

**A REVIEW OF THE GENERA AND SPECIES OF THE
BOMOLOCHIDAE (CRUSTACEA, COPEPODA), INCLUDING
THE DESCRIPTION OF SOME OLD AND NEW SPECIES**

by

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During a recent survey of Pacific psammophilous and phycophilous copepods an isolated female *Bomolochus* was found, the identification of which, in absence of its host, proved to be particularly troublesome. It became necessary to check the descriptions of all species of the genus *Bomolochus* Von Nordmann, 1832, and of several other genera of Bomolochidae, in the course of which I tried to find a satisfactory grouping of the many species described. This effort in so far proved to be disappointing that a fairly large number of species is so inadequately characterized that recognition, in absence of the host, is next to impossible. Taxonomy of parasitic copepods has, unfortunately, long been influenced by the obstinate notion that each host species should necessarily harbour its own parasitic species. This idea has overstressed the importance of the host, at the cost of information, particularly morphological information, concerning the parasitic animal, so that at present there is an overwhelming number of parasitic copepods of uncertain position, uncertain status or inadequate definition, impeding a much wanted natural grouping of the numerous species of parasitic Copepoda. The importance of complete structural information, especially for those species that are able to leave their host temporarily, cannot be too greatly stressed and it is gratifying to find such information in many of the modern publications (Stock, 1953, 1955; Shen, 1957; Shiino, 1957; Yamaguti, 1936, 1939, 1953, et al.). In the present paper I have presented, in condensed form, all available information on the Bomolochidae; I have suggested a subdivision of the genus *Bomolochus*, redescribed the female of *Bomolochus bellones* Burmeister and added the description of two new species. It is hoped that this paper will stimulate the redescription of doubtful or insufficiently described forms, preferably from type hosts.

I want to express my gratitude to Dr. M. Boeseman, Curator of Fishes, Rijksmuseum van Natuurlijke Historie, Leiden, and to Mr. H. E. Muller, Assistant, Institute of Systematic Zoology, University of Leiden, who provided me with specimens of Bomolochidae.

BOMOLOCHIDAE Claus, 1875

DIAGNOSIS. Female. Body differently developed in the various genera, generally cyclopid, flattened. Head and first thoracic somite completely fused to form the cephalic somite, the ventral aspect of which is concave, forming with the basal segments of the antennules a hollow disk, at the bottom of which the antennae and mouthparts are to be found. Ventro-caudally this disk is bordered by the, generally much enlarged and flattened, first legs. Rest of body variously developed; in the Tuccinae the second thoracic somite is much narrowed and forms a neck connecting the cephalic somite with the much enlarged rest of the body; in the Bomolochinae the second thoracic somite is usually normally developed, all thoracic somites gradually narrow and their articulation usually is distinct. Abdomen short, 1-segmented and almost vestigial in the Tuccinae, where it is hidden under the large cephalothorax, or normally developed and composed of 4 somites in the Bomolochinae.

Rostrum differently developed in the various genera, being either completely absent, or shaped as a curved rostral plate, the base of which is visible between the antennules; this rostral plate has a rounded or bifurcated apex.

Abdomen composed of the small fifth thoracic somite, sometimes hidden under the larger preceding somites, the genital somite (composed of 2 fused somites) and 1 to 3 abdominal somites. Furca cylindrical, of variable length, with 5 marginal and 1 appendicular seta on each ramus; this number may be reduced in some species.

There are two egg-strings of oval or elongated shape, attached laterally or latero-dorsally to the genital somite.

Antennules composed of 3 or 4 basal segments, of which the articulations may be very indistinct, and a 3- or 4-segmented flagellum. The basal antennular part carries 3 to 5 normal setae along the frontal margin and 2 or 3 smaller setae along the ventral margin. In addition there are 14 or 15 strong, densely plumose sensory appendages along the frontal margin of the 3 basal segments of each side. Ventral aspect of the basal portion usually, and dorsal part occasionally, reinforced with chitinized plates; 1 to 3 of the sensory appendages may become fused to these plates or to prolongations of these plates and give rise to variously shaped chitinized structures in front of the antennules. Flagellum with a variable number of normal setae.

Antennae curiously modelled prehensile organs, placed one on each side of the labrum and composed of 4 segments. Coxa large, cylindrical, pointing laterally; basis small, forming an elbow joint, usually with seta. First endopodal segment big, curved over the coxa in the direction of the median plane, its whole or caudal surface roughened by small teeth or scales, usually

arranged in longitudinal rows. Second endopodal segment small, usually fused to the first endopodal segment and forming a roughened, thumb-like projection. In addition the first endopodal segment may bear a lamelliform process, several hooked spines and a seta.

Mouthparts, with the exception of the maxillipedes, placed close together near the antennae. Labrum a prominent, hairy structure, covering part of the mandibles. Labium much less strongly developed, consisting of two plates, projecting medially from each side, often leaving the median part of the oral field free for observation. Mandible composed of a cylindrical basal segment, probably representing the praecoxa, inserting at the base of the antennae and projecting medially; it carries a conical manducatory process armed with 1 to 3 strong teeth and hidden under the free distal margin of the labrum. A small palp may be present. Maxillule a conical process near the insertion of the mandible, bearing 2 to 4 setae of varying development. Maxillules usually closely associated with a pair of rod-shaped structures named paragnaths, which are attached to the ventral surface close to the maxillules and pointing medially. Maxilla composed of a big coxa, attached to the oral surface laterally of the previously named oral parts and bearing an indistinctly articulating, rod-shaped basis with 1 or 2 big spines, pointing medially, and some smaller spinules or short setae. Maxillipede in this sex curiously developed, composed of a big, rod-shaped coxa, directed laterally, and a big triangular basis, of which the apex points rostrally. Endopodite composed of a strong claw, curved over the basis, pointing medio-caudally. Some short, spiniform setae may occur on the coxa; on the basis, and near the insertion of the claw, up to 3 haired setae may occur.

Leg 1 strongly flattened; exopodite 3-segmented, endopodite 1- to 3-segmented. Legs 2 to 4 biramous; the rami with 1-3 segments; in some species the rami are apparently 4-segmented by the development of an additional imperfect articulation of the terminal segment. Leg 5 uniramous, composed of an intermediate segment with a short seta, and a flattened terminal segment with 3 apical and 1 marginal seta. In some genera the 5th legs are obsolete. There are usually distinct genital plates (6th legs), each with some (usually 3) setae.

Male. Body generally as in the female, but smaller and more delicate. There are differences in the setation of the antennules and in the proportional lengths of antennae, oral parts and legs, but the principal difference is to be observed in the structure of the maxillipedes. These, in this sex, are chelate and usually attach the male firmly to the abdomen of the female. Each maxillipede is composed of a short coxa, attached laterally of the other oral parts and pointing inwards. It supports a big, more or less triangular basis, with

the apex pointing medially. Endopodite shaped as an unsegmented, curved, denticulated claw; the denticulations fit into incisions of the caudal basal wall. Genital segments enlarged, with distinctly visible genital apertures.

The family Bomolochidae was defined by Claus (1875, p. 340), but originally included the genus *Taeniacanthus* Sumpf, 1871, and related genera. The diagnosis has now been amended so as to exclude the Taeniacanthidae. The Bomolochidae logically fall into two subfamilies, Bomolochinae Claus, 1875, and Tuccinae nov. subfam., that can easily be distinguished with the help of the following key:

1. Second thoracic somite narrowed, forming a neck connecting the cephalic somite with the rest of the body (trunk), this trunk contains the fused thoracic somites 3 and 4. Abdomen small, concealed under the trunk, and composed of the fifth thoracic somite, the genital somite, one free somite and the furca. *Tuccinae*
- Second thoracic somite normally developed, as wide as or only slightly narrower than the cephalic somite. Abdomen well developed, distinctly visible. *Bomolochidae*

BOMOLOCHINAE Claus, 1875

DIAGNOSIS. Bomolochidae with normally developed, more or less cyclopoid body. The second thoracic somite usually only slightly narrower than the cephalic somite, never forming a neck.

Female. Rostrum well developed, represented by a distinct rostral plate, the base of which is usually visible between the antennules; the apical portion of the plate is curved, being rounded or bifurcated. Legs 2 to 4 with 3-segmented rami. Leg 5 present, uniramous, composed of intermediate segment and flattened apical segment. Abdomen composed of 5 somites preceded by the fifth thoracic somite; the genital somite is composed of the fused first and second abdominal somites.

Male. Smaller than the female, with the differences summed up in the diagnosis of the family. They are attached to the abdomen of the female by means of the strongly developed maxillipedes.

This subfamily contains the following genera: *Bomolochus* Von Nordmann, 1832; *Bomolochoides* nov. gen.; *Parabomolochus* nov. gen.; *Nothobomolochus* nov. gen.; *Orbitacolax* Shen, 1957; *Pseudoeucanthus* Brian, 1906, and *Pumiliopes* Shen, 1957.

I have not accepted C. B. Wilson's genus *Artacolax* (Wilson, 1908, p. 433), following in this respect Stock's (1953, p. 11) suggestion. The structure of the second maxillae and the width of the endopodites of legs 1 to 3, used by C. B. Wilson as additional characteristics to discriminate between *Artacolax* and *Bomolochus*, are exceedingly variable in the various species of *Bomolochus* sensu lato and are certainly inadequate for a generic distinction. The principal difference, the fusion of thoracic somites 3 and 4 in

Artacolax, is usually very incomplete and a complete scale of intermediate forms occurs between a much backward produced third thoracic somite (completely covering the fourth or even the fourth and fifth thoracic somites), as found in the typical "*Artacolax*", and a normally developed third thoracic somite, found in the typical *Bomolochus*. Moreover, there are several indications that the degree of development of the backward produced part is governed to some extent by the condition or development of the ovaries.

I have thought it advisable to split up the genus *Bomolochus* sensu lato into several smaller genera. A subdivision of the genus *Bomolochus*, indeed, has previously been attempted by C. B. Wilson (1908, 1911, 1913, the foundation of the genus *Artacolax* is in fact an attempt to remove some species from the genus *Bomolochus*), by Yamaguti (1939) and by Shen (1957). Yamaguti (1939, p. 398) instituted the subgenus *Pseudobomolochus* for such species of *Bomolochus* that have overlapping thoracic somites and a tripartite chitinized plate dorsad of the antennular base. Yamaguti's choice of this subgeneric name is very unfortunate as Wilson (1913, p. 205), in his discussion of the genus *Pseudoecanthus*, has already used this name: "Brian's genus shows neither of these peculiarities but has the mouth parts like those of *Bomolochus*, and might far better have been called *Pseudobomolochus*". I have been forced, therefore, to reject Yamaguti's name *Pseudobomolochus* as a homonym of *Pseudobomolochus* C. B. Wilson, 1913, which in its turn is an objective junior synonym of *Pseudoecanthus* Brian, 1906. The genus *Nothobomolochus* nov. gen., to be described below, has almost the same limitations as Yamaguti's subgenus *Pseudobomolochus*.

Shen (1957, p. 323) created the genus *Orbitacolax* for a Bomolochid with reduced setal condition of the legs (*Orbitacolax uniunguis* Shen, 1957); in this genus the aberrant *Bomolochus leptoscari* Yamaguti, 1953 and *Bomolochus dactylopterusi* Carvalho, 1958, can also find their proper place.

The genera *Bomolochoides* nov. gen. and *Parabomolochus* nov. gen. have been instituted to receive certain species of *Bomolochus* with aberrant antennular condition coupled with certain particulars of the legs. The genus *Bomolochus* in its restricted form, as may also appear from the discussion of this genus on p. 10, makes a heterogeneous impression but I do not feel justified, bearing in mind the very imperfect knowledge of some of its forms, to split it up even further.

The following key may serve to distinguish between the females of the various genera. No key has been constructed to identify the males, which usually are found together with the females and between which the structural differences are minute.

1. Antennule composed of 3 more or less fused basal segments and a 3- or 4-segmented, thinner flagellum. Exo- and endopodites of legs 2 to 4 normally 3-segmented, or exopodites, by development of an additional articulation, apparently 4-segmented. 3
 - Antennule composed of gradually narrowing segments; there is no distinct basal portion. Rami of legs 2 to 4 2-segmented or segmentation obscured by fusion of segments. 2
2. Antennule 4- or 5-segmented. Basis of maxillipede without additional seta. Endopodite of leg 1 flattened but not greatly expanded. Segmentation of legs 2 to 4 may be obscured by fusion of segments, but the setation and spinulation shows that they are originally 3-segmented; all first and second exopodal segments with 1, all third exopodal segments with 3 spines. Egg-strings elongate. . . . *Pseudoecanthus* Brian
 - Antennule 9-segmented. Basis of maxillipede elongate, with 1 additional seta. Endopodite of leg 1 flattened and greatly expanded. Exopodites of legs 2 to 4 originally 2-segmented, but segmentation obscure; endopodites of legs 2 and 3 2-segmented, of leg 4 3-segmented. First exopodal segments with small external spinule, second exopodal segments with a single big claw. Egg-sac ovate. *Pumiliopes* Shen
3. Setation of legs 2 to 4 reduced and of the following pattern: first and second exopodal segments with minute external spinule and no internal seta. Third exopodal segment with 2 small external spinules and bigger apical spine; there may be 2 setae on this segment. First endopodal segment with small internal seta; second endopodal segment without setae (with the exception of leg 4 where a seta may be present); third endopodal segment with 2 or 3 setae. Endopodite of leg 1 flattened and greatly expanded. *Orbitacolax* Shen
 - Setation of legs 2 to 4 well developed, third exopodal segment with 7 or 8 appendages; third endopodal segment with 3 or 4 appendages. 4
4. Basal part of antennules ventrally or dorsally reinforced with chitinized plates; some of the plumose sensory setae of the antennular base fused with chitinized prolongations of these plates. 5
 - Basal part of antennules either devoid of chitinized plates or these plates, if present, not altering the shape of the plumose sensory appendages. 6
5. Antennular base with tripartite chitinized plate, placed at dorsal part of base; the three prolongations are fused with third to fifth plumose setae, leaving 12 normally developed, plumose setae. Antennae with corrugated first endopodal segment; corrugations caused by small spinules that may be arranged in longitudinal rows. No pectinate row of spinules on endopodite of antenna. Endopodite (claw) of maxillipede usually without auxiliary tooth. *Nothobomolochus* nov. gen.
 - Antennular base ventrally with a number of chitinized plates, of which the prolongations are fused with the plumose setae 3 to 13. The character of the fourth plumose sensory seta is completely changed; it is shaped as a large, externally curved hook. Antenna with a pectinate row of spinules on the first endopodal segment. Endopodite (claw) of maxillipede with auxiliary tooth. *Parabomolochus* nov. gen.
6. Number of sensory appendages 14 or 15, occasionally reduced to 12, some of which may be supported by prolongations of the ventral plates; all are normally developed, short and plumose *Bomolochus* Von Nordmann

— Number of sensory appendages greater, being 20 to 22. No ventral or dorsal chitinized structures *Bomolochoides* nov. gen.

Bomolochus Von Nordmann, 1832

DIAGNOSIS. Female. Antennular base composed of 3 more or less fused segments, bearing, along the free rostral margin, 14 or 15 plumose sensory appendages; the last of these appendages, found on the third segment, is turned latero-caudally. Flagellum composed of 3 or 4 free segments with normal setae. First and second endopodal segments of antenna more or less distinctly fused, with fine spinules or scales, at times arranged in longitudinal rows, which give these segments a corrugated appearance. In addition there are a lamelliform process, several hooked spines, and a seta on the first endopodal segment. Maxillule with 2 to 4 setae. Endopodite (claw) of maxillipede weakly curved or strongly sigmoid, with or without additional tooth. Additional plumose setae on the basis may be present, maximally numbering 3. Leg 1 with 3-segmented rami, but the articulation may be strongly obscured by fusion, particularly of the exopodal segments. The endopodite of leg 1 may be flattened. Leg 2 to 4 with 3-segmented rami; the exopodites may at times appear 4-segmented by development of an auxiliary articulation in the third segment. Setal and spinal formulae of the following pattern (spines in roman, setae in arabian numerals):

	endopodite	exopodite
leg 1	I + 0 . I + 0 . 5	6 + 0-III
leg 2	I + 0 . 2 + 0 . 2-3 + II	0 + I . I + I . 4-5 + II-IV
leg 3	I + 0 . I-2 + 0 . 2 + II	0 + I . I + I . 4-5 + II-III
leg 4	I + 0 . I + 0 . I + I + I	0 + I . I + I . 4-5 + II-III

The endopodites of legs 2 or 3 may be flattened. Leg 5 composed of a free intermediate segment with short external seta, and an elongate, at times spatulate terminal segment, with 3 apical setae and usually a short external seta.

Males of reduced size. Basal segments of antennule not greatly modified, number of plumose sensory setae reduced. Maxillipedes chelate, attaching the male to the abdomen of the female. Leg 1 normally developed, both rami 3-segmented, not flattened. Segmentation of endopodite of leg 4 reduced. Abdomen with big genital somite, the number of abdominal somites may be reduced.

Parasites of the gill chamber of fishes, attached either to the gill filaments or to the inside of the operculum.

Type species: *Bomolochus soleae* Claus, 1864 (see remarks below).

REMARKS. In the diagnosis of the now restricted genus *Bomolochus* I have

placed great value on the structure of the antennulae, but the number of species of which the antennular structure has been adequately described is restricted. The basal antennular segments of *Bomolochus soleae*, judging from Stock's figures (1953, fig. 3), seem to be devoid of chitinized plates, at least there are no finger-shaped prolongations of such plates that fuse with the plumose sensory setae. In *Bomolochus gazzae* Shen, 1957, again according to the drawings (pl. 3 fig. 24), there are apparently 3 spine-shaped, flat, chitinized structures supporting setae 3 to 5.

I have already drawn attention to the heterogeneous character of the genus *Bomolochus* in its present form. This heterogeneity is brought about by the removal of all well defined groups of species to new genera, leaving in the genus *Bomolochus* a very small number of well defined forms and a fairly large number of ill-described species. It will be observed that I have instituted a new genus, *Bomolochoides*, for two species previously ranked under *Bomolochus* (*B. nitidus* C. B. Wilson, 1911 and *B. scutigerulus* C. B. Wilson, 1936) that have an increased number of plumose, sensory appendages on the basal antennular segments (20-22), whilst *Bomolochus teres* C. B. Wilson, 1911, with a reduced number of 12 plumose, sensory appendages, is still in *Bomolochus*. The reason for doing so is largely based on the assumption that the antennular structure in *Bomolochus teres* has been inaccurately described by C. B. Wilson as it is not observed in any other species of *Bomolochus sensu lato*; augmentation of plumose sensory appendages occurs in at least two species.

The selection of a type of the now restricted genus *Bomolochus* is particularly complicated. Originally the genus was instituted by Von Nordmann (1832) for *Bomolochus parvulus*, a gill parasite of *Amphacanthus rivulatus* (Cuvier) (= *Siganus spinus* (L.)) from the Red Sea. The description of this species is totally inadequate to recognize the species and though Von Nordmann intended to publish a figure in the following part of his paper, such a figure has indeed never been published. The chance that the species will be rediscovered on its type host and will be redescribed, though small, cannot be altogether neglected and there is a possibility that *Bomolochus parvulus*, after more careful study, will prove to be no *Bomolochus* at all or not even a Bomolochid, as several species of Taeniacanthidae have the same general appearance. *Bomolochus parvulus*, though it should become the type of the genus *Bomolochus* by monotypy, is thus totally inadequate for such a position. C. B. Wilson (1911, p. 366), who recognized this difficulty, indicated *Bomolochus bellones* as type of the genus *Bomolochus*. This species is characterized, however, by a modified plumose sensory seta, shaped as a curved hook, which sets this species, and its allies, apart from the other

Bomolochinae. There is nothing in Von Nordmann's description which suggests the presence of such a hook in his *Bomolochus parvulus*, a character which he could not have missed to observe. As the indication of a distinct, well defined type of the genus *Bomolochus* seems very desirable, the International Commission on Zoological Nomenclature will be asked to indicate, under their plenary powers, as the type of the genus *Bomolochus* the species *Bomolochus soleae* Claus, 1864, suppressing at the same time all previous type designations for the genus. Pending the decision of the International Commission on Zoological Nomenclature I have provisionally regarded *Bomolochus soleae* Claus, 1864, as the type of *Bomolochus* as defined above.

For the sake of convenience I have grouped the various species of *Bomolochus* as follows:

"albidus" group

Bomolochus albidus C. B. Wilson, 1932

"confusus" group

Bomolochus confusus Stock, 1953; *Bomolochus gazzae* Shen, 1957

"eminens" group

Bomolochus eminens C. B. Wilson, 1911

"ardeolae" group

Bomolochus ardeolae Krøyer, 1864; *Bomolochus attenuatus* C. B. Wilson, 1913; *Bomolochus acutus* Gnanamuthu, 1948

"teres" group

Bomolochus teres C. B. Wilson, 1911

"nothrus" group

Bomolochus nothrus C. B. Wilson, 1913

"soleae" group

Bomolochus soleae Claus, 1864; *Bomolochus exilipes* C. B. Wilson, 1911; *Bomolochus cuneatus* McLean Fraser, 1920

"concinnus" group

Bomolochus concinnus C. B. Wilson, 1911; *Bomolochus pectinatus* Stock, 1955; probably also *Bomolochus mugilis* Pearse, 1952

"palleucus" group

Artacolax palleucus C. B. Wilson, 1913.

The females of *Bomolochus* can be distinguished with the help of the following key:

1. Basal part of antennule with strong curve; first and second antennular segments making an acute angle. Number of plumose sensory appendages reduced (12), of very unequal length. Furcal rami tubular, about 3 times as long as wide, one of the

- setae greatly thickened and lengthened *B. teres* C. B. Wilson
- Basal part of antennule curved or straight, without an acute angle between first and second segments. Number of plumose sensory appendages 14 or 15, of equal length. Furcal rami conical, as long as or twice as long as wide, with 5 marginal and 1 appendicular seta; one of the marginal setae may be lengthened but it is never greatly thickened. 2
2. Leg 1 with normally developed, 3-segmented rami *B. albidus* C. B. Wilson
- Leg 1 with both rami flattened, the segments of the exopodite usually, of the endopodite occasionally, fused 3
3. Endopodite of leg 3 flattened, external margin strongly hairy.
- *B. palleucus* (C. B. Wilson)
- Endopodite of leg 3 normally developed, only sparingly hairy along external margin. 4
4. Endopodite of leg 2 flattened and strongly hairy along external margin. 5
- Endopodite of leg 2 normally developed, sparingly hairy along external margin. 9
5. Antenna, in addition to longitudinal rows of fine spinules, with a pectinate row of bigger, marginal spinules on first endopodal segment 6
- Antenna with first and second endopodal segments roughened by small spinules, no row of bigger spinules forming a comb-like structure. 7
6. Second and third thoracic somites slightly backward produced and overlapping. Rostral base invisible from above. Maxillipedes with 2 setae, auxiliary tooth on claw small. Third exopodal segment of legs 2 and 3 deeply incised; third endopodal segment of leg 2, in addition to 3 setae, with 2 small, blunt teeth.
- *B. pectinatus* Stock
- Second and third thoracic somites normally developed, not backward produced. Rostral base visible from above. Exopodites of legs 2 to 4 apparently 4-segmented by development of extra segmentation of third segment. Third segment of endopodite leg 2 with 3 setae and without additional small teeth *B. concinnus* C. B. Wilson
7. Rostral base invisible from above. Setae on endopodite of leg 2 short.
- *B. exilipes* C. B. Wilson
- Rostral base distinctly visible from above. Setae on endopodite of leg 2, though thickened, fairly long. 8
8. Exopodites of legs 2 to 4 with additional segmentation of third segment, so apparently 4-segmented. *B. cuneatus* McLean Fraser
- Exopodites of legs 2 to 4 normally 3-segmented. *B. soleae* Claus
9. Anterior edge of first and second endopodal segments of antenna and lamellar process of antenna with a pectinate row of spinules. *B. nothrus* C. B. Wilson
- First and second endopodal segments of antenna roughened, but without a pectinate row of spinules 10
10. Claw of maxillipede moderately developed, curved, without or with small auxiliary knob or small tooth. 11
- Claw of maxillipede strongly developed, sigmoid, with big, at times duplicated auxiliary tooth 13
11. Antenna without lamelliform process and with 2 subapical claws.
- *B. eminentis* C. B. Wilson
- Lamellar process present and inserting, together with a claw, at $\frac{2}{3}$ the length of the first endopodal segment. In addition there are 4 subapical claws and a seta. 12
12. Claw of maxillipede with a small tooth. Third exopodal segment of leg 2 with 9, of leg 3 with 8 appendages *B. confusus* Stock

- Claw of maxillipede with a small notch. Third exopodal segment of leg 2 with 8, of leg 3 with 7 appendages *B. gazzae* Shen
- 13. Cephalothorax globular, with deep V-shaped groove, opening anteriorly. Rostral base distinctly visible from above 14
- Cephalothoracic somites gradually diminishing in width. No V-shaped groove on cephalothorax. Rostral base invisible from above *B. attenuatus* C. B. Wilson
- 14. Third thoracic somite strongly and fourth thoracic somite moderately backward produced. Abdomen short, $\frac{2}{3}$ the length of cephalothorax. *B. ardeolae* Krøyer
- All thoracic somites normally developed, i.e., not backward produced. Abdomen nearly as long as cephalothorax *B. acutus* Gnanamuthu

“Albidus” group

This group contains but a single species:

Bomolochus albidus C. B. Wilson, 1932

Bomolochus albidus C. B. Wilson, 1932a, p. 382, pl. 23 figs. c-j; Pearse, 1952a, p. 196; Stock, 1953, p. 12, figs. 45-47.

Female. Total length 1.8-2.1 mm. Body cyclopid; cephalic somite semi-circular, 1.5 times as long as broad, cephalothorax gradually narrowing. Abdomen long and slender, about as long as cephalothorax. Rostral base and basal part of antennules invisible from above. No eye visible. Basal part of antennules composed of 3 segments, with 14 sensory appendages. First and second endopodal segments of antenna well separated; lamellar process and hooked claw inserting near the line of articulation, place of insertion swollen. First and second endopodal segments roughened. In addition there are 4 hooked claws and a seta. Maxillipede with a long and slender claw without auxiliary tooth, and with 1 plumose seta; basis with a short spine at internal margin. Leg 1 with distinctly 3-segmented, normally developed rami. Structure of leg 2 unknown, endopodite not flattened. Spinal and setal formulae (taken partly from C. B. Wilson, 1932a, partly from Stock, 1953) as follows:

	endopodite	exopodite
leg 1	I + 0 . I + 0 . 5	0 I . I + I . 5
leg 2	unknown	unknown
leg 3	I + 0 . 2 + 0 . 2 + II	0 + I . I + I . 5 + III
leg 4	I + 0 . I + 0 . I + I + I	0 + I . I + I . 5 + III

Leg 5 with short intermediate segment with seta, and spatulate apical segment bearing 3 subequal, apical, spiniform setae and a fine external, marginal seta. Apex finely spinulose.

Males unknown.

The type host is *Lophius piscatorius* L., the type locality Woods Hole,

Massachusetts, U.S.A. Holo- and paratypes are in the U.S. National Museum, paratypes also in the Zoological Museum, Amsterdam. The type specimens were found in the gill cavity of their host in great numbers, particularly in the small pocket above the pelvic fin, where the specimens were attached to the skin.

REMARKS. C. B. Wilson's description is incomplete in many points. The description has afterwards been augmented by Stock, who figured and described legs 1, 3 and 5, but his description and figures of legs 1 and 3 have been interchanged. A new, more complete description, including information about the antennules, antennae, maxillipedes and leg 2 is highly desirable. Amongst the other Bomolochids the position of this species is unique by the simple structure of leg 1.

"C o n f u s u s" g r o u p

The two members of this group, *Bomolochus confusus* Stock and *Bomolochus gazzae* Shen, have the following particulars in common: first and second endopodal segments of antenna fused, roughened by small teeth. Lamellar process and one hook inserting two thirds the length of first endopodal segment from base; in addition there are 3 or 4 subapical hooks and a seta. Claw of maxillipede moderately developed and weakly curved, with a small tooth or notch. Both rami of leg 1 flattened, with partial fusion of the exopodal segments. Rami of legs 2 to 4 normally developed. Intermediate segment of leg 5 with small external spinule. Apical segment spatulate, with 3 apical setae (median seta lengthened) and a short external seta. Setal and spinal formulae of both species slightly different and given below.

Bomolochus confusus Stock, 1953

Bomolochus soleae T. Scott, 1893, p. 212, pl. 5 figs. 1-13; T. Scott, 1902, p. 288, pl. 13 figs. 13-18; Bainbridge, 1909, p. 45, pl. 8 figs. 1-5; C. B. Wilson, 1911, p. 375, pl. 57 figs. 184-190, pl. 60 fig. 219, textfig. 40; T. & A. Scott, 1913, p. 36, pl. 1 fig. 3, pl. 2 figs. 6-9, pl. 3 figs. 1-4; Van Oorde-de Lint & Schuurmans Stekhoven, 1936, p. 103, fig. 43; Heegaard, 1947, p. 199, pl. 25 figs. 190, 191.

Bomolochus soleae p.p. Dollfus, 1953, p. 336, figs. 236, 237.

Bomolochus confusus Stock, 1953, p. 9, figs. 21-33; Carvalho, 1955, p. 144; Gooding, 1957, p. 217; Marine Biological Association, 1957, p. 175; Stock, 1959, p. 43.

Female. Total length 1.5 mm. Rostral plate invisible from above. Eye invisible. Antennular base apparently without chitinized plates. Endopodite of antenna roughened by short, conical spinules, not arranged in rows. Claw of maxillipede with small tooth, basis with 3 setae. Setal and spinal formulae (taken from Stock's figures) as follows:

	endopodite	exopodite
leg 1	1 + 0 . 1 + 0 . 5	0 + I . 3 + I . 3 + 0
leg 2	1 + 0 . 2 + 0 . 3 + II	0 + I . 1 + I . 5 + IV
leg 3	1 + 0 . 2 + 0 . 2 + II	0 + I . 1 + I . 5 + III
leg 4	1 + 0 . 1 + 0 . I + 1 + I	0 + I . 1 + I . 5 + III

External margin of terminal segment leg 5 spinulose above insertion of external spine; internal margin hairy.

Male. Total length 0.8 mm. The male was described by C. B. Wilson (1911, p. 375) and Bainbridge (1909, p. 46) but a complete, new redescription is urgently needed.

The type host is *Gadus callarias* L., the type locality Moray Firth, Aberdeen, Scotland. Holotype and paratypes are in the British Museum (Natural History). The species was found in the nasal fossae of its host. Additional records are from the nasal fossae of *Gadus callarias* L., *G. luscus* L. (= *Trisopterus luscus* (L.)), and *G. merlangus* L. (= *Merlangius merlangus* (L.)) from the Plymouth region (Gooding, 1957) and from nasal fossae of *Conger conger* (L.) taken off the island of Vlieland and near Egmond, both localities on the North Sea coast of the Netherlands (Stock, 1959).

REMARKS. Stock (1953) noticed that two different species have been confused in literature under the name *Bomolochus soleae* Claus; Claus' original species was redescribed by Stock (1953) from topotypical material, collected from the same host as Claus' specimens (*Solea solea* (L.)); the second species was described as *Bomolochus confusus* Stock, 1953, after material from *Gadus callarias* L. It is impossible to give the accurate distribution of both forms; moreover, *Bomolochus soleae* has been recorded from a variety of hosts some of which undoubtedly also harbour *Bomolochus confusus*. These doubtful records have been listed under *Bomolochus soleae*.

***Bomolochus gazzae* Shen, 1957**

Bomolochus gazzae Shen, 1957, pp. 302, 319, pl. 3; Yamaguti & Yamasu, 1959, p. 92.

Female. Total length 1.51 mm. General shape of body as in previous species, but rostral base visible in dorsal view at the end of a shallow, V-shaped groove over the cephalic somite. No eye visible. Basal part of antennule with a small chitinized plate with three pointed processes; these are fused with the third to fifth plumose sensory setae. Flagellum 4-segmented. Endopodite of antenna roughened by longitudinal rows of scale-shaped teeth; lamellar process with pectinate row of teeth, continuing for some distance on first endopodal segment. Claw of maxillipede moderately

developed and weakly curved, with auxiliary notch. Three setae occur on the basis. Setal and spinal formulae (taken from Shen's figures) as follows:

	endopodite	exopodite
leg 1	1 + 0 . 1 + 0 . 5	0 . 6
leg 2	1 + 0 . 2 + 0 . 3 + II	0 + I . 1 + I . 5 + III
leg 3	1 + 0 . 2 + 0 . 2 + II	0 + I . 1 + I . 5 + II
leg 4	1 + 0 . 1 + 0 . I + I + I	0 + I . 1 + I . 4 + III

External margin of terminal segment leg 5 nude, internal margin hairy.

Male unknown.

The type host is *Gazza minuta* (Bloch), the type locality Yin-ku Bay, Hainan Island, S. China. A single specimen (holotype) was obtained from the gills of its host; Shen does not state whether or where this holotype is preserved.

REMARKS. *Bomolochus confusus* and *B. gazzae* undoubtedly are closely related, though separable at once by their different setal and spinal formulae. *B. gazzae* is further remarkable by the fusion of some of the sensory setae of the antennular base with prolongations of a ventral, chitinized plate. As the structure of the antennule in the other species of *Bomolochus* is usually poorly known, the species, in this respect, may not stand alone. It approaches the condition which, more extremely developed, is to be found in *Parabomolochus*.

"Eminens" group

This group contains but a single species:

Bomolochus eminens C. B. Wilson, 1911

Bomolochus eminens. C. B. Wilson, 1911, p. 368, pl. 53, textfig. 6; C. B. Wilson, 1932, p. 41; Heegaard, 1947, p. 199, pl. 25 fig. 193; Sewell, 1949, p. 157; Stock, 1953, p. 12.

Female. Total length 2.75 mm. Body cyclopoid, cephalic somite ovate, 1.5 times as long as broad, swollen, rostral base visible but antennules almost invisible from above. No eye visible. Thoracic somites gradually narrowing, not produced backward and not overlapping. Abdomen short, $\frac{1}{3}$ the length of cephalothorax. Basal part of antennules with strong flexure and 15 plumose sensory appendages; flagellum 3-segmented. Endopodite of antenna roughened by longitudinally arranged fine spinules, bearing 2 subapical, hooked claws. Maxillule with only 2 setae. Presence of paragnaths unknown. Maxillipede with a small, weakly curved claw with a small notch; basis with a single plumose seta. Both rami of leg 1 flattened. Endopodites of legs 2 to 4 normally developed, not flattened; third exopodal segments with a deep

incision at external margin, no extra segmentation. Apical segment of leg 5 spatulate, with 3 terminal setae of which the median is lengthened. Setal and spinal formulae (taken from C. B. Wilson's figure) as follows:

	endopodite	exopodite
leg 1	1 + 0 . 1 + 0 . 5	6 + III
leg 2	0 + 0 . 1 + 0 . 3 + I	0 + I . 1 + I . 4 + III
leg 3	1 + 0 . 1 + 0 . 2 + I	0 + II . 1 + I . 4 + III
leg 4	1 + 0 . 1 + 0 . 2 + I	0 + I . 1 + I . 4 + III

There are probably several incorrectnesses in C. B. Wilson's drawing, as e.g., the duplication of the external spine of segment 1 of the exopodite of leg 3, that are reflected in the formulae given above.

Male unknown.

The type host is *Clupanodon pseudohispanicus* (Poey) (a synonym of either *Sardinella pseudohispanica* (Poey) or *S. anchovia* Cuvier & Valenciennes), the type locality Tortuga Islands, Florida. Two females were taken from the gill cavity of their host. The holotype is in the U.S. National Museum. Additional specimens are recorded by C. B. Wilson (1932) from surface and bottom plankton of Chesapeake Bay, U.S.A., where females, together with developmental stages, were found pelagically.

REMARKS. *Bomolochus eminens* is evidently closely related to the "confusus" group; separation has principally been maintained on account of the aberrant structure of the antenna in *B. eminens* and the differences in the setal and spinal formulae. Re-examination of C. B. Wilson's material is highly desirable and will probably show the identity of the "confusus" and "eminens" groups.

