Some New Zealand Parasitic Copepoda of the Family Anthosomidae

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Some New Zealand Parasitic Copepoda of the Family Anthosomidae

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Abstract

The relationship between the genera *Lernanthropus* Blainville, *Sagum* Wilson, *Pseudolernanthropus* Yamaguti and *Aethon* Krøyer is considered. The new genus *Paralernanthropus* is defined and *P. foliaceus* (Goggio) redescribed from *Thyrsites atun* and *Jordanidia solandri* is made the type species: a new species of *Lernanthropus* is described from *Seriolella brama; Aethon* is redefined and *Lernanthropus percis* Thomson is redescribed and transferred to this genus; two new species of *Aethon* are described from *Cheilodactylus macropterus* and *Latridopsis ciliaris* respectively; *Anthosoma crassum* (Abildgaard) is redescribed from New Zealand material and previous records are discussed.

INTRODUCTION

Members of the family Anthosomidae include one widely distributed species *(Anthosoma crassum)* parasitic on sharks, and a large number of other species, mostly belonging to the genus *Lernanthropus* but also assigned to several other genera, which are found as parasites on teleosts and, in general, have a much more restricted distribution than *Anthosoma crassum*.

The collection described here contains six species belonging to the family.

ANTHOSOMIDAE Yamaguti 1963

This family as defined by Yamaguti (1963, p.142) contains eight genera. Of these *Anthosoma Leach,* 1816, *Epachthes* Nordmann, 1832, *Norion* Nordmann, 1864, *Caetrodes* Wilson, 1906 and *Lernanthropodes* Bere, 1936, are all clearly distinguishable, and each is represented by a single species. Of these only *Anthosoma crassum* is represented in the present collection.

The remaining genera, *Lernanthropus* Blainville, 1822 and *Sagum* Wilson, 1913, together with *Aethon* Kroyer, 1836, and *Paralernanthropus* which is described below, are, clearly, closely related. Whether all should be united in the single genus *Lernanthropus* must be largely a subjective decision, but since this genus already contains some 90 species I feel that any unequivocal character which can be used to separate some members of the group should be accepted. In a group with, as yet, no records of its fossil history and very little obvious evidence of its phylogeny some recourse to utility in taxonomy is, I feel, acceptable.

I would, therefore, suggest the following separation of the females of these related genera.

1. Egg strings trailing from body, sublinear—*Lernanthropus* Blainville, 1822.
2. Egg strings coiled and concealed by dorsal plate of fourth segment. ——3.
3. Third thoracic segment expanded into wing-like posterolateral plates which fuse with plates of fourth segment and the third pereiopods; third pereiopods ending in a whip-like distal section—*Sagus Wilson,* 1913*.
4. Plates of third segment absent, or where present, not fused with plate of fourth

* The genus *Sagum* is not represented in the present collection.

segment; distal part of third pereiopod rounded, or narrowed but not whip-like. ——5.

5. Second pereiopod biramous, each ramous one-jointed; fourth pereiopod well developed, visible in dorsal view—*Paralernanthropus* n.gen.
6. Second pereiopod bifurcate but lacking joints; fourth pereiopod small, hidden by third pereiopods—*Aethon* Krøyer, 1836.

The males of *Sagum* and *Aethon* are unknown. I am unable to separate, at the generic level, the male of *Paralernanthropus* described below, from described males of *Lernanthropus*.

PARALERNANTHROPUS n.gen.

Anthosomidae, Female: Head fused with first thoracic segment, lateral margin of carapace expanded laterally or ventrally; remaining thoracic segments fused together, the fourth with a large plate extending posteriorly to cover the genital and abdominal segments, the caudal laminae, the egg strings and most of the fourth pereiopods; genital segment and abdomen both small; caudal laminae flattened dorso-ventrally and tapering posteriorly; first antennae small, 1 or 7 segmented with a few small setae; second antennae subchelate; mandibular palp with a divided base, each part bearing small processes or setae; maxilla with a variously toothed distal process; maxilliped subchelate; first four pairs of legs biramous; first two pairs with one-segmented rami; third and fourth pairs visible in ventral view as laminate rami extending posteriorly; fifth leg uniranous, rudimentary.

Male: Head fused with first segment, margins entire; remaining segments fused into a trunk without dorsal plates; abdomen one-segmented, visible in dorsal view; caudal rami subcircular in cross section, slightly tapering posteriorly; appendages as in the female except third and fourth pereiopods which are subcircular in cross section and fused to trunk, and fifth pereiopods which are lacking. Parasitic on marine teleosts.

Type species: *P. foliaceus* (Goggio, 1905)

PARALERNANTHROPUS FOLIACEUS (Goggio, 1905)*

Lernanthropus foliaceus Richiardi, 1878, p.20, 1880, p.150; Goggio, 1905, p.140, pl. 2(1), fig. 1.

Material Examined

From: *Thyrsites atun*—two lots of eight females. collected near Poor Knights Is. by A. N. Baker, January, 1964; three females and two males and another lot of two females collected, presumably in the region of Wellington, by H. Manter, 1951; seven females from Otago, no other data; nine females collected July, 1959, no other data.

From *Jordanidia solandri*—10 females collected off Cape Terakirae, Cooks Strait, by the author, 20 October, 1960; one female (head missing) collected, presumably in the region of Wellington, by H. Manter, 1951.

DESCRIPTION

Female (figs 1-13)

Overall length 6.5 mm - 6.8 mm.

Cephalothorax as wide as long (1.27 mm - 1.73 mm x 1.37 mm - 1.80mm), narrowing anteriorly to three-quarters this width, anterior margin curved, with small

* No description or figures of this species were given by Richiardi; Goggio apparently assumed that the host and locality data were sufficient for him to recognise it. Under articles 9 and 10 of the *International Code of Zoological Nomenclature* 1961 s Goggio must be recognised as the author of this species.

medial bulge; antennae colaterally on a frontal area, one-sixth length of cephalothorax, which is marked by a transverse groove; posterior margin of cephalothorax marked by a dorsal ridge which is highest medially, posterolateral angles of cephalothorax rounded. Cephalothorax separated from remaining thoracic segments by a very short neck.

Second and third thoracic segments fused, their junction marked by a groove; second segment four-fifths width of third, combined length three-quarters third segment segment width (second segment width 1.75 mm - 1.90 mm, third segment width 1.95 mm - 2.47 mm, combined length 1.20 mm - 2.26 mm), both segments rounded laterally.

Fourth thoracic segment partially fused with third, but separated by deep lateral grooves, a little longer than wide (3.42 mm - 4.16mm x 2.89 mm - 4.40mm), widest just before rounded posterior margin, narrowing to less than half this width anteriorly, posterior margin with a very shallow V-shaped notch medially. Segment slightly less than half length of combined plate and segment, largely hidden in ventral view by the lamellar fourth pereiopods.

Genital segment subovate, length three-fifths width (0.34 mm - 0.61 mm x 0.78 mm - 0.95 mm), entirely hidden in dorsal view by the plate of the fourth segment, and in ventral view by the fourth pereiopod.

Abdomen subrectangular, angles broadly rounded, as wide as long (0.41 mm - 0.45 mm x 0.33 mm - 0.52 mm), bearing the caudal laminae posterolaterally.

Caudal laminae with rounded proximal margin, narrowing to a point distally, width two-fifths length (0.72 mm - 0.88 mm x 0.29 mm - 0.35 mm), plate of fourth thoracic segment reaching beyond caudal laminae for a distance approximately equal to their length.

Egg strings many times length of animal, eggs uniserial, egg strings complexly coiled between plate of fourth thoracic segment and fourth pereiopod.

First antenna without obvious segmentation, basal width two-fifths length, extending laterally, distal third at right-angles to basal portion, extending posteriorly, proximal width of this section one-third basal width, narrowing distally to a point, with setae over distal fifth; outer margin of this section with four setae, three sparsely plumose, inner margin with two setae, and a further three setae on blunt tip.

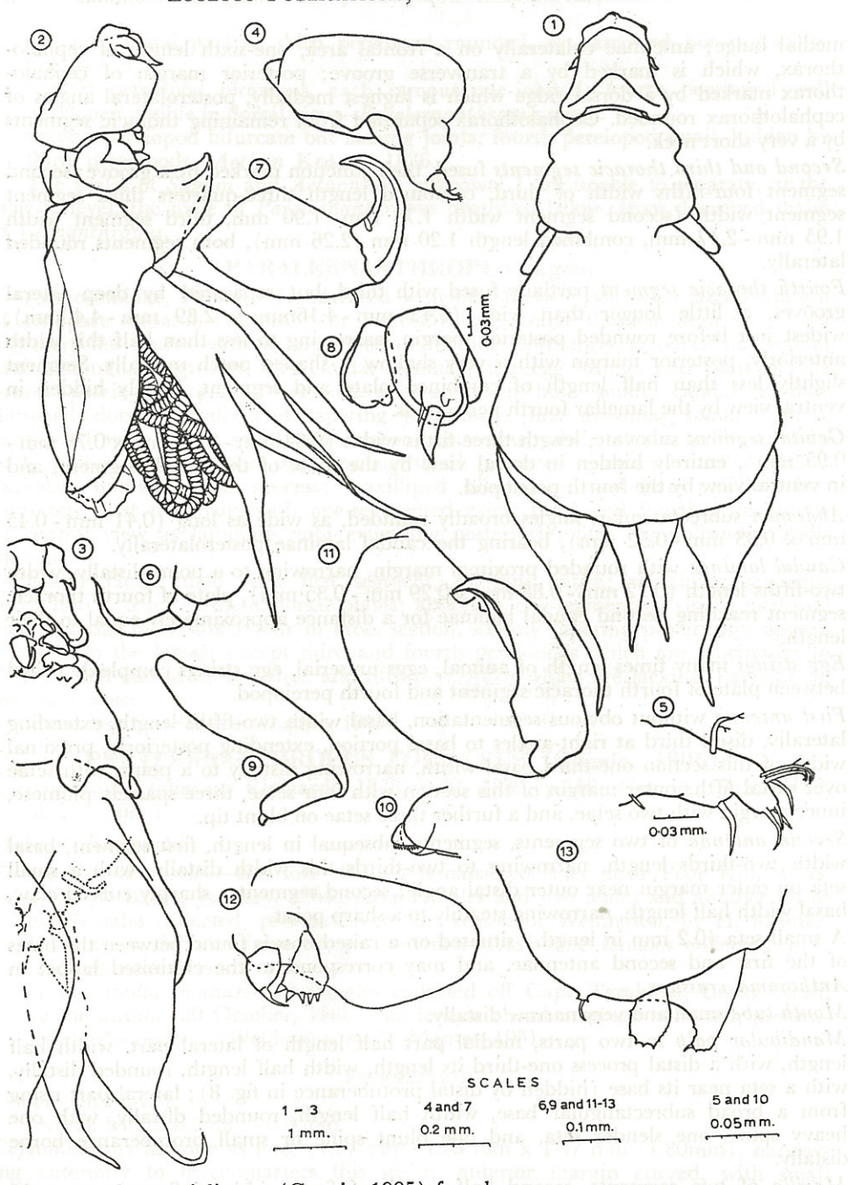
Second antenna of two segments, segments subsequal in length, first segment, basal width two-thirds length, narrowing to two-thirds this width distally, with a small seta on outer margin near outer distal angle; second segment a sharply curved claw, basal width half length, narrowing steadily to a sharp point.

