BEAUFORTIA

SERIES OF MISCELLANEOUS PUBLICATIONS

ZOOLOGICAL MUSEUM - AMSTERDAM

No. 105 Volume 9 August 20, 1962

Lichomolgus pterophilus n. sp., a cyclopoid copepod associated with the East Indian sea-pen *Pteroeides* *)

by

JAN H. STOCK

(Zoölogisch Museum, Amsterdam)

INTRODUCTION

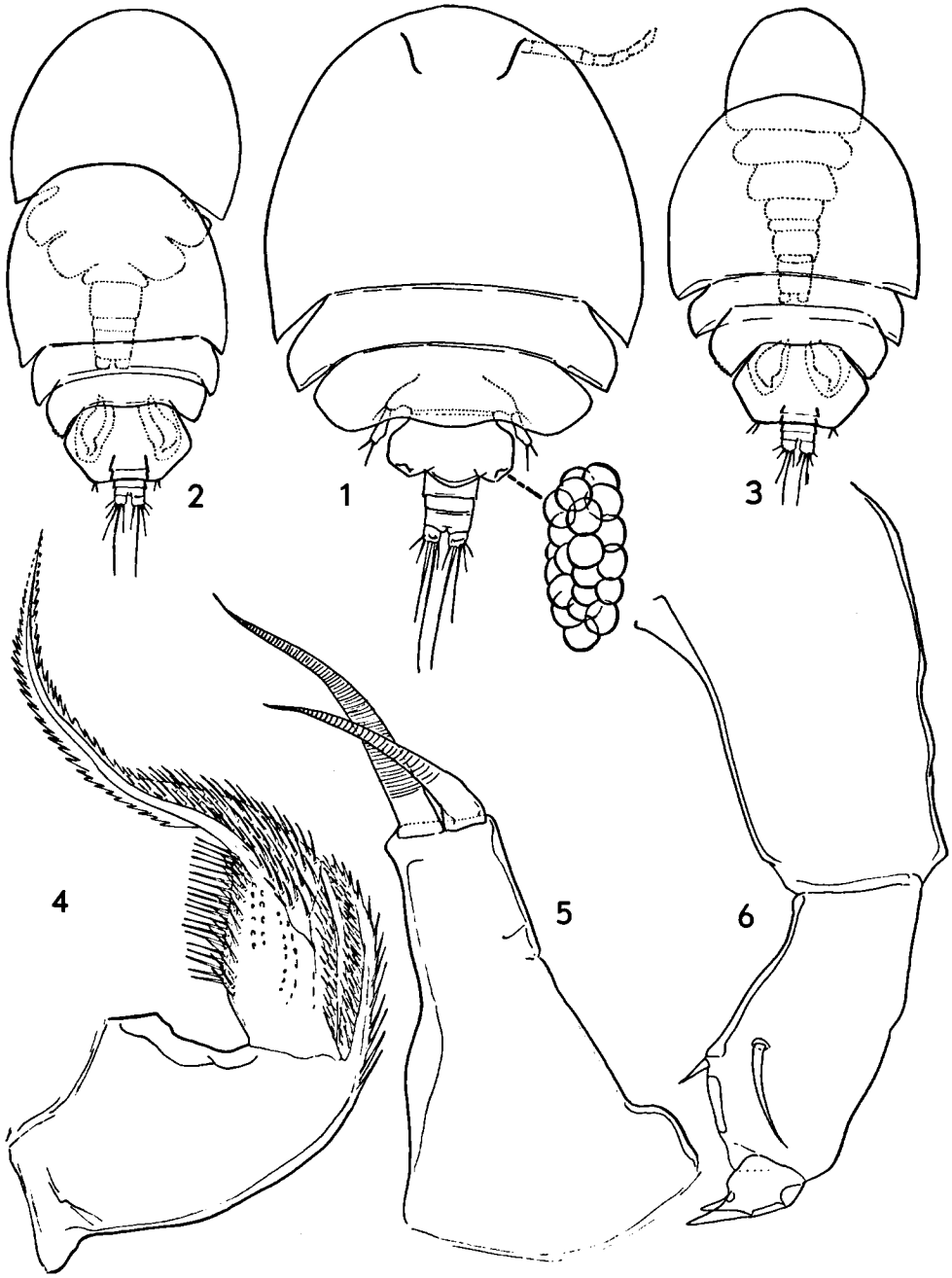
Copepod parasites of vertebrates, more particularly of fishes, have been thoroughly studied by a number of biologists all over the world. In the last decade or so, the attention of several workers has been increasingly focussed upon those copepods found on invertebrate hosts. They are usually less conspicuous than the "fish-lice", which are often fairly large in size. Nevertheless, their study is fascinating, because every step, from a freeliving, non-transformed creature, via a moderately adapted (so-called semi-parasitic) form, to an unrecognizably transformed, truly parasitic animal, can be demonstrated within the group of invertebrate associates.

