

PARASITIC COPEPODA

BY

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Pseudocycnus appendiculatus HELLER 1865.

Plate I, figs. 1-4; Plate II, fig. 1.

1865. HELLER, *Reise der Novara, Crustacea*, p. 248, pl. XXII, fig. 7.
1912. BRIAN, *Résultats des Campagnes scientifiques du Prince de Monaco*, fasc. 38, p. 15, pl. V, fig. 3; pl. VI, fig. II.
1922. WILSON, *The North American Parasitic Copepods belonging to the family DICHELESTHIDAE*. *Proc. U. S. Mus.*, vol. LX, art. 5, p. 75, pl. XII, fig. 87-96.

HABITAT AND RECORD. — One specimen female on the gills of a tunny *Euthynnus yaito* Kishin. Taken on the North of Misoöl, 28-II-1929.

DIMENSIONS. — The total length of the animal is 13.2 mm. of which the head occupies 1.3 mm., the neck 1.7 mm., the trunk 3.1 mm., the genital segment 0.3 mm. and the eggstrings 6.6 mm. The genital processes measure 2.4 mm.

HEAD. — Ovate, covered by a dorsal carapace, slightly broader than the trunk. The posterior margins of the carapace are prolonged into wide rounded lobes above the basal joints of the maxillipedes.

NECK. — The neck consists of 4 segments of which the first is seen in dorsal aspect only as a narrow neck between the posterior lobes of the carapace, and is less than one fourth the width of the head. The second, third and fourth segments are inflated or globose, the parts between them appearing constricted; they increase gradually in size so that the fourth is slightly the largest. Along the antero-dorsal border of each of these three segments on either side is a lateral dorsal lamina in the form of a thickened margin which projects considerably dorsally.

TRUNK. — The trunk is a little narrower than the fourth segment, with straight sides, more than five times as long as wide. No traces of segmentation can be seen.

THE GENITAL SEGMENT is small, square in outline, and from its posterior corners depend the genital processes which are lanceolate, flattened dorso-ventrally, and tapering to a point. The eggstrings arise on its posterior margin close to the middle line and over the base of the abdomen, and are not so long as described by other authors. They possess in this specimen two peculiarities; at the point near the lettering *Os.* in *fig. 1.* the cement substance of which the strings are composed coheres, and every fifth egg or so, but with no regularity, is larger than its fellows so as to give the strings a nodulated appearance.

There is a small rounded **ABDOMEN**, one articulated and reduced to a mere knob carrying the anus, on the dorsal side (*fig. 3.*).

THE APPENDAGES, all paired, are ten in number.

THE FIRST ANTENNAE are four-articled, the basal article forming a stout pedestal. The other articles bear spines or setae and the terminal article bears a tuft of setae at its apex.

THE SECOND ANTENNAE are very large, prehensile, and project anteriorly beyond the head. They are three-articled, with a stout basal article and a strongly curved terminal claw bearing two dentate projections.

THE MANDIBLES are styliform and apparently toothless.

THE FIRST MAXILLAE (*Pl. B, fig. 1, Mx. 1*) are filiform and three-articled, the articles bent upon themselves, without setae. They lie on either side of the mouth tube. The terminal article is bifurcated.

THE SECOND MAXILLAE are three-articled, the basal article is enlarged, the middle article slender with its outer margin crenate and provided with a row of short spines; the terminal article resembles a short curved claw.

THE MAXILLIPEDES are powerful prehensile organs. They are two-articled, the terminal article which is dentate on its inner margin being capable of flexion against the basal article. The basal article has a toothed projection on its inner margin near the middle.

The first pair of PEREIOPODS is reduced to a pair of small flattened plates, without setae, projecting from the sides of the first segment immediately inside of the basal joints of the maxillipedes. The second and third pairs are on the ventral aspect of their respective segments. The second pair is biramous; the rami are one-articled and bear spines at the apex. They differ from those described by Wilson in the details of these spines. The third pair is uniramous,

the apex bearing three spines. The fourth pair is minute and each projects from the lateral margin immediately behind the large dorsal lamina (D. L.) of the fourth segment. Each is a three-articled filiform process (P. 4.) set on an enlarged base, and has two minute spines at its apex. This appendage has not been previously figured.

The entire head was buried in a spherical cyst from which it had to be dissected out. The mouth cone is short and flask-shaped. In front of the mouth cone near the anterior margin of the carapace is a chitinous crossbar beset with two rows of teeth (fig. 4).

Caligus regalis n. sp. ♀

Plate III, fig. 1; Plate II, fig. 2.

