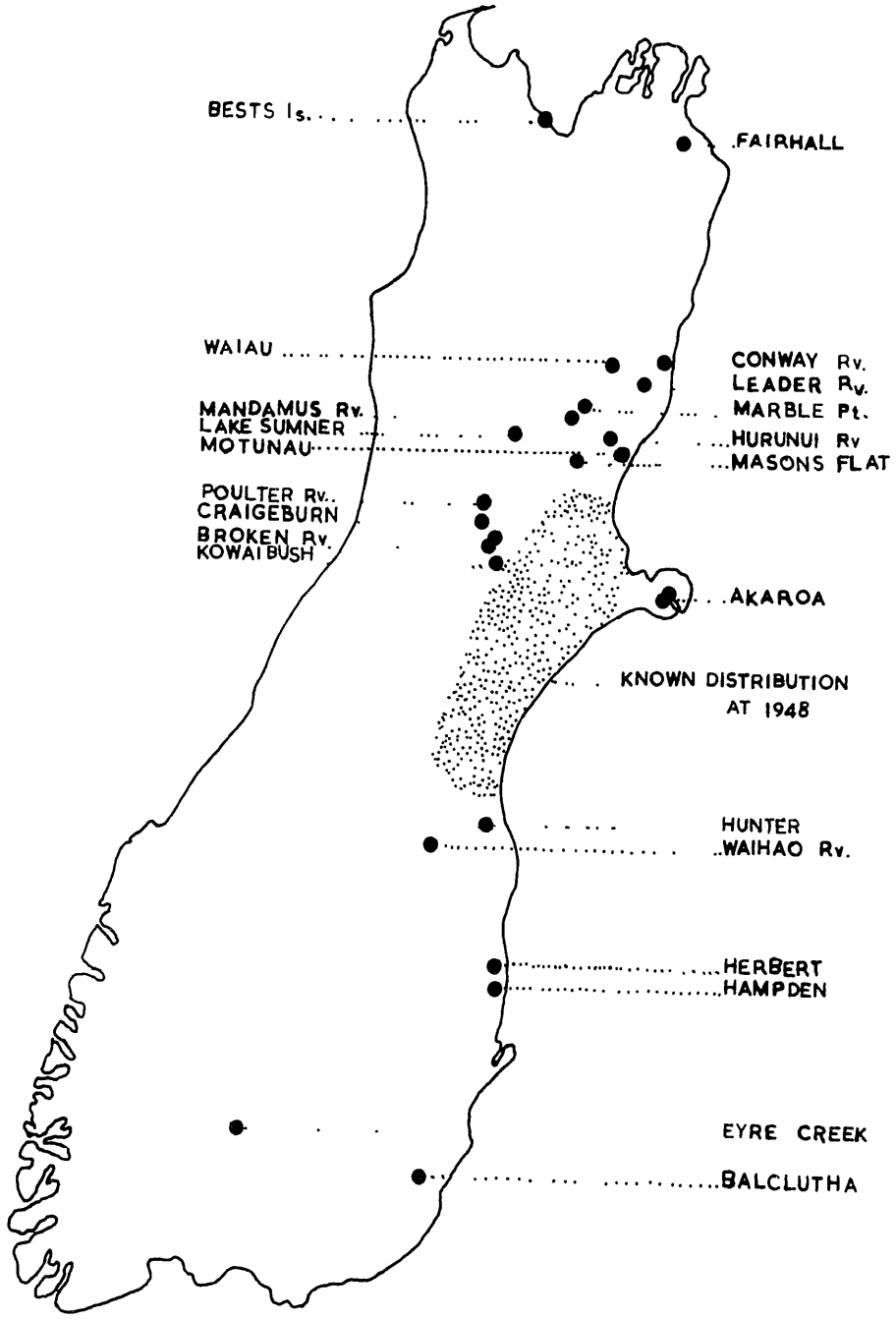
Life History and Habits of *Eriococcus orariensis*

In Canterbury there is apparently a single generation per year, although, because of the large size of individual colonies, most stages of the insect are present for long periods. Eggs are laid within the female sac, in some cases the female dying before oviposition is completed. Newly hatched nymphs remain quiescent for a period, then become particularly active, swarming over the plant in search of feeding sites. Within dense stands of *L. scoparium*, spread from plant to plant occurs through contact of branches, by wind movement of bushes and by movement of the nymphs along the ground. Dissemination over longer distances occurs when nymphs become wind-borne In recently infested areas in Hawke's Bay, spread of the insect is extensive with the prevailing wind and slight against it. The transference of nymphs by other insects, notably bees, and by birds is a possibility. Nymphs have been found on infested plants in Canterbury during the period March to September, maximum numbers free on the plant occurring during the six weeks beginning mid-April. Immature females which are naked apart from some loose cottony material, are found in increasing numbers from June onwards. By September few active nymphs may be found. Immature females are sheltered beneath exfoliated bark and are feeding in the sap stream of the plant. During the same period male puparia appear in increasing numbers. Most of the male cocoons are constructed on the surface of the black fungal growth mainly on the leaves and lower stems of the plant. From October to January large numbers of males are present, and during this period mating takes place. By February the number of live adult females is decreasing, most female sacs containing the shrivelled remains of the female and a large number of eggs.