The term "associate" was introduced by GOODING, 1957, to meet the difficulty that it is often impossible to state whether a particular species is parasitic, semi-parasitic or commensal.

Morphological, ecological and ontogenetic studies on these associates are not only of interest for copepod specialists, but are also important from a general biological point of view, since they give us indications about the origin of the phenomenon of parasitism in nature.

A surprising number of new species, and even of new genera and families has been discovered and described in the last few years. These discoveries have been made not only in poorly investigated areas, but also in the well-studied surroundings of the European and American biological stations. Most of these studies are restricted to the northern hemisphere, our knowledge of copepods associated with invertebrates from the southern hemispere and from the entire Indo-West-Pacific belt being indeed rather poor.

*) Received June 15, 1962



FIGURES 1—6. *Lichomolgus pterophilus* n.sp.
The letter following each figure title refers to the scale at which the figure was drawn (scales above fig. 9). 1, Ovigerous ♀, dorsal (a). — 2, 3, Couples consisting of an adult ♂ and a ♀ copepodid (a). — 4, Mandible ♀ (c).— 5, Anterior maxilla ♀ (c). — 6, Maxilliped ♀ (d).

Therefore, the description of a new species of *Lichomolgus*, found associated with a sea-pen of the genus *Pteroeides*, might be of a certain interest. For obvious reasons, the new associate is called *Lichomolgus pterophilus*.

Lichomolgus pterophilus *n.sp.*

A. Material, host, and locality.

50 ♀♀, partly ovigerous, 27 ♂♂, and 14 copepodids were found between the leaflets of a pennatularian of the genus *Pteroeides*. This astonishing number of associates was found on a single sea-pen of about 6½ cm in length. The host specimen was collected off the island of Billiton in the Sunda Sea by the late Prof. Dr. C. Ph. SLUITER. It was identified (probably by the coelenterate specialist A. KÖLLIKER) as *Pteroeides lacazei* KÖLLIKER. Dr. SYDNEY J. HICKSON, who also examined this host specimen, was inclined to consider it a somewhat atypical *P. argenteum* ELL. & SOL., of which (he wrote) "the rachis is very much contracted owing to loss of stalk." Which identification is correct cannot be ascertained for the moment, although I must remark that I examined 3 or 4 other sea-pens, which doubtless are *P. argenteum*, without finding a single copepod associate. One of these uninfected specimens of *P. argenteum* was collected by Professor SLUITER at the same place as the heavily infected *Pteroeides*.