"Ardeolae" group

The members of this group have the following points in common: Cephalothorax circular, brought about by strong development of head, first, and second thoracic somites; the third thoracic somite may be strongly produced backward. Abdomen slender, as long as or longer than cephalothorax. Antennules with 14 or 15 plumose sensory appendages. Antenna with endopodite roughened by small spinules, with a lamellar process and a number of hooked claws. Maxillule with 3 or 4 setae. Claw of maxillipede strongly developed, sigmoid, with a strong auxiliary tooth. Both rami of leg 1 flattened, exopodal segments fused. Endopodites of legs 2 to 4 normally developed, not flattened. There are small differences in the setal and spinal formulae of the three species. Structure of leg 5 insufficiently known, but

the spatulate apical segment has 3 terminal setae and sometimes has an additional external seta.

Bomolochus ardeolae Krøyer, 1864

Bomolochus ardeolae Krøyer, 1864, pp. 294, 300, pl. 11 fig. 3; Bassett-Smith, 1899, p. 442; Yamaguti, 1939, p. 198; Shiino, 1957, p. 422.

Artacolax (Bomolochus) ardeolae, C. B. Wilson, 1908, p. 434; Sewell, 1949, p. 157.

Artacolax ardeolae, C. B. Wilson, 1911, p. 363, pl. 52, pl. 53 fig. 146; Sewell, 1949, p. 157; Stock, 1953, p. 12.

Female. Total length 2.4 mm. Body of the "*Artacolax*" type, with big, globular cephalothorax and strongly backward produced third thoracic somite. Cephalic somite semicircular, with a deep V-shaped groove, at the opening of which the rostral plate is distinctly visible. This plate curves ventrally, its apex is apparently rounded. No eye visible. Abdomen as long as or slightly shorter than cephalothorax. Furcal rami short, as long as wide. Claw of maxillipede with a single small seta near insertion, no setae on the basal segment. Setal formulae (taken from C. B. Wilson's drawings) as follows:

	endopodite	exopodite
leg 1	2 + 0 . 1 + 0 . 5	6 + III
leg 2	1 + 0 . 2 + 0 . 2 + II	0 + I . 1 + I . 5 + III
leg 3	1 + 0 . 2 + 0 . 2 + III	0 + I . 1 + I . 6 + III
leg 4	1 + 0 . 0 + 1 . 1 + 1 + 1	0 + I . 0 + I . 5 + I

The spines along the external margin of the exopodites have denticulated internal borders.

Leg 5 (according to C. B. Wilson) with a short intermediate segment, with an external spinule, and with a spatulate apical segment; this apical segment bears 4 subequal, setiform spines.

Male unknown.

The type host is *Belone ardeola* Cuvier & Valenciennes (= *Strongylura timuca* (Walbaum)), the type locality off New Orleans, Louisiana, U.S.A. The single type specimen was found on the gills of its host. This holotype is probably lost. An additional specimen was recorded by C. B. Wilson (1911) from the gills of *Hypsypops rubicundus* (Girard) collected at La Jolla, California, U.S.A. This specimen is in the U.S. National Museum.

REMARKS. There is a notable difference between the structure of leg 5 as shown in Krøyer's and C. B. Wilson's figures. Krøyer figured an extra segmentation in the apical segment of leg 5; this may be due to incorrect observation, but the apex of the fifth leg, which carries only 3 setae, is definitely spinulose. C. B. Wilson figured a big spatulate apical segment,

apparently nude, and with 4 marginal, subequal setae. This is apparently a rare species which needs closer investigation.

Bomolochus attenuatus C. B. Wilson, 1913

Bomolochus attenuatus C. B. Wilson, 1913, p. 198, pl. 21; C. B. Wilson, 1935, p. 335; C. B. Wilson, 1937, p. 29; Sewell, 1949, p. 157; Pearse, 1952, p. 12; Pearse, 1952a, pp. 194, 196.

Female. Total length 2.28 mm. Body cyclopoid, with big, semicircular cephalic somite; thoracic somites 2 to 4 gradually narrowing. Abdomen, including the fifth thoracic somite, long and slender, 1.25 times longer than the cephalothorax. Furcal rami tubular, twice as long as wide. There is no V-shaped groove on the cephalic somite; rostral base scarcely visible from above. Median eye small, visible just behind the rostral base. Antennules, even the basal parts, distinctly visible. Spinules on endopodite of antenna arranged in oblique rows. Maxillule with 2 long and one short seta. Claw of maxillipede with a haired seta at its base; basis of maxillipede with a big and a small spine at internal margin. Setal and spine formulae (taken from C. B. Wilson's drawings and description) as follows:

	endopodite	exopodite
leg 1	1 + 0 . 1 + 0 . 5	6
leg 2	1 + 0 . 2 + 0 . 3 + II	0 + I . 1 + I . 4 + III
leg 3	1 + 0 . 2 + 0 . 2 + II	0 + I . 1 + II . 6 + II
leg 4	1 + 0 . 1 + 0 . 1 + 1 + 1	0 + I . 1 + I . 5

Structure of leg 5 unknown. Egg-strings very long, as long as body.

Male unknown.

The type host is *Scorpaena plumieri* Bloch, the type locality Montego Bay, Jamaica. Three females, two of which were ovigerous, were obtained from the gills of their host. This material, including the holotype, is in the U.S. National Museum. Additional records are of a female from the gills of *Scorpaena agassizii* Goode & Bean, taken at Dry Tortugas, Florida, U.S.A. (C. B. Wilson, 1935); a female taken from the gills of *Cheilichthys annulatus* (Jenyns) at San Francisco, Ecuador; 2 females washed from the body cavity of a *Lophius* dredged at Bahia Honda, Panama; and a female from the gills of a *Lophius* like fish at Port Utria, Colombia (C. B. Wilson, 1937). Pearse (1952) reported upon 2 females taken from the gills of *Priacanthus arenatus* Cuvier & Valenciennes and one from *Gymnachirus texae* (Günther) inspected at Port Aransas, Texas, U.S.A.

REMARKS. C. B. Wilson's drawings of the legs (and consequently the setal and spinal formulae presented here) contain several questionable points.

C. B. Wilson figures a duplicated external spine on the second segment of the exopodite of leg 3; the setation of the exopodite of leg 4 is probably incorrect as no distinction between spines and setae on the third segment has been made. The structure of the maxillipede, with the double spine on the basis, is questionable.

Bomolochus acutus Gnanamuthu, 1948

Bomolochus acuta Gnanamuthu, 1948, p. 18, figs. 1-3.

Female. Total length 2.72 mm. Body curiously shaped by the great development of the cephalic and the second thoracic somites, forming an almost circular complex; thoracic somites 3 to 5 and abdomen much narrower. Cephalic somite with a deep V-shaped groove, at the opening of which the rostral plate is distinctly visible. This plate curves strongly ventrally, the apex is two-pointed. On each of the arms of the V-shaped groove, near the insertion of the antennules, there is a short, blunt, chitinized projection. Muscles operating the antennules distinctly visible. Median eye distinctly discernable just behind rostral plate. Antennules with 14 long, plumose, sensory appendages. Spinules on endopodite of antenna arranged in longitudinal rows. Maxillule with 3 big setae. Claw of maxillipede with a duplicated auxiliary tooth; basis with 2 plumose setae. Setal and spinal formulae (taken from Gnanamuthu's drawings) as follows:

	endopodite	exopodite
leg 1	1 + 0 . 1 + 0 . 5	1 + 0 . 6
leg 2	1 + 0 . 2 + 0 . 3 + I	0 + I . 1 + II . 6 + III
leg 3	1 + 0 . 1 + 0 . 2 + II	0 + I . 1 + I . 5 + III
leg 4	1 + 0 . 1 + 0 . I + I + I	0 + I . 0 + I . 3 + III

External marginal spines of exopodites of legs 2 to 4 with a spinulose external margin. Leg 5 with a spatulate apical segment with additional segmentation, apex with 3 setae; internal margin spinulose, part of apical portion also spinulose.

The type host is *Dussumieria acuta* Valenciennes, the type locality Madras, India. A single ovigerous female was recorded from the gills of its host; this holotype specimen is in the Indian Museum, Calcutta.

REMARKS. There are several questionable points in Gnanamuthu's description of the only type specimen. The duplication of the auxiliary spine on the maxillipedal claw is quite unusual in this genus. The drawings of the legs are probably inaccurate and so consequently are the formulae given above. The structure of leg 5 of Gnanamuthu's specimen shows more conformity

with that of *Bomolochus ardeolae* as described by Krøyer (1864, pl. 11 fig. 3e), than with C. B. Wilson's account of that leg in what he considers *Bomolochus ardeolae* (Wilson, 1911, pl. 52 fig. 145, as *Artacolax ardeolae*).

„Teres” group

This group has but a single species:

Bomolochus teres C. B. Wilson, 1911

Bomolochus teres C. B. Wilson, 1911, p. 379, pl. 59, textfig. 39; C. B. Wilson, 1932, p. 381, pl. 23 figs. a, b; Bere, 1936, p. 582; Gnanamuthu, 1949, p. 318; Sewell, 1949, p. 157; Pearse, 1952, p. 12; Pearse, 1952a, p. 196; Simmons, 1957, p. 177.

Female. Total length 2.14 mm. Body cyclopoid, cephalic somite semicircular, thoracic somites 2 to 4 gradually narrowing; abdomen long and slender, as long as cephalothorax. Antennules with sharp angle between first and second segments; number of sensory appendages reduced (12), of very unequal length. Rostral base visible between antennular bases. No eye. Rami of furca tubular, 3 times as long as wide; one of the setae greatly thickened. Antenna with oblique rows of fine spinules; there is a tubercle along the margin with a pectinate row of spinules; in addition there are 5 hooked claws and a plumose seta. Maxillule with 3 setae. Maxillipede with short, slightly curved claw without auxiliary tooth; basis with 2 plumose setae. Setal and spinal formulae (taken from C. B. Wilson's drawings) as follows:

	endopodite	exopodite
leg 1	1 + 0 . 1 + 0 . 5	3 + 3
leg 2	1 + 0 . 2 + 0 . 3 + I	0 + I . 1 + I . 6 + III
leg 3	1 + 0 . 2 + 0 . 3 + I	0 + I . 1 + I . 6 + II
leg 4	1 + 0 . 1 + 0 . 2 + I	0 + I . 1 + 0 . 5 + II

Both rami of leg 1 flattened and segments partly fused. Endopodites of legs 2 to 4 normally developed, not flattened. External marginal spines of the exopodites of legs 2 to 4 with the external margin finely, the internal margin coarsely serrated; third exopodal segments with extra segmentation.

Intermediate segment of leg 5 without seta. Apical segment narrowed near apex, with 3 apical and 1 external seta. Innermost seta of apex lengthened. Egg-sacs elongated ovate.

Male unknown.

The type host is *Brevoortia tyrannus* (Latrobe), the type locality Woods Hole, Massachusetts, U.S.A. Several specimens (the accurate number is not stated) were found on the gills of the host species; this material, which includes the holotype, is in the U.S. National Museum. In 1932 C. B. Wilson

found this parasite to be common on the gills of *Brevoortia tyrannus* (Latreille) in the Woods Hole area. It also occurred on the same host at Lemon Bay, west coast of Florida, U.S.A. (Bere, 1936).

REMARKS. This group is particularly marked by the structure of antennules and furca. A strong curvature of the segments of the antennular base is not uncommon in *Bomolochus*, but it reaches an extreme degree in *B. teres*, where the angle between first and second antennular segments is acute. The number of sensory appendages appears to be reduced, but I have only C. B. Wilson's drawings upon which I can base this assumption. A complete description of this apparently not very rare *Bomolochus* is much needed.

"Nothrus group"

This group contains but a single species:

Bomolochus nothrus C. B. Wilson, 1913

Bomolochus nothrus C. B. Wilson, 1913, p. 195, pls. 19, 20; Sewell, 1949, p. 157; Pearse, 1952, p. 12; Pearse, 1952a, pp. 194, 196.

Female. Total length 2.45 mm. Body cyclopid, with very broad cephalic somite, twice as broad as long. Thoracic somites 2 to 4 gradually narrowing; abdomen short, about as long as cephalothorax. Rostral base invisible from above. No eye. Furcal rami short, about as long as wide. Egg-sacs elongate but not very long, as long as abdomen. Antennules distinctly visible from above, with 15 short and thick, plumose sensory appendages. Antennal endopodite roughened by longitudinal rows of fine spinules; in addition a pectinate row of fine spinules runs along the whole border, continuing and curving on the base of the first endopodal segment. Lamelliform process also with rows of short spinules continuing for some distance on the first endopodal segment and there bordering a slight swelling. Maxillule with 2 long and 1 short seta, the latter is fine. Claw of maxillipede with strongly sigmoid claw and large auxiliary tooth; no additional setae. Both rami of leg 1 flattened; exopodal segments fused. Endopodites of legs 2 to 4 normally developed, not flattened. C. B. Wilson's figures of the legs are interchanged: pl. 19 fig. 17 represents leg 4, fig 18 shows leg 2, and fig. 19 leg 3. Setal and spinal formulae (taken from C. B. Wilson's description) as follows:

	endopodite	exopodite
leg 1	I + 0 . I + 0 . 5	6 + II
leg 2	I + I . 2 + I . 3 + I	0 + I . I + I . 5 + III
leg 3	I + 0 . 2 + 0 . 3 + II	0 + I . I + I . 5 + II
leg 4	I + 0 . I + 0 . I + I + I	0 + I . I + I . 5 + II

Leg 5 with spatulate apical segment, bearing 3 marginal setae, no hairs or teeth are present.

Male. Total length 1.10 mm. For the description see C. B. Wilson, 1913, p. 197.

The type host is *Abudefduf saxatilis* (L.), the type locality Montego Bay, Jamaica. Holotype and paratypes in the U.S. National Museum. The species appears to be fairly common on the gills of its host. An additional, apparently female, specimen was taken from the gills of *Ogcocephalus vespertilio* (L.) at Port Aransas, Texas (Pearse, 1952).

REMARKS. A new description of the oral parts, particularly the antennae, and of the legs, is very desirable.

"Soleae" group

The three representatives of this group, *B. soleae* Claus, *B. exilipes* C. B. Wilson, and *B. cuneatus* McLean Fraser, have the following points in common:

Cephalic somite broad, twice as broad as long; thoracic somites 2 to 4 narrowed, not produced backward. Abdomen slender, 0.5-0.75 times the length of the cephalothorax. Furcal rami cylindrical, parallel, longer than broad, with 5 marginal and 1 appendicular seta. Antennules with a 4-segmented basal portion, of which the segments are fused. Flagellum 3-segmented, making an obtuse angle with the basis. There are 15 plumose sensory appendages. Endopodite roughened by longitudinal rows of fine spines; no bigger pectinate spines. In addition there are a lamelliform process, 4 hooked spines, and a seta. Maxillule with 2 big and 1 small setae. Maxillipede with a big, strongly sigmoid claw with an acute auxiliary tooth; basis with 3 setae. Both rami of leg 1 are flattened, but the 3 segments of the endo- and exopodite are fairly distinct. Endopodite of leg 2 strongly flattened, of legs 3 and 4 normally developed. Setal and spinal formulae slightly different in the three species. Leg 5 with a short intermediate segment and a spatulate apical segment, bearing 3 terminal and 1 external setae. Leg 6 is composed of 3 setae.

Bomolochus soleae Claus, 1864

Bomolochus soleae Claus, 1864, p. 374, pl. 35 figs. 16-20, pl. 36 fig. 28; P. J. van Beneden, 1871, p. 78, pl. 1 fig. 5; Stock, 1953, p. 3, figs. 1-20; Stock, 1955, p. 59.
Bomolochus soleae p.p. Dollfus, 1953, p. 336.

Female. Total length 1.6 mm. Base of rostral plate distinctly visible from above, eye invisible. Legs 1-4 with the following setal and spinal formulae (taken from Stock's (1953) drawings):

	endopodite	exopodite
leg 1	I + 0 . I + 0 . 5	6 + III
leg 2	I + 0 . 2 + 0 . 3 + II	0 + I . I + I . 5 + IV
leg 3	I + 0 . I + 0 . 2 + II	0 + I . I + I . 5 + III
leg 4	I + 0 . I + 0 . I + I + I	0 + I . I + I . 5 + III

Apical segment of leg 5 spatulate, internal border hairy; external border, above insertion of external spine, spinulose. Apex with 3 spiniform setae, the median seta lengthened.

Male. Total length 0.7 mm. For a description of this sex see Stock, 1953, p. 3.

The type host is *Solea solea* (L.), the type locality the Heligoland area, N. W. Germany. The parasites were found on the gills of their host. Claus' material, including the holotype, is probably lost. Additional reliable records are from off the Belgian coast (P. J. van Beneden, 1871) and from the Western part of the Dutch Wadden Sea (Stock, 1953). In both instances the parasites were recovered from the gills of *Solea solea*; Stock's material is in the Zoological Museum, Amsterdam.

REMARKS. This species has long been confused with *Bomolochus confusus* Stock (vide supra) and consequently its exact distribution as well as the hosts on which it occurs cannot be accurately stated. The species probably also occurs on *Solea solea* (L.) in the Mediterranean, but the only figure available of Mediterranean material (that by Delamare Debutteville & Nunes-Ruivo, 1958, fig. 1) is not detailed enough to decide which of the two forms actually is represented. I have listed below all doubtful and uncertain references to "*Bomolochus soleae*" that I have been able to find, together with the names of their hosts. Redescription of material from the fishes mentioned there is very much needed.

***Bomolochus soleae* auct. (doubtful records)**

Bomolochus soleae, Hartmann, 1870, p. 118; Richiardi, 1880, p. 147; Carus, 1885, p. 353; Bassett-Smith, 1899, p. 443; T. Scott, 1900, p. 146; T. Scott, 1900a, pp. 154, 155; A. Scott, 1901, p. 28; A. Scott, 1901a, p. 349; T. Scott, 1901, p. 121; Brian, 1902, p. 31, 32; A. Scott, 1904, p. 117; T. Scott, 1905, p. 108; Brian, 1906, p. 31; Brian, 1924, p. 7; Leigh-Sharpe, 1928, p. 423; Pesta, 1928, p. 133, fig. 115; A. Scott, 1929, p. 84; Leigh-Sharpe, 1933, pp. 110, 112; Gouillart, 1937, p. 323; Sewell, 1949, pp. 151, 157, 158, 182, 188; Delamare Debutteville & Nunes-Ruivo, 1958, p. 215, fig. 1.

The above cited papers contain references to "*Bomolochus soleae*" from the nostrils of the following Atlantic fishes: *Cyclopterus lumpus* L.; *Gadus aeglefinus* L. (= *Melanogrammus aeglefinus* (L.)); *Gadus merlangus* L. (= *Merlangius merlangus* (L.)); *Gadus pollachius* L. (= *Pollachius pol-*

ladius (L.); *Molva molva* (L.); *Pleuronectes platessa* L.; and *Pleuronectes flesus* L. (= *Platichthys flesus* (L.)). In addition "*Bomolochus soleae*" has been recorded from the back of Atlantic specimens of *Solea solea* (L.); and from the branchial cavity or gills of Mediterranean representatives of this fish.

Bomolochus exilipes C. B. Wilson, 1911

Bomolochus exilipes C. B. Wilson, 1911, p. 377, pl. 58, textfig. 10; Gnanamuthu, 1948, p. 23; Sewell, 1949, p. 157; Carvalho, 1955, p. 143; Shen, 1957, pp. 303, 321; Carvalho, 1958, p. 50.

Female. Total length 1.55 mm. This species shows a great general resemblance to *B. soleae* Claus and differs mainly in the following points: Rostral plate more strongly curved downwards, scarcely visible from above. Thoracic somites 2 to 4 wider, more gradually narrowing. Setae on endopodite of leg 2 short. The setal and spinal formulae, judging from C. B. Wilson's drawings, are slightly different from those of *B. soleae*; this, however, may be mainly due to incorrectness of C. B. Wilson's drawings:

	endopodite	exopodite
leg 1	1 + 0 . 1 + 0 . 5	0 + I . 2 + 0 . 3
leg 2	1 + 0 . 2 + 0 . 3 + II	0 + I . 1 + I . 7 + III
leg 3	1 + 0 . 1 + 0 . 2 + II	0 + I . 1 + I . 6 + I
leg 4	1 + 0 . 1 + 0 . 1 + 1 + I	0 + I . 1 + I . 5 + III

Leg 5 scarcely different from that of *B. soleae*. It is not quite clear whether or not the external marginal spines of the exopodites of legs 2 to 4 are different; in *B. soleae* they consist of a basal portion and a fine flagellum or seta; in *B. exilipes* they may be normally developed.

Male unknown.

The host is *Archosargus probatocephalus* (Walbaum), the type locality Beaufort, North Carolina, U.S.A. Some 15 specimens were found on the gills of this host; these specimens, the only ones so far known, are in the U.S. National Museum and include the holotype.

Bomolochus cuneatus McLean Fraser, 1920

Bomolochus cuneatus McLean Fraser, 1920, p. 45, pl. 1 figs. 1-11; Stock, 1955, p. 59.

Female. Total length 1.9 mm. The following points of difference with *B. soleae* Claus can be deduced from McLean Fraser's description and drawings: Rostral plate more anteriorly produced, forming a conical structure between the antennules. Thoracic somites 2 to 4 broader, more gradually

narrowing. The structure of the antenna does not appear clearly from McLean Fraser's drawing (pl. 1 fig. 3). Maxillule with 3 setae. Claw of maxillipede smaller, basis with only 2 plumose setae. Third exopodal segment of legs 2 to 4 with additional segmentation. Setal and spinal formulae (taken from McLean Fraser's drawings):

	endopodite	exopodite
leg 1	1 + 0 . 1 + 0 . 5	6
leg 2	1 + 0 . 2 + 0 . 3	0 + I . 1 + I . 5 + IV
leg 3	1 + 0 . 1 + 0 . 2 + II	0 + I . 1 + I . 5 + III
leg 4	1 + 0 . 1 + 0 . 1 + 1 + 1	0 + I . 1 + I . 4 + III

Leg 5 with spatulate apical segment with 3 terminal spiniform setae and an external spine. The segment is apparently quite nude.

Male unknown.

The female specimens, the accurate number of which is not stated by McLean Fraser, were obtained from the gills of both *Clupea pallasii* Valenciennes, and from those of *Cymatogaster aggregatus* Gibbons. No holotype has been indicated, whilst it does not appear clearly from McLean Fraser's account which of the two species of fish must be regarded as the type host. The institution where his material is now preserved is unknown to me; the material was obtained from the region of Vancouver Island, British Columbia, Canada.

"Concinnus" group

Two well defined species belong to this group, viz., *Bomolochus concinnus* C. B. Wilson, 1911, and *Bomolochus pectinatus* Stock, 1955. A third species, of which the description is inadequate, *Bomolochus mugilis* Pearse, 1952, may also belong to this group.

The species brought to this group share the following particulars:

Cephalic somite 1.5 times as broad as long, without V-shaped groove. Basal portion of the antennules, as well as the base of the rostral plate, visible from above. Rostrum a plate-like structure, the apex triangularly pointed. No eye visible. Thoracic somites 2 to 5 gradually narrowing, not or only moderately produced backward. Abdomen short, half the length of the cephalothorax; furcal rami cylindrical, 1.5 times as long as wide. Antennules with a 3-segmented basal part, apparently without chitinized plates, and a 3-segmented flagellum, making an obtuse angle with the base. There are 15 short, plumose, sensory appendages. Antenna with first and second endopodal segments separate, both roughened by longitudinal rows of

spinules. In addition there is a pectiniform row of spinules. The claws, of which at least 4 are present, are accumulated at the apex, almost obscuring the lamelliform process. Maxillule with 4 (2 strong, 2 fine) setae. Maxillipede with a strong, feebly curved claw with small auxiliary tooth; basis with 2 or 3 setae. Both rami of leg 1 flattened; exopodite 2-segmented. Leg 2 with strongly flattened endopodite; endopodites of legs 3 and 4 normally developed. External marginal spines of exopodites tubiform, with fine flagellum. Setal and spinal formulae as follows:

	endopodite	exopodite
leg 1	1 + 0 . 1 + 0 . 5	6 + I
leg 2	1 + 0 . 2 + 0 . 3 + (II)	0 + I . 1 + I . 5 + IV
leg 3	1 + 0 . 1 + 0 . 2 + II	0 + I . 1 + I . 5 + III
leg 4	1 + 0 . 1 + 0 . 1 + 1 + 1	0 + I . 1 + I . 4 + III

Leg 5 with short intermediate segment and spatulate apical segment. There are 3 terminal, setiform spines, the median is lengthened. In addition there is a short spine at the external margin. Leg 6 with 3 setae.

Bomolochus concinnus C. B. Wilson, 1911

Bomolochus concinnus C. B. Wilson, 1911, p. 371, pls. 54, 55; Sewell, 1949, p. 157; Stock, 1955, p. 59; Carvalho, 1958, p. 50.

Female. Total length 1.8 mm. Maxillule with 4 strong setae. Maxillipede with 3 plumose setae, claw with fairly big auxiliary tooth. Third exopodal segment of legs 2 to 4 with extra segmentation. Third endopodal segment of leg 2 without the 2 small spines.

Male. Total length 1 mm. For the description see C. B. Wilson, 1911, p. 372.

The type host is *Tylosaurus marinus* (Walbaum) (= *Strongylura marina* (Walbaum)), the type locality Beaufort, North Carolina, U.S.A. The species was found on the gills of its host, but it has not been rediscovered since C. B. Wilson's description. Wilson's material, including the holotype, is in the U.S. National Museum.

Bomolochus pectinatus Stock, 1955

Bomolochus pectinatus Stock, 1955, pp. 55-59, figs. 1-24.

Female. Total length 1.0-1.2 mm. Thoracic somites 3 and 4 slightly produced backward; cephalic somite very wide. Maxillipede with 2 plumose setae; claw with small auxiliary tooth. Third exopodal segment of legs 2 to 4 with incision but without extra segmentation. Third endopodal segment of leg 4 with 2 small spines (in addition to the 3 setae).

The type host is *Leuresthes tenuis* (Ayes), the type locality Mission Beach, San Diego Bay, California, U.S.A. Holotype (female) and allotype (male) in the Zoological Museum, Amsterdam. The specimens were obtained from the branchial cavity of their host, especially from the inside of the operculum. Additional specimens were obtained from the same host at Coronado Strand, and South Pylon, San Diego Bay. This material is also preserved in the Zoological Museum, Amsterdam.

“Palleucus” group

There is but a single species in this group:

Bomolochus palleucus (C. B. Wilson, 1913)

Artacolax palleucus C. B. Wilson, 1913, p. 200, pls. 22, 23; Sewell, 1949, p. 157; Stock, 1953, p. 12.

Bomolochus (Artacolax) palleucus, Shiino, 1957, p. 422.

Female. Total length 1.80 mm. Cephalothorax much inflated, thoracic somites 2 to 4, though they can be distinctly discerned, are partly fused with the cephalic somite and filled with the strongly developed ovaries. There is no groove on the cephalic somite; the antennules are distinctly visible from above; the base of the rostral plate is practically invisible. A small median eye is distinctly visible directly behind the rostral base. Abdomen slender, slightly longer than the cephalothorax; furcal rami cylindrical, twice as long as wide, two of the setae strongly developed. Egg-sacs elongated ovate, as long as abdomen. Antennules with 15 sensory, plumose appendages on the basal part. Antenna roughened by longitudinal rows of small spinules; there is one remarkably strong apical hook, a smaller hooked spine and several setae. Maxillule with 3 setae. Maxillipede with an internal spine on basis; claw strongly sigmoid, with big auxiliary hook. Leg 1 with both rami flattened, exopodal segments fused. Endopodites of legs 2 and 3 flattened, of leg 4 normally developed. Setal and spinal formulae (taken from C. B. Wilson's drawings) as follows:

	endopodite	exopodite
leg 1	1 + 0 . 1 + 0 . 5	6 + I
leg 2	1 + 0 . 2 + 0 . 3 + I	0 + I . 1 + I . 7 + II
leg 3	0 + 0 . 2 + 0 . 2 + II	0 + I . 1 + I . 8
leg 4	1 + 0 . 1 + 0 . I + 1 + I	0 + I . 1 + I . 9

Leg 5 with spatulate apical segment, tipped with 3 setae.

Male. Total length 1.3 mm. This sex has been described by C. B. Wilson (1913, p. 202).

The type host is *Scorpaena plumieri* Bloch, the type locality Montego Bay, Jamaica. The species was found to be common on the gills of its host; it has not been rediscovered since C. B. Wilson's description. Wilson's material, including the holotype, is in the U.S. National Museum. Paratypes are in the Zoological Museum, Amsterdam. These paratypes were apparently studied by Stock but not redescribed. The description of the legs of the female, however, leaves much to be desired and C. B. Wilson's drawings of the structure of the antennae is far from clear.

Bomolochoides nov. gen.

DIAGNOSIS. Female. Cephalothorax differently developed in the various species, but head and first thoracic somite fused to form the cephalic somite, which is 1.5 times as wide as long. The remaining thoracic somites either gradually tapering or forming, with the cephalic somite, a large, globular cephalothorax. Abdomen short, half the length of cephalothorax; furcal rami tubular, about as long as wide, with 5 marginal and 1 appendicular seta on each ramus. Egg-sacs ovate. Antennules composed of a more or less fused 3-segmented basal portion, without chitinized basal plates and with an increased number of plumose sensory appendages (20-22). Flagellum 3-segmented. Rostrum strongly developed, plate-like, curved ventro-caudally, base visible between the antennules; apex not incised. Antenna of the usual type, first and second endopodal segments roughened by longitudinal rows of fine spinules; in addition there are 3 hooked spines, 1 straight spine and a lamellar process. Maxillipedes with strongly curved claw without auxiliary spine; one plumose seta may be present. Both rami of leg 1 flattened; segments of exopodite fused. Legs 2 to 4 with 3-segmented rami; endopodite of leg 2 flattened. An additional segmentation may be present in the third exopodal segment of these legs, so that the exopodites may appear to be 4-segmented. Setal and spinal formulae (taken from C. B. Wilson's descriptions of *Bomolochus nitidus* and *B. scutigerulus*) as follows:

	endopodite	exopodite
leg 1	I + 0 . I + 0 . 5	6 + II
leg 2	I + 0 . I + 0 . 2	0 + I . I + I . 5 + III-IV
leg 3	I + 0 . I + 0 . 4	0 + I . I + I . 4 + III
leg 4	I + 0 . I + 0 . I + I + I	0 + I . I + I . 4 + III

Leg 5 with short intermediate segment, apparently without seta; apical segment spatulate, with 3 terminal setae.

Males unknown.

Parasites of the gill chamber of fishes, usually attached to the gill filaments.

Type species: *Bomolochus nitidus* C. B. Wilson, 1911. Further species: *Bomolochus scutigerulus* C. B. Wilson, 1936.

REMARKS. The principal feature separating this genus from *Bomolochus* sensu stricto, is the increased number of plumose sensory setae on the basal part of the antennules. The two species that have been included in this genus can be distinguished as follows:

1. Body cyclopoid, i.e., the thoracic somites gradually narrow; the third exopodal segments of legs 2 to 4 with extra segmentation, so that the exopodites of these legs appear to be 4-segmented. Rostrum squarish. . . . *B. nitidus* (C. B. Wilson)
- Cephalothorax large, inflated, pear-shaped, anteriorly broadly rounded, posteriorly fairly narrowly rounded, abdomen short. Rostrum a big, shield-shaped structure, the base of which is visible between the antennules, the apex is more or less triangular. *B. scutigerulus* (C. B. Wilson)

***Bomolochoides nitidus* (C. B. Wilson, 1911)**

Bomolochus nitidus C. B. Wilson, 1911, p. 374, pl. 56, pl. 58 fig. 201, textfig. 8; Bere, 1936, p. 582; Heegaard, 1947, p. 199, pl. 25 fig. 192; Sewell, 1949, p. 157; Pearse, 1952a, p. 196; Stock, 1953, p. 12; Carvalho, 1955, p. 143; Carvalho, 1958, p. 50.

Female. Total length 2.2 mm. Cephalic somite 1.5 times as long as wide, anteriorly rounded, posteriorly cut off squarely. Thoracic somites 2 to 4 gradually narrowing, normally developed, not inflated or produced backward. Antennules with 22 plumose, short, sensory appendages on the basal portion. Rostral base visible between antennules, apex squarish. Maxillipede with smooth, strongly curved claw without auxiliary tooth and 1 plumose seta. Exopodites of legs 2 to 4 with extra segmentation of the third segment, so that they appear 4-segmented. Leg 5 with broadly spatulate apical segment.

Male unknown.

The type host is *Mugil cephalus* L., the type locality Beaufort, North Carolina, U.S.A. Only two specimens (females) were found attached to the gills of several hundred fishes examined. C. B. Wilson's material, including the holotype, is in the U.S. National Museum. The species has also been recorded by Bere (1936) from the branchial cavity of *Strongylura timuca* (Walbaum) captured in Lemon Bay, West coast of Florida, U.S.A.

***Bomolochoides scutigerulus* (C. B. Wilson, 1935)**

Bomolochus scutigerulus C. B. Wilson, 1935, p. 335, pl. 2 figs. 14-22; Sewell, 1949, p. 157; Stock, 1953, p. 12.

Female. Total length about 3 mm (exact size not given in C. B. Wilson's description; the figure given above is taken from the drawing). Cephalotho-

rax broadly ovoid (obovate in Wilson's description), anteriorly broadly rounded, posteriorly narrowly rounded; fourth thoracic somite small. Rostrum a conspicuous structure at the anterior portion of the head, with a distinctly trilobated basal portion and a triangular apex. Eye small, situated in the median line almost near posterior end of the cephalic somite, deep in the tissue and scarcely visible. Antennules with on their basal portions 20 short, plumose sensory appendages. Abdomen very short, about $\frac{1}{3}$ the length of the cephalothorax. Maxillipedal claw smooth; there are no plumose setae on the basis. Apical segment of leg 5 scarcely spatulate, with 3 well developed, apical setiform spines.

Male unknown.

The type host is *Pseudupeneus maculatus* (Bloch) (= *Upeneus maculatus* (Bloch)), the type locality the area around Dry Tortugas, Florida, U.S.A. Only 4 specimens were found on the gills of the host; they are preserved in the U.S. National Museum and include the holotype. The species has not been recorded again since C. B. Wilson's description was published.

REMARKS. The description of this form leaves much to be desired. I have not included a reference to the "attachment pad" in the diagnosis of this species, as the structure (and function) of this "pad" does not appear clearly from the description and the occurrence of this pad is apparently quite exceptional amongst the Bomolochinae. Wilson's description of the structure of the antennae too is ambiguous. His drawing (pl. 2 fig. 16) suggests the presence of a pectinate row of spinules, but as Wilson speaks of the endopodal segments as being "bordered with a narrow corrugated flange", a reference to a pectinate structure has been omitted from the key and the description, as there may be no more than the customary corrugations caused by fine spinules.

Parabomolochus nov. gen.

DIAGNOSIS. Female. Body cyclopoid, i.e., thoracic somites 2 to 4 gradually narrowing; outline of body without sharp constrictions. Head and first thoracic somite fused to form cephalic somite, this 1.5 times as long as wide, anteriorly broadly rounded, posteriorly cut off squarely. Cephalic somite with or without a V-shaped, longitudinal groove; rostral base distinctly visible between the basal portion of antennules, rostrum curved caudo-ventrally, apex bifid and produced into a pair of acute points. Thoracic somites 2 to 4 either normally developed or slightly produced backward. Fifth thoracic somite small, fused with or separate from genital somite. Abdomen normally developed, about half the length of cephalothorax, genital somite with slightly or well developed lateral swellings. Furcal rami tubular or slightly narrowing

near the apex, with 5 marginal setae, 2 of which are lengthened, and 1 appendicular seta. Antennules with 3-segmented basal portion and 3- or 4-segmented flagellum. Basal portion ventrally covered with chitinized plates, that form finger-shaped processes, fusing with the sensory appendages 3 to 13; the fourth sensory appendage (counted from the median plane outwards) is modified and represented by a strong hook. Appendage 1, 2, 14 and 15 normally developed. Endopodite of antenna with longitudinal bands of small spinules, that give the surface a corrugated appearance. In addition there is a pectinate row of spinules on the first endopodal segment, continuing on the lamellar process. Maxillule with 4 setae. Maxillipede with a strong, sigmoid claw with a big auxiliary tooth. Basis with 2 or 3 plumose setae. Leg 1 with both rami flattened; exopodite with fused segments. Endopodite of leg 2 flattened. All exopodites of legs 2 to 4 with curiously shaped external marginal spines; external margin with several coarse spines or a fringe of fine spinules, running into a big spine or spur at the end of the external margin. Apex of spine with fine flagellum. Setal and spinal formulae (for all species with the exception of *P. xenomelanirisi*) as follows:

	endopodite	exopodite
leg 1	1 + 0 . 1 + 0 . 5	6 + I-III
leg 2	1 + 0 . 2 + 0 . 3 + I-II	0 + I . 1 + I . 5 + IV
leg 3	1 + 0 . 1 + 0 . 2 + II	0 + I . 1 + I . 5 + III
leg 4	1 + 0 . 1 + 0 . I + I + I	0 + I . 1 + I . 4 + III

Third exopodal segment of legs 2 to 4 occasionally with extra segmentation; exopodites then consequently 4-segmented.