Known Distribution of *Eriococcus orariensis* in New Zealand

The ease with which the nymphal stage of the insect may be established in new areas has led to a very considerable distribution of infested plant material by farmers and commercial interests. This distribution is still continuing in spite of strong recommendations to the contrary by some interested Government organisations. During the period 1947 to 1950 information on the establishment of *E. orariensis* was very difficult to obtain, due to reluctance on the part of farmers to divulge whether they had used the insect. More recently, with the co-operation of officers of the Extension Division, Department of Agriculture, it has been possible to obtain plant material from a number of localities for determination of the insect involved The results of the survey to date are shown on the accompanying maps (Figs. 12, 13), each location being a positive identification of *E. orariensis*. It must be realised that the distribution shown is by no means complete, and the author is of the opinion that the insect must now be well established in almost all districts where farmers consider *L. scoparium* a hindrance to farming practice.

A survey was made during 1948 to determine the approximate limits of the naturally occurring infestation in Canterbury This showed that *E orariensis*



TEXT-FIG. 3.—FIG. 12—Distribution in South Island.

was established in almost all stands of *L. scoparium* along the foothills from Cave and Fairlie, in South Canterbury, to the Waipara River, in North Canterbury. The majority of isolated stands on the Plains area—for example those at Maronan and Te Pirita—were heavily infested, as were isolated specimen plants in private gardens in Ashburton and Christchurch and plants in the Christchurch Botanic Gardens.

E. orariensis has established at 2,500 feet in Canterbury and above that altitude in the North Island.

Origin of *Eriococcus orariensis*

In order to determine the origin of the insect, specimens have been sent to entomological institutions in England, America and Australia, but in no case could the insect be identified. To presume that it is an indigenous species poses the problem of its comparatively recent devastating attack on *Leptospermum* While such occurrences are not unknown, they are rare and usually associated with some change in the ecological environment. For some time a number of people held the view that climatic conditions had temporarily lowered the population of the parasite-predator complex allowing *E orariensis* to build up to large numbers. Surveys of infested areas show that the insect is little affected either by varying climatic conditions, parasites or predators. In addition to the predacious mites mentioned earlier, coccinellid larvae and a small number of chalcids have been taken from infested plants; but it is doubtful if the latter were parasitising *E. orariensis.*

The possibility that the insect has been introduced cannot be discarded, in spite of the lack of knowledge of the species overseas, as the coccid fauna of most countries is imperfectly known. There has been a considerable interchange of ornamental varieties of *L. scoparium* with United States, Australia, Canada, and England so that it may have been introduced on plant material. The genus *Leptospermum* has representatives in Australia, New Zealand, New Caledonia and the Malay Archipelago.

Eriococcus leptospermi Maskell has been recorded from *L. laevigatum* in Australia. *E. orariensis* has been checked against the types of this species and shown to differ in a large number of characters