HABITAT AND RECORD. — Four adult females and one young on the body of a tunny, *Euthynnus yaito* Kishin. Taken on the North of Misoöl, 28-II-29.

BODY. — Carapace elongated, elliptical. Lunules large. Free (4 th) thoracic segment small, much wider than long and bearing a fourth pair of pereopods.

GENITAL SEGMENT. — Oblong, much longer than wide, the posterior lobes arcuate, sharply incurved nearly to touch the abdomen.

ABDOMEN. — Of two segments, of which the anterior is the longer and oblong, the posterior bears brief appendages each with four plumose setae.

THE APPENDAGES all paired are :

The first antennae are unusually long, three-articled, much beset with plumose setae. The basal articles are fused in the middle line to form the frontal plates, in the centre of which appear the median incision and the frontal sucker so important in the chalimus stage. The other two articles are of about equal length.

The second antennae are two-articled, the basal being massive and provided with a heart-shaped thickening in the chitin against which the strongly recurved unciform terminal article bites. This base bears towards the middle line a small projection capped with two unequal spines.

The mandibles lie wholly within the mouth tube (Pl. B, fig. 2) and bear terminally twelve recurved teeth on the inner margin only.

The first maxillae consist of a long tapering article, the aperture of the renal organ appearing on a circular plate bordered by three setae.

The second maxillae are slender and two-articled, the terminal article only half the length of the basal and ending in two enormous setae, the more medial the longer.

THE MAXILLIPEDES consist of an enlarged basal article, furnished medially with a blunt process, against which the uncinat terminal article can bite.

THE FURCA is long and shaped like a horse-shoe.

THE PEREIOPODS are :

The *first pair* differ considerably from those of other species, are uniramous and three-articled, the middle article being the longest. The basal article is much enlarged where it joins the middle. The terminal article is slightly the smallest and is provided posteriorly with three bifurcated spines.

The *second pair* is biramous, with protopodite two-articled, the basal the longer; both rami are three-articled.

The *third pair* is biramous, the basal articles fused together in the middle line to form the apron. The endopodite is one-articled and tipped with three setae. The exopodite is two-articled, the basal the larger and provided with a large two-articled hook basally and one large seta distally; the terminal article is tipped with three setae.

The *fourth pair* is uniramous and three-articled, the basal article being much the longest; the terminal article is very small, ends in a postero-lateral one small and three large apical spines.

The *fifth pair* is vestigial and is represented by a pair of unjointed papillae bearing three setae on the postero-ventral processes of the genital segment.

A *sixth pair* has not been observed.

In the young female the abdomen consists of only one segment.

THE EGGSTRINGS are nearly as long as the whole body less the abdomen.

Caligus regalis n. sp. ♂

Plate IV, fig. 1; Plate III, fig. 2.

HABITAT AND RECORD. — Five males on the body of a tunny, *Euthynnus yaito* Kishin. Taken on the North of Misoöl, 28-II-1929.

The male differs from the female in:

1. The shape of the genital segment.
2. The abdomen.
3. The second antenna, all the other anterior appendages being precisely similar.
4. The fourth pereopods.
5. The presence of a sixth pair of pereopods.

The males are much smaller than the females.

THE GENITAL SEGMENT is much wider than long.

The ABDOMEN consists of two segments but the anterior is very small, the posterior being about twice the size and square in outline.

The *second antenna* resembles that of the female except that the distal curved article bears a second lateral hook which may be regarded as specific (Planche C, fig, 2, S. P.).

The prongs of the *furca* are farther apart than in the female.

The three articles of the *fourth pereopods* are of different comparative length, being nearly equal, the terminal article is a trifle the longest instead of being the smallest.

The *sixth pereopods* resemble the fifth but bear only two setae.

Perissopus crenatus n. sp.

Plate V, figs. 1-4; Plate IV, fig. 2.

HABITAT AND RECORD. — 4 ♀♀ taken on *Carcharinus borneensis* (Bleeker) at Samarang, Java, in January 1929. The disposition of the dorsal thorax plates exactly resembles that of *P. dentatus*, Steenstrup and Lütken 1861, but the figure of these authors does not show the plates crenate at the edges as in *P. communis* Rathbun 1887. Taking into consideration that the original description of *P. dentatus* did not show the appendages in much detail and that the present specimens are from a different host and from a different part of the world, it seems convenient at present to regard the latter as a distinct species.

BODY. — *Cephalothorax* semi-elliptical, wider than long, narrowed but little anteriorly, posterior lobes short and angular. Frontal plates linear but well pronounced; frontal margin with a broad shallow median incision. No eyes visible. Three free thorax segments each with a pair of dorsal laminae crenated on the posterior margins; the first pair lateral and oblique, the second median and nearly horizontal, the third the largest, horizontal, extending entirely across the body.