B. Description of the adult female.

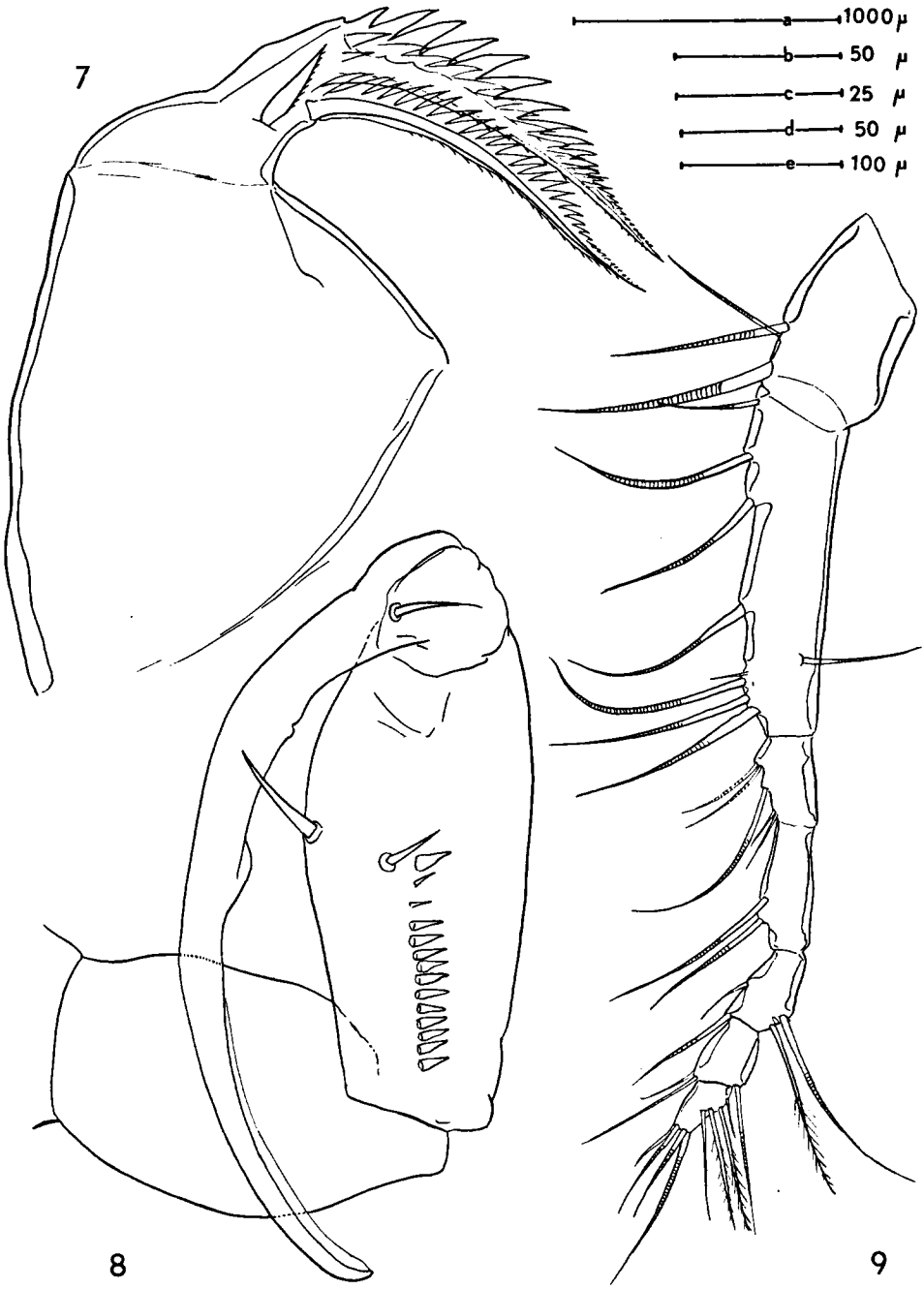
The total length, without the furcal setae, varies between 1.70 and 2.06 mm (mean: 1.87 mm, based on 22 individuals). The prosome (fig. 1) is rather large, oval to nearly circular in outline. The first pedigerous segment is fused with the cephalosome. The posterior margin of the 3rd pedigerous segment is indistinctly crenulated. The 4th and 5th pedigerous segments are invisible in dorsal view, being completely covered by the dorsally overlapping 3rd pedigerous segment. The genital segment is much wider than long, and much wider also than the caudal part of the urosome. There are 2 more segments of rectangular shape between the genital segment and the anal segment. No spines or spinules are present on the anal segment. The caudal rami (fig. 12) are squarish, armed with 6 smooth setae. An external lateral seta arises at about 3/5 of the furca. The 4 terminal setae are well-developed; the longest is about as long as the dorsally visible part of the urosome.

The ovisacs (fig. 1) are elongately oval, rather variable in dimensions: length 425—700 μ, width 290—350 μ. The eggs are large and not very numerous.

The anterior antenna (fig. 9) is 7-segmented. The figure shows the shapes, relative lengths and armature of the segments. Most setae are annulated, but smooth, except for 1 plumose seta on segment 5 and 2 such setae on segment 7. There are no aesthetes.

