Notes on the Genus *Coelostomidia*, with Descriptions of One Species and Table for Identification

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[Read before the Nelson Philosophical Society, 18th July, 1934; received by the Editor, 30th July, 1934; issued separately, September, 1935.]

In June, 1927, Morrison (3) published a brief description of new genera and species, which he placed under a new family, Margarodidae, which paper was further elaborated in 1928. (4) This alteration in the classification necessitated the erection of new sub-families, one of which was Coelostomidiinae. This again was divided into tribes, Marchalinini, Platycoelostomini, and Coelostomidiini. The first two tribes—one of which belongs to New Zealand—are each represented by a single species, and the third tribe was again divided into five genera, with two of which the present paper deals, i.e., *Utracoelostoma*, with a single species, and *Coelostomidia*, with three species, to which Green (1) has since added another. Of the three species of *Coelostomidia* and the single species of *Utracoelostoma* I have an almost complete series of all stages, with the exception of the male of *pilosae*, which I have been unable to find. Green’s species, *montana*, I have never seen, but judging from his published description, it opens up some interesting probabilities, and may, I think, ultimately have to be placed as a synonym of *wairoensis*, the adult female and second instar of which it greatly resembles. Having ample material, I think the time has now come for making a comparison of the different species, in order to find whether there is sufficient justification for amalgamating or still further splitting up the above-mentioned genera.

According to Morrison (4), Cockerell, on the basis of the stated absence of legs in the adult female, erected the new genus *Utracoelostoma*, in which he placed Maskell’s species *assimile*. In this, however, he was mistaken, as the legs, though rudimentary, are still retained in the adult stage. Apart from this fact, there was otherwise very little to justify the change, as there is a great similarity between all the other different stages of the species under consideration, including the adult males, the metamorphosis of which is the most complete. In the natural state the tests of the second instars of *zealandica* and *assimile* are so alike that it is almost impossible to tell them apart. In *wairoensis* the test is thinner and more elongate, and can easily be separated from the bark, leaving the insect in situ. In *pilosae* the test is soft and cottony, very similar to that of the Pseudoeoecinae. However, these characters, though useful and well worth bearing in mind, are not the only means of identification, and we will now deal with the more intimate microscopic characters in detail.

Antennae: The number of joints in the second instar vary considerably according to the species. In *zealandica* they range from eight to nine joints, while in *wairoensis* and *assimile* there are only four to six joints; the antennae are always short and thick, usually
conical, with several stout setae on the apical joint. Variation is often found in the antennae of one specimen, one antenna having four joints and the other five or even six joints. With the exception of assimile, in which the antennae are still rudimentary, in the adult stage we find them well developed. In zealandica there are eleven joints, in wairoensis and pilosa ten joints, and in the rudimentary antennae of assimile five. In the adult male, so far as I have observed, the antennae do not seem to vary, and are invariably ten-jointed.

Derm pores: These appear to be very similar in all four species at each successive stage. In the second instar they are mostly trilocular, with a few scattered simple pores and ventral disc pores. In the adult stage, both female and male, their centres are ill-defined, but I have invariably noticed when preparing specimens for mounting that before being dehydrated they appear to be faintly quadrilocular. I particularly noticed this recently when mounting specimens of wairoensis. Why this change should take place only in the adult stage of both sexes and in the intermediate stage of the male is, to me, unaccountable.

Derm setae: These differ very little except as to size and quantity in the adult stage. In pilosa they are longer and more numerous than in either of the other three species; zealandica is also well covered, but the setae are not quite so thick, while in wairoensis and assimile they are sparse. In the second instar there is a greater variation, the setae of pilosa, besides being very plentiful, are long and thick, with blunt apices, and appear like hollow tubes. In each of the other three species they are short, fine, and sparse.

Thoracic spiracles: The shape varies very little in all stages of the four species, the main difference being found in the pores accompanying the spiracles. In zealandica, in the second instar, there is a band of pores in the atrium, while in assimile, wairoensis, and pilosa there is only a single row of similar pores at the entrance. In the adult stage the pores are entirely absent in all four species.