GENITAL SEGMENT larger than the cephalothorax, truncated posteriorly with short acute spines at the corners and a deep median incision; the fifth pereopods some distance from the margin on the ventral surface.

ABDOMEN small and entirely hidden in dorsal aspect, wider than long; one-articled and entirely concealed beneath the genital segment. Abdominal appendages small, cylindrical, bearing laterally a large spine and apically two minute spines.

APPENDAGES. — *First antennae*, small, two-articled, the basal article the larger and bearing a small seta sub-apically, the terminal article tipped with a large seta apically and a smaller one sub-apically. The basal article is wider

than the terminal and more than twice as long, and its extremity reaches well beyond the margin of the frontal plate.

Second antennae small, two-articled. the basal article minute, the strong terminal claw curved and as long as the rest of the appendage, very roughly corrugated on the inner margin.

ADHESION PADS. — First pair at the base of, and nearly as large as the basal article of the first antenna, elliptical; second pair smaller, elliptical, at the base of the second antennae. Both pairs are on the ventral surface of the cephalothorax.

MOUTH CONE shorter than in *Caligus* and containing *mandibles* toothed on one margin and protected by coveringsheaths.

First Maxillae lamellar, triangular, pointing posteriorly, apex incurved. A small endopodite, twisted over, points outwards.

Second Maxillae slender, two-articled, the terminal article narrower and as long as the basal, with a toothed apex and two long setae some distance behind the apex.

Maxillipedes stout, two-articled, the basal article swollen and fleshy, enlarged into an adhesion pad of the same structure as those of the antennae. The terminal article ends in a strong recurved claw. Opposite the maxillipedes the lateral margin of the carapace on either side is raised into a larger spherical knob on the ventral surface as in *P. communis*.

The *pereiopods* are all biramous.

The *first pereiopod* consists of an irregular base bearing a two-articled exopodite, the basal article bearing a curved spine as long as the distal article, and the distal article terminating in four long spines, and a two-articled endopodite ending in a spherical pad of minute spines. On the base is a lateral spine.

The *second pereiopod* consists of a cylindrical base with an exopodite and endopodite like that of the first. The exopodite terminates in three spines one of which is apart from the other two. The basal joint of the endopodite is enlarged. Outside the exopodite is a rudimentary third ramus bearing apically a flexible spine.

The *third pereiopod* has an enormous reniform lamellar base with an exopodite similar to the second, a similar endopodite but with pads of spines on both articles, and an even more vestigial third ramus.

The *fourth pereiopod* has an enormous sub-orbicular lamellar base, the exopodite is one-articled and tipped with two spines and two setae, the endopodite is one-articled and bears a pad of spines. The vestigial ramus is without spines or setae.

The *fifth pereiopod* is very small, attached to the genital segment on its ventral surface half-way between the lateral margin and midline, and terminates in a long curved spine.

The genital segment bears posteriorly a pair of oblong genital processes deeply crenated on the posterior margin, some of the crenellations being bifurcated. These processes are not figured nor described in any other species.

Eggstrings slender and nearly twice as long as the body are only present on the smallest specimen. The large females, such as the one in fig. 1. bear « ghosts ». There are four pairs of *adhesion pads* (H. 1-4, fig. 2). The first pair is large and situated at the bases of the first antennae. The second pair smaller, at the bases of the second antennae. The third pair, smaller still, is at the bases of the maxillipedes. A strong horse-shoe shaped pair, more visible, observed in dorsal aspect, arise as prominences on the bases of the first pair of dorsal laminae.

The ABDOMEN is small and stout, slightly wider than long, appearing with its appendages like an inverted heart. Each abdominal appendage is short and stout and bears two minute spines apically and one longer spine laterally. There is a pair of minute *anal laminae* each bearing sub-apically a papilla and small spine.

Each VULVA is a narrow slit obliquely set, bordered medially by characteristic cells, three of them each with a scarlet nucleus. The apertures from which the eggstrings issue are strongly marked with chitinous supports.

Thysanote sp.

Plate II, fig. 4; Plate IV, fig. 3.

HABITAT AND RECORD. — One female (a fragment) taken from the pectoral region of *Mugil crenilabis* Forskal at Poelo Babi (Aroe isles), on 21-III-1929.

The specimen is incomplete and consists of head and second maxillae; the trunk, etc. are wanting.