A small seta (0.2 mm in length) situated on a raised boss is found between the bases of the first and second antennae, and may correspond to the chitinised lappet in *Anthosoma crassum*.

Mouth tube small and very narrow distally.

Mandibular palp in two parts, medial part half length of lateral part, width half length, with a distal process one-third its length, width half length, rounded distally, with a seta near its base (hidden by distal protuberance in fig. 8); lateral part rising from a broad subrectangular base, width half length, rounded distally, with one heavy spine, one slender seta, and one blunt spine or small protuberance borne distally.

Maxilla of two segments, second half length of first, width of first two-sevenths length, rounded distally, width of second one-third length, rounded distally; second segment bears distally a small subsemicircular projection, one-eighth segment length, outer margin straight and dentate, a small flange surrounding part of its base.



Paralernanthropus foliaceus (Goggio, 1905) female:
fig. 1: dorsal view; fig. 2: lateral view; fig. 3: ventral view; fig. 4: first antenna; fig. 5: distal end of first antenna further magnified; fig. 6: seta found between first and second antennae; fig. 7: second antenna; fig. 8: madibular palp; fig. 9: maxilla; fig. 10: distal process of maxilla further magnified; fig. 11: maxilliped; fig. 12: first pereiopod; fig. 13: second pereiopod.

Maxilliped of two segments, second segment three-quarters length of first, first segment half as wide at the base as long, narrowing and rounded distally, with a raised area near midpoint of inner margin against which claw-like second segment closes; second segment, basal width two-fifths length, curving, particularly near base and tip, narrowing gradually to a sharp distal point.

First pereiopod biramous, each ramus of one segment; basipod swollen, subovate, width twice length, rami situated near inner distal angle, exopod half basipod length, endopod two-thirds exopod length; exopod a little longer than wide, outer margin a little longer than inner, with five flattened spines on distal margin; endopod as wide as long, rounded distally, bearing a single distal seta.

Second pereiopod biramous, each ramus of one segment, basipod swollen, semi-circular, length half width, with a singe seta on a raised boss near outer distal angle, rami borne on inner part of distal margin; rami subequal in length, half basipod length; exopod rounded distally, width two-thirds length, with about seven very small spines around distal margin; endopod with basal width subequal to length, narrowing and rounded distally, with several small spines and one large spine on distal region.

Third pereiopod without rami, a flattened lamina, curved into a semicircle so that lateral margins are directed posteriorlv, so that total length is about one-fifth body length, rounded anterior margin raised from body by a sublinear margin two-thirds anterodistal length of appendage.

Fouth pereiopod flattened lamellae, three-quarters body length, two-fifths as wide as long, one-third this width basally, distal half bifurcate, each branch narrowing distally to a point, outer branch a little longer than inner; the fourth pereiopods overlap in the midline so as to hide in ventral view much of the fourth thoracic segment, all of the genital and abnominal segments, and the egg strings.

Male (figs. 14-24).

Overall length 3.20 mm and 4.82 mm.

Cephalothorax, width four-fifths length (1.45 mm and 1.48 mm - 1.23 mm and 1.17 mm), subovate, antennae borne laterally on a frontal area, marked by dorsal grooves, anterolateral angles rounded, two-fifths cephalothorax length, four-fifths as wide as long, shorter ventrally; posterior margin of cephalothorax an entire curve.

All remaining segments fused but second and third segments distinguished by lateral grooves, posterior margin of third segment by posterior termination of pereiopods. posterior termination of fourth segment by termination of fourth pereiopod and by lateral grooves, posterior margin of genital segment by slight grooves and by the disparity in width between the genital segment and abdomen.

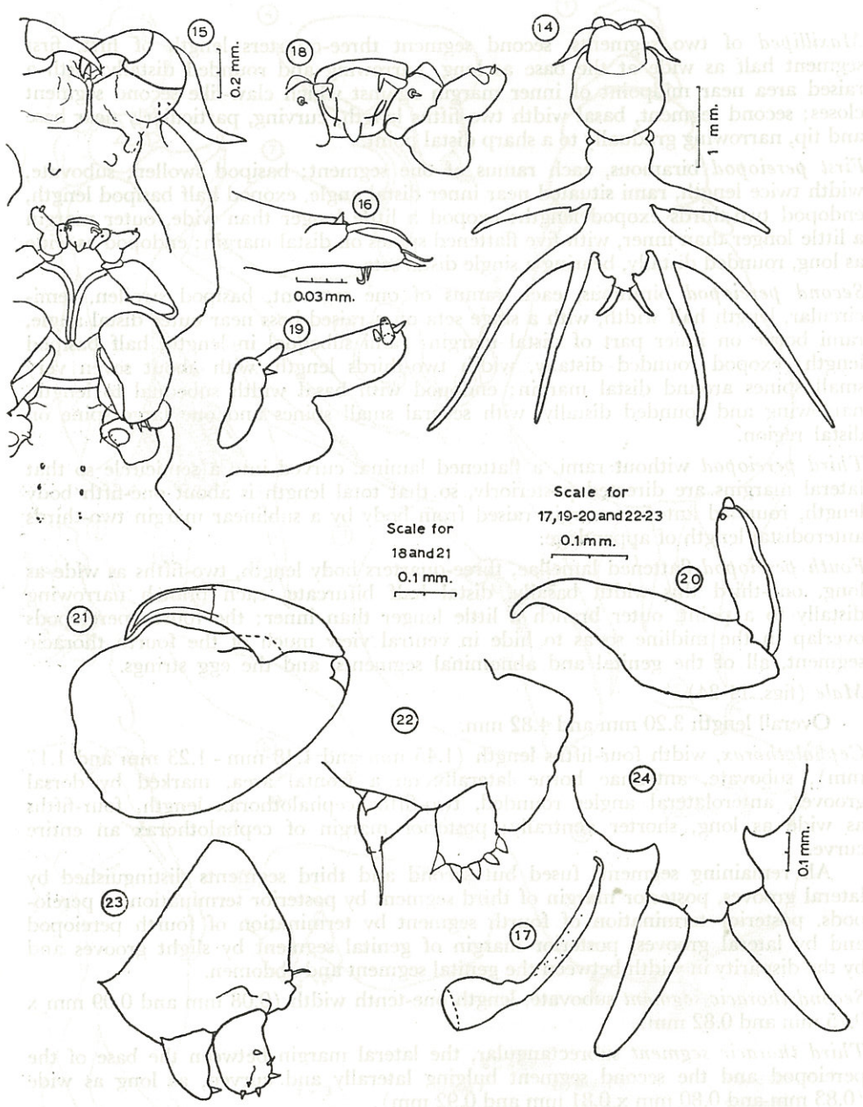
Second thoracic segment subovate, length one-tenth width (0.08 mm and 0.09 mm x 0.75 mm and 0.82 mm).

Third thoracic segment subrectangular, the lateral margin between the base of the pereiopod and the second segment bulging laterally and curved, as long as wide (0.83 mm and 0.80 mm x 0.81 mm and 0.92 mm).

Fourth thoracic segment subrectangular, length half width (0.57 mm and 0.54 mm x 0.86 mm and 0.95 mm).

Genital segment subrectangular, posterolateral angles rounded, length half width (0.33 mm and 0.28 mm x 0.61 mm and 0.58 mm).

Abdomen subrectangular, length three-quarters width (0.22 mm and 0.17 mm x 0.29 mm and 0.22 mm) slightly narrower anteriorly.



Paralernanthropus foliaceus (Goggio, 1905) male:
fig. 14: dorsal view; fig. 15: ventral view of cephalothorax, second and third thoracic segments; fig. 16: tip of first antenna; fig. 17: seta from between first and second antennae; fig. 18: mouth tube and mandibular palp; fig. 19: mandibular palp; fig. 20: maxilla; fig. 21: maxilliped; fig. 22: first pereiopod; fig. 23: second pereiopod; fig. 24: genital segment, abdomen and caudal laminae.

Caudal laminae attached to lateral part of posterior margin of abdomen, basal width one-third length (0.45 mm and 0.40 mm x 0.12 mm and 0.13 mm) narrowing slightly distally, distal margin rounded, not pointed as in female.

Appendages as in female except that the maxilla bears a flange along outer margin of second segment, and a second smaller process on inner margin near distal process, the spines on the exopod of the second pereiopod are better developed than in the female and the third and fourth pereiopods are transformed into laterally projecting cylindrical processes fused to their respective thoracic segments.

Third pereiopod projecting laterally from posterior half of third thoracic segment, length two-fifths body length, basal width one-quarter length, narrowing distally, distal margin rounded, posterior margin with a small pointed branch, one-seventh distance from base, which may represent the endopod.

Fourth pereiopod almost as long as body, extending posterolaterally from fourth thoracic segment, basal width one-ninth length, dividing one-seventh distance from base into two branches, inner branch two-thirds length of outer branch, both branches tapering gradually to a blunt point.

DISCUSSION

There seem to be no differences between the specimens from *Thysites atun* and *Jordanidia solandri* except that the combined second and third thoracic segments are longer in the latter (1.43 mm - 1.67 mm) than in the former (1.71 mm - 2.26 mm).

Lernanthropus foliaceus was found and named, but not described, by Richiardi (1878, p.20). Goggio claimed to have identified this species and gave a description and figure (pl. 2(1), fig. 1). Like Richiardi (1878, p.20, 1880, p.150), Goggio obtained his specimens from *Thyrsites pretiasus* from the Mediterranean. Goggio's specimens are considerably larger than mine (15.5 mm compared to 6.5 mm - 6.8 mm) but this difference by itself is not systematically significant.

The figure and description given by Goggio agree well with the present material in the general form of the body and in those details of the appendages that Goggio recognised. In particular the one-segmented first antennae, the vertically directed third pereiopod, convexly curved anteriorly, the lateral margins directed posteriorly and the fourth pereiopods extending well beyond the plate of the fourth thoracic segment and with their rami narrowing to filiform posterior extensions leave little doubt that the present specimens belong to Goggio's species.

Further confirmation is given by Goggio's statement that the egg strings are "aggrovigliati" (entangled) beneath the dorsal plate. This coiling of the egg strings further indicates that this species must be transferred to the genus *Paralernanthropus* as defined in this paper.

The genus *Pseudolernanthropus* was erected by Yamaguti and Yamasu (1960, p.146) who made *P. epinephali* the type species. They suggested that *Lernanthropus petersi* van Beneden, 1857 should be transferred to this new genus. Later, Yamaguti (1963, p.153 - 154) expanded the genus to include *Sagum posteli* Delamare-Debouttville and Nunes-Ruivo, 1954, *Lernanthropus angulatus* Krøyer (which Wilson, 1922, p.28, had considered a species of *Sagum*) and *Sagum texanus* Pearse, 1952, p.32. In no case does Yamaguti discuss the reasons for transferring these species to *Pseudolernanthropus*.

Pillai and Sebastian (1967, p.73) redescribed *P. epinephali* and gave good grounds for considering that it should be placed in the genus *Sagum*. With much less discussion they also placed all the other species placed by Yamaguti as *Pseudolernanthropus* in the genus *Sagum*.

