HYPERIID AMPHIPODS
(AMPHIPODA, HYPERIIDEA) OF THE WORLD OCEANS

M.E. VINOGRADOV, A.F. VOLKOV
AND T.N. SEMENOVA

Scientific Editor
Douglas Siegel-Causey

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The taxonomic part contains diagnoses and keys to the suborder Hyperiidea, relating to 23 families, 72 genera, and 233 species. Detailed descriptions are given, particularly for those families posing the maximum difficulty for identification. Descriptions are accompanied by illustrations which, for the most part, are original.

227 bibliographic entries, 256 illustrations, and 12 tables.

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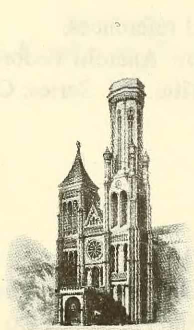

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Foreword to the English Edition

This volume reviews the systematics, natural history and ecology, distribution, and biogeography of Hyperiid Amphipoda of the world oceans. The authors present detailed descriptions, diagnostic keys, and illustrations for all of the known species in this pelagic suborder of amphipod crustaceans. Hyperiid amphipods are mostly commensals and parasitoids of gelatinous zooplankton, and as a consequence, their body morphology is extremely variable including species able to achieve near spherical shapes (*Platyscelus, Paratyphis*), the needle-like oxycephalids (*Rhabdosoma*), extraordinarlly large forms, up to 140 mm, with eyes comprising close to 25% of the body (*Cystisoma*), nearly sightless commensals of deepwater medusae (*Lanceola*), species that construct houses and brood their young within (*Phronima*), and truly pelagic, free-living species immensely abundant in polar oceans (*Parathemisto*). Hyperiidea can be found in almost any plankton tow in coastal or pelagic waters, but they are not abundant except in a few exceptional cases. There are many questions about their ecologies and role in oceanic ecosystems, but research on them has been hampered partially because the taxonomic literature is scattered and difficult to obtain. This monograph is valuable because here, for the first time in a single volume, are given complete taxonomic keys and descriptions for the entire world fauna known at the time of printing. The authors have included new information based on their own work in the Pacific, Indian, and Antarctic oceans, and present in the first chapter a quick summary of the biogeography and ecology of the major groups.

The editors have taken great care to ensure that this translation is an accurate reflection of the original text and we have minimized interpretation and glosses as much as possible. In some cases, we clarified confusing terms and phrases with the authors; otherwise the translation represents the work of the authors at the time of original printing. We have noted in the text whenever we have interpreted non-standard phrasing.

Douglas Siegel-Causey
University of Nebraska State Museum
Lincoln, Nebraska

Preface

The publication of this monograph in 1982 represented a major contribution to our understanding of the taxonomy and biology of hyperiidean amphipoda. This was the first comprehensive treatment of all species of Hyperiidea and the authors included diagnostic keys, descriptions, distributions, natural history where known, and illustrations for every species and subspecies known to the date of publication. Before this, specialists could use the synopsis of families and genera by Bowman and Gruner (1973) for higher-order classifications, or refer to scores of obscure and out-of-print publications, some of which dealt solely with regional faunas while others were strictly taxonomic treatments of a single taxon. Here, in one volume, the authors have compiled all of the relevant information pertaining to hyperiid amphipods and have created novel dichotomous keys to assist in identification.

The authors have taken the opportunity given by this translation to correct many of the errors present in the original monograph and emend or revise some of the information originally presented. Several keys were rewritten by the authors for greater clarity and accuracy. In all cases, the editors have identified where the translated text diverges from the original Russian; the original word or phase is given along with the variant in those situations where the editors thought it was important for comparisons. Otherwise, only the emended English text is provided. In addition, the authors have provided a Supplement which brings the monographic treatment up to contemporary understanding.

This translation, therefore, differs somewhat from that typically done by the Smithsonian Translations Publishing Program. The editors feel that the increased accuracy and utility of this emended edition more than justify the departure from standard practice.

Douglas Siegel-Causey
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Foreword

For many years the Zoological Institute, Academy of Sciences, USSR has been publishing a series of keys to the fauna of the USSR. A substantial part of the series comprises keys to the world fauna, primarily designed to cater to the needs of researchers engaged in various branches of fishery.

Our fishing fleet and numerous exploration and research vessels are operating in the entire water body of the World Ocean. Hence the need arises to prepare keys covering the entire world fauna. This is an exceptionally complicated job. However, the results of numerous Soviet expeditions conducted in recent decades have contributed such abundant and diverse data from all oceans that this task appears, in principle, possible. This pertains, first of all, to comparatively small and compact groups such as priapulids, nemertines, chaetognaths, euphausiids, hyperiid amphipods, and some others.

The present work was undertaken by researchers of the Institute of Oceanography, Academy of Sciences, USSR, and the Pacific Scientific Research Institute of Fisheries and Oceanography (TINRO). It is one of the first attempts in Soviet literature to compile a key to the world fauna of this group. While compiling the key we made use of the extensive collections from such vessels as the "Vityaz," "Ob'," "Akademik Kurchatov," and vessels of TINRO, and many collections from the Pacific, Indian, Atlantic, and Southern oceans, as well as from the Central Polar Basin and published data. Our collection contains nearly 85% of the species of the world hyperiid fauna, which encouraged us to undertake compilation of the present key. We do not pretend to provide original illustrations and redescriptions of all the species, but have essentially verified in detail the descriptions and illustrations of other authors who had no specimens. The absence of a particular species in our collections is always mentioned in the text.

This key includes descriptions of 233 species representing 72 genera and 23 families. Of these, 3 genera, 22 species, and 4 subspecies have been established as new and described by the authors (one genus and three species are described for the first time in the present work).

Most of the keys are original. Many of them, especially for genera which include a large number of species, were repeatedly verified from a large number of specimens and necessary corrections were incorporated in them.

It has become a tradition to preface the systematic part of the keys published by the Zoological Institute, Academy of Sciences, USSR with a brief outline of the morphology, ecology, phylogeny, and biogeography of the group. However, in the keys to gammarid amphipods published under the same series (Gur'yanova, 1951, 1962), excellent reviews have been included on the phylogeny of the entire order Amphipoda and a detailed account of their morphology. This, to a great extent, simplified our task and enabled us to touch only very briefly upon the problems of phylogeny and morphology.

The various families of Hyperiidea exhibit a wide range of characteristic ecological features. It is advisable to examine these features while describing the respective families, without including a section on ecology in the general part.

In writing the present volume, the material was distributed among the authors as follows. The general part, as also the families Archaeoscinidae, Lanceolidae, Chuneolidae, Microphasmidae, Parascinidae, Mimonectidae, Scinidae, and Hyperiidae were handled by M.E. Vinogradov. He also served as general editor of the book. A.F. Volkov described the families Lycaeopsidae, Pronoidae, Anapronoidae, Tryphanidae, Brachyscelidae, Lycaeidae, Platyscelidae, and Parascelidae. T.N. Semenova wrote up the families Vibiliidae, Cystisomatidae, Paraphronimidae, Diarellidae, Phronimidae, Phrosinidae, and Oxycephalidae.

We hope our attempt at presenting this key to the world fauna of hyperiideans will be favorably received by hydrobiologists, and that the book proves helpful to them in faunistic and scientific research work.

It is but natural that in preparing this key to the world fauna of hyperiideans, when some of the species were lacking in our collections and we could judge the structure of their representatives only from published descriptions—sometimes very brief and superficial—some errors and inaccuracies may have crept in. We shall be extremely grateful to readers for their comments and criticism.

Contents

Abbreviations Used in Figures

A_{I-II}	—	Antennae I and II
Ceph	—	Head
EP_{I-III}	—	Epimerons I-III
l	—	Labrum
L	—	Labium
Md	—	Mandible
Mx_I	—	Maxilla I
Mx_{II}	—	Maxilla II
Mxp	—	Maxilliped
P_{I-VII}	—	Pereopods I-VII
Per	—	Pereon; Roman numerals denote somite numbers
Pl	—	Pleon; Roman numerals denote somite numbers
plp Md	—	Mandibular palp
plp Mx	—	Maxillary palp
T	—	Telson
U_{I-III}	—	Uropods I-III
Us	—	Urosoma

5* SYSTEMATIC LIST OF SPECIES

Class C R U S T A C E A

Subclass M A L A C O S T R A C A

Superorder PERACARIDA

Order AMPHIPODA

Suborder HYPERIIDEA

I. Infraorder PHYSOSOMATA Pirlot, 1929

Superfamily A R C H A E O S C I N O I D E A
Barnard, 1930 (nom. nov.)

I. Family ARCHAEOSCINIDAE Barnard, 1930

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* Pagination of the original Russian text—General Editor.

* [sic]; should read 1822—General Editor.

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* [sic]; should read 1879—General Editor.

PART ONE

General

14 The order Amphipoda is distinctly divisible into four suborders: Gammaridea, Hyperiidea, Lemodipoda (Caprellidea), and Ingolfiellidea. The suborder Gammaridea is the richest in terms of absolute numbers and species composition. Its members inhabit benthic and pelagic domains of the ocean from the littoral zone to maximum depths of the ocean basins, enter fresh waters, and live on land. Members of the suborder Lemodipoda, depauperate in species composition, inhabit outgrowths of dendroid algae, hydroids, and bryozoans, or lead a parasitic mode of life (family Cyamidae—whale-lice). The Ingolfiellidea is an aberrant group. Only three of its representatives are known: two oceanic (Davis Strait and Gulf of Tonkin) and one from cavernous fresh-water reservoirs.

The suborder Hyperiidea includes purely pelagic marine forms. None of its species is benthic, but many are, to some extent, obligate commensals or parasites of coelenterates or salps and other gelatinous animals. They inhabit the pelagic layer of cold and tropical seas right from the surface down to the lowest horizons of the abyssopelagic, though as yet they have not been recorded at depths greater than, 7,000 m. In some particularly temperate cold-water regions, hyperiideans form massive congregations and occupy a primary place in the planktonic biomass, constituting the bulk of the food of planktophagous fish and whales.

1. BRIEF MORPHOLOGICAL OUTLINE

As in other amphipods, the hyperiidean body is divisible into three sections: head, thorax, and abdomen. The cephalic section, or the head (cephalon), consists of the acron and five body articles completely fused with each other. It bears six paired appendages—antennae I (or antennules), antennae II, mandibles, maxillae I, maxillae II, and maxillipeds, as well as an unpaired labrum and labium.

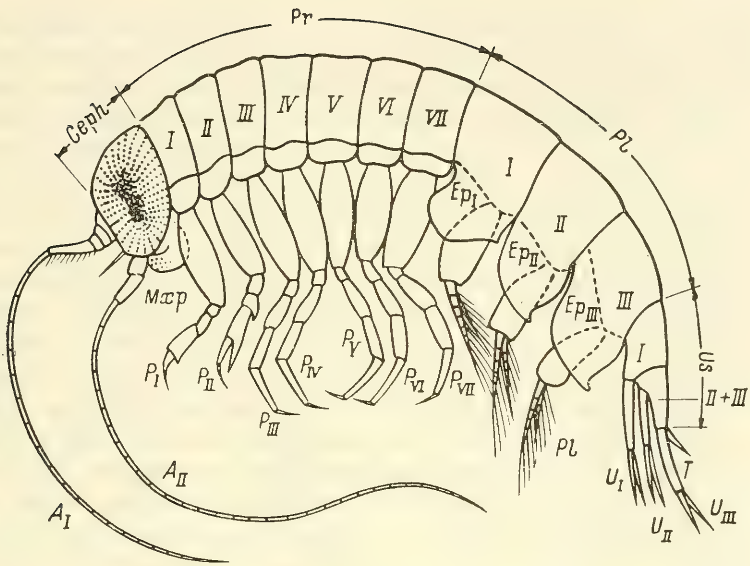
The thoracic section (pereon or mesosoma) consists of seven somites. Each thoracic article bears a pair of walking legs (pereopods). The first two pairs of these walking legs in gammarideans are provided with chelae, and are called gnathopods. In many hyperiideans, these legs are simple and do not differ essentially from the successive ones; hence it is customary to name all walking legs as pereopods I–VII. The coxal article of the sympodite articulates with the lateral margin of the corresponding somite and is modified into a coxal plate dorsally covering the proximal part of the leg.

The abdominal section consists of six somites. The first three (pleon or metasoma) bear multisegmented biramous natatory legs—the pleopods. The last three somites (urosoma) have biramous appendages—the uropods—with unsegmented rami. On the distal end
15 of the last abdominal somite, there is a freely movable telson, which is always entire in hyperiideans. Sometimes the telson is fused with the urosome (Figs. 1 and 2).

The somites of the pereon are usually free but in some genera the first two (*Acanthoscina, Spinoscina, Hyperietta, Hyperioides, Phronimopsis, Dairella, Phronimella, Phrosina, Anchylomera*) or three (*Hyperionyx*), four (*Lestrigonus*) or even five somites (*Themistella*) may be fused with each other. Similarly, somites II and III of the urosoma may also be fused.

In the species of some deepwater families (Lanceolidae, Microphasmidae, Cystisomatidae), the integument is very thin and transparent; contrarily, in fast surface swimmers such as the Pronoidae, Platyscelidae, and Parascelidae, it is hard and pigmented.

The body shape is highly variable. Many surface forms have a short, compact body with well-developed musculature. Some of them (Platyscelidae, Parascelidae) can roll themselves into a firm, quick-
16 sinking ball, sometimes armed with pointed spines formed by the processes of coxal plate V (*Platyscelus armatus*). In many deepwater Physosomata, particularly in females, the pereon is modified into an inflated sphere with a small pleon and short, contracted appendages (*Archaeoscina, Mimonectes*); in others the pereon is slightly dilated laterally and thickened dorsoventrally, which is characteristic primarily



15 Fig. 1. Schematic structure of a hyperidd amphipod (male of the genus *Hyperia*). Ceph—head or cephalon; Pr—pereon or mesosoma; Pl—pleon or metasoma; Ep_{I-III}—epimerons I-III; Us—Urosoma; T—telson; A_I—antenna I; A_{II}—antenna II; Mxp—maxilliped; P_I-P_{VII}—walking legs or pereopds I-VII; Pl—natatory legs or pleopods; U_I-U_{III}—uropods I-III.

of the genus *Scina*. Such a body shape is thus termed "scinoid". On the other hand, in the Oxycephalidae the body is slender, elongated, and in the *Rhabdosoma*, acuminate.

The body is usually smooth, without longitudinal carinae; however, the posterodorsal margins of pereon somites V–VII and pleon somites I-III are produced behind in somewhat prominent denticles (some species of *Lanceola, Scina, Parathemisto, Primno*). Rarely, such denticles are also present on pereon somites II–IV (*Acanthoscina, Ctenoscina, Spinoscina*; in the latter genus these are very strongly developed, with each exceeding the corresponding pereonite in length, and each with a deeply denticulate anterior margin). Spiny processes on the body are also very rare; only in the *Spinoscina* there are spinules on the pereon somites and in *Chuneola spinifera*, one blunt spine in the lateral part of each of the pereon somites II–IV.

The shape of the head is highly variable. In the majority of surface species it is large, spherical, higher than the pereon somites and the compound eyes occupy almost the entire surface (*Hyperia* and related genera, Pronoidae, Lycaeidae, and others). Sometimes it is equally large but not

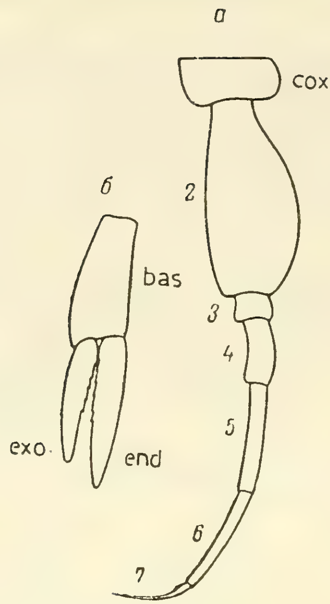


Fig. 2. Schematic structure of (a) peropod and (b) uropod of a hyperiidean. cox—coxal plate; 2—2nd article or basipodite; 3—3rd article or ishium; 4—4th article or marus; 5—5th article carpus; 6—6th article or propodus; 7—7th article or dactylus (claw); bas—peduncle or basipodite; exo—outer ramus or expodite; end—inner ramus or endopodite.

spherical and shortened (family Platyscelidae); contrarily, sometimes it has a long thin rostrum and constricted, elongated proximal part (*Calamorhynchus, Oxycephalus, Leptocotis, Streetsia*). The extreme development of this tendency is observed in *Rhabdosoma*, in which the head together with the rostrum is longer than the pereon and pleon together. The head may be vertically conical, tapering downward from the top, very high and short (family Phronimidae), very massive, exceeding the pereon in length and height (family Cystisomatidae) or, contrarily, very small, shorter and lower than pereon somite I (*Lanceola, Megalanceola., Mimonectes*, females of *Archaeoscina*). The structure and size of the eyes also vary greatly. They may occupy, as mentioned above, almost the entire surface of the large spherical head (*Hyperia* and others, family Paraphronimidae, *Cyllopus*) or only its dorsal part, or may be well separated but joined with the small part of its lateral surface (*Vibilia, Bougisia*).

The eyes may undergo a more radical reduction. The receptor elements may disappear in them, in which case the eyes may acquire the shape of broad reflector strips lining the bottom of large eye cups (*Scypholanceola*). Finally, the eyes may be modified into small pigment spots devoid of receptor elements (some *Lanceola*) or disappear altogether (some *Lanceola, Chuneola, Microphasma*, some Scinidae, *Vibilioides, and Vibilia caeca*).

The structure of the head, antennae, and oral appendages is of decisive importance in the systematics of Hyperiidea and for separating major taxa within this group: families, subfamilies, and genera. Both pairs of antennae are reduced to some extent—generally to a greater degree in females than in males. The first pair of antennae is attached to the anterior or ventral surface of the head. They generally have a three-articled base and primary flagellum; an accessory flagellum is always absent. The first two basal articles, and sometimes all three (family Scinidae) are often fused. The proximal articles of the flagellum, as in gammarideans of the family Lysianassidae, are fused, forming a highly conical or boomerang-like proximal article (males of Platysceloidea). The flagellum varies in
17 size; it may be considerably shorter than the head (*Microphasmoides*, females of Hyperiidae, Platysceloidea) or longer than the pereon and pleon together (some species of *Scina*).

The distal articles of the flagellum may be absent (families Scinidae, Paraphronimidae, Cystisomatidae, females of Hyperiidae, Phronimidae) or present as two-three rudimentary articles (families Lanceolidae, Mimonectidae, Proscinidae, Archaeoscinidae, Microphasmidae, Vibiliidae, females of Platyscelidae). However, in males of the families Phronimidae, Hyperiidae, and Dairellidae, the proximal article is small but the distal part of the flagellum is multisegmented, nearly reaching the body length (in sexually mature males of *Hyperia, Parathemisto, Phronimopsis*, and others). The conical proximal article of the flagellum is often densely covered with setae (males of Lanceolidae, Phronimidae, Hyperiidae, Platysceloidea, and others), but the thin distal articles of the flagellum, except for apical setae, are unarmed.

Antennae II are attached to the lower side of the head. Normally, they have a five-articled stalk [peduncle] and a multi-articled flagellum, usually reduced to some degree; however, antennae II may be totally absent (especially often in females). The 2nd article of the peduncle bears a conical antennal gland; in some groups it is reduced but in others well developed and almost as long as all the distal articles of antennae II (Microphasmidae, Chuneolidae). Antennae II are highly developed in males of several genera of the family Hyperiidae (*Hyperia, Hyperoche, Parathemisto, Bougisia* and others), in which they have a whiplike multisegmented flagellum and are not shorter than antennae I. The number of articles in the peduncle of antennae II is usually not more than four and that of the flagellum, 2–3. In males of the Platysceloidea, they are five-articled (three articles in the stalk and two in the flagellum), of which four are long, virgate, and tucked zigzag under the body, while the 5th (distal) is usually much shorter than the rest, sometimes rudimentary. In the *Lanceola, Scypholanceola, Megalanceola*, and *Prolanceola*, the six-eight-articled antennae II are usually longer than antennae I; in the remaining Physosomata they are short; and in some Scinidae they may be totally lacking (*Ctenoscina, Acanthoscina*). Antennae II are very small and highly reduced, just one- to two-articled in females of many species of the families Hyperiidae, Phronimidae, Platysceloidea, and others. In females of the Oxycephalidae, antennae II are totally absent, and in the *Cystisoma* are retained in the form of a spine on the lower part of the head.

The mouthparts of hyperiideans exhibit some degree of reduction compared to the initial "gammaridean" type. The labrum is small, sometimes bilobate, frequently almost not developed. The degree of reduction of the mandibles is highly variable. In the most developed type the mandibles bear a powerful, three-segmented palp, a cylindrical dental process with a worn surface, and the left mandible bears an accessory plate at the cutting edge (genus *Cyllopus*). In the *Lanceola* the dental process is reduced and the strong palp is retained; contrarily, in the *Hyperia, Hyperoche*, and *Parathemisto*, the mandibular palp is weaker. In other genera (*Hyperietta, Hyperioides, Hyperionyx, Iulopis, Lestrigonus, Themistella*) of the same family, it is present only in males and absent in females. In the Phronimidae the powerful dental process is retained, but the palp is reduced in both sexes. In many genera from different hyperiidean groups the mandibles lose both the palp and the dental process but retain the comparatively well-developed cutting edge and the accessory plate (*Mimonectes, Proscina, Mimoscina, Chuneola, Anapronoe, Paraphronima*). In the *Scina* and *Acanthoscina* the mandibles are the most reduced and retain just a short, denticulate cutting edge without the accessory plate.

Maxillae I are also reduced to a variable extent. They may be
18 well developed, with distinct and armed inner and outer lobes, and well-developed but always one-segmented palp (*Lanceola, Scypholanceola, Mimonecteola, proscina*). Different-parts of the maxillae are also reduced: the palp is shortened (*Matalanceola, Bougisia*), modified into a small protuberance with an apical seta (*Acanthoscina*), or disappears altogether (*Hyperoche*). In many groups the inner lobe is totally reduced, while in others the outer lobe is sharply reduced (*Acanthoscina, Bougisia, Dairella*); finally, maxillae I may be modified into small round plates (*Hyperoche*).

In most hyperiideans maxillae II do not have fused outer and inner lobes and are armed with one strong apical spine each. However, in some highly specialized groups, the two lobes are fused, forming a single weakly armed plate.

The maxillipeds are highly reduced compared to the gammaridean prototype. They always lack a palp and are weakly armed. In many Physosomata the maxillipeds are fairly large and stout; their inner lobes are completely separated and the large outer petaloid lobes bear apical and subapical setae (*Mimonectes, Mimoscina, Microphasmoides*). In the *Lanceola* and related genera the inner lobes are relatively small but separate. in many Vibilioidea and Phronimoidea, contrarily, these lobes may be as long as the outer lobes but are fused, forming a single plate, sometimes strongly armed with setae and spines. In the *Scina* and many Hyperiidae the fused inner lobes are much shorter than the outer lobes and are armed with weak apical setae, while in the *Acanthoscina* and some other genera of the group Phronimoidea (*Bougisia, Iulopis, Hyperietta, Themistella*) they totally disappear. The outer lobes may be petaloid and large (as in *Mimonectes*), or narrow but well armed (Vibilioidea, *Phronimopsis, Phronima*); sometimes these are reduced to two small rectangular plates attached to the distal angle of the basipodite (*Acanthoscina*) or may be totally absent (*Dairella*). Finally, both the outer and inner lobes may be fused into a single plate (Paraphronimidae). The labium is bilobate, usually weakly developed, and reduced to some degree. In some groups the complement of mouthparts is very prominent, forming the so-called "mouth cone".

Each of the seven thoracic somites bears a pair of seven-articled pereopods. The articles are generally not designated by name but by numbers from 1 to 7. The 1st—coxal article—is modified into a dilated plate, usually free, sometimes fused with the corresponding pereon somite. Coxal plates are usually small, entire, and unlike in gammarideans, never enlarged, do not cover each other, nor do they form a lateral shield. Very rarely, coxal plate V is produced into a strong and pointed spine (*Acanthoscina, Spinoscina, Amphithyrus bispinosus, Platyscelus armatus*). In many Platysceloidea the 2nd article of pereopods V,VI, and some-times VII is highly enlarged and broadened, becoming "squamiform", and forms a part of the lateral shield. In several groups pereopods VII are somewhat reduced—in some they become very weak and short (in some *Scina*), while in others some articles (4th and 5th, or 3rd, 4th and 5th) are fused or disappear entirely. Reduction of pereopods VII is extreme in the *Platyscelus* and *Phrosina*, in which the 2nd–3rd articles are present, while in the *Rhabdosoma* only the 2nd article is present.

Pereopods I and II may be simple, with a subchela (pseudochela) or a well-developed chela; usually the clawlike formations are more developed in pereopods II. The shape and structure of the distal (4th–6th) articles of pereopods I and II constitute an important taxonomic character. Pereopods III and IV are identical in structure, simple, with thin or fairly
19 thin articles; they are longer than pereopods I and II. Their 6th article

may be broadened and together with the claw may form a subchela (*Microphasma*); sometimes the subchela is formed by the broadened 5th and linear 6th article (*Anchylomera, Phrosina*); seldomly, a retractile claw is present (Chuneolidae).

Pereopods V are generally the longest and often (Phronimidae, Phrosinidae, *Microphasma*) the strongest of all [the pereopods]. They may be simple, with a retractile claw (*Paralanceola*, Lanceolidae, Chuneolidae, *Ctenoscina*). In some groups a subchela develops, formed by the dilatation of the 6th segment and the claw (*Microphasma, Microphasmoides*) or by the distally broadened and strong 5th article and the thinner, slightly bent 6th article (Phronimidae, Phrosinidae). The 2nd article is often amygdaloid or teardrop-shaped (almost all Platysceloidea, some Hyperiidae, Vibiliidae) or highly elongated; sometimes it is triangular in transverse section and bears spines or denticles on its edges or on the anterior and posterior margins (Scinidae, Cystisomatidae).

Pereopods VI and VII, with a few exceptions, are shorter and weaker than pereopods V; sometimes they have retractile claws (Lanceolidae, Chuneolidae, *Ctenoscina, Proscina*), rarely, a subchela (*Phrosina*). The 2nd article in these is often enlarged and broadened, more sharply in the Platysceloidea where this article forms the so-called "lateral shield". It is particularly well developed in the Platyscelidae and Parascelidae where the 2nd article of pereopods VI is unusually enlarged and broadened, forming an operculum. Here the distal part of the leg is reduced and some articles (usually the 4th and 5th) may fuse. By bending the abdomen, these crustaceans close the entire lower part of the body with the enlarged 2nd articles of pereopods V–VII and turn into a firm, quick-sinking ball. The tendency to form a strong lateral shield is found in some families of the suborder Gammaridea (for example, Stegocephalidae, Stenothoidae) but it always forms in them due to the growth of coxal plates.

In females the gills and brood lamellae are attached to the base of the coxal plates. The brood lamellae overlap each other on the ventral side and form a brood chamber in which the eggs mature and hatching and development of the young take place. There are usually five pairs of gills, located on pereon somites II–VI, but in some groups their number decreases to four, three, or even two pairs. The oostegites are located on somites II–V; in the *Rhabdosoma* they are reduced and very few in number.

The three pairs of natatory abdominal limbs (pleopods) are biramous; their peduncle is one-segmented; both the rami (exopodite and endopodite) are multisegmented and armed with long setae. By performing a natatory function, these limbs create a current of water that bathes the gills or young ones in the brood chamber. The lateral parts of the first three abdominal somites enlarge, forming round epimeral plates (epimerons) which laterally cover the tender natatory limbs. The lower posterior angle of all the three epimerons or only the last epimeron is drawn into a small denticle. In hyperiideans strong denticles, spines, and processes on the epimerons never develop, which are so characteristic of gammarideans. The last three abdominal somites form the urosoma, bearing three pairs of biramous appendages—the uropods. Urosomites II and III are fused, although in some Physosomata a suture can be seen between them.

Normally, all the three pairs of uropods are biramous, with free endo-and exopodites which, however, are never two-segmented. In some groups, in one or all the uropods, the endopodite is fused with the basipodite and the exopodite is reduced (*Cystisoma, Oxycephalus, Leptocotis, Simorhynchotus, Tullbergella*), sometimes to a small spine (*Scina, Spinoscina, Rhabdosoma*), or totally absent (uropod I in *Ctenoscina*). Sometimes, contrarily, the basipodite and one of the rami are reduced, in which case the uropods acquire the shape of an oval plate (family Phrosinidae). In some groups there is a tendency toward decrease in size and reduction of uropods II (*Phronima, Rhabdosoma*) down to modification into a small spine (females of *Phronimella*) and even to total absence (*Cystisoma*).

The entire and unarmed telson is usually shorter or longer than the basipodite of uropods III; usually it is free but sometimes fused with urosomite III (Oxycephalidae except *Rhabdosoma*, Platyscelidae, Parascelidae, *Pseudolycaea*).

The internal structure of amphipods has been discussed by E.F. Gur'yanova (1951), so we shall not dwell on it here.

2. NOTES ON THE TAXONOMY AND PHYLOGENY OF THE SUBORDER

Significant morphological differences within the suborder hyperiidea make it possible to divide it into several, more or less independent groups, each comprising many families.

Woltereck proposed the division of the suborder into two tribes.[1]

1. Hyperiidea Gammaridea—animals with a gammaridean body shape, short small head, and small eyes, which may even be totally absent, and free coxal plates. Depending on whether the inner lobes of the maxillipeds are fused or separated, Woltereck divides the tribe into two subtribes: Primitiva and Derivata. Those families of the Primitiva whose members retained the mandibular palp, were included by him under the group Completa, and those that lost the palp under the group Incompleta.

2. Hyperiidea Genuina—forms with a large, inflated head, with eyes occupying a large part of the head, in which the coxal plates may be fused

[1] In the current nomenclature, the tribes as interpreted by Woltereck and subsequent authors correspond to infraorders (Bowman and Gruner, 1973).

with the somites. The mandibles are well developed; the inner lobes of the maxillipeds are fused.

Depending on the structure of the antennae, this tribe was divided by Woltereck into three subtribes: Hyperiidea Recticornia, Hyperiidea Filicornia, and Hyperiidea Curvicornia. Schellenberg (1942) included in the group Genuina only the first two subtribes; the third he indentified as a special tribe, Hyperiidea Anomala.

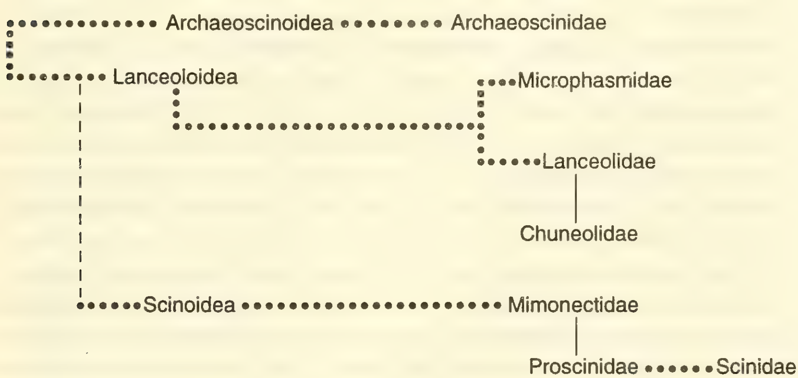
Pirlot (1929) justifiably noted that the hierarchy proposed by Woltereck is rather artificial and not at all acceptable. Actually, the genera *Mimonecteola* and *Microphasma* from the group Primitiva, which Woltereck considered the most primitive, are distinctly neotenic, and hence cannot stand at the beginning of the evolutionary series of Hyperiidea. The phyletically very close families Lanceolidae and Chuneolidae fall into different groups in this system—Completa and Incompleta; the family Mimonectidae has been included in the subtribe Primitiva, and the rather closely related family Scinidae in the subtribe Derivata. The same subtribe includes the family vibiliidae, sharply differing from the family Scinidae and from other Gammaridea. On the other hand, the family Cyllopodidae, which is extremely close to the Vibiliidae, has been included in the tribe Genuina. Finally, in recent times, in the family Hyperiidae (tribe Genuina) the genus *Bougisia* has been included, with a small head and very small eyes, which would necessitate changing the diagnosis of the tribe. Pirlot proposed a more natural classification of the suborder Hyperiidea. He divided the suborder into two tribes: Hyperiidea Physosomata and Hyperiidea Eugenuina (Physocephalata according to Bowman and Gruner, 1973). In the former tribe, whose characteristics
21 are given below, two groups are distinctly differentiated. The first is characterized by mandibles with a broad cutting edge, comparatively short antennae I, strong pereopods I with distally enlarged 5th segment, and comparatively large coxal plates; it combines the families Microphasmidae, Lanceolidae, and Chuneolidae. The genus *Mimonecteola* of the family Microphasmidae is the least specialized; other genera of this family are more obligate commensals or parasites. Intensification of the obligate nature of parasitism of coelenterates proceeded along the line Lanceolidae-Chuneolidae. The latter have obviously more completely lost the ability to swim freely and lost the mandibular palp but, contrarily, have acquired retractile claws on all the pereopods, ensuring a more complete attachment to the host tissue. Stephensen and Pirlot (1931) combined all these families in the group Lanceoliformata.

The second group—Sciniformata characterized by a long, conical, fairly thin proximal article of the flagellum of antennae I, distinct sexual dimorphism in the structure of antennae II, mandibles with a narrow cutting edge and without a mandibular palp, and almost not enlarged, often thin 5th article of pereopods I,comprises the families Mimonectidae, Proscinidae, and Scinidae, having distinctly closer phyletic relationships. Among them, the family Scinidae and particularly the genus *Acanthoscina*, is the most highly specialized. The most primitive family is the Mimonectidae, in which one of the genera even retains rudiments of the mandibular palp.

Bowman and Gruner (1973) have somewhat modernized the system of Pirlot, raising his tribes to the rank of infraorders (the tribe Physosomata to infraorder Physosomata and the tribe Eugenuina to infraorder Physocephalata) and subtribes to the rank of superfamilies. We support this system (with small changes described below) in our studies. Bowman and Gruner considered that the infraorder Physosomata included the superfamilies Lanceoloidea and Scinoidea.

The family Archaeoscinidae occupies a special position. With such important characters as the presence of a triarticulate mandibular palp and short antennae I, it comes closer to the Lanceoloidea, but the narrow cutting edge of the mandibles, structure of maxillae I and II and maxillipeds, reduced antennae II of females, distally not enlarged 5th article of pereopods V, and the sexual dimorphism of body shape bring the family Archaeoscinidae closer to the Scinoidea and primarily to the most primitive family, Mimonectidae, of this group. Probably, the family Archaeoscinidae diverged from the common root even before its division into the Lanceoloidea and the Scinoidea. This compels us to separate the family Archaeoscinidae into an independent superfamily, Archaeoscinoidea.

The phylogenetic relationships of the families within the infraorder Physosomata could possibly be represented by the following scheme:



Pirlot's tribe, Hyperiidea Eugenuina (or the infraorder Physocephalata), according to the structural characteristics of antennae I of males

and other features is divided into three groups, which were first separated by Bovallius and later, with some modification or the other, accepted by
22 all authors—first as subtribes and then as superfamilies. Pirlot's subtribe, Hyperiidea Recticornia (or superfamily Vibilioidea according to Bowman and Gruner, 1973): Antennae I of males (few-segmented) originate from the anterior part of the head. Antennae II are short and originate from the lower surface of the head; pereopods V are simple. The following families are included under this superfamily: Cystisomatidae, Vibiliidae, and Paraphronimidae. The family Cystisomatidae is closer to the infraorder Physosomata since it has larvae of the "physosoma" type. At the same time, in structure of the eyes and presence of a strong dental process on the mandibles, it may belong to the infraorder Physocephalata.

Family Paraphronimidae—highly specialized forms with indistinct phyletic links: the outer and inner lobes of the maxillipeds are fused into a single plate, which distinguishes these forms from all the remaining hyperiideans. However, in some characters they are close to the family Dairellidae of the superfamily Phronimoidea.

Pirlot's subtribe Hyperiidea Filicornia (or superfamily Phronimoidea according to Bowman and Gruner, 1973): antennae I and II originate from the anterior surface of the head; in males antennae II are multisegmented through flagelliform in at least the distal part; pereopods V may have a subchela. The subtribe includes four families: Dairellidae, Phronimidae, Phrosinidae, and Hyperiidae.

The characteristics of these families are given below. Their phyletic links are not clear and possibly the inclusion of these four families in one group is rather artificial and does not highlight the actually close phylogenetic links between them.

Pirlot's subtribe Hyperiidea Curvicornia or the superfamily Platysceloidea of our classification: antennae I and II attached to the lower surface of the head; in males the proximal article of the flagellum of antennae I is broad, bent, and the flagellum few-segmented; pereopods VII are reduced in size and often in number of segments. The superfamily Platysceloidea combines eight families: Lycaeidae, Tryphanidae, Brachyscelidae, Pronoidae, Anapronoidae, Platyscelidae, Parascelidae, and Oxycephalidae. The least specialized is the family Lycaeidae, from which arise four lines of development: the first comprises the family Brachyscelidae; the second—families Pronoidae and Anapronoidae; the third—family Platyscelidae, and the fourth—family Oxycephalidae. The unique family Tryphanidae is closer to the Lycaeidae.

Following Bowman and Gruner, we specially examined the superfamily Lycaeopsoidea. It is characterized by an unusual structure of antennae I of males, which originate from the anterior surface of the head, and a complete absence of antennae II in females; a monotypic family, Lycaeopsidae, has been identified.

The diversity in morphological structures of the various groups of Hyperiidea compels us to think that they are not a natural, monophyletic group, but include progenies of various ancestral forms which changed over to a pelagic habitat due to commensalism or parasitism on gelatinous macrozooplankton, mostly coelenterates and tunicates. Pirlot held the most extreme viewpoint in this regard, considering the suborder Hyperiidea to include at least eight, may be even ten, phylogenetically disparate groups, each of which arose from a separate taxon of Gammaridea (Pirlot, 1932).

Actually, hyperiideans do not have even a single distinct morphological character which is not found in some groups of Gammaridea. Most common features combining hyperiideans can be explained, at best, by convergence during adaptation to ectoparasitism or commensalism on medusae and siphonophores rather than historic commonality of their origin.

Let us consider from this viewpoint some basic morphological characteristics of hyperiideans.

The short antennae I, lacking an accessory flagellum, are typical of
23 several families and genera of gammarideans, for example, the family Talitridae, some genera of the Lysianassidae from the *Paracyphocaris*-group, and many others. In these groups not only the accessory flagellum, but even the distal articles of the main flagellum are reduced, while the proximal article is highly enlarged, possibly due to oligomerization, which is typical also in hyperiideans.

Reduction of maxillipeds, loss of their palp, and fusion of the inner lobes: in many genera of gammarideans from different families, we observe a reduction of the maxilliped palp, the reduction being extreme in semi-parasitic or parasitic genera. Thus, in the *Paracyphocaris* the maxilliped palp is one-segmented, while in the *Chevreuxiella* and *Danaella* (family Lysianassidae) and in some other groups, it is totally lacking. The inner lobes of the maxillipeds in some parasitic genera of gammarideans are fused. Simultaneously with a reduction of mouthparts, gammarideans lose their ornamentation on these parts. Probably, this adaptive character is also linked with parasitism on animals with gelatinous tissues. Hence this cannot prove the phylogeny of different hyperiidean groups.

The reduction of other mouthparts (mandibles, maxillae I and II) in hyperiideans is also completely analogous to some gammarideans changing over to a semiparasitic mode of life. These examples have been examined in detail by Pirlot (1931).

Parallel with the reduction of mouthparts in many genera of gammarideans, there is a structural simplification of the telson (it becomes entire) and the 2nd exopodite article of uropods III disappears. As mentioned above, these characters are also essential for all hyperiideans.

In hyperiideans the coxal plates are more weakly developed than in gammarideans. But even among the latter, the structure of the coxal plates varies considerably in different families. Even among the pelagic forms, it is difficult to compare the family Stegocephalidae, with a strong lateral shield, and the family Astyridae or, particularly, the family Vitjazianidae, in which the coxal plates do not differ greatly from the primitive hyperiidean type, which is typical, for example, of the Lanceolidae or Chuneolidae.

Finally, such characters as the broad flabellate uropods, typical of hyperiideans, are undoubtedly an adaptation to a pelagic mode of life.

Thus, most characters uniting hyperiideans ought to be considered adaptive and, possibly, convergent, and not indicative of a common origin.

On the other hand, although almost all features characterizing hyperiideans individually have analogies in some groups of Gammaridea, not a single group of the latter combines a majority of them, let alone all of them. As yet, there is no real basis for agreeing with Pirlot that different groups of Hyperiidea have less in common among themselves than with any group of Gammaridea.

If, following Pirlot, we accept the broken polyphyly of hyperiideans, then each of their groups should be deemed to be derived from the most specialized and, in addition, as a rule, parasitic groups of gammarideans. At the same time, it is well known that narrowly specialized groups are usually evolutionary blind ends and cannot act as the initial type for further dicho-tomous adaptive variability. Obviously, hyperiideans originated from some fairly primitive or less specialized group (or groups) of gammarideans, and then mostly evolved along the path of adaptive radiation. Moreover, the nature of adaptations to a pelagic mode of life, and particularly to ecto-parasitism, was identical in both suborders of
24 Amphipoda, which explains the convergent similarity of some highly specialized taxa of the Gammaridea and Hyperiidea. A substantive reason for taxonomic differentiation of hyperiideans could be that some of them inhabited the deeper layers while others were surface dwellers, where conditions require greater activity and more efficient protective measures against enemies. In particular, among the surface-dwelling forms of some Platysceloidea, the lateral shield arose as a secondary feature; however, it formed not from the coxal plates, but through the enlargement of the proximal articles of the posterior pereopods.

It should be noted that most significant changes in the morphological characters in crustaceans occur during a changeover from free-living to parasitism. Hyperiideans constitute a group comprising essentially commensals and ectoparasites of varying degree of obligate nature. Probably, some taxa during evolution became adapted to free-living while others increased the obligate nature of parasitism. Finally, the neoteny of several hyperiidean families is beyond doubt. Generally, neoteny is widespread among many groups of deepwater animals and is, obviously, one of the important paths of evolution in waters at great depths, where food is scarce (Walters, 1961). Naturally, neotenic animals considerably differ morphologically from their normal ancestral forms.

The different degree and different nature of adaptation to parasitism and neoteny can explain those significant morphological differences found in various hyperiidean groups.

Nevertheless, we do not wish to emphasize the monophyletic origin of all hyperiideans. For example, the differences between the infraorders Physosomata and Physocephalata are so great that their origin can be explained either by prolonged processes of evolution and neoteny of Physosomata, or by what is equally probable, a different origin. But we simply cannot agree with Stephensen and Pirlot (1931) regarding the polyphyly of Physosomata themselves. Although in structural type of mouthparts this infraorder can be subdivided into two groups—Lanceoloidea and Scinoidea, these are distinctly mutually linked and, as noted earlier, the family Archaeoscinidae combines in it the characters of both groups. Still less convincing is Pirlot's suggestion about the disjunct polyphyly of several other groups of hyperiideans. For example, he considers that the families Cystisomatidae, Vibiliidae, and Paraphronimidae, which are fairly close to the infraorder Physosomata, nonetheless have another root in the suborder Gammaridea, because their mandibles retain the dental process, which has disappeared in the Physosomata. This difference can be more simply explained by the greater obligate nature of parasitism of the Physosomata than of the above-mentioned families. We know that even in gammarideans of one and the same family, free-living genera have an excellently developed dental process on the mandible, while genera that changed over to parasitism or commensalism (for example, *Chevreuxiella, Crybelocephalus*, and others in the family Lysianassidae) have totally lost it.

Thus Pirlot's suggestions should be considered more than hypothetical. He hoped that later investigations of hyperiideans would allow a more precise justification for the line of development proposed by him. However, this has not happened. Present-day investigators are not inclined to consider a finer division of the group, although they do not insist on its monophyly.

3 VERTICAL AND GEOGRAPHIC DISTRIBUTION OF HYPERIIDEANS

Although without exception hyperiideans are pelagic animals, as mentioned above, individual groups of this suborder differ in their ecology.

25 Members of the infraorder Physosomata are usually few in number or are rare crustaceans inhabiting mostly the deeper parts of the ocean. Their distribution is governed by regularities common to deepwater pelagic forms.

The Physocephalata inhabit the surface layers or the middle depths of the ocean; sometimes they are numerous or even highly populous species. Among them, Platysceloidea, near-surface, warm-water animals, are the most characteristic members of the tropical epipelagic ocean fauna. The Vibilioidea and Phronimoidea include species from middle-deep waters. These superfamilies comprise several members that are highly numerous in moderately cold and cold oceanic regions.

Hence, in order to clearly describe the characteristics of geographic and vertical distribution of hyperiideans, we shall consider the infraorder Physosomata and the principal superfamilies of the Physocephalata separately.

Infraorder Physosomata

The deepwater hyperiidean Physosomata fauna of the world ocean has been poorly studied. Even in the most comprehensively investigated Kuril-Kamchatka region of the Pacific Ocean where far more deepwater catches have been made than in any other part of the ocean, the hyperiidean fauna of the abyssopelagic zone—depths over 3,000 m—is far from fully represented in collections. As for other regions, we cannot say that collections of bathypealagic and abyssal species are complete. This situation compels us, firstly, to refrain from attempting detailed characterization of the area of distribution of hyperiideans of this group, and to confine ourselves merely to a comparison of fauna of all the oceans or their principal climatic zones. Secondly, it must be borne in mind that the faunistic differences observed are largely due to inadequate and nonuniform study of the Physosomata fauna in different oceans and oceanic regions.

As mentioned earlier, the majority of Physosomata species are rare organisms. This observation pertains mainly to deepwater species inhabiting the abyssopelagic zone. The population density of bathypelagic hyperiideans is higher and many of them are known from tens of specimens. However, the bulk of the Physosomata in collections comprises several species which are found in many catches made at depths. Two of them—*Scina borealis* and *Lanceola clausi*—are numerically dominant over the remaining Physosomata in almost every ocean; the others are dominant in limited regions. Thus, besides *L. clausi* and *S. borealis* in the Kuril-Kamchatka region of the Pacific Ocean, *S. rattrayi keilhacki* and *L. serrata* rank in numbers; in the Antarctic, *S. antarctica* and *L. loveni antarctica*; and in tropical regions of all the oceans, *S. crassicornis*, *S. tullbergi* and, sometimes, *L. sayana*. However, in terms of population, none of these species outnumbers the first two mentioned above.

Vertical Distribution

Most of the Physosomata were caught in large nets during hauls from great depths to the surface; hence it is not possible to rationally assess their vertical range of habitat. Relatively reliable data are available only for the Kuril-Kamchatka region of the Pacific Ocean. Here, over a vast water body with uniform hydrological conditions during a span of several years—mainly during the 14th (1953) and 39th (1966) voyages of the "vityaz", at all depths from the surface to 9,000 m, tens of layerwise
26 catches were undertaken using BR nets with 1.0 m^2 and 0.5 m^2 openings† and graded catches by horizontal ring-trawl tows with an opening of 2.0 m^2 (Vinogradov, 1957, 1970).

Detailed investigations of the vertical distribution of hyperiideans were also carried out in the region of the Canary Islands during the "SOND" expedition in 1965 (Thurston, 1976b). For plankton collection, two nets with an opening of 1.0 m^2 were used. Catches were made in many horizontal layers to a depth of 960 m, but regrettably depths for a large part of the bathypelagic and abyssopelagic remained unrepresented in these investigations.

In examining the nature of the change in Physosomata fauna with depth, we had to rely primarily on the results obtained in the Kuril-Kamchatka region (Pacific Ocean) and in the Canary Islands region (Atlantic Ocean), and use material from different regions as a supplement.

Based on depth of habitat, the following groups can be identified among the Physosomata:

1. Epi- and mesopelagic species found from the surface to a depth of 200–500 (750) m. They are found only in warm-water tropical regions of the oceans and are absent in cold-water regions, where waters of the thermosphere are absent. These species include: *Lanceola felina, Scina marginata, S. stenopus, S. tullbergi, S. similis, Acanthoscina acanthodes*, and sexually mature spawning females of all *Mimonectes*.

2. Species primarily inhabiting intermediate waters, from 100–200 to 750–1,000 m, and rarely going deeper, beyond 2,000 m. In the Kuril-Kamchatka region, these are *Archaeoscina steenstrupi, Chuneola paradoxa, Scina curilensis, S. incerta, S. stebbingi*, and possibly, *S. submarginata*. For the tropical region, besides the foregoing species may be added: *S. crassicornis, S. damasi, S. similis, S. nana, S. excisa, S. lepisma, S. vosseleri, S. inermis*, and *S. rattrayi*.

† Changed from "I.S m^2 in Russian text by authors.—Ed.

3. Species inhabiting depths from 200–500 m to 2,000–3,000 m, i.e., dwellers of the meso- and bathypelagic. Some inhabit only the bathypelagic layer, almost never rising to depths less than 500 m[††] (such species are marked with an asterisk). Others, contrarily, especially in the juvenile stage and in warm-water regions, rise even to the near-surface layers. This group includes the majority of Physosomata species: *Lanceola serrata, Scypholanceola aestiva**, *Prolanceola vibiliformis, Mimonecteola beebei, M. diomedeae, Microphasma agassizi, Microphasmoides vitjazi, Mimonectes gaussi, M. loveni, M. sphaericus, Scina curvidactyla, S. woltereckì, S. borealis, S. spinosa, S. indica, S. submarginata, S. typhlops**, *S. pusilla, S. wagleri**, and *Ctenoscina brevicaudata.*

4. Eurybathic species inhabiting a wide range of depths from 200–500 (1,000) m to 5,000–6000 m, and possibly, even deeper. These are: *Lanceola sayana, L. pacifica, L. loveni, L. clausi, Chuneola major*, and *Scina rattrayi keilhacki.*

5. Species of still deeper waters inhabiting the abyssopelagic: adults are generally not found above 2,000–3,000 m. The lower limit of their distribution often is not clear. Some of these species are found only at a depth of 4,000–5,000 m, while others have been found in catches from depths of 5,000–6,000 m and 6,000–7,000 m (marked with an asterisk). This group includes: *Lanceola laticarpa, L. clausi gracilis**, *L. sphaerica**, *L. chelifera, Scypholanceola agassizi, Metalanceola chevreuxi, Mimoscina gracilipes, Scina wagleri abyssalis**, *Ctenoscina macrocarpa*, and *Spinoscina spinosa.* Hyperiideans have not been reported to date at depths greater than 7,000 m. Species inhabiting only the ultra-abyssal zone are absent.

The change in hyperiidean fauna with depth becomes very clear if we compare the number of species found at different depths, and how
27 many species are found in each depth interval of the upper boundary of distribution. Such a comparison is presented in Tables 1 and 2. Naturally, it does not entail the entire fauna but only those species for which information was available on the range of vertical distribution.

It can be seen from Table 1 that the Physosomata fauna from the meso- and bathypelagic is the richest. In the cold-water Kuril'sk region the largest number of species (nearly 40% of that part of the fauna examined) has an upper boundary of distribution in the upper part of the transitional layer at depths of 200–500 m. In the more uniform 750–1,000 m layer additional species do not occur at all. In the 1,000–1,500 m layer again several species appear which do not rise to lesser depths. From 1,500 to 2,500 m the faunal composition does not change, while at

[††] Changed from "1,000 m" in Russian text by authors.—Ed.

Table 1. Number of species of the Physosomata inhabiting different depths in the Kuril-Kamchatka Trench[1] (from Vinogradov, 1970)

Depth, m	Species occurring			
	Number of species encountered	Number of species	% of total number of species	% of number of species found in given depth
0–200	2	2	7.7	100
200–500	12	10	38.5	83.5
500–750	15	4	15.4	26.5
750–1,000	15	0	0	0
1,000–1,500	17	4	15.4	23.5
1,500–2,000	17	0	0	0
2,000–2,500	14	0	0	0
2,500–3,000	16	2	7.7	12.5
3,000–4,000	14	4	15.4	28.6
4,000–5,000	8	0	0	0
5,000–6,000	6	0	0	0
6,000–7,000	2	0	0	0
Above 7,000	0	—	—	—

[1]Twenty-six spceies are considered, for which two or more specimens were found.

Table 2. Number of species of the Physosomata inhabiting different depths in the Canary Islands region[1] (from Thurston, 1976b)

Depth, m	Species occurring			
	Number of species encountered	Number of species	% of total number of species	% of number of species found in given depth
0–200	10	10	62.5	100
200–500	13	4	25.0	30.8
500–750	11	2	12.5	18.1
750–1,000	9	0	0	0

[1]Sixteen species are considered, for which two or more specimens were found.

depths of 2,500–4,000 m abysso-pelagic species appear (nearly 25% of the fauna examined). At these depths lies the lower boundary of the habitat of 12 bathypelagic species (nearly half of the fauna examined). Thus, in terms of changes in the species composition of the Physosomata, three distinct layers are identifiable, which correspond to the mesopelagic (from 200 to 750–1,000 m), bathypelagic (from 1,000 to 2,500–4,000 m), and abyssopelagic (deeper than 2,500–4,000 m).

28 In tropical regions of the oceans (Table 2) the role of species inhabiting the epipelagic zone increases. Many mesopelagic species rise to even the epipelagic upper 100–200 m layer or even to the surface. However,

even here in the 750–1,000 m layer additional species do not appear. As for the ratio of bathy- and abyssopelagic species in the tropical regions, the data available is inadequate for any definite inferences.

Geographic Distribution

At present, 81 species (not considering subspecies) of hyperiidean Physosomata are known from the world ocean. They belong to 19 genera. The family Scinidae has the maximum number of species (39 species).

The Pacific Ocean leads in faunal diversity. The fauna of the Atlantic Ocean is depauperate, which might possibly be due to the fact that fewer investigations have been conducted, mainly in the North Atlantic Ocean; the number of deepwater catches in the tropical and southern regions is comparatively small. Finally, in faunal composition, the Southern Ocean (south of 50° S) lags considerably behind not only the Pacific or Indian Ocean, but even the Atlantic.

It is known that the area of distribution of the majority of deepwater bathyal animals, both in the pelagic and benthic parts of the oceans, is quite extensive and often has a panoceanic character (Brodsky, 1955; Vinogradova, 1958; Birshtein and Vinogradov, 1955). Hence it is quite natural that the degree of commonality of fauna in the Pacific, Indian, and Atlantic oceans be quite high. The cold and faunistically impoverished Southern Ocean has few endemic forms and its fauna is entirely formed by species from other oceans (Table 4). In the Pacific and Atlantic oceans, 72% of the genera and 63% of the species are common. In the Indian Ocean, 89% of the genera and 63% of the species are common to the Pacific Ocean, and 81% of the genera and 64% of the species common to the Atlantic Ocean (Table 3). If we do not take into account species inhabiting the northern temperate regions of the Pacific and Atlantic oceans, which have no parallel in the Indian Ocean, the degree of commonality of fauna rises still further and a more intimate relationship is seen between the Indian and Pacific oceans rather than the Indian and Atlantic oceans. Thus, in the Physosomata fauna of the tropical regions of the Pacific and Indian oceans, 94% of the genera and 72% of the species are common; the figures for the tropical regions of the Indian and Atlantic oceans are 81% and 69% respectively.

The high degree of commonality of fauna is not only due to panoceanic or circumtropical species common to all three oceans, whose number is not that high (72% genera and 48% species), but to a considerable extent due to different species, some of which inhabit the Indian and Pacific oceans, while others occur in the Indian and Atlantic oceans. This is true not only of species, but of genera too. Thus, the genus Megalanceola inhabits only the Atlantic and Indian oceans, while *Prolanceola, Chuneola*, and *Microphasmoides* inhabit only the Indian and Pacific oceans.

Table 3. Number of genera (g) and species (s) of the Physosomata in the Atlantic, Indian, Pacific, and Southern oceans (south of 50–55° S lat.)

Family	World Ocean		Atlantic Ocean				Indian Ocean				Pacific Ocean				Southern Ocean			
			Number		% of world fauna		Number		% of world fauna		Number		% of world fauna		Number		% of world fauna	
	g	s	g	s	g	s	g	s	g	s	g	s	g	s	g	s	g	s
Archaeoscinidae	2	3	1	1	50	33	1	1	50	33	1	2	50	67	2	2	100	67
Lanceolidae	5	18	4	10	80	56	5	14	100	78	4	15	80	83	2	5	40	28
Chuneolidae	1	3	0	0	0	0	1	2	100	67	1	3	100	100	1	1	100	33
Microphasmidae	3	6	2	2	67	33	3	5	100	84	3	5	100	84	1	1	33	17
Mimonectidae	2	6	1	4	50	67	1	4	50	67	2	6	100	84	1	1	50	17
Proscinidae	2	6	2	3	100	50	2	3	100	50	2	4	100	67	1	1	50	17
Scinidae	4	39	4	33	100	85	4	31	100	80	4	31	100	80	2	11	50	28
Total	19	81	14	53	74	65	17	60	90	74	17	65	90	80	10	22	53	27

29

Table 4. Degree of Commonality of the physosomata fauna of the Atlantic (A), Indian (I), Pacific (P) and Southern (S) oceans

Family	Number of taxa inhabiting A + I + P oceans		% of taxa common to A, I, and P oceans		Number of taxa inhabiting A + I oceans		% of taxa common to A and I oceans		Number of taxa inhabiting I + P oceans		% of taxa common to I and P oceans		Number of taxa inhabiting P + A oceans		% of taxa common to P and A oceans		% of taxa common to S and A + P + I oceans**		% of taxa common to all four oceans	
	g	s	g	s	g	s	g	s	g	s	g	s	g	s	g	s	g	s	g	s
Archaeoscinidae	1	2	100	50	1	1	100	100	1	1*	100	50*	1	2	100	50	0	0	0	0
Lanceolidae	5	18	60	45	5	15	80	60	5	17	80	65	5	16	60	50	40	22	40	22
Chuneolidae	1	3	0	0	1	2	0	0	1	3	100	100	1	3	0	0	0	0	0	0
Microphasmidae	3	6	67	17	3	7	67	14	3	6	100	67	3	5	67	40	33	17	33	17
Mimonectidae	2	6	50	50	1	5*	100	50*	2	5	50	80	2	6	50	50	50	17	50	17
Proscinidae	2	5	100	40	2	4	100	50	2	5	100	40	2	4	100	75	50	0	50	0
Scinidae	4	39	100	61	3	36	100	72	4	39	100	62	4	36	100	78	50	26	50	26
Total	18	79	72	48	16	70	81	64	18	77***	89	63	18	72	72	63	37	20	37	17

* So given in Russian original—General Editor.

** So given in Russian original; also figures in this column duplicated in the last column (expect than in the last column 17(total) replaces 20—General Editor.

*** So given in Russian original; should read "76"—Generel Editor.

There are no genera common to the Pacific and Atlantic oceans, which are not found in the Indian Ocean.

To discuss the faunal independence of various regions, we can use the index of commonality of fauna proposed by Preston (1962a, b). This is given as 1–z, where z is the index of degree in the correlation equation between the number of species inhabiting the two regions. The value of z varies between 0 and 1. Preston observed that if $z = 0$, the faunas of the two regions under consideration are indentical; if $z = 1$, these regions have no common forms. At $z = 0.27$, both faunas are in equilibrium and mutual exchange is fully possible. Hence if $z > 0.27$, there would be some interaction between the faunas but this interaction would not be complete and there would be some definite natural isolation.

It seems that at the species level for the Physosomata fauna of the Indian and Pacific oceans, $z = 0.29$, for the Indian and Atlantic oceans, $z = 0.26$, and the Atlantic and Pacific oceans, $z = 0.31$. In other words, the Indian Ocean has a total exchange of faunas with the Atlantic Ocean, while faunas of the Pacific and Atlantic oceans are isolated to some extent.

The geographic distribution of the Physosomata is intimately linked with their vertical distribution.

The bulk of the species distributed only in the tropical region inhabit the upper warmer water layers and many of them generally do not descend to deep waters. Their distribution is characteristic for a vast majority of surface tropical animals, particularly for numerous species of the superfamily Platysceloidea. Together with them, several true deep-water species are also confined to the tropical zone, which inhabit the deepest layers and do not rise over 1,000 m or even 2,000 m; such, for example, are the *Metalanceola chevreuxi, Lanceola loveni grossipes*, and others. Why these deepwater species are confined in distribution to tropical regions, is difficult to say.

Contrarily, a vast majority of the North Pacific and panoceanic species are permanent inhabitants of the deeper layers, and only a small number have a very wide range of vertical distribution, sometimes rising to the surface, mostly at night (*Lanceola sayana*) and at a definite stage of their life cycle (*Mimonectes*).[2]

As noted earlier, the extensive panoceanic distribution of many species of the Physosomata obviously depends primarily on their notable eurybathic nature, examples of which have already been given. This dependence, established for the benthic fauna by N.G. Vinogradova (1958), finds extensive confirmation even among pelagic animals.

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[2] Almost all reports of *Mimonecetes* at the surface relate to sexually mature, spawning females.

Against the backdrop of extensive panoceanic distribution of many of the Physosomata, just mentioned above, there are species whose distribution is confined to specific climatic zones or localized regions in the oceans. Thus, species found in the Pacific Ocean, according to the nature of their area of distribution, can be divided into the following groups.[3]

1. Species inhabiting both cold-water[4] and tropical regions of the ocean: *Lanceola sayana, L. loveni, L. pacifica, L. laticarpa, L. clausi, Scypholanceola agassizi, Prolanceola vibiliformis, Chuneola paradoxa, Microphasma agassizi, Mimonectes sphaericus, M. loveni, M. gaussi, Scina incerta, S. borealis, S. spinosa, S. wolterecki, S. pusilla, Ctenoscina brevicaudata, C. macrocarpa, Spinoscina spinosa.* Only one of these species (*L. laticarpa*) is not found beyond the limits of the Pacific Ocean, the remainder having a panoceanic distribution. The absence of *P. vibiliformis* in the Atlantic Ocean and *C. macrocarpa* in the Indian Ocean, should probably be attributed to the inadequate study of the deepwater faunas of these oceans.

2. Species usually found in the northern part of Pacific and not in its tropical regions, but found sometimes in the tropical regions of
31 other oceans. In this group are included: *Lanceola serrata, Mimonecteola beebei, Scina stebbingi, S. rattrayi keilhacki.*[*] Possibly, in the northern part of the Pacific Ocean, these are represented by special forms, differing very little from the typical but spatially separated forms. Nevertheless, in the Atlantic and Pacific material of *L. serrata, M. beebei,* and *S. stebbingi*, morphological differences were observed (Vinogradov, 1957).

3. Species restricted in distribution to tropical regions: *Lanceola intermedia, L. felina, L. loveni grossipes, L. clausi pirloti, Metalanceola chevreuxi, Mimonectes diomedeae, Proscina magna, Scina crassicornis, S. curvidactyla, S. vosseleri, S. marginata, S. oedicarpus, S. tullbergi, S. nana, S. excisa, S. lepisma, S. stenopus*, and *Acanthoscina acanthodes*. Practically all these species have a circumtropical distribution.

4. Endemic North Pacific species whose distribution is associated with waters of the North Pacific Ocean (*Scina curilensis*), waters of the Sea of Okhotsk (*S. wagleri*), or finally, the abyssal zone of the Kuril-Kamchatka Trench (*Lanceola sphaerica, L. chelifera*).

5. The area of distribution of species restricted by cold-water Antarctic regions: *Paralanceola anomala* and *Mimoscina setosa*.

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[3] Particularly rare forms, known from one or two reports, whose distribution is difficult to judge with any degree of reliability, will not be considered here.

[4] In referring to cold-water regions, we imply primarily northern ones, since the deepwater fauna of high latitude in the southern hemisphere in the Pacific sector has hardly been investigated.

[*] *Scypholanceola aestiva* removed from list in Russian text by authors.—Eds.

6. Species with a bipolar area of distribution interrupted in the tropical part of the ocean: *Lanceola clausi gracilis* and *Scina antarctica*. To this group must be added *S. wagleri abyssalis*, which is found only in catches from the abyssal and ultra-abyssal depths of the Kuril-Kamchatka and Izu-Bonin trenches in the Northern hemisphere and Kermadec Trench in the Southern hemisphere.

Several species are distributed throughout the entire tropical part of the Indian Ocean but are nevertheless absent in the northern and northeastern part of the Arabian Sea. Fairly extensive material from the Arabian Sea enables us to speak with a fair degree of conviction about the absence of some rather common Physosomata in its waters.

In the above region, in intermediate waters at depths from 100–200 to 1,000–1,500 m, a sharp oxygen minimum is established wherein the oxygen content is less than 0.1 ml/l and at a depth of 200–800 m free H_2S appears (Ivanenkov and Rozanov, 1961). In the upper part of the minimum oxygen layer, in the 100–200 m layer, and especially in the 200–500 m layer, the quantity of plankton sharply decreases, sometimes to almost nil; several oceanic species inhabiting depths corresponding to the minimum oxygen layer do not enter regions covered by it (Vinogradov and voronina, 1961).

Among hyperiideans, the majority of species of the upper subzone of the deepwater zone (200–2,000 m) also do not enter regions deficient in oxygen and free H2S. Such, for example, are many species of the Scinidae: *S. crassicornis, S. borealis, S. spinosa*, the typical form of *S. rattrayi, S. submarginata, S. similis, S. vosseleri*, and some others.

As a rule, species living at greater depths (for example, *Scypholanceola agassizi, Lanceola loveni, Microphasma agassizi*) or conversely in surface layers (*Lanceola felina, Scina tullbergi, S. marginata*) and highly eurybathic species found in all water depths (*Lanceola sayana, L. clausi, Scina rattrayi keilhacki*), enter the north part of the Arabian Sea in the region of sharp oxygen deficit. However, here they are found in layers above or below the zone of oxygen minimum. For example, *Microphasma agassizi* was found in the 970–1,920 and 1,900–3,750 m layers; *Lanceola loveni*, 970–1,920 m; *L. clausi*, 1,000–2,040 m; *L. sayana*, 106–213 m as well as 97–1,920, 1,520–2,050, 2,000–3,400 m; and finally, *Scina rattrayi keilhacki*, 100–200 m. Rarely, stray specimens do enter directly into the oxygenless* layer.

32 Quite possibly, specific hydrological conditions in the northern part of the Arabian Sea restrict the distribution of many hyperiideans. Evidently, this is also true of the Bay of Bengal; nevertheless, available

* "Oxygen-deficient" is meant here—Eds.

material does not suffice for an analysis of the distribution of hyperiideans in this region.

In the Atlantic Ocean, most Physosomata are found in tropical regions, although some enter northern regions by means of warm-water currents. Such, for example, are *Lanceola felina, Mimonectes sphaericus, M. loveni, Proscina magna, Scina curvidactyla, S. vosseleri, S. oedicarpus, S. lepisma*, and some others. Only a few species are adapted to just the temperate cold-water regions of one or both hemispheres. These are *Archaeoscina steenstrupi, Megalanceola stephenseni, and Proscina stephenseni.* However, it must be noted that despite a large number of expeditions, the Physosomata fauna of the Atlantic Ocean has not been sufficiently studied. More information is available only for tropical regions.

The Physosomata fauna of the Southern Ocean has been studied so little that there is no basis for drawing conclusions about its local characteristics. It can only be emphasized that the Southern Ocean contains just a small number of endemic forms (*Paralanceola anomala, Mimoscina setosa*), which do not penetrate the lower latitudes. On the whole, as seen from Table 3, this fauna is more depauperate than that of the northern regions of the Pacific and Atlantic oceans, but obviously this is largely due to inadequate study.

The unique hydrological conditions of the deepwaters of the Central Polar Basin differ sharply from those in oceanic deepwaters and determine its overall paucity of deepwater fauna (Vinogradov, 1968). Such conditions exert a strong influence on the deepwater hyperiidean fauna, which is represented by only two eurybiontic species: *Lanceola clausi* and *Scina borealis.*

Infraorder Physocephalata

The ecological diversity of taxa comprising the infraorder Physocephalata makes an overall analysis of its geographic and vertical distribution less feasible. Hence we shall individually describe each constituent of the superfamilies Vibilioidea, Phronimoidea, and Platysceloidea.

The superfamily Vibilioidea (families Vibiliidae, Cystisomatidae, and Paraphronimidae) includes only 27 species. These are mostly representatives of the mesopelagic, although the Cystisomatidae are found in the bathypelagic down to a depth of 2,000 m and more, and some Vibiliidae inhabit surface water layers.

Many Vibilioidea are known for their extensive, often panoceanic or circumoceanic range (more than 50% of the species), but not one species is found in the Central Polar Basin (Table 5). Nearly 30% of the species of this superfamily and all those of the genera *Vibilia* and *Paraphronima* are found throughout the entire remaining oceanic water bodies. Species

Table 5. Number of genera and species of the super family Vibilioidea with different types of range

Taxa	Type of range									
			Warm-water			Cold-water				
	Total number in superfamily	.Panoceanic	Narrowly circum-tropical	Broadly circum-tropical	Total warm-water	Northern hemi-sphere	Southern hemi-sphere	Bipolar	Total cold-water	Local distribution
Genera, total number	5	2	—	1	1	—	1	—	1	1
Genera, % of total	100	40	—	20	20	—	20	—	20	20
Species, total number	27	8	4	6	10	—	3	—	3	6
Species, % of total	100	29.6	14.8	22.2	37	—	11.1	—	11.1	22.2

of the family Cystisomatidae are not found even in the cold waters of the Southern Ocean. On the other hand, the occurrence range of the genera *Vibilioides* and *Cyllopus* is fairly restricted; the former inhabits only the tropical Atlantic, while the latter is found only in the waters of the Southern Ocean. Species with such restricted distribution comprise one-third of the fauna of this group (Table 6).

The richest Vibilioidea fauna is represented in the Atlantic and Pacific oceans, where respectively 81 and 74% of all the species of the group (Table 6) are found. Somewhat less diverse is the representative fauna of the Indian Ocean, apparently attributable to its lesser study. In the cold waters of the Southern Ocean occur only a small number of species (roughly one-third) of the Vibilioidea which are, in general, warm-water types; all of them, except for two species of the endemic genus *Cyllopus* and *Vibilia antarctica*, have a wide panoceanic range.

The superfamily Phronimoidea (families Hyperiidae, Dairellidae, Phronimidae, Phrosinidae), unlike the Physosomata, which includes mainly meso-, bathy-, and abyssopelagic species, is represented exclusively by epi-and mesopelagic inhabitants, and its members rarely penetrate deeper than 800–1,000 m.

Most genera and species of the superfamily, such as the *Hyperietta, Iulopis, Lestrigonus, Themistella, Phronimella, Phronima stebbingi*, and *P. colletti*, inhabit only the epipelagic zone at depths of 0–100 and 0–200 m. Others, such as the *Hyperioides, Phronimopsis, Anchylomera*, and *Phrosina* inhabit the surface and adjacent waters to a depth of 300–500 m, but a major part of their population is confined to the epipelagic zone. All of them have a range of vertical distribution similar to the Platysceloidea group considered below as well as the characteristic tropical (usually circumtropical) range, including the Platysceloidea.

However, a whole series of genera and species inhabit surface and intermediate waters, sometimes performing migrations of a fairly high amplitude. In the wide range of depths from the surface layer to 800–1,000 m, most representatives of the genera *Hyperia, Hyperiella, Hyperoche, Parathemisto*, and *Primno*, as well as some species of the genus *Phronima* (*P. atlantica*) are encountered. Some of them
34 persistently, or at least at night, concentrate in the upper 100-meter layer, while during the day the bulk of the population descends to 200–400 m and even to 400–800 m. Such migrations are performed by, for example, *Primno* (Thurston, 1976b) and *Parathemisto japonica* (Semenova, 1974), whereas in other species, diurnal and nocturnal distribution differs little (for example, *Phronima atlantica*).

Among the Phronimoidea, there are almost no species not found in the epipelagic zone (Table 7) although there are some in which the bulk of the population is persistently confined to mesopelagic depths. These

33

Table 6. Number of reported species of the superfamily Vibilioidea in the Atlantic, Indian, Pacific and Southern oceans

Family	World Ocean	Atlantic Ocean		Indian Ocean		Pacific Ocean		Southern Ocean	
	Number	Number	% of fauna*	Number	% of fauna*	Number	% of fauna*	Number	% of fauna*
Vibiliidae	20	15	75	12	60	14	70	8	40
Cystisomatidae	5	5	100	4	80	4	80	0	0
Paraphronimidae	2	2	100	2	100	2	100	1	50
Total	27	22	81	18	67	20	74	9	33

*So given in Russian original; refers to the World ocean—General Editor.

Table 7. Number of reported species of the superfamily Phronimoidea inhabiting different depths in the Canary Islands regions[1] (from Thurston, 1976b)

Depth, m	Number of species found	% of total number of species	Number of recurrent species
0–200	16	100	16
200–500	7	44	0
500–750	5	31	0
750–1,000	3	19	0

[1] Sixteen species are considered, for which more than two specimens were found. The results of diurnal and noacturnal catches have been combined.

few species have obligate links with specific deepwater medusae. Thus, one of the most deepwater Phronimoidea—*Hyperia spinigera*, associated in the North Atlantic with the medusa *Periphylla periphylla*—inhabits mostly depths of 600–900 m (Thurston, 1977). In the Sea of Japan the population of Parathemisto japonica inhabits not only surface and intermediate waters, but penetrates to depths of 2,000–3,000 m, which in this basin comprise cold subsurface waters (Vinogradov and Sazhin, 1978).

Unlike epipelagic species, usually distributed circumtropically, most species with a wider range of vertical distribution have either a panoceanic range or their range is confined to temperate-cold-water and cold-water oceanic regions. Thus, in the family Hyperiidae only the genus *Hyperiella* and the species *Hyperia macrocephala* are adapted to waters of the high Antarctic latitudes. Only species of the genus *Parathemisto* (subgenus Euthemisto) inhabit the coldest waters of both hemispheres. At the same time, among eurybathic species, some have adapted to warm waters (*Hyperia leptura, Hyperoche mediterranea, H. picta*) or even to tropical regions (*Hyperia crassa, H. bowmani, Hyperoche martinezi*). But these are less numerous, even rare species, known from a few specimens.

Eurybathic members of the families Phronimidae (*Phronima atlantica, P. sedentaria*) and Phrosinidae (*Primno macropa*) on the other hand, are widely distributed, inhabiting tropical and temperate-cold-water regions of the oceans. With respect to population density, they occupy first place among hyperiideans of the mesopelagic (200–800 m).

Special mention must be made of the lone representative of the aberrant genus *Bougisia* of the family Hyperiidae. Judging from its structure, it possibly inhabits deep waters, though it has also been found in surface waters.

Because of the above two ecological groups of species (epipelagic and eurybathic), great diversity of area of distribution is characteristic of this family (Table 8). But since the entire superfamily Phronimoidea is

Table 8. Number of genera species of the superfamily Phronimoidea with the different types of ranges

Taxa	Total number in superfamily	Type of range								
		Panoceanic	Warm-water			Cold-water				Local distribution
			Strictly circumtropical	Circum-oceanic	Total warm-water	Northern hemisphere	Southern hemisphere	Bipolar	Total cold-water	
Genera, total number	19	4	2	8	10	0	1	2	3	2
Genera, % of total	100	21	10	42	53	0	5	10	16	10
Species, total number	59	6	17	11	28	6	6	5	17	9
Species, % of total	100	10	29	19	47	10	10	8	29	15

confined to waters of the epi- and mesopelagic, its geographic distribution is governed far more by climatic zones than has been observed for
35 the deepwater Physosomata. Nearly 50% of the species and over 50% of the genera are from warm waters and have circumoceanic distribution; some rare species with a local area of distribution have been found only in tropical regions. The cold-water regions play a lesser role: they account for 16% of the genera and 30% of the species. Species with panoceanic distribution account for 10% (6 species). It must be specially mentioned that among the Hyperiidae, the bipolar species (*Hyperia galba, H. medusarum, H. spinigera, Parathemisto gaudichaudi*) play a great role; they contribute nearly 10% to the number of species of this family.

If we compare the faunal abundance of the Phronimoidea of different oceans (Table 9), it will be seen that in the Atlantic and Pacific oceans, it is almost identical. From the Pacific Ocean, 47 species (80% of the world fauna) have been reported, while 45 species are recorded from the Atlantic Ocean; only in the Atlantic Ocean do we come across such genera as *Bougisia*. Undoubtedly, these differences are partly explained by the inadequate study of the group. To a great extent, the same reason can be advanced for the great faunal paucity of the Indian Ocean—80% of the known genera and 50% of the species. Actually, in the Indian Ocean primarily those species are absent which are known from the tropical regions of the Pacific and Atlantic oceans through reports of single specimens; moreover, comparatively fewer species from the known genera have been subjected to comprehensive investigation and revision from the Atlantic or Pacific material, entailing description of new species (genera *Lestrigonus, Hyperietta*, etc.). On the other hand, in the Indian Ocean, northern cold-water species are absent, which play a substantial role in the fauna of the Pacific and Atlantic oceans, and constitute 10% of the fauna of this group (genera *Hyperoche, Parathemisto*, etc.) (Table 8).

The superfamily Platysceloidea includes eight families represented by 63 species. All of them inhabit surface waters to a depth of 150–200 m and only some of them go deeper than 200 m (about 10 species); deeper than 500 m, only isolated occurrences have been reported of species from the families Platyscelidae (*Platyscelus armatus, P. ovoides*), Oxycephalidae (*Streetsia challengeri, Rhabdosoma brevicaudatum*), and Pronoidae (*Eupronoe armata, E. minuta*).

Special studies conducted in recent years on the vertical distribution of the Platysceloidea by methods of layerwise and horizontal catches using large closing plankton nets (Thurston, 1976b; Repelin, 1978; and others), have confirmed earlier data. In waters deeper than 500 m, only isolated individuals were found, belonging to *Lycaea pulex*,

Table 9. Number of reported genera (g) and species (s) of the superfamilies Vibilioidea and Phronimoidea in the Atlantic, Indian, Pacific, and Southern (south of 50–55° S lat.) oceans

Family	World Ocean		Atlantic Ocean				Indian Ocean				Pacific Ocean				Southern Ocean			
	Number		Number		% of world fauna		Number		% of world fauna		Number		% of world fauna		Number		% of world fauna	
	g	s	g	s	g	s	g	s	g	s	g	s	g	s	g	s	g	s
Vibiliidae	3	20	2	14	67	70	1	12	33	60	1	14	33	70	2	8	67	40
Cystisomatidae	1	5	1	5	100	100	1	4	100	80	1	4	100	80	—	—	—	—
Paraphronimidae	1	2	1	2	100	100	1	2	100	100	1	2	100	100	1	1	100	50
All Vibilioidea	5	27	4	21	80	78	3	18	60	67	3	20	60	74	3	9	60	33
Hyperiide	13	43	13	31	100	72	10	17	77	40	11	31	85	72	4	7	31	16
Dairellidae	1	2	1	1	100	50	—	—	—	—	1	2	100	100	—	—	—	—
Phronimidae	2	9	2	8	100	89	2	9	100	100	2	9	100	100	2	3	100	33
Phrosinidae	3	5	3	5	100	100	3	3	100	60	3	5	100	100	1	1	33	20
All Phronimoidea	19	59	19	45	100	76	15	29	79	49	17	47	89	80	7	11	37	19

*Paratyphis parvus, Rhabdosoma brevicaudata**, *Platyscelus ovoides*, and *Eupronoe minuta*. Nevertheless, even these species are not found deeper than 600–800 m. At the same time, it was found that most of the Platy-
36 sceloidea perform daily vertical migrations of small amplitude. During the day most of the species leave the upper 50-meter layer; populations thereby become less concentrated vertically and occupy a 50–200 (300 m) layer. At night, from 7:00–8:00 p.m. to 2:00–4:00 a.m., they rise to the surface and mostly concentrate in the 0–50 (100) m layer. The Oxycephalidae, except for the more eurybathic Rhabdosoma brevicaudatum and Streetsia challengeri, are more intimately associated with surface waters and, as a rule, even in the day do not leave the 50–100 (150 m) layer, and at night concentrate in the 0–50 m layer and up to 100 m. In some areas of the ocean, in view of some special features of water dynamics, the usual pattern of vertical distribution may change somewhat.

The Platysceloidea are exclusively warm-water crustaceans, some of which never leave the tropical oceanic zone, while others may enter temperate latitudes with warm currents but are confined there to the warmest water regions, under the direct influence of warm tropical or subtropical waters. Only one species, *Tryphana malmi*, may be considered a temperate-warm-water species since, on the one hand, it is do not found in the equatorial zone and, on the other, penetrates the farthest into high latitudes (to the Irminger Sea in the Atlantic Ocean: 67° 30′ N, to 51° S in the Indian Ocean and to 42° N in the northwest Pacific Ocean). In the Irminger Sea region (to 60° N) *Rhabdosoma minor* is also
38 transported with warm waters of the Gulf Stream. It is not possible to clearly delimit the broad- and narrow-range tropical species, since many of them are known from a single catch.

Inadequacy of data on the distribution of many species precludes the possibility of inferring with certainty the extent of the circumoceanic nature of the group. The rarest of recently described species do not seem to occur in all the oceans. It is more than probable that their absence in material from any ocean is the consequence just of inadequate study of the distribution of these species. Only for a small number of species is the area of distribution restricted to small regions of the tropical zone. Such, for instance, are *Tullbergella cuspidata* or *Euscelus robustus*, found only in the seas of the Malayan archipelago and adjacent regions of the Pacific and Indian oceans.

It is noteworthy that species diversity of the fauna of the Atlantic, Indian, and Pacific oceans is almost identical in this essentially circumtropical group. More than 90% of the reported genera and 80–90% of the

* Given as *Rhabdosoma brevicaudatum* in Russian text—Ed.

Table 10. Number of reported genera (g) and species (s) of the superfamily Platysceloidea in the Atlantic, Indian, Pacific oceans

Family	World Ocean		Atlantic Ocean				Indian Ocean				Pacific Ocean			
	Number		Number		% of world fauna		Number		% of world fauna		Number		% of world fauna	
	g	s	g	s	g	s	g	s	g	s	g	s	g	s
Pronoidae	4	10	4	4	100	80	4	9	100	90	4	10	100	100
Anapronoidae	1	1	1	1	100	100	—	—	—	—	1	1	100	100
Lycaeiidae	2	7	2	5	100	71	2	4	100	57	2	7	100	100
Brachyscelidae	2	5	2	4	100	80	2	3	100	60	2	4	100	80
Tryphanidae	1	1	1	1	100	100	1	1	100	100	1	1	100	100
Oxycephalidae	8	17	7	16	100	94	8	15	100	88	8	16	100	94
Platyscelidae	5	16	5	14	100	88	5	11	100	69	5	13	100	81
Parascelidae	5	6	5	6	100	100	4	5	80	83	3	4	60	67
Total	28	63	27	55	96	87	26	48	92	76	26	56	93	89

Table 11. Degree of commonality of Platysceloidea fauna of the Atlantic(A), Indian (I) and Pacific (P) oceans

Family	Number of taxa common A + I + P				Number of taxa common to A + I				Number of taxa common to I + P				Number of taxa common to P + A			
	Number		% of world fauna		Number		% of world fauna		Number		% of world fauna		Number		% of world fauna	
	g	s	g	s	g	s	g	s	g	s	g	s	g	s	g	s
Pronoidae	4	9	100	90	4	9	100	90	4	9	100	90	4	9	100	90
Anapronoidae	—	—	—	—	—	—	—	—	—	—	—	—	1	1	100	100
Lycaeidae	2	4	100	57	2	4	100	57	2	5	100	71	2	5	100	71
Brachyscelidae	2	3	100	60	2	3	100	60	2	3	100	60	2	3	100	60
Tryphanidae	1	1	100	100	1	1	100	100	1	1	100	100	1	1	100	100
Oxycephalidae	7	14	88	82	7	14	88	82	8	15	100	88	7	15	88	88
Platyscelidae	5	8	100	50	5	9	100	56	5	9	100	56	5	12	100	75
Parascelidae	3	4	60	67	4	5	80	83	3	4	60	67	3	4	60	67
Total	24	43	86	68	25	45	89	71	25	46	89	73	25	50	89	79

species live in each of these oceans (Table 10). In the Pacific Ocean, only two rare genera, *Euscellus* and *Hemiscelus*, are absent; in the Atlantic Ocean, *Tullbergella*; and in the Indian Ocean, *Hemiscelus* and *Anapronoe*. Apparently, with further investigations, the taxa common to the fauna of different oceans will increase still further.

The common nature of the Platysceloidea fauna of different oceans is likewise very high, much higher than in all the above-mentioned groups. Nearly 86% of the genera and 68% of the species are common to all three oceans. Between the Atlantic and Indian, Indian and Pacific, and Pacific and Atlantic oceans, 90% of the genera and 70–80% of the species are common (Table 11). Hence it is absolutely clear that this is the common circumtropical fauna.

Thus, an examination of the distribution of all major taxonomic groups of the suborder Hyperiidea very clearly reveals a correlation between their bathymetric and geographic distribution. Deepwater species, predominant among the Physosomata, are basically panoceanic or, contrarily, have a narrow local distribution. Eurybathic species inhabiting the epi- and mesopelagic, are characteristic of the superfamilies Vibilioidea and phronimoidea and spread over the temperate-cold-water and cold-water regions of both hemispheres; bipolar distribution is also found among them. Finally, inhabitants of the epipelagic, comprising a large part of the superfamily Phronimoidea and all of the superfamily Platysceloidea, characteristically have a circumtropical or somewhat more extensive distribution, covering central and equatorial waters, as well as circumoceanic areas.

PART TWO

Systematics

CLASS CRUSTACEA

Subclass MALACOSTRACA

ORDER AMPHIPODA

Suborder HYPERIIDEA

39 Hyperiidea constitutes a fairly heterogeneous group. It is not always possible to speak of its phylogenetic unity. Nevertheless, a series of characters are available, which make it possible to separate hyperiideans from the remaining Amphipoda.

The following morphological features are typical of the suborder Hyperiidea. The integument is thin, usually semitransparent but sometimes highly pigmented. The shape of the body is exceptionally diverse and varies from spherical in some Physosomata and Platyscelidae to acuminate in the *Rhabdosoma*. The eyes are very large, occupying the entire lateral surface of the head and touching the vertex or, conversely, very small, poorly developed, reduced, or totally absent. Sometimes the eyes are devoid of crystalline lens or are modified into plates devoid of receptor elements lining the bottom of the large eye cones. Antennae I are always devoid of an accessory flagellum, their peduncle short, the proximal flagellar segment usually strong, conical, longer than the rest of the flagellum and peduncle; in some groups, antennae I and II in males may be very thin and long. Sexual dimorphism is distinct, with a few exceptions in the structure of antennae II. Often, especially in females, they are reduced and sometimes totally absent.

The oral appendages are small, reduced to a variable extent, and weakly armed. The mandibles often lack a dental process and palp. Maxillae I sometimes lack an inner lobe; the lobes of maxillae II are often fused; the maxillipeds usually lack a palp, their inner lobes may be fused and reduced or totally absent.

The pereon is usually enlarged, sometimes spherically inflated. The coxal plates are small, usually weakly developed, low, of one type, not overlapping, and sometimes fused with the corresponding pereon somites. The coxal plates never form a lateral shield; in groups where such a shield is present, the same is formed by the enlarged 2nd segment of the posterior pereopods.

Pereopods I and II are simple, or with a chela formed, usually, by the 6th article and projection of the 5th; the 2nd article of pereopods V–VII is
40 sometimes remarkably enlarged, forming a "roof" (operculum) over the brood chamber. Pereopods VII are sometimes reduced, comprising only two to three articles. The gills are located on pereopods II–VI, rarely on pereopods IV–VI. Pereopods II–V have oostegites. The urosoma is stout, its last somites often fused. The uropods are weakly armed; the endopodites form several groups and are fused with the peduncle; the exopodite of uropods III is always one-segmented. The oral appendages, ambulatory legs, and uropods are usually weakly armed. The spines and setae are usually short, always not plumose. The telson is always entire. Reduction of several internal organs is also characteristic of hyperiideans. The hepatopancreatic caeca are greatly reduced or totally absent; rectal glands are absent.

The suborder is divided into two infraorders, Physosomata and Physocephalata, comprising 7 and 16 families respectively, which in turn are grouped into 7 superfamilies.

*KEY TO INFRAORDERS, SUPERFAMILIES, AND FAMILIES OF SUBORDER HYPERIIDEA**

1. Head usually short, not longer than somite I of pereon. Eyes always small, aberrant or absent. Antennae I always with strong conical proximal segment of flagellum and usually with three very small distal segments (their number rarely reduced to two or quite disappearing in adults). Mandibles without dental process. Maxillae I with an inner lobe. Infraorder **Physosomata.** .... 2.

— Head usually longer than somite I of pereon. Eyes large, occupying large part of surface of head, may be small, or even absent; in the latter case, flagellum of antennae II in male whiplike or proximal segment of flagellum of antennae I oval and inner lobes of maxillipeds fused. Proximal segment of flagellum of antennae I not conical or number of distal segments more than three. Mandibles usually with dental process. Maxillae I without inner lobe, or lobe retained as a small bare process. Infraorder **Physocephalata.** .... 8.

2. Antennae I narrowly conical, stout, long, often slightly shorter or longer than pereon. Mandibles with narrow cutting margin, without palp, or with only its one-segmented rudiment. Superfamily **Scinoidea.** .... 6.

— Antennae I conical, not exceeding length of the first three-four pereonal somites. Cutting edge of mandibles may be broad or narrow, but in latter case mandibular palp always presents................ 3.

* Key has been changed slightly from Russian text by authors—Eds.

3. Pereon in females spherically bulging, in males scinoid. Mandibles with narrow cutting edge; 3rd article of long thin palp longer than its 1st and 2nd articles together. Superfamily **Archaeoscinoidea**. .. .. I. Family **Archaeoscinidae** Barnard.

— Pereon in females varies in shape but differs less than that in males. Mandibles with broad or narrow cutting edge, usually with strong three-articled palp, in which 3rd article shorter than 2nd; if palp absent, cutting edge of mandibles broad. Superfamily **Lanceoloidea**.. 4.

4. Mandibular palp present .... 5.

— Mandibular palp absent.............III. Family **Chuneolidae** Wolt.

5. Pereopods V–VII with retractile claws. Rarely (*Lanceola falsa*), claws not greatly extended. Pereon usually bulging, but even in females not spherical ....II. Family **Lanceolidae** Bov.

41 — Pereopods V–VII with nonretractile claws. Pereon in females spherical ....IV. Family **Microphasmidae** Steph. and Pirl.

6. Endopodites of all uropods fused with basipodites.................. .... VII. Family **Scinidae** Stebb.

— Rami of uropods free .... 7.

7. Pereon in sexually mature females spherically bulging, males with scinoid body. Antennae I attached to middle part of anterior surface of head .... V. Family **Mimonectidae** Bov.

— Pereon in sexually mature females not spherically bulging; both sexes with identical scinoid body. Antannae I attached to dorsal part of anterior surface of head ....VI. Family **Proscinidae** Pirl.

8. Antennae I attached to lower surface of head; 1st article of flagellum in males enlarged and curved like a boomerang. Antennae II zigzag in males. Superfamily **Platysceloidea**. .... 16.

— Antennae I attached to anterior surface of head; 1st article of flagellum in males differs in structure. Antennae II not zigzag in males... .... 9.

9. Antennae I attached in special socket on anterior surface of head; 1st article in males triangular, distal segments articulated subterminally. Gills only on pereon somites V and VI. Superfamily **Lycaeopsoidea**. .... XV. Family **Lycaeopsidae** Chevr.

— Special socket for attachment of antennae I absent. Distal segments of antennae I in males articulated to proximal segment, terminally, or absent. Gills usually on pereon somites II–VI, rarely on somites IV–VI .... 10.

10. Flagellum of antennae I in both males and females with large 1st and few (often rudimentary) subsequent articles. Antennae II comprise several cylindrical articles and even in males without long whiplike flagellum, sometimes rudimentary. Superfamily **Vibilioidea**. .... 11.

— Antennae I and II in males with long, multisegmented flagellum. superfamily **Phronimoidea** .... 13.

11. Body with thick integument. Mandibles with well-developed, three-segmented palps. Coxal plates free. Pereopod I simple, II chelate; basal articles of pereopods V–VII ovally broadened ....
....VIII. Family **Vibiliidae** Dana.

— Body with thin hyaline-transparent integument. Mandibles without palps. Coxal plates fused with pereon. Pereopod I with weak subchela, pereopod II simple, or both appendages with chela; basal articles of pereopods V–VII not enlarged .... 12.

12. Large crustaceans (50–140 mm). Maxillipeds with free outer lobes. Pereopods I and II chelate. Uropods II absent; endopodites of uropods I and III fused with basipodites ....
............................IX. Family **Cystisomatidae** Will.-Suhm.

— Crustaceans up to 30 mm in size. Outer and inner lobes of maxillipes fused into single plate. Pereopods I with weak subchela, pereopods II simple. Uropods II well developed; rami of uropods free ....
....................................X. Family **Paraphronimidae** Bov.

13. All pereopods simple, similar in structure. Mandibular palps absent in both sexes .... XII. Family **Dairellidae** Bov.

— Some pereopods with somewhat distinct chela or subchela. Mandibular palps present in both sexes or only in males. .... 14.

42 14. Uropods broad, unsegmented plates ....
.... XIV. Family **Phros inidae** Dana.

— Uropods with free rami .... 15.

15. Pereopods V with subchela formed by highly enlarged 5th and claw-like 6th articles .... XIII. Family **Phronimidae** Dana.

— Pereopods V simple, or (genus *Bougisia*) with small subchela formed by 6th and 7th articles ....XI. Family **Hyperiidae** Dana.

16. Second article of pereopods VI enlarged and broadened, operculate; all distal articles together much shorter than it and attached subterminally to inner surface of 2nd article .... 17.

— Second article of pereopods VI may be enlarged but not operculate; distal articles usually longer than it and always attached terminally to its edge .... 18.

17. Pereopods VII comprise 2nd and sometimes 1–2 rudimentary distal articles. Mouth cone short, broad, cylindrical......................
..................................XXII. Family **Platyscelidae** Bate.

— Distal segments of pereopods VII may be reduced, but number not less than four. Mouth cone elongated, tapering.....................
..................................XXIII. Family **Parascelidae** Bov.

18. Body cylindrical; head round, not produced into long tapering rostrum anterior to eyes .... 19.

— Body narrow, elongated, sometimes acicular. Head elongated, produced into tapering, sometimes very long rostrum anterior to eyes. . .
. . . . .XXI. Family **Oxycephalidae** Bate.

19. Pereopods VII seven-articled. Mandibular palps in females or in both sexes absent . . . . 20.

— Pereopods VII reduced; distal articles rudimentary, not more than two. Mandibular palps present in both sexes. . . . .
. . . . XVI. Family **Pronoidae** Claus.

20. Antennae II in females rudimentary or absent. Mandibles in males with palps . . . . 21.

— Antennae II in females present, short, with few articles. Mandibular palps absent in both sexes . . . .
. . . . XVII. Family **Anapronoidae** Bow. and Grun.

21. Pereopods II with somewhat developed subchela. Claws of pereopods II not armed. . . . . 22.

— Pereopods II simple. surface of claws of pereopods II with numerous fine setae. . . . . XIX. Family **Tryphanidae** Bov.

22. Pereopods I with strong dentate subchela. Pereopods V–VI differ little in length. Rami of all uropods free . . . .
. . . . .XX. Family Brachyscelidae Steph.

— Pereopods I simple or with smooth subchela. Pereopods V longer than others. Endopodites of uropods III or II and III fused with basipodites . . . . XVIII. Family **Lycaeidae** Claus.

Infraorder PHYSOSOMATA Pirlot, 1929

Hyperiideans in the adult stage of growth resemble "physosoma" in body shape and are characterized by a spherically bulging pereon, and weak pleon and urosoma. In adult hyperiidean Physosomata (dorsal view), the pereon is always broader than the pleon; in some families the adults (especially females) have a spherically inflated pereon. The
43 pereon somites are free and only in some genera of the family Scinidae are somites I and II sometimes fused. The head is weakly differentiated, short, usually not longer than pereon somite I, with protruding mouth cone. The eyes are small, weakly pigmented, reduced, sometimes inconspicuous; only in some species do the eyes retain the crystalline lens but even in these the optical elements are fewer. Antennae I have a short, one- to three-segmented peduncle, large conical proximal segment of the flagellum, and three small distal segments[1], which may be fused, and sometimes retained only in the juvenile stages (family Scinidae). Antennae II in males are usually well developed, in females often rudimentary.

[1] In the aberrant *Paralanceola anomala*, there are, apparently, two distal segments.

Mandibles without dental process. Maxillae I have a one-segmented palp; an inner lobe is present. The lobes of maxillae II are narrow, sometimes fused. The outer lobes of the maxillipeds lack a palp; the inner lobes are usually separate or not completely fused; in the latter case, a suture separating them into two symmetric halves is present (except in family Scinidae). The first two pairs of pereopods are weak and simple (very rarely, pereopods I chelate). The 2nd article of all pereopods lacks lobate outgrowths. Pereopods III–VII (often V–VII) in some groups with retractile claws. Pereopods VII almost always with all articles and only rarely lose the claw.

The infraorder Physosomata includes seven families: Archaeoscinidae, Lanceolidae, Chuneolidae, Microphasmidae, Mimonectidae, Proscinidae, and Scinidae.

SUPERFAMILY ARCHAEOSCINOIDEA BARNARD, 1930, NOM. NOV.

The pereon does not bulge in males. Antennae I are short in both sexes, not longer than the first two-three somites of the pereon. The cutting edge of the mandibles is narrow; the mandibular palp is thin, its 3rd segment longer than the 1st and 2nd segments together.

I. Family ARCHAEOSCINIDAE Barnard, 1930

Small animals, less than 10 mm long*, with sexual dimorphism distinct in body shape. The head in females is shorter and lower than somite I of the pereon, in males much above the pereon and nearly equal to it in length. The eyes are very small or absent. The structure of antennae II differs notably in males and females.

The mandibles taper sharply in the distal part, have a narrow cutting edge, are devoid of accessory plate, and have a thin palp. Maxillae I have a developed palp. The lobes of maxillae II are unequal in size. The outer lobes of the maxillipeds are oval and very slightly armed; the inner lobes are small and slightly separated in the distal part. The coxal plates are free, the 5th article of pereopods I is almost not enlarged distally; the claw is attached subapically. The claws of pereopods I–IV are free, those on V–VII may be retractile (genus *Paralanceola*). The uropods have long free rami. The telson is shorter than the basipodites of uropods III.

Woltereck (1909) separated the family Pygmaeidae, including in it the genera *Archaeoscina* Stab., *Micromimonectes* Wolt., *Mimonecteola* Wolt., and *Microphasma* Wolt. In doing so, he pointed out that these genera were combined by him in one family only provisionally and, possibly,

* Changed from "cm" in Russian text by authors—Eds.

the family Pygmaeidae might be divided further. Barnard (1930), having no personal material and purely from nomenclatural considerations, proposed that the name of the family be changed to Archaeoscinidae
44 since it did not include the genus *Pygmaeus*, from which the family could derive the name Pygmaeidae. This anomaly had been pointed out earlier, by Pirlot (1929).

Later, Stephensen and Pirlot (1931) separated the genus *Microphasma* into a special family, *Microphasmidae*, in which the genus *Mimonecteola* was later included (Vinogradov, 1957). Thus the family Archaeoscinidae was left with two genera: *Archaeoscina* and *Micromimonectes*. According to Stephensen and Pirlot (1931) and Vinogradov (1956), Micromimonectes is represented only by adult females, and Archaeoscina by males and sexually immature females.

A revision of available data compels us to include the genus *Paralanceola* Barnard in the family Archaeoscinidae.

Thereby the scope of the family accepted by us includes two genera: *Archaeoscina* and *Paralanceola*.

KEY TO GENERA OF FAMILY ARCHAEOSCINIDAE

1. Pereopods V–VII with long, strong, nonretractile claws. Antennae II in males not terminating in whiplike flagellum .... 1. ***Archaeoscina*** Stebb.