Leg 5 with short intermediate segment; apical segment spatulate, with 3 setae or setiform spines at the apex (median lengthened), and 1 short spine at the external margin.

Males much smaller than females, with reduced number of sensory setae on the antennules. Maxillipedes chelate, attaching male to abdomen of female. Genital somite enlarged. Intercoxal plates of legs 1 to 4 covered with small spinules, apparently serving as organs of attachment. Setation of legs different from that of female; leg 4 with 2-segmented endopodite. Leg 5 without intermediate segment, apical segment spatulate, with 2 setae.

Parasites of the gill chambers of fishes, either attached to the gill filaments or to the inside of the operculum.

Type species: *Bomolochus bellones* Burmeister, 1835.

REMARKS. This genus is characterized by particulars of the antennules, the antennae, the maxillipedes, and the legs and therefore it is much more

- Cephalic somite swollen and greatly produced laterally, sides rounded. There is a shallow longitudinal groove. Corrugations on the endopodite of the antenna caused by few rows of fairly big spinules *P. psettobius* nov. spec.

Parabomolochus bellones (Burmeister, 1835) (figs. 1-4)

Bomolochus bellones Burmeister, 1835, pp. 298, 328, pl. 24 figs. 1-6; Deshayes & Milne Edwards, 1838, p. 212; Milne Edwards, 1840, p. 479; Claus, 1864, p. 374; Heller, 1866, p. 751; Hartmann, 1870, p. 116, pl. 3 figs. 1-8, pl. 4 figs. 1-6; Richiardi, 1880, p. 147; Valle, 1882, p. 57; Carus, 1885, p. 353; Dalla Torre, 1889, p. 86; Bassett-Smith, 1899, p. 442; Brian, 1902, p. 33; Brian, 1906, p. 39; Pesta, 1928, p. 133, fig. 114; Leigh-Sharpe, 1933, p. 110; Leigh-Sharpe, 1933a, p. 113; Leigh-Sharpe, 1935, p. 268, fig. 3; Van Oorde-de Lint & Schuurmans Stekhoven, 1936, p. 101, fig. 45; Gouillart, 1937, p. 323; Yamaguti, 1939, p. 398; Sewell, 1949, pp. 182, 188; Marine Biological Association, 1957, p. 175.

The type host is *Esox bellone* L. (= *Belone bellone* (L.)), the type locality the area of Heligoland, N. W. Germany. The parasite occurs on the gills and on the inside of the operculum of its host. The species has also been recorded from the Plymouth area and from the Mediterranean. It does not appear to be rare. The type material is probably lost.

The following notes are based on a number of specimens now in the collection of the Rijksmuseum van Natuurlijke Historie, Leiden.

MEASUREMENTS. Total length 1.74-1.87 mm; greatest diameter 0.86-1.02 mm. Length of cephalothorax 1.11-1.12 mm; length of abdomen 0.63-0.75 mm. Length of cephalic somite 0.45-0.50 mm. Length of second thoracic somite 0.18-0.24 mm; width of same 0.71-0.90 mm; length of third thoracic somite 0.30-0.35 mm; diameter of same 0.45-0.54 mm; length of fourth thoracic somite 0.15 mm, diameter of same 0.36-0.38 mm; length of fifth thoracic somite 0.13-0.14 mm; width of same 0.27-0.30 mm. Total length of genital somite 0.20-0.26 mm; width of same 0.29-0.31 mm; length of third abdominal somite 0.08-0.11 mm; width of same 0.20 mm; length of fourth abdominal somite 0.07-0.08 mm; width of same 0.18 mm; length of fifth abdominal somite 0.09 mm; width of same 0.14 mm. Length of furca 0.09 mm, diameter at base 0.05 mm. Length longest furcal seta 0.46-0.53 mm.

DESCRIPTION. The following description is based on a female specimen of 1.75 mm length, which has been dissected and the appendages mounted. Another female specimen, 1.87 mm long, has also been dissected.

General shape of the body characterized by strong development of the cephalic somite; the following somites rapidly decrease in width until the fifth thoracic somite is reached. The abdomen is short and tapers very gradually (fig. 1a).

Head and first thoracic somite completely fused to the cephalic somite; there is no line of fusion. In dorsal aspect its outline is more or less semicir-

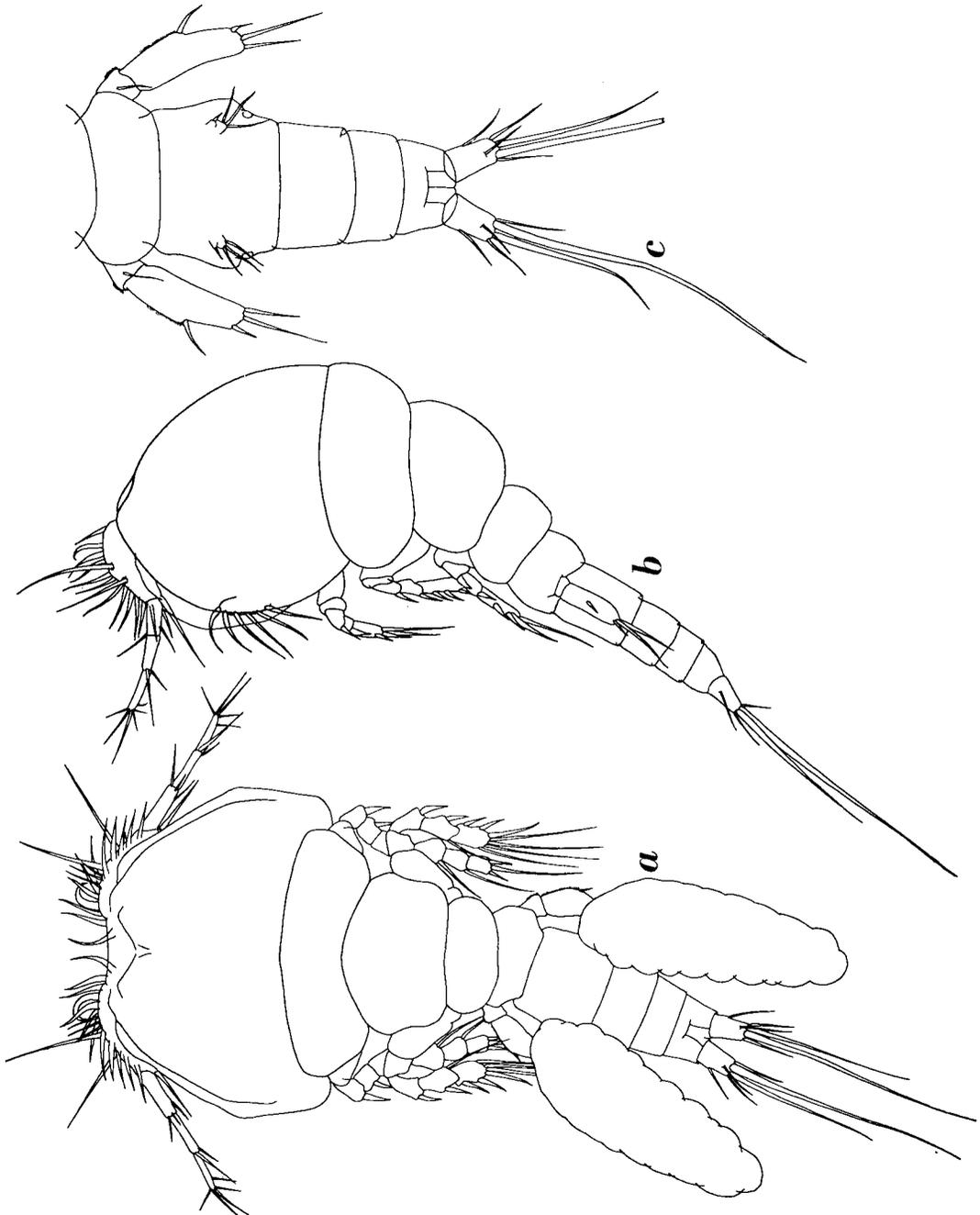


Fig. 1. *Parabomolochus bellones* (Burmeister), adult ♀ from *Belone bellone* (L.). a, whole animal, dorsal aspect; b, whole animal, lateral aspect from left side; c, 5th thoracic somite and abdomen, dorsal aspect. a, b, $\times 52$; c, $\times 85$.

cular with irregular edges, cut off squarely caudally and exactly twice as wide as long. The front is deeply depressed between the antennular bases so that the rostral plate is invisible from above. The more or less triangular, depressed part continues caudally as a shallow groove in the mid-dorsal line. Along the lateral parts of the cephalic somite there is a weak hyaline lamella. In lateral aspect the sides of the cephalic somite are absolutely flat and the dorsal wall is swollen, so that the whole cephalic somite has the shape of a big sucking disk (fig. 1b). The swollen condition of the cephalic somite is variable in the various specimens (as is the condition of the second and third thoracic somites) and apparently depends upon the development of the ovaries. It never covers a portion of the second thoracic somite and leaves the basal parts of the antennules completely free for inspection from above.

The second thoracic somite is narrow, laterally cut off almost squarely, but in lateral aspect with rounded sides and swollen dorsally.

The third thoracic somite is longer than the second, but less wide; sides, in dorsal view, slightly concave, in lateral aspect rounded, with rounded, swollen, dorsal outline. The fourth thoracic somites small, dorsally and laterally with rounded sides. The third and fourth thoracic somites caudally produced.

The fifth thoracic somite distinctly visible from above, slightly shorter than and almost as wide as the fourth, laterally slightly produced to form base of attachment for the fifth legs.

Genital somite composed of the fused abdominal somites 1 and 2, no line of fusion being visible in dorsal or lateral aspect. The somite is distinctly swollen laterally; the genital apertures are placed latero-dorsally, above the swollen parts of the genital somite and are covered by small genital plates (sixth legs), composed of a distinct basal part, bearing a short external seta, and an apical part with 3 fairly long, nude setae (figs. 1c, 2b). The receptacula, also placed laterally, are distinctly visible immediately behind the genital apertures. The third, fourth and fifth (anal) somite gradually tapering, slightly conical, the third shorter than the genital somite, the fourth shorter than the third, and the anal somite as long as the third abdominal somite. There is a distinct, broadly rounded anal flap, there are no hairs, teeth or spines along the abdominal somites.

Furcal rami slightly divergent, about twice as long as wide, slightly tapering, nude. There are 5 marginal setae and an appendicular seta. Setae 1, 4, 5 and appendicular seta small and nude; the first at end of the internal, the fourth at the end of the external border. The fifth inserts at the external margin at $\frac{1}{3}$ its length from the apex. The appendicular seta is placed on a small socle; its place can best be judged from fig 1c. Setae 2 and 3 are



Fig. 2. *Parabomolochus belloncs* (Burmeister), adult ♀ from *Belone bellone* (L.). a, ventral aspect of left part of cephalothorax, showing the basal part of the antennule, the antenna and the oral appendages; b, 5th thoracic somite and abdomen, lateral aspect from right side; c, d, antennule, ventral aspect; e, maxillipede. a, c-e, $\times 185$; b, $\times 70$.

lengthened and thickened, especially the second, reaching the length of the abdomen, the third is slightly shorter.

Many specimens have egg-sacs attached to the sides of the genital somite. Shape of egg-sacs variable, from globular to elongated ovate, much longer than the abdomen and containing many eggs.

The outline of the cephalic somite, as appears also from the lateral aspect, is flat; the ventral wall is deepened and strongly reinforced with chitinized ridges. The oral appendages are attached in the hollow part of the ventral wall and do not protrude beyond the plane of the cephalic outline.

Rostrum visible ventrally as a caudally produced plate with rounded edge, apex provided with a strongly chitinized part, consisting of two laterally directed points, united at the base by a strong ridge (fig. 2a). Ventrally to the rostral plate the ventral cephalic wall has a strongly chitinized ridge, supporting the labrum.

Antennules composed of a 3-segmented basal and a 3-segmented apical part (fig 2c, d). The basal segments are big, the proximal two are greatly developed, fused to the lateral thoracic wall and reinforced, ventrally, with a system of chitinized plates. The third basal segment is small and apparently free. There are 2 kinds of appendages on the basal antennular segments: setae and sensory appendages. There is a group of 3, one of 2, and one of a single seta on the second antennular segment and 1 seta on the third. Two of the setae are lengthened. In addition there are 3 setae on the ventral aspect of the first antennular segment, close to the articulation with the second. There are 15 sensory setae along the fronto-lateral border of the 2 proximal antennular segments; their position can best be judged from fig. 2a. Each seta has a thick base and rapidly tapers into a fine point; they are more or less ringed and densely hairy. Sensory setae 3 to 10, counted from the median line, each are ventrally reinforced by a pointed prolongation of the ventral, antennular plates. These points usually reinforce the median part of each seta for a short distance, but are particularly strongly developed in the fourth and fifth sensory brush. The character of the fourth seta consequently is changed, it forms a nude, crochet-shaped appendage, the median wall forms a sharp, knife-shaped edge, highly chitinized and also in dorsal aspect a very remarkable structure. The chitinized plates laterally rapidly decrease in size. The fourth antennular segment with 4 setae, the fifth with 2, and the sixth with 6 setae: 2 lateral and 4 apical.

Antenna 4-segmented, with long coxa, short basis and 2-segmented endopodite. The antennae are attached to the lateral parts of the ventral cephalic wall, turned medially and almost touch in the median line under the rostrum. Endopodite folded laterally over the coxa. There is a small seta on the basis,

the coxa is nude. The first endopodal segment big, the second small and almost fused to the first. Frontal surface of first and second endopodal segments with longitudinal rows of small scales, giving the impression of a

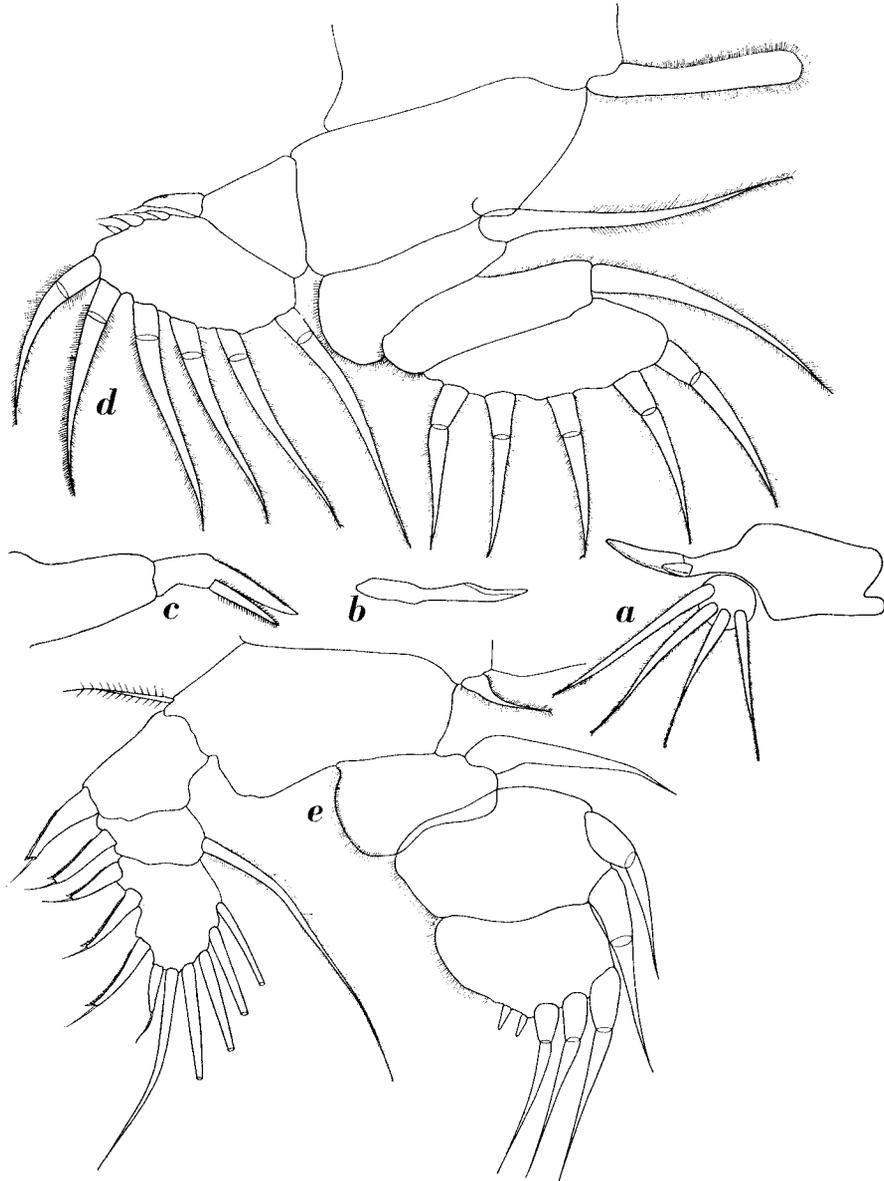


Fig. 3. *Parabomolochus bellones* (Burmeister), adult ♀ from *Bclone bellone* (L.).
a, mandible and maxillule; b, paragnath; c, maxilla; d, leg 1; e, leg 2. a-e $\times 185$.

corrugated surface. There is a firm, pectiniform row of flat spinules along the extreme frontal edge of the first segment (fig 2a). Some distance proximally to the insertion of the second segment there is a short, pointed process, bearing a row of crochet-shaped spines, and a hooked seta. In addition there are 3 large crochet-shaped spines and 3 setae, inserting near the apex of the first endopodal segment. The labrum is a large plate, covered by short hairs; it is reinforced frontally by a complicated system of chitinized ridges, the free wall indistinctly bilobated and covering the tips of the mandibular prolongation. Labium small, with thickened free wall, immediately behind the maxilla. Mandible (figs. 2a, 3a) composed of a big plate, firmly articulating with the ventral cephalic wall, produced into a long masticatory process, bearing a very thick, transversely ribbed tooth and a small auxiliary tooth. Maxillule (fig. 3a) small, shaped as a small, rounded protrusion, bearing 2 strong and 2 fine setae. Paragnaths (fig. 3b) club-shaped, nude. Maxilla (fig. 3c) with a broad proximal portion, produced into a single endite, carrying a strong, hairy spine, coalescent with the endite, and a smaller, spinulose spine.

Maxillipedes (fig. 2a, e) powerfully developed, with a short coxa attached to the ventral wall, laterally to the insertion of mandibles, maxillules and maxillae. Basis big, triangular, apex directed frontally, bearing, near the apex, a strong and a small seta. Endopodite reduced to form a highly chitinized, sigmoid claw with an acute auxiliary tooth, bearing near its base a fine, plumose seta.

Setal and spinal formulae of the legs:

	endopodite	exopodite
leg 1	I + 0 . I + 0 . 5	0 + I . 6 + III
leg 2	I + 0 . 2 + 0 . 3 + II	0 + I . I + I . 5 + IV
leg 3	I + 0 . I + 0 . 2 + II	0 + I . I + I . 5 + III
leg 4	I + 0 . I + 0 . I + I + I	0 + I . I + I . 4 + III

The first legs (fig. 3d) strongly flattened, with broadened, 3-segmented endopodites and shorter, 2-segmented exopodites. First exopodal segment with a small external spine, second exopodal segment with 3 small external spines and 6 huge, densely plumose, marginal setae. First and second endopodal segments each with internal seta and strongly haired external border; apical segment with 5 big, densely plumose setae. Legs of left and right side connected by a strong intercoxal trabecele; each coxa internally with a hairy, elongate flap.

Legs 2 to 4 with transversally elongated coxae and bases, especially leg 4.

All have 3-segmented endo- and exopodites; the endopodite of leg 2 is broadened and very flat. The details of the legs can be taken from the setal and spinal formulae, the figures and the following notes.

Leg 2 (fig. 3e) with small internal seta on coxa, close to strongly hairy coxal trabecle. Spinulose external seta on basis, close to articulation with the exopodite. All external spines of exopodite curiously shaped; composed of a basal, spiniform part, with finely serrated external lamella, terminating in a much bigger tooth, and a flagellum. Endopodite strongly broadened and compressed, internal setae on segments 1 and 2 with thick base, plumose. Apical segment with 3 setae and 2 short, blunt spines. External border of all endopodal segments densely haired.

Leg 3 (fig. 4b). Coxa and basis as in leg 2. External spines of exopodite and apical spine on third exopodal segment as in leg 2. Endopodite of normal shape, external margin hairy, setae at internal border slender. Apical endopodal segment with 2 setae and 2 short, blunt spines.

Leg 4 (fig. 4a). No seta on coxa, seta at basis very fine, nude. External and apical spine of exopodite as in legs 2 and 3. Endopodite normal, internal setae of segments 1 and 2 short, hairy. Apical endopodal segment with 2 slender spines, flanking a long seta. Internal border of endopodite hairy.

Leg 5 (fig. 4c) 2-segmented. Basal segment short, external wall spinulose, with a fine seta. Apical (free) segment slightly spatulate, external margin hairy, end of internal margin with long hairs. There is a short external spine slightly under the middle and 3 apical appendages: a short spine, a seta, and a slender, internal spine.

About 50 specimens, all females, were removed from 15 specimens of *Belone bellone* (L.); the parasites occurred on the gills and the inside of the operculum. The fishes were purchased at the local fish market of Leiden on May 16th, 1960, by Mr. H. E. Muller; they had been captured some days before in Dutch coastal waters, the exact locality being unknown. In spite of a very careful search no males of the parasite were found; the branchial cavities of the fish, however, were dirty and full of mucus, so that they may have escaped attention. The male of this species has been described and figured by Hartmann (1870, p. 136).

Parabomolochus unicirrus (Brian, 1902)

Bomolochus unicirrus (nomen nudum)) Richiardi, 1880, p. 147; Carus, 1885, p. 353; Brian, 1899, p. 197.

Bomolochus unicirrus Brian, 1902, p. 30, pl. 1 figs. 1-8; Thompson & A. Scott, 1903, p. 293; Brian, 1906, p. 30; Brian, 1924, p. 9, fig. 5; Gnanamuthu, 1948, p. 23; Sewell, 1949, pp. 169, 182, 188; Shiino, 1957, p. 422.

Female. Total length about 2.5 mm. Cephalic somite anteriorly rather flat,

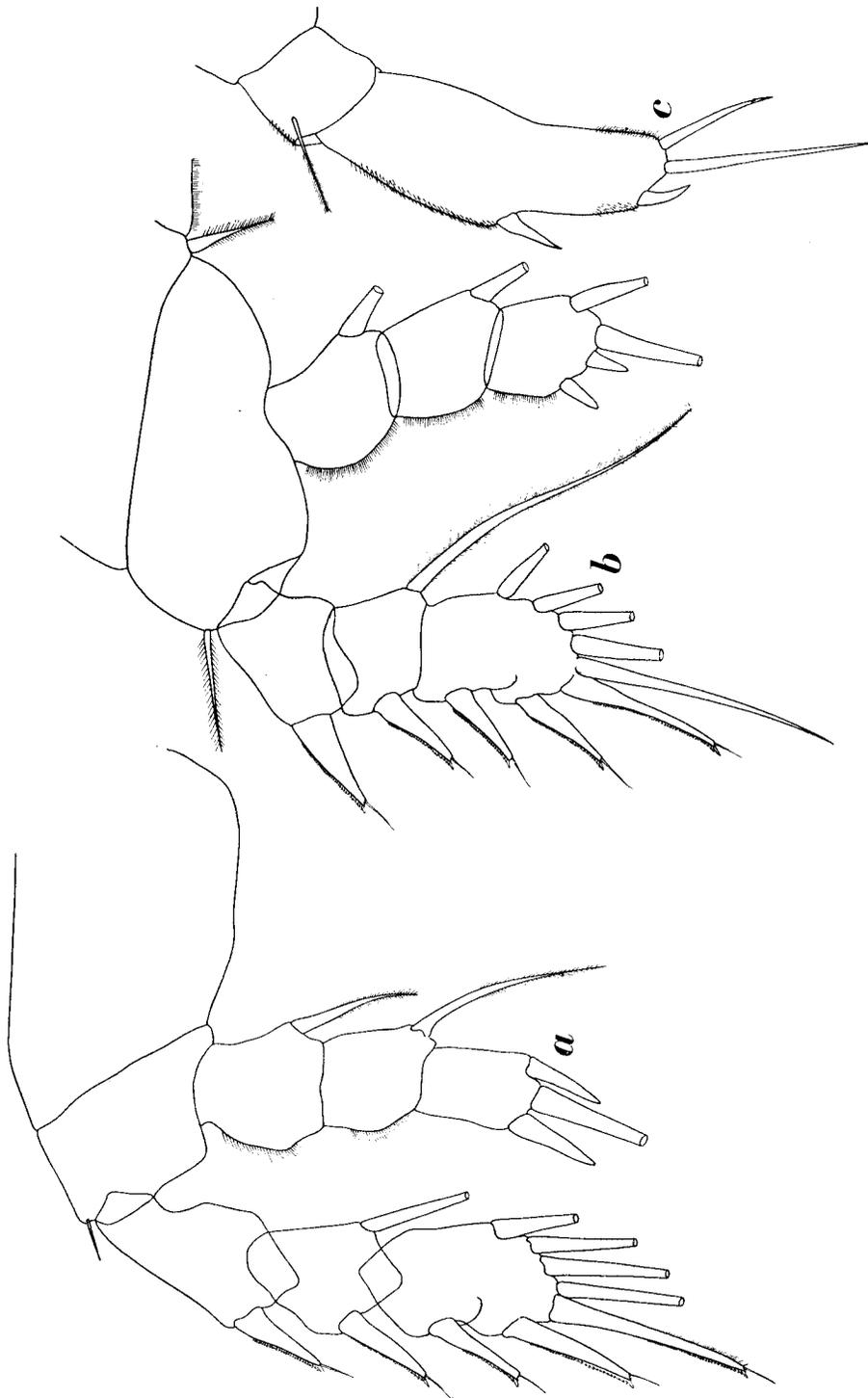


Fig. 4. *Parabomolochus bellones* (Burmeister), adult ♀ from *Belone bellone* (L.). a, leg 4; b, leg 3; c, leg 5. a-c, X 225.

because of the wide rostral base, which is distinctly visible between the antennular bases. No eye is visible. Thoracic somites 2 to 4 very gradually narrowing, thorax imperceptibly merging into abdomen, sides of genital somite rounded. Furcal rami conical, slightly narrowing. Spines along the external margin of exopodite of legs 2 to 4 with 3 to 6 strong spines along their outer edge; inner edge smooth, flagellum fine. Curved spine on antennular base (seta no. 4) slightly bigger than remaining setae, its length apparently subjected to variation. Setal and spinal formulae (taken from Brian's (1902) figures) as follows:

	endopodite	exopodite
leg 1	I + 0 . I + 0 . 5	6
leg 2	unknown	unknown
leg 3	I + 0 . I + 0 . 2 + II	0 + I . I + I . 5 + III
leg 4	I + 0 . I + 0 . I + I + I	0 + I . I + 0 . 5 + III

Male unknown.

The type host is *Lichia glauca* Risso, the type locality Portoferraio, Elba Island, Italy. The parasite was found in the branchial cavity of its host. Type specimen and paratype in the Zoological Museum of the University of Genoa. Additional specimens were recorded from the branchial chamber of *Amphisile scutata* (L.) (= *Centriscus scutatus* L.) captured off Ceylon (Thompson & A. Scott, 1903); females and males are mentioned but unfortunately not described. The species is also mentioned from *Lichia amia* Cuvier and *Sphyræna vulgaris* Cuvier & Valenciennes (= *Sphyræna sphyræna* (L.)), both from the Mediterranean (Brian, 1906). It was also recovered from the branchial cavity of *Lichia vadigo* Risso captured in the tropical Atlantic off Mauretania, W. Africa (Brian, 1924).

REMARKS. This species was briefly mentioned by Richiardi in 1880; it was described by Brian in 1902; Brian's description has been supplemented in 1924, but the species is still far from clearly established, as the structure of antennae and maxillipedes, as well as the setal and spinal formulae of the legs, are imperfectly known. The species, however, undoubtedly is a *Parabomolochus*, though of somewhat uncertain standing. A complete redescription of this form is much needed.

Parabomolochus megaceros (Heller, 1865)

Bomolochus megaceros Heller, 1865, p. 153, pl. 13 fig. 2; Bassett-Smith, 1898, p. 2; Bassett-Smith, 1898b, p. 358, pl. 10 fig. 1; Bassett-Smith, 1899, p. 442; Gnanamuthu, 1948, p. 23; Gnanamuthu, 1949, p. 359, figs. 1-7; Gnanamuthu, 1949a, p. 318; Sewell, 1949, p. 163; Stock, 1955, p. 58.

Bomolochus (Pseudobomolochus) decapteri Shen, 1957, pp. 305, 321, pls. 5, 6.

Female. Total length 3.10-4 mm. Cephalic somite wide, anteriorly with flattened rostral base, distinctly visible between the basal portions of the antennules; rostral plate terminating into two small points with thickened bases. No eye is visible. There is a deep, and anteriorly fairly wide, V-shaped groove on the cephalic somite. Thoracic somites 2 to 4 gradually narrowing, cephalothorax imperceptibly merging into abdomen. Abdomen slightly longer than half the length of cephalothorax; egg-sacs elongated sausage-shaped. Basal part of antennules with 14 sensory appendages, of which the fourth, counted from the median plane outwards, is modified to form a long spine, which is twice the length of the remaining setae, and has the apex curved outwards. Flagellum 3-segmented. Antenna with endopodite roughened by longitudinal rows of fine spinules; in addition there is a pectinate row of short spines on the first endopodal segment, continuing on the lamellar process. Maxillule with 2 long and 2 short setae. Paragnaths with a hairy tubercle. Maxillipede with 2 long setae and 1 short, plumose seta. Spines along external margin of exopodite of legs 2 to 4 with 6 to 7 big teeth along outer edge; inner edge smooth. Third endopodal segment of leg 2 with 2 short spines and 3 setae. Apical segment of leg 5 spatulate; leg 6 with 3 setae.

The male has been described by Bassett-Smith (1898b, p. 358), both description and drawings are inadequate to recognize this male from other male Bomolochids. A much better description has been published by Shen (1957, pp. 307, 321, pl. 6) under the name *Bomolochus (Pseudobomolochus) decapteri*. Length 0.88 mm.

The type host is *Stromateus niger* Bloch (= *Parastromateus niger* (Bloch)), the type locality Indian Ocean (without further specification). The parasites were found in the branchial cavity of the host, attached to the gills. Additional specimens from the same host were recorded by Bassett-Smith (1898b) from Bombay (India), Colombo (Ceylon), and Baluchistan, and from *Caranx djedaba* (Forskål) from Aden. Gnanamuthu (1949) records specimens from the inside of the operculum of *Stromateus niger* Bloch caught off Madras, India. Heller's holotype specimen very probably is no longer extant.

REMARKS. As mentioned above the male of this characteristic species was briefly described and figured by Bassett-Smith (1898b). His drawings and descriptions were hastily done and are far from satisfactory. The species was subsequently recorded by Gnanamuthu (1949); the female is briefly described and the supposed male more completely described and figured. Gnanamuthu's figures and his descriptions of the male leave no doubt that what he actually saw and described was a young female and not a mature

male. The specimens recorded by Shen (1957) as *Bomolochus* (*Pseudobomolochus*) *decapteri* in my opinion also belong to *Parabomolochus megaceros* (Heller). *Parabomolochus decapteri* is a species with a very differently developed cephalothorax and quite different antennular structure; besides, it is much smaller. A comparison of Shen's plate 5 with Heller's drawings of *Bomolochus megaceros* shows that both forms have the same general shape, with a swollen genital somite and an identical antennular structure. In Heller's figure (pl. 13 fig. 2) the two normal, lateral setae of the antennular base are figured too heavy, though in *Parabomolochus megaceros* they seem to be better developed than in other representatives of this genus. Shen has brought his specimens to the subgenus *Pseudobomolochus* Yamaguti, 1939, characterized principally by the tripartite chitinized plate dorsally of the antennular base, a feature which is fully absent from either *Parabomolochus decapteri* or *P. megaceros*. Shen's records of *Parabomolochus megaceros* are from the following hosts and the following Chinese localities: *Stromateoides sinensis* (Euphrasen) from Kwanghai, Kwangtung Province, on gill raker; *Caranx* spec., Konchung, Hainan Island, on inside of operculum and gill filaments; *Mugil* spec., Yin-Ku Bay, Hainan Island, inside of operculum; *Therapon theraps* Cuvier & Valenciennes (= *Eutherapon theraps* (Cuvier)), Yin-ku Bay, Hainan Island, and *Megalaspis cordyla* (L.), inside of operculum and on gill filaments, Sam-ha, Hainan Island.

***Parabomolochus decapteri* (Yamaguti, 1936)**

Bomolochus decapteri Yamaguti, 1936, p. 5, pl. 4 fig. 49, pl. 5 figs. 50-60; Yamaguti, 1939, p. 395; Sewell, 1949, p. 163; Gusev, 1951, p. 397; Yamaguti, 1953, p. 223; Stock, 1955, p. 59; Shiino, 1957, p. 422; Yamaguti & Yamasu, 1959, pp. 90, 93.

Female. Total length 1.75 mm. Cephalothorax 1.25 times as wide as long, anteriorly fairly obtuse by the presence of a flat rostral base between antennular bases. There is a shallow groove on the cephalic somite. Thoracic somite 2 and 3 only slightly narrower than the cephalic somite. The third somite is produced backward and partly covers the much narrower fourth thoracic somite. Abdomen short, half the length of the cephalothorax. Egg-sacs oblong-ovate. Antennular base with 15 plumose, sensory appendages; third to thirteenth ventrally reinforced; fourth modified and shaped as a strong hook, slightly larger than remaining setae. Flagellum 3-segmented. No eye visible. Antenna with longitudinal rows of very fine spinules on endopodite; in addition there is a pectinate row of spinules, continuing on the lamellar process. Maxillule and maxillipede as in previous species. Spines along external margin of exopodite of legs 3 and 4 with 3 to 6 acute spinules along outer margin; inner margin smooth. Anal somite, furca and exopodites

of legs 2 to 4 with spinulose patches. Leg 5 as in previous species.

Male unknown.

The type host is *Decapterus maruadsi* (Temminck & Schlegel), the type locality Sea of Japan. The two mature female types were found attached to the inside of the operculum of their host. Additional specimens were recorded by Yamaguti (1939) from the gills of *Trachurus trachurus* (L.), captured in the Pacific Ocean (exact locality not stated in Yamaguti's paper). Location of the holotype unknown, probably in the private collection of Dr. Yamaguti.

Gusev (1951, p. 397) records this species from the northern part of the Sea of Japan (off Antonovo, some 10 km. north of Kholmsk, Sakhalin) from two different hosts, viz. *Colalabis saira* (Brevoort) (the type host of *Parabomolochus tumidus* (Shiino)) and *Hyporhamphus sajori* (Temminck & Schlegel). Gusev's description is very brief and, moreover, is unaccompanied by drawings. I am inclined to consider these records with some doubt. The parasites occurred on the gills and on the inside of the operculum of their hosts.

Parabomolochus xenomelanirisi (Carvalho, 1955)

Bomolochus xenomelanirisi Carvalho, 1955, p. 144, pls. 1, 2.