However, descriptions of *L. petersi, S. posteli* and *S. texanus* (in the case of *L. petersi* van Beneden, the original description was not available and figures by Yamaguti (1963, pl. 168, fig. 6) and Barnard (1955, fig. 19) were consulted) make it clear that in all cases (1) the eggs are coiled up between the fourth pereiopods and plate of the fourth segment. (2) the fourth pereiopods are clearly visible in ventral view, and (3) posterolateral extensions of the third and fourth thoracic segments are not fused with the exopod of the third pereiopod; on these criteria I consider these species belong to *Paralernanthropus* as defined in this paper.

Krφyer in his description of *L. angulatus* suggests that the third pereiopod ("Femte Fodpar") is fused in part to the thorax and further, that the fourth pereiopod ("Sjette Fodpar") has a soft, whip-like flagellum as later described by Wilson for *Sagum flagellatum*. Krφyer queries the function of these structures, as did Wilson fifty-nine years late. It is clair that the soft flagellum is not just a sudden narrowing of the lamellar ramus as found in most species of *Paralernanthropus*. I therefore agree with Wilson (1922, p.28) and Pillai and Sebastian (1967, p.79) that *L. angulatus* is referable to *Sagum* and should be *Sagum angulatus* (Krφyer).

The present species, *P. foliaceus, i*s quite unlike any of the other described species of *Paralernanthropus*. It differs from *P. posteli* and *P. texanus* in lacking the sudden narrowing of the fourth pereiopods. In *P. foliaceus* and *P. petersi* these pereiopods narrow gradually towards the posterior tip. *P. foliaceus* differs from *P. petersi* in having broadly laminate fourth pereiopods (width about half length) and a long fourth thoracic segment plate (more than half body length) while in *P. petersi* the length of the fourth pereiopods are many times their width and the fourth thoracic segment plate is much less than half body length.

In some characters, e.g. the longer body shape and form of the fourth pereiopods, *P. foliaceus* resembles members of the genus *Lernanthropus* to a greater extent than do other species of *Paralernanthropus*.

LERNANTHROPUS *Blainville*, 1822

Anthosomidae. Female: Head fused with first thoracic segment, cephalothorax margins turned down ventrally; second and third thoracic segments fused; fourth thoracic segment fused to second and third, rarely free, covered by a dorsal plate which extends posteriorly to cover the genital segment, and sometimes the abdomen and caudal rami, in dorsal view; genital segment small, rounded; abdomen one-or two-segmented; caudal rami present, flattened or subcircular in cross section, usually tapering posteriorly; eggs uniseriate, flattened; egg strings usually long, trailing posteriorly from genital segment; first antenna with segments more or less fused, sometimes distinct; second antenna subchelate; mandibular palp present; maxilla two-segmented; maxilliped subchelate; first four pereiopods biramous; rami of first and second pairs rudimentary, one-segmented; those of third pair lamellar, fused, projecting at right angles or diagonally from ventral surface! rami of fourth pereiopods usually separate, lamellar, extending posteriorly; fifth pereiopods uniramous, rudimentary or lacking. Male as for *Paralernanthropus*. Parasitic on marine teleosts.
Type species: *L. musca Blainville*, 1822.

Lernanthropus microlamini n.sp.

MATERIAL

From *Seriolella brama,* one female, collected by H. Manter in 1951, presumably in the region of Wellington.

DESCRIPTION

Female (figs. 25 - 36).

Overall length 9.92 mm.

Cephalothorax subrectangular, angles rounded, little longer than wide (2.67 mm x 2.52 mm), anterior three-quarters of lateral margins parallel, cephalothorax narrowing slightly posteriorly; antennae borne on anterolateral bulges of a frontal area which is one-third cephalothorax width and one-seventh cephalothorax length, marked laterally by grooves, its sublinear anterior margin forming a dip in the anterior margin of cephalothorax, remainder of anterior margin of cephalothorax an entire curve on either side of frontal region.

Second and third thoracic segments fused, as wide as long (3.20 mm x 3.35 mm), widest posteriorly, narrowing anteriorly to half this width, projections on the posterior two-fifths of the lateral margin extend over part of surface of third pereiopod, and increase this width by two-sevenths.

Fourth thoracic segment, including plate, subrectangular, angles rounded, four-fifths as wide as long (4.27 mm x 3.39 mm) narrowing to three-quarters this width posteriorly; actual segment very short.

Genital segment very small, subovate, partly hidden in ventral view by third pereiopods, which were not dissected off to reveal this segment.

Abdomen subrectangular, posterior angles rounded, width half length (0.65 mm x 0.49 mm), narrowing slightly posteriorly.

Caudal laminae, width two-fifths length (0.45 mm - 0.19 mm), widest at base, narrowing slightly distally, distal margin rounded, three smal lspines borne distally.

Egg strings 13.00 mm in length, eggs uniserial, egg strings trailing behind body.

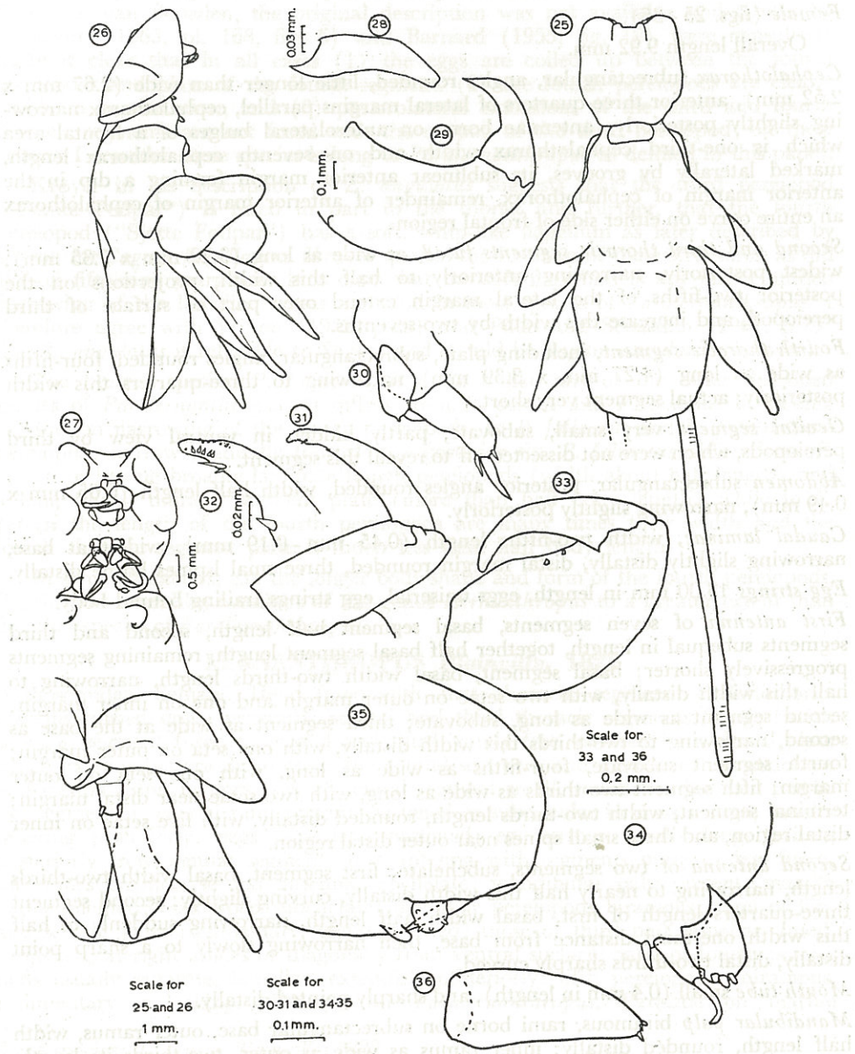
First antenna of seven segments, basal segment half length, second and third segments subequal in length, together half basal segment length, remaining segments progressively shorter; basal segment, basal width two-thirds length, narrowing to half this width distally, with two setae on outer margin and one on inner margin; second segment as wide as long, subovate; third segment as wide at the base as second, narrowing to two-thirds this width distally, with one seta on outer margin; fourth segment subovate, four-fifths as wide as long, with one seta on outer margin; fifth segment two-thirds as wide as long, with two setae near distal margin; terminal segment, width two-thirds length, rounded distally, with five setae on inner distal region, and three small spines near outer distal region.

Second antenna of two segments, subchelate; first segment, basal width two-thirds length, narrowing to nearly half this width distally, curving slightly; second segment three-quarters length of first, basal width half length, narrowing suddenly to half this width one-third distance from base, then narrowing slowly to a sharp point distally, distal two-thirds sharply curved.

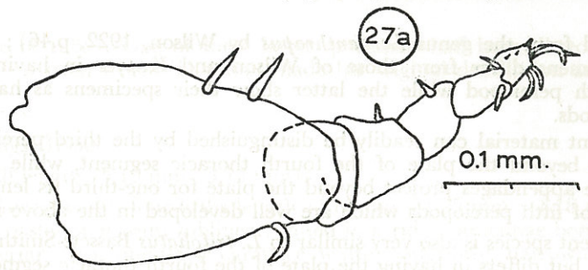
Mouth tube small (0.4 mm in length), and sharply pointed distally.

Mandibular palp biramous, rami borne on subrectangular base, outer ramus, width half length, rounded distally; inner ramus as wide as outer, two-thirds its length, both rami with one large and two small spines distally.

Maxilla of two segments, segments subequal in length, first segment subrectangular, half as wide as long; second segment basal width one-quarter length, narrowing gradually to a blunt tip, with a spine on inner margin two-sevenths distance from tip, two spines one-seventh distance from tip, and two rows each of about seven very small spines between these two and the tip.



Lernanthropus microlammi n.sp. female: fig. 25: dorsal view; fig. 26: lateral view; fig. 27: ventral view; fig. 28: spine from between first and second antennae; fig. 29: second antenna; fig. 30: mandibular palp; fig. 31: maxilla; fig. 32: tip of maxilla; fig. 33: maxilliped; fig. 34: first pereiopod; fig. 35: second pereiopod; fig. 36: caudal lamina.



Lernanthropus microlammi n.sp. female; fig. 27a: first antenna.

Maxilliped of two segments, subchelate; basal segment swollen, basal width half length, narrowing to two-thirds this width distally, outer margin strongly curved, inner margin with two small spines; second segment three-quarters length of first, basal width two-fifths length, narrowing to a point distally, sharply curved, particularly over distal half.

First pereiopod biramous, each ramus of one segment; basipod swollen, subsemicircular, half as long as wide, with a spine near base of endopod; rami subequal in length, a little shorter than basipod; exopod, width three-quarters length, rounded distally, with four blunt flattened spines on distal margin; endopod subtriangular, as wide as long, with a seta subequal in length to segment on distal apex.

Second pereiopod biramous, each ramus of one segment; basipod swollen, almost three times length of basipod of first pereiopod, similar in shape except that it swells more strongly laterally than does basipod of first pereiopod; exopod one-seventh basipod length, subsemicircular, proximal margin straight, as wide as long, with five small flattened blunt spines on distal and inner margins; endopod three-quarters length of exopod, width two-thirds length, rounded distally, with no setae.

Third pereiopod laminate, rami fused or lost, laminae a little wider than plate on fourth thoracic segment, lying transversely across body, overlapping slightly in the midline, and extending posterolaterally from the body for almost one-third their length, slightly curved, standing out at right angles from the body for a distance equal to one-fifth body length.