The *second maxillae* are united most of their length and cohere again at the apex. From them depends a large process with a single bifurcation (planche B, fig. 4.) suggestive of the genus *Thysanote*. There is a strong chitinous *bullae* represented only by its manubrium. The absence of first antennae is peculiar since they are seldom lost.

The *second antennae* are bluntly rounded as in *Clavella*, without exopodite.

The *mandibles* are only indistinctly uneven on their cutting edges where teeth are usually borne.

EXPLANATION OF THE PLATES

PLATE I.

Pseudocycnus appendiculatus ♀ :

- Fig. 1. — The entire animal in ventral aspect.
Fig. 2. — Enlarged view of the head and neck in ventral aspect.
Fig. 3. — Abdomen.
Fig. 4. — Crossbar.

PLATE II.

- Fig. 1. — *Pseudocycnus appendiculatus* ♀ the mouth region.
Fig. 2. — *Caligus regalis* ♀ the mouth cone.
Fig. 3. — *Perissopus crenatus* ♀ the mouth cone.
Fig. 4. — *Thysanote sp.* ♀ fragment.

PLATE III.

- Fig. 1. — *Caligus regalis* ♀ the entire animal in ventral aspect, with the appendages separately.
Fig. 2. — *Caligus regalis* ♂ the second antenna for comparison with that of female above.

PLATE IV.

- Fig. 1. — *Caligus regalis* ♂ the entire animal in ventral aspect.
Fig. 2. — *Perissopus crenatus* ♀ the posterior pereopods.
Fig. 3. — *Thysanote sp.* ♀ the anterior region.

PLATE V.

Perissopus crenatus ♀ :

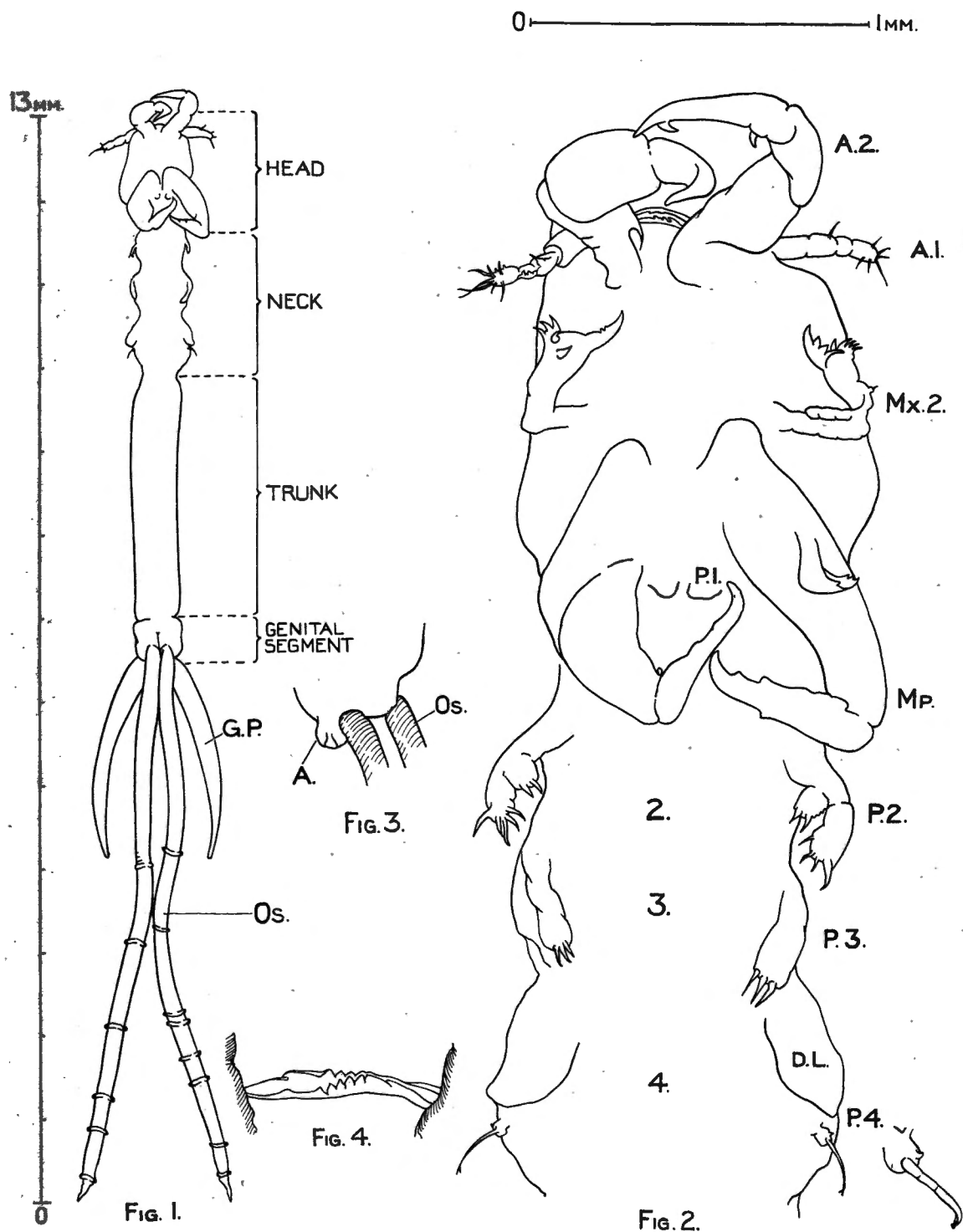
- Fig. 1. — The entire animal in dorsal aspect.
Fig. 2. — The appendages of the mouth region in ventral aspect.
Fig. 3. — The two anterior pereopods.
Fig. 4. — The abdominal region.