Female. Total length 1.3-1.7 mm. Cephalic somite only slightly wider than long, anteriorly broadly rounded. Rostral plate fairly narrow, apically running into two widely diverging, acute points. Thoracic somites 2 to 4 gradually narrowing, the third produced backward and partly covering the fourth. Abdomen short, half the length of cephalothorax. Antennules with on basal part an apparently reduced number (12) of plumose sensory appendages, the second (counted from median plane outwards) shaped like a hook and about as long as the remaining setae. Flagellum 4-segmented. No eye visible. Antenna with endopodite basally swollen, rows of fine spinules interrupted. Maxillipede with 2 plumose setae. Third exopodal segment of legs 2 and 3 with extra segmentation, so that apparently the exopodites are 4-segmented. Third endopodal segment of leg 2 with 2 spines and 3 setae. Third exopodal segment of leg 4 with 3 setae and 3 spines. External marginal spines of exopodites legs 2 to 4 with along outer margin a row of fine spinules, running into stronger spinule just above insertion of flagellum.

Male. Total length 0.7 mm. For a description of this stage see Carvalho, 1955, p. 147.

The type host is *Xenomelaniris brasiliensis* (Quoy & Gaimard) (= *Thyrina brasiliensis* (Quoy & Gaimard)), the type locality Cananéia, near São

Paulo, Brazil. The parasites were found attached to the inside of the operculum of the host. Holotype and paratypes are in the collection of the University of São Paulo, section of Biological Oceanography.

REMARKS. This species has a great general resemblance to *Parabomolochus bellones* and clearly fits into this new genus along with the other species diagnosed here. It seems probable, therefore, that Carvalho overlooked some of the internal plumose setae of the antennular base and that the total number of these appendages is 14 or 15 and not 12 as would appear from his figures.

In the description and figure the setation of the exopodite of leg 4 is probably not correctly given: there are very probably 3 spines and 4 setae on the third segment.

Parabomolochus tumidus (Shiino, 1957)

Bomolochus tumidus Shiino, 1957, p. 417, figs. 3, 4; Shiino, 1959, p. 370, fig. 17a, b; Yamaguti & Yamasu, 1959, p. 93.

Female. Total length 1.31-1.70 mm. Cephalic somite fairly wide, about $1\frac{1}{2}$ times as wide as long, anterior part broadly rounded; rostral plate narrow. No eye visible. There is a shallow, V-shaped groove on the cephalic somite. Thoracic somites 2 to 4 gradually narrowing, the third produced backward and covering the fourth; abdomen short, half the length of cephalic somite; egg-sacs oblong-ovate. Basal portion of antennule with 15 plumose, sensory appendages; the fourth (counted from median plane outwards) more heavily reinforced than remaining setae, curved, but not much bigger than the others. Flagellum 3-segmented. Endopodite of antenna with longitudinal rows of fine spinules and along the margin a pectinate row of fairly long spinules, continuing on the lamellar process. Maxillipede with 2 big and 1 small, plumose setae. Spines along external margin of exopodite of legs 2 to 4 with a row of fine spinules along outer margin; inner margin smooth. Third endopodal segment of leg 2 in holotype with 1 short spine in addition to the 3 plumose setae; in additional specimens with 2 of such spines. Third exopodal segment of legs 2 to 4 deeply incised, but without extra segmentation. Fifth thoracic somite and genital somite fused in holotype, separate in additional specimens.

Male unknown.

The type host is *Cololabis saira* (Brevoort), the type locality is off Owase, Mie Prefecture, Japan. The parasites were attached to the inside of the operculum and to the gill filaments of the fish. Holotype and paratypes in the collection of the Prefectural University of Mie, Japan. Additional specimens were found on *Ablennes hians* (Cuvier & Valenciennes), captured near Tassya, Island Sado, Sea of Japan.

Parabomolochus hyporhamphi (Yamaguti & Yamasu, 1959)

Bomolochus hyporhamphi Yamaguti & Yamasu, 1959, p. 92, pl. 1 figs. 12-21.

Female. Total length 1.27-1.43 mm. The general shape of the body is cyclopoid, with a more or less trapezoid cephalic somite and gradually narrowing thoracic somites and abdomen. The trapezoid cephalic somite is twice as wide as long, slightly swollen and truncate at its posterior end. The anterior part is notched, so that the base of the rostral plate and the basal parts of the antennules are clearly visible. In addition there is a submarginal groove on each side of the cephalic somite. There is no groove in the mid-dorsal line of the cephalic somite. The second and third thoracic somites are swollen and the third is distinctly backward produced, so that nearly the whole fourth somite is covered. The abdomen is half as long as the cephalothorax, the furcal rami are about 1.5 times as long as wide and apparently two of the 5 marginal setae are lengthened. The rostrum is bifid. The antennules reach slightly beyond the lateral margins of the cephalic somite. The 3 basal segments of each antennule are heavily reinforced by chitinized plates. There are 15 plumose, sensory appendages on each antennule; the fourth on each side is chitinized and shaped as a curved hook; it is not longer, however, than the other sensory setae. Chitinized processes occur in the sensory setae 5 to 7, but very probably they are present in some of the other setae too. The structure of the antenna is not specified in Yamaguti & Yamasu's paper. The mandible has a strong terminal tooth and one short accessory spine. Maxillipede with a sigmoid claw with auxiliary tooth; the basis has two strong, plumose setae and a short seta.

The setal and spinal formulae, taken from Yamaguti & Yamasu's figures, are as follows.

	endopodite	exopodite
leg 1	1 + 0 . 1 + 0 . 5	6
leg 2	1 + 0 . 2 + 0 . 3 + II	0 + I . 1 + I . 5 + IV
leg 3	1 + 0 . 1 + 0 . 2 + II	0 + I . 1 + I . 5 + III
leg 4	1 + 0 . 1 + 0 . 1 + 1 + I	0 + I . 1 + I . 4 + III

There are no external marginal spines on the exopodite of leg 1.

Leg 5 with a short intermediate segment, bearing a fine external seta. The slightly reniform apical segment has a short spine halfway along the external margin and 3 apical appendages. One of these apical appendages, the external spine, inserts some distance from the apex at the external margin; the remaining two apical appendages consist of a median seta and an internal, setiform spine. Egg sacs elongated ovate, twice as long as abdomen.

Male unknown.

The type host is *Hyporhamphus sayori* (Temminck & Schlegel), the type locality is given as Inland Sea, probably Seto Naikai, Japan. Six partly ovigerous females were found on the gills of the host. No distinct holotype has been selected; the whereabouts of the type material are not given in Yamaguti & Yamasu's paper, but probably the material is preserved in the collection of the Tamano Oceanographical Museum, Okayama, Japan.

REMARKS. This species shows great conformity with *P. tumidus* (Shiino) and *P. bellones* (Burmeister), though there are minor differences in the structure of the various appendages. The accurate comparison of *P. hyporhamphi* with its allies is much hampered by the fact that its antenna, of vital importance in the classification of these species, is neither described nor figured.

Parabomolochus psettobius nov. spec. (figs. 5-9)

LOCALITY. Niger delta, between Port Harcourt and Brass, Nigeria, 1960. On *Psettus sebae* (Cuvier & Valenciennes), type host, collected by Mr. H. J. G. Beets. One ovigerous female (holotype), and an adult male (allotype). In addition there are three more ovigerous female paratypes, total lengths 1.28, 1.35, and 1.42 mm. The male was attached to what appears to be a mutilated, immature female (not measured). All specimens are in the collection of the Rijksmuseum van Natuurlijke Historie, Leiden. The holotype and the allotype have been dissected and the appendages mounted.

DESCRIPTION OF THE HOLOTYPE.

Total length 1.37 mm; greatest diameter 0.77 mm. Length of cephalic somite 0.38 mm; width of same 0.77 mm. Length of second thoracic somite 0.18 mm; width of same 0.62 mm. Length of third thoracic somite 0.23 mm; width of same 0.45 mm. Length of fourth thoracic somite 0.14 mm; width of same 0.32 mm. Length of fifth thoracic somite 0.12 mm; width of same 0.23 mm. Length of genital somite 0.24 mm; width of same 0.14 mm. Length of third abdominal somite 0.18 mm; width of same at articulation with genital somite 0.09 mm. Length of fourth abdominal somite 0.15 mm, width of same at articulation with third 0.07 mm. Length fifth (anal) somite 0.12 mm; width of same at articulation with fourth 0.08 mm. Length of furcal ramus 0.07 mm; width of same at insertion 0.04 mm. Total length of abdomen (fifth thoracic somite included) 0.50 mm; length of longest furcal seta 0.3 mm.

General shape of the body cyclopoid, resembling the condition found in *Parabomolochus tumidus* (Shiino), and characterised by the swollen and laterally produced condition of the cephalic somite; the remaining somites of the body gradually decrease in width. The cephalic somite results from the complete fusion of the head and the first thoracic somite; in dorsal view

it is twice as wide as long (fig 5b), in lateral aspect it is fairly strongly curved (fig. 5a). There is a very shallow longitudinal groove on the cephalic

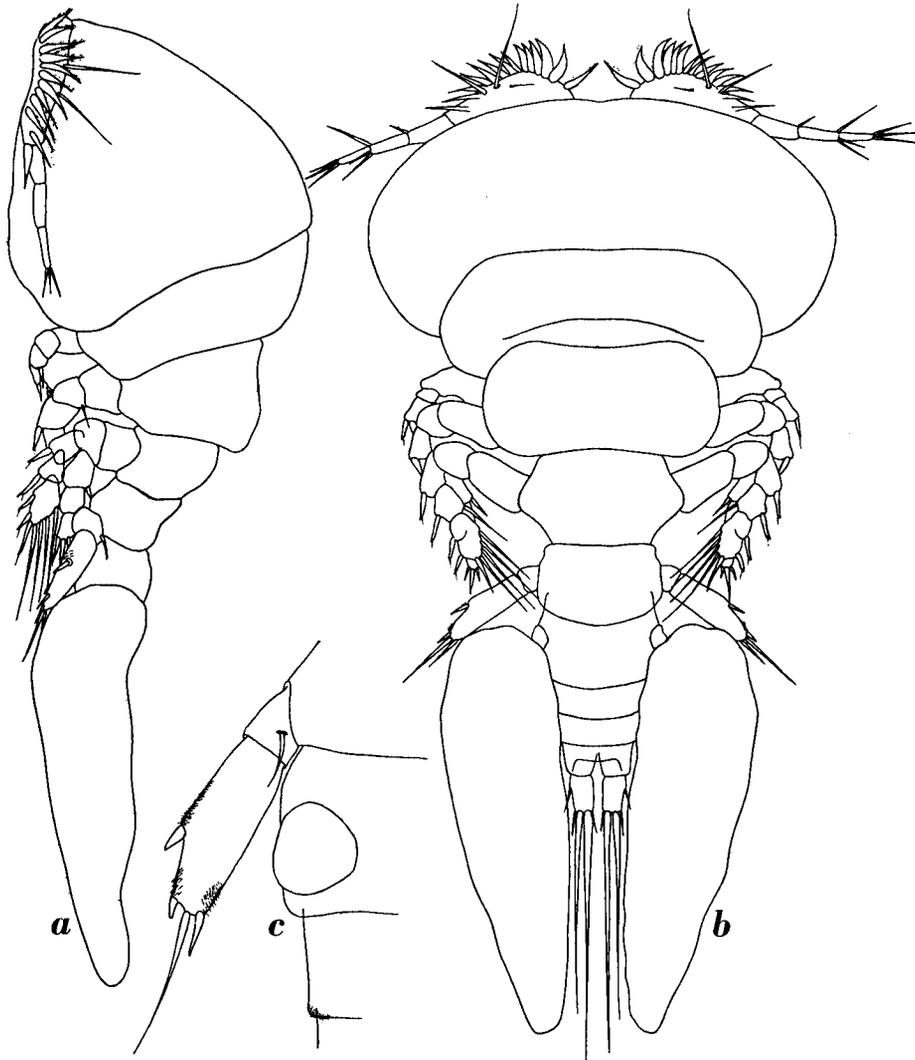


Fig. 5. *Parabomolochus psettobius* nov. spec., adult ♀ from *Psettus sebae* (Cuv. & Val.). a, whole animal, lateral aspect from left side; b, whole animal, dorsal aspect; c, left fifth leg and part of genital somite, dorsal aspect. a, b, $\times 70$; c, $\times 150$.

somite and in the mid-dorsal line the carapace shows a distinct, longitudinal chitinized ridge; the strong muscles operating the antennules, faintly visible

through the carapace, insert on this ridge. There is no trace of eyes. The base of the rostral plate is just visible between the basal parts of the antennules; it is strongly curved ventro-caudally, is provided with a strongly chitinized edge and has at the apex two diverging, acute points. The antennules, though they are fused to the fronto-ventral edge of the cephalic somite, are clearly and completely visible from above. As in other Bomolochids the ventral surface of the cephalic somite is deepened and bordered by the fairly broad, flattened margin, forming, with the first pair of legs, a sucking disk. Antennae and oral appendages attached at the bottom of the disk (fig. 6a).

The remaining thoracic somites are much narrower than the cephalic somite and have rounded sides, covering a part of the coxae of legs 2 and 3. The third thoracic somite is slightly, though distinctly, backward produced. The fourth thoracic somite is narrow, with triangular sides, completely exposing the coxae of leg 4. Fifth thoracic somite tubular, the intermediate segment of leg 5 is separated from the somite; the caudal margin of this somite is broadly rounded.

The genital somite is twice as wide as long, resulting from the fusion of the abdominal somites 1 and 2. It has distinctly produced sides; the swellings are rounded and each contains the opening of a genital duct at the dorso-lateral side. The genital plates (sixth legs) are small, semicircular plates, each with 3 fine, short setae. The remaining abdominal somites gradually decrease in width; the anal somite is distinctly conical and carries a broadly rounded anal flap (fig. 7e).

The furcal rami are tubular and diverge slightly, each being twice as long as the diameter at the base and slightly narrowing caudally. Each ramus carries 5 marginal and 1 appendicular setae, the position appears from fig. 7e. Setae 1, 4, 5 and the appendicular seta are short and fine, the fifth inserting at one third the external furcal border from the apex. Setae 2 and 3 are lengthened and thickened, especially seta 2. Both have short hairs.

The antennules are composed of a 3-segmented basal portion and a 3-segmented flagellum. The basal portion is ventrally covered with chitinized plates, that have finger-shaped processes fused with some of the sensory setae. The setation of the antennule can best be judged from figs. 6b and 6c; there are 15 plumose sensory appendages. Finger-shaped processes are to be found in setae 3 to 11, but in the setae 8 to 11 they consist of a small chitinized strip at the median wall of each seta. Seta 4 is almost completely chitinized and represented by a hook which is not larger, however, than the remaining marginal setae (fig. 6c). The antennules distinctly reach beyond the lateral thoracic margins.

The antennae are of the usual shape and insert close to the apex of the

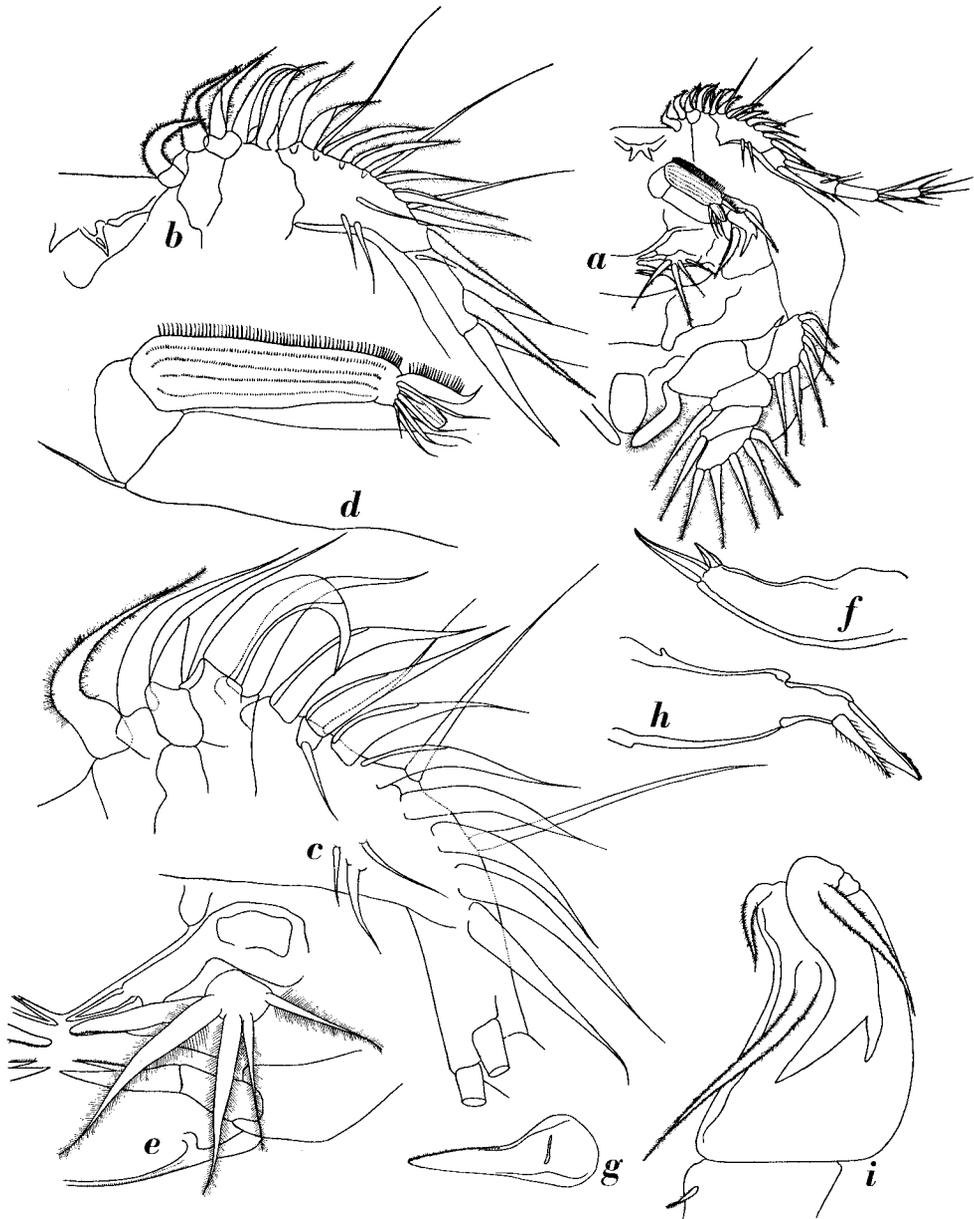


Fig. 6. *Parabomolochus psettobius* nov. spec., adult ♀ from *Psettus seabac* (Cuv. & Val.). a, ventral aspect of left part of cephalothorax, showing the left antennule, antenna, oral appendages, and first leg; b, basal part of left antennule and rostrum, ventral aspect; c, basal part of left antennule, ventral aspect (all sensory setae are plumose; the first seta only has been drawn completely); d, right antenna, inside; e, oral appendages of the left side, showing the ventral margin of the labrum, the left mandible, maxillule, paragnath, maxilla, and part of the labium; f, cutting edge of the left mandible, slightly turned to show the presence of two teeth; g, left paragnath; h, left maxilla, inside; i, left maxillipede. a, $\times 70$; b, $\times 185$; c-i, $\times 310$.

maxillipedes, pointing medially (fig. 6d). The endopodite is folded over coxa and basis. There is one seta on the coxa, the basis is small and nude. First endopodal segment corrugated by longitudinal bands of small teeth and, along the frontal margin, with a pectinate row of spines, continuing on the lamelliform process. This process is provided with a distinct hook. The second endopodal segment is separated from the first; it has some longitudinal bands of small spinules. In addition there are 4 strong setae and 1 fine short seta.

The labrum is covered with short hairs; it is broadly rounded with a free caudal margin, which just covers the tip of the mandible.

The mandible (fig. 6f) has a narrowed cutting edge, bearing one strongly developed and one much smaller tooth. The maxillule is small, globular, and has 2 strong and 2 fine setae, all are hairy. Paragnaths (fig. 6g) are present, tapering from a fairly broad base, and with a very sharp caudal edge set with a fringe of stiff hairs. The maxilla (fig. 6h) has a strongly developed tooth and a strong, hairy seta. The labium has a strongly chitinized transversal trabecle and bears short hairs. The maxillipedes (fig. 6i) are found in the usual position; the endopodite, shaped as a strong, curved claw, has a big auxiliary tooth. There are 3 hairy setae: a strong seta occurs near the insertion of the claw, a similar seta occurs on the basis and a much smaller seta near the apex of the basis. The coxa too has a small, hairy seta.

The setal and spinal formulae of the legs are as follows:

	endopodite	exopodite
leg 1	1 + 0 . 1 + 0 . 5	0 + I . 6 + I
leg 2	1 + 0 . 2 + 0 . 3 + II	0 + I . 1 + I . 5 + IV
leg 3	1 + 0 . 1 + 0 . 2 + II	0 + I . 1 + I . 5 + III
leg 4	1 + 0 . 1 + 0 . 1 + 1 + I	0 + I . 1 + I . 4 + III

The first leg (fig. 7a) has a much flattened endo- and exopodite. The coxa is small, scarcely visible, and fused with the more or less triangular intercoxal plate. In addition the coxae of each side bear a strongly haired, flat plate, pointing medially. The basis is large. The exopodite has a well separated first segment; segments 2 and 3 are almost completely fused. There are 2 external marginal spines, each with a flagellum. In addition there are 6 strongly haired setae. The endopodite is composed of 3 distinctly separated segments; 1 and 2 have an internal seta and have no external appendages. The third endopodal segment has a total of 5 appendages.

Leg 2 (fig. 7b). The endopodite is strongly flattened. Coxa with a distinct, internal seta near the articulation with the intercoxal plate. Basis with a

hairy, external seta. The second endopodal segment has 2 setae, the third endopodal segment 3 setae and 2 short spines.

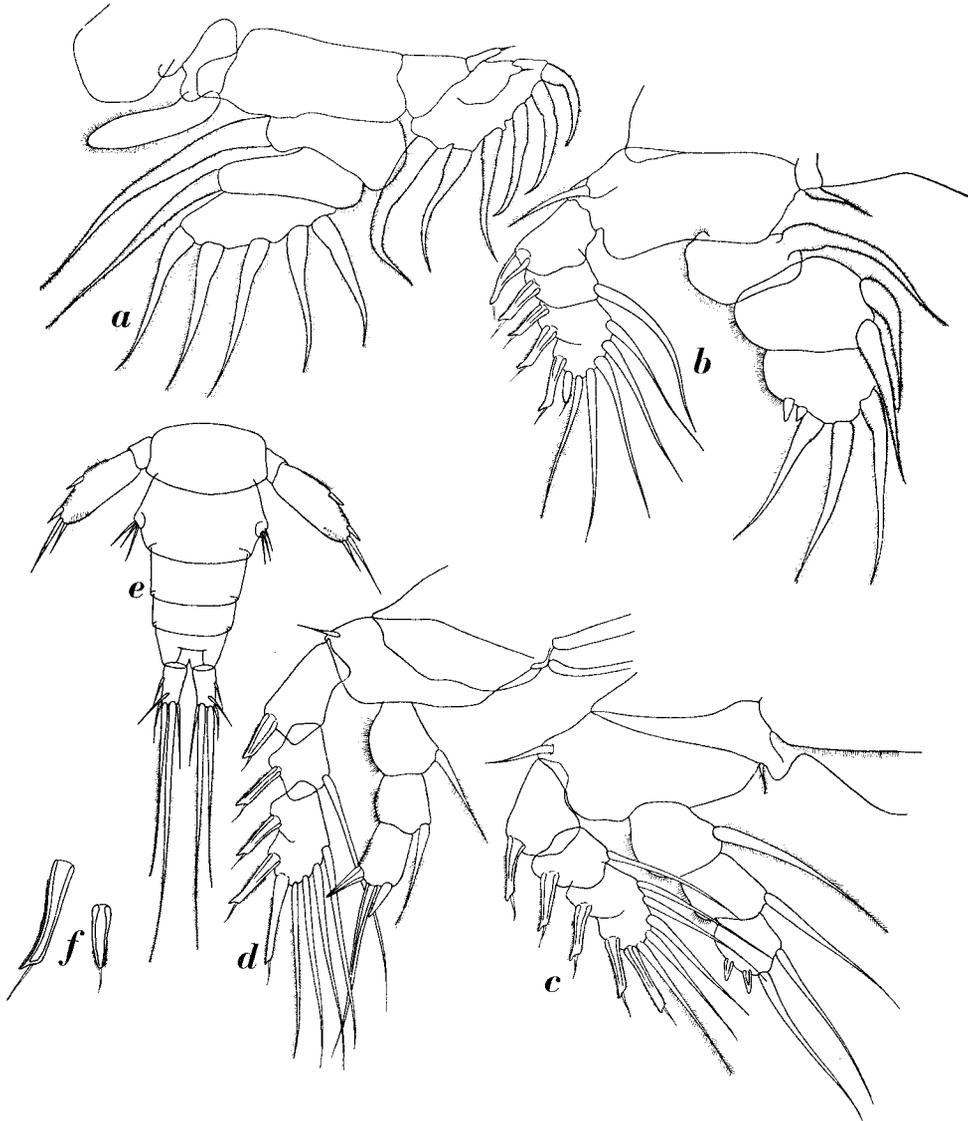


Fig. 7. *Parabomolochus psettobius* nov. spec., adult ♀ from *Psettus sebae* (Cuv. & Val.). a, leg 1; b, leg 2; c, leg 3; d, leg 4; e, abdomen, dorsal aspect; f, external marginal spine (left) and terminal spine (right) of the exopodite of leg 2. a-d, $\times 150$; e, $\times 70$; f, $\times 310$.

Leg 3 (fig. 7c). There is a small internal seta near the articulation with the intercoxal plate; external seta small, nude. The second endopodal segment has an internal seta; the third endopodal segment 2 setae and 2 short spines.

Leg 4 (fig. 7d). There is no internal seta on the coxa; the external seta of the basis is very fine. Internal setae of the endopodal segments 1 and 2 short, spiniform.

All external spines of the exopodites and the terminal spines on the third exopodal segments of legs 2 to 4 are of the flagellated type. The external edge is set with a row of stiff hairs, running into a distinct spur.

Leg 5 (fig. 5c). There is a small but free intermediate segment, carrying a small seta. The apical segment is slightly spatulate, at its apex it carries 3 appendages: 2 short spines and an intermediate seta. The hairy external margin has a short spine.

Egg-sacs elongated ovate, about 1.5 times the length of the abdomen, slightly narrowing caudally, containing big eggs.

DESCRIPTION OF THE ALLOTYPE.

Adult male, total length 0.6 mm; greatest diameter 0.29 mm. This male was attached to the abdomen of an apparently immature female specimen and was in poor condition, so that I cannot give its other measurements.

In general appearance it is not unlike the female, but the body is slenderer, and the cephalic somite is not expanded, though still slightly inflated. The antennules are invisible from above and there is no trace of the longitudinal furrow (fig. 8a). The abdominal somites narrow gradually and are only slightly laterally produced, exposing the coxae of legs 2 to 4. The thoracic somite 5 is short and has distinct shoulders because of the fusion of the intermediate segment of leg 5 with the somite. The genital somite is big, barrel-shaped, 1.25 times as long as wide, and shows no trace of genital openings or of sixth legs. The third abdominal somite is completely telescoped into the genital somite (fig. 8b), the anal somite and furca are as in the female.

I obtained a very satisfactory preparation of the antennules, antennae and oral appendages. The antennules are apparently quite free from the cephalic somite, the flagellum apparently is only 2-segmented. The setation is represented in fig. 8c; the number of plumose, sensory appendages is not reduced (being 15 as in the female), but they are shorter and slenderer and no chitinized plates occur at the basal part of the antennule. The antennae are as in the female, but shorter: the pectinate brush is composed of very slender spinules, the rows causing the corrugations are interrupted (fig. 9e). The mandibles, paragnaths, maxillules, and maxillae are as in the female, but are

correspondingly smaller. The maxillipedes (fig. 8d) are greatly developed and attach the male to the female. The coxa are cylindrical and have a single

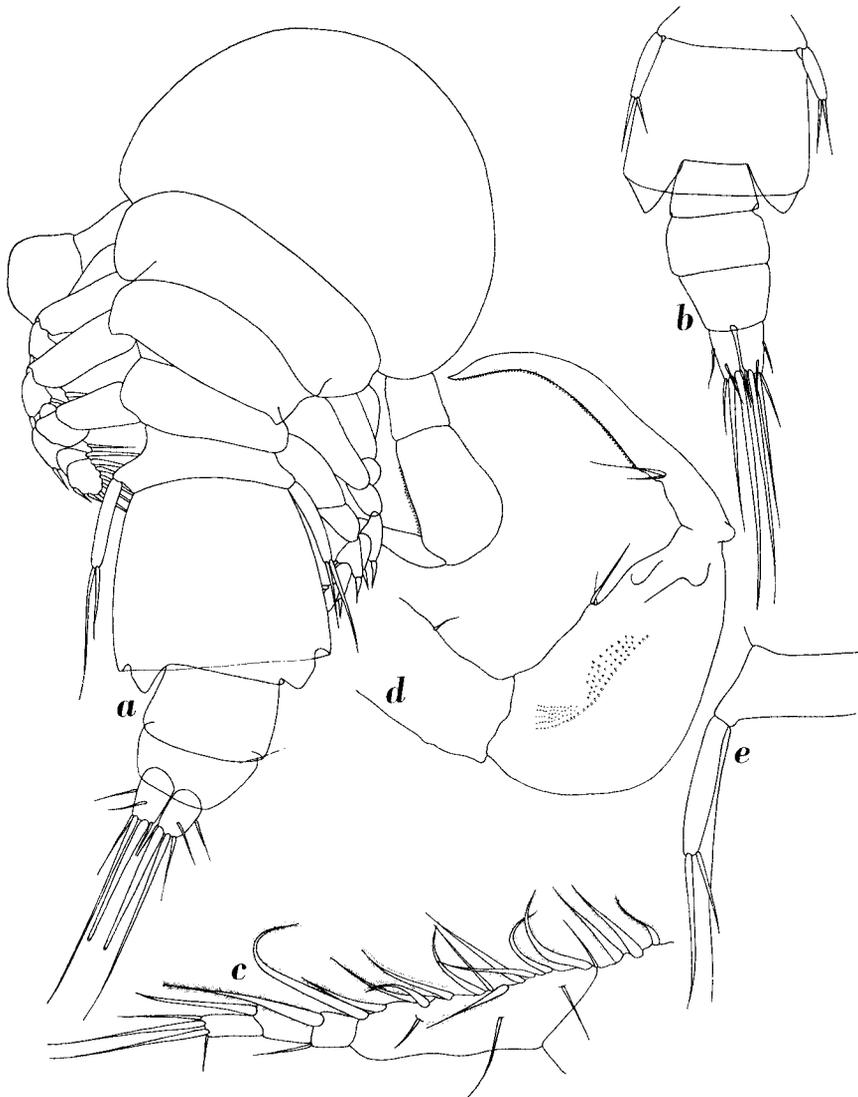


Fig. 8. *Parabomolochus psettobius* nov. spec., adult ♂ from *Psettus sebae* (Cuv. & Val.). a, whole animal, dorsal aspect; b, abdomen, dorsal aspect; c, left antennule, inside; d, left maxillipede. a, $\times 185$; b, $\times 150$; c, d, $\times 310$.

fine seta. The basis is strongly swollen and has a deepened part into which fits the claw; this part is set with fine spinules. In addition there are 2 setae.

The endopodite is represented by a strong, curved digit, which carries 2 setae at its base; apically it has fine, lamellar teeth.

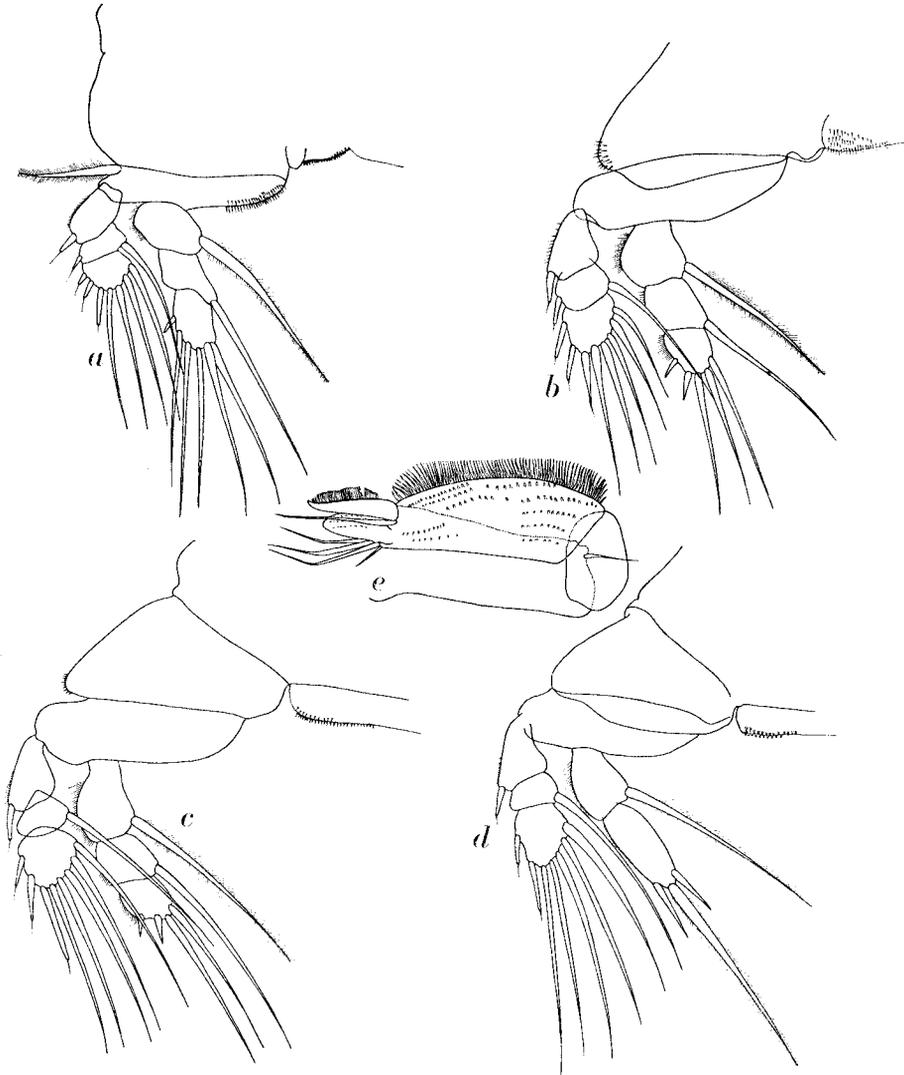


Fig. 9. *Parabomolochus psettobius* nov. spec., adult ♂ from *Psettus sebae* (Cuv. & Val.).
a, leg 1; b, leg 2; c, leg 3; d, leg 4; e, left antenna, outside. a-d $\times 200$; e, $\times 350$.

The details of legs 1 to 4 can best be taken from the spinal and setal formulae, the following notes and the figures .

The setal and spinal formulae are as follows:

	endopodite	exopodite
leg 1	I + 0 . I + 0 . 5 + I	0 + I . I + I . 4 + III
leg 2	I + 0 . I + 0 . 3 + II	0 + I . I + I . 5 + III
leg 3	I + 0 . I + 0 . 2 + II	0 + I . I + 0 . 5 + III
leg 4	I + 0 . I + I + I	0 + I . I + 0 . 5 + II

Leg 1 (fig. 9a) has an external seta at the basis; the internal corner of the basis is spinulose. The exo- and endopodites are 3-segmented.

Leg 2 (fig. 9b) has a spinulose external coxal border. The endo- and exopodites are 3-segmented.

Leg 3 (fig. 9c) has the external corner of the coxa spinulose. There is no external marginal spine on the second exopodal segment. The exo- and endopodites are 3-segmented.

Leg 4 (fig. 9d) carries no external spine on the second exopodal segment. The exopodite is 3-, the endopodite 2-segmented.

The intercoxal plates of all legs are densely covered with short, acute spinules.

Leg 5 (fig. 8a, b) reaches half the length of the genital segment. Its intermediate segment is fused with thoracic segment 5; the free apical segment is shaped as a narrow strip with at the apex two setae of unequal length.