Fourth pereiopod biramous, rami flattened lamellae separated almost to their base, exopod, width one-quarter length, narrowing gradually to one-quarter this width distally and then rounded, extending posterolaterally beyond plate of fourth segment for more than half its length; endopod five-sevenths length of exopod, two-fifths as wide as long, inner margin sublinear, outer margin curved over distal three-fifths of its length to reduce width to one-eighth basal width, lamella then rounded distally.

DISCUSSION

L. microlamini seems to be most closely related to a group of species or subspecies recorded from many parts of the world on *Caranx* spp. Initially these were described as *L. giganteus* by Krøyer (1863, p.280, pl. 8, fig. 1) from Brazil, then Wilson recorded specimens from the West Indies (1913, p.227, pl. 33, fig. 148-150, pl. 35) under the same name, although Wilson's figures differ from those by Krøyer in the length of the plate of the thoracic segment (40% of total length in Krøyer's figure, 30% in Wilson's), as well as in the shape of this plate; Kirtisinghe (1956, p.18, fig. 11) recorded specimens from Colombo under the name *L. trifoliatus* Bassett-Smith but later (1964, p.98, figs. 132-137) gave further records from the Gulf of Mannar area, now placing these and his previous records as *L. giganteus;* meanwhile Pillai (1964, p.48, fig. 9) recorded specimens from the same host genus from nearby Trivandrum as *L. carangis* Pillai (*nec. L. carangis* Hesse, 1878 which

was removed from the genus *Lernanthropus* by Wilson, 1922, p.46); these Indian Ocean specimens differ from those of Wilson and Krφyer in having a broadly laminate fifth pereiopod while the latter show their specimens as having filiform fifth pereiopods.

The present material can readily be distinguished by the third pereiopods which extend little beyond the plate of the fourth thoracic segment, while in the above records these appendages project beyond the plate for one-third its length, and also by the lack of fifth pereiopods which are well developed in the above records.

The present species is also very similar to *L. trifoliatus* Bassett-Smith (1898, p.12, pl. 7, fig. 1) but differs in having the plate of the fourth thoracic segment narrowed posteriorly while in *L. trifoliatus* it becomes wider and then broadly rounded posteriorly, and again in the lack of the fifth pereiopods which are particularly well developed in *L. trifoliatus*.

It seems possible that the present species and *L. trifoliatus* are closely related to the specimens recorded from *Caranx* spp. but, until such time as larger collections from a variety of geographical localities makes revision of this group possible, there is no way of deciding the extent of this relationship.

AETHON, Krφyer, 1836

Anthosomidae. Male probably unknown. Female: Head fused with first thoracic segment, cephalothorax usually with lateral wing-like expansions; second and third thoracic segments fused but with separate dorsal plates, and with lateral expansions which extend slightly posterolaterally but do not fuse with plate of fourth segment; fourth segment covered by a dorsal plate which extends posteriorly to hide the posterior part of the body and all or most of the egg strings in dorsal view; genital segment small, abdomen small and rounded; caudal laminae small, irregular in outline with a lateral spine-bearing projection and further spines posteriorly; eggs uniserriate, flattened; egg strings long, coiled between third pereiopods and plate of fourth thoracic segment; first antenna with six or seven segments, several with short setae; second antenna subchelate; mandibular palp with two rami, at least one with spines; maxilla of two segments usually with rows of spines distally; maxilliped subchelate; first four pereiopods biramous; first pereiopods with rudimentary one-segmented rami; second pereiopods held at right angles to body, rami fused with basipod; third pereiopods large, thickened lamellae with endopod covering egg strings in ventral view and exopod hiding them in lateral view; fourth pereiopods lamellar, divided nearly to base, about half length of third pereiopods, which completely hide them in ventral view; fifth pereiopods uniramous, rudimentary.

Parasites on marine teleosts.

Type species: *Aethon quadratus* Krφyer, 1836.

Aethon percis (*Thomson*, 1889)

Lernanthropus percis Thomson, 1889, p.336-7, pl. 27, figs. 2a-j
nec „ „ „ Wilson, 1936, p.340.

MATERIAL

From gills of *Parapercis colias* (blue cod):

One female, collected at the northern end of Kapiti Is., by the author, 4 February 1967; three females from the collection of the Otago Museum in a tube containing three labels "*Lernanthropus percis*—gills of blue cod", "G.M.T. dep. 1910" and "label on outside of tube—from gills of blue cod 23/10/79" (there is now no label on outside of tube). One of these latter specimens had been dissected and may be the specimen from which Thomson made his original description and drawings.

DESCRIPTION

Female (figs. 37-50).

Overall length (5.15 mm - 5.73 mm).

Cephalothorax, width four-fifths length (1.63 mm - 1.95 mm x 1.18 mm - 1.47 mm), subovate, posterior margin sublinear, raised in a ridge; antennae borne laterally on a short anterior area, one-third carapace width posteriorly, narrowing to two-thirds this width anteriorly, anterior margin straight, marked off from carapace by lateral grooves, extending a little beyond anterior margin of remainder of cephalothorax; lateral margin of carapace expanded as two lobes, each half length of margin, anterior lobe bulging posterolaterally, posterior lobe bulging anterolaterally, posterior lobe slightly bifid distally in some specimens, posterior lobe sometimes unequally developed (see fig. 37 in which right hand lobe is larger than left).

Second and third thoracic segments fused, but distinguished by a groove which runs dorsally and laterally; combined length three-quarters width, second segment four-fifths width of third (combined length 1.05 mm - 1.21 mm, second segment width 1.13 mm - 1.39 mm, third segment width 1.44 mm - 1.67 mm), second and third segments each with most of dorsal surface covered by a poorly developed plate; lateral margin of combined second and third thoracic segments extend laterally as wing-like expansions, which increase the width by up to one-fifth, lateral margins of expansions sublinear, anterior angles rounded, posterior angles extended postero-laterally for a distance equal to two-fifths combined segments length, narrowing and rounded distally, not fused with plate of fourth segment.

Fourth thoracic segment including plates, slightly longer than wide (2.43 mm - 3.32 mm x 2.47 mm - 2.87 mm), lateral margins sublinear and parallel for the anterior four-fifths of their length, then slightly angled, posterior margin an entire curve except for a concave invagination medially which is one-sixth plate width, and one-eighth length of plate; actual segment short, length one-third width (0.72 mm - 0.80 mm x 2.11 mm - 2.53 mm), subrectangular, angles rounded.

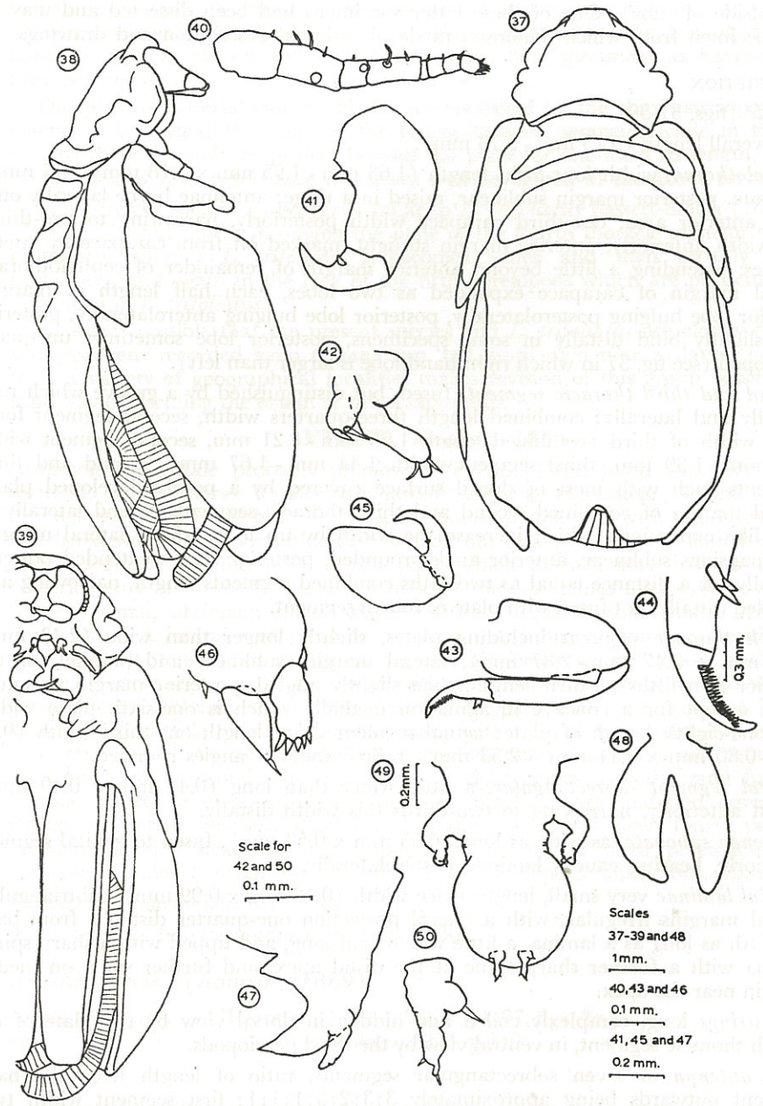
Genital segment subrectangular, a little wider than long (0.42 mm x 0.49 mm), widest anteriorly, narrowing to two-thirds this width distally.

Abdomen subovate, as wide as long (0.55 mm x 0.53 mm), fused to genital segment anteriorly, bearing caudal laminae posterolaterally.

Caudal laminae very small, length twice width (0.18 mm x 0.09 mm), subtriangular, lateral margins irregular, with a lateral projection one-quarter distance from base, one-fifth as long as a lamina, a little wider than long, and tipped with a sharp spine; lamina with a further sharp spine at the distal apex, and further spine on medial margin near the apex.

Egg strings long, complexly coiled and hidden in dorsal view by the plate of the fourth thoracic segment, in ventral view by the third pereiopods.

First antenna of seven subrectangular segments, ratio of length from the basal segment outwards being approximately 3:3:2:3:1:1:1; first segment width two-thirds length, with a small spine on outer margin, second segment width four-sevenths length, with three setae on outer margin, third segment as wide as long, with a small seta on outer margin, fourth segment width half length, with one long and one short seta on outer margin (fig. 40 shows fourth segment joined to fifth by a short membrane which could be a thinly chitinised segment), fifth segment as wide



Aethon percis (Thomson, 1889) female: fig. 37: dorsal view; fig. 38: lateral view; fig. 39: ventral view; fig. 40: first antenna; fig. 41: second antenna; fig. 42: mandibular palp; fig. 43: maxilla; fig. 44: tip of maxilla; fig. 45: maxilliped; fig. 46: first pereiopod; fig. 47: second pereiopod; fig. 48: fourth pereiopod; fig. 49: genital segment, abdomen and caudal laminae; fig. 50: caudal lamina.

as long, with two small setae on outer margin, sixth segment as wide as long, with one small seta on outer distal angle seventh segment rounded distally, width three-quarters length, with six setae on distal margin.

Second antenna of two segments, subchelate; first segment, basal width half length, narrowing to three-quarters this width distally, curved, with a stout spine on inner margin near base; second segment basal width half length, narrowing steadily to a sharp point distally, strongly curved, with a stout spine near inner margin one-quarter of distance from base.

Mouth tube small (0.5 mm in length), sharply pointed distally.

Mandibular palp, with two rami on a flattened subrectangular base; outer ramus, width two-fifths length, rounded distally, with two setae and one subrectangular process distally; inner ramus half length of outer, width two-thirds length, rounded distally, with two setae distally.

