Notodelphyid Copepods from Banyuls-sur-Mer

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Supplément n° 12 à "Vie et Milieu"

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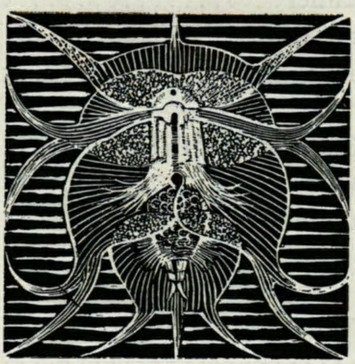

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CONTENTS

INTRODUCTION

The Copepods which live in association with Ascidians form a complex offering a wide array of interesting ecological and taxonomic problems. They have now been known for over a hundred years and in most references have been included in a loosely defined taxonomic category, the *Ascidicolidae.* This group has been shown to consist of many systematic entities, including Ascidicolids, Enterocolids, Botryllophylids, Notodelphyids, and perhaps still others. In a survey, ILLG (1958) presented a diagnosis of the family *Notodelphyidae* and a review of forms included. The range of morphological variation was seen to be very great, from presumed commensals with very little modification of appendages over that seen in primitive free-swimming Cyclopoids to parasites of scarcely recognizable copepod habitus, with inflated or vermiform bodies and with appendages degenerated to minute and often apparently functionless protuberances. Studies on a representative array of examples have been shown by DUDLEY (Ph. D. Thesis, unpublished, University of Washington) to conform to a basic pattern of life history and a uniformity of anatomy in developmental stages, which bear out the concept of the family as presented in 1958. LANG (1948) had already demonstrated that the suborder *Notodelphyoida* Sars is an artificial assemblage and that the *Notodelphyidae* are assignable to the *Cyclopoida Gnathostoma.*

The study here reported is a portion of a program in which we are seeking to redescribe some of the long-known classical forms in the family, especially from the Mediterranean Sea. The collections were made by DUDLEY and, wherever possible, she has attempted to rear the species through as many larval stages as possible. Complete series of development are available for a number of representatives and will be described in subsequent papers by DUDLEY. In the course of these, the descriptions of males for a number of the most modified forms will fall more logically into the anatomical analyses in the developmental sequences. Accordingly, below under some species, such incidences are merely noted in the present paper.

For opportunities to make the studies basic to our presentation below we are indebted to the following agencies : Laboratoire Arago, Université de Paris, Biologie Marine, Banyuls-sur-Mer, France; National Science Foundation, U.S.A. (Grant NSF *G*-4217) and the John Simon Guggenheim Memorial Foundation. For professional and personal courtesies without which the research could not have been carried on, we are indebted to M. le Professeur G. PETIT, Directeur, Laboratoire Arago, M. Cl. DELAMARE DEBOUTTEVILLE, sous-Directeur, Laboratoire Arago, Mme E. CHATTON, Banyuls-sur-Mer, and M. le Professeur H. HARANT, Université de Montpellier.

The motivation for studying at Banyuls was largely from the excellent published studies of species described by Professor E. CHATTON, some in association with M. E. BRÉMENT and some with Professor HARANT. It is our great good fortune that the hospitality of M. DELAMARE and the generosity of Mme CHATTON have made available to us the collections and remarkable manuscript notes preserved from the laboratory of Professor CHATTON. Included in the collections were representatives of some of the species described by Professor CHATTON and also specimens of new species and notes regarding them. We have based a considerable amount of our presentation below on this material. Because it included one new species of *Notodelphys* from Roscoff, we describe it here. For the collections of Professor CHATTON we have varying amounts of collection data, but for some the number is the only indication provided in the sample.

Some lots come from Roscoff, so some of those with only numbers may also. As it is obvious that Professor CHATTON kept careful records and notes we hope the data now missing may come to light in some of his manuscripts or publications.

New collections of Copepods were made from april 25 to june 16, 1958. All localities of collections were in the general vicinity of Banyuls, in the Golfe du Lion, between Cap Peyrefite and Argelès-sur-Mer, approximately 42°26'50" North, latitude, 3°14'15" East, longitude, and 42°32'50" North, latitude, 3° 05'15" East, longitude, respectively.

We present in our lists of specimens examined and remarks under each species what we consider to be the significant information about the samples collected and studied. We have grouped under each species the collections by hosts, specific location as provided by the local collectors and dates of collection. The numbers of specimens have been recorded with varying precision. Every species identification is based on dissections, with numbers of dissections made depending on material available. Total sample identifications have been made by comparison of gross characters and we consider them positive for the females. These have been counted when occurrence was sparse or number estimated or merely indicated for large lots. We have identified by inference the accompanying males and developmental stages because detailed study of males and developmental stages from these collections is a future project. Completed records from this will extend the information about the species being presented here.

Every species ever described from Banyuls, except *Brementia balneolensis* Chatton and Brément, founded on one specimen, has been restudied and fresh collections have been made for all of these except *Prophioseides abdominalis* Chatton and Brément. Every species so far described from Banyuls is bizarre and highly aberrant in some regard. It is a tribute of the highest order to Professor CHATTON that these species are readily recognizable on the basis of characters provided in the descriptions by him and his colleagues, and that his systematic arrangement is essentially retained at present as expressing the soundness of his judgment in discerning the relationship of these modified animals to less degenerate members in the family *Notodelphyidae*.

The dissections for our study were mostly prepared in lactic acid, using the stains Lignin Pink (Edward Gurr, London) and standard Methyl Blue. Permanent preparations of these are in Höyer's mounting medium and sealed with Laktoseal (Gurr). The illustrations were made mainly with the camera lucida. Where we have used the drawings prepared by Professor CHATTON, the legend so indicates. When possible and desirable, we designate as holotype an intact animal. In the species of *Notodelphys* and other less degenerate forms a dissection is used as a preferable holotype. Type material is deposited in the United States National Museum and in the CHATTON Collection, to be maintained permanently either at the Laboratoire Arago or the Muséum National d'Histoire Naturelle, Paris.

The tunicate hosts were identified at the laboratory, by reference to SALFI (1931), HARANT and VERNIÈRES (1933), and BERRILL (1950). The systematic arrangement we use is essentially from the treatment of HARANT and VERNIÈRES. We are greatly indebted to Professor HARANT who has checked and verified most of our identifications. To facilitate further reinvestigation of the host associations recorded by Professor CHATTON and his colleagues we are listing the current designations corresponding to the specific names of Tunicates which he used. Where tunicate specimens were not preserved with the CHATTON copepods but a tunicate host was named on the label, we list the current name of the Tunicate with a question mark to indicate that we have not attempted to make a zoological judgment on the question of tunicate synonymy here. In every case, we also include the name for the Tunicate used by CHATTON. Synonymies and bibliographies for the Copepods treated are not completely presented here. We refer to ILLG (1958) for additional information. BOCQUET and STOCK (1960) have published the only subsequent study we have taken into consideration. They add information on a number of species of *Notodelphys* and describe *N. transatlantica* and *N. cryptopyge.*

The following list designates Notodelphyids from Banyuls and the species from Roscoff found in the CHATTON collection, in the order of our treatment in the text. The list is headed by *Brementia balneolensis* Chatton and Brément, which we have been unable to reinvestigate. The asterisk (*) denotes species previously reported from Banyuls.

* *Brementia balneolensis* Chatton and Brément
Notodelphys allmani Thorell
Notodelphys elegans Thorell
Notodelphys prasina Thorell
Notodelphys acanthomela, new species
Notodelphys reducta, new species
Notodelphys haranti, new species
Notodelphys platymera, new species so far known only from Roscoff
Doropygus pulex Thorell
Notopterophorus elongatus Buchholz
Notopterophorus elatus Giesbrecht
Notopterophorus dimitus, new species
Botachus cylindratus Thorell
* *Bonnierilla arcuata* Brément
Bonnierilla longipes (Kerschner)
Bonnierilla armata Schellenberg
Bonnierilla similis, new species
Gunenotophorus globularis Buchholz
Doroixys uncinata Kerschner
Demoixys chattoni new genus, new species
Demoixys dialepta, new species
Lobodelphys elephas, new genus, new species

* *Scolecimorpha joubini* (Chatton)
* *Prophioseides abdominalis* (Chatton and Brément)
Prophioseides delamarei, new species
Prophioseides diplosomae, new species
Haplostatus incubatrix, new genus, new species
* *Ooneides amela* Chatton and Brément.

SYSTEMATIC ACCOUNT

Family NOTODELPHYIDAE

Genus **NOTODELPHYS** Allman, 1847

NOTODELPHYS Allman, 1847. — Thorell, 1859. — Sars, 1921. — Schellenberg, 1922. — Illg, 1958.

We refer for the diagnosis of the genus to ILLG (1958). With the addition of new species here and study of them and of representatives of various of the previously known European forms it becomes possible to predict that some details can be added to the characterization of the genus. This will be provided, it is hoped, in a subsequent, more extended presentation of the European forms. Until this type of study is made, it is difficult to refer to relationships within the group. For the identification of *N. allmani*, *N. elegans* and *N. prasina* we used the diagnostic characters provided by THORELL (1859) and SARS (1921).

Until the study referred to above becomes available we cannot provide a reliable key for the identification of species of *Notodelphys*. In order to summarize the differentiation of the new species proposed here from each other and from previously known forms, we present groupings based on key characters derived from the key in ILLG (1958), based on SCHELLENBERG (1922), and in the remarks for each new species point out characters for its specific separation. The salient characters available for such grouping, particularly where we have had to rely on the scanty descriptions of some of the species, are armature of the fifth leg, proportional length of caudal ramus in relation to the anal segment, and the relative position of the lateral seta on the caudal ramus.

It is interesting to note that most species of *Notodelphys* have been reported from Tunicates of the order *Enterogona*, suborder *Phlebobranchiata* Lahille, most of these by far from the family *Ascidiidae* Herdman. Among these species of *Notodelphys* there is a group of several, in fact most of those described by THORELL, wich are difficult to differentiate morphologically because of the subtlety of the distinguishing characters. However, simultaneous infections of some of these within one host indicate they may be specifically different and not host forms. The great anatomical resemblances strikingly suggest that the assemblage is a radiation of closely allied genetic entities. Conversely, there have been few references to species of *Notodelphys* from tunicates of the order *Pleurogona*, suborder *Stolidobranchiata* Lahille. We cannot be sure whether this is due to the paucity of examinations of these Tunicates for ascidicolous Copepods or whether there is a real scarcity of the Copepods in this group of Tunicates.

In collecting the series for the present study we have found fair populations of *Notodelphys* species in Tunicates of this suborder, although no exceptional attempts were made to sample them particularly. Three of the new species we are describing here are associated with members of the families *Styelidae* Sluiter, *Pyuridae* Hartmeyer and *Molgulidae* Lacaze-Duthiers. These are all very distinct from the previously known species, yet show definite affinities with each other. Although the evidence we possess at the present time is not at all conclusive, indications are appearing that we may be dealing with definite, although closely related groups of species associated respectively with two widely separated groups of hosts.

NOTODELPHYS ALLMANI Thorell.

For synonymy and distribution see ILLG (1958). The usage here is based on the diagnosis of SARS (1921).

Specimens examined :

From *Ascidiella aspersa* (Müller) :

Mixed trawl : (1) North of Port-Vendres, 70-30 m (2), off Cap Béar in Anse de Paulilles, 50 m, May 28, 1948, 2 females.

NOTODELPHYS ELEGANS Thorell.

For synonymy and distribution see ILLG (1958). The usage here is based on the diagnosis of SARS (1921).

Specimens examined :

From *Ciona intestinalis* Fleming :

Near Port-Vendres to near Bay of Troc, 50-25 m, May 13, 1958, 7 females, males, developmental stages.

NOTODELPHYS PRASINA Thorell

For synonymy and distribution see ILLG (1958). The usage here is based on the diagnosis of SARS (1921).

Specimens examined :

From *Ascidia mentula* (Müller) :

Mixed trawl : (1) near Port-Vendres, north, 70 m, (2) northeast of Port-Vendres, 60-30 m, May 6, 1958, 1 female, developmental stages.

Northeast to south of Cap Peyrefite, 60-50 m, May 29, 1958, 10 females, developmental stages.

NOTODELPHYS ACANTHOMELA, new species (Figures 1-4, Table I).

Types : Holotypic female, USNM 104821 (type locality, Golfe du Lion, Mediterranean Sea, from *Microcosmus sulcatus* Coquebert); allotypic male, USNM 104822 same locality and host; paratypes listed below, from same locality.

Specimens examined :

From *M. sulcatus* :

Coastal mud near Port-Vendres, 60-100 m, April 25, 1958, 2 females, males, developmental stages.

Mixed trawl : (1) near Port-Vendres, north, 70 m, (2) northeast of Port-Vendres, 60-30 m, May 6, 1958, 1 female, developmental stages, type lot.

Near Port-Vendres, 50 m, to 25 m, Bay of Troc, May 13, 1958, 1 female, 1 male, developmental stages.

Mixed trawl : (1) North of Cap Béar, 60 m, (2) northeast of Port-Vendres, 90 m, May 14, 1958, 2 females, 2 males, developmental stages.

Off Cap Béar in Anse de Paulilles 50 m May 28, 1958, 1 female, males, developmental stages.

From *M. sabatieri* Roule :

Off Banyuls, France, 1958, C. Monniot, 30 females, developmental stages.

Description :

Female (fig. 1, 2) : General features : Total length, based on measurements of individuals seen in profile, taken from anterior-most projection of cephalosome to end of caudal ramus, measured along body axis, compiled here from 4 specimens, averaging 3.36 mm. Body (figs. 1, *a*, *b*) delimited into cephalosome, metasome and urosome. Cephalosome bearing appendages through maxillipeds, metasome consisting of three relatively normal leg-bearing segments, and inflated incubatory region, a complex, bearing both fourth and fifth legs, and totally enclosing brood-pouch. Incubatory region notably slender for species of *Notodelphys*. Fifth legs ventral just at posterior edge of complex. Articulation of metasome and urosome between incubatory complex and anatomically seventh thoracic segment. Urosome (fig. 1, *c*) slender, with slight taper posteriorly, composed of 5 well-defined segments, with following proportional lengths : 2.5 : 3.2 : 3.4 : 2.7 : 1.7 : Conspicuous genital apparatus, consisting of vulva at midline, and diverging sclerotized seminal tubes, at the posterior third of first urosomal segment.

Anterior margin of head prolonged ventrally as blunt conical rostrum, reaching slightly beyond basal segment of antennule (fig. 1, *d*). Head structures : fourteen-segmented antennule (fig. 1, *d*) slender but short, reaching only to posterior third of cephalosome. Taper of the appendage very gradual, each segment only slightly narrower than next proximal. Basal group of 4 segments massive, making up more than half length of appendage. Second segment including usual second and third segments of other species of *Notodelphys*. Setal formula as follows : Segment I — 3 setae; II — 17 setae; III — 6 setae; IV — 6 setae, 1 aesthete; V — 3 setae; VI — 3 setae; VII — 3 setae; VIII — 2 setae; IX — 1 seta, 1 aesthete; X — 1 seta; XI — 1 seta; XII — 2 setae; XIII — 2 setae, 1 aesthete; XIV — 7 setae, 1 aesthete.

Antenna (fig. 1, *e*) composed of three segments, of following proportional lengths, basal to distal : 3.8 : 4 : 5.3. A rightangled flexure between clearly articulated second and third segments. A diagonal articulation setting off first from second segment in a joint apparently of very limited mobility. Two long, subequal setae inserted on inner margin of segment 1 at distal articulation. At distal third of outer margin of segment 2 a shorter seta. Inserted near outer margin of segment 3 at intervals equal to about a fourth of length of margin a single proximal seta, a single second seta, and a trio of setae at distal fourth. On distal margin (fig. 1, *f*) inserted a stout tapered, curved hook, accompanied by 3 curved, stiffened, blunt-ended setae, and 2 flexible setae. Two curving rows of spinules ornamenting inner margin of distal segment.

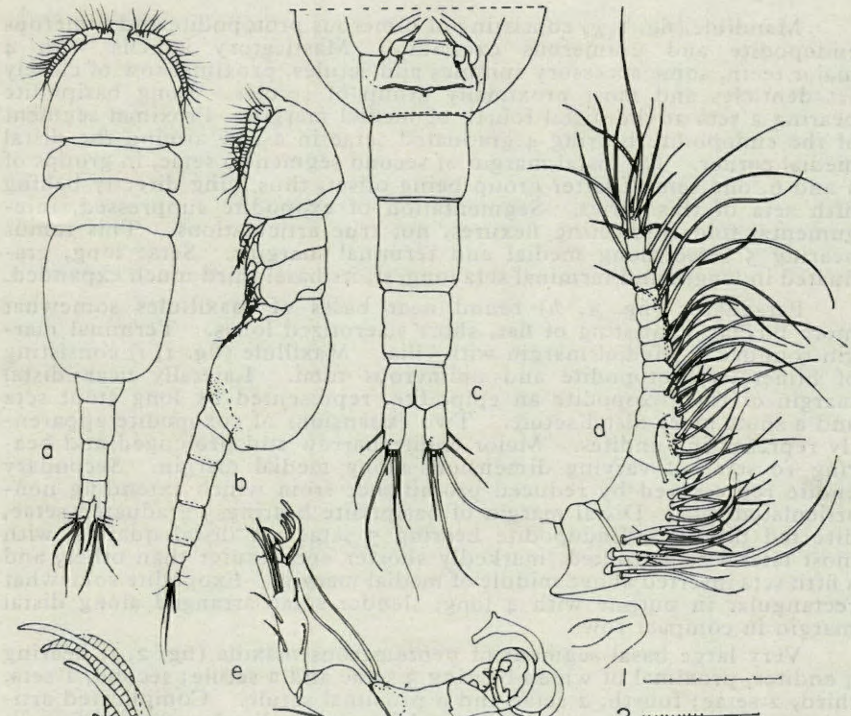

Fig. 1, *a-i*. — *Notodelphys acanthomela*, female : *a*, habit, dorsal view; *b*, habit, lateral; *c*, urosome, ventral (1); *d*, antennule and rostrum (2); *e*, antenna; *f*, apex of terminal segment of antenna; *g*, mandible (3); *h*, paragnath; *i*, [maxillule (4). Lengths represented by scales : (1) — .5 mm; (2) — .2 mm; (3) — .2 mm; (4) — .2 mm.

Mandible (fig. 1, *g*) consisting of bimerous protopodite and bimerous endopodite and unimerous exopodite. Masticatory lamella with 4 major teeth, some accessory spinules and setules, proximal row of closely set denticles and most proximally group of setules. Long basipodite bearing a seta at the distal fourth of medial margin. Proximal segment of the endopodite bearing 4 graduated setae in a row around the distal medial corner. On distal margin of second segment 9 setae, in groups of 3 and 6, one seta of latter group being offset, thus lying directly behing fifth seta of this series. Segmentation of exopodite suppressed, integumental folds indicating flexures, not true articulations. This ramus bearing 5 setae along medial and terminal margins. Setae long, graduated in length and terminal seta longest, its basal third much expanded.

Paragnaths (fig. 1, *h*) found near bases of maxillules somewhat more medial, consisting of flat, short sclerotized lobes. Terminal margin rounded. Medial margin with cilia. Maxillule (fig. 1, *i*) consisting of bimerous protopodite and unimerous rami. Laterally near distal margin of the coxopodite an epipodite, represented by long stout seta and a short more distal setule. Two expansions of coxopodite apparently representing endites. Major endite narrow and prolonged and bearing 10 setae of varying dimensions along medial margin. Secondary endite represented by reduced prominence from which extending non-articulated seta. Distal margin of basipodite bearing 3 graduated setae, directed distally. Endopodite bearing 5 setae : a distal quartet, with most lateral seta stunted, markedly shorter and stouter than other, and a fifth seta inserted above middle of medial margin. Exopodite somewhat rectangular in outline with 4 long, slender setae arranged along distal margin in compact row.

Very large basal segment of pentamerous maxilla (fig. 2, *j*) bearing 4 endites, proximal of which bearing 3 setae and a setule; second, 1 seta, third, 2 setae; fourth, 2 setae and a proximal setule. Complicated articulation of first segment with second involving distal endite of first, it appearing as independently mobile element. Second segment produced medially as long, stout, falcate process, bearing row of denticles curving from proximal to distal margin. Inserted basally on this process a shorter, slender seta and a reduced setule. Third and fourth segments each bearing 1 long, slender seta, inserted at distal medial corner. Small fifth segment bearing 3 subequal setae.

Maxilliped (fig. 2, *k*) trimerous, basal segment constituting about two-thirds of total mass and bearing 9 setae arranged in 2 groups on medial margin. Proximal group consisting of 4 setae arranged in regular row at about midpoint of margin. Distal group consisting of marginal quartet and solitary seta offset onto face of segment. Second segment trapezoidal in outline, bearing medially without obvious articulation a stout spinous element ornamented with denticles and cilia. Terminal segment a small truncate cone bearing 3 terminal setae.

Longest seta of trio somewhat stiffened and bearing denticles. Accompanying subequal couple notably longer than ordinarily occurring in other species of *Notodelphys*. Swimming legs : First swimming legs (fig. 2, 1, Table I) consisting of bimerous protopodites and trimerous rami. Intercoxal plate large and subtriangular in outline. Inserted on the distal medial corner of cosopodite a seta reaching to distal margin of first segment of endopodite. Outline of basipodite trapezoidal, with lateral margin very reduced. Inserted on lateral margin a slender seta reaching to middle of second segment of exopodite. A stout, denticulated spine articulating on medial distal corner of basipodite and reaching to distal third of first segment of endopodite. Endopodite

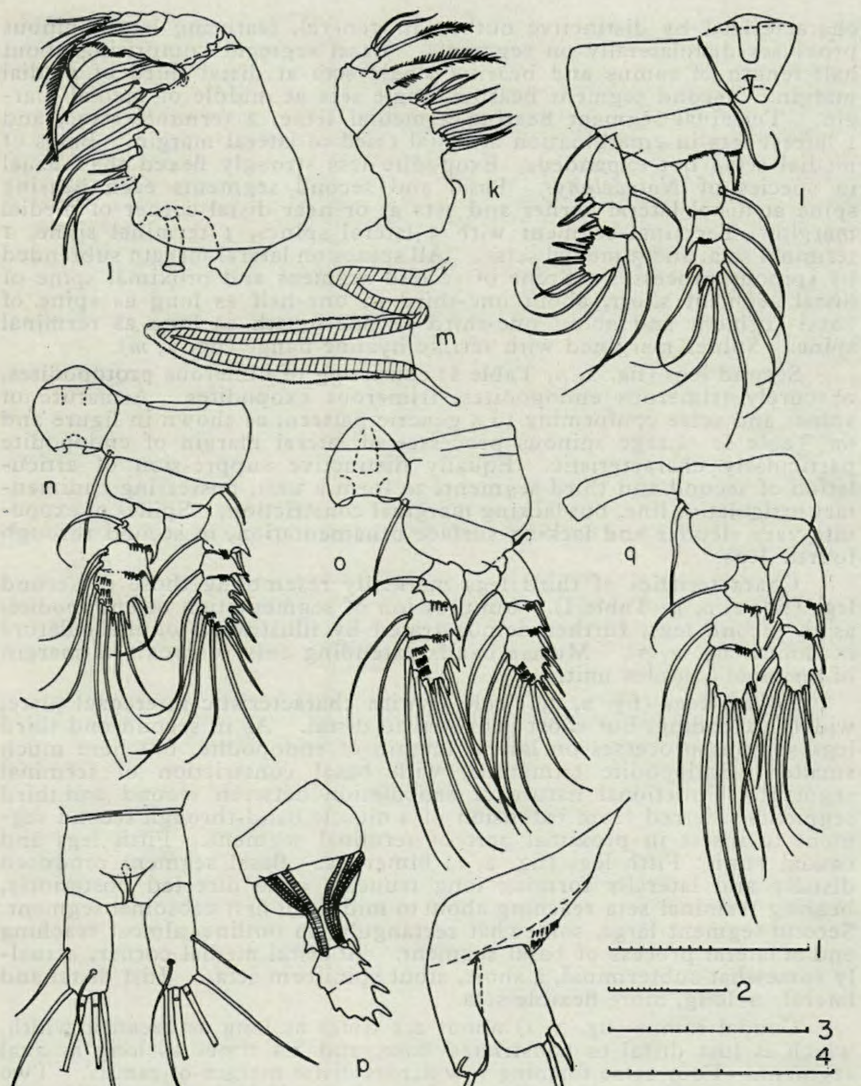

Figure 2, *j-s*, *Notodelphys acanthomela*, female : *j*, maxilla (1); *k*, maxilliped (1); *l*, first leg (2); *m*, spine of basal segment of exopodite of first leg, subtended by spinous process (3); *n*, second leg (4); *o*, third leg (4); *p*, musculature of endopodite of third leg; *q*, fourth leg (2); *r*, fifth leg (5); *s*, anal segment and caudal rami (2). Lengths represented by scales : (1) — .2 mm; (2) — .2 mm; (3) — .05 mm; (4) — .5 mm; (5) — .1 mm.

characterized by distinctive outline in general, featuring large spinous processes distolaterally on segments. Basal segment comprising about half length of ramus and bearing single seta at distal third of medial margin. Second segment bearing single seta at middle of medial margin. Terminal segment bearing 3 medial setae, 2 terminal setae, and 1 lateral seta in emargination at distal third of lateral margin. Bases of medial setae not expanded. Exopodite less strongly flexed than usual in species of *Notodelphys*. Basal and second segments each bearing spine at distal lateral corner and seta at or near distal corner of medial margin. Terminal segment with 3 lateral spines, 1 terminal spine, 1 terminal seta, and 3 medial setae. All spines on lateral margin subtended by spinous processes. Spine of second segment and proximal spine of distal segment short, about one-third to one-half as long as spine of basal segment and about one-third to one-fourth as long as terminal spine. Spines margined with serrate hyaline flange (fig. 2, *m*).

Second legs (fig. 2, *n*, Table I) consisting of bimerous protopodites, obscurely trimerous endopodites, trimerous exopodites. Armature of spines and setae conforming to a generic pattern, as shown in figure and on Table I. Large spinous processes of lateral margin of endopodite particularly characteristic. Equally distinctive suppression of articulation of second and third segments to form a unit, possessing rudimentary articulative line, but lacking marginal constriction. Spines of exopodite very slender and lacking surface ornamentation, in second through fourth legs.

Characteristics of third legs markedly resembling those of second legs (fig. 2, *o*, *p*, Table I). Suppression of segmentation of endopodite, as in second legs, further demonstrated by illustration of musculature of ramus (fig. 2, *p*). Muscle bands extending only to proximal margin of terminal complex unit.

Fourth legs (fig. 2, *q*, Table I) with characteristic intercoxal plate, widely extending, but short proximal to distal. As in second and third legs spinous processes on lateral margin of endopodite, but here much smaller. Endopodite trimerous, with basal constriction of terminal segment. Functional nature of articulation between second and third segments inferred from extension of a muscle band through second segment to insert in proximal part of terminal segment. Fifth legs and caudal rami : Fifth legs (fig. 2, *r*) bimerous. Basal segment produced distally and laterally forming long truncate cone directed posteriorly, bearing terminal seta reaching about to middle of first urosomal segment. Second segment large, somewhat rectangular in outline, almost reaching end of lateral process of basal segment. At distal medial corner, actually somewhat subterminal, a short, stout spiniform seta. Just distal and lateral, a long, more flexible seta.

Caudal ramus (fig. 2, *s*) about 2.1 times as long as greatest width, which is just distal to constricted base, and 1.1 times as long as anal segment. Four setae forming row across distal margin of ramus. Two central setae of quartet longest. Lateral seta found at approximately middle of lateral margin. Dorsal seta arising from surface of ramus at approximately distal fourth. Characteristic aspect deriving from continuous line formed by lateral margins of anal segment and ramus; ramus therefore inserted at most lateral possible position.

Male (figs. 3, 4) : General features : Overall length of one specimen 2.12 mm. Body (figs. 3, *a*, *b*) very slender, tapering very gradually posteriorly, well-divided into cephalosome, metasome and urosome. Proportions of these regions, in order : 2 : 3 : 4. Free segment for first swimming legs poorly indicated, since it lacks well-developed tergal

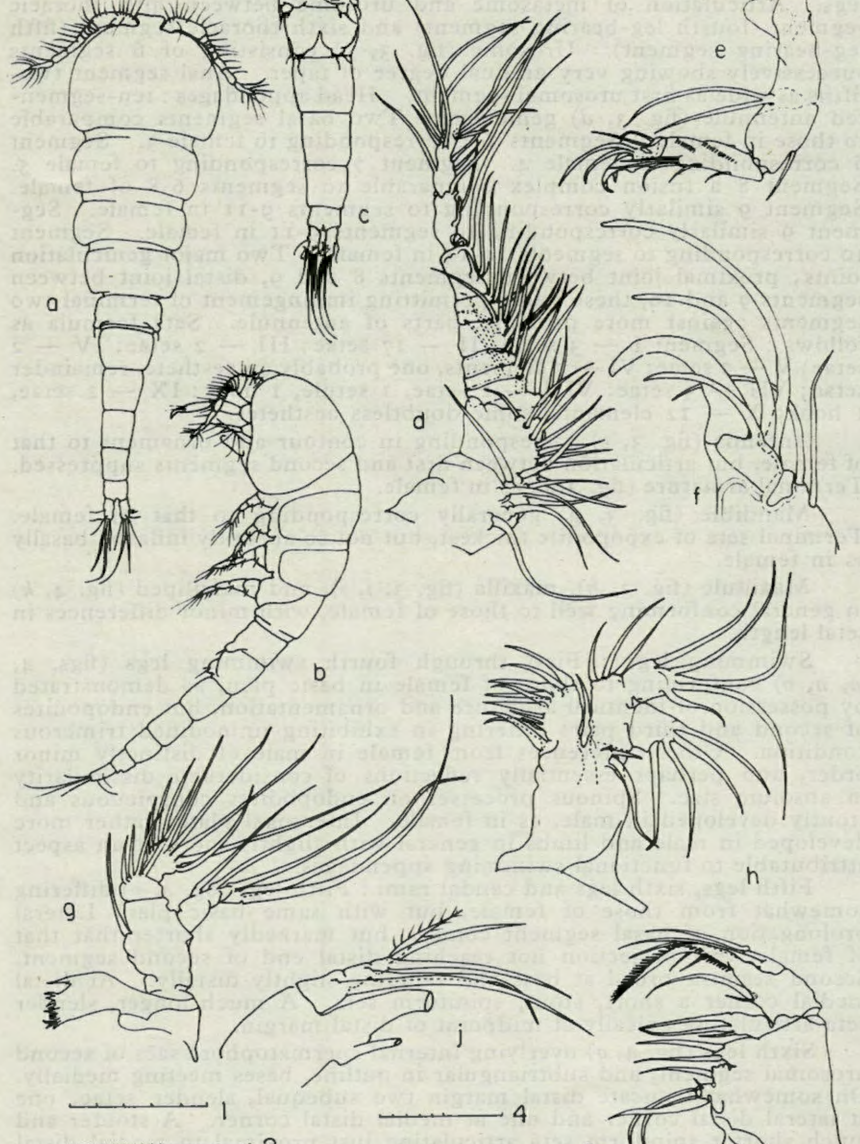

Figure 3, ***a-j, Notodelphys acanthomela*****, male :** ***a*****, habit, dorsal view;** ***b*****, habit, lateral;** ***c*****, urosome, ventral (1);** ***d*****, antennule (2);** ***e*****, antenna (2);** ***f*****, apex of terminal segment of antenna (3);** ***g*****, mandible (4);** ***h*****, maxillule (5);** ***i*****, maxilla (6);** ***j*****, terminal segments of maxilla (3). Lengths represented by scales : (1) — .5 mm; (2) — .2 mm; (3) — .05 mm; (4) — .1 mm; (5) — .1 mm; (6) — .1 mm.**

plate characteristic for segments of second through fourth swimming legs. Articulation of metasome and urosome between fifth thoracic segment (fourth leg-bearing segment) and sixth thoracic segment (fifth leg-bearing segment). Urosome (fig. 3, *c*) consisting of 6 segments successively showing very gradual degree of taper. Anal segment two-fifths as wide as first urosomal segment. Head appendages : ten-segmented antennule (fig. 3, *d*) geniculate. Two basal segments comparable to those in female. Segments 3-4 corresponding to female 3. Segment 6 corresponding to female 4. Segment 7 corresponding to female 5. Segment 8 a fusion complex comparable to segments 6-8 of female. Segment 9 similarly corresponding to segments 9-11 in female. Segment 9 similarly corresponding to segments 9-11 in female. Segment 10 corresponding to segments 10-14 in female. Two major geniculation joints; proximal joint between segments 8 and 9, distal joint between segments 9 and 10, these joints permitting impingement of terminal two segments against more proximal parts of antennule. Seta formula as follows : Segment I — 3 setae; II — 17 setae; III — 2 setae; IV — 2 setae; V — 2 setae; VI — 7 elements, one probably an aesthete, remainder setae; VII — 3 setae; VIII — 2 setae, 1 setule, 1 hook; IX — 2 setae, 1 hook; X — 12 elements, some doubtless aesthetes.

Antenna (fig. 3, *e*) corresponding in contour and ornament to that of female, but articulation between first and second segments suppressed. Terminal armature (fig. 3, *f*) as in female.

Mandible (fig. 3, g) generally corresponding to that in female. Terminal seta of expopodite thickest, but not so abruptly inflated basally as in female.

Maxillule (fig. 3, *h*), maxilla (fig. 3, *i*, *j*), and maxilliped (fig. 4, *k*) in general conforming well to those of female, with minor differences in setal length.

Swimming legs : First through fourth swimming legs (figs. 4, *m*, *n*, *o*) conforming to those of female in basic plan, as demonstrated by possession of identical armature and ornamentation, but endopodites of second and third pairs differing in exhibiting unmodified trimerous condition. Other differences from female in male of distinctly minor order, and perhaps essentially reflections of considerable dissimilarity in absolute size. Spinous processes on endopodites conspicuous and stoutly developed in male, as in female. Intercoxal plates rather more developed in male and limbs in general with slightly more of an aspect attributable to functional swimming appendages.

Fifth legs, sixth legs and caudal rami : Fifth legs (fig. 4, *p*) differing somewhat from those of female, but with same basic plan. Lateral prolongation of basal segment conical, but markedly shorter that that of female, this projection not reaching distal end of second segment. Second segment broad at base and tapering slightly distally. At distal medial corner a short, stout, spiniform seta. A much longer, slender seta articulating apically at midpoint of distal margin.

Sixth legs (fig. 4, *q*) overlying internal spermatophore sacs of second urosomal segment, and subtriangular in outline, bases meeting medially. On somewhat truncate distal margin two subequal, slender setae, one at lateral distal corner and one at medial distal corner. A stouter and much shorter spiniform seta articulating just proximal to medial distal seta.

Caudal ramus (fig. 4, *r*) about 2.2 times as long as width, and 1.1 times as long as anal segment. Armature of ramus same as in female, only notable difference being in more distal location of lateral seta, at about three-fifths length of ramus.

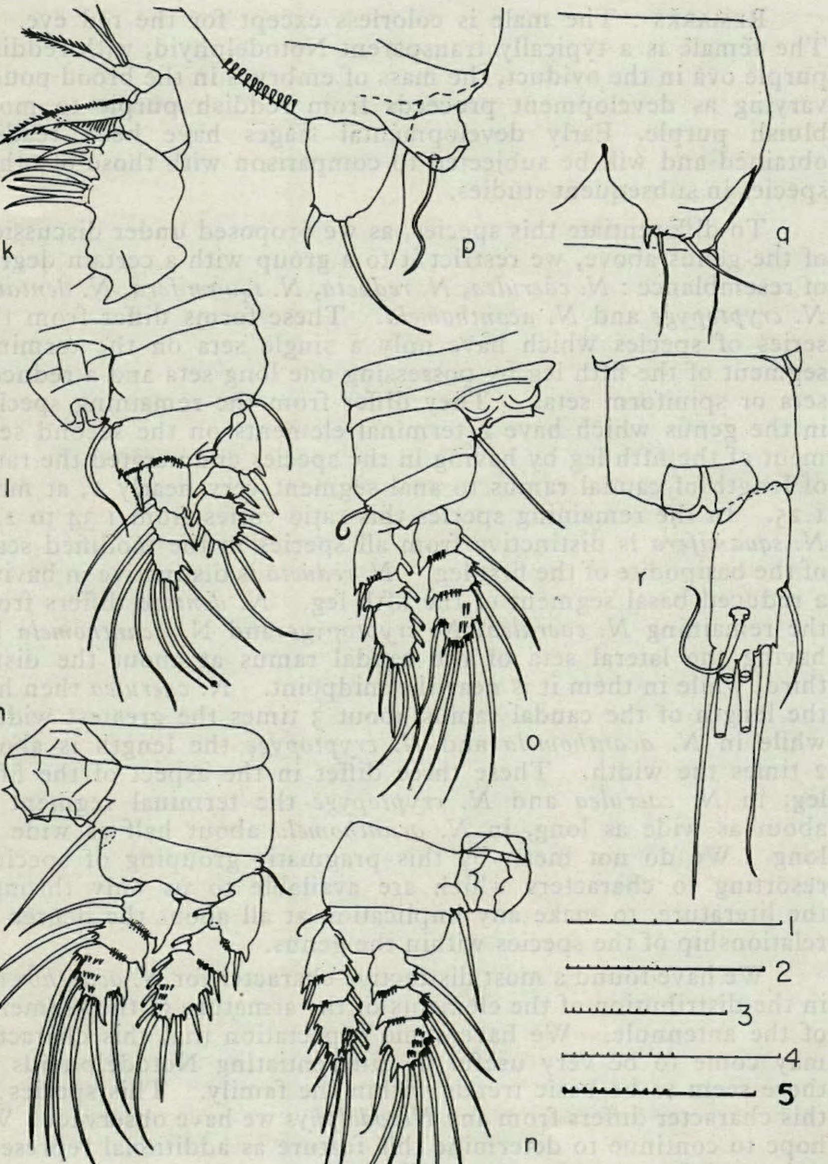

Figure 4, *k-r*, *Notodelphys acanthomela*, male : *k*, maxilliped (1); *l*, first leg (2); *m*, second leg (2); *n*, third leg (3); *o*, fourth leg (2); *p*, fifth leg (1); *q*, sixth leg (4); *r*, anal segment and caudal ramus (5). Lengths represented by scales : (1) — .1 mm; (2) — .2 mm; (3) — .2 mm; (4) — .2 mm; (5) — .1 mm.

REMARKS : The male is colorless except for the red eye. The female is a typically transparent Notodelphyid, with reddish purple ova in the oviduct, the mass of embryos in the brood pouch varying as development proceeds from reddish purple to more bluish purple. Early developmental stages have been readily obtained and will be subjected to comparison with those of other species in subsequent studies.

To differentiate this species, as we proposed under discussion of the genus above, we restrict it to a group with a certain degree of resemblance : *N. caerulea*, *N. reducta*, *N. squamifera*, *N. dentata*, *N. cryptopyge* and *N. acanthomela*. These forms differ from the series of species which have only a single seta on the terminal segment of the fifth leg by possessing one long seta and a reduced seta or spiniform seta. They differ from the remaining species in the genus which have 2 terminal elements on the second segment of the fifth leg by having in the species enumerated the ratio of length of caudal ramus to anal segment very nearly 1, at most 1.25. In the remaining species this ratio varies from 1.34 to 2.0. *N. squamifera* is distinctive from all species in the modified scale of the basipodite of the first leg. *N. reducta* is distinctive in having a reduced basal segment of the fifth leg. *N. dentata* differs from the remaining *N. caerulea*, *N. cryptopyge* and N. *acanthomela* by having the lateral seta of the caudal ramus at about the distal third, while in them it is near the midpoint. *N. caerulea* then has the length of the caudal ramus about 3 times the greatest width, while in *N. acanthomela* and *N. cryptopyge* the length is about 2 times the width. These three differ in the aspect of the fifth leg; in *N. caerulea* and *N. cryptopyge* the terminal segment is about as wide as long, in *N. acanthomela* about half as wide as long. We do not mean by this pragmatic grouping of species, resorting to characters which are available to us only through the literature, to make any implication at all about the degree cf relationship of the species within the genus.

We have found a most distinctive character for *N. acanthomela* in the distribution of the elements of the armature of the segments of the antennule. We have some expectation that this character may come to be very useful in differentiating Notodelphyids as there seem to be basic trends within the family. This species in this character differs from any *Notodelphys* we have observed. We hope to continue to determine this feature as additional representatives of the genus become available to us.

Although the characters we have been forced to use for systematic diagnosis may seem to be subtle, we consider that exactly such subtle characters, when accurately described and compared, will be very useful in differentiating populations which may show considerable significance in host relationships. We have considered the present species to be a characteristic associate of *Microcosmus sulcatus* Coquebert *sensu latiori* at Banyuls. We have lately received evidence that there may be significant exception tot his opinion. C. Monniot has furnished specimens collected in the course of his studies on the genus *Microcosmus*. He identifies 4 species formerly all included within the concept of *M. sulcatus*. We have identified *N. acanthomela* from *M. sabatieri* and *M. vulgaris* among these. One specimen from *M. polymorphus* Heller is different from all other *Notodelphys* we know of. It possesses very long caudal rami, peculiar modification of the integument and a very long second segment of the fifth leg. When the bionomics of these forms are better known and more material available for diagnosis, it is possible that different species will prove to be characteristic associates of these very similar and closely related tunicates.

Notodelphys squamifera Schellenberg comes from a closely related host, *Microcosmus senegalensis* Michaelsen, and its type locality, Gorée, West Africa, indicates there may be zoogeographic affinity. The description includes some bizarre characteristics, and, being based upon a solitary specimen, may, one suspects, involve abnormalities. Aside from these, however, the characters of antennular segmentation, the setae on the basipodite of the maxillule, the heavy spine of the maxilliped, and the unique aspect of the fifth leg should serve to establish clearly that it is specifically distinct from *N. acanthomela*.

NOTODELPHYS REDUCTA, new species (Figures 5-8, Table I).

Types : Holotypic female, USNM 104824 (type locality, Golfe du Lion, Mediterranean Sea, from *Ctenicella appendiculata* (Heller); allotypic male, USNM 104825 same locality and host; paratypes listed below, from the same locality.

Specimens examined :

From *C. appendiculata* :

Mixed trawl : (1) near Port-Vendres-North, 70 m, (2) northeast of Port Vendres, 60-30 m, May 6, 1958, 5 females, males, developmental stages.

Mixed trawl : (1) North of Cap Béar 60 m, (2) northeast of Port-Vendres, 90 m, May 14, 1958, 5 females, males, developmental stages, type lot.

Off Banyuls, France, 1958, C. Monniot, 1 female.

DESCRIPTION :

Female (figs. 5, 6, Table I) : General features : the total length, based on measurement of individual seen in profile, from anteriormost projection of cephalosome to end of caudal ramus, measured along body axis, compiled here from 4 specimens, averaging 2.35 mm. The body (figs. 5, *a*, *b*) divided into cephalosome, metasome and urosome. Cephalosome bearing appendages through maxillipeds. Metasome consisting of 3 relatively normal leg-bearing segments and inflated incubatory region, which is a complex, bearing both fourth and fifth legs, totally enclosing brood pouch. Fifth legs lying ventrally very near posterior edge of complex, but not at edge. In dorsal view incubatory region appearing notably slender for a species of *Notodelphys*, but in profile, more than usually protuberant. Articulation of metasome and urosome between incubatory complex and anatomically seventh thoracic segment. Urosome (fig. 5, *c*) consisting of 5 well-defined segments, with following proportional length taken for greatest length of each segment, proceeding from anterior to posterior : 1.6 : 2.3 : 2.3 : 2.2 : 1.7. Genital apparatus, consisting of vulva at the midline and diverging sclerotized seminal tubes, at posterior fourth of first urosomal segment.