REMARKS. This new species appears to be closely allied to *Parabomolochus tumidus* Shiino, 1957. A comparison of the foregoing description and the figures with Shiino's detailed account and beautiful drawings of *Bomolochus tumidus* shows that the appendages are almost fully identical. There are small differences in the type of the corrugations on the endopodites of the antennae: in *P. tumidus* there are many rows of fine spinules, in *P. psettobius* there are fewer rows composed of bigger spinules. There is, however, a fairly big difference in the general shape of the body. The cephalic somite, in *P. tumidus*, is more irregularly shaped, with a distinct, fairly deep V-shaped furrow, terminating under the insertion of the rostral plate. Such a groove is almost absent in *P. psettobius*. The third thoracic somite in *P. tumidus* is strongly backward produced and completely covers the dorsal part of the fourth thoracic somite; the dorsal development of the third thoracic somite in *P. psettobius* is of a quite different nature.

Nothobomolochus nov. gen.

DIAGNOSIS. Female. Body more or less cyclopoid, i.e., the thoracic somites gradually diminish in width and the cephalothorax gradually merges into the abdomen. In some species, however, the third thoracic somite is produced

backward and may almost completely cover the fourth somite. Head and first thoracic somite fused to form the cephalic somite, this somite is broadly rounded anteriorly and cut off squarely posteriorly. A V-shaped groove may be present, opening under the insertion of the rostral plate, the base of which may be visible from above. Abdomen short, of normal shape, half the length of cephalothorax or slightly shorter. Furcal rami slightly conical, with 5 marginal and one appendicular seta on each ramus. Antennules with 3 fused basal segments and a 3- or 4-segmented flagellum. There are 12 plumose sensory appendages on the basal portion; in addition there is, laterally of the median line, a dorsal chitinized plate, of which the finger-shaped prolongations are fused with 3 sensory appendages, totally changing their character, and thus accounting for their reduction in number. The development of the three spines of each dorsal plate is quite different in the various species. One of the "normal" antennular setae inserts immediately laterally of the dorsal plate and may form, with the plate, a homogeneous structure. The endopodite of the antenna is covered with small spines, that may be arranged in longitudinal rows. Close to the insertion of the lamellar process the first endopodal segment shows a more or less distinct swelling with a row of pectinate bristles, continuing on the lamellar process. In addition to the process there are 5 strong hooks and a seta. Maxillule with 4 (2 strong and 2 short) setae. Maxillipede with 2 strong, plumose setae and a much smaller seta. Claw strong, curved with or without auxiliary tooth. Leg 1 with flattened exo- and endopodites; the segments of the exopodite almost completely fused. Endopodite of leg 2 strongly flattened; both rami of legs 2 to 4 3-segmented. Setation slightly different in the various species. Leg 5 with a short intermediate segment, bearing a fine seta, and a spatulate apical segment, bearing 3 terminal setae and a small external spine. Egg-sacs ovate, short, as long as or slightly longer than abdomen.

Male. The only male of this genus which has been described is that of *Nothobomolochus multispinosus* (Gnanamuthu); it shows the same features as those of *Bomolochus* and *Parabomolochus*. The tripartite dorsal plate at the antennular base is absent in the male and the number of plumose, sensory appendages is reduced. The maxillipedes are chelate; the setation of the legs is slightly reduced. Leg 5 without intermediate segment; apical segment elongated ovate, with 2 setae. Genital somite very large. The males are attached to the abdomen of the female.

These parasites are found in the gill cavity of fishes, either attached to the inside of the operculum or to the gill filaments.

Type species: *Bomolochus* (*Pseudobomolochus*) *managaturwo* Yamaguti, 1939.

- cephalic somite or slightly shorter. *N. triceros* (Bassett-Smith)
 — Finger-shaped processes, though well developed, never more than one third the length
 of the cephalic somite 5
5. Innermost process of tripartite plate reduced, half the length of median and outer-
 most spines and much less chitinized, setiform 6
 — The three finger-shaped spines more or less equally developed. 7
6. Second thoracic somite much narrowed; third thoracic somite wider than second,
 strongly backward produced and covering the fourth thoracic somite
N. gibber (Shiino)
 — Second and third thoracic somites gradually narrowing, not backward produced.
 Apex of leg 5 not spinulose *N. cypseluri* (Yamaguti)
7. Finger-shaped processes of dorsal plate contiguous for the greater part of their
 length; apical portions slightly diverging. *N. multispinosus* (Gnanamuthu)
 — Finger-shaped processes of dorsal plate diverging from their base onwards. 8
8. Third thoracic somite backward produced, covering the fourth thoracic somite. 9
 — Thoracic somites normally developed, gradually narrowing, not backward produced.
 10
9. Cephalic somite more or less trapezoid; maxillipedes with 2 plumose setae.
N. saetiger (C. B. Wilson)
 — Cephalic somite globular, maxillipedes without setae. *N. scomberesocis* (Krøyer)
10. Finger-shaped spines long and slender; cephalic somite with V-shaped groove
N. managatuwo (Yamaguti)
 — Finger-shaped spines short and stubby; cephalic somite smooth, thoracic somites
 3 and 4 fused *N. cornutus* (Claus)

Nothobomolochus scomberesocis (Krøyer, 1864)

Bomolochus scomberesocis Krøyer, 1864, pp. 291, 300, pl. 10 fig. 5; Heller, 1865, p. 153;
 Bassett-Smith, 1899, p. 442; Thompson & A. Scott, 1903, p. 293; Sewell, 1949, pp. 169,
 177, 188; Shiino, 1957, p. 422.

Artacolax scomberesocis, Delamare Deboutteville & Nunes-Ruivo, 1958, p. 217, fig. 2.

Female. Total length about 2 mm. Body short; cephalic somite twice as long, anteriorly rounded, posteriorly cut off squarely. Second thoracic somite much narrowed, third wider than second, backward produced, covering the fourth. Abdomen short, half the length of cephalothorax. Furcal rami conical, twice as long as broad, one of the setae lengthened and thickened. Rostral base visible from above between bases of antennules; no eye visible. Antennular base composed of 3 fused segments, with 12 sensory appendages, three long "normal" setae, and a tripartite dorsal plate, split into three widely diverging finger-shaped processes, median longer than either of the lateral processes. First and second endopodal segments of antenna fused, corrugated at apex and base. Endopodite with slight swelling at insertion of lamellar process; both swelling and process with pectinate row of spinules. In addition there are 3 slender, hooked spines, a thick spine and a seta. Claw of maxillipede strong, curved, without auxiliary tooth. Setation of legs, with exception of leg 4, unknown; third exopodal segment of leg 4 with 4 setae

and 2 spines. Apical segment of leg 5, according to Delamare Deboutteville & Nunes-Ruivo (1958), with 2 apical setae and a short spine at the external margin; the segment is slightly spatulate and spinulose at the tip. Probably a third, small apical seta has been present which has been obscured because of the position of leg 5 in the preparation of the above mentioned authors.

Male unknown.

The type host is *Scomberesox* spec. (no specific name given by Krøyer, but very probably the species was *Scomberesox rondeletii* Cuvier & Valenciennes (= *S. saurus* (Walbaum)), on which host the species was rediscovered later), the type locality warm parts of the Atlantic Ocean. A single female specimen was found attached to the gills of its host; this holotype specimen is very probably lost. A second female specimen was described by Delamare Deboutteville & Nunes-Ruivo (1958) from the branchial cavity of *Scomberesox rondeletii* Cuvier & Valenciennes (= *S. saurus* (Walbaum)), captured off Cabo Creus, N. E. Spain; some of the appendages of this second specimen were figured but unfortunately it was not completely redescribed, so that our information concerning this rare form is still very incomplete. Another female, with two "larval forms attached to vulva" was recorded from the gills of *Caranx leptolepis* Cuvier & Valenciennes (= *Selaroides leptolepis* Cuvier) from Aripu, Ceylon, by Thompson & A. Scott (1903). The record is unaccompanied by a drawing or description; it is, moreover, from a host on which the species has never been rediscovered since. Bearing in mind the great resemblance of the females of this genus I am inclined to regard this record with extreme doubt.

Nothobomolochus cornutus (Claus, 1864)

Bomolochus cornutus Claus, 1864, p. 378, pl. 35 figs. 21-23; Hartmann, 1870, p. 118; Richiardi, 1880, p. 147; Valle, 1882, p. 57; Carus, 1885, p. 353; Brian, 1898, p. 9, pl. 2 fig. 12; Bassett-Smith, 1899, p. 443; Brian, 1902, pp. 32, 33; Brian, 1903, p. 7 (83); Brian, 1906, p. 31; Bainbridge, 1909, p. 46; Brian, 1924, p. 11; Shiino, 1957, p. 422.
Artacolax cornutus C. B. Wilson, 1911, p. 361; Brian, 1924, p. 11.

Female. Total length 2-3 mm. Cephalic somite twice as wide as long, anteriorly broadly rounded, posteriorly cut off squarely. Thoracic somites 2 to 4 gradually narrowing; third and fourth fused to form shield-shaped complex. Abdomen half the length of cephalothorax, furcal rami conical, slender, 3 times as long as wide, one of the setae on each side lengthened. Cephalic somite without groove, rostral base visible between antennular bases, no eye observable. Dorsal plate split into three finger-shaped, acutely pointed processes, the innermost shorter than remaining spines. Number of sensory appendages unknown, flagellum 3-segmented. Structure of antenna unknown; maxillipede with a curved, smooth claw and apparently without

setae. Setal formulae of legs 2 to 4 unknown. Leg 5 with a short intermediate segment; apical segment spatulate, with 3 apical setae and a short external spine.

Male unknown.

The type host is *Asterodermus coryphaenoides* Lowe (= *A. elegans* Bonaparte = *Luvarus imperialis* Rafinesque), the type locality Messina, Sicily, Italy. Claus' holotype material is lost. Additional records are from *Exocoetus volitans* L., *Sayris camperi* (Risso) (= *Scomberesox saurus* (Walbaum)) and *Alosa sardina* (Lowe) (= *Sardina pilchardus* (Walbaum)) from the Mediterranean, in all cases the parasites were attached to the gill filaments of their hosts (Richiardi, 1880); Valle (1882) records specimens from the gills of *Alosa papalina* Bonaparte (= *Clupea sprattus* L.) captured off Trieste in the Adriatic. From some of the above mentioned hosts other, closely related Bomolochids have been taken, so that some of these records at least must be taken with reserve. The same applies, possibly even more forcibly, to Brian's (1898) record of this species from the gills of *Scomberesox rondeletii* Cuvier & Valenciennes (= *Scomberesox saurus* (Walbaum)), the type host of *Nothobomolochus scomberesocis* taken off Genoa, Italy. Brian (1924) also records two females from *Diagramma mediterraneum* Guichenot (= *Parapristipoma mediterraneum* (Guichenot)) captured in the Atlantic west of Mauritania, W. Africa, one of which was attached to the gills, the other to the palate of its host.

REMARKS. This species, though repeatedly mentioned in the literature, is one of the least known Bomolochids. An accurate redescription and a study of the hosts is urgently needed.

Nothobomolochus saetiger (C. B. Wilson, 1911)

Artacolax saetiger C. B. Wilson, 1911, p. 361, pl. 51; C. B. Wilson, 1932, p. 384, fig. 236; C. B. Wilson, 1937, p. 29; Pearse, 1947, p. 7; Sewell, 1949, p. 157; Stock, 1953, pp. 11, 12; Shiino, 1957, pp. 417, 422; Yamaguti & Yamasu, 1959, p. 92.

Bomolochus saetiger, Yamaguti, 1939, p. 398.

Bomolochus (*Artacolax*) *saetiger*, Yamaguti, 1953, p. 225.

Female. Total length 2 mm. Body short and compactly built, cephalothorax fairly tumid. Cephalic somite trapezoid, anteriorly flat, but rostral base invisible from above. Posterior margin of cephalic somite straight. Thoracic somites 2 and 3 narrowing, the third greatly produced backward; the produced, sac-shaped part completely covers the fourth and part of the fifth thoracic somites. Abdomen half the length of the cephalothorax; furcal rami short, as long as wide, two of the setae on each side lengthened and thickened, one half as long as the other. Antennules short, scarcely reaching beyond

cephalic somite, flagellum 3-segmented. Basal portion with 12 sensory, plumose appendages. Dorsal plates at free margin split up into 3 finger-shaped processes; each of the processes fairly stubby, blunt at apex. Antenna with endopodite roughened by rows of fine spinules; there are 3 hooked spines. Condition of lamellar process unknown. Maxillule with 3 setae. Maxillipede with short, curved claw; basis with 2 setae. Setal and spinal formulae (according to C. B. Wilson's drawings) as follows:

	endopodite	exopodite
leg 1	I + 0 . I + 0 . 5	5
leg 2	I + 0 . 2 + 0 . 3 + II	I + I . I + I . 5 + III
leg 3	I + 0 . 2 + 0 . 3 + II	0 + I . I + I . 5 + II
leg 4	0 + 0 . 0 + 0 . I + I + I	0 + I . I + I . 5 + II

Structure of leg 5 unknown. Wilson figured the spines along the external margin of the exopodites of legs 2 to 4 with a row of fine spinules running into a big spur along the internal margin, but it seems highly probable that in this he is mistaken and that the row of spinules and the spur occur along the external margin of these spines, which is the condition prevailing in all Bomolochinae with denticulated spines on the exopodites. Egg-sacs ovate, about as long as abdomen.

Male unknown.

The type host is *Exocoetus volitans* L., the type locality Woods Hole, Massachusetts, U.S.A., Three females were found, apparently on the gills of the host. This material, which includes the holotype, is in the U.S. National Museum. An additional female was recorded from the gills of *Cypselurus callopterus* (Günther) captured off Charles Island, Galapagos Archipelago (C. B. Wilson, 1937), Pearse (1947) mentions an ovigerous female from *Menidia menidia* (L.) taken at Beaufort, North Carolina, U.S.A. Wilson's (1937) record of this form from a Pacific locality must be taken with much reserve.

REMARKS. This too is an exceedingly poorly known species. It shows a great deal of resemblance with *Nothobomolochus gibber*, to be described below. An accurate redescription of *Nothobomolochus saetiger* is much needed.

Nothobomolochus tricerus (Bassett-Smith, 1898)

Bomolochus tricerus Bassett-Smith, 1898, p. 3, pl. 1 fig. 1; Bassett-Smith, 1899, p. 443; Gnanamuthu, 1948, p. 24; Gnanamuthu, 1949, p. 318; Sewell, 1949, p. 169.

Female. Total length unknown. Cephalic somite about half as long as wide, anteriorly broadly rounded; posterior margin concave. Rostral base fairly

broad, distinctly visible between antennular bases; there is apparently no deepened groove on the cephalic somite and no eye is visible. Thoracic somites 2 to 4 gradually narrowing; third somite either fused with fourth or produced backward and covering the fourth (this does not appear clearly from Bassett-Smith's drawing (pl. 1 fig. 1) and description). Abdomen short, half the length of cephalic somite. Antennules with 4-segmented flagellum; the dorsal plates are split into 3 slender, very long processes, pointing obliquely forwards and much longer than the plumose, sensory setae. Antennae roughened by fine spinules and near insertion of lamellar process with a swelling; both process and swelling set with a pectinate row of spinules. Maxillipede with smooth claw and a single plumose seta. Setal formulae (taken from Bassett-Smith's drawings) as follows:

	endopodite	exopodite
leg 1	1 + 0 . 1 + 0 . 5	6
leg 2	unknown	unknown
leg 3	1 + 0 . 1 + 0 . 6	0 + I . 1 + I . 5 + III
leg 4	1 + 0 . 1 + 0 . 5	0 + I . 1 + I . 4 + III

Leg 5 with slightly spatulate apical segment, bearing 3 apical setae and an external spine.

Male mentioned by Bassett-Smith but not actually described.

The type host is *Stromateus cinereus* Day (= *Pampus argenteus* (Euphrasen)), the type locality Bombay, India. Many specimens were obtained from the gill cavity of the host. Holotype unknown. Some of Bassett-Smith's material has probably been deposited in the British Museum (Natural History).

REMARKS. This is an insufficiently known form, which, should it be rediscovered, may be easily recognized by the long and slender finger-shaped spines of the dorsal plates. The setal and spinal formulae, as given above, are almost certainly incorrect, Bassett-Smith's drawings of the legs being very inaccurate.

Nothobomolochus denticulatus (Bassett-Smith, 1898)

Bomolochus denticulatus Bassett-Smith, 1898a, p. 78, pl. 3 fig. 1; Bassett-Smith, 1899, p. 433; Gnanamuthu, 1948, p. 24; Gnanamuthu 1949, p. 318; Sewell, 1949, p. 169.

Female. Total length 3-4 mm. Body cyclopoid, the cephalic somite is big, length $\frac{3}{4}$ the width, anteriorly broadly rounded, thoracic somites 2 to 4 gradually narrowing. Cephalothorax imperceptibly merging into abdomen, this half as long as cephalic somite. Furcal rami conical, about 3 times as

long as wide, one of the setae on each side lengthened. Cephalic somite with V-shaped groove, opening under the rostral plate, the base of which is visible from above and is slightly concave. Muscles of antennules strongly developed and visible through tegument; no eye. Basal portion of antennules with 12 plumose sensory appendages, flagellum 3-segmented. Dorsal plates tripartite at free distal margin; points short, scarcely exceeding the plumose sensory setae. Antenna with endopodite roughened by fine spinules, placed in longitudinal rows; first endopodal segment with tubercle some distance under insertion of lamellar process. Both process and tubercle with a pectinate row of spinules. Maxillipede with a smooth claw and 1 plumose seta. Setal and spinal formulae (taken from the drawings of Bassett-Smith) are as follows:

	endopodite	exopodite
leg 1	I + 0 . I + 0 . 5	6
leg 2	I + 0 . I + 0 . 4	0 + I . I + I . 6 + III
leg 3	I + 0 . I + 0 . 4	0 + I . I + I . 5 + III
leg 4	I + 0 . I + 0 . 3	I + I . I + I . 4 + III

Leg 5 with elongated apical segment, bearing 3 apical setae and a small external spinule. Outer edge of spines inserting along external margin of exopodites of legs 2 to 4 with 5 to 6 very strong teeth and a spur immediately above insertion of flagellum; internal margin smooth. Egg-sacs very long, as long as whole body.

Males unknown.

The type host is *Sphyraena jello* Cuvier, the type locality Trincomalee, Ceylon. Found on the same host near Ceylon and on *Hemiramphus far* Forskål at Trincomalee. The parasites were found in the gill cavity of the host, apparently attached to the gills. The species has not been recaptured since and is very imperfectly known. Holotype unknown. Some of Bassett-Smith's material is probably in the British Museum (Natural History).

Nothobomolochus managatuwo (Yamaguti, 1939)

Bomolochus (*Pseudobomolochus*) *managatuwo* Yamaguti, 1939, p. 396, pl. 3 figs. 28, 29, pl. 4 figs. 30-37; Sewell, 1949, p. 163; Shen, 1957, pp. 304, 321, pl. 5.

Female. Total length 2.65-3.0 mm. Body cyclopoid, with a broad cephalic somite and gradually narrowing thoracic somites and abdomen. The cephalic somite is about twice as wide as long and more or less trapezoid; anteriorly

it is deeply notched so that the antennules and the base of the frontal plate are distinctly visible from above. There is a deep V-shaped groove on the cephalic somite opening under the base of the frontal plate. The thoracic somites 2 and 3, in lateral aspect, are slightly swollen; according to Yamaguti's description the second thoracic somite slightly overlaps the third and covers two small spines on the anterior part of thoracic somite 3; this third somite covers about half the fourth thoracic somite. The abdomen is three fifths the length of the cephalothorax; the furcal rami are about twice as long as wide and slightly conical; one of the marginal setae on each side is lengthened. The antennules reach slightly beyond the lateral margins of the cephalic somite. The dorsal plate on each antennule is strongly developed and split into three forward directed, finger-shaped, chitinized processes, the median of which is slightly shorter than the lateral processes and bluntly pointed. In addition there are 12 plumose, sensory appendages on the three basal segments of the antennule; the flagellum is 3-segmented. The endopodite of the antenna is completely covered with sharp spinules; the tubercle and the lamellar process have a pectinate row of bigger spinules. In addition there are, on the endopodite of the antenna, 4 hooked spines and 3 setae. The maxillipede has a strong, smooth, sigmoid claw; in addition there are on the basis 2 strong, plumose setae and a very small seta. The setal and spinal formulae (taken from Yamaguti's accurate figures) are as follows:

	endopodite	exopodite
leg 1	1 + 0 . 1 + 0 . 5	6 + III
leg 2	1 + 0 . 2 + 0 . 3 + II	0 + I . 1 + I . 5 + IV
leg 3	1 + 0 . 2 + 0 . 2 + II	0 + I . 1 + I . 5 + III
leg 4	1 + 0 . 1 + 0 . 1 + 1 + I	0 + I . 1 + I . 4 + III

Leg 5 with a small intermediate segment which carries no seta. The apical segment is spatulate and carries 4 appendages; there is a setiform spine half-way along the external margin and 2 of such spines at the apex that flank a longer, plumose seta. Egg sacs ovate, slightly longer than the abdomen.

Male unknown.

The type host is *Stromateoides argenteus* (Euphrasen) (= *Pampus argenteus* (Euphrasen)), the type locality is not specified ("Pacific"). Three ovigerous females, of which no holotype has been selected, were obtained from the gills of the host. These type specimens very probably are in Dr. Yamaguti's private collection. Additional female specimens were recorded by Shen (1957, p. 321) from the same host captured near Kwanghai,

Kwantung Province, China. An additional specimen occurred on the gills of an unspecified "white fish" from Yin-ku Bay, Island Hainan, China.

REMARKS. *Nothobomolochus managatuwo* may very well prove to be identical with *N. triceros* (Bassett-Smith). Both species were obtained from the same host and there is a lot of conformity in both descriptions. Bassett-Smith's description, however, is incomplete and a comparison of the figures of the antennules shows that in *N. triceros* the finger-shaped processes of the dorsal plates are much longer. Pending a redescription of Bassett-Smith's material I have kept both species separate.

Nothobomolochus multispinosus (Gnanamuthu, 1949)

Bomolochus multispinosa Gnanamuthu, 1949, p. 309, figs. 1-5.

Female. Total length 2.75 mm; actual body length slightly shorter, as this figure, cited from Gnanamuthu, includes the egg-sacs. Body cyclopid, cephalic somite anteriorly broadly rounded, length 0.75 times the width, fusion of head and first thoracic somite marked by a distinct groove. There is a deep V-shaped groove on the somite, opening under the rostrum; rostral plate visible from above, flat. No eye is visible. The muscles operating the antennules are distinctly visible through the carapace. Thoracic somites 2 to 4 gradually narrowing. Abdomen well separated from cephalothorax by a narrowing at the fifth thoracic somite, about three fourth the length of cephalothorax. Furcal rami conical, 3 times as long as wide, one of the setae on each side greatly thickened. Antennules with 3-segmented flagellum and on the basal segments 12 plumose, hairy setae. Rostral plate apically split into three thick processes, contiguous for the greater part of their length. One of the "normal" setae of the base closely applied to the dorsal plate. Antenna with endopodite roughened by oblique rows of fine spinules. Structure not quite clearly represented in Gnanamuthu's drawings and description, but a lamellar process and a swelling, both set with a pectinate row of spinules, is almost certainly present. In addition there are 4 hooked spines. Maxillipede with a smooth claw and 2 plumose setae. Maxillule with 3 setae. Setal formulae of the legs, taken from Gnanamuthu's drawings, are as follows:

	endopodite	exopodite
leg 1	1 + 0 . 1 + 0 . 5	6
leg 2	1 + 0 . 1 + 0 . 3 + 1	0 + 1 . 1 + 1 . 6 + II
leg 3	1 + 0 . 2 + 0 . 2 + II	0 + 1 . 1 + 1 . 5 + II
leg 4	1 + 0 . 1 + 0 . 1 + 1 + 1	0 + 1 . 1 + 1 . 4 + 1

Leg 5 according to Gnanamuthu composed of 3 segments, but very probably the appendage has become folded in his preparation. Probably the structure is as follows: intermediate segment short, without setae; apical segment spatulate, with 3 apical, spiniform setae and an external spine. Leg 6 composed of 2 setae. The egg-sacs in this species are elongated sausage-shaped.

Male. Total length 1.36 mm. For a description of this stage see Gnanamuthu, 1949, p. 314.

The type host is *Dussumiera acuta* Valenciennes, the type locality Madras, India. The parasites were attached to the inside of the operculum of the host. Holotype (female) and male allotype in the collection of the Zoological Survey of India, Calcutta; paratypes in Dr Gnanamuthu's private collection. The species has not been recaptured since the original publication.

REMARKS. This is the only *Nothobomolochus* of which the male has been described. Unfortunately neither female nor male are adequately described and the drawings, especially those of the legs, are vague and probably inaccurate.

***Nothobomolochus cypseluri* (Yamaguti, 1953)**

Bomolochus (Artacolax) cypseluri Yamaguti, 1953, p. 224, pl. 2 fig. 19, pl. 3 figs. 20-27, pl. 4 fig. 28.

Artacolax cypseluri Shiino, 1957, pp. 417, 422; Yamaguti & Yamasu, 1959, p. 92.

Female. Total length 2.4 mm. Cephalic somite broad, twice as wide as long, slightly trapezoid, anteriorly fairly flat, postero-lateral corners produced, posterior margin slightly convex. There is no V-shaped groove on the cephalic somite and no eye is visible. Thoracic somites 2 and 3 much narrower than cephalic somite, third dorsally covering the fourth, but apparently both segments are not fused. Abdomen slender, $\frac{4}{5}$ the length of cephalothorax, furcal rami conical, 3 times as long as wide, one of the setae on each side lengthened and thickened. Antennular base with 12 plumose, sensory appendages; dorsal plates with tripartite free margin; of the finger-shaped processes the innermost are fairly short and almost setiform, the 2 remaining processes of each side are strongly developed, diverging and more than twice as long as the plumose setae. Endopodite of antenna with fairly coarse spinules; lamellar process and tubercle with pectinate row of spinules. In addition there are 3 hooked spines, 1 straight spine and 2 setae. Claw of maxillipede strong, smooth, basis with 2 strong and 1 short, fine seta. Setal and spinal formulae (taken from Yamaguti's very accurate figures) as follows:

	endopodite	exopodite
leg 1	I + 0 . I + 0 . 5	6 + III
leg 2	I + 0 . 2 + 0 . 3 + II	0 + I . I + I . 6 + III
leg 3	I + 0 . 2 + 0 . 2 + II	0 + I . I + I . 5 + III
leg 4	I + 0 . I + 0 . I + I + I	0 + I . I + I . 5 + III

Leg 5 with short intermediate segment bearing a minute seta. Apical segment scarcely spatulate, with 3 apical setae (median lengthened) and a short external seta. Egg-sacs elongated ovate, longer than abdomen.

Male unknown.

The type host is *Cypselurus agoo* (Temminck & Schlegel) (= *Prognichthys agoo* (Temminck & Schlegel)), the type locality Hamazima, Mie Prefecture, Japan. A single specimen was found on the gills of the host. Holotype in Dr. Yamaguti's private collection.

REMARKS. Yamaguti's description is very complete and the drawings are admirable; though the species has never been recaptured it may easily be recognized by the structure of the rostral plate.

Nothobomolochus gibber (Shiino, 1957)

Bomolochus gibber Shiino, 1957, p. 411, figs. 1, 2.

Female. Total length 2.28 mm. Cephalic somite broad, twice as wide as long, inflated, anteriorly fairly flat, laterally and latero-caudally produced. There is a distinct V-shaped groove, opening under the insertion of the rostral plate, the base of which is practically invisible from above. There is no eye. Muscles operating the antennules distinctly visible through the carapace. Second thoracic somite much narrower than cephalic somite; third thoracic somite wider, only slightly narrower than cephalic somite, inflated, much produced backward to cover the fourth and fifth thoracic somites. Abdomen short, half the length of the cephalothorax; furcal rami short, conical, $1\frac{1}{2}$ times as long as wide, one of the setae on each side lengthened and thickened. Antennules with 12 plumose sensory setae on basal portion. Dorsal plates with a tripartite free anterior edge; innermost finger-shaped process moderately developed, half as long as the remaining processes, almost setiform. The two remaining "fingers" are of equal size and about twice as long as the sensory setae. They diverge from the base onwards. Endopodite of antenna roughened by very small spinules. There is a small swelling at the insertion of the lamellar process, both swelling and process have a lamellar row of pectinate spinules. In addition there are 6 hooked spines. Maxillule with 2 strong and 2 fine setae. Maxillipede with a moderate-

ly developed, curved claw and 3 setae, one of which is fine. Setal and spinal formulae (taken from Shiino's very accurate drawings) as follows:

	endopodite	exopodite
leg 1	1 + 0 . 1 + 0 . 5	6 + III
leg 2	1 + 0 . 2 + 0 . 3 + II	0 + I . 1 + I . 5 + III
leg 3	1 + 0 . 2 + 0 . 2 + II	0 + I . 1 + I . 5 + III
leg 4	1 + 0 . 1 + 0 . 1 + 1 + 1	0 + I . 1 + I . 5 + III

Leg 5 with slightly spatulate apical segment, bearing 3 terminal, spiniform setae (the median seta lengthened) and an external seta. Apex of this segment finely spinulose. External marginal spines on exopodite of legs 2 to 4 with a fringe of short, stiff hairs along both margins and a spur at the upper margin; the spines terminate in a flagellum.

Male unknown.

The type host is *Tylosurus giganteus* (Temminck & Schlegel) (= *T. indicus* (Le Sueur)), the type locality Owase, Mie Prefecture, Japan. Seventeen females were taken from the inside of the operculum of the host. Holotype in the collection of the Prefectural University of Mie; paratypes in the private collection of Dr. Shiino.

REMARKS. This species, particularly in the shape of the body, greatly resembles *Nothobomolochus saetiger*, it seems to differ, however, in particulars of the legs, notably the structure of the spines along the external margin of the exopodites of legs 2 to 4.

Nothobomolochus lateolabracis (Yamaguti & Yamasu, 1959)

Artacolax lateolabracis Yamaguti & Yamasu, 1959, p. 90, pl. 1 figs. 1-11.

Female. Total length 1.43-1.61 mm. Body cyclopoid, with a large, transversally produced cephalic somite and with the remaining thoracic somites gradually narrowing. The cephalic somite is slightly less than twice as wide as long and it is anteriorly deeply notched, so that the frontal parts of the antennules and the basal part of the rostral plate are distinctly visible from above. There is a V-shaped groove running posteriorly from the rostral plate. The second thoracic somite is much narrower than the cephalic somite; the third thoracic somite is backward produced and covers the major part of thoracic somite 4. The furcal rami are about twice as long as wide and one of the setae on each side is lengthened. The antennules are 6-segmented; there are 3 basal segments and a 3-segmented flagellum. On the basal segments there is the usual arrangement of plumose, sensory setae; the dorsal

plate is divided into three fairly broad and bluntly pointed finger-shaped processes of about the same length as the sensory setae. The antennules do not reach beyond the lateral margins of the cephalic somite. The endopodal segments of the antenna are roughened by rows of fine spinules; the tubercle and the lamellar process have a pectinate row of bigger spinules. The claw of the maxillipede is smooth but strongly curved; there are, on the maxillipedal basis, two large plumose setae and a small seta. The setal and spinal formulae (taken from the drawings by Yamaguti & Yamasu) are as follows:

	endopodite	exopodite
leg 1	I + 0 . I + 0 . 5	6
leg 2	I + 0 . 2 + 0 . 3 + II	0 + I . I + I . 5 + IV
leg 3	I + 0 . 2 + 0 . 2 + II	0 + I . I + I . 5 + III
leg 4	I + 0 . I + 0 . I + I	0 + I . I + I . 4 + III

The external marginal spines of the exopodites of the legs 2 to 4 are provided with a fine flagellum and a spur, but the external margin of these spines is smooth.

Leg 5 has a small intermediate segment with a small external seta. The apical segment is spatulate and has 3 apical spiniform setae, of which the median seta is lengthened. In addition there is a spiniform seta halfway along the external margin.

Male unknown.

The type host is *Lateolabrax japonicus* (Cuvier & Valenciennes); the type locality is given by Yamaguti & Yamasu as Inland Sea, probably Seto Naikai, Japan. 10 ovigerous female specimens were obtained from the gills of the host. No holotype has apparently been selected; the place where the type material is preserved is not stated in Yamaguti & Yamasu's paper, but probably it is in the collections of the Tamao Oceanographical Museum, Okayama University, Japan.

REMARKS. *Nothobomolochus lateolabracis* approaches *N. denticulatus* rather closely, especially in the structure of the antennule. There are some vague points in the description of *N. lateolabracis* by Yamaguti & Yamasu; the abdomen, for instance, is stated to be 3-segmented whilst the structure of the antenna does not appear clearly from the description. It is a pity that the beautiful figures illustrating the description of this species are so strongly reduced that the structure of the antennule (pl. 1 fig. 7) is obscured. Though the species was originally included in the genus *Artacolax* it is very distinctly a *Nothobomolochus* which agrees in all essential details with the well de-

scribed species of this genus (*N. managatuwo* (Yamaguti), *N. cypseluri* (Yamaguti), *N. gibber* (Shiino) and *N. epulus* nov. spec.).

***Nothobomolochus epulus* nov. spec.** (figs. 10-12)

LOCALITY. Niger delta between Port Harcourt and Brass, Nigeria, 1960. On *Diagramma macrolepis* Boulenger, type host, collected by Mr. H. J. G. Beets. One non-ovigerous female of 1.40 mm length (holotype) and two ovigerous females (paratypes) of 1.37 and 1.38 mm length. All specimens were collected from the branchial cavity of two juvenile specimens of the type host. All specimens are in the collection of the Rijksmuseum van Natuurlijke Historie, Leiden; the holotype has been dissected.

DESCRIPTION OF THE HOLOTYPE.

Total length 1.40 mm; greatest diameter 0.78 mm. Length of cephalic somite 0.42 mm; width of same 0.78 mm. Length of second thoracic somite 0.17 mm; width of same 0.57 mm. Length of third thoracic somite 0.32 mm; width of same 0.47 mm. Total length of cephalothorax 0.90 mm; length of abdomen (fifth thoracic somite included) 0.50 mm. Length of genital somite 0.17 mm; width of same 0.28 mm. Length of third abdominal somite 0.09 mm; width of same 0.20 mm. Length of fourth abdominal somite 0.06 mm; width of same 0.17 mm. Length of fifth abdominal somite 0.06 mm; width of same 0.14 mm. Length of furca 0.09 mm; diameter of same at base 0.05 mm. Length of longest furcal seta 0.35 mm.

The general shape of the body reminds of *Nothobomolochus gibber* (Shiino); it is more or less cyclopid, with the greatest diameter at the cephalic somite and with the remaining thoracic somites gradually narrowing. The head and the first thoracic somite are fused to form the cephalic somite, which in dorsal view has an even, broadly rounded frontal outline and is squarely cut off posteriorly (fig. 10a). It is about twice as wide as long and has a deep V-shaped, longitudinal groove, opening under the very distinct rostral plate. The mid-dorsal line is marked by an (internal) chitinized ridge; the muscles operating the antennules insert on that plate, and are faintly visible through the tegument. No eye is visible. The back, in lateral view, is evenly rounded (fig. 10b).