The second antenna (fig. 18) is slender and rather simple in structure. The 2nd and 4th (= terminal) segments are elongated. The 1st segment bears 1 terminal seta, the 2nd segment 1 seta at about 3/5 of its length, the short 3rd segment 2 terminal setae and a spine. The distal armature consists of 2 curved, slender claws, of slightly unequal size, and a seta.

The mandible (fig. 4) is of a very characteristic and complex structure. The smooth basal part is clearly separated from the lappet. Several rows of spinules are borne on the basal expansion of the lappet. The medial margin



FIGURES 7—9. *Lichomolgus pterophilus* n.sp.
7, Posterior maxilla ♀ (b). — 8, Maxilliped ♂ (d). — 9, Anterior antenna ♀ (e).

of the lappet bears a crest-like structure, likewise armed with numerous spinules. The apical lash is denticulated at both margins.

The anterior maxilla (fig. 5) is a simple lobe, armed distally with 2 annulated, thick setae of unequal length.

The posterior maxilla (fig. 7) has 2 apical lashes; the median of these is armed with two parallel rows of teeth at its median margin; the lateral lash bears only 1 row of teeth at its median margin. A denticulated spine is borne near the implantation of the latter lash.

The maxilliped (fig. 6) consists of a smooth, elongated basal segment; an elongated 2nd segment, armed at its inner margin with a spine and a seta; and a knob-like distal segment which is prolongated into 2 acute projections, forming together a pseudochela.

Legs 1 to 3 are biramous, each ramus being trimerous. Figures 10, 16, and 20 give enough details to make a lengthy description unnecessary. Especially noteworthy are the very long spiniform processes, which — more particularly on the endopods — reach an unequalled development. Two such long spiniform processes, resembling together an opened bird's bill, occur at the outer margin of segment 2 of the 1st, 2nd and 3rd endopods.

The 3rd leg is very similar to the 2nd, but bears one less seta on the 3rd endopod segment (fig. 20).

The 4th leg (fig. 19) has a 3-segmented exopod, and a 2-segmented endopod, which is about as long as the exopod. The 2 endopod segments are subequal, the proximal segment bears a thin, short, plumose internal seta; the distal segment bears 2 terminal spines. The spiniform projections on the exopod are similar to those found on legs 1, 2 and 3, but those of the endopod are very much smaller.