— Pereopods V–VII with small retractile claws. Antennae II in males with long whiplike flagellum .... 2. ***Paralanceola*** Bar.

1. Genus *Archaeoscina* Stebbing, 1904

Stebbing, 1904: 19; Stephensen and Pirlot, 1931: 534; Vinogradov, 1956: 199; Bowman and Gruner, 1973: 10.—*Micromimonectes* Woltereck, 1906a: 190.

The body is smooth, the integument transparent. The pereon in adult females is spherically bulging due to the distension of somites I–V. In males and young females the body is scinoid. The head is short and high. The eyes are small. Antennae I in females have a three-segmented peduncle, in males a two-segmented peduncle; in females the antennae are shorter than the first two pereon somites, in males equal to the first three pereon somites. The articles of the flagellum in antennae II are conical in females and virgate in males. The inner lobes of maxillae II are broader and shorter than the outer lobes. The inner lobes of the maxillipeds are separated. Pereopods III and IV have an amygdaloid 5th article. Pereopods V–VII have nonretractile claws.

Type species: *Mimonectes steenstrupi* Bovallius, 1885.

This genus includes two species: *A. steenstrupi* and *A. stebbingi*. The latter is known from a single specimen, very briefly described and schematically (total outline) illustrated by Woltereck. Thus the species validation of *A. stebbingi* is doubtful.

1. ***Archaeoscina steenstrupi*** (Bovallius, 1885) (Fig. 3)

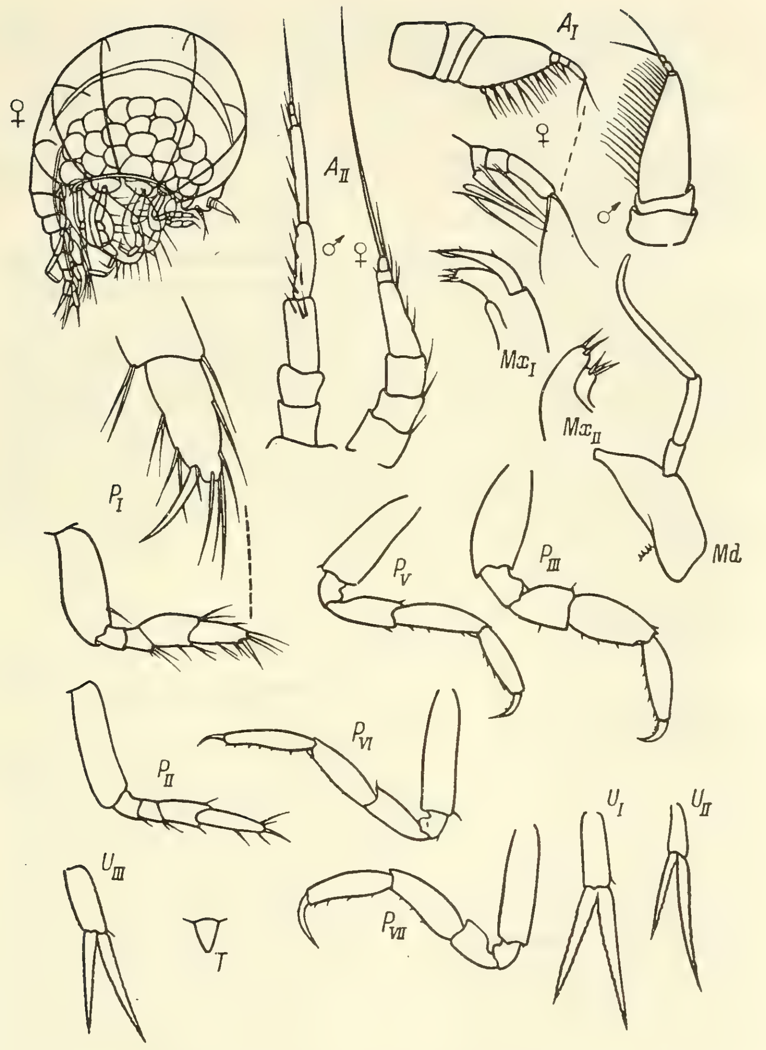
Bovallius, 1885a: 2 (*Mimonectes*), 1887a: 558 (*Mimonectes*); Stephensen, 1923: 7 (*Mimonectes*, part.); Stephensen and Pirlot, 1931: 534 (*Micromimonectes*); Pirlot, 1939: 18; Vinogradov, 1956: 200. —*bonnieri* Stebbing, 1904; 19;—*irene* Woltereck, 1906a: 190 (*Micromimonectes*); Barnard, 1932: 250.—*typus physosoma* Woltereck, 1906a: 191 (*Micromimonectes*).

Sexually mature females 3.5–4.0 mm long, males 2.5–3.5 mm long. The peduncle of antennae I is nearly equal in length, or shorter than the broad proximal segment of the flagellum; the three distal segments are comparatively well developed and together nearly equal to half the length of the proximal segment; the 3rd distal segment is longer than the two preceding segments together, with two apical setae, equal in length.

Antennae I in males are longer (almost equal to the first three somites of the pereon in length and, together with the apical setae reach up to
45 pereon somites IV–V) and narrower than in females; the proximal segment of the flagellum is 2.0–2.5 times longer than the peduncle; the distal segments are small, their total length 1/5–1/4 of the proximal segment; the 3rd distal segment is nearly equal to the 2nd, and apically bears two setae. Antennae II are shorter than antennae I; in females they are six-segmented; the 4th segment is conical and the longest, equal to the 2nd and 3rd together, and three times longer than the 5th and 6th segments together; the 6th segment has one long apical seta. Antennae II in males are seven-segmented, almost two times longer than antennae II in females.

The structure of the mouthparts and pereopods is similar in both sexes. The mandibular palp is much longer than the mandibular body, with a thin, curved 3rd segment somewhat larger than the two preceding segments together. Maxillae I have a weak palp, comparatively narrow outer lobes, and narrow apically rounded inner lobes. The inner lobes of maxillae II are broader and shorter than the outer; the outer lobes have two apical setae and the inner lobes three short stiff setae. The
46 maxillipeds have an oval unarmed outer lobe, the distal part of its inner margin being denticulate; the inner lobe is small.

In pereopods I the 5th segment is almost not enlarged distally and the 6th segment equally long and transversely oval; the claw is not attached apically but distally on the posterior margin, and is strong and straight. Pereopods II are longer and thinner; their 5th segment is shorter than the transversely oval 6th segment and the claw is terminal. Pereopods III



45 Fig. 3. *Archeoscina steenstrupi* (Bovallius).

Female, general view—after Woltereck (1906a); rest—after Vinogradov (1956).

and IV are the longest and strongest of all the pereopods and identical in structure. The 2nd segment of pereopods III is shorter than the 4th and 5th together; the broad 4th segment is somewhat shorter than the amygdaloid 5th segment, which in turn is equal in length to the narrower 6th segment. Pereopods V–VII are nearly equal in length; the 4th segment of pereopods V is somewhat shorter than the 5th or almost equal to the 6th segment; the curved claw is almost half the length of the 6th segment. In pereopods VI the segments are almost equal in length but their claws are relatively shorter. In the stronger pereopods VII the 4th segment is half as long as the 5th; the claw is only 2/3 the length of the 6th segment.

The basipodites of the uropods are 2/3–1/2 as long as their rami; in uropods II they are very narrow and short; the rami are narrowly lanceolate and denticulate along the margin. The telson is triangular, apically rounded, reaching half the length of the basipodites of uropods III.

Distribution: This is a widely distributed species, known from different regions of the North Atlantic (between 65 and 30° N) and southern parts of this ocean (43° 20′ S, 46° 02′ W). In the Pacific Ocean it is common in the northwestern regions (including the Bering Sea) between 60 and 40° N lat., but evidently is distributed more extensively since it has been found along the coasts of South America (5° 57′ S, 80° 50′ W and 27° 20′S, 117° 30′ W*). It is also found in the Indian Ocean, along the coast of Sumatra. It inhabits meso- and possibly bathypelagic layers. In the northwestern part of the Pacific Ocean, it is found in catches from depths of 200–500 m, 300–500 m, and also in all catches from depths of 700 m, 1,000 m and more to the surface.

2. ***Archaeoscina stebbingi*** Woltereck, 1909

Woltereck, 1909: 154.

Known from a single specimen, 3.0 m long, briefly described and schematically illustrated.

The main difference between *A. stebbingi* and *A. steenstrupi* is that the 5th segment of pereopods I and II is much broader in the former than in *A. steenstrupi*; Woltereck suggests that this difference might be age-related. The 6th segment of pereopods I and II in *A. stebbingi* is well developed and conical, not oval, in shape (may be the result of Woltereck's schematic drawing; he has allowed similar inaccuracies in other instances). Finally, Woltereck mentions that in *A. stebbingi* the highly curved 3rd segment of the mandibular palp is three times longer than its 1st and 2nd segments together, while in *A. steenstrupi*, according to him, the length is no more than 1.5 times greater. It is this difference that prevents us from considering the two species identical.

Moreover, Woltereck, while comparing his specimen with that of *A. bonnieri* (= *A. steenstrupi*) from the Bay of Biscay, found several differences in the structure of the antennae: in *A. stebbingi*, antennae II have narrow peduncular segments versus broad segments in *A. steenstrupi*; the proximal segment of the flagellum of antennae I in *A. stebbingi* is five times longer than the distal segments, while in *A. steenstrupi* the distal

* Changed from Russian text—Eds.

segments are 2/3 the length of the proximal segment. There are also differences in the structure of antennae II. However, all of them are based
47 on the fact that Stebbing described a young female and Woltereck had a sexually mature or almost mature male.

Distribution: Found in the southern part of the Pacific Ocean in Humboldt current, near 15° S, 100° W.

Absent in our collections.

2. Genus *Paralanceola* Barnard, 1930

Barnard, 1930: 398; Bowman and Bruner, 1973: 22.

Known from a lone, rather poorly preserved specimen of a sexually immature male, serving as the type specimen for describing the species and separation of the genus. The primary diagnosis is cryptic and the illustration schematic.

The entire integument, including antennae I, the body of the mandibles, pereopods, and uropods has hexagonal markings. The rostrum is not conspicuous. The eyes are small, consisting of four ocelli with crystalline prisms.

Antennae I are attached to the anterior part of the head and project forward; the peduncle is two-segmented. Antennae II have a long thin flagellum. Maxillae II have unequal lobes. The maxillipeds have an oval, almost unarmed outer and small, reduced inner lobe. In pereopods I the 5th segment is almost not enlarged distally, and the 6th segment is oval. In pereopods III–IV the 4th and 5th segments are oval or distally enlarged. Pereopods V–VII have retractile claws.

Type species: *Paralanceola anomala* Barnard, 1930.

In almost all the characteristic features (including the two-segmented peduncle of antennae I in males), this genus is proximate to the genus *Archaeoscina* and differs from it primarily in the retractile claws of pereopods V–VII, bringing it closer to the family Lanceolidae, and the whiplike flagellum of antennae II. However, the retractile claws on the last pair of pereopods are typical not only of the Lanceolidae, but even of the Chuneolidae, Proscinidae, and some Scinidae (genus *Ctenoscina*). The whiplike flagellum of antennae II is not known for any other hyperiideans except the Physosomata. Thus the place occupied by *Paralanceola* in the system of hyperiideans is fairly indeterminate. Barnard (1930) included it, with some reservations, in the family Lanceolidae. However, a detailed comparison of characters shows that *Paralanceola* is closest to the *Archaeoscina*, which permits its inclusion in the family Archaeoscinidae.

1. ***Paralanceola anomala*** Barnard, 1930 (Fig. 4)

Barnard, 1930: 398.

Length of sexually immature male, 6.0 mm.

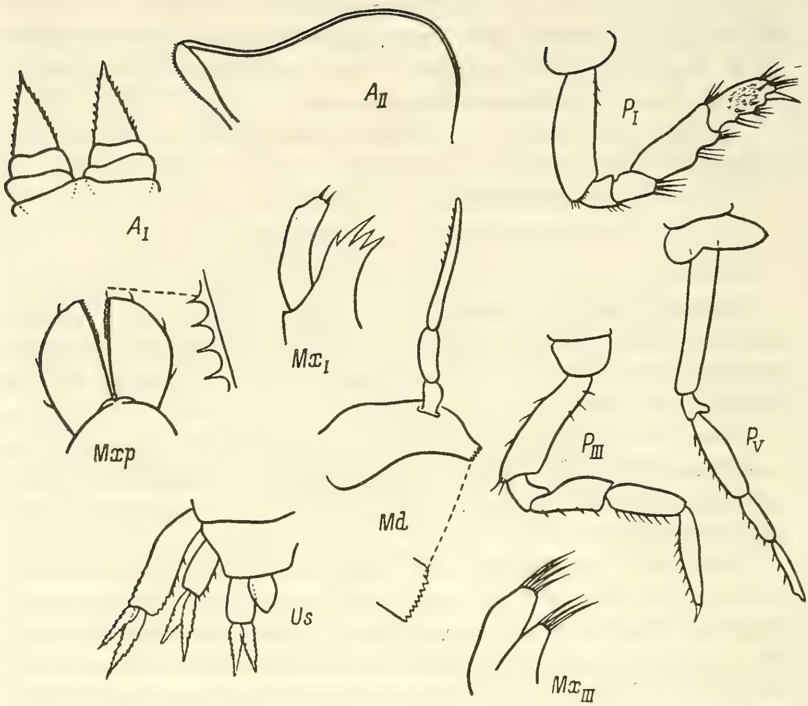


Fig. 4. *Paralanceola anomala* Barnard (after Barnard, 1930).
[Mx_{III} in Russian original should be Mx_{II} —Eds.]

The proximal segment of the flagellum of antennae I is broadly conical; there are two small distal segments. Antennae I are short, with a two-segmented peduncle. Antennae II have an elongated, slightly distally enlarged peduncular segment; the flagellum is long, whiplike, and judging from Barnard's (1930) schematic drawing, not segmented.

The mandibles are similar in structure to the *Archaeoscina* with a narrow, denticulate cutting edge. Maxillae I have four large odontoid spines on the distal margin of the outer lobes; the inner lobes are absent (lost?); the palp is weak. Maxillae II have strong outer lobes; the inner lobes are shorter and narrower; each lobe apically bears three-four setae. The maxillipeds have oval, almost nonsetose outer lobes with a distally denticulate inner margin, and very small inner lobes.

48 The coxal plates are well developed: I—elongated, II-IV—semicircular, V—bilobate, its length more than its height, VI—equal in length and height, and VII—small.

The 5th segment of pereopods I is cyclindrical, only slightly enlarged distally; the anterior distal corner of the 6th segment is produced and overhangs an almost straight claw. Pereopods II are similar in structure, but thinner, and the claw is terminal. In pereopods III and IV the claw is well developed but short. Pereopods V are longer than pereopods III and IV; pereopods VI are shorter than V and VII. The basipodite of uropods I is denticulate in the distal part of the anterior and posterior margins; the posterior margin of the basipodite of uropods II is also denticulate; the rami of all uropods are denticulate. The telson is triangular, almost reaching the distal margin of the basipodite of uropods III.

Distribution: Pacific sector of the Antarctica (71° 41′ S, 166° 47′ W) in 0–1,000 m catch.

Absent in our collections.

SUPERFAMILY LANCEOLOIDEA BOVALLIUS, 1887

Pereon is equally bulging in both males and females. Antennae I are short in both sexes, not extending beyond the first two-three somites of the pereon. The cutting edge of the mandibles is broad, rarely narrow; the mandibular palp is usually strong, its 3rd segment is shorter than the 1st and 2nd together.

II. Family LANCEOLIDAE Bovallius, 1887

Medium- or large-sized crustaceans, 8–57 mm in length. The body is cylindrical, massive. All somites of the pereon are free. The head is shorter than or equal in length to somite I of the pereon and may be higher or lower than it. The eyes are usually small, rudimentary, and
49 sometimes inconspicuous, but in the genus *Scypholanceola* have the form of broad strips lying in large cup-shaped depressions on the sides of the head. Antennae I are stout and short; the peduncle is three-segmented; all segments of the stout broad flagellum, except the three small distal ones, are fused. Antennae II are thin, usually longer, but sometimes (genus *Metalanceola*), especially in males, shorter than antennae I.

The mandibles have a broad or narrow (*Megalanceola, Prolanceola*) cutting edge but always have a stout three-segmented palp; the accessory cutting plate is always developed to some extent. Maxillae II are bilobed, usually with narrow, but sometimes broad (*Prolanceola*) lobes. The maxillipeds are armed with setae; the outer lobes are round; the inner lobes are relatively well developed, separate, rarely rudimentary (*Metalanceola*). The coxal plates are large and free. Pereopods I and II are noticeably shorter than the subsequent ones, their 2nd segment broadened to some extent; the 5th segment is broadened distally (stronger in pereopods I than in pereopods II). Pereopods V–VII, in some genera only pereopods VI and VII or conversely pereopods III–VII, terminate in a spoon-shaped depression accommodating a wholly or partly retractile claw. Rarely, these formations are very weakly developed and almost inconspicuous. The uropods have free rami. The telson constitutes 1/3–1/2 the length of the basal segment of uropods III or is somewhat longer.

A typical deepwater family. Its species usually do not ascend higher than 200–500 m. Only two close species, *Lanceola felina* and *L. intermedia*, live in surface waters; rarely one comes across the highly eurybathic *L. sayana*.

Lanceolids are parasites and partly commensals of deepwater coelenterates—medusae and siphonophores. Their guts are usually filled with a brownish-red mass—the host tissue containing numerous cnidoblasts. In large crustaceans the guts contained fragments of chaetognaths and even pieces of cephalopods with tentacles and luminous organs. Apparently, the fragments of these animals could have been pulled out by the crustaceans from the trapping filaments of siphonophores or medusae. The long retractile claws on the last two, three, or even four pairs of pereopods could stretch into a spoon-shaped depression at the tip of the 6th segment, together with the seized tissue of the host, which would ensure a firm attachment of the crustacean to its "carrier". Their occurrence on large deepwater coelenterates enables the less mobile lanceolids to reach larger sizes, up to 30–70 mm.

Family lanceolidae includes five genera.

KEY TO GENERA OF FAMILY LANCEOLIDAE

1. Sixth segment of pereopods I narrows distally. Eyes compact or absent. Pereopods V with spoon-shaped tips and retractile claws, sometimes poorly developed .... 2.

— Sixth segment of pereopods I enlarges distally. Eyes comprise individual eye spots. Pereopods V without retractile claws ....5. **Prolanceola** Wolt.

2. Mandibles with broad cutting edge and very small, sometimes reduced to a tubercle, accessory plate .... 3.

— Mandibles with narrow cutting edge and well-developed, almost equally broad accessory plate ....3. **Megalanceola** Pirl.

3. Spoon-shaped formation on pereopods V–VII developed to some
50 extent but not swollen on rear side; claws 1/10–1/5 length of 6th segment. Palp of maxillae I at least equal in length to outer lobe .. .. 4.

— Spoon-shaped formation on pereopods V–VII well developed, swollen on rear side; claws 1/4–1/3 length of 6th segment. Palp of maxillae I reduced and nearly half length of outer lobe .... 4. **Metalanceola** Pirl.

4. Eyes modified into reflector organs, resembling two large cup-shaped depressions on both sides of head ....2. **Scypholanceola** Wolt.

— Eyes reniform or round, on small prominence on sides of head, sometimes very weakly developed......................1. **Lanceola** Say.

1. Genus *Lanceola* Say, 1818

Say, 1818: 318; Bovallius, 1887b: 28; Bowman and Gruner, 1973: 20.

Animals large or medium in size. The integument is thin, transparent or compact, even faceted. The eyes are small and reniform, at times inconspicuous. In antennae I the conical proximal segment of the flagellum is more or less pubescent* sometimes curved; the size and shape of the three small distal segments are important in species diagnosis. Antennae II are longer than or equal to antennae I. Sexual dimorphism in the structure of the antennae is not pronounced. The 3rd segment of the mandibular palp is shorter than the 2nd segment. The inner lobes of maxillae I are large and broad. The maxillipeds have large, highly armed outer lobes and small separate inner lobes. The 5th segment of pereopods I and II is enlarged but the 6th segment narrows distally. Pereopods III–VII are long, their segments rod-shaped. Pereopods V–VII have a somewhat developed spoon-shaped depression and retractile claws. The gills are located on somites II–VI.

Type species: *Lanceola pelagica* Say, 1818.

For most of the species of the genus *Lanceola*, represented in large numbers in the material examined by us, variability of many features, such as body shape, thickness of integument, relative length of appendages, shape and relative length of the segments of the pereopods, length and shape of the telson, etc., is characteristic. Some of these features vary markedly while others vary less. Variability is associated not only with the age and sex of the animal, but with some extraneous factors, in particular, possibly with the habits of the host, according to Woltereck.

Various authors have described nearly twenty species of this genus. Some have been transferred to other genera while others have been considered synonyms. However, there are some doubtful species that might possibly be synonyms but the brevity of the original descriptions, schematic and impressionistic illustrations do not permit confirmation of this with certitude. Thus *L. sayana* Bovallius and *L. pelagica* Say are possibly synonyms; the latter species has the right of priority but its

* Changed from Russian text by authors—Eds.

description and illustrations do not permit reliable identification. *Lanceola serrata* Bovallius is possibly a synonym of *L. australis* Stebbing and *L. suhmi* Stebbing, while *L. felina* Bovallius is a synonym of *L. murrayi* Norman.

In the contemporary understanding, the genus *Lanceola* includes 12 species.

*KEY TO SPECIES OF GENUS LANCEOLA**

1. Telson nearly equal in length to basipodite of uropods III, sometimes slightly shorter or longer; tip of telson usually blunt .... 7.

51 — Telson appreciably (1/2–5/6) shorter than basipodite of uropods III; tip of telson usually acute .... 2.

2. Spoon-shaped formation on distal end of 6th article of pereopods V–VII well developed; claws fully retractile 3

— Spoon-shaped formation on distal end of 6th article of pereopods V and VII almost not developed; only proximal part of claw retractile .. .. 5. ***L. falsa*** Vinogr.

3. Somite VII of pereon and somites of pleon with somewhat developed, at times very small, dorsal denticles. Pereopods VI equal to or longer than pereon, much longer than pereopods IV...... 6. ***L. loveni*** Bov.

— All somites of pereon and pleon without dorsal denticles. Pereopods VI shorter than pereon and nearly equal to pereopods IV in length .... 4.

4. Pereopods III and IV simple, their 5th articles with parallel anterior and posterior margins, 6th article almost straight................. 5.

— Perepods III and IV with well-developed subchela formed by amygdaloid 5th and curved rod-shaped 6th articles .... 12. ***L. chelifera*** Vinogr.

5. Pereopods V simple with fully retractile claws and rod-shaped 6th article. Pereon of female not spherically bulging .... 6.

— Pereopods V with poorly developed subchela formed by narrow amygdaloid 6th article and partially retractile claws. Pereon of females spherically bulging .... 11. bit L. sphaerica Vinogr.

6. Antennae II with rod-shaped 4th segment in peduncle. Claws of pereopods III,1/5–1/4 length of 6th segment .... 9. ***L. clausi*** Bov.

— Antennae II with flat and broadened 4th segment in peduncle. Claws of perepods III exceptionally long, 2/3 length of 6th article .... 10. ***L. longidactyla*** Vinogr.

7. Dorsal denticles on pereon somites VI and VII, on all somites of pleon, and somite I of urosome large and conspicuous. Pereopods I

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* Key changed from Russian text by author—Eds.

with distally highly broadened 5th segment forming upper and lower lobes; 6th segment simple, comparatively narrow, its base occupying only half distal margin of 5th segment .... 7. ***L. serrata*** Bov.

— Somites VI and VII of pereon and all somites of pleon lacking large dorsal denticles .... 8.*

8. Pereopods V with rod-shaped 4th segment. Somite I of pleon without dorsal depression .... 9.

— Fourth segment of pereopods V broadened, elongated-oval. Somite I of pleon with dorsal depression .... 8. ***L. laticarpa*** Vinogr.

9. Head with distinct straight or hook-shaped rostrum.............. 10.

— Rostrum absent .... 4. ***L. pacifica*** Stebb.

10. Distal segments of antennae I not fused. Pereopods VI equal to or shorter than pereon .... 11.

— Distal segments of antennae I fused (Fig. 6). Pereopods VI longer than pereon.. 1. ***L. sayana*** Bov.

11. Fourth segment of peduncle of antennae II not forming distal lobe.
52 Pereopods VI nearly same length as pereon. Apical segment of flagellum of antennae I discoid and longer than two preceding segments (Fig. 6.) .... 3. ***L. felina*** Bov.

— Fourth segment of peduncle of antennae II forms conspicuous distal lobe. Pereopods VI equal in length to somites I–IV of pereon. Apical segment of antennae I not discoid and nearly equal to two preceding segments (Fig. 6).......................... 2. ***L. intermedia*** Vinogr.

1. ***Lanceola sayana*** Bovallius, 1885 (Figs. 5, 6)

Bovallius, 1885b: 7, 1887b: 30; Woltereck, 1909: 158 (var. *typica* + var. *longipes*); Stephensen, 1918: 8; Vinogradov, 1957: 190; 1960a: 200; 1964: 109.—*pelagica* (?) Say, 1818: 318; Shoemaker, 1945a: 206.

Length of a sexually mature individuals varies from 19 to 42 mm.

The color of unfixed specimens is fairly variable: they are dark red, orange or colorless; sometimes the anterior half of the body, i.e. head and
53 part of the pereon, is colored while the posterior part of the pereon, pleon and urosome is colorless; at times the reverse is seen, i.e., the pereon is colorless while the pleon, mouthparts, and pereopods are orange or carmine-red.

The integument is dense; the dorsal side of the pereon and pleon has a blunt, poorly developed keel; the surface of the somites is covered with sculptured thickenings, at times very weakly developed. The pereon of the female bulges to some extent or, in any case, is dilated. Males well proportioned, the pereon differing little from the pleon in width.The head has an acute triangular rostrum, sometimes straight and longer but often short and curved beaklike. The eyes are conspicuous, with crystalline cones.

* Number missing in the Russian original—translator.

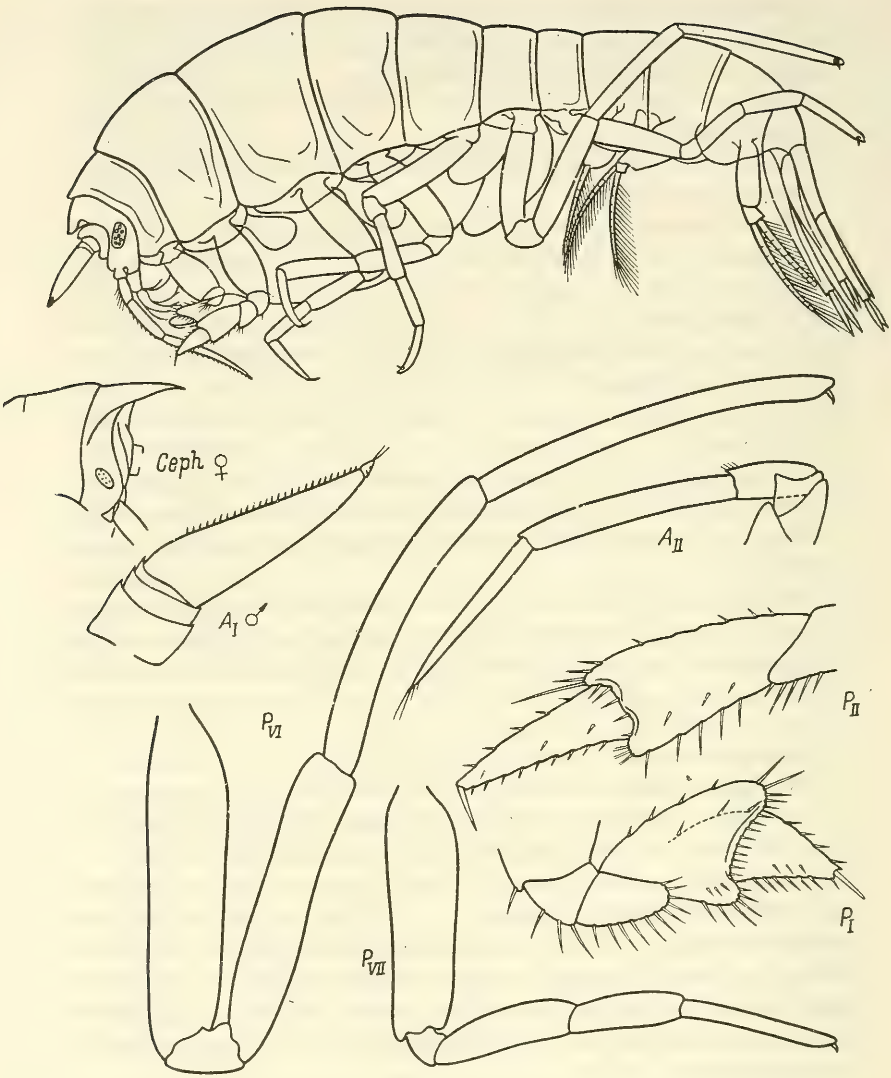
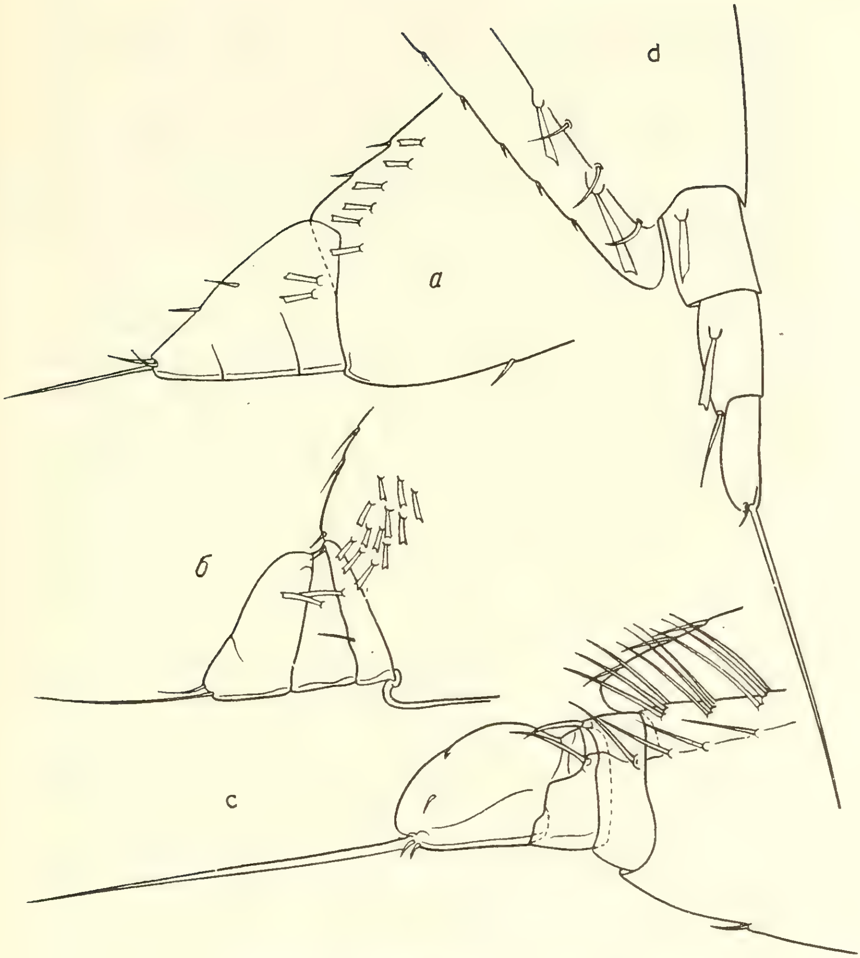


Fig. 5. *Lanceola sayana* Bovallius.

cepn ♀—head of female with straight rostrum

Antennae I are short, shorter than the first two somites of the pereon together, in larger individuals shorter than somite I; the flagellum in females is only slightly, and in males, more than twice longer than the peduncle; the proximal segment of the flagellum is almost straight, narrowing distally; the three distal segments are fused and apically bear three setae, of which the



53 Fig. 6. Distal articles of antennae I (after Vinogradov, 1906a).
a—*L. sayana* Bovallius; b—*L. intermedia* Vinogradov; c—*L. felina* Bovallius; d—*L. loveni* Bovallius.

longest is almost half the length of all the distal segments of the flagellum together. Antennae II are more than twice longer than antennae I; their peduncle in young individuals is longer, in larger individuals shorter than
54 the flagellum; the flagellum is three- to four- segmented, the proximal segment is long and styletlike; the two-three distal segments are short.

The structure of the mouthparts is nearly identical in all the species of the genus. The mandibles have a broad cutting edge that is narrower than the body of the mandible, and a long, strong, three-segmented palp that is much longer than the body of the mandible; the 1st segment of the palp is short, dolioform; the 2nd segment is larger, stronger, and broadened distally; the 3rd segment is narrow, conical. Maxillae I have a broad, single-segmented palp, bear one seta in the distal part, and have a slightly denticulate inner margin; the outer lobes are pubescent in the distal part and bear a few (five) short stout spines; the inner lobes are broad with a smoothly curved distal margin. The lobes of maxillae II are nearly equal in length and width and have an incised distal margin provided with long, stout spines. The maxillipeds have elongated-oval outer lobes armed with stout setae and relatively short, weakly pubescent inner lobes.

The relative length of the pereopods is variable. In sexually mature individuals, pereopods I are short, stout, with a broad 2nd segment, their 3rd and 4th segments short; the 5th segment is highly broadened distally so that its maximum width equals its length and the anterior and posterior distal corners form round lobes; the 6th segment is conical with a straight posterior and slightly protruding (sometimes straight or even concave) anterior margin forming a small denticle over the claw; the 6th segment is slightly longer than its maximum width; the claw is straight. Pereopods II are much longer than pereopods I; their 2nd segment is equal in width to pereopods I but almost 1.5 times longer; the 5th segment is slightly broadened distally so that its maximum width is almost 2/5 its length; the 6th segment is narrow, conical, slightly shorter than the 5th and its posterior margin concave. Pereopods III and IV are nearly equal in length; their 2nd segment is broadened, shorter than the 4th and 5th together; the 6th segment is thin, longer than the 5th but shorter than the 4th; the claw is almost straight. Pereopods V are longer than pereopods IV; their linear or broadened 2nd segment is longer than the 4th, the latter 1.5 times longer than the 5th; the 6th segment is longer than or equal to the 5th. Pereopods VI are longer and stronger than pereopods V, in typical forms slightly longer than the pereon; the width of the 2nd segment is the same as in pereopods I and II (fairly often, particularly in young individuals, it is appreciably shorter); the 4th segment is strong, only slightly shorter than the 2nd; the 5th segment is slightly arcuate, equal to or slightly longer and appreciably thinner than the 4th segment; the rod-shaped 6th segment is much longer than the 4th. Pereopods VII are half the length of pereopods VI and weak. The claws of pereopods V–VII are retractile, stout, and curved.

The uropods are short and broad; their rami are narrowly lanceolate in uropods I, broader in uropods II, and broadly lanceolate in uropods III. The telson is equal to or longer than the basipodite of uropods III, narrows distally, and is apically rounded.

Notes: Lanceola sayana is possibly identical to *L. pelagica*, described by Say (1818). This fact has been reported by many authors, including Stebbing (1888) and Bovallius (1885b), who described *L. sayana.*

However, the brief diagnosis provided by Say precludes reliable identification of these species.

Lanceola sayana f. *longipes*, a form described by Woltereck (1909), differs from the typical in that its body is dorsoventrally compressed; in the typical form the body is fusiform. Pereopods VI in this form are larger and the head narrower and higher. Woltereck relates these differences to
55 the type of host on which these lanceolids live, proposing that forma *typica* lives on larger medusae, while forma *longipes* is associated with smaller coelenterates. It must be noted that similar differences have also been observed in other species of this genus. An examination of a large amount of material enabled us to find specimens with features distinctly specific to both variants, as well as a large number of individuals with intermediate characters that could not be reliably included in either variant.

Distribution: One of the most common species of the family Lanceolidae, it inhabits all the oceans but is not found in the Arctic Basin. In
56 Antarctic waters it is found up to 60–64° S. Extensively eurybathic, it dwells in surface layers (and even on the surface at night) but descends to depths exceeding 3,000 m, but more often to depths of 1,000–2,000 m.

2. ***Lanceola intermedia*** Vinogradov, 1960 (Figs. 6, 7)

Vinogradov, 1960a: 200, 1964: 110.

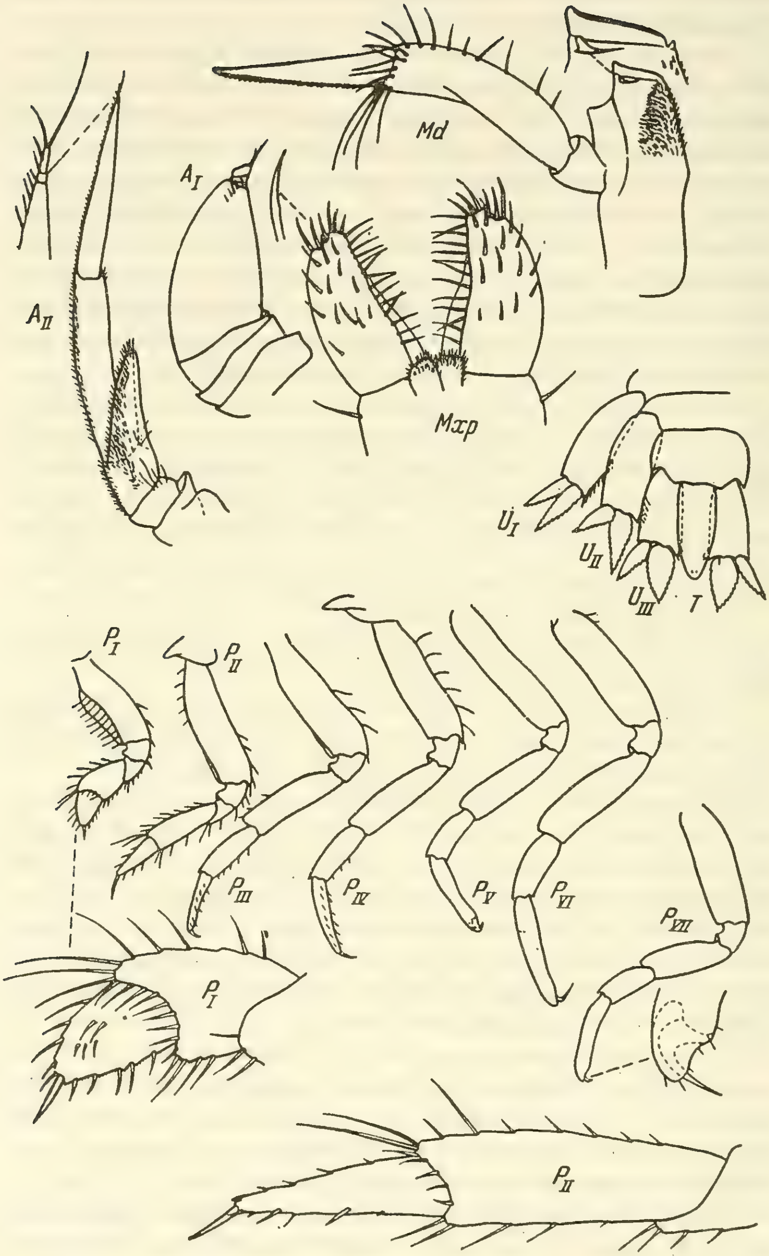
Sexually mature individuals are not known. The size of the specimens examined varies from 6 to 15 mm.

The integument is dense and finely faceted. The body is smooth, without keels and spines. The head has a short, broad, slightly bent, overhanging rostrum. The eyes are relatively large and oval.

In antennae I the flagellum comprises a broad short proximal segment and three short, unfused, flat distal segments, their width much greater than their length; the apical seta is roughly equal in length to the three distal segments together. Antennae II are much longer than antennae I; the 4th segment of the peduncle distally extends into a flattened lobe of variable length, longer than the 4th segment and reaching 1/2–3/4 the length of the 5th; the 1st segment of the flagellum is only slightly shorter than the 5th segment of the peduncle.

The mandibles have a broad cutting edge and a small spinous accessory plate; the mandibular palp is stout, longer than the body of the mandible. The lobes of maxillae II are equal in width. The outer lobes of the maxillipeds are elongated-oval and well armed; the inner lobes, compared to most other species of the genus, are small.

The 5th segment of pereopods I barely broadens distally so that the distal margin is only slightly broader than the base of the oval-conical 6th segment. The 5th segment of pereopods II has nearly parallel margins and is much longer than the narrowly conical 6th segment. Pereopods III and IV are identical in structure and nearly equal in



55 Fig. 7. *Lanaceola intermedia* Vinogradov, sexually immatrue specimen (after Vinogradov, 1960a).

length. Pereopods V are shorter than IV. Pereopods VI are shorter than the pereon. The length ratios of pereopods V, VI, and VII are 1:1.1:0.9. The rami of the uropods are broadly lanceolate. The telson is longer than the basipodite of uropods III, and apically rounded.

Notes: This species is close to *L. sayana* but differs from it primarily in the shape of the distal segments of the flagellum of antennae I, the presence of lobes on the 4th segment of the peduncle of antennae II and much shorter pereopods V–VII.

Distribution: Equatorial and southern regions of the tropical part of the Pacific Ocean and Arabian Sea. It inhabits mostly surface waters but also descends to deeper layers, being reported from catches at depths of 1,000–2,000 m.

3. ***Lanceola felina*** Bovallius, 1885 (Figs. 6, 8)

Bovallius, 1885b: 7; Vinogradov, 1960a: 204; Woltereck, 1909: 159 (var. *longipes*).—*curticeps* Bovallius, 1885b: 8.—(?) *murrayi* Norman, 1900: 135.

Length of sexually mature individual (female) up to 33 mm.

The integument is weakly faceted. The body has no keel. The head has a short, slightly bent, blunt rostrum. The eyes are relatively large, oval, with crystalline cones, as in *L. sayana.*

The 1st segment of the flagellum of antennae I is broad, with a bulging posterior margin; the distal segments are not fused; the apical segment is longer than the two preceding segments together, flat, with a
57 rounded apex and bears two or three setae, of which one is very stout and much longer than all the distal segments together.

The mandibles have a relatively broad cutting edge which is nevertheless narrower than the mandibular body; the palp is larger than the mandibular body. The lobes of maxillae II are equal in width. The outer lobes of the maxillipeds are elongated-oval, the inner lobes small, as in *L. intermedia.*

The 5th segment of pereopods I is distally weakly broadened. The spoon-shaped formation and retractile claws on pereopods V–VII are well developed. Pereopods VI are relatively shorter than those in *L. sayana*, equal in length to the pereon, or slightly longer or shorter than it.

The uropods are short and broad. The telson is equal to the basipodite of uropods III in length, or slightly shorter, equal to 3/4 its length.

Notes: The form identified by Woltereck (1909)—*L. felina* f.*longipes*—differs from the typical form in several of the usual variations of characters (length of pereopods VI and telson).

Bovallius (1885b, 1887b) in describing *L. felina*, neither considered the structure of the mouthparts nor illustrated them. Pirlot (1935, 1939) did not have access to the data on the structure of the mandibles of this species and based on the presence of fairly large oval eyes and the

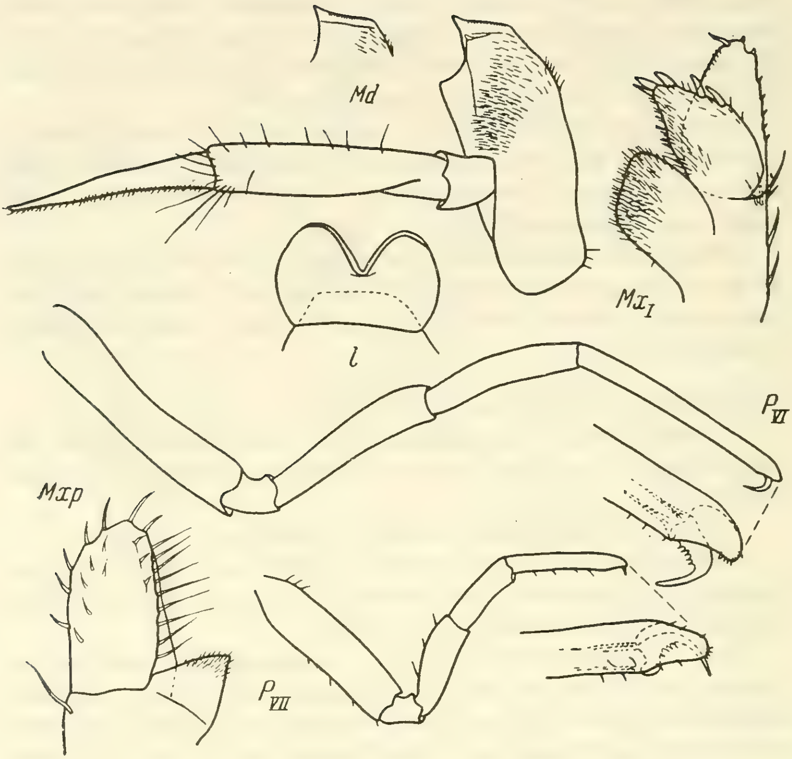


Fig. 8. *Lanceola felina* Bovallius, sexually immature specimen (after Vinogradov, 1960a)

slightly broadened 5th segment of pereopods I, proposed that *L. felina* Bovallius should be included under the genus *Megalanceola*. However, an examination of the structure of the mandibles of this species revealed that Pirlot's assumptions are not reliable and that *L. felina* undoubtedly belongs to the genus *Lanceola*.

This species is close to *L. sayana* and *L. intermedia*. It differs from them primarily in the shape of the distal segments of the flagellum of antennae I, still shorter rostrum and pereopods VI, which are shorter than in *L. sayana* but longer than in *L. intermedia*.

Distribution: A circumtropical species. In the Pacific and Indian oceans confined to the warmest waters between 28° N and 30° S, but in the Atlantic Ocean distributed quite extensively from Tristan de Cuhna Island in the south to 46° N. It inhabits surface waters and has never been reported in deep catches.

Among the Lanceolidae, the above three species are regularly found at the surface. This is evidently due to the fact that, compared to other species of Lanceola, the eyes in *L. sayana* and *L. felina*[2] have retained crystalline prisms (Woltereck, 1909), which have disappeared from the other representatives of the family that almost never ascend to the surface layers.

4. ***Lanceola pacifica*** Stebbing, 1888 (Fig. 9)

Stebbing, 1888: 1302; Stephensen, 1918: 14.—var. *robusta* Woltereck, 1909: 160.

Sexually mature females reach a length of 22—38 mm, males 26–34 mm.

The body is flattened dorsoventrally. The dorsal surface of the somites of the pereon and pleon is sculptured. A rostrum is absent. The eyes are reniform, large but the ommatidia lack crystalline prisms.

In antennae I the flagellum has a short broad proximal segment, tapering distally somewhat more sharply than in *L. sayana*; the distal segments of the flagellum are neither fused nor flattened; the 1st and 2nd segments are dolioform, their length equal to or slightly less than their width; the relative length and shape of the 3rd segment are variable; the apical setae are weak and short.

The mandibles have a relatively narrow cutting edge and a stout palp, roughly 1.5 times the length of the mandible. Maxillae I have a broad inner lobe. Maxillae II have narrow lobes, the inner ones being slightly broader than the outer.

Pereopods I have a broad 2nd segment which is almost oval in adults; the 5th segment is distally broadened, its maximum width roughly equal to its length; the 6th segment is conical with a broad base occupying the greater part of the distal margin of the 5th segment. Pereopods II have a broad 2nd segment, a slightly broadened 5th and a narrowly conical 6th. Pereopods III and IV are identical in length and structure; their 2nd segment is broad and broadens distally; the 4th segment in young individuals is shorter, in adults longer than the 5th segment; the claw is slightly curved. Pereopods V are longer than pereopods IV; their 2nd segment is slightly shorter than or equal to the 4th and 5th together; the relatively broad 4th segment, sometimes very slightly broadened distally, is shorter than the mutually equal 5th and 6th segments. Pereopods VI are somewhat longer and stouter than pereopods V; their 2nd segment is longer than or almost equal to the 4th segment, which in turn is longer than or equal to the 5th but shorter than the rod-shaped 6th segment. Pereopods VII are shorter than V, their 2nd segment shorter in adults but longer in young individuals than the 4th and 5th segments together. The claws on pereopods V–VII are thin, curved, and retractile.

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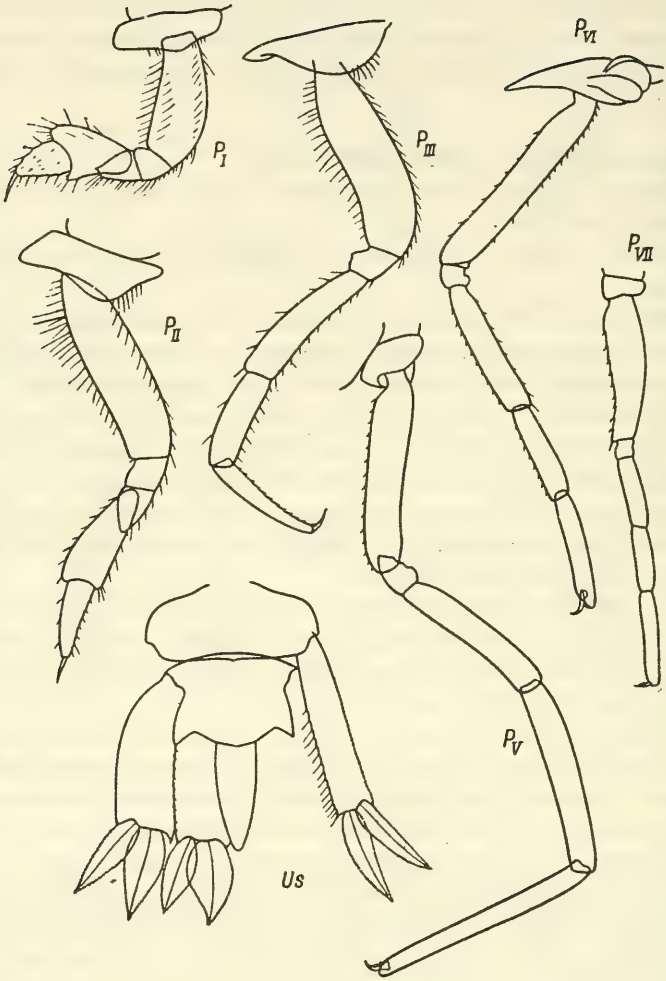
[2] The structure of the eyes of *L. intermedia* has not been studied.



59 Fig. 9. *Lanceola pacifica* Stebbing (forma *robusta*), male (after Stebbing, 1888).

The uropods are relatively short, with broad basipodites. The telson is slightly longer than the basipodite of uropods III, and from about midlength slightly narrows distally to a roundish tip.

59 *Notes*: In addition to the usual forms of *L. pacifica*, there are larger specimens with an exceptionally dense integument. Their pereon is stouter than in the typical form and flattened dorsoventrally; the pereopods are relatively shorter, with thickened segments, and stouter. Woltereck (1909) includes such individuals in a special "biological"

variant, *L. pacifica* var. robusta, and proposes that they live on large deepwater siphonophores endowed with strong muscular gastrozooids.

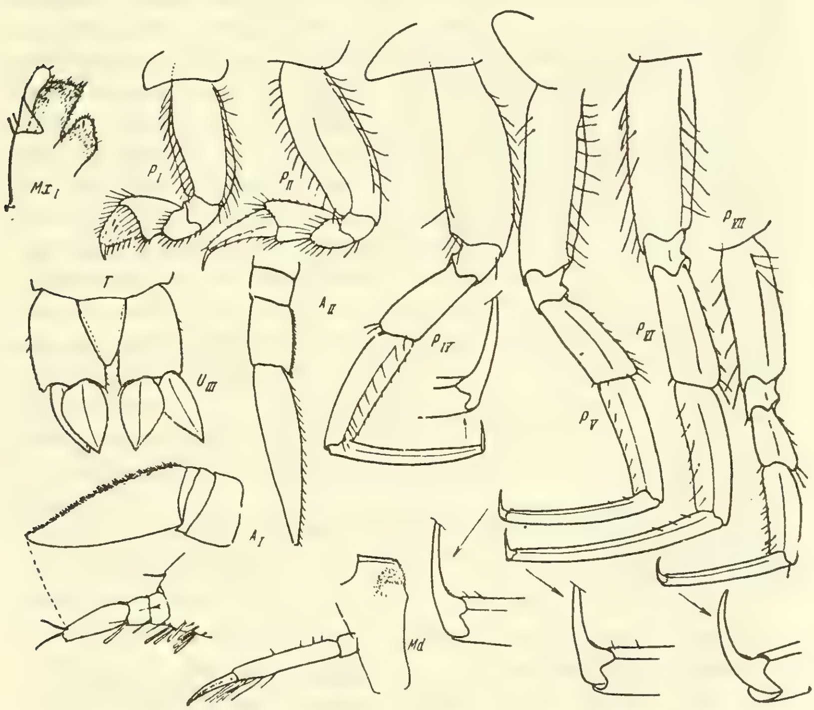
Distribution: Northern, central and southern regions of the Atlantic, Indian, and Pacific oceans. Not reported from the Arctic Basin and Antarctic waters. It inhabits a wide range of depths, meso- and bathypelagic, from 100–200 (juvenile specimens) to 3,000–4,000 m, and descends even deeper; it has been reported in catches from 4,000–8,000 m in the Kuril-kamchatka region of the Pacific Ocean.

60 5. ***Lanceola falsa*** Vinogradov, 1970 (Fig. 10)

Vinogradov, 1970: 391.

Length of sexually mature females 22–24 mm. Males not known. The body has neither a keel nor spines.The integument is thin. The head has a small, poorly developed falcate rostrum. The eyes are reniform, distinct, but smaller than in *L. sayana*.

Antennae I are relatively short and broad; in the flagellum the proximal segment is slightly pubescent, the apical segment elongated-oval and bears two subapical, short setae that are longer than the 1st and 2nd



60 Fig. 10. *Lanceola falsa* Vinogradov, female (after Vinogradov, 1970).

distal segments together; the width of each of these segments is slightly more than their length, Antennae II are longer than antennae I, the terminal segment of the flagellum oval-lanceolate, longer than the entire proximal part of the antenna.

The mandibles have a broad cutting edge and a weakly armed palp; the rod-shaped 2nd segment is more than twice longer than the narrow conical and slightly curved 3rd segment.

Pereopods I and II are the same as in *L. sayana.* The maximum width of the 5th segment of pereopods I is roughly equal to its length; the width of the base of the 6th segment is only slightly less than the width of the distal margin of the 5th segment. The 6th segment of pereopods II is narrowly conical and slightly curved; the 5th and 6th segments are almost equal in length and together shorter than the 2nd. The 2nd segment
61 of pereopods I and II is slightly broadened. Pereopods III and IV are identical in structure and the length ratios of their segments the same as in *L. sayana.* The 2nd segment is slightly broadened distally and equal in length to the 4th and 5th segments together. The 4th segment is slightly shorter than the 5th, which in turn is shorter than the 6th. The 4th segment slightly broadens distally while the 5th and 6th narrow distally; the claws are strong and almost straight. Pereopods V–VII are strong, with broad, stout segments, provided with longitudinal ridges. The main distinguishing feature is the very weakly developed spoon-shaped formation on the distal end of the 6th segment; the claws on pereopods V–VII are strong, almost straight, and nonretractile. Pereopods V are longer than IV but the length ratios of their segments similar: the 4th segment is somewhat shorter than the 5th, which in turn is slightly shorter than the 6th. Pereopods VI are longer than V, their 2nd segment 2/3 the length of the 4th and 5th together and nearly equal to the 6th segment; the 4th and 5th segments are equal in length. Pereopods VII are shorter, their 2nd segment equal in length to the 4th and 5th together, the 4th being 2/3 the length of the 5th, which in turn is slightly shorter than the 6th segment.

The uropods are broad, with short, broadly lanceolate (especially uropods III) rami. The telson is 3/4–4/5 the length of the basipodite of uropods III.

Distribution: Known from two specimens collected from the Kuril-kamchatka region of the Pacific Ocean in catches from 0–4,000 and 0–5,850 m depth.

6. ***Lanceola loveni*** Bovallius, 1885

Bovallius, 1885b: 6, 1887b: 36; Shoemaker, 1945a: 206; Vinogradov, 1957: 190, 1960a: 205.—*aestiva* Stebbing, 1888: 1309 (part.); Stephensen, 1918: 15; Hurley, 1956: 4.

Length of sexually mature individuals varies from 15 to 29 mm.

The integument is thin. The body has a low dorsal keel forming small denticles on somites III–VII of the pereon, somites of the pleon, and somite I of the urosoma. The small high head has a small rostrum. The eyes are small, without crystalline prisms.

Antennae I are much shorter than the first two somites of the pereon; the proximal segment of the flagellum is relatively narrow with an extended posterior and bulging (particularly in the distal part) anterior margin; the Ist and 2nd distal segments are small with almost parallel margins; their length is more than their width; the elongated 3rd segment has a stout apical seta, almost equal in length to the three distal segments together. Antennae II are much (more than twice) longer than antennae I.

The mandibles have a relatively narrow slanted cutting edge, a triangular accessory plate and a very long palp, more than twice longer than the mandibular body. Maxillae I have broad inner lobes. Maxillae II have narrow lobes that are equal in width.

Pereopods I are stout, with a slightly broadened 2nd segment; the 5th segment is highly broadened distally, its length just slightly more than its width; the 6th segment is oval, with bulging anterior and posterior margins, sometimes almost hemispherical, with maximum width at its base or in the proximal third; the length and width proportions are variable and decrease as the animal ages; the claw is straight. The 5th segment of pereopods II is weakly broadened distally, usually equal to the 6th but may be somewhat shorter or longer; these segments together are roughly equal to the 2nd in length. Pereopods III and IV are nearly equal in length and similar* in structure; their 2nd segment has parallel margins or slightly broadens distally; the 4th segment is somewhat longer than the 5th, which in turn is shorter than or equal to the thin 6th segment; the claws are long, almost straight. Pereopods V are longer than IV; their 2nd segment is longer than
62 the 4th, which in turn is longer than the 5th, and the latter longer than the 6th segment. Pereopods VI are longer than V; their 4th segment is slightly shorter than the 2nd, but appreciably (nearly 1.3 times) longer than the 5th segment; the 6th segment is also longer than the 5th but shorter than the 4th. Perepods V and VI are longer than the pereon. Pereopods VII are appreciably shorter than VI; their 4th segment is equal to the 6th, longer than the 5th but shorter than the 2nd segment. The claws on pereopods V–VII are thin, curved, and retractile.

The uropods have narrowly lanceolate rami. The telson is triangular (sometimes helmet-shaped), usually (but not always!) with an acute tip; its length is 1/2, rarely 1/3, the length of the basipodite of uropods III.

Notes: It was earlier suggested (Vinogradov, 1957, 1962) that *L. loveni* Bovallius and *L. aestiva* Stebbing are identical and attention

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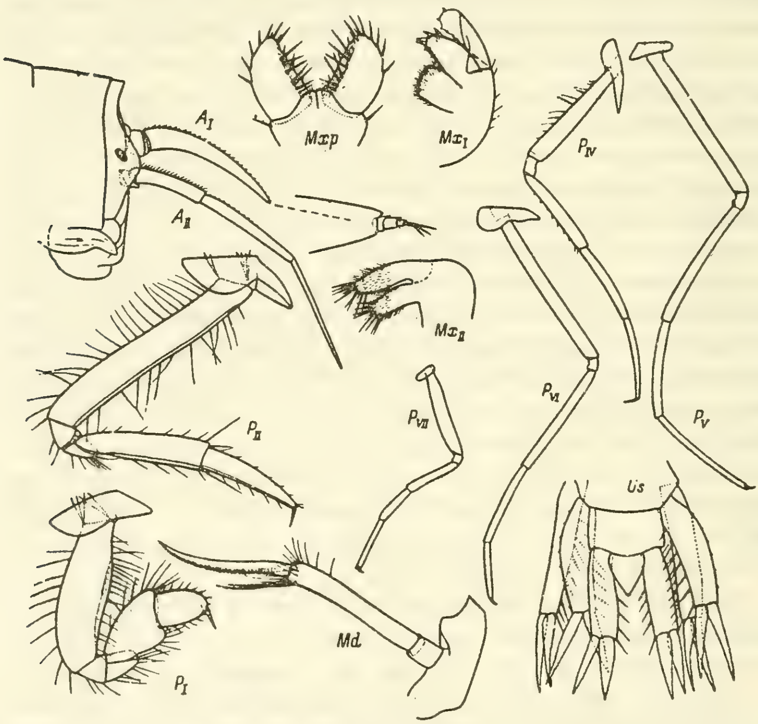
* Changed from Russian text by authors—Eds.

was drawn to the similarity of descriptions (save for the structure
of the eyes) and illustrations of *L. aestiva* given by Stebbing (1888)
and of *Scypholanceola vanhoeffeni* prepared by Woltereck (1905). The
eyes of *L. aestiva* have not been very precisely described by Stebbing
and it is their exceptional structure which served as the basis for
Wolterek's establishment of the genus *Scypholanceola*. A later review
of the type specimen of *L. aestiva* preserved in the British Museum
showed that the holotype (larger specimen) should actually be considered
Scypholanceola, and that the paratype (smaller specimen) is identical to
63 *Lanceola loveni* (see Thurston, 1973). Thus *L. aestiva* Stebbing should be
considered the older synonym of *S. vanhoeffeni* and *L. aestiva* in works
by later authors should be considered a synonym of *L. loveni* Bovallius.

Lanceola loveni loveni Bovallius, 1885 (Fig. 11)

Bovallius, 1885b: 6, 1887b: 36; Shoemaker, 1945a: 206; Vinogradov, 1957: 190, 1960, 205.—*aestiva* Stebbing, 1888: 1309 (part.); Stephensen, 1918: 15; Hurley, 1956: 4.



62 Fig. 11. *Lanceola loveni loveni* Bovallius, male (after Shoemaker, 1945a)

Length of sexually mature individuals varies from 15 to 23 mm.

In adults, the low dorsal keel running along the body forms small, barely perceptible denticles on pereon somites III–VII and the somites of the pleon. The structure of the distal part of the 6th segment of pereopods VI is usual but does not form the unique club in whose cleft the retractile claw fits.

Distribution: Northern, tropical, and southern regions of the Pacific and Atlantic oceans and tropical regions of the Indian Ocean (including the Arabian Sea and Bay of Bengal). The northernmost occurrence has been reported from Davis Strait and the Bering Sea. A deepwater species, known from 500–700 to 3,000–4,000 m but the maximum records relate to 1,000–2,000 m depths.

Lanceola loveni grossipes Shoemaker, 1945 (Fig. 12)

Shoemaker, 1945a: 209; Vinogradov, 1957: 191, 1960a: 206.

Length of sexually mature females 27–29 mm.

Shoemaker (1945a), based on material from the Atlantic Ocean (Bermuda Islands), identified the subspecies *L. loveni grossipes*, differing from the typical form in the structure of pereopods VI and VII. Pereopods VI are relatively longer than in the typical form; the 6th segment broadens distally to form a club in whose deep cleft the long and stout curved claw fits. Pereopods VII are half the length of pereopods VI. Shoemaker had at his disposal eight specimens (size, sex, and age not mentioned) of this subspecies, and used the sexually mature female, 29 mm long, as the type specimen. In the material examined by us the

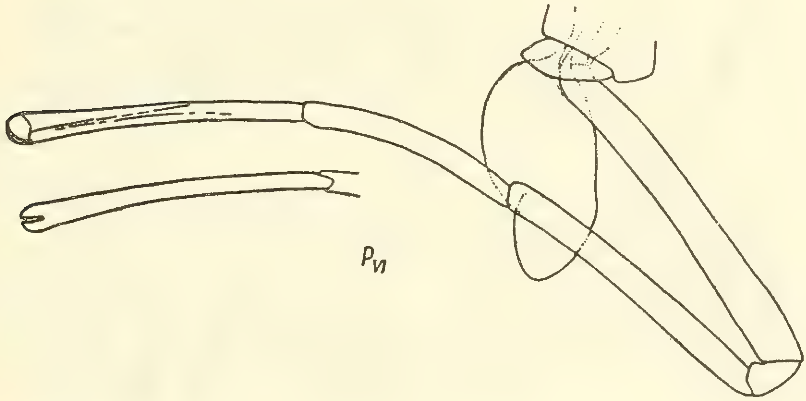


Fig. 12. *Lanceola loveni grossipes* Shoemaker, female (after Shoemaker, 1945a)

features characteristic of *L. loveni grossipes* were exhibited only by sexually mature females 27–29 mm long. The maximum length of the female typical form is 23 mm.

64 *Distribution*: Atlantic Ocean (Bermuda Islands) and tropical waters of the Pacific Ocean southeast of Japan and off the Marshall Islands.

Lanceola loveni antarctica Vinogradov, 1962 (Fig. 13)

Vinogradov, 1962: 6.—(?) australis Stebbing, 1888: 1310.

Length of sexually mature individuals up to 27 mm.

Individuals of all ages have dorsal denticles on the pleon somites and denticles on somite I of the urosoma which are stouter than in the typical form; the 6th segment of pereopod I and the rami of the uropods are relatively longer and narrower. The two latter differences are well marked in young specimens (7–12 mm long) and are practically absent in larger individuals (19–27 mm long). True, even in the typical individuals the young specimens have a narrower 6th segment in pereopods I and relatively longer rami in the uropods than do the adults. However, in them the age-dependent changes are not manifest as sharply as in *L. loveni antarctica*.

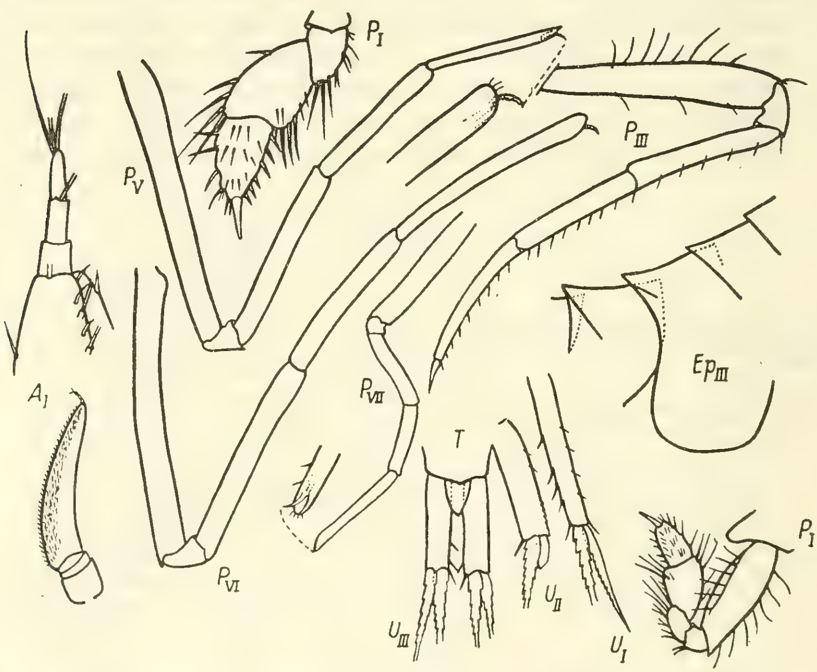


Fig. 13. *Lanceola loveni antarctica* Vinogradov, female (after Vinogradov, 1962).

Distribution: Indian Ocean sector of the Antarctic, from 55° S to the coastal waters of Antarctica (Davis Sea). Found in catches from depths of 200–500 m and in total catches from depths of 2,000–3,000 m to the surface.

7. ***Lanceola serrata*** Bovallius, 1885 (Fig. 14)

Bovallius, 1885b: 7, 1887b: 34.—*suhmi* Stebbing, 1888; 1313.

Length of sexually mature males 28–34 mm, females 33–34 mm.

The integument is thin and finely faceted. Pereon somites V–VII, pleon somites, and somite I of the urosoma have well-developed dorsal denticles, especially large on the pleon somites. The head is small and high with a poorly developed, obtuse, overhanging rostrum that is sometimes absent. The eyes are small, oval, and bulging.

65 Antennae I are longer than pereon somite I; the proximal segment of the flagellum is long and narrow, slightly curved. Antennae II are equal (in females) in length to three-four somites of the pereon together.

The mandibles have a relatively narrow cutting edge (as in *L. loveni*) and a longer palp, more than 1.5 the length of the mandibular body. Maxillae II are equal in length and width, with relatively broader lobes. The maxillipeds have narrowly oval outer lobes with long setae; the inner lobes have fairly short setae.

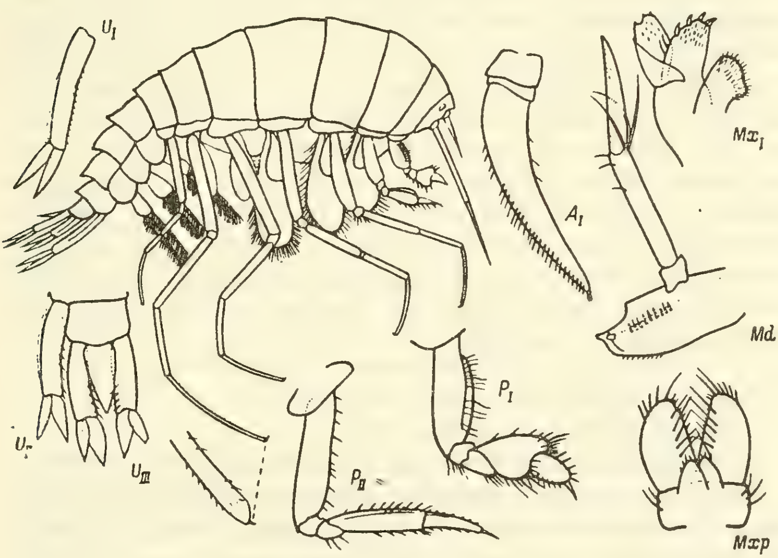


Fig. 14. *Lanceola serrata* Bovallius, female, general view (after Bovallius, 1887b).

Pereopods I have a slightly broadened 2nd segment; the 5th segment is large, highly broadened distally, and its maximum width equals its length; the base of the 6th segment occupies only about half the distal margin of the 5th segment; the 6th segment is narrow, conical; the claw is straight. Pereopods II are much longer (about 1.5 times) than pereopods I; the long, distally weakly broadened 5th segment is less than twice longer than the narrowly conical 6th segment; the claw is straight. Pereopods III and IV are almost similar in length and identical in structure; their 2nd segment is shorter than the 4th and 5th together; the 4th segment is somewhat longer than the 5th, which in turn may be shorter than, equal to,or longer than the distally narrowed 6th segment; the claws are thin, almost straight. Pereopods V are longer than IV and exceed the pereon in length; their 2nd segment is much shorter than the 4th and 5th together; the 4th segment is longer than the rod-shaped 5th and the latter longer than the thin 6th segment. Pereopods VI are longer and stouter than V; their 2nd segment is roughly equal to the 4th, which in turn is somewhat longer than or equal to the 5th but shorter than the thin, slightly curved 6th segment. Pereopods VII are roughly half as long as V; their 4th segment is nearly half the 2nd but somewhat longer than the 5th; the thin 6th segment is 1.5 times longer than the 5th. The retractile claws of pereopods V–VII are thin and curved.

66 The uropods have narrowly lanceolate rami. The narrowly triangular acute telson reaches or nearly reaches the distal end of the basipodite of uropods III.

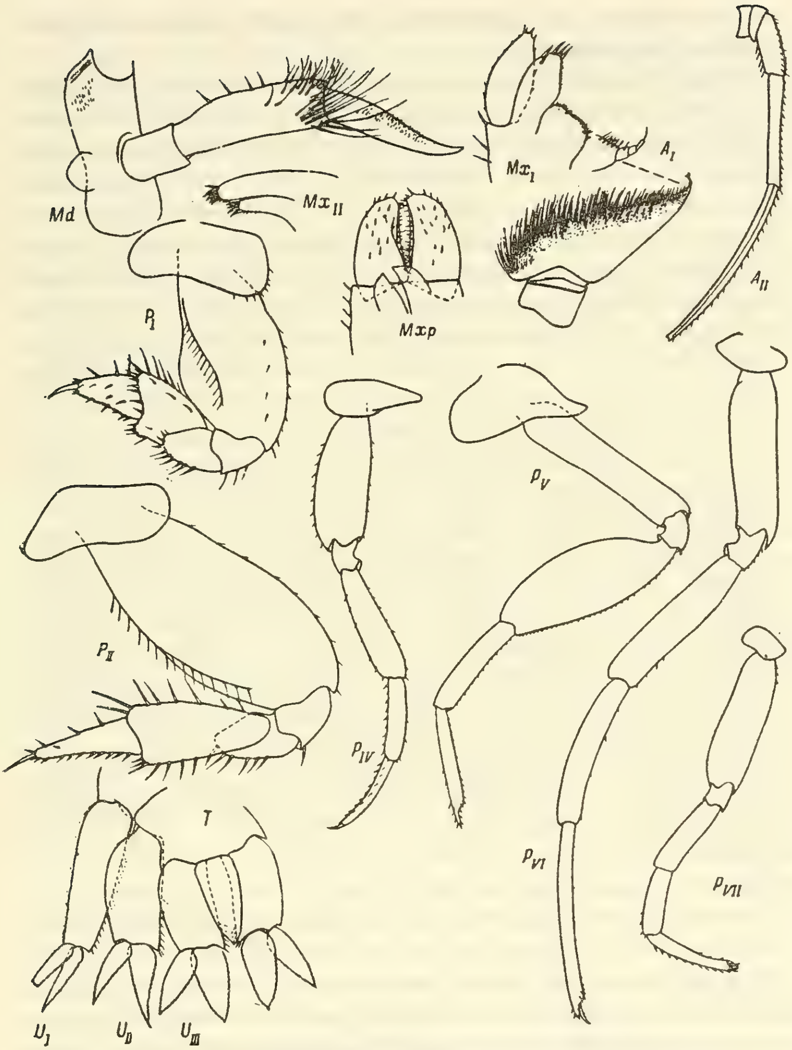
Distribution: Atlantic Ocean from 64° N to 52° S, but found more rarely in tropical regions than in the boreal. In the Pacific Ocean this species is common in the northern boreal regions, in the Sea of Okhotsk, and the Bering Sea; it is never found in the tropics. The southernmost catches in the Pacific Ocean are: 38°36′ N, 142°55′ E and 33°11′ N, 143°56′ E. It is rarely found in the tropical (north of the equator) regions of the Indian Ocean. It inhabits a wide range of depths, from 300–400 m (in the tropical region—1,000 m) to 2,000 m but is more commonly found at depths of 750–1,500 m.

8. ***Lanceola laticarpa*** Vinogradov, 1957 (Fig. 15)

Vinogradov, 1957: 192, 1960a: 206.

Length of males 20-21 mm, females 16–20 mm.

The color of unfixed specimens is pinkish; the integument is fairly dense. The body is smooth, narrow, with a slightly broadened pereon. The dorsal surface of the pereon and pleon somites is sculptured; a deep depression occurs in the anterior part of somite I of the pleon. A rostrum is absent. The eyes are small, situated on the sides of the head, in its lower part, and hence not visible from above.



67 Fig. 15. *Lanceola laticarpa* Vinogradov, male (after Vinogradov, 1957).

Antennae I are short and broad, the proximal segment of the flagellum is broad and with dense pubescence on the anterior part. The distal segments are dolioform; the apical seta is weak. Antennae II are much longer than I.

The mandibles have a relatively short cutting edge and a strong palp that is twice longer than the mandibular body. The outer lobes of maxillae II are somewhat longer and broader than the inner ones. the maxillipeds are well developed, their inner lobes, with a slightly tapering inner distal corner, are unarmed.

Pereopods I and II have a broadened 2nd segment. In pereopods I the width of the 2nd segment is more than half its length; the 5th segment is highly broadened distally and almost equal in length to the conical 6th segment. The 5th segment of pereopods II is broadened distally, slightly longer than the elongated-conical 6th segment. Pereopods III and IV are identical in structure; pereopods III are slightly shorter than IV, their 2nd segment more highly broadened than in other species of *Lanceola* but not as strongly as in pereopods I or II. Pereopods V have an oval, medially broadened 4th segment whose maximum width is 2/5–1/2 its length. Pereopods VI are longer than V, their 4th segment equal to the 2nd, slightly longer than the 5th and somewhat shorter than the 6th. Pereopods VII are almost half the length of VI.

The rami of uropods I and II are narrowly lanceolate; the basipodites of all uropods, especially of II and III, are broadened. The telson has an acute tip reaching the distal end of the basipodite of uropods III.

Notes: *Lanceola laticarpa* differs from other species of the genus in broader 2nd segment of pereopods I–IV, broadened 4th segment of pereopods V, and a deep depression on somite I of the pleon. The long pereopods VI and antennae II, as also the shape of the telson, which reaches the distal end of the basipodite of uropods III, bring this species closer to the *L. sayana*—*L. pacifica* group. However, in the structure of antennae I it shows a distinct affinity for the *L. clausi* group.

Distribution: Kuril-Kamchatka region and waters off New Zealand—32° S, 177° W. It is found in total catches from depths of 4,000 m and more to the surface.

67 9. ***Lanceola clausi*** Bovallius, 1885

Bovallius, 1885b: 8, 1887b: 40; Sars, 1900: 15; Shoemaker, 1945a: 209; Vinogradov, 1962: 10.

Length of sexually mature individuals, judged from the abundant material at our disposal, from different regions of the ocean, is 10–16 mm for females and 9–14 mm for males. Some authors (Bovallius, 1887b; Woltereck, 1927; Barnard, 1932) state that the length of sexually mature individuals may reach 19–20 mm.

68 The color of unfixed specimens is whitish, pink, sometimes orange. The integument is thin. The body is smooth, without a longitudinal keel, although the anterior margin of the somites of pereopods II–VI is sometimes thickened; the pereon is somewhat broad, at times bulging; the pleon is relatively short. A rostrum is absent. The eyes, along the sides of the head, are better developed than in the foregoing species.

The flagellum in antennae I has an elongated-conical proximal segment; in sexually mature males it is often broadened at the base and forms a recurved roundish lobe that reaches the distal margin of the 1st segment of the peduncle; its anterior margin is highly pubescent. The distal segments of the flagellum are relatively better developed and cylindrical; the 3rd segment is usually longer than the preceding two taken together. Antennae II are relatively short, only slightly longer than antennae I.

The mandibles have a broad cutting edge and an accessory plate reduced to a spine; the palp is thin, weakly armed, and slightly longer than the mandibular body. Maxillae I have a developed palp and a broad inner lobe. Maxillae II have narrow, uniformly broad lobes. The maxillipeds have well-developed outer lobes armed with strong setae, and small inner lobes.

The shape and length ratio of the appendages are fairly variable. Pereopods I and II differ little in length; their 2nd segment is broadened (sometimes very strongly, especially in pereopods I); the 5th segment of pereopods I is broadened distally such that its maximum width roughly equals its length; the broad base of the short conical 6th segment occupies a large part of the distal margin of the 5th segment; the claw is nearly straight. The 5th and 6th segments of pereopods II are longer than in pereopods I; the 5th segment is appreciably broadened distally; the claw is nearly straight. Pereopods III and IV are strong, identical in length and structure, their broad 2nd segment somewhat shorter than the 4th and 5th segments together or equal to them; the 4th segment is shorter (sometimes appreciably) than the 5th, which in turn is shorter than the 6th. Pereopods V are shorter than the pereon and also shorter and weaker than pereopods IV; the 2nd segment is shorter than the 4th and 5th together; the 4th, 5th, and 6th segments are equal in length or the 6th may be slightly longer and the 4th shorter than the 5th. Pereopods VI are longer and somewhat stronger than pereopods V; the 2nd segment is shorter than the 4th and 5th together; the 4th segment is somewhat shorter than or equal to the 5th; the 6th is longer than the 5th. Pereopods VII are much shorter and weaker than pereopods V; the 2nd segment is longer than the equally long 4th and 5th segments together; the 6th segment is longer than the 5th. The retractile claws of pereopods V–VII are small and curved.

Uropods I have narrowly lanceolate and uropods III broadly lanceolate rami. The triangular telson reaches 1/2–2/3 the length of the basipodite of uropods III but does not reach the distal margin of the basipodite.

Notes: Variability of many features is characteristic of *L. clausi*, especially the body shape and structural details of the appendages. Some of these are not constant while others offer a possibility to identify subspecies, and still others are so significant and constant that they enable one to identify a group of independent species that are mutually close and also close to *L. clausi*. This group includes the species considered below, viz., *L. longidactyla*, *L. sphaerica*, and *L. chelifera*. All these are characterized by small size, more or less broad pereon, short and broad pleon, and relatively short antennae and pereopods V–VII.

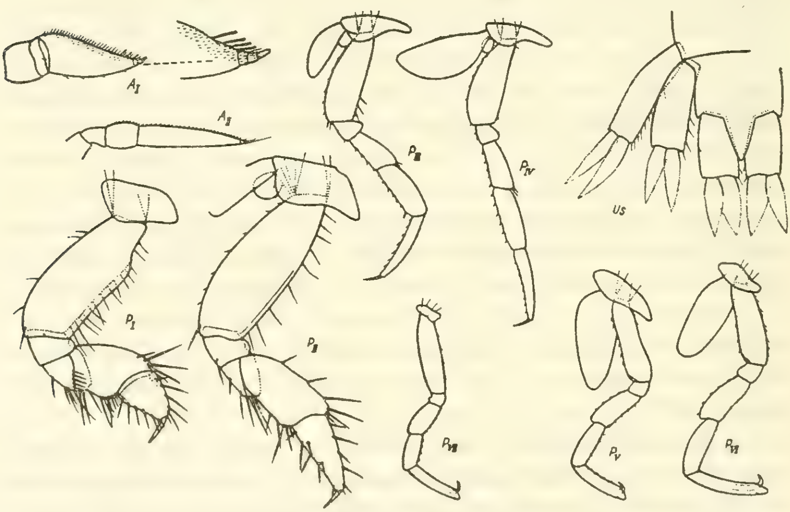
70 ***Lanceola clausi clausi*** Bovallius, 1885 (Fig. 16)

Bovallius, 1885b: 8, 1887b: 40; Sars, 1900: 15; Shoemaker, 1945a: 209; Vinogradov, 1962: 10.

Length of sexually mature individuals in our collections 10–16 mm for females and 9–14 mm for males.

The width of the pereon (dorsal view) is much greater than that of the pleon. The 2nd segment of pereopods I is not very strongly broadened and its maximum width much less than its length. Pereopods VI are only slightly longer than pereopods V. In pereopods VII the 4th and 5th segments are equal. The telson reaches 1/2–2/3 the length of the basipodite of uropods III.

Distribution: A panoceanic species known from many records from the tropical and cold-water regions of the Atlantic, Indian, and Pacific oceans. In the Antarctic it reaches right up to the coast of Antarctica. Of all the *Lanceola*, only this species is found in the Arctic Basin. It inhabits a wide range of depths, from 200–500 to 5,000–5,500 m, possibly even deeper. It is more often found at depths of 1,000–3,000 m, i.e., in the bathypelagic.



69 Fig. 16. *Lanceola clausi clausi* Bovallius, male (after Shoemaker, 1945a).

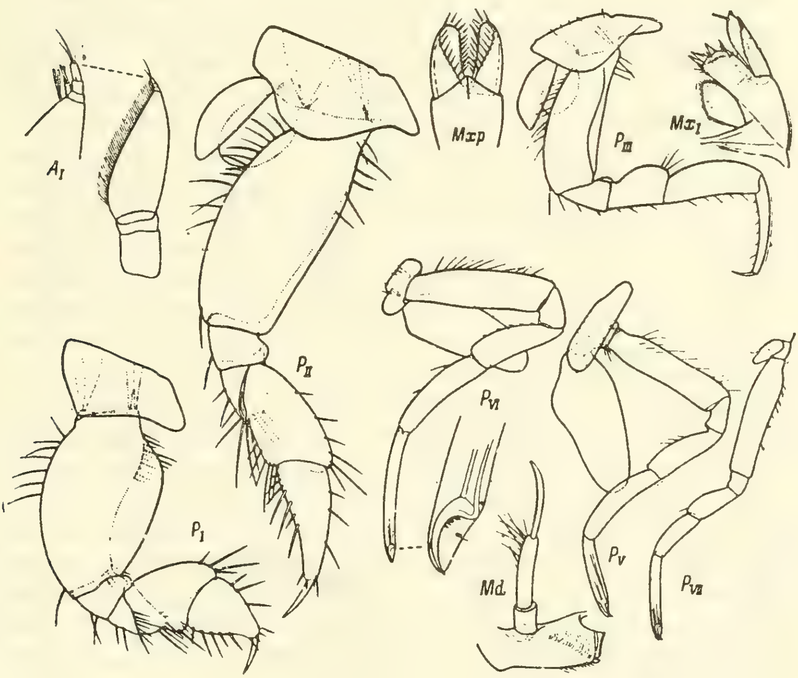
Lanceola clausi pirloti Shoemaker, 1945 (Fig. 17)

Shoemaker, 1945a: 212 (pro sp.); Vinogradov, 1964: 112.

Length of sexually mature specimens 12–16 mm.

L. clausi pirloti basically differs from the typical form in that the 2nd segment of pereopods I is highly broadened, pereopods III–IV are stronger, and pereopods VI are relatively longer.

71 *Notes*: Based on the differences noted above, Shoemaker (1945a) identified *L. pirloti* as an independent species, but a review of abundant material revealed that these differences are variably expressed or only some discernible. Thus individual specimens could actually be included with certitude under *L. pirloti* while others occupy an intermediate position between *L. pirloti* and *L. clausi*. The wide variability of *L. clausi* reveals variation in several features, including those that served as the basis for identification of an independent species, *L. pirloti*, by Shoemaker. Evidently, there is no adequate justification for such an identification and *L. pirloti* should be considered a subspecies of the highly variable *L. clausi*.



70 Fig. 17. *Lanceola clausi pirloti* Shoemaker, female (after Shoemaker, 1945a).

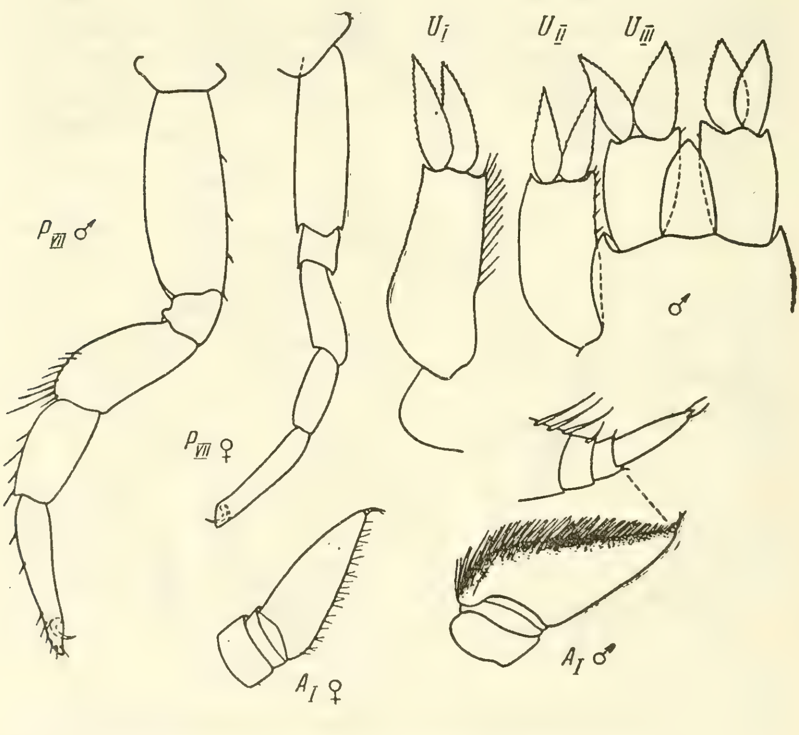
Distribution: Tropical regions of the Atlantic, Indian, and pacific oceans. Possibly circumtropical in distribution. It has been found in catches from depths of 1,900–4,500 m (Indian Ocean) and in through catches from depths of several thousand meters to the surface.

Lanceola clausi gracilis Vinogradov, 1956 (Fig. 18)

Vinogradov, 1956: 196, 1957: 195, 1962: 10.

Length of sexually mature specimens 9–11 mm.

The basic differences from the typical form are: a better proportioned body with cylindrical, almost unbulging pereon and broad pleon, great width of the urosomal somites, and a much longer telson, which almost reaches the tip of the basipodite of uropods III. Moreover, in pereopods VII the 5th segment is somewhat shorter than the 4th while in the typical form they are equal in length. Finally, in sexually mature males of *L. clausi gracilis* the proximal segment of the flagellum of antennae I
72 is particularly broad and richly pubescent on the anterior margin, which is not characteristic of males of the typical form.



71 Fig. 18. *Lanceola clausi gracilis* Vinogradov (after Vinogradov, 1957).

Distribution: Northwestern part of the Pacific Ocean north of 40° N (inclusive of the Bering Sea) and Antarctic regions (62° 55′ S, 118° 52′ E). One of the deepest water hyperiideans, it possibly inhabits only the abyssopelagic zone (deeper than 2,500–3,000 m) and enters deepwater trenches. Found in catches from depths of over 2,500 m to the surface and from 2,900, 3,000–4,000, 4,000–6,000, and 6,000–7,000 m.

10. ***Lanceola longidactyla*** Vinogradov, 1964 (Fig. 19)

Vinogradov, 1964: 112.

Known from a lone sexually mature female 8 mm in length.

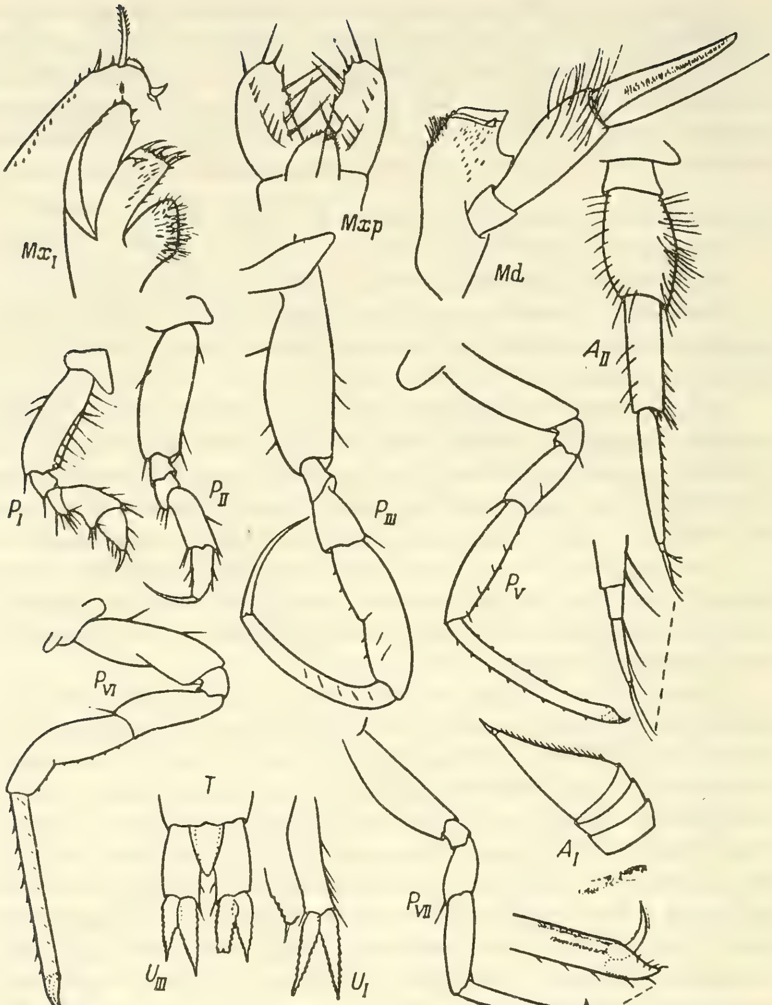
The body is smooth with a thin integument. The pereon is broad, the pleon is relatively short. A rostrum is absent. The eyes are small and poorly noticeable.

73 The flagellum of antennae I has an elongated-conical, weakly pubescent proximal segment of the same shape as in *L. clausi*. The peduncle in antennae II has a flat, broad, and oval 4th segment that is slightly shorter than the 5th segment but twice broader than it; the flagellum is 1.5 times longer than the 5th segment of the peduncle.

The mandibles have a broad cutting edge and an accessory plate reduced to a spine. The palp is almost twice longer than the mandibular body, its 2nd segment broadened distally. Maxillae I and II and the maxillipeds are the same as in *L. clausi*.

Pereopods I and II have long claws which, in pereopods II, are only slightly shorter than the 6th segment. The 5th segment of pereopods I is longer than the 6th, its maximum width 1.5 times its length. Pereopods II are longer than pereopods I; the elongated 5th segment is slightly broadened distally; the conical and slightly curved 6th segment is slightly shorter than the 5th segment. Pereopods III and IV are similar in structure. In pereopods III the 4th segment is only slightly longer than the 3rd and nearly 1/3 the length of the 5th, which in turn is equal to the 6th; the claw is nearly straight, thin, and usually long, just less than 2/3 the 6th segment. Pereopods V are slightly shorter and weaker than pereopods IV; the 5th article is nearly equal to the 2nd, twice longer than the 4th but somewhat shorter than the rod-shaped 6th article. The stronger pereopods VI are very slightly longer than pereopods V and have roughly the same length ratio of segments. In pereopods VII the 6th article is equal to the 2nd in length and slightly longer than the 5th. The claws on pereopods V–VII are not long, as in *L. clausi*. The uropods are relatively short and broad, as in *L. clausi*. The telson is narrowly triangular, slightly longer than half the length of the basipodite of uropods III.

Notes: *L. longidactyla* distinctly differs from *L. clausi* in the shape of the 4th segment of antennae II, stronger mandibular palp, very long claws of the first four pairs of pereopods, and relatively longer 6th segment of pereopods V–VII.



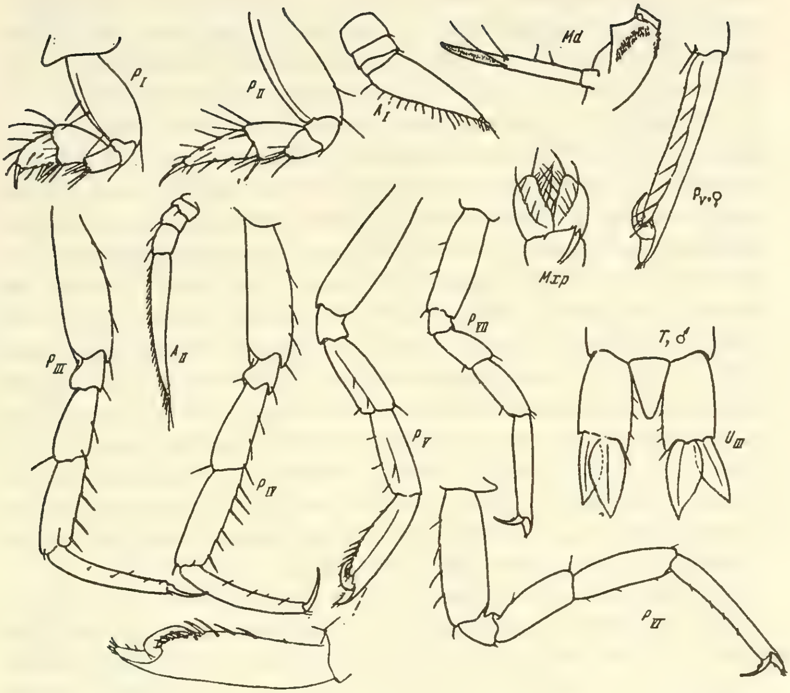
72 Fig. 19. *Lanceola longidactyla* Vinogradov, female (after Vinogradov, 1964).

Distribution: Indian Ocean (19°09′ S, 63°07′ E) in catches from 0–2, 700 m.

11. ***Lanceola sphaerica*** Vinogradov, 1970 (Fig. 20)

Vinogradov, 1970: 383.—*clausi* Vinogradov, 1957: 196 (*sphaerica* var.).

This species is known from three specimens in which the length of the sexually mature females is 8 mm and that of the male 9 mm.



74 Fig. 20. *Lanceola sphaerica* Vinogradov, male (after Vinogradov, 1970).

The integument is very thin and transparent. The pereon bulges notably, being almost spherical in the females. The pereon is short and broad. A rostrum is absent. The eyes are small, poorly discernible in fixed specimens.

The proximal segment of the flagellum of antennae I is elongated-conical, weakly armed on the anterior margin; the distal segments are well developed. Antennae II of the male are slightly longer than antennae I, their four-articled flagellum twice longer than the peduncle. The mandibles have a thin palp, slightly larger than the mandibular body. The outer lobes of the maxillipeds are well developed and armed with strong setae, the inner lobes small, tapering apically.

Pereopods I and II are structured as in L. clausi; their 2nd segment is broad—in pereopods I the width of the 2nd segment is 1/2 and in pereopods II slightly less than 1/2 its length. Pereopods III are strong, the 2nd segment slightly shorter than the 4th and 5th together and somewhat longer than the 6th; the 4th segment is broadened distally; the 5th segment is linear, almost 1.5 times as long as the 4th, and in the male richly

armed with strong setae, in the females weakly armed; the 6th segment is thin, rod-shaped, slightly longer than the 5th; the claw is thin, almost
74 straight, in the male 1/3–1/2 and in the females 2/7–1/4 the length of the 6th segment. Pereopods IV are slightly longer than pereopods III.

In pereopods V the 4th segment is slightly broadened distally, nearly equal in length to the linear 5th segment, which in turn is slightly shorter than the 6th. In the male the 6th segment in the distal half of the bulging anterior margin is armed with strong, short setae, the spoon-shaped tip of the segment flattened, but well developed, constituting almost 1/5–1/4 the entire length of the segment. The claw is long, strong, curved, and pressed to the anterior margin of the 6th segment, which is armed with spines forming an indistinct subchela. In the females the 6th segment is almost bare, without strong spines in the distal part of the anterior margin and, consequently, despite the presence of a strong curved claw freely pressed to the anterior margin of the 6th segment, no subchela is formed. Pereopods VI and VII are the same as in *L. clausi*. In pereopods VI the 2nd segment is slightly shorter than the 6th, or the 4th and 5th segments together; the 5th segment is insignificantly shorter than the 4th. Pereopods VII are shorter and weaker than pereopods VI.

The basipodites of all uropods, particularly of the third pair, are relatively broader in the females than in the male. The triangular telson reaches half the length of the basipodite of uropods III or slightly more.

Notes: *L. sphaerica* differs from *L. clausi* in the highly bulging
75 (especially in the females) pereon, a series of finer structural peculiarities and the unique 6th segment of pereopods V in the male, which together with the movable long and curved claw is capable of forming a subchela, albeit weakly developed.

Distribution: All records of *L. sphaerica* are confined to the Kuril-Kamchatka Trench. This is one of the deepest living hyperiideans, inhabiting only the abyssal zone (including the waters of the trench per se where it was found in a 6,000–7,000 m catch) and not ascending above 3,000 m in the bathypelagic.