The figures are all drawn from the specimens mounted temporarily in Farrant's medium.

EXPLANATION OF THE LETTERING OF THE FIGURES

A. = Abdomen.	H. = Adhesion pads.
A. A. = Abdominal appendages.	L. = Lunules.
A. 1 = First antennae.	M. = Mouth.
A. 2 = Second antennae.	M. C. = Mouth cone.
B. = Bulla.	Mn. = Mandibles.
C. = Cephalothorax.	Mp. = Maxillipedes.
D. L. = Dorsal lamina.	Mx. 1 = First maxillae.
En. = Endopodite.	Mx. 2 = Second maxillae.
Ex. = Exopodite.	Od. = Aperture of oviduct.
F. = Furca.	Os. = Ovisacs (eggstrings).
G. = Genital segment.	P. = Pereiopods.
G. P. = Genital processes.	S. P. = Specific spine or process.

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Pseudocycnus appendiculatus HELLER.

W.-H. LEIGH-SHARPE. — Parasitic Copepoda.

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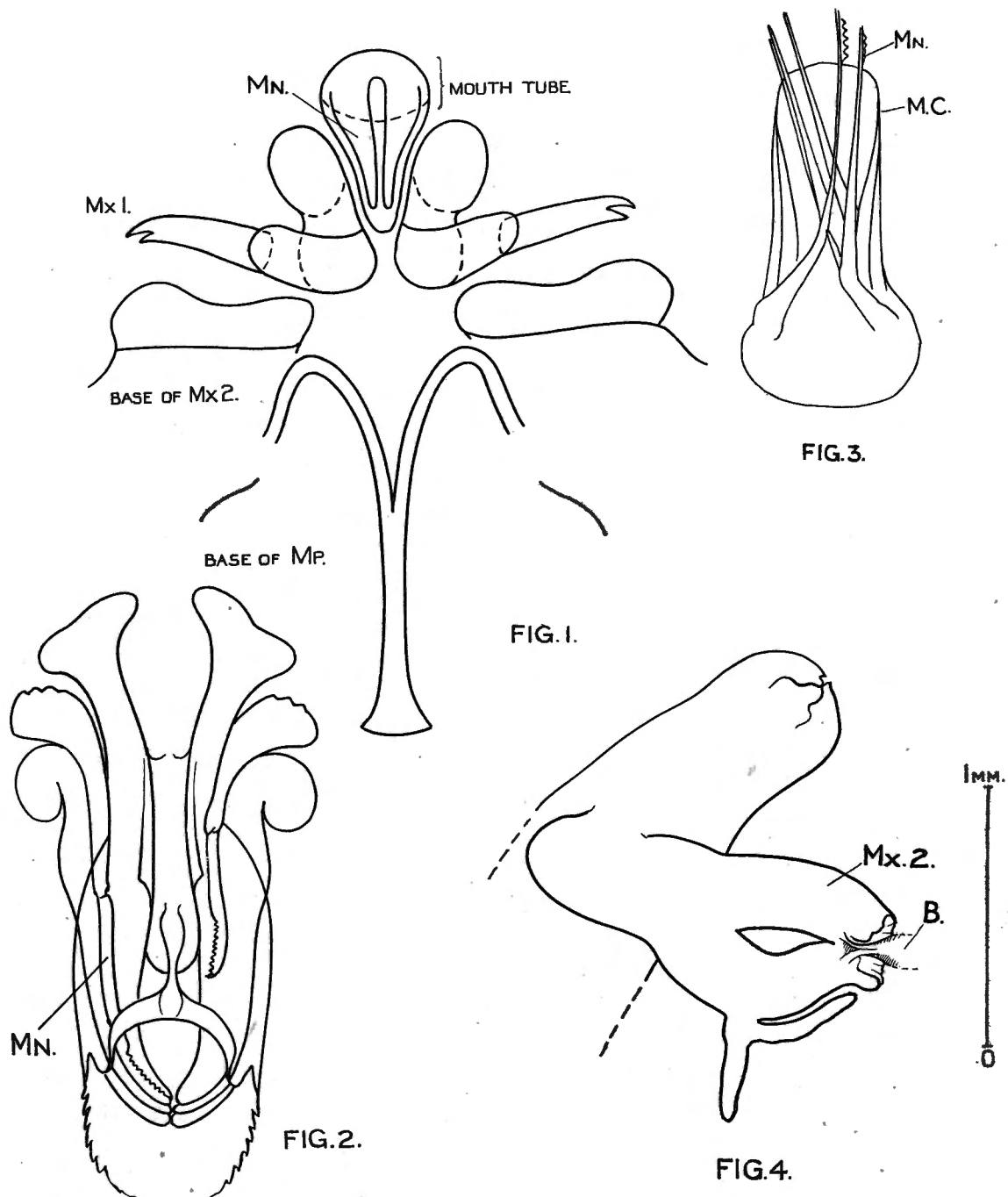
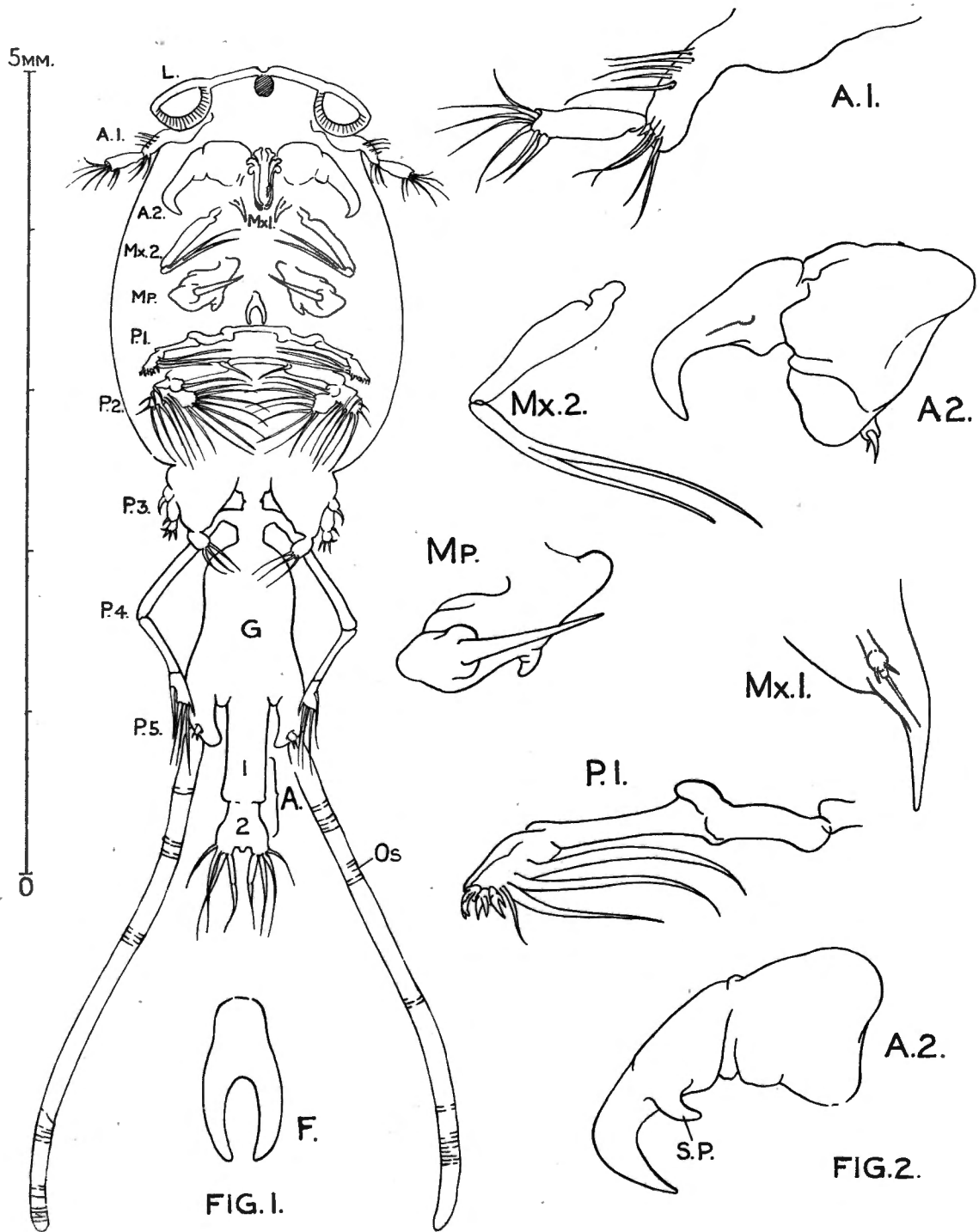