Abdominal spiracles: Again in the second instar of zealandica there is a broad band of pores in the atrium. In assimile this band is reduced to a single ring, while in the remaining two species the pores are entirely absent. The adult stages are without pores as usual.

Ventral cicatrices: In all the New Zealand species belonging to the subfamily Coelostomidiinae, ventral cicatrices are to be found only in the larva and second instar, none ever having been found in the adult female or male. They are most numerous in zealandica, which has about six transverse, irregular segmental rows across the ventral abdominal region. There are also a few similar pores on the dorsum of this species, several being noticed close to the antennae. In the other three species the pores are not so numerous, nor in so many rows, as will be seen on reference to the table for indentification.
Rectal tube: In the second instar of *zealandica* there is a broad band of what are called wax pores at the inner end of the tube; these have the form of polygonal plates or cells, the centres of which are multilocular. About the middle of the tube there is also a broad band of irregular-shaped pores. In *wairoensis* the wax pores only are present, the middle band being missing, its place being taken by a thickening of the tube, giving to it a darker appearance at this spot. In *pilosa*, besides the wax pores, there is a single ring of circular ones, which appear to have a clear centre. *Assimile* also has a single ring of pores as well as the usual band of wax pores; they are very similar to those found in *zealandica* and quite different from the pores found in the tube of *pilosa*. In the adult stage no pores are to be found in the rectal tube.

Larva: Not having a full series of the larva of all four species, I am unable to say how far they will help in the classification. At first glance there appears to be very little to distinguish between them, the antennae, legs, and most of the other organs of the body being very similar in both the species in my collection. However, a closer examination proved that there are at least two material facts that separate *zealandica* from *wairoensis*. In the former the pores are of three types, viz., simple, quadrilocular, and quinquelocular. In *wairoensis*, on the other hand, there are also three types of pores—simple, trilocular, and quadrilocular. According to Morrison, the derm pores of the larva of *assimile* are all quadrilocular. Another point that separates *wairoensis* from *zealandica* is the presence of spines on the abdominal segment of the former, exactly similar to those seen on the abdominal segment of the second instar of the same species. Green mentions similar spines on the second instar of *montana*, which makes me doubt the validity of his species.

In making a summary of the evidence now before us the one outstanding fact is that, with the exception of the rudimentary legs and antennae of *assimile*, there is more variation in anatomical detail in *zealandica* than in the other three species. The greatest similarity exists between *wairoensis* and *pilosa*, as it is only in the test, the rectal tube, and in the derv vestiture that we find sufficient evidence to separate these two. In the test and in the adult male, *assimile* approaches very close to *zealandica*, while in the antennae and thoracic spiracles of the second instar the relationship appears to be more with *wairoensis* and *pilosa*. In the abdominal spiracles and rectal tube of the same stage *assimile* again approaches *zealandica*. It is here that we find a certain amount of overlapping, as, while the abdominal spiracles of *wairoensis* and *pilosa* are very much alike, the rectal tube of *pilosa* is unlike that of *wairoensis* and resembles that of *assimile*.

I will leave it for others to decide whether these slight anatomical details are of generic importance, but I cannot see what aid classification will gain by the erection of a new genus for, as in this case, one species only. It is for this reason that I have retained *assimile* in the genus *Coelostomidia*. 
The drawings have all been prepared under the writer's directions by Miss Laura Ingram, and will, I believe, be found sufficiently correct for identification purposes. I am also indebted for much help and advice to Professor Morrison, of Canterbury College, and Dr David Miller, of the Cawthron Institute, to whom my thanks are due.

Life History.

Of the life history of Coelostomiida and the number of different stages through which it passes very little is known. In the majority of the coccidae the female is known to cast its skin twice, and from what observations I have made, exactly the same form is gone through by the females of Coelostomiida. In the male, however, there are four different changes, the two additional ones being the intermediate stages—which the male assumes when it emerges from the test of the second instar—and the nymph or pupa, both of these cast skins being found in the male test. Maskell mentions the cast skin of the intermediate stage of the male, but did not recognise it for what it really was. By a lucky chance I found out what they were, when what I thought were small females emerged from the hard waxy tests of the second instar in confinement. These I placed in a small glass-covered box, and I was very surprised some weeks later to find several adult males crawling about on the under surface of the glass. Delving about among the cottony secretion, I found the cast skins of the intermediate stage, but by some mischance missed that of the pupa. Exactly the same thing happened with some specimens of assimile, of which I once witnessed, in their natural habitat, the emergence of huge numbers. Again, however, I missed the pupa, and it was only recently, when searching some old male tests of wairoensis on the chance of finding a perfect male, that I came across the pupal skin.