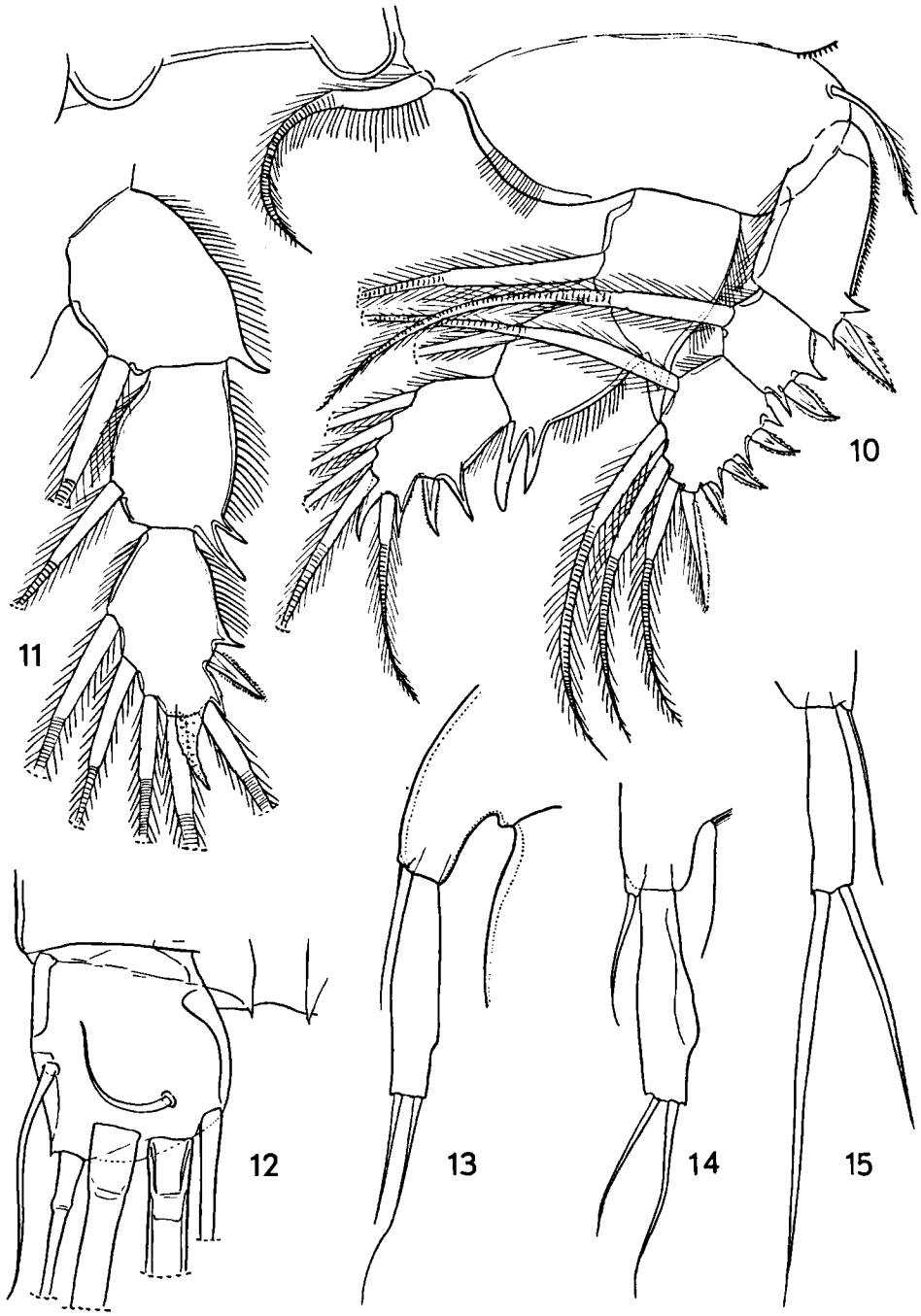
The spine and setal formula of the biramous legs is as follows (spines in Roman, setae in Arabic numerals):

P 1	exp.	I—0;	I—1;	III-I-4
	enp.	0—1;	0—1;	I-5
P 2	exp.	I—0;	I—1;	III-I-5
	enp.	0—1;	0—2;	III-2
P 3	exp.	I—0;	I—1;	III-I-5
	enp.	0—1;	0—2;	III-2
P 4	exp.	I—0;	I—1;	II-I-5
	enp.	0—1;	II—0	

The unisegmented 5th leg is implanted on a prominent expansion of the somite that carries it (fig. 13). This expansion bears a smooth seta, which is distinctly longer than half the length of the free segment. The shape of this unique segment is somewhat variable; while the outer margin forms usually a regular curve, the inner margin shows a kind of swelling or obtuse dentation at about 2/3 of its length (figs. 13, 14). There are 2 smooth terminal setae, a longer internal and a shorter external.

C. Description of the male.

The total length of the male shows less range than that of the female, and



FIGURES 10—15. *Lichomolgus pterophilus* n.sp.
10, First leg ♀ (e). — 11, Endopod of first leg ♂ (d). — 12, Caudal ramus ♀ (d). — 13, 14, Fifth leg ♀ (e). — 15, Fifth leg ♂ (d).

varies between 1.16 and 1.31 mm (mean: 1.25 mm, based on 12 individuals). Here, too, the 3rd pedigerous segment dorsally overlaps and covers completely the 4th and 5th pedigerous segments. Consequently, in dorsal view the genital segment appears to follow the 3rd pedigerous segment (figs. 2, 3). The genital segment is hexangular and very large. The 2 spermathecae are very conspiuous and of a dark colour. The posterior part of the genital segment dorsally overlaps and covers abdominal segments 2 and 3. Abdominal segments 4 and 5 (the latter being the anal segment) protrude from under the genital segment.

No secondary sexual differences were observed in the antennae and mouth parts. The maxilliped (fig. 8), however, is transformed into a strong grasping organ.