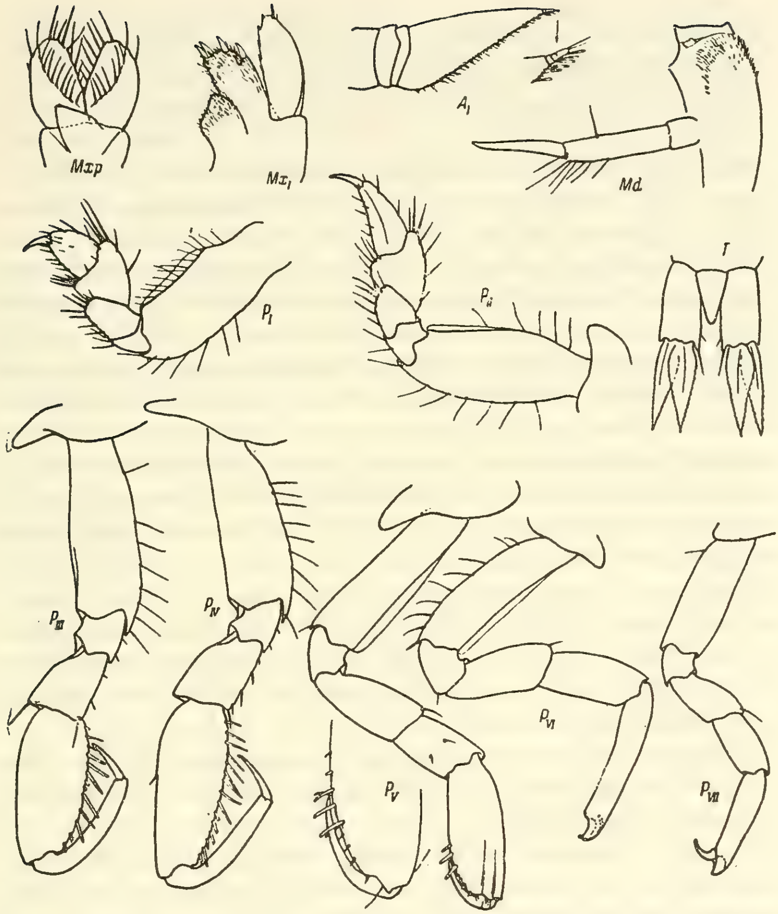
12. ***Lanceola chelifera*** Vinogradov, 1970 (Fig. 21)

Vinogradov, 1970: 388.

Length up to 9 mm (females) to 9.5 mm (males).

The body has a broadened pereon and a relatively broad and short pleon, which is characteristic of all the species of the group *L. clausi*. A rostrum is absent. The eyes are small, barely noticeable.

In antennae I the peduncle consists of short broad segments; the proximal segment of the flagellum is large, broadly conical, and weakly armed; of the three small distal segments, the apical is equal in length to the two preceding ones together. Antennae II are slightly longer than antennae I.



76 Fig. 21. *Lanceola chelifera* Vinogradov, female (after Vinogradov, 1970).

The mandibles have a small accessory plate that is not spine-shaped; the palp is slightly longer than the manidbular body, its 3rd segment shorter than the 2nd.

Pereopods I and II are structured as in *L. clausi*; the width of the 2nd segment in pereopods I is 1/2 and in pereopods II, 2/5 its length. Pereopods III are strong, with broad segments; the 2nd segment is twice longer than the 3rd and 4th segments together; the short distally broadened 4th segment is only slightly longer than the 3rd and armed with short setae on the posterior margin; the 5th segment is broad, amygdaloid, its length twice its maximum width, and armed with a row of strong, blunt, marginal spines on the posterior margin; the 6th segment is slightly curved, narrow, less than 1/3 the width of the 5th, its length slightly less than that of the 5th segment; the claw is almost straight, 2/7–1/3 the length of the 6th segment. Pereopods IV are similar in structure, the 5th and 6th segments only slightly longer than in pereopods III. In juvenile specimens the 5th segment of pereopods III and IV is relatively narrower than in adults but the amygdaloid shape is retained. Pereopods V have a well-developed subchela formed by the bulging palmate margin of the 6th segment and the claw; the 2nd segment is equal in length to the 4th and 5th together; the distally broadened 4th segment is 1.5 times longer than the 5th; the narrowly amygdaloid 6th segment is only slightly shorter than the 2nd segment, its maximum width 2/5 its length; the spoon-shaped formation typical for *Lanceola* is absent at the distal end of the segment; the bulging anterior margin of the 6th segment is medially armed with three pairs of strong, blunt, interlocking spines, and distally with a row of shorter setae. The long, strong, slightly curved claw may fit compactly in the palmate margin of the 6th segment, nearly reaching its midlength. In pereopods VI the 2nd segment is equal to the 6th; the distally broadening 4th segment is almost equal to the 5th; the 6th segment is slightly shorter than the 4th and 5th together, slightly narrows distally, and has a well-developed spoon-shaped depression in which the small curved claw extends. Pereopods VII are slightly shorter than VI, with roughly the same proportions, although the 6th segment is relatively shorter.

The uropods are broad, short, and structured as in *L. clausi*. The narrow triangular telson is slightly longer than half the length of the basipodite of uropods III.

76 *Notes*: *L. chelifera* differs from *L. clausi* (and also from the other species of *Lanceola*) in the unique structure of the distal segments of pereopods III–V. The broadened amygdaloid 5th segment of pereopods III and IV and the broad 6th segment of pereopods V are immediately recognizable.

L. chelifera is closest to *L. sphaerica*; moreover, the unique structural features of pereopods III–V which distinguish *L. sphaerica* from *L. clausi*, are better developed in *L. chelifera*. For *L. sphaerica* the large 5th segment of pereopods III and IV armed with strong marginal setae is characteristic. In *L. chelifera* these segments are even more amygdaloidly broadened and the marginal setae modified into spines so that the 5th and 6th segments touch and tend to form a subchela. The anterior margin of the 6th segment of pereopods V is provided with true interlocking spines and together with the long strong claw form a subchela; moreover, the
77 spoon-shaped process in the distal part of the segment, modified into a plate in *L. sphaerica*, is totally absent here (or becomes so brittle and

weak that it breaks off) and naturally the claw loses the possibility of retracting into the body of the segment.

The formation of subchelae on pereopods III–V evidently assists in better attachment of this crustacean to the host tissues than is inherent in other Lanceola.

Thus, in the series *L. clausi*—*L. sphaerica*—*L. chelifera* a distinct increase of specialization is observable in pereopods III–V and their modification from the simple to a prehensile type. An absolutely similar series of changes in the appendages can also be traced in another group close to the lanceolids, the family Microphasmidae. Unfortunately, all species with transitionally structured pereopods are very rare and known from lone specimens; hence it is not possible as yet to compare the above changes in a larger series, which would enable identification of total and individual variability.

Distribution: Kuril-Kamchatka Trench. Evidently it inhabits only the abyssopelagial as it has not been found even once at depths of less than 3,000 m; however, in the trench waters it has not been recorded deeper than 6,000 m.

2. Genus *Scypholanceola* Woltereck, 1905

Woltereck, 1905; 414, 1927: 65; Bowman and Gruner, 1973: 22.

Large crustaceans, up to 60 mm long.

The integument is very thin and transparent. The structure is the same as in the genus *Lanceola*, differing only in the unique structure of the eyes, which are modified into reflector organs. The eyes resemble a strip folded in half, the broadened ends of which lie in deep funnel-shaped niches formed by the lateral walls of the head (Fig. 22). The refractive elements and the eye pigment have disappeared while the receptor elements are very highly developed. Eyes of similar structure are known not only in *Scypholanceola*, but in some other deepwater crustaceans of the orders Ostracoda, Copepoda, and others. According to Woltereck (1909), they reflect the light falling on them form the luminous organs of other animals and flash it in the dark, attracting thereby the prey or confusing the predators.

Type species: *Scypholanceola vanhoeffeni* Woltereck, 1905.

Four species of this genus have been described: S. agassizi Woltereck, *S. aestiva* (Stebbing) (=*S. vanhoeffeni* Woltereck), *S. chuni* Woltereck, and *S. richardi* Chevreux. The difference between the last three species is confined to a slightly different shape of the eye cups and width of the eye strip. Howerver, Chevreux (1920) noted variability in the shape of the eye cups when he described *S. richardi*. Later, Woltereck (1927) and Barnard (1932), after examining a large amount of material from the Southern and Atlantic Oceans, concluded that the shape of the eye cup cannot be taken as a specific character; hence *S. aestiva* and *S. richardi* should be considered synonyms. Barnard (1932) considered that *S. chuni* should also be considered a synonym of *S. aestiva*. This view was later supported by Pirlot (1939). The material at our disposal likewise revealed no specific distinctions among these three species, enabling us thereby, following Barnard and Pirlot, to consider them identical.

The differences of *S. agassizi* from the above-cited species are also not great and some researchers have proposed (Pirlot, 1939) that this species is identical to *S. aestiva*. However, our examination of the new material from the "Vityaz" collection showed that *S. agassizi* possesses
78 several constant characters that differentiate it from *S. aestiva* and determine its species independence. True, only the large, undamaged specimens could be considered reliably identified.

KEY TO SPECIES OF GENUS SCYPHOLANCEOLA

1. Head with a small tapering rostrum. Apical segment of antennae I elongated-oval .... 1. ***S. aestiva*** (Stebb.).
— Head without a tapering rostrum. Apical segment of antennae I elongated-conical, narrowing distally .... 2. ***S. agassizi*** Wolt.

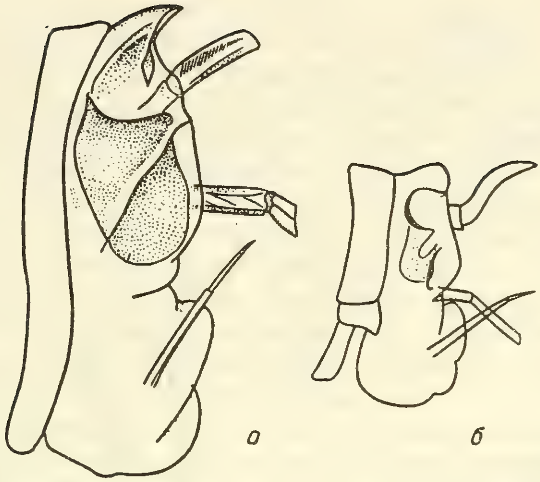
1. ***Scypholanceola aestiva*** (Stebbing, 1888) (Figs. 22, 23, 24)
Stebbing, 1888: 1309 (part.) (Lanceola).—*vanhoeffeni* Woltereck, 1909: 161, 1927: 65; Pirlot, 1939: 8 (part.).—*clausi* Woltereck, 1909: 161.—*richardi* Chevreux, 1920: 10, 1935: 139; Pirlot, 1930: 45.

Length of the sexually mature females in our collections from 27 to 53* mm, of males from 30 to 35 mm. But Woltereck found a specimen measuring 61 mm (*S. chuni*) in the Southern Ocean.

The body has a thin transparent integument; the pereon bulges markedly; the somites of the pleon have weakly developed, blunt dorsal denticles. The head is short and high with a small, straight, tapering rostrum. The eye cups are large, shallow, and occupy the entire lateral surface of the head; the crest between the upper and lower cups broadens in the anteroposterior plane but is generally fairly narrow; the bottom of the cups (even in freshly caught specimens) lacks a metallic sheen.

S. aestiva is similar to *Lanceola loveni* in structure of the appendages. Antennae I are longer than somite I but shorter than somites I and II of the pereon together; the proximal segment of the flagellum is elongated-conical, narrow, and slightly bent; its tapering margin is variably pubescent (usually weakly) and the inner proximal

* Changed from "43" in Russian text by authors—Eds.



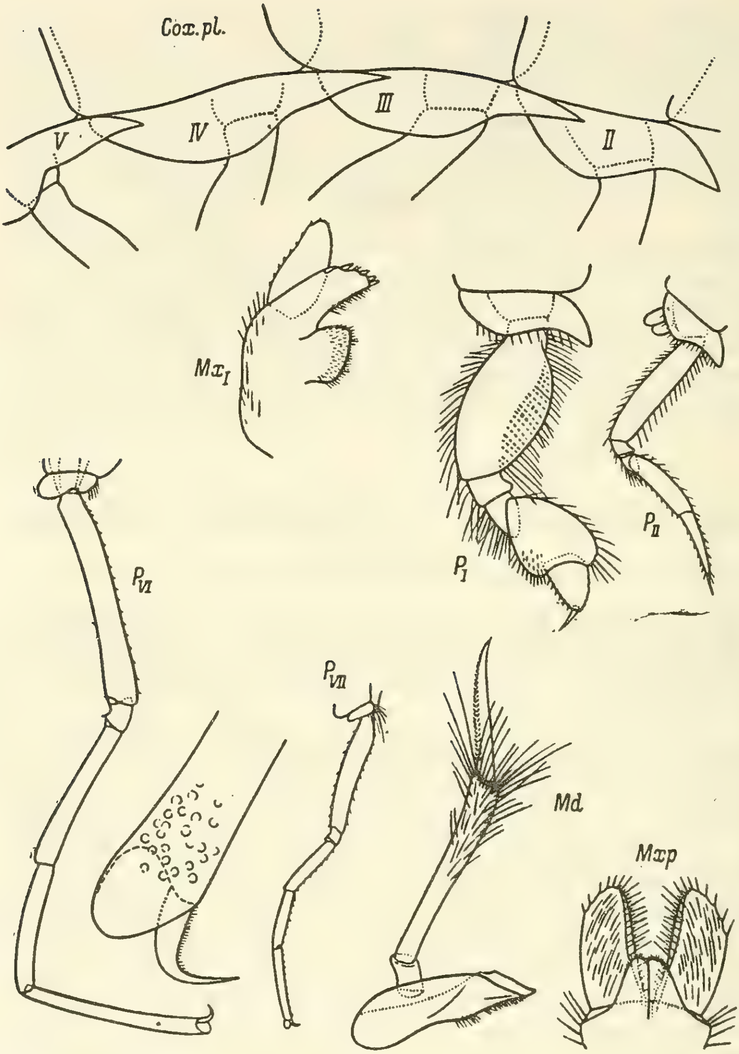
78 Fig. 22. Head of (a) *Scypholanceola aestiva* (Stebbing) and (b) *S. agassizi* Woltereck (after Woltereck, 1909).

angle may be stretched backward into a small roundish lobe; the apical segments are small; the 1st and 2nd are dolioform, the 3rd elongated-oval, almost not narrowing distally and less than 1.5 times longer than the 2nd. Antennae II are thin, nearly 1.5–2.5 times longer than antennae I; the 5th segment of the peduncle is much longer than all the preceding segments together; the distally narrowing proximal segment of the flagellum may be shorter than, equal to, or longer than the 5th segment of the peduncle.

The mandibles have a narrow, elongated body, their cutting edge is not broad, the palp is long and strong, 1.5–2.0 times longer than the body of the mandible. Maxillae I have a broad, one-segmented palp and
79 a broad inner lobe. Maxillae II have narrow, almost equal lobes. The maxillipeds have oval outer lobes armed on the outer and distal margins with strong setae; the inner lobes are small, weakly armed distally.

Coxal plate I is roundish, rhomboid, with a slightly stretched forward and downward tapered anterior distal angle. Coxal plates III–V taper anteriorly.

Pereopods I, particularly in large specimens, have a broad 2nd segment; the 5th segment is highly broadened distally so that its maximum width is equal to or slightly less than its length; the posterior and especially the anterior distal angles form a large roundish lobe overhanging the 6th segment (sometimes in young individuals the anterior lobe may be almost undeveloped); the base of the oval-conical 6th segment is nearly half the length of the distal margin of the 5th segment; the anterior distal angle of the 6th segment is produced into a denticle overhanging the



79 Fig. 23. *Scypholanceola aestiva* (Stebbing), male (after Shoemaker 1945a).

claw—the relative size of this denticle, prominent in younger individu-
80 als, reduces as the crustacean grows, and in larger individuals becomes almost inconspicuous. Pereopods II are longer than pereopods I; the very weak, distally broadened 5th segment (in large specimens it is nearly cylindrical) is usually somewhat longer but may be equal to or slightly shorter than the narrowly conical 6th segment. Pereopods III and IV are

about 1.2–1.5 times longer than pereopods II. Pereopods V are nearly the same length as pereopods IV; their 2nd segment is slightly shorter than the rod-shaped 4th and 5th segments together; the 4th segment is longer than the 5th and equal to or longer than the 6th, which in turn may be longer, equal to, or slightly shorter than the 5th. Pereopods VI are longer and stronger than pereopods V; their 2nd segment is much shorter than the 4th and 5th segments together; the 4th segment is longer than the 5th but slightly shorter than the 6th. Pereopods VII are shorter than pereopods V; their 4th segment is slightly longer than the 5th and the 6th is longer than each of them and sometimes almost equal to the length of the 4th and 5th segments together. The claws of pereopods V–VII are relatively large, retractile; in larger specimens the distal third is falcate, in younger specimens almost straight.

The Uropods have narrowly lanceolate rami and comparatively thin basipodites. The telson is triangular with a roundish, rarely tapering tip, reaching roughly half (rarely 3/4) the length of the basipodite of uropods III.

Notes: The similarity in structure of the appendages of *L. aestiva* Stebbing, 1888 and *S. vanhoeffeni* Woltereck, 1909 together with the imprecise description of the structure of the eyes of *L. aestiva* given by Stebbing, has enabled the assumption that these two species are identical (Vinogradov, 1957, 1962). A review of the type specimen of *L. aestiva* deposited in the British Museum (Thurston, 1973) showed that it is identical to *S. vanhoeffeni*. Thus the name *vanhoeffeni* is relegated to a junior synonym.

Distribution: A widely distributed species, *S. aestiva* is known from various regions of the Atlantic Ocean (from 46°29′ N, 5°18′ W to 33°53′ S, 9°26′ E), from the Indian Ocean in its tropical parts, and from Antarctic waters right up to the coastal regions of the Davis Sea (65° S). In the Pacific Ocean it is common in the northern parts, including the Sea of Okhotsk and the Bering Sea; in the tropical regions it is not found in the western part of the ocean (south of 27–30° N) but is present in notal (50° S, 82° W) and in Antarctic waters (64°03′S, 161°51′ E).

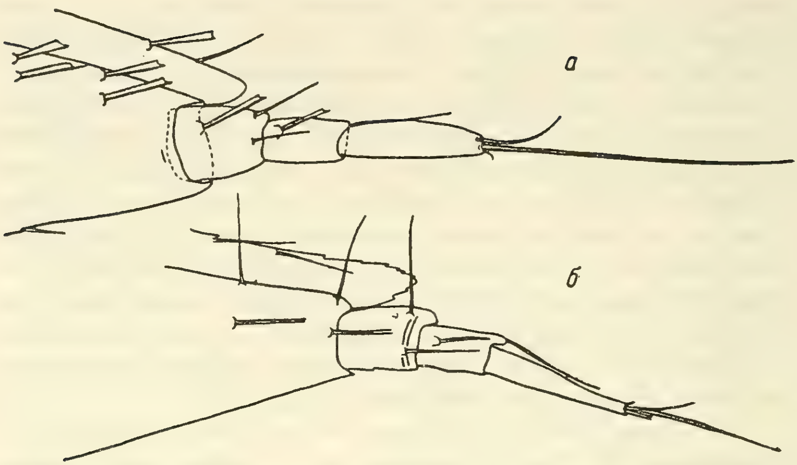
81 It inhabits a wide range of meso- and bathypelagic depths. Found in sectional collections from depths greater than 500 m to 2,000–3,500 m but the highest frequency was recorded for the 1,000–1,500 m layer.

2. ***Scypholanceola agassizi*** Woltereck, 1909 (Figs. 22, 24)

Woltereck, 1909: 167; Vinogradov, 1957: 197, 1960a: 208.

Sexually mature specimens not described. Specimens ranging from 9 to 36 mm in length are reported.

S. agassizi is very close to *S. aestiva*; it differs from the latter only in some structural details.



80 Fig. 24. Distal segments of antennae I of (a) *S. aestiva* and (b) *S. agassizi* (after Vinogradov, 1960a).

The body is smooth with a very thin, finely faceted transparent integument. The head is short and high, without a rostrum. The eye cups are large and well demarcated; their anterior margin projects forward behind the frons; the width of the commissure between the lower and upper cups varies; the bottom of the cups in freshly caught specimens has a dull metallic sheen.

The structure of the appendages varies and evidently has no constant characters that distinguish this species from *S. aestiva*. The exception is the structure of the distal segments of the flagellum of antennae I: the inner distal angles of the 1st and 2nd segments are drawn forward; the 3rd segment is conical, rarely narrows distally and is nearly two times longer than the 2nd segment.

Distribution: Found in the Pacific Ocean, in the Kuril-Kamchatka Trench region, and in the south up to 23°30′ S. In the Indian Ocean it is known from the northern regions (Arabian Sea) to 20° S. It inhabits bathy- and abyssopelagic depths. Not found even once above 1,000 m; the deepest record is the 5,000–6,000 m layer.

3. Genus *Megalanceola* Pirlot, 1935

Pirlot, 1935: 1, 1939: 8; Vinogradov, 1964: 114.

Large crustaceans, up to 75 mm in length.

The body is massive, with a bulging or flattened but dorsoventrally broadened pereon. The integument is thick. The head is shorter than somite I of the pereon, with a small rostrum. The eyes are narrow, reniform, and relatively large.

Antennae I have a three-segmented peduncle; the broad weakly pubescent proximal segment of the flagellum and the small distal segments are nearly equal in length. Antennae II are strong and considerably longer than antennae I.

The mandibles have a narrow denticulate cutting edge; the left mandible has an additional plate, almost the same width as the cutting edge; the mandibular palp is strong, its 3rd segment much longer than the 2nd. The inner lobes of maxillae I are narrow, papilliform. The inner lobes of maxillae II are narrower than the outer lobes. The lobes of the maxillipeds are broadly oval; the inner lobes are almost the same length as the outer.

The 5th segment of pereopods I and II is almost not broadened distally; the 6th segment is narrowly conical, its maximum width much less than its length. Pereopods V–VII or even pereopods III–VII have retractile claws.

Type species: *Lanceola stephenseni* Chevreux, 1920.

This genus was established by Pirlot (1935) from the female described by him as *Megalanceola terra-novae*. Later (1939), he included this species in the synonymy for *Lanceola stephenseni* described by Chevreux (1920), transferring the latter to the genus *Megalanceola*. Pirlot (1939) considered that perhaps even *L. felina* Bovallius should be included under the genus *Megalanceola*. However, it was later demonstrated (Vinogradov, 1960a) that *L. felina* Bovallius is a typical
82 representative of the genus *Lanceola* and hence cannot be included under the genus *Megalanceola*. One more species belongs to this genus, which was described by Barnard (1932) as *Lanceola* remipes.

KEY TO SPECIES OF GENUS MEGALANCEOLA

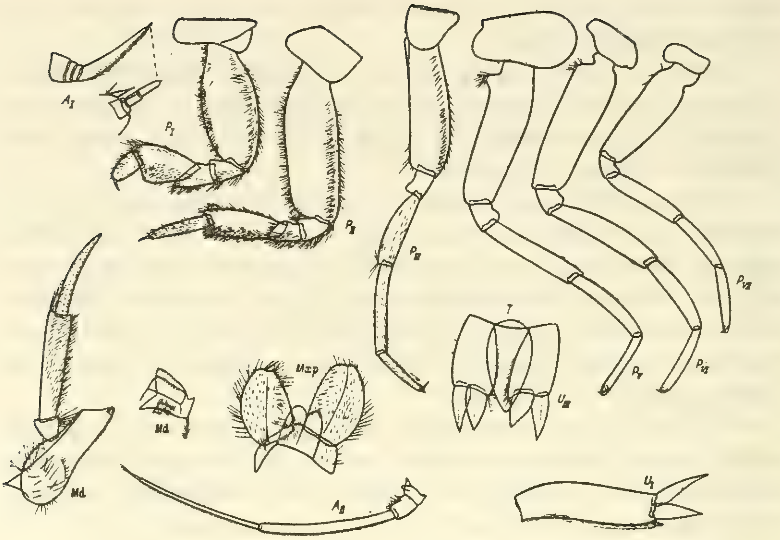
1. In pereopods III and V, 4th-6th segments not notably broad; claws on pereopods III–IV nonretractile; 2nd article of mandibular palp longer than 3rd .... 1. ***M. stephenseni***(Chevr.).

— In perepods III and V, 4th–6th articles very broad, oval or conical; claws of pereopods III–IV very small, retractile; 2nd article of mandibular palp shorter than 3rd .... 2. ***M. remipes*** (Bar.).

1. ***Megalanceola stephenseni*** (Chevreux, 1920) (Fig. 25)

Chevreux, 1920: 4 (*Lanceola*), 1935: 137 (*Lanceola*); Pirlot, 1939: 9; Shoemaker, 1945a: 212.—*terra-novae* Pirlot, 1935: 2.

Largest of the known lanceolids. Length of sexually mature females up to 73 mm, of males up to 48 mm.



83 Fig. 25. *Megalanceola stephenseni* (Chevreux), female (after Pirlot, 1939).

The head is short, with a very small rostrum; the interantennal lobe is fairly narrow with a concave lateral surface. The pereon lacks a dorsal keel. The mandibles have a strong palp, longer than the mandibuler body. Maxillae I have short oval inner lobes; the palp has a straightly truncated distal edge. The maxillipeds have highly pubescent outer lobes.

The 5th segment of pereopods I is very slightly broadened distally, in pereopods II its margins are almost parallel; the 6th segment is fairly broad, roundish-oval, less than half the length of the 5th; the claw is straight. The 6th segment of pereopods II is weakly conical, slightly shorter than the 5th. The 2nd–6th segments of pereopods I and II, both on the anterior and posterior margins and partly on the ventral surface, bear numerous fine setae. Pereopods III and IV are identical in structure with rod-shaped 4th–6th segment; the 4th segment is only slightly shorter than the 5th but longer than the thin 6th segment; the claws are simple and nonretractile. Pereopods V are longer than the preceding ones; the 4th–6th segments are rod-shaped, the 4th nearly equal to the 5th in length, the 6th slightly shorter; the broader 2nd segment has a typical prominence in the proximal part of the anterior margin. Pereopods VI–VII are structured as in *Lanceola*, with a small prominence in the proximal part of the anterior margin of the 2nd segment. The telson is elongated-triangular, reaching the distal end of the basipodite of uropods III.

Distribution: Northern part of the Atlantic Ocean from Newfoundland to the Azores and Bermuda islands. Chevreux (1920) and later Shoemaker (1945a) proposed that in the illustration of the *Lanceola* sp. presented by Willemoes Suhm and reproduced by Stebbing (1888), collected by the "Challenger" expedition from the Bandung Sea (Indonesian Sea) *M. stephenseni* has been depicted.

Absent in our collections.

2. ***Megalanceola remipes*** (Barnard, 1932) (Fig. 26)

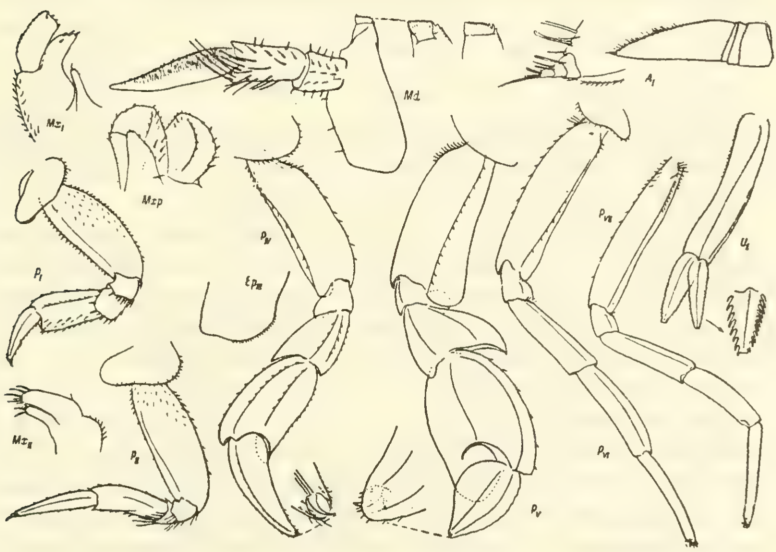
Barnard, 1932: 255 (*Lanceola*); Vinogradov, 1964: 114.

The only known sexually mature specimen (male) is 40 mm long.

85 The head has a small straight rostrum. The eyes are well developed. the pereon has a dorsal keel.

The mandibular palp is strong, longer than the body of the mandible. Maxillae I have very narrow inner lobes, bearing an apical seta each; the palp is broad, with a straightly truncated distal edge. The inner lobes of maxillae II are slightly shorter and narrower than the outer lobes. The inner lobes of the maxillipeds are more than half the length of the broad outer lobes.

The 5th segment of pereopods I is almost not broadened distally, its maximum width 2/3 its length; the 6th segment is narrowly conical, slightly shorter than the 5th; the claw is very small and straight. All the



84 Fig. 26. *Megalanceola remipes* (Barnard) (after Vinogradov, 1964).

segments are armed on the posterior margin with short strong setae, while the 2nd, 5th, and 6th segments bear such setae on the distal surface also. The nearly linear 5th segment of pereopods II is slightly shorter than the narrowly conical 6th; together they are slightly shorter than the 2nd segment. Pereopods III and IV are similar* in structure; their 3rd, 4th and 5th segments are flat, highly broadened distally, so that the maximum width of the 4th segment is only slightly less than its length while that of the 5th segment is 2/3 its length; the conical, distally sharply tapering 6th segment is equal to the 5th in length; the claw is very small, slightly curved, and retractile.

All the segments of pereopods V are even more broadened and flattened; the 2nd–4th segments are broadened distally; the 4th is particularly more sharply broadened, triangular, its maximum width more than its length; the 5th segment is only slightly less wide than long, with a depression in the lower posterior part into which fits the posterior proximal part of the 6th segment; the 6th segment is oval, sharply narrows distally, and 2/3 the length of the 5th segment; the claw is very small and retractile. Pereopods VI and VII are structured as in the *Lanceola*; their 2nd segment in the proximal part of the anterior margin has a small prominence, as in *M. stephęnseni*. The uropods have highly denticulate rami. The telson reaches the distal end of the basipodite of uropods III.

Distribution: Known from two records–in the South Atlantic (41°43′S, 42°20′ W) and in the Indian Ocean (3°11′ N, 67°02′ E) from the total catches at depths of over 2,000 m to the surface.

4. Genus *Metalanceola* Pirlot, 1931

Pirlot, 1931: 1.

Medium-sized crustaceans. In females the pereon bulges markedly. The integument is thin and transparent. The head is shorter than somite I of the pereon. The eyes are roundish and very small.

In antennae I the peduncle consists of short broad segments; in the flagellum the proximal segment is broadly conical and weakly pubescent; the distal segments are better developed than in other lanceolids, their total length 2/5–1/2 the length of the proximal segments. Antennae II are shorter than antennae I; in males the segments of the flagellum are rod-shaped.

The mandibles have a broad cutting edge; the 3rd segment of the mandibular palp is slightly longer than the 2nd. The palp of maxillae I, unlike in other genera of the family, is significantly shorter than the outer lobe; the inner lobe is small. The inner lobe of the maxillipeds is reduced to a small prominence. The spoon-shaped formation on the tip of the 6th

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* changed from Russian text by authors–Eds.

segment of pereopods V–VII is hypertrophied. The gills are located on pereopods IV–VI.

Type species: Metalanceola chevreuxi Pirlot, 1931.

86 1. ***Metalanceola chevreuxi*** Pirlot, 1931 (Figs. 27, 28)

Pirlot, 1931: 1, 1939: 13; Vinogradov, 1960a: 210.

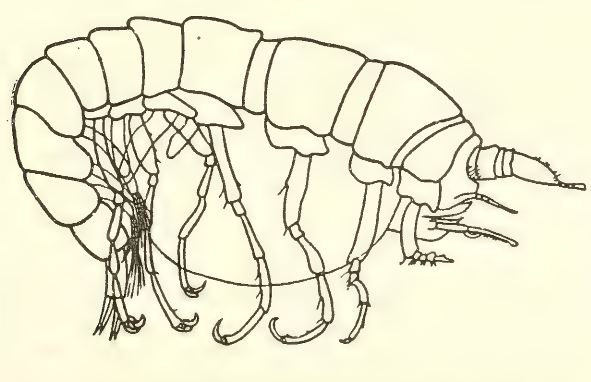
Length of sexually mature specimens 7.5 to 8.0 mm.

The body is lanceolate, with a thin integument, and without keels and spines. The head is short and without a rostrum. The eyes are small, oval, carmine-red in unfixed specimens, and not noticeable in fixed specimens.

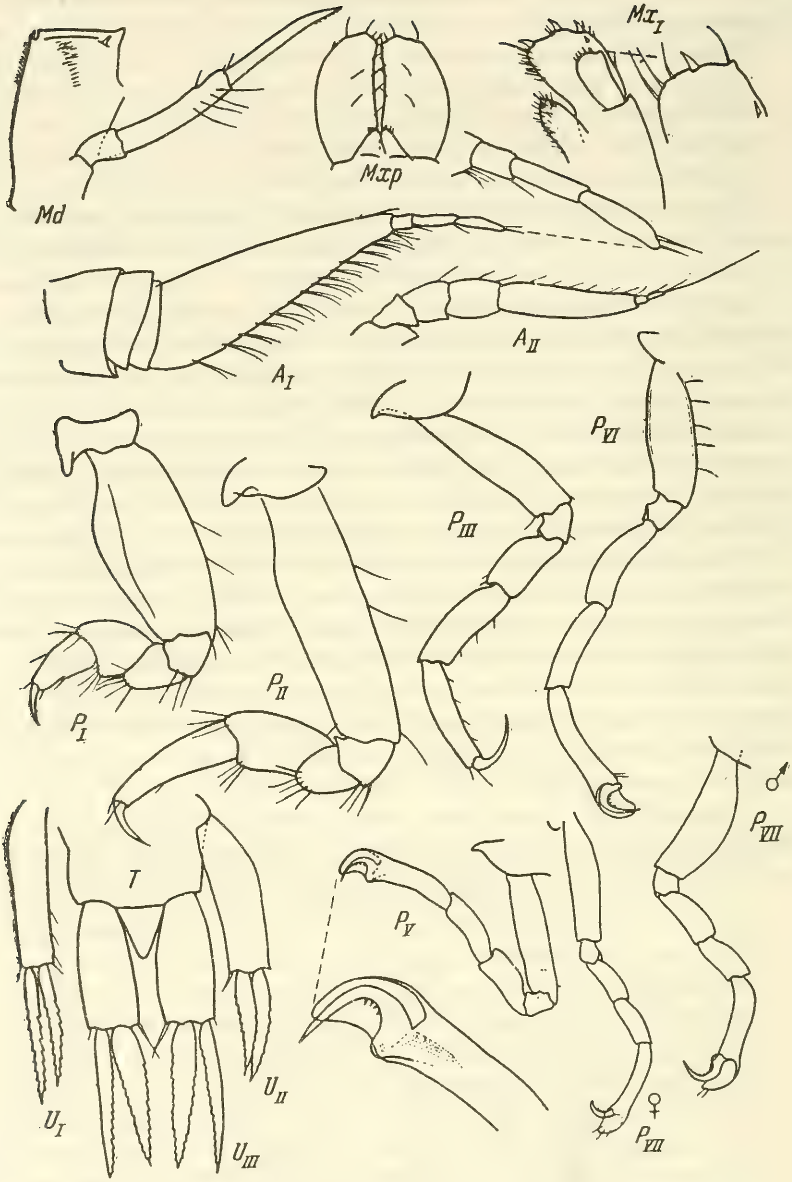
In antennae I the peduncle consists of short broad segments; the proximal segment of the flagellum is conical, with a convex inner margin. The segments of the peduncle and the proximal segment of the flagellum are much wider in males than in females (ratio of maximum width of proximal segment to its length in females 1: 3, in males 1: 2 or 1: 1.5). Antennae II in females are only barely shorter but in males roughly half the length of antennae I; the peduncular segments are short, so that the length of the peduncle is equal to that of the flagellum.

The mandibles have a broad cutting edge and the accessory plate is reduced to a spinule; the palp is weakly armed and thin; its length is less than twice the length of the mandibular body. The palp of maxillae I is half as long as the outer lobe; the outer lobe has a straightly truncated distal edge bearing three spinules (and five as in the genera of the family Lanceolidae considered thus far); the inner lobe is narrowly oval. The maxillipeds have an oval, weakly armed outer lobe and a very small, tubercle-shaped inner lobe.

Pereopods I and II are small, weakly armed; pereopods I have a slightly broadened 2nd segment, a distally broadened, almost triangular 5th segment and a conical 6th which, unlike in other lanceolids, is



86 Fig. 27. *Metalanceola chevreuxi* Pirlot, male (after Pirlot, 1939).



87 Fig. 28. *Metalanceola chevreuxi* Pirlot, female (after Vinogradov, 1960a).

longer than the 5th segment; the claw is small and slightly curved. Pereopods II are longer than pereopods I; the 5th segment is only slightly broadened distally, much shorter than the narrowly conical 6th segment.

Pereopods III and IV are unusually long, their 2nd segment equal to the 4th and 5th together; the 4th segment is much shorter than the 5th, which in turn is slightly shorter than the narrower 6th segment; the claw is strongly curved and half as long as the 6th segment. Pereopods V are shorter than pereopods III or IV; the 2nd segment is only slightly longer than the 6th but shorter than the 4th and 5th together. Pereopods VI are the longest of all; the 2nd segment is equal to the 6th but shorter than the 4th and 5th together, the latter segments being equal in length. Pereopods VII are slightly shorter and weaker than pereopods V; the 4th segment is longer than the 6th or the 4th and 5th together. In males pereopods VII are stronger than in females. The hypertrophy of the spoon-shaped formation on the tip of the 6th segment of pereopods V–VII is noteworthy; the distal end of these segments bulges and a cup-shaped depression occurs into which the strong falcate claw retracts.

88 The uropods have narrowly lanceolate, highly denticulate rami. The telson is triangular with a rounded tip and does not reach half the length of the basipodite of uropods III.

Distribution: Tropical part of the Pacific Ocean (between the equator and 23°30′ S), Indian Ocean (between 5° S and the equator), and Atlantic Ocean (madeira and Bermuda islands). It has been found in catches from depths of 985–2,000, 1,900–3,300 m and in total catches from depths of more than 1,800 m to the surface.

5. Genus *Prolanceola* Woltereck, 1907

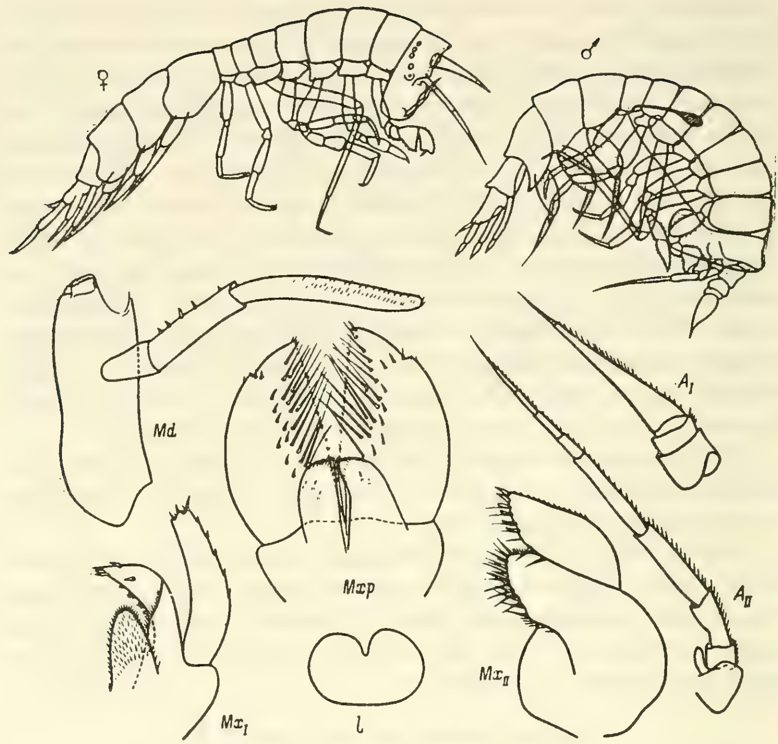
Woltereck, 1907: 7.

Crustaceans of medium size. Body better proportioned than in other lanceolids with a gammaridean appearance; the pereon is flat, not bulging in males. The head is high, nearly equal to pereon somite I in length. The eyes comprise a chain of eye spots (ocelli). Antennae I differ in structure in males and females; in the female the peduncle is short and three-segmented and the proximal segment of the flagellum is long, conical, and tapers distally. Antennae II are markedly longer than antennae I, with a multisegmented (5–6 segments) flagellum. The mandibles have a narrow cutting edge, broad accessory plate, and a strong palp with its 3rd segment much longer than the 2nd. Maxillae I have a long palp and a large oval inner lobe. Maxillae II have broad lobes. The Maxillipeds have a large armed outer lobe and a well-developed separate inner lobe. Pereopods I have a weakly developed chela, formed by the 5th and 6th segments. Pereopods VI–VII have small, curved, retractile claws.

Type species: Prolanceola vibiliformis Woltereck, 1907.

1. ***Prolanceola vibiliformis*** Woltereck, 1907 (Figs. 29, 30)

Woltereck,1907: 7, 1909: 157; vinogradov, 1957: 198.



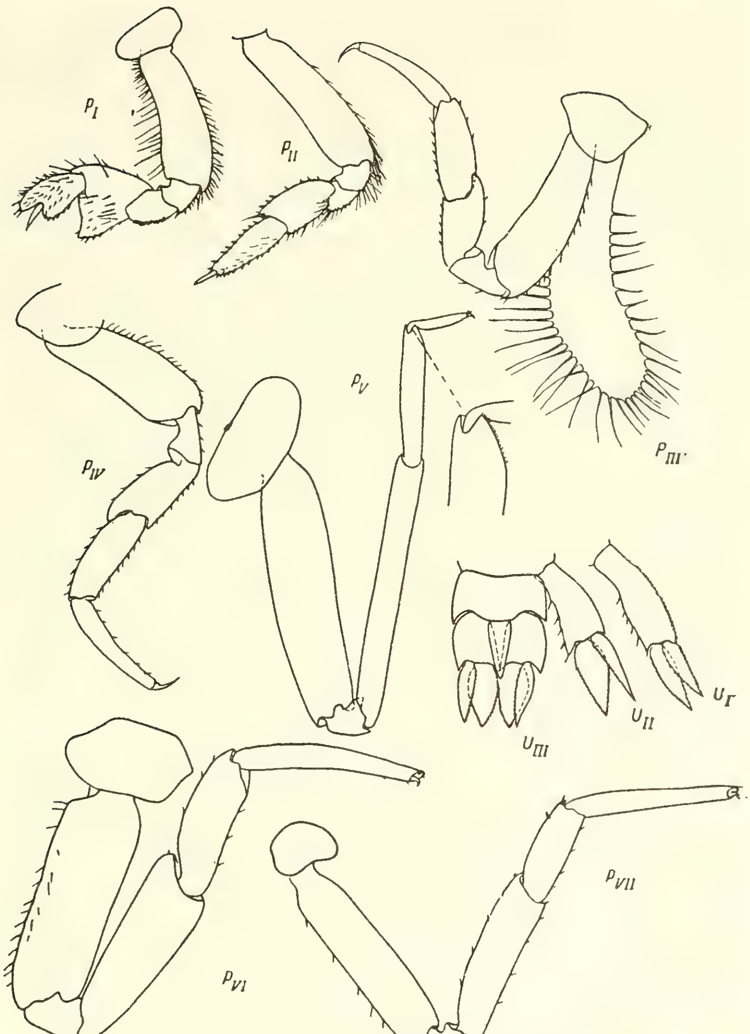
89 Fig. 29. *Prolanceola vibiliformis* Woltereck (after Vinogradov, 1957;general viiew, after Woltereck, 1909).

Length of sexually mature individuals 11 to 14 mm.

In females the body has a weakly developed dorsal keel, in males it is smooth.

In females the length of the 1st segment of the peduncle of antennae I exceeds the length of the 2nd and 3rd segments together; the sharply distally tapering proximal segment of the flagellum is 2–2.5 times longer than the peduncle; the small 1st distal segment is half the length of the 2nd. In males the relative length of antennae I is roughly the same as in females but the length of the peduncle is roughly equal to that of the flagellum; the proximal segment of the flagellum is teardrop-shaped, conical, and very broad in the proximal part.

The labrum is rounded, with a shallow depression (notch) on the anterior margin. The mandibles have a relatively short denticulate cutting edge and a well-developed accessory plate; the 3rd segment of the palp is longer than the 2nd and 1st segments together; the length of the palp is less than 1.5 times that of the mandibular body. The outer lobe of



90 Fig. 30. *Prolanceola vibiliformis* Woltereck, female (after Vinogradov, 1957). P_V drawn to a smaller scale than in the remaining pereopods.

maxillae I narrows distally and bears five short spines in the distal part and a fascicle of setae on the inner margin; the inner lobe is oval, the palp linear and slightly curved. The two lobes of maxillae II are similar in length, short and broad; on the distal margin they bear a row of spines with long strong setae at their base. The outer lobe of the maxillipeds has a convex outer and a straight inner margin; at the surface, parallel to the inner margin, are two rows of long and one row of short setae; the inner lobe has a tapered inner distal angle and is slightly pubescent.

Coxal plate I is oval and slightly tapers distally. The 5th segment of pereopods I is notably broadened distally and almost equal in length to
89 the 6th segment; its lower anterior angle is stretched into a lobe; the 6th segment is likewise broadened distally, its upper and lower distal angles stretching into rounded lobes, projecting behind the base of the straight and strong claw; the 5th segment of pereopods II is not broadened distally, it is slightly broader than and 2/3 the length of the 6th segment. Pereopods III and IV are identical in structure; their 2nd segment is equal in length to the 4th and 5th segments together; the 6th segment is slightly longer than the 5th and 1.5 times longer than the 6th. Pereopods V are much longer than pereopods III and IV, and somewhat longer than VI; the rod-shaped 4th segment is equal in length to the 2nd but much narrower than it; the weak, slightly curved 6th segment is less than 1/2 the length of the 5th and 1/4 the 4th segment; the claw is small, slightly curved, and nonretractile. Pereopods VI are shorter than V; the width of the 2nd segment is 1/3 its length; the 4th segment is broadened distally, 1.5 times longer than the 5th and equal in length to the thin 6th segment. Pereopods VII have almost the same length ratios as pereopods VI but are much weaker; the width of the 2nd segment is 1/4 its length.

The endopodite of uropods I is 2/3 the length of the basipodite, in uropods II almost equal to it, and in uropods III longer than it. The telson is slightly longer than the basipodite of uropods III.

Distribution: This is a widely distributed but fairly rare species. In the Pacific Ocean some specimens have been found in the region of the
90 Kuril-Kamchatka Trench, along the coast of Peru, and in the central part (20°20′ N, 173°24′ E; 43° S 158° E) of the Ocean. In the Indian Ocean it has been found at the Cocos Islands and south of the Seychelles. It has not been reported from the Atlantic Ocean. Found in catches from the 1,500–2,000 m layer (Kuril-Kamchatka region) and in total catches taken from depths of more than 2,000 m to the surface.

III. Family CHUNEOLIDAE Woltereck, 1909

Medium to large crustaceans, reaching a length of 40 mm. The body is massive, usually dorsoventrally compressed to a variable degree. All the pereon somites are free. The head is roughly equal to or (together with
91 the rostrum) slightly longer than somite I of the pereon. The eyes are rudimentary or absent. Antennae I are short, equal in length to the head, sometimes shorter or slightly longer than it. The proximal segment of the flagellum is short, often vesicular; the distal segments are very small, often inconspicuous. Antennae II are shorter than antennae I, rudimentary, with a vesicular peduncle. The mandibles lack palps in both sexes;

their cutting edge is slightly denticulate; the left mandible has an accessory plate. Maxillae I are the same as in Lanceola, with a broad outer and small narrow inner lobe. In maxillae II the lobes are equal in size. The maxillipeds have a large round outer lobe densely armed with long setae and a small separate inner lobe.

The pereopods are strong and short; pereopods III and IV are longer than the rest. Pereopods III–VII are strong, with a well-developed spoon-shaped formation at the distal end of the 6th segment and a curved retractile claw. The uropods are short and broad. The telson is roundish-triangular and shorter than the basipodite of uropods III.

The structure of the pereopods, armed with retractile claws, and the structure of the mouthparts often bring this family close to the family Lanceolidae, from which it differs primarily in the absence of the mandibular palp and rudimentary antennae II.

According to Woltereck (1909), the chuneolids parasitize deepwater tunicates and medusae. Actually, in the stomach of *Chuneola* not even once could any food other than a brownish red mass (pigmented layer of deepwater medusae), containing a large quantity of nematocysts of some coelenterates, be found. True, such a food composition is characteristic also of a vast majority of other Physosomata (Vinogradov, 1957). However, in the Chuneolidae the relationship with the host is more intimate. The falcate retractile claws, which serve for a dependable grasp on the soft tissues of the host, are present in these crustaceans not only on pereopods V–VII, but also on pereopods III–IV, and in less developed forms also on pereopods II. The short and strong pereopods facilitate a dependable attachment to the host. The high degree of obligate parasitism in the Chuneolidae is also indicated by very weak pleopods and uropods, reduced antennae and dorsoventrally flattened body (especially in the young specimens). The loss of mandibular palps is certainly associated with this.

It is interesting to note that gammarid groups of the genera *Cyphocaris* of the family Lysianassidae (*Paracyphocaris, Metacyphocaris, Crybelocyphocaris, Crybelocephalus*, and others), having adapted to ectoparasitism and developed the requisite adaptation for stable attachment to host tissues (formation of strong pseudochelae on pereopods III–V and sometimes on pereopods VI–VII), likewise exhibit a tendency toward weakening of the uropods and pleopods, shortening of the antennae, and total or partial reduction of the mandibular palps.

The family includes only one genus, *Chuneola*.

1. Genus *Chuneola* Woltereck, 1909

Woltereck, 1909: 152.

The integument is thin and transparent. The body is spindle shaped; in sexually mature females the pereon bulges due to the enlarged somites

II–V. The head has a projecting, visorshaped, bulging frons, and in some species a massive and broad vesicular rostrum that covers the antennae from above. The eyes are small, oval, poorly developed, even sometimes absent.

In antennae I the proximal segment of the flagellum is broadly conical or elongated-oval, straight or slightly curved. Antennae II are rudimentary with a highly developed antennal gland.

92 The pereopods have a broad 2nd segment. Pereopods I and II have a distally broadened 5th segment and a distally slightly narrowing 6th segment; the 6th segment of pereopods III–VII is almost cylindrical with a broad distal margin and a depression into which the strong curved claw completely retracts. The claws of pereopods I and II may partly retract into the body of the 6th segment.

Type species: *Chuneola paradoxa* Woltereck, 1909.

The genus *Chuneola* comprises three species.

KEY TO SPECIES OF GENUS CHUNEOLA

1. Pereopods III–VII with 6th segment shorter than or equal to the 5th segment. Lateral surface of 6th segment of pereopods II–IV smooth. Eyes distinct .... 2.

— Pereopods III–VII with 6th segment slightly longer than 5th segment. Eyes almost indistinct .... 2. ***C. major*** Vinogr.

2. Body smooth, without keels and spines. Telson shorter than basipodite of uropods III .... 1. ***C. paradoxa*** Wolt.

— Somites II–IV of pereon with lateral spines. Head extended into a triangular vesicular rostrum. Telson almost equal in length to basipodite of uropods III .... 3. ***C. spinifera*** Vinogr.

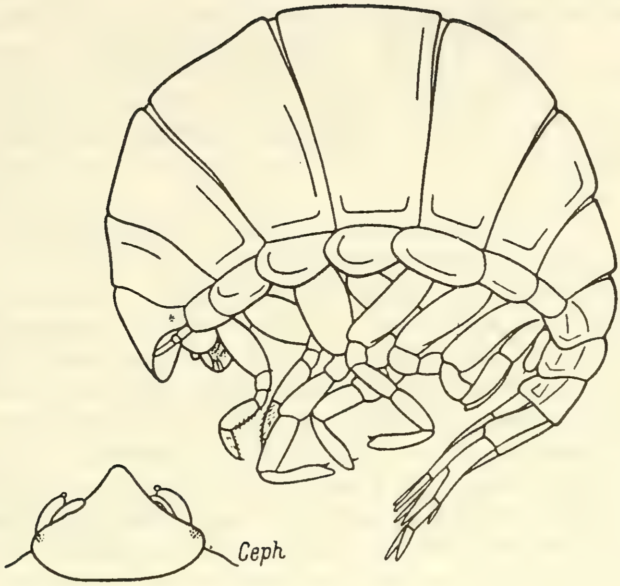
1. ***Chuneola paradoxa*** Woltereck, 1909 (Figs. 31, 32)

Woltereck, 1909: 152;Pirlot, 1930: 3.—*parasitica* Vinogradov, 1956: 196, 1962: 11.

Length of almost sexually mature female 28 mm. All the remaining known specimens of this species are immature and range in length from 6 to 11 mm.

The color of unfixed specimens is cherry-red. The body is spindle-shaped, in young specimens flattened dorsoventrally and without keels and spines. The head in the sexually mature specimen has a broad visor-
93 shaped rostrum; in young specimens the rostrum is not developed but the roundish frontal part of the head extends forward. The eyes are small and distinct.

Antennae I are short, inserted in sockets along the sides of the head, and only slightly project beyond the vertical frons; their vesicular broad

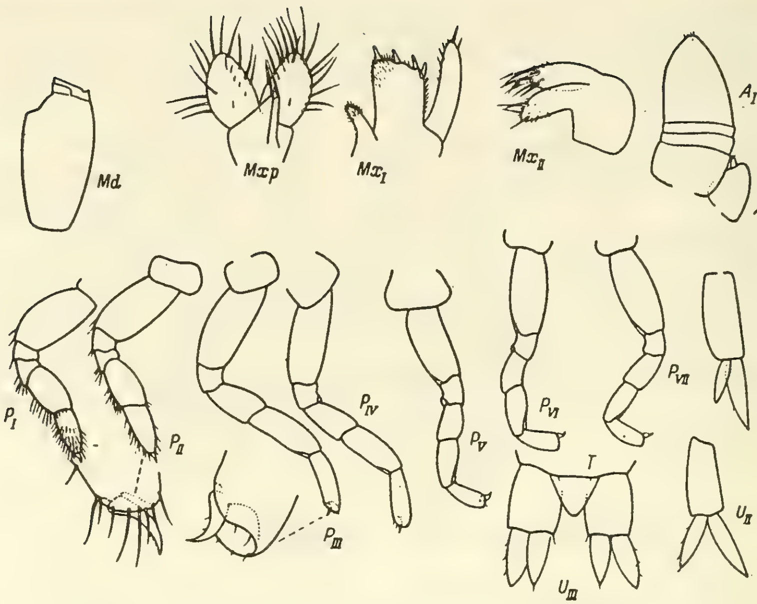


92 Fig. 31. *Chuneola paradoxa* Woltereck, female (after Vinogradov, 1962).

flagellum is only slightly longer than the three-segmented peduncle; the flagellum terminates in two very small distal segments that often are not developed. Antennae II have a vesicular, relatively large basal segment; in young specimens it is shorter than the peduncle of antennae I, while in the adult female it is almost the same length as antennae I.

Maxillae I have a narrow one-segmented palp, which is longer than the broad outer lobe, with a straight distal truncated edge armed with 4–5 spines; the inner lobe is small and narrow. The maxillipeds have an oval outer lobe armed with long setae, and a relatively large, distally narrowing inner lobe apically bearing one long and strong and one-two small setae.

The coxal plates are elongated-rectangular, with rounded margins and a shallow notch on the lower margin. The pereopods are relatively short and strong. The 2nd segment of pereopods I is slightly shorter than the 5th and 6th segments together, its width 1/2 its length; the oval 5th segment is equal to or slightly larger than the distally tapering 6th segment (in Woltereck's illustration the 5th segment is shorter than the distally broadened 6th segment); tip of the 6th segment with a depression into which the slightly curved claw retracts partly. Pereopods II are similar in structure but slightly longer than pereopods I; their 5th segment is equal to or slightly shorter than the 6th segment.



93 Fig. 32. *Chuneola paradoxa* Wotereck, female (after Vinogradov, 1956).

Pereopods III and IV are identical in structure, longer than the preceding pair of pereopods; the 2nd segment in young specimens has parallel margins, in the adult is broadly oval but always shorter than the 4th and 5th segments together; the 4th segment is shorter than the 5th and slightly (in Woltereck's illustration—very strongly) broadened distally; the 5th segment is slightly longer than or equal to the 6th; there is a
94 small hollow in the distal part into which the 6th segment may retract; the claw is falcate, strong, and retractile. Pereopods V–VII are identical in length and in ratios of segments; their 4th segment is shorter than the 6th, which in turn is much shorter than the corresponding 5th segment; the 6th segment is appreciably broadened distally; the claws are strong, curved, and retractile.

The basipodite of uropods I is slightly longer than the endopodite. The basipodite of uropods II is equal to the endopodite and slightly longer than the exopodite. Uropods II are short and broad, the basipodite slightly longer than broad. The telson is roundish-triangular with a blunt tip, more than half the length of the basipodite of uropods III and sometimes only barely not reaching its distal margin.

Distribution: Northwestern part of the Pacific Ocean, central part of the Indian Ocean, Arafura Sea, Tasman Sea, and the Indian Ocean sector of Antarctica (59°29′ S, 97°08′ E). Not found in the Atlantic Ocean.

It inhabits meso- and bathypelagic depths and is found in catches from depths of 0–750 and 550–1,100 m as well as in total catches from depths of more than 1,000 m to the surface.

2. ***Chuneola major*** Vinogradov, 1957 (Figs. 33, 34)

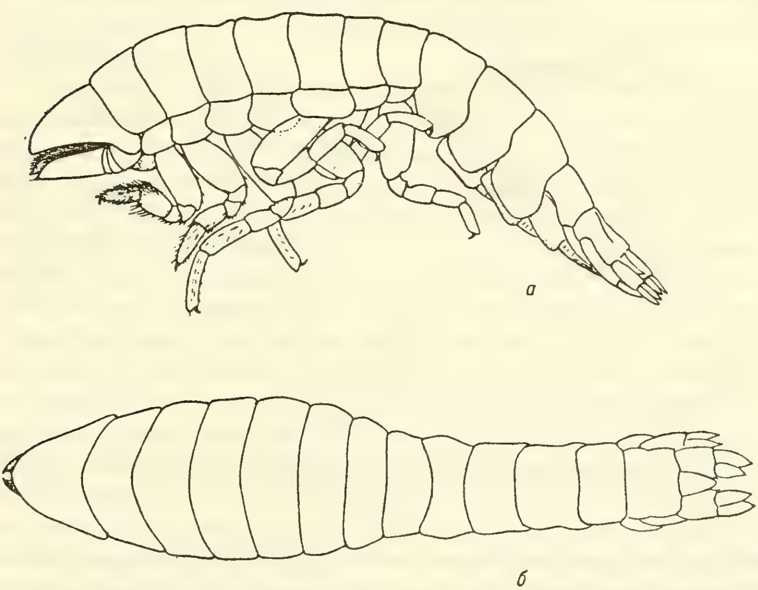
Vinogradov, 1957: 201, 1964: 118.

Length of caught specimens 16 to 25 mm. Sexually mature specimens not known.

The color of unfixed specimens is reddish-pink.

The body is spindle-shaped, slightly flattened dorsoventrally, and smooth; a barely perceptible furrow runs along the middorsal line from the anterior margin of the head to the base of the telson. The head has a blunt frons that projects strongly in the form of a visor, almost entirely covering antennae I from above. The eyes are indistinct.

96 The length of antennae I is equal to that of the first two somites of the pereon; the peduncle is broad and short; the three-segmented flagellum is 2.5–3.0 times longer than the peduncle; its proximal segment is broad, almost cylindrical, the two distal segments are very small and apically bear two short setae. Antennae II are two-segmented, the basal segment broad, vesicular and the distal one small and oval; in a 21-mm long



94 Fig. 33. *Chuneola major* Vinogradov (after Vinogradov, 1957).

a—lateral view; b—dorsal view

95 Fig. 34. *Chuneola major* Vinogradov (after Vinogradov, 1957).

specimen antennae II are shorter than the peduncle of antennae I; in a larger specimen, longer. The outer lobe of maxillae I is broad, with a straightly truncated apex, bearing five strong spines and a row of short setae; similar setae are present on the inner and outer margins and on the surface of the lobe; the palp has a row of spines on the inner margin, the spines becoming larger toward the distal end. The outer lobe of the maxillipeds is armed with numerous long strong setae; the inner lobe is armed in the distal part with 2–4 strong setae .

In pereopods III and IV the 5th and 6th segments bear short setae on the distal surface. The 6th segment of pereopods III–VII is longer than the 5th; in pereopods V–VII the 5th segment is equal to the 4th, the 6th segment of pereopods V–VII is longer than the 5th but not broadened distally.

In uropods I the basipodite has a highly convex anterior margin and both rami are tapered. In uropods II the basipodite is broadened distally and equal in length to the endopodite and both rami are tapered. In uropods III the basipodite is short and broad, the two rami equal in length, broadly lanceolate, and terminally acute. The broad oval telson reaches the distal margin of the basipodite of uropods III.

Distribution: Known from the northwestern part of the Pacific Ocean north of 40° N and from the Indian Ocean (northern tip of Sumatra). It is found in catches from depths of 0–400 and 0–1,000 m and in catches from the 3,500–5,000 m layer.

97 3. ***Chuneola spinifera*** Vinogradov, 1960 (Figs. 35, 36)

Vinogradov, 1960b: 251.

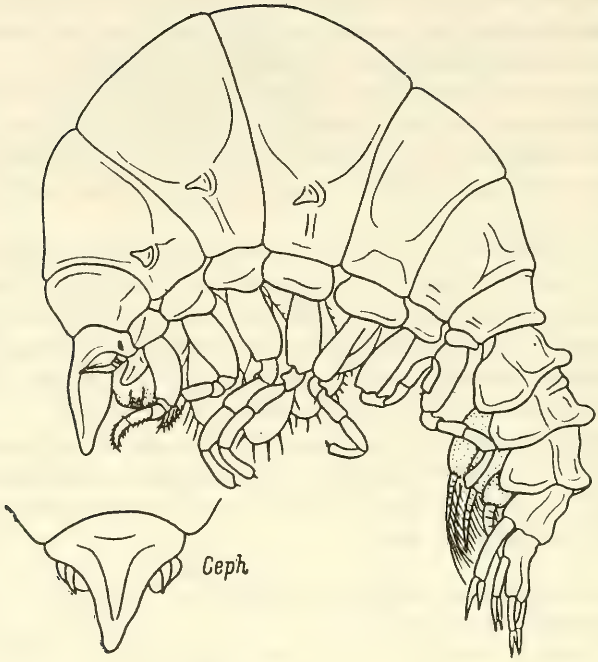
One sexually mature female 41 mm long known.

The color of the unfixed specimen was pale pink with darker pereopods and urosoma.

The anterior somites of the pareon bulge markedly. The integument is semitransparent and thin. Spinelike processes occur in the ventral part
98 of pereon somites II–IV, one pair on each somite. The posterior dorsal margin of the pereon somite VII and especially somites I–II of the pleon are cylindrical. The head extends into a strong triquetrous vesicular rostrum that is terminally rounded; it is equal in length to the first two pereon somites. The eyes are small but distinct. The mouth cone is well developed.

Antennae I are inserted in broad depressions and only slightly project beyond the vertical frons; they are shorter than somite I of the pereon; the peduncle is half the length of the flagellum; the two distal segments of the flagellum are rudimentary, as in *C. major*. The vesicular antennae II are slightly shorter than antennae I, their distal segments very small and entirely situated in the depression of the preceding segment.

The mandibles have a finely denticulate cutting edge; a small area on the inner surface of the mandibular body is covered with short setae. The outer lobe of maxillae I is broad, with a straightly truncated apex bearing five strong spines; the inner lobe is small, oval, and densely covered with short setae, among which some are prominent by their length and thickness; the palp has three apical spines and a row of spines on the inner margin. Maxillae II are the same as in other species of the genus.



96 Fig. 35. *Chuneola spinifera* Vinogradov, female (after Vinogradov, 1960b).

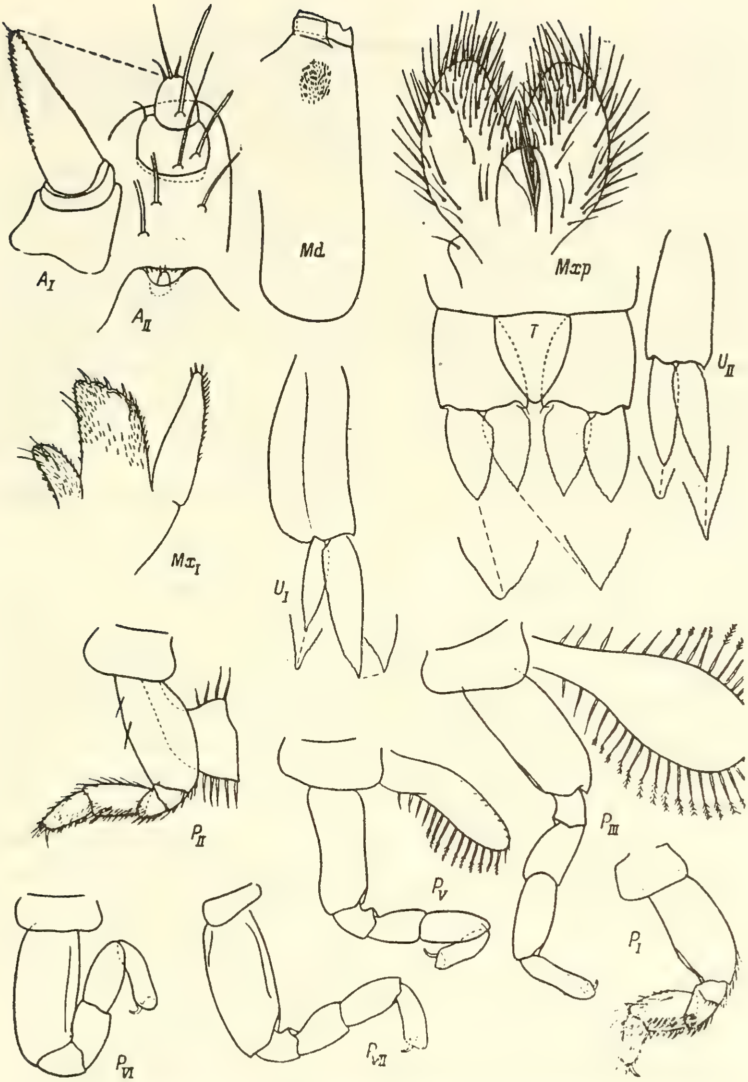
The outer lobe of the maxillipeds is broadly oval, armed on the outer and inner margins as well as on the surface with numerous long strong setae; the well-developed inner lobe bears short setae on the distal margin, and a row of longer setae on the inner margin.

The coxal plates are trapezoidal, with broadly rounded angles; they increase from I to III and again decrease from V to VII; the last plate is very small and truncated anteroposteriorly. The oostegites decrease from pereon somites II to V. The oostegites of somite V bear long setae only on one side.

The pereopods are structured as in *C. paradoxa*.

The basipodite of uropods I has a highly convex outer margin; both rami taper; the exopodite is much narrower and 2/3 the length of the endopodite. The basipodite of uropods II slightly broadens distally; both rami are equal in width. The basipodite of uropods III is short and broad; the tip of the exopodite is rounded and that of the endopodite pointed. The rounded-triangular telson almost reaches the distal end of the basipodite of uropods III.

Distribution: The only specimen was found in the Pacific Ocean (38°03′ N, 144°12′ E) in a total catch from 0–3,000 m.



97 Fig. 36. *Chuneola spinifera* Vinogradov, female (after Vinogradov, 1960b).

98 IV. Family MICROPHASMIDAE Stephensen and Pirlot, 1931

Small animals (5–12 mm long). The body is devoid of keels and spines. The pereon usually bulges to a variable extent (in females more so than in males) due to the broadened pereon somites II–V. The head is high and short, with a protruding massive mouth cone. The eyes are small, rudimentary, sometimes absent. Antennae I are lanceolate, with a three segmented short peduncle and four-segmented flagellum consisting of a broadly conical proximal segment and three small distal segments. Antennae II are developed as in the family Lanceolidae, or reduced, but to a lesser degree than in the family Chuneolidae.

The mandibles have a broad cutting edge; the left mandible has a small accessory plate; the 3rd segment of the mandibular palp is shorter than the 2nd. The inner lobe of maxillae I is broad; the palp is well developed and longer than the outer lobe. Maxillae II have narrow lobes of
99 equal length. The maxillipeds have a large outer lobes armed with strong setae; the inner lobes are separate, well developed or rudimentary. The coxal plates are free. Pereopods I and II have distally broadened 5th and 6th segments. Pereopods III–VI lack retractile claws but pseudochelae, variably developed, may be present on pereopods III–V. The rami of the uropods are free. The telson is short and triangular.

The family Microphasmidae is undoubtedly close to the Lanceolidae. It includes three genera.

KEY TO GENERA OF FAMILY MICROPHASMIDAE

1. All pereopods simple or pereopods V may have a weakly developed pseudochela with a long palmate margin. Antennae II well developed and almost equal in length to antennae I..... 1. ***Mimonecteola*** Wolt.

— At least pereopods V with broadened 6th segment and well-developed pseudochela. Antennae II reduced and shorter than small antennae 1 .... 2.

2. Only pereopods V with broadened 6th segment and well-developed pseudochela .... 3. ***Microphasmoides*** Vinogr.

— Pereopods III–V with broadened 6th segment and well-developed pseudochela .... 2. ***Microphasma*** Wolt.

1. Genus *Mimonecteola* Woltereck, 1909

Woltereck, 1909: 153.

The body is smooth, lanceolid in shape; the pereon is slightly convex, more so in females than in males. The head is shorter than somite I of the pereon, with a visor-shaped projecting frons. The eyes are small and reniform.

Antennae I are longer than the first two but shorter than the first three somites of the pereon. In females the proximal segment of the flagellum is narrowly conical, and 3–5 times longer than the peduncle. In sexually mature males the proximal segment of the flagellum is highly pubescent; it is relatively shorter and broader than in females and forms a lobe in the proximal part which covers the 2nd and 3rd segments of the peduncle. Antennae II are thin, in females equal to or longer than antennae I, in males shorter; the three segmented flagellum consists of a narrow and long proximal segment and two small distal segments.

The mandibles have a long palp, much longer than the body of the mandible. Maxillae I have a strong outer lobe armed on the distal margin.

The maxillipeds have a narrowly oval, highly armed outer lobe and a small tapering inner lobe.

Pereopods I have a distally highly broadened, almost triangular 5th segment and a conical or ovally conical 6th segment. Pereopods II are longer than pereopods I; their 5th segment is weakly broadened, and the 6th segment narrowly conical. Pereopods IV are longer than pereopods III. Pereopods V are simple or have a weakly developed subchela. Pereopods VI are longer than pereopods V, but with the same length ratios, always simple, and with a long strong claw. Pereopods VII are shorter and weaker than pereopods VI; the claw is either free or partly retractile, sometimes forming with the 6th segment a weakly developed subchela.

Type species: *Mimonecteola diomedeae* Woltereck, 1909.

An analysis of the material available to us of the genus *Mimonecteola* from various regions of the ocean and of the published information,
100 revealed that specimens could be separated into groups exhibiting at least slight but stable differences. We consider these groups to be different species, although possibly they are lower in rank.

The genus Mimonecteola comprises five species, one of which—*M. macronyx* Barnard—has been so cryptically described and fragmentarily and schematically illustrated that its structure cannot be compared with the other species; as a *nomen dubium* it must be excluded from consideration.

KEY TO SPECIES OF GENUS MIMONECTEOLA

1\. All pereopods simple, without subchelae and retractile claws .... 2.

— Pereopods V with subchela, although latter poorly developed; pereopods VII with partly retractile claw .... 3.

2\. Fifth segment of pereopods III, IV, and VI elongated-oval; 6th segment of pereopods V almost not narrowing distally, bearing tuft of strong setae at base of claw ....2. ***M. diomedeae*** Wolt.

— Fifth segment of pereopods III, IV, and VI with parallel margins; 6th segment of pereopods V narrows distally, without special ornamentation at base of claw .... 1. ***M. beebei*** Shoem.

3\. Sixth segment of pereopods V broad, with weakly developed subchela formed by long thin claw and long, undulating, well-developed palmate margin armed with strong spines. Pereopods VII with long, almost straight, partly retractile claw ..... 4. ***M. subchelata*** Vinogr.

— Sixth segment of pereopods V with barely perceptible subchela formed by thin claw and steep, poorly developed palmate margin armed with thin setae. Pereopods VII with short, curved, partly retractile claw capable of forming with 6th segment a weakly developed subchela........................... 3. *M. mixta* Vinogr.

1. ***Mimonecteola beebei*** Shoemaker, 1945 (Fig. 37)

Shoemaker, 1945a: 124; Vinogradov, 1956: 199, 1957: 204, 1964: 119.

Length of sexually mature males 10.5 to 11 mm, of females 11 to 12 mm.

The color of unfixed crustaceans is olive-green.

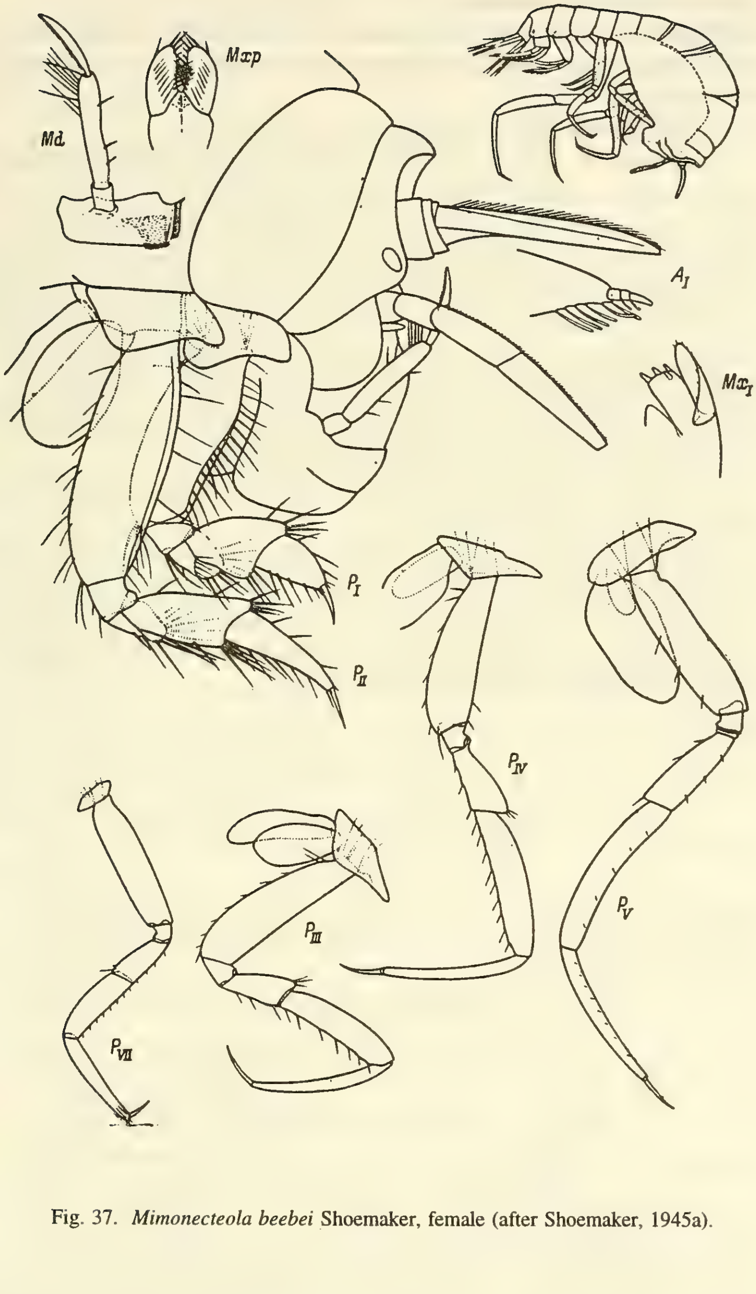
In sexually mature females the 5th and 6th segments of pereopods II are relatively narrower than in immature specimens or in males. Pereopods III and IV are identical in structure but pereopods IV are somewhat longer; their distally broadened 4th segment is half the length of the narrowly amygdaloid 5th segment; the narrow 6th segment is slightly longer than the 5th; the almost straight and strong claw is 2/7–1/3 the length of the 6th segment. Pereopods V in females are slightly longer than pereopods IV, while in immature specimens or in males they may be equal to or shorter than pereopods IV. Possibly, these are individual differences and are not sex related. The 4th segment of pereopods V is slightly shorter than the 5th segment, which in turn is equal to or slightly shorter than the 6th; the claw is strong and straight. Pereopods VI are longer and stronger than pereopods V; their 4th segment is 1/2–2/3 the length of the 5th segment; the 6th segment is longer than the 5th. Pereopods VII are much shorter and weaker than pereopods VI; their 4th segment is 2/3 the length of the 5th segment; the 6th segment is much longer than the latter; the claw is straight.

Uropods I and II have narrowly lanceolate rami.

Uropods III may have broadly or narrowly lanceolate rami. The triangular telson is 1/2–2/3 the length of the basipodite of uropods III.

Notes: Some differences are apparent among specimens from the Atlantic and Pacific oceans. In the latter specimens the 5th segment of pereopods II is slightly shorter, pereopods V in some specimens are
102 shorter and not longer than pereopods IV, the rami of uropods III are narrower, and the telson is about 1/2 and not 2/3 the length of the basipodite of uropods III. But as all these characters are subject to individual differences, we do not consider them sufficient for taxonomic separation of the Pacific and Atlantic ocean crustaceans.

Distribution: Atlantic Ocean (region of Bermuda Islands). Common in the northwestern part of the Pacific Ocean north of 38° N (including the Sea of Okhotsk and the Bering Sea). In the Atlantic Ocean these crustaceans have been found in through catches from 1,900 m up to the surface; in the Pacific Ocean they inhabit depths of the meso- and



101 Fig. 37. *Mimonecteola beebei* Shoemaker, female (after Shoemaker, 1945a).

bathypelagic from 500 to 3,000 m (catches from 500–750, 1,000–1,500, 2,500–3,000 m) but are most common at depths of 1,000–1,500 m.

2. ***Mimonecteola diomedeae*** Woltereck, 1909 (Fig. 38)

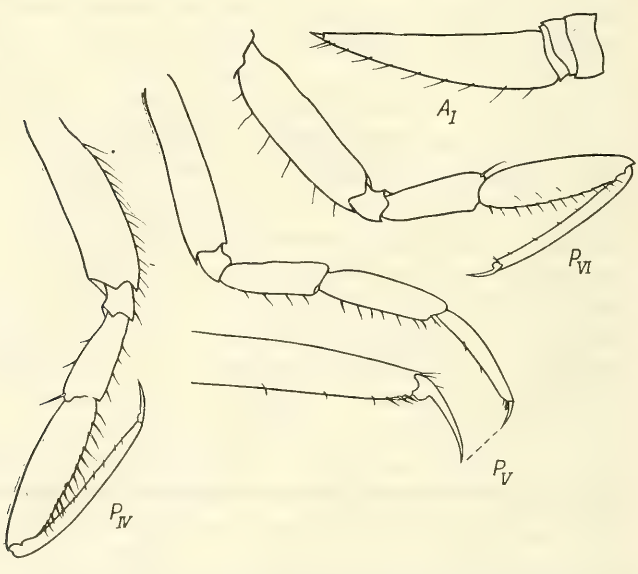
Woltereck, 1909: 153; Vinogradov, 1964: 120.—beebei (non Shoemaker, 1945a: 124); Vinogradov, 1960a: 212 (non Vinogradov, 1956: 199, 1957: 204).

Length of sexually mature specimens 10 to 12 mm.

Pereopods IV: the 6th segment is slightly longer than the 5th and slightly narrows distally; the 5th segment is oblong-oval; the claw is 2/9–1/4 the length of the 6th segment. Pereopods V: the 6th segment is equal to the 5th in length and nearly 2/3 of the 2nd segment, narrowly conical, slightly narrowing distally, its distal end broader than the claw base, slightly obtuse and bearing several strong setae; the 5th segment is longer than the 4th; the claw is straight, 2/9–1/3 the length of the 6th segment. Pereopods VI: the 6th segment is insignifically longer than the 5th and almost twice longer than the 4th; the 5th segment is oblong-oval; the 7th segment is 1/4 the length of the 6th segment.

The telson reaches half the length of the basipodite of uropods III but may vary in length somewhat.

Notes: This species, considered the type species of the genus, was very briefly described and schematically and inaccurately illustrated by Woltereck. Hence, in the description given above, based on a study of the new material from the Indian Ocean, certain details do not correspond with the illustration provided by Woltereck.



102 Fig. 38. *Mimonecteola diomedeae* Woltereck, female (after Vinogradov, 1964).

103 *Distribution*: Pacific Ocean (coast of Peru, the Solomon Sea; 40°21′ S 158° W); Indian Ocean north of madagascar and in the central part (10° S, 86° 30′ E). Found in through catches from depths greater than 1,000 m to the surface.

3. ***Mimonecteola mixta*** Vinogradov, 1964 (Fig. 39)

Vinogradov, 1964: 122.

Length of sexually mature specimens 9,5–11 mm.

Pereopods III and IV are identical in structure but pereopods IV longer; the distally almost not broadened 4th segment of pereopods IV is 2/3 the length of the 5th segment; the 6th segment is equal to or somewhat shorter than the 5th.

Pereopods V: the 4th segment is slightly shorter than the 5th; the narrower 6th segment has parallel margins, does not narrow distally, and is nearly equal in length to the 5th segment. In females the 6th segment
104 is armed in the distal part of the posterior margin with a short row of strong paired setae forming an almost palmate margin, much shorter than the length of the claw. In males the row of setae on the palmate margin is longer but the setae themselves are thinner; the claw is longer and stronger in females. Pereopods VI: the thin 6th segment is 1.5 times longer than the 5th while the 4th segment is somewhat shorter than it. Pereopods VII: the 5th segment is equal to the 4th and 2/3 the length of the 6th; the latter almost does not narrow distally, its posterior margin extending beyond the base of the claw and forming the spoon-shaped depression so characteristic of the Lanceolidae; the anterior margin of the segment has a depression in the distal part into which the short curved claw may be retracted, forming a shape similar to the subchela.

The triangular telson reaches half the length of the basipodite of uropods III.

Distribution: Pacific Ocean in the region of the deepwater Philippine Trench, and 13°35′ N 101°45′ W; eastern part of the equatorial region of the Indian Ocean (0°, 83° E). It is found in through catches from depths of several thousand meters to the surface.

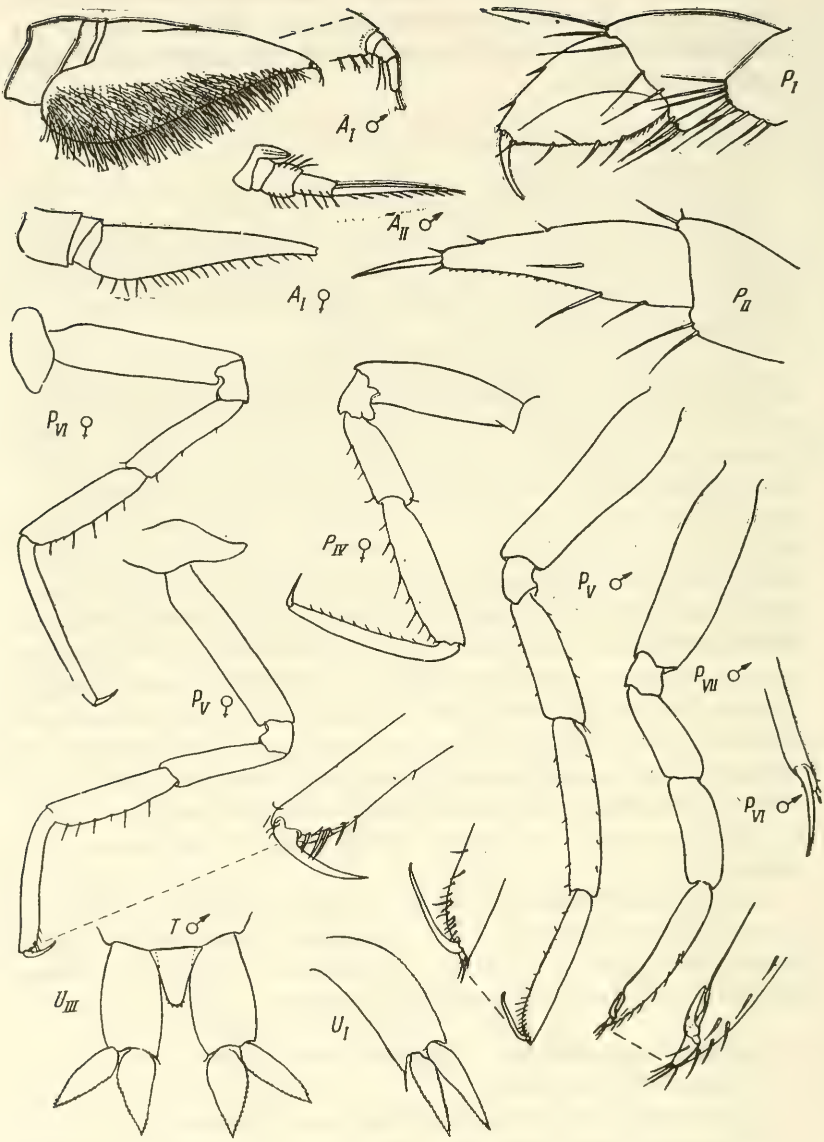
4. ***Mimonecteola subchelata*** Vinogradov, 1964 (Fig. 40)

Vinogradov, 1964: 124.

One sexually immature female 8 mm long is known.

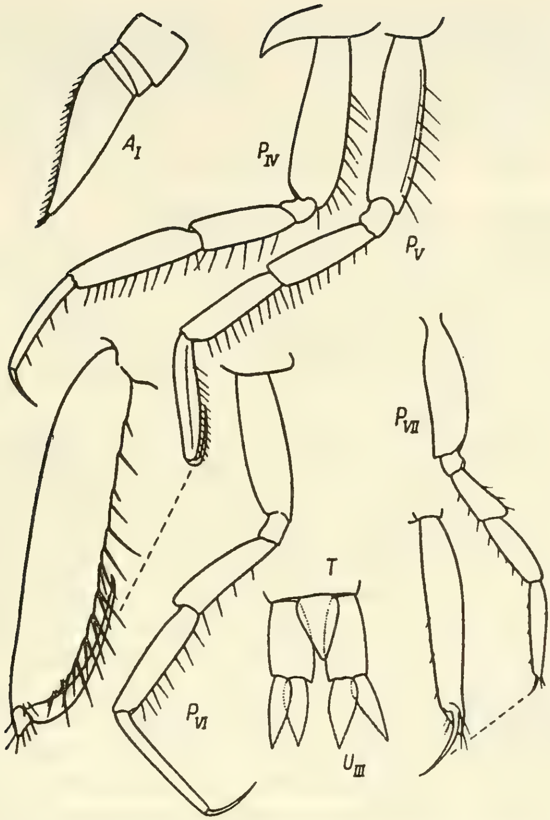
The general shape, structure of antennae, mouthparts and pereopods I–II are the same as in other species of the genus.

105 Pereopods IV; the distally slightly narrowing 6th segment is slightly shorter than the 5th, which also narrows only slightly distally; the claw is long, about 1/3 the length of the 6th segment. Pereopods V: the 6th segment is oblong ovate, slightly longer than the 5th and 2/3 the length of the 2nd segment; its convex posterior margin is armed with long setae,



103 Fig. 39. *Mimonecteola mixta* Vinogradov (after Vinogradov, 1964).

fairly densely in the distal half so that a long palmate margin is formed, whose length exceeds the length of the slightly curved claw; the claw is just about 1/2 the length of the 6th segment; the 5th segment is equal to the 4th and 2/3 the length of the 2nd. Pereopods VI: the 6th segment is



104 Fig. 40. *Mimonecteola subchelata* Vinogradov, female (after Vinogradov, 1964).

almost equal to the linear 5th segment, which in turn is slightly longer than the 4th. The long straight claw is just about half as long as the 6th segment. Pereopods VII: the 4th segment is slightly shorter than the 5th, which in turn is almost 2/3 the length of the 6th segment; the spoon-shaped formation in the distal part of the 6th segment into which the almost straight long claw may be retracted, is weakly developed.

The telson reaches 3/4 the length of the basipodite of uropods III.

Distribution: Indian Ocean (6°32′ S, 100°08′ E) in catches from 0–4,600 m.

2. Genus *Microphasma* Woltereck, 1909

Woltereck, 1909: 153; Stephensen and Pirlot, 1931: 539.

The body is compact, smooth, and with a spherically bulging pereon in both sexes. The eyes are small and poorly discernible. Antennae I are short, slightly projecting beyond the anterior margin of the head. Antennae II are slightly shorter than antennae I; the 2nd segment of the peduncle bulges in the form of a vesicle. The antennal gland is very large.

The mandibular palp is weak. Pereopods III and V have a subchela formed by the amygdaloid 6th segment and strong curved claw.

Type species: *Microphasma agassizi* Woltereck, 1909.

1. ***Microphasma agassizi*** Woltereck, 1909 (Fig. 41)

Woltereck, 1909: 153; Pirlot, 1930: 52; Stephensen and Pirlot, 1931: 539; Shoemaker, 1945a: 218.

Length of sexually mature female up to 8 mm, male up to 6 mm.

The color of an unfixed animal is cherry-red.

Antennae I are longer than the pereon somite I, in males longer and thicker than in females.

Mandibles with a short body and a broad cutting edge; the weak three-segmented palp is equal in length to the body of the mandible, its distally narrowing 3rd segment slightly shorter than the 2nd. The outer lobe of maxillae I is broad and armed with 4–5 strong spines; the inner lobe is broad with a truncated distal margin. The lobes of maxillae II are nearly equal in length and breadth. The outer lobe of the maxillipeds is oblong-ovate, and armed with setae; the inner lobe is well developed.

Pereopods I have a distally broadening triangular 5th segment equal in length to the conical 6th segment; the claw very slightly exceeds the length of the 6th segment. Pereopods II are slightly longer than pereopods I, their 6th segment longer than the 5th and slightly curved. Pereopods III and IV are equal in length and identical in structure, longer and stronger than the preceding and succeeding pereopods, their 2nd segment nearly equal to the 4th and 5th segments together; the amygdaloid broad 6th segment is equal to the 2nd, with a well-developed smooth palmate margin armed with a
107 few strong spines; the strongly curved claw is equal in length or slightly shorter than the palmate margin and forms a subchela with it. Pereopods V are shorter than pereopods III and IV and almost identical in structure; the palmate margin of the 6th segment is shorter, steeper, and armed with still shorter spines; the length of the claw exceeds the width of the 6th segment. Pereopods VI are shorter than pereopods V; the 2nd segment is longer than the 4th and 5th together, which in turn are almost equal to the distally narrowing 6th segment; the strong claw is 1/2 the lengh of the 6th segment. Pereopods VII are still shorter; the 2nd segment is equal to the 6th or 4th and 5th together; the claw is long, strong and slightly curved.

The uropods have narrowly lanceolate rami. The rounded-triangular, sometimes almost hemispherical telson reaches half the length of the basipodite of uropods III.

Distribution: Northern and tropical part of the Atlantic ocean (Bay of Biscay, near Madeira Island, among the Azores and Bermuda Islands);

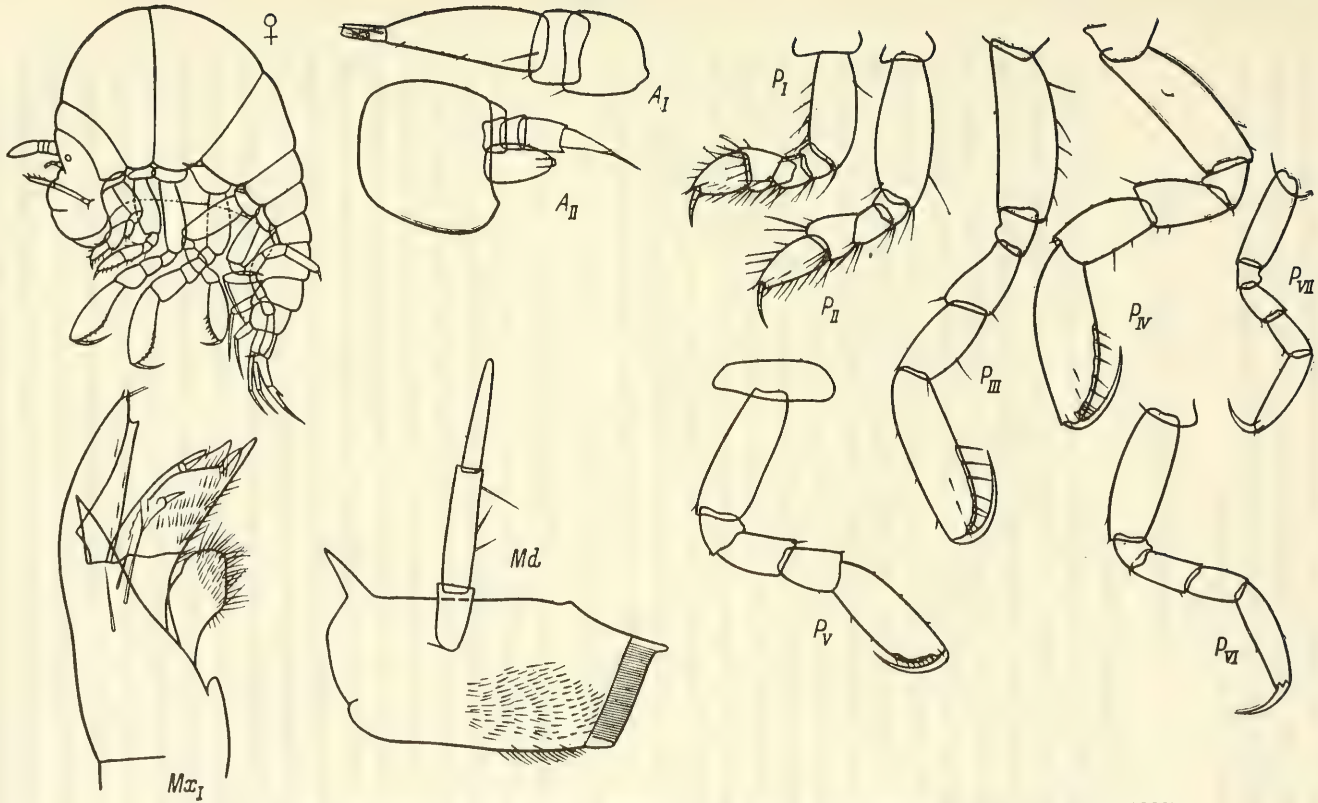


Fig. 41. *Microphasma agassizi* Woltereck (general view of female—after Woltereck, 1909; rest—Pirlot, 1939).

western part of the Indian Ocean including the Arabian Sea; northwestern part of the Pacific Ocean (Kuril-Kamchatka region) and also near Peru and in the region of kermadec Islands. It is found in catches from depths of 970–1,920 and 1,900–3,750 m and in through catches form depths of over 2,000 m up to the surface.

3. Genus *Microphasmoides* Vinogradov, 1960

Vinogradov, 1960a: 213.

The body is compact, smooth, and with a spherically bulging pereon. The eyes are absent. Antennae I are small, not projecting beyond the line of the frons; the flagellum has three well-developed distal segments. Antennae II are very short; the peduncle has a vesicularly bulging 2nd segment and short distal segments; the flagellum is small and the cone of the antennal gland strongly developed. The mouthparts are the same as in other genera of the family Microphasmidae. The mandibular palp is weak. Pereopods I–II have a distally broadened 5th and conical 6th segment. Pereopods III–IV are simple. The short palmate margin of the broad 6th segment of pereopods V is armed with strong setae that form a pseudochela with the falcate claw. Pereopods VI–VII have a distally narrowed 6th segment and strongly curved claws that are identical in structure. Pereopods VII are much weaker than pereopods VI.

Type species: *Microphasmoides vitjazi* Vinogradov, 1960.

This genus is very close to *Microphasma*; only the structure of pereopods III and IV differs significantly.

1. ***Microphasmoides vitjazi*** Vinogradov, 1960 (Figs. 42, 43)

Vinogradov,1960a: 214.

Length of sexually immature specimens 5 to 6 mm.

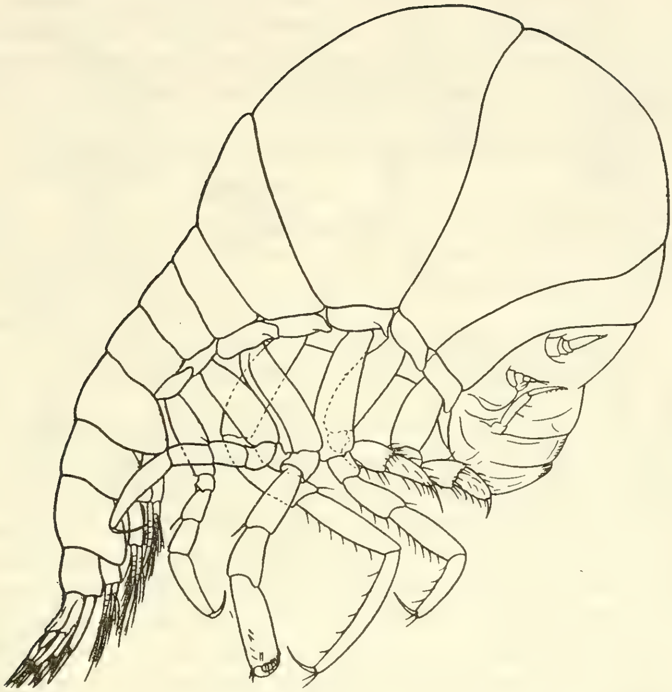
The color of unfixed crustaceans is cherry-red.

The flagellum of antennae I is less than 1.5 times longer than the peduncle, its proximal segment five times longer than the three distal segments together. Antennae II are slightly shorter than antennae I, seven-segmented, the vesicularly bulging 2nd segment slightly longer than the remaining part of the antenna.

The mandibles have a weak, thin palp that is nearly equal in length to the mandibular body. The outer lobe of mixillae I has a straight truncated edge armed with seven spines or the distal margin; the inner lobe is small, oval; the palp slightly narrows distally. The maxillipeds have a fairly large inner lobe, almost reaching half the length of the outer lobe.

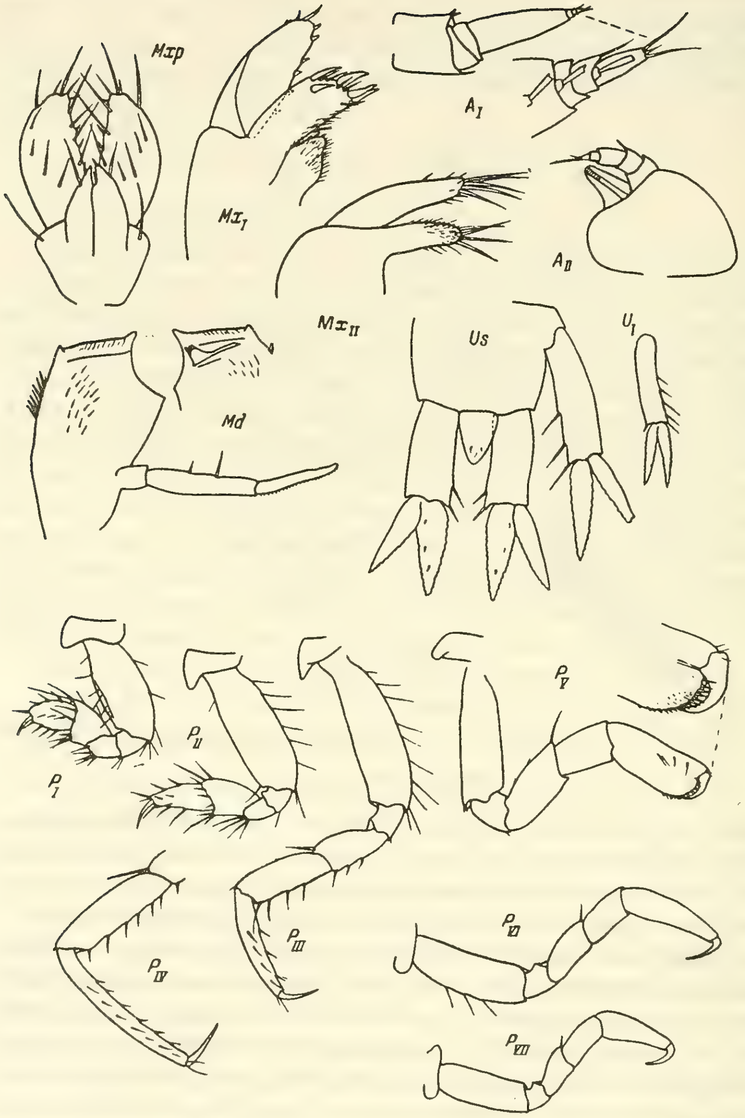
108 Coxal plates I–V have a slightly stretched, roundish lower anterior angle; coxal plates VI–VII are oval.