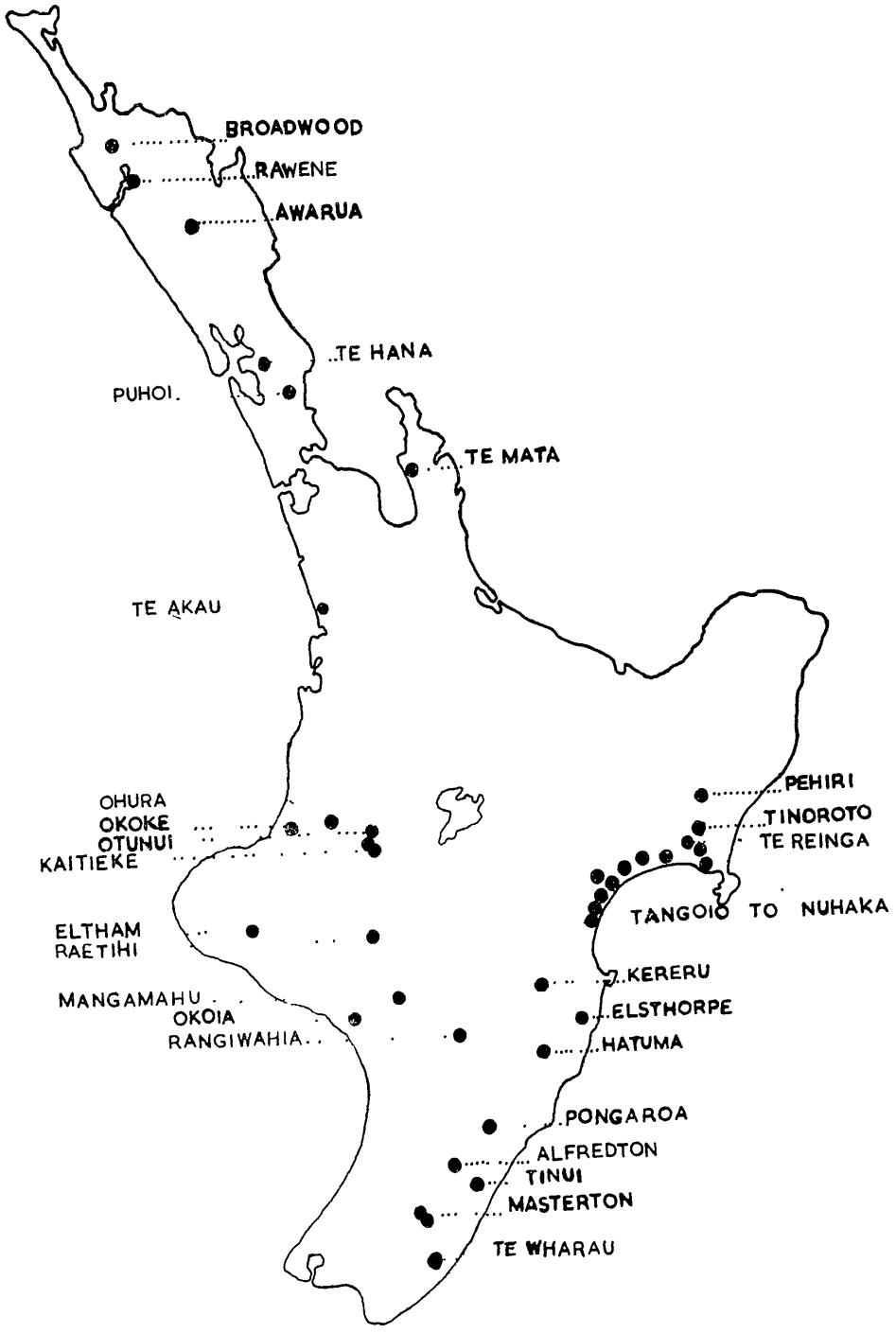
Control of *Eriococcus orariensis*

This insect on *Leptospermum* may readily be controlled with a number of sprays. A mixture of 50% p.p.i. wettable DDT or 10% gamma isomer wettable BHC, nicotine sulphate and a wetting agent in the proportions of 8:1:8 in 800 parts of water gives effective control, and treated plants recover satisfactorily. The efficacy of the spray depends on the thoroughness of coverage. Cost of such treatment would scarcely justify its use except in a national campaign to eliminate the insect, but the spray could be used to free ornamental trees from infestation.

A chalcid parasite of another species of *Eriococcus* is under investigation with a view to its possible utilisation for the biological control of *E. orariensis.*

Discussion

Leptospermum scoparium occupies a considerable proportion of the land area of New Zealand. It plays an integral part in the regeneration to indigenous forest. The widespread distribution of *Eriococcus orariensis* focuses attention on



TEXT-FIG 4.—FIG 13—Distribution in North Island

a problem of national importance. If the insect continues to exert its effects on the plant it is difficult to envisage the survival of any of the larger stands of *L. scoparium* in New Zealand.

If the eriococcid has been accidentally introduced, lack of knowledge of the species in its original habitat suggests that it has been kept in check there by natural enemies. The introduction of such parasites or predators offers possibility of biological control but search for them would necessitate a heavy expenditure in time and money. Chemical control, while feasible for small areas, would not be practicable on a national scale.

Acknowledgments

The writer wishes to acknowledge the helpful advice and criticism given by Mr. J. M. Kelsey, and to thank officers of the Extension Division, Department of Agriculture, particularly Mr. T. G. Sewell, for the material forwarded for identification.

Bibliography

Green, E. E., 1922. The *Coccidae* of Ceylon Part 5, Sub-family *Eriococcinae* p. 345–353, Dalau, London.

Maskell, W. M., 1887. The Scale Insects (*Coccidae*), Genus *Eriococcus* p. 92–96, Government Printer, Wellington, p 116.

——— 1890 Further Coccid Notes *Trans Proc N Z Inst.*, 23: 22

——— 1894. Synoptical List of *Coccidae* reported from Australasia and the Pacific Islands up to December, 1894. Ibid. 27: 22.

Myers, J. G., 1922. A Synonymic Reference List of New Zealand *Coccidae*. *N.Z. Journ. Sci. Tech.* 5: 196–201.