Head appendages : Fourteen-segmented antennule (fig. 5, *d*) very short, not reaching to middle of cephalosome. Segments 3 through 11 notably short for their width. Relative lengths of segments readily determinable by reference to figure. Setal formula as follows : Segment I — 3 setae; II — 17 setae; III — 6 setae; IV — 4 setae, 1 aesthete; V — 2 setae; VI — 2 setae; VII — 2 setae; VIII — 1 seta; IX — 1 seta, 1 aesthete; X — 1 seta; XI — 1 seta; XII — 2 setae; XIII — 2 setae, 1 aesthete; XIV — 7 setae, 1 aesthete.

Obscurely trimerous antenna (fig. 5, *e*) notable in suppression of complete articulation between segments 1 and 2. Proportional lengths of segments, basal to distal, : 5 : 5 : 6.5.

A right-angled flexure between clearly articulated segments 2 and 3. Diagonal articulation on one side only setting off segment 1 from segment 2. Two long setae inserted on inner margin of segment 1 at distal articulation. At distal two-fifths of outer margin of segment 2 a seta reaching to distal margin of segment. Inserted near outer margin of terminal segment at intervals of one-third, one-half and three-fourths of total length a single proximal seta, a single second seta, and a trio of distal setae. On distal margin (fig. 5, *f*) slender, tapered, curved hook accompanied by 3 curved, stiffened, blunt-ended setae, and 2 flexible setae. Two curving rows of spinules ornamenting inner margin of distal segment.

Mandible (fig. 5, *g*) of bimerous protopodite, unimerous exopodite, obscurely inserted bimerous endopodite. Masticatory lamella with 4 major teeth, some accessory spinules and setules, a proximal row of closely set denticles and most proximal a group of setules. Long basipodite bearing distal medial seta at level where endopodite would normally articulate. Proximal segment of endopodite bearing 4 graduated setae in a row around distal medial corner. On distal margin of second segment 9 setae disposed in groups of 3 and 6, one seta of latter group being offset, thus lying directly behind fifth seta of series. Segmentation of exopodite suppressed, with integumental folds indicating flexures which are not true articulations. This ramus bearing 5 setae along medial and terminal margins. Setae long, graduated in length, terminal seta longest, with basal third much expanded.

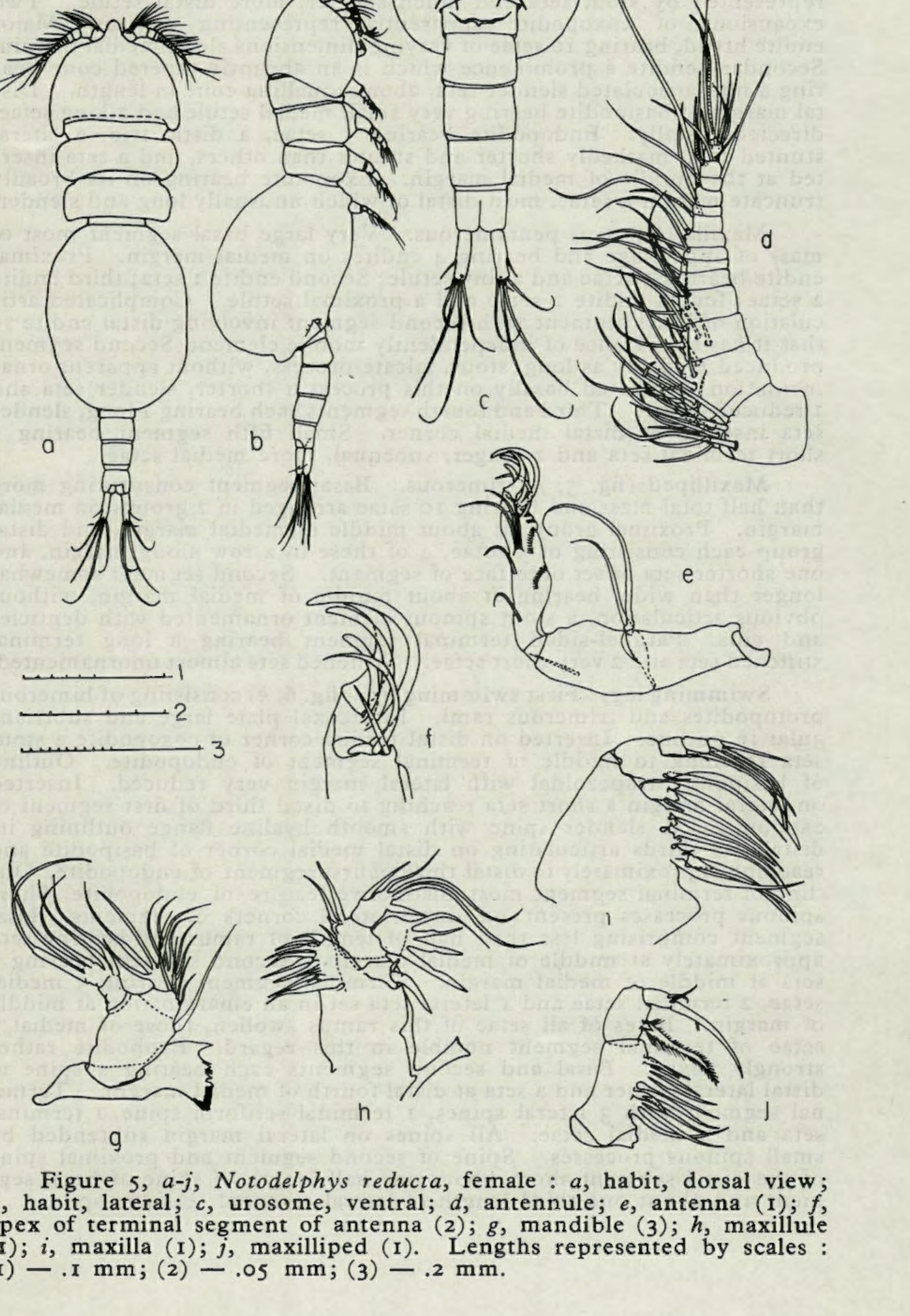

Figure 5, *a-j*, *Notodelphys reducta*, female : *a*, habit, dorsal view; *b*, habit, lateral; *c*, urosome, ventral; *d*, antennule; *e*, antenna (1); *f*, apex of terminal segment of antenna (2); *g*, mandible (3); *h*, maxillule (1); *i*, maxilla (1); *j*, maxilliped (1). Lengths represented by scales : (1) — .1 mm; (2) — .05 mm; (3) — .2 mm.

Maxillule (fig. 5, *h*) consisting of bimerous protopodite and unimerous rami. Laterally near distal margin of coxopodite an epipodite, represented by stout seta and much shorter, more distal setule. Two expansions of coxopodite apparently representing endites. Major endite broad, bearing 10 setae of varying dimensions along medial margin. Secondary endite a prominence which is an abruptly tapered cone bearing a non-articulated slender seta, about equalling cone in length. Distal margin of basipodite bearing very small medial setule and 2 long setae, directed distally. Endopodite bearing 5 setae, a distal trio, a lateral stunted seta, markedly shorter and stouter than others, and a seta inserted at the middle of medial margin. Exopodite bearing on its broadly truncate margin 4 setae, most distal of which unusually long and slender.

Maxilla (fig. 5, *i*) pentamerous. Very large basal segment most of mass of appendage and bearing 4 endites on medial margin. Proximal endite bearing 3 setae and a tiny setule; Second endite 1 seta; third endite 2 setae; fourth endite 2 setae and a proximal setule. Complicated articulation of basal segment with second segment involving distal endite so that it has appearance of independently mobile element. Second segment produced medially as long, stout, falcate process, without apparent ornamentation. Inserted basally on this process a shorter, slender seta and 1 reduced setule. Third and fourth segments each bearing 1 long, slender seta inserted at distal medial corner. Small fifth segment bearing 1 short terminal seta and 2 longer, subequal, more medial setae.

Maxilliped (fig. 5, *j*) trimerous. Basal segment constituting more than half total mass and bearing 10 setae arranged in 2 groups on medial margin. Proximal group, at about middle of medial margin, and distal group each consisting of 5 setae, 4 of these in a row along margin, and one shorter seta offset onto face of segment. Second segment somewhat longer than wide, bearing at about middle of medial margin, without obvious articulation, a stout spinous element ornamented with denticles and cilia. Parallel-sided terminal segment bearing a long terminal stiffened seta and 2 very short setae. Stiffened seta almost unornamented.

Swimming legs : First swimming legs (fig. 6, *k*) consisting of bimerous protopodites and trimerous rami. Intercoxal plate large and subtriangular in outline. Inserted on distal medial corner of coxopodite a stout seta reaching to middle of terminal segment of endopodite. Outline of basipodite trapezoidal with lateral margin very reduced. Inserted on lateral margin a short seta reaching to distal third of first segment of exopodite. A slender spine with smooth hyaline flange outlining its distal two-thirds articulating on distal medial corner of basipodite and reaching approximately to distal third of first segment of endopodite. Outline of terminal segment most distinctive feature of endopodite. Short spinous processes present on distal lateral corners of segments. Basal segment comprising less than half of length of ramus and bearing seta approximately at middle of medial margin. Second segment bearing a seta at middle of medial margin. Terminal segment bearing 3 medial setae, 2 terminal setae and 1 lateral seta set in an emargination at middle of margin. Bases of all setae of this ramus swollen, those of medial 3 setae of terminal segment notable in this regard. Exopodite rather strongly flexed. Basal and second segments each bearing a spine at distal lateral corner and a seta at distal fourth of medial margin. Terminal segment with 3 lateral spines, 1 terminal setiform spine, 1 terminal seta and 3 medial setae. All spines on lateral margin subtended by small spinous processes. Spine of second segment and proximal spine of the distal segment short, about one half length of spine of basal segment and about one third length of lateral terminal setiform spine.

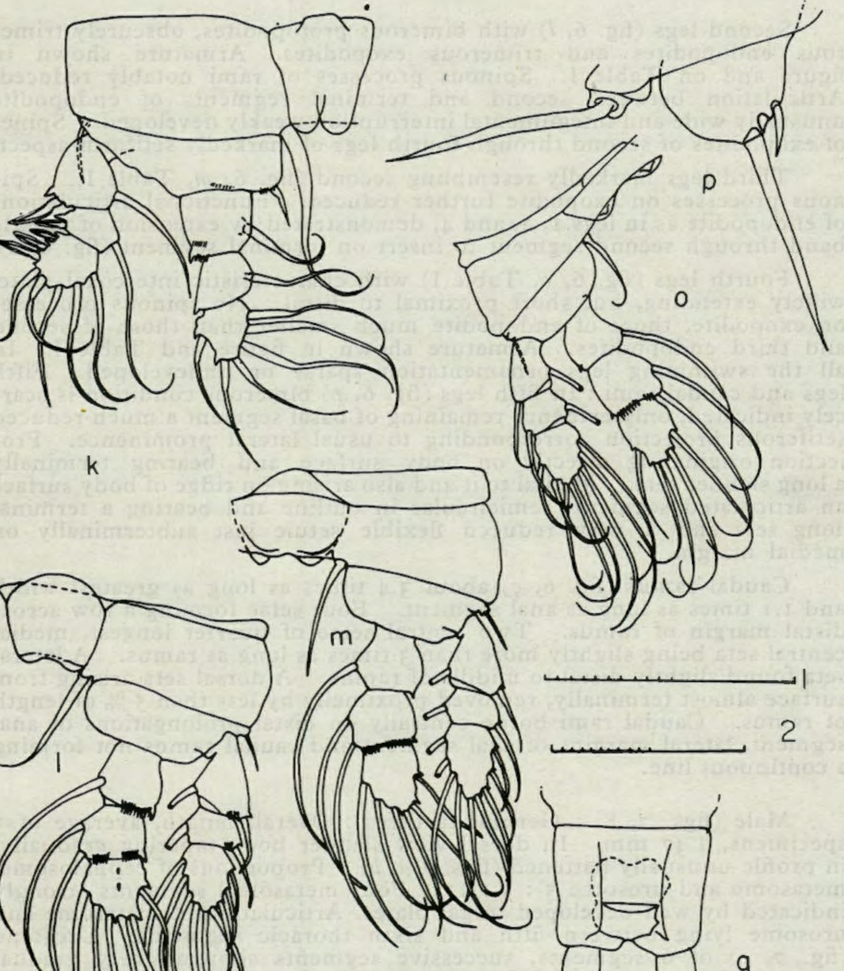

Figure 6, *k-q*, *Notodelphys reducta*, female : *k*, first leg (1); *l*, second leg (2); *m*, third leg (2); *n*, musculature of endopodite of third leg; *o*, fourth leg (2); *p*, fifth leg (3); *q*, anal segment and caudal rami (4). Lengths represented by scales : (1) — .2 mm; (2) — .2 mm ; (3) — .05 mm; (4) — .2 mm.

Second legs (fig. 6, *l*) with bimerous protopodites, obscurely trimerous endopodites and trimerous exopodites. Armature shown in figure and on Table I. Spinous processes of rami notably reduced. Articulation between second and terminal segments of endopodite unusually wide and integumental interruption weakly developed. Spines of exopodites of second through fourth legs of markedly setiform aspect.

Third legs markedly resembling second (fig. 6, *m*, Table I). Spinous processes on exopodite further reduced. Functional articulations of endopodite as in legs 1, 2, and 4, demonstrated by extension of muscle band through second segment to insert on terminal segment (fig. 6, *n*).

Fourth legs (fig. 6, *o*, Table I) with characteristic intercoxal plate, widely extending, but short proximal to distal. No spinous processes on exopodite, those of endopodite much smaller than those of second and third endopodites. Armature shown in figure and Table I. In all the swimming legs ornamentation sparse or undeveloped. Fifth legs and caudal rami : In fifth legs (fig. 6, *p*) bimerous condition is scarcely indicated, only evidence remaining of basal segment a much reduced setiferous projection corresponding to usual lateral prominence. Projection originating directly on body surface and bearing terminally a long slender seta. Medial to it and also arising on ridge of body surface an articulated segment, semicircular in outline and bearing a terminal long seta and a very reduced flexible setule just subterminally on medial margin.

Caudal ramus (fig. 6, *q*) about 3.4 times as long as greatest width and 1.1 times as long as anal segment. Four setae forming a row across distal margin of ramus. Two central setae of quartet longest, medial central seta being slightly more than 3 times as long as ramus. A lateral seta found slightly distal to middle of ramus. A dorsal seta arising from surface almost terminally, removed proximally by less than 5 % of length of ramus. Caudal rami borne centrally on distal prolongations of anal segment, lateral margins of anal segment and caudal ramus not forming a continuous line.

Male (figs. 7, 8) : General features : Overall length, average of 3 specimens, 1.47 mm. In dorsal view slender body tapering gradually, in profile unusually flattened (figs. 7 *a*, *b*). Proportions of cephalosome, metasome and urosome 5 : 5 : 11. Four metasomal segments strongly indicated by well-developed tergal plates. Articulation of metasome and urosome lying between fifth and sixth thoracic segments. Urosome (fig. 7, *c*) of 6 segments, successive segments showing very gradual taper. Anal segment slightly more than half as wide as first urosomal segment.

Head appendages : Ten segmented antennule (fig. 7, *d*) appearing 11-segmented, line of articulation between usual second and third segments well-defined on uppermost surface, but incomplete on other surface. Segments 1 and 2 comparable to those in female. Segments 3-5 corresponding to female 3; segment 6 corresponding to female 4; segment 7 corresponding to female 5; segments 8, 9, and 10 fusion complexes, comparable to segments 6, 7, 8; 9, 10 11; and 12, 13, 14, respectively, in female. Two major geniculation joints, proximal joint between segments 8 and 9, distal joint between segments 9 and 10. Setal formula as follows : Segment I — 3 setae; II — 17 setae; III — 2 setae; IV — 2 setae; V — 2 setae; VI — 4 setae, 1 aesthete; VII — 2 setae; VIII — 2 setae, 1 hook; IX — 1 seta, 1 aesthete, 1 hook; X — 12 elements, some doubtless aesthetes.

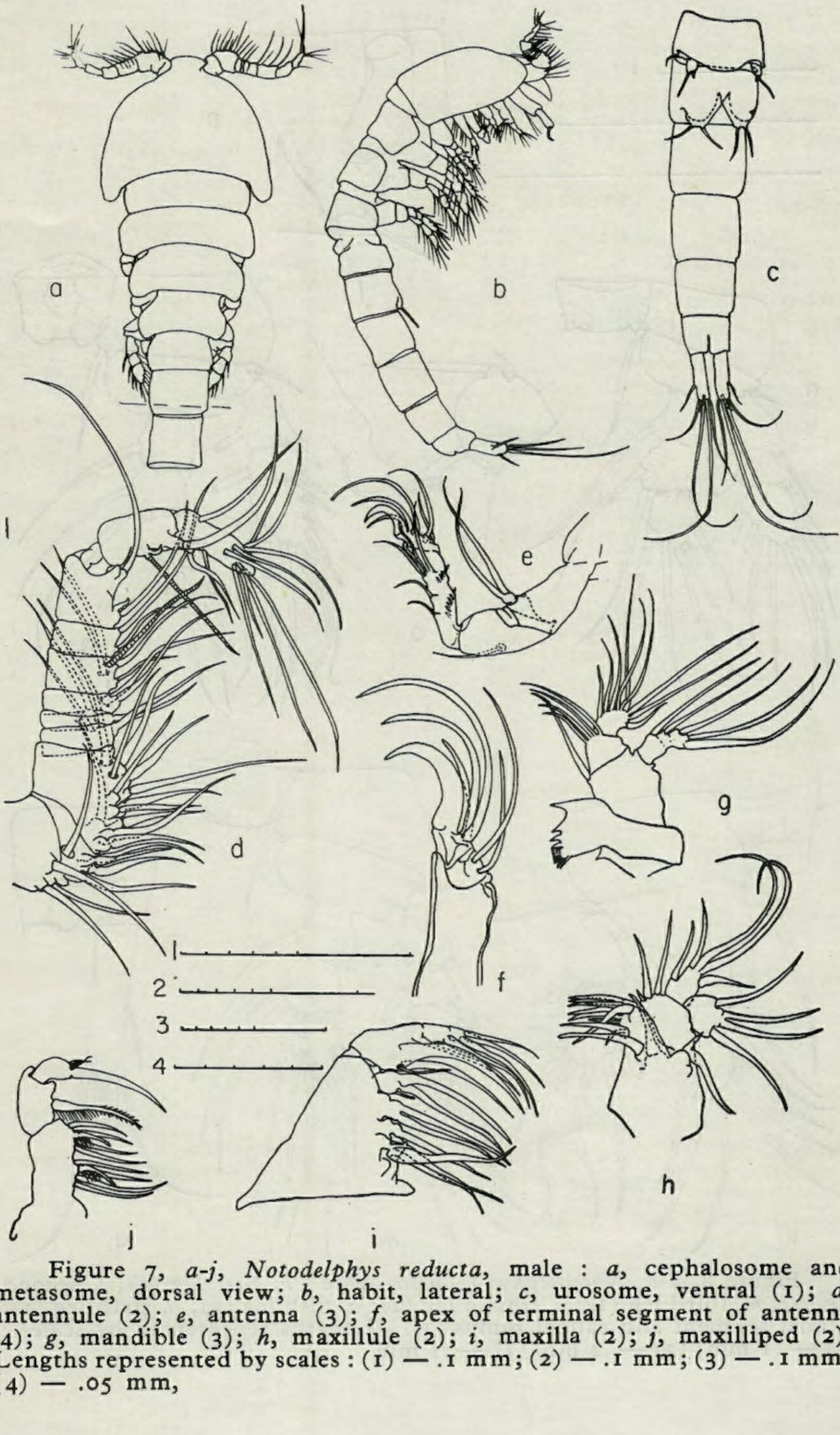

Figure 7, *a-j*, *Notodelphys reducta*, male : *a*, cephalosome and metasome, dorsal view; *b*, habit, lateral; *c*, urosome, ventral (1); *d*, antennule (2); *e*, antenna (3); *f*, apex of terminal segment of antenna (4); *g*, mandible (3); *h*, maxillule (2); *i*, maxilla (2); *j*, maxilliped (2). Lengths represented by scales : (1) — .1 mm; (2) — .1 mm; (3) — .1 mm; (4) — .05 mm,

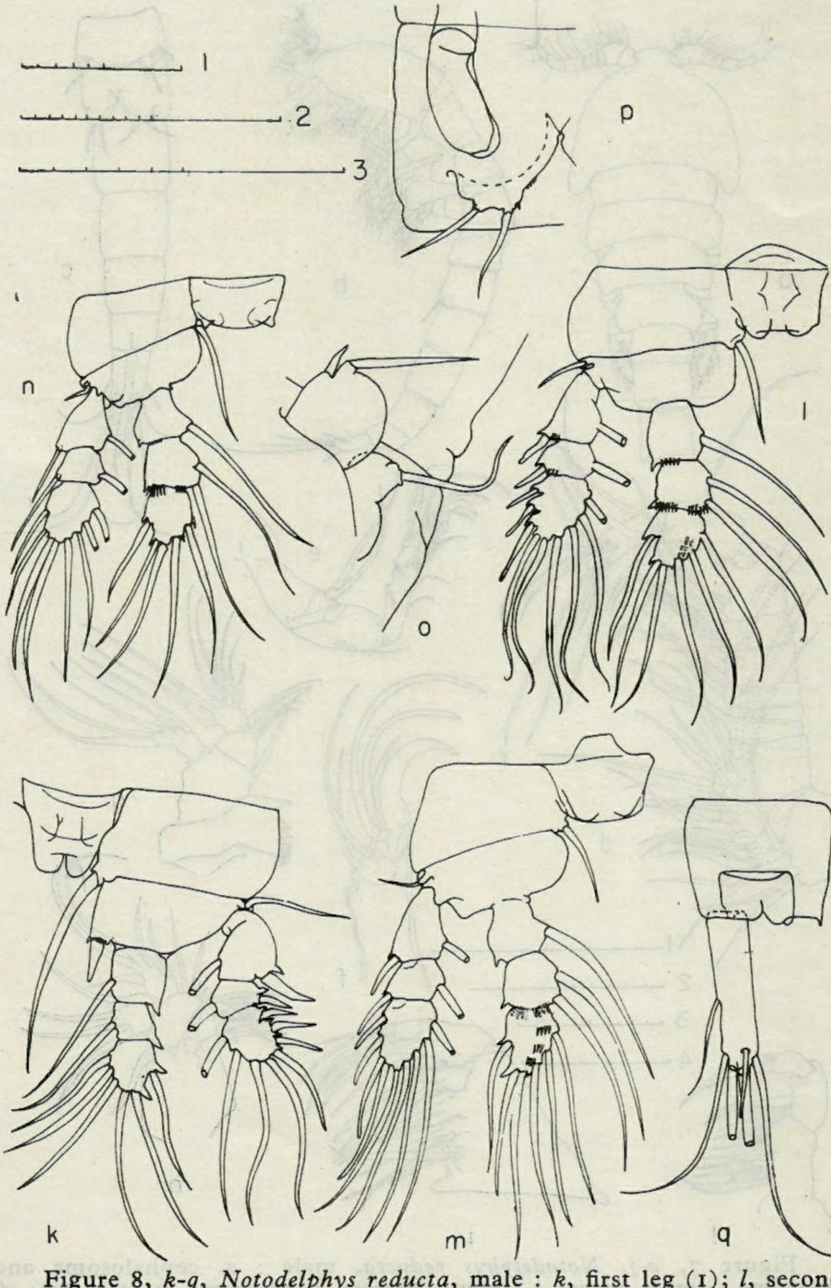

Figure 8, *k-q*, *Notodelphys reducta*, male : *k*, first leg (1); *l*, second leg (2); *m*, third leg (2); *n*, fourth leg (2); *o*, fifth leg (3); *p*, sixth leg (1); *q*, anal segment and caudal ramus (1). Lengths represented by scales : (1) — .1 mm; (2) — .2 mm (3) — .1 mm.

Antenna (fig. 7, *e*) corresponding in general in contour and ornamentation to that of female, but a well-defined articulation between basal and second segments, and terminal segment somewhat more narrow in proportion to its length. Terminal armature (fig. 7, *f*) as in female, except that setae are longer and slenderer.

Mandible (fig. 7, *g*) generally corresponding to that in female, except articulation between basipodite and endopodite stronger.

Maxillule (fig. 7, *h*), maxilla (fig. 7, *i*), and maxilliped (fig. 7, *j*) in general conforming to those in female with slight differences in such features as setal lengths.

Swimming legs : First through fourth swimming legs (figs. 8, *k*, *l*, *m*, *n*) markedly similar to those of female in basic plan. Slight differences seen in that endopodites show unmodified trimerous condition, spines of first through third exopodites much shorter and more stiffened than in female, and spinous processes of endopodites heavier.

Fifth legs, sixth legs and caudal rami : Fifth legs (fig. 8, *o*) showing same basic plan as female, but more developed. Basal segment undefined. Lateral prolongation, however, present, arising from surface of body, and somewhat longer than that in female. Second segment longer in proportion to its width, with resulting stronger lateral curvature and displacement of terminal seta more medially.

Sixth legs (fig. 8, *p*) overlying internal spermatophore sacs of second urosomal segment and subtriangular in outline, bases meeting medially. On somewhat truncate distal margin 2 subequal, slender setae, one on lobe at lateral distal corner and one on a lobe at medial distal corner. A very short spinule just proximal to medial seta on medial margin.

Caudal ramus (fig. 8, *q*) about 3.6 times as long as greatest width in proportion to its length. Terminal armature (fig. 7, *f*) as in female, but lateral seta inserted a trifle more proximally.

REMARKS : The male is colorless except for the red eye. The female is a typically transparent Notodelphyid, with light green ova in the oviduct, and with the mass of embryos in the brood pouch light to yellowish green. Early developmental stages have been obtained and will be subjected to comparison with those of other species in subsequent studies.

This species differs from every known species of *Notodelphys* in the reduction of the basal segment of the fifth leg. As we pointed out above under the genus and under *N. acanthomela*, it can be categorized with *N. acanthomela*, *N. caerulea*, *N. squamifera*, *N. cryptopyge* and *N. dentata* in which there are two terminal elements on the terminal segment of the fifth legs, and in which the length of the caudal ramus is very nearly 1, at most 1.25 times the length of the anal segment. This grouping of species is not intended as representing relationship but as an expression of useful key characters.

The only other Notodelphyid we have found recorded as occurring in molgulids is *N. agilis*, this coming from a great roster of hosts of several families. *N. reducta* has only been found by us in *Ctenicella appendiculata* and our inference is that it is an uncommon associate of this host at Banyuls.

NOTODELPHYS HARANTI, new species (Figures 9-10, Table I).

Types : Holotypic female, USNM 104827 (type locality, Golfe du Lion, Mediterranean Sea, from *Polycarpa gracilis* Heller); paratypes indicated below, from the same locality.

Specimens examined :

From *P. gracilis* :

Cap Dosne, 50 m, May 2, 1958, 4 females, developmental stages, type lot.

DESCRIPTION :

Female (figs. 9, 10, Table I) : General features : Total length based on measurement of individual from anteriormost projection of cephalosome to end of caudal ramus, measured along body axis, compiled here from 2 specimens, averaging 2.43 mm. Body (figs. 9, *a*, *b*) divided into cephalosome, metasome and urosome. Cephalosome bearing appendages through maxillipeds. Metasome consisting of 3 relatively normal leg-bearing segments and inflated incubatory region, bearing both fourth and fifth legs and totally enclosing brood pouch. Fifth legs ventral, near posterior edge of incubatory complex, but not at extreme edge. Articulation of metasome and urosome between incubatory complex, and anatomically seventh thoracic segment. Urosome (fig. 9, *c*) consisting of 5 well-defined segments with following proportional lengths, from anterior to posterior; 1.8 : 2.1 : 2.0 : 1.7 : 1.8. Genital apparatus, consisting of vulva at midline and diverging seminal tubes, lying at posterior third of first urosomal segment.

Head appendages : Fifteen-segmented antennule (fig. 9, *d*) short, reaching to about middle of cephalosome, relative proportions of segments discernible from figure. Setal formula as follows : Segment I — 3 setae; II — 5 setae; III — 12 setae; IV — 6 setae; V — 4 setae, 1 aesthete; VI — 2 setae; VII — 2 setae; VIII — 2 setae; IX — 1 seta; X — 1 seta, 1 aesthete; XI — 1 seta; XII — 1 seta; XIII — 2 setae; XIV — 2 setae, 1 aesthete; XV-7 setae; 1 aesthete.

Antenna (fig. 9, *e*) trimerous. Proportional lengths of segments, basal to distal, 4.7 : 4 : 6. A diagonal articulation between segments 1 and 2 and a right-angled flexure at articulation between segments 2 and 3. Narrow terminal segment characteristic, about 6 times as long as wide. Two long setae inserted on inner margin of segment 1 at distal articulation. At distal third of outer margin of segment 2 a seta reaching slightly beyond distal margin of segment. Inserted near outer margin of terminal segment at intervals of one-fourth, one-half, and two-thirds of its length are a single proximal seta, a single second seta, and a trio of distal setae. On distal margin (fig. 9, *f*) a stout, curved hook, accompanied by 3 sout, curved, stiffened, blunt-ended setae and 2 flexible setae. Two curving rows of spinules ornamenting inner margin of distal segment.

Mandible (figs. 9, *g*, *h*) consisting of bimerous protopodite, unimerous protopodite, unimerous exopodite, and obscurely inserted, bimerous endopodite. Coxopodite (fig. 9, *g*) expanded medially into masticatory lamella with 4 major teeth, with some accessory spinules and setules and

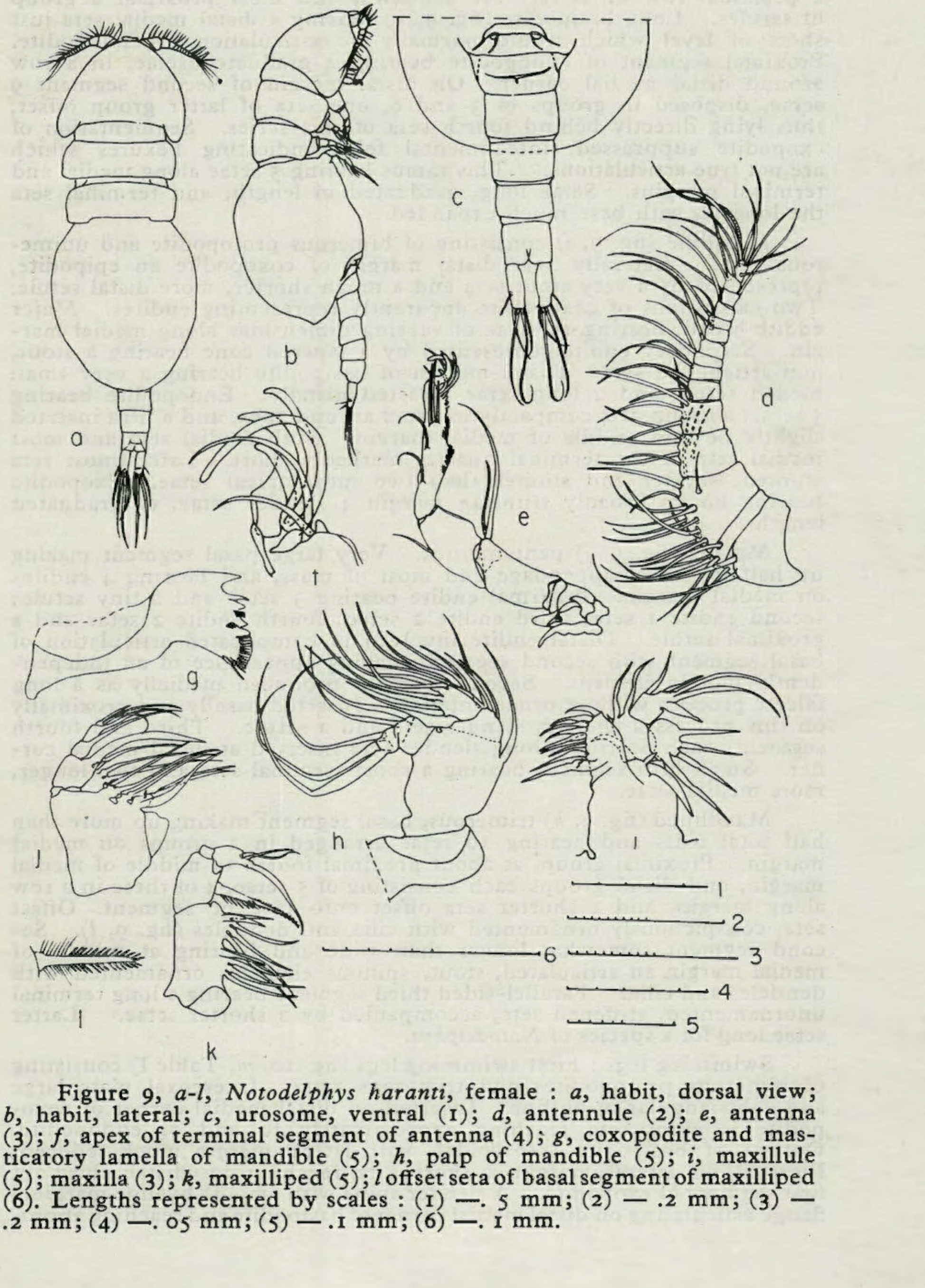

Figure 9, *a-l*, *Notodelphys haranti*, female : *a*, habit, dorsal view; *b*, habit, lateral; *c*, urosome, ventral (1); *d*, antennule (2); *e*, antenna (3); *f*, apex of terminal segment of antenna (4); *g*, coxopodite and masticatory lamella of mandible (5); *h*, palp of mandible (5); *i*, maxillule (5); maxilla (3); *k*, maxilliped (5); *l* offset seta of basal segment of maxilliped (6). Lengths represented by scales : (1) —. 5 mm; (2) — .2 mm; (3) — .2 mm; (4) —. 05 mm; (5) — .1 mm; (6) —. 1 mm.

a proximal row of closely set denticles, and most proximal a group of setules. Long basipodite (fig. 9, *h*) bearing a distal medial seta just short of level which would normally be articulation of endopodite. Proximal segment of endopodite bearing 4 graduated setae, in a row around distal medial corner. On distal margin of second segment 9 setae, disposed in groups of 3 and 6, one seta of latter group offset, thus lying directly behind fourth seta of this series. Segmentation of exopodite suppressed, integumental folds indicating flexures which are not true articulations. This ramus bearing 5 setae along medial and terminal margins. Setae long, graduated in length, and terminal seta the longest, with base much expanded.

Maxillule (fig. 9, *i*) consisting of bimerous protopodite and unimerous rami. Laterally near distal margin of coxopodite an epipodite, represented by a very stout seta and a much shorter, more distal setule. Two expansions of coxopodite apparently representing endites. Major endite broad, bearing 10 setae of varying dimensions along medial margin. Secondary endite represented by a tapered cone bearing a stout, non-articulated seta. Distal margin of basipodite bearing a very small medial setule and 2 long setae directed distally. Endopodite bearing 5 setae, a group of 4 compactly inserted around apex, and a fifth inserted slightly beyond middle of medial margin. Both medial seta and most medial seta of the terminal quartet markedly short. Lateralmost seta stunted, shorter and stouter than two most apical setae. Exopodite bearing on its broadly truncate margin 4 slender setae, of graduated lengths.

Maxilla (fig. 9, *j*) pentamerous. Very large basal segment making up half length of appendage and most of mass, and bearing 4 endites on medial margin. Proximal endite bearing 3 setae and a tiny setule; second endite 1 seta; third endite 2 setae; fourth endite 2 setae and a proximal setule. Distal endite involved in complicated articulation of basal segment with second segment, having appearance of an independently mobile element. Second segment produced medially as a long falcate process, without ornamentation. Inserted basally and proximally on this process a shorter, slender seta and a setule. Third and fourth segments each bearing a long slender seta inserted at distal medial corner. Small fifth segment bearing a short terminal seta and two longer, more medial setae.

Maxilliped (fig. 9, *k*) trimerous, basal segment making up more than half total mass and bearing 10 setae arranged in 2 groups on medial margin. Proximal group, at about proximal fourth to middle of medial margin, and distal groups each consisting of 5 setae, 4 of these in a row along margin, and 1 shorter seta offset onto face of segment. Offset seta, conspicuously ornamented with cilia and denticles (fig. 9, *l*). Second segment somewhat longer than wide and bearing at middle of medial margin an articulated, stout, spinous element, ornamented with denticles and cilia. Parallel-sided third segment bearing a long terminal unornamented, stiffened seta, accompanied by 2 shorter setae. Latter setae long for a species of ***Notodelphys***.

Swimming legs : First swimming legs (fig. 10, *m*, Table I) consisting of bimerous protopodites and trimerous rami. Intercoxal plate large and subtriangular in outline. Inserted on distal medial corner of coxopodite is stout seta reaching approximately to end of endopodite. Outline of basipodite trapezoidal, with lateral margin much reduced. Inserted on lateral margin a short seta reaching to distal third of first segment of exopodite. A slender spine with smooth hyaline marginal flange articulating on distal medial corner of basipodite and reaching appro-

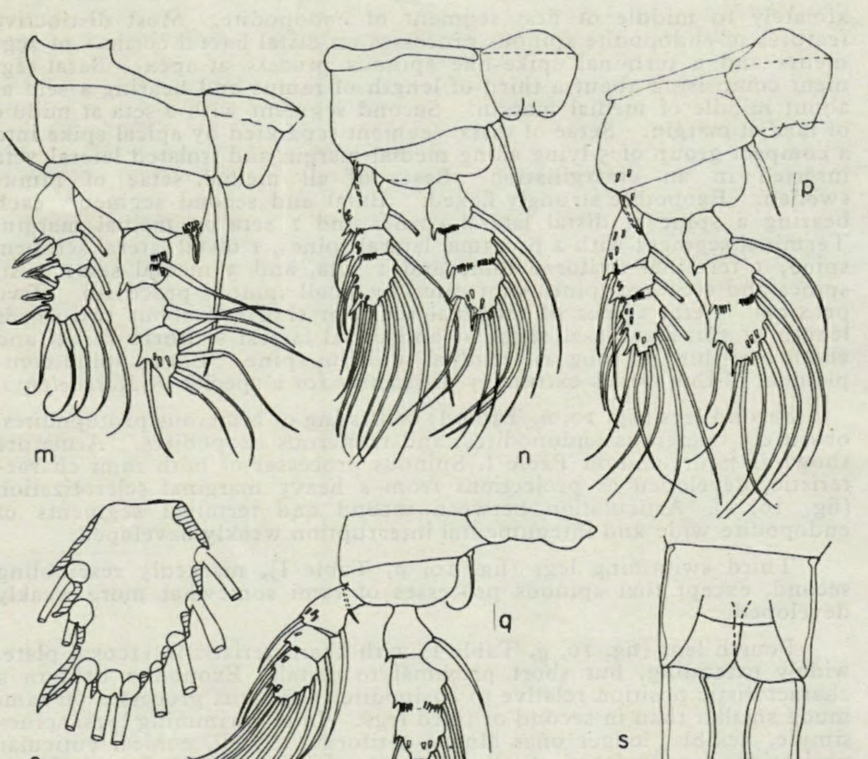

Figure 10, *m-s*, *Notodelphys haranti*, female : *m*, first leg (1); *n*, second leg (2); *o*, sclerotization and spinous processes of terminal segment of exopodite of second leg (3); *p*, third leg (2); *q*, fourth leg (1); *r*, fifth leg (3); *s*, anal segment and caudal rami. Lengths represented by scales : (1) — .2 mm; (2) — .2 mm; (3) — .1 mm.

ximately to middle of first segment of endopodite. Most distinctive features of endopodite spinous processes on distal lateral corners of segments and a terminal spike-like spinous process at apex. Basal segment comprising about a third of length of ramus and bearing a seta at about middle of medial margin. Second segment with a seta at middle of medial margin. Setae of distal segment separated by apical spike into a compact group of 5 lying along medial margin and isolated lateral seta inserted in an emargination. Bases of all medial setae of ramus swollen. Exopodite strongly flexed. Basal and second segments each bearing a spine at distal lateral corner and 1 seta on medial margin. Terminal segment with 2 proximal lateral spines, 1 distal lateral setiform spine, 1 terminal setiform spine and 1 seta, and 3 medial setae. All spines and setiform spines subtended by small spinous processes. Two proximal lateral spines of terminal segment shortest, about two-thirds length of spine of basal segment and distal lateral setiform spine, and about one-third as long as terminal setiform spine. Entire spine complement of this ramus extremely distinctive for a species of *Notodelphys*.

Second legs (fig. 10, *n*, Table I) consisting of bimerous protopodites, obscurely trimerous endopodites, and trimerous exopodites. Armature shown in figure and on Table I. Spinous processes of both rami characteristic, developed as projections from a heavy marginal sclerotization (fig. 10, *o*). Articulation between second and terminal segments of endopodite wide and integumental interruption weakly developed.

Third swimming legs (fig. 10, *p*, Table I), markedly resembling second, except that spinous processes of rami somewhat more weakly developed.

Fourth legs (fig. 10, *q*, Table I) with characteristic intercoxal plate, widely extending, but short proximal to distal. Exopodite held in a characteristic position relative to basipodite. Spinous processes on rami much smaller than in second or third legs. In all swimming legs, spines simple, flexible, longer ones almost setiform. Small, conical cuticular projections on surfaces of all swimming legs and fifth legs. Those on first leg found on face of terminal segment of endopodite. Those on second through fourth legs on surfaces of segments of exopodites near lateral margins and on face of terminal segment of each endopodite.

Fifth legs and caudal rami : Fifth legs (fig. 10, *r*) bimerous, but no well-defined articulation of basal segment with body. Basal segment extending laterally and bearing a seta on lateral distal corner. Second segment short and broad, lateral margin much longer and more curved than medial margin. At about middle of broad distal margin a single seta articulating on as mall conical projection. Small cuticular projections which seem characteristic for this species found on lateral ventral surface of basal segment, and ventral face of second segment.

Caudal rami (fig. 10, *s*) with strongly sclerotized margins. Rami about 2.6 times as long as their greatest width and 1.1 times as long as anal segment. Four setae forming a row across distal margin of ramus. Two central setae of quartet longest, medial central seta being slightly more than 3 times as long as ramus. A lateral seta about seven-tenths length of ramus from its base. A dorsal seta arising from surface at level slightly more than four-fifths the length of ramus. Caudal rami borne laterally on distal prolongations of anal segment. Lateral margins of anal segment and caudal ramus forming an almost continuous line.

REMARKS : No males have been found in this species. The female is a typically transparent Notodelphyid, with light green ova in the oviduct and with the mass of embryos in the brood pouch light green.

The species known with 1 seta on the terminal segment of the fifth leg unaccompanied by an additional element, are two North American species, *N. monoseta* and *N. affinis*, and *N. transatlantica* Bocquet and Stock, 1960 and *N. haranti*, from Europe. *N. haranti* differs from the others in having 15 segments in the antennule, *N. monoseta* having 10 and *N. affinis* and *N. transatlantica* 12.

Notodelphys parva Schellenberg comes from a closely related host *Polycarpa ehrenbergi* Hartmeyer from the Gulf of Suez. *N. parva* is a most distinctive species, having a unique aspect of the anal segment. The antenna also in *N. parva* serves to differentiate it from any *Notodelphys* known. There seems to be little indication of unusually close genetic affinity between *N. parva* and *N. haranti*.

The only other species of *Notodelphys* reported from species of *Polycarpa* is *N. agilis*, this being such a wide-ranging form and with such a diverse roster of recorded hosts as to exhibit little significance with regard to zoogeographic conclusions.

NOTODELPHYS PLATYMERA, new species (Figures 11-12 Table I).

Type : Holotypic female, CHATTON collection. [Type locality, coast of France, Roscoff, from? *Ascidia mentula* (Müller)].