In pereopods I the 5th segment is equal to the 6th. Pereopods II are identical in structure but slightly longer; the 5th and 6th segments are



108 Fig. 42. *Microphasmoides vitjazi* Vinogradov, sexually immature specimen (after Vinogradov, 1960a).

equal; the claw is long and strong. Pereopods III are more than 1.5 times longer than pereopods II, their 2nd segment is almost equal to the 4th and 5th segments together; the narrower 6th segment is almost twice longer than the 4th; the claw is long, strong, and slightly curved. Pereopods IV are longer than pereopods III because of the greater length of the distal segments. Pereopods V are shorter than IV but the distal segments (particularly the 6th) are markedly massive; the 2nd segment is equal to the 4th and 5th together and slightly longer than the 6th; the 6th segment is very broad, almost linear and forms with the claw a well-developed subchela; its palmate margin is shorter and steeper than in the *Microphasma* and armed with a row of strong, short setae, increasing in size in the distal part of the row; the length of the strong curved claw is less than the width of the 6th segment. Pereopods VI are slightly shorter than pereopods V and much weaker; their 2nd segment is equal to the 4th and 5th together and slightly longer than the markedly distally narrowing 6th segment; the claw is long, strong, and curved. Pereopods VII are the same in structure and length ratios of segments as pereopods VI but only 2/3 their length.



109 Fig. 43. *Microphasmoides vitjazi* Vinogradov, sexually immature specimen (after Vinogradov, 1960a).

The uropods have lanceolate, acute, and denticulate rami. The telson is triangular with an obtuse tip; it reaches half the length of the basipodite of uropods III.

Distribution: Tropical regions of the Pacific and Indian oceans in the region of the Philippines, New Hebrides, and Japanese deepwater trenches. It is found in catches from depths of 500–2,000 m and in through catches from depths of 1,700 m and more to the surface.

110 **SUPERFAMILY SCINOIDEA STEBBING, 1888**

The pereon of males does not bulge. Antennae I of males (often in both sexes) longer, not shorter than four-five pereon somites. The cutting edge of the mandibles is narrow; the mandibular palp is absent or only its one-segmented rudiment retained.

V. Family MIMONECTIDAE Bovallius, 1885

Crustaceans of medium size, length up to 25–30 mm. The pereon is broad and in sexually mature females spherically bulging due to the enlarged somites I–V. All the pereon somites are free. The head is not longer than pereon somite I and high. The eyes are small, consisting of several facets, or absent. Antennae I have a short two- or three-segmented peduncle; the flagellum consists of a long, narrowly conical proximal segment and three small distal segments; the total length of antennae I in females is more than the length of pereon somite I and in males may reach the length of its five somites. Antennae II in females are small and rudimentary, in males longer, thin, sometimes just slightly exceeding the length of antennae I. The mandibles have an accessory plate; the palp is either absent or a one-segmented rudiment present. The maxillipeds have a weakly armed oval outer lobes and a separate inner lobes. The coxal plates are free. The pereopods are simple. The 5th segment of pereopods I and II is only slightly broadened distally. Pereopods III–VII barely differ in length. The uropodal rami are free. The telson is short and triangular.

The family includes two genera.

KEY TO GENERA OF FAMILY MIMONECTIDAE

1. Mandibles lack palp; outer lobe of maxillae I normally developed and roughly equal in length to palp; claws of pereopods VI–VII small, straight or slightly curved .... 2. ***Mimonectes*** Bov.

— Mandibles with rudimentary one-segmented palp; outer lobe of maxillae I weakly developed, shorter than palp; claws of pereopods VI and VII large and falcate .... 1. ***Pseudomimonectes*** Vinogr.

1. Genus *Pseudomimonectes* Vinogradov, 1960

Vinogradov, 1960a: 219.

The body integument is thin. The head lacks a rostrum. Eyes are absent. Antennae I are longer, vesicular, and the distal segments of the flagellum well developed. The labrum is roundish, with a notch in the anterior part. The mandibles have a rudimentary one-segmented palp. Maxillae I have a weakly developed outer lobe. Maxillae II have narrow lobes that are equal in length. The maxillipeds are small, weakly armed, and have narrow inner lobes. Perepods VI–VII are short and strong, with falcate claws. The uropods are weak, the tips of the rami obtuse.

Type species: *Pseudomimonectes robustus* Vinogradov, 1960.

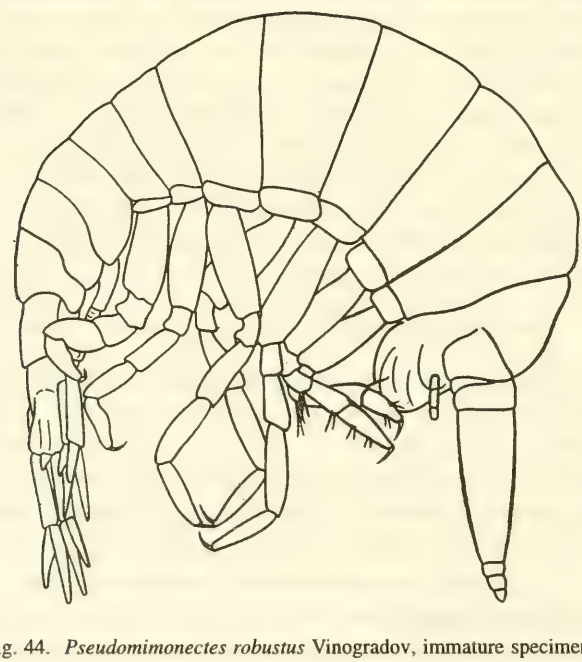
1. ***Pseudomimonectes robustus*** Vinogradov, 1960 (Figs. 44, 45)

Vinogradov, 1960a : 219.

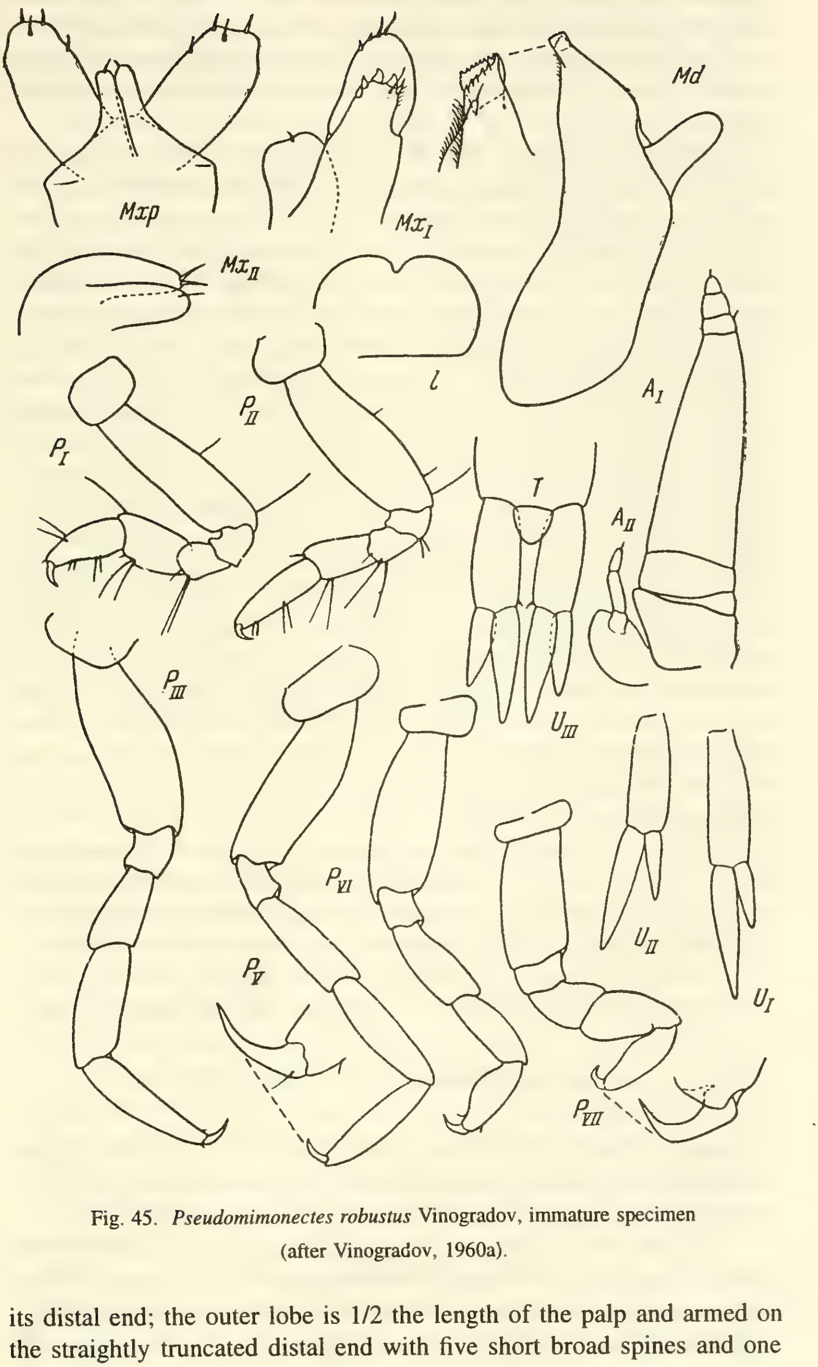
Known from just one immature specimen 4.5 mm in length.

The body is compact. The head is equal in length to pereon somite I. The mouth cone projects slightly. Antennae I are well developed; the
111 vesicular, bulging, four-segmented flagellum is 2.5 times longer than the peduncle, its distal segments constituting 1/4 the length of the conical proximal segment. Antennae II are equal in length to the peduncle of antennae I.

The labrum in round, with a notch on the anterior margin, which is characteristic of the Mimonectes. The mandibles are large, the width of the accessory plate slightly more than the width of the cutting edge. The broadly oval palp of maxillae I bears two setae and two short spines at



111 Fig. 44. *Pseudomimonectes robustus* Vinogradov, immature specimen (after Vinogradov, 1960a).



112 Fig. 45. *Pseudomimonectes robustus* Vinogradov, immature specimen (after Vinogradov, 1960a).

its distal end; the outer lobe is 1/2 the length of the palp and armed on the straightly truncated distal end with five short broad spines and one long seta; the inner lobe is broad. The outer lobe of maxillae II is armed with two apical setae, the inner lobe with one seta. The maxillipeds are weak; the outer lobes are elongated-oval with a truncated apex; the inner lobes narrow, with a rounded apex; each inner lobe is armed with a short apical seta.

Coxal plates I–II are rectangular. Coxal plates V–VII are oval. The gills are located ventrally on somites II–VI. The length of the 2nd segment of pereopods I is equal to that of the 4th, 5th and 6th together; the distally very weakly broadened 5th segment is equal to the conical 6th segment. Pereopods II are much longer and stronger than pereopods I, their 2nd segment slightly broader and the 5th segment narrower than in pereopods I; the 6th segment is longer and equal to the 4th and 5th together. Pereopods III and IV are equal in length and identical in structure; their distally slightly broadened 2nd segment is equal in length to the 4th and 5th segments together; the 4th segment is 2/3 the length of the 5th, which in turn is only slightly shorter than the 6th. Pereopods V are equal in length to pereopods III and IV but somewhat weaker; their 2nd segment is shorter than the 4th and 5th segments together; the 4th segment is only slightly shorter than the 5th and equal to the 6th; the claw is long and slightly curved. Pereopods VI are shorter but stronger than pereopods V; the 4th segment is equal to the 5th and slightly longer than the 6th; the latter broadens in the middle. Pereopods VII are still shorter and stronger; the width of the 2nd segment is only 1/2 its length; the distally broadened 4th segment is 2/3 the length of the 5th segment,
112 which markedly broadens in the anterior third of its length and then narrows; the 6th segment is equal in length to the 5th thinner; the claw is strong and falcate.

The rami of the uropods are narrowly lanceolate. Exopodites of uropods I and II are 1/2 and exopodite of uropods III is 2/3 the length of the endopodite; the tip of both rami of all the uropods is rounded. The oval-triangular telson is 1/2 the length of the basipodite of uropods III.

Distribution: The lone specimen was found in the Pacific Ocean in the deepwater Ryukyu Trench in a catch from the 4,080–5,500 m layer.

113 ## 2. Genus *Mimonectes* Bovallius, 1885

Bovallius, 1885a: 2, 1889: 59; Stephensen and Pirlot, 1931: 503.—Parascina Stebbing, 1904: 20; Pirlot, 1929: 53.—Sphaeromimonectes Woltereck, 1904b: 621, 629; 1906b: 865, 1927: 80; Pirlot, 1929: 54.

The body has a thin integument. The head lacks a rostrum. The eyes are small, poorly discernible or inconspicuous. Antennae I are long and strong; the distal segments of the flagellum are well developed. The mandibles lack a palp but have a developed accessory plate. The outer lobe of maxillae I is well developed and almost not shorter than the one-segmented palp. The outer lobe of the maxillipeds is large and broadly oval. The pereopods have nonretractile claws.

Type species: *Mimonectes loveni* Bovallius, 1885.

The genus *Mimonectes* was separated by Bovallius in 1885 and served as the basis for the formation of the family Mimonectidae. In this family Bovallius also included the genus *Sphaeromimonectes*, while Stebbing (1904) added the genus *Parascina*. Later, Woltereck (1906b, 1927) came to the conclusion that the genus *Parascina* is a younger form or male of the genus *Sphaeromimonectes*.

While describing the genus *Mimonectes*, Bovallius accepted some inaccuracies (he was not certain about the number of gills) and included in it the species *Mimonectes steenstrupi* (= *Archaeoscina steenstrupi*), which differs from other species of the genus in the presence of a mandibular palp, thereby actually belonging to another family; the differences between the genera *Sphaeromimonectes* and *Mimonectes* mentioned by Woltereck almost entirely depend on the errors in the description of Bovallius and structural peculiarities of *A. steenstrupi*. If these were not considered, the basis for the separation of these two genera would disappear. Thus we are compelled to support Stephensen and Pirlot (1931) who combined the genera *Mimonectes, Sphaeromimonectes*, and *Parascina* into a single genus, *Mimonectes*.

The genus includes five species.

KEY TO SPECIES OF GENUS MIMONECTES

1. Sixth segment of pereopods I and II terminates in an acute projection extending above base of the claw. Sixth segment of pereopods III and IV sharply narrows distally .... 2.

— Sixth segment of pereopods I and II lacking projection above base of the claw. Sixth segment of pereopods III–IV only slightly narrows distally .... 3.

2. Sixth segment of pereopods I conical, narrowing distally. Projection above claw narrow .... 4. ***M. gaussi*** (Wolt).

— Sixth segment of pereopods I oval, almost not narrowing distally. Projection above claw broad .... 5. ***M. diomedeae*** (Wolt.).

3. Sixth segment of pereopods II with notch in distal part of posterior margin .... 1. ***M. sphaericus*** Bov.

— Notch absent in distal part of posterior margin of 6th segment of pereopods II .... 4.

4. Pereopods VI–VII with long, slightly curved claws; 3rd segment only slightly shorter (roughly 1/3) than 4th segment.....................
....3. ***M. spandli*** Steph. and Pirl.

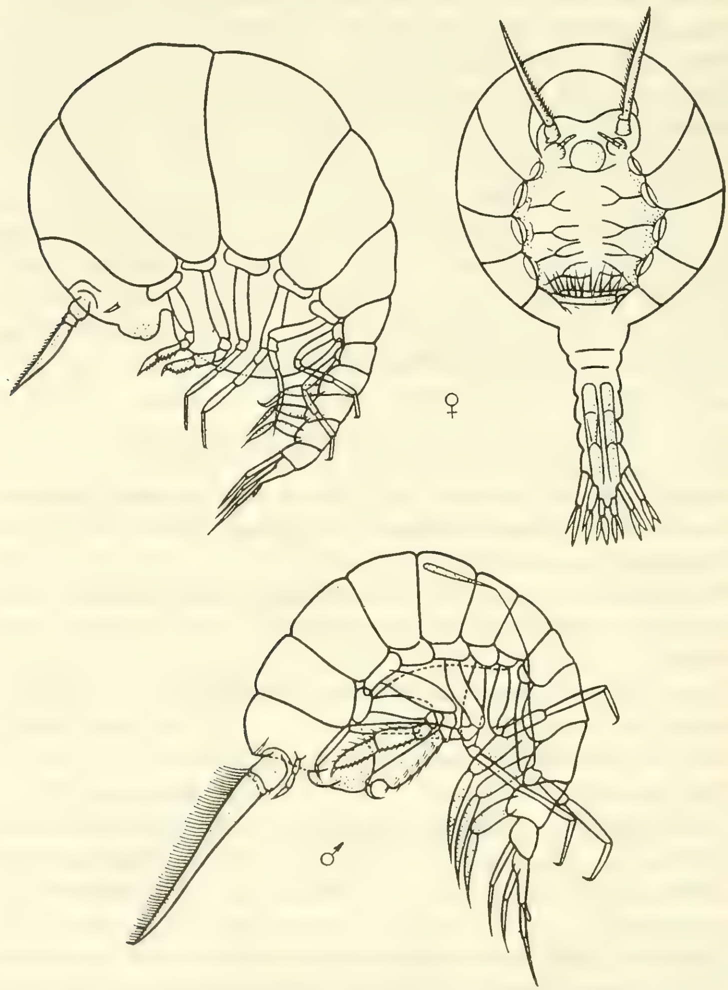
— Pereopods VI–VII with short falcate claws; 3rd segment not less than 2/5–1/2 length of 4th segment . . . . 2. ***M. loveni*** Bov.

114 1. ***Mimonectes sphaericus*** Bovallius, 1885 (Figs. 46, 47)

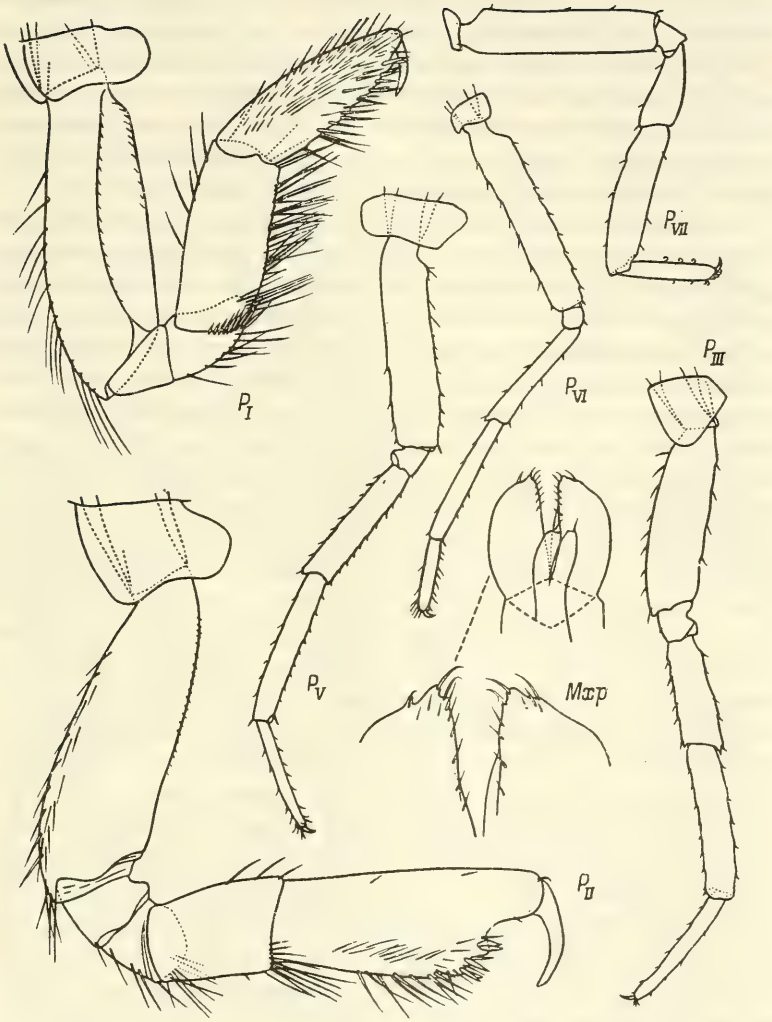
Bovallius, 1885a: 11, 1889: 66; Stephensen and Pirlot, 1931: 516; Behning, 1939: 364.—*valdiviae* Woltereck, 1904a: 621, 1909: 148 (*Sphaeromimonectes*).

Length of sexually mature males 10 mm, females 18 mm.

Antennae I have a two-segmented peduncle; the flagellum has a long conical proximal segment with pubescence along the margin (especially



114 Fig. 46. *Mimonectes sphaericus* Bovallius (after Woltereck, 1909, 1927).



115 Fig. 47. *Mimonectes sphaericus* Bovallius, male (after Shoemaker, 1945a).

in males); of the three distal segments, the apical one is narrow but somewhat longer than the two preceding ones. In females the antennae are slightly longer than pereon somite I and in sexually mature males more than 5-6 pereon somites in length.

Maxillae I have a pateloid palp and an elongated-roundish inner lobe. In females the inner lobe of maxillae II is nearly equal to the outer in width, in males 1.5-2.0 times broader, armed with three strong setae and

pubescent in the distal part.The outer lobe of the maxillipeds is armed in the distal part of the inner margin with short setae, with somewhat larger setae present on the distal angle of each lobe; between the apical and the preceding setae there is a somewhat developed notch so that the outer
115 seta seems as if attached to an independent prominence, which Woltereck (1909) considered a rudimentary maxillary palp; the inner lobe is long, deeply split, and a small apical seta is present on each lobe.

In males pereopods I are strong; the 2nd segment is shorter than the 5th and 6th together; the linear or distally very weakly broadened 5th segment is equal to or slightly shorter than the oval-conical 6th segment; the 6th segment is armed with numerous setae, with especially strong ones on the posterior margin; the distal part of the posterior margin, in addition to setae, bears short blunt spines; the long, strong, slightly curved claw is apically attached. In females pereopods I are much weaker though the ratios of their segments are the same. Pereopods II are slightly longer than pereopods I; in sexually mature males the 6th segment is equal to or slightly shorter than the 2nd segment, amygdaloid in shape, with a notch in the distal part of the posterior margin locking in the strong
116 curved claw; the distal part of the posterior margin of the segment bears long setae and several short blunt spines. The notch in the distal part may vary in development; sometimes it is only weakly developed and sometimes in large sexually mature specimens markedly developed, in which case the segment broadens distally. Such an extreme form was described as a unique species, *M. valdiviae*. In young crustaceans and in females the 6th segment is always amygdaloid; the notch in the distal part of its posterior margin is developed to a lesser degree and the segment itself is relatively shorter. Pereopods III and IV are longer than the preceding ones, the 2nd segment may be broadened, shorter than the 4th and 5th segments together, or rarely equal to them; the 4th segment is either shorter than the 5th or nearly equal to it; the thin 6th segment may be shorter or slightly longer than the 5th; the variations in the length proportions of these segments are not sex related; the linear or narrow amygdaloid 6th segment is shorter than the 5th, and may be shorter or longer than the 4th segment. Pereopods VI are slightly thinner than pereopods V; the 2nd, 4th, and 5th segments are usually linear although in some specimens the 4th segment is markedly broadened distally while the 5th is broadened in its middle part; the 6th segment is narrowly oval; the 4th and 5th segments are roughly equal in length, or the 4th is somewhat longer than the 5th but the 6th is shorter than each of them[3], although Woltereck (1909) illustrates on the total outline of the male an

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[3] In the illustration provided by Behning (1939) pereopods VI and VII have been confused.

inverse length ratio of these segments, which is evidently explained by an inaccuracy in drawing—so characteristic of this author. Pereopods VII are shorter but stronger than pereopods VI; their 5th segment is considerably (1.4–1.8 times) longer than the 4th and slightly longer than the linear or narrowly oval 6th segment. The claws of pereopods V–VII are short, strong, and curved.

Distribution: Northern and tropical regions of the Atlantic Ocean (Bay of Biscay, Canary Islands, Madeira Island, Bermuda Islands); tropical regions of the Indian Ocean from 6° N to 30° S; various regions of the Pacific Ocean (Bering Sea and Kuril-Kamchatka Trench, Philippine Sea, Galapagos Islands, Tonga Trench); Antarctic waters: 64°03′ S, 161°59′ E. Young specimens are found in catches from depths of 200 to 2,000 m but sexually mature females or the casts of spawned females have been found repeatedly right at the surface.

2. ***Mimonectes loveni*** Bovallius, 1885 (Fig. 48)

Bovallius, 1885a: 3, 1889: 60; Shoemaker, 1945a: 219.—*cultricornis* Woltereck, 1906: 862, 1927: 83 (*Sphaeromimonectes*).—*chevreuxi* Pirlot, 1929: 56; Stephensen and Pirlot, 1931: 531; Barnard, 1932: 253 (*Parascina*), 1937: 179.

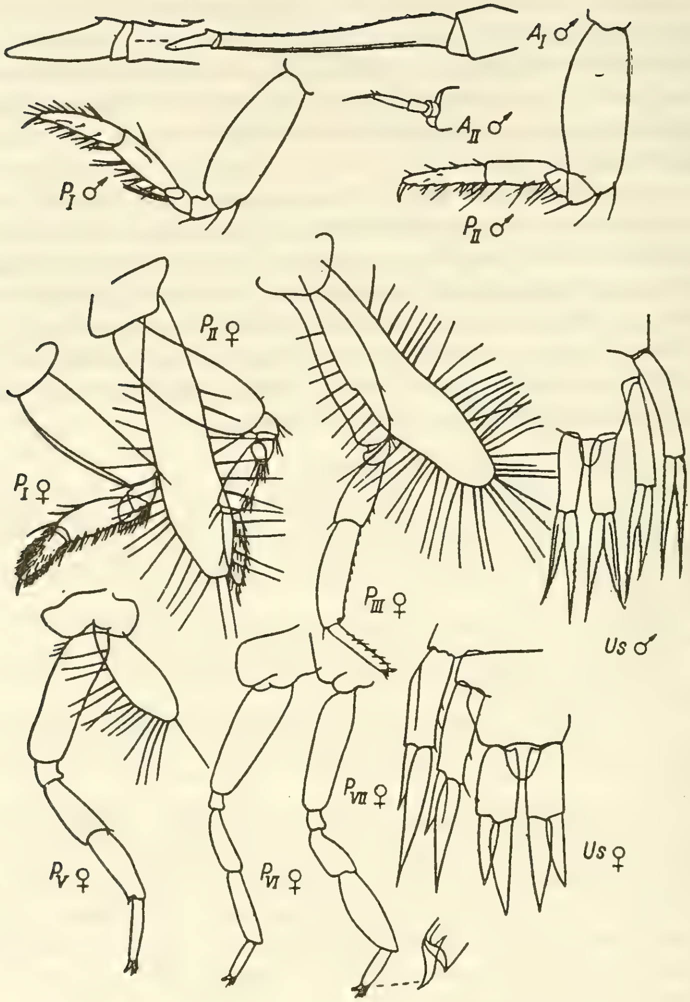
Maximum size of males 13 mm, of females 24–28 mm.

In external appearance and basic structural features this species is close to the preceding one.

For *M. loveni*, the very large and broad apical segment of antennae I is characteristic; it is many times longer than the two preceding distal segments.

The cutting edge of the mandibles is considerably broader than in *M. sphaericus*; the accessory plate constitutes nearly half its width. The inner lobe of maxillae I is oval, with a small apical seta. The inner lobe of maxillae II is broader than the outer and armed with three (two on the outer lobe) strong setae. The maxillipeds are identical to those of *M. sphaericus* but lack the characteristic notch in the distal part of the outer margin of the outer lobe.

The 2nd segment of pereopods I is roughly the same length or slightly shorter than the 5th and 6th segments together; the 5th seg-
117 ment is equal to or slightly longer than the 6th; the oval-conical 6th segment is armed with numerous setae but devoid of blunt spines on the posterior margin. Pereopods II are slightly longer but not stronger than pereopods I; the 2nd segment is equal to or slightly longer than the 5th and 6th together; the latter two segments are roughly equal in length; the conical or oval-conical 6th segment does not have a notch in the distal part of the posterior margin in either males or females, its distal angles below and above the claw forming very small denticles; the claw is short and straight. The 2nd segment of pereopods III and IV is shorter than or



117 Fig. 48. *Mimonectes loveni* Bovallius (after Stephensen and Pirlot, 1931).

equal to the 4th and 5th segments together; the 4th segment is shorter than the 5th, which is nearly equal to the narrowly oval 6th segment; the claw is long and almost straight. The structure and length ratios of pereopods V–VII are roughly the same as in *M. sphaericus*; the 5th segment of pereopods VII is usually broad, amygdaloid in shape, and just barely longer than the distally broadened 4th segment. It is significant to note that the 3rd segment of pereopods V–VII is also short, as in *M. sphaericus*; it is not less than 2/5–1/2 the length of the 4th segment in the corresponding pereopods ; the claw is short and falcate.

Distribution: Known from many places in the Atlantic Ocean, from Greenland (63° 19′ N, 26°50′ W) to the Bermuda and Azores islands, and
118 the Gulf of Guinea. In the Indian Ocean it is found from the Arabian Sea and Malayan Archipelago to 35° S. In the Pacific Ocean it has been reported from the Kuril-Kamchatka region as well as tropical and equatorial regions of the western part of the ocean. Young individuals have been found in catches from depths of 200–1,000 m and the casts of spawned females right at the surface.

3. ***Mimonectes spandli*** Stephensen and Pirlot, 1931 (Fig. 49)

Stephensen and Pirlot, 1931: 532; Shoemaker, 1945a: 244.—*steenstrupi* (non *steenstrupi* Bovallius, 1885a); Pirlot, 1929: 46.

Length of sexually mature specimens 7–15 mm.

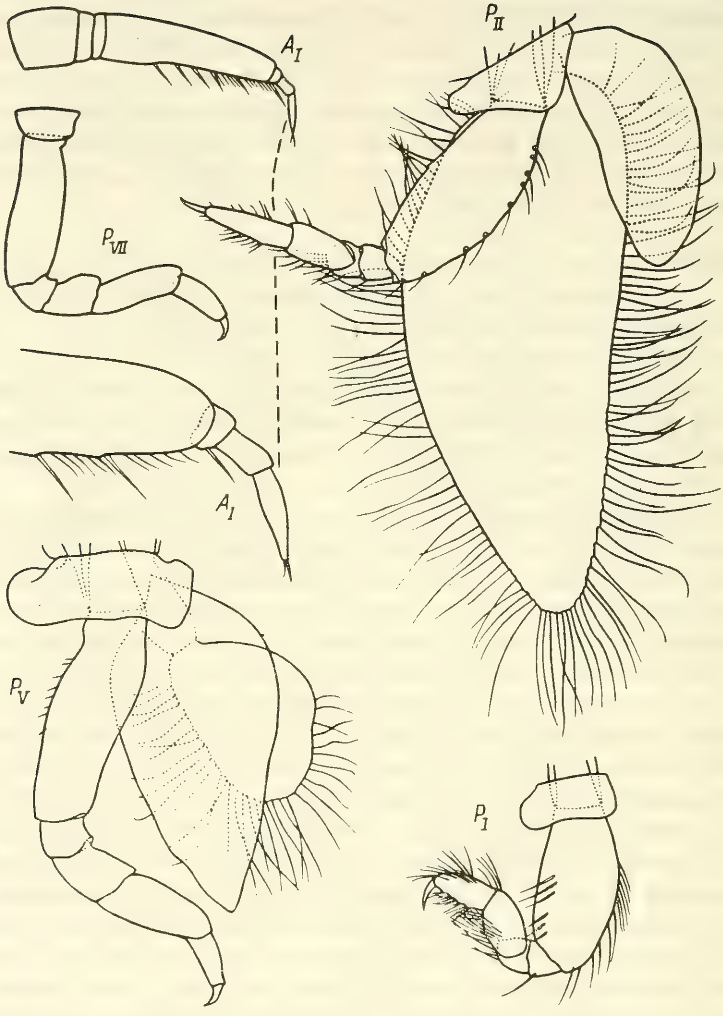
Antennae I have a three-segmented peduncle; the proximal segment of the flagellum (in females) is fairly broad and conical, the distal segments large, of which the conical apical segment is narrower but longer than the two preceding segments.

The mandibles are narrow with a finely denticulate cutting edge and a small accessory plate. The lobes of maxillae I are highly pubescent, the inner lobe small and oval. The lobes of maxillae II are narrow, the outer
119 lobe slightly shorter but broader than the inner. The outer lobe of the maxillipeds is oval with a rounded distal angle, and armed on the inner margin with sparse setae; the inner lobe is short and not deeply split.

The pereopods are short and strong with broad segments. In sexually mature females pereopods I–V have a broad 2nd segment. The 2nd segment of pereopods I is longer than the 5th and 6th together; the conical 6th segment is slightly longer than the 5th or equal to it; the claw is long, strong, and almost straight. In pereopods II the narrowly conical 6th segment is appreciably longer than the 5th and the claw is straight. Pereopods III and IV are the longest of all, the 4th segment unusually short—only slightly longer than the 3rd and less than half the length of the 5th segment; the narrow 6th segment is shorter than the 5th; the claws are strong and almost straight. Pereopods V and VI have identical ratios but pereopods V are slightly longer; the 2nd segment is slightly larger than the 3rd, 4th, and 5th together; the 4th segment is very short, less than half the length of the 3rd; the conical 6th segment is shorter and narrower than the broad 5th segment; the claws are long, strong, and slightly curved. Pereopods VII are shorter and much weaker than pereopods VI though with nearly the same length ratios of the various segments.

Distribution: Boreal and subtropical regions of the Atlantic Ocean (38°20′ N, 9°20′ W; 34°41′ N, 9°30′ W and vicinity of the Bermuda Islands).

Absent is out collections.



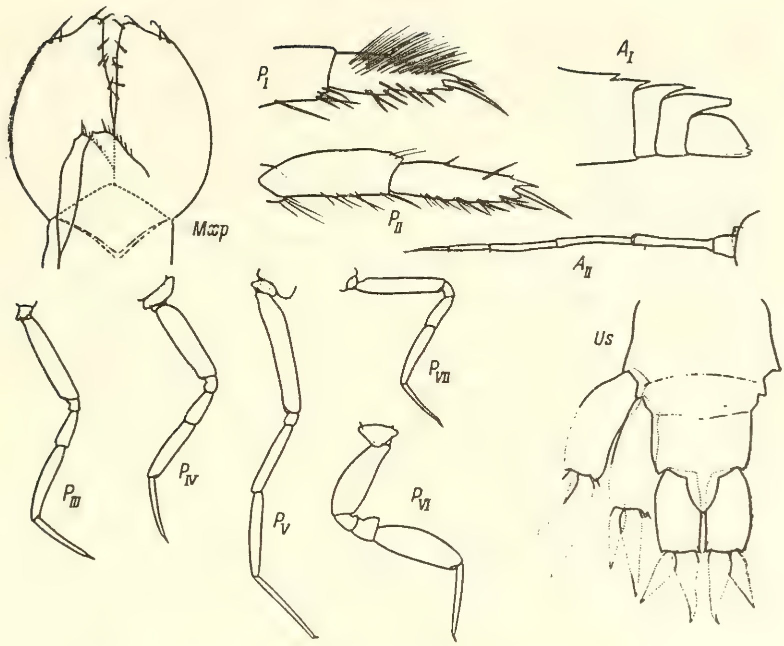
118 Fig. 49. *Mimonectes spandli* Stephensen and Pirlot, female (after Shoemaker, 1945a).

4. ***Mimonectes gaussi*** (Woltereck, 1904) (Fig. 50)

Woltereck, 1904b: 627 (*Sphaeromimonectes*); 1927: 80 (*Sphaeromimonectes*); Stephensen and Pirlot, 1931: 531; Shoemaker, 1945a: 221 (part.).—*fowleri* Stebbing, 1904b: 21 (*Parascina*); Stephensen and Pirlot, 1931: 519.

Length of sexually mature females 11–18 mm, of males up to 9 mm.

The apical segment of the flagellum of antennae II is nearly equal in length to both the preceding segments.



120 Fig. 50. *Mimonectes gaussi* (Woltereck), male (after Shoemaker, 1945a).

Antennae II in sexually mature males are about 3/4 the length of antennae I.

The mandibles have a finely denticulate, comparatively broad cutting edge, with a deep notch in its lower part. In maxillae I the distal margin of the lobes and the palp is rounded; the spines on the outer lobe are weak; the outer and inner lobes bear numerous thin setae,usually longer on the distal margin of the outer lobe. The inner lobe of maxillae II is almost square, twice broader than the outer; both lobes bear numerous thin setae. The outer lobes of the maxillipeds is armed with short setae on the inner margin and, in addition, with some longer and stronger setae in the distal part of the outer margin, with no small setae occurring between the two groups; the outer lobe is oval or its outer distal margin from the site of attachment of the outermost seta straightly truncated, and the angle stretched and acute; the inner lobes are broad, pubescent, and armed with isolated strong setae in the distal part.

Pereopods I, and especially pereopods II, have a conical, distally narrowed 6th segment; this segment terminates in a long thin denticulate process projecting above the claw, and a shorter process under the claw; the posterior margin of the segment bears long and strong setae, while in males the distal surface of the 6th segment of pereopods I bears long

thin hairs; the 5th segment of pereopods I is 1.1–1.3 times longer than the 6th; the claw is long,thin, and straight. Pereopods III and IV are alike in structure; their 4th segment is almost equal to the 3rd or longer than it by not more than two times, and not less than half the length of the 5th; the 5th segment is linear or amygdaloid, equal to or slightly shorter than the
120 2nd; the 6th segment is thin, distally tapering, and slightly shorter than the 5th; the claw is almost straight in females or slightly curved in males. Pereopods V are almost the same length as pereopods IV; the 4th segment is equal to the 5th or shorter, but not by more than 1/2–2/3 its length; the 6th segment is thin and distally tapering. Pereopods VI in males are the same length as pereopods V, in females slightly shorter; the length ratios of these segments show individual variation;the 4th segment may be equal to the 5th or almost 1/2 in length; the 5th segment may be somewhat shorter or longer than the weakly conical 6th segment. Pereopods VII are weaker than pereopods V but with roughly the same length ratios of segments.

Distribution: North Atlantic Ocean from Davis Strait (63°06′ N, 56° W) up to the Madeira and Bermuda islands, South Atlantic off South Africa. In the Indian Ocean it is found in the Arabian Sea and in tropical regions up to 20° S, in the Pacific Ocean—in the northwestern part, south of 50° N, in the Philippine Sea, Solomon Sea, and in the region of the deepwater Kermadec trench. It generally inhabits depths of more than 500 m, but rises to shallow depths; casts of females that had died after spawning have been found in surface catches.

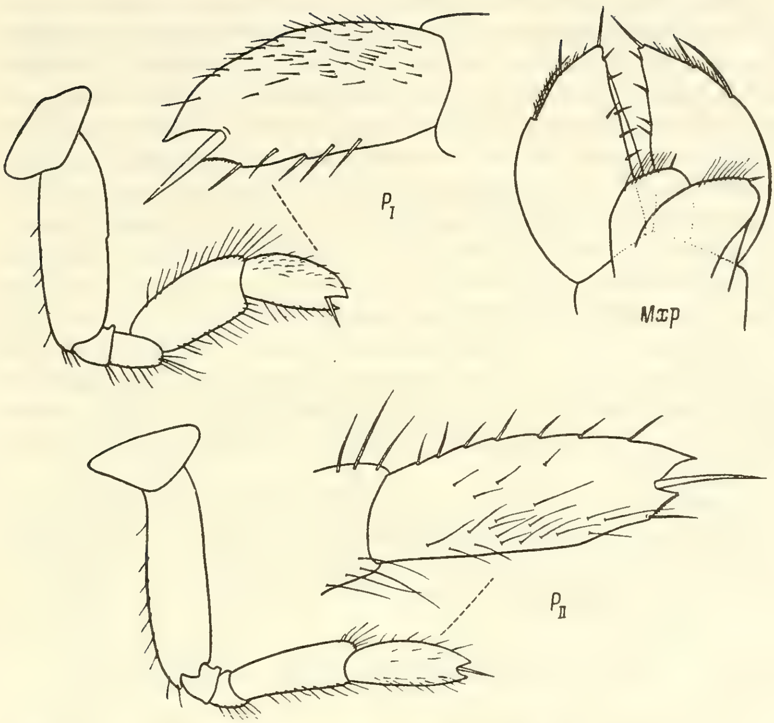
121 5. ***Mimonectes diomedeae*** (Woltereck, 1909) (Fig. 51)

Woltereck,1909: 148 (Sphaeromimonectes); Stephensen and Pirlot, 1931: 531; Vinogradov, 1957: 208.—*gaussi* (non Woltereck, 1904b); Shoemaker, 1945a: 221 (part.).

Length of sexually mature female 15 mm; of not fully mature male 14 mm.

The mandibles have a very narrow denticulate cutting edge, and an accessory plate almost equal in width to it; the notch on the cutting edge is almost imperceptible. The outer lobe of maxillae I bears relatively weak distal spines; the inner lobe is petaloid, broad, and apically rounded. The outer lobes of the maxillipeds tapers apically because the distal part of the outer margin is straight, not bulging; one long strong seta is situated at the point where the bulging outer margin becomes straight; a second smaller seta is situated in the middle of the straight part while a third seta is apical; between these setae the margin of the lobe is finely pubescent; the inner margin of the outer lobe is armed with numerous short setae; the inner lobes are broad, oval, and pubescent in the distal part, with one apical seta.

Unlike in *M. gaussi*, the 6th segment of pereopods I and II is not conical but oval, almost not tapering distally, its distal denticle projecting



121 Fig. 51. *Mimonectes diomedeae* (Woltereck), male (after Vinogradov, 1957).

over the claw, broad, basally petaloid; the 5th segment of pereopods I is 1.3–1.5 times longer than the 6th segment.

Notes: This species is close to *M. gaussi*—a fact pointed out by its author, Woltereck. Later, Shoemaker on this basis included it in the synonymy of *M. gaussi*. However, an examination of the new material showed that *M. diomedeae* has several distinctive features, enabling a clear separation of the two species.

122 *Distribution*: Warm-water regions of the Pacific and Indian oceans. In the Pacific Ocean it is found in the north-western part (39°58′ N, 164°55′ E), among the Hawaiian Islands (20°21′ N, 173°24′ W), and off the coast of Peru (11°59′ S, 83°40′ W). In the Indian Ocean it is found at the eastern coast of Madagascar (16°07′ S, 53°39′ E).

VI. Family PROSCINIDAE Pirlot, 1933

The body of both males and females is slender; the pereon is not bulged spherically in females but broadened and slightly flattened dorsoventrally in both sexes. All the pereon somites are free. The head is high and short. The eyes are inconspicuous. Antennae I are strong and long, projecting forward; in females they are equal to 2–4, and in males 5–7 somites of the pereon; the peduncle is two-segmented; the proximal segment of the flagellum is narrow; the three distal segments in comparison with other Physosomata are well developed. Antennae II in males are thin, almost not shorter, or longer than antennae I; in females they are short, rudimentary. The mandibles lack a palp, have a narrow cutting edge and an accessory plate. The outer lobe of maxillae II exhibits a tendency toward reduction; it is narrower and shorter than the inner lobe. The outer lobes of the maxillipeds are large, oval; the inner lobes are split almost from the base. The coxal plates are free. In pereopods I and II the 5th segment is almost not broadened distally. In pereopods V the 2nd segment has smooth margins. Pereopods V–VII may have retractile claws. The rami of the uropods are free. The gills are located under somites II–VI.

The family Proscinidae includes rare deepwater species; their sex- and age-related dimorphism is poorly studied; possibly, with the availability of new material, this family will require significant revision.

The family includes two genera.

KEY TO GENERA OF FAMILY PROSCINIDAE

1. Inner lobes of maxillipeds broad, weakly tapering and with pubescence only in distal part. Pereopods V-VII without spoon-shaped structure at tip of 6th segment; claws on these pereopods nonretractile .... 1. ***Proscina*** Steph. and Pirl.

— Inner lobes of maxillipeds strongly tapering distally and with one strong apical seta. Pereopods V–VII with spoon-shaped a structure at tip of 6th segment; claws on these pereopods retractile .... 2. ***Mimoscina*** Pirl.

1. Genus *Proscina* Stephensen and Pirlot, 1931

Stephensen and Pirlot, 1931: 343.

Crustaceans of medium size. The integument is thin. The head is almost as high as somite I of the pereon. The proximal segment of the flagellum of antennae I is long and strong, conical, and structured as in the genus *Mimonectes*; the 1st and 2nd distal segments are short and broad; the 3rd segment is longer than both the preceding segments. Antennae II in males are thin, multisegmented, and roughly the same length as antennae I; in females they are shorter, sometimes reduced to an acicular appendage. The mandibles have a well-developed (in the left mandible) accessory plate; its length is equal to that of the cutting edge.

The spines on the distal margin of the outer lobe of maxillae I are divided into two groups. The outer lobe of maxillae II is weaker than the inner lobe and apically with two spines; the inner lobe has three spines. The
123 inner lobes of the maxillipeds are split up to the base. The 5th segment of pereopods I and II are broad, almost linear. Pereopods V–VII with simple nonretractile claws.

Type species: *Parascina stephenseni* Pirlot, 1929.

The genus includes four rare, poorly studied species.

KEY TO SPECIES OF GENUS PROSCINA

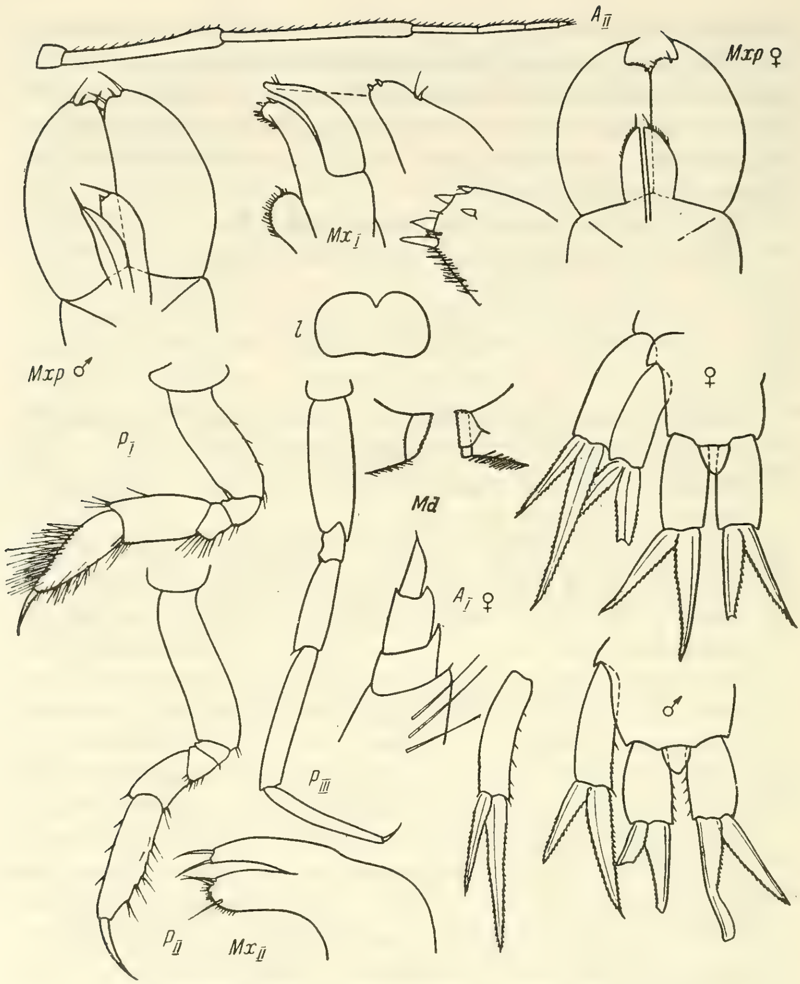
1. Proximal segment of flagellum of antennae I and 6th segment of pereopods I pubescent, with numerous long setae .... 2.
— Proximal segment of flagellum of antennae I and 6th segment of pereopods I with few short setae .... 3.
2. Inner lobe of maxillae I broadened distally; 4th segment of pereopods III and IV more than twice longer than corresponding 3rd segment; 5th segment narrow, appreciably narrower than 2nd segment; claws short .... 1. ***P. stephenseni*** (Pirl.).
— Inner lobe of maxillae I not broadened distally; 4th segment of pereopods III and IV only slightly longer than 3rd segment; 5th segment almost same width as 2nd segment; claws very long and strong ... .4. ***P. scinoides*** (Wolt.).
3. Sixth segment of pereopods I shorter than 5th and with rows of short setae on distal surface. Inner lobe of maxillipeds about 2/3 length of outer lobe. Fourth segment of pereopods V shorter than 5th segment ....2. ***P. magna*** Steph. and Pirl.
— Sixth segment of pereopods I longer than 5th and with only a few short setae. Inner lobe of maxillipeds 1/2 length of outer lobe. Fourth segment of pereopods V roughly equal to 5th segment............. ....3. ***P. birsteini*** Vinogr.

1. ***Proscina stephenseni*** (Pirlot, 1929) (Fig. 52)

Pirlot, 1929: 57 (*Parascina*); Stephensen and Pirlot, 1931: 544; (?) Barnard, 1937: 179; Vinogradov, 1957: 208.—*magna* (non Stephensen and Pirlot, 1931); Pirlot, 1939: 25 (part.).

Nearly sexually mature specimens have a length of 9–10 mm.

The body is smooth, with slightly dorsoventrally flattened pereon. Antennae I are slightly longer than the pereon or equal to it; the proximal segment of the flagellum is armed on the dorsal surface with rows of numerous long thin setae; the three distal segments are small but well developed.



124 Fig. 52. *Proscina stephenseni* (Pirlot) (after Vinogradov, 1957).

The mandibles have a finely denticulate cutting edge and an accessory plate that is only slightly narrower than the cutting edge of the mandible. The spines on the distal margin of the outer lobe of maxillae I are indis-tinctly divided into two groups; the inner lobe is small, oval, and slightly broadened distally. The outer lobe of the maxillipeds is oval, with convex outer and straight inner margins; the notch in the distal part of the inner margin is more strongly developed in females and weaker in males; the inner lobe has a rounded distal margin and is oblong.

Pereopods I have an almost linear 5th segment that is slightly shorter than the conical 6th; the latter has rows of long thin setae on its posterior

surface; the claw is thin, almost straight, 2/7–2/5 the length of the 6th segment. Pereopods II are slightly longer than pereopods I; the 5th segment is almost 1/2 the length of the 6th; the claw is 1/4–1/2 the length of the 6th segment, in females relatively shorter than in males. Pereopods III and IV are similar in size and structure; they are not only longer than the
124 stronger pereopods I and II but even the weaker pereopods V–VII; the 2nd segment is shorter than the 4th and 5th together; the length ratios of the distal segments (4th, 5th, and 6th) is roughly 7/10/9. Pereopods V and the still slightly shorter pereopods VI are similar in size ratios; their 2nd segment is only slightly shorter than the 4th and 5th segments together, while the distal segments are almost equal to each other (ratio 8: 8: 7). Pereopods VII are only slightly shorter than pereopods VI and have the same length ratios. The claws of pereopods V–VII are small, short, and slightly curved.

The uropods have narrowly lanceolate, denticulate rami; the endopodite of all the uropods (especially uropods I and II) is longer than the exopodite. The basipodite of uropods III is broader (especially in males) than in the preceding two pairs. The distal part of the endopodite of uropods III is curved and broadened in males but normal in structure in females. The telson is triangular oval and does not reach 1/2 the length of the basipodite of uropods III.

Distribution: Known from the North Atlantic (47°10′ N, 18°02′ W), the Arabian Sea, and northwestern part of the Pacific Ocean (44°07′ N, 150°32′ E). All specimens were found in through catches from depths greater than 1,500 m up to the surface.

125 2. ***Proscina magna*** Stephensen and Pirlot, 1931 (Fig. 53)

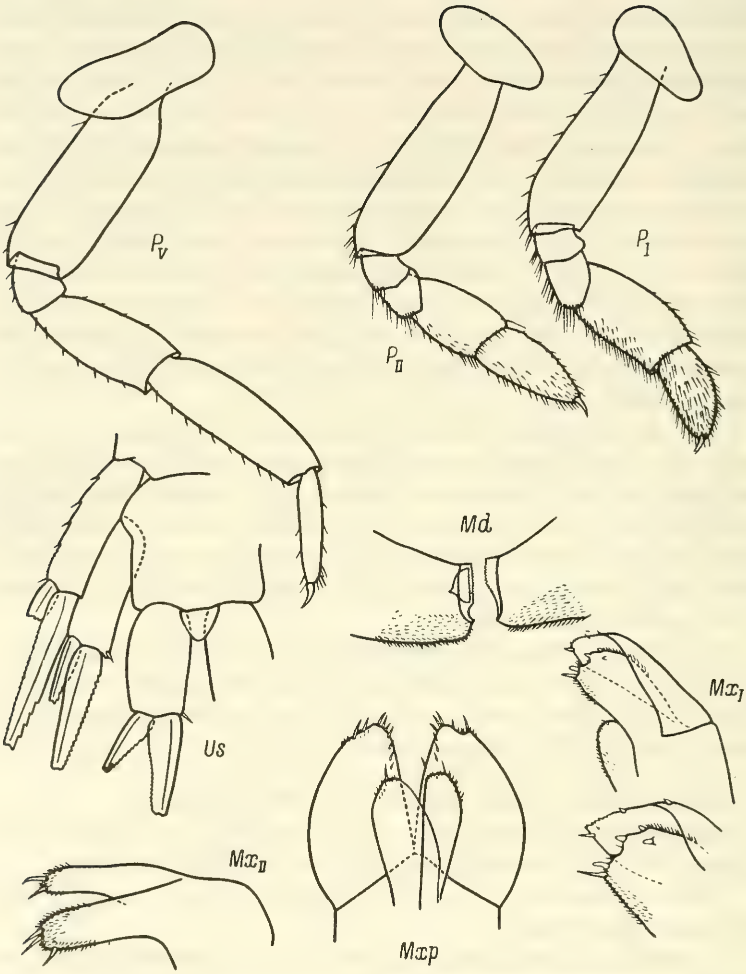
Stephensen and Pirlot, 1931: 545; Pirlot, 1939: 25 (part.); Vinogradov, 1957: 210.—*fowleri* Chevreux, 1905: 3; (*Parascina* part.).

Two specimens of this species are known: female—length 18 mm and male—length 9 mm.

In body shape this species is identical to *P. stephenseni* but the appendages are shorter and stronger.

The proximal segment of the flagellum of antennae I is less pubescent than in *P. stephenseni.* Antennae II in the sexually mature male are slightly longer than antennae I; the first two segments of the peduncle are fused; the 3rd is short, the 4th and 5th segments long and thin; the four-segmented flagellum is slightly longer than the 5th segment of the peduncle.

The mandibles are narrow and strong; the cutting edge is narrow, bent, and finely denticulate; the width of the accessory plate is nearly half of the cutting edge; the distal part of the inner surface of the body of the mandible is covered with numerous short setae. The inner lobe of maxillae I is broad, the spines on the distal margin distinctly divided into



125 Fig. 53. *Proscina magna* Stephensen and Pirlot, female (after Vinogradov, 1957).

126 two groups; the inner lobe is apically rounded. Maxillae II are the same as in *P. stephenseni* but the distal setae relatively shorter and stronger. The outer lobes of the maxillipeds are more stretched than in *P. stephenseni*, without a notch in the distal part of the inner margin; the inner lobes are slightly broadened distally and relatively longer than in *P. stephenseni*.

The 5th segment of pereopods I is longer than the oval-conical 6th segment; the latter has numerous short setae on its lateral and dorsal surface; the claw in the male is 1/3, in the female 1/5–1/4 the length of the 6th segment. Pereopods II are nearly the same length as pereopods I, the 5th segment shorter than that of pereopods I; the conical 6th segment is very slightly larger than the 5th and less densely armed than the 6th segment of pereopods I. Pereopods III and IV are similar in structure, long, and strong; the 2nd is almost equal to the 4th and 5th segments together; the 4th segment is slightly shorter than the 5th and almost equal to the narrower 6th segment. Pereopods V are as strong as the preceding ones; the broad 2nd segment is almost 2/3 the length of the 4th and 5th segments together; the length ratios of the distal segments are 10: 14: 9. Pereopods VI–VII in the male are thin and weak (not described in the female); the 2nd segment is much shorter than the 4th and 5th segments together; the length ratios of the distal segments are 10: 8: 5 in pereopods VI and 6: 9: 5 in pereopods VII. The claws of pereopods V–VII are short and strong.

The uropods have broader basipodites and rami than in *P. stephenseni*. In the male the distal part of the endopodite of uropods III is curved and apically obtuse. The telson is oval-triangular and reaches 1/3 the length of the basipodite of uropods III.

Distribution: Found in the Atlantic (36°17′ N, 28°53′ W) and Pacific (30°52′ N, 153°16′ E) oceans in total catches from 0–3,000 and 0–5,000 m.

3. ***Proscina birsteini*** Vinogradov, 1956 (Fig. 54)

Vinogradov, 1956: 202.

One male 6 mm long is known.

The proximal segment of the flagellum of antennae I is weakly pubescent and roughly thrice longer than the peduncle. In antennae II the long peduncle consists of rod-shaped segments.[4] Maxillae I have a broad petaloid palp; the outer lobe has a straight distal margin armed with five spines divided into two groups; the inner lobe is broad, with a straight distal margin. The outer lobes of maxillae II are slightly narrower than the inner lobe. The outer lobe of the maxillipeds are broadly oval, slightly concave on the inner margin, and apically with a small depression in which a seta is lodged; the oblong inner lobes reache 1/2 the length of the outer lobe and are armed in the distal part with small thin setae.

In pereopods I the 2nd segment is shorter than the 5th and 6th together, the 5th segment shorter than the slightly conical 6th segment, and the latter armed with a few short setae; the claw is straight and less than half the length of the 6th segment. Pereopods II are equal in length to pereopods I but the 5th and 6th segments relatively narrower.

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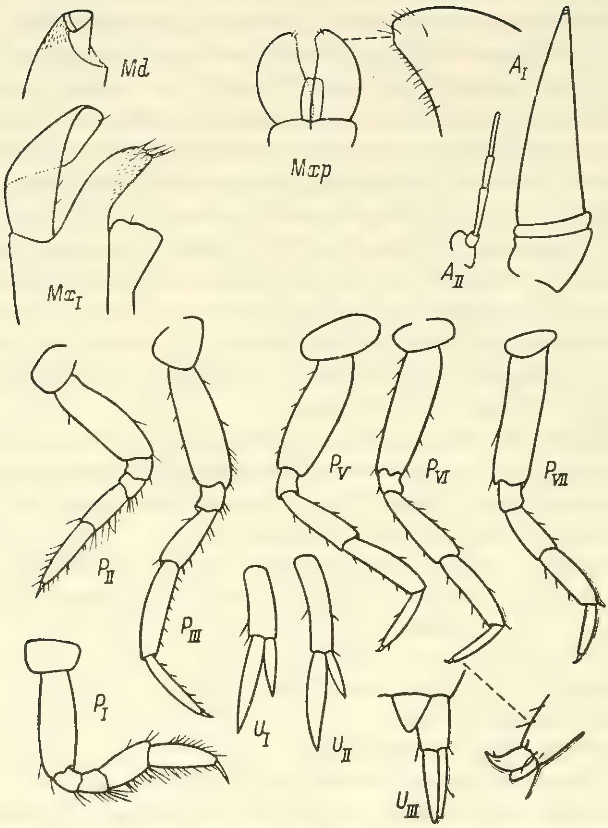
[4] The distal segment [of antennae II] are broken in the specimen available.



127 Fig. 54. *Proscina birsteini* Vinogradov, male (after Vinogradov, 1956).

Pereopods III and IV are alike in structure, their distally broadened 4th segment slightly shorter than the linear 5th segment, which in turn is longer than the thin 6th segment; the claw is short and curved. Pereopods V and VI are identical in length and structure, the 4th segment longer than in the preceding pair of pereopods and equal to the 5th segment; the 6th segment is narrow, linear, and shorter than the 5th; the
127 claw is short, thick, and falcate. Pereopods VII are slightly shorter than the preceding pereopods; the 4th segment is shorter than the 5th and equal to the 6th.

The length of the basipodites of the uropods decreases from I to III; the basipodite of uropods III is broad, shorter than both the rami; the rami are elongated-lanceolate, in uropods I and II sharply differing in length and in uropods III almost similar. The telson is roundish-triangular and more than half the length of the basipodite of uropods III.

Distribution: Found in the Bering Sea (60°47′ N, 175°38′ E) in catches from depths of 500–1,500 m.

4. ***Proscina scinoides*** (Woltereck, 1906) (Fig. 55)

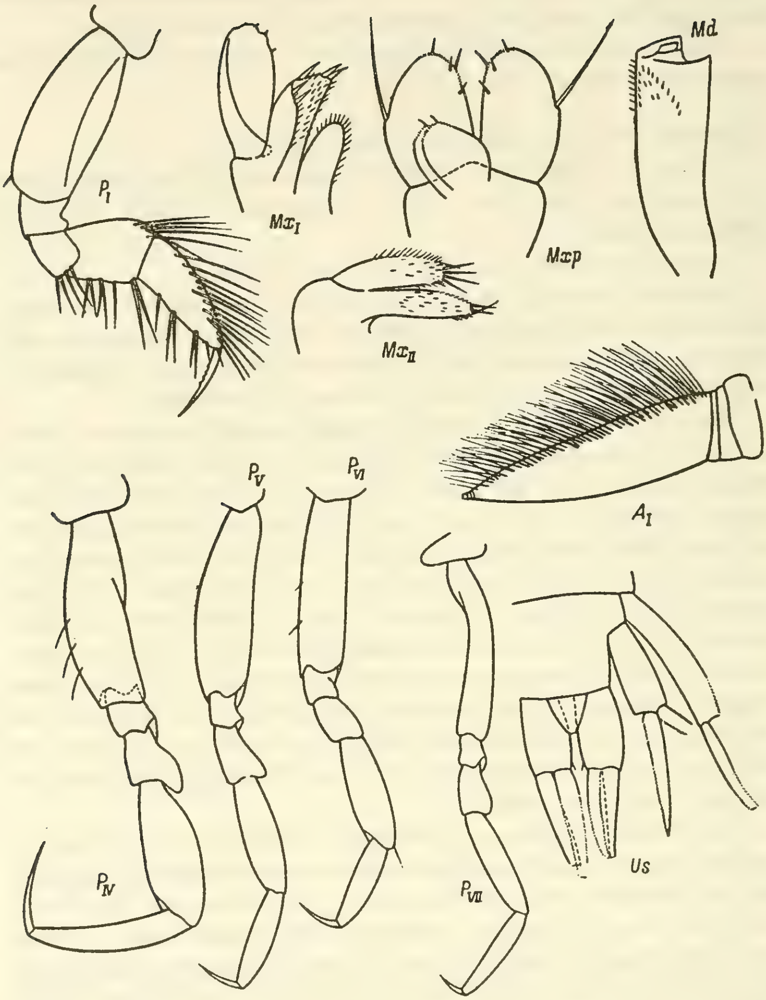
Woltereck, 1906b: 866 (*Sphaeromimonectes*); Vinogradov, 1964: 127.—gracilipes [non Pirlot, 1933 (*Mimoscina*) : Pirlot, 1939: 29 (*Mimoscina* part.).

Length of sexually mature female about 20 mm.

Antennae I are equal in length to the four pereon somites; the proximal segment of the flagellum in young specimens is densely covered with long setae on the dorsal surface, which are shed in the adult. Antennae II in females thin and at least 1/4–1/2 the length of antennae I.

The mandibles have a relatively broad, slightly denticulate cutting edge; the left mandible has a small accessory plate; the distal part of the anterior margin of the mandibles is armed with short setae. The outer lobe of maxillae I is broad, armed with five apical spines divided into
128 two groups by a wide gap; the inner lobe is comparatively narrow and apically oval; the palp is broad and bears three small spines in the distal part of the inner margin. The lobes of maxillae II are narrow, the inner lobe slightly longer than the outer; besides numerous thin setae, the outer lobe also bears five and the inner lobe three apical spines. The outer lobes of the maxillipeds are oval, with three short setae in the distal part and one long seta on the maximally bulging part of the outer margin; the inner lobes are more than half the length of the outer, broadly oval, and with one small apical seta each.

The broad 2nd segment of pereopods I is shorter than the 5th and 6th segments together; the 5th segment is shorter than or equal to the conical 6th, with numerous long thin setae on the anterior margin; the claw is 1/2–2/3 the length of the 6th segment and denticulate in the proximal part of its posterior margin. Pereopods II are slightly longer and thinner
129 than pereopods I; the posterior margin of the claw is denticulate. Pereopods III and IV are considerably stronger than the preceding as well as succeeding pairs of pereopods; their 4th segment is not broadened, only slightly longer than the 3rd and much shorter than the broad and stronger 5th segment; the 6th segment is narrow, slightly conical, somewhat shorter than or equal to the 5th segment; the claws are long, almost straight, in young specimens only 1/2–5/6 the length of the 6th segment. Pereopods V–VII are thinner and weaker in young specimens, in sexually mature crustaceans they are rod-shaped; pereopods VII are particularly thin and weak, though in length not less than the two preceding pairs of pereopods; the almost linear 5th segment is somewhat longer than the 6th; the claws are strong, 2/5–1/2 the length of the 6th segment.



128 Fig. 55. *Proscina scinoides* (Woltereck), female (after Vinogradov, 1964).

The uropods have narrow, thin, denticulate rami. The telson is roundish-triangular and 1/2 the length of the basipodite of uropods III.

Notes: Woltereck (1960b) provided a very brief description and schematic total illustration of the sexually mature female recovered from the central part of the Indian Ocean. In roughly the same region we found young specimens of this crustacean which, in several features, ought to be included under the same species as the Woltereck specimens; the existing differences are explained by age-dependent variations and the schematic nature of Woltereck's illustration.

Distribution: Indian Ocean (30°07′ S, 87°50′ E and 3° S, 66–67° E) in catches from depths of 2,000–3,000 m.

2. Genus *Mimoscina* Pirlot, 1933

Pirlot, 1933: 2, 1939: 29.

Medium-sized crustaceans. The integument is transparent. The head has no rostrum and is higher than pereon somite I but not longer than it. The proximal segment of the flagellum of antennae I is narrowly conical, sometimes in shape approaching that in members of the family Scinidae (*M. gracilipes*); its distal segments are developed to an equal extent. Antennae II in females are reduced but not as strongly as in the Proscina. The mandibles have a weakly developed accessory plate which is shorter than the cutting edge. The spines on the distal margin of the outer lobe of maxillae I are not divided into two groups. The outer lobe of maxillae II is narrower than the inner and weakly armed. The outer lobes of the maxillipeds oval, the inner lobes distally narrowing, and split up to the base. The 5th segment of pereopods I and II is narrow, almost linear; the claws of pereopods V–VII are small, curved, and retractile.

Type species: *Mimoscina gracilipes* Pirlot, 1933.

The genus includes two species.

KEY TO SPECIES OF GENUS MIMOSCINA

1. Basipodites of uropods I and II pubescent in distal part of outer margin. Pereopods VI–VII almost same as pereopods III and IV in width of segments and ornamentation................. 2. ***M. setosa*** (Barn.).

— Basipodites of uropods I and II are not pubescent in distal part of outer margin*. Pereopods VI–VII, unlike III–IV, very thin, rod-shaped, and not armed .... 1. ***M. gracilipes*** Pirl.

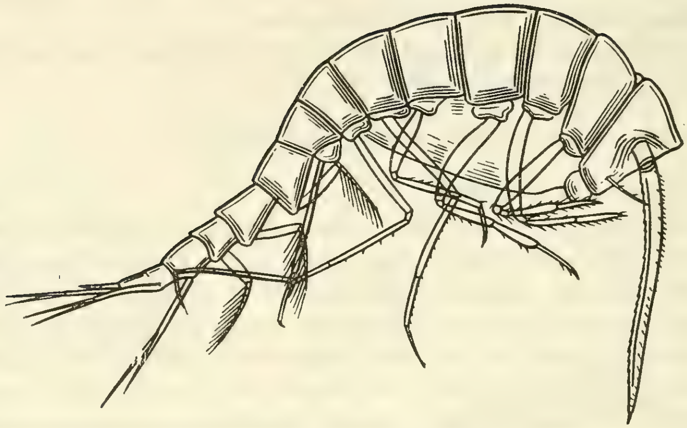
1. ***Mimoscina gracilipes*** Pirlot, 1933 (Figs. 56, 57)

Pirlot, 1933: 2, 1939: 29; Vinogradov, 1962: 223.

Three not fully sexually mature females of this species are known; length 4.5–8 mm.

The head has a visor above the place of attachment of antennae I. Antennae I are equal in length to six somites of the pereon; the proximal
130 segment of the flagellum is narrow, triquetrous, armed on each margin with short denticles, as in the genus *Scina*; the distal segments are small

* Changed from Russian original by author—Eds.



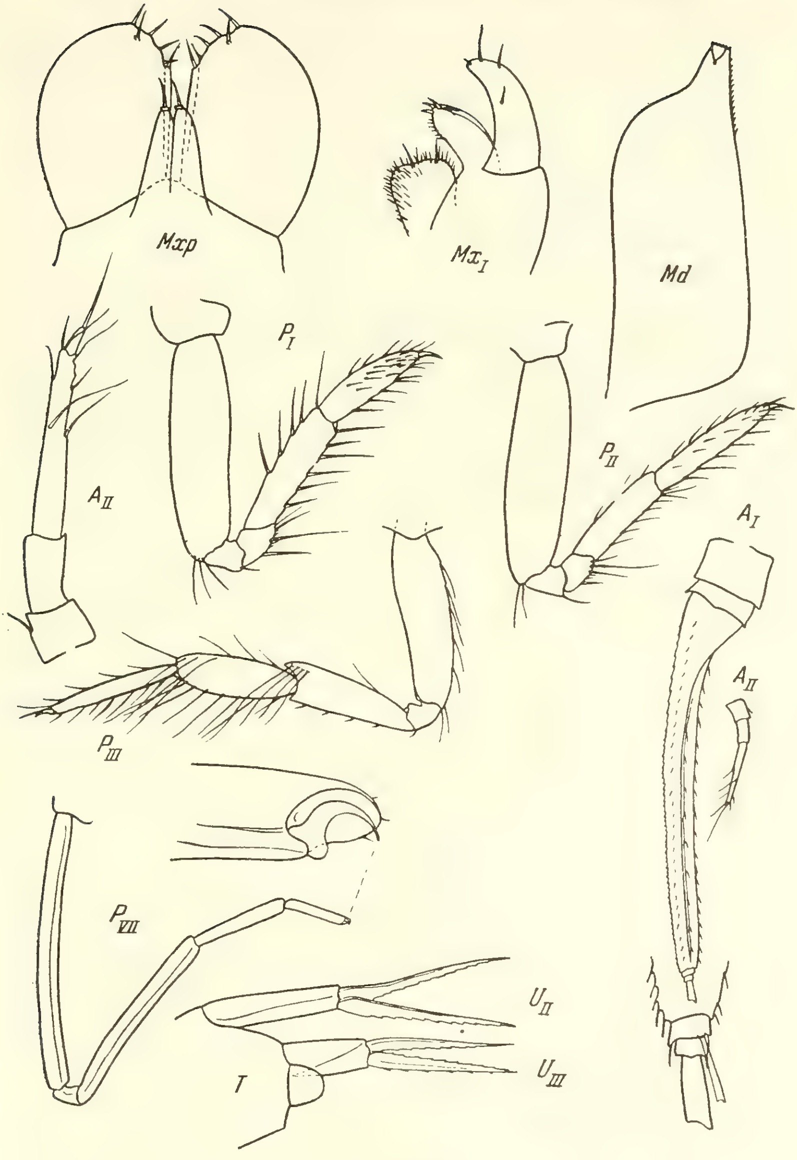
130 Fig. 56. *Mimoscina gracilipes* Pirlot, female (after Pirlot, 1939).

but well noticeable; the 1st and 2nd segments are short; the 3rd is narrower and long. Antennae II in females are four-segmented and slightly longer than the peduncle of antennae I.

The cutting edge of the left mandible is formed by two fully nonoverlapping plates. Maxillae I have a broad inner lobe; the spines on the outer lobe are small and weak.

The outer lobe of the maxillae is narrower and shorter than the inner lobe. The maxillipeds have broadly oval outer lobes armed on the inner distal angle with a row of short setae; the inner lobes are longer than half the length of the outer lobes and bear a row of short setae and one strong apical seta each.

Pereopods I and II have a slightly curved 5th segment; the distally slightly narrowing 6th segment in pereopods I is shorter, in pereopods II longer than the 5th segment, and bears numerous setae on both the anterior and posterior margins and the distal surface (especially in pereopods I). Pereopods III are longer than the preceding pairs, their 2nd segment much shorter than the 4th and 5th segments together; the distally broadening 4th segment is equal to or slightly longer than the oval 5th and slightly shorter than the thin 6th segment; the claws are small and curved. Pereopods IV have roughly the same proportions but their distal segments are stronger. Pereopods V–VII are roughly equal in length (pereopods VII slightly shorter), thin, rod-shaped; the length of their 2nd segment is roughly equal to the length of the 4th and 5th segments together; the long 4th segment is almost equal to or even longer than the 5th and even shorter 6th segments together; the 6th segment has a spoonshaped formation; the claws are retractile.



131 Fig. 57. *Mimoscina gracilipes* Pirlot, female (after Vinogradov, 1960a).

The uropods have long narrow rami, longer than the basipodites. The telson is roundish, roughly equal to 1/2 the length of the basipodite of uropods III.

Distribution: Found in the Atlantic Ocean (41°29′ N, 15°44′ W), the Indian Ocean (Arabian Sea—16°50′ N, 62°21′ E) and the Pacific Ocean (27°15′ S, 175°39′ W) in catches from the 1,900–3,750 m layer and in total catches from depths of over 2,000 m to the surface.

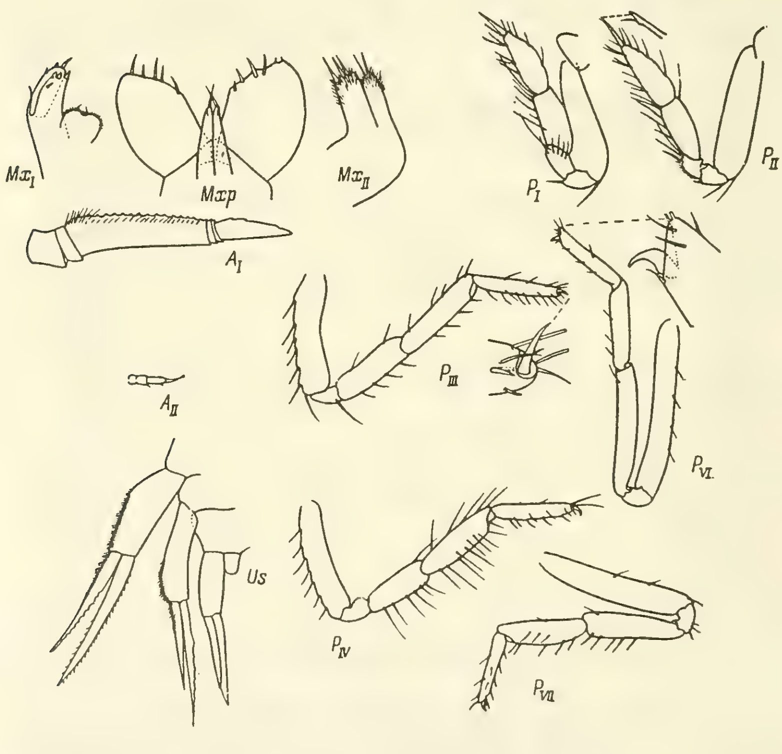
2. ***Mimoscina setosa*** (Barnard, 1930) (Fig. 58)

Barnard, 1930: 395 (Parascina); Vinogradov, 1962: 13.

Three sexually not fully mature specimens (2 females, 1 male) are known; length 3–6 mm.

131 The head has no visor above the place of attachment of antennae I.

In antennae I the flagellum has a strong, slightly distally narrowing proximal segment; of its three distal segments, the first two are broad but very short, and the dagger-shaped 3rd segment is very large, but only 1/2 the length of the proximal segment, but longer than the peduncle of the antennae. Antennae II in the females are four-segmented, small, not longer than the peduncle of antennae I; in the immature male they are multisegmented and half the length of antennae I.



132 Fig. 58. *Mimoscina setosa* (Barnard), female (after Vinogradov, 1962).

Maxillae I have a broad inner and a weakly armed outer lobe. The outer lobe of maxillae II is shorter and narrower than the inner lobe. The broadly oval outer lobes of the maxillipeds are armed with a few
132 setae on the truncated distal margin; the narrowly conical inner lobes are longer than half the length of the outer lobe and bear one strong apical seta.

The oval-conical 6th segment of pereopods I and II is slightly longer than the 5th; the claws are thin, almost straight. Pereopods III and IV are longer than the preceding pairs, their 4th segment is slightly shorter than or equal to the 5th and narrower 6th segment. Pereopods V are the same length as pereopods IV; the 5th segment is slightly broadened distally and much longer than the oblong-oval 6th segment. Pereopods VI are longer than all the preceding pairs; the 4th segment is 1.5 times longer than the 5th or the 6th segment, which is nearly equal to the latter. Pereopods VII are shorter than pereopods VI; the 4th and 5th segments are equal, the 6th slightly shorter. The 6th segment of pereopods III–VII has a spoon-shaped formation (poorly discernible in pereopods III and IV) and small curved retractile claw.

The basipodites of uropods I and II have a bulging anterior margin and are densely pubescent with numerous setae; the rami are long, narrowly lanceolate.The telson is roundish-triangular and does not reach half the length of the basipodite of uropods III.

Distribution: Antarctic species, known from the Pacific and Indian Ocean sectors of the Antarctic, south of 64° S (the southernmost record, 67°23′S, 177°59′ W). The three specimens were found in through catches from depths of over 500 m to the surface.

133 VII. Family SCINIDAE Stebbing, 1888

Crustaceans of small to medium size, from 2.5 to 30 mm in length (without antennae). The body is slightly flatened dorsoventrally, smooth or with a low dorsal keel (genus *Scina*) or armed with strong denticles and keels (genera *Ctenoscina, Spinoscina, Acanthoscina*). Pereon somites I and II may be coalesced. The head is short but in width just slightly less than the pereon. The eyes are small, sometimes not perceptible. Antennae I are strong and almost the same length as the pereon and pleon together; the single-segmented peduncle is much shorter than the powerful, narrowly conical, often almost linear basal segment of the flagellum, which is equipped with longitudinal keels; in juvenile specimens the distal segments of the flagellum are sometimes retained. Antennae II in females are rudimentary; in sexually mature males they are long and thin (genus *Scina*) or rudimentary (genus *Ctenoscina*).

The mouthparts are more greatly reduced than in other families of the Physosomata. The mandibles lack a palp, their cutting edge is narrow and without accessory plates. Maxillae I and II are usually normally developed but in *Acanthoscina* the palp of maxillae I is absent and the lobes of maxillae II are fused. The outer lobes of the maxillipeds are weakly armed, sometimes reduced to small plates; the inner lobes are rudimentary and always fused, or sometimes absent. Coxal plates VI–VII may be fused with the pereon somites. The pereopods are long and slender, usually simple, although sometimes pereopods I may have a poorly developed chela and pereopods V a subchela. Pereopods V–VII may have retractile claws. Pereopods V are usually the longest of all the pereopods but sometimes are shorter than pereopods VI. The uropods have fused basi- and endopodites; exopodites I and II and sometimes also uropods III are reduced to small spines. The telson is small and short.

Among the Hyperiidea, this family is the richest in species. It is distributed in all regions of the world ocean from the Arctic Basin to the Antarctic. The scinids are the most characteristic members of the meso-, bathy-, and abyssopelagic zones. Evidently, only a small number of species have secondarily adapted to living in surface waters while at the same time retaining their deepwater features. The scinids are either depigmented or reddish-violet or bright red (mesopelagic species). Some species are capable of phosphorescence. Most scinids, judging from their stomach contents, feed on tissues of deepwater coelenterates.

The long and strong, forwardly directed antennae I are noteworthy; they are attached to the upper anterior angles of the anteriorly straightly truncated broad head. Together with the narrow pleon and a comparatively broad pereon they (antennae I) impart a horn-like appearance.

The family includes four genera.

KEY TO GENERA OF FAMILY SCINIDAE

1. Body without dorsal spines and denticles. Pereopods without retractile claws and fused segments .... 1. ***Scina*** Prestan.

— At least some somites of pleon and pereon with long dorsal denticles or spines. Pereopods V–VII with retractile claws or distal segments of pereopods V fused .... 2.

2. Outer lobes of maxillipeds reduced to two small rectangular plates; inner lobes absent. Fourth, 5th, and 6th segments of pereopods V fused .... 4. ***Acanthoscina*** Vos.

— Outer lobes of maxillipeds not in form of small rectangular plates; inner lobes present. Fourth, 5th, and 6th segments of pereopods V not fused .... 3.

134 3. First two somites of pereon fused. Inner lobes of maxillipeds reach 1/3–1/2 length of outer lobes. Pereopods III–VII with nonretractile

small claws. Second segment of pereopods V armed on both margins with thin pointed spines .... 3. ***Spinoscina*** Bow. and Grun.

— First two somites of pereon not fused. Inner lobes of maxillipeds absent. Pereopods III–VII with retractile claws. Posterior margin of 2nd segment of pereopods V bears blunt festoonlike lobes ....
.... 2. ***Ctenoscina*** Wagl.

1. Genus *Scina* Prestandrea, 1833

Prestandrea, 1883: 8.

Somites I and II of the pereon are free; the pereon and pleon lack dorsal denticles or spines; the dorsal keel may be present or absent. The eyes are highly reduced but generally perceptible. Antennae II in males are well developed, multisegmented, thin, and whiplike; in females they are reduced, very small, and one-, two- or three-segmented. Maxillae I have a single-segmented palp which is longer, equal to, or just slightly shorter than the outer lobe. Maxillae II have separated lobes. The maxillipeds have developed outer lobes and fused inner lobes; the latter are reduced to some extent but always present. The coxal plates are free. Pereopods I and II are simple; in pereopods V the outer distal angle of the 2nd segment is extended into an acute denticle that is usually larger than the 3rd segment; pereopods V–VII are without retractile claws. Pereopods VII are shorter than pereopods VI. The telson is free. The oostegites have marginal setae. The gills are located on pereon somites II–VI or III–VI.

Type species: *Scina ensicorne* Prestandrea, 1833 nom. dub.

To date, 32 species of Scina have been described. Some groups of closely related species are apparent among them, which possess an entire series of common morphological features. These groups, named after the typical species, are:

1. Group *crassicornis*. Includes *S. crassicornis, S. curvidactyla, S. curilensis*; are close to them *S. incertas, S. langhansi, S. vosseleri*, and possibly *S. borealis* are close to it.
2. Group *spinosa*. Includes *S. spinosa, S. indica*, and *S. pubera*; *S. stebbingi* is close to it.
3. Group *marginata*. Includes *S. marginata* and *S. submarginata*.
4. Group *rattrayi*. Includes *S. rattrayi, S. antarctica; S. oedicarpus, S. woltereckí, S. wagleri, S. stenopus*.
5. Group *tullbergi*. Includes *S. tullbergi, S. similis, S. nana, S. setigera, S. excisa*, and *S. damasi*.
6. Group *latifrons*. Includes *S. latifrons, S. pusilla*, and *S. typhlops*; the most unusual of the *Scina* species, *S. chelata*, is closer to it in several features.

Finally, *S. lepisma, S. inermis*, and *S. alberti* stand out independently.

The characteristic features of each of these groups are given below in the descriptions of individual species.

Most of the species of *Scina* are deepwater forms, living in meso- and bathypelagic zone, i.e., in depths from 200–500 to 3,000 m; only a few species live exclusively in the abyssopelagic zone, i.e. deeper than 3,000 m, or inhabit surface waters. Such surface-dwelling Scina species are found only in the warm water regions of the ocean.

135 *KEY TO SPECIES OF GENUS SCINA*

1. Pereopods V: 4th segment nearly same length as 5th, sometimes shorter than or only slightly (not more than 25%) longer than it ... . 2.
— Pereopods V: 4th segment much longer than 5th .... 21.
2. Pereopods V: 6th segment thin, weak, and short, less than half 5th in length. Large species with antennae I exceeding pereon in length .. .. 3.
— Pereopods V: 6th segment half or slightly more than half, equal to, or slightly longer than 5th. Species generally smaller, with variable length ratios of antennae I and pereon .... 6.
3. Pereopods VII: 6th segment equal to or longer than 5th .... 4.
— Pereopods VII: 6th segment shorter than 5th .... 5.
4. Pereopods VI: claw long, almost straight; 4th segment almost equal to 6th, each of them slightly longer than 5th .... 1. ***S. crassicornis*** (Fabr.)
— Pereopods VI: claw very short and falcate; 4th segment roughly 1.5 times longer than 5th or 6th .... 2. ***S. curvidactyla*** Chevr.
5. Pereopods V: anterior and posterior margin of 2nd segment smooth or, in an extreme case, anterior margin at base of distal process with some denticles.............................. 11. ***S. stebbingi*** Chevr.
— Pereopods V: 2nd segment denticulate along entire posterior margin and finely denticulate along entire anterior margin; large denticle present only in its distal part. Second segment of pereopods III, is 2/3 length of 4th and 5th segments together........................ .... 3. ***S. curilensis*** Vinogr.
6. In pereopods I or in pereopods I and II, 6th segment extended over claw in form of a small distal denticle .... 7.
— In pereopods I and II, 6th segment without distal denticle........ 9.
7. Pereopods VI–VII: 6th segment longer than 5th. Outer lobes of maxillipeds stretched, more than 5 times longer than inner lobes....... .... 4. ***S. incerta*** Chevr
— Pereopods VI–VII: 6th segment shorter or equal to 5th. Outer lobes of maxillipeds roundish-oval, less than half length of inner lobes .. .. 8.

8. Pereopods III and IV thin and long. Distal denticles of 6th segment of pereopods I and II large .... 12. ***S. marginata*** (Bov.)

— Pereopods III and IV well proportioned with broad 4th, 5th, and 6th segments. Distal denticle of 6th segment of pereopods I small (especially in females), and totally absent in pereopods II.......... ....13. ***S. submarginata*** Tat.

9. Pereopods VII with broad segments; length of 6th segment 2 times or less exceeds its width; claw small and uncinate .... 10.

— Pereopods VII: length of 6th segment more than twice width; claw of normal structure, not uncinate .... 13.

10. Pereopods V–VII with numerous long setae on distal surface of their segments .... 10. S. pubera Wagl.

— Pereopods V–VII without numerous setae on distal surface of their segments .... 11.

11. Antennae I equal in length to pereon and pleon together. Pereon and pleon with dorsal keel; denticle on last somite of pleon. Pereopods V: anterior margin of 2nd segment smooth, except for three denticles on distal process .... 32. ***S. alberti*** Chevr.

136 — Antennae I equal to or shorter than pereon in length. Body without dorsal keel or denticles. Pereopods V: anterior margin of 2nd segment highly denticulate .... 12.

12. Pereopods III and IV; posterior margin of 6th segment in its distal part with more or less distinct notch. Pereopods V: 2nd segment shorter than rest together; 4th segment somewhat larger than 5th .. ..8. ***S. spinosa*** Vos.

— Pereopods III and IV: posterior margin of 6th segment without notch in distal part. Pereopods V: 2nd segment at least in sexually mature females longer than rest together; 4th segment equal to 5th ....9. ***S. indica*** Vinogr.

13. Pereopods VII longer than 2nd segment of pereopods VI. Pereopods V: claw not highly elongated .... 14.

— Pereopods VII shorter than 2nd segment of pereopods VI. Claw of pereopods V long and thin .... 20.

14. Uropods I armed with large spines on inner margin .... 15.

— Uropods I with smooth inner margin .... 17.

15. Maxillipeds with long, distally highly tapering outer lobes. Length of lobes, more than thrice their width. Claw on pereopods V smooth .. .. 16.

— Maxillipeds with short oval outer lobes. Length of lobes less than twice their width. Claw on pereopods V with row of setae on posterior margin .... 6. ***S. vosseleri*** Tat.

16. Uropods long and narrow. Width of urosomite III less than its length. Exopodites of uropods I and II long........... 18. ***S. wagleri*** Behn.

— Uropods broad. Width of urosomite III greater than its length. Exopodites od uropods I and II reduced to small spines .... 7. ***S. borealis*** (G. Sars)

17. Inner margin of uropods II facing point of attachment of exopodite does not bend sharply .... 18.

— Inner margin of uropods II facing point of attachment of exopodite bends sharply .... 24. ***S. excisa*** Wagl.

18. Length of urosomite III more than its width. Pereopods V: distal process of 2nd segment short, not reaching or only slightly exceeding distal margin of 3rd segment .... 19.

— Length of urosomite III less than its width. Pereopods V: distal process of 2nd segment very long, reaching almost half length of 4th segment .... 25. ***S. damasi*** Pirl.

19. Pereopods V: broad 2nd segment has large denticles on anterior and posterior margins; 6th segment longer than 5th. Rami of uropods I and II small; exopodite 1/7–1/6 of basipodite in length .... 27. ***S. pusilla*** Chevr.

— Pereopods V: narrow 2nd segment weakly armed on anterior and posterior margins; 6th segment 1/2 length of 5th. Rami of uropods I and II very long; exopodite of uropods I equal to half length of basipodite but in uropod II equal to it .... 26. ***S. typhlops*** Wagl.

20. Pereopods V: 4th segment roughly equal to 5th; 6th segment half length of 4th. Pereopods VI considerably longer than pereopods V; claw absent .... 31. ***S. inermis*** Chevr.

— Pereopods V: 4th segment almost half length of 5th, which is equal to 6th. Pereopods VI roughly equal in length to pereopods V; claw present .... 30. ***S. lepisma*** (Chun.)

21. Pereopods V: 5th and 6th segments very short, forming a subchela. Pereopods VII: 2nd segment broadened and oval ....29. ***S. chelata*** Vinogr.

137 — Pereopods V: 5th and 6th segments not very short and do not form a subchela. Pereopods VII: 2nd segment linear .... 22.

22. Uropods I on inner margin facing point of attachment of exopodite with a separate large spine and slightly smaller spines on basipodite .... 23.

— Uropods I on inner margin facing point of attachment of exopodite without large solitary spine .... 24.

23. Maxillipeds with narrow and highly elongated outer lobes: length of lobes roughly eight times their maximum width. Pereopods VI roughly same length as pereopods V .... 17. ***S. woltereckii*** wagl.

— Length of outer lobes of maxillipeds thrice their maximum width. Pereopods VI markedly shorter and stronger than pereopods V .... 16. ***S. oedicarpus*** Stebb.

24. Pereopods VI: 6th segment equal to or slightly shorter than 5th .... 25.
— Pereopods VI: 6th segment longer than 5th .... 27.
25. Pereopods and uropods very long and thin. Pereopods VI: 4th segment roughly 1.5 times longer than 5th ...... 19. ***S. stenopus*** Stebb.
— Pereopods and uropods not abnormally long. Pereopods VI: 4th segment equal to or shorter than 5th .... 26.
26. Pereopods V: 2nd segment denticulate along anterior margin. Pereopods VII: 6th segment considerably longer than 5th .... 5. ***S. langhansi*** Wagl.
— Pereopods V: 2nd segment smooth along anterior margin, only at base of distal process may have one–two denticles. Pereopods VII: 6th segment shorter than 5th .... 20. ***S. tullbergi*** (Bov.)
27. Pereopods V: 2nd segment armed with large denticles on anterior and posterior margins .... 15. ***S. antarctica*** Wagl.
— Pereopods V: anterior margin of 2nd segment smooth or with 1–2 (rarely 3–4) more or less conspicuous denticles (seen only during examination in profile) at base of distal process. Posterior margin denticulate .... 28.
28. Pereopods V: anterior margin of 2nd segment only at base of distal process with solitary denticles; posterior margin armed with large denticles .... 29.
— Pereopods V: anterior margin of 2nd segment smooth; posterior margin denticulate .... 31.
29. Pereopods V: 5th segment twice or more longer than 6th. Pereopods V and VI very long and thin .... 14. ***S. rattrayi*** Stebb.
— Pereopods V: 5th segment only slightly longer than or equal to 6th .... 30.
30. Uropods narrow; exopodite of uropods I very long, roughly 2/3 length of basipodite and twice longer than exopodite of uropods II. Long seta above claw of pereopods V and VI...................... .... 23. ***S. setigera*** Wagl.
— Uropods broad, exopodites of uropods I and II small, spinelike. Setae above claws of pereopods V and VI absent ..... 22. ***S. nana*** Wagl.
31. Pereopods V: 2nd segment coarsely denticulate on posterior margin. Pereopods VI: 6th segment slightly longer than 5th. Uropods broad. Length of outer lobes of maxillipeds at least two times their width .. .. 21. ***S. similis*** Stebb.
— Pereopods V: 2nd segment finely denticulate on posterior margin. Pereopods VI: 6th segment almost 1.5 times longer than 5th. Uropods narrow. Length of outer lobes of maxillipeds twice their width .... 26. ***S. latifrons*** Wagl.

138 1. ***Scina crassicornis*** (Fabricius, 1775) (Fig. 59)

Fabricus, 1775: 481 (*Astacus*); Herbst*, 1793: 134 (*Cancer*); Stebbing, 1904: 24; Tattersall, 1906: 7; Stephensen, 1918: 19, 1923: 9; Chevreux, 1919: 10; Wagler, 1926: 325, 1927: 90; Shoemaker, 1945a: 228; Vinogradov, 1960a: 221.—Shoemaker, 1945a: 228 (*bermudensis* var.).—cornigera Milne-edwards, 1830: 387 (*Hyperia*); 1840: 80 (*Tyro*); Stebbing, 1888:1273, 1895: 351; Chevreux, 1900: 121.—*gracilis* Dana, 1853: 834 (*Clydonia*).—atlantica Bovallius, 1885b: 14 (*Tyro*).—*sarsi, atlantica, longipes* Bovallius, 1887b: 9, 13, 15 (*Tyro*).

Largest and one of the most abundant species of the genus Scina.The size of sexually mature specimens varies from 12 to 29 mm in females.

The pereon is broadly oval. The pleon and urosomite I have one low dorsal and two lateral keels.

The head has a highly protruding mouth cone. Antennae I surpass the pereon in length but are shorter than the pereon and pleon together.

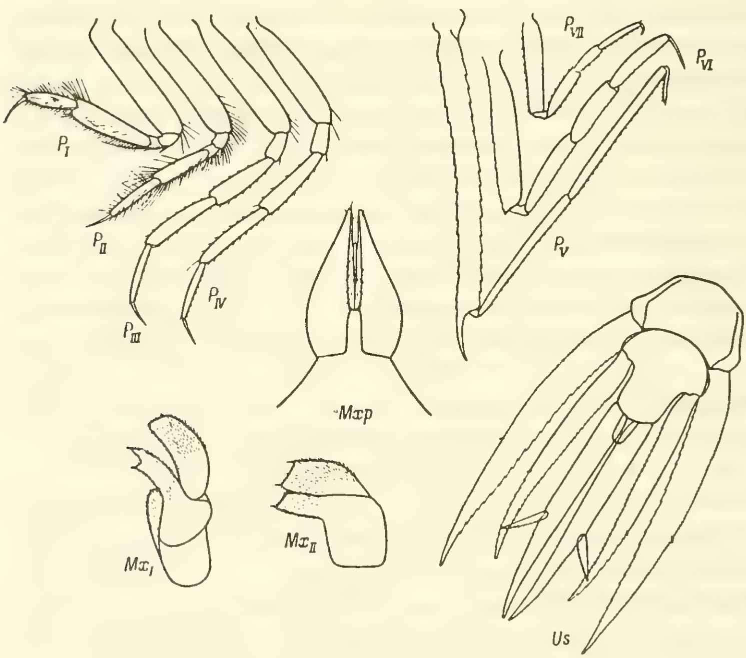


Fig. 59. *Scina crassicornis* (Fabricius) (after Wagler, 1926).
(The author does not mention the sex of the illustrated specimen; this is true of several of his other illustrations).

* Not listed in Lit. Cited—Ed.

Antennae II in males are long, the 3rd and 4th segments of the peduncle clavate, and the thin flagellum five-segmented.

The outer lobes of the maxillipeds taper sharply in the distal part; the fused inner lobes are roughly half the length of the outer, their apex straightly truncated and bearing two setae.

The structure of the appendages, particularly the last three pairs of pereopods, is fairly constant. Pereopods III–IV are identical in length and structure; the 4th and 5th segments are equal in length; the 6th segment is slightly narrower and shorter; the claws are long and thin. The
139 2nd segment of pereopods V is slightly denticulate on the anterior[5] and posterior margins; its anterior distal angle is produced into a smooth acute process, several times longer than the 3rd segment; the 4th segment is roughly the same length as the 5th or slightly shorter than it, and together they are longer than the 2nd segment; the 6th segment is weak and short, usually 1/4–1/3 the length of the 5th; the claws are short and curved. Pereopods VI are noticeably shorter but stronger than pereopods V; the 2nd segment is smooth along both the anterior and posterior margins; the 4th segment is longer than the 5th, which in turn is longer than the 6th or equal to it; the claw is long and slightly curved. Pereopods VII are weak, their 6th segment longer than the 5th; the claw is long and curved. Uropods I and II are uniformly finely denticulate on the posterior margin; the posterior margin of uropods III is smooth. The telson has parallel margins and is apically rounded.

Notes: There are specimens in which the proportions of pereopods V–VII differ from the typical: the 4th segment of pereopods V is almost half the length of the 5th; the 6th segment of pereopods VI and VII is notably shorter than the 5th; the claws of pereopods VI and VII are shorter than in the typical form. Such differences from the typical specimens have been observed in the specimens from the tropical part of the Pacific Ocean and from the South and North Atlantic (Barnard, 1932; Shoemaker, 1945a; Vinogradov, 1960a). The presence of specimens exhibiting intermediate characteristics of these features does not permit us to share the opinion voiced by Shoemaker about

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[5] Here and later, referring to the ornamentation of the anterior margin of the 2nd segment of pereopods V, we permit some arbitrariness. This segment in the greater majority of the *Scina* species is triquetrous in cross section; moreover its base forms the anterior margin and its apex—the posterior margin of the segment.Both the anterior keels reach the distal end of the segment where they unite to form a denticle in which the anterior distal angle of the segment is produced ; the outerkeel is more chitinized than the inner one. In mounted appendages only the outer keel is visible and in speaking about the ornamentation of the anterior margin of the 2nd segment, we actually imply the ornamentation of only the anterior outer keel. The inner keel is weakly armed in extreme cases similar to the outer keel. In mounted specimens it is discernible with great difficulty.

the possibility of separating specimens that deviate maximally from the type specimen into a special subspecies.

In the structure of pereopods, length of antennae, and several other features, many species—*S. curvidactyla* and *S. curilensis* and, to a lesser extent, *S. incerta* and *S. langhansi*—come closer to *S. crassicornis*, and form a single group. Some general features of the species of this group are also found in *S. borealis* and *S. vosseleri* but since several significant differences exist, they cannot be included in the *crassicornis* group.