Maxilla of two segments, segments subequal in length; first segment, basal width half length, narrowing slightly distally, distal margin rounded; second segment basal width one-tenth length, narrowing gradually distally except that distal seventh narrows suddenly and bears a longitudinal row of small spines reaching almost to the slightly blunted tip, a small process, one-third length of narrowed distal region, width half length, is situated near inner margin one-quarter distance from tip, and bears two setae distally, the larger setea subequal in length to process, the other a little smaller.

Maxilliped of two segments, subchelate; first segment, basal width two-thirds length, narrowing slightly distally, distal margin rounded; second segments basal width half length, narrowing gradually to a distal point, sharply curved over distal two-thirds, with a small spine on inner margin one-third distance from base.

First pereiopod biramous, each ramus of one segment; basipod swollen, subsemi-circular, length two-thirds width, with one small spine medial to endoped and another on a raised boss lateral to exopod; exopod subovate, subequal in length to basipod, width half length, with five flattened spines on distal margin; endopod subtriangular, subequal in length to exopod, basal width half length, distal apex bearing a spine.

Second pereiopod biramous, the rami fused to the basipod, length including rami more than twice length of first pereiopod, as long as basal width, narrowing steadily distally, to end in a sharp point, the terminal section presumed to include the endopod, distal portion curving sharply medially and posteriorly away from the body, inner margin with a well developed subtriangular expansion one-third distance from base, and a further process on outer margin two-thirds distance from base is assumed to be the reduced exopod; exopod one-quarter length of combined basipod and endopod, basal width half length, narrowing gradually for three-quarters its length then more suddenly to one-third basal width, tip rounded.

Third pereiopod very large, two-thirds length of body, biramous, the rami lamellar, directed posteriorly and separated but fused with base which is one-fifth length of subequal rami; exopod a flattened subsemiovate lamella, basal width two-thirds length, narrowing slightly distally, distal margin rounded, hiding the egg strings in lateral view; the endopod is folded almost into a right angle in cross section, the inner portion lying flat against egg strings, the outer portion turned ventrally, involving one-quarter width of endopod distally, less proximally, the ventrally turned portion lying almost parallel to exopod, endopod if flattened would be sub-rectangular, width one-quarter length, posterior angles rounded.

Fourth pereiopod biramous, total length half total length of third pereiopod, rami fused with basipod which is one-quarter length of exopod and narrows towards its base so that its lateral margins form entire curves with outer margin of exopod and inner margin of endopod; exopod one-quarter as wide at the base as long, narrowing and rounded distally, outer margin a convex curve, inner margin sublinear, with a very small spine on a raised boss on outer margin near junction with basipod; endopod three-quarters exopod length, width at midpoint half length, narrowed slightly proximally, more narrowed distally, rounded distally, outer margin an entire curve, inner margin sublinear.

Fifth pereiopod borne near midpoint of genital segment lateral margin, almost as long as genital segment, width one-quarter length, rounded distally, bent into a right angle, directed laterally, then posteriorly, with a small seta on a well developed projection near distal margin.

DISCUSSION

The material on hand agrees well with Thomson's description and figures (1889, p.366-7, pl. 27, figs. 2a-j); this could be expected in the case of the Otago Museum material since it had been identified as *L. percis* by Thomson himself.

Wilson (1936, p.340) claimed to have found this species on *Promicrops itaira* at the Dry Tortugas. The only description he gives is that the first antennae "prove to be six-segmented, with no setae except two minute ones at the tip of the end segment". Since in *A. percis* the antenna is seven segmented with setae on every segment it seems that Wilson's record is of yet another species of *Aethon*.

A. percis resembles *A. quadratus* Krφyer in its general form and in its possession of forked, unsegmented, second pereiopods, and in the development of the third pereiopods, but it can be separated from *A. quadratus* in that the latter has the posterior lateral lobe of the cephalothorax extending out well beyond the anterior (which may even be missing; Krφyer does not make this clear) while in *A. percis* the posterior lobe is only slightly longer than the anterior. Further, *A. quadratus* has a well developed neck region, almost entirely missing in *A. percis*.

Aethon garricki n.sp.

MATERIAL

From gills of *Cheilodactylus macropterus:* One female collected by the author from Somes Island, Wellington Harbour, 28 April, 1961.

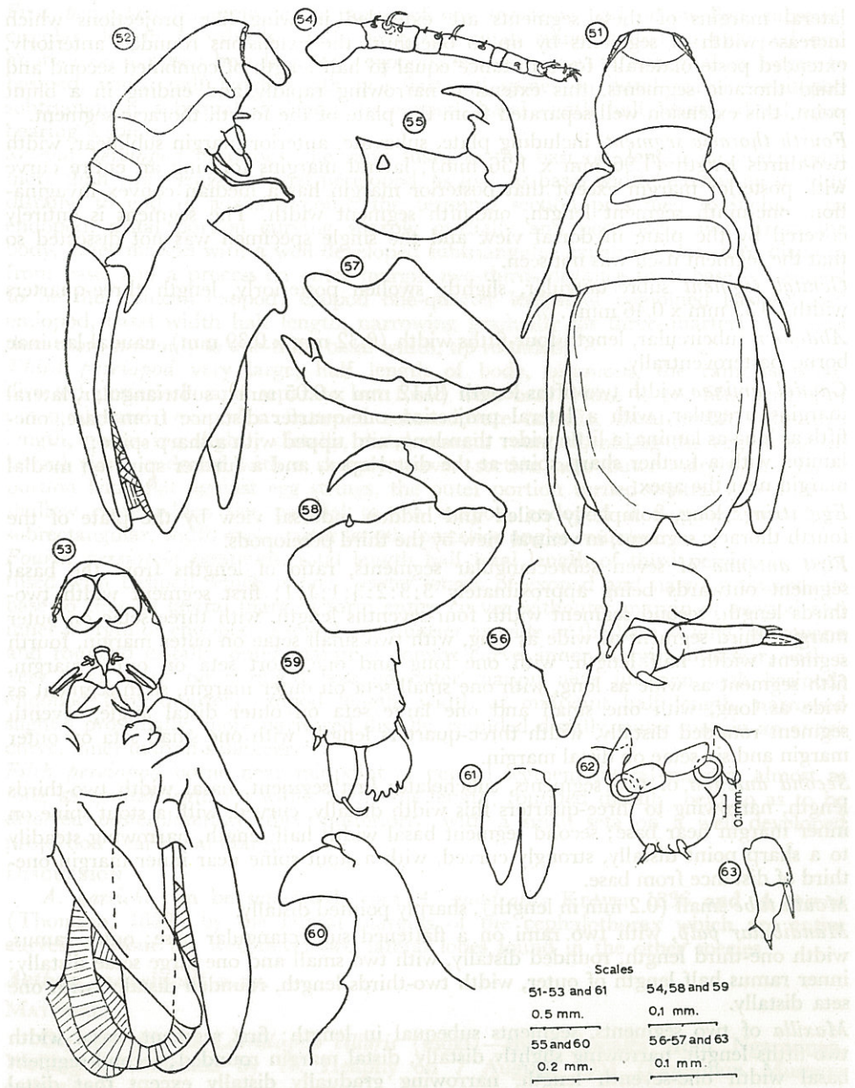
DESCRIPTION

Female (figs. 51-63).

Overall length 3.82 mm.

Cephalothorax subovate, width two-thirds length (1.22 mm x 0.86 mm), anterior and posterior margins sublinear, lateral margins entire convex curves, anterior margin half cephalothorax width, posterior margin three-quarters cephalothorax width; antennae carried laterally on an anterior area one-quarter cephalothorax length, half cephalothorax width posteriorly, slightly narrower anteriorly, distinguished by very faint grooves; cephalothorax without lateral expansions.

Second and third thoracic segments fused, distinguishable by a dorsal and lateral transverse groove, combined length two-thirds width, width of second segment four-fifths width of third (combined length 0.81 mm, width of second thoracic segment 1.04 mm, width of third thoracic segment 1.24 mm); two poorly developed dorsal plates which are rounded laterally, cover much of the dorsum of each segment;



Aethon garricki n.sp. female: fig. 51: dorsal view; fig. 52: lateral view; fig. 53: ventral view; fig. 54: first antenna; fig. 55: second antenna; fig. 56: mouth tube and mandibular palp; fig. 57: maxilla; fig. 58: maxilliped; fig. 59: first pereiopod; fig. 60; second pereiopod; fig. 61: fourth pereiopod; fig. 62: genital segment, abdomen and caudal laminae; fig. 63: caudal lamina.

lateral margins of these segments are extended in wing like projections which increase width of segments by up to one-third the extensions rounded anteriorly, extended posterolaterally for a distance equal to half length of combined second and third thoracic segments, this extension narrowing rapidly and ending in a blunt point, this extension well separated from the plate of the fourth thoracic segment.

Fourth thoracic segment, including plate, subovate, anterior margin sublinear, width two-thirds length (1.96 mm x 1.36 mm), lateral margins forming an entire curve with posterior margin except that posterior margin has a median convex invagination, one-ninth segment length, one-fifth segment width. The segment is entirely covered by the plate in dorsal view and the single specimen was not dissected so that the segment itself was not seen.

Genital segment subrectangular, slightly swollen posteriorly, length three-quarters width (0.33 mm x 0.46 mm).

Abdomen subcircular, length four-fifths width (0.32 mm x 0.39 mm), caudal laminae borne posteroventrally.

Caudal laminae width two-fifths length (0.12 mm x 0.05 mm), subtriangular, lateral margins irregular, with a lateral projection one-quarter distance from base, one-fifth as long as lamina, a little wider than long, and tipped with a sharp spine; lamina with a further sharp spine at the distal apex, and a further spine on medial margin near the apex.

Egg strings long, complexly coiled and hidden indorsal view by the plate of the fourth thoracic segment, in ventral view by the third pereiopods.

First antenna of seven subrectangular segments, ratio of lengths from the basal segment outwards being approximately 3:3:2:3:1:1:1; first segment width two-thirds length, second segment width four-sevenths length, with three setae on outer margin, third segment as wide as long, with two small setae on outer margin, fourth segment width half length, with one long and one short seta on outer margin, fifth segment as wide as long, with one small seta on outer margin, sixth segment as wide as long, with one small and one large seta on outer distal angle, seventh segment rounded distally, width three-quarters length, with one small seta on outer margin and six setae on distal margin.

Second antenna of two segments, subchelate; first segment, basal width two-thirds length, narrowing to three-quarters this width distally, curved, with a stout spine on inner margin near base; second segment basal width half length, narrowing steadily to a sharp point distally, strongly curved, with a stout spine near inner margin one-third of distance from base.

Mouth tube small (0.2 mm in length), sharply pointed distally.

Mandibular palp, with two rami on a flattened subrectangular base; outer ramus, width one-third length, rounded distally, with two small and one large setae distally; inner ramus half length of outer, width two-thirds length, rounded distally, with one seta distally.

Maxilla of two segments, segments subequal in length; first segment, basal width two-fifths length, narrowing slightly distally, distal margin rounded; second segment basal width one-seventh length, narrowing gradually distally except that distal seventh narrows suddenly; a small process, half length of narrowed distal region is situated on inner margin at base of this region.

Maxilliped of two segments, subchelate; first segment, basal width half length, narrowing slightly distally, distal margin rounded, with a small spine one-third of distance from base; second segment basal width two-fifths length, narrowing gradually to a distal point, sharply curved over distal half.