Specimen examined :

From? *A. mentula* :

Roscoff, 1912, type lot. The single specimen was obtained from the collections of Professor E. CHATTON, made available to us at the Laboratoire Arago.

DESCRIPTION :

Female (figs. 11, 12, Table I) : General features : Total length' based on measurement of holotype, taken from anteriormost projection of rostrum to end of caudal ramus, as near midline of body as possible, 2.64 mm. Body (fig. 11, *a*) divided into cephalosome, metasome and urosome. Cephalosome bearing appendages through maxillipeds. Metasome consisting of 3 leg-bearing free segments and very inflated incubatory region which is a complex, bearing both fourth and fifth legs and totally enclosing broodpouch. Fifth legs lying ventrally near posterior margin, their setae extending just to posterior margin. Tergal plates of the first and third metasomal segments not as well-defined as that of second segment. Incubatory region about twice as wide at its widest point as third metasomal segment. Articulation of metasome and urosome between incubatory complex and anatomically seventh thoracic segment. Urosome (fig. 11, *b*) consisting of 5 well-defined segments with following proportional lengths : 1.7 : 2.3 : 2.2; 1.8 : 1.8. Degree of taper very slight, anal segment being three-fourths as wide as first urosomal segment. Genital apparatus, consisting of a vulva at midline and diverging sclerotized seminal tubes, at posterior fourth of first urosomal segment.

Head appendages : Fifteen-segmented antennule (fig. 11, *c*) long, reaching past the middle of cephalosome. Relative proportions of segments determinable from figure. Setal formula : Segment I — 3 setae; II — 5 setae; III — 11 setae on holotype (possibly a seta is missing); IV — 6 setae; V — 4 setae, 1 aesthete; VI — 2 setae; VII — 2 setae; IX — 1 seta; X — 2 elements, one of which may be an aesthete; XI — 1 seta; XII — 1 seta; XIII — 2 setae; XIV — 2 setae, 1 aesthete; XV — 8 elements, one of which may be an aesthete.

Antenna (fig. 11, *d*) bimerous, articulation normally present between two basal segments here missing. Proportional lengths of 2 segments 8 : 5.7 A right-angled flexure at articulation between basal and terminal segments. Two long setae inserted at about middle of inner margin of basal segment, and a shorter seta inserted at distal seven-eights. Inserted near outer margin of terminal segment, at intervals of approximately one-fourth, one-half, and three-fourths of its length, a single proximal seta, a single second seta, and a trio of distal setae. On distal margin (fig. 11, *e*) a stout, curved hook, accompanied by 3 stout, curved, stiffened setae and 2 more flexible setae.

Mandible (fig. 11, *f*) consisting of bimerous protopodite and bimerous endopodite and unimerous exopodite. Coxopodite expanded medially into a lamella differentiated along masticatory margin with 4 major teeth. Proximal complex consisting of a mass of close-set denticles, these separated by interruptions into 2 toothlike prominences and a long plate, and a proximal group of setules. Long baspodite bearing medial seta at distal fourth. Proximal segment of endopodite bearing 4 graduated setae on medial half of distal margin. On distal margin of second segment 9 setae disposed in groups of 3 and 6, one of latter group offset and lying directly behind fourth seta of this series. Segmentation of exopodite suppressed, with a single integumental fold at about middle of segment indicating a flexure which is not a true articulation. This ramus bearing 5 setae along medial and terminal margins. Most terminal seta longer than the others and its base much expanded.

The maxillule (fig. 11, *g*) consisting of bimerous protopodite and unimerous rami. Laterally near distal margin of coxopodite an epipodite, represented by a long, stout seta and a much shorter more distal setule. Two expansions of coxopodite apparently representing endites. Major endite bearing 8 setae of varying dimensions along medial margin. Secondary endite represented by a short cone, bearing a long, tapered, non-articulated seta. Distal margin of basipodite bearing a small medial setule and two long setae directed distally. Endopodite bearing 6 setae, grouped as follows : 2 on medial margin beyond midpoint, 3 terminal and 1 short, stout, stunted seta on lateral margin near apex. Exopodite bearing on its broadly trunctae margin 4 stout setae.

Maxilla (fig. 11, *h*) pentamerous. Basal segment very long, making up more than half length of appendage and most of mass, and bearing 4 endites on medial margin. Proximal endite with 3 setae and a tiny

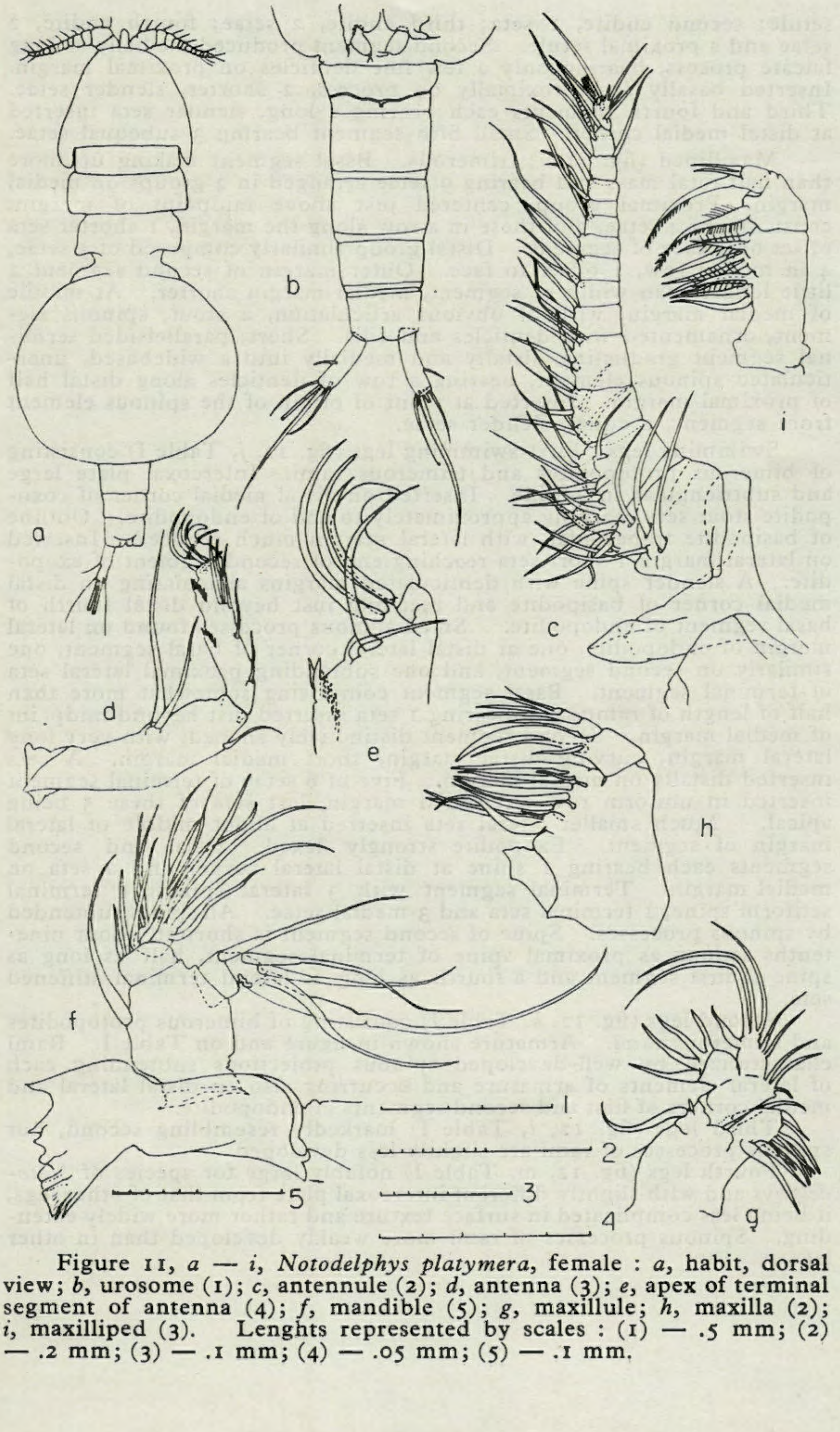

Figure 11, *a — i*, *Notodelphys platymera*, female : *a*, habit, dorsal view; *b*, urosome (1); *c*, antennule (2); *d*, antenna (3); *e*, apex of terminal segment of antenna (4); *f*, mandible (5); *g*, maxillule; *h*, maxilla (2); *i*, maxilliped (3). Lenghts represented by scales : (1) — .5 mm; (2) — .2 mm; (3) — .1 mm; (4) — .05 mm; (5) — .1 mm.

setule; second endite, 1 seta; third endite, 2 setae; fourth endite, 2 setae and a proximal setule. Second segment produced medially as long falcate process, bearing only a few fine denticles on proximal margin. Inserted basally and proximally on process, 2 shorter, slender setae. Third and fourth segments each bearing a long, slender seta inserted at distal medial corner. Small fifth segment bearing 3 subequal setae.

Maxilliped (fig. 11, *i*) trimerous. Basal segment making up more than half total mass and bearing 9 setae arranged in 2 groups on medial margin. Proximal group, centered just above midpoint of margin, consisting of 4 setae, 3 of these in a row along the margin, 1 shorter seta offset onto face of segment. Distal group similarly composed of 5 setae, 4 in medial row, 1 offset to face. Outer margin of second segment a little longer than width of segment, medial margin shorter. At middle of medial margin, without obvious articulation, a stout, spinous element, ornamented with denticles and cilia. Short, parallelsided terminal segment graduating distally and medially into a widebased, unarticulated spinous element, bearing a row of denticles along distal half of proximal margin. Inserted at point of origin of the spinous element from segment, 2 equal, slender setae.

Swimming legs : First swimming legs (fig. 12, *j*, Table I) consisting of bimerous protopodites and trimerous rami. Intercoxal plate large and subtriangular in outline. Inserted on distal medial corner of coxopodite stout seta reaching approximately to end of endopodite. Outline of basipodite trapezoidal, with lateral margin much reduced. Inserted on lateral margin 1 short seta reaching end of second segment of exopodite. A slender spine with denticulated margins articulating on distal medial corner of basipodite and reaching just beyond distal fourth of basal segment of endopodite. Small spinous processes found on lateral margin of endopodite, one at distal lateral corner of basal segment, one similarly on second segment, and one subtending proximal lateral seta of terminal segment. Basal segment comprising somewhat more than half of length of ramus and bearing 1 seta inserted just beyond midpcint of medial margin. Second segment distinctively shaped, with very long lateral margin, curving distal margin, short medial margin. A seta inserted distally on medial margin. Five of 6 setae of terminal segment inserted in uniform row on medial margin, last seta of these 5 being apical. Much smaller lateral seta inserted at about middle of lateral margin of segment. Exopodite strongly flexed. Basal and second segments each bearing 1 spine at distal lateral corner and a seta on medial margin. Terminal segment with 3 lateral spines, 1 terminal setiform spine, 1 terminal seta and 3 medial setae. All spines subtended by spinous processes. Spine of second segment is shortest, about nine-tenths as long as proximal spine of terminal segment, half as long as spine of first segment and a fourth as long as lateral terminal stiffened seta.

Second legs (fig. 12, *k*, Table I) consisting of bimerous protopodites and trimerous rami. Armature shown in figure and on Table I. Rami characterized by well-developed spinous projections subtending each of lateral elements of armature and occurring also on distal lateral and medial corners of first and second segments of endopodite.

Third legs (fig. 12, *l*, Table I) markedly resembling second, but spinous processes of rami are slightly less developed.

Fourth legs (fig. 12, m, Table I) notably large for species of *Notodelphys* and with slightly different intercoxal plate from that of other legs, it being less complicated in surface texture and rather more widely extending. Spinous processes of rami more weakly developed than in other legs.

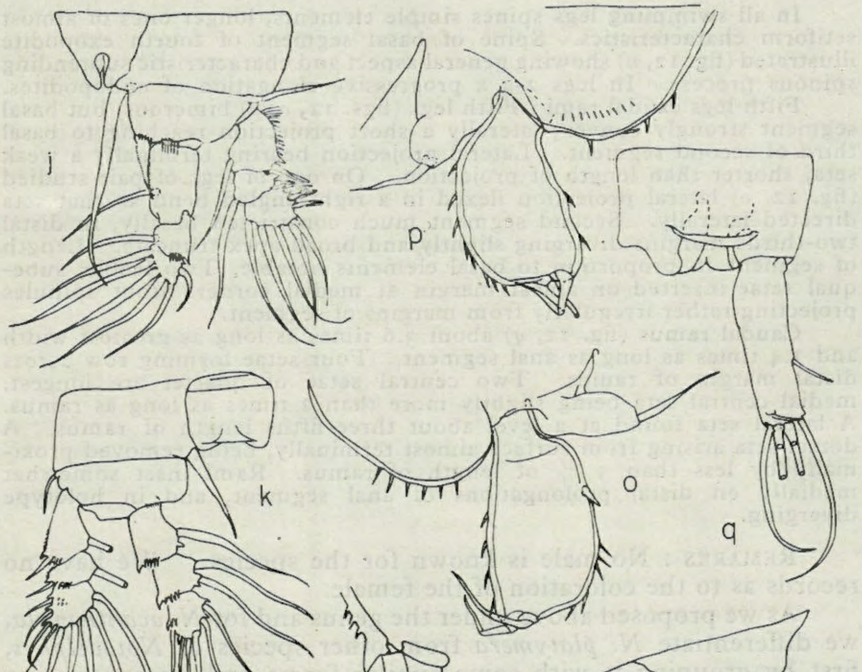

Figure 12, *j-q*, *Notodelphys platymera*, female : *j*, first leg (1); *k*, second leg (2); *l*, third leg (2); *m*, fourth leg (2); *n*, spine and subtending spinous process of first segment of exopodite of fourth leg (3); *o*, fifth leg (4); *p*, fifth leg (4); *q*, anal segment and caudal ramus (1). Lengths represented by scales : (1) — .2 mm; (2) — . 2 mm; (3) — .05 mm; (4) — .1 mm.

In all swimming legs spines simple elements, longer ones of almost setiform characteristics. Spine of basal segment of fourth exopodite illustrated (fig. 12, *n*) showing general aspect and characteristic subtending spinous process. In legs 2-4 a progressive elongation of endopodites.

Fifth legs caudal rami : Fifth legs (figs. 12, *o p*) bimerous, but basal segment strongly convex, laterally a short projection reaching to basal third of second segment. Lateral projection bearing terminally a weak seta, shorter than length of projection. On one of legs of pair studied (fig. 12, *o*) lateral projection flexed in a right-angled bend so that seta directed laterally. Second segment much constricted basally, in distal two-thirds margins diverging slightly and broad apex truncate. Length of segment in proportion to basal elements notable. Two feeble, subequal setae inserted on apical margin at medial corner. Stout spinules projecting rather irregularly from margins of segment.

Caudal ramus (fig. 12, *q*) about 3.6 times as long as greatest width and 1.4 times as long as anal segment. Four setae forming row across distal margin of ramus. Two central setae of quartet are longest, medial central seta being slightly more than 2 times as long as ramus. A lateral seta found at a level about three-fifths length of ramus. A dorsal seta arising from surface almost terminally, being removed proximally by less than 5 % of length of ramus. Rami inset somewhat medially on distal prolongations of anal segment, and in holotype diverging.

REMARKS : No male is known for the species. We have no records as to the coloration of the female.

As we proposed above under the genus and for *N. acanthomela*, we differentiate *N. platymera* from other species of *Notodelphys*, first by grouping it with some similar forms and by contrasting it with these. It differs from a small group of species which have only a single seta instead of two elements on the distal segment of the fifth leg. Among those with 2 elements on the distal segment of the fifth leg it is included in the series in which the caudal ramus is not approximately equal in length with the anal segment, but where it is 1.3 — 2 times as long. Species so characterized are *N. agilis*, *N. ciliata*, *N. patagonica*, *N. weberi*, *N. allmani*, *N. rufescens*, *N. pachybrachia*, *N. tenera*, *N. elegans*, and *N. platymera*. From all these and indeed from all species of *Notodelphys*, *N. platymera* is distinguished by a very characteristic fifth leg. In this the terminal segment is very long, constricted at the base and flaring distally to a truncate terminal margin. To place the species in a more restricted group among those noted above as similar in proportional length of caudal ramus relative to anal segment, *N. platymera* is included with forms in which the lateral seta of the caudal ramus is inserted less than half the length of the caudal ramus but more than its width from the apex. Such forms are *N. patagonica*, *N. weberi*, *N. allmani*, *N. rufescens*, and *N. platymera*.

We have not seen the specimen of the host from which this form was collected and do not know how accurately the identification of the host was made.

DOROPYGUS Thorell, 1859

The treatment of the genus *Doropygus* here follows ILLG (1958).

DOROPYGUS PULEX Thorell, 1859 (Figures 13-14, Table I).

THORELL described the species from a collection of material he obtained from diverse hosts. He listed these as *Ascidia venosa*, *A. canina*, *A. aspersa*, *A. parallelogramma* and *Cynthia lurida.* His specimens, then, were from representatives of the family *Ascidiidae* Herdman, of the family *Corellidae* Lahille, very likely a member of the *Pyuridae* Hartmeyer, and remotely possibly a member of the *Cionidae* Lahille. Material we have seen from further south in Europe demonstrates that there are differentiated forms inhabiting the various host, a fact long since noted by practically every authority. Evidence begins to accumulate that there are definite forms for the families or genera of hosts represented. To minimize further confusion the type host for THORELL'S species should be fixed as an ascidiid and further exploration and study of Scandinavian material is essential. We have had access to material from Sweden in the Bristish Museum. Recorded as coming from THORELL'S collections was one specimen designated in the institutional records as a type. The absence of data as to the host of this specimen has made it impossible for us to utilize the studies made on it for fixing our concept of *D. pulex*. Reference of this specimen to THORELL'S illustrations convinces us that his species is indeed represented and that the illustrations of SARS, 1921, do not correspond. SARS may have included more than one form among his illustrations, since he records that his material was furnished from numerous hosts. We feel sure that several of his figures of appendages do not completely accurately represent any member of the *D. pulex* complex of forms, since the drawings are stylized and only generally indicate configuration and ornamentation. Accurate reproduction of the more minute details obviously was not attempted.

In the Mediterranean Sea, *D. pulex* and its close allies occur in relatively few hosts, extremely sparsely in most of these, and in any abundance only in *Microcosmus sulcatus s. lat.*, to judge from our experience so far. We refer all ours pecimens to the species, although they differ from THORELL'S and SARS's illustrations in small details. We describe and illustrate in full the commonly encountered form from *M. sulcatus*, recognizing that it may eventually come to be designated as a different species.

Material examined :

From *Pyura squamulosa* Alder :

Aquarium, Banyuls, exact locality of collection unknown, May, 1958, 2 females.

From ? *Pyura savignyi* (Philippi) (CHATTON manuscript identification *Cynthia morus*) :

Roscoff. Included here because it was a part of the CHATTON collection.

From *Microcosmus sulcatus* Coquebert :

Coastal mud near Port-Vendres, 60-100 m, April 25, 1958, 2 females, males, developmental stages.

Mixed trawl : (1) near Port-Vendres — north, 70 m, (2) northeast of Port-Vendres, 60-30 m, May 6, 1958, 1 female, developmental stages.

Near Port-Vendres, 50 m-25 m, Bay of Troc, May 13, 1958, 1 female, developmental stages.

Mixed trawl : (1) north of Cap Béar, 60 m, (2) northeast of Port-Vendres, 90 m, May 14, 1958, 2 females, developmental stages.

Off Cap Béar, in Anse de Paulilles, 50 m, May 28, 1958, 1 female, males, developmental stages.

From *Microcosmus sabatieri* Roule :

Off Banyuls, 1958, C. MONNIOT, 100 plus females.

From *Microcosmus vulgaris* Heller :

Off Banyuls, 1958, C. MONNIOT, 3 females.

DESCRIPTION :

Female from *Microcosmus sulcatus* (figs. 13, 14, Table I) : General features : Body (fig. 13, *a*) 2.0 mm. total length, average from 5 specimens, measured on a continuous arc running along the axis of the body from the anteriormost point on cephalosome to end of caudal ramus, relatively small for species of *Doropygus*. Body delimited into cephalosome, metasome, urosome. Cephalosome supporting appendages through maxillipeds. Metasome of first 4 leg-bearing segments, fourth posteriorly inflated to enclose brood-pouch. Metasome much fused, first and third segments not clearly delimited. Articulation of metasome and urosome between anatomically thoracic segments of fourth swimming legs and fifth legs, however, considerable ventral fusion of this joint. Urosome (fig. 13, *b*) slender, obscurely 6-segmented. First and second urosomal segments fused ventrally. Segments with following proportional lengths : 1.7 (although anterior margin difficult to determine) : 1.1 : 1.6 : 1.5 : 1.0 : 1.0, measured ventrally. Genital apparatus with

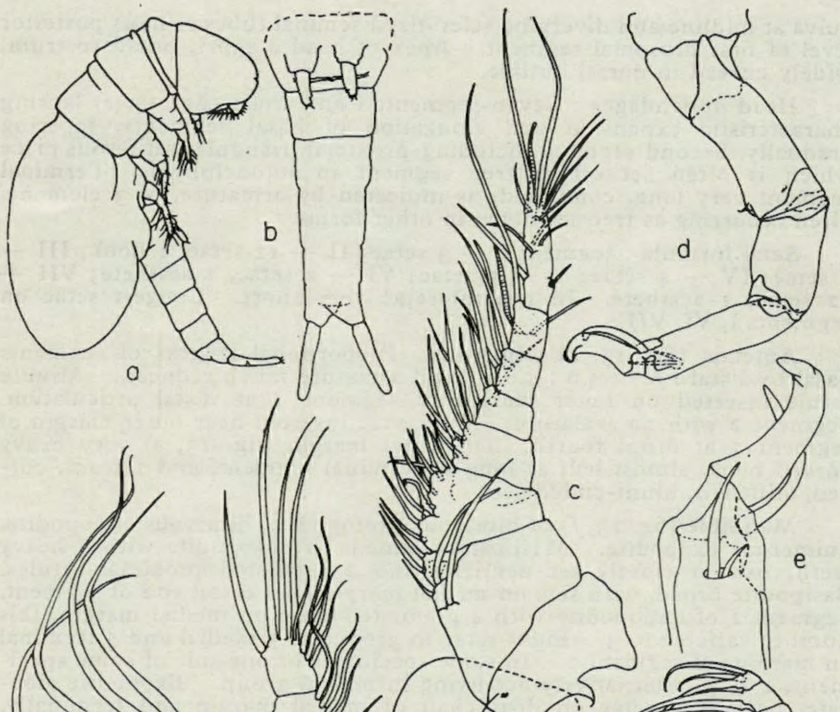

Figure 13, *a-i*, *Doropygus pulex*, female : *a*, habit, lateral view; *b*, urosome; *c*, antennule (1); *d*, antenna (2); *e*, apex of terminal segment of antenna (3); *f*, mandible (1); *g*, maxillule (4); *h*, maxilla (4); *i*, maxilliped (4). Lengths represented by scales : (1) — .1 mm; (2) — .1 mm; (3) — .05 mm. (4) — .1 mm.

vulva at midline and diverging sclerotized seminal tubes at most posterior level of first urosomal segment. Apex of head a short, broad rostrum, widely curved in dorsal outline.

Head appendages : Seven-segmented antennule (fig. 13, *c*) lacking characteristic expansion and elongation of basal segments, tapering gradually. Second segment including proximal triangular setiferous piece which is often set off as free segment in notodelphyids. Terminal segment very long, composed, as indicated by armature, of 3 elements often occurring as free segments in other forms.

Setal formula : segment I — 3 setae; II — 12 setae, 1 hook; III — 6 setae; IV — 4 setae; V — 3 setae; VI — 2 setae, 1 aesthete; VII — 12 setae, 1 aesthete. In general setae very short. Longest setae on segments I, VI, VII.

Antenna (fig. 13, *d*) trimerous. Proportional lengths of segments basal to distal : 6.7 : 4.0 : 5.6. Setal armature much reduced. Minute setule inserted on inner margin of segment 1 at distal articulation. Segment 2 with no armature. Two setae inserted near outer margin of segment 3 at distal fourth. On distal margin (fig. 13, *e*) very heavy curved hook, almost half as long as terminal segment, and 1 stout, curved, stiffened, blunt-ended seta.

Mandible (fig. 13, *f*) of bimerous protopodite, bimerous endopodite, unimerous exopodite. Masticatory lamella of coxopodite with 4 heavy teeth, row of closely set denticles and 2 separated proximal setules. Basipodite broad, with seta on medial margin near distal end of segment. Segment 1 of endopodite with 4 graduated setae on medial margin, this number variable to 3. Eight setae in groups of 3 medial and 5 terminal on margins of segment 2. In some specimens or one side of some specimens, 2 setae alternatively occurring in medial group. Exopodite elongate, bearing 4 setae on distal half of medial margin and terminally. Cuticular lines indicate flexures of the segment which are not true articulations.

Maxillule (fig. 13, *g*) with obscurely bimerous protopodite and unimerous rami. Epipodite represented by seta and more distal setule. Major endite small, bearing 9 subequal setae on medial margin. Secondary endite represented by wide pointed lamella. Basipodite bearing 3 distally directed graduated setae on terminal margin. Endopodite reduced, bearing 1 terminal seta and 1 medial seta. Exopodite with 4 setae on margin, most proximal longer than other.

Maxilla (fig. 13, *h*) pentamerous, narrow, segments in relatively straight line. Long basal segment about as long as remaining segments combined, with 4 endites. Basal endite with 3 subequal setae; second endite with 1 seta; third endite with 2 setae; fourth endite with 2 setae and proximal setule. Distal endite appearing as independently mobile element. Second segment about as wide as long, produced medially as short, feeble, falcate process. Inserted basally and proximally to process, 1 long slender seta and reduced setule. Segment 3 broader than long, with long seta on distal medial corner. Segment 4 about as wide as long, with seta at distal medial corner. Segment 5 reduced, with 3 setae, 2 terminal shorter than medial.

Maxilliped (fig. 13, *i*) unimerous. Setae on medial margin of broad basal portion crowded, but arranged in 2 groups of 4 proximal and 5 distal. In each group 1 seta offset onto face of segment, other setae marginal. Low unarticulated lateral terminal lobe, bearing 2 distally directed, long, subequal setae.

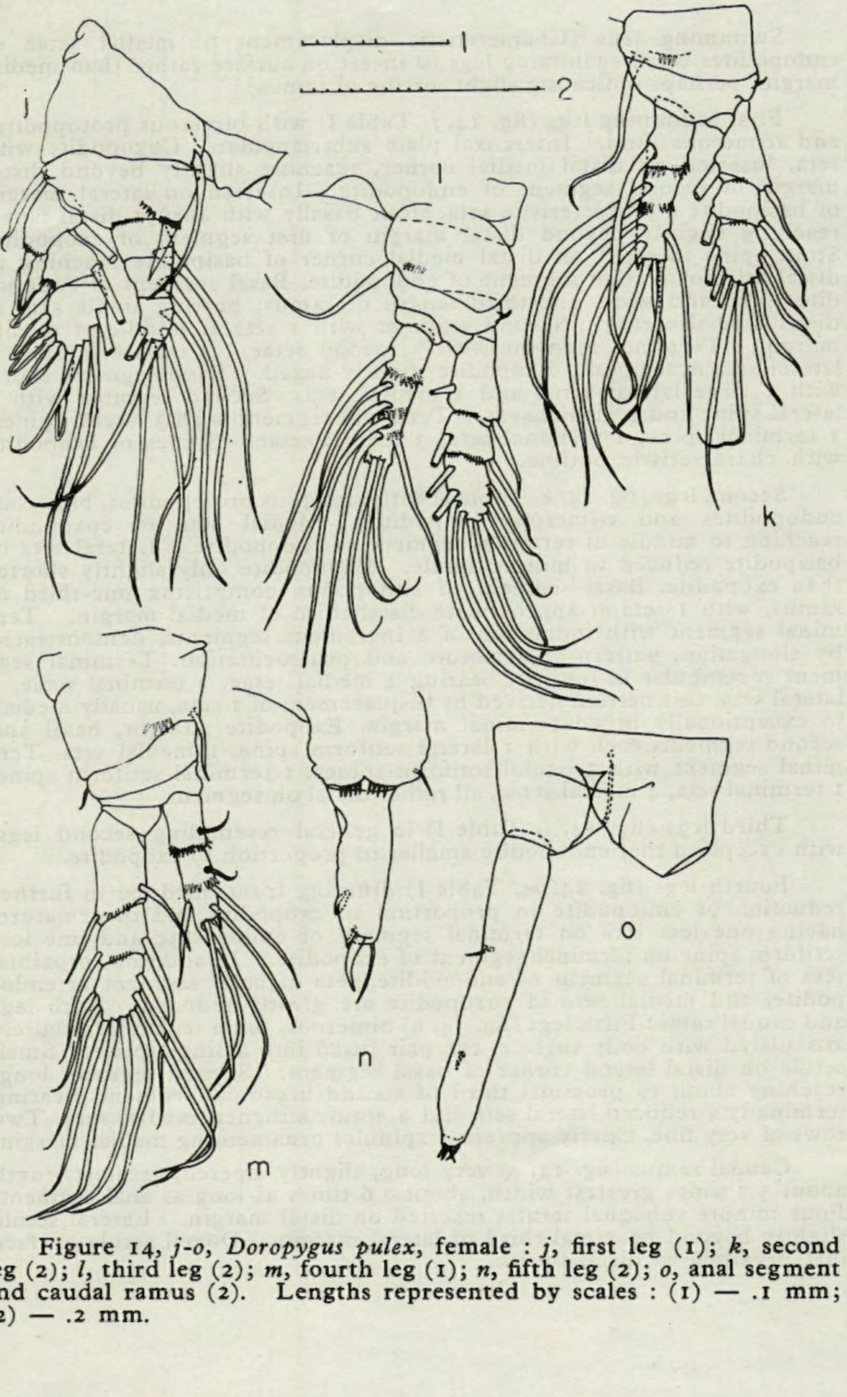

Figure 14, ***j-o, Doropygus pulex,*** **female :** ***j,*** **first leg (1);** ***k,*** **second leg (2);** ***l,*** **third leg (2);** ***m,*** **fourth leg (1);** ***n,*** **fifth leg (2);** ***o,*** **anal segment and caudal ramus (2). Lengths represented by scales : (1) — .1 mm; (2) — .2 mm.**

Swimming legs (Characteristic displacement of medial setae of endopodites of all swimming legs to insert on surface rather than medial margin, perhaps indicating slight torsion of ramus) :

First swimming legs (fig. 14, *j*, Table I) with bimerous protopodites and trimerous rami. Intercoxal plate subtriangular. Coxopodite with seta, inserted on distal medial corner, reaching slightly beyond distal margin of second segment of endopodite. Inserted on lateral margin of basipodite a characteristic seta, stout basally with abrupt distal taper, reaching slightly beyond distal margin of first segment of exopodite. Stout spine inserted on distal medial corner of basipodite reaching to distal third of second segment of endopodite. Basal segment of endopodite short and wide, one-third length of ramus, bearing single seta at distal medial corner. Second segment with 1 seta at middle of medial margin. Terminal segment with 3 medial setae, 2 terminal setae, 1 lateral seta near apex. Exopodite slightly flexed. Basal segment short, with 1 large lateral spine and 1 medial seta. Second segment with 1 lateral spine and 1 medial seta. Terminal segment wirh 3 lateral spines, 1 terminal spine, 1 terminal seta, 3 medial setae. Spines of exopodite with characteristic outline.

Second legs (fig. 14, *k*, Table I) with bimerous protopodites, bimerous endopodites and trimerous exopodites. Medial seta of coxopodite reaching to middle of terminal segment of endopodite. Lateral seta of basipodite reduced to minute setule. Endopodite only slightly shorter than exopodite. Basal segment of endopodite comprising one-third of ramus, with 1 seta at approximate distal third of medial margin. Terminal segment with indication of 2 ingredient segments, demonstrated by elongation, pattern of armature and ornamentation. Terminal segment rectangular in outline, bearing 4 medial setae, 3 terminal setae, 1 lateral seta, this pattern derived by displacement of 1 seta, usually medial, to exceptionally broad terminal margin. Exopodite straight, basal and second segments each with 1 lateral setiform spine, 1 medial seta. Terminal segment with 3 lateral setiform spines, 1 terminal setiform spine, 1 terminal seta, 4 medial setae, all rather distal on segment.

Third legs (fig. 14, *l*, Table I) in general resembling second legs, with exception that endopodite smaller in proportion to exopodite.

Fourth legs (fig. 14, *m*, Table I) differing from third leg in further reduction of endopodite in proportion to exopodite and in armature, having one less seta on terminal segment of endopodite and one less setiform spine on terminal segment of exopodite. In addition, proximal seta of terminal segment of endopodite, seta of basal segment of endopodite, and medial seta of coxopodite are greatly reduced. Fifth legs and caudal rami : Fifth legs (fig. 14, *n*) bimerous, basal segment obscurely articulated with body surface, the pair fused into a single plate. Small setule on distal lateral corner of basal segment. Second segment long, reaching about to proximal third of second urosomal segment, bearing terminally a reduced lateral seta and a stout, stiffened medial seta. Two rows of very fine, closely appressed spinules ornamenting medial margin.

Caudal ramus (fig. 14, *o*) very long, slightly tapered, greatest length about 5.7 times greatest width, about 2.6 times as long as anal segment. Four minute subequal setules inserted on distal margin. Lateral setule slightly beyond proximal third of lateral margin. Dorsal setule on face just proximal to distal fourth.

REMARKS : This form is smaller than the other *Doropygus pulex* forms examined here. The forms from *Pyura squamulosa* and ? *P. savignyi* (from Roscoff) are from 2.5 to 2.75 mm in length, as measured along the body axis in profile view. Both are heavy-bodied forms. In these also the rostrum is notably different from that of the *Microcosmus* form being elongate and pointed. In the specimens from *Pyura* spp. the antennule is thicker basally and it is heavily sclerotized; the fifth legs are smaller, shorter and thicker in proportion; the anal segment has very little divergence of the distal prolongations, which meet in the midline and form an almost uninterrupted distal margin to the segment; the caudal rami are proportionally shorter and thicker and with a much more pronounced taper. We have so few specimens of these forms available that we have not described them here, since we feel that the variation of *Doropygus pulex* must be studied through examination of large series of specimens. Males and developmental stages of the form from *M. sulcatus* have been obtained and will be described subsequently.

NOTOPTEROPHORUS Leuckart, 1859.

The systematic treatment of this genus is after ILLG (1958) essentially based on SCHELLENBERG (1922). There remain some nomenclatural questions in attribution of authority and in the designation of the european species, but we prefer to leave these questions open, along with the considerable zoological problems of host incidence and genetic differentiation of some of the described forms. The recognizable Notopterophores, which can be differentiated by salient anatomical characters of the adult females, and for which the literature and our findings show definite indication of host specificity, have been designated here as species.
We recognize that this may represent an overemphasis of the distinctions found, but we are attempting to provide designations for important forms that will surely be subject to considerable future discussion. We include in the genus, then, *N. elongatus* Buchholz, type of the genus, with heavy dorsal winglike outgrowths terminating in small points; *N. papilio* Hesse and *N. elatus* Giesbrecht, with delicate wide dorsal winglike outgrowths terminating in long threads; *N. micropterus* Sars, with dorsal outgrowths much reduced in size, but winglike; *N. auritus* (Thorell), dorsal outgrowths reduced to humps; and the new species here described, with pairs of dorsal tubular ourgrowths, not at all winglike. We have few specimens of any of these forms from Banyuls, but there are large numbers of *N. elongatus* and *N. elatus* in our collections

from Naples and vicinity and we will publish later fuller accounts based on this material. Thanks to the courtesy of M. Cl. DELAMARE DEBOUTTEVILLE we have been able to examine topotypes of *N. papilio* from Brest, France.

NOTOPTEROPHORUS ELONGATUS Buchholz, 1869.

From *Phallusia mammillata* (Cuvier) :

Mixed trawl : (1) Near Port-Vendres — north, 70 m, (2) northeast of Port-Vendres, 60-30 m, May 6, 1958, 4 females, males, developmental stages.

Near Port-Vendres to near Bay of Troc, May 13, 1958, 5 females, males, developmental stages.

Cap Béar, large gravel, 115-50 m, May 27, 1958, 1 female.

NOTOPTEROPHORUS ELATUS Giesbrecht, 1882.

From *Ascidia mentula* (Müller) :

Mixed trawl : (1) near Port-Vendres — north, 70 m, (2) northeast of Port-Vendres, 60-30 m, May 6, 1958, 1 female, developmental stages.

Northeast to south of Cap Peyrefite, 60-50 m, May 29, 1958, 1 female, males, developmental stages.

NOTOPTEROPHORUS DIMITUS, new species (Figures 15-16, and Table I).

Type : Holotypic female, USNM 104829 (type locality, Golfe du Lion, Mediterranean Sea, from *Ciona intestinalis* Fleming).

Specimens examined :

From *C. intestinalis* :

Mixed trawl : (1) north of Port-Vendres, 70-30 m, (2) off Cap Béar in Anse de Paulilles, 50 m, May 28, 1958, 1 female, 1 fifth copepodid female, type lot.

DESCRIPTION :

Female (figs. 15, 16, Table I) : General Features : Total length, taken from anteriormost projection of cephalosome to end of caudal

Figure 15, *a-j*, *Notopterophorus dimitus*, female : *a*, habit, lateral view; *b*, pair of dorsal tubular processes; *c*, urosome, ventral (1); *d*, antennule (2); *e*, antenna (3); *f*, apex of terminal segment of antenna (4); *g*, mandible (3); *h*, maxillule (3); *i*, maxilla (3); *j*, maxilliped (3). Lengths represented by scales : (1) — .5 mm; (2) — .2 mm; (3) — .1 mm; (4) — .1 mm.

ramus, measured along body axis, 4.5 mm. Body (fig. 15, *a*) stout, curved ventrally, delimited into cephalosome, metasome and urosome. Cephalosome bearing appendages through maxillipeds. Metasome consisting of 4 leg-bearing segments. First 3 segments of metasome prolonged dorsally into pairs of long, slender, acute tubular processes (fig. 15, *b*) each process about equal to dorsal-ventral depth of the animal. Brood-pouch totally enclosed in inflated fourth metasomal segment, produced posteriorly. Articulation cf metasome and urosome between anatomically thoracic segments of fourth swimming legs and of fifth legs. Urosome (fig. 15, *c*) stout, 6-segmented. Segments 3, 4, 5 each showing distinct contraction into preceding segment. Reduced perianal ring, longer ventrally than dorsally, and supporting caudal rami, is counted as segment 6. Line of articulation between segments 1 and 2 incomplete medially on ventral surface. Segments of urosome, anterior to posterior, with following proportional lengths : 3.2 : 4.2 : 4.7 : 2.9 : 1.8 : 1.2, measured ventrally. Conspicuous genital apparatus on firts urosomal segment with vulva at midline between bases of fifth legs and with diverging sclerotized seminal tubes looping into second urosomal segment.

Anterior margin of head prolonged into very small rostrum (fig. 15, *d*).

Head appendages : Eight-segmented antennule (fig. 15, *d*) with characteristic great expansion and elongation of basal segments, segments 1 and 2 thus making up half the length of the antennule. Setal formula as follows : Segment I — 3 setae; II — 22 setae; III — 4 setae, 1 aesthete; IV — 5 setae; V — 3 setae, 1 aesthete; VI — 2 setae; VII — 2 setae, 1 aesthete; VIII — 7 setae, 1 aesthete.

Antenna (fig. 15, *e*) obscurely trimerous. Articulation between segments 1 and 2 not fully formed. Proportional lengths of segments, basal to distal : 4.5 : 3.5 : 4.2. Small setule inserted on inner margin of segment 1 at obscurely defined articulation with segment 2. Second segment with no armature. Inserted near outer margin of segment 3 at intervals of thirds, are 1 proximal setule and a distal group of 2 setules and 1 seta. On distal margin (fig. 15, *f*) inserted very heavy, curved hook and 2 feeble stiffened curved, blunt-ended setae and 1 stouter, more flexible seta.

Mandible (fig. 15, *g*) of bimerous protopodite, obscurely articulated bimerous endopodite and unimerous exopodite. Masticatory lamella of coxopodite with 4 teeth, row of closely set denticles, of which most proximal and most distal very coarse, and proximal setule. Basipodite broad, with seta at distal third of medial margin. Segment 1 of endopodite with 4 graduated setae on medial and distal margins. On distal and medial margins of segment 2 of endopodite, 9 setae, in groups of 4 medial and 5 terminal, one seta of latter group offset, lying directly behind fourth seta of series. Exopodite a plate with no flexures or evidence of articulations, bearing 5 long, graduated setae along medial and terminal margins.

Maxillule (fig. 15, *h*) with bimerous protopodite and unimerous rami. Epipodite represented by long seta and more distal setule distally on lateral margin of coxopodite. Major endite with peculiar curved lateral margin. Medial margin with 9 subequal setae. Secondary endite represented by stout prominence, continuing without articulation as long, slender seta. Distal margin of basipodite with 4 setae, directed distally. Endopodite bearing 6 or 7 setae, arranged as distal trio of long setae and 3 or 4 short setae on medial margin. Exopodite rectangular, bearing 4 long subequal, marginal setae.

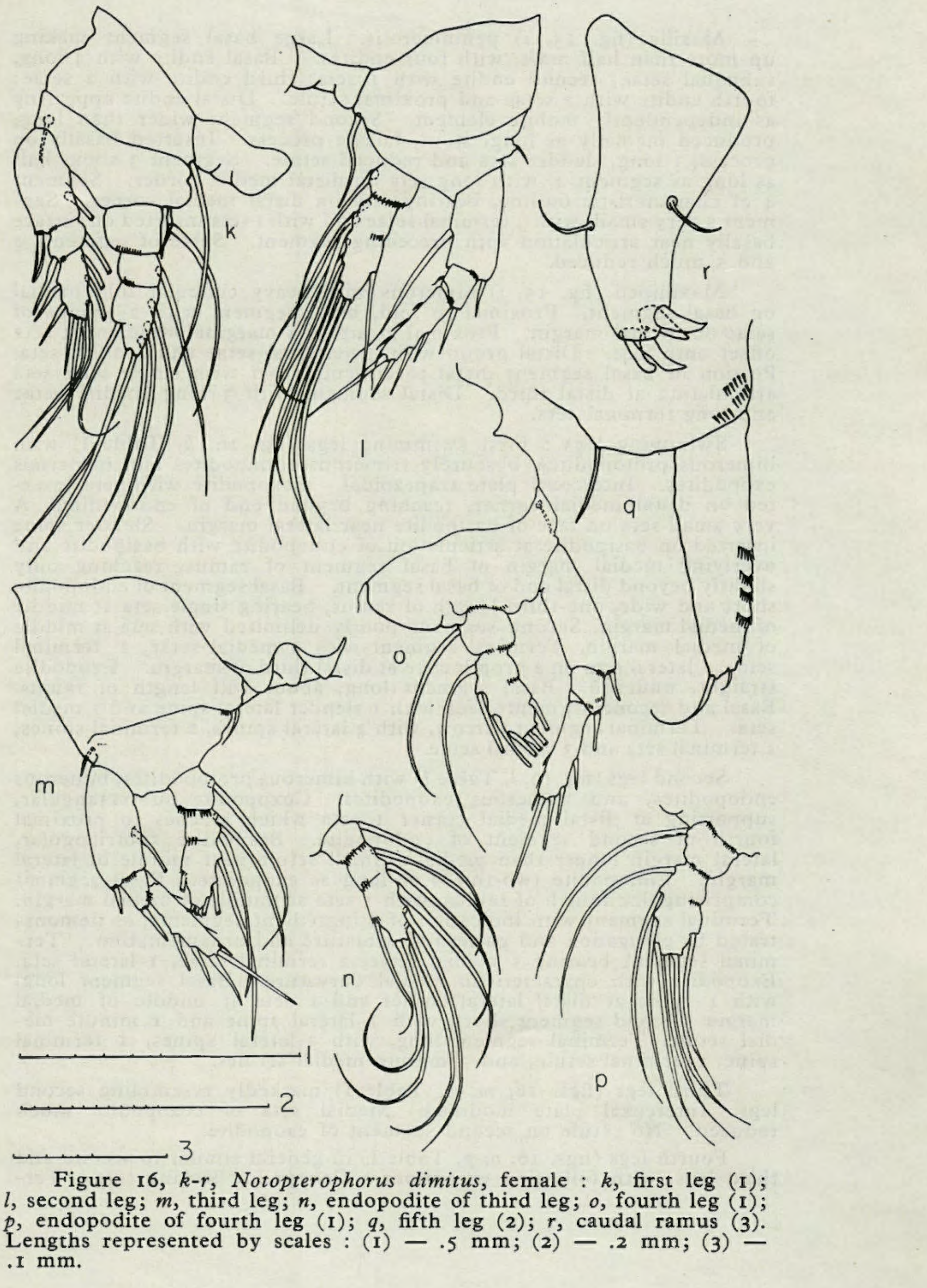

Figure 16, *k-r*, *Notopterophorus dimitus*, female : *k*, first leg (1); *l*, second leg; *m*, third leg; *n*, endopodite of third leg; *o*, fourth leg (1); *p*, endopodite of fourth leg (1); *q*, fifth leg (2); *r*, caudal ramus (3). Lengths represented by scales : (1) — .5 mm; (2) — .2 mm; (3) — .1 mm.