Distribution: A circumoceanic warm-water species that enters, however, the cold-water regions of the Atlantic Ocean (up to 64°N) and Antarctica (66°S). In the Pacific Ocean it is not found north of 44° N. It is absent in the northeastern part of the Arabian Sea where there is a distinct subsurface layer deficient in oxygen. It inhabits mostly the upper 500 m but is also known from catches of 1,400–2,700 m. Repeatedly found in surface waters. According to the data of Thurston (1976b) its diurnal migrations are of large amplitude. It can produce phosphorescence in the form of running violet flashes moving from the proximal to the distal end of the pereopods.

2. ***Scina curvidactyla*** Chevreux, 1914 (Fig. 60)

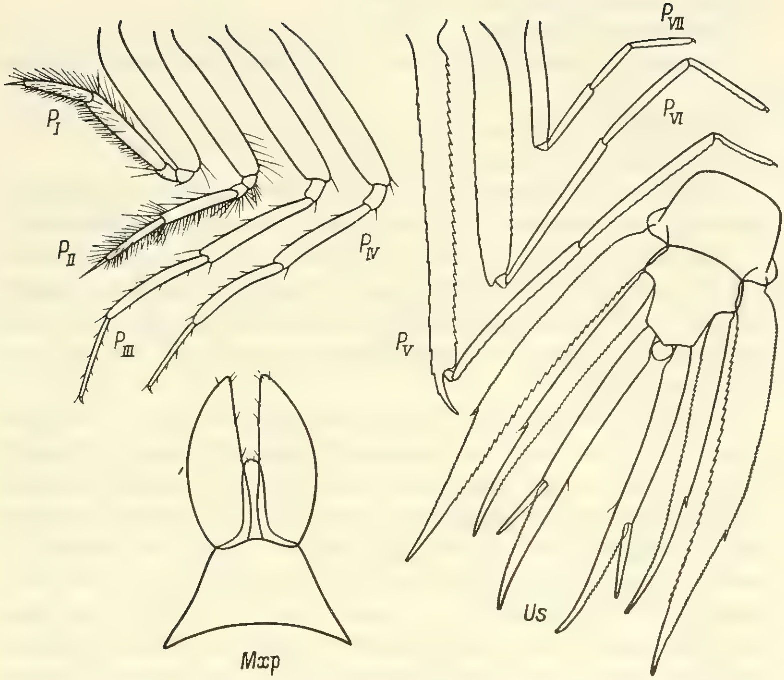
Chevreux, 1914: 3, 1919: 12; Wagler, 1926: 328, 1927: 92; Barnard, 1932: 259; Shoemaker, 1945a: 230; Vinogradov, 1960a: 228.

Sexually mature specimens vary in length from 13 to 23 mm (females).

140 The body has well-developed dorsal and lateral keels originating at the base of antennae I. Antennae I exceed the length of the pereon, reaching 2/3 the body length.

The mouth cone is somewhat less distinct than in *S. crassicornis.* The outer lobe of the maxillipeds is oval, not tapering sharply to the distal end; the inner lobe reaches almost half the length of the outer and on its rounded distal end bears two small apical setae.

Pereopods III and IV are identical in length and structure, their rod-shaped 4th and 5th segments roughly equal, the thin 6th segment slightly shorter than either of them; the claw is short and curved. The 2nd segment of pereopods V is denticulate on the anterior and posterior margins but the denticles more distinct on the posterior margin; the slightly curved, long distal process bears 1–3 denticles on the anterior margin; the 4th segment is slightly longer than the 5th; the 6th segment is very thin and short, about 1/4 the length of the 5th; the claw is very small. Pereopods VI, unlike in S. crassicornis, are only slightly shorter than pereopods V; the 2nd segment is slightly denticulate in the middle part of the posterior margin; the 4th segment is markedly longer than the 5th; the 6th segment is longer and stronger than in pereopods V; the claw is very small and curved. Pereopods VII are weak; the 6th segment is roughly equal to the



140 Fig. 60. *Scina curvidactyla* Chevreux female (after Wagler, 1926).

5th; the claw is very small and somewhat curved. The claws of pereopods VI and VII may not be as short and strongly curved as depicted in the illustration. Specimens with almost straight claws have been found in the Pacific Ocean and North and South Atlantic (Barnard, 1932; Shoemaker, 1945a; Vinogradov, 1960a). In sexually mature specimens the segments are broader than in younger ones; the length ratios of the segments also vary somewhat with age.

Upropods I and II are finely denticulate on the posterior margin; moreover, in uropods I the denticles are large. Uropods III have a smooth posterior margin. The telson is triangular-oval; its maximum width is almost equal to its length.

Distribution: This is a circumtropical species, more strictly confined to the warm-water zone than *S. crassicornis*. It is known from the Pacific, Indian, and Atlantic oceans and the Mediterranean Sea. It is found from 44–49° N (Pacific Ocean in the zone of Kuroshio, Atlantic Ocean in the zone of influence of the Gulf Stream) to 43° 20′ S (southern Africa). It inhabits the upper 1,000–1,500 m layer but adults rarely rise above 200 m.

3. ***Scina curilensis*** Vinogradov, 1956

Vinogradov, 1956: 203.

The color of freshly fixed specimens is white with reddish pigment cells.

The pereon is oblong-oval, smooth; a low dorsal and two lateral keels are present on the pleon and urosomite I.

Antennae I are longer than the pereon but shorter than the pereon and pleon together. Antennae II in males have a five-segmented flagellum.

The outer lobes of the maxillipeds are elongated-oval and armed with a row of short setae at the distal end and along the inner margin;
142 the inner lobes are apically straightly truncated and bear two short setae; in males the inner lobes are roughly 1/4 and in females 2/5–1/3 the length of the outer lobes.

The distal process of the 2nd segment of pereopods V is long and slightly curved; there are two denticles on its anterior margin, the remaining part of the anterior side of the segment is denticulate; the posterior side of the segment has large curved denticles; the 4th segment is almost equal in length to the 5th; in males the claw is short and curved, in females almost straight. Pereopods VI are slightly shorter than pereopods V; the 4th segment is 1.5 times longer than the 5th and more than twice longer than the 6th segment; the claw in females is straight, in males curved. Pereopods VII are weak; the 4th segment is insignificantly longer than, and the 6th almost half the length of the 5th; the slightly curved claw is 2/5 the length of the 6th segment.

Uropods I and II are finely denticulate on the posterior margin. Uropods III have a smooth posterior margin. The telson is roundish-triangular; its height is equal to its width at the base.

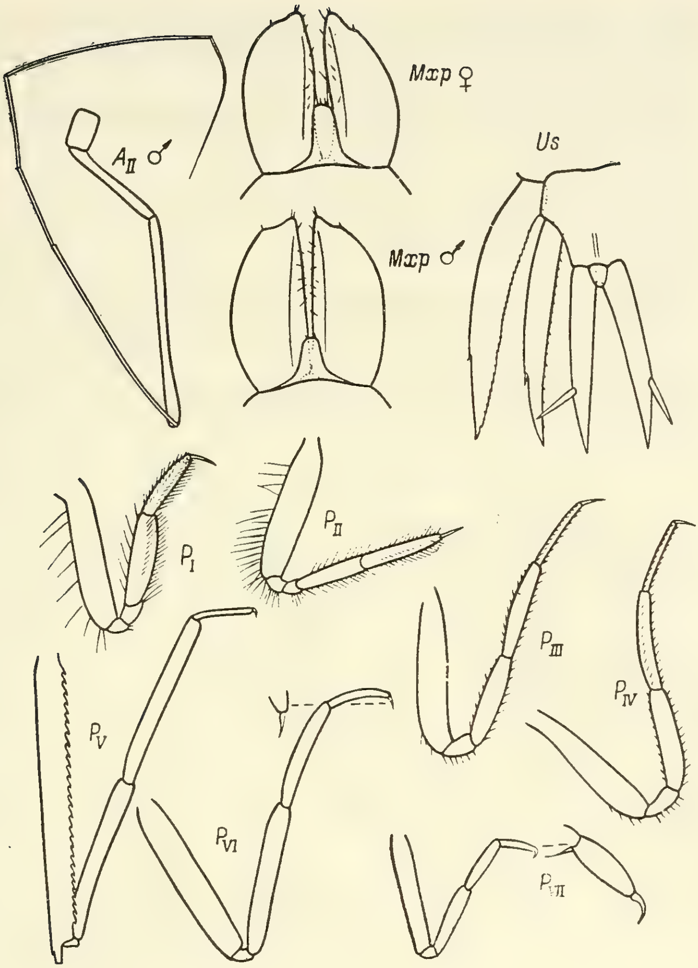
Scina curilensis curilensis Vinogradov, 1956 (Fig. 61)

Vinogradov, 1956: 203 (pro sp.).

Sexually mature specimens 15–17 mm in length.

Pereopods I and II: in females the 2nd segment is shorter than the 5th and 6th segments together; in males the 5th segment is longer than the 6th, in females it is almost equal to the 6th. Pereopods III and IV are identical in length and structure; the 2nd segment is 2/3 the length of the 4th and 5th together; the length of the 4th, 5th, and 6th segments is almost similar–the 5th segment is only insignificantly longer and the 6th shorter than the rest; the claw is straight and long. The 2nd segment of pereopods V is denticulate only on the anterior margin; the slightly curved 6th segment is 1/2 the length of the 5th segment.

Distribution: Bearing (up to 62° N) and Okhotsk seas and the adjoining cold-water Kuril-Kamchatka region of the ocean. It does not enter the warm waters of Kuroshio. The southernmost record is 42°30′ N,



141 Fig. 61. *Scina curilensis curilensis* Vinogradov, male (after Vinogradov, 1956).

150° 19′ E and 47° 36′ N, 153°04′ E. It inhabits the upper 1,000 m layer but has not been found above 100–200 m.

Scina curilensis hawaiensis Brusca, 1978

Brusca, 1978: 288 (pro sp.).

Length of the only known srecimen, a sexually immature female, 9 mm.

This form differs from the type form in the smaller size and somewhat different length ratios of segments of pereopods I–VI. The 2nd segment of pereopods I is longer than the 5th and 6th together. The 2nd segment of pereopods III is equal to the 4th and 5th together. The 2nd segment of pereopods V is coarsely denticulate on the anterior margin; the 6th segment is half the length of the 5th.

Distribution: Found southwest of Oahu (Hawaiian Islands) in a catch from a depth of 750 m.

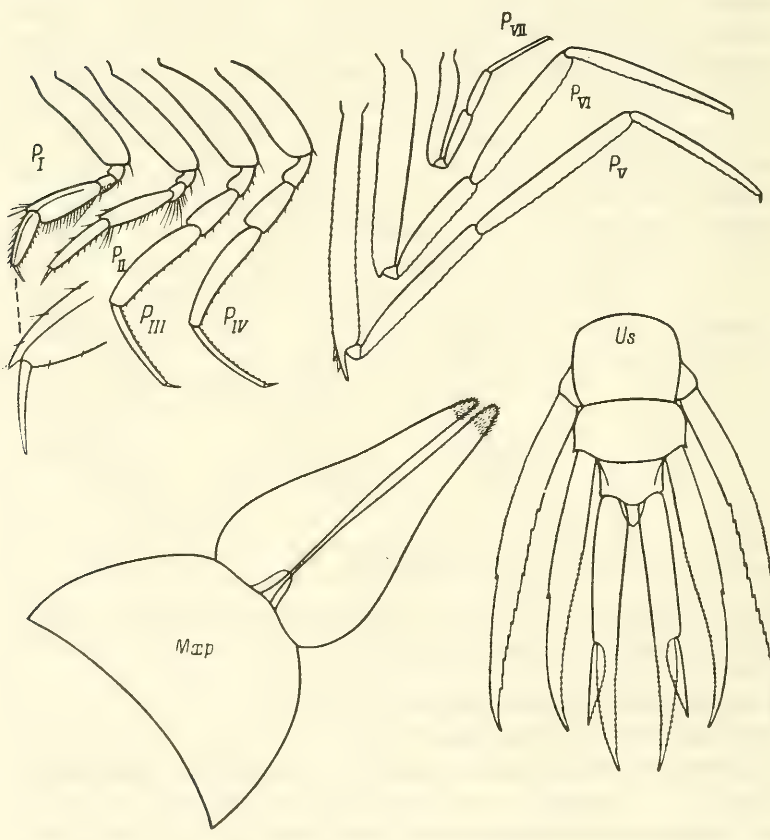
4. ***Scina incerta*** Chavreux, 1900 (Fig. 62)

Chevreux, 1900: 123; Wagler, 1926: 331, 1927: 93; Shoemaker, 1945a: 230.

Length of sexually mature specimens ranges from 8.5 to 16 mm.

The color of live crustaceans is wine-red. The pereon is oblong-oval. The dorsal keel is well developed.

Antennae I are thin, equal to or longer than the pereon and pleon together.



143 Fig. 62. *Scina incerta* Chevreux (after Wagler, 1926).

143 The mouth cone projects markedly. The outer lobes of the maxillipeds are longer, abruptly tapering distally; the inner lobes are not armed and roughly 1/8–1/6 of the outer.

Pereopods I are roughly equal in length to pereopods II but stronger; the anterior part of the broadened, oblong-oval 6th segment is compressed in the form of a plate, its anterior distal angle produced into a small acute denticle projecting above the claw, which makes it possible to readily differentiate this species from the other larger species of the genus Scina. Pereopods III and IV are similar in structure, their 4th segment broadened distally and considerably shorter than the mutually equal 6th and 5th segments; the claw is long, thin, and slightly curved. Pereopods V are longer than the rest, their 2nd segment considerably shorter than the 4th, 5th, and 6th segments together; the anterior and posterior margins of the 2nd segment are finely denticulate, the distal process is slightly longer than the 3rd segment and bears two very distinct denticles on the anterior margin; the 6th segment is insignificantly shorter than the 5th. Pereopods VI are only slightly shorter than pereopods V; their 6th segment is longer than the 5th, which in turn is longer than the 4th segment. Pereopods VII are small, their 6th segment longer than the 5th while the latter is shorter than the 4th. The claws of pereopods V–VII are short and slightly curved.

Uropods I are finely denticulate on the posterior margin. The basipodite of uropods* III is smooth while the endopodite is finely denticulate on the anterior and posterior margins.

Distribution: This is a panoceanic species and does not enter the Arctic Basin nor the Antarctic region. It is known from the Atlantic (from 46°15′ N, 50°09′ W to 35°18′ S, 19°00′W), Pacific (from the Bering Sea up to 41°19′ S, 177°44′ E) and tropical regions of the Indian
144 Ocean, including the Arabian Sea. It is common in the 200–1,000 m layer but more often found at depth of 500–750 m. It is one of the most common species of the genus *Scina.*

5. ***Scina langhansi*** Wagler, 1926 (Fig. 63)

Wagler, 1926: 335; vinogradov, 1964: 131.

Length of sexually mature specimens 8–10 mm.

The pereon is broadly oval and smooth. The pleon has a weakly developed keel.

Antennae I are roughly equal in length to the pereon. The mouth cone is relatively small and barely projects. The outer lobes of the maxillipeds are small and markedly tapering distally; the inner lobes are weakly developed and distally only 1/5 the length of the outer.

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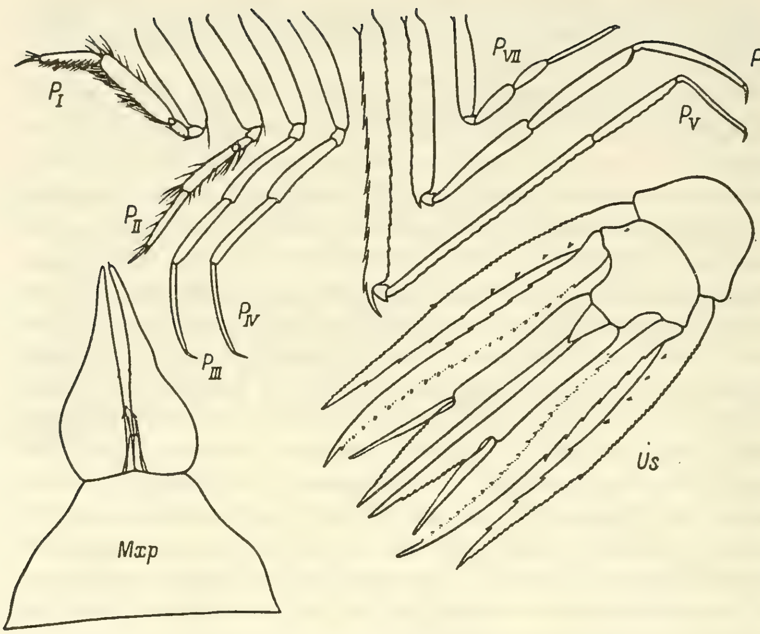
* Changed from Russian original by author —Eds.



144 Fig. 63. *Scina langhansi* Wagler (after Wagler, 1926).

In pereopods I and II the 2nd segment is somewhat shorter than the 5th and 6th segments together; the claw is long and thin. Pereopods III and IV are long, thin, and very weakly pubescent; their 6th segment is insignificantly longer than the 5th. The 2nd segment of pereopods V bears long, slightly curved, and projecting denticles on its anterior margin, while the posterior margin is finely denticulate; the distal process is curved and only slightly longer than the 3rd segment; the 4th segment is longer than the 5th and 6th together. Pereopods VI are slightly shorter than pereopods V; their 4th, 5th, and 6th segments are roughly equal in length; the claw is slightly curved. Pereopods VII are short, their 6th segment is only slightly shorter than the 5th and 4th* segments together; the claw is short and curved.

Uropods I are denticulate along the entire anterior margin and bear isolated spines on the posterior margin. The basipodite of uropods II bears sparse denticles on the anterior margin; the posterior margin of the basipodite and endopodite is finely denticulate. The posterior margin of the expodite of uropods III and the anterior margin of their basipodite

* Changed from Russian original by author—Eds.

smooth; the anterior margin of the endopodite is denticulate. The telson is oblong-triangular with an acute tip.

145 *Distribution*: This species is known from the equatorial regions of the eastern Atlantic; tropical, central and eastern Pacific, and equatorial regions of the western part of the Indian Ocean. It has been found only in total catches from depths of over 500–1,000 m to the surface.

6. ***Scina vosseleri*** Tattersall, 1906 (Fig. 64)

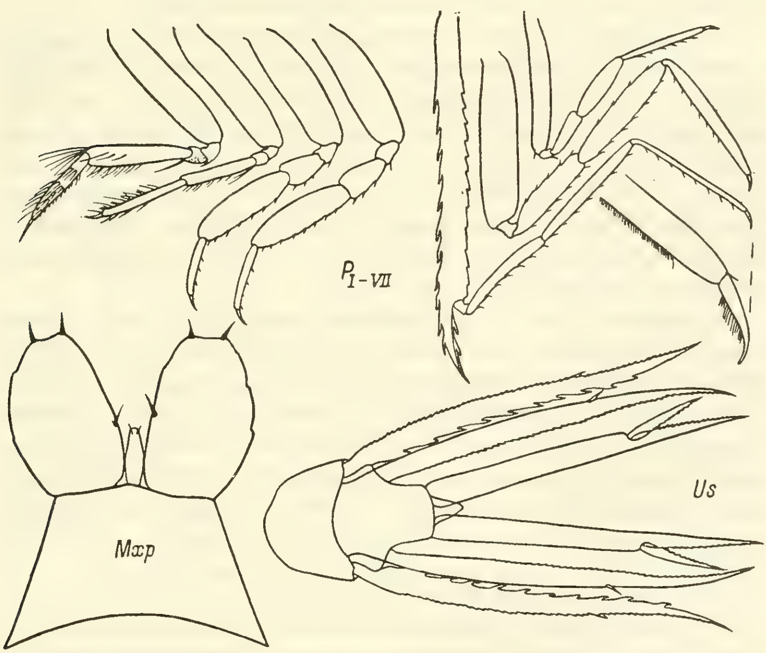
Tattersall, 1906: 7; stephensen, 1918: 27; Chevreux, 1919: 11; Wagler, 1926: 416.

Length of sexually mature specimens ranges from 9 to 15 mm.

The body is smooth; the head has a weakly developed keel. Antennae I are rather thin and equal in length to the entire body.

The mouth cone is large. Maxillae I have a very short palp that does not reach the distal end of the outer lobe. The maxillipeds have short, oval outer lobes, with a straightly truncated apex; the inner lobes are 1/3 the length of the outer.

In pereopods I and II, unlike in most *Scina* species, the 5th and 6th segments together are longer than the 2nd segment. In pereopods I the



145 Fig. 64. *Scina vosseleri* Tattersall, female (after Wagler, 1926).

5th segment is slightly longer than the 6th while in pereopods II they are almost equal and very thin. Pereopods III and IV are characterized by broad 4th and 5th segments; moreover, the 5th segment is roughly 1.5 times longer than the rod-shaped 6th segment and roughly twice longer than the distally broadened 4th segment. The 2nd segment of pereopods V is narrow and armed on the anterior margin with long, slightly curved denticles, while the posterior margin of the segment may be either denticulate or bear similar denticles as on the anterior margin; the strong, distal process is long, acute, slightly curved, falling just short of the 4th segment and in length is nearly 1/4 the 2nd segment; the anterior and posterior margins of this process also bear similar denticles as on the anterior margin of the segment; the 4th segment is nearly 4/5
146 the length of the 5th segment, which in turn is roughly equal to the 6th. All the distal segments, especially the 6th, are very thin; the long conical claws are slightly curved in the distal part and bear numerous long setae on the anterior margin. Pereopods VI are notably shorter than pereopods V; their 2nd segment is almost half the length but broader than the 2nd segment of pereopods V; the 4th segment is shorter than the 5th, which in turn is slightly longer than the 6th segment. Pereopods VII are slightly shorter than pereopods VI; their 4th segment is slightly shorter than the 5th, which in turn is shorter than the 6th segment.

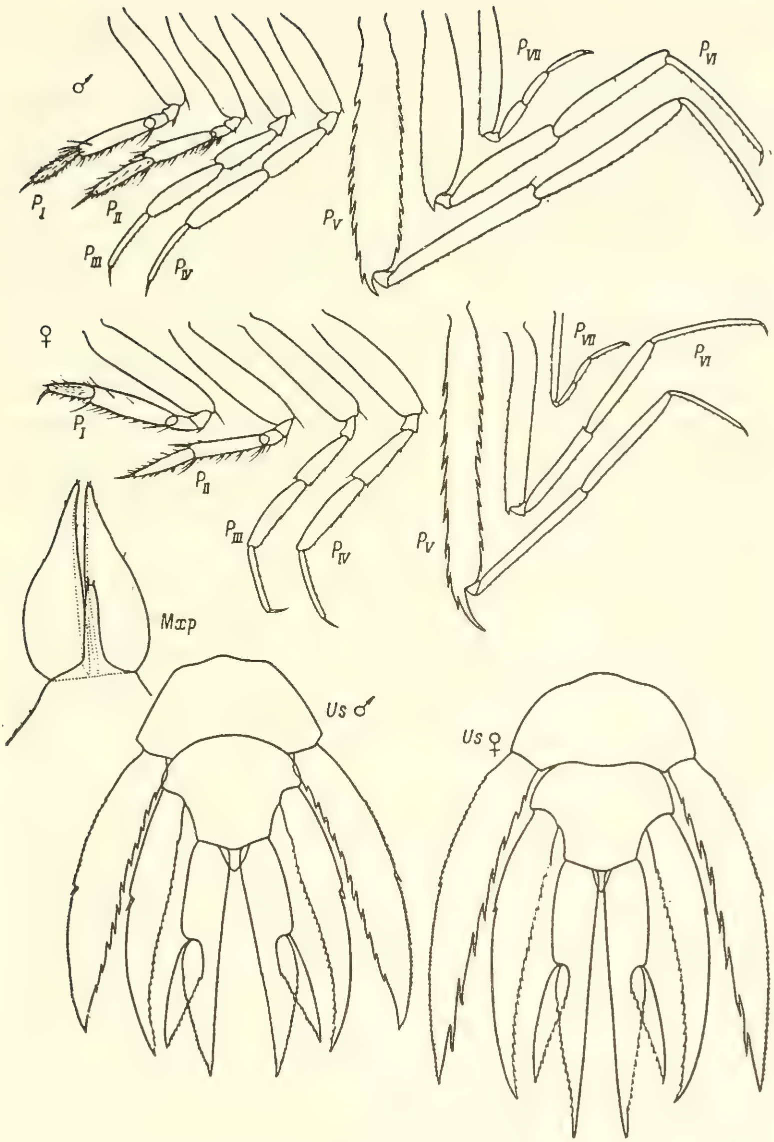
The uropods are narrow and long; the basipodite in all the uropods is considerably longer than the endopodite, the expodite in uropods I is reduced to a very small spine and in uropods II to a longer spine. The anterior margin of uropods I is finely denticulate and the posterior margin armed with sparse, long, slightly curved spines. The anterior margin of uropods II is smooth while the posterior margin is finely denticulate. In uropods III only the inner margin of the expodite and endopodite is denticulate. The telson is triangular with an acute tip; its length is nearly equal to its basal width.

Distribution: This is a warm-water species known from various regions of the Atlantic Ocean (from 53°07′ N, 15°06′ W to 31°21′ S, 9°46′ E) and from the northern part of the Indian Ocean (up to 29°43′ S, 90°02′ E). In the Pacific Ocean it is found in the northern tropical and equatorial regions (from 28°08′ N, 141°08′ E to 43° S , 158°W). Sexually mature specimens were found in the 500–1,800 m layer and in many through catches from depths over 1,000 m to the surface; however, younger specimens were found in the 50–100 m layer.

7. ***Scina borealis*** (G.O. Sars, 1882) (Fig. 65)

G.O. Sars, 1882: 77 (*Clydonia*), 1890: 20; Bovallius, 1887b: 16 (*Tyro*), 1887c: 550 (*Tyro*); Wagler, 1926: 337, 1927: 94.—clausi Bovallius, 1885b: 14 (*Tyro*), 1887b: 18 (*Tyro*); Vosseler, 1901: 104.

Length of sexually mature specimens reaches 7–8 mm.



147 Fig. 65. *Scina borealis* (G.O. Sars) (after Wagler, 1926).

The body is smooth and without keels; low crests run only on the head from the middle of the front to the antennae. Antennae I are thin and slightly longer than the pereon.

The mouth cone does not project markedly. The outer lobes of the maxillipeds are long, tapering distally; the inner lobes are nearly half the length of the outer and their distal margin is straight.

The width of the segments and the degree to which the pereopods and uropods are armed vary markedly. The claws of pereopods I and II are long and thin. Pereopods III and IV are identical in structure; their 6th segment is almost equal in length to the 4th and somewhat shorter than the 5th; the claw is long and almost straight. Pereopods V are the longest of all the pereopods, oblong-oval, or with parallel margins; the 2nd segment has numerous large denticles on the anterior and posterior margins and a slightly curved, distal process that varies in length from short to 2–3 times longer than the 3rd segment; the 4th segment is equal to or slightly longer than the 5th, which in turn is much (1.5 times) longer than the 6th segment. Pereopods VI are slightly shorter than pereopods V; their 6th segment is somewhat longer than each of the almost equally long 4th and 5th segments. Pereopods VII are longer than the 2nd segment of pereopods VI; their 6th segment is considerably longer than the 5th segment; the claw is short and curved.

Uropods I bear a small number of strong, slightly curved spines on the posterior margin and are finely denticulate on the anterior margin. Uropods II have a smooth anterior and finely denticulate posterior margin. In uropods III both the anterior and posterior margins of the basipodite are smooth but only the posterior margin of the exopodite.
147 The length of the small triangular telson may be slightly more or less than its basal width.

The females have a brood pouch containing 60–80 eggs.

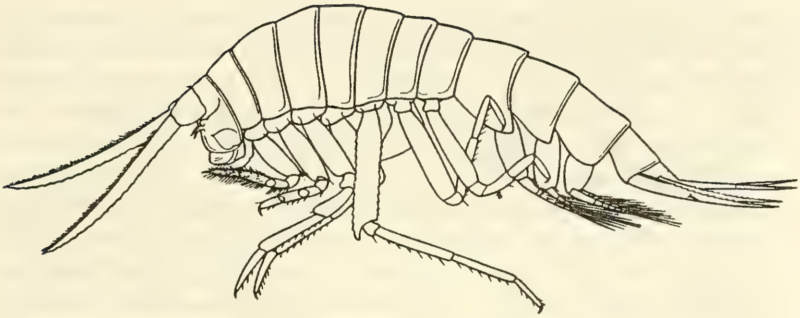
Distribution: A panoceanic species. It is the most common and numerous scinid inhabiting the temperate, cold-water, and tropical regions. In the Arctic Basin it is found at 80° N, in the Antarctic in ice right up to 65–72° S. It inhabits a wide range of depths; found in catches from 50–100 to 2,000–3,000 m but is most numerous in the 200–1,000 m layer.

148 8. ***Scina spinosa*** Vosseler, 1901 (Figs. 66, 67)

Vosseler, 1901: 108; Shoemaker, 1945a: 230; Vinogradov, 1957: 214, 1960a: 231, 1964: 132.—Wagler, 1926: 350 (spinosa subsp.), 1927: 95; Wagler, 1926: 352 (affinis subsp.).—uncipes Stebbing, 1904: 23; Wagler, 1926: 345 (uncipes subsp.).—lamperti Vosseler, 1901: 110.—uncipes lamperti Wagler, 1926: 348.

Length of sexually mature females ranges from 5.5 to 10.5 mm, of males from 8 to 9 mm.

The body is thickset, without keels. The eyes are small. Antennae I are strong but shorter than the pereon. The mouth cone protrudes



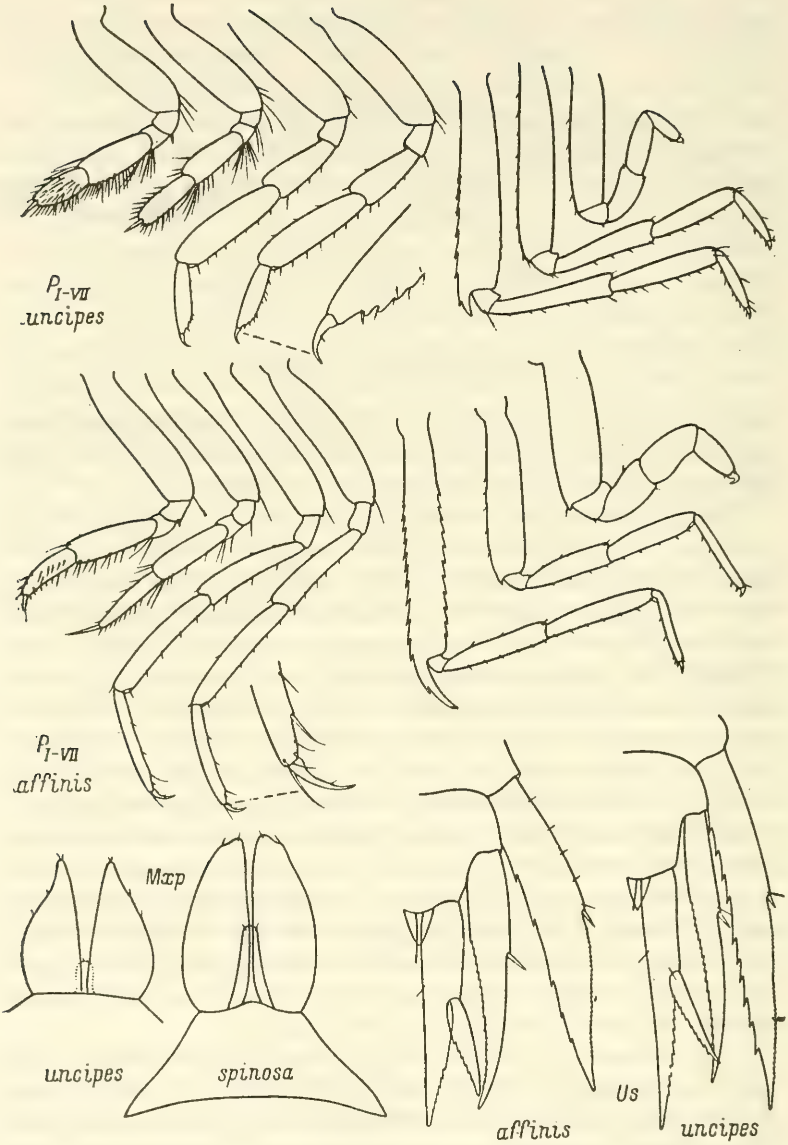
148 Fig. 66. *Sciina spinosa* Vosseler, female.

markedly. The outer lobes of the maxillipeds are short and broad, tapering distally to some degree; the length of the inner lobes varies greatly and may constitute 1/4–1/2 the length of the outer lobes.

Pereopods I and II have broad, highly pubescent 5th and 6th segments, of which the former is slightly longer than or equal to the 2nd segment. Pereopods III and IV are much longer than pereopods I and II; their 4th segment is notably shorter than the 5th and almost equal to the 6th in length; the distal part of the posterior margin of the 6th segment is curved. The 2nd segment of pereopods V is shorter than all the rest together, denticulate on the anterior and posterior margins, its distal process 2–3 times as long as the 3rd segment though it may also be shorter than it, and has one denticle on the anterior margin; the 4th segment is slightly longer than the 5th and 1.5–2.0 times longer than the 6th segment, which is short and slightly curved. Pereopods VI have roughly the same proportions as pereopods V but are shorter, and the margins of their 2nd segment are not denticulate; the claw is short and slightly curved. Pereopods VII are slightly shorter but generally stronger than pereopods VI; the 4th and 5th segments are equal and each is slightly longer than the 6th segment, although there are specimens with a relatively longer 6th segment; the claw is short and uncinately curved.

The uropods are short and broad. Uropods I bear numerous large spines on the posterior margin; the endopodite has a finely denticulate anterior margin. Uropods II have a smooth anterior margin and are finely denticulate in the distal part of the posterior margin. In uropods III both the posterior and anterior margin of the basipodite are smooth; the posterior margin of the endopodite and the anterior margin of the exopodite are likewise smooth. The telson is large and oblong-triangular.

Notes: *S. spinosa* is characterized by a thickset body, relatively short antennae, large protruding mouth cone, and strong short pereopods. Pereopods VII are strong, sometimes not shorter than pereopods VI, and their



149 Fig. 67. *Scina spinosa* Vosseler (after Wagler, 1926).
Variations in the structure of the maxillipeds, pereopods, and uropods.

claw short and uncinately curved. However, the structural details of the maxillipeds, the relative length of the pereopods, the shape of the 6th
149 segment of pereopods III and IV, and the degree of ornamentation of the

2nd segment of pereopods V and of the uropods are all highly variable. This served as a basis for describing different specimens as independent species or subspecies. However, we often came across specimens occupying an intermediate position, which could not be assigned to a particular subspecies since in some characters they are close to one while in other
150 characters they are closer to others. For example, the specimen found by us in the Indian Ocean, in the shape of the outer lobes of the maxillipeds and ornamentation of the uropods III is close to *S. uncipes uncipes*, in the shape of the 6th segment of pereopods III could be included under *S. spinosa affinis*, and in the structure of pereopods VII under *S. uncipes lamperti*, according to the illustration given by Wagler. This provides a basis for considering *S. spinosa* a single, highly variable species while bearing in mind that after a detailed analysis of a fairly large amount of material from different regions of the ocean, it might be possible to separate the actual subspecies that exist.

Scina indica, S. pubera, S. stebbingi, and *S. alberti* are quite close to *S. spinosa.* These species form a more or less compact group.

Distribution: *S. spinosa* is known from the tropical regions of the Indian (except the northeastern part of the Arabian Sea) and Pacific oceans, from the northern part of the Pacific Ocean (including the deepwater regions of the Bering Sea) and from the southern regions of the Atlantic (up to 55° S) and Indian (up to 64° S) oceans. It is most frequently found at depths of 200–1,000 m, but also in deeper layers (1,000–4,000 m). Evidently, it does not rise to depths less than 200–500 m.

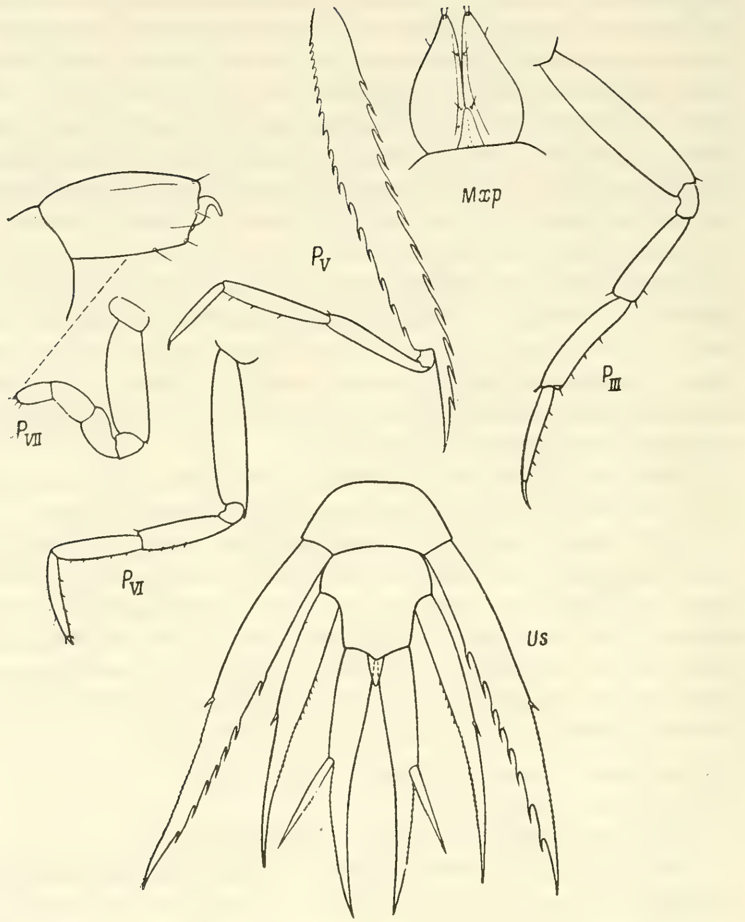
9. ***Scina indica*** Vinogradov, 1964 (Fig. 68)

Vinogradov, 1964: 133.

Size of sexually mature females 6–8 mm; males not known.

The body, as in *S. spinosa*, is thickset. The antennae are shorter than the pereon, strong with large forwardly bent spines on both sides.

The outer lobes of the maxillipeds are short, sharply tapering distally. Pereopods I and II are also similar in structure to *S. spinosa.* In pereopods I the 6th segment is slightly shorter than the 5th, and in pereopods II it is equal to the 5th segment; the claw is long and straight. Pereopods III and IV are identical in structure; the distally slightly tapering 6th segment is shorter than the 5th but equal to the 4th; the distal part of the posterior margin of the 6th segment lacks a notch. The 2nd segment of pereopods V is longer than the rest of the segments together, its posterior and especially the anterior margin is armed with long, strong, slightly curved denticles reaching beyond the anterior margin of the long distal process whose tip almost reaches the distal end of the 4th segment; the 5th segment is equal to the 4th and slightly longer than the 6th. Pereopods VI are considerably shorter than pereopods V; the 2nd segment is shorter than the 5th and 6th together; the 4th segment is equal to the 5th



151 Fig. 68. *Scina indica* Vinogradov, female (after Vinogradov, 1964).

and slightly longer than the 6th segment. In the strong pereopods VII the 6th segment is shorter than the 5th and almost does not taper distally; the claw is small and uncinately curved.

Uropods I are armed on the posterior margin with long curved spines. In uropods II the posterior margin is finely denticulate and in uropods III it is smooth. The telson is oblong-triangular; its length is more than its basal width.

Distribution: Tropical regions of the Indian Ocean. It is found in catches from 100–500 and 950–2,000 m.

10. ***Scina pubera*** Wagler, 1926 (Fig. 69)

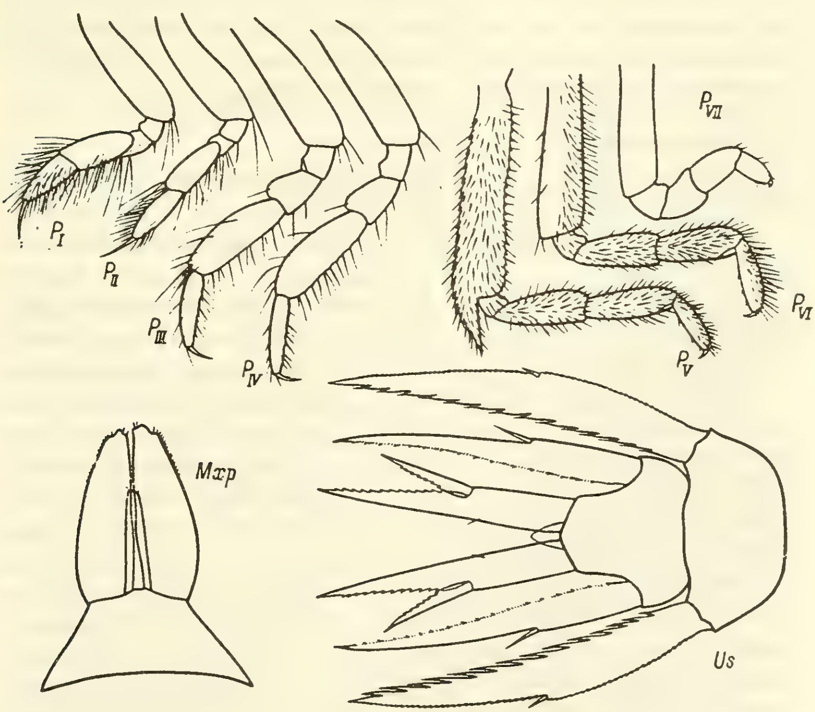
Wagler, 1926: 354; Vinogradov, 1964: 134.

Length of known specimens does not exceed 8.5 mm; sexually mature specimens have not been found.

The body, as in *S. spinosa*, is thickset. The mouth cone is large. Antennae I are strong, shorter than the pereon. The eyes are small.

The maxillipeds have oblong-oval outer lobes weakly tapering dis-
151 tally; the long inner lobes are more than half the length of the outer lobes, i.e., their relative length is more than in any other species of *Scina*.

The pereopods are short and strong. In pereopods I and II the 5th and 6th segments are equal in length; the claw is long (equal to half the length of the 6th segment) and slightly curved. In pereopods III and IV the 4th segment is short; unlike in *S. spinosa*, it is considerably—at least 50%—shorter than the 5th segment and differs little in length from the 3rd segment; the 6th segment is notably weaker (narrower) and shorter than the 5th; the claw is long and slightly curved. The 2nd segment of pereopods V is denticulate on the anterior margin (more coarsely) and



152 Fig. 69. *Scina pubera* Wagler, male (after Wagler, 1926).

posterior margin (finely), with a long distal process with a denticle on the anterior margin; the 4th and 5th segments are equal in length; the 6th segment is shorter than either of them; the claw is short and curved; the surface of all the segments is covered with a large number of fine setae. Pereopods VI are roughly the same length as pereopods V, and have roughly the same segment length ratios although the 2nd segment is somewhat shorter, and the 6th segment is longer than in pereopods V; as in pereopods V, the surface of the segments is covered with a large number of fine setae. Pereopods VII are strong and slightly shorter than pereopods VI; the distal segments are short and broad; the 5th segment is somewhat longer than the almost mutually equal 4th and 6th segments; the claw is short and uncinately curved.

Uropods I bear long, slightly curved spines on the posterior margin and are finely denticulate on the entire anterior margin. Uropods II are
152 smooth on the anterior margin and finely denticulate on the posterior margin. The posterior margin of uropods III is smooth; the anterior margin of the basipodite is smooth and the posterior margin denticulate. The telson is oblong-oval with an acute tip.

Distribution: Equatorial and southern parts of the Atlantic Ocean and the northern part of the Indian Ocean (Zanzibar, southern part of the Arabian Sea and east of Sri Lanka). It is found only in total catches from depths of not more than 1,000 m to the surface.

11. ***Scina stebbingi*** Chevreux, 1919 (Fig. 70)

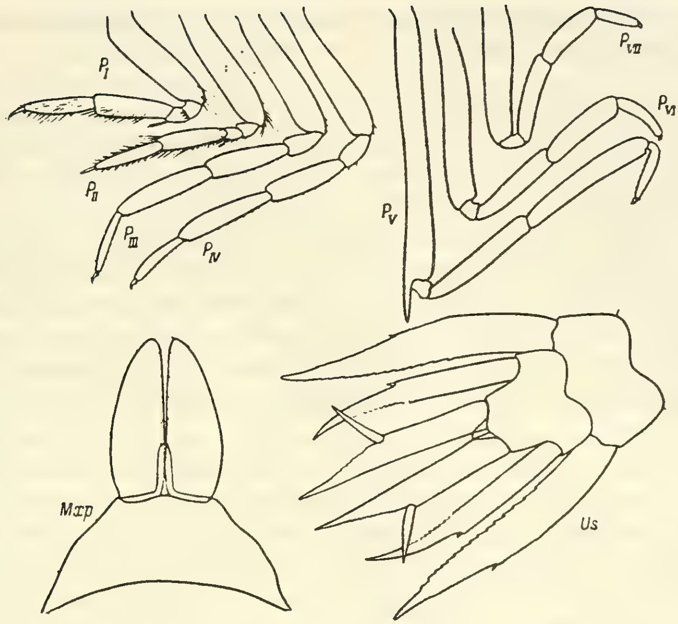
Chevreux, 1919: 1; Wagler, 1926: 356; vinogradov, 1957: 215, 1970: 394.—*armauer-hanseni* Pirlot, 1929: 72.

Size of known specimens 8–13 mm; sexually mature specimens have not been found.

The body is smooth; weakly developed crests are present only on the head. Antennae I constitute roughtly 1/3 the body length and are equal to or shorter than the pereon; they are armed very weakly or not at all.

The outer lobes of the maxillipeds are oblong-oval and their relative length varies greatly—in Wagler's illustration (Wagler, 1926) for the almost sexually mature male the ratio of length of lobes to breadth is 3:1 and in the sexually immature female examined by us, 2:1 (vinogradov, 1957); the inner lobes in Wagler's specimen reach 1/3 and in our specimen 1/2 the length of the outer lobes.

Pereopods I are equal in length to pereopods II but are slightly stronger; the 5th segment of pereopods I is longer than the 6th. In pereopods II these segments are equal in length and the claw is relatively short and slightly curved. Pereopods III and IV are much longer and stronger than the first pair; the 6th segment is somewhat shorter than the 4th, which in turn is shorter than the 5th; the claw is short and
153 curved. The last three pairs of pereopods are devoid of setae. The 2nd



153 Fig. 70. *Scina stebbingi* Chevreux, sexually immature specimen (after Wagler, 1926).

segment of pereopods V has smooth anterior and posterior margins, its distal process is only slightly longer than the 3rd segment and is also smooth; the 4th segment is slightly shorter than the 5th; the weak 6th segment is less than half the length of the 5th; the claw is short and strongly curved. Pereopods VI are somewhat shorter than pereopods V; the 5th segment is slightly shorter than the 4th and 2/3 the length of the 6th segment; the claw is small. Pereopods VII are somewhat shorter than pereopods VI, the length ratios of the distal segments the same as in pereopods VI; the claw is small and falcate.

The uropods are smooth or very weakly armed. Uropods I are very finely denticulate in the distal half of the anterior margin and bear small sparse denticles on the posterior margin. In uropods II only the proximal part of the posterior margin of the endopodite is finely denticulate while in uropods III the middle part of the anterior margin of the endopodite. The triangular telson has a blunt apex.

Distribution: Tropical Atlantic (from 28°29′ S, 6°14′E to 38°20′ N, 9°20′W), Mediterranean Sea, northwestern part of the Pacific Ocean (Kuril-Kamchatka region), and southern part of the Bering Sea. It is found in catches from depths of 100–500 (Bering Sea) and 1,000–1,500 m

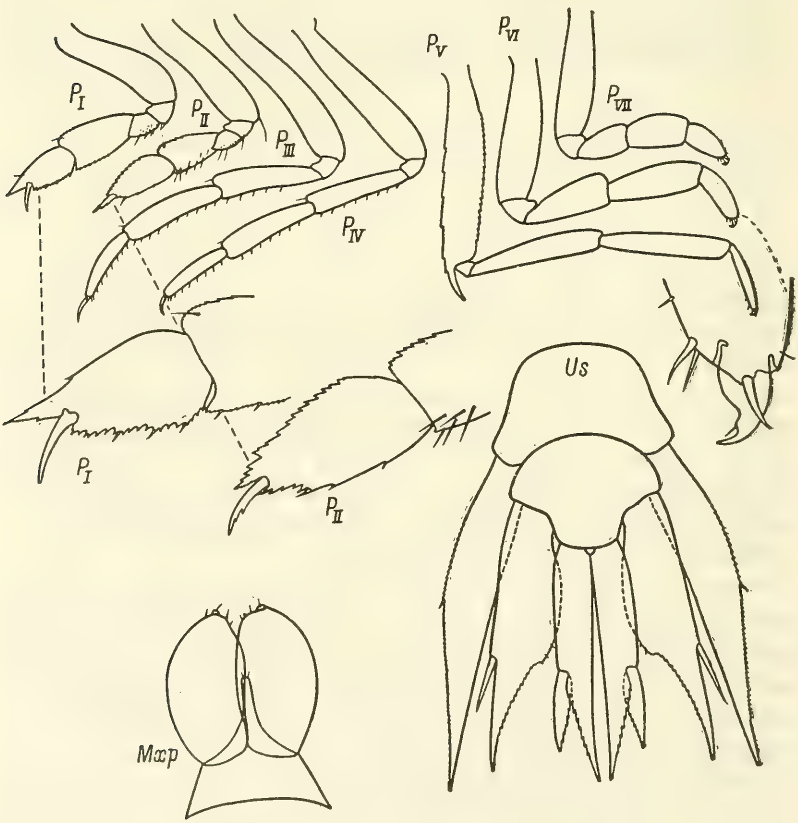
(Kuril-Kamchatka region). In the Atlantic Ocean near the Canaries it has been found in catches from depths of 40, 350 and 600 m as well as in total catches from depths of 1,000 m to the surface.

12. ***Scina marginata*** (Bovallius, 1885) (Fig. 71)

Bovallius, 1885b: 15 (*Tyro*), 1887b: 21 (*Tyro*); Stebbing, 1888: 1272; Garbowsky, 1896: 100; chevreux, 1900: 122; Wagler, 1926: 361.—*lepisma Chun*, 1889a: 533 (*fortunata*); Chun, 1889b: 289.

Length of sexually mature animals 4.5–6.5 mm.

The body is thickset and without keel. The mouth cone protrudes markedly. The eyes are well noticeable. Antennae I are strong, somewhat shorter than the pereon. The outer lobes of the maxillipeds are broadly
154 oval; the inner lobes are long and constitute 1/2–2/3 the length of the outer lobes, apically rounded, and bear two apical setae.



154 Fig. 71. *Scina marginata* (Bovallius) (after Wagler, 1926).

The pereopods are relatively short and strong. In pereopods I 2nd segment is somewhat shorter than the 5th and 6th together; the 5th segment is broad and finely denticulate in the distal part of the anterior and posterior margins; the 6th segment is shorter than the 5th, denticulate on the posterior margin and extended over the claw as a long acute spine almost equal in length to the claw. In pereopods II and 2nd segment is somewhat longer than in pereopods I and is also longer than the 5th and 6th segments together; the 5th segment is almost equal in length to the 6th, broadened distally, and denticulate in the distal half of the anterior margin; the 6th segment is denticulate along the entire anterior margin and distal third of the posterior margin, and extended over the claw as a small denticulate spine equal roughly to 1/4 the length of the spine on the 6th segment of pereopods I. Pereopods III and IV are much longer and thinner than pereopods I or II; their 4th segment is nearly the same length as the 5th segment, which is only slightly longer than the 6th; the claw is long, thin, and curved. Pereopods V are only slightly longer than pereopods III and IV; their broad 2nd segment is slightly denticulate on the anterior and posterior margins and its distal process slightly curved; the 4th segment is equal to the 5th, which is twice longer than the thinner 6th segment. Pereopods VI and VII are strong with segments shorter and broader than in pereopods V. Pereopods VII are somewhat shorter than pereopods VI; the 5th segment of pereopods VI and VII is slightly longer than the 4th and 6th segments; in pereopods VI the 4th segment is longer than the 6th and in pereopods VII these segments are equal. The claws of the last three pairs of pereopods are short, strong, and falcate; in pereopods V the claws are weaker than in pereopods VI and VII.

155 The uropods are broad and fairly weakly armed. In uropods I the exopodite is reduced to a small spine; the endopodite is longer than the basipodite; the anterior margin of the basipodite and endopodite is finely denticulate. The posterior margin of uropods II at the level of attachment of the exopodite is bent sharply so that the endopodite is tapered; its posterior margin is denticulate. Uropods III are the thinnest of all the uropods, with a well-developed lanceolate exopodite; the anterior margin of the endopodite is strongly denticulate. The telson is small and triangular.

Notes: The above description and illustration characterize sexually mature animals. In sexually immature specimens the uropods are less broad and may have a rather different ornamentation, for example isolated strong spines on the posterior margin of the basipodite of uropods I. The relative width of the segments of the pereopods changes with age and varies according to sex. In addition, these changes are also subject to strong individual variations.

Distribution: This is a warm-water surface species known from different regions of the Atlantic Ocean (from 52° N, 15° W to 19° S, 20° W), the Mediterranean Sea, central and northern regions of the Indian Ocean (up to 19°09′ S, 68°07′ E) and from the tropical regions of the Pacific Ocean. It is found in catches from depths of 40–100, 100–200, 200–500, and 500–1,000 m.

13. ***Scina submarginata*** Tattersall, 1906 (Fig. 72)

Tattersall, 1906: 12; Wagler, 1926: 367; Vinogradov, 1964: 135.—*marginata* Garbowski, 1896: 100.—*latipes* Stephensen, 1918: 32.

Length of sexually mature animals 5–8 mm.

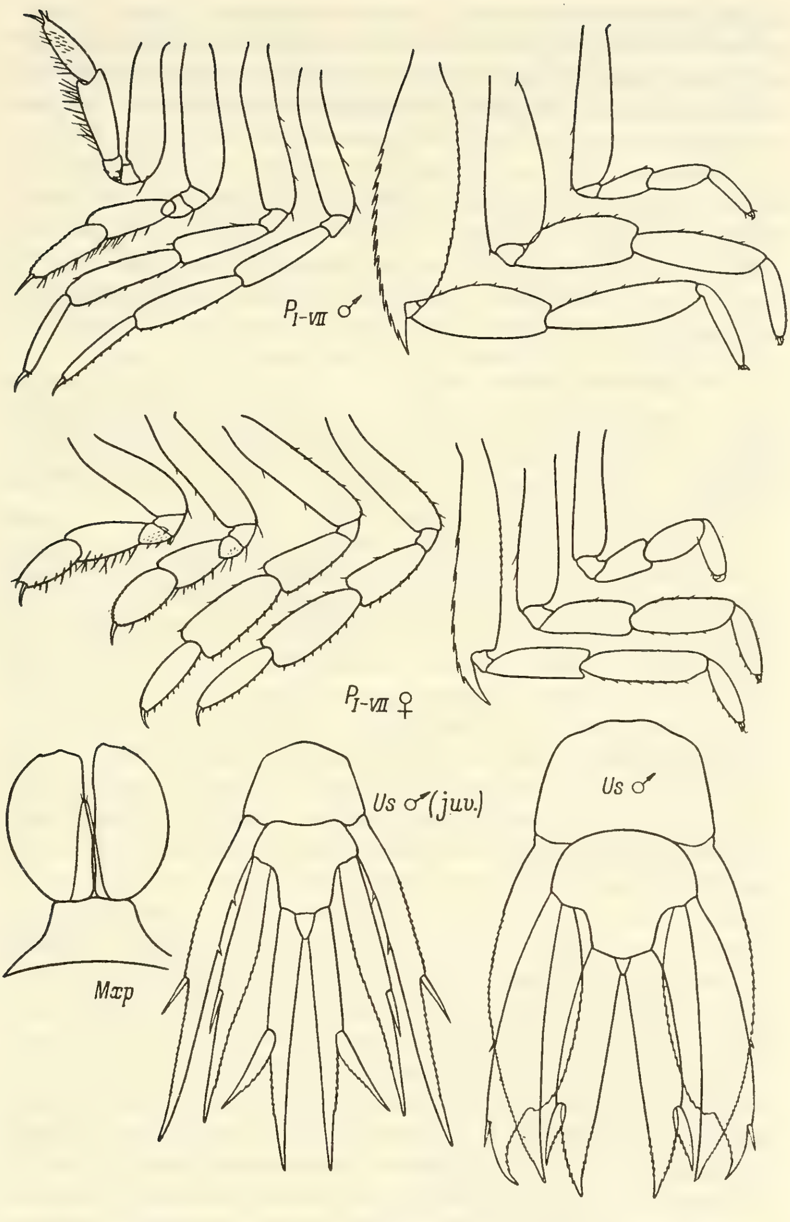
The body is thickset and without keels. The mouth cone protrudes markedly. The eyes are well noticeable. The strong antennae I are shorter than the pereon.

The outer lobes of the maxillipeds are broadly oval; the inner lobes are long, reaching 2/3–3/4 the length of the outer lobes, and armed with two small apical setae.

The pereopods are short and strong. The 2nd segment of pereopods I is shorter than the 5th and 6th segments together; the 5th segment is not denticulate in the distal part of the anterior and posterior margins; the 6th segment is the same length as the 5th or shorter, oblong-oval, and not extended over the claw in the form of a long spine. The 5th segment of pereopods II is not denticulate in the distal part of the anterior margin; the 6th segment is oval, not denticulate on the posterior margin, and does not bear a distal spine. Pereopods III and IV are longer and thinner than the preceding pair; their 4th segment is shorter than the 5th; the claw is thin and slightly curved. Pereopods V are longer than pereopods III and IV; their proximal segments are rod-shaped or elongated-oval; the 2nd segment is coarsely denticulate on the anterior margin and finely denticulate on the posterior margin, its distal process long, straight or weakly curved; the 4th segment is shorter than the 5th. Pereopods VII are shorter than pereopods VI; the 5th segment of the last pairs of pereopods is longer than the 4th or 6th segment. The width of the segments of the last three pairs of pereopods is highly variable but their claws are always short, strong, and falcate.

The uropods are weakly armed; the exopodite of all the uropods is shorter than the basipodite. The posterior margin of uropods II is sharply bent at the level of attachment of the exopodite, so that the endopodite is tapered; the posterior margin of the endopodite of uropods II and III is denticulate. The telson is small, triangular, with a rounded or acute apex.

Notes: This species is close to *S. marginata*. In pereopods V the 2nd segment strongly varies in width, being particularly broad in sexually mature males, its anterior margin more strongly armed than in *S. marginata*, and the distal process is longer.



156 Fig. 72. *Scina submarginata* Tattersall (after Wagler, 1926).

156 The width of the rami of the uropods and some details of their ornamentation are subject to strong variation. It was earlier thought that

the particularly broad rami (type *latipes*) are typical of sexually mature males but subsequently sexually mature females were found with similarly broad uropodal rami. Evidently, this species could be divided into subspecies, as was mentioned by Wagler (1926), but the paucity of material does not yet permit a justifiable separation.

Distribution: Atlantic Ocean from 53° N, 15° W to 55°57′ S, 16°15′ E, Indian Ocean north of 30° S, Pacific Ocean from the south-
157 western part of the Bering Sea to 38°16′ N, 143°48′ E. In the northern part of the Pacific Ocean it is found in catches from depths of 200–500, 500–750, and 1,000–4,000 m but in the tropics found and at lesser depths, in catches from 40 and 150 m.

14. ***Scina rattrayi*** Stebbing, 1895

Stebbing, 1895: 358, 1904: 26; Chevreux, 1900: 123; Lo Bianco, 1901: 446; Tattersall, 1905: 10; Stephensen, 1918: 29; Wagler, 1926: 375, 1927: 104; vinogradov, 1964: 136.—*bovallii* Vosseler, 1901: 105.

Length of sexually mature specimens 2.5–6.0 mm.

The body is smooth, flattened, and without keels. Antennae I are strong, roughly equal in length to the pereon. Maxillae I and II are very small. The maxillipeds are large, their outer lobes are oblong-oval, slightly tapering distally, and with rounded distal end; the inner lobes are very short, reduced to a small trapezoid plate.

The pereopods are long and thin. The 5th segment of pereopod I is slightly longer than the 6th, and together they are longer than the 2nd segment; the claw is long, thin, and almost straight. Pereopods II are almost the same length but somewhat weaker; the 5th and 6th segments are roughly equal in length; the claw is long, thin, and almost straight. Pereopods III and IV are identical in structure and longer than the first pair; the 5th segment is longer than the 6th, which in turn is longer than the 4th segment; the claw is thin, not long, and slightly curved. Pereopods V are long and thin; their rod-shaped 2nd segment is 2.5 times longer than the 2nd segment of the preceding pairs; it bears long, slightly curved denticles along the entire posterior margin but only two (rarely three or four) such denticles occur on the anterior margin in its distal part; the distal process is very small, shorter than the 3rd segment; the 4th segment is usually only slightly shorter than or equal to the 2nd segment but is much thinner; the 5th segment is half the length of the 4th, while the 6th segment is 1/2 or 1/3 the length of the 5th; the claw is very small, wedge-shaped. In some individuals the 6th segment is more than half but nevertheless still markedly shorter than the 5th segment while the claw is longer; these individuals also deviate in some other features from the type, coming close to another closer species, *S. antarctica*. Pereopods VI are also very long and thin but none the less somewhat shorter than pereopods V; the 2nd segment is considerably longer than the 4th, which is somewhat longer than the 6th; the latter is longer than the 5th; the claw is short. Pereopods VII are very short and weak; their 2nd segment is not longer than that of pereopods VI; the 4th and 5th segments are same length; the 6th segment is slightly longer; the claw is short and triangular.

Scina rattrayi rattrayi Stebbing, 1895 (Fig. 73)

Stebbing, 1895: 358, 1904: 26; Chevreux, 1900: 123; Stephensen, 1918: 29; Wagler, 1926: 375, 1927: 104; vinogradov, 1964: 136.—*bovallii* vosseler, 1901: 105.

Length of sexually mature specimens 2.5–4.0 mm.

The length of the outer lobes of the maxillipeds is roughly twice their maximum width.

The uropods are strongly armed. In uropods I the posterior margin bears sparse long curved spines; the anterior margin of the basipodite also bears large spines and is denticulate between the spines; the anterior margin of the endopodite is finely denticulate. In uropods II the anterior margin of the basipodite has long curved spines while its posterior margin is coarsely denticulate; these denticles are finely denticulate in turn. The posterior margin of the basipodite of uropods III bears a few (3–4) long
158 curved spines. The telson is galeiform and its length is only slightly more than its width.

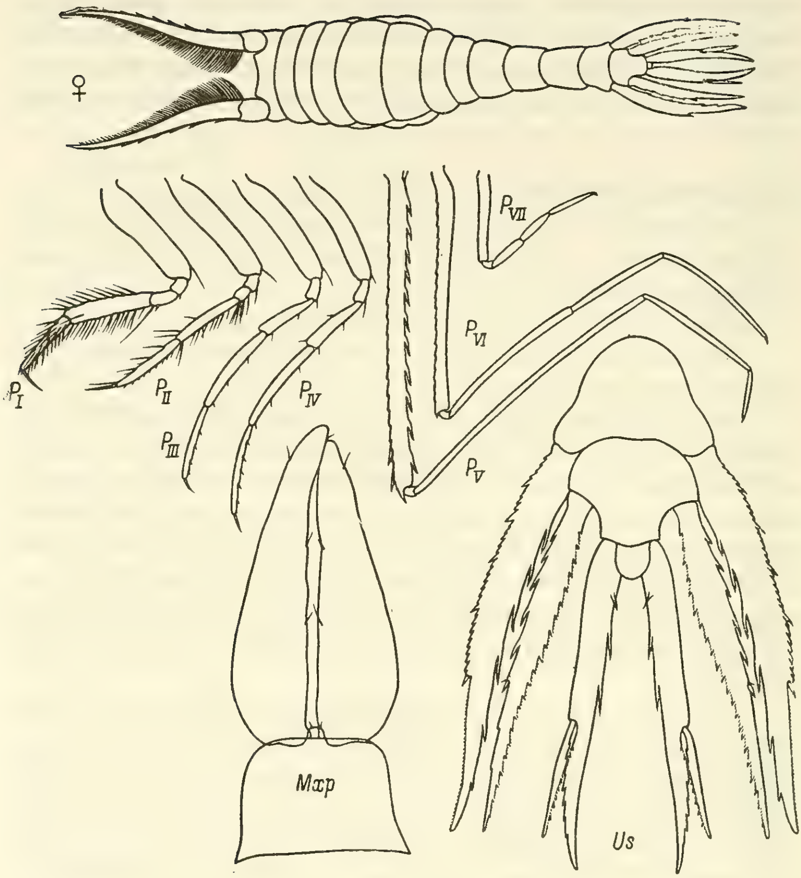
Distribution: It is known from various regions in the Atlantic Ocean (51° N, 33° S), the Mediterranean Sea and the Indian Ocean, inhabiting the northern regions (Gulf of Aden, Sri Lanka) to Antarctic waters (64°29′ S, 85°27′ E) as well as the equatorial regions of the Pacific Ocean. It is found in catches from depths of 150, 200–500, 570, and 625 m and in total catches from depths greater than 500 m to the surface.

Scina rattrayi keilhacki Uaeler, 1926 (Fig. 74)

Wagler, 1926: 380; vinogradov, 1956: 207, 1957: 216.

Length of sexually mature females 4–5 mm, of males 5–6 mm.

This subspecies differs from the typical form in relatively longer outer lobes of the maxillipeds and principal ornamentation of the uropods, which are devoid of the long curved marginal spines so characteristic of the typical form. The posterior margin of uropods I, the anterior margin of the basipodite of uropods II, and the posterior margin of the basipodite of uropods III are smooth; the anterior margin of the basipodite of uropods I is finely denticulate and without large denticles. The telson is oblong-triangular with a rounded apex; its length is almost
159 twice its width. In some specimens the ornamentation of uropods I is similar to that in *S. rattrayi keilhacki* and that of uropods II and III as in *S. rattrayi rattrayi*.



158 Fig. 73. *Scina rattrayi rattrayi* Stebbing (after Wagler, 1926).

Distribution: Varies in different oceans. In the Atlantic Ocean it is rare (reported only at 12°28′ N, 29°42′ W) In the tropical regions of the Indian Ocean it is fairly common; found in the Arabian Sea, in the equatorial zone between 10° N and 10° S, and enters Antarctic waters[6] (62°55′ S, 118°52′ E and 58°58′ S, 109°21′ E). It is not found in the tropical regions of the Pacific Ocean but known in the north western part north of 35° N. (Kuril-kamchatka region, southern part of the Bering Sea, southern part of the Sea of Okhotsk) together with *S. borealis*—a more common and numerous species of the genus *Scina*.

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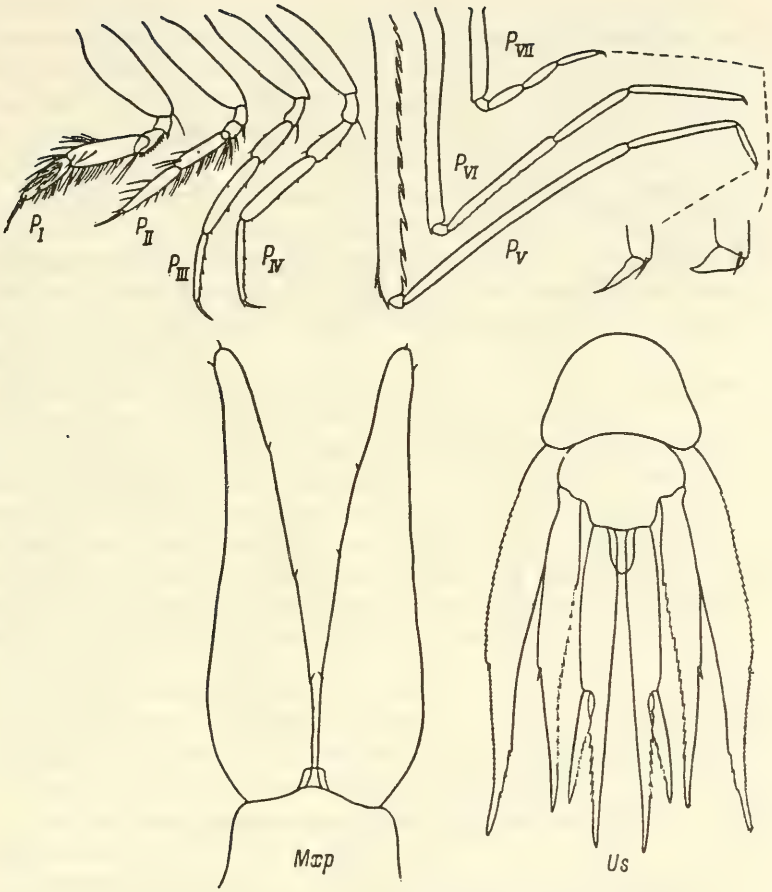
[6] The specimens found in the Antarctic waters are close to *S. antarctica* in some details of ornamentation of the uropods and the length ratios of the segments of pereopods V.



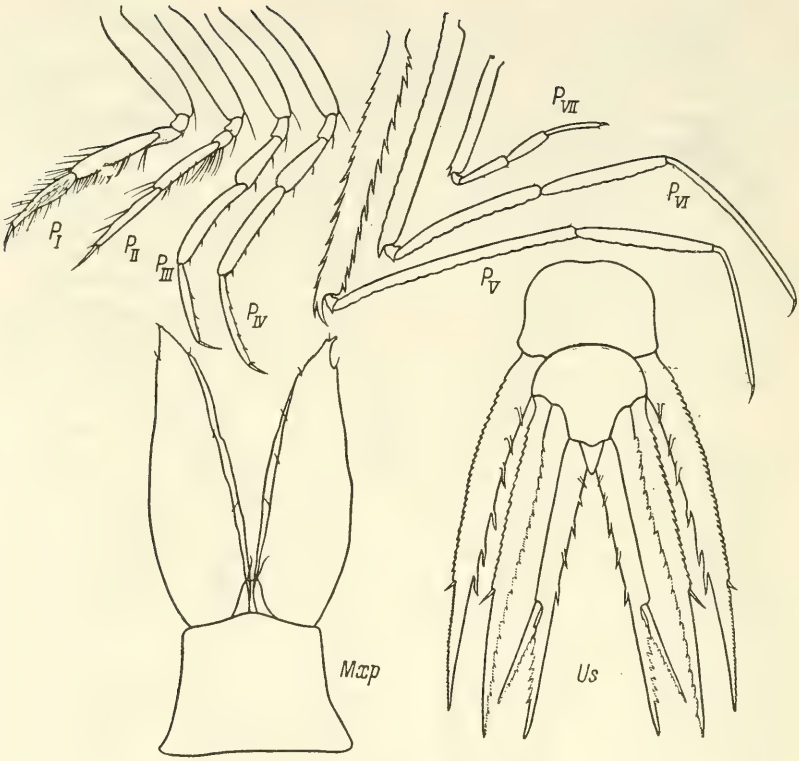
159 Fig. 74. *Scina rattrayi keilhacki* Wagler (after Wagler, 1926).

S.r. keilhacki is an extremely eurybathic subspecies. In the tropical regions of the ocean it is found in catches from depths of 100-200 and 200–500 m. In the northwestern part of the Pacific Ocean it is found in catches from depths of 0–300, 300–500, 500–750, 750–1,000, 1,000–1,500, 1,500–2,000, and 2,000–4,000 m but is more common at depths of 1,000–2,000 m.

160 15. ***Scina antarctica*** Wagler, 1926 (Fig. 75)

Wagler, 1926: 381, 1927: 105; Vinogradov, 1962: 17.

Length of sexually mature individuals about 4 mm. The body is smooth and without keels. Antennae are strong and slightly shorter than the pereon.



160 Fig. 75. *Scina antarctica* Wagler (after Wagler, 1926).

Maxillae I and II are very small. The maxillipeds are large, their outer lobes armed, oblong-oval, and tapering distally, with acute distal ends; the inner lobes are longer than in *S. rattrayi* with two apical setae.

The pereopods are long and thin. The 5th segment of pereopods I is longer than the 6th segment, and the two together are longer than the 2nd segment; the claw is long, thin, and almost straight. Pereopods II are roughly the same length; the 5th and 6th segments are roughly the same length; the claw is long, thin, and almost straight. The 2nd segment of pereopods V on its anterior and posterior margins is armed with long, slightly curved denticles (smaller in the proximal part of the anterior margin); the distal process is longer than the 3rd segment and curved, with a denticle on the anterior margin; the 5th segment is almost half the length of the 4th; the thin 6th segment is equal to the 5th in length; the claw is comparatively long, thin, and straight. Pereopods VI are almost the same length as pereopods V; the 4th segment is slightly longer than the 5th but shorter than the 6th (their length ratios are 6:5:7); the claw is relatively long, thin, and slightly curved. Pereopods VII are short and weak but relatively longer than in *S. rattrayi*; the 2nd segment in the distal part of the anterior margin may have one-two small denticles; the 5th segment is slightly shorter than the 4th or the 6th; the claw is short and curved.

161 Uropods I are finely denticulate along the entire anterior margin and bear long curved spines on the posterior margin of the basipodite. Uropods II are denticulate on the anterior margin of the basipodite and along the entire posterior margin. Uropods III bear sparse long spines on the posterior margin of the basipodite. The telson is narrowly triangular and with an acute tip.

Notes: This species is very close to *S. rattrayi* and some specimens have been found with mixed features of both the species.

Distribution: The atlantic, Indian, and Pacific sectors of Antarctica from the coastal regions of Antarctica to the zone of Antarctic covergence. Isolated specimens are reported farther north in the tropical regions of the Indian Ocean (between the Seychelles and Chagos islands) and in the southern part of Atlantic Ocean where they evidently enter with the flow of antarctic deep waters. Found only in total catches from depths of over 1,000–2,000 m up to the surface.

16. ***Scina oedicarpus*** Stebbing, 1895 (Fig. 76)

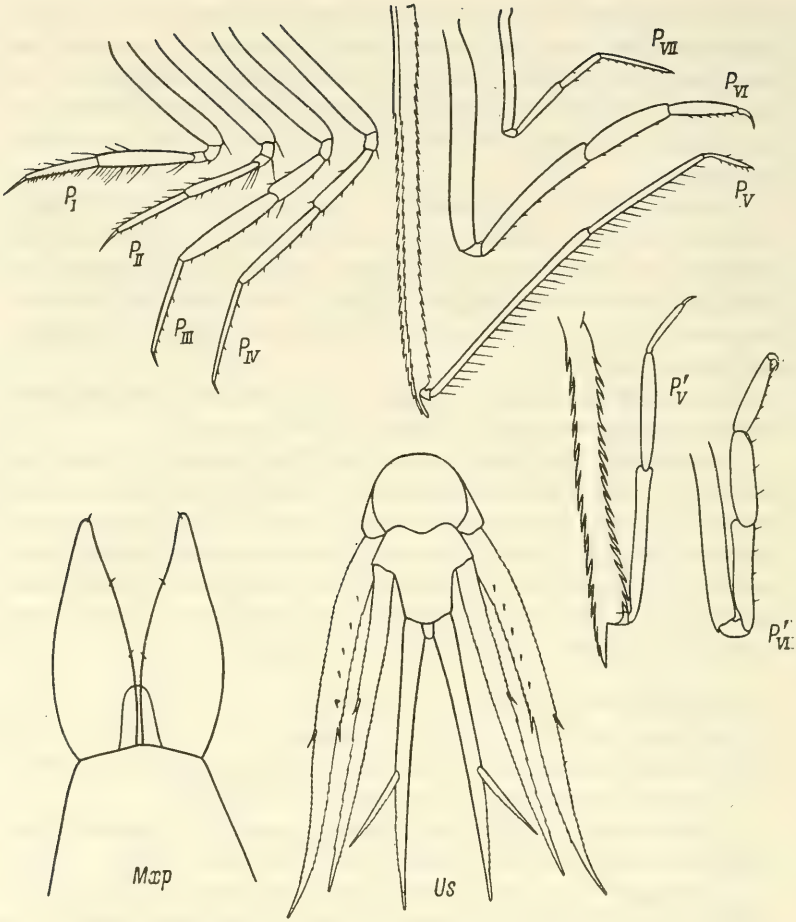
Stebbing, 1895: 356, 1904: 25; Chevreux, 1919: 12; Wagler, 1926: 369; vinogradov, 1960a: 232, 1964: 136.—*megameros* Chevreux, 1919: 1.

Length of sexually mature individuals 7.5–8.0 mm.

The broad pereon tapers abruptly behind somite V; the weakly developed keels are visible on the dorsal side. The eyes are small.

Antennae I are slightly shorter than the pereon and the pleon together.The mouth cone is relatively small. The outer lobes of the maxillipeds are lanceolate and taper distally; the inner lobes have a rounded distal end and reach 1/4 the length of the outer lobes.

The pereopods are long and thin. In pereopods I the 5th segment is longer than the 6th, in pereopods II it is roughly equal in length; the claw is long and straight. Pereopods III and IV are alike in structure; their 5th segment is somewhat longer than the thin 6th segment and markedly longer than the 4th; the claw is thin, comparatively short, and slightly curved. Pereopods V are conspicuous by their length; the rod-shaped 2nd segment is armed on the anterior and posterior margins with numerous slightly curved and long denticles; its distal process is longer than the 3rd segment, slightly curved or straight, with denticles on the anterior margin; specimens are known in which the anterior margin of the segment is armed very weakly; the 4th segment is considerably longer than the 5th, which in turn greatly (sometimes more than twice) exceeds the



162 Fig. 76. *Scina oedicarpus* Stebbing (after Wagler, 1926).
P'_V, P'_{VI}—pereopods V and VI of the atypical form.

length of the 6th segment; the claw is thin, relatively shorter, and slightly curved. Pereopods VI are much shorter and usually much stronger than pereopods V; the 4th segment is markedly longer than the 5th, which in turn is longer than the 6th segment; however, the length ratios of the segments even in sexually mature individuals are fairly variable and in various studies of specimens the length ratios of the 2nd, 4th, 5th, and 6th segments have varied from 10:8:5.5:2.5 to 10:5.5:5:4; the claw is long, strong, and curved. Pereopods VII are shorter and thin as in pereopods VI, and the length ratios of the segments is highly variable: the 4th segment may be equal to the 6th and each of them 1.5 times longer than the 5th, or the 5th and 6th segments may be almost equal and notably shorter than the 4th segment; the claw is very small and slightly curved.

The uropods are long and thin. The basipodite of uropods I is somewhat longer than the endopodite; the anterior and posterior margins of both are armed with fine denticles and on the inner margin opposite to the place of attachment of the expodite an isolated long curved spine occurs; sometimes 3–4 such spines are present on the lower surface of the basipodite. In the narrow uropods II the basipodite is shorter than the endopodite; their ornamentation is similar to that of uropods I but
162 the larger spines are absent. In uropods III only the anterior margin of the endopodite and the posterior margin of the expodite are denticulate. The telson is oval-triangular and short.

The variability of the length ratios of the segments of the last two pairs of pereopods is characteristic even of other species of this group, particularly of *S. rattrayi* and *S. wolterecki.*

Distribution: Found in the Atlantic Ocean from 45° 30′ N to 34° S, in the Indian Ocean north of 30° S and in the Pacific Ocean between 6 and 43° S, most reports are confined to the equatorial zone. It occurs in catches from 200–500 m, in horizontal catches from depths of 400, 500, 660, 720, and 800 m, and in catches from depths of more than 1,000 m to the surface.

17. ***Scina wolterecki*** Wagler, 1926 (Fig. 77)

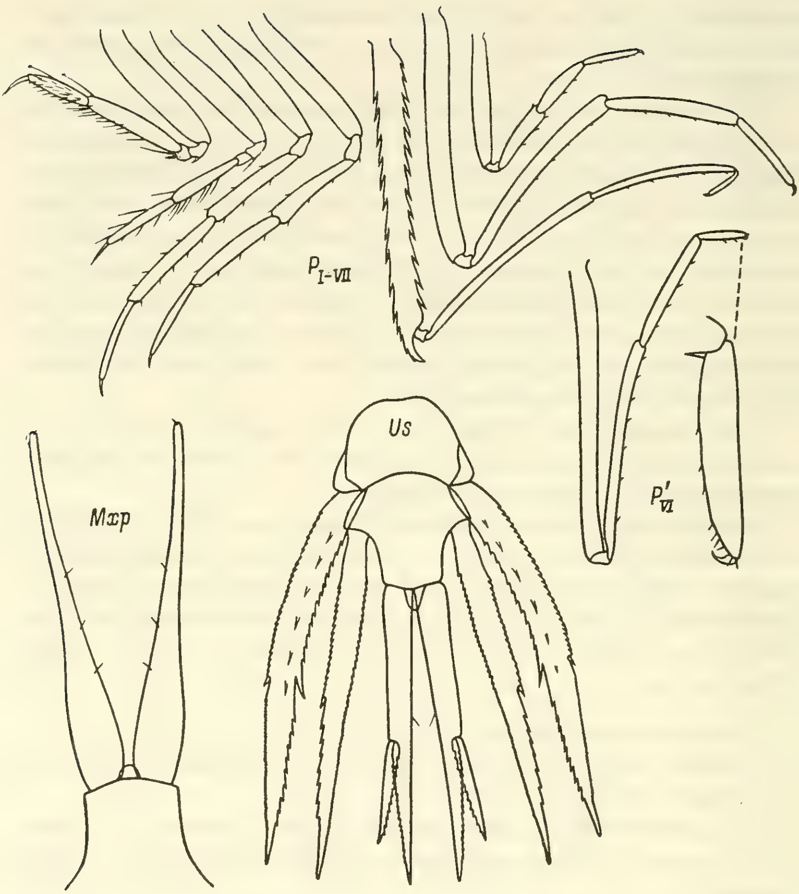
Wagler, 1926: 372; Barnard, 1932: 261; vinogradov, 1957: 215, 1962: 16, 1964: 136.

Length of sexually mature females 7–9 mm, of males up to 10 mm.

This species is close to *S. oedicarpus* and similar to it in external features.

The eyes are small. Antennae I are almost equal in length to the pereon and pleon together. The maxillipeds differ sharply from those of all other species of the genus Scina in the unusually narrow and long outer lobes,
163 and in the inner lobes being reduced to small triangular-oval plates.

Pereopods I and II are thin and weak; the 5th segment of pereopods I is notably longer than the 6th while in pereopods II these segments are almost equal in length. In pereopods III and IV the 6th segment is very thin and shorter than the 5th, which is almost equal in length to the 4th. The length ratios of the segments of pereopods V–VII are fairly variable. Pereopods V are long but relatively shorter than in *S. oedicarpus*; the 2nd segment on the anterior margin is armed with strong, slightly curved denticles and with somewhat weaker denticles on the posterior margin; the distal process is long, slightly curved and armed with fine denticles on the anterior margin; the 5th segment is usually shorter than the 4th, being 2/3 its length; the 6th segment is only 1/5–1/3 the length of the 5th although it may sometimes



163 Fig. 77. *Scina woltereckі* Wagler (after Wagler, 1926).
P'_{VI}—pereopods VI of the atypical form.

reach 2/3 its length; the claw is small and curved. Pereopods VI are roughly the same length as pereopods V and have roughly the same length ratios of segments, but the distal segments are stronger than in pereopods V, while the 6th segment is 1/3–2/3 the length of the 5th segment or even equal to it. In the short pereopods VII the 4th, 5th, and 6th segments are roughly equal in length, although sometimes the 6th segment is slightly longer or shorter than the 5th; the claw is small and curved.

164 The uropods are similar in structure to *S. oedicarpus* but somewhat broader. Together with specimens which have on the inner margin of uropods I a solitary long spine opposite the place of attachment of the

exopodite, specimens which bear a few similar spines on the basipodite have also been recorded.

Distribution: A panoceanic species known from the tropical and southeastern parts of the Atlantic Ocean, the southern and tropical regions of the Indian Ocean, the northwestern part of the Pacific Ocean, the deepwater parts of the Bering Sea and the Sea of Okhotsk, the central and southern regions of the Pacific Ocean, and the Antarctic (up to 66° S). In the tropical regions it reaches 200–250 m and in the northwestern regions of the Pacific Ocean is found in catches from 500–1,000, 1,000–3,000, 2,000–2,500, and 2,000–4,000 m. It is most common in the upper part of the bathypelagic zone at a depth of 1,000–2,000 m.

18. ***Scina wagleri*** Behning, 1939

Behning, 1939: 357.—orientalis Bulycheva, 1955: 1049.

Length of sexually mature specimens 5.5–7.5 mm.

The body is smooth and without a dorsal keel. The pereon is flattened dorsoventrally; it appears oval when viewed from above. Antennae I are shorter than the pereon.

The outer lobes of the maxillipeds are long, strong, and tapering distally, with a pointed apex; the inner lobes are 2/11-2/5 the length of the outer and bear two apical setae.

Pereopods I and II are weak and long with thin, straight claws. Pereopods III and IV are slightly longer than the preceding pair, with narrowly oval or rod-shaped distal segments; the claws are very long (up to 3/4 the length of the 6th segment) and straight; the 2nd segment of pereopods V is coarsely denticulate on the anterior margin and more finely denticulate on the posterior margin; its anterior distal angle is stretched into an acute process reaching beyond the distal margin of the 3rd segment up to 1/5–1/3 the length of the 4th segment; the 5th segment is longer than the 4th or the 6th, which are roughly equal in length; the claw is short and almost straight. Pereopods VI are shorter than pereopods V and the claws short. Pereopods VII are very short, almost half the length of pereopods VI; the claws are short and slightly curved or straight.

The uropods are thin, with fairly well-developed exopodites; the basipodites are slightly longer than the endopodites or equal to them. Uropods I bear on their posterior margin long and thin denticles while uropods II have small spines. The telson is oblong-triangular with a rounded tip.

Notes: Bulycheva (1955) found two specimens of sexually immature scinids in the Kuril-Kamchatka region of the Pacific Ocean, which she designated as a new species, *S. orientalis*. She provided neither a diagnosis nor an illustration of the new species and restricted herself to pointing out its differences from *S. wagleri*. These differences are:

in *S. orientalis* the distal process of the 2nd segment of pereopods V reaches 1/3 the length of the 4th segment while in *S. wagleri* just to its proximal margin; actually, judging from the illustration of the type specimen of *S. wagleri* supplied by Behning (1939) and from our material on this species, the distal process of the 2nd segment in *S. wagleri* reaches 1/5–1/4 the length of the 4th segment. Moreover, in *S. orientalis* the length of the telson is roughly equal to its breadth, while in *S. wagleri* the length of the telson is more than its breadth. Thus the differences appear to be extremely unclear and constitute individual variation of the characters of *S. wagleri*.

The data available do not provide a basis for considering *S. orientalis* as valid species.

The species *S. wagleri* is divided into several subspecies whose characteristics are given below.

165 ***Scina wagleri wagleri*** Behning, 1939 (Fig. 78)

Length of sexually mature females up to 5.5 mm.

The characteristic structural features of the typical subspecies are given in Table 12.

Distribution: Deepwater part of the Sea of Okhotsk and that part of the ocean surrounding the Kuril Islands, not farther than 200 miles from them. The easternmost report is 49°26′ N, 158°42′ E. In the north it enters as far as the Kamchatka Strait, in the south up to 36° N (35°43′ N, 151°13′ E). In the Sea of Okhotsk it is found at depths greater than 500 m, in the Kuril-Kamchatka region in catches from depths of 1,000–2,000 m and in total catches from depths greater than 1,000 m to the surface.

Scina wagleri abyssalis Vinogradov, 1957 (Fig. 79)

Vinogradov, 1957: 217, 1970: 394.

Length of sexually mature females 7.0–7.5 mm; males not known.

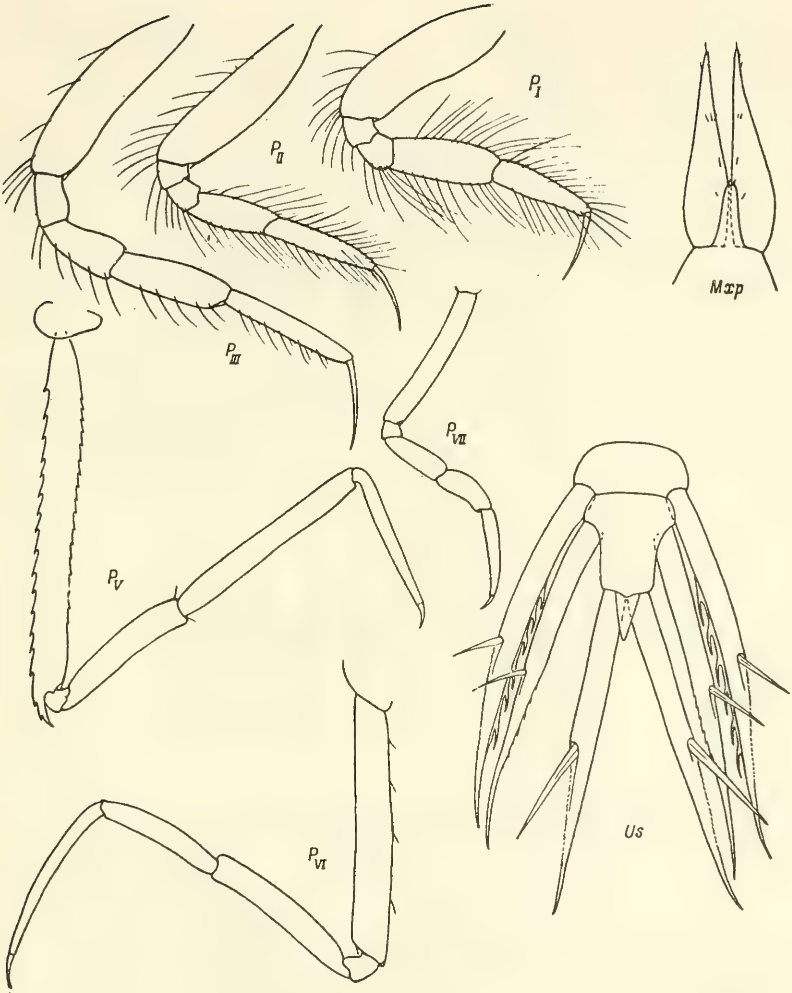
This deepwater subspecies of *S. wagleri*, in general appearance, structure of the mouthparts, pereopods, and ornamentation of the uropods is similar to the typical subspecies; however, it differs from *S. wagleri* wagleri in several features (see Table 12).

Distribution: This abyssopelagic form is found only at depths greater than 3,000 m (in catches from about 3,500, 4,200–7,800, 6,000–8,500, 0–8,500, and 0–9,400 m) in the Pacific Ocean in the region of the Kuril-Kamchatka, Izu-Bonin and Kermadec deepwater trenches. The species cought from all the three trenches are morphologically absolutely identical.

Scina wagleri atlantis Thurston, 1976

Thurston, 1976a: 154.

Length of nearly sexually mature males 3.9–4.2 mm; females not known.



166 Fig. 78. *Scina wagleri wagleri* Behning, female.

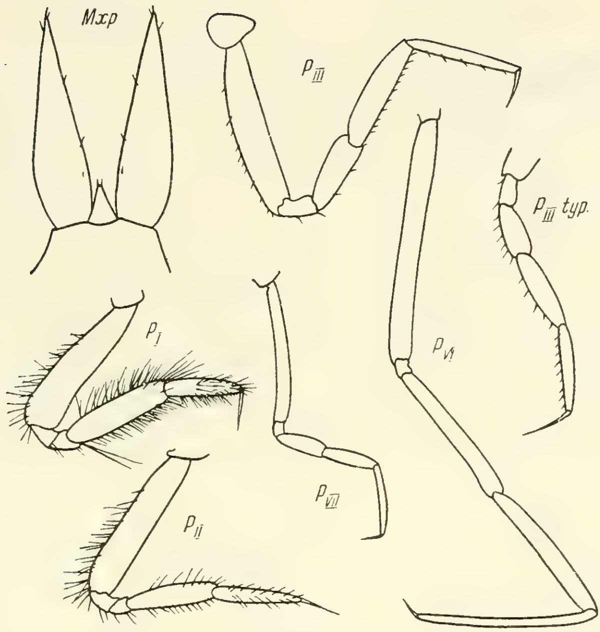
166 This subspecies of *S. wagleri* is very close to the type subspecies but differs from it in many structural details (see Table 12). Moreover, pereopods VII are relatively stronger and longer than in the type form.

Distribution: Region of the Canary Islands. It is found in catches from depths of 500–800 m. It is possible that the sexually mature individuals live at greater depths.

This subspecies is absent in our collections.

Table 12. Characteristic Structural Features of the Three Subspecies of *Scina Wagleri* Behning

Character		S.w. *wagleri*	S.w. *abyssalis*	S.w. *atlantis*
Shape of pereon (top view)		Roundish	Oblong-oval	Oblong-oval
Maxillipeds: inner lobes		2/7–1/3 of outer lobes	2/11 of outer lobes	2/5 of outer lobes
Pereopods:	I	5th segment equal to 6th	5th segment 1.5 times longer than 6th	5th segment slightly longer than 6th
	II	5th segment shorter than 6th	5th segment equal to 6th	5th segment shorter than 6th
	III	Claw more than 1/3 length of 6th segment	Claw less than 1/3 length of 6th segment	Claw 1/2 length of 6th segment
	III,IV,VI	2nd segment equal to 4th and 5th together	2nd segment shorter than 4th and 5th together	2nd segment equal to 5th and 5th together
	VI	6th segment shorter than 5th or 4th	6th segment longer than 5th or 4th	6th segment equal to 5th and shorter than 4th
	VII	2nd segment less than twice length of 6th	2nd segment twice length of 6th	2nd segment twice length of 6th



167 Fig. 79. *Scina wagleri abyssalis* Vinogradov, female (after Vinogradov, 1957).

19. ***Scina stenopus*** Stebbing, 1895 (Fig. 80)

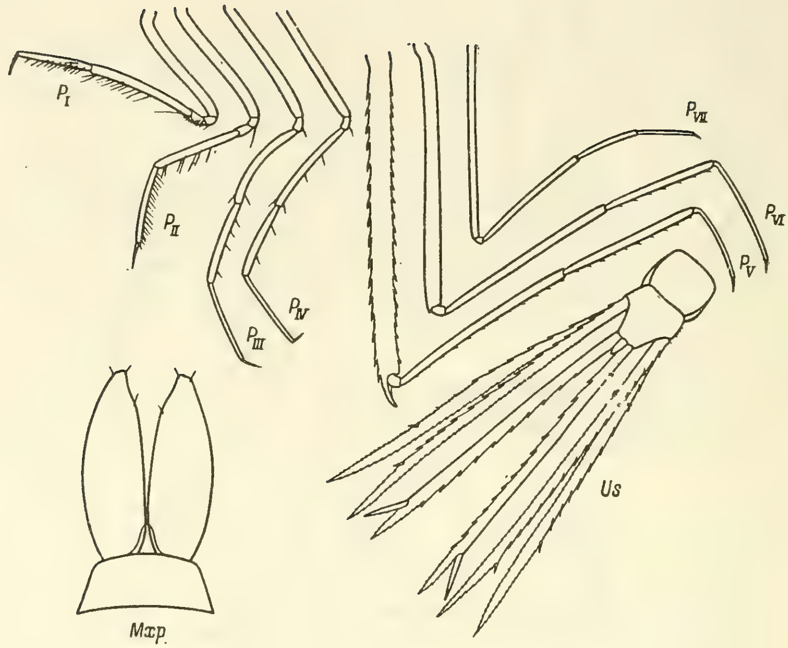
Stebbing, 1895: 354; vosseler, 1901: 104; Chevreux, 1919: 11; Wagler, 1926; 419, 1927: 108; Vinogradov, 1964: 139.—*chuni* Garbowski, 1896: 107.

Length of sexually mature specimens 5-9 mm.

The body is smooth. The head has dorsal keels running from the place of attachment of antennae I and large spines on the sides below the
167 place of attachment of antennae I. The eyes are very small. Antennae I are the same length as the pereon and pleon together.

The mouth cone is small; the outer lobes of the maxillipeds are oblong-oval, slightly tapering distally, and the inner lobes very small and not armed.

All the pereopods are unusually thin and long. Pereopods I are shorter than the rest, their segments thin; even the 5th segment is not broadened distally, is very slightly shorter than the 2nd, and 1.5 times longer than the 6th; the claw is long and broad. In pereopods II the 5th and 6th segments are almost equal in length. Pereopods III and IV are similar in structure; they differ from the corresponding structures of other species of the Scina by an unusually long 4th segment which is



168 Fig. 80. *Scina stenopus* Stebbing (after Wagler, 1926).

only slightly shorter than the 2nd segment; the shorter 5th and 6th segments are roughly equal. The 2nd segment of pereopods V is long, with parallel margins bearing roughly equal, long, and slightly curved denticles whose number varies markedly in different specimens; the distal process is thin and long, with denticles on the anterior margin; the 4th and 5th segments together are equal to the 2nd in length; the length ratios of the 4th, 5th, and the particularly thin 6th segments are 10:7:4.5; the claw is small and slightly curved. Pereopods VI are slightly shorter than pereopods V; the length ratios of the 2nd, 4th, 5th, and 6th segments are 26:10:6:6; the 6th segment is notably narrower than the preceding ones. Pereopods VII are slightly shorter and thinner than pereopods VI; the length ratios of the corresponding segments are 15:10:5:5; the claw is very small and strongly curved at the tip.

All the uropods are rod-shaped, equal in length, and equal to half the length of antennae I; their basipodites are many times longer than the rami; the exopodites of uropods I and II are reduced to small spines. All three pairs of uropods on the anterior and posterior margins are deeply denticulate or armed with long spines; only the anterior margin of the basipodite and exopodite of uropods III is smooth. Uropods I and III are distinctly triquetrous in cross section and clearly exhibit ornamentation on all the three sides. The telson is almost twice longer than its basal width, with an acute tip.

168 *Notes*: In the proportions of the last three pairs of pereopods, the structure of the claw of pereopods VII, some structural details of the mouthparts, and the number of gills, *S. stenopus* comes close to the group of species *rattrayi*; contrarily, in length of antennae I it is closer to the *crassicornis* group.

Distribution: It is a warm-water species known from different regions of the Atlantic Ocean (from 46°15′ N to 35°35′ S, 18°20′ E), from the Mediterranean Sea, and from many points in the northern part of the Indian Ocean (except the Arabian Sea) where its southernmost report refers to 29°7′ S, 40°46′ E and 27°58′ S, 91°40′ E. In the Pacific Ocean it is found only at one station (30°53′ N, 153°09′ E). It inhabits the intermediate layer between 100 and 500 m but is found in catches from depths of 500–1,000 m and in horizontal catches from depths of 600 and 625 m.