In zealandica the intermediate males emerge a little before the adult females make their appearance, and the adults of the two sexes really appear at the same time. In assimile, however, as far as I have observed, the adult males make their appearance while the females are still in the second instar, and it has been several weeks later before I have been able to find females just beginning to lay eggs. Judging from this, I should say that copulation takes place during the second instar, just before the insect mouls. This will account for the fact mentioned by Maskell, who was inclined to think that the females of pilosa at least were parthenogenetic. So far as I have observed, there is only one emergence of the males yearly, and the same may be said as regards the females. If this is so, it is very evident that the whole life-cycle of the insect takes more than a year to accomplish, as no matter what time of the year one examines them in their natural habitat, one will find all sizes among the tests of the second instar, both in zealandica and assimile. At all stages of their growth, from the newly-hatched larva up to the adult insect, they are very full of fat, which, on maceration in potassium hydroxide, turns to soap, making the task of cleaning out the body contents a matter of some difficulty.
As regards wairoensis, there appears to be a variation in its life history. On the 10th May, 1923, Myers (1) found the male tests and what were really intermediate males of this species. Being preserved in spirits, they were submitted to Green, who, unaware of the intermediate stage of the male, described and published them as females. About the middle of December, 1931, I managed to come across them very thickly infesting Lepostopernum ericoides at Ruby Bay, a short distance from Motueka. An examination of the tests of the second instar brought to view the adult female and the eggs. It appeared very evident that these eggs had not been laid very long, and they subsequently hatched out a fortnight later. Moreover, the adult males, of which I found a few dead ones in the male tests, also had every appearance of being fresh, and were probably alive in November. It appears somewhat strange that the males should emerge in the late autumn in North Auckland and late in spring in Nelson. I have found the adult females of zealandica in South Auckland in December, the same month in which I found them in North Otago and Nelson. It would be interesting to know if the males of pilosa go through the same number of stages as do those of the other three species.

Genus Coelostomidia, Cockerell.

C. wairoensis, Maskell (5).

Test of second instar white, hard, thin, waxy. Adult female remaining in the same test and ovipositing. Always accompanied by much fumagine. The waxy tube exerted by the insect is very long, with a large drop of honey-dew at end. Colour of all stages brick-red. Tests of the intermediate males thickly congregated beneath the loose bark of the main limbs of the host plant.

Adult female (Pl. 15) elongate-ovate. Antennae set close together, of ten joints, first and second joints longest and equal, formula: (1, 2) 10, 9 (3, 4, 5, 6, 7, 8) ; all joints with ring of long fine setae, apical joint with two spine-like (sensory) setae and numerous fine ones. Rostrum absent. Legs (Pl. 15, fig. 1) well developed, stout, tibia twice length of tarsus; claw stout with two digitules on each side. Thoracic spiracles normal, with a ring of about nine trilocular pores at entrance to aperture, but not appearing to be within it. Seven pairs of abdominal spiracles, without pores in the atrium. Rectal tube not very prominent, without pores or any apparent thickenings. Derm pores of one type only, fairly large, and faintly bilocular or trilocular. Derm setae of one type only, fairly plentiful, long and fine, each mounted on a small conical tubercle. Length about 3.85 mm.; width about 2.32 mm.