First pereiopod biramous, each ramus of one segment; basipod swollen, subsemicircular, length two-thirds width, with one small spine medial to endopod and another on a raised boss lateral to exopod; exopod subovate, subequal in length to basipod, width half length, with five flattened spines on distal margin; endopod subtriangular, subequal in length to exopod, basal width half length, distal apex bearing a spine.

Second pereiopod biramous, the rami fused to the basipod, length including rami more than twice length of first pereiopod, as long as basal width, narrowing steadily distally, to end in a sharp point, the terminal section presumed to include the endopod, distal portion curving sharply medially and posteriorly away from the body, inner margin with a well developed subtriangular expansion one-third distance from base, and a process on outer margin two-thirds distance from base is assumed to be the reduced exopod; exopod one-quarter length of combined basipod and endopod, basal width half length, narrowing gradually for three-quarters its length then more suddenly to one-third basal width, tip rounded.

Third pereiopod very large, half length of body, biramous, the rami lamellar, directed posteriorly and separate but fused with base which is one-fifth length of subequal rami; exopod a flattened subsemiovate lamella, basal width two-thirds length, narrowing slightly distally, distal margin rounded, hiding the egg strings in lateral view; endopod with a sharply curved section near outer margin, the inner portion lying flat against egg strings, the outer portion turned ventrally, to form a shallow ridge which lies parallel to the exopod, endopod if flattened would be subrectangular, width one-quarter length, posterior angles rounded.

Fourth pereiopod biramous, total length half total length of third pereiopod, rami fused with basipod which is one-quarter length of exopod and narrows towards its base so that its lateral margins form entire curves withouter margin of exopod and inner margin of endopod; exopod one-quarter as wide at the base as long, narrowing and rounded distally, outer margin a convex curve, inner margin sublinear, with a very small spine on a raised boss on outer margin near junction with basipod; endopod three-quarters exopod length, width at midpoint half length, narrowed slightly proximally, more narrowed distally, rounded distally, outer margin an entire curve, inner margin sublinear.

Fifth pereiopod borne near midpoint of genital segment lateral margin, almost as long as genital segment, width two-fifths length, rounded distally, bent so as to be directed posterolaterally, then posteriorly, with a small seta on a well developed projection near distal margin.

DISCUSSION

A. garricki can be separated from *A. quadratus* Krφyer 1836 and *A. percis* (Thomson, 1889) by the lateral margins of the cephalothorax which are entire curves, without the well developed lateral lobes found in the other species.

Aethon morelandi n.sp.

MATERIAL

On the gills of *Latridopsis ciliaris* (moki)—three females from Ngaraunga, Wellington, collected by W. Heaphy on 7 August, 1951 (Dominion Museum collection).

DESCRIPTION

Female (figs. 64-77).

Overall length 4.45 mm - 4.71 mm.

Cephalothorax, length nine-tenths width (1.25 mm - 1.33 mm x 1.36 mm - 1.46 mm) anterior and posterior margins sublinear, antennae carried laterally on an anterior

area which is two-fifths cephalothorax length, one-quarter cephalothorax width, and which is marked off laterally by shallow grooves, and extends anteriorly a little beyond remainder of anterior margin of cephalothorax, anterior margin of anterior area very slightly curved; anterior quarter and posterior three-quarters of lateral margin expanded as two rounded lateral lobes, the anterior one directed laterally, posterior one directed anterolaterally.

Second and third thoracic segments fused, the junction between them marked by a transverse groove running dorsally and laterally, second segment nine-tenths width of third, overall length six-tenths width of third (second segment width 1.12 mm - 1.41 mm, third segment width 1.31 mm - 1.61 mm. overall length 0.77 mm - 0.85 mm); the combined segments are extended laterally as wing-like projections, which may increase width of segment by up to two-fifths, lateral margins sublinear, anterior angles rounded, posterior angles extended posterolaterally for a distance equal to two-fifths segment length, free margins slightly serrate.

Fourth thoracic segment including plate, width nine-tenths length (2.32 mm - 2.61 mm x 2.17 mm - 2.46 mm), subovate, with slightly developed blunt posterolateral angles, posterior margin divided into two entire curves by a median concave invagination which is one-tenth segment length, one-eighth segment width, margin of plate slightly serrated. Fourth segment completely covered by plate, a little narrower than plate, but less than one-third its length (0.6 mm).

Genital segment subovate, length three-fifths width (0.39 mm x 0.65 mm).

Abdomen subcircular, as long as wide (0.56 mm x 0.55 mm), caudal laminae carried posteroventrally.

Caudal laminae very small, length twice width (0.18 mm x 0.09 mm), subtriangular, lateral margins irregular, with a lateral projection one-quarter distance from base, one-fifth as long as lamina, a little wider than long, and tipped with a sharp spine; lamina with a further sharp spine at the distal apex, and a further spine on medial margin near the apex.

Egg strings long, complexly coiled and hidden in dorsal view by the plate of the fourth thoracic segment, in ventral view by the third pereiopods.

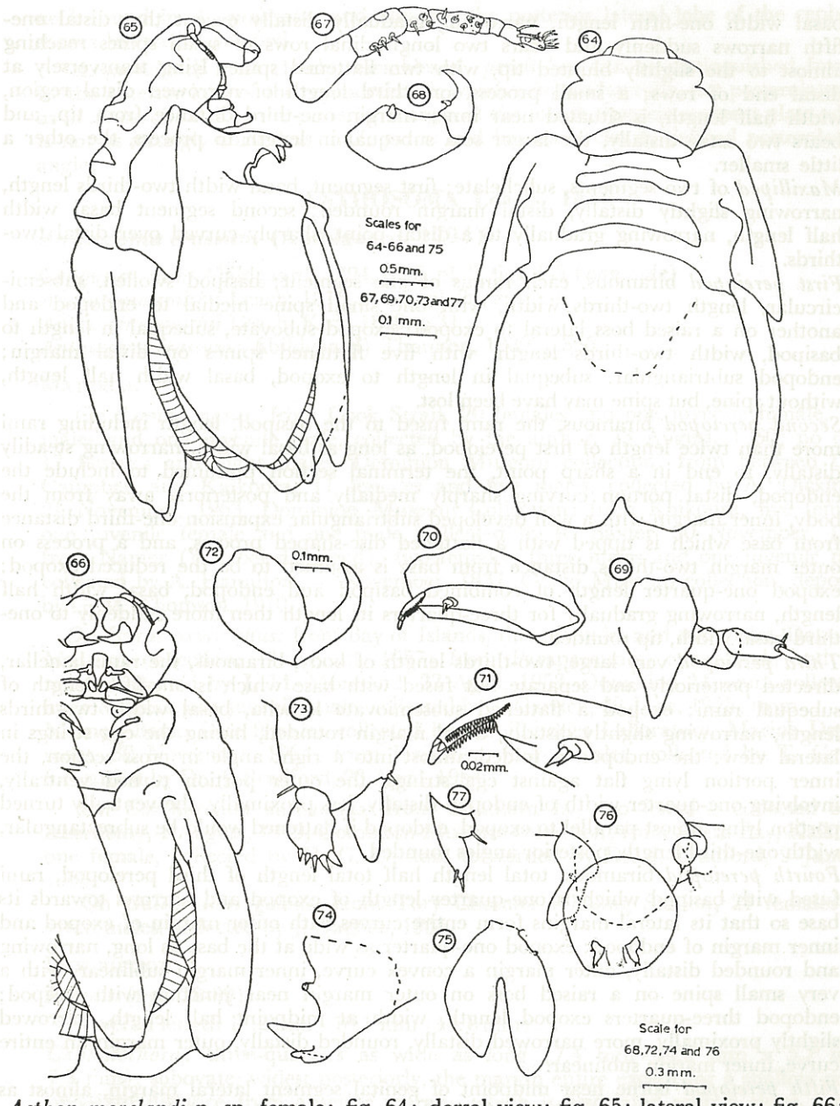
First antenna of seven subrectangular segments, ratio of lengths from the basal segment outwards being approximately 3:3:2:3:1:1:1; first segment width two-thirds length, second segment width four-sevenths length, with three setae on outer margin, third segment as wide as long, with three setae on outer margin, fourth segment width half length, with five setae on outer margin, fifth segment as wide as long, sixth segment as wide as long, with two long setae on outer distal angle and one small seta on distal margin, seventh segment rounded distally, width three-quarters length, with one small seta on outer margin and six setae distally.

Second antenna of two segments, subchelate; first segment, basal width half length, narrowing to three-quarters this width distally, curved, with a stout spine on inner margin near base; second segment, basal width half length, narrowing steadily to a sharp point distally, strongly curved, with a stout spine near inner margin one-quarter of distance from base.

Mouth tube small (0.25 mm in length), sharply pointed distally.

Mandibular palp, with two rami on a flattened subrectangular base; outer ramus width two-fifths length, rounded distally, with one long and one short seta distally; inner ramus half length of outer, width two-thirds length, rounded distally.

Maxilla of two segments, segments subequal in length; first segment basal width two-fifths length, narrowing slightly distally, distal margin rounded; second segment



Aethon morelandi n. sp. female: fig. 64: dorsal view; fig. 65; lateral view; fig. 66: ventral view; fig. 67: first antenna; fig. 68: second antenna; fig. 69: mouth tube and mandibular palp; fig. 70: maxilla; fig. 71: tip of maxilla; fig. 72: maxilliped; fig. 73: first pereiopod (dorsal view); fig. 74: second pereiopod; fig. 75: fourth pereiopod; fig. 76: genital segment, abdomen and caudal laminae; fig. 77: caudal lamina.

basal width one-fifth length, narrowing gradually distally except that distal one-fifth narrows suddenly and bears two longitudinal rows of small spines reaching almost to the slightly blunted tip, with two flattened spines lying transversely at distal end of rows; a small process, one-third length of narrowed distal region, width half length, is situated near inner margin one-third distance from tip, and bears two setae distally, the larger seta subequal in length to process, the other a little smaller.

Maxilliped of two segments, subchelate; first segment, basal width two-thirds length, narrowing slightly distally, distal margin rounded; second segment basal width half length, narrowing gradually to a distal point, sharply curved over distal two-thirds.

First pereiopod biramous, each ramus of one segment; basipod swollen, subsemicircular, length two-thirds width, with one small spine medial to endopod and another on a raised boss lateral to exopod; exopod subovate, subequal in length to basipod, width two-thirds length, with five flattened spines on distal margin; endopod subtriangular, subequal in length to exopod, basal width half length, without spine, but spine may have been lost.

Second pereiopod biramous, the rami fused to the basipod, length including rami more than twice length of first pereiopod, as long as basal width, narrowing steadily distally, to end in a sharp point, the terminal section presumed to include the endopod, distal portion curving sharply medially and posteriorly away from the body, inner margin with a well developed subtriangular expansion one-third distance from base which is tipped with a flattened disc-shaped process, and a process on outer margin two-thirds distance from base is assumed to be the reduced exopod; exopod one-quarter length of combined basipod and endopod, basal width half length, narrowing gradually for three-quarters its length then more suddenly to one-third basal width, tip rounded.