Maxilla (fig. 15, *i*) pentamerous. Large basal segment making up more than half mass, with four endites. Basal endite with 4 long, subequal setae; second endite with 1 seta; third endite with 2 setae; fourth endite with 2 setae and proximal setule. Distal endite appearing as independently mobile element. Second segment wider than long, produced medially as long, stout, falcate process. Inserted basally on process, 1 long, slender seta and reduced setule. Segment 3 about half as long as segment 4, with long seta on distal medial corner. Segment 4 of characteristic outline, bearing seta on distal medial corner. Segment 5 very small, with 3 terminal setae and with 1 seta inserted on surface basally near articulation with preceding segment. Setae of segments 4 and 5 much reduced.

Maxilliped (fig. 15, *j*) bimerous with heavy cuticular fold medial on basal segment. Proximal to fold, basal segment with 2 groups of setae on medial margin. Proximal group of 3 marginal setae and 1 seta offset onto face. Distal group with 4 marginal setae and 1 offset seta. Portion of basal segment distal to cuticular fold with single long seta articulating at distal third. Distal segment with 3 long medial setae and long terminal seta.

Swimming legs : First swimming legs (fig. 16, *k*, Table I) with bimerous protopodites, obscurely trimerous endopodites and trimerous exopodites. Intercoxal plate trapezoidal. Coxopodite with seta inserted on distal medial corner, reaching beyond end of endopodite. A very small seta on face of basipodite near lateral margin. Slender spine inserted on basipodite at articulation of endopodite with basipodite and overlying medial margin of basal segment of ramus, reaching only slightly beyond distal end of basal segment. Basal segment of endopodite short and wide, one-third length of ramus, bearing single seta at middle of medial margin. Second segment poorly delimited with seta at middle of medial margin. Terminal segment with 3 medial setae, 2 terminal setae, 1 lateral seta on a prominence at distal third of margin. Exopodite straight, unflexed. Basal segment long, about half length of ramus. Basal and second segments each with 1 slender lateral spine and 1 medial seta. Terminal segment narrow, with 2 lateral spines, 2 terminal spines, 1 terminal seta and 3 medial setae.

Second legs (fig. 16, *l*, Table I) with bimerous protopodites, bimerous endopodites, and trimerous exopodites. Coxopodite subrectangular, supporting at distal medial corner 1 seta which reaches to proximal fourth of second segment of endopodite. Basipodite subtriangular, lateral margin longer than medial. Small setule near middle of lateral margin. Endopodite two-thirds as long as exopodite. Basal segment comprising one fourth of ramus, with 1 seta at middle of medial margin. Terminal segment with indication of 2 ingredient segments, as demonstrated by elongation and pattern of armature and ornamentation. Terminal segment bearing 5 medial setae, 2 terminal setae, 1 lateral seta. Exopodite with characteristic medial curvature. Basal segment long, with 1 spine at distal lateral corner and 1 seta at middle of medial margin. Second segment short, with 1 lateral spine and 1 minute medial setule. Terminal segment long, with 3 lateral spines, 1 terminal spine, 1 terminal setule, and 3 minute medial setules.

Third legs (figs. 16, *m*, *n*, Table I) markedly resembling second legs. Intercoxal plate modified. Medial seta of coxopodite much reduced. No setule on second segment of exopodite.

Fourth legs (figs. 16, *o*, *p*, Table I) in general similar to second and third legs, with following exceptions : Coxopodite lacking seta. Terminal segment of endopodite (fig. 16, *p*) with 4 medial setae. Basal and second segments of exopodite without setules, terminal segment with 2 medial setules.

Fifth legs and caudal rami : Fifth legs (fig. 16, *q*) bimerous, basal segment obscurely articulated with body surface, pair fused into a single plate. Small setule on distal lateral corner of basal segment. Second segment long, reaching to middle of second urosomal segment, bearing terminally a slender lateral seta and a minute medial setule. Rows of spinules ornamenting medial margin.

Caudal ramus (fig. 16, *r*) truncate cone, medial margin shorter than lateral, greatest length about 1.8 times greatest width, and about 1.2 times as long as perianal ring, measured on ventral surface. Four stout hooks, 2 ventral, 2 dorsal, found on distal margin. Lateral seta at approximate middle of lateral face. Dorsal seta at distal two-fifth of dorsal margin.

REMARKS : The animal is transparent, with reddish purple ova in the oviduct. The brood pouch in the holotype was empty.

We describe this scantily represented from as a new species because we are convinced the specimen is normal and anatomical details except for the dorsal processes are confirmable in a second, immature specimen, Further, there appears to be host specificity among mediterranean Notopterophores, at least as far as the habitus of the adult female is concerned. Anatomical bases for separation of this species lie only in the segmentation and armature of the antennule; and in the form of the dorsal body processes. More subtle reenforcing evidence, difficult to interpret with the few specimens available, lies in the proportions of the segments of the rami of the legs, the lengths of the elements of armature, and perhaps the coloration of the ova in the oviducts and embryos in the broodpouch. Ova in *N. elatus* and *N. elongatus* are light green, the embryos varying from light true green to yellowish-green, with age.

BOTACHUS Thorell, 1859.

The treatment of ILLG (1958), which follows THORELL (1859), and SARS (1921) is adopted here.

BOTACHUS CYLINDRATUS Thorell, 1859.

From *Ascidia mentula* (Müller) :

Mixed trawl : (1) near Port-Vendres — north, 70 m, (2) northeast of Port-Vendres, 60-30 m, May 6, 1958, many females, males developmental stages.

Northeast to south of Cap Peyrefite, 60-50 m, May 29, 1958. Cap l'Abeille, 25 m, June, 3 1958, two females.

BONNIERILLA ARCUATA Brément, 1909, *species incerta sedis.*

Our study of *Bonnierilla arcuata* Brément reveals that in important features the species differs strongly from our concept of *Bonnierilla.* The antenna bears a long seta on the distal inner margin of the basal segment, rather than a small setule. The fifth legs are reduced, as compared with those of species of *Bonnierilla.* A modified perianal ring, upon which the caudal rami insert, is markedly different from the simpler anal segment of species of *Bonnierilla.* The caudal rami are prehensile with striking anatomical differentiation, so differing from the rather generalized notodelphyid rami of *Bonnierilla.* Further, we find that in practically every basic detail, appendages, perianal ring and caudal rami in this form correspond to those of *Ustina clarki* Illg, 1951. Referring the specific level of variation of the elements thus compiled for *B. arcuata* and *U. clarki* to those found in *Goniodelphys trigona* Buchholz, 1869 and in the two species of *Notopterophoroides* Schellenberg, 1922, leads us to conclude that *G. trigona*, *B. arcuata*, *N. armadillo* Schellenberg, *N. malacodermatus* Schellenberg and *U. clarki* might well in the light of present knowledge be included in a single generic concept. This becomes, admittedly, one of almost unsupportably great discrepancy and variability, but is more congruous than the classification adhered to prevously. Discovery of more species and refinement of knowledge of the anatomy of BUCHHOLZ' and SCHELLENBERG'S species may serve to provide grounds either for combining the species into one genus or for redispersing these forms into more soundly conceived categories. We present below a discussion, based on females, of unifying characters and also the differentiating characters which distinguish the species.

The antennule, of 7 or 8 segments, apparently has a basically similar plan throughout. The antenna is trimerous with at least 1 well-developed, long, plumose seta inserted on the distal inner corner of the basal segment. The maxillule is distinctive in that the exopodite bears 3 setae. The maxilla is pentamerous, with endites well-developed and 3 setae borne on the basal endite. In the first legs there is no seta on the inner corner of the coxopodite; the lateral seta of the basipodite is well-developed and about as long as or longer than the exopodite. There is no seta on the basal segment of the endopodite. Although all the anatomical information is not available to us, indications are strong that the first leg is highly modified and distinctive for this series of species. It is also characteristic for great modifications to occur in the second to fourth legs, which may consist of elongation of segments or rami; conversion of setae to stiffened or spiniform elements;

bizarre transformations of elements of armature, various in the species; tendency to loss of armatural elements; exaggerations and reductions in certain setae; and a tendency toward suppression of segmentation of endopodites. Any or all of these transformations may occur in certain other notodelphyid genera, including the genus *Bonnierilla* Fifth legs are very small, tending to great reduction, and with a single seta on the terminal segment. The anal segment is modified as a perianal ring with double ventral pads and some specialization of the integument. The very characteristic caudal rami are short, sclerotized and with some heavy, articulated claws, clearly of prehensile nature.

The species range from very small to medium large, *B. arcuata* .83 mm, *N. armadillo* 1.9 mm, *G. trigona* 2.0 mm, *U. clarki* 2.2 mm, and *N. malacodermatus* 3.4 mm in overall length. The body is heavily sclerotized in *N. armadillo* and *U. clarki*, moderately so in *B. arcuata* and weakly sclerotized in *N. malacodermatus*. The incubatory pouch is included entirely in the fourth leg-bearing segment in *N. armadillo* extends into the segment preceding in *U. clarki* and *N. malacodermatus* and extends to the anterior end of the second leg-bearing segment in *B. arcuata*. The antennule is 7- segmented in *N. armadillo* and *N. malacodermatus*, 8-segmented in *G. trigona*, *B. arcuata*, and *U. clarki*. In *G. trigona*, *B. arcuata*, *U. clarki* and *N. armadillo*, the falcate process of the second segment of the maxilla is weak, in *N. malacodermatus* it is stout. The endopodite of the first leg is bimerous in *N. armadillo*, *B. arcuata* and *U. clarki*, trimerous in *G. trigona* and *N. malacodermatus*. In legs 2 to 4, the endopodite is trimerous in *G. trigona* *N. malacodermatus* and *N. armadillo* bimerous in *B. arcuata* and *U. clarki*. In proportional lengths of segments and rami of the swimming legs and in the armature, the species are distinctive. The second segment of the fifth leg in *N. armadillo* is much longer than the basal segment and so much different from the other species in which this segment is very short or reduced to a mere process. The caudal ramus of *N. armadillo* and probably *N. malacodermatus* has 2 claws and 2 setae that of *U. clarki* has 2 claws and 3 setae, that of *B. arcuata* has 3 claws and 3 setae, and that of *G. trigona* apparently has 2 claws and 4 setae.

A most disconcerting discrepancy in the reference of *B. arcuata* to this group is in its occurrence in compound tunicates of the family *Didemnidae* Giard, while the other species are from solitary tunicates. *N. armadillo* is from *Ascidia latesiphonica* and *A. gemmata*. *N. malacodermatus* is from *A. canelata* and *U. clarki* from a small solitary Tunicate. We have found an immature specimen of *G. trigona* at Naples in *Ascidiella aspersa*. Equally troublesome is the character of the incubatory cavity, in *N. arma-*

dillo, *N. malacodermatus*, and *U. clarki* clearly posterior and occupying only the fourth or third and fourth leg-bearing segments, but in *B. arcuata* extending from the fourth to the anterior end of the second leg-bearing segments. We have seen no variation in this feature of *B. arcuata* but BRÉMENT, the author of the species, very possibly did find specimens with fewer segments involved in the incubatory cavity, since he emended the diagnosis of *Bonnierilla* in this regard to accomodate his species (BRÉMENT, 1909, pp. 62-63). The incubatory cavity is doubtless a character of great significance but we have concluded that it should not out-weigh the evidence derived from anatomical details of the appendages. We are thus brought to consider that the development of the incubatory cavity, being adaptive, is a character of evolutionary plasticity under certain circumstances. We remain convinced that ordinarily in the Notodelphyids the segmental composition of the incubatory cavity, when there is also correspondence of appendages, is a diagnostic character of generic weight. In the many specimens of Notodelphyids we have examined we have been struck by the constancy of the incubatory cavity among specimens of any given species.

BONNIERILLA ARCUATA Brément, 1909 (Figures 17-18, Table I).

Specimens examined :

From *Trididemnum tenerum* Verrill :

Mixed trawl : (1) near Port-Vendres, 70 m (2) near Port-Vendres, northeast, from 60-30 m, May 6, 1958, 1 female.

From *Polysyncraton lacazei* Giard :

Cap l'Abeille, 25 m, June 3, 1958, 3 females.

From didemnid, probably *Trididemnum* sp. :

Presumably near Banyuls, CHATTON number 337, 2 females.

From ?*Didemnum dentatum* della Valle (CHATTON manuscript identification- *Leptoclinum dentatum*) :

From Troc to l'Abeille, October 23, 1910, CHATTON number 131, 3 females.

From ?*Didemnum maculosum* Milne Edwards (CHATTON manuscript identification- *Leptoclinum dentatum-maculosum*) :

From Troc to l'Abeille, November 3, 1910, CHATTON numbre 143 1 female.

Figure 17, *a-j*, « *Bonnierilla* » *arcuata*, female : *a*, habit, lateral; *b*, urosome (1); *c*, rostrum (2); *d*, antennule (2); *e*, antenna (3); *f*, apex of terminal segment of antenna (4); *g*, mandible (3); *h*, maxillule (2); *i*, maxilla (2); *j*, maxilliped (2). Lengths represented by scales : (1) — .2 mm; (2) — .1 mm; (3) — .1 mm; (4) — .05 mm.

From ?*Didemnum* sp. (CHATTON manuscript identification- « leptocline blanc ») :

Baie de Banyuls, November 11, 1910, CHATTON number 152, 1 female.

From ?*Diplosoma gelatinosum* var. *listerianum* Milne Edwards (CHATTON manuscript identification- *Diplosoma spongiforme*) :

Port-Vendres, September 19, 1912, CHATTON number 159, 4 females.

North of Argelès to Canet, October 12, 1912, CHATTON number 165, 1 female.

DESCRIPTION :

Female (figs. 17, 18, Table I) : General features : Body (fig. 17, *a*). 83 mm total length, average of 4 specimens, measured on continuous arc along axis of body, seen in profile, from anteriormost point on cephalosome to end of caudal ramus, a very small species. Body regions : cephalosome, metasome, urosome. Cephalosome supporting appendages through first legs. Metasome of 3 leg-bearing segments, poorly delimited from each other laterally, but with well-defined tergal plates. Incubatory cavity occupying entire metasome, in incubating females vaulting body surface dorsally. Articulation of metasome and urosome between anatomically thoracic segments of fourth and fifth legs. Urosome (fig. 17, *b*) with small amount of taper posteriorly, of 4 segments and perianal ring supporting caudal rami. Perianal ring here considered a segment. Segments heavily sclerotized, segments 3 and 4 each contracted into next preceding segment. Proportional length of segments : 2 : 2.7 : 3 : 3 : 1. Conspicuous genital apparatus, with vulva opening at ventral midline at posterior border of first segment, and sclerotized seminal tubes diverging through first urosomal segment to last metasomal segment.

Apex of head bending abruptly into subtriangular flattened rostrum bearing terminal sclerotized point (fig. 17, *c*).

Head appendages : Eight-segmented antennule (fig. 17, *d*) short, stout, with heavily sclerotized segments. Second segment including proximal triangular setiferous piece often set off as free segment in notodelphyids. Third segment probably representing more than one segment, as indicated by heavy sclerotized anterior line almost dividing segment 2 and by setal armature apparently also indicative of multiple composition. Basal 2 segments wider than remaining. Setal formula : Segment I — 2 setae; II — 14 setae; III — 8 setae; IV — 3 setae; V — 2 setae, 1 aesthete; VI — 2 setae; VII — 3 elements, one of which may be an aesthete; VIII — 6 setae, 1 aesthete.

Antenna (fig. 17, *e*) trimerous. Segments of following proportional lengths, basal to distal : 5.5 : 3.7 : 5. Elongate plumose seta articulating on inner distal corner of first segment. Second segment with seta inserted at distal fourth near outer margin and reaching to proximal third of terminal segment. Terminal segment with group of 3 weak setae at distal two fifths on surface. Terminal margin (fig. 17, *f*) with short, slender curved hook, 3 curved, stiffened, blunt-ended setae, and 2 more flexible, short, pointed setae. Another flexible seta articulating on inner margin a slight distance proximal to hook. Longest seta of terminal group about equal to length of terminal segment.

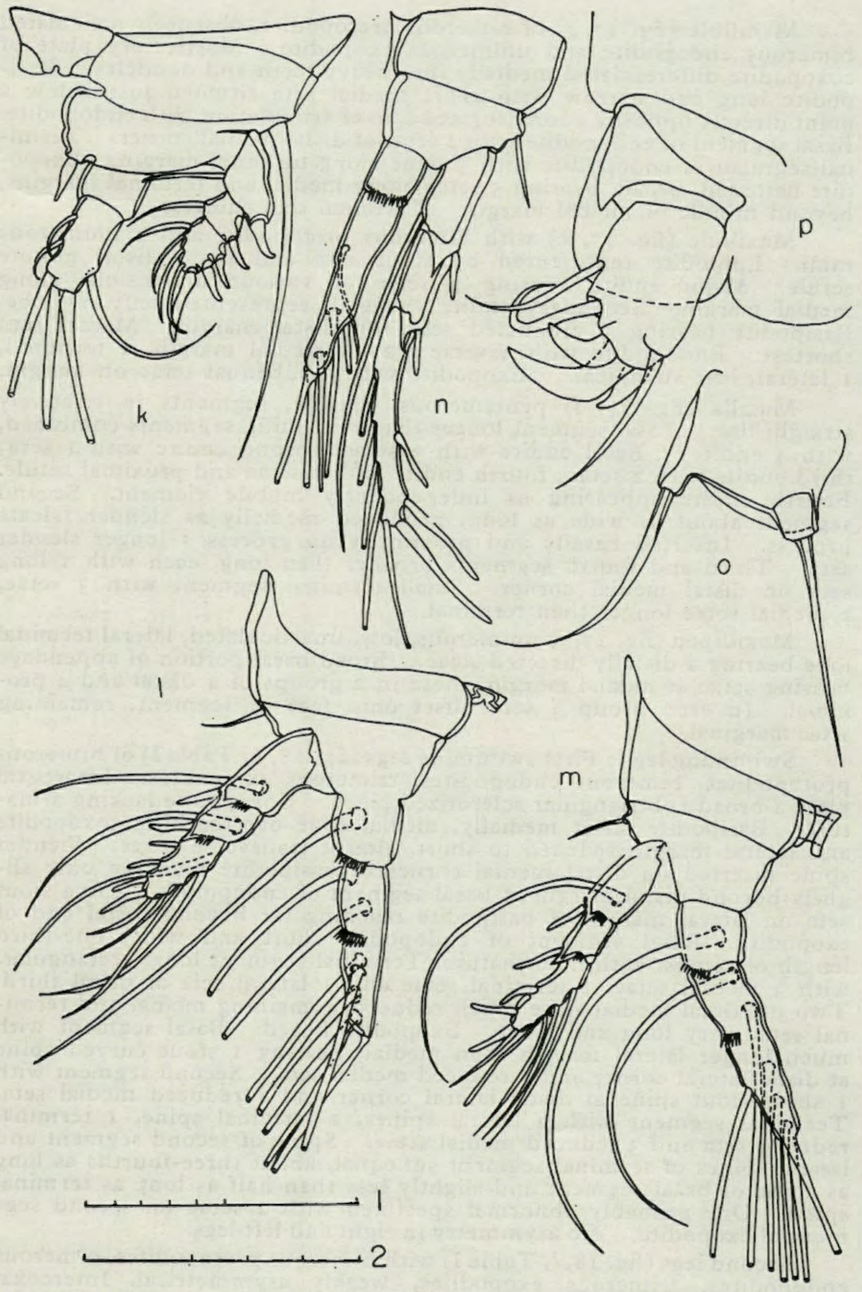

Figure 18, *k-p*, « *Bonnierilla* » *arcuata*, female : *k*, first leg (1); *l*, second leg, right; *m*, third leg, right; *n*, fourth leg, left; *o*, fifth leg (2); *p*, caudal ramus (2). Lengths represented by scales : (1) — .1 mm; (2) — .05 mm.

Mandible (fig. 17, *g*) of bimerous protopodite, obscurely articulated bimerous endopodite and unimerous exopodite. Masticatory plate of coxopodite differentiated medially into heavy teeth and denticles. Basipodite long and narrow with short medial seta situated just below a point directly opposite poorly formed line of articulation with endopodite. Basal segment of endopodite with 2 setae at distal medial corner. Terminal segment of endopodite with 5 setae along terminal margin. Exopodite flattened, broad, bearing 5 setae along medial and terminal margins, beyond middle of medial margin. Terminal seta shortest.

Maxillule (fig. 17, *h*) with bimerous protopodite and 2 unimerous rami. Epipodite represented by stout seta and more distal minute setule. Major endite bearing 7 setae of various dimensions along medial margin. Secondary endite vestigial, represented only by lobe. Basipodite bearing 3 graduated setae on distal margin. Medial seta shortest. Endopodite with 4 setae : 2 on medial margin, 1 terminal, 1 lateral, just subapical. Exopodite with 3 subequal setae on margin.

Maxilla (fig. 17, *i*) pentamerous, narrow, segments in relatively straight line. Basal segment longer than remaining segments combined, with 4 endites. Basal endite with 3 setae; second endite with 1 seta; third endite with 2 setae; fourth endite with 2 setae and proximal setule. Fourth endite appearing as independently mobile element. Second segment about as wide as long, produced medially as slender falcate process. Inserted basally and proximally on process 1 longer slender seta. Third and fourth segments broader than long, each with 1 long seta on distal medial corner. Small terminal segment with 3 setae, 2 medial setae longer than terminal.

Maxilliped (fig. 17, *j*) unimerous, low, unarticulated, lateral terminal lobe bearing 2 distally directed setae. Broad basal portion of appendage bearing setae at medial margin, these in 2 groups of 4 distal and 4 proximal. In each group 1 seta offset onto face of segment, remaining setae marginal.

Swimming legs : First swimming legs (fig. 18, *k*, Table I) of bimerous protopodites, bimerous endopodites, trimerous exopodites. Intercoxal plate a broad subtriangular sclerotized piece. Coxopodite lacking armature. Basipodite offset medially, medial edge overreaching coxopodite and lateral margin reduced to short, almost transverse ledge. Slender spine inserted on distal medial corner of basipodite reaching only slightly beyond distal margin of basal segment of endopodite. Long stout seta on lateral margin of basipodite reaching far beyond distal end of exopodite. Basal segment of endopodite short and wide, one-third length of ramus, with no armature. Terminal segment long, rectangular, with 3 medial setae, 2 terminal setae and 1 lateral seta at distal third. Two proximal medial setae much reduced, remaining medial and terminal setae very long and stout. Exopodite flexed. Basal segment with much longer lateral margin than medial, bearing 1 stout curved spine at distal lateral corner and 1 reduced medial seta. Second segment with 1 short stout spine at distal lateral corner and 1 reduced medial seta. Terminal segment with 2 lateral spines, 1 terminal spine, 1 terminal reduced seta and 3 reduced medial setae. Spine of second segment and lateral spines of terminal segment subequal, about three-fourths as long as spine of basal segment and slightly less than half as long as terminal spine. One probably abnormal specimen with 2 setae on second segment of exopodite. No asymmetry in right and left legs.

Second legs (fig. 18, *l*, Table I) with bimerous protopodites, bimerous endopodites, trimerous exopodites, weakly asymmetrical. Intercoxal plate much reduced. Coxopodite with no armature. Right leg (fig.

18, *l*) : Basipodite with short lateral seta reaching to middle of basal segment of exopodite. Endopodite slightly longer than exopodite. Basal segment of endopodite comprising less than one-third of ramus, with insertion of usual medial seta displaced to posterior surface, indicating rotation of ramus. Second segment with indication of 2 ingredient segments, demonstrated by elongation, pattern of armature and ornamentation. With 5 anatomically medial setae inserted on posterior surface, 2 terminal setae, 1 anatomically lateral seta at distal third of anterior surface. All setae of endopodite very long, more than twice as long as longest seta of exopodite. Exopodite in contour presenting no evidence of rotation, but 3 most proximal setae displaced onto posterior surface. Basal segment with 1 weak spine at distal lateral corner and 1 anatomically medial seta at distal fourth on posterior surface. Second segment with 1 weak spine at lateral distal corner and anatomically medial seta near middle of posterior surface. Terminal segment with 3 weak lateral spines, 1 terminal weak spine, 1 terminal reduced seta, 4 setae at or near medial margin. Terminal medial seta much reduced, other medial setae of moderate length. Well-developed sclerotization of all parts of leg obvious marginally. Lateral marginal sclerotizations of exopodite extending as flattened pointed scalelike projections just medial to points of insertion of spines of basal and seconds segments. Left Leg : Asymmetry shown only by longer spines and setae of terminal segment of exopodite.

Third legs (fig. 18, *m*, Table I) with protopodites and endopodites very similar to those of leg 2. Asymmetry more pronounced than in leg 2. Right leg (fig. 18, *m*) : Basal segment of exopodite with weak lateral spine, anatomically medial seta displaced onto posterior surface at distal third. Second segment with 1 weak lateral spine and integumental pit on posterior surface marking site of insertion of usual seta, here absent. Terminal segment with 2 weak lateral spines above middle, 1 terminal spine, 1 terminal reduced seta and 4 marginal medial setae. Left leg : Asymmetry shown by following : Long seta of posterior surface of basal segment of exopodite lacking; anatomically medial setule on posterior surface of second segment; spines and setae of terminal segment much longer than in right leg.

Fourth legs (fig. 18, *n*, Table I) with protopodites longer and narrower than those of preceeding legs, but similar in composition. Differing markedly from preceeding legs in setation of endopodites and outline of exopodites. Asymmetrical. Left leg (fig. 18, *n*) : Basal segment of endopodite one fourth as long as terminal segment, with no armature. Second segment with 3 anatomically medial setae displaced onto posterior surface, 2 terminal setae, 1 lateral seta at distal third. Exopodite extremely elongate, slightly less than 2 times as long as endopodite. Basal segment with 1 weak lateral spine, 1 long medial seta. Second segment with only 1 weak lateral spine. Terminal segment with 2 weak lateral spines, 1 weak terminal spine, 1 long terminal seta and 4 long medial setae. Terminal lateral and terminal spines long, 2-2.5 times as long as proximal lateral spine of terminal segment. Right leg : Endopodite slightly longer in proportion to exopodite than in left leg. Individual variability demonstrated in this appendage among specimens studied, one specimen having on terminal segment of endopodite a setule on the posterior surface extending proximally the anatomically medial row of setae; a second specimen exhibiting at this point a pit only. First specimen also with setule on posterior surface of basal segment. Further demonstration of asymmetry in shorter spines and setae of terminal segment of exopodite.

Fifth legs and caudal rami : Fifth legs (fig. 18, *o*) small rectangular plates ending in lateral and medial conical setiferous protuberances, without obvious articulation with general body surface. Lateral and medial protuberances similar, each with long terminal seta.

Caudal ramus (fig. 18, *p*) with very complicated insertion on perianal ring. Terminal margin with 3 stiffened stout hooks, strongly bent ventrally. A dorsal seta articulating just proximal to group of hooks and 2 setae on ventral lateral surface proximal to group of hooks.

REMARKS : No males have been found for this species. Spe cimens collected in 1958 were transparent, with green ova in oviducts; some from Naples had embryos in the incubatory cavity which were reddish-orange due to presence of some reddish-orange yolk globules among clear yolk globules. In the original description, BRÉMENT gives as the color « blanc grisâtre uniforme. Œil rouge. Yeux des embryons incubés rouges ».

Specimens collected in 1958 were obtained by teasing and shredding of host colonies, so exact localization of the copepods in the ascidian was not determinable. At Naples, however, specimens were obtained from common cloacal chambers of *Didemnum maculosum*. BRÉMENT recorded that he obtained his specimen from the branchial cavities of the hosts.

All specimens so far known of this Copepod have been taken from hosts of the family *Didemnidae* Giard, thus indicating a high degree of host affinity.

BONNIERILLA Canu, 1891

BONNIERILLA Canu, 1891. — Illg, 1958 (part).

By removing from this genus *Bonnierilla arcuata* Brément, as discussed above, although we have not definitively assigned that species, we have a genus in which all species exhibit essentially the same habitus and form of appendages. In all, there is a great similarity in the segmentation of the antennules, in the modification of the mandibular palp and in the composition and armature of the maxilliped. In the swimming legs, there are general tendencies toward bizarre elongation, asymmetry, and modification of armature. In all, the incubatory cavity extends to the anterior limit of the metasome.

Our research adds two species to the known fauna of the Mediterranean Sea, one providing a zoogeographic extension, one described below as new. The forms from Banyuls may be differentiated as follows : *Bonnierilla longipes* (Kerschner) possesses a characteristic posterior sculptured margin of the cephalosomal shield, conspicuous even in gross examination. *B. similis*, new species, lacks this collar and possesses modifications of the terminal armature of the antenna. It can be differentiated from the remaining species by the presence of normal, inconspicuous fifth legs. *B. armata* Schellenberg lacks the cephalosomal collar and is strikingly distinctive in the possession of large fifth legs with enormously long, conspicuous ornamenting setae.

BONNIERILLA LONGIPES (Kerschner), 1879.

For synonomy and distribution see Illg (1958).

From *Pyura* sp. :

Cap Oullestreil, November 7, 1957, M^lle^ Kerneïs, collector, 1 female.

BONNIERILLA ARMATA Schellenberg, 1922, (Figures 19-20, Table I).

Specimens examined :

From *Ciona roulei* Lahille :

Mixed trawl : (1) north of Port-Vendres, 70-30 m, (2) off Cap Béar in Anse de Paulilles, 50 m, May 28, 1958, 1 female.

Description :

Female (figs. 19, 20, Table I) : General features : Body (fig. 19, *a*) 2.28 mm total length, measured an continuous arc running though body seen in profile, from anteriormost point on cephalosome to end of caudal ramus. Body regions cephalosome, metasome, urosome. Cephalosome supporting appendages through first legs. Cephalosomic shield with blunt lateral posterior corners, no sculptured cuticular collar. Metasome of 3 poorly defined leg-bearing segments, with no tergal plates. Incubatory cavity extending from segment of fourth legs anteriorly to margin of metasome, in incubating females vaulting body dorsally. Articulation of metasome and urosome between fourth and fifth leg-bearing segments. Urosome (fig. 19, *b*) of 6 articulated elements, anatomical segmental composition not obvious, of following proportional lengths anterior to posterior : 1 : .9 : 2.2 : 1.8 : 1.2 : 2.3. Fifth legs borne on first articulated element. Vulva opening at ventral midline at anteriormost limit of third urosomal element, sclerotized seminal tubes diverging from vulva immediately into second urosomal element. Morphological identity of third, urosomal element not apparent from adult anatomy. Position of vulva exceptional for a notodelphyid genital segment.

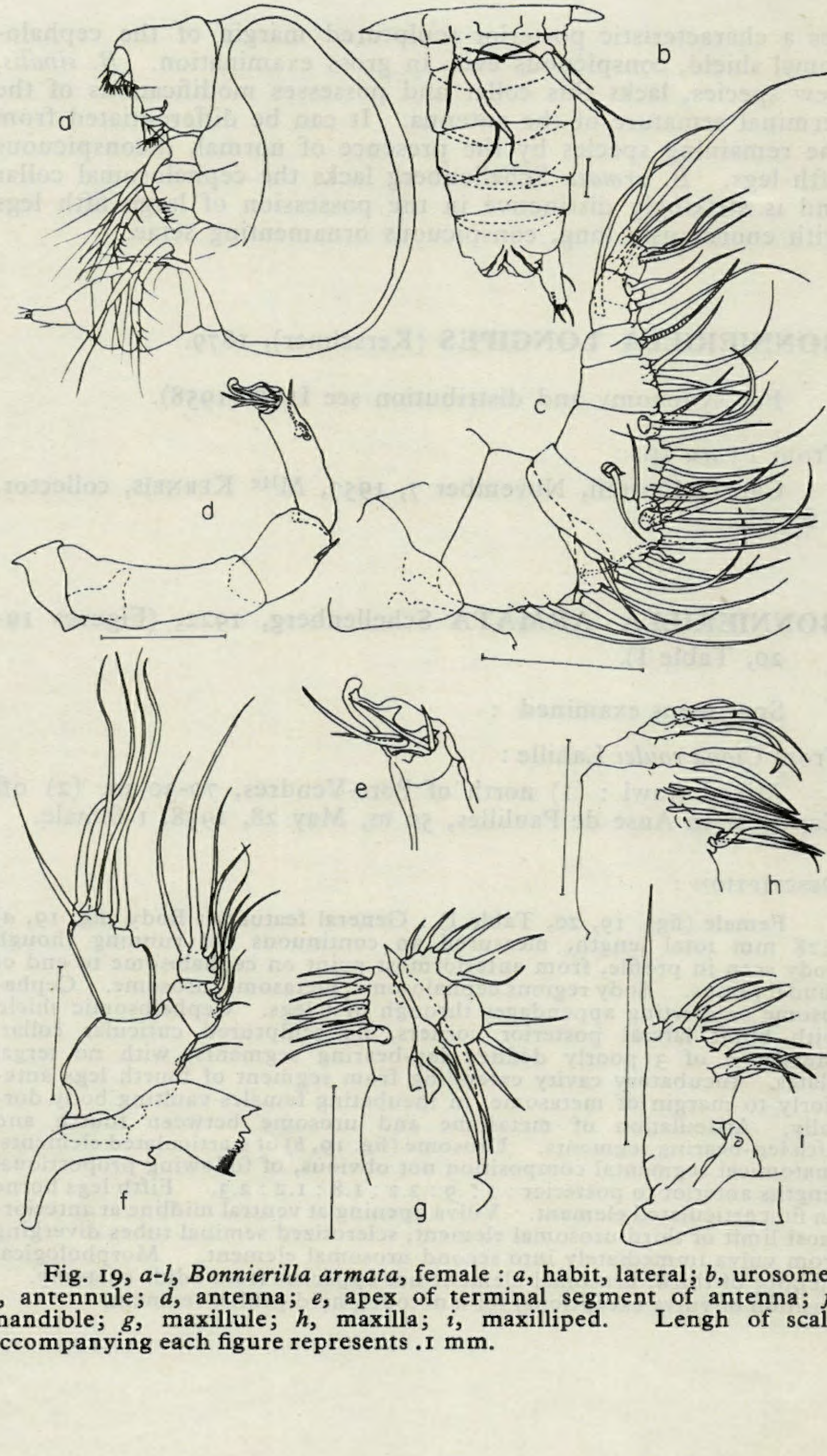

Fig. 19, *a-l*, *Bonnierilla armata*, female : *a*, habit, lateral; *b*, urosome; *c*, antennule; *d*, antenna; *e*, apex of terminal segment of antenna; *f*, mandible; *g*, maxillule; *h*, maxilla; *i*, maxilliped. Lengh of scale accompanying each figure represents .1 mm.

Apex of head prolonged ventrally into short subtriangular rostrum.

Head appendages : Seven-segmented antennule (fig. 19, *c*) short, reaching only to anterior third of cephalosome. Second segment including proximal triangular setiferous piece often set off as complete free segment in Notodelphyids. Segment 3 probably representing more than 1 segment, since anterior line almost divides segment and setal armature indicates multiple composition. Segment 6 also probably representing 2 segments, since strong integumental indentation found on one surface and setal armature also indicative of multiple composition. Setal formula : Segment I — 3 setae; II — 15 setae, 1 hook; III — 9 setae, 1 aesthete; IV — 4 setae; V — 1 seta, 1 aesthete; VI — 4 elements; VII — 6 elements.

Antenna (fig. 19, *d*) trimerous. Proportional lengths of segments basal to distal : 7 : 3.5 : 5.5. Second segment with short setule at distal fourth of outer margin. Terminal segment with 2 separated setules inserted on surface near outer margin at approximately distal third. Terminal margin (fig. 19, *e*) with stout apically curved hook, 5 setae.

Mandible (fig. 19, *f*) of bimerous protopodite, bimerous endopodite. unimerous exoposite. Masticatory plate of coxopodite differentiated medially into 5 distal heavy teeth, row of fused denticles and proximal setule. Basipodite broad, with seta at distal third of medial margin. Basal segment of endopodite with 4 graduated setae around distal medial corner. Terminal segment with 5 setae around distal and medial margins. Exopodite a long, flattened plate, with 4 long subequal setae above middle of medial margin and a shorter terminal seta.

Maxillule (fig. 19, *g*) with bimerous protopodite, unimerous rami, Epipodite represented by stout seta and more distal setule. Major endite bearing 8 setae of various dimensions along medial margin. Secondary endite massive, outline tapering from wide base to flat triangular terminal lobe. Basipodite with 3 graduated setae on distal margin. Endopodite reduced, with 1 medial seta, 1 terminal seta, 1 lateral seta. Exopodite large, with 4 setae on margin.

Maxilla (fig. 19, *h*) pentamerous. Basal segment comprising most of mass of appendage, with 4 endites. Basal endite with 3 setae; second endite with 1 seta; third endite with 2 setae; fourth endite with 2 setae, 1 proximal setule. Second segment longer than wide, produced medially into stout, long, falcate process. Inserted basally on process 1 slightly longer seta. Third and fourth segments each with 1 seta on distal medial corner. Small terminal segment with only 2 setae.

Maxilliped (fig. 19, *i*) unimerous, with 1 terminal seta and 2 groups of setae on medial margin. In each group of 5 setae, 1 seta offset onto face of segment, remaining setae at or near margin. Swimming legs : First swimming legs (fig. 20, *j*, Table I) with bimerous protopodites, trimerous rami. Intercoxal plate elongate, subtriangular. Coxopodite lacking armature. Basipodite with long medial margin, short lateral margin, on which articulating 1 long, stout seta surpassing endopodite in length. Spine usually present at distal medial corner of basipodite in Notodelphyids here lacking. Basal segment of endopodite wider than remaining segments, with short seta at middle of medial margin. Second segment with 1 seta on surface near distal third of medial margin. Terminal segment with 1 reduced medial seta at distal third, 1 long stout distal medial seta, 2 long, stout, terminal setae, 1 shorter, lateral seta, articulating on surface at approximate middle of segment. Basal segment of exopodite about equalling combined lengths of remaining segments, with 1 long spine at distal lateral corner and 1 seta at about middle of medial margin. Second segment with 1 long spine at distal lateral corner. Terminal segment with 3 long lateral spines, 1 long terminal spine, 1 terminal setule, 3 setules articulating on surface of segment near medial margin. All lateral spines subequal, slightly less than two-thirds of length of terminal spine. No asymmetry.

Second legs (figs. 20, *k*, *l*, Table I) with slender bimerous protopodites, trimerous rami. In our specimen, with somewhat damaged armature, no apparent asymmetry. Coxopodite without armature. Basipodite with short seta at distal lateral margin. Endopodite with short, wide, basal segment, one-fourth as long as remainder, and with terminal segment notably elongate and of characteristic outline. Basal segment with single seta at middle of medial margin, second segment with 2 setae on surface, near medial margin, terminal segment with 3 setae on surface, 2 terminal setae, and 1 seta on opposite surface, probably representing lateral seta. Exopodite (fig. 10, *l*) about one-third longer than endopodite, flexed. Basal segment longer than either of remaining segments, with 1 short stiffened setiform spine on surface near distal lateral corner and 1 seta on distal third of opposite surface. Second segment with 1 setiform spine at lateral distal corner and 1 seta on surface near medial distal corner. Terminal segment with 3 lateral setiform spines, 1 terminal spine with peculiar basal expansion, 1 terminal seta, 4 setae on surface near medial margin.

Third legs (figs. 20, *m*, *n*, Table I) slightly asymmetrical. One leg in general similar to second legs, except that endopodite longer in proportion to exopodite; peculiar flanges bearing spinules on distal margins of first and second endopodite segments; terminal segment of exopodite with only 2 lateral setiform spines. Other leg with spines of exopodite (fig. 20, *n*) shorter, stouter, less modified.

Fourth legs (figs. 20, *o*, *p*, Table I) asymmetrical to about same extent as third legs, but in low degree. One leg differing from third leg of same side by having endopodite longer in proportion to exopodite; with only 5 setae on terminal segment of endopodite; apex of endopodite peculiarly rounded. Other leg (fig. 20, *p*) demonstrating asymmetry by having shorter, stiffer spines on lateral and terminal margins of last segment of exopodite.

Fifth legs and caudal rami : Fifth legs (fig. 20, *q*) bimerous, bases arising without obvious articulation from surface of first urosomal segment, joined by narrow uniting plate. Basal segment with long seta on lobe at distal lateral corner. Second segment extremely long and narrow, length 6.2 times greatest width, reaching to approximate middle of fourth urosomal segment. Long seta articulating on lateral margin near distal third, and shorter seta terminal. Medial margin ornamented by curving serrate hyaline flanges (fig. 20, *r*) composed of closely fused fine elements, in about 14 subequally distributed rows.

Caudal ramus (fig. 20, *s*) stout, tapering distally. Greatest length about twice greatest width and about equal to length of anal segment. Three setae articulating on distal margin, central probably longest, as indicated by size of base. Lateral seta articulating at about middle of ramus. Dorsal seta at distal third.