Female of second instar (Pl. 17) almost circular when mounted, but very convex on the dorsum and flat beneath when seen in the living state. Antennae broad, short, tapering, of about seven joints, apical joint hemispherical, remainder annular, several short, stout setae on the apical joint. Rostrum well developed, mentum slightly longer than broad, with several stout setae at apex. Thoracic spiracles normal to the genus, with a ring of about eight trilocular pores at entrance to aperture. Seven pairs of abdominal spiracles, without
pores, in the atrium. Legs rudimentary, short, and stout, four joints distinguishable, claw absent. Rectal tube large, constricted and invaginated at upper end, with a broad band of polygonal wax pores; a little below the pores there is a slight thickening of the tube, giving it the appearance of a dark band; at the edge of the opening there are a few short fine setae. Posterior portion of the body not chitinised, with many thick, short spines, majority of which closely surround anal opening. Ventral cicatrices varying in size, in three transverse rows immediately below the posterior pair of legs. Derm pores of two types, small, simple, and trilocular pores, both kinds are most numerous at either extremity. Derm setae sparse, very short and fine. Length about 2.20 mm.; width about 1.70 mm.

Larva (Pl. 16) with body elongate-ovate colour brick-red. Antennae of six joints, last joint very large and club-shaped, formula: 6, 2, 1 (3, 4, 5), last joint with two sensory setae and several long fine setae; there is a ring of long fine setae on each of the remaining joints. Rostrum and mentum normal. Legs stout, with very few setae, tarsus a little longer than the tibia; claw with denticle and two digitules. Thoracic and abdominal spiracles normal, without pores. Rectal tube with narrow band formed of two rows of oval-shaped pores at inner end, and a single row of what appear to be tubular pores a little below. Derm pores numerous, of three types—simple, trilocular, and quadrilocular. Ventral cicatrices present, three in a row above rectal tube. A few spines, broad at base and tapering to a point, on the last abdominal segment. Derm setae not plentiful, very small and fine. Length about 1.20 mm.; width about 0.75 mm.

Intermediate stage male (Pl. 16) very similar to, but smaller than the adult female. Antennae of nine joints, first and second joints longest and equal, formula: (1, 2) (3, 9) (4, 5, 6, 7, 8); apical joint with two sensory setae and numerous fine ones, remainder each with a ring of long, fine setae. Legs stout, tibia not quite twice length of tarsus; claw stout, digitules two on each side. Thoracic spiracles normal, without pores in the atrium. Seven pairs of abdominal spiracles, normal, without pores. Rectal tube large, without pores or thickenings. Derm pores of one type only, exactly similar to those of the adult female. Derm setae numerous, long and fine, mostly small, but a few macrosetae are scattered here and there. Length about 2.26 mm.; width about 1.28 mm.

Cast skin of male nymph elongate, appendages sac-like. Antennae set very close together show ten joints, with a few fine setae only on the first joint. Legs sac-like, without claw, the last joint is long and without setae, the remaining joints are ill-defined, but are all covered with numerous short, fine setae. Wing cases about two-thirds length of body, broad, almost square at the basal end, with straight, parallel sides, and rounded at apex. There is a faint crinkling of the wing case that appears to follow the line of the main vein. Thoracic spiracles normal. Abdominal spiracles somewhat similar to those of the adult, without pores. Rectal tube ill-defined, apparently short, opening in the centre of a broad, oval, slightly chitinised plate. Derm pores in transverse bands, of one
type only, similar to those of the adult. Derm setae of three types, those on the abdominal portion are mostly short and thick with blunt points, on the middle portion of the body there are both long and short fine setae, together with a few blunt ones, while at the cephalic extremity the setae are all long and fine. Length about 2.30 mm.; width about 1.20 mm. Length of antennae 1.28 mm.