The second thoracic somite, in dorsal view, is visible as a narrow band with rounded sides; it is broader than the third thoracic somite. This third thoracic somite is well developed and strongly produced backward, completely covering the fourth and part of the fifth thoracic somites; it is, nevertheless, not fused with the fourth thoracic somite. The exact shape of somite 3 appears clearly from a comparison of figs. 10a and 10b. The fourth thoracic somite is small, in dorsal aspect it is completely hidden under the backward-

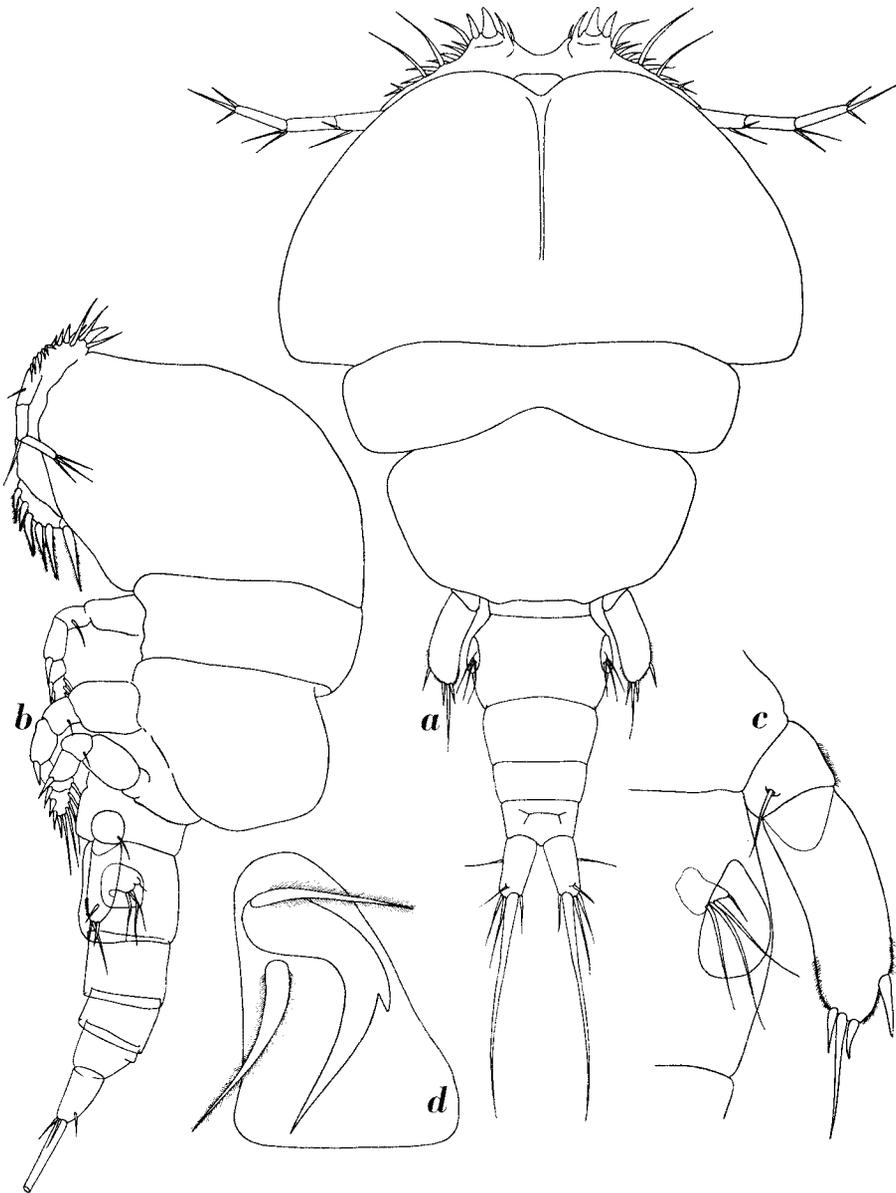


Fig. 10. *Nothobomolochus epulus* nov. spec., adult ♀ from *Diagramma macrolepis* Boulenger. a, whole animal, dorsal aspect; b, whole animal, lateral view from left side; c, right fifth leg and part of genital somite, dorsal aspect; d, left maxillipede. a, b, $\times 70$; c, $\times 185$; d, $\times 310$.

produced part of somite 3. The fifth thoracic somite is represented by a narrow ring, just visible behind the margin of the third somite. Coxae and bases of legs 1 to 4 are not visible from above.

The genital somite of the abdomen is composed of the fused abdominal somites 1 and 2; it has distinct lateral swellings and is 1.5 times as wide as long. There is, on each side, a large opening, situated latero-dorsally, bordered by a strongly chitinized margin. From the opening protrude three fine setae, placed on a distinctly visible but small genital flap (leg 6), the basal part of which has a small seta. The genital flaps and the part on which they insert are strongly chitinized. Abdominal somites 3 to 5 tapering, gradually narrowing, the anal somite with an almost straight anal flap.

The furcal rami are conical and slightly tapering; they are 1.5 times as long as wide. Each ramus has 5 marginal setae and 1 appendicular seta, the position appears clearly from fig. 10a. The setae 1, 3 to 5 and the appendicular seta are small and short, the fifth inserting some distance above the middle of the external margin. Seta 2 is greatly thickened and reaches the end of the abdomen. It has a distinct basal portion, beyond which it suddenly narrows.

A fairly broad part of the lateral margin of the cephalic somite is turned inwards; the frontal parts of this margin are fused with the basal parts of the antennules. The antennules are distinctly and completely visible from above; they are united frontally by a median plate. The rostral plate is visible from above in front of the deepened part of the cephalic somite. The rostral plate curves sharply ventro-caudally; the free margin is distinctly thickened and medially produced into a knob with 2 short points. The ventral part of the cephalic somite is deepened to form a disk bordered by the antennules, the lateral margins of the somite and the first legs. The second antennae and the oral parts insert on the deeper parts of this disk (fig. 11a).

Each antennule is composed of an, apparently 3-segmented, basal part and a 3-segmented flagellum. The articulation of the segments of the basal part is very indistinct; the basal part is furthermore characterized by the presence, on each side, of a strongly chitinized dorsal plate. These dorsal plates continue ventrally as a chitinized, ring-shaped structure, taken up into the antennular structure and fused with the system of chitinized ridges of the ventral part of the cephalic somite. Three of the plumose sensory appendages of the ventral surface of each antennular base are fused with the dorsal plate and are chitinized, forming, at the base of each antennule, a three-pointed structure, which is directed forward (fig. 11b, c, d). The median spine is particularly strongly chitinized and dagger-shaped, its base is distinctly swollen. The flanking spines, though of the same length as the median spine,



Fig. 11. *Nothobomolochus epulus* nov. spec., adult ♀ from *Diagramma macrolepi*. Boulenger. a, ventral aspect of left part of cephalothorax, showing the left antennule, antenna, oral appendages, and first leg; b, left antennule, dorsal aspect; c, dorsal plate and two median setae of left antennule; d, basal part of left antennule, ventral aspect; e, left mandible, slightly turned to show the position of the smaller tooth; f, paragnath; g, maxillule; h, left maxilla, inside; i, leg 4. a, $\times 65$; b, e, f-h, $\times 300$; c, d, i, $\times 175$.

can still be recognized as setae and insert on a moderately swollen basal part. In addition there are 12 plumose sensory setae on the ventral surface of each antennular base; two insert medially of the dorsal plate, the rest laterally. In addition there are, on each base, three normal marginal setae and some smaller ventral setae, the position of which appears from figs. 11b and 11d.

Second antennae (fig. 12d) of the usual structure, inserting close to the apex of the maxillipedes, pointing medially, with the endopodite folded over coxa and basis. The first and second endopodal segments are separate, both covered with longitudinal rows of fairly big spines. Four strong, hooked setae and a small seta insert near the articulation between the endopodal segments. In addition there is a lamelliform process with a pectinate row of fine teeth. Near the insertion of the lamelliform process there is a strong, curved spine and a small tubercle or flap with a row of pectinate spinules. A fine seta occurs on the coxa. Cutting edge of the mandible with one big tooth with strongly chitinized, ribbed edge and a much smaller tooth; the free margin of the labrum projects slightly over the median part of the mandibles (fig. 11e). Paragnaths are present (fig. 11f), the free margin rounded and highly chitinized, apparently with a small notch or tooth. Maxillule with 4 setae, two of which are fine (fig. 11g). The maxilla has a slender median lobe, at the apex of which there are two haired teeth (fig. 11h). The maxillipedes are to be found in the usual position, the claw is strongly sigmoid and has a distinct, acute auxiliary tooth (fig. 10d); there are two haired setae, one on the basis and one near the insertion of the claw.

The setal and spinal formulae of the legs are as follows:

	endopodite	exopodite
leg 1	I + 0 . I + 0 . 5	0 + 0 . 3 + I . 3 + 0
leg 2	I + 0 . I + 0 . 3 + II	0 + I . I + I . 5 + IV
leg 3	I + 0 . 2 + 0 . 2 + II	0 + I . I + I . 5 + III
leg 4	I + 0 . I + 0 . I + I + I	0 + I . I + I . 4 + III

The endo- and exopodites of the first legs (fig. 12a) are strongly flattened. The coxa is strong and fused with the triangular intercoxal plate. There is, on each side, a medially directed, hairy plate. The basis is big. The segments of the exopodite are well separated; the first has no appendages, the second a small external spine and three internal setae; the third has 3 setae. All setae are strongly plumose. The first and second endopodal segments have hairy external borders and each have a strongly hairy, big internal seta. The third has a total of 5 big, hairy setae.

Leg 2 has flattened endopodites. The coxa has a small internal seta, the

basis a fine external seta. The second endopodal segment has 2 internal setae; third endopodal segment with 3 setae and 2 spines (fig. 12b).

Leg 3 has a strong, hairy seta on the internal part of the coxa. The second and third exopodal segments have denticulated lamellae along the external

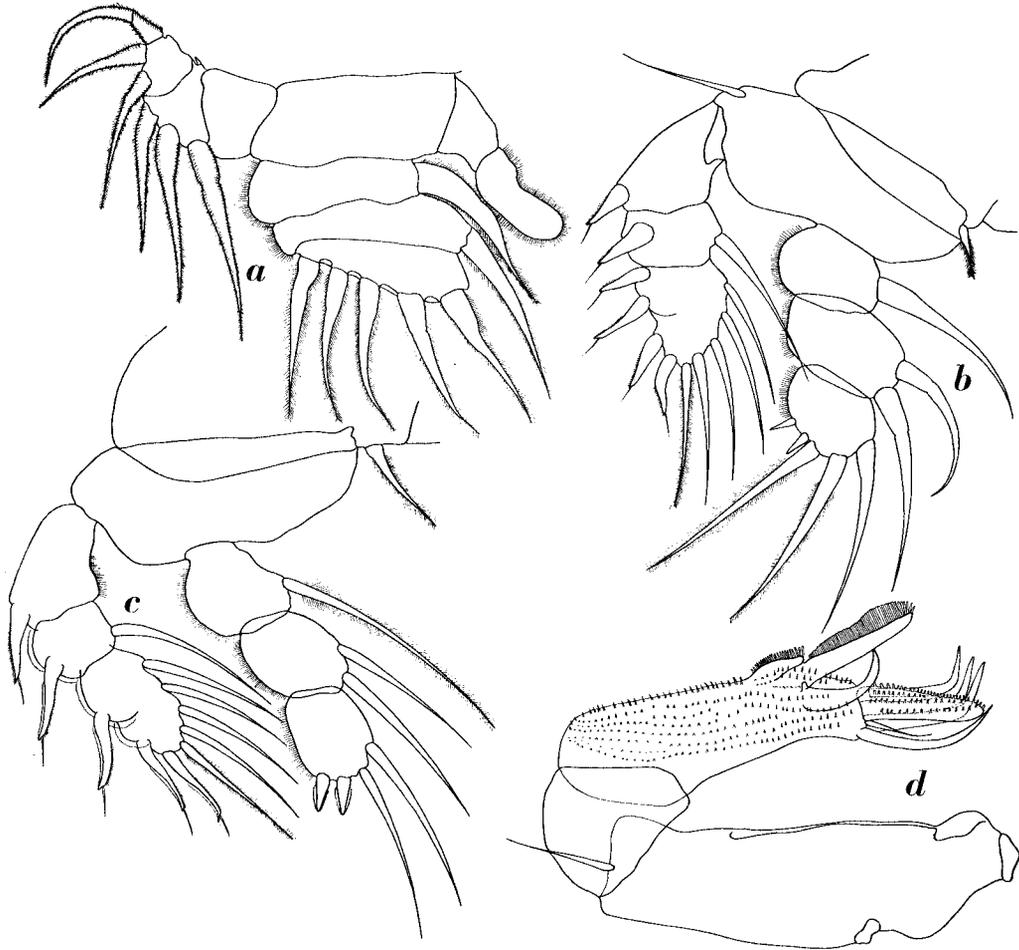


Fig. 12. *Nothobomolochus cpulus* nov. spec., adult ♀ from *Diagramma macrolepis* Bou-
lenger. a, leg 1; b, leg 2; c, leg 3; d, left antenna, outside. a-c, $\times 185$; d, $\times 310$.

margin. The second endopodal segment has 2 internal setae; the third has 2 setae and 2 short spines (fig. 12c).

Leg 4 has a small external seta on the basis; the coxa is without seta. The external margins of the exopodal segments have denticulated lamellae. Internal setae of first and second endopodal segments short, spiniform (fig. 11i).

All the external and apical spines of the exopodites of the second to fourth legs are of the flagellate type: the external margin has a fine, denticulated lamella, running into a distinct spur, the internal margin bears short hairs, and the apex has a fine flagellum.

The intermediate and apical segments of leg 5 are well separated; the intermediate segment has a fine seta. The apical segment is only slightly reniform; there are three apical appendages: two short spines flanking a median seta. In addition there is a spine at the external margin, close to the apex. The terminal parts of the in- and external margins bear short hairs (fig. 10c).

REMARKS. This appears to be the only species of *Nothobomolochus* with an auxiliary tooth on the claw of the maxillipede. Amongst those species of *Nothobomolochus* that have a backward produced third thoracic somite it approaches *Nothobomolochus gibber* closest; its general shape, however, is different by the more evenly rounded cephalic somite, the broader second thoracic somite and the reduced size of the backward produced part of somite three. The only noteworthy differences with the appendages of *Nothobomolochus gibber*, fully illustrated by Shiino, 1957, are the presence of an external spine on the first exopodal segment of leg 1 and a differently shaped leg 5. The dorsal plate of the antennule too shows some small differences.

Orbitacolax Shen, 1957

DIAGNOSIS. Female. Body more or less cyclopoid, cephalothorax variously developed in different species; the thoracic somites either gradually narrow or they have the same diameter down to the fourth thoracic somite, which is suddenly strongly narrowed. Head and first thoracic somite fused to form the cephalic somite, the anterior portion of which is usually rounded, the posterior wall cut off squarely. There is a prominent, produced part between the antennular bases, supporting the rostrum, which may even become articulating with the cephalic somite. Thoracic somites 2 to 4, viewed from above, with broadly rounded sides, exposing the bases of the legs. Abdomen short, about half the length of cephalothorax or shorter; genital somite with distinct lateral swellings. Furcal rami slightly tapering, 1.5 times as long as wide, with 5 marginal and 1 appendicular seta; one of the setae on each side is lengthened. Antennules composed of a 3-segmented basal part and a 3-segmented flagellum. Basal part ventrally unarmed, bearing 14 or 15 plumose, sensory appendages, none of which is abnormally shaped. Antenna with first and second endopodal segments fused, corrugated by longitudinal rows of small spinules. There is a lamellar process with a pectinate row of short spinules and 3 hooked and 2 normal setae. Maxillule with 3 setae. Paragnaths present. Maxillule with a strong, sigmoid claw, bearing a big auxiliary tooth.

The number of setae on the maxillipede varies between 0 and 2. Exopodite of leg 1 with fused segments, flattened. Endopodite very strongly flattened and broadened, composed of 3 more or less separate segments. Legs 2 to 4 characterized by inflation of coxae and bases. All rami 3-segmented, but external marginal spines of exopodites of reduced size, setation of both endo- and exopodite reduced. Bases with external seta; setal and spinal formulae slightly different in the various species. Leg 5 composed of an intermediate segment (in some species fused with somite 5) and an apical, spatulate segment, bearing 2 or 3 setae. Egg-sacs ovate, about as long as abdomen.

The males of this genus have been described by Shiino (1960, p. 505). They have a flattened, shield-shaped cephalothorax as is also observed in the females, though much less wide. The antennules and the maxillipedes are modified, whilst the segmentation and setation of the legs differs considerably from that found in the females of *Orbitacolax*. As is usual in the males of the Bomolochinae the maxillipedes are chelate and are used to attach the male to the abdomen of the female.

Parasites of the orbit, gills and skin of fishes.

Type species, by original designation, *Orbitacolax uniunguis* Shen, 1957.

Further species: *Bomolochus leptoscari* Yamaguti, 1953, *Bomolochus dactylopterusi* Carvalho, 1958, and *Taeniacanthus hapalogenyos* Yamaguti & Yamasu, 1959.

REMARKS. This genus is well differentiated from those mentioned above by a combination of characters of cephalothorax, antennules, maxillipedes and legs. The extreme flatness of the endopodite of leg 1 and the reduction of the setation of legs 2 to 4 are particularly noteworthy, whilst the flatness of the cephalothorax though less extreme, is also observed in the male.

Key to the females of *Orbitacolax*:

1. Thoracic somites gradually narrowing. Rostral base articulating with cephalic somite. Intermediate segment of leg 5 free. Antennular base composed of two separate parts, antennule curved backwards along side of cephalic somite. *O. uniunguis* Shen
- Cephalic somite and thoracic somites 2 and 3 form a large, shield-shaped part; body suddenly narrowed behind third somite because of much narrowed fourth thoracic somite. Rostral base forming a rounded mass in front of the cephalic somite, fused with that part of the body. Intermediate segment of leg 5 fused with thoracic somite 5. Antennular base composed of 3 fused segments; flagellum 3-segmented, curving anteriorly 2
2. Fourth thoracic somite three fourth the width of the preceding somites. Endopodite of the antenna with interrupted, short rows of spinules. *O. dactylopterusi* (Carvalho)
- Fourth thoracic somite half as wide as preceding somites. Endopodite of antenna with uninterrupted rows of spinules. 3
3. Outline of shield-shaped cephalothorax interrupted by deep, rounded incisions between cephalic somite and thoracic somite 2 and between the second and third thoracic

- somites. Third exopodal segment of leg 4 with 2 setae at the internal margin. *O. hapalogenyos* (Yamaguti & Yamasu)
- Outline of shield-shaped cephalothorax uninterrupted, no deep incisions between the various somites. Third exopodal segment of leg 4 without setae at the internal margin. *O. leptoscari* (Yamaguti)

Orbitacolax leptoscari (Yamaguti, 1953)

Bomolochus leptoscari Yamaguti, 1953, p. 222, pl. 1 figs. 9-11, pl. 2 figs. 12-18; Shiino, 1960, p. 501, figs. 1-3.

Bomolochus (Orbitacolax) leptoscari, Shen, 1957, p. 310.

Female. Total length 1.15 mm. Body of a very characteristic shape as the cephalic somite and thoracic somites 2 and 3 have the same width; the fourth is much narrower and the abdomen is very short. Cephalic somite anteriorly broadly rounded, with produced part between the antennules carrying the rostral base. Apex of rostrum split into 2 strongly chitinized points. No eye is visible. Sides of thoracic somites 2 and 3 rounded. Thoracic somite 4 about half as wide as preceding somites. Fifth thoracic somite with broad shoulders because of fusion of intermediate segment of leg 5 with somite. Abdomen short, one third the length of cephalothorax, genital somite with rounded sides. Furcal rami 1.5 times as long as wide, slightly narrowing; one of the setae on each side thickened. Antennular base composed of 3 fused segments, bearing 14 sensory appendages; flagellum 3-segmented. Antenna with continuous bands of spinules on the endopodite. Maxillipede with 2 setae, auxiliary tooth on claw blunt. Endo- and exopodal segments of leg 1 more or less fused. Setal and spinal formulae (taken from Yamaguti's drawings) as follows:

	endopodite	exopodite
leg 1	1 + 0 . 1 + 0 . 5	6 + IV
leg 2	1 + 0 . 0 + 0 . 3	0 + I . 0 + I . 2 + III
leg 3	1 + 0 . 0 + 0 . 2	0 + I . 0 + I . 2 + III
leg 4	0 + 0 . 0 + 0 . 2	0 + I . 0 + I . 0 + III

Spines along external margin of exopodites of reduced size.

Leg 5 with intermediate segment fused with thoracic somite 5, bearing a short seta. Apical segment spatulate, with 2 unequal, terminal setae. Egg-sacs ovate, longer than abdomen, with large eggs.

For a description of the male I may refer to Shiino, 1960, p. 505.

The type host is *Leptoscarus japonicus* (Cuvier & Valenciennes), the type locality Hamazima, Mie Prefecture, Japan. A single female was found attached to the gills of its host. This holotype is in Dr. Yamaguti's private collection. Additional female and male specimens were described from

the same host by Shiino (1960, p. 501). The females measured 0.90 mm, the males 0.46 mm. The females have almost the same setal and spinal formulae as Yamaguti's specimen, but here the first endopodal segment of leg 4 has a distinct, internal setiform spine. Shiino's material, including the allotypic male, is probably preserved in the collections of the Faculty of Fisheries, Prefectural University of Mie, Japan. The parasites were found on the skin of the host, which was captured off Seto, Kii Province, Japan.

REMARKS. An ovigerous female specimen of this species was found in a weed washing from the Caroline Islands (Vervoort, in press). This specimen has slightly different setal and spinal formulae, whilst the setae on the bases, which are not figured by Yamaguti, but which almost certainly have been present as they are also illustrated by Shiino (l.c., fig. 2 b-d), are very conspicuous here. The spinal and setal formulae of this specimen from the Caroline Islands are the following:

	endopodite	exopodite
leg 1	1 + 0 . 1 + 0 . 5	6 + IV
leg 2	1 + 0 . 2 + 0 . 3	0 + I . 0 + I . 1 + III
leg 3	1 + 0 . 2 + 0 . 2	0 + I . 0 + I . 2 + III
leg 4	1 + 0 . 1 + 0 . 2	0 + I . 0 + I . 0 + III

Leg 5 with 1 fine external and 3 apical setae on the terminal segment.

External margin of exopodal segments set with fine, scale-shaped teeth.

***Orbitacolax uniunguis* Shen, 1957**

Orbitacolax uniunguis Shen, 1957, pp. 308, 322.

Bomolochus (*Orbitacolax*) *uniunguis* Shen, 1957, pl. 7.

Female. Total length 2.00 mm. Body characterized by a broad cephalic somite and gradually narrowing thoracic somites, cephalothorax imperceptibly merging into abdomen. Cephalic somite transversally widened, twice as wide as long, anteriorly flat; rostral plate in dorsal aspect of a conical structure, articulating with cephalic somite, apex rounded. No eye is visible. Sides of thoracic somites rounded. Fifth thoracic somite small, intermediate segment of leg 5 not fused with thoracic somite 5. Abdomen short, half the length of cephalothorax. Antennules with an apparently 2-segmented basal portion, bearing about 13 sensory appendages; flagellum 3-segmented. Second endopodal segment of antenna slender; corrugations caused by fine spinules, arranged in rows. Maxillipede with a single seta; claw with big, pointed auxiliary tooth. Endopodite of leg 1 even more flattened and broadened than in the previous species. Setal and spinal formulae (taken from Shen's drawings) as follows:

	endopodite	exopodite
leg 1	1 + 0 . 1 + 0 . 5	6 + IV
leg 2	1 + 0 . 0 + 0 . 3	0 + I . 0 + I . III
leg 3	1 + 0 . 0 + 0 . 2	0 + I . 0 + I . 1 + III
leg 4	1 + 0 . 0 + 0 . 2	0 + I . 0 + I . 1 + III

External marginal spines of exopodites of legs 2 to 4, with exception of apical spine, of reduced size; apical spine strong. Terminal segments set with fine, scale-shaped teeth. Leg 5 with a fine seta on intermediate segment; apical segment elongated ovate, with 2 terminal setae. Egg-sacs broadly ovate, slightly longer than abdomen.

Male unknown.

The type host is *Caranx* spec., the type locality New Village, Hainan Island, China. Three females were found attached to the orbit of their host.

***Orbitacolax dactylopterusi* (Carvalho, 1958)**

Bomolochus dactylopterusi Carvalho, 1958, p. 47, fig. 1.

Female. Total length 1.1 mm. General shape of body as in *O. leptoscari* (Yamaguti); thoracic somites, however, slightly narrowing, fourth somite wider. Base of rostral plate smaller; rostrum curved caudo-ventrally, apex with two strongly chitinized points. There is no eye. Intermediate segment of leg 5 fused to thoracic somite 5; abdomen short, less than half the length of cephalothorax. Furcal rami slightly tapering, one of the setae on each side thickened and lengthened. Basal part of antennules distinctly 3-segmented, with 15 sensory appendages; flagellum 3-segmented. Rows of spinules on endopodite of antenna interrupted. Maxillule with 3 setae. Maxillipede with strongly curved claw with small auxiliary tooth; no setae occur on the maxillipede. Leg 1 with a strongly flattened and broadened endopodite, covered with short hairs. Legs 2 to 4 with transversally elongated bases; these segments as well as the segments of the endopodite, have patches of short hairs. Exopodites with scale-shaped teeth along their external margins. Setal formulae only known of legs 1 and 2; though Carvalho states that legs 3 and 4 are similar to leg 2 there have almost certainly been small differences in setation. External marginal spines of exopodites, with exception of apical spine, slender. Intercoxal plates hairy. Setal and spinal formulae (of legs 1 and 2 only, taken from Carvalho's figures) as follows:

	endopodite	exopodite
leg 1	1 + 0 . 1 + 0 . 5	6 + III
leg 2	1 + 0 . 1 + 0 . 3	0 + I . 0 + I . 2 + III

Leg 5 with intermediate segment fused to thoracic somite 5, seta inserting on the "shoulder" of his segment. Apical segment weakly spatulate, with indistinct articulation, 3 terminal setae (median lengthened) and 2 patches of fine spinules.

Male unknown.

The type host is *Dactylopterus volitans* (L.); type locality, São Paulo, Atlantic coast of Brazil. The parasite was apparently found on the gills of its host, though this is not distinctly stated in Carvalho's paper. The holotype is in the collection of the Oceanographic Institute of the University of São Paulo.

Orbitacolax hapalogenyos (Yamaguti & Yamasu, 1959)

Taeniacanthus hapalogenyos Yamaguti & Yamasu, 1959, p. 95, pl. 3 figs. 44-55.

Female. Total length 1.0-1.71 mm. Cephalothorax shield-shaped, flattened, ovoid in outline. The cephalic somite is as long as the combined lengths of thoracic somites 2 and 3, frontally broadly rounded, posteriorly cut off squarely. The basal part of the rostral plate is firmly attached to the cephalic somite and forms a rounded prominence between the basal parts of the completely visible antennules. The apex of the rostrum is split into two diverging points. Deep rounded incisions separate the cephalic somite from the second thoracic somite, and the second and third thoracic somites. Sides of the second and third thoracic somites rounded. Fourth thoracic somite half as wide as the preceding somites. Abdomen short, about one third the length of the cephalothorax; furcal rami narrowing, one of the setae on each side lengthened. The ventral aspect of the abdominal somites 3 to 5 and the furcal rami are covered with small spinules. The basal part of the antennules is indistinctly 3-segmented and carries 15 plumose, sensory appendages; the flagellum is 3-segmented. The endopodite of the antennule is covered with long rows of small spinules, whilst the lamellar process has a pectinate row of spinules. The maxillule has 3 setae. The maxillipede has a strongly curved claw and apparently only 2 setae; one of these setae is big and plumose and inserts on the basis, the second seta is small and inserts close to the base of the claw. Leg 1 strongly flattened, spinules occur on the basis and the endopodal segments; the intercoxal plate too is strongly spinulose. The legs 2 to 4 have 3-segmented, spinulose endo- and exopodites, the bases are transversally elongated. The external marginal spines of the exopodites are slender. The setal and spinal formulae, taken from Yamaguti & Yamasu's drawings, are as follows:

	endopodite	exopodite
leg 1	1 + 0 . 1 + 0 . 5	6 . III
leg 2	1 + 0 . 2 + 0 . 3	0 + I . 0 + I . 3 + III
leg 3	1 + 0 . 1 + 0 . 3	0 + I . 0 + I . 3 + III
leg 4	1 + 0 . 1 + 0 . 3	0 + I . 0 + I . 3 + III

Intermediate segment of leg 5 fused with fifth thoracic somite and apparently without seta. The free segment is more or less spatulate and has two patches of spinules along the external border. There are three apical setae, the median of which is lengthened, and a fine seta at the external margin. The genital plates (sixth legs) are armed with 3 setae. The egg-sacs are ovoid and slightly depressed; they are more than twice as long as the abdomen.

Male unknown.

The type host is *Hapalogenys mucronatus* (Eyedoux & Souleyet); the type locality is specified as Inland Sea, probably Seto Naikai, Japan. The parasites, seven ovigerous females, were found on the gills and in the oral cavity of their host; no distinct holotype has been indicated and the place where the type material is preserved is not stated. Probably the material is in the collection of the Tamano Oceanographical Museum, Okayama, Japan.

REMARKS. Though this species was described as *Taeniacanthus hapalogenyos* there is no doubt at all that its proper place is in the genus *Orbitacolax*.

***Pseudoeucanthus* Brian, 1906**

DIAGNOSIS. Female. Body generally more elongated than in the previous genera; head fused with the first thoracic somite, though a line of fusion may be distinctly visible. Cephalic somite rounded anteriorly and laterally, cut off squarely posteriorly. Place of attachment of rostrum distinctly produced between insertion of antennules, development of rostrum unknown, apex bifid.

Thoracic somites gradually narrowing; cephalothorax imperceptibly merging into abdomen. Genital somite with distinct swellings laterally; anal plates (leg 6) armed with 2 setae. Abdomen short, one third the length of cephalothorax or shorter. Furcal rami tubular, twice as long as wide, with 5 marginal and 1 appendicular setae; one of the setae on each side thickened but only slightly lengthened. Antennules without modified basal portion, composed of 5 or more segments, with sensory setae and an unknown number of normally developed setae. Development of oral appendages as in previous genera, though the detailed structure of the antenna is unknown. Paragnaths present. Maxillipede with curved claw without auxiliary tooth;

no plumose setae. Leg 1 with both rami flattened; endopodite comparable to those found in *Bomolochus*, *Nothobomolochus* and *Parabomolochus*, though not so strongly broadened as in *Orbitacolax*. Segments of endopodite usually well defined, those of exopodite fused. Segments of endo- and exopodites of legs 2 to 4 more or less distinctly fused, though originally 3-segmented. Segments 1 and 2 of exopodites without internal setae. Leg 5 without intermediate segment or this segment fused to somite 5. Apical segment elongated reniform, with 2-3 apical and 0-1 external setae. Egg-strings very long and slender, eggs large.

Males unknown.

Type species (by monotypy): *Pseudoecanthus alosae* (Brian, 1902).

Further species: *Pseudoecanthus uniseriatus* C. B. Wilson, 1913.

Parasites from the orbit and the mouth of fishes.

REMARKS. The diagnosis of this genus contains several uncertain points, as, e.g., the structure of rostrum, antennules, and antennae. Brian's original diagnosis of this genus contains several mistakes, that have partly been amended by C. B. Wilson (1913, p. 205), but unfortunately Wilson's informations are not complete on the points mentioned above.

The two species of this genus can be distinguished as follows:

1. Cephalic somite longer than broad, rostral base not greatly produced between antennular bases; no eye visible. Egg-strings elongated ovate, eggs arranged in two rows. *P. alosae* (Brian)
- Cephalic somite about as long as wide, rostral base distinctly produced between the antennular bases. Median eye immediately behind rostral base. Egg-strings long and slender, eggs arranged in one row. *P. uniseriatus* C. B. Wilson

Pseudoecanthus alosae (Brian, 1902)

Eucanthus alosae Brian, 1902, p. 33.

Pseudoecanthus alosae, Brian, 1906, p. 26, pl. 11 figs. 1-8; C. B. Wilson, 1913, p. 381.

Female. Total length 1.08 mm. Body characterized by the rounded cephalic somite, composed of fused head and first thoracic somite, the slender and slightly tapering rest of the thorax and the short, thin abdomen. Cephalic somite slightly longer than wide, ovoid; rostral base not produced between antennular bases, no eye visible. Apex of rostrum bifid. Second thoracic somite narrow and short; somites 3, 4 and 5 better developed and wider. Abdomen short, one third the length of the cephalothorax; furcal rami tubular, about 3 times as long as wide. Number of segments of antennule unknown; basal segments with a number of hairy sensory appendages. First and second endopodal segments of antenna fused, with a pectiniform row of spinules and several rows of smaller spinules. In addition there is a lamellar process and at least 4 hooked spines or setae.

Exopodites of legs 1 to 4 fused; segments of endopodites more or less distinctly separated. Setal and spinal formulae (taken from Brian's drawings) as follows:

	endopodite	exopodite
leg 1	1 + 0 . 1 + 0 . 5	6
leg 2	1 + 0 . 2 + 0 . 4	0 + 1 . 0 + 1 . 3 + 1
leg 3	1 + 0 . 1 + 0 . 4	0 + 1 . 0 + 1 . 3 + 1
leg 4	1 + 0 . 1 + 0 . 2	0 + 1 . 0 + 1 . 3 + 1

Leg 5 with intermediate segment absent or fused with fifth thoracic somite. Apical segment elongated, with 2 apical setae. Armature of each genital plate composed of 2 setae. Egg-strings elongated ovate, with the eggs arranged in two rows.

Male unknown.

The type host is *Clupea alosa* L. (= *Alosa alosa* (L.)), the type locality Portoferraio, Elba, Italy. The parasite was attached to the eye of its host. Holotype in the collection of the Zoological Museum of the University of Genoa.

REMARKS. This species has not been recorded again since the publication of Brian's description. A redescription of this rare species is highly desirable.

***Pseudoeucanthus uniseriatus* C. B. Wilson, 1913**

Pseudoeucanthus uniseriatus C. B. Wilson, 1913, p. 203, pl. 24.

Female. Total length 1.25 mm. Body elongated; cephalic somite, formed by a complete fusion of the head and the first thoracic somite, is shield-shaped, as long as wide, with its postero-lateral corners rounded, produced, and slightly overlapping the second thoracic somite. Rostral base produced between the antennules, rounded. Median eye small, directly behind rostral base. Thoracic somites 2 to 5 of almost the same width. Abdomen slender and short, shorter than half the length of cephalothorax, genital somite rounded on both sides. Furcal rami twice as long as wide, one of the setae on each side thickened but scarcely lengthened. Antennules with 5 indistinctly separated segments. Endopodite of antenna with first and second endopodal segments separate, a row of pectinate teeth is found on both segments; in addition there are at least 2 hooked spines and a seta. Maxillule with 3 setae. Maxillipede without setae, claw curved, smooth. Segments of endo- and exopodites of legs 1 to 4 more or less fused, though the original articulation can still be observed. Setal and spinal formulae (taken from C. B. Wilson's figures) as follows:

	endopodite	exopodite
leg 1	I + 0 . 2 + I . 4	6
leg 2	I + 0 . 2 + 0 . 3 + II	0 + I . 0 + I . 3 + II
leg 3	I + 0 . 1 + 0 . 3 + I	0 + I . 0 + I . 3 + III
leg 4	I + 0 . 1 + 0 . 2 + I	0 + I . 0 + I . 3 + III

Leg 5 without intermediate segment (or this segment fused to thoracic somite 5). Apical segment slightly reniform, with 3 apical setae (median lengthened) and a short external spine.

Males unknown.

The type host is *Caranx crysos* (Mitchill), the type locality Montego Bay, Jamaica. Three females were taken from the oral cavity of the host; this lot, comprising the holotype, is in the U.S. National Museum.

Pumiliopes Shen, 1957

DIAGNOSIS. Female. Body cyclopoid, flattened, with large, shield-shaped cephalic somite and gradually narrowing thoracic somites, cephalothorax gradually merging into abdomen. Head and first thoracic somite fused, rounded, posterior border cut off squarely. Part of cephalic somite supporting the rostrum and the antennules set off from rest of cephalic somite by two lateral grooves, slightly produced, rostral base articulating with that portion, plate-shaped, wider than long. Paired median eyes visible directly behind rostrum. Thoracic somite 3 produced backward, covering part of fourth somite. Fifth thoracic somite narrow. Abdomen short and slender, about half the length of cephalothorax, genital somite with rounded sides. Furcal rami twice as long as broad, with 5 marginal setae, one of which is thickened and lengthened. An appendicular seta is probably also present. Antennules with a 3-segmented basal part and a 6-segmented, slender flagellum. There are 14 plumose, sensory setae on the base. Antenna of a type different from that commonly found in Bomolochinae, according to Shen "situated far apart from the mouthparts". There is a large coxa and a smaller base; the endopodite is folded over the coxa, resembling the condition found in other Bomolochinae. First endopodal segment large, with a longitudinal row of strong, short spines and a strong, hooked spine, inserting near the second endopodal segment. Second segment small, with 3 hooked spines and a seta. Mandibles, maxillules and maxillae as in other Bomolochinae; maxillule without setae. Paragnaths present, finger-shaped. Maxillipede with a strongly developed, cylindrical basis, bearing 2 setae. Endopodite claw-shaped; this claw strongly hooked at the apex, without auxiliary tooth. Leg 1 with exo- and endopodites

strongly flattened, the endopodite also broadened, resembling strongly the condition found in *Orbitacolax*. Legs 2 to 4 with transversally elongated bases and reduced segmentation. Exopodites 2-segmented but segments almost completely fused. Endopodites of legs 2 and 3 2-segmented, of leg 4 3-segmented. Number of spines and setae also reduced. Leg 5 with a small intermediate segment, bearing a small seta; apical segment reniform, with 3 terminal setae.