REMARKS : No males are known for the species. The animal is transparent, embryos in the incubating female are green. We have found excellent general conformity with SCHELLENBERG's description of the species. His work is so reduced to

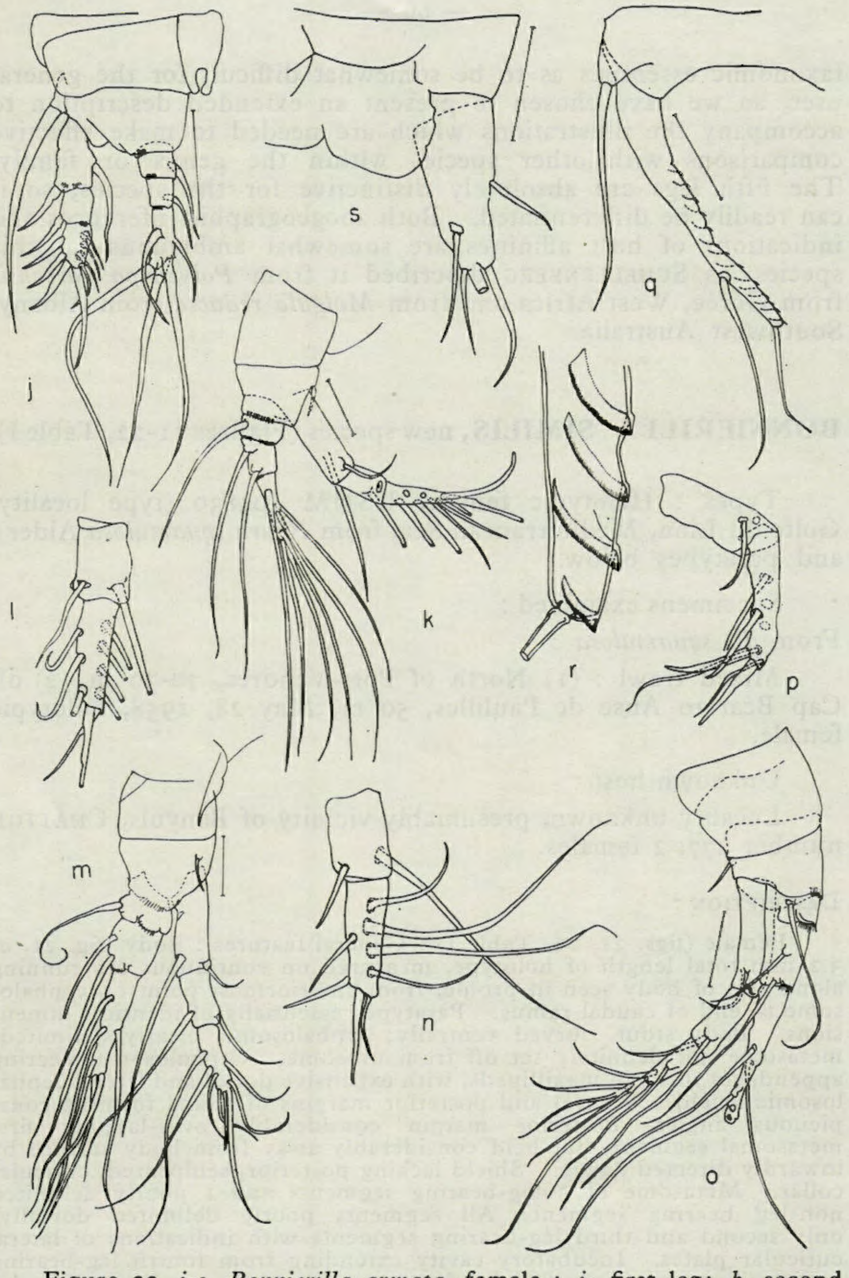

Figure 20, *j-s*, *Bonnierilla armata*, female : *j*, first leg; *k*, second leg; *l*, terminal segments of exopodite of opposite second leg; *m*, third leg; *n*, terminal segments of exopodite of opposite third leg; *o*, fourth leg; *p*, terminal segments of exopodite of opposite fourth leg; *q*, fifth leg; *r*, apex of fifth leg, dorsal view, high power, showing marginal ornamentations; *s*, anal segment and caudal ramus. Length of scale accompanying each figure represents .1 mm.

taxonomic essentials as to be somewhat difficult for the general user, so we have chosen to present an extended description to accompany the illustrations which are needed to make effective comparisons with other species within the genus or family. The fifth legs are absolutely distinctive for the species, so it can readily be differentiated. Both zoogeographic inferences and indications of host affinities are somewhat ambiguous for this species, as SCHELLENBERG described it from *Polycarpa goreensis* from Gorée, West Africa and from *Molgula reducta* from Albany, Southwest Australia.

BONNIERILLA SIMILIS, new species (Figures 21-22, Table I).

Types : Holotypic female, USNM 104830 (type locality, Golfe du Lion, Mediterranean Sea, from *Pyura squamulosa* Alder); and paratypes below.

Specimens examined :

From *P. squamulosa* :

Mixed trawl : (1) North of Port-Vendres, 70-30 m, (2) off Cap Béar in Anse de Paulilles, 50 m, May 28, 1958, holotypic female.

Unknown host :

Locality unknown, presumably vicinity of Banyuls, CHATTON number 277, 2 females.

DESCRIPTION :

Female (figs. 21, 22, Table I) : General features : Body (fig. 21, *a*) 3.2 mm total length of holotype, measured on continuous arc running along axis of body seen in profile, from anteriormost point on cephalosome to end of caudal ramus. Paratypes essentially of identical dimensions. Body stout, curved ventrally; cephalosome, clearly delimited; metasome not definitely set off from urosome. Cephalosome, bearing appendages through maxillipeds, with expansive dorsal and lateral cephalosomic shield. Ventral and posterior margins of shield forming conspicuous angles. Posterior margin considerably over-lapping first metasomal segment, but held considerably away from body surface by inwardly directed flange. Shield lacking posterior, sculptured, cuticular collar. Metasome of 5 leg-bearing segments and 1 poorly delimited non-leg bearing segment. All segments poorly delimited dorsally; only second and third leg-bearing segments with indications of lateral cuticular plates. Incubatory cavity extending from fourth leg-bearing segment anteriorly into first leg-bearing segment, in incubating females vaulting body dorsally. Usually clearly defined articulation between metasome and urosome not developed. Urosome (fig. 21, *b*) of 4 clearly defined terminal segments of body, but morphological identity of first

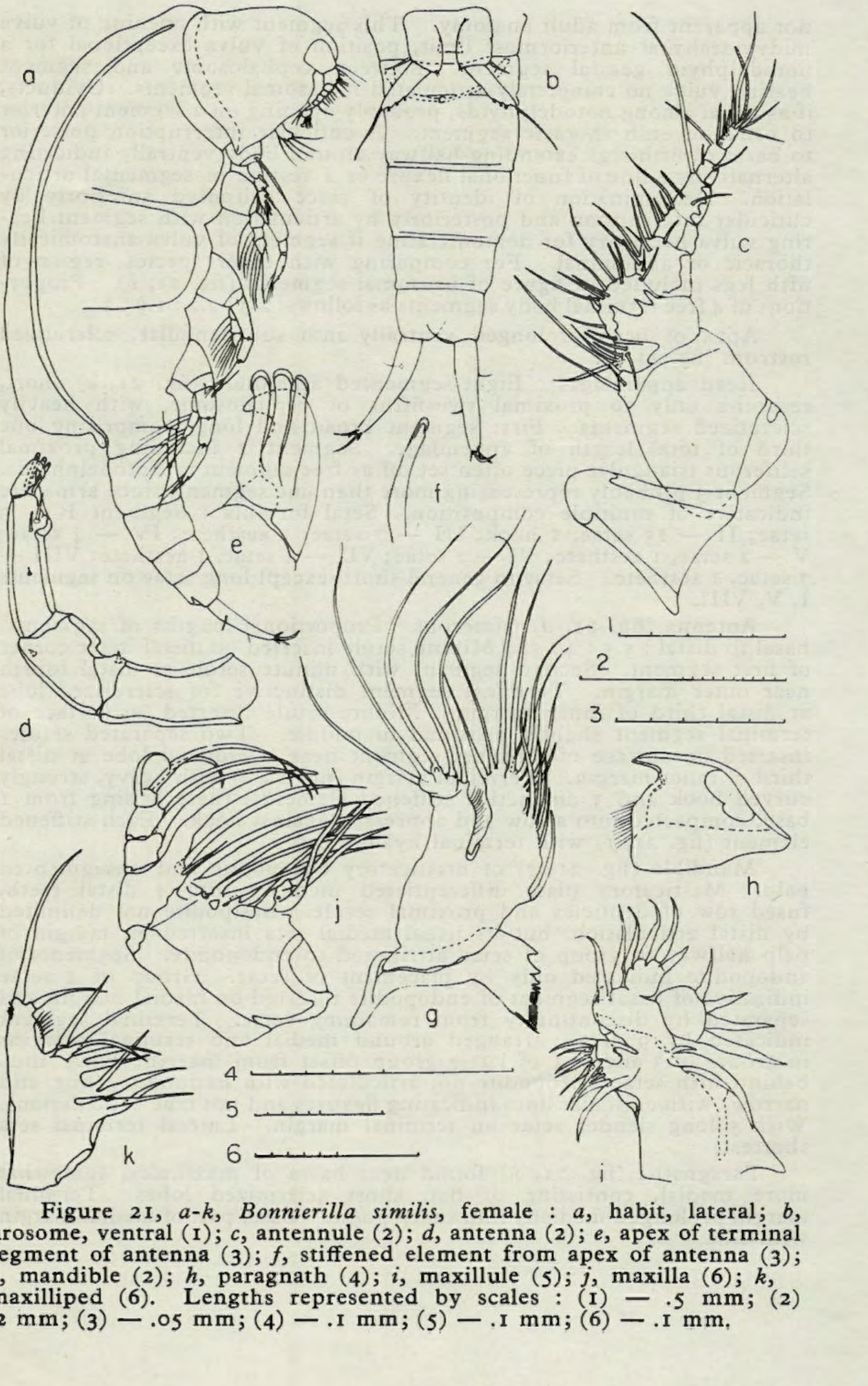

Figure 21, *a-k*, ***Bonnierilla similis***, **female :** *a*, **habit, lateral;** *b*, **urosome, ventral (1);** *c*, **antennule (2);** *d*, **antenna (2);** *e*, **apex of terminal segment of antenna (3);** *f*, **stiffened element from apex of antenna (3);** *g*, **mandible (2);** *h*, **paragnath (4);** *i*, **maxillule (5);** *j*, **maxilla (6);** *k*, **maxilliped (6). Lengths represented by scales : (1) — .5 mm; (2) .2 mm; (3) — .05 mm; (4) — .1 mm; (5) — .1 mm; (6) — .1 mm.**

not apparent from adult anatomy. This segment with opening of vulva midventrally at anteriormost limit, position of vulva exceptional for a notodelphyid genital segment. Between cephalosome and segment bearing vulva no completely articulated metasomal segments. Oviducts, if as usual among notodelphyids, probably opening on a segment anterior to usual seventh thoracic segment. A cuticular interruption posterior to bases of fifth legs extending halfway around body ventrally indicating alternatively a line of functional flexure or a vestige of segmental articulation. Determination of identity of piece delimited anteriorly by cuticular interruption and posteriorly by articulation with segment bearing vulva necessary for demonstrating if segment of vulva anatomically thoracic or abdominal. For comparing with other species, region of fifth legs included in figure of urosomal segments (fig. 21, *b*). Proportions of 4 free terminal body segments as follows: 2.3 : 2.2 : 1.9 : 2 .

Apex of head prolonged ventrally into subtriangular, sclerotized rostrum (fig. 21, *c*).

Head appendages : Eight-segmented antennule (fig. 21, *c*) short, reaching only to proximal two-fifths of cephalosome, with heavily sclerotized segments. First segment broad and long, comprising one third of total lentth of appendage. Segment 2 including proximal setiferous triangular piece often set off as free segment in Notodelphyids. Segment 3 probably representing more than one segment, since armature indicative of multiple composition. Setal formula : Segment I — 3 setae; II — 15 setae, 1 hook; III — 7 setae, 1 aesthete; IV — 4 setae; V — 2 setae, 1 aesthete; VI — 2 setae; VII — 2 setae, 1 aesthete; VIII — 7 setae, 1 aesthete. Setae in general short, except long setae on segments I, V, VIII.

Antenna (fig. 21, *d*) trimerous. Proportional lengths of segments, basal to distal : 5.5 : 4 : 5. Minute setule inserted on distal inner corner of first segment. Second segment with minute setule at distal fourth near outer margin. Terminal segment distinctive for sclerotized lobe at distal third of inner margin. Minute setule inserted on surface of terminal segment slightly proximal to middle. Two separated setules inserted on surface of terminal segment near sclerotized lobe at distal third of inner margin. Terminal margin (fig. 21, *e*) with heavy, strongly curved hook and 3 distinctive stiffened elements, these arising from 1 base, compacted into a row and appressed against hook. Each stiffened element (fig. 21, *f*) with terminal hyaline cap.

Mandible (fig. 21, *g*) of masticatory coxopodite and unsegmented palp. Masticatory plate differentiated medially into 4 distal teeth, fused row of denticles and proximal setule. Basipodite not delimited by distal articulation, but its usual medial seta inserted on margin of palp halfway to group of setae attributed to endopodite. Segments of endopodite indicated only by placement of setae. Group of 4 setae indicative of basal segment of endopodite inserted on medial margin and separated by discontinuity from remaining setae. Terminal segment indicated by 9 setae, arranged around medial and terminal margins in groups of 3 and 6, 1 of latter group offset from margin, lying thus behind fifth seta. Exopodite not articulated with basipodite, long and narrow, with cuticular lines indicating flexures and not true articulations. With 5 long slender setae on terminal margin. Lateral terminal seta shortest.

Paragnaths (fig. 21, *h*) found near bases of maxillules, somewhat more medial, consisting of flat, short sclerotized lobes. Terminal margin prolonged medially into sharp point. Basal part of medial margin with cilia.

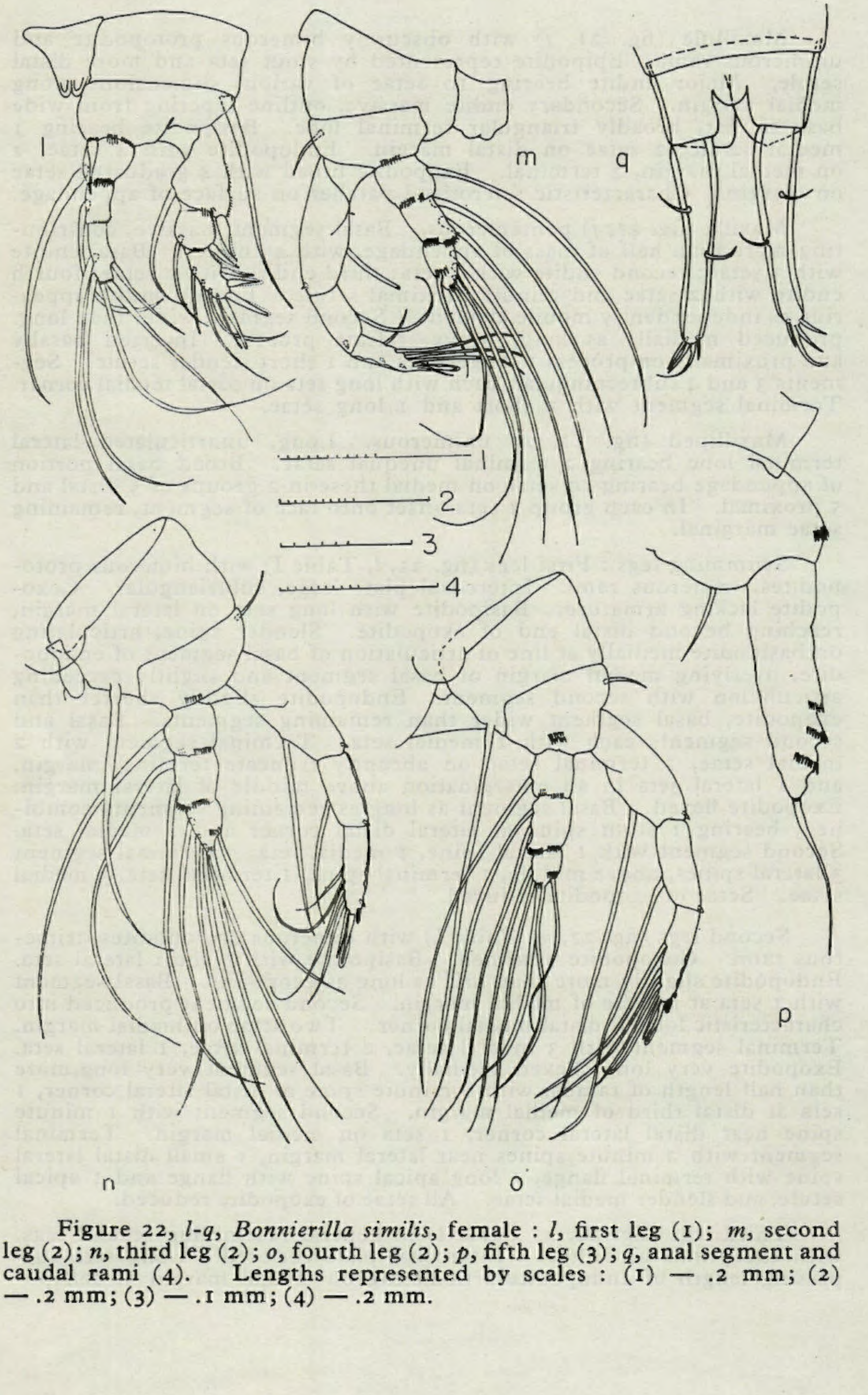

Figure 22, *l-q*, *Bonnierilla similis*, female : *l*, first leg (1); *m*, second leg (2); *n*, third leg (2); *o*, fourth leg (2); *p*, fifth leg (3); *q*, anal segment and caudal rami (4). Lengths represented by scales : (1) — .2 mm; (2) — .2 mm; (3) — .1 mm; (4) — .2 mm.

Maxillule (fig. 21, *i*) with obscurely bimerous protopodite and unimerous rami. Epipodite represented by stout seta and more distal setule. Major endite bearing 10 setae of various dimensions along medial margin. Secondary endite massive, outline tapering from wide base to flat, broadly triangular terminal lobe. Basipodite bearing 1 medial setule, 2 setae on distal margin. Endopodite with 4 setae, 2 on medial margin, 2 terminal. Exopodite broad with 4 graduated setae on margin. Characteristic sclerotized patches on surface of appendage.

Maxilla (fig. 21, *j*) pentamerous. Basal segment massive, contributing more than half of mass of appendage, with 4 endites. Basal endite with 3 setae; second endite with 1 seta; third endite with 2 setae; fourth endite with 2 setae and minute proximal setule. Fourth endite appearing as independently mobile element. Second segment wider than long. produced medially as long, heavy, falcate process. Inserted basally and proximally on process 1 longer seta and 1 short slender setule. Segments 3 and 4 subrectangular, each with long seta on distal medial corner. Terminal segment with 2 short and 1 long setae.

Maxilliped (fig. 21, *k*) unimerous. Long, unarticulated lateral terminal lobe bearing 2 terminal unequal setae. Broad basal portion of appendage bearing 10 setae on medial these in 2 groups of 5 distal and 5 proximal. In each group 1 seta offset onto face of segment, remaining setae marginal.

Swimming legs : First legs (fig. 22, *l*, Table I) with bimerous protopodites, trimerous rami. Intercoxal plate large, subtriangular. Coxopodite lacking armature. Basipodite with long seta on lateral margin, reaching beyond distal end of exopodite. Slender spine, articulating on basipodite medially at line of articulation of basal segment of endopodite, overlying medial margin of basal segment and slightly exceeding articulation with second segment. Endopodite slightly shorter than exopodite, basal segment wider than remaining segments. Basal and second segments each with 1 medial seta. Terminal segment with 2 medial setae, 2 terminal setae on abruptly truncate terminal margin, and 1 lateral seta in an emargination above middle of lateral margin. Exopodite flexed. Basal segment as long as remaining segments combined, bearing 1 stout spine at lateral distal corner and 1 medial seta. Second segment with 1 lateral spine, 1 medial seta. Terminal segment 3 lateral spines, above middle, 1 terminal spine, 1 terminal seta, 3 medial setae. Setae of exopodite reduced.

Second legs (fig. 22, *m*, Table I) with bimerous protopodites, trimerous rami. Coxopodite unarmed. Basipodite with 1 short lateral seta. Endopodite slightly more than half as long as exopodite. Basal segment with 1 seta at middle of medial margin. Second segment produced into characteristic lobe at distal medial corner. Two setae on medial margin. Terminal segment with 3 medial setae, 2 terminal setae, 1 lateral seta. Exopodite very long, flexed medially. Basal segment very long,more than half length of ramus, with 1 minute spine at distal lateral corner, 1 seta at distal third of medial margin. Second segment with 1 minute spine near distal lateral corner, 1 seta on medial margin. Terminal segment with 2 minute spines near lateral margin, 1 small distal lateral spine with terminal flange, 1 long apical spine with flange and 1 apical setule, and slender medial setae. All setae of exopodite reduced.

Third legs (fig. 22, *n*, Table I) in general resembling second legs, with exceptions as follows : Intercoxal plate reduced. Long seta surpassing length of endopodite articulating on medial margin of coxopodite. Terminal segment of exopodite with only 1 minute lateral spine, remainder of armature as in second legs. Exopodite longer in proportion to endopodite.

Fourth legs (fig. 22, *o*, Table I) very similar to third legs, differing only in slightly greater length of exopodite in proportion to endopodite, and in having only 5 setae on terminal segment of endopodite.

Fifth legs and caudal rami : Fifth legs (fig. 22, *p*) bimerous, bases arising from plate-like specialization of body surface. Short uniting plate between basal segments. Basal segment with seta at distal lateral corner. Terminal segment long, tapering sharply beyond distal third, bearing 1 long terminal seta. Three rows of spinules ornamenting medial margin beyond distal third.

Caudal ramus (fig. 22, *q*) long, tapering distally to one-third of basal width. Greatest length about 4.4 times greatest width and about 2.3 times as long as anal segment. Four short setae articulating on distal margin. Central medial seta longest, about one third as long as ramus. Lateral dorsal seta at approximately proximal third of ramus. Medial dorsal seta just distal to middle of ramus.

REMARKS : No males are known for the species. The body of the adult female is transparent, with light green ova in the oviducts, embryos in the incubatory cavity with darker green and yellow yolk. This form corresponds startlingly to *Bonnierilla longipes* (Kerschner) in most anatomical details. Characters strongly distinguishing it from the other form, however, are so conspicuous that we have felt justified in providing a specific designation for it. *B. similis* lacks the cephalic collar so notable in *B. longipes*. The antenna of *B. similis* is a distinctly different appendage from that *B. longipes*, differing in proportions of segments and in its most characteristic terminal armature. We have been unable to make detailed comparisons of the antennules in the two species, but the remaining appendages and caudal rami correspond except in the minutest of details. This species could possibly be the form to which SCHELLENBERG (1922, p. 251) called attention in his description of *B. acollaris* Schellenberg. He recorded as coming from *Pyura gangelion* (Savigny) and *Styela canopus* (Savigny), from the Gulf of Suez, two specimens differing from his *B. acollaris* and corresponding to *B. longipes* except for the lack of the cephalosomic collar and lateral spine. He remarked that his specimens were poorly preserved. From *B. acollaris*, *B. similis* differs in having 1 less seta on the basal endite of the maxilla; slighter rami of second to fourth legs; 1 more seta on the medial margin of the terminal segment of the third and fourth exopodites; fifth leg with 1 terminal seta instead of 2; and the last third of the under-surface of the caudal ramus not denticulate.

GUNENOTOPHORUS Buchholz, 1869

We are following the usage of ILLG (1958). Questions of nomenclature and priority are not dealt with here.

GUNENOTOPHORUS GLOBULARIS Buchholz, 1869.

For synonomy and distribution see ILLG (1958).

From *Polycarpa pomaria* (Savigny) :

Cap Dosne, 50 m, May 2, 1958, 4 females, developmental stages.

Mixed trawl : (1) near Cap Béar, 60 m — north (2) northeast of Port-Vendres — 90 m, May 14, 1958, 12 females, developmental stages.

DOROIXYS Kerschner, 1879

We are following the usage of ILLG, 1958.

DOROIXYS UNCINATA Kerschner, 1879.

For synonymy and distribution see ILLG (1958). Diagnosis based on CANU (1892).

From *Amaroucium densum* Giard :

Cap l'Abeille, September 28, 1910, CHATTON number 72, 5 females, developmental stages.

Cap l'Abeille, September 29, 1910, CHATTON number 77, 1 female.

Cap l'Abeille, 26 m, April 30, 1958, 10 females, developmental stages.

Mixed trawl : (1) North of Port-Vendres, 70-30 m (2) off Cap Béar in Anse de Paulilles, 50 m, May 28, 1958, 4 females, developmental stages.

Cap l'Abeille, 25 m, June 3, 1958, 5 females, developmental stages.

From *Aplidium griseum* Lahille :

Aquarium, Banyuls, September 26, 1910, CHATTON number 78, 4 females.

From *Aplidium caeruleum* Lahille :

North Argelès to Canet, October 1, 1912, CHATTON numbeɪ 170, 9 females.

From *Aplidium aspersum* Drasche :

Cap Béar, October 17, 1910, CHATTON number 118, 45 females.

From *Aplidium gibbulosum* Savigny :

Cap Béar, October 15, 1910, CHATTON number 115, 3 females, developmental stages.

From ?*Amaroucium glabrum* Verrill (CHATTON manuscript identification *Parascidia flavum*) :

Argelès, October 1, 1910, CHATTON number 101, 7 females.

From ?*Sidnyum turbinatum* (Savigny) (CHATTON manuscript identification *Circinalium concrescens*) :

CHATTON number 236, 1 female.

From *Polycitor cristallinus* Renier :

Coastal mud near Port-Vendres, 60-100 m, April 25, 1958, 3 females, developmental stages.

From unidentified host :

Gabès, Tunisia, CHATTON number 226, 6 females.

DEMOIXYS, new genus

Type species : *Demoixys chattoni*, new species.

Taxonomic characters : The two species we are assigning to this genus are remarkably similar when the degeneration within the genus is considered. The specific differentiation is very clear, but is expressed as alternative possibilities or modifications applying to a very consistent set of characters. The body form is globular; segmentation is poorly developed. The antennules are reduced to simple tapered lobes, with poorly developed segmentation and ornamentation. The antennae are trimerous. The mandible has a well-developed masticatory plate and a characteristically organized palp. Although the rami are reduced, the setal armature is indicative of the basic notodelphyid organization of the appendage. In the maxillule, the masticatory endite clearly retains its identity. Groups of setae indicate the composition of the palp, 1 for the epipodite, 4 for the exopodite, 3 for the endopodite, 1 for the basipodite. The maxilla is 4-segmented, the basal segment has 3 endites, the remaining segments vary in armature according to species, but are basically similar. The maxilliped is reduced and bears 2 terminal setae. The first to fourth legs vary according to species, but all are represented. The fifth legs are highly distinctive, each triangular, with armature terminal and with bases participating in a fused apron-like ventral plate. Both representatives of the genus occur in hosts of the family *Didemnidae* Giard.

The poorly segmented, inflated body separates this genus from most notodelphyids. This feature, the reduction of antennules, and the particular modification of mouth parts and legs differentiate it from any closely approaching genus. There are differences for practically every anatomical character in the two species, but the salient differentiating features are as follows : The rostrum is very long in *D. chattoni*, shorter in *D. dialepta*. The mandibles differ, *D. chattoni* with 4 setae representing the exopodite, *D. dialepta* with 3; the endopodite in *D. chattoni* has 6 setae on a shortened flat ramus, in *D. dialepta* has 5 setae on an elongate ramus. In the maxillule, the major endite of *D. chattoni* is small and the terminal setae are much reduced, the process with its 3 setae having a markedly different aspect from that of *D. dialepta* which is normally formed and bears 4 subequal setae. In *D. chattoni* the second segment of the maxilla bears only a reduced setule, with no evidence as to whether this represents a seta or the usual hook process, both of which are represented in *D. dialepta*. In the latter there are 3 setae on the terminal segment, while there are only 2 in *D. chattoni*. The first through fourth legs are much better developed in *D. dialepta*, all biramous, while in *D. chattoni* all are reduced, the second through fourth mere single lobes. In *D. dialepta* the terminal armature of the fifth legs consists of a single sclerotized point and a lateral feature, that of *D. chattoni* is comprised of a single sclerotized hook and a lateral setule. The caudal rami of *D. dialepta* are small, well-formed lobes bearing terminal armature, those of *D. chattoni* are large swollen lobes without armature.

From this list of specifically differentiating characters, it is apparent that this generic concept is a very broad one. It has seemed important to us emphasize similarities particularly since these are reinforced by close systematic affinity of the hosts.

DEMOIXYS CHATTONI, new species (Figures 23-24).

Types : Holotypic female USNM 104 833, (from Golfe du Lion, Mediterranean Sea, from *Polysyncraton lacazei* Giard); and paratypes below.

Specimens examined :

From *P. lacazei* :

Cap l'Abeille, 25 m, June 3, 1958, holotype and 1 paratypic female.

From unidentified host :

Locality unknown, possibly from vicinity of Banyuls, CHATTON number 323, 2 females.

DESCRIPTION :

Female (figs. 23, 24) : General features : Body (figs. 23, *a*, *b*) globular, length about 1.75 mm, a contracted female measuring 1.54 mm and one with urosome extended, 1.97 mm, measured from anteriormost point on cephalosome to end of caudal ramus. Cuticle pliable, small hairs covering surface. Body divided into cephalosome, metasome and urosome. Cephalosome including appendages through first legs, apex prolonged into very long, finger-shaped, terminally rounded rostrum (fig. 23, *d*, *R*). Lateral margins of cephalosome (fig. 23, *d*, *LM*) inflected ventrally, forming lateral limits of oral field. Metasome inflated, hemispherical, bearing second through fifth legs. Segments not delimited. Reduced legs on flattened ventral surface. Incubatory cavity extending from posterior end of metasome to anterior limit of metasome. Articulation between metasome and urosome clearly developed dorsally and obscure ventrally, represented only by a general area overlain by an apron-like ventral structure associated with bases of fifth legs. Opening of incubatory cavity at extreme posterior dorsal limit of metasome. Urosome (fig. 23, *c*) without clear indication of segmentation, conspicuous genital apparatus consisting of vulva and diverging sclerotized seminal types lying ventrally near anterior end of urosome somewhat posterior to basal structure of fifth legs. Distal portion of urosome retractile, but not telescopically, with resultant inflation of terminal section, displacing caudal rami anteriorly.

Head appendages : Antennule (fig. 23, *d*, *A*1, fig. 24, *e*) with at least 1 poorly defined distal articulation. Distal parts with elements probably representing setae. Cuticular hairs covering general surface.

Antennae (fig. 23, *d*, *A*2, fig. 24, *f*) enclosed within oral field, bases considerably overlain by lateral ventral margins of cephalosomic folds. Three-segmented, with following proportional lengths, basal to distal : 4.5 : 5 : 4.5. All segments heavily sclerotized; basal 2 segments without armature. Apex of terminal segment with sclerotized hook and 2 small setae.

Labrum (fig. 23, *d*, *L*, fig. 24, *g*) not conspicuously large, over-reached by posteriorly directed rostrum. Margins sclerotized. Terminally with 2 small lobes bearing cilia.

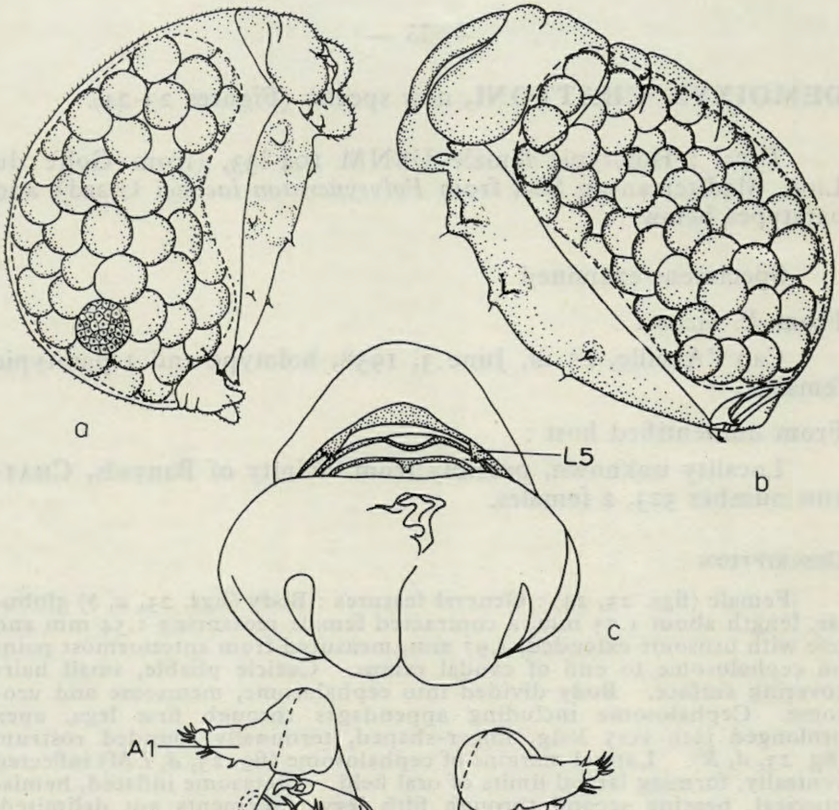

Figure 23, *a-d*, *Demoixys chattoni*, female : *a*, habit, lateral view; *b*, another individual, lateral view; *c*, urosome, ventral; *d*, oral area. Legend : *A1*, antennule; *A2*, antenna; *L*, labrum; *LM*, lateral margin of oral field; *L1*, first leg; *L5*, fifth leg; *MD*, mandible; *MX*, maxilla; *MXL*, maxillule; *MXP*, maxilliped; *PP*, postoral plate, *R*, rostrum.

Mandible (fig. 23, *d*, *MD*, fig. 24, *h*) with bimerous protopodite, obscurely articulated endopodite and unarticulated exopodite. Masticatory lamella large, medially differentiated into distal teeth, row of fused denticles and proximal teeth. Basipodite with seta at distal medial corner at poorly developed articulation of endopodite. Endopodite a broad plate with 6 setae arranged around medial and distal margins. Exopodite undeveloped, represented by a slight prominence furnishing insertion for 4 setae in distal and lateral groups of 2. Setae markedly stouter and longer than those of endopodite.

Maxillule (fig. 23, *d*, *MXL*, fig. 24, *i*) without segmentation, but with setal elements indicating segmental composition. Major endite with 3 setae on distal and medial margins, 2 distal markedly smaller than proximal. Remainder of appendage with 9 setae arranged around distal and lateral margins, as follows : One proximal lateral seta probably representing epipodite; lateral group of 4 setae representing exopodite; terminal group of 3 setae representing endopodite; 1 isolated subapical medial seta representing basipodite.

Maxilla (fig. 23, *d*, *MX*, fig. 24, *j*) 4-segmented, length of basal segment greater than that of remaining segments combined, with 3 endites. Basal endite with 3 setae; second endite with 2 setae; terminal endite with 2 setae. Terminal endite appearing as independently mobile element. Second segment about as wide as long, with minute setule at middle of medial margin. Third segment with single stout seta at distal medial corner. Fourth segment with 1 stout medial seta and 1 reduced terminal seta.

Maxilliped (fig. 23, *d*, *MXP*, figs. 24, *k*, *l*) a simple lobe with terminal portion slightly inflected on wider base. Two subequal terminal setae. Appendages of the 2 sides inserted at lateral limits of a sclerotized postoral plate (fig. 23, *d*, *PP*).

Legs : First legs (fig. 23, *d*, *L1*, fig. 24, *m*) consisting of poorly articulated lobes arising from an expanded base. Lobes probably representing rami. Endopodite with no differentiated armature. Exopodite with approximately 5 lateral and terminal elements presumably representing armature, differentiated with difficulty from general cuticular hairs.

Second leg (fig. 24, *n*) a simple lobe, with single terminal differentiated setiform element.

Third legs (fig. 24, *o*) and fourth legs (fig. 24, *p*) each consisting of a simple lobe with terminal differentiated setiform element, fourth leg much smaller than third.

Fifth legs (fig. 24, *q*) unsegmented, consisting only of triangular sclerotized lobes united medially and basally to participate in characteristic bilobed plate, Each leg with differentiated double sclerotized hook on apex and setule inserted just subapically on lateral margin.

Caudal ramus (fig. 23, *c*) consisting of simple lobe with no armature.

REMARKS : The male is unknown for the species. The early development will be described in a subsequent publication. The females collected in 1958 were found in bubble-like cysts enclosed in the matrix of the host. The cysts were not associated with any other host element and were conspicuously white against the general background pink to orange color of *Polysyncraton lacazei*. The female was transparent white, embryos in brood pouch had pinkish yolk.

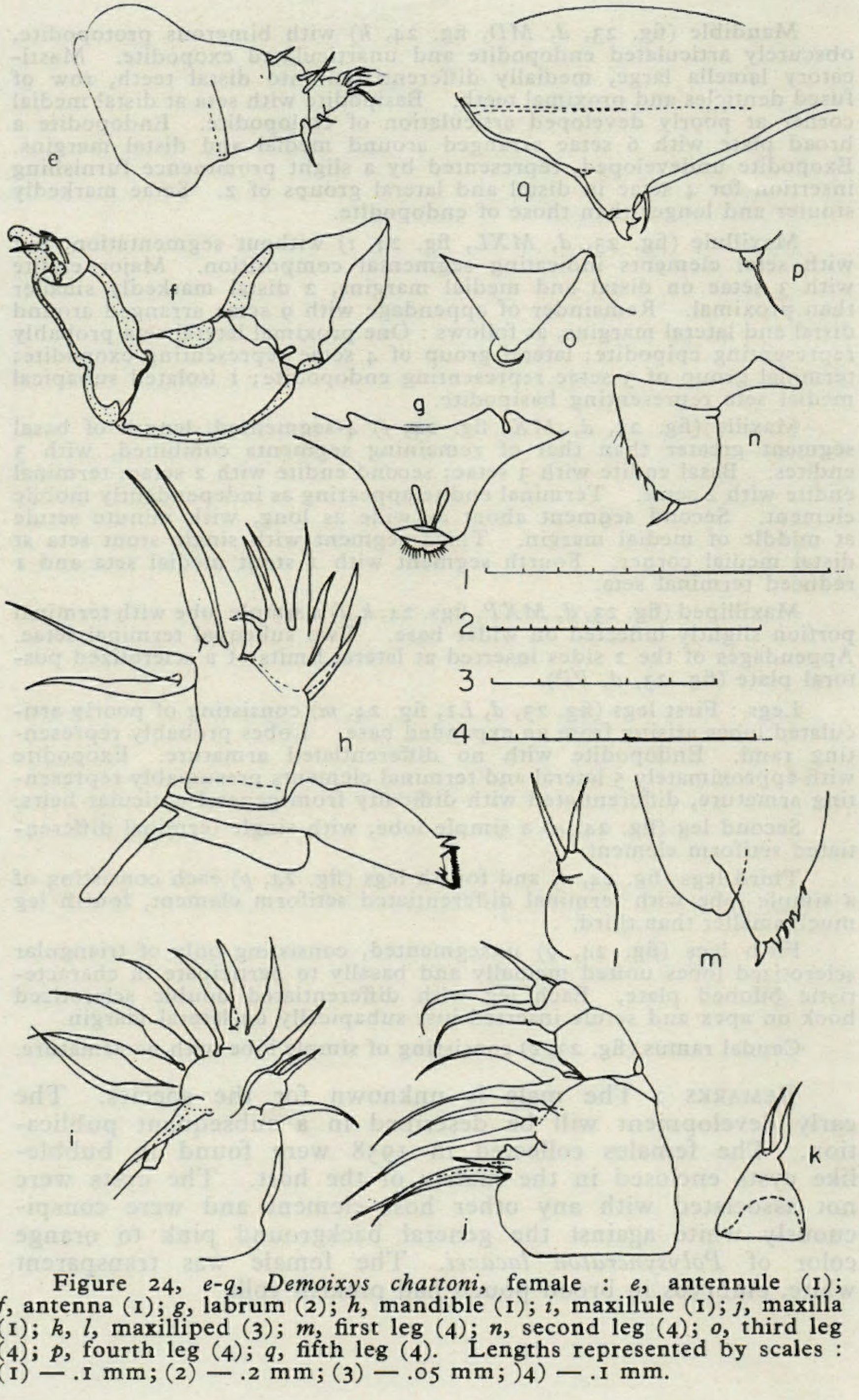

Figure 24, *e-q*, *Demoixys chattoni*, female : *e*, antennule (1); *f*, antenna (1); *g*, labrum (2); *h*, mandible (1); *i*, maxillule (1); *j*, maxilla (1); *k*, *l*, maxilliped (3); *m*, first leg (4); *n*, second leg (4); *o*, third leg (4); *p*, fourth leg (4); *q*, fifth leg (4). Lengths represented by scales : (1) — .1 mm; (2) — .2 mm; (3) — .05 mm;)4) — .1 mm.

DEMOIXYS DIALEPTA, new species (Figures 25-26).

Types : Holotypic female USNM 104832 (type locality Western Golfe du Lion, Mediterranean Sea, from *Didemnum fulgens* Milne Edwards).

Specimens examined :

From *D. fulgens* :

Mixed trawl (1) north of Cap Béar, 60 m, (2) northeast of Port-Vendres, 90 m, May 14, 1958, holotypic female.

DESCRIPTION :

Female (fig. 25, 26) : General features : Body (fig. 25, *a*) globular, curved, 1.79 mm long, measured on continuous arc running along axis of body from anteriormost point on cephalosome to end of caudal ramus. Measurement on straight line through body about 1.4 mm. Cuticle pliable, small hairs covering surface. Body divided into cephalosome, metasome, and urosome. Cephalosome including appendages through maxillipeds, apex prolonged into short, broad, terminally rounded rostrum (fig. 25, *b*, *R*, fig. 25, *e*). Antero-lateral margins of cephalosome somewhat inflected ventrally. Metasome inflated, roughly hemispherical, bearing first through fifth legs. Segments poorly delimited. Legs displaced laterally. Incubatory cavity in non-gravid female extending to about level of third legs. Articulation between metasome and urosome clearly developed dorsally and obscure ventrally, represented only by a general area overlain by apron-like fused fifth legs. Opening of incubatory cavity (fig. 25, *c*) at extreme posterior dorsal limit of metasome, formed of a wide slit. Actual opening somewhat internal at anterior limit of inflection of general body surface. Urosome (figs. 25, *c*, *d*) without clear indication of segmentation. Conspicuous genital apparatus consisting of vulva and diverging sclerotized seminal tubes lying ventrally near anterior end of urosome between bases of fifth legs. Large dorsal anal operculum.

Head appendages : Antennule (fig. 25, *d*, *A1*, fig. 25, *e*) protruding tapered lobe. Some elements, probably representing setae, found on terminal and anterior margins, but difficult to discriminate from hairs covering general surface.

Antenna (fig. 25, *b*, *A2*, fig. 25, *f*) trimerous, with following proportional lengths of segments, basal to distal : 5 : 4.5 : 5. All segments heavily sclerotized. Basal 2 segments without armature. Terminal segment with setal protrusion at middle of outer margin. Terminal margin with blunt sclerotized point and 3 small setae.

Mandible (fig. 25, *g*, *MD*, fig. 26, *h*) with bimerous protopodite, unimerous endopodite and obscurely articulated unimerous exopodite. Masticatory lamella differentiated medially into 3 distal teeth, row of denticles and proximal setule. Basipodite with seta near distal medial corner. Endopodite with 1 isolated proximal seta, 3 distal setae on medial margin and 1 terminal seta. Exopodite a short flat plate with 5 setae around medial and terminal margins. Most lateral seta shortest.