Fig. 1. *Pseudocycnus appendiculatus* HELLER. — Fig. 2. *Caligus regalis* n. sp.

Fig. 3. *Perissopus crenatus* n. sp. — Fig. 4. *Thysanote* sp.

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Caligus regalis n. sp.

W.-H. LEIGH-SHARPE. — Parasitic Copepoda.

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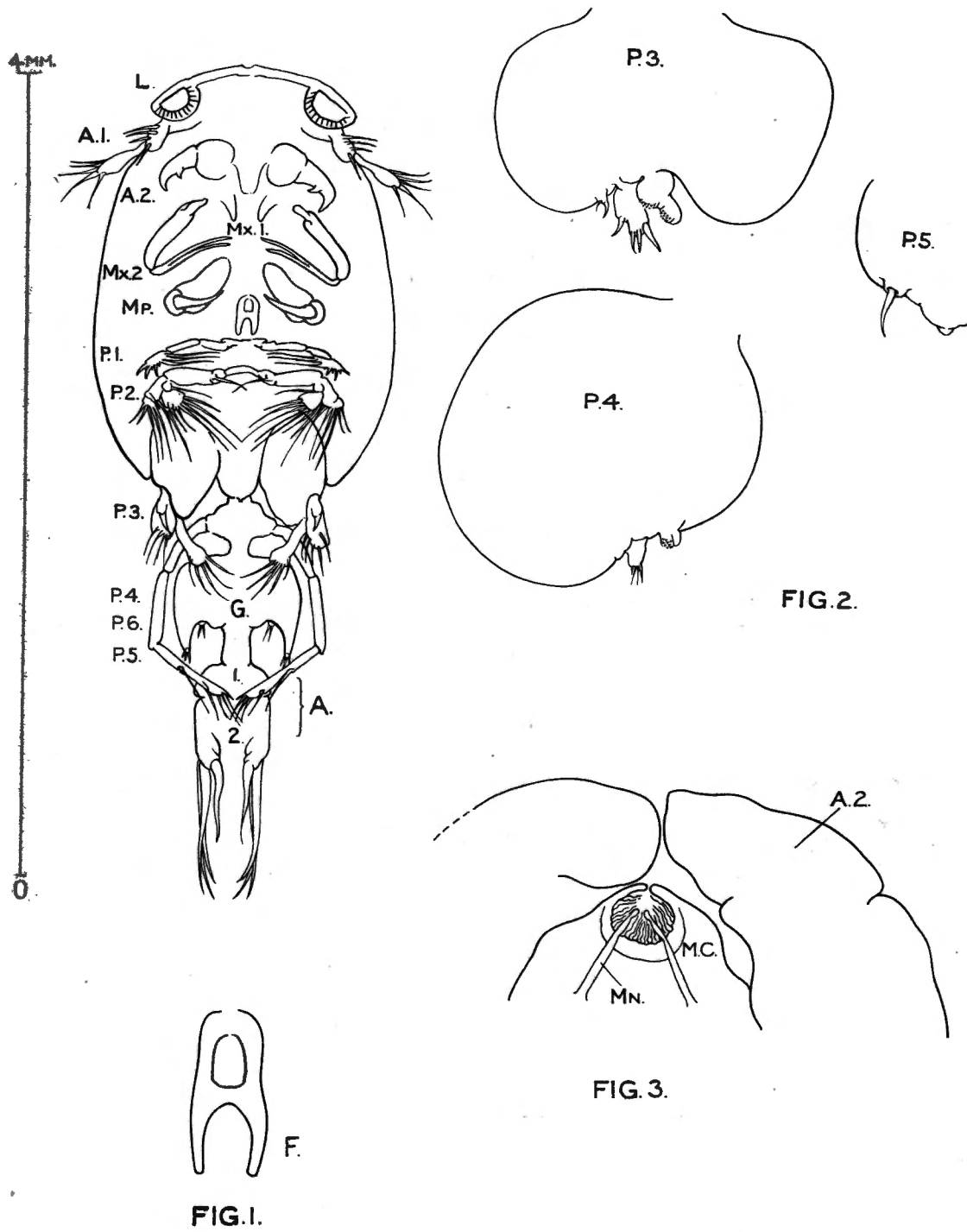