Male unknown.

Parasites of fishes, attached to the eye.

Type species (by monotypy): *Pumiliopes opisthopteri* Shen, 1957.

REMARKS. This genus resembles *Orbitacolax* in many points (the shape of the antennules, mandibles, maxillules, maxillae and legs) but differs in the structure of the antennae and maxillipedes.

Pumiliopes opisthopteri Shen, 1957

Pumiliopes opisthopteri Shen, 1957, pp. 310, 322, pl. 8.

Female. Total length 1.82 mm. This species is characterized by the particulars given under the generic diagnosis. Second and third endopodal segments of leg 1 completely fused. External margin of endopodal segments and first exopodal segment of legs 2 to 4 finely spinulose; external margin of second exopodal segment of these legs finely serrated, with big apical claw. Setal and spinal formulae (taken from Shen's drawings) as follows:

	endopodite	exopodite
leg 1	1 + 0 . 6	6 + I
leg 2	1 + 0 . 5 + 0	0 + I . 0 + I
leg 3	1 + 0 . 3 + 0	0 + I . 0 + I
leg 4	1 + 0 . 1 + 0 . 2 + 0	0 + I . 0 + I

Intermediate segment of leg 5 with a very small spinule. External seta of the set of 3 on the tip of the apical segment very small.

Male unknown.

The type host is *Opisthopterus tardoore* (Cuvier), the type locality Yin-ku Bay, Hainan Island, China. Two females were found attached to the eyes. Holotype unknown, probably in the collection of the Institute of Zoology, Academia Sinica, Peking.

Bomolochinae of uncertain position

Bomolochus parvulus von Nordmann, 1832

Bomolochus parvulus Von Nordmann, 1832, p. 135; Deshayes & Milne Edwards, 1838,

p. 212; Hartmann, 1870, p. 117; Bassett-Smith, 1899, p. 443; C. B. Wilson, 1911, p. 366; Gnanamuthu, 1949, p. 318; Sewell, 1949, p. 178.

Female. Length about 2 mm. The description of this species by Von Nordmann is such that the genus, but not the species, can be recognized. Though this is the first description of a Bomolochid ever published, the species is too poorly known to serve as type of any of its genera. Von Nordmann intended to give later a figure of his species: "in dem nächsten Hefte dieses Werkes werde ich eine Abbildung von *Bomolochus parvulus* liefern" (l.c., p. 137). Von Nordmann's Mikrographische Beiträge were never continued (c.f. Von Nordmann, 1864, pp. 461, 462) and a figure of *Bomolochus parvulus* has never been published.

Male unknown.

The type host is *Amphacanthus rivulatus* (Cuvier) (= *Siganus spinus* (L.)), the type locality the Red Sea. The parasite was found on the gills of its host.

Bomolochus chatoessi Krøyer, 1864

Bomolochus chatoessi Krøyer, 1864, pp. 288, 300, pl. 11 fig. 5; Hartmann, 1870, p. 121; Bassett-Smith, 1899, p. 442; Brian, 1924, p. 13; Gnanamuthu, 1948, p. 23; Sewell, 1949, p. 163.

Female. Length about 2 mm. Though this species is diagnosed at length by Krøyer, the exact structure of antennae, maxillipedes and legs is unknown. It has never been redescribed; Brian (1924, p. 13) compares this form with his *Artacolax monodi*, also a doubtful species.

Male unknown.

The type host is *Chatoessus* spec., the type locality seas of the East Indian Archipelago. The parasite was obtained from the gills of its host species.

Bomolochus glyphisodontis Krøyer, 1864

Bomolochus glyphisodontis Krøyer, 1864, pp. 297, 300, pl. 11 fig. 4; Hartmann, 1870, p. 125; Bassett-Smith, 1899, p. 443.

Female. Length about 2 mm. This species likewise is insufficiently known, its exact position cannot be ascertained because of lack of information about its antennae and legs. It probably belongs to the "ardeolae" group.

Male unknown.

The type host is *Glyphisodon saxatilis* Auct. (= *Abudefduf marginatus* (Bloch)), the type locality San Juan, Nicaragua. The parasite was taken from the gills of its host.

Bomolochus minimus Richiardi, 1880

Bomolochus minimus (nomen nudum) Richiardi, 1880, p. 147; Carus, 1885, p. 353; Brian, 1906, p. 32.

This is an undescribed species mentioned by Richiardi from the gills of *Serranus scriba* L. from the Mediterranean.

Bomolochus oblongus Richiardi, 1880

Bomolochus oblongus (nomen nudum) Richiardi, 1880, p. 147; Carus, 1885, p. 353; Brian, 1906, p. 32.

This species is also an undescribed form, mentioned by Richiardi as found on the gills of *Oblada melanura* Cuvier & Valenciennes, obtained in the Mediterranean.

Bomolochus monodi (Brian, 1924)

Artacolax monodi Brian, 1924, p. 11, figs. 7, 8, 9, 10.

Female. Length 2.25 mm. The structure of the maxillipede is insufficiently known, that of the legs completely unknown. It is a typical *Bomolochus*, but more information is needed to ascertain its correct status.

Male unknown.

The type host is *Tetrodon laevigatus* L. (= *Lagocephalus laevigatus* (L.)), the type locality is unknown, it probably is the Atlantic Ocean west of Mauritania, West Africa. Some material of this species has probably been deposited in the collection of the "Institut Français d'Afrique Noire" at Dakar.

Bomolochus efficatus Leigh-Sharpe, 1934

Bomolochus efficatus Leigh-Sharpe, 1934, p. 13, fig. 9; Sewell, 1949, p. 163.

Based on a juvenile female 0.9 mm long. The species is not described in detail but the figure of the ventral surface, showing all the appendages, is fairly accurate. No host is known; the type locality is equally unknown but the specimen probably originates from the seas of the East Indian Archipelago.

Bomolochus hirsutus Gnanamuthu, 1949

Bomolochus hirsutus Gnanamuthu, 1949, p. 318.

I am unable to make out to which species Gnanamuthu's reference refers, as no species of Bomolochidae and Taeniacanthidae with the trivial name "*hirsutus*" is known to me.

Bomolochus achirus Pearse, 1952

Bomolochus achirus Pearse, 1952a, p. 191, figs. 9-13.

Female. Length 2.59 mm. The structure of the antennules and antennae is insufficiently described, that of the maxillipede and legs is fully unknown. Without data additional to the original description the species cannot be properly placed. Externally it shows points of resemblance with the "ardeolae" group.

Male. Length 1.24 mm.

The type host is *Achirus fasciatus* Lacépède, the type locality Alligator Harbor, Florida, U.S.A. The parasite was taken from the gills of its host. The material, which includes the holotype, is in the U.S. National Museum.

Bomolochus mugilis Pearse, 1952

Bomolochus mugilis Pearse, 1952a, p. 194, figs. 14-17.

Female. Length 2.1 mm. Judging from the scanty information available on this species I should be inclined to include this form in the "concinnus" group of *Bomolochus*, but the particulars of the maxillipedes and legs are too vague for a definite inclusion of this form in the above named group.

Male unknown.

The type host is *Mugil cephalus* L., the type locality Alligator Harbor, Florida, U.S.A. The parasites were taken from the gills of their host. All the material, including the holotype, is in the U.S. National Museum.

TUCCINAE nov. subfam.

DIAGNOSIS. Bomolochidae with curiously shaped body, composed of the cephalic somite, connected with the large, swollen trunk by means of a short, narrow neck. Cephalic somite, formed by fusion of the head and the first thoracic somite, globular, its ventral surface deepened to form a concavity into which fit the oral appendages and the first pair of legs. Laterally the somite shows bilobated wings. Neck formed by the second thoracic somite, much narrower than cephalic somite. Trunk composed of fused somites 3 to 5, inflated, much wider than cephalic somite and usually longer than wide, with rounded corners and at times produced into lobes. Abdomen small, either found at the end of the "trunk" or hidden under the trunk, composed of a small genital somite and an anal somite with small furcal rami, bearing a reduced number of setae.

Female. Four pairs of biramous legs present; first leg almost as in the Bomolochinae, second to fourth pairs biramous, but with reduced number of segments. Fifth pair at articulation between "trunk" and abdomen, uniramous,

1-segmented, with some setae. Egg-sacs elongated, sausage-shaped, containing a great number of small eggs.

Males. Smaller than female, but with same general shape of body. Antennules and maxillipedes modified. Genital somite enlarged, armed with a pair of big hooks.

This family contains but a single genus: *Tucca* Krøyer, 1837. A second genus, introduced by Pearse (1952, p. 13) as *Tuccopsis*, type species *Tuccopsis pinguis* Pearse, 1952, was shown by Causey (1955, p. 7) to be synonymous with Krøyer's genus *Blias* of the family Chondracanthidae. The type of the genus *Blias*, *B. prionoti* Krøyer (1864, p. 262, pl. 12 fig. 5), is subjectively synonymous with *Tuccopsis pinguis* Pearse (1952, pp. 13-15, figs. 28-37), so that *Tuccopsis* Pearse, 1952, must disappear as a junior subjective synonym of *Blias* Krøyer, 1864, a genus which must be classified in a totally different family.

Tucca Krøyer, 1837

DIAGNOSIS. Female. Characterized by the particulars summed up above under the diagnosis of the subfamily. Leg 2 with transversally elongated basis, 2-segmented endopodites, and 3-segmented exopodites.

Male smaller than female, with enlarged genital somite, carrying a hook on each side. Antennules and maxillipedes modified.

Parasites of fishes, usually attached, by means of the maxillipedes, to the skin under or near the pectoral fins of their host.

Type species (by monotypy): *Tucca impressus* Krøyer, 1837.

Further species: *Tucca corpulentus* C. B. Wilson, 1911, *Tucca verrucosus* C. B. Wilson, 1911.

REMARKS: The genus originally contained a very doubtful form described by Pearse (1952, p. 12, figs. 23-27) as *Tucca* spec. This species, as was demonstrated by Pearse (1955, p. 11) is probably based on a mutilated specimen of *Blias prionoti* Krøyer, 1864; it has not been included here.

Key to the species of *Tucca*:

1. Postero-dorsal part of trunk three-lobated. *T. impressus* Krøyer
- Postero-dorsal part of trunk not three-lobated, either rounded or cut off squarely with rounded corners 2
2. Trunk circular in outline, slightly wider than long; abdomen concealed under the trunk; skin smooth *T. corpulentus* C. B. Wilson
- Trunk rectangular with rounded edges, distinctly longer than wide. Abdomen visible in dorsal view; skin covered with conical papillae *T. verrucosus* C. B. Wilson

Tucca impressus Krøyer, 1837

Tucca impressus Krøyer, 1837, p. 479, pl. 5 fig. 2 a-g; Milne Edwards, 1840, p. 496;

Bassett-Smith, 1899, p. 469; C. B. Wilson, 1908, p. 625; C. B. Wilson, 1911, p. 354, pls. 48, 49; C. B. Wilson, 1913, p. 200; C. B. Wilson, 1932, p. 379, fig. 234; Bere, 1936, p. 582; Heegaard, 1947, pl. 25 fig. 195; Sewell, 1949, p. 157; Pearse, 1952a, p. 191.

Female. Total length 1.67 mm. Cephalic somite with regularly bilobed lateral wings. Trunk more or less rectangular, with rounded "shoulders" and at the dorso-lateral corners produced into rounded protuberances. There is also a medio-dorsal produced part, so that the dorso-caudal end of the trunk is distinctly trilobed. There are, on the ventral and dorsal surface of the trunk, four pits arranged in a quadrate; those on the ventral surface contain legs 3 and 4. Antennules composed of a 3-segmented basis, carrying about 20 plumose sensory appendages, and a 1-segmented flagellum. Antenna of the same general pattern as those of the Bomolochidae, first and second endopodal segments fused, roughened over their entire surface by small spinules. In addition there are 5 slender, hooked spines and a strongly developed claw. Maxillule with 3 setae. Maxillipede of the same general pattern as in Bomolochinae, but reaching less far forward; basis not triangular but more or less conical, supporting a thick, curved claw without auxiliary tooth. There are apparently no setae. Endopodite of leg 1 3-segmented, structure of exopodite unknown. Leg 2 with 2-segmented endo- and exopodite. Legs 3 and 4 with 1-segmented endo- and 2-segmented exopodites. Setal and spinal formulae (as far as these can be taken from C. B. Wilson's figure) as follows:

	endopodite	exopodite
leg 1	1 + 0 . 1 + 0 . 6	unknown
leg 2	1 + 0 . 6	0 + 1 . 5
leg 3	1	0 + 1 . 8
leg 4	1	0 + 1 . 4 + 1

Leg 5 absent, but the muscles for these legs are still present and observable through the carapace.

Males. Total length 1.27 mm. General shape of body as in female, with rounded cephalic lappets and more elongated trunk. Antennules and maxillipedes modified. Legs 2 to 4 with differently developed setae and spines (cf. C. B. Wilson, 1911, pl. 49). Fifth legs present, uniramous, with 3 terminal setae and a short internal seta. Genital somite enlarged, with on each side a powerful hook. Furcal rami larger than in female, setae better developed.

The type host is *Diodon hystrix* L., the type locality the region of the former Danish West Indies. Additional specimens were found on *Chilomycterus schoepfi* (Walbaum) from Beaufort, North Carolina, U.S.A., and the region of Woods Hole, Massachusetts, U.S.A. (C. B. Wilson, 1911 and

1932); on *Sphaeroides marmoratus* (Ranzani), *Chilomycterus antennatus* (Cuvier), and *Diodon hystrix* L. from Montego Bay, Jamaica (C. B. Wilson, 1913) and on *Chilomycterus spinosus* (L.) from Lemon Bay, West coast of Florida, U.S.A. (Bere, 1932). Carvalho (1951) recorded 37 females from *Chilomycterus schoepfi* captured off Praia Grande, São Paulo, Brazil. The parasites were attached to the skin under the pectoral fins of the hosts. Wilson's material has been deposited in the U.S. National Museum; Krøyer's material, including the holotype, is probably lost.

REMARKS. This species is different from that described by Von Nordmann (1864, p. 491) under the same name. For the latter C. B. Wilson introduced the name *Tucca verrucosus* (vide infra). It should be borne in mind that Krøyer's original description of *Tucca impressus* is not very detailed and gives practically no particulars of the appendages. C. B. Wilson, after a careful comparison of his specimens with the descriptions of Krøyer and Von Nordmann, felt confident that his material was identical with that of Krøyer and consequently he had to introduce a new name for Von Nordmann's species. I have based the diagnosis given above on the description of *Tucca impressus* in C. B. Wilson's 1911 paper.

***Tucca corpulentus* C. B. Wilson, 1911**

Tucca corpulentus C. B. Wilson, 1911, p. 358, pl. 49 figs. 116, 117, pl. 50; C. B. Wilson, 1932, p. 380, fig. 235; Heegaard, 1947, pl. 25 fig. 194; Sewell, 1949, p. 157.

Female. Total length 2.29 mm. Cephalic somite with irregularly quadrilobed lappets on each side. Trunk big, circular in outline, much wider than cephalic somite, dorsally flattened, posteriorly covering the abdomen. Antennules as in previous species, with at least 20 sensory appendages. Antenna with a spine on the basis. First endopodal segment swollen; second small, both corrugated by longitudinal rows of spinules. There are 4 big, hooked claws, a lamellar process, and a plumose seta. Maxillule with 3 setae. Maxilla with 3 big, denticulated spines on basis. Maxillipede with big basis and strongly developed claw. Claw sigmoid, with an almost basal, blunt tooth; apex blunt, with several transverse folds. Segmentation of legs 1 to 4 as in *T. impressus*; setal and spinal formulae (according to C. B. Wilson's drawings) as follows:

	endopodite	exopodite
leg 1	1 + 0 . 1 + 0 . 6	unknown
leg 2	0 + 0 . 7	0 + I . 7
leg 3	1	0 + III . 6
leg 4	1	0 + 0 . 5

Bases of legs 3 and 4 with external spine and an indentation or notch opposite insertion of endopodite.

Presence or absence of leg 5 unknown.

Male unknown.

The type host is *Sphaeroides maculatus* (Bloch & Schneider), the type locality Woods Hole, Massachusetts, U.S.A. The parasites were attached to the pectoral fins of their host. C. B. Wilson's material, including the holotype, is in the U.S. National Museum.

***Tucca verrucosus* C. B. Wilson, 1911**

Tucca impressus Von Nordmann, 1864, p. 491, pl. 6 figs. 7-10.

Tucca verrucosus C. B. Wilson, 1911, pp. 359, 360.

Female. Total length unknown, probably about as long as *Tucca impressus*, i.e., 1.5-2 mm. General shape of body as in that species, but the antennules are apparently free from the body and easily visible from above, while the trunk is rectangular with straight sides and rounded corners, about twice as long as wide. Genital somite small, abdomen narrow, visible behind the trunk in dorsal view. Pits on dorsal surface of trunk arranged in a trapezoid figure, the anterior pits nearer the median line than the posterior ones. Entire body, including the "neck", covered with small, conical papillae.

Male unknown.

The type host is *Diodon* spec., the type locality the west coast of Africa. The parasites were attached to the fins of their host. Von Nordmann's material, including the holotype, is probably lost.

LIST OF THE SPECIES NAMES OF BOMOLOCHIDAE FOUND IN THE LITERATURE
WITH THEIR MODERN EQUIVALENTS (INCLUDING THE NAMES OF SOME SPECIES
ERRONEOUSLY REFERRED TO THAT FAMILY)

Old name	Proposed name
<i>Artacolax ardeolae</i> (Krøyer)	<i>Bomolochus ardeolae</i> Krøyer
<i>Artacolax cornutus</i> (Claus)	<i>Nothobomolochus cornutus</i> (Claus)
<i>Artacolax cypseluri</i> Yamaguti	<i>Nothobomolochus cypseluri</i> (Yamaguti)
<i>Artacolax lateolabracis</i> Yamaguti & Yamasu	<i>Nothobomolochus lateolabracis</i> (Yamaguti & Yamasu)
<i>Artacolax monodi</i> Brian	<i>Bomolochus monodi</i> (Brian)
<i>Artacolax palleucus</i> C. B. Wilson	<i>Bomolochus palleucus</i> (C. B. Wilson)
<i>Artacolax saetiger</i> C. B. Wilson	<i>Nothobomolochus saetiger</i> (C. B. Wilson)
<i>Artacolax scomberesocis</i> (Krøyer)	<i>Nothobomolochus scomberesocis</i> (Krøyer)
<i>Bomolochus achirus</i> Pearse	<i>Bomolochus achirus</i> Pearse
<i>Bomolochus acutus</i> Gnanamuthu	<i>Bomolochus acutus</i> Gnanamuthu
<i>Bomolochus albidus</i> C. B. Wilson	<i>Bomolochus albidus</i> C. B. Wilson
<i>Bomolochus ardeolae</i> Krøyer	<i>Bomolochus ardeolae</i> Krøyer

Old name	Proposed name
<i>Bomolochus attenuatus</i> C. B. Wilson	<i>Bomolochus attenuatus</i> C. B. Wilson
<i>Bomolochus bellones</i> Burmeister	<i>Parabomolochus bellones</i> (Burmeister)
<i>Bomolochus chatoessi</i> Krøyer	<i>Bomolochus chatoessi</i> Krøyer
<i>Bomolochus concinnus</i> C. B. Wilson	<i>Bomolochus concinnus</i> C. B. Wilson
<i>Bomolochus confusus</i> Stock	<i>Bomolochus confusus</i> Stock
<i>Bomolochus cornutus</i> Claus	<i>Nothobomolochus cornutus</i> (Claus)
<i>Bomolochus cuneatus</i> McLean Fraser	<i>Bomolochus cuneatus</i> McLean Fraser
<i>Bomolochus cypseluri</i> Yamaguti	<i>Nothobomolochus cypseluri</i> (Yamaguti)
<i>Bomolochus dactylopterusi</i> Carvalho	<i>Orbitacolax dactylopterusi</i> (Carvalho)
<i>Bomolochus decapteri</i> Yamaguti	<i>Parabomolochus decapteri</i> (Yamaguti)
<i>Bomolochus decapteri</i> Shen	<i>Parabomolochus megaceros</i> (Heller)
<i>Bomolochus denticulatus</i> Bassett-Smith	<i>Nothobomolochus denticulatus</i> (Bassett-Smith)
<i>Bomolochus efficatus</i> Leigh-Sharpe	<i>Bomolochus efficatus</i> Leigh-Sharpe
<i>Bomolochus eminens</i> C. B. Wilson	<i>Bomolochus eminens</i> C. B. Wilson
<i>Bomolochus exilipes</i> C. B. Wilson	<i>Bomolochus exilipes</i> C. B. Wilson
<i>Bomolochus gazzae</i> Shen	<i>Bomolochus gazzae</i> Shen
<i>Bomolochus gibber</i> Shiino	<i>Nothobomolochus gibber</i> (Shiino)
<i>Bomolochus glyphisodontis</i> Krøyer	<i>Bomolochus glyphisodontis</i> Krøyer
<i>Bomolochus gobi</i> Brian	<i>Anchistrotos gobi</i> (Brian) (Family Taeniacanthidae)
<i>Bomolochus gracilis</i> Heller	<i>Irodes gracilis</i> (Heller) (Family Taeniacanthidae)
<i>Bomolochus hyporhamphi</i> Yamaguti & Yamasu	<i>Parabomolochus hyporhamphi</i> (Yamaguti & Yamasu)
<i>Bomolochus leptoscari</i> Yamaguti	<i>Orbitacolax leptoscari</i> (Yamaguti)
<i>Bomolochus managatuwo</i> Yamaguti	<i>Nothobomolochus managatuwo</i> (Yamaguti)
<i>Bomolochus megaceros</i> Heller	<i>Parabomolochus megaceros</i> (Heller)
<i>Bomolochus minimus</i> Richiardi n.n.	<i>Bomolochus minimus</i> Richiardi n.n.
<i>Bomolochus monodi</i> (Brian)	<i>Bomolochus monodi</i> (Brian)
<i>Bomolochus mugilis</i> Pearse	<i>Bomolochus mugilis</i> Pearse
<i>Bomolochus multispinosa</i> Gnanamuthu	<i>Nothobomolochus multispinosus</i> (Gnanamuthu)
<i>Bomolochus muraenae</i> Richiardi n.n.	<i>Phagus muraenae</i> (Brian) (Family Taeniacanthidae)
<i>Bomolochus muraenae</i> Brian	<i>Phagus muraenae</i> (Brian) (Family Taeniacanthidae)
<i>Bomolochus nitidus</i> C. B. Wilson	<i>Bomolochoides nitidus</i> (C. B. Wilson)
<i>Bomolochus nothrus</i> C. B. Wilson	<i>Bomolochus nothrus</i> C. B. Wilson
<i>Bomolochus oblongus</i> Richiardi n.n.	<i>Bomolochus oblongus</i> Richiardi n.n.
<i>Bomolochus onosi</i> T. Scott	<i>Anchistrotos onosi</i> (T. Scott) (Family Taeniacanthidae)
<i>Bomolochus ostracionis</i> Richiardi	<i>Anchistrotos ostracionis</i> (Richiardi) (Family Taeniacanthidae)
<i>Bomolochus palleucus</i> (C. B. Wilson)	<i>Bomolochus palleucus</i> (C. B. Wilson)
<i>Bomolochus parvulus</i> Von Nordmann	<i>Bomolochus parvulus</i> Von Nordmann
<i>Bomolochus pectinatus</i> Stock	<i>Bomolochus pectinatus</i> Stock
<i>Bomolochus saetiger</i> (C. B. Wilson)	<i>Nothobomolochus saetiger</i> (C. B. Wilson)
<i>Bomolochus scomberesocis</i> (Krøyer)	<i>Nothobomolochus scomberesocis</i> (Krøyer)

Old name	Proposed name
<i>Bomolochus scutigerulus</i> C. B. Wilson	<i>Bomolochoides scutigerulus</i> (C. B. Wilson)
<i>Bomolochus soleae</i> Auct.	<i>Bomolochus soleae</i> Claus, p.p.; <i>Bomolochus soleae</i> Auct., p.p.; <i>Bomolochus confusus</i> Stock p.p.
<i>Bomolochus tetraodontis</i> Bassett-Smith	<i>Irodes tetraodontis</i> (Bassett-Smith) (Family Taeniacanthidae)
<i>Bomolochus teres</i> C. B. Wilson	<i>Bomolochus teres</i> C. B. Wilson
<i>Bomolochus tricerus</i> Bassett-Smith	<i>Nothobomolochus tricerus</i> (Bassett-Smith)
<i>Bomolochus tumidus</i> Shiino	<i>Parabomolochus tumidus</i> (Shiino)
<i>Bomolochus unicirrus</i> Richiardi n.n.	<i>Parabomolochus unicirrus</i> (Brian)
<i>Bomolochus unicirrus</i> Brian	<i>Parabomolochus unicirrus</i> (Brian)
<i>Bomolochus uniunguis</i> (Shen)	<i>Orbitacolax uniunguis</i> Shen
<i>Bomolochus xenomelanorisi</i> Carvalho	<i>Parabomolochus xenomelanorisi</i> (Carvalho)
<i>Bomolochus zeugopteri</i> T. Scott	<i>Anchistrotos zeugopteri</i> (T. Scott) (Family Taeniacanthidae)
<i>Orbitacolax leptoscari</i> (Yamaguti)	<i>Orbitacolax leptoscari</i> (Yamaguti)
<i>Orbitacolax uniunguis</i> Shen	<i>Orbitacolax uniunguis</i> Shen
<i>Pseudobomolochus decapteri</i> Shen	<i>Parabomolochus megaceros</i> (Heller)
<i>Pseudobomolochus managatuwo</i> (Yamaguti)	<i>Nothobomolochus managatuwo</i> (Yamaguti)
<i>Pseudoeucanthus alosae</i> (Brian)	<i>Pseudoeucanthus alosae</i> (Brian)
<i>Pseudoeucanthus uniseriatus</i> C. B. Wilson	<i>Pseudoeucanthus uniseriatus</i> C. B. Wilson
<i>Pumiliopes opisthopteri</i> Shen	<i>Pumiliopes opisthopteri</i> Shen
<i>Taeniacanthus hapalogenyos</i> Yamaguti & Yamasu	<i>Orbitacolax hapalogenyos</i> (Yamaguti & Yamasu).
<i>Tucca corpulentus</i> C. B. Wilson	<i>Tucca corpulentus</i> C. B. Wilson
<i>Tucca impressus</i> Krøyer	<i>Tucca impressus</i> Krøyer
<i>Tucca impressus</i> Von Nordmann	<i>Tucca verrucosus</i> C. B. Wilson
<i>Tucca verrucosus</i> C. B. Wilson	<i>Tucca verrucosus</i> C. B. Wilson
<i>Tucca</i> spec. in Pearse, 1952	<i>Blias prionoti</i> Krøyer (Family Chondracanthidae)
<i>Tuccopsis pinguis</i> Pearse	<i>Blias prionoti</i> Krøyer (Family Chondracanthidae)

ALPHABETIC LIST OF BOMOLOCHID PARASITES, RECORDING THE HOST, THE PLACE OF ATTACHMENT, AND THE LOCALITY FROM WHICH THE SPECIES HAS BEEN REPORTED

Parasite	Host	Place of attachment	Locality
<i>Bomolochoides nitidus</i> (C. B. Wilson) (p. 30)	<i>Mugil cephalus</i> L.	gills	Atlantic coast of U.S.A.
	<i>Strongylura timuca</i> (Walbaum)	gills	Gulf of Mexico
<i>Bomolochoides scutigerulus</i> (C. B. Wilson) (p. 30)	<i>Pseudupeneus maculatus</i> (Bloch) (= <i>Upeneus maculatus</i> (Bloch))	gills	Gulf of Mexico
	<i>Achirus fasciatus</i> Lacépède	gills	Strait of Florida

Parasite	Host	Place of attachment	Locality
(p. 92)			
<i>Bomolochus acutus</i> Gnana- muthu (p. 20)	<i>Dussumieria acuta</i> Valen- ciennes	gills	Bay of Bengal
<i>Bomolochus albidus</i> C. B. Wilson (p. 13)	<i>Lophius piscatorius</i> L.	gill chamber	Atlantic coast of U.S.A.
<i>Bomolochus ardeolae</i> Krøyer (p. 18)	<i>Belone ardeola</i> Cuvier & Valenciennes (= <i>Stron- gylura timuca</i> (Wal- baum)	gills	Atlantic coast of U.S.A.
	<i>Hypsypops rubicundus</i> (Gi- rard)	gills	Pacific coast of U.S.A.
<i>Bomolochus attenuatus</i> C. B. Wilson (p. 19)	<i>Scorpaena plumieri</i> Bloch	gills	Caribbean Sea
	<i>Scorpaena agassizii</i> (Goode & Bean	gills	Gulf of Mexico
	<i>Cheilichthys annulatus</i> (Je- nyns)	gills	Pacific coast of Ecuador
	<i>Priacanthus arenatus</i> Cu- vier & Valenciennes	gills	Gulf of Mexico
	<i>Gymnachirus texae</i> (Gün- ther) (= probably <i>Gym- nachirus fasciatus</i> Gün- ther)	gills	Gulf of Mexico
<i>Bomolochus chatoessi</i> Krøyer (p. 90)	<i>Chatoessus</i> spec.	gills	East Indian Seas
<i>Bomolochus concinnus</i> C. B. Wilson (p. 27)	<i>Tylosurus marinus</i> (Wal- baum) (= <i>Strongylura marina</i> (Walbaum))	gills	Atlantic coast of U.S.A.
<i>Bomolochus confusus</i> Stock (p. 14)	<i>Gadus callarias</i> L.	nasal fossae	British Channel coast; North Sea
	<i>G. luscus</i> L. (= <i>Trisopte- rus luscus</i> (L.))	nasal fossae	British Channel coast
	<i>G. merlangus</i> L. (= <i>Mer- langius merlangus</i> (L.))	nasal fossae	British Channel coast
	<i>Conger conger</i> (L.)	nasal fossae	North Sea
<i>Bomolochus cuneatus</i> McLean Fraser (p. 25)	<i>Clupea pallasii</i> Valenciennes	gills	Pacific coast of Canada
	<i>Cymatogaster aggregatus</i> Gibbons	gills	Pacific coast of Canada
<i>Bomolochus eminens</i> C. B. Wilson (p. 16)	<i>Clupanodon pseudohispani- cus</i> (Poey) (= <i>Sardinella pseudohispanica</i> (Poey) or <i>S. anchovia</i> Cuvier & Valenciennes))	gill cavity	Gulf of Mexico
<i>Bomolochus exilipes</i> C. B. Wilson (p. 25)	<i>Archosargus probatocephal- us</i> (Walbaum)	gills	Atlantic coast of U.S.A.
<i>Bomolochus gazzae</i> Shen (p. 15)	<i>Gazza minuta</i> (Bloch)	gills	South China Sea
<i>Bomolochus glyphisodontis</i> Krøyer (p. 90)	<i>Glyphisodon saxatilis</i> Auct. (= <i>Abudefduf marginat- us</i> (Bloch)	gills	Caribbean Sea

Parasite	Host	Place of attachment	Locality	
<i>Bomolochus minimus</i> Richiardi n.n. (p. 91)	<i>Serranus scriba</i> L.	gills	Mediterranean Sea	
<i>Bomolochus monodi</i> (Brian) (p. 91)	<i>Lagocephalus laevigatus</i> (L.)	gills	Atlantic coast of Mauretania	
<i>Bomolochus mugilis</i> Pearse (p. 92)	<i>Mugil cephalus</i> L.	gills	Gulf of Mexico	
<i>Bomolochus nothrus</i> C. B. Wilson (p. 22)	<i>Abudefduf saxatilis</i> (L.)	gills	Caribbean Sea	
	<i>Ogcocephalus vespertilio</i> (L.)	gills	Gulf of Mexico	
<i>Bomolochus oblongus</i> Ri- chiardi n.n. (p. 91)	<i>Oblada melanura</i> Cuvier & Valenciennes	gills	Mediterranean Sea	
<i>Bomolochus palleucus</i> (C. B. Wilson) (p. 28)	<i>Scorpaena plumieri</i> Bloch	gills	Caribbean Sea	
<i>Bomolochus parvulus</i> Von Nordmann (p. 89)	<i>Amphacanthus rivulatus</i> (Cuvier) (= <i>Siganus spi-</i> <i>rius</i> (L.))	gills	Red Sea	
<i>Bomolochus pectinatus</i> Stock (p. 27)	<i>Leuresthes tenuis</i> (Ayres)	gills	Pacific coast of U.S.A.	
<i>Bomolochus soleae</i> Auct. (p. 24)	<i>Cyclopterus lumpus</i> L.	gills	Atlantic Ocean	
	<i>Gadus aeglefinus</i> L. (= <i>Melanogrammus aeglefinus</i> (L.))	gills	Atlantic Ocean	
	<i>Gadus merlangus</i> L. (= <i>Merlangius merlangus</i> (L.))	gills	Atlantic Ocean	
	<i>Gadus pollachius</i> L. (= <i>Pollachius pollachius</i> (L.))	gills	Atlantic Ocean	
	<i>Molva molva</i> (L.)	gills	Atlantic Ocean	
	<i>Pleuronectes platessa</i> L.	gills	Atlantic Ocean	
	<i>Pleuronectes flesus</i> L. (= <i>Platichthys flesus</i> (L.))	gills	Atlantic Ocean	
	<i>Solea solea</i> (L.)	back	Atlantic Ocean	
	<i>Solea solea</i> (L.)	branchial cavity and gills	Mediterranean Sea	
	<i>Bomolochus soleae</i> Claus (p. 23)	<i>Solea solea</i> (L.)	gills	North Sea
	<i>Bomolochus teres</i> C. B. Wilson (p. 21)	<i>Brevoortia tyrannus</i> (La- trobe)	gills	Atlantic coast of U.S.A.; Gulf of Mexico
	<i>Nothobomolochus cornutus</i> (Claus) (p. 62)	<i>Asterodermus coryphaenoides</i> Lowe (= <i>Luvarus imperialis</i> Rafinesque)	gills	Mediterranean Sea
		<i>Asterodermus elegans</i> Bonaparte (= <i>Luvarus imperialis</i> Rafinesque)	gills	Mediterranean Sea
<i>Exocoetus volitans</i> L.		gills	Mediterranean Sea	
	<i>Sayris camperi</i> (Risso) (=	gills	Mediterranean Sea	