Maxillule (fig. 25, *g*, *MXL*, fig. 26, *i*) with coxopodite and palp of obscure composition. Coxopodite with distal endite bearing 4 setae

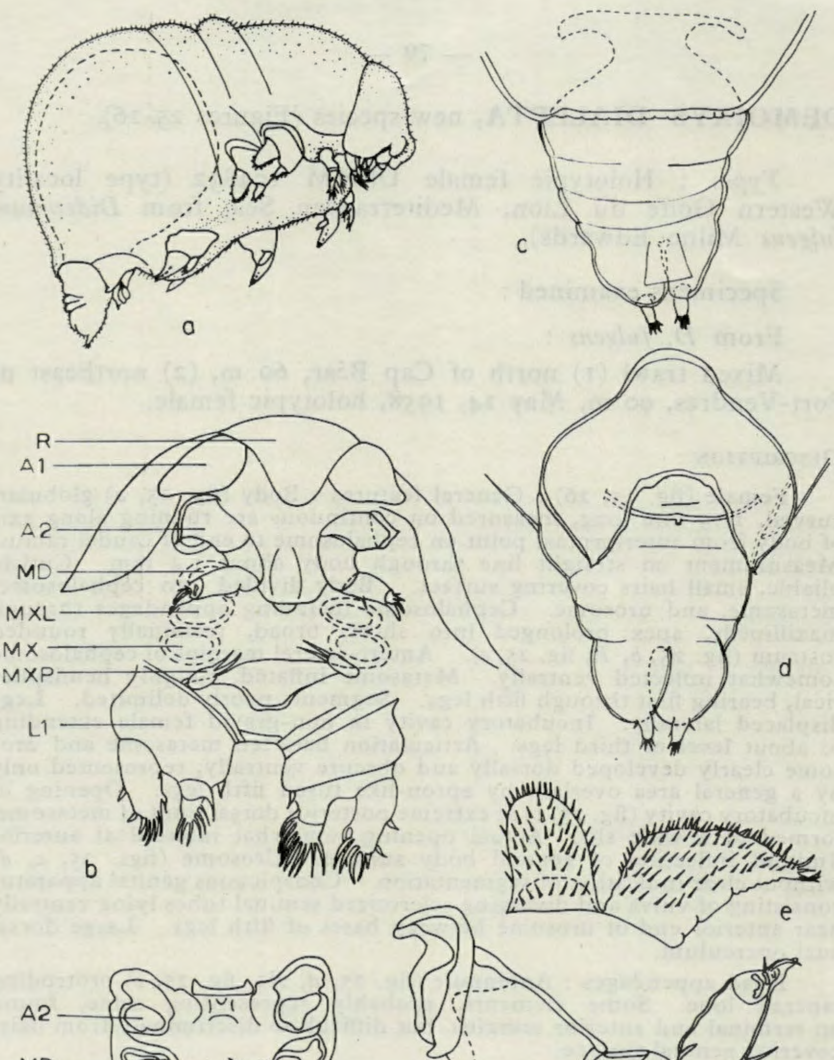

Figure 25, *a-g*, *Demoixys dialepta*, female : *a*, habit, ventral view; *b*, head, ventral (1); *c*, urosome, dorsal (1); *d*, urosome, ventral (1); *e*, rostrum and antennule (2); *f*, antenna (3); *g*, oral area (1). Legend : *A*1, antennule; *A*2, antenna; *L*, labrum; *L*1, first leg; *MD*, mandible, or site of articulation; *MX*, maxilla, or site of articulation; *MXL*, maxillule, or site of articulation; *MXP*, maxilliped; *R*, rostrum. Lengths represented by scales : (1) — .2 mm; (2) — .1 mm; (3) — .1 mm.

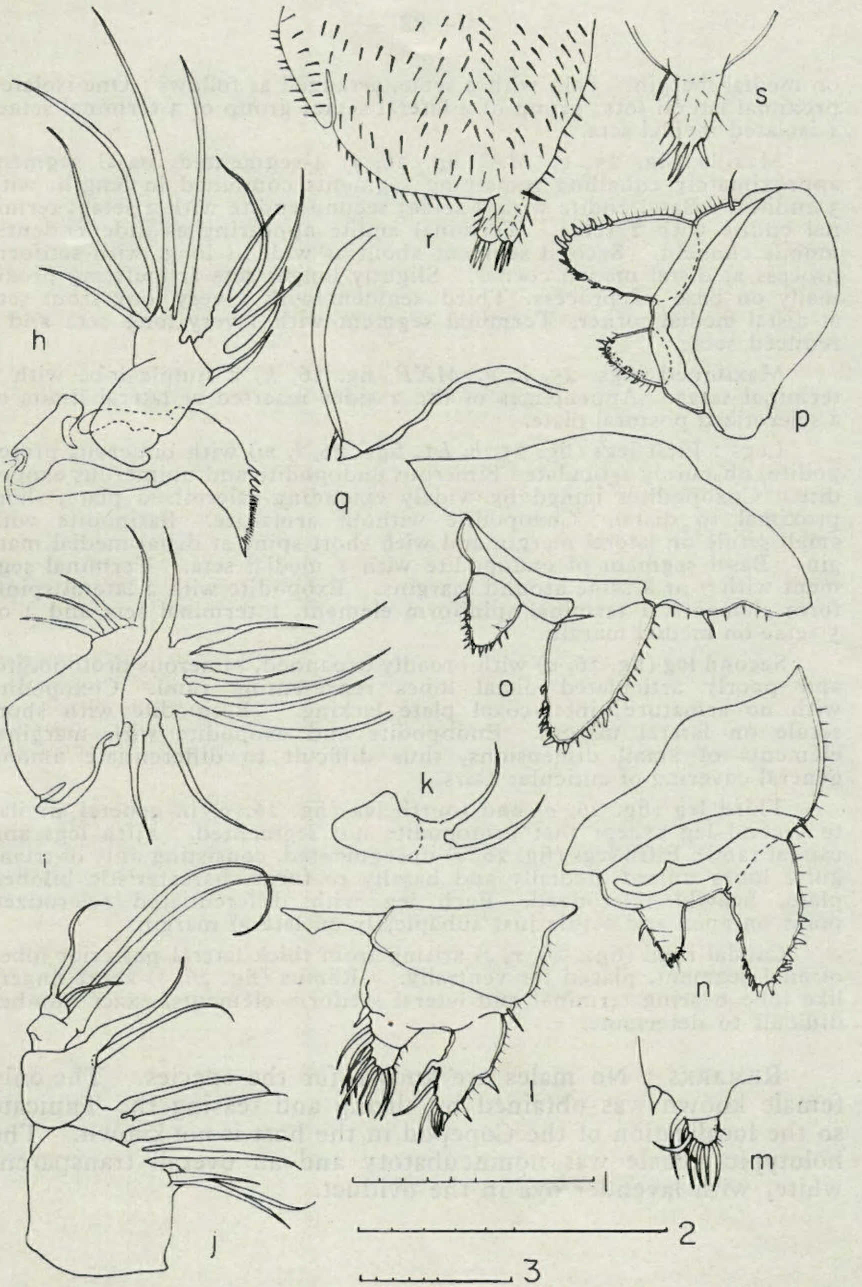

Figure 26, *h-s*, *Demoixys dialepta*, female : *h*, mandible (1); *i*, maxillule (1); *j*, maxilla (1); *k*, maxilliped (2); *l*, first leg (3); *m*, basipodite and endopodite of first leg of another specimen (3); *n*, second leg (3); *o*, third leg (3); *p*, fourth leg (3); *q*, fifth leg (3); *r*, lobe of anal segment, lateral view ; *s*, caudal ramus (2). Lengths represented by scales : (1) — .1 mm. (2) — .1 mm; (3) — .1 mm.

on medial margin. Palp with 9 setae, arranged as follows : One isolated proximal lateral seta; group of 4 lateral setae; group of 3 terminal setae; 1 isolated medial seta.

Maxilla (fig. 25, *g*, *MX*, fig. 26, *j*) 4-segmented, basal segment approximately equalling remaining segments combined in length, with 3 endites. Basal endite with 3 setae; second endite with 2 setae; terminal endite with 2 setae. Terminal endite appearing as independently mobile element. Second segment about as wide as long, with setiform process at distal medial corner. Slightly longer seta articulating proximally on base of process. Third segment with 1 very long stout seta at distal medial corner. Terminal segment with 1 very long seta and 2 reduced setae.

Maxilliped (figs. 25, *b*, *g*, *MXP*, fig. 26, *k*) a simple lobe with 2 terminal setae. Appendages of the 2 sides inserted at lateral limits of a sclerotized postoral plate.

Legs : First legs (fig. 25, *b*, *L1*, figs. 26, *l*, *m*) with bimerous protopodite, obscurely articulated bimerous endopodite and unimerous exopodite. Coxopodites joined by widely extending sclerotized plate, short proximal to distal. Coxopodite without armature. Basipodite with small setule on lateral margin and with short spine at distal medial margin. Basal segment of endopodite with 1 medial seta. Terminal segment with 7 or 8 setae around margins. Exopodite with 2 lateral spiniform elements, 1 terminal spiniform element, 1 terminal seta and 4 or 5 setae on medial margin.

Second leg (fig. 26, *n*) with broadly expanded, bimerous protopodite, and poorly articulated distal lobes representing rami. Coxopodite with no armature; inter-coxal plate lacking. Basipodite with short setule on lateral margin. Endopodite and exopodite with marginal elements of small dimensions, thus difficult to differentiate among general covering of cuticular hairs.

Third leg (fig. 26, *o*) and fourth leg (fig. 26, *p*) in general similar to second leg except that protopodite not segmented. Fifth legs and caudal rami : Fifth legs (fig. 26, *q*) unsegmented, consisting only of triangular lobes united medially and basally to form characteristic bilobed plate, heavily sclerotized. Each leg with differentiated sclerotized point on apex and setule just subapically on lateral margin.

Caudal rami (figs. 26, *r*, *s*) arising from thick lateral posterior lobes of anal segment, placed far ventrally. Ramus (fig. 26, *s*) short finger-like lobe bearing terminal and lateral setiform elements, exact number difficult to determine.

REMARKS : No males are known for the species. The only female known was obtained by slicing and teasing the Tunicate so the localization of the Copepod in the host is not known. The holotypic female was nonincubatory and an overall transparent white, with lavender ova in the oviduct.

LOBODELPHYS, new genus

Type species : Lobodelphys elephas, new species.

Taxonomic characters : The definition of this monotypic genus is provided in the description of the type species below. This form can be differentiated very readily from all other Notodelphyids. Only species of *Gunenotophorus* approach it in the globular inflation of the metasome. In reduction of appendages it resembles *Scolecodes* and *Scolecimorpha*, but both of these genera so far have only vermiform representatives, lack at least one pair of mouthparts, and have legs of very different construction.

LOBODELPHYS ELEPHAS, new species (Figures 27-28).

Types : Holotypic female USNM 104836 (type locality Golfe du Lion, Mediterranean Sea, from *Pyura squamulosa* Alder); and paratype.

Specimens examined :

From *P. squamulosa* :

Mixed trawl : (1) North of Port-Vendres, 70-30 m, (2) off Cap Béar in Anse de Paulilles, 50 m, May 28, 1958, holotype and 1 paratype.

DESCRIPTION :

Female (figs. 27, 28) : General features : Body (figs. 27, *a*, *b*) extremely globular, contained in a circular area of about 3.2 mm diameter, divided into cephalosome, metasome and obscurely defined urosome. Cephalosome (figs. 27, *c*, *d*) subtriangular in dorsal view, prolonged anteriorly into long, finger-shaped rostrum (fig. 27, *c*, *R*); with posterior dorsal (fig. 29, *d*, *RI*) and lateral, ventral (fig. 29, *c*, *VF*) considerably rounded, elongate, strongly developed ridges defining most of corresponding margins; bearing appendages through first legs. Metasome with anteriormost second leg-bearing segment well-defined and of same width as posterior part of cephalosome, remainder extremely inflated, the major mass attributable to fourth leg-bearing segment. Second leg-bearing segment with 2 somewhat trifid hyaline processes (fig. 27, *d*, *P*), inserted on lobes dorsally near articulation with cephalosome. Globular shape of metasome not due to inflated incubatory cavity, but resulting from expanded body cavity, embryos lying in a single superficial layer in a true brood pouch with 2 lateral and one posterior prominent wide lobes. Third legs displaced laterally, fourth legs considerably removed posteriorly. Transition from metasome to urosome not an articulation, but apparently taking place within dorsoventral extent of single segment, this being delimited ventrally by an inflected anterior fold, but dorsally continuing as a contricted lobe of metasome. Opening

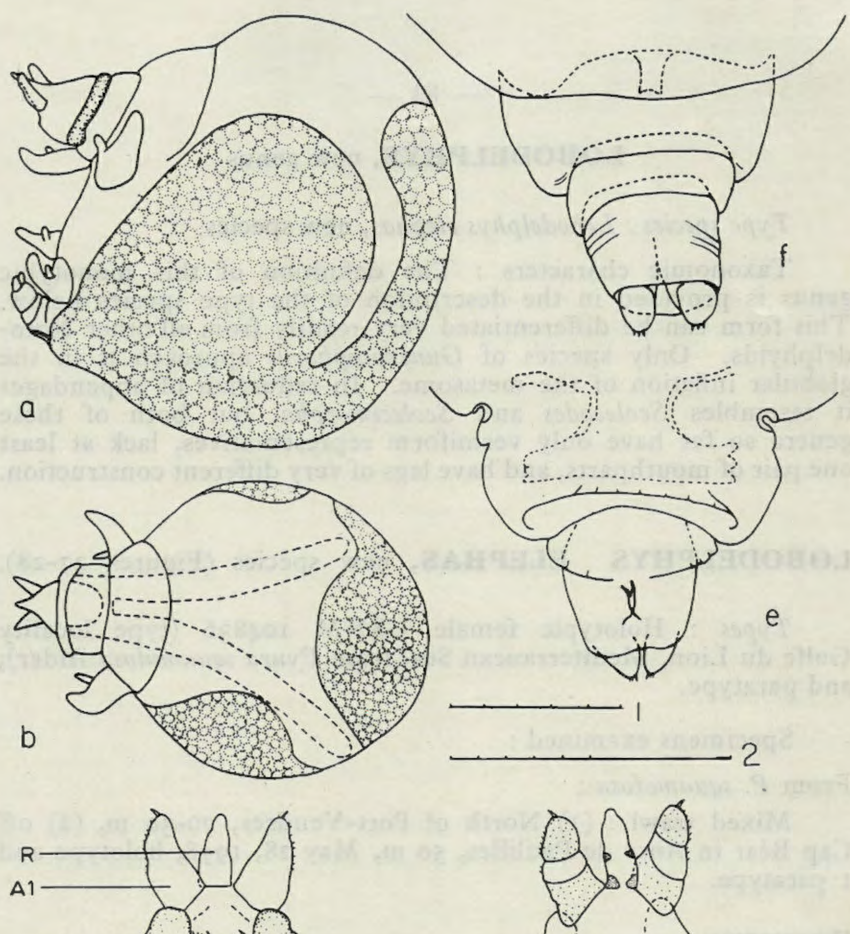

Figure 27, *a-f*, *Lobodelphys elephas*, female : *a*, habit, lateral view; *b*, habit, dorsal; *c*, cephalosome and second legs, ventral (1); *d*, cephalosome and second legs, dorsal (1); *e*, posterior end of metasome and urosome, dorsal (2); *f*, posterior end of metasome and urosome, ventral (2). Legend : *A1*, antennule; *L*, labrum; *L1*, first leg; *L2*, second leg; *P*, process; *R*, rostrum; *RI*, dorsal cephalosomic ridge; *VF*, ventral cephalosomic ridge. Lengths represented by scales : (1) — .5 mm; (2) — .5 mm.

of incubatory cavity (fig. 27, *e*) at extreme posterior dorsal limit of metasomal posterior lobe, formed of wide slit, somewhat internal at anterior limit of an inflection of general body surface. Remaining urosomal elements (figs. 27, *e*, *f*) poorly defined, confluent dorsally, ventrally delimited into 2 segmental elements, posteriormost contractile into preceding. Characteristic anal operculum lacking. Anus apparently simple middorsal opening, considerably subterminal.

Head appendages : Antennule (fig. 27, *c*, *A*1, fig. 28 *g*) consisting of long fingerform sclerotized protrusion subapically inserted, directed distally and slightly exceeding rostrum. Bearing small stiffened hairs on anterolateral margin and 1 longer element on apex. Sclerotizations perhaps indicative of segmental composition.

Ventral cephalosomic surface mostly an oral field, (fig. 27, *c*, fig. 28, *h*) delimited laterally by lateral ventral ridges (fig. 27, *c*, *VF*) and posteriorly closed by anteriorly directed first legs (fig. 27, *c*, *L*1). Labrum (fig. 27, *c*, fig. 28, *h*, *l*), broad, occupying almost entire oral area, with antennae and mouthparts linearly distributed along lateral margins.

Antenna (fig. 28, *h*, *A*2, fig. 28, *i*) bimerous, basal segment 3 times as long as and twice as wide as terminal segment. Margins of both segments heavily sclerotized, of slightly irregular outline. Terminal segment considerably tapering, bearing 2 setae subterminally. Apex a sclerotized cone (fig. 28, *j*) with sharp, defined terminal point rather than usual articulated hook.

Mandibles (fig. 28, *h*, *MD*, figs. 28, *k*, *l*) without masticatory plate, simple lobes, rectangular in outline, longer than wide, bearing terminal unarticulated stout setae in groups of 2 medial and 3 lateral. Heavy sclerotizations surrounding bases of lobes and sclerotized plates on surfaces of mandibles.

Maxillules (fig. 28, *h*, *MXL*, fig. 28, *m*) consisting of lobes, somewhat expanded in terminal outline. Bearing 8 unarticulated setae, 4 lateralmost subequal, long, stout, equidistant. Terminal medial seta shorter, distally directed. Three medial setae slenderer than lateral setae, subequal with terminal seta. Heavy sclerotizations surrounding bases of appendages and sclerotized plates on surfaces.

Maxillae (fig. 28, *h*, *MX*, figs, 28, *n*. *o*) bimerous, basal and terminal segments approximately equal in length but appendage markedly tapering. Basal segment with proximal medial modified element consisting of heavy basal protrusion from which arising 1 seta and 1 setule, 1 seta just distal, and a distal endite bearing 2 setae. Terminal segment with 4 setae and 1 setule, 3 setae unarticulated. Heavy sclerotizations surrounding bases of maxillae.

Maxilliped (fig. 28, *h*, *MXP*, fig. 28, *o*) reduced to single seta at each side, articulating at base of maxilla at lateral termination of long medial sclerotized bar.

Legs : First leg (fig. 27, *c*, *L*1, fig. 28, *p*) consisting of terminally bilobed inflated protrusions, representing undifferentiated bases and rami. Legs joined by sclerotized bar, possibly vestige of intercoxal plate. On distal surface of base at origin of endopodite lobe a slender, curved spine, probably usual spine of basipodite. Endopodite lobe with 6 unarticulated setiform elements around apex. Exopodite lobe, longer than endopodite lobe, with 3 or 4 terminal setiform elements and 4 or 5 small spiniform elements along lateral margin.

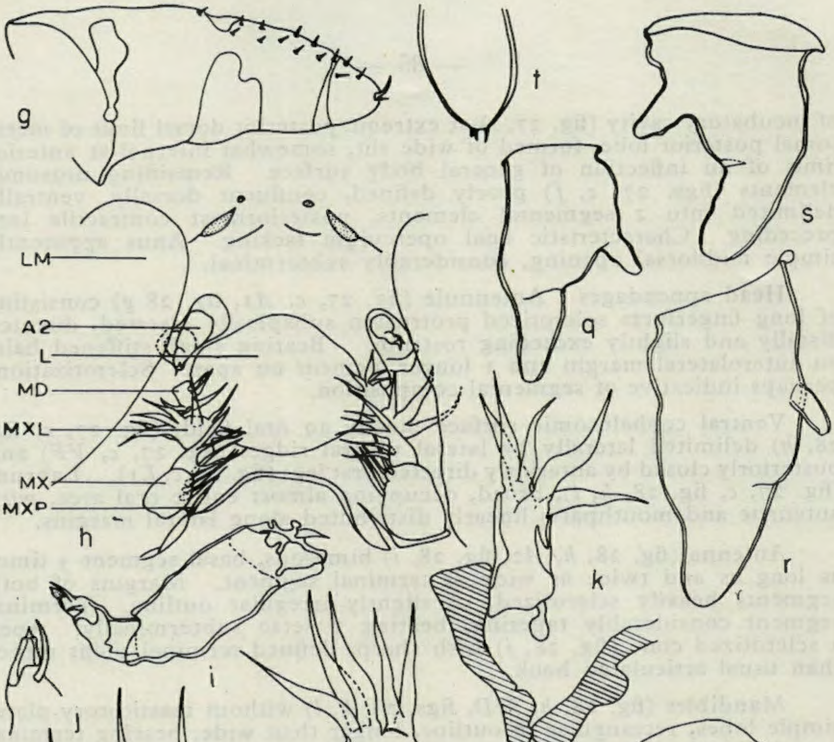

Figure 28, *g-t*, *Lobodelphys elephas*, female : *g*, antennule (1); *h*, oral field; *i*, antenna (2); *j*, apex of terminal segment of antenna (3); *k*, *l*, mandible (4); *m*, maxillule (2); *n*, maxilla (2); *o*, maxilla and maxilliped (2); *p*, first leg (5); *q*, second leg (5); *r*, third leg (5); *s*, fourth leg (5); *t*, caudal ramus (5). Legend : *A2*, antenna; *L*, labrum; *LM*, lateral margin of oral field; *MD*, mandible; *MX*, maxilla; *MXL*, maxillule; *MXP*, maxilliped. Lengths represented by scales : (1) — .2 mm; (2) — .1 mm; (3) — .05 mm; (4) — .1 mm; (5) — .1 mm.

Leg 2 (figs. 27, *c*, *d*, *L2*, fig. 28, *q*), leg 3 (fig. 28, *r*), leg 4 (fig. 28, *s*) consisting of inflated lobes each with terminal protrusion representing exopodite and much smaller medial lobe representing endopodite. No intercoxal plates, legs lacking armature.

Caudal ramus (fig. 28 *t*) incompletely articulated lobe bearing minute apical setules.

REMARKS : The ground color of the adult is pale orange. The legs and cephalosome are white. The eggs in the oviducts are reddish purple and the embryos in the incubatory cavity dull reddish lavender, later changing to purple and orange.

No male is known for the species.

The Copepod occurs lying freely in the branchial basket of the host.

SCOLECIMORPHA Sars, 1926

Scolecimorpha Sars, 1926. — Illg, 1958.

This genus differs from most Notodelphyids by the vermiform habitus, which otherwise occurs only in *Ophioseides* Giard, 1873, *Prophioseides* Chatton and Brément, 1915*c*, *Scolecodes* Illg 1958 *Pholeterides* Illg, 1958, *Haplostatus*, new genus, p. 75, below, and *Ophioseidus* Bate, 1864, indeterminable genus. *Ophioseides* and *Haplostatus* differ from *Scolecimorpha* in lacking legs; *Prophioseides* differs in having the complete complement of well-developed mouthparts; *Pholeterides* differs in details of appendages, especially the form of the legs; *Scolecodes* differs in placement and construction of the legs, the development of the incubatory cavity in the segment of the fourth legs, the lack of the labrum and the possession of 1 more pair of mouthparts. It is probably worthy of mention that *Scolecimorpha* and *Scolecodes* are the only ones among those mentioned above which occure in solitary tunicates. The type of the genus is *Scolecimorpha insignis* Sars, 1926, which appears to us quite possibly conspecific with *S. joubini*, the older species. This question will probably have to be settled by study of topotypic material of SARS' species from Norway.

SCOLECIMORPHA JOUBINI (Chatton), 1909 (Figures 29-30).

Ophioseides joubini Chatton, 1909 (type locality, Banyuls, France in *Microcosmus sabatieri* Roule).

Scolecimorpha joubini Illg, 1958.

Specimens examined :

From *Microcosmus sulcatus* Coquebert :

Coastal mud near Port-Vendres, 60-100 m, April 25, 1958, many females.

Off Cap Béar in Anse de Paulilles, 50 m, May 28, 1958, many females, developmental stages.

From ?*M. sulcatus* (CHATTON manuscript identification *M. sabatieri*) :

Banyuls, September, 1906, CHATTON number 1, many females, developmental stages.

Banyuls, 1907, CHATTON number 2, many females, developmental stages.

Locality not known, CHATTON number 291, 2 females.

We have found the original description to be accurate, but since we have some excellent supplementary figures prepared by Professor CHATTON we are presenting fuller description and illustration of details.

DESCRIPTION :

Female (figs. 29, 30) : General features : Body length variable, depending on degree of maturity of adult female, varying from 10 to 20 mm in females bearing embryos and from 2 to 10 mm in nonincubatory adults. Cuticle pliable, small hairs (fig. 30, *o*) covering surface. Vermiform body (figs. 29, *a*, *b*) divided into cephalosome, metasome and urosome. Cephalosome including appendages through second mouthparts. Rostrum only a small raised lobe directed midventrally at apex of cephalosome (fig. 30, *l*, *R*). Lateral margins of cephalosome inflected ventrally, forming slightly raised lobes, which define oral field. Metasome greatly elongated, many times longer than cephalosome or urosome, bearing first through fourth legs. Segment of first leg defined by dorsal constrictions.

Incubatory cavity extending from posterior end of metasome to segment of first legs. Opening of incubatory cavity at posterior dorsal limit of metasome, a wide slit under an inflection of body surface (figs. 30, *m*, *n*, *o.c.i.*). Conspicuous genital apparatus consisting of midventral vulva and diverging sclerotized tubes at posterior ventral limit of metasome (figs. 30, *m*. *n*, *p*. *f*., fig. 29, *c*). Urosome (fig. 29, *c*, figs. 30, *m*, *n*) a short lobe with no articulations, terminally indented. Caudal rami not defined.

Head structures : Antennules (fig. 30, *l*, *Ale*, fig. 29, *d*) gradually tapered unsegmented lobe with perhaps some elements on anterior and terminal margins, but impossible to determine exactly among generally covering cuticular hairs.

Antenna (fig. 30, *l*, *Ane*, figs. 29, *e*, *f*) bimerous, enclosed within oral field, with proportional lengths of segments, basal to distal, 5.5 : 3.

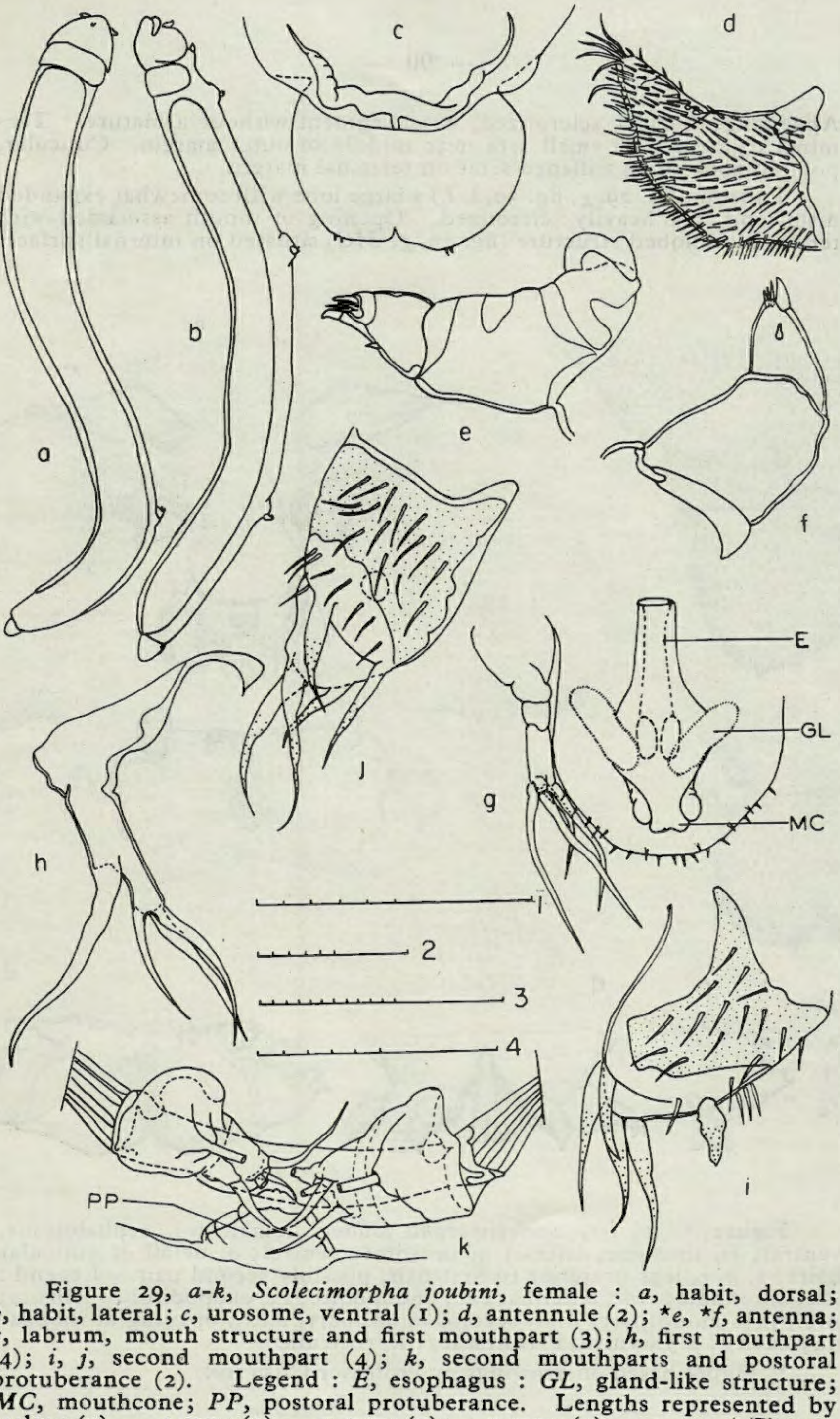

Figure 29, *a-k*, *Scolecimorpha joubini*, female : *a*, habit, dorsal; *b*, habit, lateral; *c*, urosome, ventral (1); *d*, antennule (2); **e*, **f*, antenna; *g*, labrum, mouth structure and first mouthpart (3); *h*, first mouthpart (4); *i*, *j*, second mouthpart (4); *k*, second mouthparts and postoral protuberance (2). Legend : *E*, esophagus : *GL*, gland-like structure; *MC*, mouthcone; *PP*, postoral protuberance. Lengths represented by scales : (1) — .5 mm; (2) — .1 mm; (3) — .2 mm; (4) — .1 mm.* Figures after illustrations prepared by Professor CHATTON.

Appendage heavily sclerotized, basal segment without armature. Terminal segment with small seta near middle of outer margin. Cuticular, pointed hook and 4 stiffened setae on terminal margin.

Labrum (fig. 29, *g*, fig. 30, *l*, *L*) a large lobe with somewhat expanded distal end, not heavily sclerotized. Opening of mouth associated with terminally bilobed structure (fig. 29, *g*, *MC*) situated on internal surface,

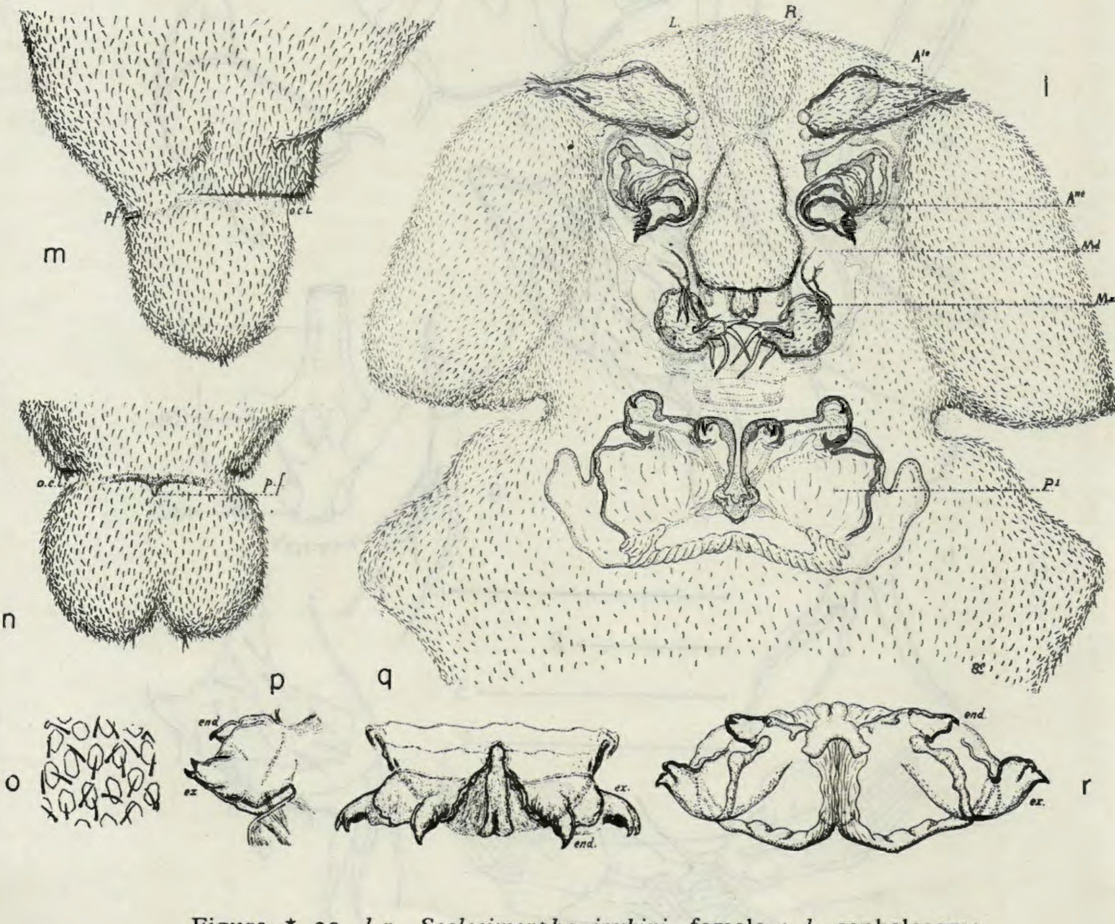

Figure * 30, *l-r*, *Scolecimorpha joubini*, female : *l*, cephalosome, ventral; *m*, urosome, lateral; *n*, urosome, ventral; *o*, detail of cuticular hairs; *p*, *q*, *r*, legs posterior to first pair, possibly second pair. Legend : *Ale*, antennule; *Ane*, antenna; *end*, endopodite; *ex*, exopodite; *L*, labrum; *Md.*, first mouthpart; *Mx.*, second mouthpart; *o.c.i.*, opening of incubatory cavity : *p. f.*, vulva; P 1, first leg; *R*, rostrum.

* Figure based on drawings by Professor CHATTON.

and capable of protrusion beyond posterior margin. Gland-like structures associated with this end piece and esophagus (fig. 29, *g*, *GL*, *E*).

First mouthpart (fig. 30 *l*, *Md*, figs. 29, *g*, *h*) located at lateral margin of labrum, rather anteriorly, an elongate narrow lobe with some basal expansion, bearing 4 setae, 1 of these isolated from terminal group of 3.

Second mouthpart (fig. 30, *l*, *Mx*, figs. 29, *i*, *j*, *k*) articulating at lateral ends of somewhat sclerotized transverse bar posterior to labrum, and associated with medial postoral protuberance (fig. 29, *k*, *PP*). These appendages broad heavy lobes with 5 setae arranged around apex. Form of setae varying bilaterally and individually. Heavy sclerotized plate and heavy cuticular hairs on surface of lobe. Cuticle tending somewhat to fall into folds.

Legs : First legs (fig. 30, *l*, *P1*) located on anteriormost part of metasome, but by virtue of size and position somewhat delimiting oral field posteriorly. Protopodite very large, with 2 terminal lobes representing rami. Each lobe with single, heavy sclerotized hook.

Second legs (figs. 29, *p*, *q*, *r*), third legs, fourth legs all similar and fairly large. Protopodites each bearing 2 lobes. External lobe, representing exopodite, larger, with 2 heavy terminal hooks. Endopodite with 1 heavy terminal hook. All legs heavily sclerotized and with rami set diagonally on diverging protopodites.

REMARKS : A male was described by CHATTON in the original description of the species. Some details about the development of the male will be included in a forthcoming account of the life history of this species. Color notes and ethological remarks were provided in the original description.

PROPHIOSEIDES Chatton and Brément, 1915

Prophioseides Chatton and Brément, 1915*c*. — Illg, 1958.

Type species : *Ophioseides abdominalis* Chatton and Brément.

The genus was founded as a monotypic taxon. The addition of two species in the present work makes it possible to disdinguish some of the characteristics as unifying and some as of specific value.

The generic characters then include vermiform habitus, well indicated cephalosome, metasome and urosome. The vulva and seminal tubes of the female are situated on the metasome. The incubatory cavity extends over almost the entire length of the metasome, thus occupying a region corresponding to at least 2 and possible more segments. The rostrum is very large, consisting of a rather simple, massive lobe. Lateral ventral cephalosomic folds provide definition for an oral field, the extent of posterior delimitation various in the the species. The antennule is essentially an inflated unsegmented tapered lobe, with elements of armature poorly defined. The antenna is bimerous, the basal segment lacking armature. The terminal segment bears 1 or 2 setae on the outer margin and a hook and 2 or 3 setae insert on the terminal margin. The mandible has a well-differentiated coxopodite with developed gnathobase, although the extent of formation of the masticatory lamella varies among the species. The palp has relatively undeveloped segmentation although the ingredient elements are strongly indicated by the armature. The armature of the endopodite is much reduced, all the species so far seen with 5 or 6 setae. The exopodite is relatively strongly developed, in all the species listed here with 4 setae. The maxillule has poorly developed segmentation, but the large major endite bearing setae is well-differentiated and setiferous lobes of similar construction and armature among the species probably represent the rami. The basic notodelphyid pattern of structure is strongly suggested in the maxilla although the armature is reduced and the degree of segmentation varies. The maxilliped is an unsegmented lobe, setal armature varying as to number. The first legs are present in all, but are variously reduced. The second to fourth legs are possibly present in all, but always greatly reduced and very difficult to locate on the elongate metasome. Probably the fifth legs are lacking throughout.

Prophioseides is differentiated from most Notodelphyids by the vermiform habitus, which occurs only in *Ophioseides* Giard, 1873, *Scolecimorpha* Sars, 1926, *Scolecodes* Illg, 1958, *Pholeterides*, Illg 1958, *Haplostatus*, new genus below and *Ophioseidus* Bate, 1864, indeterminable genus. From *Pholeterides*, *Haplostatus*, *Scolecimorpha* and *Scolecodes* the genus *Prophioseides* is readily separated by the possession of all mouthparts, these being so developed that they conform readily to the basic notodelphyid anatomical pattern. An apparently different trend of modification of the legs occurs in *Prophioseides* from that appearing in *Scolecimorpha* and *Scolecodes*. Complete anatomical details for *Ophioseides* have never been provided and there is a possibility that when this genus is understood in terms of modern taxonomy that *Prophioseides* may have to revert to synonymy with the older genus. GIARD'S species, *Ophioseides apoda*, type of the genus (see ILLG, 1958) was found at Roscoff, France in *Astellium perspicuum* Giard, currently termed *Diplosoma gelatinosum*. This is the type host of one of our new species below. To us it appears there can be little justification for the exhumation of the genus *Ophioseidus* Bate, but there does remain a very remote possibility that this name may reappear and it may turn out in that case to supersede *Prophioseides*.

Several salient features serve for differentiating the species of *Prophioseides*. The habitus is characteristic for *P. abdominalis* in the abrupt posterior constriction of the metasome, as well as the posterior insertion of the segmented urosome on the dorsal portion of the posterior constricted prolongation of the metasome. In *P. delamarei* the metasome is much more regularly cylindrical. In *P. delamarei* and *P. diplosomae* the cephalosome is markedly narrower than the widest part of the metasome, in *P. delamarei* there is a smaller degree of taper. An oral area is defined in *P. abdominalis* by lateral cephalosomic folds and is enclosed posteriorly by the plate-like first legs; in *P. diplosomae* the oral area is partially defined laterally by flat folds and only partially closed posteriorly by the first legs. In *P. delamarei* a continuous highly developed lateral and posterior fold encloses the oral area, with the vestigial first legs standing decidedly outside, removed posteriorly and laterally. The labrum of *P. abdominalis* is not notably developed; it is larger and heavily sclerotized and muscularized in *P. diplosomae*. In *P. delamarei* it is large and very complicated. The mandibles differ in the coxal process, this being greatly reduced to a mere point in *P. abdominalis*, well-developed as an elongate, heavily sclerotized lamella in the remaining two. In *P. delamarei* the lamella has a distal heavy tooth and proximal row of denticles. In *P. diplosomae* it has the most conspicuous tooth proximal and has only teeth, denticles being lacking. The maxilliped in *P. abdominalis* and *P. delamarei* is minute, consisting of a simple lobe bearing 3 setae; in *P. diplosomae* it is complex and bears 2 terminal and 5 medial setae. The first legs in *P. diplosomae* have a large spine on the basipodite and indications of 2 rami; those of *P. abdominalis*, somewhat similarly plate-like, have only 1 lobe and no spine; those of *P. delamarei* are vestigial.

PROPHIOSEIDES ABDOMINALIS (Chatton and Brément), 1911 (Figures 31-32).

Ophioseides abdominalis Chatton and Brément, 1911, p. 30-33, fig. 1 (type locality, Banyuls-sur-Mer, France, from *Amaroucium densum* Giard).

Prophioseides abdominalis Chatton and Brément, 1915*c*, p. 155, Illg, 1958, p. 480.

Specimens examined : We know of no new material of this species since the collections upon which the authors based the original description. We have been able to use some of the types from the CHATTON collection in working out the following extended description. We are presenting some figures based on some illustrations made by Professor CHATTON. We have found the original description to be accurate, but are including fuller discussion and illustration of details in order to make comparisons with the new species we are adding in the genus. The samples we have are :

From *A. densum* :

Cap l'Abeille, Sep. 28, 1910, CHATTON number 71, 7 females.

Cap l'Abeille, September 29, 1910, CHATTON number 76, 3 females.

From unidentified host :

CHATTON number 194, 1 female.

DESCRIPTION :

Female (figs. 31, 32) : General features : Body (figs. 31, *a*, *b*) vermiform, head and urosome narrower than the remainder of body. Length about 2 mm, 1.86 mm in a contracted specimen, 2.24 mm in a specimen with urosome extended, measured from anteriormost point on cephalosome to end of caudal ramus. Cuticle pliable, small hairs covering surface. Body divided into cephalosome, metasome, and urosome. Cephalosome including appendages through first legs, apex prolonged ventrally into voluminous, fingershaped, terminally-rounded rostrum (fig. 31, *d*, *R*). Lateral margins of cephalosome (fig. 31, *c*, *LM*) inflected ventrally, forming lateral limits of oral field. Metasome greatly elongated, about fifteen times as long as cephalosome, bearing second through fourth legs. Incubatory cavity extending from posterior end of metasome almost to anterior limit. Metasome abruptly contracted posteriorly. Opening of incubatory cavity almost as wide as posterior end of metasome, appearing at extreme posterior dorsal margin (figs, 31, *e*, *f*). Articulation between metasome and urosome lying between constricted terminal piece of metasome and anatomically unidentifiable, but clearly delimited first segment of urosome. Urosome (figs. 31, *c*, *d*) 4-segmented. Segments retractile, but not telescopically : inflating when shortened. Caudal rami terminal on small anal segment.

Head appendages : Antennule (figs. 31, *c*, *d*, *A*1, fig. 32, *g*) gradually tapering, curved, unsegmented lobe with perhaps some elements of armature terminally, but impossible to determine exactly among generally covering cuticular hairs.

Antenna (figs. 31, *c*, *d*, *A*2, fig. 32, *h*) enclosed within oral field, bases overlain by lateral ventral margins of cephalosomic fold. Two-segmented with proportional lengths of segments, basal to distal : 5 : 4. Appendage heavily sclerotized. Basal segment without armature. Terminal segment with small seta inserted at terminal fourth of outer margin. Stout, curved, tapering, pointed hook inserting widely at terminal margin with two subequal setules articulated at its base.

Labrum (figs. 31, *c*, *d*, *L*, fig. 32, *i*) simple in structure, consisting of untapered projection with rounded, narrower terminal lobe. Apical margin with row of heavier, stiffer hairs than those covering general surface of labrum.