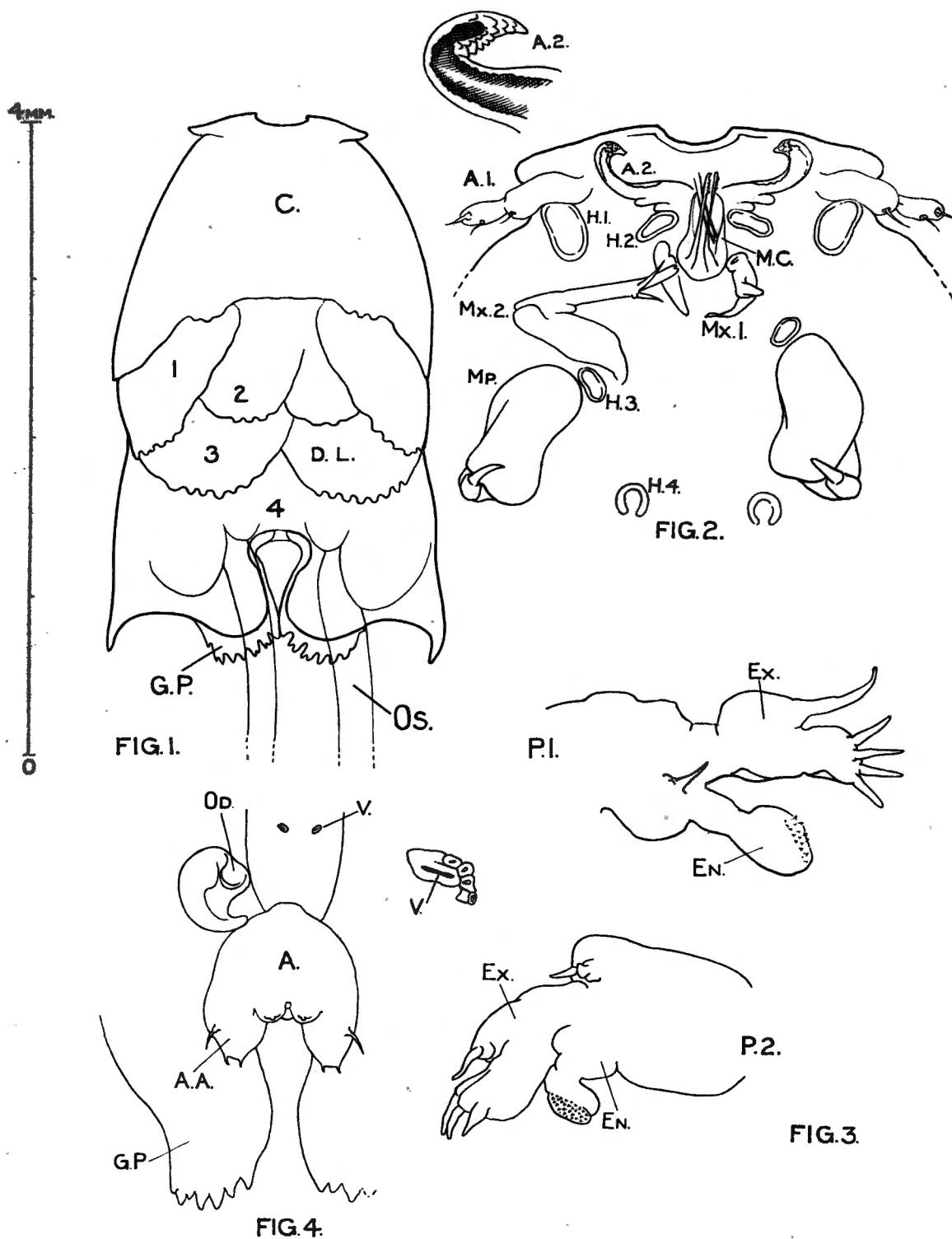


Fig. 1. *Caligus regalis* n. sp. — Fig. 2. *Perissopus crenatus* n. sp.
Fig. 3. *Thysanote* sp.

W.-H. LEIGH-SHARPE. — Parasitic Copepoda.

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Perissopus crenatus n. sp.

W.-H. LEIGH-SHARPE. — Parasitic Copepoda.