Third pereiopod very large, two-thirds length of body, biramous, the rami lamellar, directed posteriorly and separate but fused with base which is one-fifth length of subequal rami; exopod a flattened subsemiovate lamella, basal width two-thirds length, narrowing slightly distally, distal margin rounded, hiding the egg strings in lateral view; the endopod is folded almost into a right angle in cross section, the inner portion lying flat against egg strings, the outer portion turned ventrally, involving one-quarter width of endopod distally, less proximally, the ventrally turned portion lying almost parallel to exopod, endopod if flattened would be subrectangular, width one-third length, posterior angles rounded.

Fourth pereiopod biramous, total length half total length of third pereiopod, rami fused with basipod which is one-quarter length of exopod and narrows towards its base so that its lateral margins form entire curves with outer margin of exopod and inner margin of endopod; exopod one-quarter as wide at the base as long, narrowing and rounded distally, outer margin a convex curve, inner margin sublinear, with a very small spine on a raised boss on outer margin near junction with basipod; endopod three-quarters exopod length, width at midpoint half length, narrowed slightly proximally, more narrowed distally, rounded distally, outer margin an entire curve, inner margin sublinear.

Fifth pereiopod borne near midpoint of genital segment lateral margin, almost as long as genital segment, width half length, rounded distally, bent into a right angle, directed laterally, then posteriorly, with a small seta on a raised boss near distal margin.

DISCUSSION

A. morelandi can be separated from *A. garricki* since its cephalothorax possesses lateral lobes which are lacking in the latter. *A. morelandi* lacks the well developed neck round in *A. quadratus* and also has the posterior lateral lobe of the cephalothorax less well developed.

A. morelandi most closely resembles *A. percis* but can be distinguished from it by the anterior lobe of the cephalothorax which projects laterally, not posterolaterally as in *A. percis,* and by the posterior margin of the fourth thoracic segment plate which is not as strongly curved as in *A. percis* and has more clearly defined posterolateral angles.

ANTHOSOMA Leach, 1816

Anthosoma crassum (Abildgaard, 1794)

Caligus crassum Abildgaard, 1794, p.46, pl. 5, figs. 1-3 (*non vide*)
Anthosoma smithii Leach, 1816, p.406, pl. 20, figs. 1-6
Anthosoma smithii Leach, Kirk, 1888, p.31
Anthosoma crassum (Abildgaard) Thomson, 1889, p.365.

MATERIAL

On *Lamna nasus:* from Cook Strait, 20 females and one juvenile female, nine males and one juvenile male, collected by the author, 23 August, 1960; no data, 17 females and eight males, Dominion Museum collection; from between Cape Campbell and Kaikoura, 11 females and five males, collected by A. Dickinson, 21 November, 1963, Dominion Museum Collection; from Kaikoura, five females, one juvenile female and one male, collected by R. Baxter, 30 November, 1955; from Napier (?; label damaged), two females, three males and one juvenile male, collected by A. Hamilton, — November, 1837, Otago Museum collection, deposited by G. M. Thomson, 1910.

On Isurus oxyrinchus: from Bay of Islands, three females and two males, Dominion Museum collection, 14 March, 1957; from Paraparaumu, one female and four males, collected by J. M. Moreland, 23 April, 1953, Dominion Museum collection; from Makara, one juvenile male, collected by J. Garrick, 29 June, 1955; from Marnoo Bank, four females collected by the Fisheries Laboratory, Marine Department, 30 November, 1964; from Kaikoura, four females, collected by T. Garbes, forwarded by Dr. J. Bradford, 23 April, 1964.

On *Carcharodon carcharias:* from Chatham Is., two females, collected by F. Abernethy, 1 August, 1949, Dominion Museum collection; from South Bay, Kaikoura, one female, collected by H. G. Upston, forwarded by Dr. J. Bradford, 9 January, 1965.

On *Galeorhinus galeus:* from Tory Channel Whaling Station, 21 females and seven males, collected by J. Garrick, 1955.

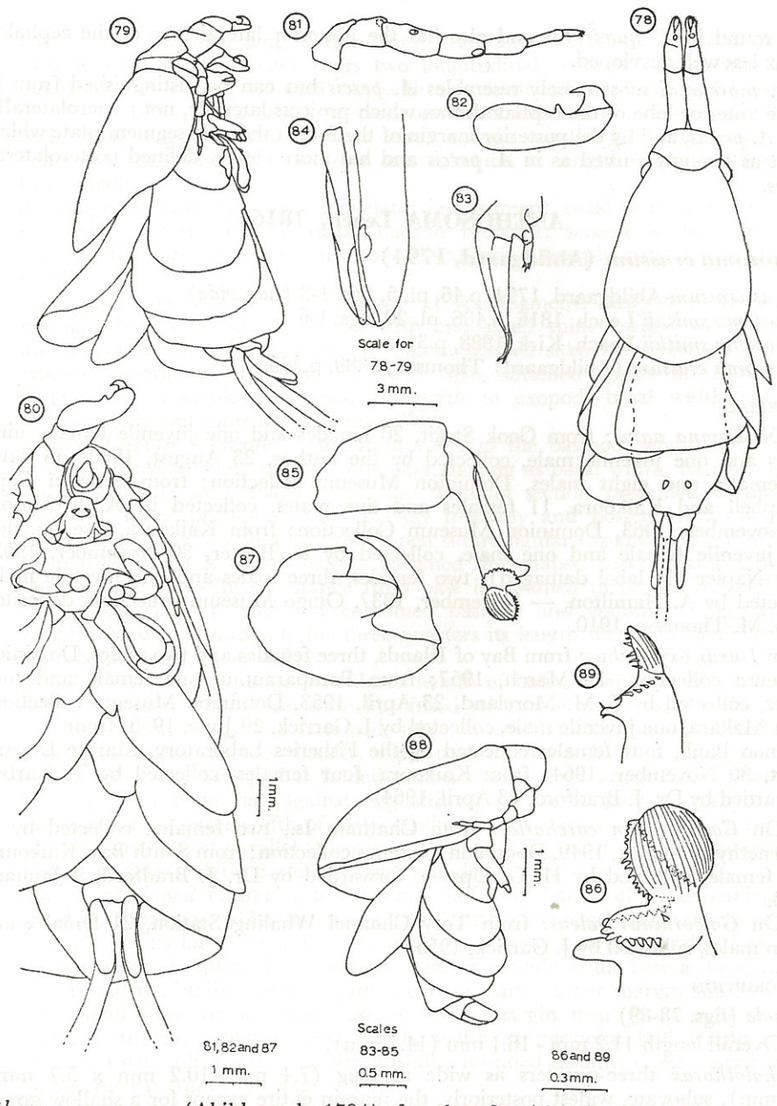
DESCRIPTION

Female (figs. 78-89)

Overall length 11.2 mm - 16.1 mm (14.1 mm).

Cephalothorax three-quarters as wide as long (7.4 mm - 10.2 mm x 5.7 mm - 7.3 mm), subovate, widest posteriorly, the margin entire except for a shallow groove one-sixth distance from anterior margin, which is associated with a ridge running across dorsum of cephalothorax, dorsum otherwise smooth. Posterior margin of cephalothorax overlying remaining thoracic segments and anterior part of genital segment.

Second thoracic segment disc-like, five times as wide as long (2.3 mm - 2.7 mm x 0.4 mm - 0.8 mm), with a pair of broad, flattened, dorsal plates, one-fifth length of



Anthosoma crassum (Abildgaard, 1794) female: fig. 78: dorsal view, specimen unusually extended so that genital segment is visible; fig. 79: lateral view, specimen with post-cephalothoracic region normally flexed; fig. 80: ventral view; fig. 81: first antenna; fig. 82: second antenna, two distal segments; fig. 83: mandibular palp; fig. 84: mouth tube, dorsolateral view; fig. 85: maxilla; fig. 86: maxilla, detail of distal part of second segment; fig. 87: maxilliped; fig. 88: juvenile female, lateral view; fig. 89: maxilla of juvenile female, detail of distal part of second segment.

body, each as wide as the carapace, overlapping in the midline and curved down around the body laterally; these plates have the same membranous structure as the basipods of the pereiopods and are similar to them in texture.

Third thoracic segment similar to second but slightly longer and narrower (1.9 mm - 2.4 mm x 0.5 mm - 1.2 mm), and lacking plates.

Fourth thoracic segment difficult to discern. Shiino (1955, p.54) states that it is fused with the genital segment. Lewis (1966, p.69) says it is indistinctly fused and similar to two preceding segments although partly or completely covered by the swollen genital segment. In the specimens I have examined it appears to be very reduced and totally concealed by the genital segment in dorsal view although there is a small subtriangular area ventral to the anterior part of the genital segment indicating the position of this segment.

Genital segment subovate, width two-thirds length (4.7 mm - 7.7 mm x 3.8 mm - 4.7 mm), with a slight narrowing at its midpoint.

Abdomen, length half width (0.6 mm - 1.0 mm x 1.3 mm - 1.6 mm) narrowing slightly posteriorly, with caudal rami on posterolateral angles.

Caudal rami subovate, width four-tenths length (1.4 mm - 1.8 mm x 0.45 mm - 0.75 mm), with scattered very small spines irregularly over surface.

Egg string 35 mm - 68 mm in length.

First antenna of six segments, third and fourth segments subequal in length, otherwise segments becoming shorter distally so that distal segment is one-quarter basal segment length, basal segment partially divided by a groove running medially and proximally along the outer margin; second and third segments each with single setae, distal segment with several very small setae.

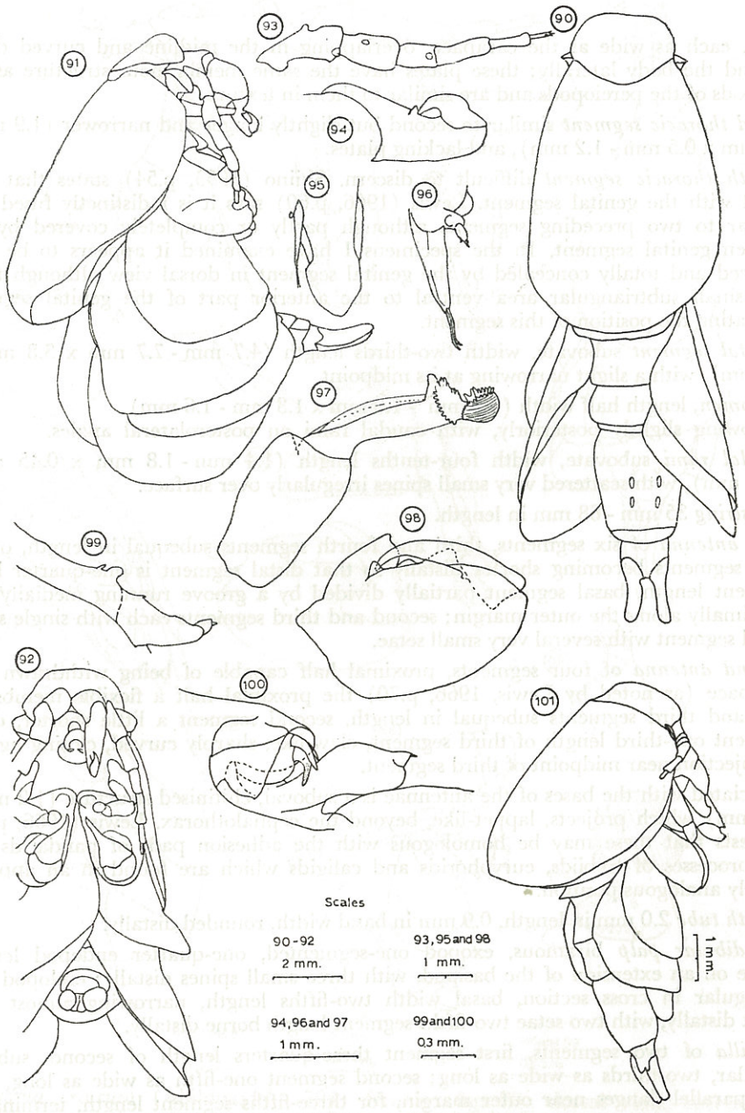
Second antenna of four segments, proximal half capable of being withdrawn into carapace (as noted by Lewis, 1966, p.70) the proximal half a flexible membrane, first and third segments subequal in length, second segment a little shorter, distal segment one-third length of third segment, claw-like, sharply curved, closing against a projection near midpoint of third segment.