Parasite	Host	Place of attachment	Locality
	<i>Scomberesox saurus</i> (Walbaum)		
	<i>Clupea sardina</i> Lowe (= <i>Sardina pilchardus</i> (Walbaum))	gills	Mediterranean Sea
	<i>Alosa papalina</i> Bonaparte (= <i>Clupea sprattus</i> L.)	gills	Mediterranean Sea
	<i>Scomberesox rondeletii</i> (= <i>Scomberesox saurus</i> (Walbaum))	gills	Mediterranean Sea
<i>Nothobomolochus cornutus</i> (Claus) (p. 62)	<i>Diagramma mediterraneum</i> Guichenot (= <i>Parapristipoma mediterraneum</i> (Guichenot))	gills	Atlantic coast of Mauretania
<i>Nothobomolochus cypseluri</i> (Yamaguti) (p. 69)	<i>Cypselurus agoo</i> Temminck & Schlegel (= <i>Prognichthys agoo</i> (Temminck & Schlegel))	gills	Pacific coast of Japan
<i>Nothobomolochus denticulatus</i> (Bassett-Smith) (p. 65)	<i>Sphyræna jello</i> Cuvier	gill cavity	Indian Ocean off Ceylon
<i>Nothobomolochus epulus</i> nov.spec. (p. 73)	<i>Hemiramphus far</i> Forskål	gill cavity	Indian Ocean off Ceylon
<i>Nothobomolochus gibber</i> (Shiino) (p. 70)	<i>Diagramma orolepis</i> Boulenger	gill cavity	Niger delta
	<i>Tylosurus giganteus</i> (Temminck & Schlegel) (= <i>Tylosurus indicus</i> (Le Sueur))	inside operculum	Pacific coast of Japan
<i>Nothobomolochus lateolabracis</i> (Yamaguti & Yamasu) (p. 71)	<i>Lateolabrax japonicus</i> (Cuvier & Valenciennes)	gills	Seto Naikai, Japan
<i>Nothobomolochus managatuwo</i> (Yamaguti) (p. 66)	<i>Stromateoides argenteus</i> (Euphrasen)	gills	Pacific off Japan; South China Sea
<i>Nothobomolochus multispinosus</i> (Gnanamuthu) (p. 68)	<i>Dussumiera acuta</i> Valenciennes	inside operculum	Bay of Bengal
<i>Nothobomolochus saetiger</i> (C. B. Wilson) (p. 63)	<i>Exocoetus volitans</i> L.	gills	Atlantic coast of U.S.A.
	<i>Cypselurus collopterus</i> (Günther)	gills	Pacific Ocean off Galapagos Islands
	<i>Menidia menidia</i> (L.)	gills	Atlantic coast of U.S.A.
<i>Nothobomolochus scomberesocis</i> (Krøyer) (p. 61)	<i>Scomberesox rondeletii</i> Cuvier & Valenciennes (= <i>S. saurus</i> (Walbaum))	gills	Atlantic Ocean; Mediterranean Sea
	<i>Caranx leptolepis</i> Cuvier & Valenciennes (= <i>Selaroides leptolepis</i> (Cuvier))	gills	Indian ocean off Ceylon
<i>Nothobomolochus triceros</i> (Bassett-Smith) (p. 64)	<i>Stromateus cinereus</i> Day (= <i>Pampus argenteus</i> (Euphrasen))	gill cavity	Arabian Sea
<i>Orbitacolax dactylopterusi</i> (Carvalho) (p. 83)	<i>Dactylopterus volitans</i> (L.)	gills	Atlantic coast of Brazil
<i>Orbitacolax hapalogenyos</i> (Yamaguti & Yamasu) (p. 84)	<i>Hapalogenys mucronatus</i> (Eydoux & Souleyet)	gills and oral cavity	Seto Naikai, Japan
<i>Orbitacolax leptoscari</i> (Ya-	<i>Leptoscarus japonicus</i> (Cu-	gills and skin	Pacific Ocean off Japan

Parasite	Host	Place of attachment	Locality
maguti) (p. 81) <i>Orbitacolax uniuuguis</i> Shen (p. 82)	vier & Valenciennes) <i>Caranx</i> spec.	orbit	South China Sea
<i>Parabomolochus bellones</i> (v. Nordmann) (p. 34)	<i>Esox bellone</i> L. (= <i>Belone bellone</i> (L.))	gills	British Channel coast; North Sea
<i>Parabomolochus decapteri</i> (Yamaguti) (p. 45)	<i>Belone rostrata</i> Fabr. (= <i>Belone bellone</i> (L.))	gills	Adriatic Sea
<i>Parabomolochus hyporhamphi</i> (Yamaguti & Yamasu) (p. 48)	<i>Decapterus maruadsi</i> Temminck & Schlegel <i>Trachurus trachurus</i> (L.)	inside operculum gills	Sea of Japan Pacific Ocean
	<i>Colalabis saira</i> (Brevoort)	gills and operculum	Sea of Japan
	<i>Hyporhamphus sajori</i> (Temminck & Schlegel)	gills and operculum	Sea of Japan
	<i>Hyporhamphus sajori</i> (Temminck & Schlegel)	gills	Seto Naikai, Japan
<i>Parabomolochus megaceros</i> (Heller) (p. 43)	<i>Stromateus niger</i> Bloch (= <i>Parastromateus niger</i> (Bloch)) <i>Caranx djedaba</i> (Forskål)	gills gills	Indian Ocean Arabian Sea South China Sea
	<i>Stromateoides sinensis</i> (Euphrasen)	gills	South China Sea
	<i>Caranx</i> spec.	gills	South China Sea
	<i>Mugil</i> spec.	gills	South China Sea
	<i>Therapon theraps</i> Cuvier & Valenciennes (= <i>Eutherapon theraps</i> (Cuvier))	gills	South China Sea
	<i>Megalaspis cordyla</i> (L.)	gills	South China Sea
<i>Parabomolochus psettobius</i> nov. spec. (p. 49)	<i>Psettus sebae</i> (Cuvier & Valenciennes)	gill cavity	Niger delta
<i>Parabomolochus tumidus</i> (Shiino) (p. 47)	<i>Colalabis saira</i> (Brevoort)	inside operculum	Pacific Ocean off Japan
	<i>Ablennes hians</i> (Cuvier & Valenciennes)	inside operculum	Sea of Japan
<i>Parabomolochus unicirrus</i> (Brian) (p. 42)	<i>Lichia glauca</i> Risso	branchial cavity	Mediterranean Sea
	<i>Lichia amia</i> Cuvier	branchial cavity	Mediterranean Sea
	<i>Sphyraena vulgaris</i> Cuvier & Valenciennes (= <i>S. sphyraena</i> (L.))	branchial cavity	Mediterranean Sea
	<i>Amphisile scutata</i> (L.) (= <i>Centriscus scutatus</i> L.)	branchial cavity	Indian Ocean off Ceylon
	<i>Lichia vadigo</i> Risso	branchial cavity	Atlantic Ocean off Mauritania
<i>Parabomolochus xenomelanorisi</i> (Carvalho) (p. 46)	<i>Xenomelaniris brasiliensis</i> (Quoy & Gaimard) (= <i>Thyrina brasiliensis</i> (Quoy et Gaimard))	gills	Atlantic coast of Brazil
<i>Pseudoecanthus alosae</i> (Brian) (p. 86)	<i>Clupea alosa</i> L. (= <i>Alosa alosa</i> (L.))	eye	Mediterranean Sea
<i>Pseudoecanthus uniseriatus</i> C. B. Wilson (p. 87)	<i>Caranx crysos</i> (Mitchill)	oral cavity	Caribbean Sea

Parasite	Host	Place of attachment	Locality
<i>Pumiliopes opisthopteri</i> Shen, 1957 (p. 89)	<i>Opisthopterus tardoore</i> (Cuvier)	eye	South China Sea
<i>Tucca corpulentus</i> Wilson (p. 95)	C. B. <i>Sphaeroides maculatus</i> (Bloch & Schneider)	fins	Atlantic coast of U.S.A.
<i>Tucca impressus</i> (p. 93)	Krøyer <i>Diodon hystrix</i> L. <i>Chilomycterus schoepfi</i> (Walbaum)	skin skin	Caribbean Sea Atlantic coast of U.S.A. and Brazil Caribbean Sea
	<i>Sphaeroides marmoratus</i> (Ranzani)	skin	
	<i>Chilomycterus antennatus</i> (Cuvier)	skin	
	<i>Chilomycterus spinosus</i> (L.)	skin	
<i>Tucca verrucosus</i> Wilson (p. 96)	C. B. <i>Diodon</i> spec.	fins	Gulf of Mexico Atlantic Ocean off West coast of America

LIST OF FISHES WITH THEIR BOMOLOCHID PARASITES ¹⁾

Teleostomi Actinopterygii	
Ordo Clupeiformes	
Family Clupeidae	
<i>Alosa alosa</i> (L.)	<i>Pseudoecanthus alosae</i> (Brian) (p. 86)
<i>Brevoortia tyrannus</i> (Latrobe)	<i>Bomolochus teres</i> C. B. Wilson (p. 21)
<i>Chatoessus</i> spec.	<i>Bomolochus chatoessi</i> Krøyer (p. 90)
<i>Clupea pallasii</i> Valenciennes	<i>Bomolochus cuneatus</i> McLean Fraser (p. 26)
<i>Clupea sprattus</i> (L.)	<i>Nothobomolochus cornutus</i> (Claus) (p. 62)
<i>Dussumicria acuta</i> Valenciennes	<i>Bomolochus acutus</i> Gnanamuthu (p. 20)
	<i>Nothobomolochus multispinosus</i> Gnanamuthu (p. 69)
<i>Opisthopterus tardoore</i> (Cuvier)	<i>Pumiliopes opisthopteri</i> Shen (p. 89)
<i>Sardina pilchardus</i> (Walbaum)	<i>Nothobomolochus cornutus</i> (Claus) (p. 63)
<i>Sardinella anchovia</i> Cuvier & Valenciennes	<i>Bomolochus eminens</i> C. B. Wilson (p. 17)
<i>Sardinella pseudohispanica</i> (Poey)	<i>Bomolochus eminens</i> C. B. Wilson (p. 17)
Ordo Anguilliformes	
Family Congridae	
<i>Conger conger</i> (L.)	<i>Bomolochus confusus</i> Stock (p. 14)
Ordo Beloniformes	
Family Belonidae	
<i>Ablennes hians</i> (Cuvier & Valenciennes)	<i>Parabomolochus tumidus</i> (Shiino) (p. 47)
<i>Belone bellone</i> (L.)	<i>Parabomolochus bellones</i> (v. Nordmann) (p. 34)

1) Within the families the genera have been arranged alphabetically; a discussion of the parasite is to be found on the page indicated.

- Family Mugilidae
Mugil cephalus L. *Bomolochoides nitidus* (C. B. Wilson) (p. 30)
Mugil spec. *Bomolochus mugilis* Pearse (p. 92)
Parabomolochus megaceros (Heller) (p. 44)
- Family Atherinidae
Leuresthes tenuis (Ayres) *Bomolochus pectinatus* Stock (p. 28)
Medinia medinia (L.) *Nothobomolochus saetiger* (C. B. Wilson) (p. 64)
Thyrina brasiliensis (Quoy & Gaimard) *Parabomolochus xenomelanirisi* (Carvalho) (p. 46)
- Ordo Perciformes
Family Serranidae
Lateolabrax japonicus (Cuvier & Valenciennes) *Nothobomolochus lateolabracis* (Yamaguti & Yamasu) (p. 72)
Serranus scriba L. *Bomolochus minimus* Richiardi n.n. (p. 91)
- Family Theraponidae
Eutherapon theraps (Cuvier) *Parabomolochus megaceros* (Heller) (p. 45)
- Family Lutjanidae
Diagramma macrolepis Boulenger *Nothobomolochus epulus* nov.spec. (p. 73)
- Family Priacanthidae
Priacanthus arenatus Cuvier & Valenciennes *Bomolochus attenuatus* C. B. Wilson (p. 19)
- Family Leiognathidae
Gazza minuta (Bloch) *Bomolochus gazzae* Shen (p. 16)
- Family Pomadasysidae
Hapalogenys mucronatus (Eydoux & Souleyet) *Orbitacolax hapalogenyos* (Yamaguti & Yamasu) (p. 85)
Parapristipoma mediterraneum (Guichenot) *Nothobomolochus cornutus* (Claus) (p. 63)
- Family Sparidae
Archosargus probatocephalus (Walbaum) *Bomolochus exilipes* C. B. Wilson (p. 25)
Oblada melanura Cuvier & Valenciennes *Bomolochus oblongus* Richiardi n.n. (p. 91)
- Family Mullidae
Upeneus maculatus (Bloch) *Bomolochoides scutigeralus* (C. B. Wilson) (p. 31)
- Family Psettidae
Psettus sebae (Cuvier & Valenciennes) *Parabomolochus psettiobius* n. sp. (p. 49)

- Family Carangidae
- Caranx crysos* (Mitchill) *Pseudoecanthus uniseriatus* C. B. Wilson (p. 88)
- Caranx djedaba* (Forskål) *Parabomolochus megaceros* (Heller) (p. 44)
- Caranx* spec. *Orbitacolax uniunguis* Shen (p. 83)
- Caranx* spec. *Parabomolochus megaceros* (Heller) (p. 45)
- Decapterus maruadsi* (Temminck & Schlegel) *Parabomolochus decapteri* (Yamaguti) (p. 46)
- Lichia amia* Cuvier *Parabomolochus unicirrus* (Brian) (p. 43)
- Lichia glauca* Risso *Parabomolochus unicirrus* (Brian) (p. 43)
- Lichia vadigo* Risso *Parabomolochus unicirrus* (Brian) (p. 43)
- Megalaspis cordyla* (L.) *Parabomolochus megaceros* (Heller) (p. 45)
- Selaroides leptolepis* (Cuvier) *Nothobomolochus scomberesocis* (Krøyer) (p. 62)
- Trachurus trachurus* (L.) *Parabomolochus decapteri* (Yamaguti) (p. 46)
- Family Embiotocidae
- Cymatogaster aggregatus* Gibbons *Bomolochus cuneatus* McLean Fraser (p. 26)
- Family Pomacentridae
- Abudefduf marginatus* (Bloch) *Bomolochus glyphisodontis* Krøyer (p. 90)
- Abudefduf saxatilis* (L.) *Bomolochus nothrus* C. B. Wilson (p. 23)
- Hypsypops rubicundus* (Girard) *Bomolochus ardeolae* Krøyer (p. 18)
- Family Labridae
- Leptoscarus japonicus* (Cuvier & Valenciennes) *Orbitacolax leptoscari* (Yamaguti) (p. 81)
- Family Siganidae
- Siganus spinus* (L.) *Bomolochus parvulus* Von Nordmann (p. 90)
- Family Luvaridae
- Luvarus imperialis* Rafinesque *Nothobomolochus cornutus* (Claus) (p. 63)
- Family Stromateidae
- Pampus argenteus* (Euphrasen) *Nothobomolochus triceros* (Bassett-Smith) (p. 65)
- Parastromateus niger* (Bloch) *Nothobomolochus managatuwo* (Yamaguti) (p. 68)
- Stromateoides sinensis* (Euphrasen) *Parabomolochus megaceros* (Heller) (p. 44)
- Parabomolochus megaceros* (Heller) (p. 44)

Family Scorpaenidae	
<i>Scorpaena agassizii</i> Goode & Bean	<i>Bomolochus attenuatus</i> C. B. Wilson (p. 19)
<i>Scorpaena plumieri</i> Bloch	<i>Bomolochus attenuatus</i> C. B. Wilson (p. 19)
	<i>Bomolochus palleucus</i> (C. B. Wilson) (p. 29)
Family Cyclopteridae	
<i>Cyclopterus lumpus</i> L.	<i>Bomolochus soleae</i> Auct. (p. 24)
Ordo Dactylopteriformes	
Family Dactylopteridae	
<i>Dactylopterus volitans</i> (L.)	<i>Orbitacolax dactylopterusi</i> (Carvalho) (p. 84)
Ordo Pleuronectiformes	
Family Pleuronectidae	
<i>Pleuronectes platessa</i> L.	<i>Bomolochus soleae</i> Auct. (p. 25)
<i>Platichthys flesus</i> (L.)	<i>Bomolochus soleae</i> Auct. (p. 25)
Family Soleidae	
<i>Achirus fasciatus</i> Lacépède	<i>Bomolochus achirus</i> Pearse (p. 92)
<i>Gymnachirus texae</i> (Günther)	<i>Bomolochus attenuatus</i> C. B. Wilson (p. 19)
<i>Solea solea</i> (L.)	<i>Bomolochus soleae</i> Auct. (p. 25)
	<i>Bomolochus soleae</i> Claus (p. 24)
Ordo Tetraodontiformes	
Family Tetraodontidae	
<i>Cheilichthys annulatus</i> (Jenyns)	<i>Bomolochus attenuatus</i> C. B. Wilson (p. 19)
<i>Lagocephalus laevigatus</i> (L.)	<i>Bomolochus monodi</i> (Brian) (p. 91)
<i>Sphaeroides maculatus</i> (Bloch & Schneider)	<i>Tucca corpulentus</i> C. B. Wilson (p. 96)
<i>Sphaeroides marmoratus</i> (Ranzani)	<i>Tucca impressus</i> Krøyer (p. 95)
Family Diodontidae	
<i>Chilomycterus antennatus</i> (Cuvier)	<i>Tucca impressus</i> Krøyer (p. 95)
<i>Chilomycterus schoepfi</i> (Walbaum)	<i>Tucca impressus</i> Krøyer (p. 95)
<i>Chilomycterus spinosus</i> (L.)	<i>Tucca impressus</i> Krøyer (p. 95)
<i>Diodon hystrix</i> L.	<i>Tucca impressus</i> Krøyer (p. 95)
Ordo Lophiiformes	
Family Lophiidae	
<i>Lophius piscatorius</i> L.	<i>Bomolochus albidus</i> C. B. Wilson (p. 13)
Family Ogcocephalidae	
<i>Ogcocephalus vespertilio</i> (L.)	<i>Bomolochus nothrus</i> C. B. Wilson (p. 23)

REFERENCES

- BAINBRIDGE, M. E., 1909. Notes on some parasitic Copepoda; with a description of a new species of *Chondracanthus*. *Trans. Linn. Soc. Lond., Zool., ser. 2 vol. 11*, pp. 45-60, pls. 8-11.
- BASSETT-SMITH, P. W., 1898. Some new Parasitic Copepods found on Fish at Bombay. *Ann. Mag. nat. Hist., ser 7 vol. 1*, pp. 1-15, pls. 1-7.
- , 1898a. Further new Parasitic Copepods found on Fish in the Indo-tropical Region. *Ann. Mag. nat. Hist., ser. 7 vol. 2*, pp. 77-98, pls. 3-6.
- , 1898b. Some new or rare Parasitic Copepods found on Fish in the Indo-tropic Region. *Ann. Mag. nat. Hist., ser. 7 vol. 2*, pp. 357-372, pls. 10-12.
- , 1899. A systematic description of Parasitic Copepoda found on fishes, with an Enumeration of the known species. *Proc. Zool. Soc. Lond., 1899 pt. 2*, pp. 438-507, pl. 26, textfigs. 1-6.
- BENEDEN, P. J. VAN, 1871. Les poissons des côtes de Belgique, leurs parasites et leurs commensaux. *Mém. Acad. R. Belg., vol. 38 no. 4*, pp. i-xx, 1-100, pls. 1-6.
- BERE, R., 1936. Parasitic Copepods from Gulf of Mexico Fish. *Amer. Midl. Nat., vol. 17*, pp. 577-625, pls. 1-12.
- BRIAN, A., 1898. Catalogo di Copepodi parassiti dei Pesci della Liguria. *Atti Soc. Ligust. Sci. nat. geogr., vol. 9*, pp. 1-31, pls. 1-4.
- , 1899. Crostacei parassiti di Pesci dell' Isola d'Elba (II. Contribuzione). *Boll. Mus. Zool. Anat. comp. Genova, no. 85*, pp. 1-11. Also in: *Atti Soc. Ligust. Sci. nat. geogr., vol. 10*, pp. 197-207.
- , 1902. Note sui alcuni crostacei parassiti dei pesci del Mediterraneo. *Atti Soc. Ligust. Sci. nat. geogr., vol. 13*, pp. 30-45.
- , 1903. Sui Copepodi parassiti di pesci marini dell' Isola d'Elba (4a nota). *Boll. Mus. Zool. Anat. comp. Genova, no. 121*, pp. 1-8. Also in: *Atti Soc. Ligust. Sci. nat. geogr., vol. 14*, pp. 77-84.
- , 1906. Copepodi parassiti dei Pesci d'Italia, pp. 1-189, pls. 1-21, textfigs. 1-4. Genova.
- , 1924. Copepoda. In: *Parasitologia Mauritanica. Matériaux pour la faune parasitologique en Mauritanie*, pt. 1 no. 1, pp. 1-66, figs. 1-69 (*Bull. Com. d'Études Hist. Sci. Afr. Occ. Fr., vol. 9*, pp. 363-427, figs. 1-69).
- BURMEISTER, H., 1835. Beschreibung einiger neuen oder weniger bekannten Schmarotzerkrebse, nebst allgemeinen Betrachtungen über die Gruppe, welcher sie angehören. *Nova Acta Leop. Carol., vol. 17 pt. 1*, pp. 269-336, pls. 23, 24, 24a, 25.
- CARUS, J. V., 1885. *Prodromus Faunae Mediterraneae sive descriptio animalium maris mediterranei incolarum*, vol. 1, pp. I-XI, 1-524 (Copepoda pp. 318-378). Stuttgart.
- CARVALHO, J. DE PAIVA, 1951. Notas sobre alguns Copépodos parasitos de Peixes marítimos da costa do Estado de São Paulo. *Bol. Inst. Paulista Ocean., vol. 2 pt. 2*, pp. 135-144.
- , 1955. *Bomolochus xenomelanirisi* n. sp. Parasito de Peixa-Rei *Xenomelaniris brasiliensis* (Quoy & Gaimard) (Copepoda-Cyclopoida-Pisces-Mugiloidea). *Bol. Inst. Oceanogr. S. Paulo*, vol. 6 pt. 1/2, pp. 143-155, pls. 1, 2.
- , 1958. *Bomolochus dactylopterus* sp. nov. (Crust. Copepoda), parasita del „Pez volador”. *Neotropica*, vol. 4, pp. 47-50, figs. 1-11.
- CAUSEY, D., 1955. The External Morphology of *Blias prionoti* Krøyer, a Copepod Parasite of the Sea Robins (*Prionotus*). *Publ. Inst. Mar. Sci., vol. 4 no. 1*, pp. 5-12, figs. 1-7.
- CLAUS, C., 1864. Beiträge zur Kenntnis der Schmarotzerkrebse. *Z. wiss. Zool., vol. 14*, pp. 365-383, pls. 33-36.
- , 1875. Neue Beiträge zur Kenntnis parasitischer Copepoden nebst Bemerkungen über das System derselben. *Z. wiss. Zool., vol. 25*, pp. 327-360, pls. 22-24.

- DALLA TORRE, K. W. VON, 1889. Die Fauna von Helgoland. Zool. Jb., Syst., suppl. vol. 2, pp. 1-99.
- DELAMARE DEBOUTTEVILLE, C. & L. NUNES-RUIVO, 1958. Copépodes parasites des poissons Méditerranéens (4e série). Vie et Milieu, vol. 9, pp. 215-235, figs. 1-11.
- DESHAYES, G. P. & H. MILNE EDWARDS, 1838. In: J. B. P. A. DE LAMARCK, Histoire Naturelle des Animaux sans Vertèbres, etc., ed. 2 vol. 5, pp. 1-699.
- DOLLFUS, R. P., 1953. Aperçu général sur l'Histoire naturelle des Parasites Animaux de la Morue Atlanto-Arctique (*Gadus callarias* L. (= *morhua* L.)). Encycl. Biol., vol. 43, pp. 1-423, figs. 1-253.
- GNANAMUTHU, C. P., 1948. *Bomolochus acuta* n. sp., a Copepod parasitic on the gills of *Dussumieria acuta*. Proc. Indian Acad. Sci., vol. 27B, pp. 18-25, figs. 1-3.
- , 1949. *Bomolochus multispinosa*, sp. nov.: an Ergasilid copepod observed in copulation. Rec. Indian Mus., vol. 45, pp. 309-319, figs. 1-5.
- , 1949a. Two Male Parasitic Copepods from Madras. Ann. Mag. nat. Hist., ser. 12 vol. 2, pp. 359-367, figs. 1-23.
- GOODING, R. U., 1957. On some Copepoda from Plymouth, mainly associated with Invertebrates, including three new species. J. Mar. biol. Ass. U.K., vol. 36, pp. 195-221, figs. 1-6.
- GOUILLART, M., 1937. Recherches sur les Copépodes parasites (Biologie spermatogénèse, ovogénèse). Trav. Stat. zool. Wimereux, vol. 12 no. 4, pp. 309-457, figs. 1-262.
- GUSEV, A. V., 1951. Parazititseskie Copepoda s nekotorykh morskikh Ryb. (Parasitic Copepods of some marine fishes). Parazitol. Sb., vol. 13, pp. 394-463, figs. 1-37.
- HARTMANN, R., 1870. Beiträge zur anatomischen Kenntniss der Schmarotzerkrebse. Arch. Anat. Physiol. Wiss. Med., 1870, pp. 116-158, 726-752, pls. 3, 4, 17, 18.
- HEEGAARD, P., 1947. Contribution to the Phylogeny of the Arthropoda. Spolia zool. Mus. Hauniensis (Skr. Univ. Zool. Mus. København), vol. 8, pp. 1-236, pls. 1-27.
- HELLER, C., 1865. Crustaceen. In: Reise der Österreichischen Fregatte Novara um die Erde in den Jahren 1857, 1858, 1859, Zool., vol. 2 pt. 3, pp. 1-280, pls. 1-25.
- , 1866. Carcinologische Beiträge zur Fauna des Adriatischen Meeres. Verh. zool.-bot. Ges. Wien, vol. 15, pp. 723-760.
- KRØYER, H., 1837. Om Snyltekrebsene, isear med Hensyn til den danske Fauna. Naturh. Tidsskr., ser. 2 vol. 1, pp. 172-208, 252-304, 476-504, 605-628; ser. 2 vol. 2, pp. 8-25, 131-157.
- , 1864. Bidrag til Kundskab om Snyltekrebsene. Naturh. Tidsskr., ser. 3 vol. 2, pp. 75-426, pls. 1-18.
- LEIGH-SHARPE, W. H., 1928. Degeneracy in parasitic Copepoda in relation to the distribution of their hosts in time. Parasitology, vol. 20, pp. 421-426.
- , 1933. A list of British Fishes with their characteristic parasitic Copepoda. Parasitology, vol. 25, pp. 109-112.
- , 1933a. A second list of Parasitic Copepoda of Plymouth with a description of three new species. Parasitology, vol. 25, pp. 113-118, figs. 1-5.
- , 1934. The Copepoda of the Siboga Expedition. Part ii. Commensal and parasitic Copepoda. Siboga Monogr., vol. 29b, pp. i-vii, 1-43, figs. 1-39.
- , 1935. *Anchistrotos laqueus* n. sp., a parasitic Copepod of *Serranus cabrilla*. Parasitology, vol. 27, pp. 266-269, figs. 1-3.
- LEUCKART, R., 1859. Carcinologisches. Arch. Naturgesch., vol. 25 pt. 1, pp. 232-264, pls. 6, 7.
- MCLEAN FRASER, C., 1920. Copepods parasitic on Fish from the Vancouver Island Region. Proc. Roy. Soc. Can., ser. 3 vol. 13 sect. 5, pp. 45-67, pls. 1-8.
- MARINE BIOLOGICAL ASSOCIATION, 1957. Plymouth Marine Fauna, ed. 3, pp. 1-457, charts 1-4. Plymouth.
- MILNE EDWARDS, H., 1840. Ordre des Copépodes. In: Histoire Naturelle des Crustacés,

- comprenant l'Anatomie, la Physiologie et la Classification de ces Animaux, vol. 3, pp. 411-529, pls. 37-40.
- NORDMANN, A. VON, 1832. Mikrographische Beiträge zur Naturgeschichte der Wirbellosen Tiere, vol. 2, pp. 1-150, pls. 1-10.
- , 1864. Neue Beiträge zur Kenntnis Parasitischer Copepoden. Erster Beitrag. Bull. Soc. Nat. Moscou, vol. 37, pp. 461-520, pls. 5-8.
- OORDE-DE LINT, G. M. VAN & J. H. SCHUURMANS STEKHOVEN, 1936. Copepoda parasitica. In: G. GRIMPE & E. WAGLER, Die Tierwelt der Nord- und Ostsee, vol. 10c 2, pp. 73-198, figs. 1-192.
- PEARSE, A. S., 1947. Parasitic Copepods from Beaufort, North Carolina. J. Elisha Mitchell Sci. Soc., vol. 63 no. 1, pp. 1-16, figs. 1-51.
- , 1952. Parasitic Crustacea from the Texas coast. Publ. Inst. Mar. Sci. Univ. Texas, vol. 2 pt. 2, pp. 1-42, figs. 1-157.
- , 1952a. Parasitic Crustacea from Alligator Harbor, Florida. Quart. J. Florida Acad. Sci., vol. 15, pp. 187-243, figs. 1-143.
- PESTA, O., 1928. Krebstiere oder Crustacea. I: Ruderfüusser oder Copepoda (1. Calanoida, 2. Cyclopoida) (3. Ordnung). In: F. DAHL, Die Tierwelt Deutschlands und der angrenzenden Meeresteile nach ihren Merkmalen und nach ihrer Lebensweise, pt. 9, pp. 1-136, figs. 1-115.
- POCHE, F., 1902. Bemerkungen zu der Arbeit des Herrn Basset-Smith: "A Systematic Description of Parasitic Copepoda found on Fishes, with an Enumeration of the known Species". Zool. Anz., vol. 26, pp. 8-20.
- RICHIARDI, S., 1870. Intorno ad una nuova specie del genere Bomolochus (B. ostracionis). Arch. Zool. Anat. Fisiol., ser. 2 pt. 2, pp. 47-59.
- , 1880. Contribuzioni alla Fauna d'Italia. I. Catalogo sistematico di Crostacei che vivono sul corpo di animali acquatici. In: Catalogo generale della sezione Italiana alla Esposizione internazionale della Pesca in Berlino, 1880, pp. 147-152.
- SCOTT, A., 1901. In: W. A. HERDMAN, Fourteenth Annual Report of the Liverpool Marine Biology Committee and their Biological Station at Port Erin. Proc. Liverpool biol. Soc., vol. 15, pp. 27-29.
- , 1901a. Some additions to the Fauna of Liverpool Bay, collected May 1st, 1900, to April 30th, 1901. Proc. Liverpool biol. Soc., vol. 15, pp. 342-352, pls. 1, 2.
- , 1904. Some parasites found on fishes in the Irish Sea. Proc. Liverpool biol. Soc., vol. 18, pp. 113-125.
- , 1929. The copepod parasites of Irish Sea fishes. Proc. Liverpool biol. Soc., vol. 43, pp. 81-119, pls. 1, 2, textfigs. 1, 2.
- SCOTT, T., 1893. Additions to the Fauna of the Firth of Forth. Part V. Ann. Rep. Fish. Bd. Scotland, vol. 1 pt. 3, pp. 197-219, pls. 2-5.
- , 1900. Notes on some Crustacean parasites of fishes. Ann. Rep. Fish. Bd. Scotland, vol. 18 pt. 3, pp. 144-186, pls. 1-4.
- , 1900a. On Copepods living in the nostril of Fishes. Ann. Scot. nat. Hist., vol. 9, pp. 153-155.
- , 1901. Notes on some parasites of Fishes. Ann. Rep. Fish. Bd. Scotland, vol. 19 pt. 3, pp. 120-153, pls. 7, 8.
- , 1902. Notes on some parasites of fishes. Ann. Rep. Fish. Bd. Scotland, vol. 20 pt. 3, pp. 288-299, pls. 12, 13.
- , 1905. Observations on some parasites of fishes new or rare in Scottish waters. Ann. Rep. Fish. Bd. Scotland, vol. 23 pt. 3, pp. 108-119, pls. 5, 6.
- SCOTT, T. & A., 1913. The British Parasitic Copepoda, vol. 1, pp. 1-252, pls. A, B; vol. 2, pp. i-xi, pls. 1-72. London (Ray Society).
- SEWELL, R. B. SEYMOUR, 1949. The Littoral and semi-parasitic Cyclopoida, the Monstriloida and Notodelphyoida. The John Murray Exped., Sci. Rep., vol. 9 no. 2, pp. 17-199, figs. 1-41, chart 1.

- SHEN, C. J., 1957. Parasitic Copepods from fishes of China. Part 1. Cyclopoida (1). Acta Zool. Sinica, vol. 9, pp. 297-328, pls. 1-9.
- SHIINO, S. M., 1957. Copepods parasitic on Japanese fishes. 16. Bomolochidae and Taeniacanthidae. Rep. Fac. Fish. Prefect. Univ. Mie, vol. 2, pp. 411-428, figs. 1-6.
- , 1959. Sammlung der parasitischen Copepoden in der Präfectur Universität von Mie. Rep. Fac. Fish. Prefect. Univ. Mie, vol. 3 no. 2, pp. 334-374, figs. 1-17.
- , 1960. Copepods Parasitic on Fishes from Seto, Province Kii, Japan. Rep. Fac. Fish. Prefect. Univ. Mie, vol. 3 no. 3, pp. 501-517, figs. 1-7.
- SIMMONS, E. G., 1957. An Ecological Survey of the Upper Laguna Madre of Texas. Publ. Inst. Mar. Sci., vol. 4 no. 2, pp. 156-200, figs. 1-13.
- STOCK, J. H., 1953. Bomolochus soleae Claus, 1864 and B. confusus n. sp.: Two hitherto confounded parasitic copepods, with remarks on some other Bomolochus species. Beaufortia, no. 24, pp. 1-13, figs. 1-47.
- , 1955. A new Bomolochus (Copepoda parasitica) from the California Grunion. Beaufortia, vol. 5 no. 49, pp. 55-59, figs. 1-24.
- , 1959. New hosts and distribution records of parasitic Copepoda. Bull. Aquatic Biol., vol. 1 no. 6, p. 43.
- SUMPF, K., 1871. Ueber eine neue Bomolochiden-Gattung nebst Bemerkungen über die Mundwerkzeuge der sogenannten Poecilostomen, pp. I-VI, 1-32, pls. 1, 2. Göttingen (Inaug. Diss.).
- THOMPSON, I. C. & A. SCOTT, 1903. Report on the Copepoda collected by Professor Herdman, at Ceylon, in 1902. Report Ceylon Pearl Oyster Fish., vol. 1, pp. 227-307, pls. 1-20, fig. 1.
- VALLE, A., 1882. Crostacei Parassiti dei Pesci del Mare Adriatico. Boll. Soc. Adriat. Sci. Nat., vol. 6, pp. 55-90.
- VERVOORT, W., in press. Free-living Copepoda from Ifaluk Atoll, Caroline Islands. Bull. U.S. Nat. Mus.
- WILSON, C. B., 1908. North American Parasitic Copepods: A list of those found upon the fishes of the Pacific Coast, with descriptions of new genera and species. Proc. U.S. nat. Mus., vol. 35, pp. 431-481, pls. 66-83.
- , 1911. North American Parasitic Copepods belonging to the family Ergasilidae. Proc. U.S. nat. Mus., vol. 39, pp. 263-400, pls. 41-60.
- , 1913. Crustacean parasites of West Indian fishes and land crabs, with descriptions of new genera and species. Proc. U.S. nat. Mus., vol. 44, pp. 189-277, pls. 18-53.
- , 1932. The Copepod Crustaceans of Chesapeake Bay. Proc. U.S. nat. Mus., vol. 80, art. 18, pp. 1-54, pls. 1-5.
- , 1932a. The Copepoda of the Woods Hole Region, Massachusetts. Bull. U.S. nat. Mus., no. 158, pp. 1-635, pls. 1-41, figs. 1-316.
- , 1935. Parasitic Copepods from the Dry Tortugas. Papers Tortugas Lab., vol. 29 no. 12 (= Publ. Carnegie Inst. Wash., no. 452), pp. 329-347, pls. 1-6.
- , 1937. Parasitic Copepods taken during the third Hancock Expedition to the Galapagos Islands. Rep. Hancock Pac. Exped., vol. 2, pp. 23-30, pl. 1.
- YAMAGUTI, S., 1936. Parasitic Copepods from fishes of Japan. Part I. Cyclopoida, I, pp. 1-8, pls. 1-5.
- , 1939. Parasitic Copepods from fishes of Japan. Part 4. Cyclopoida, II. Vol. Jubilare pro Prof. Yoshida, vol. 2, pp. 391-415, pls. 1-13.
- , 1953. Parasitic Copepoda from fishes of Japan. Part 7. Cyclopoida, III and Caligoida, IV. Publ. Seto Mar. Biol. Lab., vol. 3 pt. 2, pp. 221-231, pls. 13-17.
- YAMAGUTI, S. & T. YAMASU, 1959. Parasitic Copepods from Fishes of Japan with Descriptions of 26 New Species and Remarks on Two Known Species. Biol. J. Okayama Univ., vol. 5, pp. 89-165, figs. 1-302 on pls. 1-14.