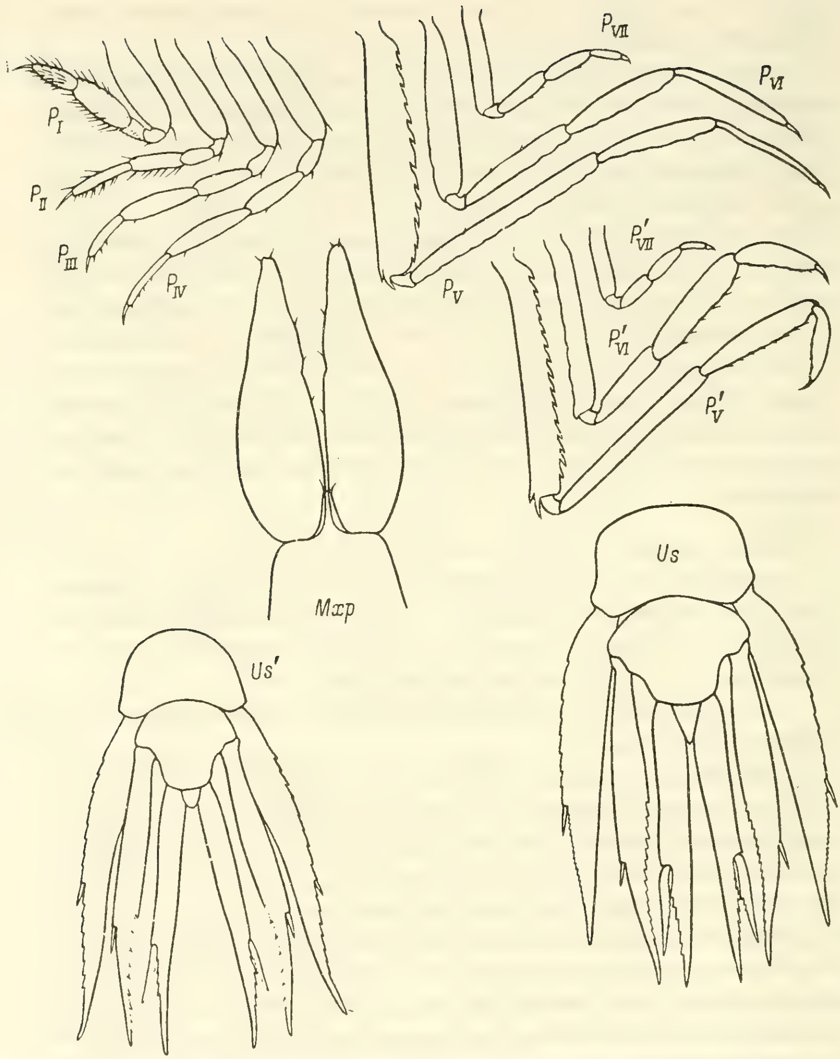
20. ***Scina tullbergi*** (Bovallius, 1885) (Fig. 81)

Bovallius, 1885b: 15, 1887b: 532, 1887c: 23 (*Tyro*); Vosseler, 1901: 113; Wagler, 1926: 384, 1927: 101.—*pacifica* Bovallius, 1887b: 25, 1887c: 4 (*Tyro*); vosseler, 1901: 113; Tattersall, 1905: 14; Stephensen, 1918: 29.—*concors* Stebbing, 1895: 360.

One of the smallest *Scina* species. Length of sexually mature individuals 2.0–4.5 mm.

The body is smooth and without keels. Antennae I are thick and short, not exceeding the pereon in length. The mouth cone is small. The outer lobes of the maxillipeds are long, oblong-oval, tapering distally, with a rounded apex; the inner lobes are very short, only 1/12–1/8 the length of the outer lobes and with two apical setae.

Pereopods I have broad segments; the 2nd segment is slightly shorter than the 5th and 6th together; the 5th segment is longer than the 6th;
169 the claw is long, thin, and slightly curved. Pereopods II are longer and weaker than pereopods I; the 6th segment is the same length as the 5th or somewhat longer; the claw is long, thin, and straight. Pereopods III and IV are identical in structure but pereopods IV are somewhat longer; the 5th segment is somewhat longer than the almost mutually equal 4th and 6th segments; the claw is slightly curved. Pereopods V are long and strong; the 2nd segment is armed on the posterior margin with long and slightly curved spines while the anterior margin is smooth; the distal process is shorter than the 3rd segment, with a solitary denticle at its base; the 4th segment is only slightly shorter than the 2nd and almost twice longer than the 5th; the 6th segment is equal to the 5th or shorter, sometimes being 1/2–2/3 its length; the claw is slightly curved. Pereopods VI



169 Fig. 81. *Scina tullbergi* (Bovallius) (after Wagler, 1926).
Variations in structure of the pereopods and uropods.

are noticeably shorter than pereopods V; their 4th segment is considerably smaller, sometimes less than half the length of the 2nd segment, and equal to or somewhat shorter than the 5th; the 6th segment is insignificantly shorter than or equal to the 5th segment; the claw is long and slightly curved. Pereopods VII are weak and short; the 4th and 5th seg-
170 ments together are equal to the 2nd in length; the 6th segment is shorter than the 5th; the claw is large, strong, with a broad base and bent tip.

The uropods are weakly armed. Uropods I are denticulate on the entire anterior margin; the denticles on the basi- and endopodite may vary in size; the posterior margin is smooth. Uropods II are coarsely denticulate in the distal part of the posterior margin. In uropods III the inner margin of the exo-and endopodite is denticulate. The telson is roundish-triangular with rounded or acute tip.

Notes: The length ratios of the pereopod segments are subject to fairly significant individual variation, which served as the basis for describing several independent close species, which later were combined into a single fairly variable species.

The two rare species—*S. similis* and *S. nana*—described below are close to *S. tullbergi*. Specimens are known which are intermediate in several characters to all these species. However, the paucity of material for *S. similis* and *S. nana* and the fact that "transitional" specimens could nonetheless be reliably included under any one of these species, allows us for the present to consider the three as independent species. *Scina setigera, S. excisa*, and *S. damasi* have much in common with *S. tullbergi*. These six species constitute a single group, *tullbergi*, which distinctly differs from other species of *Scina*.

Distribution: *S. tullbergi* is the most common surface species of scinids of the warm-water regions of the oceans. It is known from the tropical Atlantic (from 39°44′ N, 28°53′ S to 33°53′ S, 9°26′ E), Mediterranean Sea, from many parts of the Indian Ocean where its southern most report relates to 42° 20′ S., 121° 25′ E and from the Pacific Ocean where it is found from Cape Horn and the Tasman Sea, south to San Diego and north to 20° N. It is found in catches from 0–50, 50–100, 100–200, 200–500 m and in horizontal catches from the near-surface layers (40–50 m) to depths of 625, 660, and 720 m.

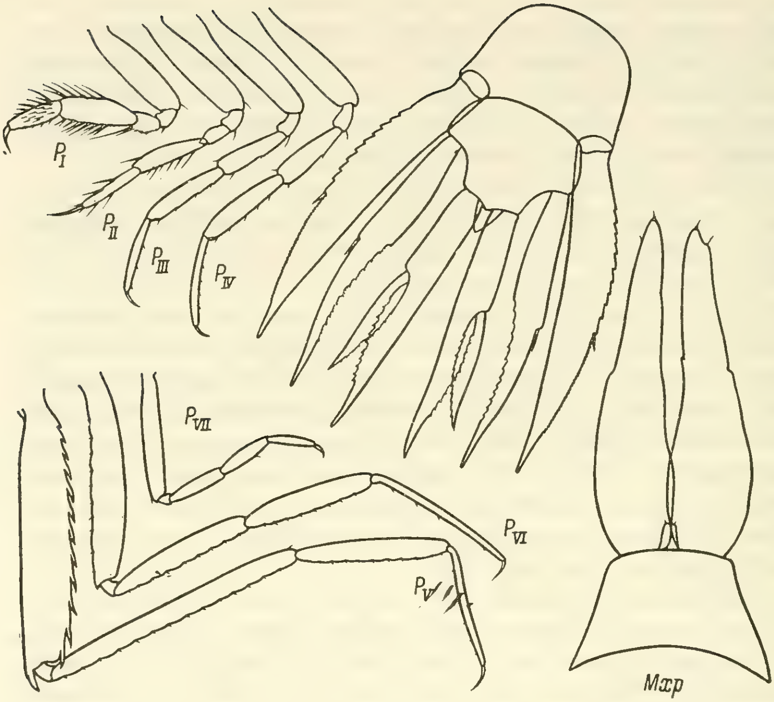
21. ***Scina similis*** Stebbing, 1895 (Fig. 82)

Stebbing, 1895: 362; Stephensen, 1918: 29; Chevreux, 1919: 15; Wagler, 1926: 390, 1927: 102; vinogradov, 1964: 138.

Length or sexually mature specimens 2.5–3.5 mm.

The body is smooth and without keels. Antennae I are strong, equal in length to the pereon or just slightly shorter than it. The mouth cone is small. The outer lobes of the maxillipeds are long, oblong-oval, tapering distally, with an acute tip; the inner lobes are very short, with two apical setae.

Pereopods I–IV are the same as in *S. tullbergi*; the 2nd segment of pereopods V is broad and armed on the posterior margin with long, curved denticles; the anterior margin of the segment is smooth, with one or two denticles only at the base of the short distal process; the 4th segment is almost the same length as the 2nd, and the 5th segment is almost half its length; the thin 6th segment usually constitutes 3/4–5/6 the length



171 Fig. 82. *Scina similis* Stebbing (after Wagler, 1926).

of the 5th segment; the claw is long and slightly curved. Pereopods VI are noticeably shorter than pereopods V; the 4th segment is considerably shorter than the 2nd; the 5th segment is somewhat shorter than the 4th[7]; the thin 6th segment is longer than the 5th and roughly equal to the 4th segment; the claw is long and slightly curved. Pereopods VII are roughly half the length of pereopods VI; the 4th, 5th, and 6th segments are almost equal in length and all of them together are slightly longer than the 2nd segment; the claw is long and slightly curved, without a broadened base. Occasionally we came across specimens with claws shorter than illustrated in the Figure but still longer than in *S. nana* described below. The uropods are the same as in *S. tullbergi.*

171 *Distribution*: A tropical species known from the tropical (28° N, 14° W) and equatorial regions of the Atlantic Ocean, the Mediterranean Sea, and from the tropical regions of the Indian Ocean (up to 30° S). It has not been reported from the Pacific Ocean. It is found in catches from depths of 0–25, 25–100, 100–200, and 200–500 m.

[7] Sometimes much shorter, as is characteristic of the species *S. nana* described below.

22. ***Scina nana*** Wagler, 1926 (Fig. 83) Wagler, 1926: 393, 1927: 103.

Length of sexually mature specimens 2–4 mm.

The body is smooth and without keels. Antennae I are strong, equal in length to the pereon or slightly shorter than it. The mouth cone is small. The outer lobes of the maxillipeds are oblong-oval, slightly tapering distally; the inner lobes are short, with two apical setae.

Pereopods I–IV are the same as in *S. tullbergi* but the 4th segment of pereopods III–IV is relatively shorter. The 2nd segment of pereopods V is armed on the posterior margin with long curved denticles, the anterior margin of the segment is smooth, with one or two large denticles only at the base of the short distal process; the 4th segment is slightly shorter than the 2nd and roughly twice longer than the 5th, which in turn is somewhat

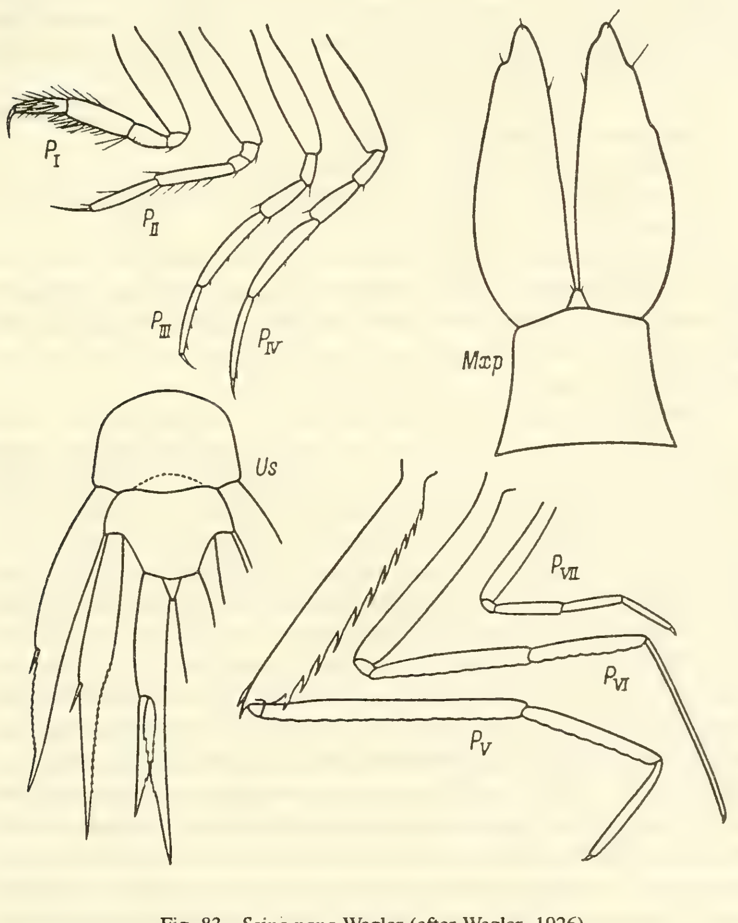


Fig. 83. *Scina nana* Wagler (after Wagler, 1926).

longer than the 6th segment; the claw is very small. Pereopods VI are somewhat shorter than pereopods V, the 2nd segment is equal to the 4th and 5th together, the 4th segment is 1.5 times longer than the 5th, the thin 6th segment is slightly longer than the 4th, but considerably longer than the 5th; the claw is very small and curved. Pereopods VII are short, the 4th segment is slightly longer than the 5th, which in turn is slightly
172 longer than the 6th; the claw is short with a broadened base and a bent acute tip.

In uropods I only the inner margin of the endopodite is denticulate. In uropods II the distal half of the posterior margin is finely denticulate, while in uropods III the inner margin of the exo- and endopodite is denticulate. The telson is triangular with an acute tip.

Distribution: Tropical regions of the Atlantic and Indian oceans, eastern tropical part of the Pacific Ocean (Californian coasts), and Antarctic waters (one report—64°29′ S, 85°27′ E). It is found in catches from depths of 100–200, 200–500, 1,000–2,000 m and in total catches from depths of over 2,000 m to the surface.

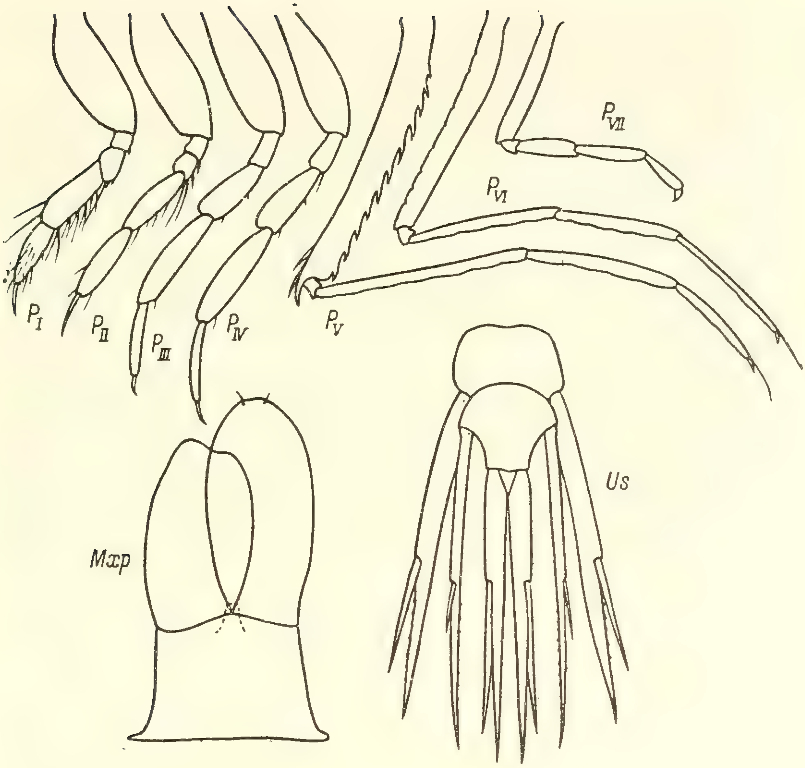
23. ***Scina setigera*** Wagler, 1926 (Fig. 84)

Wagler, 1926: 396.

A very small species of Scina, of roughly the same size as *S. tullbergi* and *S. similis*.

The body is smooth and without keels. Antennae I are strong and shorter than the pereon. The mouth cone is small. The protopodite of the maxillipeds is almost rectangular and only slightly broadened at the base; the outer lobes are broad and oval, and the inner lobes are very small and unarmed.

Pereopods I–IV have a broad 2nd segment. In pereopods I the 5th segment is somewhat longer than the 6th and together they are longer than the 2nd segment; the claw is long and almost straight. In pereopods II the 5th and 6th segments are almost equal in length; the claw
173 is long and almost straight. The proportions of pereopods III and IV are the same as in *S. tullbergi*; the 5th segment is somewhat longer than the 4th or the 6th, which are mutually almost equal in length; the claw is long and slightly curved. The 2nd segment of pereopods V is armed on the posterior margin with long, slightly curved denticles, the anterior margin is smooth with two strong denticles only at the base of the short distal process; the length ratios of the 2nd, 4th, 5th, and 6th segments are 12.5:10:7:5; the 6th segment in the distal part of the posterior margin bears a solitary strong and very long seta which projects far above the small slightly curved claw; a similar seta is found on pereopods VI also. Pereopods VI are somewhat shorter than pereopods V; the length ratios of the 2nd, 4th, 5th, and 6th segments are 15:10:8:9; the claw is similar to that in pereopods V. Pereopods VII are short but strong; the 5th segment



173 Fig. 84. *Scina setigera* Wagler (after Wagler, 1926).

is somewhat longer than the 4th and the 6th, which are almost equal in length; the claw is short with a broadened base and bent acute tip.

The uropods are thin with a relatively well-developed exopodite and weakly armed. Uropods I: the exopodite is long, more than 2/3 the length of the endopodite; ornamentation is in the form of small sparse denticles only on the inner margin of the endopodite. uropods II are very narrow, the exopodite constitutes nearly 1/4 the length of the endopodite; ornamentation is in the form of small sparse denticles only on the distal part of the posterior margin of the uropods. In uropods III the endopodite is longer than the basipodite; the exopodite is only slightly shorter than the endopodite; the margins of the basipodite and both rami are smooth. The telson is oblong-triangular with an acute tip.

Distribution: The lone specimen (a sexually mature female) was found in the Indian Ocean at the Seychelles.

This species is absent in our collections.

174 24. ***Scina excisa*** Wagler, 1926 (Fig. 85)

Wagler, 1926: 398, 1927: 103.

Length of sexually mature specimens 4–7 mm.

The body is smooth and without keels. Antennae I are strong, somewhat shorter than the pereon or equal to it in length. The mouth cone is small. The protopodite of the maxillipeds is greatly broadened at the base; the outer lobes are oblong-oval; the inner lobes are 1/5–1/4 the length of the outer, with two strong apical setae.

In pereopods I the 5th and 6th segments together are equal to the 2nd in length; the 5th segment is appreciably longer than the 6th; the claw is long, thin, and almost straight. Pereopods II are weaker, the difference in the length of the 5th and the 6th segment is less; the claw is long and thin. Pereopods III and IV are identical in structure, long, and thin; the 5th segment is slightly longer than the 4th, which in turn is somewhat longer than the 6th segment; the claw is medium in length and slightly curved. The 2nd segment of pereopods V is slightly broadened distally; its anterior margin is armed with long curved denticles while the distal angle is stretched into a long process reaching beyond the distal margin

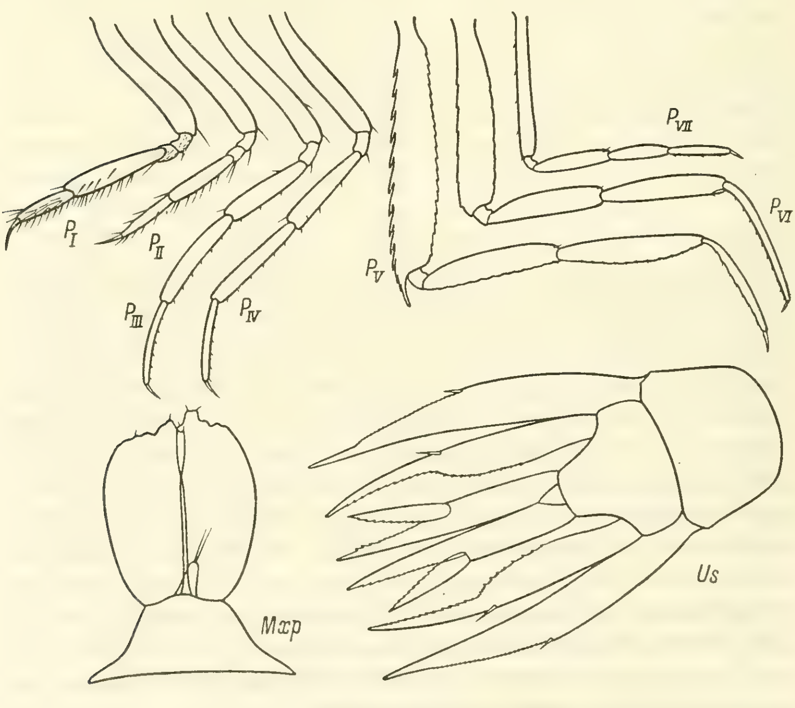


Fig. 85. *Scina excisa* Wagler (after Wagler, 1926).

of the 3rd segment; the posterior margin of the 2nd segment is finely denticulate; the 4th and 5th segments are equal in length or the 4th is somewhat shorter; the thin 6th segment is roughly 1/4 shorter than the 5th; the claw is long and straight. Pereopods VI are somewhat shorter than pereopods V; the anterior margin of the 2nd segment is armed with sparse small denticles; the 6th segment is stronger and longer than in pereopods V; it is longer than the 5th segment (or sometimes equal to it); the 4th and 5th segments are roughly equal in length; the claw is somewhat shorter than in pereopods V. Pereopods VII are weaker but relatively longer. The length ratios of the 2nd, 4th, 5th, and 6th segments are roughly 18:10:8:8; the claw is small and not strongly broadened at the base.

The uropods are broad and weakly armed. The basipodite in all the uropods is longer than the endopodite. The exopodite of uropods I
175 and II is reduced to a strong spine, as is characteristic of the remaining species of the *tullbergi* group, except *S. setigera*. In uropods I only the proximal part of the inner margin of the endopodite is finely denticulate. In uropods II a large part of the posterior margin is denticulate and opposite the place of attachment of the exopodite forms a sharp bend. In uropods III the inner margin of the exo- and endopodite is denticulate. The telson is triangular and with an acute tip.

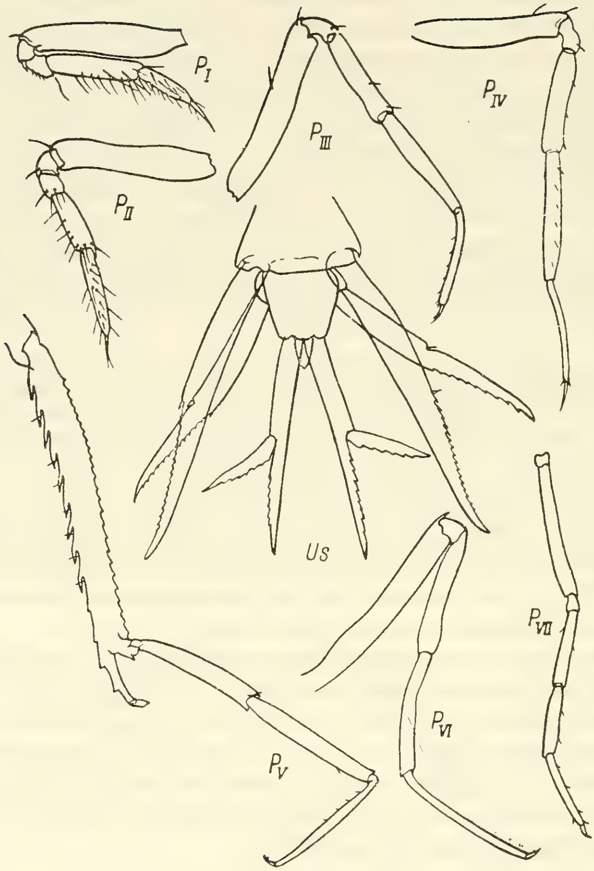
Distribution: Various regions of the Atlantic Ocean (from 28°04′ N, 14°04′ W and Bermuda Islands in the north to 32°08′ S, 8°28′ E, and 33°23′ S, 16°19′ E in the south), the equatorial and southern parts of the Indian Ocean (up to 33°23′ S, 16°19′ E), the central part of the Pacific Ocean south of 30° N, and Antarctic waters (64°29′ S, 85°27′ E). It is found in catches from depths of 200–500 m and in horizontal catches from depths of 250, 300, 350, and 410 m.

25. ***Scina damasi*** Pirlot, 1929 (Fig. 86)

Pirlot, 1929: 80. Small species. Sizes not given.

The body lacks dorsal keels. Antennae I reach midbody. The mouthparts have not been described.

Pereopods I are thin; the 6th segment is 2/3 the length of the 5th; the claw is thin, long, and straight. The 6th segment of pereopods II is longer than the 5th segment; the claw is shorter than in pereopods I.
176 Pereopods III and IV are identical in structure; the 5th segment is longer than the 4th; the thin 6th segment is 2/3 the length of the 5th segment; the claw is thin and straight. The anterior margin of the 2nd segment of pereopods V bears long curved denticles which give way to a long distal process; the latter reaches half the length of the 4th segment; the posterior margin of the 2nd segment is very finely denticulate; the 3rd–5th segments together are shorter than the 2nd; the 4th segment is slightly shorter than the 5th and is almost equal to the 6th in length; the



175 Fig. 86. *Scina damasi* Pirlot (after Pirlot, 1929).

claw is straight and short. The 2nd segment of pereopods VI has smooth margins and a small distal denticle which is actually a process of the anterior margin; the 4th segment is roughly equal to the 5th and both are shorter than the 6th segment; the claw is small and slightly curved. The 2nd segment of pereopods VII is roughly equal in length to that of pereopods V; the 4th segment is roughly equal to the 6th and longer than the 5th; the claw is small and slightly curved.

The endopodite in uropods I has a finely denticulate outer margin; in the shorter uropods II its inner margin is finely denticulate; in uropods III the inner margin of the exopodite and outer margin of the endopodite are denticulate. The telson is elongated-oval-triangular and has an acute tip.

Notes: As far as it is possible to judge from the structure of the pereopods, this species is close to *S. excisa* but differs from it in a longer distal denticle on the 2nd segment of pereopods II, relatively greater length of this segment, absence of a sharp bend in the inner margin of uropods II opposite the place of attachment of the exopodite, and a narrower telson. Evidently this species of *Scina* could be included in the *tullbergi* group.

Distribution: Northern tropical Atlantic between 25° and 40° N and 10° and 25° W Pacific Ocean—the Fiji Islands. It is found in catches from 0–250 m (Pacific Ocean) and in horizontal catches from depths of 350 and 360 m.

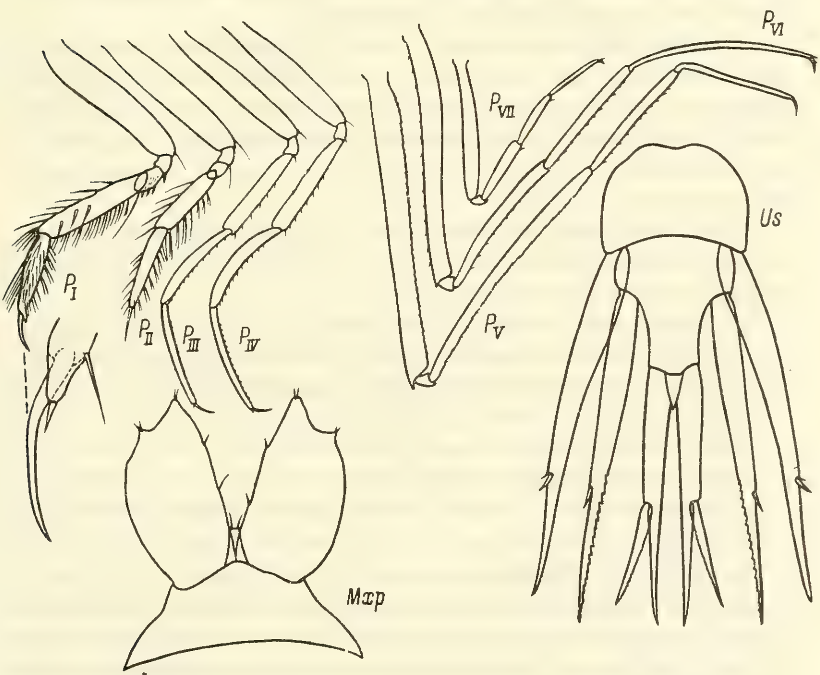
This species is absent in our collections.

26. ***Scina latifrons*** Wagler, 1926 (Fig. 87)

Wagler, 1926: 401, 1927: 107.

Length of sexually mature specimens up to 6 mm.

The body and head are without keels. Antennae I are very wideset; they are relatively thick and equal to the pereon in length. The mouth cone is small. The protopodite of the maxillipeds is broad but very short;



177 Fig. 87. *Scina latifrons* Wagler (after Wagler, 1926).

the outer lobes are short, oval, and distally terminate in two papillae, each bearing a pair of short setae; the inner lobes are 1/4 the length of the outer and bear two setae on the straightly truncated distal margin.

The pereopods are long and thin. In pereopods I the 2nd segment is broader than the rest; the 5th segment is 1.5 times longer than the 6th; the posterior distal angle of the 6th segment extends over the claw and terminates in a strong seta; the claw is almost half the length of the 6th segment and is slightly curved. Pereopods II are somewhat shorter and weaker than pereopods I; the 6th segment is equal to the 5th and does not have a process above the claw; the claw is long and straight. Pereopods III and IV are exceptionally thin; the 4th, 5th and 6th segments are mutually almost equal, the latter two are arcuately curved; the claw is medium in length and straight. The 2nd segment of pereopods V has a smooth anterior and finely denticulate posterior margin; the process on the anterior distal angle is very short and several times into the 3rd segment; the length ratios of the 2nd, 4th, 5th, and 6th segments are 12:10:5:4.5. The length ratios of pereopods VI are somewhat different; the 6th segment is the next largest after the 2nd; the length ratios of the 2nd, 4th, 5th, and 6th segments are 16.5:10:9:13. In pereopods VII the 5th and 6th segments are equal in length and both insignificantly shorter than the 4th segment; the claw is very small.

The urosomites are stretched; II and III together are longer than I. The basipodites of the uropods are longer than the rami. The margins of uropods I are smooth, in uropods II the distal part of the posterior
177 margin is denticulate. In uropods III the inner margin of the exopodite is finely denticulate. The telson is stretched and triangular, its length twice its basal width.

Notes: The species described below—*S. pusilla* and *S. typhlops*—are fairly close to S. latifrons and together form an Natural group. *S. chelata* is close to this group in some features.

Distribution: A rare species, known from a few specimens from the tropical parts of the Atlantic Ocean, from the western part of the Indian Ocean (south of Socotra Island), and the Hawaiian Islands.

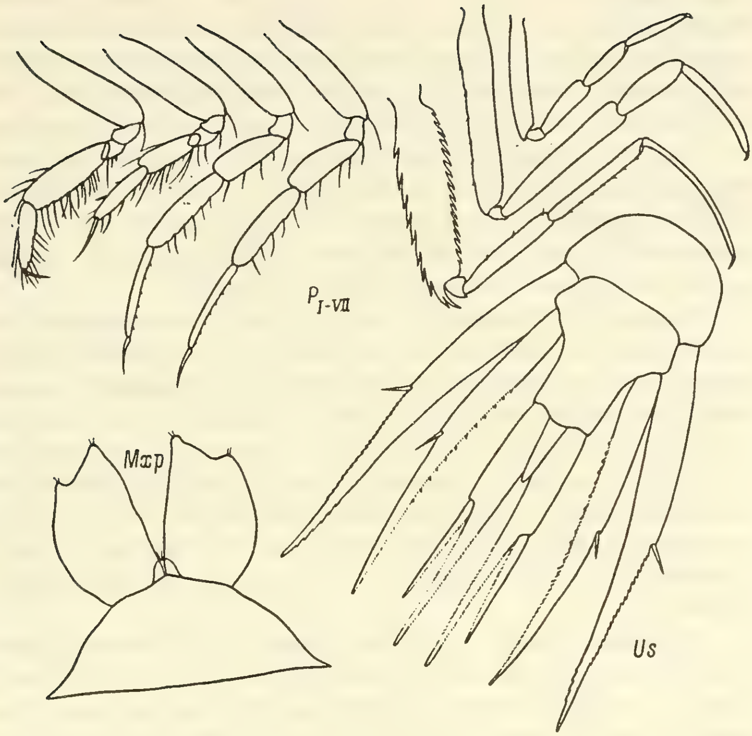
This species is absent in our collections.

27. ***Scina pusilla*** Chevreux, 1919 (Fig. 88)

Chevreux, 1919: 5; Wagler, 1926: 404; Vinogradov, 1960a: 234, 1962: 17, 1970: 394.

Length of sexually mature specimens 3.0–4.0 mm.

In external appearance it is very similar to *S. latifrons*. The pereon is very broad dorsally and tapers sharply after somite V. Antennae I are very wide and in length insignificantly shorter than the pereon. Keels are absent on the body and very weakly developed on the head, so much so that sometimes they are not distinguishable. The mouth cone is small.



178 Fig. 88. *Scina pusilla* Chevreux, male (after Wagler, 1926).

The maxillipeds are the same as in *S. latifrons* but their inner lobes are slightly shorter.

Pereopods I are notably stronger than pereopods II; the 6th segment is shorter than the 5th; the claw is 1/2 the length of the 6th segment, thin, and straight. In pereopods II the 6th segment is longer than the 5th and the thin straight claw about 1/2 the length of the 6th segment. Pereopods III and IV are identical in proportions; the 4th segment is slightly shorter than the 5th or the 6th, which are mutually equal, but the 6th segment is markedly thinner than the 5th; the curved claw constitutes 1/3–1/2 the length of the 6th segment. In pereopods V the 2nd segment
178 is broad and armed on both sides with long, slightly curved denticles[8] that are sometimes larger and sparser on the anterior margin; its distal process, with denticles on the anterior margin, almost reaches the distal margin of the 3rd segment; the 4th segment is shorter, equal to or slightly

[8] The denticles on both margins could be longer than shown in the illustration.

longer than the 5th, which in turn is shorter than or equal to the very thin and slightly curved 6th segment; the claw is small, thin, and slightly curved. Pereopods VI are only slightly shorter than pereopods V but have different length ratios; the 4th segment is usually longer than each of the distal segments; the length ratios of the 2nd, 4th, 5th, and 6th segments are 13:10:5:6; although the 6th segment may be relatively somewhat longer, this segment is somewhat thinner than the 5th; the claw is small and falcate. Pereopods VII are relatively well developed; the 4th and 6th segments are roughly equal to each other and both are somewhat longer than the 5th segment; the claw is small and falcate.

In uropods I the basipodite is roughly equal to the endopodite; the inner margin of the endopodite and the distal end of the posterior margin of the uropod is finely denticulate. In uropods II the basipodite is somewhat shorter than the endopodite; the posterior margin has very small and thin spines. In uropods III the basipodite is considerably shorter than the endopodite (sometimes less than half its length); the inner margin of the exopodite and both margins of the endopodite bear thin and dense spines. The telson is unusually long, reaching 1/2 the length of the basipodite of uropods III, its length is two or three times its basal width; its tip is rounded.

Distribution: Known from several records from the tropical regions of the eastern part of the Atlantic Ocean (from the Azores and Canary Islands to the Gulf of Guinea). It is not found in the Indian Ocean. In the
179 Pacific Ocean it is found in the region of the Kermadec, Bougainville, and Kuril-Kamchatka deepwater trenches. It enters Antartic waters (64°03′ S, 161°59′ E; 63°18′ S, 135°14′ E). In the northwestern part of the Pacific Ocean it is found in catches from depth of 500–1,000 m, in the Canary Islands in horizontal catches from a depth of 500 m. All the remaining reports pertain to total catches from depths of several thousand meters to the surface.

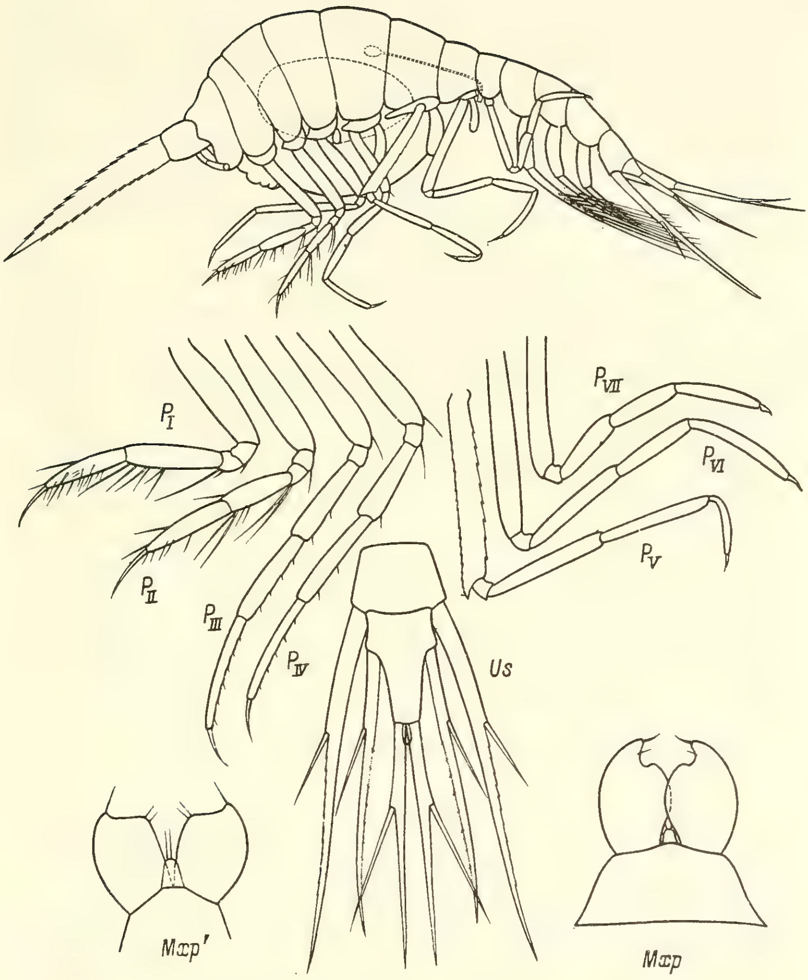
28. ***Scina typhlops*** Wagler, 1926 (Fig. 89)

Wagler, 1926: 407; Vinogradov, 1957: 218, 1962: 18.

Length of specimens close to sexual maturity 3.0–3.5 mm.

The body is without keels, head and the first five somites of the pereon broad. The eyes are not noticeable. Antennae I are strong, armed along the edge with long denticles, and somewhat shorter than the pereon.

The mouth cone is small. Maxillae I, as in *S. latifrons* and *S. pusilla*, are well developed. The protopodite of the maxillipeds is trapezoid, broad, and short; the outer lobes are broadly oval and short, with a
180 more or less developed notch in the distal part of the inner margin; the shape of the lobes is variable; the inner lobes are small with a rounded tip and bear two apical (sometimes fairly strong) setae.



179 Fig. 89. *Scina typhlops* Wagler (after Wagler, 1926; Mxp'—after Vinogradov, 1957).

Pereopods I and II are not stronger than the succeeding pereopods. In pereopods I the 5th segment is longer than the 6th while in pereopods II the 6th is longer than the 5th; the claw is very long and almost straight. Pereopods III and IV are identical in structure, the 4th and 5th segments are almost equal and the 6th is slightly longer; the claw is long and thin. Pereopods V are only very slightly longer than pereopods III or IV; the narrow 2nd segment has sparse denticles on the anterior and posterior margins; the distal process is short, not reaching the distal end of the 3rd segment; the 4th and 5th segments are equal to each other, the 6th segment roughly half their length, bent forward, and evidently being bent may form a poorly developed subchela with the 5th segment. Pereopods VI are the same length as pereopods V but are stronger; the length ratios of the 2nd, 4th, 5th, and 6th segments are 17.5:10:7.5:10; the claw is the same length as in pereopods V but stronger. Pereopods VII are slightly shorter than pereopods VI; the 4th and 5th segments are equal to each other in length, the 6th segment is slightly longer; the claw is short and strong.

The uropods are long, very thin, and weakly armed; the basipodites of all the uropods are significantly shorter than the endopodites (sometimes less than half their length); the exopodites of uropods I and II are relatively well developed, only 2/5–1/3 the endopodites in length. In uropods I the inner margin of the endopodite is denticulate, in uropods II the posterior margin of the endopodite is finely pubescent, while in uropods III the inner margin of the exopodite is very finely denticulate. The telson is oblong, broadened in the distal part, and has a rounded tip.

Distribution: One specimen was found in the Atlantic Ocean south of the Canary Islands, one in the Antarctic waters of the Indian Ocean (64°25′ S, 92°52′ E), and two in the northwestern part of the Pacific Ocean in the Kuril-Kamchatka region. One specimen was found in a catch from 2,500–3,000 m while others were found in total catches from depths of several thousand meters to the surface.

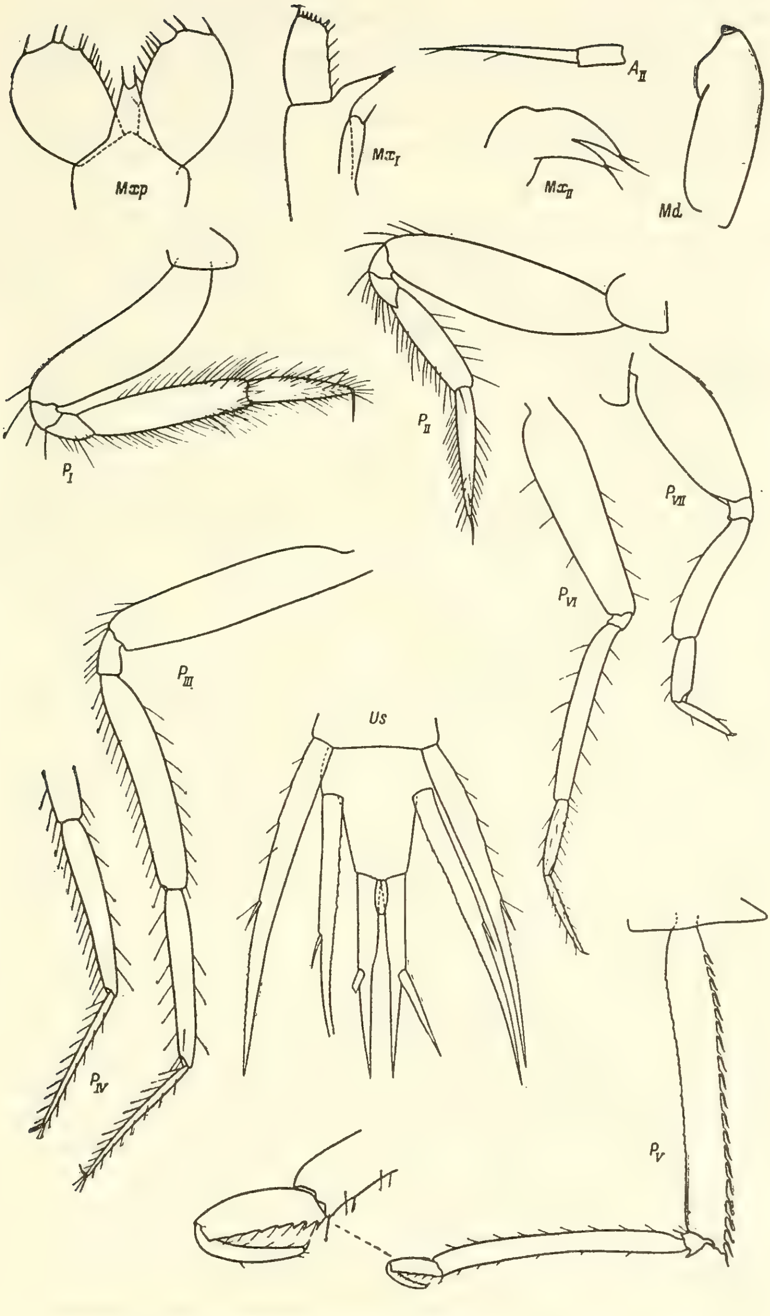
29. ***Scina chelata*** Vinogradov, 1970 (Fig. 90)

Vinogradov, 1970: 394.

Length of sexually mature female 11 mm.

The body is without keels. The eyes are not noticeable. Antennae I are strong and armed with small, marginal, forwardly bent denticles.

The mouth cone is small. In maxillae I the outer lobes are distally tapering and the inner lobes rounded in the distal part and stretched; the palp is broad, almost rectangular, with denticles on the straightly truncated distal margin, and several setae on the inner margin. The outer lobes of the maxillipeds, as in all species of the *latifrons* group, are broadly oval and short (ratio of length of lobe to width, 4:3); each lobe has more than ten short setae on the inner and distal margins: the inner lobes are well developed and reach half the length of the outer, with one seta each on the angles of the concave distal margin. Pereopods I and II are strong, as in the other species of the latifrons group. Pereopods I are notably stronger than pereopods II. Pereopods I have a broad and slightly curved 2nd segment; the 5th segment is very slightly shorter than the 2nd and 1.5 times longer than the distally tapered 6th segment; the claw is almost straight. The 5th segment of pereopods II is half as long as the 2nd and equal in length to the 6th segment. Pereopods III and IV are



181 Fig. 90. *Scina chelata* Vinogradov, female (after Vinogradov, 1970).

longer and identical in structure. The 2nd segment of pereopods III is very slightly longer but narrower than the 2nd segment of pereopods II; the 5th and 6th segments taper distally, which is not characteristic of all the remaining species of the family Scinidae; the 4th segment is slightly shorter than the 2nd but is longer than the 5th; the 5th segment in turn is slightly longer than the thin 6th segment; the claw is small, weak, and slightly curved.

182 In the structure of pereopods V, *S. chelata* differs sharply from all the known species of *Scina* in the presence of a subchela formed by the 5th and 6th segments, although a tendency toward the formation of such a subchela is present in *S. typhlops*. The 2nd segment of pereopods V is only slightly shorter than the remaining segments together; its anterior margin is armed with long curved denticles while the posterior margin is finely denticulate; the distal process is longer than the 3rd segment; the rod-shaped, slightly curved 4th segment is only slightly shorter than the 2nd segment; the 5th and 6th segments are strong and short; the 5th segment is deeply denticulate in the proximal part of the anterior margin and sensory setae occur at the base of these denticles; the relatively thin and slightly curved 6th segment is insignificantly shorter than the 5th, and may be bent at its anterior margin to form a well-developed subchela; the claw is short and strong. Pereopods VI are very insignificantly shorter than pereopods V; the 2nd segment tapers distally and is only slightly longer than the rod-shaped 4th segment; the almost mutually equal 5th and 6th segments together are slightly shorter than the 4th, and each of these segments tapers distally; the claw is small and slightly curved. Pereopods VII are relatively well developed, as in other species of the *latifrons* group. They have roughly the same proportions as in pereopods VI but are shorter; the broadly oval 2nd segment is slightly longer than the 4th, which is almost equal to the 5th and 6th segments together; the claw is small and curved.

The basipodites of the uropods are longer than the endopodites; the exopodites are relatively well developed. In uropods I the anterior margin of the basipodite bears strong setae while the inner margin of the endopodite is finely denticulate. In uropods II the posterior margin of the basipodite is slightly denticulate. Uropods III have a smooth posterior margin and a sharp bend opposite the attachment of the outer ramus. The telson is oblong-oval and 2/5 the length of the basipodite of uropods III; its tip is rounded.

Notes: *Scina chelata* differs sharply from all species of the genus *Scina* in the well-developed subchela of pereopods V, the distally tapering tips of the segments of pereopods III, IV, and VI, and in the well-developed and basally broad inner lobes of the maxillipeds. However, in many other features (well-developed maxillae, shape of the outer lobes of the maxillipeds, structure of pereopods I and II, stronger pereopods VII, weak ornamentation of the uropods, shape of the urosoma and telson) it is clearly closer to the species of the *latifrons* group.

Distribution: The one specimen was caught in the Kuril-Kamchatka region of the Pacific Ocean (45°23′ N, 153°04′ E) in the through catch from a depth of 7,750 m to the surface.

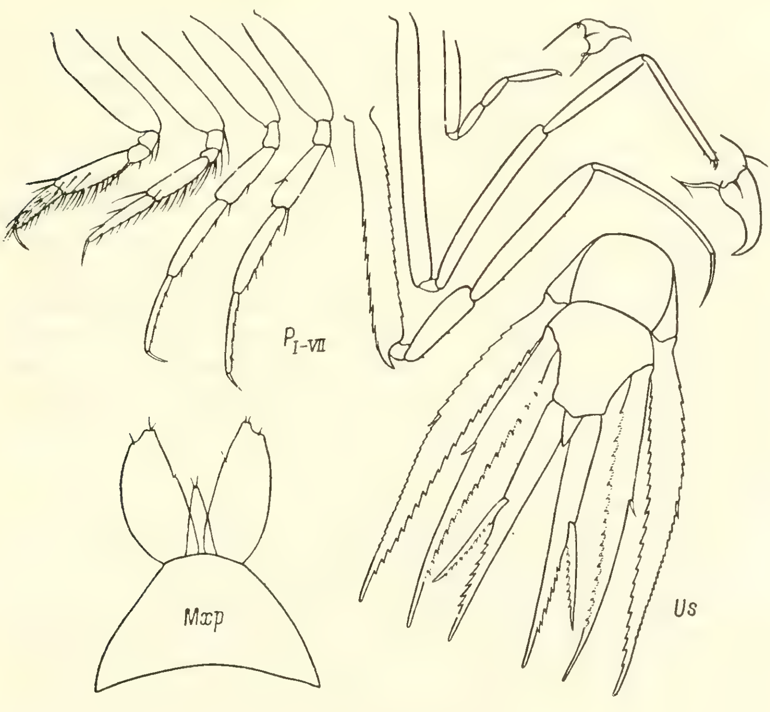
30. ***Scina lepisma*** (Chun, 1889) (Fig. 91)

Chun, 1889a: 533 (*Fortunata*); Stebbing, 1903: 27; Stephensen, 1918: 30; Chevreux, 1919: 17; Wagler, 1926: 410, 1927: 107.—*bovallii* Chun, 1889b: 308.

Length of sexually mature specimens 7–10 mm.

The body is smooth and without keels. In females the pereon is broad and rounded and the pleon is narrow; in males the differences between the pereon and the pleon are not so great. The eyes are very small.

Antennae I are slightly longer than the pereon. The protopodite of the maxillipeds is trapezoid; the outer lobes are short, oval, and with an



183 Fig. 91. *Scina lepisma* (Chun) (after Wagler, 1926).

uneven distal margin; the inner lobes are long, reaching half the length of the outer lobes, and bear two apical setae.

Pereopods I and II are similar in structure, as in the species of the *tullbergi* group. Pereopods III and IV are identical in structure; the length ratios of the 2nd, 4th, 5th, and thin 6th segments are 20:10:13.5:12. The
183 claws of the first four pairs of the pereopods are long and almost straight. The 2nd segment of pereopods V is denticulate on the anterior and posterior margins; on the posterior margin the denticles are very small and on the anterior margin they are sparser and larger; the anterior distal angle is produced into a small process, usually not reaching the distal margin of the 3rd segment; the 4th segment is roughly half the length of the 5th; the very thin 6th segment is only insignificantly shorter than the 5th; the claw is unsually long and thin. Pereopods VI are almost the same length as pereopods V; the rod-shaped thin 2nd segment is somewhat shorter than the 4th and 5th segments together; the 5th segment is 2/3 the length of the 4th and is equal to the 6th; the claw is short, strong, and falcate. Pereopods VII are short and less than 1/2 the length of pereopods VI; the 4th and 5th segments are almost equal and each is considerably shorter than the 6th; the claw is very small, with a broadened base, and curved thin distal part.

The uropods are narrow and strongly armed; the basipodites are shorter than the endopodites. In uropods I the anterior margin of the basipodite, the inner margin of the endopodite, and the entire posterior margin are coarsely denticulate. In uropods II the entire posterior margin is denticulate. In uropods III the inner margin of the exo- and endopodite is denticulate. The telson is triangular, its length more than its width, and the tip acute.

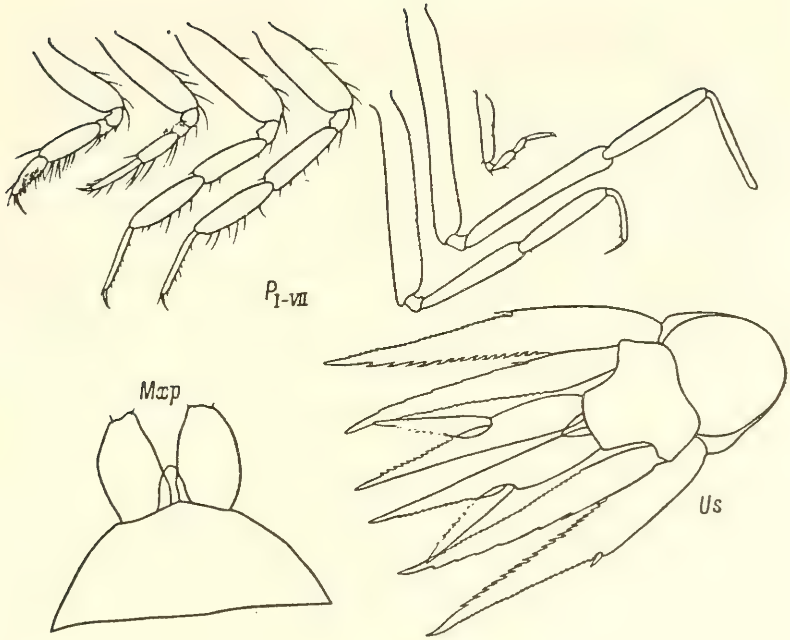
Distribution: Atlantic Ocean (from 51°N, 11°34′ W to 28°28′ S, 6°13′ E) and tropical part of the Indian Ocean (the southernmost record—34°14′ S, 80°31′ E). In the Pacific Ocean it is found around the Hawaiian Islands and in the Tasman Sea (Great Barrier Reef). Around the Canary Islands it is found in horizontal closed catches at depths from 200 to 940 m, and in the region of the Hawaiian Islands at a depth of 450–600 m.

184 31. ***Scina inermis*** Chevreux, 1919 (Fig. 92)

Chevreux, 1919: 7; Wagler, 1926: 413.

Length of sexually mature specimens about 4 mm.

The body is without keels; the dorsal keels on the head are weakly developed. Antennae I are roughly the same length as the pereon. The protopodite of the maxillipeds is trapezoid, very short and broad at the base; the outer lobes are small, oval, with a blunt tip, and bear two setae; the inner lobes are unarmed and fall slightly short of 1/2 the length of the outer lobes.



184 Fig. 92. *Scina inermis* Chevreux (after Wagler, 1926).

Pereopods I and II are usual in structure, relatively short and week; the 2nd segment is thin and shorter than in pereopods III and IV. Pereopods III and IV have a broad 2nd and very narrow 6th segment. The length ratios of the 2nd, 4th, 5th, and 6th segments of pereopods III are roughly 20:10:13:10; in pereopods IV the 4th and 5th segments are almost equal in length. Pereopods V are only slightly longer than pereopods IV; the ornamentation of the 2nd segment is variable: both its margins may be smooth, or only the posterior margin weakly denticulate, or the anterior margin may have fairly large and the posterior margin weaker denticles; the distal process is small, shorter than the 3rd segment, or it may be totally absent; the 4th and 5th segments are roughly equal in length; the 6th segment is thin, curved and 1/2 the length of the 5th segment; the long, thin claw is 1/3–1/2 the length of the 6th segment. Pereopods VI are considerably longer than pereopods V; the 4th segment is 2/3 the length of the 2nd and almost 1.5 times longer than the 5th or the thin 6th segment, the latter two being equal in length; the claw is absent. Pereopods VII are considerably shorter than the 2nd segment of pereopods VI and are weak; the 4th and 6th segments are almost equal in length and each markedly longer than the 5th segment; the claw is small, with a broadened base, and an acute tip.

In all the uropods the endopodites are longer than the basipodites. In uropods I the inner margin of the endopodite is finely denticulate and the posterior margin of the uropods is armed with long denticles. In uropods II the inner margin of the endopodite has sparse, barely perceptible denticles; the posterior margin of the uropods has numerous
185 distinct small denticles. In uropods III the inner margin of the exo- and endopodite is denticulate. The telson is triangular; its basal width is very slightly less than its length, and the tip is acute.

Distri bution: The northern tropical part of the Atlantic Ocean, and northern tropical and equatorial regions of the Indian Ocean. It is found in catches from depths of 200–500, 500–1,000 m, and in through catches from depths of over 200 m to the surface.

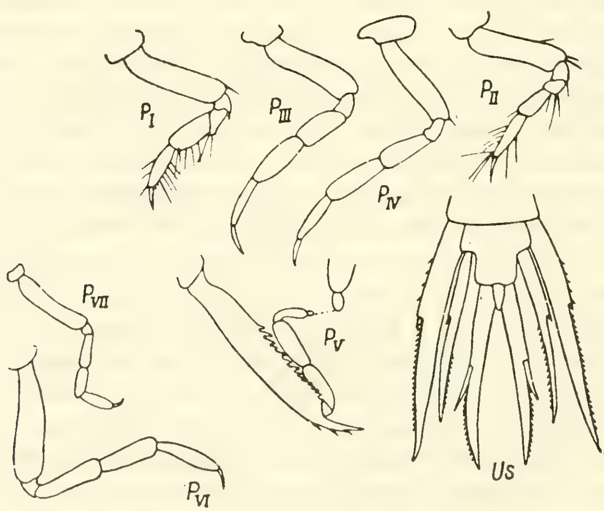
32. ***Scina alberti*** Chevreux, 1919 (Fig. 93)

Chevreux, 1919: 3.

Only one specimen is known, which has been incompletely described; sizes not given.

The body has a dorsal keel which, on the last pleon somite, terminates in a denticle. The eyes are absent. Antennae I are equal to the body in length. The mouthparts are not described.

In pereopods I the 5th segment is somewhat longer than the 6th, in pereopods II shorter; the claw is thin and more than 1/2 the length of the 6th segment. Pereopods III and IV are identical in structure; the 4th segment is roughly equal to the 6th in length, the 5th segment is slightly shorter; the claw is very thin and long, being 2/3 the length of the 6th segment.



185 Fig. 93. *Scina alberti* Chevreux, male (after Chevreux, 1935).

Pereopods V are only slightly longer than pereopods III or IV; the 2nd segment is longer than all the subsequent segments together, its anterior margin is smooth except for three denticles on the distal process of the anterior distal angle, the posterior margin is denticulate in the distal part along its 2/3 length, and the distal process is unusally long, roughly four times longer than the 3rd segment; the 4th and 5th segments are strong, almost equal in length; the 6th segment, curved in the proximal part, is 2/3 the length of the 5th segment: the claw is very small, ovate. Pereopods VI are the same length as pereopods V; the 4th and 6th segments are equal in length, the 5th very slightly shorter than each; the claw is short and strongly curved. Pereopods VII fall short of 1/2 the length of pereopods VI; the 4th and 6th segments are equal in length while the 5th segment is slightly shorter; the claw is short and strongly curved.

Uropods I are broad, the basipodite shorter than the endopodite. Contrarily, uropods II are very thin and much shorter than upropods I, and the endopodite is much longer than the basipodite. The exopodites of
186 uropods I and II are small and spinelike. The endopodite of uropods III is slightly longer than the basipodite and strongly denticulate on the inner margin. The telson is short and triangular.

Distribution: Mediterranean western of Sardinia. This species absent in our collections.

2. Genus *Ctenoscina* Wagler, 1926

Wagler, 1926: 430; vinogradov, 1957: 218; Bowman and Gruner, 1973: 14.

Somites I and II of the pereon are not fused; a dorsal keel runs along the pereon and pleon and on the posterior margin of at least the last five somites of the pereon and all the somites of the pleon, merges with strong denticles; similar denticles are present on the 1st segment of the urosome. The eyes are well noticeable. Antennae II may be reduced to an acute spine not only in the female, but also in the male. Maxillae II have separated lobes. The maxillipeds lack an inner lobe. The coxal plates are free. Pereopods I have weakly developed chelae; the 2nd segment of pereopods V has several large denticle-lobes on the posterior margin; pereopods III–VII have retractile claws. Pereopods VII are longer than pereopods VI but shorter than pereopods V. The telson is free. The gills are located on somites IV–VI of the pereon.

Type species: *Ctenoscina tenuis* Wagler, 1926.

KEY TO SPECIES OF GENUS CTENOSCINA

1. All pereon somites with dorsal denticles. Anterior distal angle of 2nd segment of pereopods V produced into long, curved, slender simple or broad festooned process .... 2.

— Dorsal denticles present only on pereon somites III–VII. Anterior distal angle of 2nd segment of pereopods V produced into two long slender processes, of which one may be weakly developed .... 1. ***C. brevicaudata*** Wagl.

2. Second segment of pereopods V denticulate on anterior margin and anterior distal angle produced into a large notched lobe .... 2. ***C. tenuis*** Wagl.

— Second segment of pereopods V not denticulate on anterior margin, its anterior distal angle produced into simple curved process .... 3. ***C. macrocarpa*** (Chevr.).

1. ***Ctenoscina brevicaudata*** Wagler, 1926 (Fig. 94)

Wagler, 1926: 435; vinogradov, 1957: 218, 1962: 18.

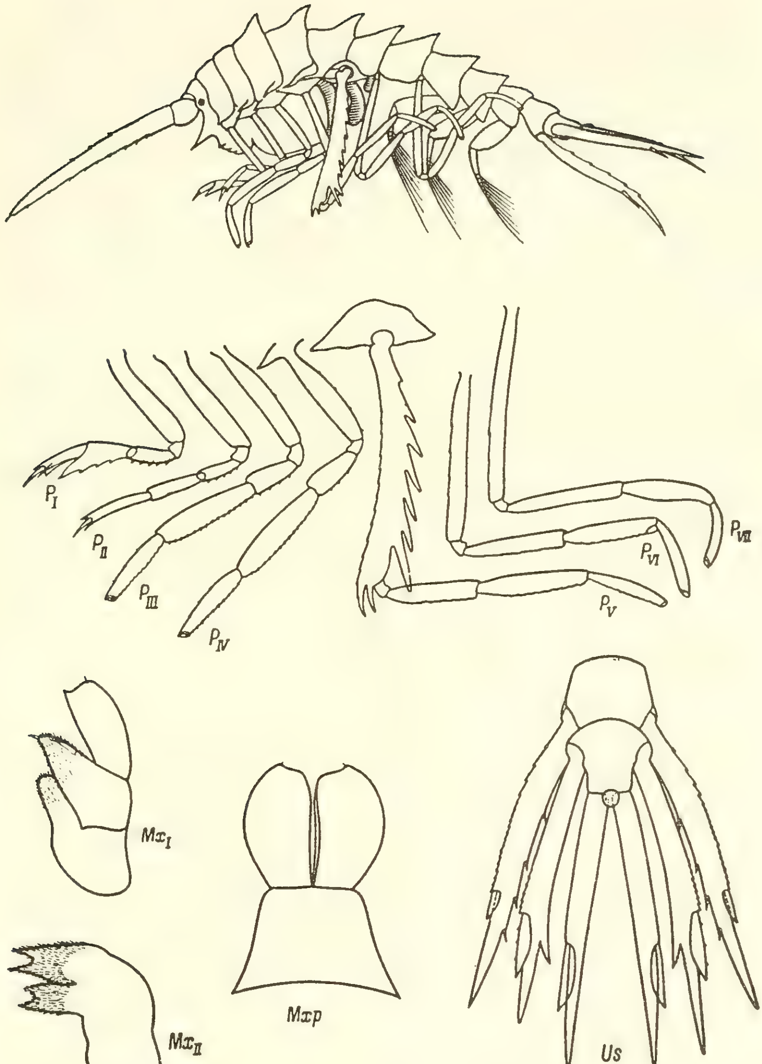
Length of sexually mature specimens about 4 mm.

Dorsal denticles are present on pereon somites III–VII, pleon somite I–III, and on urosomite I; these denticles (except the urosomal) are weakly denticulate on the anterior margin. The head has long, forwardly directed spines, which are located under antennae I.

Antennae I are armed on the outer edge with strong spines, and reach the length of the pereon. Antennae II are absent in both males and females. Maxillae I and II are scinoid in form; each lobe of maxillae II terminates in two spines. The maxillipeds have broadly oval outer lobes with one apical seta each; the inner lobes are in the form of a small tubercle or totally imperceptible.

Coxal plates II–V taper anteriorly and posteriorly.

Pereopods I have a chela formed by the prolonged large lobe of the distal posterior angle of the 5th segment, which is denticulate on
187 the posterior margin, and the posterior margin of the 6th segment; the anterior distal angle of the 6th segment is stretched over the claw into a small acute denticle, while the posterior distal angle is produced into a small rounded lobe; the claw is strong and straight. In pereopds II the 5th and 6th segments are roughly equal to each other while the 4th is 2/3 their length; the distal angle of the 6th segment is stretched over and under the claw into straight acute denticles; the claw is strong and straight. Pereopods III and IV have broad distal segments, weakly, denticulate on the posterior margin; the length ratios of the 2nd, 4th, 5th, and 6th segments are 18:10:16:13; the claw is small, curved, and retractile. The posterior margin of the 2nd segment of pereopods V bears 7 to 11 long denticle-lobes, the anterior margin is armed with sparse
188 low denticles; the anterior distal angle of the 2nd segment is produced into two long processes, of which the inner is less developed than the outer; the 4th and 6th segments are roughly equal; the 5th segment is slightly longer; the claw is small, curved, and retractile. Pereopods VI are considerably shorter than pereopods V; the length ratios of the 4th,



187 Fig. 94. *Ctenoscina brevicaudata* Wagler, female (after Wagler, 1926).

5th, and 6th segments are 10:9:9; the anterior margin of the 2nd segment is weakly denticulate; the claw is retractile. Pereopods VII are somewhat longer than pereopods VI due to the longer 2nd and 4th segments; the length ratios of the distal segments are 11:8:6; the claw is retractile.

The basipodites of the uropods are considerably longer than the endopodites; the exopodites are relatively well developed and the same size in uropods II and III but slightly smaller in uropods I; all the exopodites are considerably shorter than the endopodites. In uropods I the anterior margin of the basipodite is denticulate while the posterior margin of the uropod is armed with a small number (4–5) of strong straight spines. In uropods II the distal part of the anterior margin of the basipodite is denticulate, and distal to the base of the exopodite a large recurved denticle-lobe occurs on the inner margin, which has a finely denticulate inner margin. The telson is rounded and its width greater than its length.

Distribution: This is a widely distributed but rare species. It is known from a few specimens caught near the Canary Islands, at the Cape of Good Hope, in the tropical regions of the Indian Ocean (the Seychelles), and its Antarctic regions (55°27′ S, 28°59′ E, 65°06′ S, 111°24′ E), as well as in the southern (30°32′ S, 176°38′ W), eastern equatorial and northwestern (between 49° and 43° N, 152° and 158°30′ E) regions of the Pacific Ocean. It is found in catches from depths of 700, 500–1,000, 950–1,500, 2,200–5,250 m and in through catches from depths of over 1,000 m to the surface.

2. ***Ctenoscina tenuis*** Wagler, 1926 (Fig. 95)

Wagler, 1926: 431.

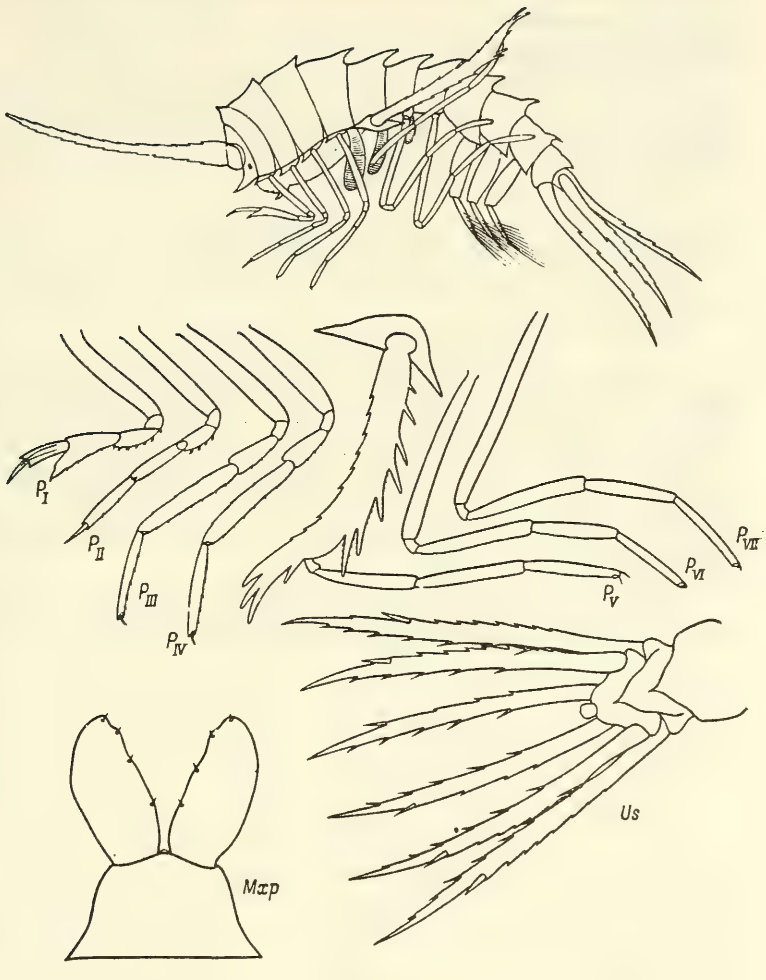
Length of sexually mature female 3.5 mm.

Dorsal denticles are present on all the pereon somites, pleon and urosomite I; the denticles on the first three pereon somites are short, and the one on somite I is stretched forward; all the denticles are smooth. The head has forwardly directed spines located under antennae I.

The strong antennae I are armed with spines on the inner and outer edges; antennae II are absent in both males and females. The mouth cone is small. Maxillae I have a distally tapering inner lobe. In maxillae II the outer lobe terminates in one spine and the inner lobe in two spines. The maxillipeds have oblong-oval outer lobes carrying small marginal setae on the inner margin.

Coxal plates I–V have acute angles.

Pereopods I and II are the same as in *C. brevicaudata*. Pereopods III and IV have similar proportions; the length ratios of the 2nd, 4th, 5th, and 6th segments are 24:10:22:16; the inner margin of the three distal segments is slightly denticulate; the claw is small and retractile. The long and broad 2nd segment of pereopods V is armed with seven large denticle-lobes, as in *C. brevicaudata*; the anterior margin has small denticles; the broad lobelike distal prolongation of the 2nd segment is very long, nearly reaches the distal end of the 4th segment, and is divided into four large denticle-lobes; the 4th, 5th and 6th segments are roughly equal;



189 Fig. 95. *Ctenoscina tenuis* Wagler, female (after Wagler, 1926).

the claw is small and retractile. The weak pereopods VI are shorter than pereopods V; the length ratios of the 2nd, 4th, 5th, and 6th segments are 14:10:7:7. Pereopods VII are likewise thin but longer than pereopods VI; the length ratios of the segments are 18:10:8:8. The claws of pereopods VI and VII are small and retractile.

The basipodites of the uropods are considerably longer than the endopodites; the exopodites are reduced to small spines; in uropods III
189 the exopodites are particularly small. The outer margin of all three pairs

of uropods is deeply and sparsely denticulate and the inner margin bears sparse (5-7) strong spines. The telson is almost square, slightly broadened distally, with a bulging distal margin.

Distribution: Waters of the Guinean and Benguelan currents of the Atlantic Ocean and waters of the equatorial currents of the Indian Ocean. The depth of occurrence is not given.

This species is absent in our collections.

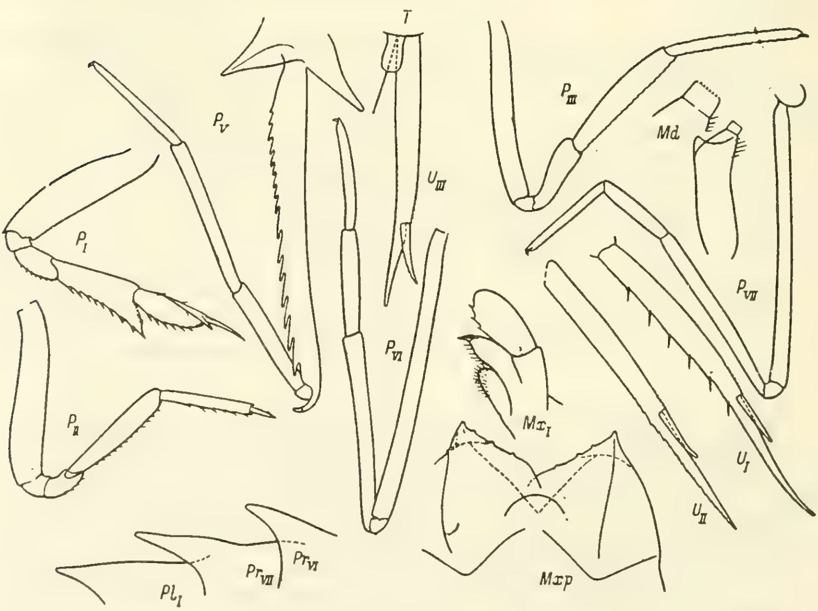
3. ***Ctenoscina macrocarpa*** (Chevreux, 1905) (Fig. 96)

Chevreux, 1905: 2 (*Acanthoscina*); Wagler, 1926: 439; Bristein and Vinogradov, 1963: 82.

Length of sexually mature specimens about 7 mm.

Backwardly directed, flat dorsal denticles are present on all the somites of the pereon and pleon and on urosomite I, their size increasing
190 from pereon somite I to VII and then decreasing from pleon somite I to III; the denticle on the urosomite is relatively small. The head is broad, with an almost vertical frons. The eyes are well noticeable, with forwardly directed short spines located below them and one long unpaired spine situated above the labrum.

Antennae I are long, roughly equal in length to the pereon and pleon together. Antennae II in the female are reduced to small spines; in the



190 Fig. 96. *Ctenoscina macrocarpa* (Chevreux), female.

male they are multisegmented and their basal segment bears a long forwardly directed denticle.

The mandibles are narrow, with a small rectangular cutting plate which is denticulate on the distal margin; the dentate margin bears several short thin setae. Maxillae I have a well-developed palp which is armed in the distal part of the inner margin with small denticles; the outer lobe bears a few distal spines and a row of thin satae on the inner margin; the inner lobe is oval and bears thin setae on the inner margin. The lobes of maxillae II are roughly equal in size and oval, and each has one small distal denticle. The maxillipeds are strong, with short outer lobes having a flat anterior and rounded posterior surface; some small tubercle-shaped spines occur along the inner margin of each lobe.

Pereopods I have a weakly developed chela; the 5th segment is distally broadened, forming an acute lobe on the posterior margin, adjacent to the posterior margin of the 6th segment; the 6th segment is shorter than the 5th; its posterior margin is not uniformly denticulate and is armed with short spines; above the claw there are two teeth of unequal size; the claw is straight and stylet-shaped. Pereopods II are simple; the 5th segment is rod-shaped; the 6th segment is somewhat shorter than the 5th and stretched above the claw as a strong, acute denticle. The 6th segment of pereopods III and IV is thin and longer than the 5th segment; the
191 claws are small and retractile. Pereopods V are long and strong; the 2nd segment is somewhat shorter than the remaining segments together; its anterior margin is smooth and the posterior margin bears several (12–22) long, blunt denticle-lobes, enlarged in the distal part of the row; the anterior distal angle of the segment is drawn into a long, curved denticle; the 4th segment is shorter than the 5th and almost equal to the thin 6th; sometimes the 5th and 6th segments are equal; the claw is very small and retractile. Pereopods VI are only slightly shorter but weaker than pereopods V; the 4th segment is roughly twice longer than the 5th, which in turn is shorter than or equal to the 6th. Pereopods VII have almost the same proportions as pereopods VI but are slightly shorter. The claws of pereopods VI and VII are small and retractile.

The basipodites of the uropods are longer than the endopodites; the exopodites are comparatively well developed, roughly similar to those in *C. brevicaudata*. The distal part of the anterior margin of the basipodite of uropods I is finely denticulate and the posterior margin bears a small number of strong spines. The posterior margin of uropods II is denticulate, and opposite the place of attachment of the exopodite bears an isolated large denticle that, however, is not as large as in *C. brevicaudata*. The anterior margin of the basipodite of uropods III is weakly denticulate. The telson is spatulate, with a rounded tip.

Distribution: The northern tropical Atlantic Ocean between 30° and 37° N and 19° and 42° W, Pacific Ocean in the region of the Philippine and Kuril-Kamchatka trenches; the northernmost report is for 45°48′ N,153°18′ E. In the Kuril-Kamchatka Trench a sexually mature female was found in a catch 4,000–5,000 m; all the remaining records from through catches pertain to adult specimens from a depth of 3,000 m and more to the surface and juvenile in catches from 0–1,500 m.

3. Genus *Spinoscina* Bowman and Gruner, 1973

Bowman and Gruner, 1973: 16.—*Ctenoscina* Wagler, 1926: 430 (part.); vinogradov, 1957: 219 (part.).

Pereon somites I and II are fused. Pereon somites II–VII and pleon somites I–III dorsally bear long, narrow, recurved denticles which are deeply denticulate on the anterior margin; urosomite I has a small dorsal denticle. The head has two lateral and one median forwardly directed long spines. The eyes are not discernible. Antennae I exceed the length of the pereon. Antennae II in females are completely reduced. Maxillae I have a better developed one-segmented palp, and armed outer and rounded inner lobes. The lobes of maxillae II are separated. The maxillipeds have oval outer lobes and comparatively large inner lobes which may reach half the length of the outer. Coxal plates VI and VII are fused with the pereon somites. The pereopods are unusually long and thin. Pereopods I have chelae, as in *Ctenoscina*. The 2nd segment of pereopods V is armed with thin spines. The claws of pereopods III–VII are very small, curved, but not retractile. Pereopods VII are slightly shorter than pereopods VI. The telson is fused with urosomite III. The gills are located on pereon somites III–VI.

Type species: *Acanthoscina spinosa* Chevreux, 1914.

Chevreux (1914) described a new species of the genus Acanthoscina—*A. spinosa*—based on several features differing significantly from those in the other species of the genus, *A. acanthodes*. Later, Wagler (1926), having no personal material of this species and relying solely on Chevreux's description, transferred *A. spinosa* to the genus *Ctenoscina* newly established by him. However, Chevreux gave only a very brief description of the crustacean, in which the structure of the mouthparts was not included. A more thorough examination of the other specimens of the same species by Vinogradov (1957) showed that *C. spinosa* differs in several significant characters from the other species of the genus *Ctenoscina* (see description of the genus). Later, one more species was
192 identified, which is close to *C. spinosa*. Thereby the genus *Ctenoscina*, in the volume accepted by Wagler, became divided into two mutually sharply differing groups of species, which provided the basis on which Bowman and Gruner (1973) separated the independent genus *Spinoscina*.

KEY TO SPECIES OF GENUS SPINOSCINA

1. In addition to long ventral denticle, pereon somites III–VI with barely noticeable spines on distal surface. In pereopods III–V, 6th segment shorter than 5th .... 1. ***S. spinosa*** (Chevr.)

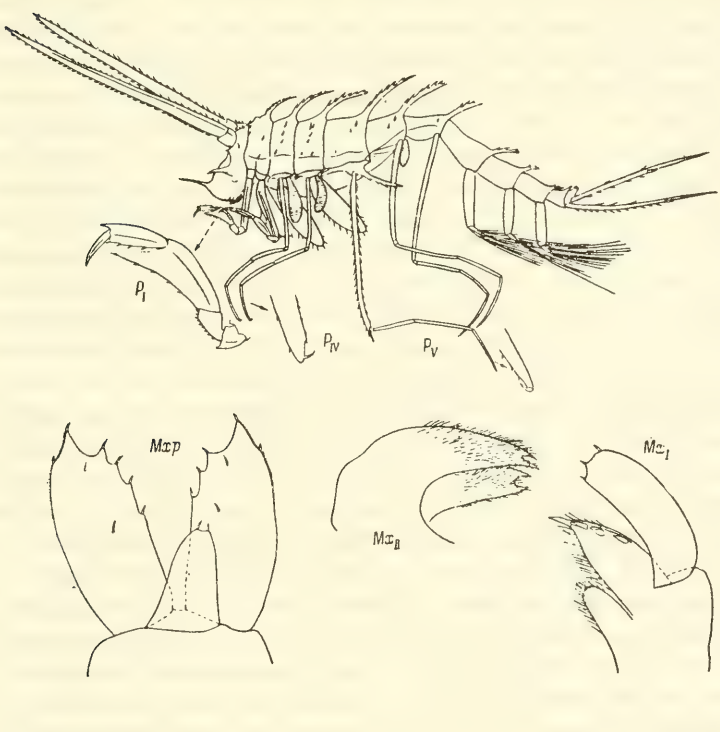
— In addition to long ventral denticle and small spines, pereon somites III–VI with large lateral spines on distal surface. In pereopods III–V, 6th segment longer than 5th .... 2. ***S. echinata*** (Vinogr.)

1. ***Spinoscina spinosa*** (Chevreux, 1914) (Fig. 97)

Chevreux, 1914: 7 (*Acanthoscina*), 1935: 166 (*Acanthoscina*); Wagler, 1926: 444 (*Ctenoscina*); Vinogradov, 1957: 219 (*Ctenoscina*).

Length of sexually mature females 7.5–8.5 mm; males not known.

The body is narrow. The longest dorsal denticles are found on pereon somites IV–VII. Moreover, on the distal surface of pereon somites I–VII on each side there are some (1–6) barely noticeable spines. The head is short and high, with long forwardly directed lateral spines located



193 Fig. 97. *Spinoscina spinosa* (Chevreux), female (after Vinogradov, 1957).

under antennae I and still longer solitary spine above the mouth cone; moreover, small spines are present directly above the place of attachment of antennae I and on the keels of the head, running from the base of antennae I to the occiput. Eyes are absent. Antennae are strong and their upper and lower edges are armed with long strong spines.

The mouth cone does not project. The palp of maxillae I is armed on the straightly truncated distal margin with sparse short setae. The lobes of maxillae II terminate in a pair of spines on each. The maxillipeds have oblong-oval outer lobes which are armed in the distal part of the inner margin with apical, strong short setae; a pair each of such setae is present on the surface of the lobes; the inner lobes reach half the length of the outer, taper distally, and carry two apical setae. Coxal plates III–V have prolonged and acute anterior angles, while on coxal plates V, in addition the lower posterior angle is stretched into a long thin process which is denticulate on the lower margin.

The 4th segment of pereopods I is very short, roughly equal to the 3rd; the lower margin of the 5th segment is produced into a large lobe with an acute distal angle; the shorter 6th segment has a slightly denticulate posterior margin and its anterior distal angle is extended above the claw into a short acute denticle; the claw is narrowly lanceolate and more than 1/2 the length of the 6th segment. Pereopods II are simple; the 4th segment is not as short as in pereopods I; the 6th segment is slightly longer than the 5th and roughly three times longer than the lanceolate claw. The 5th and 6th segments and the claw of pereopods I and II have lateral keels. Pereopods III and IV are very thin and long; the 5th and 6th segments are roughly equal and the 4th segment is slightly shorter; the claw is very small, curved, but not retractile. Pereopods V are somewhat longer than the body; the thin, rod-shaped 2nd segment is roughly equal to all the remaining segments together and is armed on both the anterior and posterior margins with sparse long and slightly curved spines, the anterior distal angle is stretched into a long and acute process, reaching far beyond the distal margin of the 3rd segment; the 4th segment is shorter than the 6th, which in turn is somewhat shorter than the 5th seg-
193 ment; the claw is very small but not retractile. Pereopods VI are slightly shorter than pereopods V; the 2nd segment is equal in length to the 5th and 6th together; the 6th segment is longer than the 5th. Pereopods VII are roughly as long as pereopods VI, but the 2nd segment is longer and the distal segments are shorter; the 6th segment is longer than the 5th. The claws on pereopods VI and VII are small, curved, but not retractile.

The uropods are long and thin, their basipodites are considerably longer than the endopodites. The exopodites are greatly reduced to an equal extent in uropods II and III; the basipodites of all the uropods are armed with sparse long and slightly curved spines. In uropods II and III a large spine is situated on the inner margin opposite the place of attachment of the exopodite. The telson is very small, its length equal to its width.

Distribution: Known from two records from the Atlantic Ocean (33°14′ N, 19°38′ W and 34°02′ N, 12°21′ W) and a few records from the northwestern part of the Pacific Ocean (between 43° 43′ and 46°11′ N and 149°39′ and 155°55′ E). In the Pacific Ocean it is found in catches from depths of 2,200–5,250 m, about 2,400 and 3,000–4,000 m, and in the Atlantic Ocean in through catches from 0–1,500 and 0–4,000 m.

2. ***Spinoscina echinata*** (Vinogradov,1964) (Fig. 98)

Vinogradov, 1964: 140 (*Ctenoscina*).

Length of sexually mature specimens 5–6 mm.

This species is close to *S. spinosa*. The following differences were noted: the lateral spines on the head and the dorsal denticles on the pereon
194 and pleon somites are longer than in *S. spinosa*. One spine occurs on each side of the distal surface of pereon somites III–VI and pleon somites I–III.

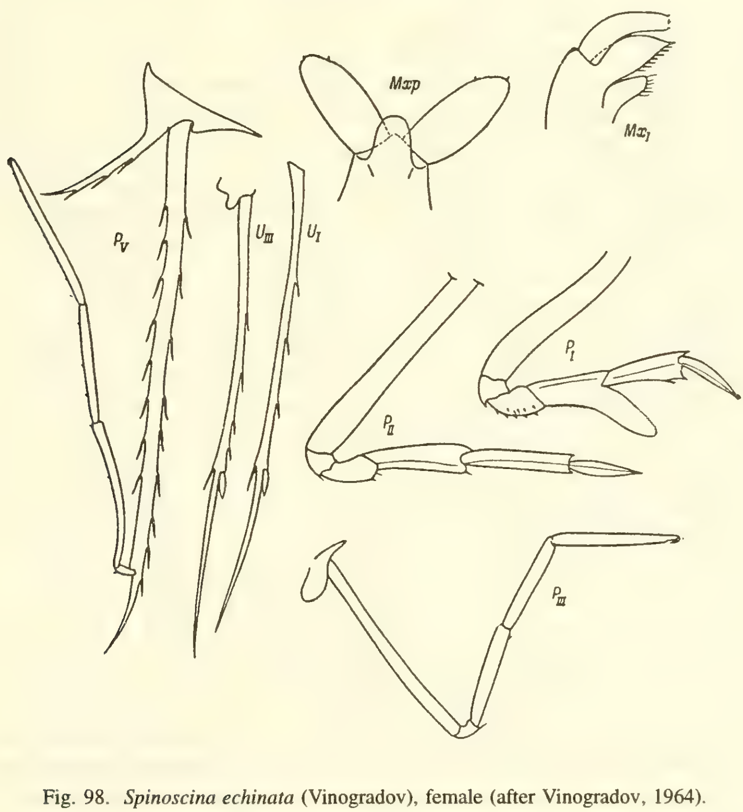


Fig. 98. *Spinoscina echinata* (Vinogradov), female (after Vinogradov, 1964).

The outer lobe of maxillae I is armed on the distal margin with only a single spine while the distal end of the inner lobe is almost straightly truncated. The outer lobes of the maxillipeds are amygdaloid and in the distal part of the inner margin bear only two short setae; the unarmed inner lobes fall far short of 1/2 the length of the outer lobes, and their distal margin is rounded.

The claws of pereopods I and II are longer and broader than in *S. spinosa*; the lobe on the 5th segment of pereopods I is strongly developed and, moreover, the 6th segment also has a weakly developed lobe. In pereopods III–V the 6th segment is longer than the 5th, which in turn is shorter than the 4th segment. The basipodites of the uropods bear curved spines only on the anterior margin; on the posterior margin there is a solitary spine opposite the place of attachment of the exopodite.

Distribution: Found in the Indian Ocean in the cental region (16°03′ S, 90°06′ E) and in the Arabian Sea in catches from depths of 2,020–2,990 and 0–2,010 m.

195 ### 4. Genus *Acanthoscina* Vosseler, 1900

Vosseler, 1900: 675; Wagler, 1926: 424.

Differs markedly from the original form of the specialized genus. Pereon somites I and II are fused. Pereon somites II–VII and pleon somites I–III have dorsal denticles. The head has two lateral spines. The eyes are small, well noticeable. Antennae I are longer than the pereon. Antennae II are absent in both males and females. The mouthparts are very small and reduced to a greater extent than in other scinids. Maxillae I have a palp which is reduced to a small tubercle. Maxillae II have reduced, small, apically tapering lobes. The outer lobes of the maxillipeds are reduced to two small narrow plates; the inner lobes are absent. Coxal plates II–V have prolonged and acute spines on the anterior and posterior margins. Pereopods I and II are simple. The distal segments (4th, 5th, and 6th) of the pereopods are fused. Pereopods VII are equal to or longer than pereopods VI. The telson is free. The gills are located on pereon somites II–VI.

Type species: *Scina acanthodes* Stebbing, 1895.

The genus includes two close species.

KEY TO SPECIES OF GENUS ACANTHOSCINA

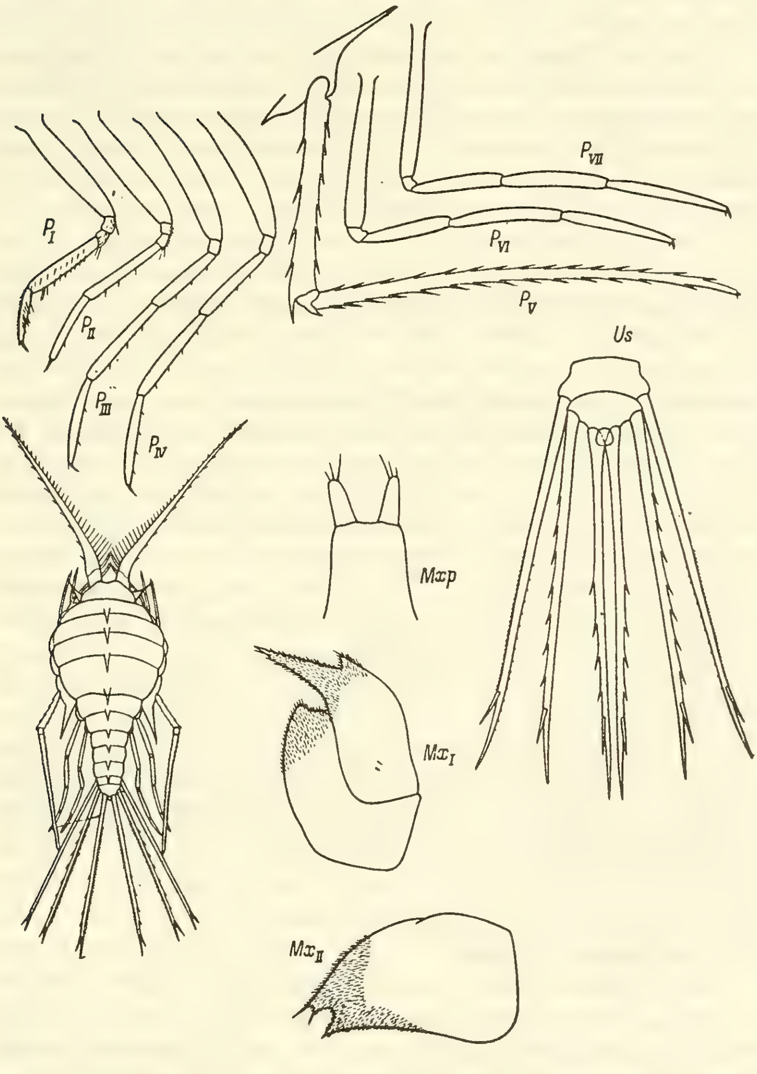
1. Claws of pereopods I and II, 1/5–1/4 length of 6th segment; 2nd segment of pereopods V, 1.5 times longer than 2nd segment of pereopods IV; 6th segment of pereopods VI roughly equal to 5th segment .... 1. ***A. acanthodes*** (Stebb.)

— Claws of pereopods I and II, 1/3–1/2 length of 6th segment; 2nd segment of pereopods V almost twice longer than 2nd segment of pereopods IV; 6th segment of pereopods VI markedly shorter than 5th segment ....2. *A. birsteini* Vinogr.

1. ***Acanthoscina acanthodes*** (Stebbing, 1895) (Fig. 99)

Stebbing, 1895: 352 (*Scina*); Chevreux, 1905: 1; Wagler, 1926: 426.—*serrata* Vosseler, 1900: 675.

Length of sexually mature specimens 4-6 mm.



196 Fig. 99. *Acanthoscina acanthodes* (Stebbing) female (after Wagler, 1926).

Pereon somites II–VII and pleon somites I–III have backwardly directed, acute, and smooth dorsal denticles. The posterior lower angle of coxal plate V is stretched into a long acute denticle.

The head has long lateral spines. The eyes are small. Antennae I are equal in length to the pereon and pleon together; the outer margin of the flagellum is armed with strong spines and the inner margin with setae; in males the proximal part of the inner margin bulges so that a plate is formed at the base of the flagellum; the plate has long sensory setae along its margins.

The lobes of maxillae II are proximally fused and bear two spines on the upper distal angle and one on the lower distal angle. The protopodite of the maxillipeds is almost rectangular, its breadth in the middle part 2/3 its length; the outer lobes have the form of narrow triangular plates attached to the outer angles of the distal margin of the protopodite; the distal margin of the lobes is rounded and armed with three spines.

Pereopods I and II are thin and simple; their 4th segment is very short and equal to the 3rd; the 5th segment of pereopods I is 1.5 times and of pereopods II only slightly longer than the 6th segment; the claws of both pairs are moderately long and almost straight. The 4th and 6th segments of pereopods III and IV are roughly equal and each of them somewhat shorter than the 5th; the claws are small and almost straight.
196 Pereopods V are longer than the remaining pairs; the rod-shaped 2nd segment has 4–5 long straight spines on its anterior margin and 6–7 on its posterior margin; the distal process is thin and acute; the 4th, 5th, and 6th segments are fused; the claw is very small and thin. Pereopods VI are shorter than pereopods V; the length ratios of the 2nd, 4th, 5th, and 6th segments are 20 : 10 : 14.5 : 16; the claw is small and curved. Pereopods VII are somewhat longer than pereopods VI and have the same proportions; the claw is straighter.

The uropods are thin and rod-shaped. The telson is spatulate and distally broadened.

Distribution: Atlantic Ocean from 61° N to 28–39° S, tropical regions of the Indian Ocean, southern tropical regions of the Pacific Ocean at New Caledonia and New Zealand. Most records are confined to the tropical regions. A. acanthodes lives in the near-surface layers to a depth of 200–500 m.

197 2. ***Acanthoscina birsteini*** Vinogradov, 1976 (Fig. 100)

Vinogradov, 1976: 130.

Size of sexually mature female 7 mm.

Pereon somites II–VII have dorsal, backwardly directed denticles which are particularly large on somites VI and VII; the pleon somites have shorter denticles. The head has small lateral spines. The eyes are not noticeable.

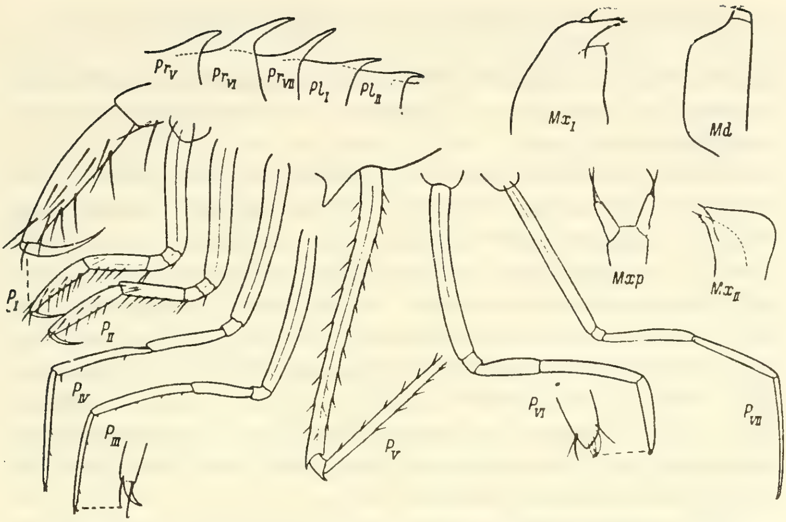


Fig. 100. *Acanthoscina birsteini* Vinogradov, female (after Vinogradov, 1976).

The lobes of maxillae II are separated, with prolonged tips, bearing a single strong apical spine on each. The maxillipeds are very small; the outer lobes are reduced to narrow, slightly proximally broadened plates, armed with two strong apical setae on each; their outer margin bends sharply near the base.

Pereopods I and II are stronger than in *A. acanthodes*; the 2nd segment of pereopods I is roughly equal to the length of the 5th and 6th segments together; the short 4th segment is almost equal to the 3rd; the 5th segment is somewhat shorter than the 6th which tapers distally; the claw is slightly curved and strong. Pereopods II are weak. Pereopods III and IV are long and thin; the 2nd segment is equal to the 4th and 5th together; the 4th segment is shorter than the 5th, which in turn is shorter than or equal to the 6th segment. The claws are very small and curved. the 2nd segment of pereopods V is relatively longer than in *A. acanthodes*; it is triangular in cross section and armed on all three edges with numerous thin spines. Pereopods VI are shorter but weaker than pereopods V; the 6th segment is teardrop shaped, tapering distally; the small claw has a unique structure; it is falcate and forms with the process of the segment a movable structure like a pair of tongs. Pereopods VII are slightly longer but much weaker than pereopods VI.

The uropods are rod-shaped and long. The telson is spatulate and distally broadened.

Distribution: The lone specimen was found in the equatorial Pacific Ocean (7°36′ N, 162°01′ E) in a catch from 0–3,500 m.

The pereon is usually not inflated spherically (except in the family Cystisomatidae) and, when viewed from above, does not differ from the pleon in width.

The head is well differentiated, large and longer than somite I of the pereon. The eyes are usually large, well developed, and occupy a large part of the surface of the head, but sometimes are reduced or completely absent. Sexual dimorphism is generally distinct in the structure of antennae II and sometimes of antennae I. The mandibles may be armed with a strong cylindrical dentate process. Maxillae I usually lack an inner lobe. In the maxillipeds the inner lobes are completely fused and the outer lobes without a palp. Pereopods I and II often have a chela or subchela. Pereopods V–VII never have retractile claws; their 2nd segment is highly broadened, with a lobelike process. Pereopods VII may be reduced and the number of segments reduced to two.

The infraorder Physocephalata is divided into four superfamilies: Vibilioidea, Phronimoidea, Lycaeopsoidea and Platysceloidea. The entire group is quite heterogeneous and it is not always possible to establish phylogenetic links between these superfamilies or even between the families within them.

SUPERFAMILY VIBILIOIDEA DANA, 1852

The antennae are straight and short. Antennae I originate from the frontal part of the head; their flagellum consists of one large and sometimes several rudimentary segments attached terminally to the 1st segment. Antennae II originate from the frontal or ventral part of the head; they are straight, few-segmented or rudimentary. Only pereopods I and II may be armed with a chela or subchela. Pereopods III–VI are always simple. Pereopods VII are simple or shortened, with modified distal segments. The telson is free.

The morphological differences among the representatives of the three families constituting the superfamily Vibilioidea are so wide that their inclusion in one superfamily seems artificial to some extent.

VIII. Family VIBILIIDAE Dana, 1852

These crustaceans are medium in size (0.5–20 mm). The body has a more or less thick integument, slightly flattened laterally. The head is small, with a weakly developed rostrum, more often without rostrum. The eyes, if present, comprise dark pigmented ocelli and usually occupy only a part of the lateral surface of the head; sometimes (genus *Cyllopus*) they are highly developed, adjoining dorsally and occupying the entire surface of the head. Antennae I have a highly developed, flattened or bulged 1st segment of the flagellum and a few rudimentary distal segments. Antennae II are thin and inserted on the head frontally; in length, they are comparable to antennae I. The mandibles have a well-developed palp, denticulate cutting edge and strong dentate process. Maxillae I have a well-developed outer lobe while the inner lobe is in the form of a small round process without ornamentation or is absent. Maxillae II are small and have two short lobes. The maxillipeds have completely fused inner lobes forming a single medial lobe.