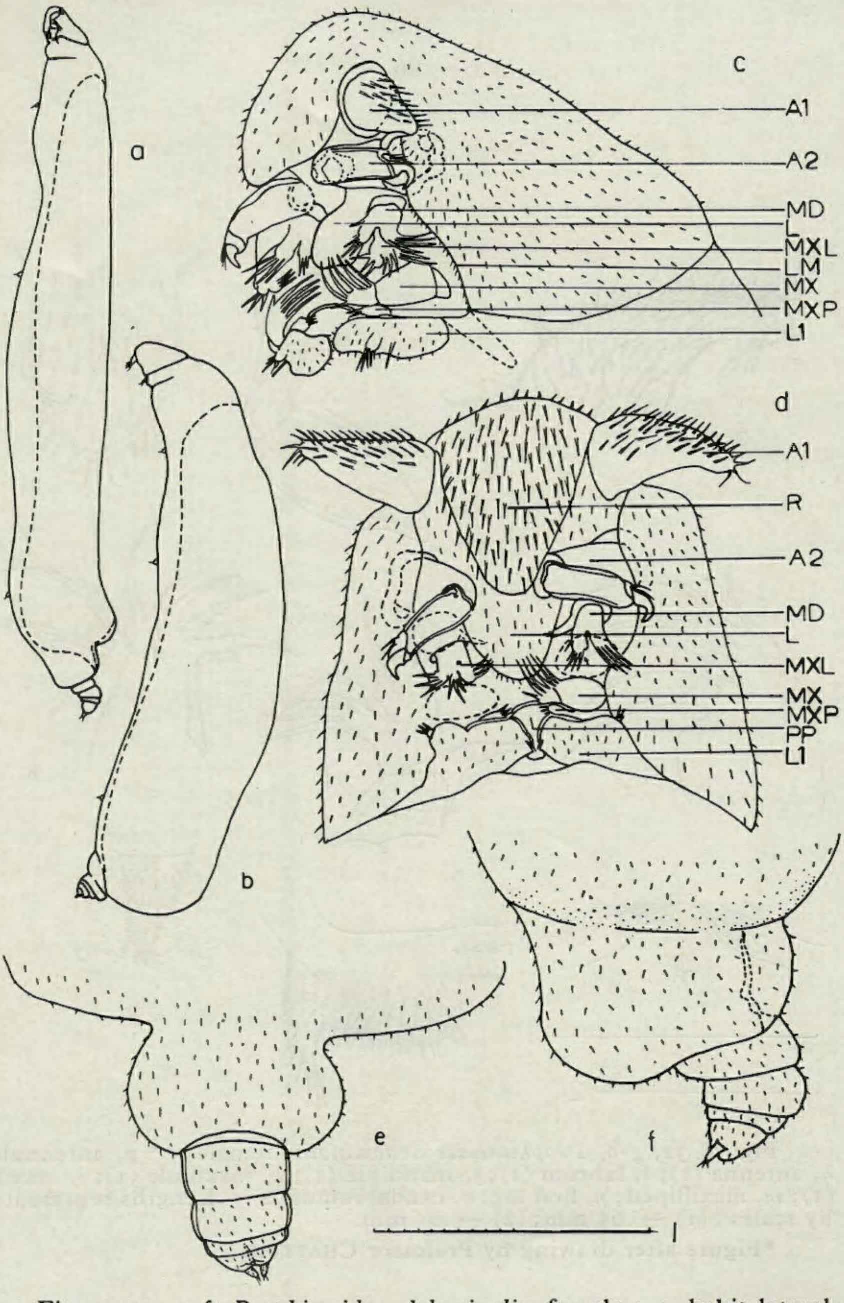

Figure 31, *a-f*, *Prophioseides abdominalis*, female : *a*, habit lateral; *b*, habit, lateral; **c*, cephalosome, lateral; **d*, cephalosome, ventral; *e*, urosome, dorsal (1); *f*, urosome, lateral (1). Legend : *A*1, antennule; *A*2, antenna; *L*, labrum; *LM*, lateral margin of oral field; *L*1, first leg; *MD*, mandible; *MX*, maxilla; *MXL*, maxillule; *MXP*, maxilliped; *PP*, postoral plate; *R*, rostrum. Length represented by scale : (1) — .2 mm.

* Figures after drawings by Professor CHATTON.

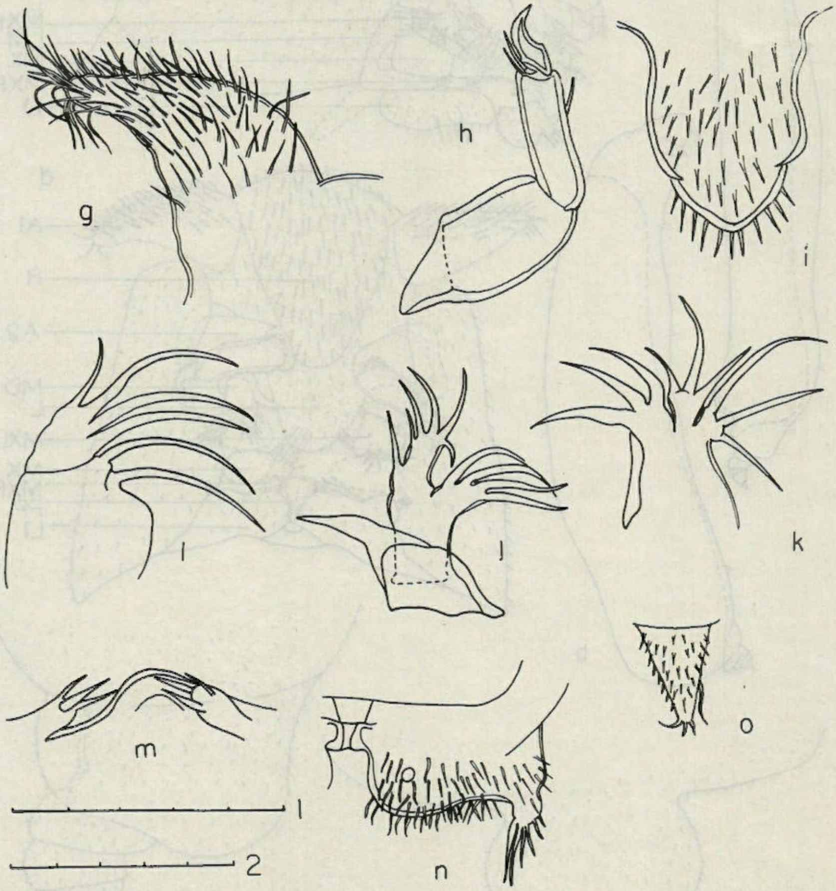

Figure 32, *g-o*, *Prophioseides abdominalis*, female : * *g*, antennule; *h*, antenna (1); *i*, labrum (1); *j*, mandible (1); *k*, maxillule (1); *l*, maxilla (1); *m*, maxilliped; *n*, first leg; *o*, caudal ramus (2). Lengths represented by scales : (1) — .05 mm; (2) — .05 mm.

*Figure after drawing by Professor CHATTON.

Mandible (figs. 31, *c*, *d*, *MD*, fig. 32, *j*) with coxopodite and obscurely segmented palp. Medial protrusion of coxopodite not a lamella but a simple point in our specimens; original description indicates some ornamentation may accompany principal point. No clear-cut delimitation of basipodite. Medial margin of palp with one seta possibly indicating distal extent of basipodite. Five setae of diverse lengths around terminal margin of medial lobe representing endopodite. Unarticulated exopodite a tapered lobe bearing 4 setae along medial and terminal margins.

Maxillule (figs. 31, *c*, *d*, *MXL*, fig. 32, *k*) without articulations, but with well-defined endite and 2 setiferous lobes possibly representing rami. Major endite with 3 large subequal setae on medial and distal margins. Medial apical lobe with 3, subequal terminal setae, element strongly suggesting endopodite. Strongly flaring lateral lobe bearing 3 long, distal marginal setae.

Maxilla (figs. 31, *c*, *d*, *MX*, fig. 32, *l*) bimerous. Basal segment with 2 setae on distal medial margin. Second segment with lateral indentations indicating multiple composition, with three long medial setae, one reduced terminal seta.

Maxilliped (figs. 31, *c*, *d*, *MXP*, fig. 32, *m*) extremely minute, simple lobe, with 3 small terminal setae. Appendages of the 2 sides inserted at lateral limits of sclerotized postoral plate (fig. 31, *d*, *PP*).

Legs : First legs (figs. 31, *c*, *d*, *L1*, fig. 32, *n*) wide plate-like structures, each with small distal, lateral setiferous lobe, probably representing exopodite. Bases united by short sclerotized intercoxal plate. Pair of legs acting as distinctive flap-like, posterior closing element for oral space. Exopodite with 6 graduated setae on distal margin, 2 medial setae much the longest. Entire appendage covered with cuticular hairs of general body surface.

Legs 2 to 4 minute lobes, the pairs widely removed from each other along the ventral body surface.

Caudal rami (fig. 32, *o*) conical, somewhat longer than basal width, possibly some differentiated armature, but elements impossible to discriminate accurately among cuticular hairs of general surface.

REMARKS : The male is unknown. We cannot add further information on color and other details to that presented in the original description since we have no additional material. The maxillipeds are so minute that many dissections were necessary to locate them and to verify the description given by the original authors. The legs are so minute that we were unable to find them on our poorly preserved specimens, but have the good fortune to be able to make use of excellent sketches provided from the notes of Professor CHATTON. We note from the original description that this species occurs in the postabdomen of the host zooid.

PROPHIOSEIDES DELAMAREI, new species (Figures 33-34).

Types : Holotypic female USNM 104831 (from Golfe du Lion, Mediterranean Sea, from *Amaroucium densum* Giard); and paratypes below.

From *A. densum* :

Cap l'Abeille, 25 m, April 30, 1958, holotype, 1 paratype, developmental stages.

Cap l'Abeille, 25 m, June 3, 1958, 1 female.

DESCRIPTION :

Female (figs. 33, 34) : General Features : Body (fig. 33, *a*) vermiform, urosome narrower than general mass, head not tapered abruptly. Length 6.27 mm, measured on holotype from anteriormost point on cephalosome to end of caudal ramus. Cuticle pliable, small hairs covering surface. Body divided into cephalosome, metasome, and urosome. Cephalosome including appendages through first legs, apex prolonged ventrally into heavy terminally rounded rostrum (fig. 33, *d*, *R*). Metasome greatly elongated, at least eighteen times as long as the cephalosome, with no discernible legs. Two paired sets of muscle bands extending from cephalosome to urosome, on ventral and dorsal surfaces. Ventral set with diagonal bands of muscle extending to midventral points, equally spaced at 3 levels along body. Incubatory cavity, although none seen by us occupied by embryos, apparently extending from posterior end of metasome almost to anterior limit. Metasome with anomalous features of reproductive structures rendering anatomical identification difficult. A dorsal broad plate-like sclerotization with inwardly diverging anterior tubes (fig. 33, *b*) possibly representing vulva and seminal tubes, however position on metasome and on dorsal surface doubly anomalous. Urosome (figs. 33, *b*, *c*) represented by very short unarticulated, terminally bilobed element. A plate, appearing to be anal operculum, on posterior dorsal surface overlying medial bases of terminal lobes. Head structures : Lateral and posterior marginal integumental folds (fig. 33, *d*, *LM*) of cephalosome continuous with lateral margins of rostrum delimiting a depressed oral area, within which appendages through maxillipeds enclosed.

Antennule (fig. 33, *d*, *A*1, fig. 33, *e*) consisting of globular base, with much narrower shorter unarticulated terminal piece. Cuticular inflections in base probably representing lines of flexure rather than true articulations. With some elements of armature along anterior margins and on terminal piece, these probably representing setae, but impossible of exact determination among general covering of cuticular hairs.

Antenna (fig. 33, *d*, *A*2, fig. 34, *f*) bimerous, enclosed within oral field, base overlain by lateral cephalosomic folds. Segments with proportiona lengths, basal to distal, 4.2 : 3. Appendage heavily sclerotized, basal segment without armature. Terminal segment with small seta inserted near apical structures on outer margin. Stout curved hook and 2 subequal setae articulating on terminal margin.

Labrum (fig. 33, *d*, *L*, fig. 34, *g*) very complicated, occupying most of midcentral portion of oral area. With heavily sclerotized transverse bars, furnishing insertion for muscle bands, and with sclerotized bars

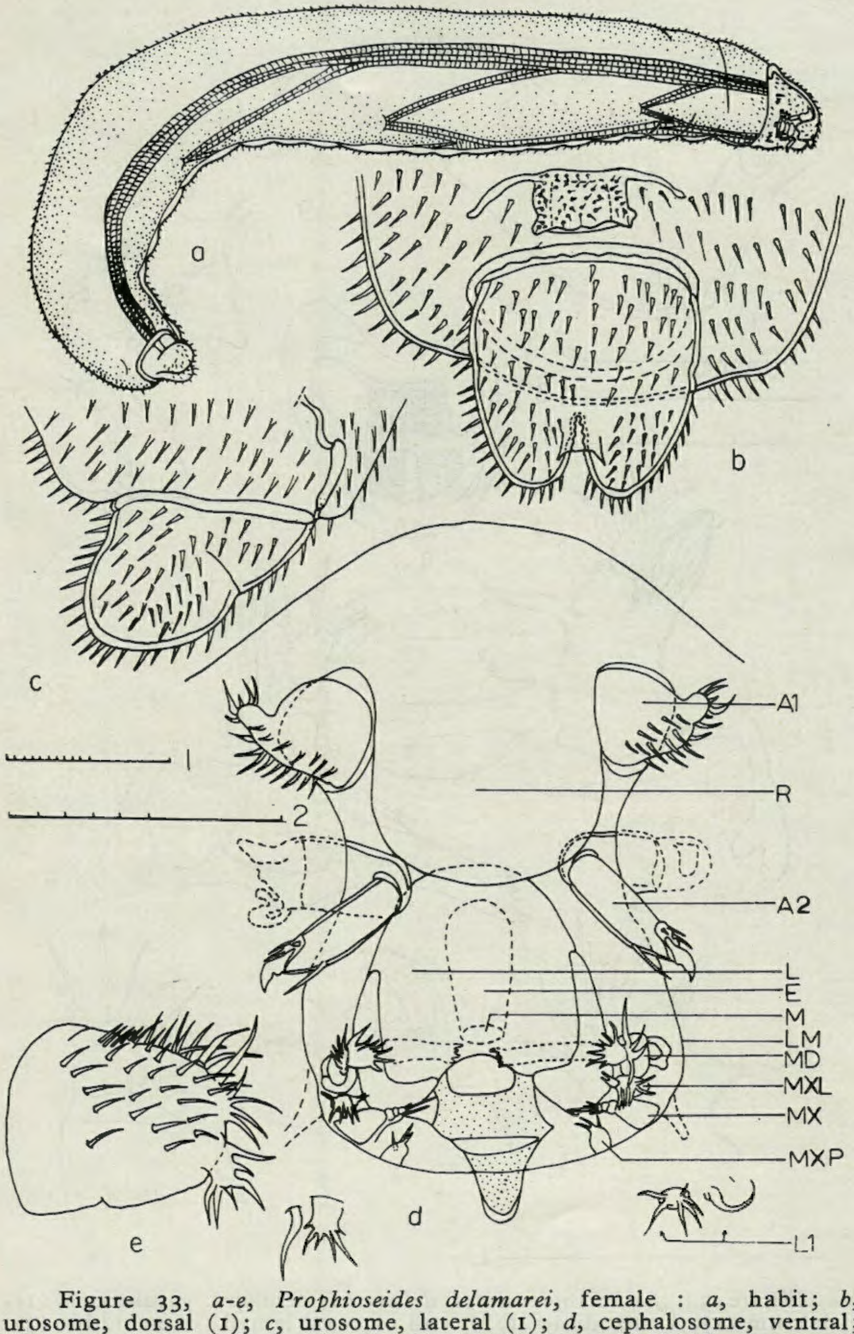

Figure 33, *a-e*, *Prophioseides delamarei*, female : *a*, habit; *b*, urosome, dorsal (1); *c*, urosome, lateral (1); *d*, cephalosome, ventral; *e*, antennule (2). Legend : *A*1, antennule, *A*2, antenna; *E*, esophagus; *L*, labrum; *LM*, lateral margin of oral field; *L*1, first leg; *M*, mouth; *MD*, mandible; *MX*, maxilla; *MXL*, maxillule; *MXP*, maxilliped; *R*, rostrum. Lengths represented by scales : (1) — .2 mm; (2) — .1 mm.

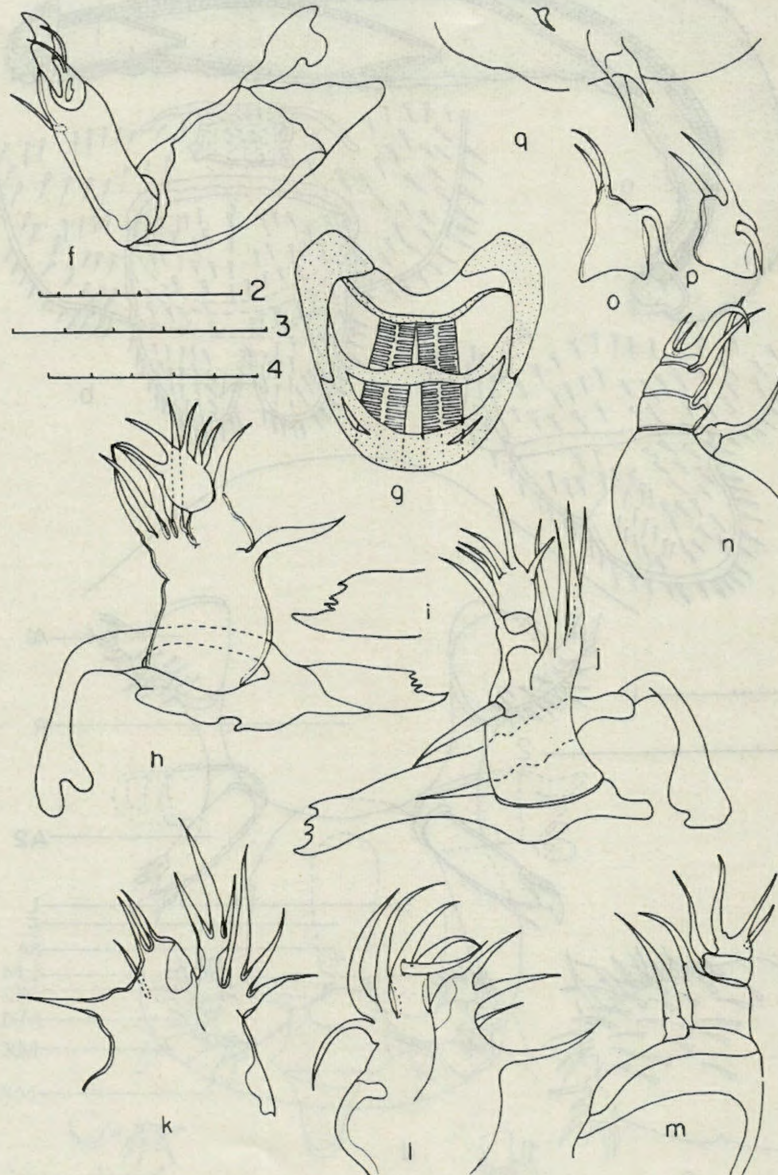

Figure 34, *f-q*, *Prophioseides delamarei*, female : *f*, antenna (1); *g*, labrum (2); *h*, mandible (1); *i*, end of coxal lamella of mandible (3); *j*, mandible (1); *k*, *l*, maxillule (4); *m*, *n*, maxilla (4); *o*, *p*, maxilliped (4); *q*, a leg posterior to first pair. Lengths represented by scales : (1) — .1 mm; (2) — .1 mm; (3) — .05 mm; (4) — .05 mm.

extending posteriorly and dorsally interiorly from posterior corners. Mouth (fig. 33, *d*, *M*) a small midventral opening under posterior margin of labrum. Esophagus (fig. 33, *d*, *E*) curving dorsally and posteriorly from mouth. Mouthparts very small in proportion to size of labrum, at posterior third of oral cavity.

Mandible (fig. 33, *d*, *MD*, figs. 34, *h*, *i*, *j*) with extremely long and heavily sclerotized coxal lamella, unarticulated basipodite and exopodite, and endopodite inserted on basipodite without definite articulation. Masticatory lamella (fig. 34, *i*) differentiated medially into 3 or 4 small distal teeth and 1 very large proximal tooth. Basipodite with 1 medial seta. Poorly defined basal segment of endopodite with 1 seta at distal medial corner. Terminal articulated segment of endopodite with 5 short setae around medial and terminal margins. Unarticulated exopodite a flattened lobe bearing 4 setae along medial and terminal margins.

Maxillule (fig. 33, *d*, *MXL*, figs. 34, *k*, *l*) without articulations but with well-defined endite and 2 setiferous lobes possibly representing rami. Major endite with 3 slender setae on medial and distal margins and 1 small setule offset onto surface. Medial apical lobe with 3 unequal terminal setae, element strongly suggesting endopodite. Strongly flaring lateral lobe, possibly exopodite, bearing 3 setae on distal margin.

Maxilla (fig. 33, *d*, *MX*, figs. 34, *m*, *n*) 4-segmented. Basal segment with distal medial lobe bearing 1 seta. Second and third segments each with 1 seta at distal medial corner. Fourth segment with 3 setae, 2 more lateral much reduced. Maxilliped (fig. 33, *d*, *MXP*, figs. 34, *o*, *p*) minute simple lobe with 2 small terminal setae and 1 lateral seta. Maxillipeds, as well as all anterior mouthparts, articulating on heavy sclerotizations and associated with sclerotizations on roof of oral area. Very heavy cuticular hairs on posterior margin of integumentary fold delimiting oral field. Legs : First legs (fig. 33, *d*, *L1*) represented by minute vestiges just posterior to and more ventral to margin of oral field. Consisting of internal lobe with approximately 6 armatural elements arranged around distal margin and 1 more lateral heavy long seta separated from lobe and arising directly from body surface.

Possibly second to fourth legs occurring as minute setiferous prominences on body surface, as in *P. abdominalis*. Only one such lobe made out on our specimens (fig. 34, *q*) it probably representing one of these.

Extent of caudal rami, if present, undeterminable, body terminating in simple lobes.

REMARKS : No males are known for the species. Our females are nonincubatory, color transparent white, with orange gut and yellow ova in oviducts. All specimens were removed from undefined positions in the matrix of the host, clearly not involving zooids. It is remarkable that two species of *Prophioseides* should occur in the same host species, in the same geographical area. We seem here to be dealing with a case of isolation on some level not so far interpretable, but at least indicated by the specialization of sites of infestation of these 2 associated species. The morphological grounds for distinguishing the species, as discussed above, are considerable.

PROPHIOSEIDES DIPLOSOMAE, new species (Figures 35-26).

Types : Holotypic female, CHATTON collection (from France, presumably Golfe du Lion, Mediterranean Sea, from *Diplosoma gelatinosum* Milne Edwards var. *listerianum* Milne Edwards); and paratypes below.

Specimens examined :

From *D. gelatinosum* var. *listerianum* :

Locality unknown, presumably from near Banyuls, France, CHATTON number 304, holotypic female.

Host not certain, probably *D. gelatinosum* var. *listerianum* :

From vial with specimen of *D. gelatinosum* var. *listerianum*, presumably from Banyuls, France, CHATTON number 304, 1 female.

From ? *D. gelatinosum* var. *listerianum* (CHATTON manuscript identification *Diplosoma spongiforme*) :

North Argelès to Canet, October 1, 1912, CHATTON number 163, 2 females.

From unidentified host :

CHATTON number 336, 1 female.

DESCRIPTION :

Holotypic female (fig. 35) : General features : Body form and general organization impossible to determine and illustrate from contorted specimen seeming to conform in principal superficial characters with paratypic specimens described below. Body divided into short cephalosome, elongate metasome, widening posteriorly, and urosome. Cuticle pliable, small hairs covering surface of body. Cephalosome bearing appendages through first legs, apex prolonged ventrally into elongate rostrum with terminal expansion. Vulva and diverging seminal tubes at midventral line at posterior ventral limit of metasome (fig. 35, *a*). Urosome (figs. 35, *a*, *b*), with segmentation undefined, narrower than posterior part of metasome. Specimen contracted and lobes bearing caudal rami much appressed. Anal operculum small semicircular plate, with margins overlying terminal lobes of urosome.

Head structures : Antennule (fig. 35, *c*) very short, heavy lobe with perhaps some elements of armature terminally but of impossible exact determination among generally covering cuticular hairs.

Antenna (fig. 35, *d*) 2-segmented with proportional lengths of segments, basal to distal, 9 : 5. Appendage heavily sclerotized, basal segment without armature. Terminal segment with 2 small stiffened elements of armature slightly distal to middle of outer margin. Stout hook of peculiar construction and 3 small setules on apical margin.

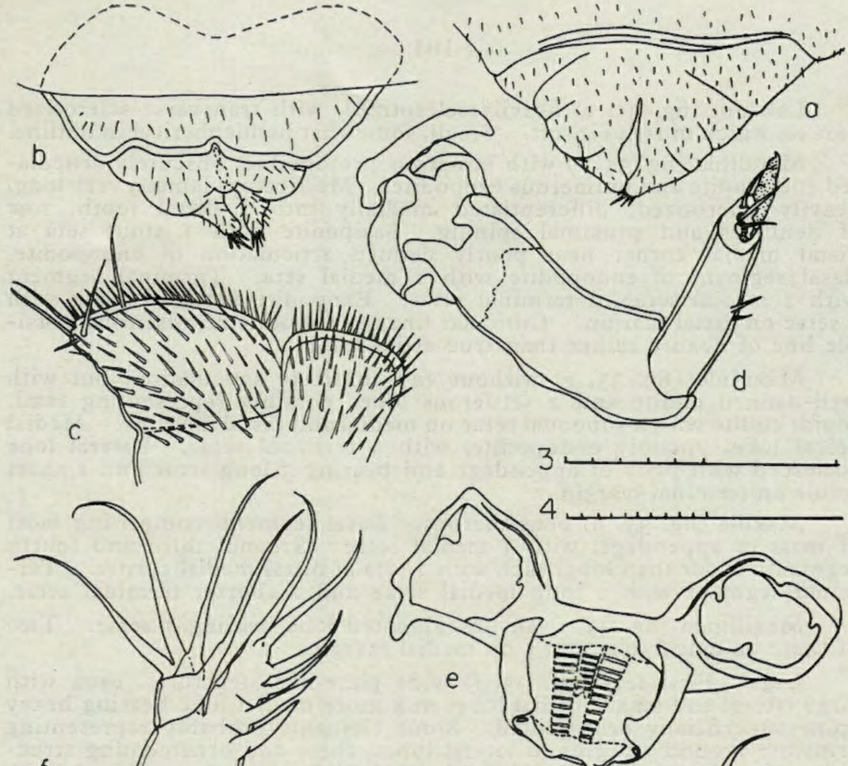

Figure 35, *a-k*, *Prophioseides diplosomae*, female : *a*, urosome, ventral (1); *b*, urosome, dorsal (1); *c*, antennule (2); *d*, antenna (3); *e*, labrum (4); *f*, mandible (3); *g*, maxillule (3); *h*, maxilla (3); *i*, maxilliped (3); *j*, first leg (2); *k*, second leg (3). Lengths represented by scales : (1) — .2 mm; (2) — .1 mm; (3) — .1 mm; (4) — .2 mm.

Labrum (fig. 35, *e*) heavily sclerotized, with transverse sclerotized bars on which muscles insert. Small, somewhat hemispherical in outline.

Mandible (fig. 35, *f*) with bimerous protopodite, obscurely articulated endopodite and unimerous exopodite. Masticatory lamella very long, heavily sclerotized, differentiated medially into 1 distal tooth, row of denticles and proximal spinule. Basipodite with 1 stout seta at distal medial corner near poorly defined articulation of endopodite. Basal segment of endopodite with 1 medial seta. Terminal segment with 2 medial setae, 2 terminal setae. Exopodite flattened plate with 4 setae on distal margin. Cuticular line in exopodite representing possible line of flexure rather than true articulation.

Maxillule (fig. 35, *g*) without any complete articulation, but with well-defined endite and 2 setiferous lobes possibly representing rami. Major endite with 4 subequal setae on medial and distal margins. Medial apical lobe, possibly endopodite, with 3 terminal setae, Lateral lobe coalesced with body of appendage and bearing 3 long setae and 1 short setule on terminal margin.

Maxilla (fig. 35, *h*) pentamerous. Basal segment, comprising most of mass of appendage, with 3 medial setae. Second, third and fourth segments wider than long, each with 1 seta at distal medial corner. Terminal segment with 2 long medial setae and 2 shorter terminal setae.

Maxilliped (fig. 35, *i*) an unsegmented lobe bearing 7 setae. Two of these on apical lobe and 5 on medial margin.

Legs : First legs (fig. 35, *j*) wide plate-like structures, each with large lateral and small medial lobes and more medial lobe bearing heavy spine superficially ornamented. Some elements probably representing armature around margins of lateral lobes, these and ornamenting structures of more medial lobe difficult to distinguish from stiffened hairs of general surface.

Second leg (fig. 35, *k*) consisting of lateral simple lobe and separated medial lobe arising directly from body surface. Ornamenting structures difficult to distinguish as true armature as against generally covering cuticular hairs.

Third and fourth legs not discernible. Caudal rami (figs. 35, *a*, *b*) small tapering lobes continuing directly from posterior terminal lobes of urosome. Difficult to determine exact extent of ramus. With terminal setiform elements somewhat longer than cuticular hairs but numbers not exactly determined.

Paratypic females (fig. 36) : General features : Body (figs. 36, *l*, *m*) modified vermiform, head tapering gradually, urosome abruptly constricted. Length 4.6 mm, measured from anteriormost point on cephalosome to end of caudal ramus on 1 specimen. Cuticle pliable, small hairs covering surface. Body divided into cephalosome, metasome and urosome. Cephalosome including appendages through first legs, apex prolonged ventrally into large finger-shaped, terminally rounded and inflated rostrum (fig. 36, *n*, *R*). Lateral margins of cephalosome partially inflected ventrally, forming lateral limits of flattened oral field. Metasome greatly elongated, about 15 times as long as cephalosome, bearing at least second through third legs, well-separated in anterior half. Fourth legs not discernible. Metasome tapering, anterior width same as that of cephalosome, greatest width, at approximate distal, third, more than 3 times that of cephalosome and urosome. Incubatory cavity extending from posterior end of metasome to level of second legs. Small anterior section of metasome set off anteriorly by line of articula-

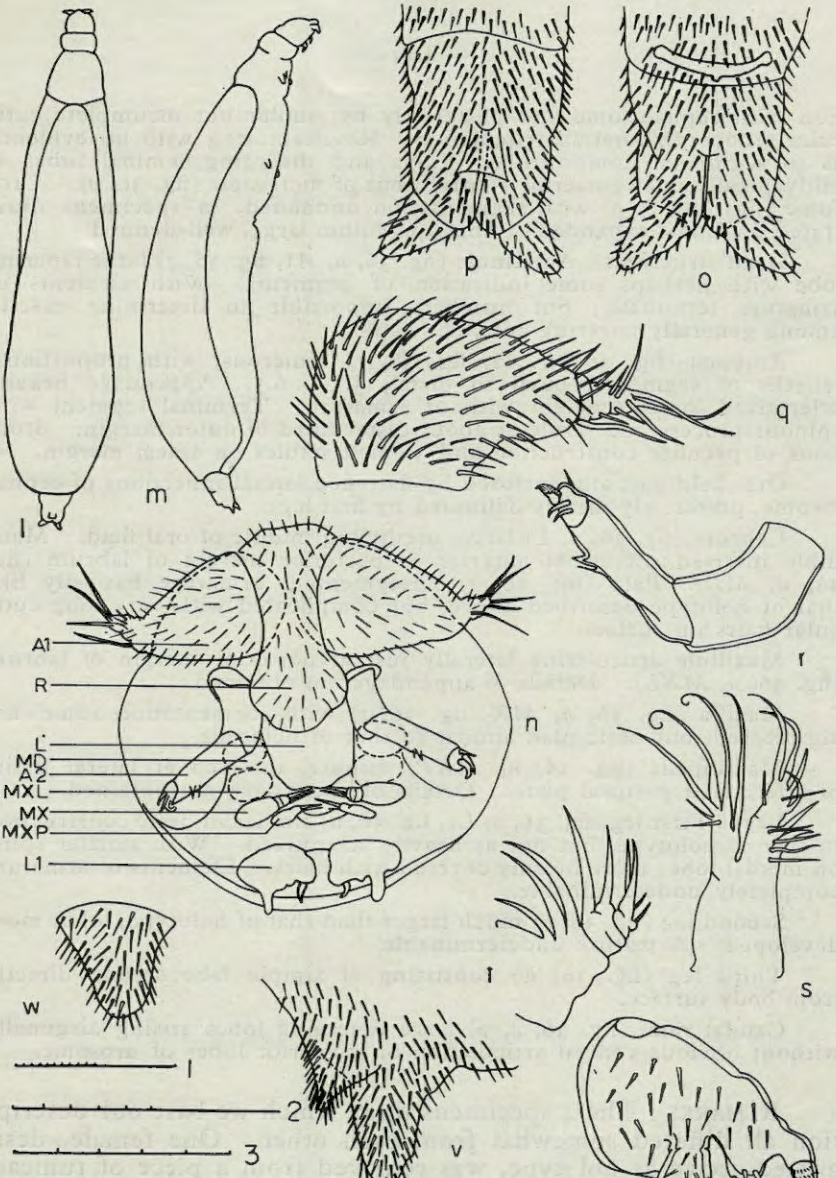

Figure 36, *l-w*, *Prophioseides diplosomae*, female : *l*, habit, dorsal; *m*, habit, lateral; *n*, cephalosome, ventral; *o*, urosome, ventral (1); *p*, urosome, dorsal (1); *q*, antennule (2); *r*, antenna (2); *s*, mandible (2); *t*, maxilla (3); *u*, first leg (2); *v*, second leg (4); *w*, third leg (5). Legend : *A*1, antennule; *A*2, antenna; *L*, labrum; *L*1, first leg; *MD*, mandible; *MX*, maxilla; *MXL*, maxillule; *MXP*, maxilliped; *R*, rostrum. Lengths represented by scales : (1) — .2 mm; (2) — .1 mm; (3) — .05 mm; (4) — .1 mm; (5) — .1 mm.

tion with cephalosome and posteriorly by similar but incomplete cuticular groove, this not an articulation. Resultant ring with no evidence as to segmental composition. Vulva and diverging seminal tubes at midventral line at posterior ventral limit of metasome (fig. 36, *o*). Urosome (figs. 36, *o*, *p*) with segmentation undefined, in specimens illustrated doubtless expanded. Anal operculum large, well-defined.

Head structures : Antennule (fig. 36, *n*, *A*1, fig. 36, *q*) large tapering lobe with perhaps some indication of segments. With elements of armature terminally, but numbers impossible to determine exactly among generally covering cuticular hairs.

Antenna (fig. 36, *n*, *A*2, fig. 36, *r*) bimerous, with proportional lengths of segments, basal to distal, 5.5 : 6.5. Appendage heavily sclerotized, basal segment without armature. Terminal segment with spinous process and setule at about distal third of outer margin. Stout hook of peculiar construction and 3 small setules on apical margin.

Oral field partially enclosed by flattened lateral inflections of cephalosome, posteriorly merely delimited by first legs.

Labrum (fig. 36, *n*, *L*) large, occupying middle of oral field. Mandible inserted somewhat anterior to posterior margin of labrum (fig. 36, *n*, *MD*). Palp (fig. 36, *s*) unsegmented, armature basically like that of holotype described above, but complicated with very long cuticular hairs on surface.

Maxillule articulating laterally just at posterior margin of labrum (fig. 36, *n*, *MXL*). Details of appendage not obtained.

Maxilla (fig. 36, *n*, *MX*, fig. 36, *t*) with segmentation somewhat suppressed, but basic plan similar to that of holotype.

Maxillipeds (fig. 36, *n*, *MXP*) minute, inserted at lateral limits of sclerotized postoral plate. Details of appendage not obtained.

Legs : First leg (fig. 36, *n*, *L*1, fig. 36, *u*) similar in basic construction to that of holotype, but not as heavily sclerotized. With smaller spine on medial lobe; more heavily covered with hairs. Elements of armature completely undeterminable.

Second leg (fig. 36, *v*) much larger than that of holotype, lobes more developed. Armature undeterminable.

Third leg (fig. 36, *w*) consisting of simple lobe arising directly from body surface.

Caudal rami (fig. 36, *o*, *p*) large diverging lobes arising diagonally without obvious ventral articulation on posterior lobes of urosome.

REMARKS : The 4 specimens upon which we base our description all differed somewhat from each other. One female, designated above as holotype, was removed from a piece of tunicate host preserved by Professor CHATTON. The host was identified as *Diplosoma gelatinosum*, so we can definitely fix the association of this specimen with the host. We have been able to describe most of the appendages of this animal, but it was contorted and compressed in the preservation of the tunicate and cut in half in dissection of the Tunicate for removal. We are therefore unable to describe the habitus, but it grossly corresponds to our other specimens. The most notable differences are in minor details of antennules, antennae, legs, and overall aspect of urosome and caudal rami. The paratypes were rather more consistent with each other. All were found preserved separately from hosts and question could arise as to the positive determination of association of copepod and host. We were unable to get complete dissections of any one. We therefore describe these as variants from the holotype, in the hope that further study will clarify the questions as to host association and variation in anatomical details. The species from *Diplosoma* thus has been fixed by us.

No males are known corresponding with these females. The paratype figured for habitus was recorded by Professor CHATTON as transparent whitish, with orange gut, with brown ova in the oviduct and with purplish brown embryos in the incubatory cavity.

HAPLOSTATUS, new genus

Type species : Haplostatus incubatrix, new species.

Taxonomic characters : The definition of this monotypic genus is provided in the description of the type species below.

The genus can be differentiated from all known vermiform notodelphyids by the absence of any well-formed appendages posterior to the antennae and by the characteristic form of the vulva.

HAPLOSTATUS INCUBATRIX, new species (Figures 37-38).

Types : Holotypic female, USNM 104835 (type locality, Golfe du Lion, Mediterranean Sea, from *Cystodites dellechiajei* della Valle); paratypes listed below.

Specimens examined :

From *C. dellechiajei* :

Cap l'Abeille, 25 m, May 7, 1958, holotypic female.

CHATTON number 219, 1 female.

From ?*C. dellechiajei* (CHATTON manuscript identification *Cystodites philippinensis*) :

CHATTON number 230, 1 female.

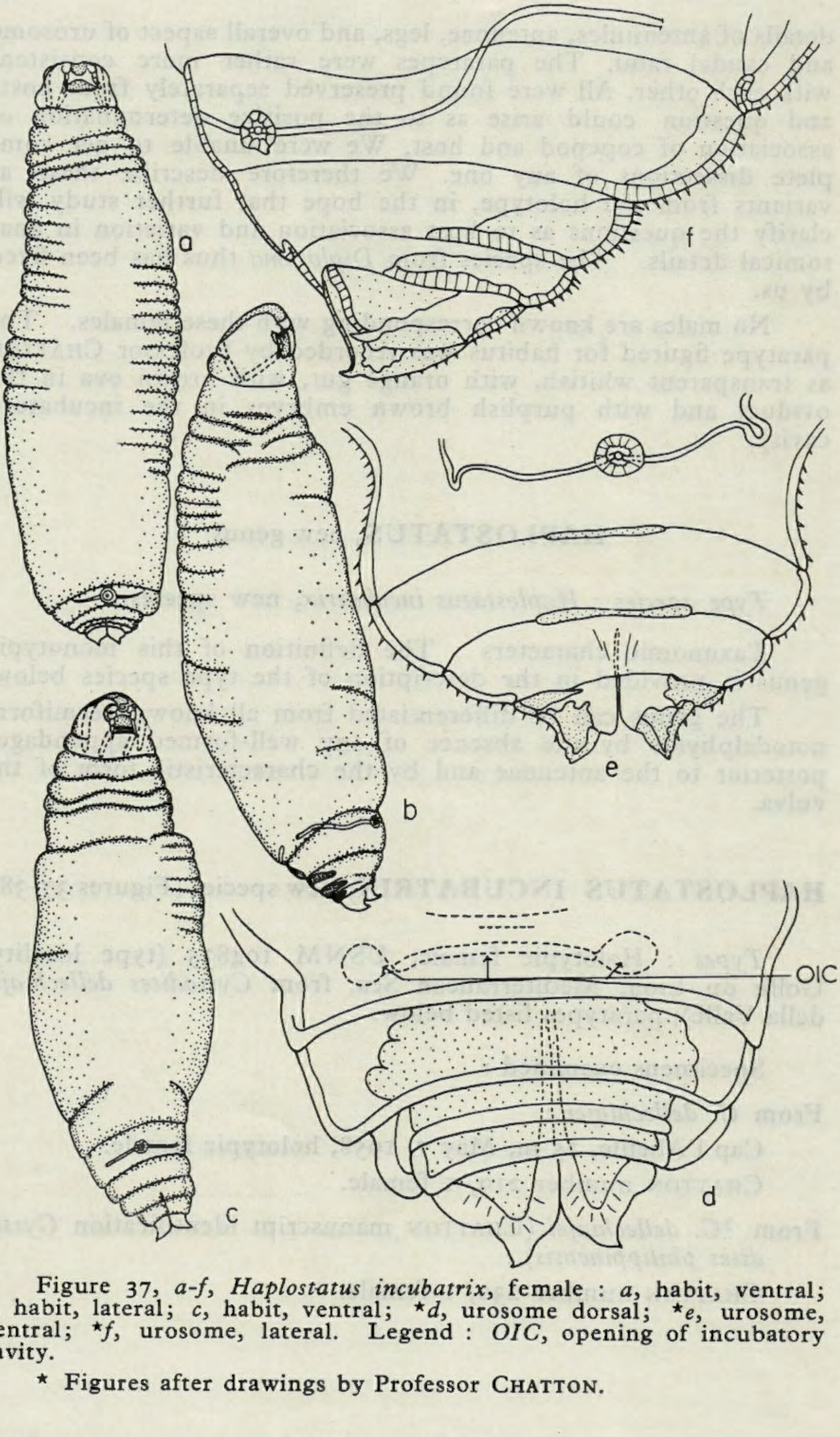

Figure 37, *a-f*, *Haplostatus incubatrix*, female : *a*, habit, ventral; *b*, habit, lateral; *c*, habit, ventral; **d*, urosome dorsal; **e*, urosome, ventral; **f*, urosome, lateral. Legend : *OIC*, opening of incubatory cavity.

* Figures after drawings by Professor CHATTON.