Adult male normal for the genus. Eyes prominent, facetted. Antennae of ten joints, third joint longest, formula: 3 (4, 5, 7) (10, 8) (6, 9) 2, 1; all joints with very long, fine setae evenly spaced. Wings well developed, about 1.80 mm. long, with one main nervure extending almost the full length of the wing and close to the upper margin. The upper margin is somewhat dense, as if chitinised, but gradually fades off as it approaches the nervure. Extending through this denser portion and parallel with the nervure, starting from close to the wing joint, there is a narrow, clear space which extends about half the length of the wing. Slightly below and overlapping this space there is a similar clear strip which extends almost to the apex of the wing. Through the denser portion and parallel with the margin there is a zig-zag row of what appear to be pores, but are actually, in my opinion, clear hyaline spots in the wing fabric. Branching from the main nervure are three subsidiary nervures, the middle one of which is shorter and denser than the other two. On the posterior portion of the wing for about two-thirds from the apex there are numerous veins forming a network pattern, which appears somewhat similar to that seen in the wing of the dragonfly. As the specimen under observation had never taken wing, but died while still in the male test, this network may be more pronounced than usual. Halteres narrow, with three curved spines at apex, the points of which are barbed. Legs long and slender, tibia three times length of tarsus; claw with thick base covered with numerous digitules, each of which is knobbed. Penis sheath broadly rounded anteriorly, tapering posteriorly to a broadened bilobate point. Thoracic and abdominal spiracles normal, without pores in the atrium. Derm setae very long and fine, arranged in bands. Derm pores of three types: medium and small disc, with what appear to be a granular centre, and short tubular pores or pustules. Length about 2.42 mm.

Habitat.—On Leptospermum ericoides and L. scoparium, Ruby Bay, Nelson, New Zealand, 14/12/31.

Note.—Green's supposed adult female of this species as published in Bull. Entom. Res., vol. xix, pt. 4, p. 369, is really the intermediate stage of the male insect.

Table for the Identification of the Species Belonging to the Genus Coelostomidia.

- **Thoracic spiracles:**
  - **Second Instar.**
    - *zealandica*—Band of pores in atrium.
    - *wairoensis*—Single row of pores at entrance to atrium.
    - *pilosa*—Single row of pores at entrance to atrium.
    - *assimilé*—Single row of pores at entrance to atrium.
Abdominal spiracles:

zealandica—Band of pores in atrium.
waioensis—Pores absent.
pilosa—Pores absent.
asimile—Ring of pores in atrium.

Antennae:

zealandica—9-jointed.
waioensis—4 to 6-jointed.
pilosa—4 to 6-jointed.
asimile—4 to 6-jointed.

Ventral cicatrices:

zealandica—Present in 6 transverse rows.
waioensis—Present in 4 transverse rows.
pilosa—Present in 4 transverse rows.
asimile—Present in 3 transverse rows.

Rectal tube:

zealandica—Broad band of wax pores at inner end, band of irregular pores about middle.
waioensis—Broad band of wax pores only.
pilosa—Broad band of wax pores at inner end, single ring of circular pores about middle.
asimile—Broad band of wax pores at inner end, single ring of irregular pores about middle.

Adult Female.

Antennae:

zealandica—11-jointed.
waioensis—10-jointed.
pilosa—10-jointed.
asimile—5-jointed.

Note.—Pores similar to the ventral cicatrices are also found on the dorsum in zealandica.

LITERATURE CITED.


(3) ——— 1891. Further Coccid Notes, with Descriptions of New Species and Remarks on Coccids from New Zealand, Australia, and elsewhere, Trans. N.Z. Inst., vol. xxiv, p. 46.


Fig. 1.—Leg of adult female. Fig. 2.—Adult female, outline, optical section. Fig. 3.—Antenna. Fig. 4.—Derm pores and setae. Fig. 5.—Derm setae much enlarged. Fig. 6.—Derm pore much enlarged. Fig. 7.—Abdominal spiracle.
C. waioensis.

Fig. 1.—Intermediate male, outline, optical section. Fig. 2.—Antenna. Fig. 3.—Foot.

Fig. 4.—Derm pores and setae. Fig. 5.—Derm pore enlarged.
**C. wairoensis.**

Fig. 1.—Female second instar, outline, optical section. Fig. 2.—Antenna. Fig. 3.—Leg. Fig. 4.—Rectal tube. Fig. 5.—Thoracic spiracle. Fig. 6.—Abdominal spiracle. Fig. 7.—Abdominal spines. Fig. 8.—Derm pores and ventral ciliaris. Fig. 9.—Derm pore much enlarged. Fig. 10.—Derm setae.

Face pt. 16.
**C. waioocusis.**

Fig. 1.—Larva, outline, optical section.  Fig. 2.—Antenna.  Fig. 3.—Leg.  Fig. 4.—Derm pores.  Fig. 5.—Derm pore, quadrilocular, much enlarged.  Fig. 6.—Derm setae.