The exopods of legs 1 to 4 are similar to those of the female, but the endopods show a number of sexual differences. The spiniform projections are less developed on the 1st endopod (fig. 11), with the exception of the most distal one (on segment 3) which is more robust than the corresponding projection in the female, and which has a roughened surface. All spiniform projections on the 2nd and 3rd (fig. 17) endopods are less developed in the male than in the female. The 4th endopod resembles that of the female, but the seta on the basal segment is somewhat longer.

The 5th leg (fig. 15) is of the same elongated shape as that of the other sex. The seta at its basal implantation is about as long as the free segment. The terminal setae are relatively longer. The inner swelling is practically not indicated in the male.

The natural colour of living specimens is unknown; in alcohol they are opaque, white.

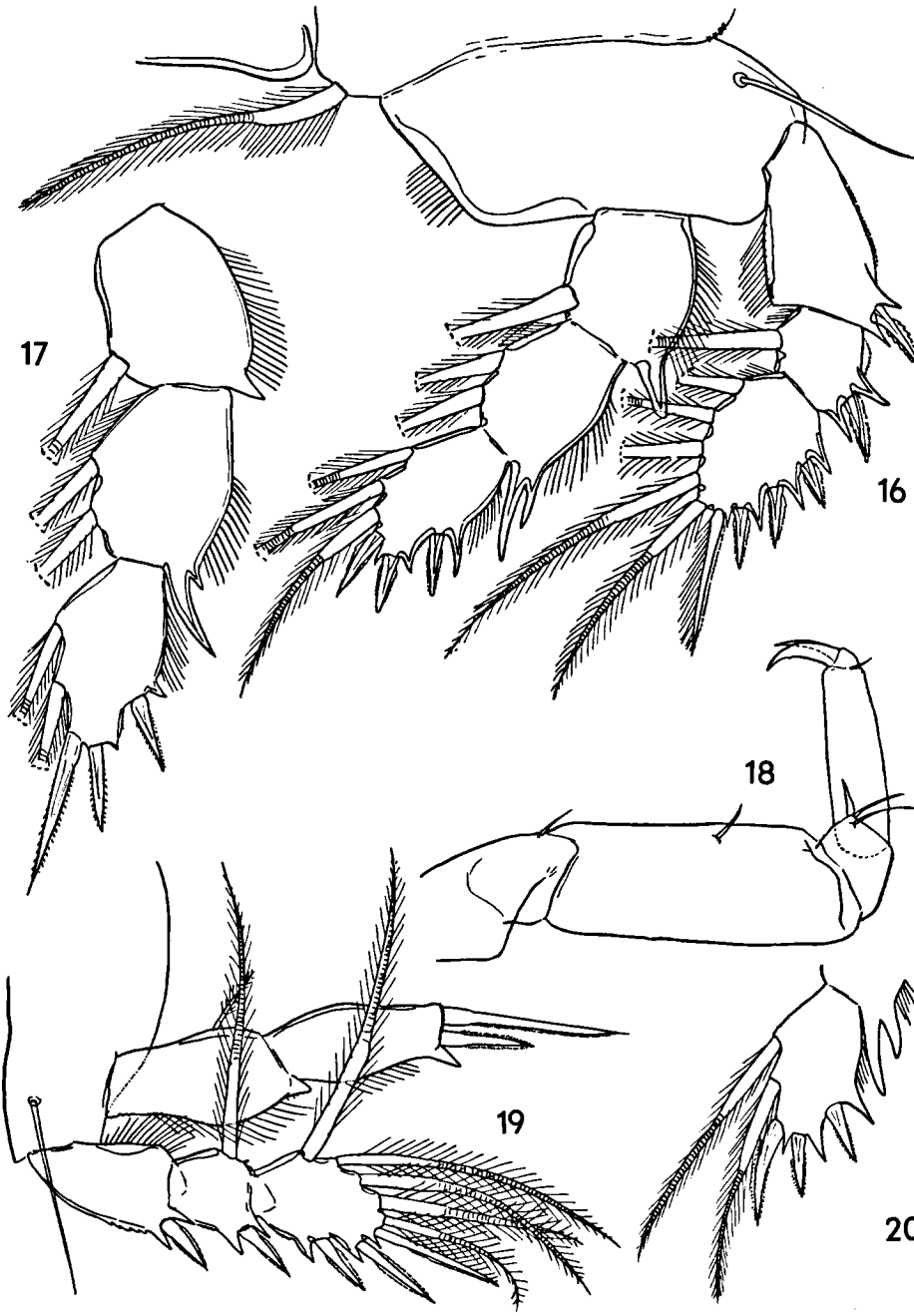
D. Biological notes.