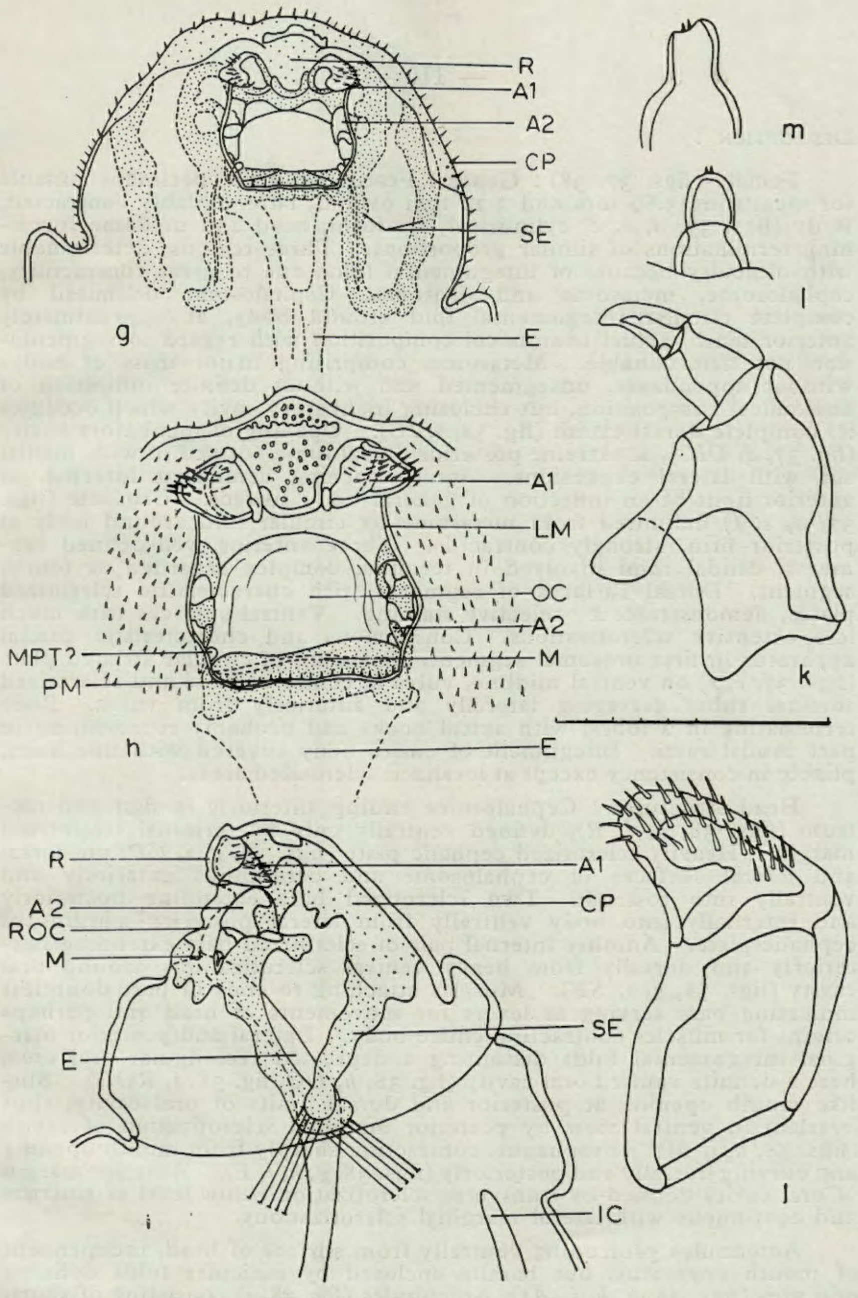

Figure 38, *g-m*, *Haplostatus incubatrix*, female : * *g*, cephalosome, ventral; **h*, oral area; **i*, cephalosome, lateral; *j*, antennule (1); *k*, antenna (1); *l*, *m*, lobe, perhaps mouthpart, *l*, lateral view, *m*, anterior view (1). Legend : *A1*, antennule; *A2*, antenna; *CP*, cephalic plate; *E*, esophagus; *IC*, anterior limit of incubatory cavity; *LM*, lateral margin of oral field; *M*, mouth; *MPT?*, lobe, perhaps mouthpart; *PM*, posterior margin of oral field; *OC*, oral cavity; *R*, rostrum; *ROC*, roof of oral cavity; *SE*, sclerotized bar. Length represented by scale : (1) — .1 mm.

* Figures after drawings by Professor CHATTON.

DESCRIPTION :

Female (figs. 37, 38) : General Features : Two specimens suitable for measuring 3.89 mm and 2.21 mm overall, latter notably contracted, Body (figs. 37, *a*, *b*, *c*) cylindrical, fusiform, head and urosome furnishing terminations of similar proportions. Three regions, determinable with difficulty because of integumental folds due to great contractility, cephalosome, metasome and urosome. Cephalosome delimited by complete circular integumental fold around body, at approximately anterior tenth, actual anatomical composition with regard to segmentation not determinable. Metasome, comprising major mass of bodys without appendages, unsegmented and without definite indication of anatomical composition, but enclosing incubatory cavity which occupies its complete dorsal extent (fig. 38, *i*, *IC*). Opening of incubatory cavity (fig. 37, *d*, *OIC*), at extreme posterior dorsal limit, formed of wide medial slit with lateral expansions. Actual opening somewhat internal, at anterior limit of an inflection of general body surface. Urosome (figs. 37, *d*, *e*, *f*) delimited from metasome by circular fold around body at posterior fifth, strongly contractile. Three anterior well-defined segments, caudal rami involved in terminal complex regarded as fourth segment. Dorsal surfaces of segments with characteristic sclerotized plates, demonstrable by selective staining. Ventral surfaces with much less extensive sclerotizations. Conspicuous and characteristic genital apparatus in first urosomal segment, consisting of circular striated plate (figs. 37, *e*, *f*) on ventral midline, vulva at center of plate and sclerotized seminal tubes diverging laterally and anteriorly from vulva. Body terminating in 2 lobes, with apical hooks and probably representing in part caudal rami. Integument of entire body covered with fine hairs, pliable in consistency except at localized sclerotized areas.

Head structures : Cephalosome ending anteriorly in flattened rostrum (figs. 38, *g*, *i*, *R*), defined ventrally only by terminal sclerotized margin. Heavily sclerotized cephalic plate (figs. 38, *g*, *i*, *CP*) on dorsal and lateral surfaces of cephalosome and continuous anteriorly and ventrally into rostrum. Two sclerotized bars extending posteriorly and internally into body ventrally from lateral posterior margins of cephalic plate. Another internal pair of sclerotized bars extending posteriorly and dorsally from heavy ventral sclerotizations around oral cavity (figs. 38, *g*, *i*, *SE*). Muscles attaching to ends of bars doubtless indicating bars serving as levers for movements of head and perhaps origins for muscles contracting entire body. Lateral and posterior marginal integumental folds delimiting a depressed rectangular oral area, here a definite vaulted oral cavity (fig. 38, *h*, *OC*, fig. 38, *i*, *ROC*). Slit-like mouth opening at posterior and dorsal limits of oral cavity, thus overlain in ventral view by posterior marginal sclerotization of cavity (figs. 38, *h*, *i*, *M*). Esophagus, contracting sharply from mouth opening and curving dorsally and posteriorly (figs. 38, *g*, *h*, *i*, *E*). Anterior margin of oral cavity defined by transverse sclerotization below level of rostrum and continuous with lateral marginal sclerotizations.

Antennules protruding ventrally from surface of head, independent of mouth apparatus, but basally enclosed by cuticular folds defining oral area (figs. 38, *g*, *h*, *i*, *A1*). Antennules (fig. 38, *j*) consisting of short, sclerotized lobes covered with stiffened hairs.

Bimerous antennae (fig. 38, *k*) articulating on lateral marginal sclerotizations of oral area, just posterior and dorsal to antennules, lying thus in oral cavity and extending to lateral posterior corners of cavity (figs. 38, *g*, *h*, *i*, *A2*). Position and structure strongly indicating assumption of function as mouthparts. Large basal segment making up more than half of mass of appendage, terminal segment articulating strongly with heavy straightened hook.

Very small, obscurely bimerous lobes (figs. 38, *l*, *m*) bearing terminal spinules found at lateral posterior corners of sclerotizations near mouth opening (fig. 38, *h*, *MPT?*). These possibly representing mouthparts.

REMARKS : The body is transparent, the gut is yellow, and the ova in the oviduct are pale blue-green. The host species of Tunicate is characterized by enclosure of the zooids by specializations resembling capsules formed of overlapping discoidal spicules. The specimen collected in 1958 was found in such a capsule; whether in the body of the zooid or not was not determined. On one of CHATTON's labels he states the specimen was taken in the superficial tunic. One of the available specimens has enclosed embryos in the incubatory cavity.

OONEIDES Chatton and Brément, 1915

OONEIDES Chatton and Brément, 1915*b*. — Illg, 1958.

The unique habitus of this monotypic genus, as an inflated ovoid with no superficially inserted appendages, serves to differentiate it from all other Notodelphyids.

OONEIDES AMELA Chatton and Brément, 1915 (Figures 39-41).

Ooneides amela Chatton and Brément, 1915*b* (type locality, Banyuls, France, in *Leptoclinum dentatum* della Valle). — Illg, 1958.

Specimens examined :

From *Didemnum dentatum* della Valle :

Cap l'Abeille, 25 m, June 3, 1958, 1 female.

From ?*Didemnum* sp. (CHATTON manuscript identification « Leptocline blanc ») :

Baie du Fontaulé, Banyuls, November 10, 1910, CHATTON number 148, 1 female.

From ?*Didemnum fulgens* Milne Edwards (CHATTON manuscript identification « *Leptoclinum commune* var. orange claire ») : CHATTON number 193, 4 females.

From ?*Didemnum sp.* (CHATTON manuscript identification « Leptocline rouge brique ») :

Baie du Fontanlé, Banyuls, November 10, 1910, 6 females, of type series.

From *Didemnum candidum* Savigny :

Mixed trawl (1) near Port-Vendres, 70 m — North (2) near Port-Vendres from 60 m to 30 m — northeast, May 6, 1958, 3 females.

From *Didemnum maculosum* Milne Edwards :

Mixed trawl (1) north of Cap Béar, 60 m, (2) northeast of Port-Vendres, 90 m, May 14, 1958, 1 female.

From *Didemnum fulgens* Milne Edwards :

Mixed trawl (1) north of Cap Béar, 60 m, (2) northeast of Port-Vendres, 90 m, May 14, 1958, 2 females.

We consider the original description of this species remarkable because this is one of the most difficult of Copepods to dissect. Some of the appendages are particularly minute and all are remotely enclosed by secondary inflections of the body surface. We present some slight emendations of detail and reinterpret some findings.

DESCRIPTION :

Female (figs. 39, 40, 41) General Features : Body (figs. 39, *a*, *b*) ovoid, extremely inflated; length of longitudinal axis 1.7 mm, average of two specimens. Cephalosome completely fused with metasome. Small urosome (fig. 39, *c*) anteroventrally directed, articulating on body at about middle of ventral surface. Segmentation of urosome obscure, large anal operculum present. Cuticle pliable, covered with small hairs. Incubatory cavity opening just posterior to urosome and extending throughout most of body mass. Inflation of body due both to expanded body cavity and capacious brood pouch.

Rostrum elongate, finger-shaped (figs. 39, *d*, *e*, *R*), its lateral margins continuous with conspicuous lobulate inflections (figs. 39, *d*, *e*, *IA*, I, II, III, IV) which form a sort of involucre containing a much-invaginated oral cavity. Muscle bands extending around margins of lobes, capable of contracting almost to close orifice of involucre, or of relaxing to permit wide expansion of orifice (fig. 39, *d*, relaxed, fig. 39, *e*, contracted).

Antennule (figs. 39, *d*, *e*, *A*1, fig. 40, *f*) found in loop formed by juncture of margins of rostrum and lobes IA, somewhat protruding. Appendage, an unarticulated lobe, inflated basally, terminally constricted, with some long elements of armature particularly apically, but these distinguishable with difficulty from generally covering cuticular hairs.

Antenna (figs. 39, *d*, *e*, 40, *i*, *A*2, fig. 40, *g*) articulating under lobe IA. Appendage bimerous, capable of being extended from oral cavity.

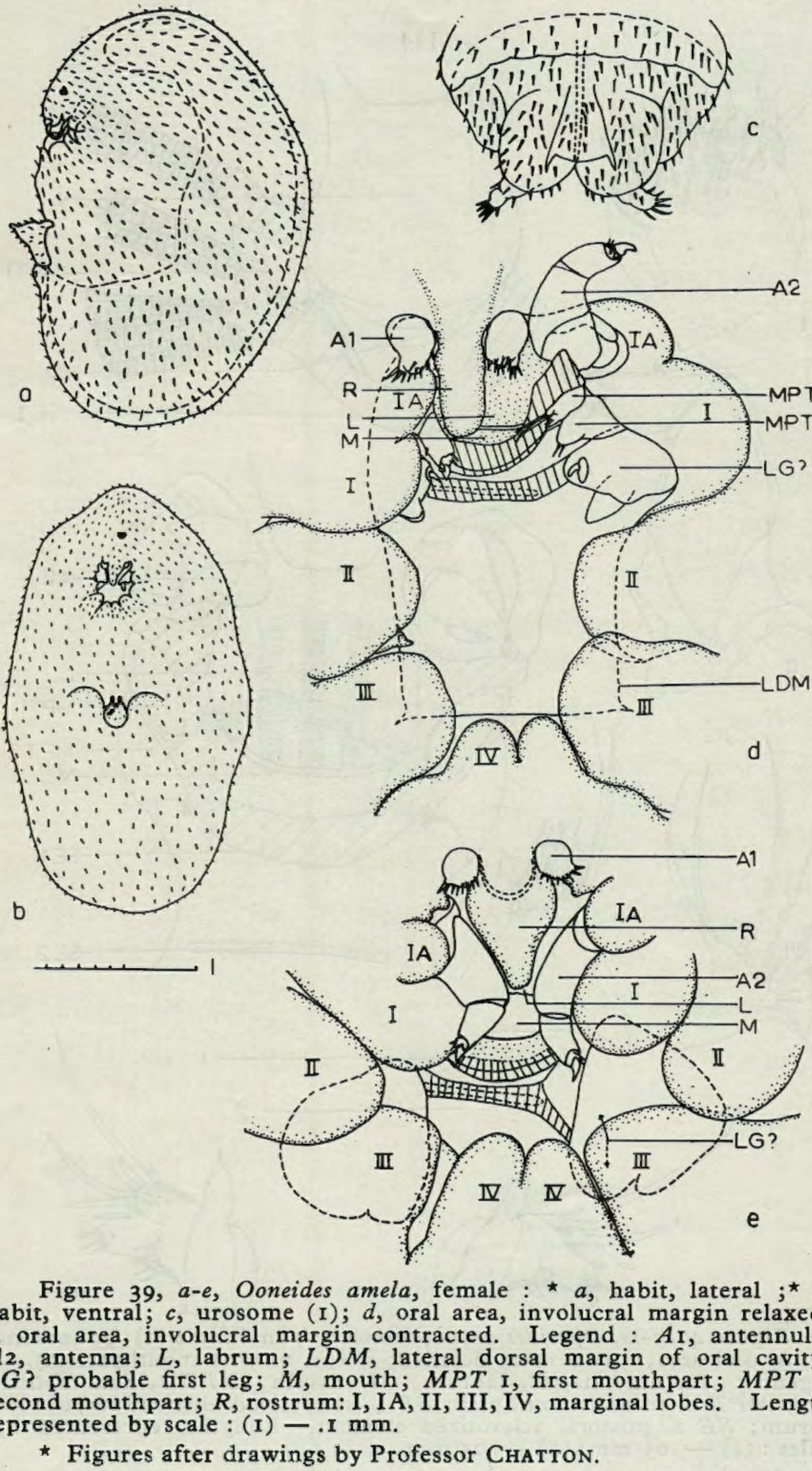

Figure 39, *a-e*, *Ooneides amela*, female : * *a*, habit, lateral ;* *b*, habit, ventral; *c*, urosome (1); *d*, oral area, involucral margin relaxed; *e*, oral area, involucral margin contracted. Legend : *A*1, antennule; *A*2, antenna; *L*, labrum; *LDM*, lateral dorsal margin of oral cavity; *LG*? probable first leg; *M*, mouth; *MPT* 1, first mouthpart; *MPT* 2, second mouthpart; *R*, rostrum: I, IA, II, III, IV, marginal lobes. Length represented by scale : (1) — .1 mm.

* Figures after drawings by Professor Chatton.

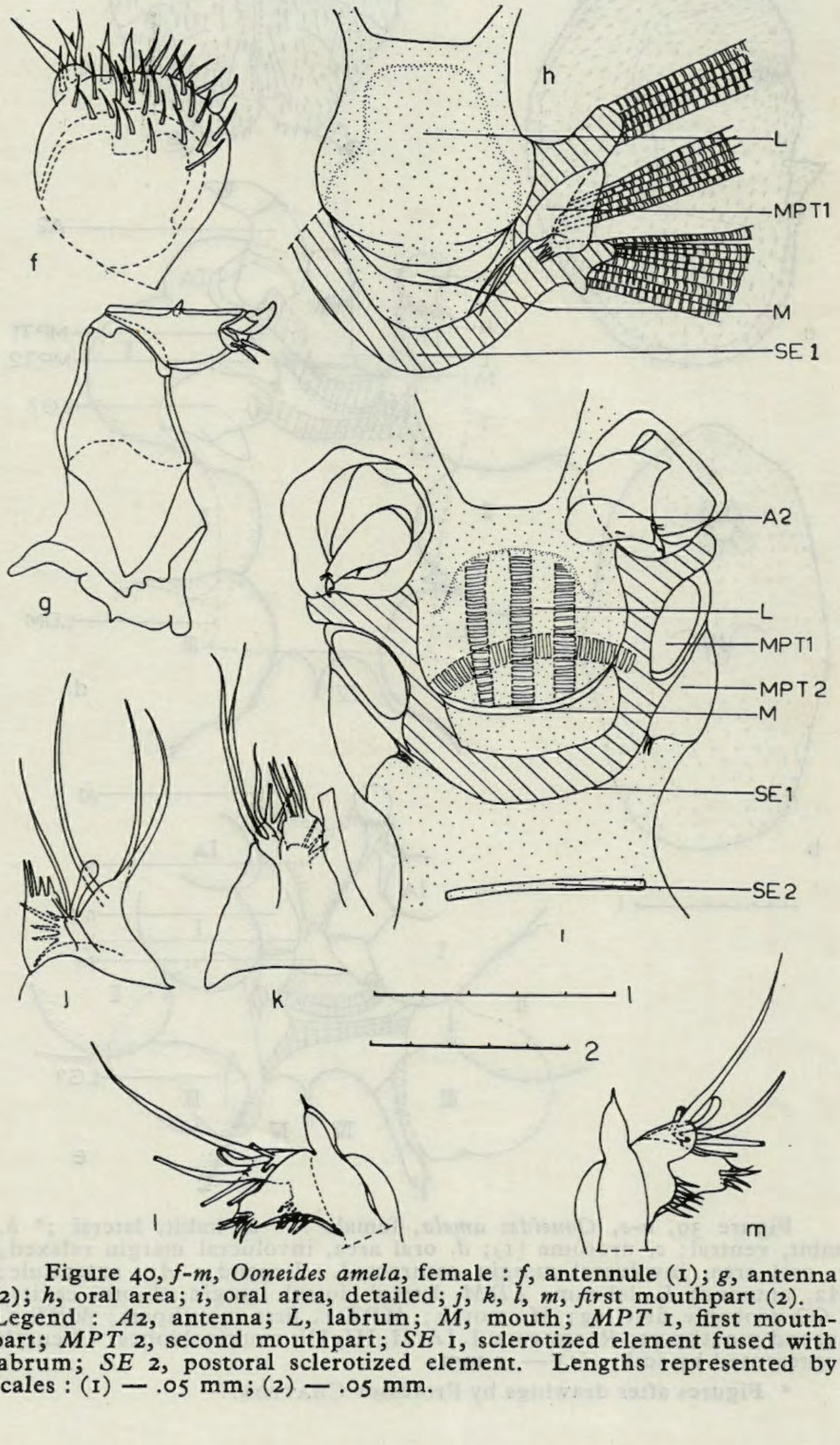

Figure 40, *f-m*, *Ooneides amela*, female : *f*, antennule (1); *g*, antenna (2); *h*, oral area; *i*, oral area, detailed; *j*, *k*, *l*, *m*, *first* mouthpart (2). Legend : *A2*, antenna; *L*, labrum; *M*, mouth; *MPT 1*, first mouthpart; *MPT 2*, second mouthpart; *SE 1*, sclerotized element fused with labrum; *SE 2*, postoral sclerotized element. Lengths represented by scales : (1) — .05 mm; (2) — .05 mm.

Proportional lengths of segments basal to distal 2 : 1. Basal segment without armature, terminal segment with setule near middle of outer margin, and with 3 setae and 1 heavy hook on apex.

Labrum (figs. 39, *d*, *e*, 40, *h*, *i*, 41, *n*, *L*) very complicated, large, with sclerotizations and muscles. In expanded condition almost closing mouth (figs. 40, *h*, *i*, *M*). In contracted state, strongly withdrawn anteriorly to open mouth widely (fi. 41, *n*, *M*). Heavy U-shaped sclerotized bar joined with lateral margins of labrum (figs. 40, *h*, *i*, *SE*, *l*). Bar defining locus of articulation of first mouthpart (figs. 40, *h*, *i*, 41, *n*, *MPT* 1).

First mouthpart (figs. 39, *d*, 40, *h*, 41, *n*, *MTP* 1, figs. 40, *j*, *k*, *l*, *m*) located under cuticular lobe I. Appendage complex, composed of 2 bilobed elements. One element with smaller lobe bearing 3 setae, 1 of

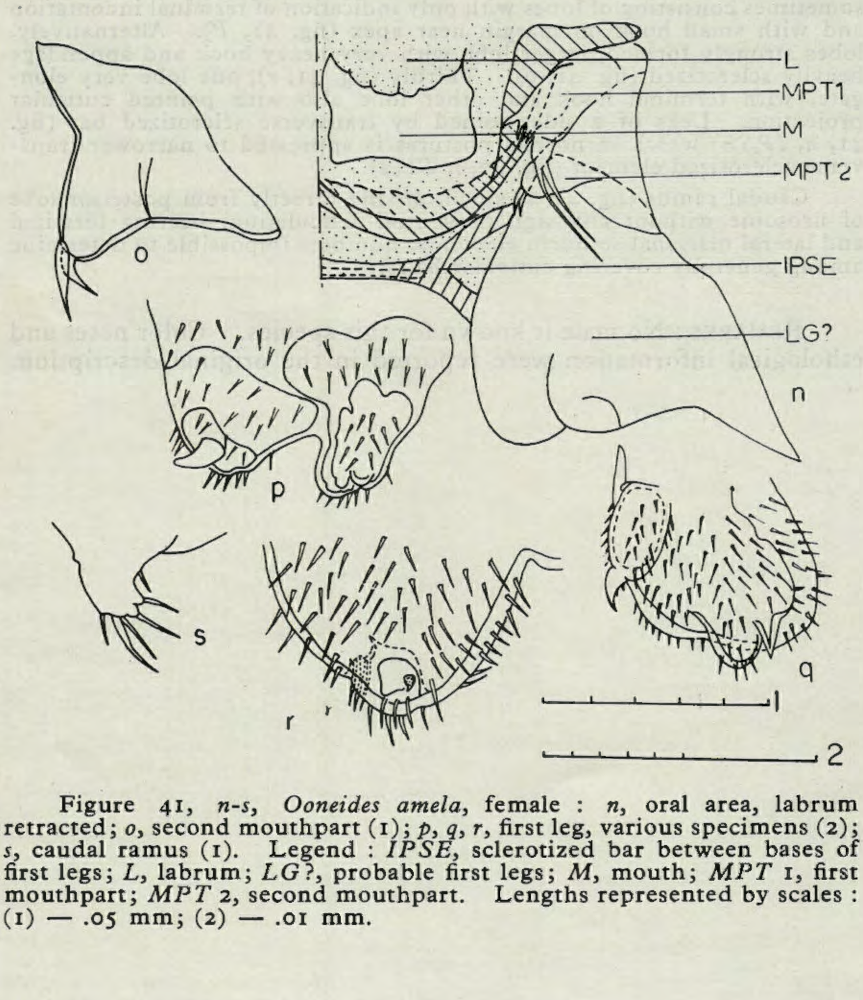

Figure 41, *n-s*, *Ooneides amela*, female : *n*, oral area, labrum retracted; *o*, second mouthpart (1); *p*, *q*, *r*, first leg, various specimens (2); *s*, caudal ramus (1). Legend : *IPSE*, sclerotized bar between bases of first legs; *L*, labrum; *LG*?, probable first legs; *M*, mouth; *MPT* 1, first mouthpart; *MPT* 2, second mouthpart. Lengths represented by scales : (1) — .05 mm; (2) — .01 mm.

these modified as spatulate blade. Second lobe of this element with 4 short, heavy, tooth-like processes, these sometimes setiform. Other element with 2 to 4 elongate setae on major lobe and smaller subterminal lobe with 3 to 5 small setae.

Second mouthpart (figs. 39, *d*, 40, *i*, 41, *n*, *MPT* 2, fig. 41, *o*) also found under lobe I, but distal to first mouthpart. Consisting of pyramidal lobe with 2 short terminal setae. This appendage was designated by CHATTON and BRÉMENT as « Maxille I », in the figures, « Mx I ».

A large bilobed structure which we consider to be one of a pair of legs (fig. 41, *n*, *LG?*, figs. 41, *p*, *q*, *r*) labelled by Chatton and Brément as « Maxille II », in figures « Mx II », articulating on lateral dorsal margin (fig. 39, *d*, *L D M*, *LG*?) of oral cavity lying under lobe I in expanded state of oral area, but covered by lobes I, II and III in contracted state of oral area (figs. 39, *e*, *LG?*). Variable among specimens dissected, sometimes consisting of lobes with only indication of terminal indentation and with small hook on margin near apex (fig. 41, *P*). Alternatively, lobes strongly formed, larger lobe with very heavy hook and appendage heavily sclerotized (fig. 41, *q*). Thirdly (fig. 41, *r*), one lobe very elongate, with terminal hook and other lobe also with pointed cuticular projection. Legs of 2 sides joined by transverse sclerotized bar (fig. 41, *n*, *IPSE*) which in normal postures is appressed to narrower transverse sclerotized element (fig. 40, *i*, *SE* 2).

Caudal ramus (fig. 41, *s*) small, arising directly from posterior lobe of urosome without any sign of ventral articulation, bearing terminal and lateral marginal setiform elements, numbers impossible to determine among generally covering cuticular hairs.

REMARKS : No male is known for this species. Color notes and ethological information were reported in the original description.

DISCUSSION

The finding of new species and indeed of new genera in the present study has expanded the knowledge of the family *Notodelphyidae* but has not brought us to any major proposal with regard to rearrangement of the systematics of the family. We can now make somewhat more surely some generalizations and predictions with regard to phyletic relationships and host associations and add information on zoogeography.

In compiling records of the species we have studied, we note some indications of trends of distribution of Notodelphyids found in the Mediterranean Sea. There is a group of species from the Mediterranean Sea still unreported elsewhere; we are sure some of these will indeed turn up in other areas when more exploration is carried on, but an indication does exist. These are *Goniodelphys trigona* Buchholz; « *Bonnierilla* » *arcuata* Brément; *Prophioseides abdominalis* (Chatton and Brément); *Ooneides amela* Chatton and Brément; *Brementia balneolensis* Chatton and Brément; and except for *Notodelphys platymera*, new species, all our new species described above. These last, of course only serve as the feeblest of indications in this matter. With the exception of *Brementia balneolensis* and *Goniodelphys trigona*, we have seen material of all of these from Banyuls.

Another group is known from the Mediterranean and ranges northward along the Atlantic Coast to as far as the British Isles or, further still, to Scandinavia. These include *Bonnierilla longipes* (Kerschner); *Doroixys uncinata* Kerschner; *Notopterophorus elatus* Giesbrecht; *Notopterophorus elongatus* Buchholz; *Botachus cylindratus* Thorell; *Notodelphys agilis* Thorell; *N. allmani* Thorell; *N. elegans* Thorell; *N. prasina* Thorell; *N. rufescens* Thorell; *N. tenera* Thorell; *Doropygus pulex* Thorell; *Doropygella psyllus* (Thorell); *D. normani* (Brady); *Pachypygus gibber* (Thorell);

Gunenotophorus globularis Buchholz. Some of these range farther still, as noted below. We have found most of these at Banyuls, the exceptions being *Notodelphys agilis*, *N. tenera*, *N. rufescens*, *Doropygella psyllus*, *D. normani*, *Pachypygus gibber*.

One species, *Scolecimorpha joubini* (Chatton) is found in the Mediterranean Sea, is reported from New Zealand, and, we suspect, ranges to Norway.

One species, *Bonnierilla armata* Schellenberg, ranges from the Mediterranean Sea to West Africa and Australia. This species and *S. joubini* are the only very strong indicators of affinity with Indopacific fauna (and we feel *Doropygus pulex* at present must be disregarded in this connection). So far there are no reports for the many species known from the Gulf of Suez as ranging on into the Mediterranean Sea.

Very tenuous indications exist that 4 of the wide-ranging European species extend to North America. Two of these, *N. agilis* and *P. gibber*, may represent a boreal pattern of distribution. Two others, *D. pulex* and *G. globularis*, may represent a subequatorial continuity.

Our findings provide strong indication that there is a correlation of phylogenetic differentiation in the Notodelphyids and in their hosts. There are degrees of expression of this, ranging from species specificities to broad general divergences at the ordinal level of the tunicates. The published record will offer contradictions to some of the indications we note below, but we have developed a conviction for these and offer them as promising subjects for further investigation.

Notodelphys elegans is characteristically associated with *Ciona intestinalis* Fleming. As far as our evidence is concerned the species of *Notopterophorus* which we have found in the Mediterranean are definite associates of species of Tunicates in different genera, whatever the genetic status of the differentiation of the Copepods may be. *N. papilio* occurs in *Ascidia mentula* (Müller). *N. elongatus* occurs in *Phallusia mammillata* (Cuvier). Our new species, *N. dimitus*, is associated with *Ciona intestinalis* Fleming. In *Doropygus* there do not occur such striking anatomical characters as the excrescences of *Notopterophorus*, but in *D. pulex* identifiable forms occur with definite hosts, some with specific affinity, and some ranging through a generic series. *Botachus cylindratus*, in the Mediterranean Sea is associated with *Ascidia mentula* (Müller). *Haplostatus incubatrix* occurs only in *Cystodites dellechiajei* della Valle. There are other records among the extremely degenerate forms as occurring in only one host, but the distribution of these is so poorly known that it would be misleading to make broad generalizations on this basis.

As an example of association with host at the generic level we have found *Gunenotophorus globularis* in the Mediterranean Sea only in species of *Polycarpa*, *P. pomaria* and *P. gracilis*.

Indications of familial affinity exist in several examples. « *Bonnierilla* » *arcuata* is so far known only from hosts of the family *Didemnidae* Giard. Interestingly, from the same family we have found both species of *Demoixys*, of rather rare occurrence so far. Ranging through several species in the family is *Ooneides amela*. *Doroixys uncinata* occurs mainly in members of the family *Polyclinidae* Milne Edwards, but we have found it also in a member of the family *Clavellinidae* Forbes and Hanley. Certain species of *Notodelphys*, as perusal of the record will show, but unsubstantiated so far by us, seem to demonstrate affinity at the familial level of their hosts.

Among *Notodelphys* species, we have stated above (p. 12) that there are indications of two definite, although closely related, groups of species, associated respectively with two orders of Tunicates, order *Enterogona*, suborder *Phlebobranchiata* Lahille, and order *Pleurogona*, suborder *Stolidobranchiata* Lahille.

In very broad outlines further indications appear. Among the much modified globular and vermiform genera there is a marked tendency for most to appear in association with the compound tunicates. However, a group composed of such highly modified forms composed of *Gunenotophorus* and *Lobodelphys*, globular, and *Scolecimorpha*, vermiform, occurs in the solitary tunicates. As discussed further below, these genera also form a consistent group on morphological bases. There are indications of ecological specialization within the host of the associated notodelphyids, although the situation is much complicated by simultaneous infestations with botryllophilids, ascidicolids, and enterocolids, as well as more remotely related families of Copepods. This situation has pertinently appeared as a definite problem in our present systematic considerations. Two species of *Prophioseides*, *P. abdominalis* and *P. delamarei* are found from the same species of compound tunicate. We know of no record as yet of a simultaneous infection. *P. abdominalis* has only been reported from the postabdomens of the individual zooids. *P. delamarei* was found in the matrix of the colony. Such physical separation could be regarded as an effective specific isolation for species of sedentary symbionts. Indications from this same line of evidence offer us certain inferences as to category of symbiotic relationship of Copepod and host. In the solitary Tunicates, the Notodelphyids with the least degenerated degree of anatomical modification live in the branchial baskets. No form is known yet as occuring as adult females in the atrium, although males and developmental forms may occur there, however, in close association with the stigmata. These least modified forms are possible commensals. In the solitary Tunicates, the highly modified forms, *Gunenotophorus* and *Lobodelphys* also live in branchial baskets, so little implication is available here. A highly modified vermiform representative is *Scolecimorpha*, the females living in cysts in the tunic, perhaps in definite association with blood vessels. These doubtless are parasites.

In compound Tunicates we have remarked several habitats. The less modified Notodelphyids live in branchial baskets of zooids. Larger, more degenerate forms lie inactively in the expanded common cloacal chambers. Another form, *Demoixys chattoni*, is completely invested in a cyst in the matrix of the host, a situation completely enigmatic to us as far as nutritional inferences are concerned. The most intimate association of Copepod and compound Tunicate would probably be exemplified by *Prophioseides abdominalis*, lying in the postabdomen of the zooid.

As we have studied the anatomy of representatives, particularly of the degenerate forms, we have noted certain trends of specialization concerned with the oral area, in addition to degenerations of the mouthparts. The margins of the cephalosome inflect ventrally and a series is seen in which resultant margins variously enclose and delimit the oral field. In an advanced state a continuous margin delimits the oral area, and, perhaps at the extreme, *Ooneides amela*, a lobulate involucre, capable of distention and constriction forms a secondary opening to an enclosed and vaulted preoral cavity. In some stages in the progression toward this state, other specializations occur, some involving the rostrum as participant in oral functions. In some, the first legs become definitely cephalosomic and serve to close the mouth area posteriorly and even to a certain extent ventrally. In some, a posterior marginal fold, non-contractile, is the posterior limit of a depressed oral area. Perhaps in correlation with these trends, the antennules and antennae show modification. Antennules lose all traces of segmentation and the armature becomes obsolete. In the antennae, an interesting respecialization is seen, in which the prehensile function seems to be superseded by a transference to activity in manipulation of food rather than attachment to the host.

Parallel with, or independently of, these specializations there are seen reductions in the size and the armature of the mouthparts. However, certain parts of the appendages, such as the setae of the terminal segments, and a condition of elongation of the mandibular lamella in order to reach to the mouth, would seem to indicate the mouthparts still act in manipulation and mastication. In some forms, such as *Ooneides* and *Haplostatus*, both of which posses a depressed and confined oral cavity, some mouthparts are completely absent, the antennae and the specialized margins seeming capable of serving in feeding activities.

Among the group of degenerate Notodelphyids living in solitary Tunicates, *Lobodelphys elephas* and *Scolecimorpha joubini*, seem to show a trend with respect to modifications of mouthparts different from that shown by *Prophioseides*, and *Demoixys*, which live in compound Tunicates. In the former group, it is difficult to discern a Notodelphyid anatomical pattern in the mouthparts, this being determinable only by study of developmental stages. In the latter genera, however, although the mouthparts are reduced, a basic notodelphyid pattern is apparent. These seem intermediate, then, between still less retrograde forms, such as *Doroixys*, and still more modified representatives, such as *Ooneides*, and *Haplostatus*. *Demoixys*, particularly, seems to provide a case of direct transition toward the more degenerate level. In all essentials, it is directly comparable with the features of *Doroixys*, but in all with a degree of modification that to us demands systematic separation.

In comparison, basic trends of degenerate modification in *Lobodelphys* and *Scolecimorpha* seem derivable from a level to which *Gunenotophorus* belongs and together these form a series in which, however, we have not seen such a direct transition as found between *Doroixys* and *Demoixys*.

Doroixys seems to correspond to the level of modification found in *Gunenotophorus*, although its modifications differ in a way suggesting association with a different lineage, one associated with compound tunicates.

All the genera of extremely degenerate Notodelphyids proposed until now have been established as monotypic. By the assignment of our new species to rather broad genera, we have attempted to establish that there are indeed polytypic groups. It is probable that careful examination of Tunicate hosts for associated Copepods will disclose many more representatives of these groups. The definitive establishment of these as lineages and the discovery of other phylogenetic indications will depend on the thoroughness with which they are studied and described.

TABLE I

Setation, spination and segmentation of swimming legs in females of species of *Notodelphys*, *Doropygus*, *Notopterophus*, and *Bonnierilla*.

Legend : *s* — seta; *sp* — spine; *sl* — setule; *si* — minute spine; M — medial margin; L — lateral margin; T — terminal margin. Numbers in appendage column refer to number of segments; ( ) denotes segment which is obscurely articulated ; — indicates absence of elements of armature of usual occurrence among these Notodelphyids.

	Notodelphys acanthomela			*Notodelphys reducta*			*Notodelphys haranti*		
	M	L	T	M	L	T	M	L	T
Leg 1									
Coxopodite	1 s			1 s			1 s		
Basipodite	1 sp	1 s		1 sp	1 s		1 sp	1 s	
Endopodite									
1	1 s			1 s			1 s		
2	1 s			1 s			1 s		
3	3 s	1 s	2 s	3 s	1 s	2 s	5 s	1 s	
Exopodite									
1	1 s	1 sp		1 s	1 sp		1 s	1 sp	
2	1 s	1 sp		1 s	1 sp		1 s	1 sp	
3	3 s	3 sp	1 sp, 1 s	3 s	3 sp	1 sp, 1 s	3 s	3 sp	1 sp, 1 s
Leg 2									
Coxopodite	1 s			1 s			1 s		
Basipodite		1 s			1 s			1 s	
Endopodite									
1	1 s			1 s			1 s		
2	(2 s)			(2 s)			(2 s)		
3	3 s	1 s	2 s	3 s	1 s	2 s	3 s	1 s	2 s
Exopodite									
1	1 s	1 sp		1 s	1 sp		1 s	1 sp	
2	1 s	1 sp		1 s	1 sp		1 s	1 sp	
3	4 s	3 sp	1 sp, 1 s	4 s	3 sp	1 sp, 1 s	4 s	3 sp	1 sp, 1 s
Leg 3									
Coxopodite	1 s			1 s			1 s		
Basipodite		1 s			1 s			1 s	
Endopodite									
1	1 s			1 s			1 s		
2	(2 s)			(2 s)			(2 s)		
3	3 s	1 s	2 s	3 s	1 s	2 s	3 s	1 s	2 s
Exopodite									
1	1 s	1 sp		1 s	1 sp		1 s	1 sp	
2	1 s	1 sp		1 s	1 sp		1 s	1 sp	
3	4 s	3 sp	1 sp, 1 s	4 s	3 sp	1 sp, 1 s	4 s	3 sp	1 sp, 1 s
Leg 4									
Coxopodite	1 s			1 s			1 s		
Basipodite		1 s			1 s			1 s	
Endopodite									
1	1 s			1 s			1 s		
2	2 s			2 s			(2 s)		
3	2 s	1 s	2 s	2 s	1 s	2 s	2 s	1 s	2 s
Exopodite									
1	1 s	1 sp		1 s	1 sp		1 s	1 sp	
2	1 s	1 sp		1 s	1 sp		1 s	1 sp	
3	4 s	2 sp	1 sp, 1 s	4 s	2 sp	1 sp, 1 s	4 s	2 sp	1 sp, 1 s

	Notodelphys platymera			*Doropygus pulex*			*Notopterophorus dimitus*		
	M	L	T	M	L	T	M	L	T
Leg 1									
Coxopodite	1 s			1 s			1 s		
Basipodite	1 sp	1 s		1 sp	1 s		1 sp	1 s	
Endopodite									
1	1 s			1 s			1 s		
2	1 s			1 s			(1 s)		
3	4 s	1 s	1 s	3 s	1 s	2 s	3 s	1 s	2 s
Exopodite									
1	1 s	1 sp		1 s	1 sp		1 s	1 sp	
2	1 s	1 sp		1 s	1 sp		1 s	1 sp	
3	3 s	3 sp	1 sp, 1 s	3 s	3 sp	1 sp, 1 s	3 s	2 sp	2 sp, 1 s
Leg 2									
Coxopodite	1 s			1 s			1 s		
Basipodite		1 s			1 sl			1 sl	
Endopodite									
1	1 s			1 s			1 s		
2	2 s			4 s	1 s	3 s	5 s	1 s	2 s
3	3 s	1 s	2 s						
Exopodite									
1	1 s	1 sp		1 s	1 sp		1 s	1 sp	
2	1 s	1 sp		1 s	1 sp		1 sl	1 sp	
3	4 s	3 sp	1 sp, 1 s	4 s	3 sp	1 sp, 1 s	3 sl	3 sp	1 sp, 1 sl
Leg 3									
Coxopodite	1 s			1 s			1 s		
Basipodite		1 s			1 sl			1 sl	
Endopodite									
1	1 s			1 s			1 s		
2	2 s			4 s	1 s	3 s	5 s	1 s	2 s
3	3 s	1 s	2 s						
Exopodite									
1	1 s	1 sp		1 s	1 sp		1 s	1 sp	
2	1 s	1 sp		1 s	1 sp		—	1 sp	
3	4 s	3 sp	1 sp, 1 s	4 s	3 sp	1 sp, 1 s	3 sl	3 sp	1 sp, 1 sl
Leg 4									
Coxopodite	1 s			1 s			—		
Basipodite		1 s			1 sl			1 sl	
Endopodite									
1	1 s			1 s			1 s		
2	2 s			3 s	1 s	3 s	4 s	1 s	2 s
3	2 s	1 s	2 s						
Exopodite									
1	1 s	1 sp		1 s	1 sp		—	1 sp	
2	1 s	1 sp		1 s	1 sp		—	1 sp	
3	4 s	2 sp	1 sp, 1 s	4 s	2 sp	1 sp, 1 s	2 sl	3 sp	1 sp, 1 sl

	« *Bonnierilla* » *arcuata*			*Bonnierilla armata*			*Bonnierilla similis*		
	M	L	T	M	L	T	M	L	T
Leg 1									
Coxopodite	—			—			—		
Basipodite	1 sp	1 s		—	1 s		1 sp	1 s	
Endopodite									
1	—			1 s			1 s		
2	3 s	1 s	2 s	1 s			1 s		
3				2 s	1 s	2 s	2 s	1 s	2 s
Exopodite									
1	1 s	1 sp		1 s	1 sp		1 s	1 sp	
2	1 s	1 sp		—	1 sp		1 s	1 sp	
3	3 s	2 sp	1 sp, 1 s	3 sl	3 sp	1 sp, 1 sl	3 s	3 sp	1 sp, 1 s
Leg 2									
Coxopodite	—			—			—		
Basipodite		1 s			1 s			1 s	
Endopodite									
1	1 s			1 s			1 s		
2	5 s	1 s	2 s	2 s			2 s		
3				3 s	1 s	2 s	3 s	1 s	2 s
Exopodite									
1	1 s	1 sp		1 s	1 sp		1 s	1 si	
2	1 s	1 sp		1 s	1 sp		1 s	1 si	
3	4 s	3 sp	1 sp, 1 s	4 s	3 sp	1 sp, 1 s	4 s	2 si, 1 sp	1 sp, 1 sl
Leg 3									
Coxopodite	—			—			1 s		
Basipodite		1 s			1 sl			1 sl	
Endopodite									
1	1 s			1 s			1 s		
2	5 s	1 s	2 s	2 s			2 s		
3				3 s	1 s	2 s	3 s	1 s	2 s
Exopodite									
1	1 s*	1 sp		1 s	1 sp		1 s	1 si	
2	—**	1 sp		1 s	1 sp		1 s	1 si	
3	4 s	2 sp	1 sp, 1 s	4 s	2 sp	1 sp, 1 s	4 s	1 si, 1 sp	1 sp, 1 sl
Leg 4									
Coxopodite	—			—			1 s		
Basipodite		1 s			1 sl			1 sl	
Endopodite	***								
1	—			(1 s)			1 s		
2	3 s	1 s	2 s	2 s			2 s		
3				3 s	1 s	1 s	2 s	1 s	2 s
Exopodite	***								
1	1 s	1 sp		1 s	1 sp		1 s	1 si	
2	—	1 sp		1 s	1 sp		1 s	1 si	
3	4 s	2 sp	1 sp, 1 s	4 s	2 sp	1 sp, 1 s	4 s	1 si, 1 sp	1 sp, 1 sl

* condition asymmetrical; this seta present in right leg, absent on left

** condition asymmetrical; a setule present here on left leg.

*** somewhat variable among specimens and tending to asymmetrical differences in right and left legs.

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