199 The somites of the pereon are free. Pereopods I–II are shorter than the remaining ones. Pereopods I are simple (except in *Cyllopus lucasi*). Pereopods II are chelate (except in *Vibilia bovallii*, in which they are simple).

Pereopods V–VI are the longest. The 2nd segment of pereopods V–VII is broadened, particularly in pereopods VII. Pereopods VII have a modified 7th segment (finger-shaped, clavate or knife-shaped). The gills are located on somites II–VI of the pereon and the oostegites on somites II–V. The somites of the pleon are massive and their height is more than the height of the somites of the pereon. The border between the fused urosomites II–III is marked by lateral notches and a dorsal furrow. The uropods have free rami. The telson is shorter than uropods III.

The family includes three genera.

KEY TO GENERA OF FAMILY VIBILIIDAE

1. Eyes occupy entire surface of head. First segment of flagellum of antennae I clavate, with bulged proximal part and stretched distal part .... 3. ***Cyllopus*** Dana.

— Eyes (if present) oval or pyriform, lateral on head. First segment of flagellum of antennae I flattened laterally .... 2.

2. Mandibles with simple, conical masticatory process; distal segment of palp shorter than preceding segment. Maxillae I without inner lobe. Maxillae II greatly reduced or absent .... 2. ***Vibilioides*** Chevr.

— Masticatory process of mandibles with flat tubercular surface; distal segment of palp longer than preceding segment. Maxillae I with roundish inner lobe. Maxillae II normally developed, bilobed .... 1. ***Vibilia*** M.-Edw.

1. Genus *Vibilia* Milne-Edwards, 1830

Milne-Edwards, 1830: 386; Stebbing, 1888: 1270; Bovallius, 1887b: 43; Vosseler, 1901: 118; Behning, 1912: 212; Stephensen, 1918: 32; Bowman and Gruner, 1973: 24.

These crustaceans externally resemble gammarids. The body is compact, most often with small, nonbulging head. The eyes are usually distinct and located laterally on the head, occupying 1/5–1/2 the lateral surface; in some cases they are absent or comprise individual rows of ocelli. In antennae I the 1st segment of the flagellum is flattened, spatulate, and bears two longitudinal bands of sensory setae on the inner surface; one-two highly reduced, successive segments present apically in the flagellum, which are difficult to discern in adults but well defined in younger individuals. Antennae II are five- to eight-segmented, in females shorter, in males longer than antennae I or equal to them. The mandibles have a long palp, its 3rd segment longer than the 2nd; the masticatory process has a flat oval or rectangular apex covered with tubercles and bordered with denticles. Maxillae I have a small oval inner lobe. The 2nd segment of pereopods I–II is not broadened (except in *V. robusta*). Pereopods VII have a full complement of segments, their 2nd segment in all species (except *V. chuni*) considerably shorter than the remaining part of the leg. The epimeral plates have a rounded edge. The basipodite of uropods III may be longer or (rarely) shorter than the rami; sometimes it is equal to them in length. The telson does not extend beyond the middle of the basipodite of uropods III.

Type species: *Vibilia peroni* Milne-Edwards, 1830.

Most of the species of *Vibilia* are associated with swarms of salps. They are often found in the body cavity of salps, although on being
200 alarmed when the salps are caught, they usually exit from the host. However, according to our observations, when put in an aquarium with live salps, they moved inside them and rarely emerged from their shelter. *Vibilia* species use salps as a source for food; they select some of the salp's catch concentrating directly at the entrance into the esophagus or branchial cord, along which the food particles filtered by the salp are passed over to the esophagus (Madin and Harbison, 1977).

The salps also have a less important role in the life cycle of Vibilia, as shelter for the young crustaceans. Laval (1963) observed in an experiment how the female transfers larvae from the brood chamber to the surface of the salp by means of the specialized pereopods VII. At this stage the larvae lack pereopods and are not capable of independent active swimming. They live in salps up to complete development of the natatory legs. Obviously, this is the reason why most often females and young and rarely the males are caught along with salps. Laval also noticed the feeding of early larvae of *Vibilia* on the tissues of the host; more adult crustaceans feed only on the suspension matter filtered by the salps. There is a definite link between the structure of antennae I and the semiparasitic mode of life of *Vibilia*; the distal part of the flagellum of antennae I was lost as it made their movement inside the salp difficult; this was compensated by the development and ornamentation of receptor organs of the basal segment of the flagellum, which apparently serves as an organ of chemo- and rheotaxis while searching for salps in pelagic zones.

All the species of *Vibilia* live in the surface layers of the water, most of them distributed circumtropically, concentrating in places of mass accumulation of the salps. Barnard (1930) had earlier predicted that with the accumulation of new information, the number of species of *Vibilia* might be reduced. In fact, the study of the collection, which provided material for assessing individual, age, and geographic variability of some species, as well as a review of the literature, convinced us that at present 15 species may be considered a reliable number. Two more species, viz., *V. bovallii* Bonnier, 1896 and *V. affinis* Bate, 1862, have been included in the key, although their validity is doubtful. *V. peroni* Milne-Edwards, 1830 and *V. depilis* Templeton, 1836 were described on the basis of young specimens and so briefly that it is impossible to associate them with any definite species.

KEY TO SPECIES OF GENUS VIBILIA

1. Posterior lateral angles of last urosomite do not project backward .. .. 2.
— Posterior lateral angles of last urosomite project backward along lateral sides of telson .... 11.
2. Process of 5th segment of pereopods II reaches end of 6th segment, often extending beyond base of claw .... 3.
— Process of 5th segment of pereopods II does not reach end of 6th segment, extending only to 1/2–3/4 its length .... 5.
3. Eyes absent. Antennae I very long, longer than head and first three somites of pereon together .... 11. ***V. caeca*** Bul.
— Eyes normally developed. Antennae I shorter than head and first three somites of pereon .... 4.
4. All pereopods thin and long; 4th segment not broadened; claws not longer than 1/3 of preceding segment. Pereopods V–VI longer than preceding pairs by 1/4 or more their length, mainly by virtue of elongation of distal segments. Endopodite of uropods III in male broadened and considerably longer than exopodite .... 4. ***V. antarctica*** Stebb.
201 — Pereopods III–IV with strong broadened 4th segment, claw equal in length to preceding segment or slightly shorter. Pereopods V–VI longer than preceding pairs by 1/6–1/5 their length. Uropods III of male and female with rami of equal length, endopodite not broadened .... 2. ***V. viatrix*** Bov.
5. Size of adults rarely exceeds 5 mm, on average 3–5 mm .... 6.

— Size of adults exceeds 5 mm .... 7.

6. Eyes comprise three rows of separate ocelli. Flagellum of antennae I slightly broadened, gradually tapering toward apex which is shifted toward lower margin. Antennae II very short, not longer than base of antennae I and comprise 2–4 segments .... 10. ***V. australis*** Stebb.

— Eyes compact. Flagellum of antennae I highly broadened, with parallel upper and lower margins, anteriorly obliquely truncate, apex shifted toward upper margin. Antennae II with 6–8 segments and comparable in length to antennae I .... 3. ***V. stebbingi*** Behn. and Wolt.

7. Sexually mature adults more than 15 mm. Second segment of pereopods I broadened, oval .... 6. ***V. robusta*** Bov.

— Sexually mature adults less than 15 mm. Second segment of pereopods I not broadened, but if broadened, just slightly so .... 8.

8. Frontal part of head forming round projection (very prominent in males) above base of antennae I, length of which approximately equal to head and first two somites of pereon .... 8. ***V. borealis*** Bate and Westwood.

— Frontal part of head in females inclined toward base of antennae I, in males rounded but without noticeable projection. Antennae I not longer than head and 1st somite of pereon together .... 9.

9. Length of claws of pereopods V–VI less than 1/4 length of preceding segment .... 1. ***V. jeangerardi*** Lucas

— Length of claws of pereopods V–VI about 1/3 length of preceding segment .... 10.

10. Body highly chitinized. Eyes of females occupy about 1/3 lateral surface of head. Base of antennae I massive and not less than 1st segment of flagellum in height. Basipodite of uropods I twice longer than rami; endopodite of uropods III in male broadened and longer than exopodite by 1/3 its length ....5. ***V. propinqua*** Stebb.

— Body weakly chitinized. Eyes of females occupy not more than 1/4 lateral surface of head. Height of basal part of antennae I considerably less than height of flagellum. Basipodite of uropods I, 1.5 times longer than rami; endopodite of uropods III in both sexes almost not distinguishable from expodite in shape and length .... 7. ***V. gibbosa*** Bov.

11. Antennae I longer than head and first two somites of pereon together .... 17. ***V. affinis*** Bate

— Antennae I not longer than head and first two somites of pereon together .... 12.

12. Pereopods II simple, without chela .... 16. ***V. bovallii*** Bonnier

— Pereopods II with chela .... 13.

13. Basipodite of uropods III longer than exopodite .... 14.

— Basipodite of uropods III shorter than exopodite or equal in length .. .. 15.

14. Second segment of pereopods VII longer than remaining part of leg. Process of 5th segment of pereopods II reaching middle of 6th segment. Flagellum of antennae I with parallel upper and lower margins and obliquely truncate anteriorly ....9. *V. chuni* Behn and Wolt.

202 — Flagellum of antennae I elongated-lanceolate, almost rhombic, with acute apex. Process of 5th segment of pereopods II reaches base of claw; 2nd segment of pereopods VII considerably shorter than remaining part of leg .... 12. *V. armata* Bov.

15. Length of antennae I equal to length of head and somite I of pereon. Process of 5th segment of pereopods II extends beyond middle of 6th segment, often reaching base of claw; anterior distal angle of 5th–6th segments of pereopods VII forms round projection.............. 16.

— Antennae I longer than head and somite I of pereon. Process of 5th segment of pereopods II not extending beyond middle of 6th segment; anterior distal angle of 5th–6th segments of pereopods VII does not form projection............................ 15. *V. pyripes* Bov.

16. Distal segment of pereopods VII has characteristic knife shape with acute apex.................................... 13. *V. cultripes* Voss.

— Distal segment of pereopods VII finger-shaped, with round apex... .... 14. *V. longicarpus* Behn.

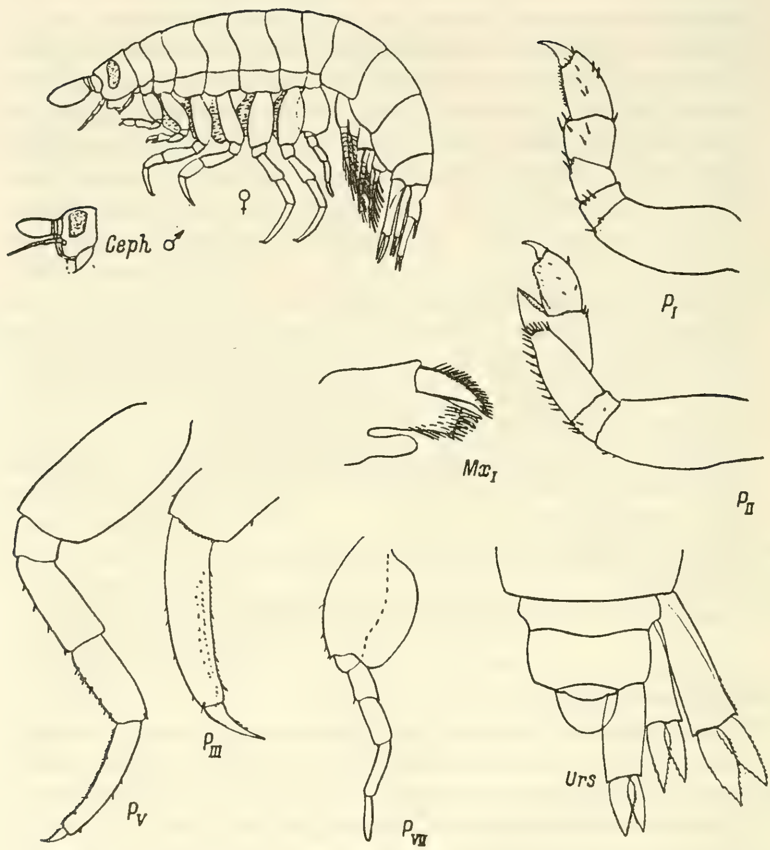
1. ***Vibilia jeangerardi*** Lucas, 1845 (Fig. 101)

Lucas, 1845: 56; Bovallius, 1887b: 47; Chevreux, 1900: 125; Behning, 1912: 212; Chevreux and Fage, 1925: 383.—*speciosa* Costa, 1853: 61.—*mediterranea* Claus, 1872: 335.

Length of adult crustacean up to 11 mm.

The body is cylindrical with a thick integument. The height of the head slightly exceeds the length; the rostrum is very short. The eyes are very dark and small; in males they are larger than in females, oblong-oval, broadened above; the peripheral ocelli are larger than the inner ocelli. antennae I have a massive base, the basal segment being longer than the remaining two segments together. The 1st segment of the flagellum is very broad, bulging, oval, twice as long as the base; two-three rudimentary segments are present apically, well discernible only in young individuals. Antennae II of females are five-segmented and shorter than antennae I, of males seven- to nine-segmented and the same length as antennae I or slightly longer; the 3rd–4th antennal segments are the longest, the distal segments short, equal in length, and with fine setae.

Somite I of the pereon is shorter than somite II; somite V is the longest. The lower posterior angle of the 4th segment of pereopods I projects weakly; the process of this segment does not reach the middle



203 Fig. 101. *Vibilia jean gerardi* Lucas (P_{I-III}, P_V' Us—after Bovallius, 1887b; rest—after Chevreux and Fage, 1925).

of the 5th segment; the 5th segment is shorter than the 6th, the lower margin finely denticulate and distally armed with several strong setae; the posterior margin of the 6th segment is straight, highly denticulate, and bent toward the base of the claw; the claw is strong, weakly bent, denticulate posteriorly and half the length of the 6th segment. The lobe of the 4th segment of pereopods II broadens distally and is armed along the margin with long strong spiniform setae; the posterior distal angle of the 5th segment has a process which is denticulate along the margins and is 3/4 the length of the 6th segment; the 6th segment is broad, equal in length to the preceding segment, highly denticulate along the posterior margin and at the base of the claw; the claw is less than half the length of the 6th segment, with a highly denticulate posterior margin. Pereopods III–IV are similar in length; the 4th segment is slightly longer than the 5th segment and is not bulged; the 6th segment is longer than the 5th and highly denticulate posteriorly; the claw is curved, less than 1/3 the length of the 6th segment, and has a few teeth on the posterior margin. Pereopods V–VI are almost equal in length; the 2nd segment is quite broad and oval; the 4th segment is smooth, somewhat longer than the 5th; the 5th segment is shorter than the 6th and both segments have a finely denticulate anterior margin; the claw is very short, less than 1/4 the length of the 6th segment. Pereopods VII are relatively long (ratio of their length to that of pereopods VI, 7 : 9); the 2nd segment is broadly oval, its length slightly more than width; the finger-shaped 7th segment is approximately the same length as the preceding one or slightly shorter.

203 The pleon is longer than the last four somites of the pereon. The rami of the pleopods comprise 12–13 segments. Urosomite I is longer than the fused urosomites II and III, urosomite II being the shortest. The posterior angles of the last urosomite are round and not stretched backward. The basipodite of the uropods is much longer than the rami and has parallel margins. The basipodite of uropods I is finely denticulate from the outer side. The rami of all uropods are equal in length and in uropods I–II are finely denticulate on both sides. The exopodite of uropods III is smooth from the outer side. The telson is broad, semicircular, of the same length as urosomite III and extends to the middle of the basipodite of uropods III. Sexual dimorphism is hardly expressed in the structure of this pair of uropods.

Notes: The species is closest to *V. propinqua* but is distinguished by the short claws of pereopods V–VI, absence of distinct sexual dimorphism in the structure of uropods III and by a round telson.

Distribution: The species was described from the Mediterranean Sea and is mainly found in the Atlantic Ocean; it has been detected in the Indian Ocean also, northeast of Madagascar.

2. ***Vibilia viatrix*** Bovallius, 1887 (Fig. 102)

Bovallius, 1887a: 8; 1887b: 63; Behning, 1925: 482; Stephensen, 1918: 41.—*viator* Stebbing, 1888: 1286. hirondellei Chevreux, 1900: 126.—*dentata* Chevreux, 1900: 129.—*californica* Holmes, 1908: 490.

Length of sexually mature adults up to 8.1 mm.

205 The body is well proportioned. The head has a small triangular rostrum; the frontal part of the head in females converges gently towards the base of antennae I; in males this part of the head is more convex. The eyes are average in size but in males larger and tapering downward. The 1st segment of the base of antennae I is approximately the same length as the 2nd and 3rd together; the flat 1st segment of the flagellum in females is slightly longer than the head, in males is equal to the head

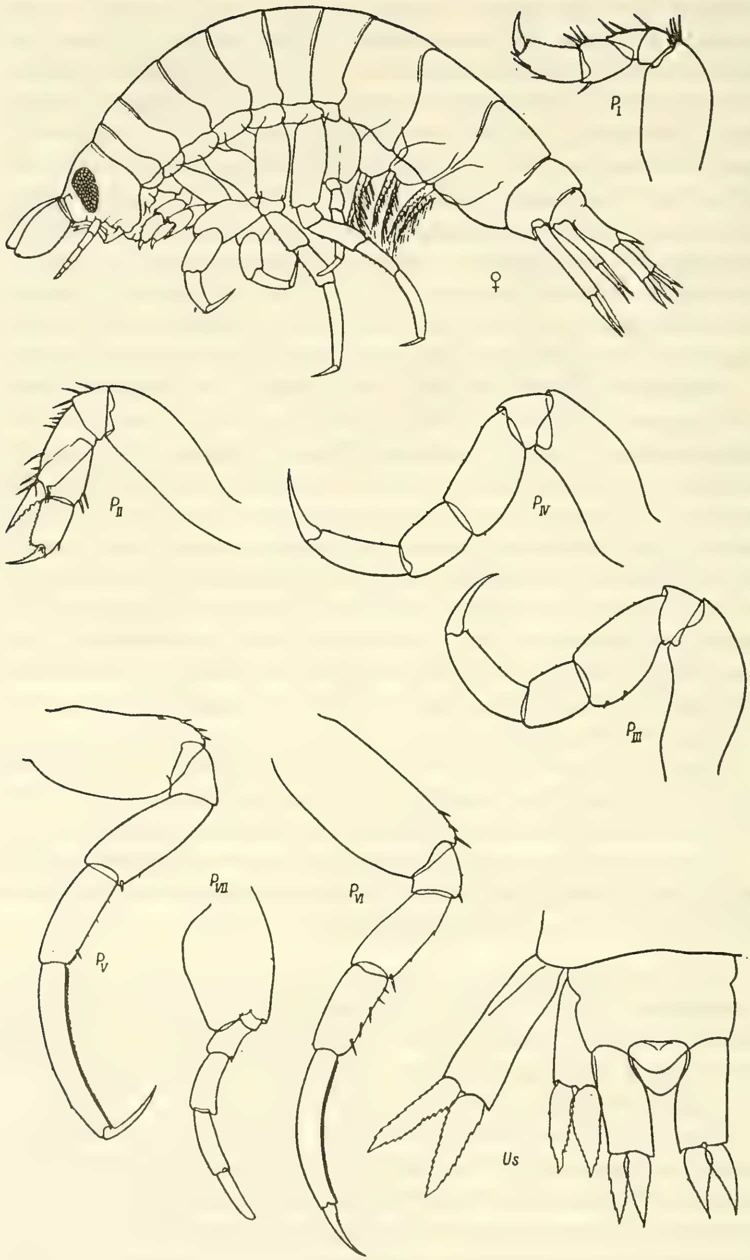


Fig. 102. *Vibilia viatrix* Bovallius.

and somite I of the pereon; the lower and upper margins are almost straight and parallel; the anterior edge is obliquely truncate; the line of truncation forms a distinct angle with the lower margin. Antennae II in females are six- to seven-segmented and shorter than antennae I, in males slightly longer and eight- to nine-segmented.

The legs are long and strong. The 2nd segment of pereopods I has convex margins and is shorter than the remaining part of the leg; the posterior part of the distal margin bears four-five spiniform setae; similar setae are present in the posterior distal part of the 3rd–5th segments; the anterior margin of the 5th–6th segments also bears two setae each; the posterior margin of the 6th segment is straight and denticulate distally; the claw is strong, with denticles along the posterior margin, and longer than half the 6th segment. The 2nd segment of pereopods II is approximately equal to the rest of the leg; the posterior distal angle of the 3rd segment has two spiniform setae; the lobe of the 4th segment is also armed with setae and extends to the base of the process of the 5th segment; the anterior distal angle of the 5th segment bears two setae, the acute process of this segment is denticulate from the inner side and extends to the end of the 6th segment, the posterior and distal margins of which are also denticulate; the anterior margin of the 6th segment has three small spinules; the claw is denticulate posteriorly and slightly longer than half the 6th segment. Pereopods III–IV are strong, with strong musculature; the 2nd segment has an S-shaped anterior margin and a convex posterior margin; the 4th segment broadens distally and has a straight posterior and highly convex anterior margin; the 5th segment is shorter than the 4th and its length slightly exceeds its width; the 6th segment is equal to the 4th in length, its posterior margin slightly concave with minute sparse spinules, and its anterior margin smooth and slightly convex; the claw is almost equal to the preceding segment in length or slightly shorter, posteriorly smooth, and has a few minute denticles at the base. The highly developed 4th segment and the claws are good diagnostic features of this species. The 2nd segment of pereopods V is broadened and shorter than in pereopods IV and the distal part of the anterior margin has four strong spinules; the 4th and 5th segments are equal in size and both bear a few spinules on the anterior margin, while the 5th has one strong spine in the distal part of the anterior margin. The 2nd segment of pereopods VI is equal in length to the 2nd segment of pair IV and is armed with five spines in the distal part of the anterior margin; the 4th segment in the distal part of its anterior margin and the 5th segment throughout its anterior margin bear strong spines. The 6th segment of pereopods V–VI is longer than the 5th with a finely denticulate anterior margin; the claw is long and straight and half the length of the 6th segment. Pereopods VII extend to the end of the

5th segment of pereopods VI; the maximum width of the 2nd segment is slightly less than its length and the round lobe of the posterior margin is weakly stretched downward to the end of the 3rd segment; the anterior margin of the 2nd–4th segments bears one distal spinule, the 4th segment having a similar spinule in the distal part of its posterior margin; the 5th segment is equal to the 4th in length, while the 6th segment is slightly longer; the distal margin of the 5th segment is finely denticulate; the 7th segment has an indistinct alveolate pattern throughout its surface.

The rami of the pleopods are 10- to 12-segmented.

The fusion of urosomites II and III is laterally demarcated by a shallow notch. Urosomite I is the longest and equal in length to urosomites II and III together, and urosomite II is the shortest. The lateral angles of the last urosomite are not stretched posteriorly. The uropods are similar in males and females. The rami are shorter than the basipodites. the
206 basipodite of uropods I is finely denticulate along the distal part of the inner margin and coarsely denticulate in the distal half of the outer margin; the rami are very coarsely denticulate and their ends extend to the end of uropods III. Uropods II are shorter, with a smooth basipodite; the ends of the rami extend slightly beyond the basipodite of uropods III; both margins of the endopodite and the inner margin of the exopodite are denticulate, while the outer margin of the exopodite is denticulate only distally. The basipodite of uropods III is smooth; the rami in both sexes are similar in length and apically acuminate; both margins of the endopodite and the inner margin of the exopodite are finely and uniformly denticulate; the outer margin of the exopodite is smooth, with several sensillae. The telson is roundish-triangular, almost equilateral.

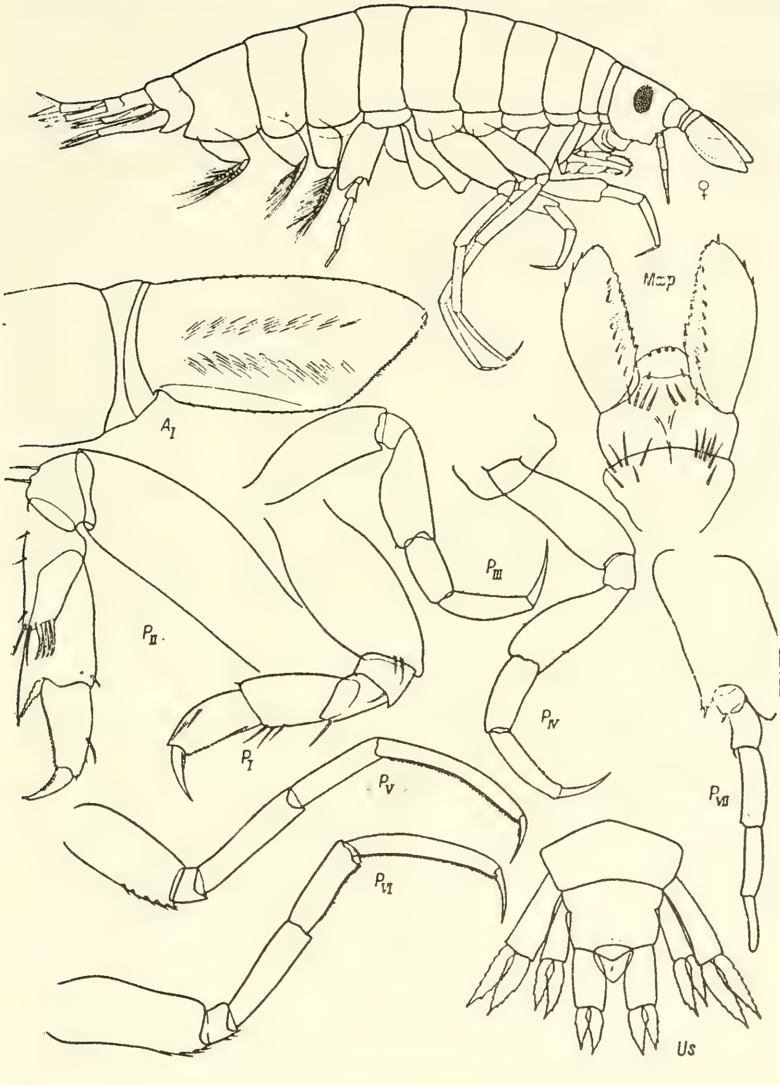
Notes: *V. dentata* Chevreux, 1901 was described from one young female and undoubtedly belongs to the present species; the shape of antennae I, the long process of the 5th segment of pereopods II, the bulged 4th segment of pereopods III–IV, long claws as well as the structure of the urosome confirm the identical nature of these forms. The basic distinguishing feature of *V. dentata* is the relatively large denticles on the posterior margin of the 6th segment of pereopods I, a feature characteristic of *V. viatrix* as well.

Distribution: Very widely distributed in the surface waters of three oceans from 50° N to 50° S, but is more abundant in warm waters.

3. ***Vibilia stebbingi*** Behning and Woltereck, 1912 (Fig. 103)

Behning and Woltereck, 1912: 5; Behning, 1912: 213; 1925: 482.

Small species, in which adults reach only 5.5 mm. The body is well proportioned, with a thin integument. The head is equal in length and height. The eyes of females are small but in males large (occupying 1/5 and 1/2 of the lateral surface of the head respectively). Antennae I are longer than the head and first two somites of the pereon; the 1st segment



207 Fig. 103. *Vibilia stebbingi* Behning and Woltereck (Us—after Behning, 1925).

of the flagellum is longer than the head and somite I of the pereon, anteriorly acute, obliquely truncate, and with parallel lower and upper margins; the flagellum is broader and longer in males than in females. The 2nd segment of the flagellum is small, reduced, and located apically on the 1st. Antennae II in females are shorter than antennae I and five- to six-segmented, in males longer than antennae I and seven- to eight-segmented. The medial lobe of the maxillipeds is trapezoid with a round apex while the lateral lobes have a row of seven-eight spinules on the surface and three-four spinules in the distal part of the outer margin.

In pereopods I the 2nd segment is broadened in the middle; the 5th segment is distinctly longer than wide and bears several setae; the 6th segment is twice longer than wide and its posterior margin straight and finely denticulate except in the proximal part; the claw is longer than half the 6th segment and posteriorly denticulate. In pereopods II the 2nd segment is elongated, its posterior margin convex and the anterior margin straight; the lobe of the 4th segment has several spiniform setae at the apex; the acute process of the 5th segment is denticulate and extends to the middle of the 6th segment; the 6th segment is constricted distally, longer than its maximum width, and the distal 3/4 of its posterior margin finely denticulate; the claw is strong, longer than half the 6th segment, with several denticles on the posterior surface. Pereopods III–IV are identical in structure but pair IV slightly longer; the 4th segment is broadened distally, twice longer than its maximum width, and has a convex anterior margin; the 5th segment is linear and its length is 1.5–2 times its width; the 6th segment is about five times longer than broad; the claw is smooth and longer than half the preceding segment. In structure of pereopods III–IV, *V. stebbingi* is similar to *V. viatrix* but distinguished by lesser developed musculature of the legs, much elongated segments, and shorter claws. Pereopods V–VI are long and thin. The length of the 2nd segment of pereopods V constitutes 1/5 that of the entire leg, is twice its
208 width, the anterior margin distally bearing five small spinules; the 4th–6th segments are narrow and the ratio of their lengths 3 : 2 : 4; the claw is 1/4 the length of the 6th segment and its posterior margin, like that of the 6th segment, is finely serrated. The 2nd segment of pereopods VI is the same width as in pereopods V but its length three times its width, constituting 1/4 the length of the leg; the distal part of the anterior margin has four spinules; the proportions of the 4th–6th segments are the same as in pereopods V; not only the posterior margin of the 6th segment but most of the posterior margin of the 5th segment also is denticulate; the claw is slightly longer than 1/4 the length of the 6th segment. The structure of pereopods VII is characteristic for the species: the 2nd segment is almost half the length of the leg and relatively narrower (length twice width); the wing of the posterior margin is cuneate and stretches downward to the middle of the 4th segment or even farther; the anterior margin is straight or slightly concave, distally acute and stretched downward, with an apical spinule; the 4th–7th segments are cylindrical and each successive one narrower than the preceding segment, with the 5th the longest; the last segment is finger-shaped.

The urosome is identical in females and males. The posterior lateral angles of the last urosomite do not project backward. The basipodites of the uropods are smooth except for the faintly denticulate distal part of the outer margin of pairs I–II. The rami of uropods I are denticulate on both margins. The denticulation in uropods II is much finer on the inner margin of the rami than on the outer. The rami of uropods III are shorter than the basipodite, identical in length and structure in both sexes, and constricted towards the end; a characteristic apical seta is located in a notch on the endopodite of the male.

Notes: This species closely resembles *V. viatrix* as well as *V. antarctica*. It is distinguished from the first species by long antennae I, short process on the 5th segment of pereopods II, much weaker development of pereopods III–IV with elongated segments and short claws, and highly stretched margins of the 2nd segment of pereopods VII. It differs from the second species in smaller size, length of antennae II*, straight posterior margin of the 6th segment of pereopods I, short process of the 5th segment of pereopods II, proportions of pereopods III (much shorter 5th segment), proportions and ornamentation of pereopods V–VI, long and narrow 2nd segment of pereopods VII with more stretched distal angles, and finally, in the absence of any distinct sexual dimorphism in the structure of the uropods. The similarity between *V. stebbingi* and *V. antarctica* and inadequacy of the existing keys for identification (Behning, 1912) have led to some confusion in identifying them. For example, Hurley (1955) described a specimen from New Zealand as *V. stebbingi*, which should have been related to *V. antarctica*, as is clear from the drawings and description given by the author. Ornamentation of the lower margin of epimeron III (as per key of Behning) cannot be considered a satisfactory character for the separation of the species antarctica and stebbingi because this is a variable trait. Apparently, the difficulty in differentiating these species has arisen because *V. stebbingi* has "penetrated" into antarctic waters. We did not find this species south of the Subtropical Convergence.

Distribution: Tropical and subtropical waters of the three oceans as well as in the Mediterranean Sea. Catches everywhere are small in number.

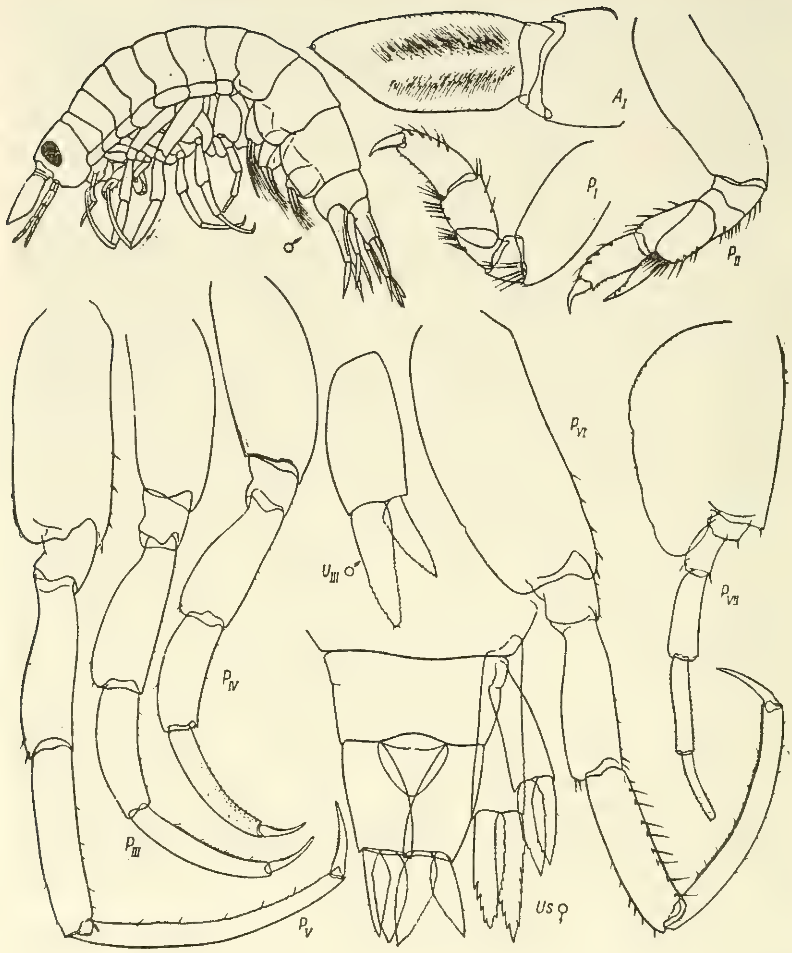
4. ***Vibilia antarctica*** Stebbing, 1888 (Fig. 104)

Stebbing, 1888: 1290; Behning, 1913: 530; 1925: 486; 1927: 118.—*Vibilia* sp. (II) Stebbing, 1888: 1293.—*stebbingi*? (non Behning, 1912): Hurley, 1955: 125.

Body length up to 14 mm.

The head is roundish-rectangular (lateral view) and slightly projects above the base of antennae I (frontal view); its height is barely more than
209 its length, which in females is equal to the length of the first two somites

* Changed from Russian original by author—Eds.



209 Fig. 104. *Vibilia antarctica* Stebbing.

of the pereon, in males, longer. The eyes are usually weakly pigmented and individuals with intense pigmentation are rare finds; in males the eyes occupy about 1/4 the lateral surface of the head, in females less. antennae I in females are slightly shorter than the head and somite I of the pereon but the broadened 1st segment of the flagellum is equal to or slightly shorter than the head. In males the 1st segment of the flagellum has parallel lower and upper margins and anteriorly is more sharply truncated than in females; the line of truncation is straight or even slightly concave, forming a distinct angle with the low nargin. The 2nd segment is highly reduced and situated apically on the 1st segment of the flagellum (in young specimens there may be two distinct segments). Antennae II in females are shorter than or equal to antennae I and five- to six-segmented; in males they are notably longer than antennae I and seven-segmented.

210 The pereon is equal to the pleon and urosome together. somite I is the shortest, the length of the somites increasing from I to IV; somites IV–VI are similar, each approximately twice longer than somite II; somite VII is also the same length as somite II. The 2nd segment of pereopods I is equal in length to the rest of the leg, its length twice its maximum width, and the margins convex; the 5th segment is approximately equal in width and length; the 6th segment is slightly longer, tapers distally, its posterior margin denticulate; the claw is strong, broad at the base, and denticulate posteriorly; the distal part of the posterior margin of the 2nd–5th segments and the anterior margin of the 5th–6th segments bear strong setae. The 2nd segment of pereopods II is shorter than or equal in length to the rest of the leg, its length 2.5 times its width, its margins slightly convex; the process of the 5th segment is long and extends to the distal margin of the 6th segment, often even beyond the base of the strong claw; the claw 1/2–1/3 the length of the 6th segment. The margins of the lobe of the 4th segment are armed with spiniform setae; similar setae occur on the anterior margin of the 5th and the posterior margin of the 3rd; the inner part of the chela is finely denticulate. The 2nd segment of pereopods III has a straight anterior margin, a convex posterior margin, and is twice longer than wide; the 4th and 5th segment together are the same length as the 2nd and 3rd; the 4th segment is barely longer and broader than the 5th; the 6th segment is narrower and equal to the 4th in length; the claw is strong, almost straight and 1/2–1/3 the length of the 6th segment. Ornamentation is weak: a small spinule is present in the distal part of the anterior margin of the 4th segment and a minute denticle along the posterior margin of the 6th segment. The proportions of pereopods IV are the same but all the segments are longer. Pereopods V have a relatively shorter 2nd segment: its length is twice its width and equal to the total length of the 3rd–4th segments; the distal part of the anterior margin bears several short spinules; the 5th segment is somewhat longer than the 4th and has sparse minute setae along the anterior margin, which is finely denticulate distally; the 6th segment is slightly curved, 8–10 times longer than wide, and its anterior margin finely denticulate; the claw is almost straight and 1/3 the length of the 6th segment. Pereopods VI are the same length as pair V but stronger and distinguished by their proportions: the 2nd segment is relatively longer, its length 2.5 times

its width, the anterior margin slightly concave and distally with four–six spinules; the 4th segment has a spinule in the posterior distal angle; the 5th segment bears 6–10 strong spines and is distally denticulate; the 6th segment is shorter than in pereopods V, its length six-seven times more than its width, and the anterior margin finely denticulate; the claw is 1/3 the length of the 6th segment. The anterior margin of the 2nd segment of pereopods VII is almost straight, slightly projecting downward and armed with a spinule; the posterior margin is uniformly convex, the distal lobe stretched downward to the middle of the 4th segment and the segment itself equal to the total length of the 3rd–5th segments and half of the 6th; the anterior distal angle of the 3rd segment and distal angles of the 4th segment bear one spinule each; the 5th and 7th segments are equal in length, the 6th segment slightly longer; the 7th segment is finger-shaped, with an uneven surface covered with fine villi.

The length of the somites of the pleon increases from I to III; somite III is the same length as the last two pereon somites together. The urosome is equal in length to somite III of the pleon. Urosomite I is barely shorter than the next (geminate) urosomite. The posterolateral angles of the urosome do not project. The rami of the uropods are shorter than the basipodite. The basipodite of uropods I broadens distally, its length approximately three times its maximum width, and the distal half of its outer margin denticulate. The rami are equal in length; the outer margin of the exopodite is proximally finely denticulate, the denticles increase distally; the inner margin is finely denticulate almost up to the apex where three-four large denticles are present subapically; the outer margin and distal part of the inner margin of the endopodite
211 are uniformly denticulate, while the proximal 2/3 of the inner margin is smooth. The basipodite of uropods II is smooth, shorter than in pair I; the rami are equal in length; the exopodite distally bears large denticles along both sides, while the proximal part of the inner margin is finely denticulate; the endopodite is distally coarsely denticulate on both sides; large denticles and groups of minute denticles alternate in the proximal parts of its outer margin; the proximal part of the inner margin is smooth. The rami of uropods I and II are 3/4 the length of the basipodites. Sexual dimorphism appears in the structure of uropods III—in males the endopodite is elongated while in females the rami are almost equal and the basipodite is smooth, its length twice its width; the rami in females are about 2/3 the length of the basipodite, the endopodite barely longer than the exopodite and basally slightly broader; in males the endopodite is 3/4–4/5 the length of the basipodite and highly broadened at the base. The sides of the rami face each other; the inner margin of the endopodite and the distal part of the outer margin of the exopodite are finely denticulate (in males the outer margin of the exopodite is smooth but the

rounded apex of the endopodite bears one-two minute setae situated in a pit). The telson is roundish-triangular, its length barely more than its width, the apex extending to the middle of the basipodite of uropods III.

Notes: *Vibilia edwardsi* Bate, 1862 and V. longipes Bov., 1887 are possibly also related to this species. *V. edwardsi* was described on the basis of a single specimen from the South Orkney Islands; in shape of antennae I (acutely truncate in front), highly elongated distal segments of pereopods V–VI, and proportions and ornamentation of the uropods, it is closer to *V. antarctica*. It is distinguished from the latter mainly by a much shorter process on the 5th segment of pereopods II, which is still within the limits of individual variability of this character. Bovallius, who described *V. longipes* (from the South Atlantic Ocean), considered it closer to *V. Edwardsi*. In fact, these two species are quite close in several characters and basically differ in the anteriorly highly rounded antennae I of *V. longipes*. The process of the 5th segment of pereopods II is the same length in *V. antarctica* and the highly elongated distal segments of pereopods V–VI also relate *V. longipes* to *V. antarctica*. A very cogent argument for the identity of *V. antarctica* and *V. longipes* is the morphology of the urosome of the latter species, particularly the presence of sexual dimorphism in VIS uropods III. Bernard (1932) also indicated the proximity of relationship between *V. edwardsi* and *V. longipes* with *V. antarctica*.

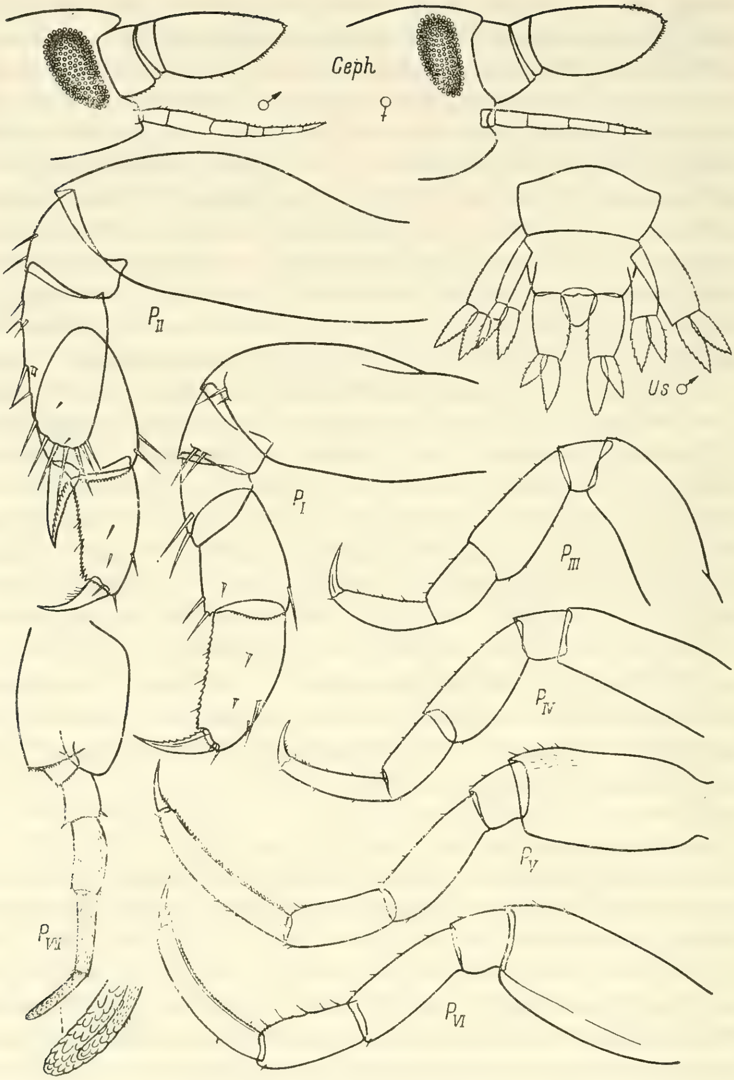
Distribution: Southern Ocean, south of the Subtropical Convergence. Solitary finds in the vicinity of Peru and in the Gulf of Guinea could evidently be explained by drift from the southern latitudes caused by the cold Peruvian and Benguela currents.

5. ***Vibilia propinqua*** Stebbing, 1888 (Fig. 105)

Stebbing, 1888: 1275; Vosseler, 1901: 124; Behning, 1912: 213; Stephensen, 1818: 43;—*milnei* Stebbing, 1888: 1284.—*Vibilia* sp. (I) Stebbing, 1888: 1285.

Body length up to 12 mm.

The integument of the body is thick and brown stellate chromatophores are present in live specimens. the head is small, its height not exceeding the height of somite I of the pereon, and its length equal to the total length of somites I and II; in females the head tapers conically toward the base of antennae I, while in males it is almost rectangular with a height slightly more than its length; the frons roundly projects above the base of antennae I. The eyes are intensely colored; in females they are narrow, reniform, and occupy about 1/3 the lateral surface of the head; in males they are larger and dorsally broadened. Antennae I in females are not longer than the head and somite I of the pereon and their base is short; the flagellum is almost regularly oval and the same length as the head. Antennae II are shorter than antennae I and in females are



212 Fig. 105. *Vibilia propinqua* Stebbing
(Ceph ♀, ♂ and Us ♂—after Behning, 1925).

six- to seven-segmented. Antennae I in males are slightly longer than the head and somite I of the pereon; the 1st segment of the flagellum
212 is more elongated than in females, longer than the head, with parallel upper and lower margins; antennae II are notably longer than antennae I and eight-segmented.

Somite I of the pereon is very short, somite II is twice longer and equal to somite VII, and the remaining somites approximately equal, each being 1.5 times longer than somite II. The pereopods are strong. The 2nd segment of pereopods I is weakly broadened and barely shorter than the distal part of the leg; the posterior margin is uniformly convex while the anterior margin has a small hump in the middle; the 6th segment is longer than the 5th and equal to the 3rd–4th segments together; the posterior margin is denticulate except for the proximalmost part; the posterior distal angles of the 2nd–5th segments as well as the anterior distal angle of the 5th and the anterior margin of the 6th segment bear strong spiniform setae; the claw is strong, weakly curved, denticulate posteriorly, and about half the length of the 6th segment. The 2nd segment of pereopods II is longer than the rest of the leg and has uniformly convex margins; the lobe of the 4th segment extends almost to the base
213 of the process of the 5th segment; spiniform setae border the lobe posteriorly and gradually transform at the apex into strong spines with curved ends; the process of the 5th segment is 2/3 the length of the 6th segment; the margins of the process and those of the 6th segment face each other are coarsely denticulate; the claw is strong, curved, somewhat longer than 1/3 the length of the 6th segment and denticulate posteriorly. The 2nd segment of pereopods III is equal in length to the 3rd–5th segments together and slightly S-shaped; the 5th segment is 2/3 the length of the 4th; the 6th segment is narrow and slightly curved; the claw is almost straight, thin, and more than 1/3 the length of the 6th segment. The posterior margin of the 6th segment, except for the proximalmost part, as well as the distal margins of the 4th–6th segments are very finely denticulate. Pereopods IV differ from pereopods III only in slightly longer segments. The 2nd segment of pereopods V is slightly broadened, equal in length to the 5th-6th segments together, its length twice its width; the distal part of the anterior margin bears several short spinules and leans over the base of the 3rd segment; the 4th segment is 2.5–3 times longer than wide; the 5th segment is short; the 6th segment narrow and long; the claw is almost straight and 2/7 the length of the 6th segment. Ornamentation is weak: sparse spinules occur on the anterior surface of the 3rd–5th segments and fine denticulation is observed on the distal margin of the 4th–6th segments and along the anterior margin of the 6th segment. The 2nd segment of pereopods VI is larger than in the preceding pair but the proportions are the same; the 4th and 5th segments are short and massive; the 6th segment is narrow and its length five—six times its width; the distal margin of the 4th and anterior margin of the 5th–6th segments are finely denticulate; the anterior margin of the 5th segment is denticulate and, moreover, bears five-seven strong spinules; the claw is weakly curved, thin, and 1/3 the length of the 6th segment. Pereopods VII have a

relatively shorter 2nd segment and a long distal part; the length of the 2nd segment hardly exceeds its width and is approximately equal in length to the 3rd–5th segments together, the posterior lobe extending far beyond the base of the 4th segment; the anterior margin of the 2nd segment has a slight transverse groove and a distal spinule; the 4th segment is broadened distally; the length of the 5th segment is 2.5–3 times its width and equal to the 6th; the 7th segment is narrow, finger-shaped, with complex squamose pattern on the surface, and 2/3 the length of the 6th segment.

The pleon and urosome are equal to the pereon in length. Urosomite I is narrower than the next (geminate) urosomite whose lateral angles do not project backward. The basipodites of the uropods are longer than the rami. The outer margin of the basipodite of uropods I is distally denticulate; the rami are equal in length, 2/3 the length of the basipodite, with coarsely denticulate margins. The basipodite of uropods II is narrower, 2/3 the length of the basipodite of uropods I, with smooth margins; the endopodite is slightly broader and longer than the exopodite and both have denticulate margins. The structure of uropods III differs in females and males; the smooth basipodite is 1.5 times longer than wide in females and two or slightly more times in males; the rami in both sexes are finely denticulate except in the smooth proximal part of the outer margin of the exopodite; in females the exopodite is narrower than the endopodite but equal in length, which is slightly more than half the length of the basipodite; in males the endopodite is broadened and highly elongated, its length about 3/4 the length of the basipodite and 1/3 times more than the exopodite; the apex of the endopodite is round, with a small seta in a notch. The telson is roundish-triangular, its length equal to its width at the base.

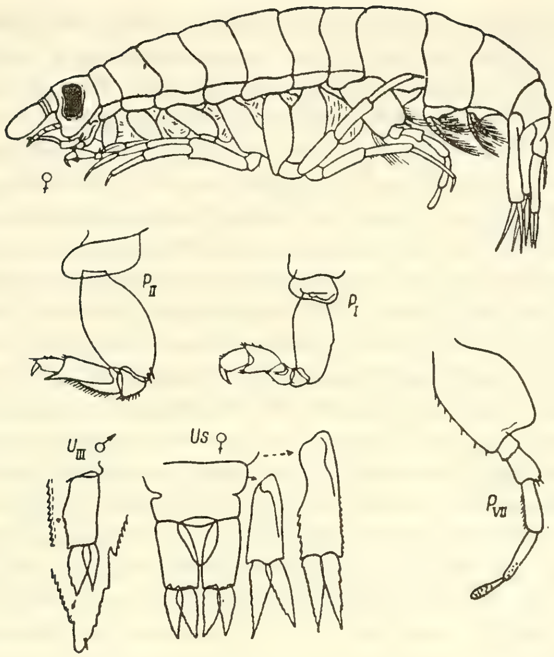
Distribution: Widely distributed in the tropical and temperate zones of the three oceans, spreading in the North Atlantic up to 60° N, in the Pacific Ocean up to 50° N and in the Southern Ocean up to the Antarctic Convergence. Sometimes it is found in considerable numbers, particularly in dense salp swarms.

214 6. ***Vibilia robusta*** Bovallius, 1887 (Fig. 106)

Bovallius, 1887a: 7; Behning, 1912: 213; 1927: 116; Stephensen, 1918: 37.—*hirsuta* Behning and Woltereck, 1912: 9.

The largest species of *Vibilia*, with a body length up to 20 mm.

Sexual dimorphism is manifest so weakly that only the presence of oostegites or their rudiments serve as a reliable indication of the sex. The body integument is very thick. The head is small, its height somewhat more than its length, and the latter less than the length of the first two somites of the pereon; the frons, particularly in large individuals, projects prominently over the base of antennae I. The eyes are very large, occupying half or more of the lateral surface of the head,



214 Fig. 106. *Vibilia robusta* Bovallius (Us, P_I, P_{II}—after Stephensen, 1918).

elongated, and intensely pigmented. The base of antennae I is short; the 1st segment of the flagellum is not longer than the head, with parallel upper and lower margins, anteriorly rounded, and slightly inclined ventrally; the 2nd segment of the flagellum is subapical and highly reduced in large individuals and discernible only under a microscope; the two reduced apical segments are quite distinct in individuals less than 15 mm in length. Antennae II are not longer than antennae I and seven- to eight-segmented.

The pereon is equal in length to the pleon and urosome together. Somite I of the pereon is half the length of somite II. Somites III–VI are each slightly longer than somite II, while somite VII is equal to it. The 2nd segment of pereopods I is equal in length to the remaining segments together, its margins uniformly convex, and its maximum width more than half its length; the 4th segment is elongated along the posterior margin; contrarily, the 5th segment is longer along the anterior margin,
215 the distal margin and the distal part of the posterior margin denticulate, and the posterior distal angle bears a group of several adjacent chitinized spines; the 6th segment is approximately the same length as the 5th and has a convex anterior margin bearing several setae and a straight posterior margin; the posterior and distal margins are denticulate; the claw is

broadened at the base and denticulate posteriorly. Pereopods I like pereopods II might serve functionally as catching and grasping legs. The 2nd segment of pereopods II is longer than the rest of the leg, highly broadened (width 2/3 the length), with one-two spinules in the posterior distal angle; the lobe of the 4th segment is long, 3–3.5 times longer than the basal part of the segment and armed posteriorly and distally with spines; the 5th segment is equal to the 4th but wedge-shaped, its maximum width half its length, and its process hardly extends to the middle of the 6th segment; the distal margin of the 5th segment and both margins of the process are denticulate; the 6th segment is half the length of the 5th, with denticulate posterior and distal margins; the claw is strong, half the length of the 6th segment, and denticulate posteriorly. The 2nd segment of pereopods III is equal to the 4th–5th segments together, its length twice its maximum width, and the posterior margin more convex than the anterior; the 4th segment is equal to the 5th; the 6th segment is 1.5 times longer, weakly curved, its length about six times its width; the claw is smooth, slightly curved, and 1/4 the length of the 6th segment; the distal part of the 5th–6th segments is finely denticulate. Pereopods IV are similar to pair III but the segments are slightly longer. The margins of the 2nd segment of pereopods V are weakly convex, the length twice the width and equal to the length of the 6th segment, and slightly less than the total length of the 4th–5th segments; the 4th segment is slightly shorter than the 5th; the 6th segment is slightly curved and finely denticulate anteriorly, its length almost ten times its width; the claw is smooth, weakly curved, and about 1/5 the length of the 6th segment. Pereopods VI are similar to pereopods V but the 2nd and 5th segments are broader; the distal part of the anterior margin of the 2nd segment bears several spinules and the distal margin is the largest; the anterior margin of the 5th segment is armed with 8–10 strong short spines, while a few somewhat weaker spines occur in the distal half of the 4th segment. The 2nd segment of pereopods VII is 1/3 the length of the rest of the leg and equal in length to the 3rd–5th segments together, broadly oval, its maximum width barely less than its length; the distal lobe of the posterior margin is broadly rounded and 1/3 the size of the 4th segment; the distal part of the anterior margin of the segment bears several minute spinules; the distal angles of the 6th segment protrude laterally from the narrow base of the 7th segment; the anterior distal angles of the 2nd–5th segment are armed with minute denticles; the clavate 7th segment has a squamose pattern on the surface.

The pleon is equal in length to the last four somites of the pereon. The urosome is the same length as somites II–III of the pleon; the geminate urosomite is equal in length to the last somite of the pleon while urosomite I is 1.7 into it; lateral notches divide the last urosomite almost in the middle; the distal angles are not prominent[*]. The basipodites of the uropods are longer than the rami. The basipodite of uropods I is barely longer than the rami, coarsely denticulate distally from both sides, and 2.5 times longer than wide; the rami are narrow, with highly stretched ends; the margins of the endopodite and the inner margin of the exopodite are coarsely denticulate; the outer margin of the exopodite has faintly discernible adjacent denticles. The proportions of uropods II are the same; the endopodite is somewhat longer than the exopodite and proximally broader; the basipodite is smooth and the rami have similar ornamentation. The basipodite of uropods III is finely denticulate in the distal half of the inner margin and twice longer than wide; the rami are about half the length of the basipodite; the endopodite is barely longer than the exopodite, proximally broader, and finely denticulate on both sides; the exopodite is denticulate only on the inner side. The telson is roundish-triangular, its length barely exceeding its basal width and about half the length of the geminate urosomite.

216 *Notes*: This species does not differ significantly from *vibilia hirsuta* Behning and Woltereck, 1912, which was described on the basis of a single specimen; the latter is identified by the following characters: eyes large, antennae and legs with numerous minute setae, flagellum of antennae I with well-noticeable rudimentary segments, anterior margin of flagellum of antennae I rounded, maxillae *V. hirsuta* 4th segment of pereopods II highly setaceous, and pereopods VII with a relatively small basal segment. Most of these characters are age-related and observed in young individuals. If we consider that a young specimen of a large-sized species (*V. hirsuta* reaches 8.5 mm in length) was described, then in several characters it is closer to *V. robusta*: eyes large, posterior distal angle of the 5th segment of pereopods I with fascicle of strong setae, short process of chela in pereopods II, absolutely straight posterior margin of 6th segment in pereopods II, some peculiarities in structure and ornamentation of the urosome etc. We compared a young specimen of *V. robusta* (10.8 mm) from the southwestern part of the Pacific Ocean with the drawing of *V. hirsuta* and established similarity of structure and ornamentation of pereopods II as well as densely pubescent maxillae. Thus, if we exclude the characters subject to age variability, then *V. hirsuta* does not exhibit adequately significant differences from *V. robusta* to qualify for consideration as an independent species.

Distribution: Atlantic Ocean from 45° N to 30° S; Indian Ocean in the central part and also found in the southeastern coastal region of Africa. In the Pacific Ocean it is known from the eastern part of the tropics, region of New Zealand, and southern coastal region of Tasmania.

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[*] Changed from Russian text by author—Eds.

7. ***Vibilia gibbosa*** Bovallius, 1887 (Fig. 107)

Bovallius, 1887b: 53; Vosseler, 1901: 119; Behning 1912: 213, 215; 1913: 529; Stephensen, 1918: 36; Chevreux and Fage, 1925: 384; Semenova, 1973: 171.

Length of females up to 8 mm, of males up to 7 mm.

The body integument is thin and often dorsally raised at the borders of somites, which is reflected in the name of the species. The crustacean

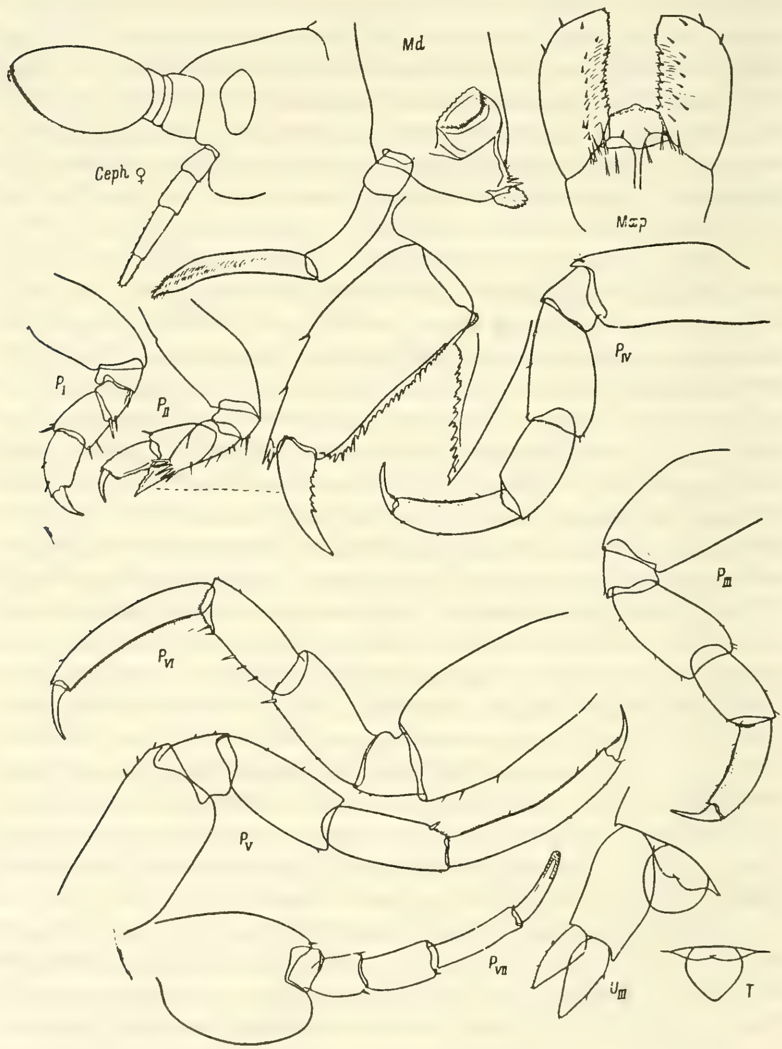


Fig. 107. *Vibilia gibbosa* Bovallius.

usually has a characteristic appearance: steeply curved back, small head, and weak extremities. The head tapers toward the antennae, its height more than its length; in males the cephalic length is equal to, in females less than the length of the first two somites of the pereon. The eyes in females occupy about 1/4 the lateral surface of the head, in males about 1/3, dorsally broadened; the degree of pigmentation varies from almost black to bright brown. Antennae I are equal in length to the head and somite I of the pereon together; the base is short, the 1st segment of the flagellum barely longer than the head, almost oval, anteriorly rounded, with apically situated rudiment of the 2nd segment. Antennae II are shorter than antennae I, especially in females, and five- to six-segmented.

The slightly bulged pereon is equal in length to the pleon and urosome together. Somite I is half the length of somite II; the somites increase in length from I to IV, somites V and VI are barely shorter than somite IV, and somite VII equal to somite III. The 2nd segment of pereopods I is shorter than the rest of the leg, the margins convex, particularly the anterior one, and its length approximately 1.7 times its maximum width; the 4th segment projects along the posterior margin of the 5th segment; a thin spine is present in the posterior distal angle of the 2nd–4th segments; the 5th segment is barely longer than wide, with one spine in the anterior distal angle and two–three much stronger spines in the posterior distal angle; the 6th segment is longer than the 5th, with a highly convex anterior margin bearing three–four spinules
217 and a straight, finely denticulate posterior margin; the distal margin of the 5th–6th segments and the posterior margin of the claw are also denticulate; the claw is about half the length of the 6th segment. The 2nd segment of pereopods II is equal in length to the rest of the leg; the anterior margin is straight but the posterior margin is faintly convex and bears a spine in the distal part; the spoon-shaped lobe of the 4th segment projects along the posterior margin of the 5th segment over 3/4 its length; the spines along the posterior margin of the lobe are thin, distally strong, with a bent apex; the process of the 5th segment reaches 1/2–2/3 of the next segment; the inner sides of the chela are denticulate; the anterior margin of the 6th segment is convex, with three-four thin
218 spinules; the claw is about half the length of the 6th segment. Pereopods III–IV are similar, pereopods IV slightly longer; the 2nd segment is twice longer than wide; the distal margin of the 5th and posterior margin of the 6th segment are finely denticulate; the claw is 1/2–1/3 the length of the preceding segment. The 2nd segment of pereopods V has straight margins, its length approximately 1.5 times more than its width; the anterior margin distally bears several spinules; the 5th and 4th segments are equal in length; the 6th segment is narrow and very long, its

length 8–10 times more than its width; the anterior and distal margins are finely denticulate; the thin claw is 1/4 the length of the 6th segment. The 2nd segment of pereopods VI is longer than in pereopods V, the distal part of the anterior margin with five-seven spinules; the 4th segment is slightly longer than the 5th, which has five–seven strong spines on its anterior margin while much weaker spines occur on the distal part of the anterior margin of the 4th segment; the narrow 6th segment is seven-eight times longer than wide and its anterior margin denticulate; the claw is slightly more than 1/4 the length of the 6th segment. The 2nd segment of pereopods VII is broad and short, 1/3 the length of the leg, its length about equal to its width, and its posterior lobe broadly rounded and slightly extending beyond the base of the 4th segment; the 4th segment is slightly longer than wide, with spines in the distal angles; the 5th segment is twice longer than wide; the 6th segment is slightly longer and notably narrower than the 5th; the 7th segment is finger-shaped and 2/3 the length of the 6th segment; the anterior distal parts of the 2nd–5th segments are finely denticulate; the 7th segment has a squamose pattern on the surface.

The urosome is the same length as somite III of the pleon. Urosomites I and III are identical in size; urosomite II is very short; the border between urosomites II and III is marked by a shallow lateral notch. The basipodite of uropods I is almost three times longer than wide and the distal half of its outer margin is denticulate; the rami are equal in length, half the length of the basipodite, and have coarsely denticulate margins except in the proximal part of the inner margin of the endopodite. Uropods II are short; the basipodite is twice longer than wide and its inner distal angle is stretched; the endopodite is broader and somewhat longer than the exopodite and slightly smaller than the basipodite in length; the ends of the rami extend to or slightly beyond the end of the basipodite of uropods III; the sides of the rami facing each other are coarsely denticulate; the outer margin of the exopodite distally bears several denticles while the entire remaining part is smooth as is the proximal part of the inner margin of the endopodite. Uropods III have a massive basipodite, which is equal to the basipodite of uropods II in length but distinctly broader, its length being just 1.5 times its width. Sexual dimorphism apparently is not distinct in uropods III; the endopodite in both sexes is barely longer and broader than the exopodite but in males this character is better noticeable. The rami are about 3/4 the length of the basipodite and their margins finely denticulate except for the proximal part of the outer margin of the exopodite and inner margin of the endopodite. The telson is large, roundish-triangular, sometimes almost round, its length approximately equal to its width; the apex extends up to the middle of the basipodite of uropods III.

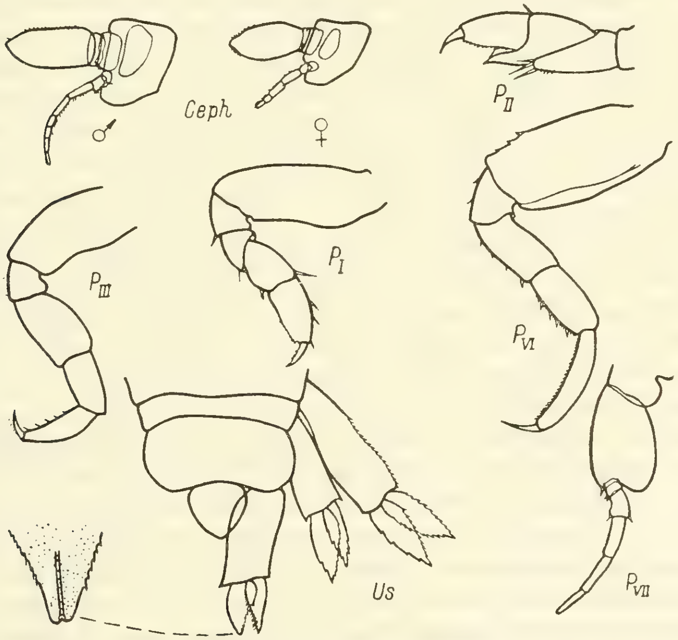
Distribution: Widely distributed in the Atlantic Ocean (from 45° N to 20° S) and in the Mediterranean Sea. In the Pacific Ocean it occurs southeast of Japan, in tropical waters of the eastern part, and has also been found in Californian waters, although due to the young age of the specimens caught here, identification was difficult (Hurley, 1956). Not found in the Indian and Southern oceans.

219 8. ***Vibilia borealis*** Bate and Westwood, 1868 (Fig. 108)

Bate and Westwood, 1868: 524; Bovallius, 1887b: 57; Norman, 1900: 137; Behning, 1912: 215; Stephensen, 1923: 11; Schellenberg, 1927: 615; Pirlot, 1930: 10.—*kroyeri* Bovallius, 1887b: 58; Stephensen, 1918: 38.

Body length up to 13 mm, but more often 6–7 mm.

The body integument is thin. The head in females is equal to, in males longer than the first two somites of the pereon; its frontal part in males is highly projected in the form of a round bulge above the base of antennae I in such a way that the dorsal line of the head is often concave; in females the frons projects slightly and the cephalic line converges gently toward antennae I; the height of the head is more than its width. The eyes of females are elongated-oval, reniform, or dorsally broadened,



219 Fig. 108. *Vibilia borealis* Bate and Westwood
(P_{I-III} VI, Us—after Bovallius, 1887b; rest—Stephensen, 1928).

occupying almost half of the lateral surface of the head. Antennae I in males are the same length as the head and first two somites of the pereon; in females they are slightly shorter, the base is shorter, and the length of the 1st segment of the flagellum is equal to the head and somite I of the pereon. In males the 1st segment of the flagellum has parallel upper and lower margins and is evenly truncated at the anterior end, while in females this segment is almost oval; one–two rudimentary segments are situated apically but not well noticeable. Antennae II in males are seven- to eight-segmented and longer than antennae I; in females they are approximately the same in length but six-segmented.

The somites of the pereon increase in length from I to IV; somite I is very short, II twice longer, III barely longer than II, IV–VI identical in size, and VII identical to somite III. The pereopods are strong. The 2nd segment of pereopods I is the same length as the rest of the leg, its anterior margin slightly convex, and the posterior margin has a small
220 prominence in the middle and is twice longer than its maximum width; the 5th segment is barely shorter than the 6th, its anterior margin convex, and the posterior margin straight; the claw is strong and more than half the length of the 6th segment. The posterior distal angles of the 2nd–5th segments bear spines; the distal margin of the 5th segment, posterior and distal margins of the 6th segment as well as the proximal part of the posterior margin of the claw are finely denticulate. The 2nd segment of pereopods II is linear, longer than the distal part of the leg, its length three times its width; the lobe of the 4th segment extends to the base of the process of the 5th segment; the 5th segment is elongated, its length 1.5 times the maximum width; its anterior margin is convex and the coarsely denticulate process up to 2/3 the length of the succeeding segment; the 6th segment is shorter than the 5th, its anterior margin convex, and posterior margin denticulate; the claw is half the length of the 6th segment. The 2nd segment of pereopods III has a straight anterior margin and barely convex posterior margin, its length being approximately 2.5 times its width and equal to the 3rd-5th segments together; the 4th segment is strong, slightly broadened and twice longer than wide; the 5th segment is shorter than the 4th, its length 1.5 times its width; the slightly curved 6th segment is equal in length to the 4th, the length being four times its width; the claw is strong and barely half the length of the 6th segment. Pereopods IV are similar to pereopods III but all the segments are slightly longer; the claw is 1/3 the length of the 6th segment. The ornamentation of these two pairs of pereopods is weak; solitary sensillae occur on the surface of the segments, denticulation is poorly evident on the distal part of the posterior margin of the 6th segment, and one–two spines occur in the distal part of the posterior margin of the 2nd segment. The 2nd segment of pereopods V is twice longer than wide, with

five-six spinules in the distal part of its anterior margin; the 4th segment is notably longer than the 5th and three times longer than wide; the 6th segment is long, its length seven to eight times its width, and its anterior margin finely denticulate; the claw is 1/5 the length of the 6th segment; one small spine is present in the anterior distal angle of the 5th segment. Pereopods VI are distinguished only by their ornamentation and the proportions of the 2nd and 6th segments; the 2nd segment is longer and the 6th segment shorter than their counterparts in pereopods V; the claw is 1/4 the length of the 6th segment; the anterior margin of the 5th–6th segments is denticulate and the 5th segment additionally bears five–six strong spines. The 2nd segment of pereopods VII is broadly oval, its length 1.5 times its width; the distal lobe of the posterior margin is evenly rounded, slightly extending beyond the base of the 4th segment, and a small spine projects downward in the anterior distal angle; in the short 3rd segment one-two spines are present in the anterior distal angle; the slightly curved 4th segment is slightly longer than wide and bears one spine anteriorly and one spine posteriorly in the distal angle; the 5th segment is elongated, about 2.5 times longer than wide; the 6th segment is narrower and longer than the 5th segment; the 7th segment is still narrower but slightly shorter than the 5th segment, finger-shaped, and has an uneven surface lacking a distinct squamose pattern.

The pleon is the same length as the pereon, its somites somewhat increasing in length from I to III. The urosome is slightly longer than somite III of the pleon. Urosomite I is half the length of the last somite of the pleon and equal to the last (geminate) urosomite, which is divided almost in the middle by deep lateral notches; a dorsal depression separates the fused urosomites II and III. The lateral angles of the last urosomite do not project backward. The rami of the uropods are shorter than the basipodites. Sexual dimorphism is not manifest in uropods III. The basipodite of uropods I is 3–3.5 times longer than wide, the rami about half its length; the distal part of the outer margin of the basipodite and the margins of the rami are coarsely denticulate. The basipodite of uropods II is twice longer than wide and its inner distal angle projects slightly; the rami are coarsely denticulate except in the proximal half of the inner margin of the endopodite; the endopodite is slightly longer than the exopodite and about 3/4 the length of the basipodite. The basipodite of uropods III is broader than that of uropods I–II, its length 1.5 times its
221 width and equal to the length of the basipodite of uropods II; the rami are equal in length or the endopodite is barely longer than the exopodite; the sides of the rami facing each other are finely denticulate while the opposite sides are smooth; the length of the rami is 2/3 the length of the basipodite. The telson is large, roundish-triangular with a broadly

rounded apex, sometimes almost round and extends up to the middle of the basipodite of uropods III.

Distribution: A sparsely populated species widely distributed in the North Atlantic, up to 60° N. It is also known from the Mediterranean Sea, region of the Moluccas Islands and the Sulu Sea. In the Pacific Ocean it is found in the region of New Zealand (farther north of the Subtropical Convergence) and in the southeastern part of the tropics of the Pacific Ocean.

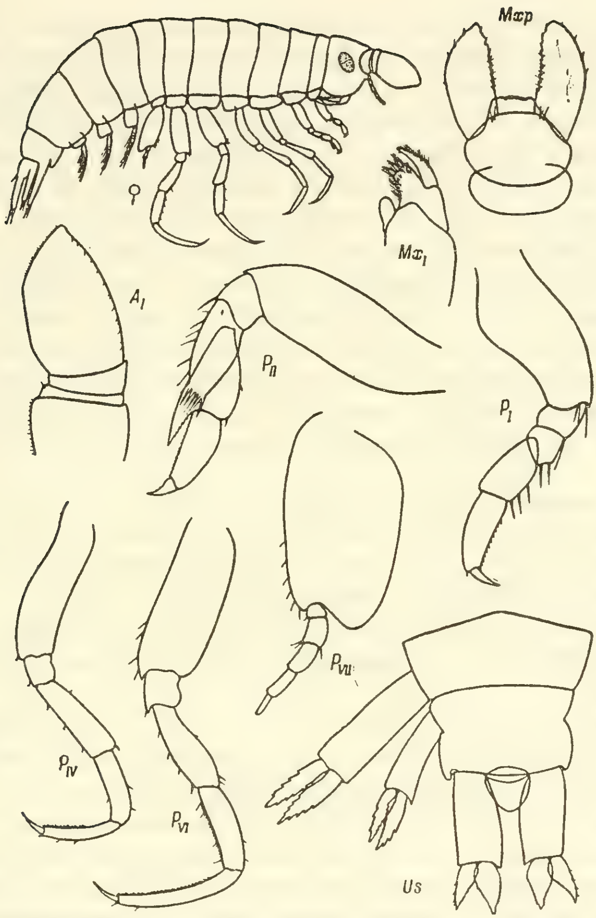
9. ***Vibilia chuni*** Behning and Woltereck, 1912 (Fig. 109)

Behning and Woltereck, 1912: 8; Behning, 1925: 495; Barnard, 1930: 405.—*hodgsoni* Stewart, 1913: 248.

Length up to 7.5 mm.

The head is without a rostrum, its height more than its length, and equal to the length of the first two somites of the pereon. In males the head sometimes projects roundly over the base of antennae I. The eyes are small, in males occupying up to 1/4 the lateral surface of the head, but in females less. The base of antennae I is short; the 1st segment of the flagellum is broad, its width more than half the height of the head, the upper and lower margins parallel; the flagellum is obliquely truncated anteriorly; the highly reduced 2nd segment of the flagellum is situated apically in a notch and bears two setae. Antennae II in females are five-segmented and shorter than antennae I; in males they are seven-segmented and equal to antennae I in length. The maxillipeds have lanceolate outer lobes, each with three–four spinules along the outer margin and eight–nine spinules on the surface; the medial lobe is low, not extending to the middle of the outer lobes; the distal margin is straight and in males has a central prominence.

Somite I of the pereon is half the length of somite II, while somites IV–VII are about equal in length. The 2nd segment of pereopods I is equal in length to the rest of the leg and its anterior margin convex in the middle; the 5th and 6th segments are equal in length, the posterior margin of the 6th segment is straight and denticulate; the claw is half the length of the 6th segment. Pereopods II are barely longer than pereopods I; the 2nd segment is equal in length to the rest of the leg; the 5th segment is longer than the 6th and its process extends to the middle of the 6th segment; six strong setae occur in the distal part of the posterior margin of the 4th segment; the posterior margin of the 6th segment and the margins of the process facing it are denticulate. Pereopods III–IV are identical except that the IV are slightly longer. The 2nd segment of pereopods III has barely convex margins. In pereopods IV the 2nd segment is almost linear; the 4th segment is equal to the 6th in length, the 5th segment slightly shorter; the 6th segment has very minute setae along its posterior margin; the claw is strong, almost straight, and 1/3 the length of the 6th



222 Fig. 109. *Vibilia chuni* Behning and Woltereck (after Behning, 1925).

segment. Pereopods V–VI are longer than the preceding pairs due to the greater length of the 6th–7th segments; the 5th segment of pereopods VI bears spines anteriorly; the 6th segment of both pairs is finely denticulate in the middle of both margins. The structure of pereopods VII readily distinguishes this species from others; they are relatively shorter and do not extend to the distal end of the 5th segment of pereopods VI. The 2nd segment is broad, with convex margins, the round lobe of its posterior margin reaches the middle of the 4th segment, and the segment per se is notably longer than the other segments together. The 4th segment is square; the 5th and 6th segments equal in length, each being respectively 2 and 2.5 times longer than wide; the last segment is narrow, finger-shaped, and shorter than the preceding one.

222 In the pleon, somite III is the longest and the urosome is shorter than it. The lateral notches marking the fused urosomites II and III are very small. The geminate urosomite is approximately equal in length to urosomite I and its posterior lateral angles are slightly stretched backward and acute. The basipodites of the uropods are longer than the rami. The rami of uropods I–II are coarsely denticulate along the margins. The outer margin of the exopodite of uropods III is smooth, while both margins of the endopodite and the inner margin of the exopodite are finely denticulate. Sexual dimorphism is distinctly expressed in the structure of uropods III: in males the endopodite is notably broader than the exopodite, longer, and apically rounded. The telson is roundish-triangular, not extending to the middle of the basipodite of uropods III.

Distribution : Tropical waters of the Atlantic, Pacific and Indian oceans; the species occurs everywhere is small numbers.

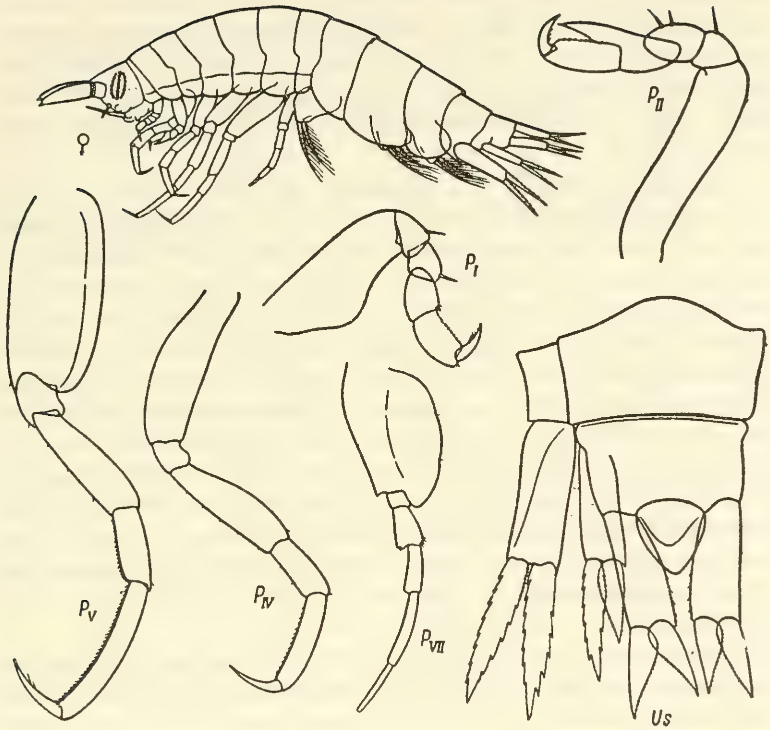
223 10. ***Vibilia australis*** Stebbing, 1888 (Fig. 110)

Stebbing, 1888: 1287; Vosseler, 1901: 124; Behning, 1912: 219; Behning and Woltereck, 1912: 219 (*pelagica* var.); Behning, 1925: 488; 1927: 119; Pillai, 1966: 208.—*seriocellatus* Stephensen, 1932: 9.

Among all the known species of *Vibilia* this is the smallest. The body of the adult crustacean rarely reaches more than 5 mm, on average about 3 mm.

The body is well proportioned. The head is small, not exceeding in length the first two somites of the pereon, its height reducing towards the anterior margin. The rostrum is small and triangular. The structure of the eyes is specific: they are pale and consist of three vertical rows of individual ocelli. Antennae I are notably longer than the head, being equal to it and somite I of the pereon; the antennal base is massive—thicker than the flagellum and 1/3 the length of the entire antennae; the flagellum broaded slightly, tapers gently toward the apex, and is shifted toward the straight lower margin; two apical rudimentary segments bearing short setae are well noticeable. Antennae II are very short, not longer than the base of antennae I, and consist of two to four short segments, of which the distal segment is armed with short setae. The maxillipeds have a low medial lobe whose distal margin is concave in the middle, distally broadened outer lobes, have a rounded apex.

The somites of the pereon are almost equal in size, somites I–II being the shortest and V–VI the longest. The 2nd segment of pereopods I is broadened and equal in length to the rest of the leg; the 6th segment is oval, longer than the 5th segment; the claw is strong, curved, just barely shorter than the 6th segment, and has a finely denticulate posterior margin. The 2nd segment of pereopods II barely broadens, is slightly S-
224 shaped, and hardly longer than the rest of the leg; the process of the



223 Fig. 110. *Vibilia australis* Stebbing.

5th segment is broad at the base and does not reach the end of the 6th segment; the claw is strong and half the length of the 6th segment. Pereopods III–IV are identical; the 2nd segment is equal to the 3rd–5th together; the 4th segment is elongated, slightly broadened, especially in pereopods III, and equal to the 6th segment in length; the 5th segment is almost half the length of the 6th; the 6th segment is narrow; the claw is strong, slightly curved, and half the length of the 6th segment. The 2nd segment of pereopods V is broadened, twice longer than wide; the 4th segment is equal to the 2nd in length; the 6th segment is slightly longer than the 4th and twice longer than the 5th; the claw is about 1/3 the length of the 6th segment. Pereopods VI are similar to pair *V. Pereopods* VII reach the 5th segment of pair VI; the 2nd segment attains maximum width in the proximal part; the ratio of length to maximum width is 3:2; the rounded lobe of its posterior margin extends to the middle of the 4th segment, and its anterior margin is distally stretched acutely; the total length of the remaining segments is equal to or slightly more than the length of the 2nd segment; the anterior margin of the 4th segment distally forms a small, finely denticulate lobe and the posterior margin is also distally denticulate; the 5th segment is linear and equal to the 4th in length; the 6th segment is equal to the 5th and 4th together; the finger-shaped 7th segment is about 2/3 the length of the 6th segment, its surface covered with thin villi.

The pleon is shorter than the pereon. The urosome is equal to the last somite of the pleon in length. The two urosomites are about equal in length but the last (geminate) divided by a barely perceptible groove giving rise to a very short urosomite II and a much longer urosomite III; the distal angles of the latter do not project backward. The rami of uropods I are equal in length, equal to the basipodite in length, and with coarsely denticulate margins. The exopodite of uropods II is slightly longer than the endopodite and equal to the basipodite in length; its outer and distal part of the inner margin are boldly denticulate and the side of the endopodite facing it finely denticulate, while the inner margin of the endopodite is smooth. The rami of uropods III are shorter than the basipodite, whose length is twice its width; the sides of the rami facing each other are finely denticulate while the opposite sides are smooth. The telson is roundish-triangular, relatively large, and extends to the middle of the basipodite of uropods III.

Distribution: Widely distributed in the surface waters of the tropical zone of the three oceans. It is found in the southern parts of the Atlantic and Indian oceans up to 50° S. It is known from 40° N in the Pacific Ocean to the southern Subtropical Convergence.

11 11. ***Vibilia caeca*** Bulycheva, 1955 (Fig. 111)

Bulycheva, 1955: 1050; Vinogradov, 1956: 208.

Length of adult crustaceans up to 6 mm.

The head is short, with a small rounded rostrum bent downward. Eyes are absent. Antennae I are longer than the head and first three somites of the pereon; the base is deeply thrust into the cephalic capsule and is cylindrical; the length of the 1st segment is more than its height; the flagellum is longer than the head and the first two somites of the pereon, its height does not exceed the base, and it is proximally cylindrical but distally flat and obliquely truncate; each of the two apically situated rudimentary segments bears a few setae. Antennae II are short, extend to the middle of antennae I, and four-segmented; the distal segment is the longest and bears minute setae on the surface. The maxillipeds have broad outer lobes which are rounded at the ends and have a band of 14–20 spinules running parallel to the inner margin; the medial lobe is small, with a roundly elevated or truncate apex.

225 The 2nd segment of pereopods I is 2/5 the length of the entire leg, its anterior margin proximally convex, the posterior margin straight, and the

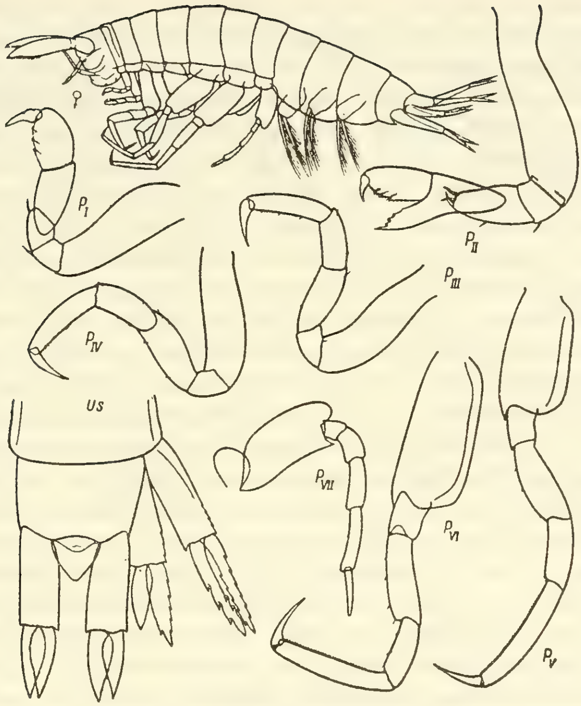


Fig. 111. *Vibilia caeca* Bulycheva.

posterior distal angles of both the 2nd and 3rd segments bear spines; the 6th segment is 1.5 times longer than wide, its anterior margin uniformly convex, and the posterior margin with complex denticulation (groups of minute denticles are divided by deeper incisions); the claw is thick, almost straight, and somewhat longer than half the 6th segment. The 2nd segment of pereopods II is slightly longer than the rest of the leg, its anterior margin convex, and the posterior margin slightly S-shaped; the 3rd-4th segments bear spines along the anterior margin; the 5th segment is the same length along its anterior* margin as the 6th segment, its process extends to the base of the claw, and its inner margin as well as the anterior margin of the 6th segment with complex denticulation (as in pair I); the claw is short, equal to half the length of the 6th segment. The 2nd segment of pereopods III has an S-shaped anterior margin while its posterior margin is convex; all the segments are smooth and their length ratio 3:1:2:1.5:2.3:1. Pereopods IV are slightly longer and thinner and the length ratio of the segments 3.5:1:2:1.5:2.4:1.3; the distal part

* Changed from Russian text by authors—Eds.

of the posterior margin of the 5th segment bears one very small seta while that of the 6th segment has an indistinct denticulate broader with individual setae. Pereopods V–VI are similar; the claw is 2/5 the length of the 6th segment; the 4th segment has solitary setae along its anterior margin; the 5th–6th segments are finely denticulate along the anterior margin. The 2nd segment of pereopods VII is less than 1/3 the length of
226 the entire leg, its width is less* than its length; its margins are parallel, the posterior lobe stretched downward to the end of the 3rd segment, the anterior margin slightly concave, and the distal angle stretched (as in *V. stebbingi*); the length ratio of the 4th–7th segments is 9:13:17:10; each successive segment is narrower than the preceding one; the 7th segment is finger-shaped and has a characteristic squamose pattern on its surface.

The urosome is somewhat longer than somite III of the pleon but the posterior lateral angles are not prominent. The basipodites of the uropods are longer than the rami and their inner distal angles acutely stretched; the basipodites of uropods I–II extend to the middle of the basipodite of uropods III and bear strong denticles on the outer margin. The rami of uropods I are equal in length; the exopodite has a coarsely denticulate outer margin while the proximal 2/3 of the inner margin is finely denticulate and the distal part bears large denticles; in the endopodite the margins are distally boldly denticulate, the proximal half of the outer margin finely denticulate and the inner margin smooth. The exopodite of uropods II has a coarsely denticulate outer margin while the proximal 3/4 of the inner margin is finely denticulate, with a large denticle distally; the endopodite is shorter than the exopodite, with a finely denticulate outer margin and an uneven inner margin without distinct denticles. The basipodite of uropods III is distally armed with very minute denticles; the rami in both sexes are equal in length, similar in shape, and finely denticulate along the sides facing each other; the exopodite has a smooth outer margin; the inner margin of the endopodite is uneven. The telson is elongated-triangular, apically rounded, and extends to the middle of the basipodite of uropods III.

Distribution: Northwestern part of the Pacific Ocean, southwestern part of the Bering Sea, and Bussol Strait.

12. ***Vibilia armata*** Bovallius, 1887 (Fig. 112)

Bovallius, 1887b: 69; Behning, 1912: 213; Stephensen, 1918: 46; Behning, 1925: 491.—*gracilis* Bovallius, 1887b: 65.—*gracilenta* Bovallius, 1887b: 67.—*erratica* Chevreux, 1892b: 32.

Body length up to 11.2 mm, on average 5–7 mm. In the tropical part of the area of its distribution, females with eggs have been recovered, measuring no more than 5 mm in length.

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* Changed from Russian original by author—Eds.

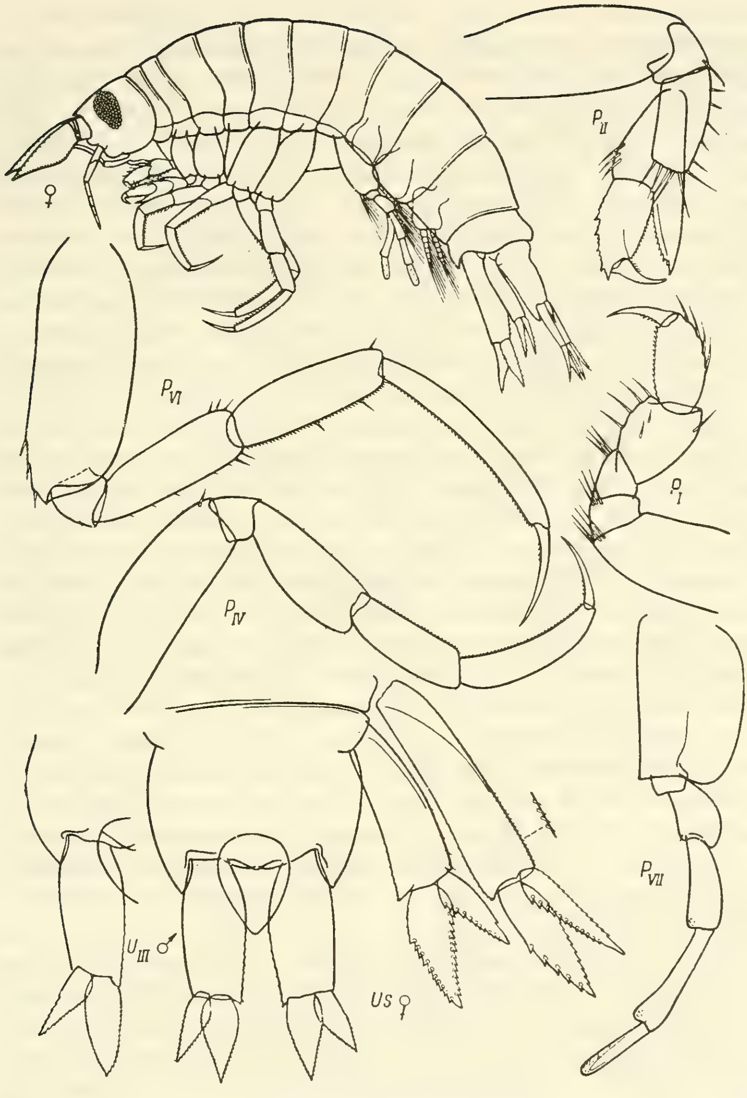


Fig. 112. *Vibilia armata* Bovallius.

The crustacean is transparent, well proportioned, and has long extremities. The body proportionality is enhanced by forwardly projecting antennae I, with an elongated-lanceolate and anteriorly acute flagellum. Viewed laterally, the head is almost square. The eyes are intensely pigmented and large, especially in males, in which they occupy about half the lateral surface of the head. The frontal part of the head in males projects roundly above the base of antennae I; the rostrum is almost absent or very small. The flagellum of antennae I is equal in length to the head and somite I of the pereon, while the antennae are equal to the head and first two somites of the pereon. The shape of the flagellum is a good diagnostic character of this species: it is broadened in the proximal 1/3 (especially the underside), then gradually tapers to an acute, sometimes even slightly stretched, tip. A minute rudiment of the 2nd segment, bearing a fascicle of short setae, is situated in a notch at the apex of the 1st segment; similar setae are uniformly arranged along the margins of the 1st segment of the flagellum. Antennae II in females are six- to eight-segmented and equal to antennae I in length; in males they are seven- to nine-segmented and distinctly longer than antennae I, mainly because the segments are longer.

Pereopods I bear several strong setae on the posterior margin of the 5th segment and on the anterior margin of the 6th. The claw is strong, longer than half the 6th segment (the same proportion is also observed in pereopods III–IV). The process of the 5th segment of pereopods II extends to the base of the claw and its inner side is unevenly denticulate; the margins of the 6th segment are also denticulate; the largest denticle occurs at the base of the claw. Pereopods III–IV are identical and have a very small pecten of setae along the posterior margin of the 5th–6th
227 segments. Pereopods V–VI are also similar; the anterior margins of the 4th–6th segments are armed with minute setae and the anterior margin of the 2nd segment with several thin spinules; the claws are slightly shorter than half the 6th segment. Pereopods VII are relatively longer and extend to the end of the 5th segment of pair VI; the 2nd segment has a round posterior lobe; the 4th, 5th, and 7th segments are about equal in length; the 6th segment is narrower and twice longer than the 5th and slightly broadened distally; the last segment is finger-shaped with a squamose pattern on the surface.

The posterior lateral angles of the last urosomite project prominently backward along the sides of the telson. The basipodites of the uropods are longer than the rami. The basipodite of uropods III is longer than wide; in females the rami are of equal length, while in males the endopodite is broader and somewhat longer than the exopodite. The telson is roundish-triangular.

Distribution: Mainly found in tropical and subtropical waters, but
228 often strays into the boreal region where, of course, it is found in small numbers. In the Southern Hemisphere, it is distributed up to 50° S.

13. ***Vibilia cultripes*** Vosseler, 1901 (Fig. 113)

Vosseler, 1901: 121; Behning, 1912: 213; 1913: 533; Stephensen, 1918: 53; Chevreux and Fage, 1925: 388; Shoemaker, 1945a: 234.

One of the largest species of *Vibilia*: adults reach up to 15 mm.

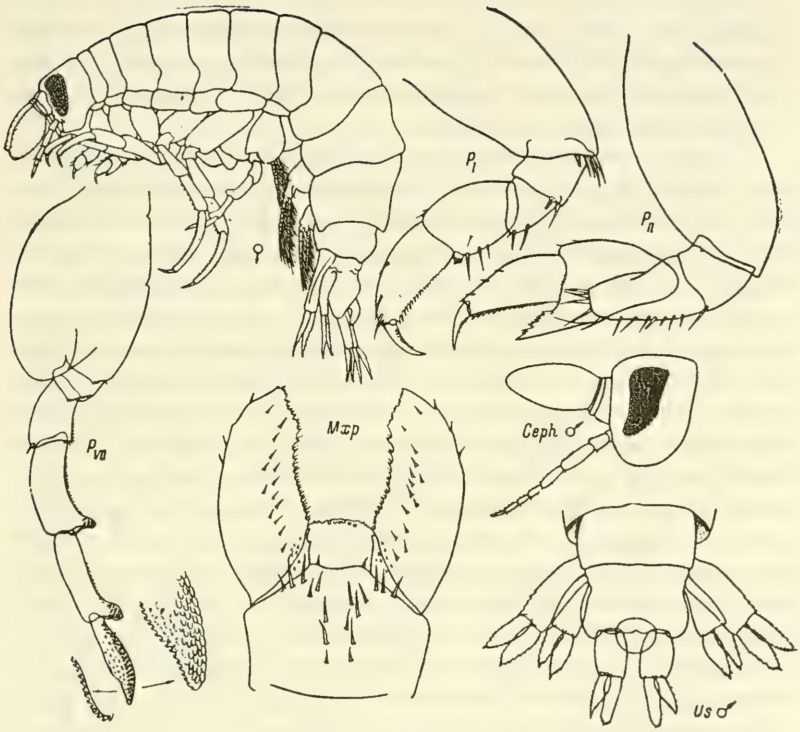


Fig. 113. *Vibilia cultripes* Vosseler (Ceph ♂, Us ♂—after Behning, 1925).

The body is thickset with a thick integument tuberculous laterally. The head lacks a rostrum, is almost rectangular, and its height slightly more than its length, which is equal to the first two somites of the pereon. The eyes are very large; in females they are elongated-reniform and occupy about 1/3 the lateral surface of the head; in males they are dorsally broadened, contiguous, and occupy more than half the lateral surface of the head. Antennae I are equal in length to the head and somite I of the pereon together and their base is short; the 1st segment of the flagellum is ovate (lateral view) and its apex round; the flagellum is equal to the head in length; the rudimentary 2nd segment is apically barely discernible. Antennae II in females are not longer than antennae I, are six-segmented, all the segments with convex margins, and each succeeding segment somewhat narrower than the preceding one; the margins of the 4th–6th segments bear minute setae; antennae II in males are eight-segmented,
229 longer than antennae I length by at least three distal segments of its, and the margins of the last four segments are armed with setae. In the

maxillipeds the outer lobes have a slightly convex inner margin and bear spinules (more than 14) on the surface; the outer margin may bear four to nine spinules; the medial lobe does not extend to the middle of the outer lobes, and the distal margin is almost straight in females but with a central prominence in males.