Associated with the bases of the antennae is a suboval, chitinised structure (1.2 mm x 1.1 mm) which projects, lappet-like, beyond the cephalothorax. Lewis (1966, p.72) suggests that these may be homologous with the adhesion pads of pandarids and the processes of trebiids, euryphorids and caligids which are found in an approximately analogous position.

Mouth tube 2.0 mm in length, 0.9 mm in basal width, rounded distally.

Mandibular palp biramous, exopod one-segmented, one-quarter endopod length, borne on an extension of the basipod, with three small spines distally; endopod subtriangular in cross section, basal width two-fifths length, narrowing almost to a point distally, with two setae two-fifths segment length borne distally.

Maxilla of two segments, first segment three-quarters length of second, subrectangular, two-thirds as wide as long; second segment one-fifth as wide as long, with two parallel flanges near outer margin, for three-fifths segment length, terminating on an outer spur-like projection of outer margin, distal fifth of segment rounded, with longitudinal striations, and a longitudinal semicircular denticulate ridge running longitudinally around it, associated with a further semicircular denticulate ridge around outer portion of its base. these denticulate ridges are derived from rows of spines clearly seen in juvenile specimens, in which this distal portion of segment is smaller, narrower and more pointed distally.



Anthosoma crassum (Abildgaard, 1794) male. fig. 90: dorsal view, specimen mechanically extended; fig. 91: lateral view, specimen naturally flexed; fig. 92: ventral view; fig. 93: first antenna; fig. 94: second antenna, two distal segments; fig. 95: mouth tube; fig. 96: mandibular palp; fig. 97: maxilla; fig. 98: maxilliped: fig. 99: rami of first pereiopod; fig. 100: rami of second pereiopod; fig. 101: juvenile male.

Maxilliped of two segments, basal segment, two-thirds as wide as long, somewhat rounded distally, outer margin rounded, inner margin swollen medially and proximally, the second claw-like segment closing against and between these swellings; second segment two-thirds length of first, basal width half length, pointed distally, moderately curved.

First second and third pereiopods with basipod greatly enlarged and flattened, in each case overlapping in the ventral midline, and extending laterally to hide much of the genital segment in lateral view, the second pereiopod partly overlying the plates on the second thoracic segment, and these plates partly overlying the basipod of the third pereiopod which extends further around the body than do the other two; the basipods of the pereiopods and the plates of the second segment between them envelope much of the body, hiding from view the three thoracic segments and much of the genital segment; first and second pereiopods each with a mediodistal notch, in the apex of which are faint signs of degenerate rami, third pereiopod which no notch and no signs of rami.

Male (figs. 90-101)

Overall length 9.0 mm - 16.7 mm (smaller specimens may be less mature males).

Carapace similar in form to that of female, two-thirds as wide as long (5.2 mm - 9.5 mm x 4.0 mm - 7.3 mm).

Second thoracic segment disc-shaped, length one-third width (0.6 mm - 1.4 mm x 2.8 mm - 3.5 mm), lacking the dorsal plates found in the female.

Third thoracic segment similar in form to second , length half width (1.1 mm - 2.5 mm x 1.9 mm - 4.3 mm).

Genital segment subrectangular, angles rounded, slightly wider anteriorly, a little longer than wide (2.0 mm - 3.3 mm x 1.5 mm - 3.2 mm), with two plate-like ventral extensions of posterior margin covering much of ventral surface of abdomen, the extensions separated by a narrow V-shaped sinus; two small semicircular projections from the base of these extensions could perhaps be degenerate fifth pereiopods.

Abdomen subrectangular, two-thirds as long as wide (0.4 mm - 1.2 mm x 0.8 mm - 1.8 mm), the caudal rami carried on posterolateral angles.

Caudal rami of similar form to those in female, width one-third length (0.9 mm - 1.8 mm x 0.3 mm - 0.7 mm).

Appendages as in female, except that in the first and second pereiopods the notch in the basipod is shallow and the degenerate rami are slightly better developed; in the first pereiopod each ramus is of one segment, lying against margin of pereiopod, each subrectangular, endopod slightly narrowed distally, each with several small spines and one broader spine along outer and distal margins; rami of second pereiopod more complex, exopod subcircular, with two setae and one heavy spine distally, the spine with pigmentation over distal half, the whole ramus almost hidden by a thin hood extending around it from the basipod, endopod similar to rami on first pereiopod but broader.

Juvenile specimens (female, fig. 88, male, fig. 101) very similar to adults, but can be recognized by their smaller size, their relatively smaller genital segment and the nature of the maxilla (see above).

DISCUSSION

Anthosoma crassum has been recorded from many parts of the world and on a number of host species, the most frequent being members of the family Lamnidae.

Previous records include:

NORTH-EAST ATLANTIC: on *Lamna nasus*—Aberdeen (Scott and Scott. 1913, p.109); Exmouth, Dartshire (Baird, 1850, p.299 and Leach, 1816, p.406 refer to same specimens); Devonshire (Leach, 1819, p.533); Φresund (Steenstrup and Lütken, 1861, p.397; Olssen, 1868, p.23); Hornbaek, Kattegat (Krφyer, 1838, p.295); Belgium (van Beneden, 1870, p.8).

on *Cetorhinus maximus*—Newlyn, England (Birkett and Burd, 1952, p.392).

on a shark, in the collection of the British Museum (Milne Edwards, 1840, p.483; Bassett Smith, 1899, p.468).

on *Mustelus mustelus*—Belgium (van Beneden, 1870, p.5).

MEDITERRANEAN: on *Isurus oxyrinchus*—Palavas, France (Delamare Deboutville and Nunes-Ruivo, 1953, p.205); Genoa (Brian, 1902, p.7); Portoferraio (Brian, 1902, p.7); Adriatic (Valle, 1880, p.62).

NORTH-WEST ATLANTIC: on *I. oxyrinchus*, L. nasus, Carcharinus obscurus,* and *Odontaspis taurus*—Martha's Vineyard and Woods Hole, Mass. (Wilson, 1922, p.23, 1932, p.446).

on *Carcharodon carcharias*—Woods Hole, Mass. (Wilson, 1924, p.12); Padre Is., Texas (Pearse, 1952, p.28).

SOUTH-EAST ATLANTIC: on *I. oxyrinchus*—Angola (Nunes-Ruivo, 1956**); South Africa (Hee gaard. 1962, p.181).

on *Carcharias* sp. and *L. nasus*—Table Bay and False Bay, South Africa (Barnard, 1955, p.272).

INDIAN OCEAN: on *Carcharias* sp. and *L. nasus*—Durban (Barnard, 1955, p.272).

on unnamed host—Port Natal, Durban (Wilson, 1923, p.13).

SOUTH-WEST ATLANTIC: on *L. nasus*—Mar del Plata (Brian, 1944, p.208).

on *Cetorhinus maximus*—Mar del Plata (Fontes, 1949, p.185).

NORTH-EAST PACIFIC: on an unnamed host—Vancouver Is., and Californian Coast (Wilson, 1932, p.446).

probably on *I. oxyrinchus*—45°11′ N, 174°54′ W (Lewis, 1966, p.67).

on *Carcharodon carcharias*—Pokai Bay, Hawaii (Lewis, 1966, p.67).

NORTH-WEST PACIFIC: on *L. nasus*—Toyama Bay, Japan (Yamaguti, 1936, p.12); Kesennuma, Japan (Shiino, 1955, p.50).

on *L. ditropis*—Kesennuma, Japan (Shiino, 1957, p.370).

on *Prionace glauca*—Tyôsi, Japan,

on *I. oxyrinchus*—Owase, Japan.

on *Heptranchias perlo*—Kannoura, Japan (Shiino, 1955, p.50).

on an unnamed host—Japan (Wilson, 1932, p.446).

SOUTH-EAST PACIFIC: on an unnamed host—Concepcion, Chile (Brian, 1944, p.208).

SOUTH-WEST PACIFIC: on *Isurus oxyrinchus*—Long Reef, nr. Port Jackson, New South Wales and French Pass, Cook Strait, New Zealand (Heegaard, 1962, p.181).

on *L. nasus*—Napier, New Zealand (Thomson, 1889, p.366); Otago, New Zealand (Kirk, 1888, p.31).

on *Carcharias sp.*—probably New South Wales and on an unnamed host—Port Jackson, New South Wales (Heegaard, 1962, p.181).

* *I. tigris and I. punctatus* = *I. oxyrinchus* (?).

** From translation as supplied by the Fisheries Research Board of Canada, original page numbers not retained.

As well as its almost complete latitudinal distribution, *Anthosoma crassum* has been taken from Aberdeen, Scotland (59°9′ N) to Otago, New Zealand (45°45′ S).

Despite the numerous records of this species there have been few detailed descriptions or figures given. Those available (the fullest being those by Wilson 1922, p.23, pl. 1, figs. 1-9, Shiino, 1955, p.50, figs. 1-2, and Lewis 1966, p.67, figs. 4-6) suggest there is little variation except in size. Minor morphological variations shown or described could well be due to variations in optical equipment available to the various authors, with the possible exception of the female specimen figured by Brian (1944, fig. 44), which appears to have notches in the third pereiopod and plate of the second thoracic segment, as well as in the first and second pereiopods.

Size as measured by total length varies considerably, e.g. Yamaguti (1936) gives 8.8 mm - 11.0 mm for the female compared with Brian (1944) who gives 15.3 mm - 18.0 mm for this measurement, while Wilson (1922) gives the male as 8 mm - 10 mm compared with Brian (1944) who gives 12 mm - 13 mm. However when the range in the specimens available to me is considered (9.9 mm - 18.0 mm for the female, 9.0 mm - 16.7 mm for the male) the above apparent differences can be understood as individual variation. There is some suggestion of a host specific influence on size in my material but the numbers are not sufficient for statistical analysis and it would not be surprising if geographical factors, the site of attachment and the intensity of infection were also involved.

There appears to be considerable variation in the intensity of infection. Wilson (1922, p.25) states that this species "never occurs in any number on a host, but is more often solitary, although occasionally the two sexes are associated upon the same fish". Birkett and Bund (1952, p.392) on the other hand state that their specimens were numerous and did considerable damage to the host. In the present collection the author obtained one lot of 31 specimens from a single host which had been severely damaged, particularly on the dorsal surface of the tongue, which appeared to be partly hollowed out, while other collectors reported both single and multiple infections (see MATERIAL above).

TYPE MATERIAL

Type specimens are deposited with the Dominion Museum, Wellington, except the possible type and paratypes of *Aethon percis* (Thomson), which are returned to the Otago Museum.

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