Not only adult males and females occur on the host, but also copepodids in various stages of development. Among the material collected, there are several couples. The adult male grasps a female copepodid with the maxillipeds and holds it against his ventral body surface (figs. 2, 3). Apparently, female copepodids in different stages of development are grasped. Female copepodids are sometimes found which are practically as large as the males that carry them, and which probably are in the 5th copepodid stage (fig. 2). Other males carry much smaller female copepodids, probably stages 3 and 4 (fig. 3). I could not ascertain in which stage fecundation takes place, although it will probably not be before the female reaches the 5th copepodid stage. The couples consisting of a male and a younger female are then in a precopulatory position.

Fixation to the tissues of the host is not very firm, and is achieved primarily by the prehensile action of the posterior antenna.

E. Affinities.

Morphologically very dissimilar species haven been grouped together in the genus *Lichomolgus*. Even if we remove a number of very different species



FIGURES 16—20. *Lichomolgus pterophilus* n.sp.
16, Second leg ♀ (e). — 17, Endopod of third leg ♂ (d). — 18, Posterior antenna ♂ (e). — 19, Fourth leg ♀ (e). — 20, Terminal portion of endopod of third leg ♀ (e).

to related genera, like *Macrochiron* and *Stellicola,* more than 50 species stay under the generic name *Lichomolgus,* which is in my eyes a generic group rather than a genus. The present species shows a quite natural relationship to a number of species (some of them being also associates of coelenterates) being characterized by their complex mandibular structure, by the presence of marked secondary sexual differences in the anterior biramous legs, and by ornamented (toothed, spinulated) 5th legs. To this group belong species such as *L. pteroidis* DELLA VALLE, 1880; *L. actiniae* DELLA VALLE, 1880; *L. audens* HUMES, 1958; and *L. anomalus* A. SCOTT, 1909.

For practical purposes, the grouping according to chaetotaxis of the legs, as schematically carried out by SEWELL, 1949, is easy for a rapid identification. I do not think, however, that all species belonging to one of SEWELL's groups are necessarily closely related. The present species, *L. pterophilus* n.sp., falls in SEWELL's group of *L. gigas* THOMPSON & A. SCOTT, 1903, just as its close relative *L. pteroidis* DELLA VALLE, 1880. In the same group, however, fall species like *L. protulae* STOCK, 1959, and *L. serpulae* STOCK, 1960, which are certainly not closely related to *L. pterophilus.*

At any rate, *L. pterophilus* n.sp. can be separated from all species that belong to the group with the same chaetotaxis, by the presence of 2 spiniform projections (in a beak-like arrangement) on the 2nd endopod segments of legs 1 to 3. All other species have only 1 or no such projections at that place.

F. Types.

A female holotype and a male paratype are in the Zoological Museum, Amsterdam, together with a number of paratypes (cat. no. Co. 100,628 a-d). Other paratypes are deposited in the British Museum (Natural History), London (reg. no. B.M. 1960.11.23.1), and in the U.S. National Museum, Washington (cat. no. 106381).

G. Sommaire.

Description d'une nouvelle espèce de Copépode Cyclopoïde, *Lichomolgus pterophilus* n.sp., trouvée sur un pennatulaire des Indes Orientales, *Pteroeides* cf. *lacazei* Köll.

LITERATURE CITED

GOODING, R. U.
1957 On some Copepoda from Plymouth, mainly associated with invertebrates, including three new species. — J. mar. biol. Ass. U.K., 36: 195—221.

SEWELL, R. B. SEYMOUR
1949 The littoral and semi-parasitic Cyclopoida, the Monstrilloida and Notodelphyoida. — John Murray Exp., Sci. Reps., 9 (2): 17—199.