The pereon is equal to the pleon and urosome together. Somite I is about half the length of somite II which in turn is 3/4 of somite III; the subsequent segments are approximately equal in length. The 2nd segment of pereopods I has convex margins and its maximum width is 3/5 its length; the anterior margin of the 4th segment projects along the 5th segment up to its middle and is armed with two strong setae; the 5th segment bears three–four setae on the distally denticulate posterior margin and minute setae in the distal part of the convex anterior margin; the 6th segment is equal to the 5th and tapers distally; the posterior margin is denticulate while the anterior margin bears short setae; the claw is strong, slightly curved, equal to half the length of the 6th segment, and slightly denticulate posteriorly. Pereopods II are slightly longer than pereopods I; the 2nd segment is twice longer than wide, its margins convex, and the posterior distal angle bears one-two short setae; the 4th segment is posteriorly armed with setae which are modified to stiff spines on the distal lobe extending to the middle of the posterior margin of the 5th segment; the 5th and 6th segments are about equal in length, the anterior margins convex and distally with several thin spinules; the process of the 5th segment extends to the middle of the 6th segment and is anteriorly nonuniformly denticulate; the 6th segment is twice longer than wide and its posterior margin is denticulate; the claw is half the length of the 6th segment and slightly denticulate posteriorly. In pereopods III–IV the 2nd segment is twice longer than wide; the 4th and 6th segments are approximately equal in length and the 5th segment slightly shorter than they; the posterior margins of the 4th–5th segments bear some spinules while the 6th segment is denticulate; the claw is about 1/5 the length of the 6th segment. Pereopods V–VI are identical, somewhat longer than pereopods III–IV, mainly because of the greater length of the distal segments; the 4th and 5th segments are equal in length, the 6th segment longer than they, with finely denticulate anterior margin; the 5th segment of pereopods VI is anteriorly armed with equidistant spiniform setae. The structure of pereopods VII is specific. They are approximately equal in length to pereopods IV; the 2nd segment is equal in length to the next three segments together, its width 3/4 its length, the distal lobe of the posterior margin round and extends slightly beyond the base of the 4th segment; the three distal segments are about equal in length; the anterior distal angle of the 5th–6th segment forms a short finger-shaped process with a squamose pattern on the surface that also covers the anterior and distal part of the 7th segment, modifying posteriorly into groups of very fine short setules; the 7th segment is broadened, flattened in the middle, and constricted toward the end, resembling a knife blade, whereby the name of the species—*cultripes* (knife-legged); the distal half of the posterior margin of the 7th segment is uniformly denticulate and the apices of the denticles upcurved.

The last of the epimeral plates has a slightly produced posterior margin. Urosomite I is almost half the length of the last somite of the pleon and 2/3 of the last (geminate) urosomite, in which the posterior lateral angles project markedly backward. The rami of uropods I–II are equal in length. The basipodite of uropods I is denticulate on the outer and distal margin; the margins of the exopodite are finely denticulate proximally and more coarsely distally; the outer margin of the endopodite is similarly armed but the inner margin is proximally smooth. Uropods II are shorter than uropods I; the basipodite is distally broadened, its length barely more than its width; the sides of the rami facing each other are denticulate (more coarsely toward the ends) while the opposite sides
230 are denticulate only distally. The endopodite of uropods III is longer than the exopodite, especially in males; the length of the basipodite slightly exceeds its width. Ornamentation of the rami differs in the two sexes: in females the inner margin of the exopodite is coarsely, in males very finely denticulate; the endopodite in males tapers toward the middle in the distal 1/3 has parallel margins, and apically bears a minute seta embedded in a deep notch between two broad denticles; in females the apical seta is barely discernible and situated in a shallow pit. In both sexes the outer margin of the exopodite is denticulate only distally and the inner margin of the endopodite is smooth. The telson is transversely oval, almost round, and extends to the middle of the basipodite of uropods III.

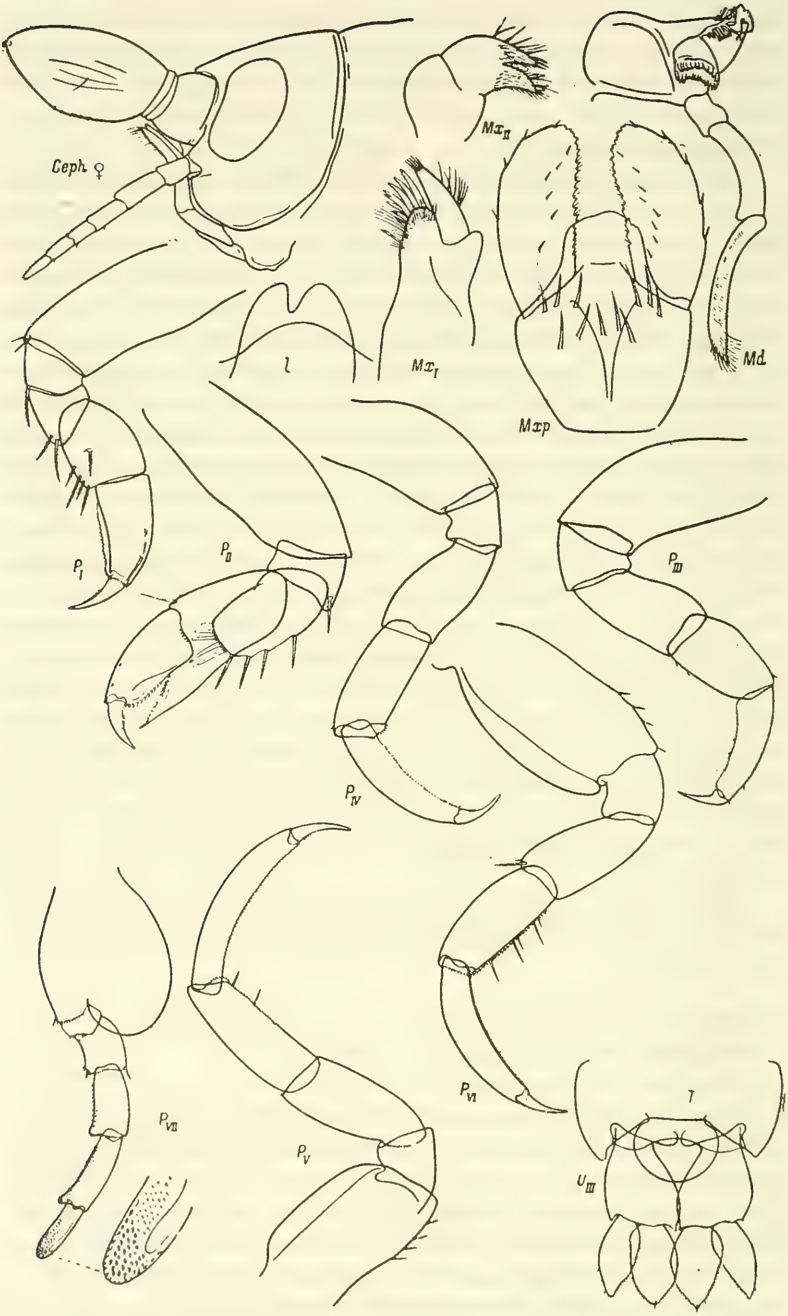
Distribution: Tropical waters of the Atlantic, Indian and Pacific oceans; common in the Mediterranean Sea. Catches are small in number everywhere.

14. ***Vibilia longicarpus*** Behning, 1913 (Fig. 114)

Behning, 1913: 530; Semenova, 1973: 174.

Body length up to 12 mm.

This is a large species of *Vibilia*, close to *V. cultripes*. The body is cylindrical, thickset, and has a smooth thick integument. In females the length of the head is slightly less than its height, in males these are equal. The eyes are large, oval, intensely pigmented, and occupy about 1/3 the lateral surface of the head. Antennae I are about the same length as the head and somite I of the pereon; the flagellum is not longer than the head, elongated-oval, more convex from below; the reduced 2nd segment is almost not noticeable. Antennae II of the female are seven-segmented and



231 Fig. 114. *Vibilia longicarpus* Behning

equal to antennae I in length; the 3rd segment is the largest. Antennae II in the male are eight-segmented, longer than antennae I, at least in the length of the two distal segments. The maxillipeds have an almost round medial lobe that extends to the middle of the outer lobes; each outer lobe has a row of six–eight spinules on the surface and four–five minute spinules along the outer margin.

The pereon is much longer than the pleon and urosoma together; somites III–VII are approximately equal in size, somites I–II shorter than they. The pereopods are strong. The 2nd segment of pereopods I is shorter than the remaining segments together; the 2nd–5th segments bear one–four setae in the posterior distal angle; the 6th segment is longer than the 5th and has a denticulate posterior margin; its anterior margin bears two short setae distally; the claw is half the length of the 6th segment and denticulate posteriorly. The 2nd segment of pereopods II is shorter than the rest of the leg, with a barely convex posterior margin; the process of the 5th segment extends to the base of the claw; the anterior distal angle of this segment is armed with a strong seta; the posterior margin of the 6th segment and the margin of the process facing it are denticulate. The 2nd segment of pereopods III–IV has a straight anterior and a convex posterior margin; the posterior distal angle of the 5th segment of pereopods IV and the posterior margin of the 6th segment of both III and IV are finely denticulate; the claw is 1/3 the length of the 6th segment. Pereopods V–VI are almost equal in length; the 2nd segment is equal in length to the 3rd and 4th segments together, in pereopods V, 1.5 times, in pereopods VI, 2 times longer than wide, and anteriorly bears several spinules distally; the anterior and distal margins of the 5th and anterior margin of the 6th segment are finely denticulate and the 5th additionally bears several equidistant thin spines on the anterior side; the claw is 2/7 the length of the 6th segment. The 2nd segment in pereopods VII is highly broadened, its width almost equal to its length, and the rounded lobe of the posterior margin reaches 1/3 the 4th segment; the anterior side of the 2nd–3rd segments is distally ornamented with minute denticles; the 4th segment is almost square, finely denticulate distally and bears one seta in the anterior and posterior distal angles; the 5th segment
232 is 1.5 times longer than the 4th, anteriorly and distally bears very small spinules, and slightly projects above the base of the 6th segment; the 6th segment is three times longer than wide and its anterior side covered with minute spinules; the anterior distal angle of the 6th segment also projects; the 7th segment is finger-shaped, shorter and slightly narrower than the 6th segment, and its surface anteriorly and distally covered with a squamose pattern that proximally modifies into very minute spinules.

The posterior lateral angles of the urosome project backward. The basipodite of uropods I is denticulate in the distal part of the outer margin and twice longer than wide; the rami are 2/3 the length of the basipodite and finely denticulate proximally, more coarsely distally. The basipodite of uropods II is 1.5 times longer than wide and the inner distal angles project; the rami are smooth proximally, unevenly denticulate distally, and equal to or barely shorter than the basipodite. The basispodite of uropods III is about equal in length and width; the rami in females are identical in length and equal to the basipodite; the endopodite is distinctly broader than the exopodite; the latter is finely denticulate along the inner margin but without distinct denticles on the outer margin; the endopodite is uniformly denticulate along the outer margin and also in the distal half of the inner margin, and the apical seta lies in a shallow pit. In males the rami are more coarsely denticulate distally than proximally, the endopodite is broader and longer than the exopodite, and the apical seta of the endopodite situated in a deep notch between two denticles. The telson is transversely oval, sometimes round.

Distribution: This is a rare species, found only in the tropical part of the eastern pacific and in the northwestern part of the Indian Ocean.

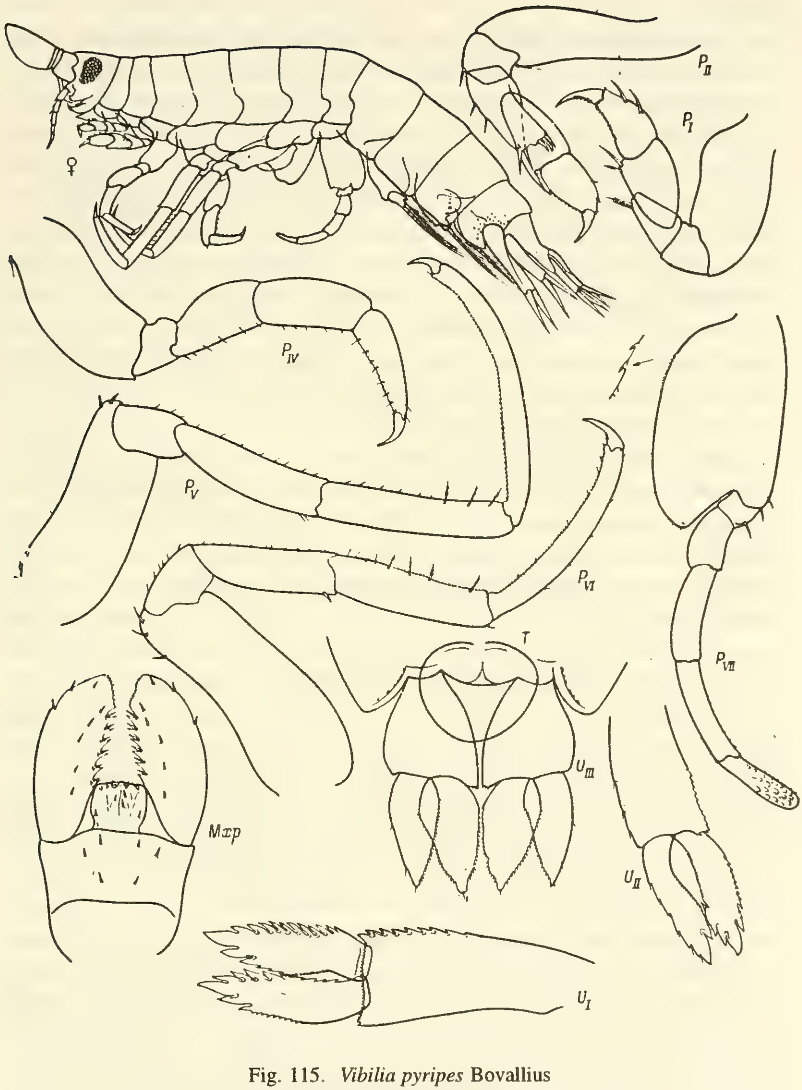
15. ***Vibilia pyripes*** Bovallius, 1887 (Fig. 115)

Bovallius, 1887a: 10; 1887b: 71; Behning, 1912: 213; Stephensen, 1918: 52.—*grandicornis* Chevreux, 1900: 131; Stephensen, 1918: 53.

Body length up to 11 mm but generally less than 5–7 mm.

The body integument is thick. The head lacks a rostrum, is slightly shorter than the first two somites of the pereon, and its height is greater than its length. The eyes occupy about 1/4 the lateral surface of the head, are oval in females and slightly dorsally broadened in males. Antennae I have a shape characteristic for the species. The base is cylindrical, with a large proximal segment whose width is more than half the height of the head but equal to the head in length; the 2nd–3rd segments together are 1/3 the length of the proximal segment; the 1st segment of the flagellum is longer than the head and somite I of the pereon; the upper margin is straight or slightly concave, the lower margin convex, the apex rounded and shifted dorsally. Antennae II in females are six- to seven-segmented and not longer than antennae I; in males they are eight-segmented and longer than antennae I, at least in the length of the two distal segments; the 3rd segment is the longest.

Somite I of the pereon is very short and the length and height of successive segments increase gradually; somites IV–VII are almost identical in size. The 2nd segment of pereopods I has parallel margins and is slightly shorter than the other segments together; the 5th segment is equal to the 6th in length and has a straight posterior margin; the anterior margin of the 6th segment is convex while the posterior margin is straight and finely denticulate; the claw is half the length of the 6th segment and denticulate posteriorly. The 2nd segment of pereopods II is equal to



233 Fig. 115. *Vibilia pyripes* Bovallius

the rest of the leg in length and distally slightly broadened; the process of the 5th segment is denticulate and short, not extending beyond the middle of the 6th segment; the 6th segment is shorter than the 5th, its margins convex and denticulate posteriorly; the claw is smooth and 1/3 the length of the preceding segment. Pereopods III–IV have highly developed musculature. The 2nd segment of pereopods III has an S-shaped

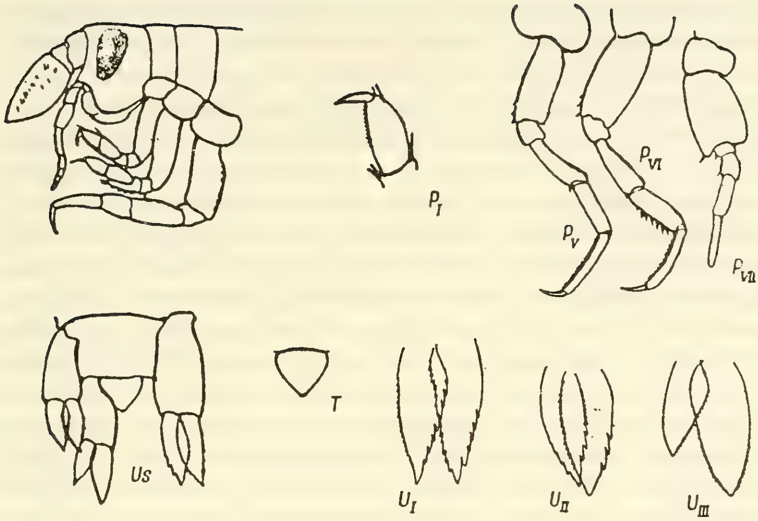
233 anterior margin (proximally convex, medially concave) and highly convex posterior margin; the 4th and 5th segments are approximately equal in length; the claw is 1/4 the length of the 6th segment. The 2nd segment of pereopods IV has a straight anterior and convex posterior margin; in all other aspects pereopods IV are identical to pereopods III; the posterior margins of the 4th–6th segments are finely denticulate. Pereopods V–VI are also identical except that pereopods V are slightly longer, the 4th–6th segments are linear and narrow, the 5th segment is armed with spiniform setae, and the anterior margin of the 6th segment is serrate, posterior is smooth. Pereopods VII extend to the end of the 5th segment of pereopods VI; the 2nd segment is longer than wide, the posterior lobe
234 quite broad, extending up to the base of the 4th segment; the 3rd–6th segments gradually increase in length; the 7th segment is notably shorter than the 6th and slightly shorter than the 5th.

The pleon is equal in length to the last five somites of the pereon. The urosome is equal in length to somites II and III of the pleon. Judging from the lateral notches demarcating the fused urosomites II and III, urosomite II is the shortest and urosomites I and III approximately identical. The posterior lateral angles of the urosome are stretched backward, forming round lobes. The basipodite of uropods I is distally denticulate on the outer side and twice the length of the rami, which are equal in length; the exopodite has large denticles on the outer side; the sides of the rami facing each other are finely denticulate; the fine denticulation on the inner margin of the endopodite is replaced by coarser denticles toward the apex. The basipodite of uropods II is 1.5 times longer than the rami; the exopodite has short sparse denticles on the outer side; the sides of the rami facing each other are finely denticulate; the proximal part of the inner margin of the endopodite is smooth. The basipodite of uropods III is typically "pyriform" (in plane), i.e., it is extremely narrow proximally and broadens distally (shence—pyripes), the maximum width being equal to the length; the inner distal angle is stretched backward; the endopodite is not distinctly denticulate along the outer margin and the inner margin is smooth; the sides of the rami facing each other are finely denticulate. Distinct sexual dimorphism is not seen in the structure of uropods III. The telson is large, round, and its apex reaches the middle of the basipodite of uropods III.

Distribution: Found in both tropical and temperate waters of the Atlantic Ocean but only tropical waters of the Indian Ocean. It is known in the Pacific Ocean from the waters of southeastern Japan, the eastern part of the tropical zone, and southward of New Zealand.

235 16. ***Vibilia bovallii*** Bonnier, 1896 (Fig. 116)

Bonnier, 1896: 612; Behning, 1912: 221.



235 Fig. 116. *Vibilia bovallii* Bonnier, male (after Bonnier, 1896).

The species was described from two specimens about 10 mm in length.

The body is bulged and tapers backward. The head lacks a rostrum and has highly developed pyriform eyes. Antennae I have a short base with a shortened 2nd segment; the 1st segment of the flagellum is ovally broadened and the rudimentary 2nd segment barely perceptible apically. antennae II are somewhat longer than antennae I, their flagellum three-segmented.

The 2nd segment of pereopods I is strong and not broadened; the 4th–5th segments are without a process; the 6th segment has a denticulate posterior margin; the claw is strong and curved. Pereopods II are similar to pereopods I but the 4th segment has a spatulate lobe extending almost to the distal margin of the 5th segment; the 5th segment is without a process—which is the most typical character of this species. Pereopods III–IV are identical, somewhat shorter than the subsequent pairs. Pereopods V–VII differ little in length, pereopods VII being just slightly shorter than the preceding ones; the 2nd segment is broadened, very much so in pereopods VII, with minute spinules distally on the anterior margin; the anterior margin of the 6th segment in V–VI pairs is finely denticulate; the 7th segment in VII pair is covered with minute squamose formations with incised margins.

The somites of the pleon are massive. The posterior lateral angles of the last urosomite project slightly. The basipodite of uropods I is almost twice longer than the rami; the inner margin of the endopodite has four–five large denticles in the distal part and its outer margin is denticulate; the exopodite has a series of strong denticles on the outer margin, while the inner margin is finely denticulate almost throughout its length. Uropods II are much shorter than uropods I; the basipodite
235 is slightly longer than the rami; the endopodite has three large denticles on the inner margin and is finely denticulate on the outer side; the exopodite has several large denticles on the inner margin which are replaced proximally by very fine denticulation, while the outer margin is weakly denticulate. In uropods III the rami are unequal in length—the endopodite is longer and denticulate on both sides while the exopodite is denticulate only on the inner side. The telson is small and triangular.

Notes: Judging from the description, the species *V. bovallii* is close to *V. pyripes* (projecting angles of the last urosomite, short basipodite of uropods III, very little difference in length of pereopods III–VI, and relatively long pereopods VII). In addition to the absence of a chela on pereopods II (which distinguishes this species among all the *Vibilia), V. bovallii* differs from *V. pyripes* in a small triangular telson and distinctly expressed sexual dimorphism in the structure of uropods III (in *V. pyripes* the rami of uropods III are equal in length in both sexes).

Distribution: V. bovallii was described from the Bay of Biscay and there are no references to further finds, which casts doubt upon the validity of the species since the Bay of Biscay has been investigated several times.

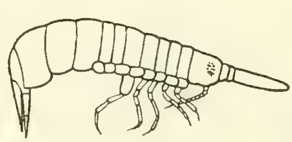
Absent in our collections.

17. ***Vibilia affinis*** Bate, 1862 (Fig. 117)

Bate, 1862: 302; Bovallius, 1887b: 50.

Body length about 7 mm.

The head has a poorly developed rostrum, is longer than the first two somites of the pereon, and its height is equal to its length. The eyes are small. Antennae I are very long, considerably longer than the head and first two somites of the pereon; the base is about half the length of



236 Fig. 117. *Vibilia affinis* Bate (after Bate, 1862).

the head; the 1st segment of the base is equal in length to the next two segments together; the flagellum is three time longer than the antennal base, lanceolate, and anteriorly acute. Antennae II are thin, not longer than antennae I, shifted backward, and extend to somite III of the pereon.

236 The pereon is longer than the pleon, the first two somites approximately equal in length, each slightly shorter than somite III, with somite IV the longest. The pereopods are short and without pubescence. Pereopods I–II are thin and short. The 5th segment of pereopods II has a process. Pereopods III–IV are approximately equal in length, their 4th segment not broadened. Pereopods V–VI are slightly longer than the preceding ones and have an ovally broadened 2nd segment. Pereopods VII are short. The last pair of uropods does not extend beyond the end of pairs I–II. The telson is small, squamiform.

Notes: In the brief description of the species the author makes no mention of the shape of the last segment of the urosome, i.e., whether its lateral angles project backward or not. However, very short uropods III are common for the group of species in which the angles of the last urosomite project. Therefore, this species has been tentatively placed in this group in the identification key.

Distribution: Only one specimen is known, which was caught near Jave.

Absent in our collections.

2. Genus *Vibilioides* Chevreux, 1905

Chevreux, 1905b: 1; 1935: 176; Stephensen, 1918: 56.

In external appearance these crustaceans are close to *Vibilia.* The body integument has transverse folds on the somites, which are raised on the sides of the pereon above the bases of the coxal plates in the form of low longitudinal crests, modifying into a chitinous ridge on the pleon that continues onto urosomite I. The head is small, slightly shorter than somite I of the pereon. The antennae are similar in structure to *Vibilia.* The mandibles and maxillae are reduced and the dentate process of the mandibles is in the form of a simple conical projection without a masticatory surface. Maxillae I are devoid of an inner lobe. Maxillae II are either absent or "so reduced that they were not observed during dissection of the crustacean" (Chevreux, 1935). Broadening of the 2nd segment in all pairs of the pereopods is characteristic, the broadening being significant in pereopods I–II. Pereopods VII have five segments; the three distal segments are reduced and together constitute less than half the length of the 2nd segment. The epimeral plates of the pleon are posteriorly acute. Complete fusion of urosomites II and III is noticed only in the middle of the dorsal side and the lateral borders between them are well demarcated and slightly extend over the dorsal surface.

Uropods III have a short basipodite, equal to the rami in length. The telson is relatively large and extends beyond the middle of the basipodite of uropods III.

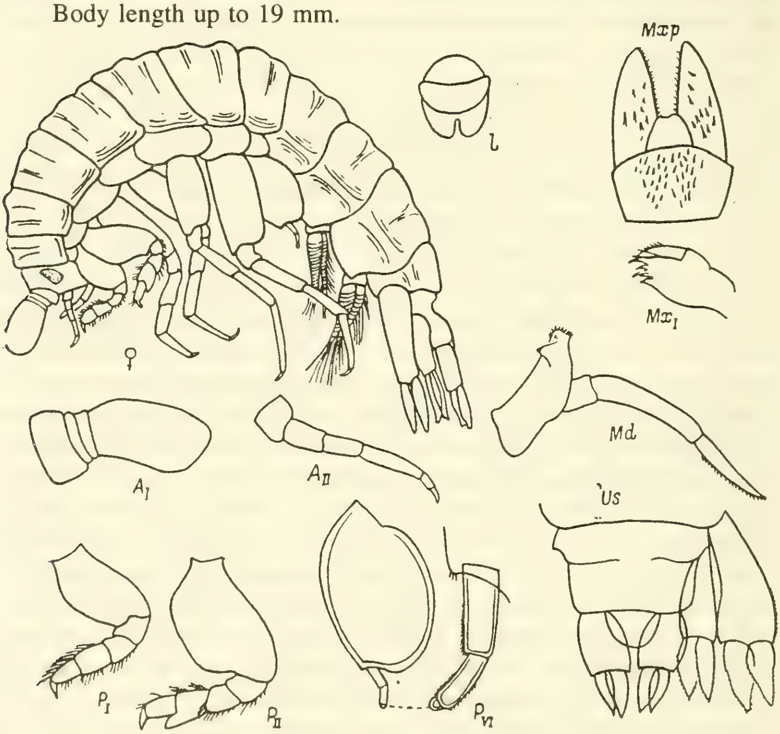
Type species: vibilioides alberti Chevreux, 1905.

The basic differences from the closest genus, *Vibilia*, pertain to the structure of the body integument, morphology of the mouthparts, and structure of pereopods VII. Bowman and Gruner (1973) treated *Vibilioides* as a synonym of the genus *Vibilia*, considering the differences between the two genera regarding pereopods VII insignificant; these authors did not take cognizance of other morphological characters. However, the structure of the oral appendages in *Vibilioides* differs markedly from that in *Vibilia* and, furthermore, these differences may quite unambiguously be considered as due to reduction. This and other characters place *Vibilioides* apart in the family Vibiliidae and, obviously, it is more correctly treated as separate genus.

237 **1. *Vibilioides alberti*** Chevreux, 1905 (Fig. 118)

Chevreux, 1905b: 1; 1935: 176; Stephensen, 1916: 56; Bowman and Gruner, 1973: 8 (*Vibilia*).

Body length up to 19 mm.



237 Fig. 118. *Vibilloides alberti* Chevreux (after Chevruex, 1935).

The integument has transverse constrictions on each somite of the pereon and the pleon, such that their dorsal surface appears tubercular. The head is approximately equal to or slightly shorter than somite I of the pereon and its height markedly more than its length. The eyes in fixed specimens look like irregularly triangular yellow spots, narrowed dorsally, and with no trace of ocelli. Antennae I are equal in length to the head and somite I of the pereon; the base is short; the 1st segment of the flagellum is elongated-oval with a rounded anterior end. Antennae II are shorter than antennae I, six-segmented, with the 4th segment the largest. In the mandibles the palp is strong, with elongated segments, the 2nd segment much longer than the 3rd. In maxillae I the outer lobe bears six spines. The maxillipeds have a low medial lobe extending to 1/3 the height of the outer lobes.

The lower lateral sides of the somites of the pereon project above the base of the coxal plates in the form of a pecten, similar to the longitudinal crest, which modifies on the lateral sides of the pleon and urosomite I
238 into a longitudinal ridge. The pereon is longer than the pleon and urosome together; somite II is just slightly longer than somite I and equal to somite VII; somites IV–VI are the largest and almost equal in size. The coxal plates have a more or less pronounced anterior lobe. The 2nd segment of pereopods I is broadened, with a covex anterior margin, and is somewhat shorter than the rest of the leg; the 5th segment is slightly elongated; the 6th segment is equal to the 5th in length but narrower; the posterior margin of the 4th–6th and anterior margin of the 5th–6th segments are pubescent and have short setae; the claw is strong and about 1/3 the length of the 6th segment. The 2nd segment of pereopods II is highly broadened, with a semicircular anterior margin, barely convex posterior margin, and 1.8 times longer than wide, exceeding the length of the rest of the leg; the 5th segment is slightly longer than the 4th; the process of the chela hardly extends to the middle of the 6th segment; the 6th segment is equal to the 5th in length; the claw is about half the length of the 6th segment; the sides of the chela facing each other and the posterior margin of the claw are finely denticulate. The 2nd segment of pereopods III–IV is equal in width to the maximum width of the analogus segment in pereopods II and V, and its length is approximately twice its width; the 6th segment in pereopods III is slightly longer, in pereopods IV, 1.5 times longer than the 5th segment; the claw is 1/4 and 1/5 the length of the 6th segment in pereopods III and IV respectively. The 2nd segment of pereopods V is twice longer than wide; the 4th and 5th segments are equal in length and three times longer than wide; the 6th segment is narrower than the 5th and 1.5 times longer; the claw is about 1/6 the length of the 6th segment. The 2nd segment of pereopods VI is broader and longer than in pereopods V, its length twice its width; the 6th segment is barely shorter than the 5th; the

claw is about 1/5 the length of the 6th segment; the anterior margin of the 6th segment in pereopods V–VI is finely denticulate. Pereopods VII have a characteristic shape: the 2nd segment is as broad as in pereopods VI, the same length as in pereopods V, and proximally very convex anteriorly; the posterior margin is uniformly convex with a small round distal lobe not quite extending beyond the base of the 3rd segment; the 3rd–5th segments together are 1/4 the length of the 2nd segment; the 3rd segment is the largest and the 5th segment bud-shaped and without ornamentation; the anterior margin of the 3rd and all margins of the 4th segment bear minute spinules; a group of similar spinules occurs in the distal angle of the 2nd segment.

The pleon is equal in length to somites IV–VII of the pereon. Somite III of the pleon is the most massive. The posterior distal angles of the epimeral plates are acute but not stretched backward. The urosome is slightly shorter than the last two somites of the pleon; urosomites II and III are almost completely separated, the border absent only in the middle of the dorsal side; moreover, urosomite III is almost equal in length to urosomite I, urosomite II somewhat shorter; the posterior lateral angles of the urosome do not project backward. The telson is broadly rounded, its length slightly less than its width at the base. The uropods are relatively short; uropods I and III terminate at the same level while uropods II are barely shorter. The basipodite of uropods I broadens distally, is twice longer than wide, and in the distal half of the outer margin finely denticulate; the rami are equal in length, 2/3 the length of the basipodite, their margins finely denticulate (except the proximalmost parts). The basipodite of uropods II extends to the end of the basipodite of uropods I and is twice longer than wide; the rami are equal in length; the exopodite has finely denticulate margins except for the outer. The basipodite of uropods III is slightly broadened distally, has convex margins, and is as long as its maximum width; the endopodite is slightly longer than the exopodite, its length equal to that of the basipodite; the margins of the rami are very finely denticulate.

Distribution: This species has only been found in the Atlantic Ocean: in the southern part of the Bay of Biscay, environs of the Canary and
239 Azore islands, and vicinity of Rio-de-Janeiro. The deep-water nature of *V. alberti* was presumed (Chevreux, 1905) because most of the findings occurred in catches at a depth of 1,000 m or more. However, the largest specimens (17 and 19 mm) were caught in the surfacial zone.

3. Genus *Cyllopus* Dana, 1853

Dana, 1853: 990; Stebbing, 1888: 1296; Bovallius, 1889: 3; Barnard, 1930: 405; Bowman and Gruner, 1973: 25.

The head is spherical and entirely occupied by highly pigmented eyes. Antennae I in males have a proximally bulged 1st segment in the flagellum, which is stretched toward the apex; the flagellum in males barely broadens and gently tapers toward the end. Antennae II in females are shorter than or equal to antennae I, in males longer, mainly because of the elongation of the segments. Maxillae I have a small oval inner lobe. The masticatory process of the mandibles has a flat grating surface; the 2nd segment of the mandibular palp is much longer and broader than the 3rd segment. The basal segment of pereopods I-II is almost not broadened. The 2nd segment of pereopods VII is longer than the distal part of these legs. The epimeral plates have rounded margins. The basipodite of uropods III is longer than the rami. The telson is small.

In external appearance these crustaceans resemble representatives of the family Hyperiidae, coming closer to *Parathemisto* in body proportions. Morphological peculiarities indicate the affinity of *Cyllopus* to the family Vibiliidae.

Type species: *Cyllopus magellanicus* Dana, 1852.

Notes: While revising this genus, Barnard (1930) considered *C. levis* Bovallius, 1889 a doubtful species and the remaining known species as synonyms of *C. magellanicus* and *C. lucasi.* Hurley (1955) suggested retention of *C. macropis* (Bovallius, 1887) based on the incomplete segmentation of pereopods VII.

Analysis of extensive material from the environs of New Zealand, however, revealed wide variation in the segmentation of pereopods VII and the age-related nature of other less significant differences, thereby enabling confirmation of the identity of *C. macropis* with *C. magellanicus.*

At present, the genus includes two species, distributed in the cold waters of the Southern Hemisphere.

KEY TO SPECIES OF GENUS CYLLOPUS

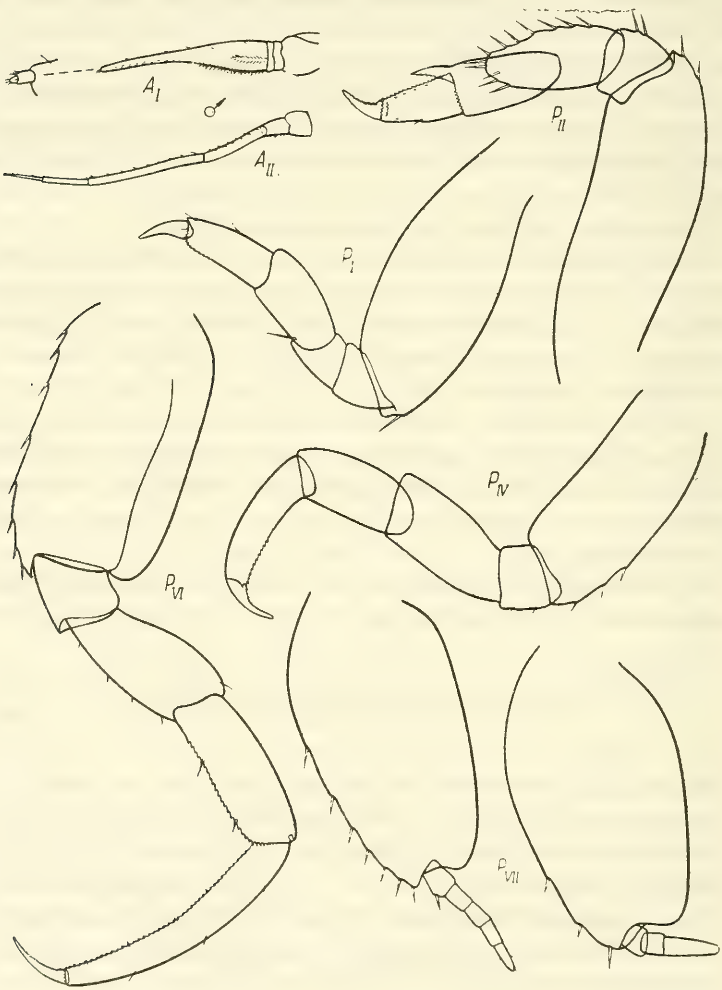
1. Second segment of pereopods VII almost oval, with uniformly convex margins; 5th segment of pereopods I not broadened, its length more than width; process of 5th segment of pereopods II extends to middle of 6th segment .... 1. **C. magellanicus** Dana.

— Second segment of pereopods VII narrows distally, posterior margin concave; 5th segment of pereopods I broadens distally, its maximum width equal to or more than length; process of 5th segment of pereopods II extends beyond middle of 6th segment ....
.... 2. **C. lucasi** Bate.

1 ***Cyllopus magellanicus*** Dana, 1853 (Fig. 119)

Dana, 1853: 990; Bovallius, 1889: 5; Barnard 1930: 408; Hurley, 1955: 129; Semenova, 1976: 140.—*danae* Bate, 1862: 305; Bovallius, 1889: 7. —*macropis* Bovallius, 1887b: 51 *(Vibilia)*; Behning, 1925: 480 *(Vibilia)*; Hurley, 1955: 133.—*hookeri* Stebbing,
240 1888: 1296.—*levis* Bovallius, 1889: 8.—*armatus* Bovallius, 1889: 10; Spandl, 1927: 174.—*batei* Bovallius, 1889: 14.—*serrata* Stewart, 1913: 248 *(Vibilia)*.

Body length up to 17 mm, average 10-12 mm.



240 Fig. 119. *Cyllopus magellnius* Dana (A I-II—after Hurley, 1955).

The head is equal in length to the first three somites of the pereon and is more rounded in females than in males, in which the height of the head exceeds its length. The eyes in females and young crustaceans are brown but in males almost black. Antennae I in females are equal to the head in length; the 1st segment of the flagellum is 2.5 times longer than the base, tapers gently, and distally bears two distinct rudimentary segments. Antennae II in females are shorter than antennae I and six- to seven-segmented. Males are distinguished by the highly stretched end of antennae I whose length is equal to the head and first two somites of the pereon; the constricted distal part of the 1st segment of the flagellum is equal in length to the highly broadened proximal part. Antennae II in males are longer than antennae I, with highly elongated 4th–5th segments.

The 2nd segment of pereopods I is barely broadened and slightly shorter than the rest of the leg; the 5th–6th segments are elongated, the 5th somewhat broader than the 6th; the claw is strong and half the length of the 6th segment; the posterior margin of the 5th–6th segments and the claw are denticulate. The 2nd segment of pereopods II is linear and
241 distinctly longer than the rest of the leg; the 4th segment has a well-developed lobe supporting the chela; the chela weak: process of the 5th segment does not extend to the middle of the 6th segment, and has an uneven inner margin; the 6th segment is shorter and narrower than the 5th; the claw has a broad base and, like the two preceding segments, is denticulate posteriorly. The 2nd segment of pereopods III–IV has parallel margins and is twice longer than wide; the 4th segment is broadened distally; the 5th segment is slightly narrower and shorter than the 4th; the 4th–5th segments of pereopods III are 1.5 times, of pereopods IV twice longer than wide; the 6th segment is narrower than the 5th and about equal to the 4th, and three-four times longer than wide; the claw has a broad base and is half the length of the 6th segment. Pereopods V–VI are almost equal in length, much longer than pereopods III–IV, and have long thin distal segments; the 2nd segment is broadened, has faintly convex margins, bears several spinules in the distal part of the anterior margin, and leans on the base of the 3rd segment. The 2nd segment in pereopods V is 1.5 times longer, of pereopods VI twice longer than wide; the 5th segment is longer than the 4th; the 6th segment is about twice longer than the 5th and slightly curved. However, if the 2nd segment in pereopods VI is longer than in pereopods V, then the 4th–5th segments are concomitantly shorter, the 6th segment 10–12 times longer than wide, and the claws 1/8–1/7 the length of these segments. Pereopods VII barely extend to the middle of the 4th segment of pereopods VI; the highly broadened 2nd segment is longer than the rest of the leg, almost perfectly oval, armed with spines anteriorly, about 1.7 times longer than

its maximum width, and the structure of its distal part subject to notable age and individual variation. Usually, adult individuals have a completely segmented extremity in which the distal part comprises five segments, the last being finger-shaped; however, individuals have been encountered in which pereopods VII are asymmetrically developed with respect to shape and general segmentation; crustaceans have also been found with a three- and four-segmented distal part or with complete segmentation of the extremity, but with a bud-shaped (or gemma-shaped) 7th segment.

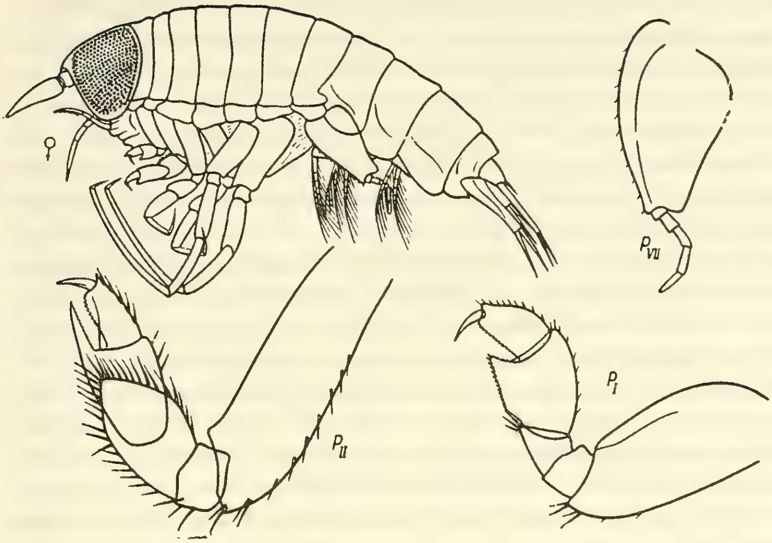
The pleon is longer than the pereon. The urosome is shorter than somite III of the pleon. Urosomite I is slightly shorter than the last (geminate) urosomite; the border between the fused urosomites II and III is demarcated by a sharp projection and lateral notches. The distal angles of the urosome protrude backward. The basipodite of uropods I is equal to the rami in length, distally broadened, with a sharply projecting inner margin; the rami are distally unevenly denticulate, proximally on the outer side finely denticulate, on the inner side smooth; the endopodite is slightly longer than the exopodite. The basipodite of uropods II is notably shorter than the rami and hardly extends beyond the end of the urosome; the endopodite is longer than the exopodite and in females slightly, but in males distinctly broader than the exopodite; the exopodite is very finely denticulate on the inner margin and more coarsely on the outer; the endopodite is slightly denticulate on the outer margin and smooth on the inner except for three-four subapical denticles; the rami are narrower and more distinctly denticulate in the female. The basipodite of uropods III is 2.5 times longer than the rami; the rami are equal in length, the endopodite barely broader; the exopodite is finely denticulate on the outer margin except in the proximal part, and also on the inner margin except distally where minute denticles are interspersed among much larger ones; the endopodite is finely denticulate on both sides but sometimes the fine denticulation is interrupted by large denticles. The poorly expressed sexual dimorphism in the structure of uropods II of *Cyllopus* is a characteristic difference from the genus *Vibilia* in which of the same type dimorphism is observed in the structure of uropods III. The telson is small, semicircular or roundish–triangular, its length less than its basal width and half the length of the last urosomite.

Distribution: Circum-antarctic, reaching the higher latitudes and sometimes forming small concentrations, often with *Parathemisto* gaudichaudi.

242 **2. *Cyllopus lucasi*** Bate, 1862 (Fig. 120)

Bate, 1862: 306; Bovallius, 1889: 16; Barnard, 1930: 409.—*antarcticus* Spandl, 1927: 175.

Large crustaceans, reaching up to 23 mm in length.



242 Fig. 120. *Cyllopus lucasi* Bate.

The head is large, its length in females exceeding that of the first three somites of the pereon and in males the first four somites; the height of the head is barely more than its length and the dorsal side slightly convex; a small, roundish-triangular rostrum is present. In antennae I the constricted distal part of the flagellum in females is 1/2–1/3 the length of the flagellum, in males somewhat longer. Antennae II are six- to seven-segmented and in males about equal to antennae I in length, in females sometimes shorter.

The 2nd segment of pereopods I is equal in length to the rest of the leg, twice longer than its maximum width, and with smooth margins; the 4th segment bears many spiniform setae on the small distal lobe of the posterior margin; the 5th segment broadens distally, its length equal to its maximum width, its posterior margin broadly protruding backward and up to 1/4 the 6th segment forms with it a weak chela; the 6th segment is narrower and shorter than the 5th, its anterior distal angle protruding slightly; the posterior margin of the 5th–6th segments is denticulate while the anterior margin bears solitary spiniform setae; the claw is about 2/3 the length of the 6th segment and denticulate posteriorly. The 2nd segment of pereopods II is longer than the rest of the leg and has parallel margins; the 4th segment has a large broad lobe extending to 3/4 the 5th segment and bordered with strong spiniform setae; the 5th segment, without the process, is 1.5 times longer than its width in the distal part, while the process extends to the end of the 6th segment; the inner side

of the chela is finely and nonuniformly denticulate; the 6th segment is shorter than the 5th; the base of the claw protrudes sharply anteriorly; the posterior margin of the 2nd–4th segments and anterior margin of the 5th–6th bear solitary spiniform setae; the claw is about 1/6 the length of the 6th segment. The 2nd segment of pereopods III–IV is distally
243 broadened and its length twice its width; the anterior margin is straight and the posterior distally convex with solitary setae; the 5th segment is slightly embedded in the distal part of the 4th segment, broadened in the middle, especially in pereopods III, its posterior margin denticulate, and its length exceeding that of the 4th segment; the 6th segment is the same length as the 5th, narrow, slightly curved, denticulate posteriorly, and 4–5 times longer than wide; the claw is longer than half the 6th segment. The 2nd segment of pereopods V is 1.5 times longer than wide, its anterior margin proximally concave, distally convex and armed with spinules, its posterior margin almost straight; the 2nd, 4th, and 5th segments are equal in length but the 4th–5th segments twice narrower than the 2nd, three times longer than wide, their anterior margin finely denticulate and with solitary spinules; the 6th segment is equal in length to the 4th–5th segments together, slightly curved, 12–15 times longer than wide, with a finely serrated anterior margin; the claw is thin and 1/8 the length of the 6th segment. Pereopods VI are stronger than pereopods V; the 2nd segment is S-shaped, twice longer than wide, with spinules on its anterior margin; the 4th segment is shorter than that of pereopods V, broadens distally, and is twice longer than wide; the 5th segment is longer than the 4th, almost the same length as the 4th segment of pereopods V but somewhat broader; the anterior margin of the 4th–5th segments is finely serrate, with uniformly located spines; the 6th segment and the claw have the same proportions as in pereopods V. Pereopods VII have a characteristically shaped 2nd segment: the proximal part is highly broadened and projects backward as the round lobe, and the maximum segmental width is 2/3 its length; the distal part is twice constricted in such a way that the posterior margin is distally concave and projects downward, extending to 1/3 of the 4th segment; the anterior margin distally bears strong short spines. All the remaining segments together are shorter than the 2nd segment; the 6th and 7th segments are the largest and equal in length and the 7th segment is finger-shaped.

The pleon is slightly shorter than the pereon. The urosome without the telson is equal in length to somite III of the pleon. The geminate urosomite is slightly longer than urosomite I, lateral notches divide it into a short II and thrice longer urosomite III, and the posterior lateral angles project abruptly along the sides of the telson. The basipodite of uropods I is broadened distally is twice longer than its maximum width, bears large contiguous denticles along the outer margin and one small denticle on the inner margin, which projects backward. The rami are about equal to the basipodite in length; the endopodite is slightly broader and longer than the exopodite; the outer margin of the endopodite and exopodite are coarsely denticulate; the inner margin of the exopodite is finely denticulate except distally where two–four coarse denticles occur. The basipodite of uropods II is broadened distally and extends to the end of the telson; its length hardly exceeds its maximum width and the inner margin terminates in an acute denticle. The rami are longer than the basipodite; the endopodite is distinctly longer and broader than the exopodite, uniformly broadened along the entire length, and constricted only toward the apex. The basipodite of uropods III has parallel margins, the inner distal angles are acute, and its length is 2.5 times its width. The rami, about half the length of the basipodite, are equal in length; the endopodite is broader than the exopodite; the outer margin of the exopodite is smooth proximally but indistinctly denticulate distally; the inner margin is finely serrate; the endopodite is coarsely denticulate on both sides except in the proximal part of the outer margin. The telson is small and roundish-triangular.

Distribution: A stenothermic, cold-water, circum-Antarctic species; all catches have occurred south of the Antarctic Convergence.

244 **IX. Family CYSTISOMATIDAE Willemoes-Suhm, 1875**

Some of the largest hyperiideans belong to this family: the females may reach 140 mm while the males are generally smaller (50–70 mm). The body integument is distinguished by exceptional transparency, so much so that the inner organs are visible through it. The head is unusually large and without a rostrum. The ventral (in males—frontoventral) surface of the head is flat and separated from the lateral surface by a dentate keel (marginal denticles). The eyes occupy dorsal and partly lateral sides of the head. Antennae I are conical with poorly demarcated segments. Antennae II present on the ventral surface but reduced to short spines. The oral appendages are likewise notably reduced. The mandibles have no palp. Maxillae I lack an inner lobe; maxillae II have one lobe, with the inner lobe in the form of a small tubercle or absent. The maxillipeds have a well-developed unsplit medial lobe, thickened at the end, and with a concave distal margin.

The first two somites of the pereon are generally fused. Pereopods I–II are very short, with a chela, and the other pereopods long and thin. Pereopods VII are shorter than pair VI and in females have a modified distal part forming a unique subchela. The gills are located at the base of pereopods II–VI or IV–VI. The oostegites occur on somites II–V of the pereon. The somites of the pleon are lower than those of the pereon. No border is discernible between the fused urosomites II–III. Uropods

II are totally absent. The basipodites of the uropods are fused with the endopodites while the exopodites are free. The telson is very small.

The method of rearing the progeny differs notably from that for other hyperiideans (Pirlot, 1938). The ventral surface of somites I-II of the pereon protrudes strongly and overhangs the deeply depressed anterior surface of somite III of the pereon deep into the body. The depression thus formed is protected from the sides by raised ridges, covered with lobes of complex configuration both posteriorly and ventrally, and bifurcated at the base—by homologues of the oostegites of somites II–III. Thus a firmly closed brood chamber is formed, which is embedded in the abdominal surface of the crustacean, with a narrow protected opening facing posteriorly, which undoubtedly ensures reliable protection of the developing progeny. The oostegites of somite IV are reduced to a small tubercle, but on somite V are modified into a protective valve covering the opening of the oviduct. It has been suggested (Woltereck, 1903) that coincident with the above-described structure of the brood chamber and its remoteness from the efferent ducts of the reproductive system, specialization occurred in the distal part of pereopods VII in the mature female as an adaptation for the transfer of eggs from the opening of the oviduct to the brood chamber.

Early stages of development of the crustaceans exhibit significant morphological differences from the late stages and adults; they were earlier named physosoma (Woltereck, 1903) or *thaumonectes* (Senna, 1903). They are characterized by spherical building of the thoracic portion, relatively small head, and strong ornamentation of the body surface with spines.

The family includes one genus represented by several species, living mainly at levels deeper than 1,000 m.

1. Genus *Cystisoma* Guérin-Méneville, 1842

Guérin-Méneville, 1842: 214; Stebbing, 1888: 1318; Barnard, 1916: 286; 1932: 268; Pirlot, 1938: 364; 1939: 33; Bowman and Gruner, 1973: 26.—Thaumops Willemoes-Suhm, 1873: 206.—Thaumatops Martens, 1875: 189.

245 Length of females up to 140 mm, of males, on average, up to 50 mm.

The head in females is spherically bulged, its height considerably exceeding the height of the person. In males the head is of the same height as somite I of the pereon; dorsally it is convex and from the base of antennae I straightly truncated toward the oral appendages (frontoventral surface). antennae I have an indistinct border between the base and the flagellum; in adults they may be longer or shorter than the head, sometimes with highly developed apical glands. The head, in addition to lateral marginal denticles, ventrally bears a number of structures in the central part which are important in the identification of the species. Anterior to the oral appendages, two rows of denticles occur, which proceed forward from the outer margins of the mandibles; anterior tooth is the largest and following (glandular) more poorly developed teeth, present in specimens of all species; moreover, second tooth is homologous with the rudiment of antennae II, this is confirmed by a gland opening at its base (Stebbing, 1888). The number of rest denticles forming the arcuate rows may vary in different species from zero to six in each row; sometimes asymmetry of number is observed on the right and left.

The pereon is longer than the pleon, the somites are separated by deep grooves (except the first two), and each somite bears several denticles dorsally. The first (geminate) somite of the pereon is very narrow and the border between the fused somites in the form of a shallow groove. The coxal plates are fused with the pereon. The so-called coxal spine, developed to a variable extent in different species, is located above the base of the 2nd segment of pereopods I–II. The chelae of pereopods I–II are well developed and the legs, not longer than the 2nd segment of pereopods III, closely adjoin the oral appendages and form with them a unified functional complex. Pereopods III–IV consist of long narrow segments. Pereopods V are the longest. In adult females the distal part of the 6th segment, especially in pereopods VII, is often broadened because of the strong development of the glandular tissue. The 2nd segment of pereopods VII is proximally more or less broadened, especially in males. In adult females the distal part of pereopods VII is modified into the so-called egg forceps (Woltereck, 1903): the distal end of the elongated 6th segment bulges, has a concave surface (notch conforms to size of the egg), and the claw is steeply curved, movable, and perhaps prevents the egg from falling during its transfer from the opening of the oviduct into the brood chamber.

The urosome (without uropods) is shorter than the pleon. Even traces of uropods II are absent. The rami of the uropods are shorter than the basipodites.

Type species: Cystisoma neptunus Guérin-Méneville, 1842.

Notes: Records of *Cystisoma* are few to date. This is because of the deepwater habitat of this genus and its notably sparse populations. Due to wide age-related changes and sexual dimorphism as well as incomplete initial descriptions, an unjustifiably high number of species have been included in this genus. According to Barnard (1932):"It would be more correct to say about this genus that we are describing the specimens and not the species." Only Pirlot (1938) was able to understand its sexual dimorphism, a very confusing character; the majority of the earlier researchers mistook young females for males with rudimentary oostegites (!). As a result, in describing the male subsequent researchers sometimes

found themselves in a difficult situatiml, qince in the species to which the given specimen could have been related, the "male" had already been described. We are convinced that neither the length of antennae nor the degree of fusion of the first pereon, somites can serve as good
246 diagnostic characters. The number of ventral, marginal, and mandibular denticles also varies within a known range and per se is less suitable for diagnosis. However, the combination of these characters can serve as a basis for the identification of species. Practically, from a size of 30 mm, the sex of the crustacean can be identified because the development of oostegites commences now in the female. The absence or presence of lateral denticles on the mandible is obviously a stable character although their number (when present) is liable to variation. An increase in number of marginal denticles to 17–18 is also an important character, although variations within the range of 12–16 denticles hardly qualifies it as such. The length ratio of the rami of the uropods can be used as a species character only in combination with other characters. The absence of an arcuate row of denticles among the ventral ones may also be used in identification, as a character independent of sex and age. Here, too, the morphology of the "egg forceps" appears quite promising as a structure associated with reproduction and, therefore, a more reliably genetically fixed character; unfortunately, it is inherent only in mature females.

KEY TO SPECIES OF GENUS CYSTISOMA

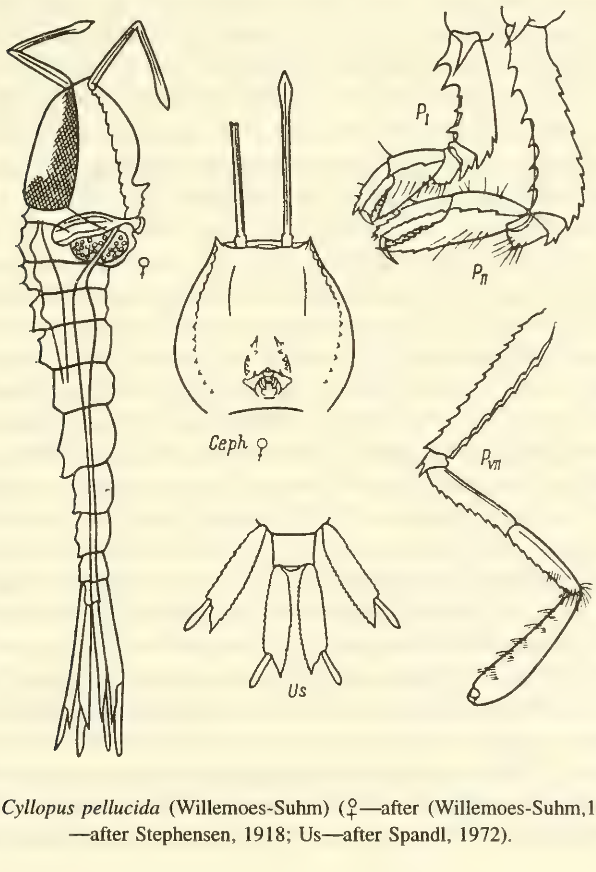
1. Mandibles with one central denticle; lateral denticles absent ...... 3.
— Mandibles with one central and one-two lateral denticles......... 2.
2. Pereopods thin, particularly pair V; 2nd segment of pereopods VII weakly broadened proximally .... 4. **C. longipes** (Bov.)
— Pereopods with broadened segments, particularly VI–VII; 2nd segment of pereopods VII pyriform, proximal width four times distal width ....5. **C. latipes** (Steph.)
3. Only two pairs of ventral denticles—anterior and glandular; denticles of arcuate rows not developed................. 3. **C. fabricii** Stebb.
— Four-six pairs of ventral denticles; denticles present in arcuate rows .... 4.
4. Adult females with highly developed glands in distal part of 6th segment of pereopods III–VII and also with apical glands on antennae I and exopodites of uropods; exopodites distinctly longer than endopodites; urosome with uropods longer than pleon .... 1. **C. pellucida** (W.-Suhm)
— Adult females without distinct glandular inclusions on antennae and extremities. Rami of uropods equal in length; urosome with uropods not longer than pleon......................... 2. **C. magna** (Wolt.)

1. Cystisoma pellucida (Willemoes-Suhm, 1874) (Fig. 121)

Willemoes-Suhm, 1874: 634 *(Thaumatops);* Woltereck, 1903: 452 *(Thaumatops)*; Stephensen, 1918: 64 (Thaumatops); Spandl, 1927: 172 *(Thaumatops)*; Barnard, 1932: 272; Pirlot, 1938: 364.—? neptunus Guérin-Ménewille, 1842: 215.—*longipes* type sp. B. Bovallius, 1889: 47 *(Thaumatops).—parkinsoni* Stephensen, 1918: 27 *(Thaumatops).*

Body length up to 85 mm.

The head is slightly more in length than height. The eyes occupy the dorsal and partly lateral surfaces, leaving free the relatively broad, slightly convex remaining part of the head. There are 13–15 marginal denticles. Antennae I in females are attached (lateral view) at the level of the lower border of the eyes or lower and their length is approximately the same as that of the head. The head in males is relatively lower and the antennae adjacent and much longer than the head. In females the
247 tip of the flagellum is bulged due to the presence of a highly developed



247 Fig. 121. *Cyllopus pellucida* (Willemoes-Suhm) (♀—after (Willemoes-Suhm,1864; P_{I-II} —after Stephensen, 1918; Us—after Spandl, 1972).

apical gland. The ventral denticles comprise four to seven pairs, more often five-six pairs. The mandibles have one highly developed central denticle.

The coxal spines of pereopods I–II are strong, long, and very acute. The 2nd segment of pereopods I is equal in length to the rest of the leg, with denticles present along the entire anterior margin and the distal part of the posterior margin; the process of the 5th segment is equal to the basal part of the segment or slightly longer than it, with denticulate margins, and extends to the base of the claw; the 6th segment has a straight denticulate posterior margin while the anterior margin is barely convex with two denticulate keels terminating distally in large denticles along both sides of the claw; the claw is evenly curved and slightly longer than 1/3 the 6th segment. The 2nd segment of pereopods II is just a little shorter than pereopods I and slightly longer than the rest of the leg; the 5th segment is distally broadened; the process on the posterior margin of the 5th segment is distinctly longer than the rest of the segment, its width at the base more than half the segmental width here, its margins denticulate, its tip extending to the base of the claw; the 6th segment is narrow, longer than the 5th, and its ornamentation similar to that in pereopods I; the claw is almost straight and 1/3 the
248 length of the 6th segment. The surface of the distal segments of both these pereopods bears sparse setae. The 2nd segment of pereopods III is carinate and equal to the whole pereopods II in length, being 10 times or more longer than wide, with strong denticles on the posterior margin and weakly denticulate anterior chela; the 4th and 5th segments are equal in length and coarsely denticulate posteriorly; the 6th segment is the same length as the preceding segments but narrower and more finely denticulate posteriorly, its distal end bulged in the mature female because of the developed gland; the claw is barely curved and about 1/5 the length of the 6th segment; the surface of the 4th–6th segments has sparse groups of thin setae. Pereopods IV are longer than pereopods III; the 2nd segment is slightly broader than successive ones; the 6th segment is longer than the 5th. Pereopods V are the longest due to elongation of the distale segments; the 2nd segment is denticulate on both sides and the distal denticle of the anterior margin reaches almost to the end of the 3rd segment;the 5th segment is longer than the 4th, anteriorly denticulate like it except for the narrowed distal part, evenly curved forward; the 6th segment is narrow, highly elongated, and in a folded condition reaches the middle of the 4th segment. Pereopods VI are shorter than pereopods V by half the length of their 6th segment. Pereopods VII have narrow 2nd–5th segments and extend to the end of the 4th segment of pereopods VI or are slightly longer; the 2nd segment is slightly constricted distally and five-six times longer than wide; the

4th and 5th segments are about 2/3 the length of the 2nd segment; the medial surface of the 5th–6th segments has transverse rows of thin setae; the 6th segment in mature females is bulged and clavate because of the highly developed gland, its maximum width occurring slightly before the distal end, the medial surface covered with setae, and the anterior prominence of the distal margin separated from the base of the claw by a notch; the base of the claw rises above the notch and the thick, deeply curved claw rests with its tip in the anterior prominence, thus closing the place for the egg.

The urosome (with uropods) is longer than the pleon. The basipodite of uropods I is four times longer than wide; the endopodite is short and proximally broad; the exopodite in females is much longer, in males slightly longer than the endopodite; in females it is almost half the length of the basipodites, distally bulged, but with an acute apex. The basipodite of uropods III is slightly broadened distally and the ratio of length to maximum width 3:1; the exopodite is slightly more than half the length of the basipodite.

Distribution: Widely distributed in the Atlantic (from 45° N to 35° S) and Indian oceans, and in the Indo-West Pacific. In the Pacific Ocean it was found off southern California and in the waters of Tasmania at 43° S, and 150° E.

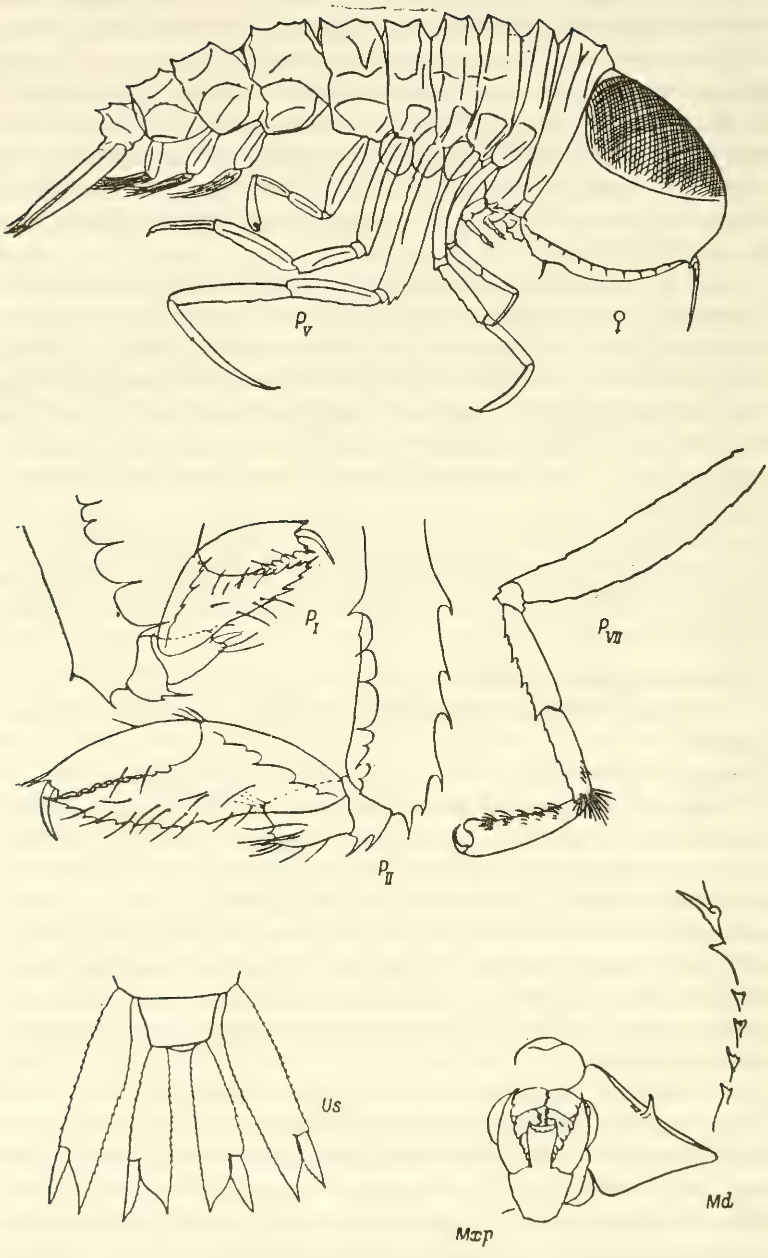
2. Cystisoma magna (Woltereck, 1903) (Fig. 122)

Woltereck, 1903: 455 (*Thaumatops*); Spandl, 1927: 171 (*Thaumatops).*

Length of females up to 140 mm, of males up to 70 mm.

The head in females is spherical, in males its height slightly exceeds its length. The eyes are dorsal, occupy only upper part of the smooth convex lateral surface. There are 10–14 marginal denticles. The ventral surface of the head is slightly convex but highly so in the region of two–six pairs of ventral denticles; the anterior denticles are very large while the glandular denticles do not differ from the subsequent ones. The mandibles have one strong short central denticle each. Antennae I (viewed laterally) are distinctly attached in the female below the lateral border of the eyes.

The pereon is significantly lower than the head, with a dorsal crest more raised than in other species. The coxal spines are shorter than in *C. pellucida.* The 2nd segment of pereopods I is almost the same length as the rest of the leg, its anterior margin denticulate and the posterior margin smooth; the 5th segment is convex anteriorly and bears two carines, its process is broad and denticulate and extends to the end of the 6th segment; the 6th segment is shorter than the 5th, its anterior margin convex and carinate, the posterior margin stright and denticulate;
249 the chelae of the 5th–6th segments are indistinctly denticulate, sometimes



249 Fig. 122 *Cystisoma magna* (Woltereck) (after Woltereck, 1903; P_{I-II}, Us—after Spandl, 1927).

smooth; the distal denticles on the 6th segment are large and project along the sides of the claw; the claw is half the length of the 6th segment. The 2nd segment of pereopods II is slightly longer than the remaining part of the leg, its posterior margin coarsely denticulate and slightly broadened distally; the 5th segment is elongated, the anterior margin convex and carinate; the width of the chelate process is more than half the maximum width of the segment, but the apex extends beyond the middle of the claw; the 6th segment is longer than the 5th, its anterior keels smooth or weakly denticulate and terminating in denticles along the sides of the claw, its posterior margin straight and denticulate; the chelate process somewhat more massive than 6th the segment; the claw is barely curved and about 1/3 the length of the 6th segment. Pereopods III–IV are long and narrow. The 2nd segment of pereopods III is the same length as the whole of pereopods II, slightly curved forward, its posterior margin distally denticulate; the 4th and 5th segments are the same size and together equal to the 2nd in length; the 6th segment is the same length as the preceding segments but narrower and with three sharp keels; the posterior margin of all three segments is denticulate, while the distal part of the 4th, the proximal part of the 6th, and the entire 5th segment bear transverse rows of resilient setae. Pereopods III extend only to the middle of the 5th segment of pereopods IV. The 2nd segment of pereopods IV is narrow and equal to the total length of the 2nd–4th segments of the preceding pereopods; ornamentation is the same as in pereopods III but the transverse rows of setae are more strongly developed on the 6th segment and, on the 5th segment, only in the distal part. Pereopods V are longer and more massive than the remaining ones; the 2nd segment is twice broader and 1.5 times longer than in pereopods IV, the distal part of the anterior margin bears low denticles, with the last denticle broad and overhanging the 3rd segment but not extending to its end; the 4th segment is half the 2nd in length while the 5th segment is 1.5 times longer than the 4th; both these segments bear denticles anteriorly; the 6th segment is narrow and somewhat longer than the 5th and curves forward evenly; the claw is small. Pereopods VI are shorter than V by approximately half the length of the 6th segment. Pereopods VII are almost half the length of the preceding pereopods; the 2nd segment is linear or slightly convex posteriorly, its margins weakly denticulate; it is somewhat longer than the 4th and 5th segments together; both segments are anteriorly denticulate, the 5th also bearing a fascicle of setae in its distal part; the 6th segment is narrow at the base and distally clavate; the medial surface of the 5th–6th segments bears transverse rows of setae. The "egg forceps" is formed by the anterior bulge of the distal margin of the 6th segment and the uncinate claw, attached to the raised posterior distal part of the segment; its base is inclined forward and an almost perfectly round pore is left between the claw and notch of the distal margin; the apex of the claw leans toward the anterior side of the bulge covering it and the maximum width of the segment occurs along the distal margin. In males the 6th segment is narrow and equal to the 5th segment.

The urosome (with uropods) is somewhat shorter than the pleon. The total length of the urosomites is equal to the length of the last somite of the pleon; urosomite II is slightly shorter than urosomite I. The rami of the uropods are equal in length and the basipodites are broad. The basipodite in uropods I is three times longer than wide, its margins denticulate; the rami are 1/4 the length of the basipodite; the endopodite is proximally very broad and distally sharply constricted and acute, while the exopodite is narrow. The basipodite of uropods III is distally broadened, its length four times the maximum width; the ratio of length of rami and basipodite is the same; the sides of the rami facing each other are finely serrate while the opposite sides bear low denticles.

Notes: Shoemaker (1945a) reported a find of 15 specimens of *Cystisoma* in the region of the Bermuda islands, which he identified as *C. magna* on the basis of Stephensen's (1918) and Barnard's (1932) keys. However, from the morphological notes of the author, it appears that an error has occurred in identification: as per the aforesaid keys, the given specimens should have been related to the species *C. longipes* which bears two spinules on each of the mandibles and up to 18 marginal denticles.

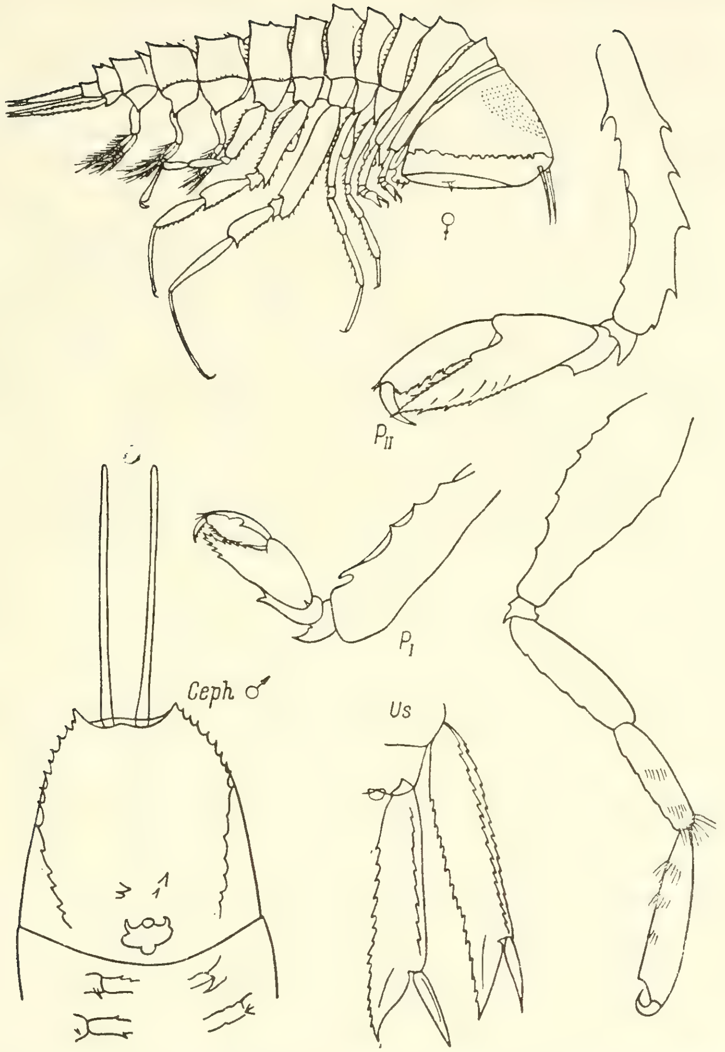
Distribution: Three reliable finds are known from the tropical part of the Indian Ocean (two females, one male) and one from the southern Atlantic (female). We obtained three adult females and one male—from the eastern equatorial and north central (27°03′N 117°52′W) parts of the Pacific Ocean. Thus the species may be considered as distributed in the warm waters of these three oceans.

251 3. ***Cystisoma fabricii*** Stebbing, 1888 (Fig. 123)

Stebbing, 1888: 1333; Woltereck, 1903: 457 (Thaumatops); Stephensen, 1918: 63 *(Thaumatops)*; Barnard, 1932: 272.—*loveni* Bovallius, 1889: 52 *(Thaumatops).—coalita* Woltereck, 1903: 457 *(Thaumatops).*

Length of females up to 80 mm, of males rarely more than 50 mm.

The head in females is slightly longer than wide, the dorsal side convex, the ventral side flat, slightly convex only in the region of the ventral denticles. In males the head is short and high (in lateral view almost wedge-shaped), obliquely truncate on the frontoventral plane, and convex in the region of the ventral denticles. Antennae I in females are shorter than the head, in males much longer; the antennal bases are contiguous; the flagellum is triquetrous and has an acute apex. There are 12–16 marginal denticles while the ventral denticles only two pairs: the



251 Fig. 123. *Cystisoma fabricii* Stebbing. (♀—after Bovallius, 1889; P_{I-II}—after Stebbing, 1888; Ceph ♂, Us—after Stephensen, 1918).

anterior denticles are highly developed and twice larger than the glandular; arcuate rows of denticles are absent. The mandibles have one central, very acute denticle, slightly curved medially.

252 The height of the somites of the pereon is significantly less than that of the head in females, but similar in males. The coxal spines are smaller than in *C. pellucida* but nonetheless quite distinct. The 2nd segment of

pereopods I is equal in length to the rest of the leg; the process of the 5th segment is large, denticulate, and extends almost to the base of the claw; the 6th segment is 1.5–2 times longer than wide; the margins of both the 5th and 6th segments are carinate and denticulate; the claw is more than 1/3 the length of the 6th segment. The 2nd segment of pereopods II is slightly longer than the other segments together, narrow, with three–four denticles on the carinate posterior margin, a denticulate anterior lateral keel, and smooth anteromedial margin (keels of pereopods I–II in *C. fabricii* more weakly developed than in *C. pellucida);* the length of the basal part of the 5th segment is more than the maximum width but less than the length of the chelate process extending beyond the base of the claw; the 6th segment is narrow, with convex anterior and straight denticulate posterior margin; it tapers slightly distally and is four times longer than wide; the anterior keels are denticulate, projecting with the denticles along the sides of the claw. The 2nd–5th segments of pereopods III–IV have a denticulate carinate posterior margin and a smooth anterior margin. The 2nd segment of pereopods III is approximately equal to the length of the 3rd–5th segments together, shorter than in pereopods II, and slightly curved forward; the 4th segment is shorter than the 5th; the 6th segment is narrower than, equal to, or slightly shorter than the 5th, with a weakly denticulate posterior keel; the surface of the 4th–6th segments bears transverse rows of resilient setae which are more highly developed in the distal part of the 5th segment; the claw is small and narrow. The proportions and ornamentation of pereopods IV are approximately the same but the leg itself is large, with the result that pereopods III hardly extend to the end of its 5th segment; the 6th segment in females is about equal to the 5th but in males considerably shorter. Pereopods V–VII have broadened proximal segments, especially in large individuals. Pereopods V constitute about 3/4 the body length of the crustacean; the 2nd segment is approximately six times longer than wide, its anterior margin distally with a sharp lobe extending to the end of the 3rd segment; the 5th segment is longer than the 4th but slightly shorter than the 2nd, its anterior margin denticulate and tapering distally; the 6th segment is longer than the 5th, narrow, without ornamentation, and bent forward at the base. Pereopods VI extend to the end of the 5th segment of pereopods V. The 2nd segment of pereopods VII is broadened proximally, its length in males and large females not more than three times the maximum width, in females smaller than 70 mm about four times the width; the margins are denticulate and proximally convex, and the width along the distal margin is half the maximum width; the 4th–6th segments are almost equal in size and the anterior margin weakly denticulate; in males the 6th segment is narrow, linear, and without projections and the claw small and barely curved; in females the 6th segment is distally broadened, somewhat bulged, and the distal part of the anterior margin terminates in an acute denticle not reaching the level of articulation of the claw; the latter originates from the projection of the posterior distal part of the segment and hence the notch between the denticle and the base of the claw is anteriorly truncate; the claw is short, very deeply curved, with its apex toward the middle of the notch, and does not extend to the anterior denticle (in very large females the denticle may be less prominent and the projection rounded).

The urosome is short and somewhat longer than the last somite of the pleon. The urosomites are equal in length but the last one narrower. The uropods have broad basipodites, their length in females 2.5–3 times, in males 3–4 times the width. The endopodites are highly broadened proximally; the exopodites are equal in length but very narrow and triquetrous. The margins of the basipodites and rami are denticulate; the rami of uropods I are about 1/3, of uropods III half the length of the basipodite.

Distribution: Found in the Atlantic Ocean between 50° S and 50° N, the tropical part of the Indian Ocean, and southwestern part (north of the Subtropical Convergence) and eastern equatorial part of the Pacific Ocean.

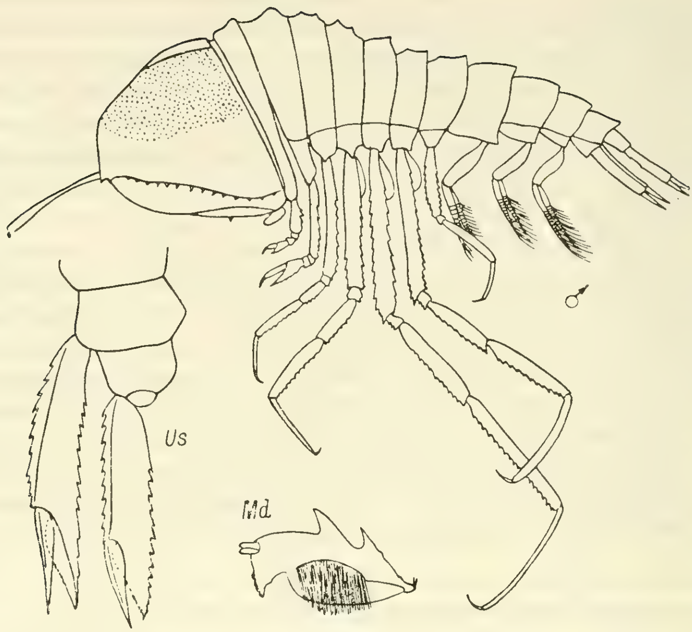
253 4. ***Cystisoma longipes*** (Bovallius, 1886) (Fig. 124)

Bovallius, 1886: 13 *(Thaumatops)*; 1889: 47 (*Thaumatops* spec. A, non B); Stebbing, 1888: 1327.—bovallii Woltereck, 1903: 457 *(Thaumatops);* Stephensen, 1918: 59 *(Thaumatops).*—africanum Barnard, 1916: 287.—magna (non Woltereck, 1903); Shoemaker, 1945a: 233.

Length of females up to 80 . mm; males are smaller.

The head in females is spherical. Marginal denticles are numerous, more so than in other species: 15–18, more often 16–17. The number of marginal denticles on the left and right, as in other species, is sometimes not equal. There are five–six pairs of ventral denticles; the anterior denticles are very large, glandular, almost not differentiated from the denticles of the arcuate rows. The mandibles bear two denticles: the large central one is acute and slightly curved medially and the lateral denticle, though similar to the central, is smaller and placed about midway between the central denticle and the place of attachment of the mandible; a third denticle sometimes occurs on the outer side (either as a tubercle as shown by Stephensen or as a developed denticle, as in the specimen in our collection).

Pereopods I–II have well-developed basal spines although these are shorter than in *C. pellucide*. The 2nd segment of pereopods I is longer than the rest of the leg and bears denticles on its anterior margin and in the distal part of its posterior margin; the 4th segment is asymmetrical, with a shortened anterior margin and an angular lobe posteriorly armed with setae; the 5th segment is elongated, the process coarsely denticulate and extends to the base of the claw; the 6th segment is anteriorly convex,



253 Fig. 124. *Cystisoma longipes* (Bovallius)
(♂, Us—after Bovallius, 1889; Md—after Stephensen, 1918).

has two denticulate keels that project with acute denticles along the sides of the claw, and is twice longer than wide; the claw is half the length of the 6th segment. The 2nd segment of pereopods II is longer than the rest of the leg and armed as in pair I; the denticulate process of the 5th segment is longer than its basal part and extends beyond the base of the claw; the 6th segment is four times longer than wide, more coarsely
254 denticulate posteriorly than anteriorly, and weakly curved; the claw is half the length of the 6th segment. The 2nd segment of pereopods III is narrow and longer than the 3rd–5th segments together; the 4th segment is shorter than the 5th, the 6th segment equal to it but narrower; all the distal segments are denticulate on the posterior side but the 5th–6th segments have transverse rows of setae on the surface. In pereopods IV the segments are approximately of the same proportions but longer. Pereopods V–VI are very long, pair V almost as long as the animal itself and pair VI shorter by the length of the last segment. The 2nd segment of pereopods V has denticulate carinate margins, is six-seven times longer than wide, and the anterior margin distally has a denticulate lobe overhanging the base of the 3rd segment; the total length of the 4th–5th segments is notably more than the length of the 2nd; the 4th segment is

shorter than the 5th and both have denticulate anterior margins; the 6th segment is narrow, equal to or slightly longer than the 5th segment. Pereopods VI are similar to pereopods V but all the segments are relatively shorter. Pereopods VII are short, not extending beyond the end of the 4th segment of pair VI. Unfortunately, the structure of the "egg forceps" of the mature female was not described because Bovallius worked with a young female (which he mistook for a male). According to the description of *C. africanum* given by Barnard, the "egg forceps" is similar to that in *C. pellucide*: the notch of the distal margin of the 6th segment is not deep and the deeply curved claw touches the apex of the process of the anterior margin; the segment itself is distally broadened.

Notes: Barnard (1916) described the species *C. africanum* based on a specimen with three denticles on the mandible but in other characters hardly distinguishable from *C. longipes*. Shoemaker (1945a), having at his disposal fifteen specimens of *C. longipes* (icredibly indentified by him as *C. magna*), mentions the often observed asymmetry in large females in number of denticles on the left and right mandibles—two and three. Hence the identification of the species *C. africanum* on the basis of three mandibular denticles can hardly be justified; moreover, Barnard himself remarks that a larger volume of material might lead to a change in the diagnosis of his species.

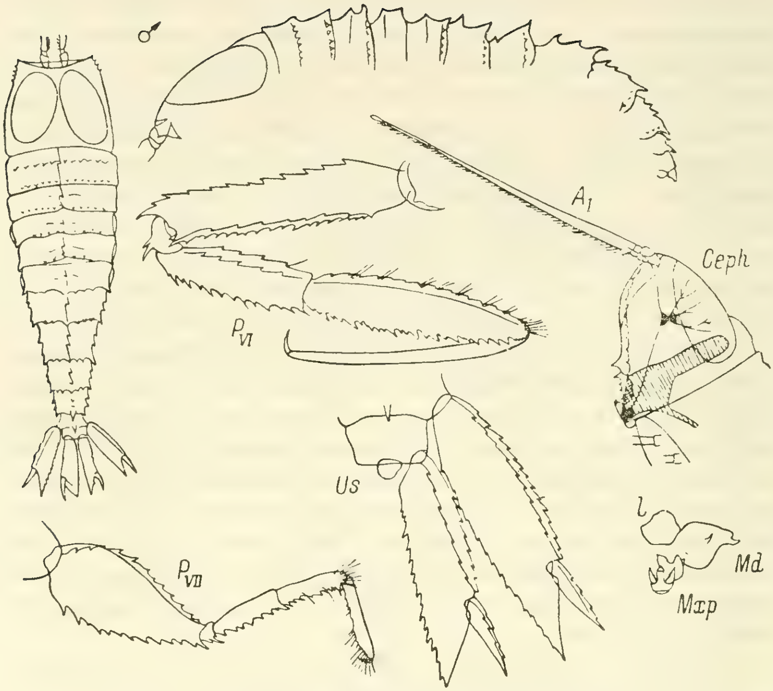
Distribution: The Atlantic Ocean from 57° N to 33° S, tropical region of the Indian Ocean, south-eastern and equatorial parts of the Pacific Ocean (30° S, 165° E; 7°40′ N 150° W).

5. ***Cystisoma latipes*** (Stephensen, 1918) (Fig. 125)

Stephensen 1918: 62 (*Thaumatops*); Pirlot, 1938: 86; 1939: 34.

Length of males up to 50 mm. Female not described. The head is not bulged, elongated, with straight (viewed from the top) frontal margin; its width is approximately equal to somite I of the pereon. The eyes are relatively small, not extending to the border with the pereon. Antennae I are adjacent at the base and much longer than the head; the base is two-segmented; the flagellum is not segmented, long, and pubescent on the inner side. The frontodorsal surface of the head is slightly convex; there are 14–15 pairs of marginal denticles and 5–6 pairs of ventral; the anterior denticles are small, almost indistinguishable from the adjacent glandular denticles. The mandibles bear two denticles; the central and lateral denticles located at the site of attachment of the mandibles.

The pereon has a low dorsal keel. The coxal spines of pereopods I–II are low prominences. The pereopods are broader and more massive than in other species, especially pereopods VI–VII. The 2nd–5th segments of pereopods VI are almost equal in width, equal in length, and have denticulate margins; the 2nd segment is uniformly broadened while the maximum width of the 5th occurs in the middle, and the length of each



255 Fig. 125. *Cystisoma latipes* (Stephensen) (after Stephensen, 1918).

segments is almost 4.5 times the width; the 6th segment is narrow and slightly longer than the 5th. Pereopods VII are about half the length of pair VI; the 2nd segment is broadened (pyriform), its maximum width (in proximal 1/3) four times the width along the distal margin, its length
255 about twice the maximum width; the 4th–6th segments are narrow, equal in length, have a denticulate anterior margin, with dense setae in the distal part of the 5th and a few rows of setae on the 6th segment; the claw is short and not more than 1/5 the length of the 6th segment.

The urosome is short and together with the uropods not longer than the pleon. The uropods are broad, with denticulate basipodites whose length is 2.5 times the width. The basipodite of uropods I attains maximum width in the middle, of uropods III-distally; the rami are approximately equal in length, in uropods I not more than half the length of the basipodite and in uropods III, 2/3.

The description given is after Stephensen (1918).

Distribution: Four catches of this species (males) are known—all from between 30° and 50° N in the Atlantic Ocean.

Absent in our collection.

X. Family PARAPHRONIMIDAE Bovallius, 1887

Crustaceans of average size (up to 30 mm), with a transparent body integument. The head is very large, roundish-cubical, without rostrum, and almost entirely occupied by the eyes, which imparts a resemblance to *Phronima* (reflected in the family name). Antennae I are attached to the frontal part of the head and are similar in both sexes: the base is three-segmented and the flagellum has one segment, better developed in males. Antennae II are directly attached before the oral appendages and very short in females but longer than the head in males. The oral appendages are highly reduced. The mandibles have neither palp nor dentate process. Maxillae I lack an inner lobe. Maxillae II have broad and low lobes. The maxillipeds have inner and outer lobes which are fused and form a single broad plate.

The somites of the pereon are free. Pereopods I–II are very short, pereopods I have a weak subchela, and pereopods II are simple. Pere-
256 opods III–VI are simple and barely differentiated in size. Pereopods VII are slightly shorter than the preceding pairs and have a claw-shaped 7th segment. The gills are located on somites II–VI and the oostegites on somites II–V of the pereon. The pleon is slightly shorter than the pereon, its segments equal to or more than the somites of the pereon in height. The rami of the uropods are free. The telson is small. The border between the fused urosome somites II–III is not discernible.

The family includes one genus.

1. Genus *Paraphronima* Claus, 1879

Claus, 1879: 64; Chevreux and Fage, 1925: 389; Pirlot, 1929: 104.

The head in relation to the pereon projects markedly on the ventral side and is longer than the first three somites of the pereon. The eyes are subdivided into dorsal and ventral (lesser in volume) parts but not as distinctly as in *Phronima*. Antennae II in males have elongated basal and terminal segments. The mandibles resemble a rhombic plate with a slightly concave posterior margin and a "functional part" (consisting of the denticulate cutting plate and a row of setae) shifted to the anterior medial angle. The maxillipeds consist of a basal segment and single distal lobe, which is much broader, with convex lateral margins, and an almost straight distal margin with a small wedgeshaped notch in the middle.

The pereon somites are low and elongate gradually in the posterior direction. The coxal plates are partially or fully fused with the corresponding somites. Pereopods I have a prehensile distal part: the projections of the posteior margin of the 4th and 5th segments form a weak double subchela. Pereopods III–VI are long, with linear segments and small claws. Pereopods VII are hardly differentiated from the preceding legs in size; the distal segments are shorter than in pereopods VI. The pleopods have a massive base and very short rami. The urosome is short and about equal in length to somite III of the pleon. The rami of the uropods are much shorter than the basipodites.

The genus includes two species which are quite close.

Type species: *Paraphronima gracilis* Claus, 1879.

KEY TO SPECIES OF GENUS PARAPHRONIMA

1. Pereopods VII extend to end of 5th segment of pereopods VI. Length of head slightly less than its height. First two somites of pereon small, their total length about equal to length of somite III .... 1. ***P. gracilis*** Claus

— Pereopods VII almost same length as pereopods VI. Length of head slighty more than height. First four somites of pereon about equal in size .... 2. ***P. crassipes*** Claus

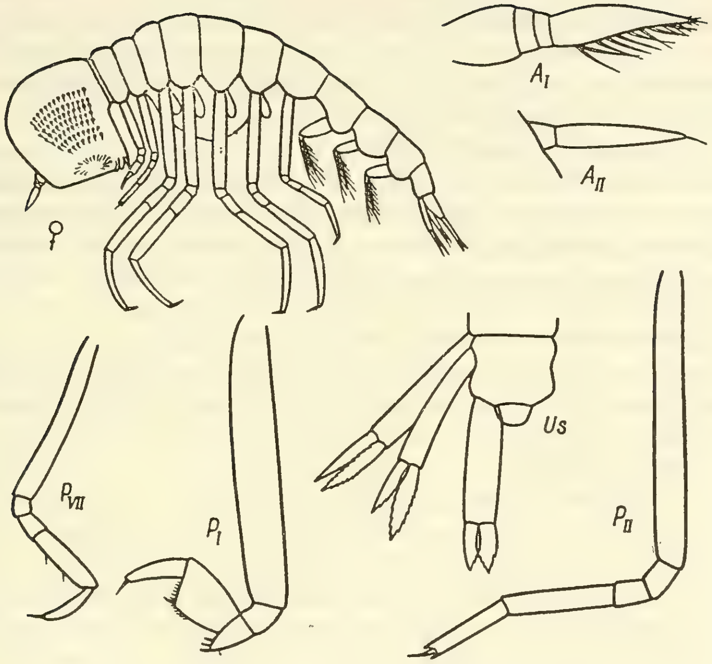
1. ***Paraphronima gracilis*** Claus, 1879 (Fig. 126)

Claus, 1879: 65; Bovallius, 1887b: 27; Chevreux and Fage, 1925: 391; Spandl, 1927: 165.—*edwardsi* Bovallius, 1885b: 12.

Length of females up to 16.5 mm, of males up to 11 mm; the usual length of sexually mature specimens is about 10 mm.

The head is disproportionately large and massive compared to the thin body and weak extremities, its length exceeding the total length of somites I–IV of the pereon, and its height slightly more than the length and more than twice the height of the pereon somites. Antennae I in
257 females are at least 1/3 the head in length and the single segment of the flagellum does not differ in width from the segments of the peduncle, while in males it is broadened and elongated but the whole antenna slightly shorter than the head. Antennae II in females are two-segmented, but in males with a highly elongated 1st segment in the peduncle.

Somites I–II of the pereon are approximately equal in total length to somite III; somite VII is shorter and lower than the preceding ones and its length twice its height. The coxal plates of all pereopods in males are fused with the pereon but in females the coxae of pairs II–V are free. Pereopods I and II are very small and their 2nd segment is narrow. The 4th segment of pereopods I forms in the posterior distal part a spoon-shaped projection with several setae along the margin; the 5th segment is distally broadened and its length about twice its width; the 6th segment is narrow, slightly shorter than the 5th, and movably articulated with its anterior distal angle in such a way that in a bent position it forms a sort of weak double subchela; the claw is very short and thickened at the base. Pereopods II are simple and have narrow



257 Fig. 126. *Paraphronima gracilis* Claus (after Bovallius, 1889).

virgate segments. Pereopods III–VI have a long narrow 2nd segment and long 5th–6th segments. Pereopods VII are shorter and somewhat narrower than the preceding ones but in general similar to them.

The pleon is shorter than the pereon by about the length of the first three somites of the pereon; somite I of the pleon is lower and slightly longer than the other two. The urosome is shorter than the pleon; urosomite I is equal in length to the last (geminate) urosomite. The basipodites of all the uropods are approximately equal in length or that of uropods III is slightly shorter; the width of the basipodites noticeably increases from pair I to pair III so that the ratio of length to width of the basipodite pair I is approximately 7 : 1, in pair II, 4 : 1, and in pair III, 3 : 1. The rami of all uropods are considerably shorter than the basipodites. The exopodite of uropods I is narrow and shorter than the endopodite. the exopodite of pair II is slightly shorter but distinctly narrower than the endopodite, which, in turn, is approximately two times narrower than the basipodite. The rami of uropods III are very short, proximally broad, their maximum width slightly less than the length. The telson is almost three times narrower at the base than the distal margin of the last urosomite.

258 *Distribution*: Tropical and subtropical waters of the three oceans; it does not occur beyond the limits of the Subtropical Convergences. It has also been recorded from the eastern part of the Mediterranean Sea. It is found up to a depth of 500 m, rarely deeper, and possibly undergoes in diurnal vertical migrations (Brusca, 1967a).

Reproduction probably takes at the end of the summer, in autumn, when the sex ratio in the population equalizes and the greatest number of females with eggs is found. The pereon of the egg-bearing females is usually highly bulged and the brood chamber well noticeable in a lateral view because not covered by the coxal plates.

2. ***Paraphronima crassipes*** Claus, 1879 (Fig. 127)

Claus, 1879: 65; Bovallius, 1889: 33; Vosseler, 1901: 97; Chevreux and Fage, 1925: 390; Spandl, 1927: 166; Pillai, 1966: 210.—*clypeata* Bovallius, 1885b: 11; 1889: 33.—*pectinata* Bovallius, 1885b: 13.—*cuivis* Stebbing, 1888: 1337.

Adult females may reach 31 mm and males 24 mm; the usual size is up to 24 and 20 mm respectively.

The head is very large, but as the body is more massive than in *P. gracilis*, the disproportion between size of head and body is less conspicuous. The head is slightly more in length than in height but does not exceed the total length of somites I-IV of the pereon. The head in males

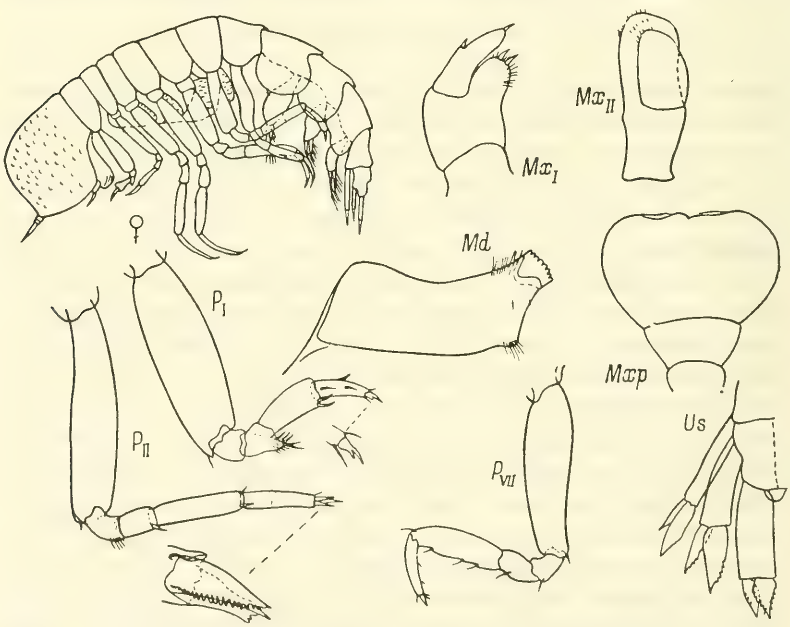


Fig. 127. *Paraphronima crassipes* Claus (♀, Us—after Chevreux and Fage, 1925; Mx_{I-II} Mxp, Md—after Bovallius, 1889; P_{I-II}, VII—after Pillai, 1966).

is rounder and relatively smaller than in females. Antennae I are similar to those of the preceding species. Antennae II in females are equal to antennae I in length.

Somites I–IV of the pereon are almost identical in size; somites V–VII are somewhat longer. Somite VII is the longest. The legs are better developed than in *P. gracilis* and have a slightly broadened 2nd segment. Coxal plates II–V are free in females. The 2nd segment
259 of pereopods I is longer than the rest together, its length three times its width, and the margins slightly convex; the 4th segment forms in the posterior distal part a spoon-shaped projection armed with spiniform setae; the 5th segment is twice longer than wide, its anterior margin convex and the posterior margin straight; the segment broadens distally and its projecting posterior distal angle bears spines; the 6th segment is narrow, equal to or slightly shorter than the 5th, and when bent may form with it a weak subchela; the claw is small and thickened at the base. Pereopods II are barely longer and narrower than pereopods I; the 2nd segment is narrow, four times longer than wide, and approximately equal in length to the rest of the leg; the 6th segment is narrower and longer than the 5th segment; the claw has a triangular lobe at the base, comparable to it in size and denticulation of the margin facing the claw. Pereopods III–IV are identical; the 2nd segment is somewhat shorter than the next three segments together; the 5th segment is 3.5 times longer than wide; the 6th segment is narrower and shorter than the 5th segment; the claw is small. Pereopods V–VII are also identical; the 2nd segment is approximately three times longer than wide; the rest of the segments are of the same proportions as those of the preceding pairs. Pereopods VII, if shorter than pereopods VI, only slightly so; the 2nd segment is somewhat longer than the analogical segment of pair VI, with a straight or slightly concave anterior and barely convex posterior margin; it is equal to or somewhat shorther than the rest of the leg.

The pleon and urosome together are equal to the pereon in length. The somites of the pleon are higher than those of the pereon and project downward more; the large bases of the pleopods impart more massiveness to the pleon. The urosomites are approximately equal in length. The basipodites of the uropods are equal in length, but the width increases from pair I to III; the ratio of length to width in pair I is approximately 4 : 1, in pair II, 2.5 : 1, and in pair III, 2 : 1. The exopodite of uropods I is spiniform and about 1/3 shorter than the lanceolate endopodite, whose length is more than half that of the basipodite. The exopodite of uropods II is narrowly lanceolate, about half as narrow and slightly shorter than the broad endopodite, whose length is also more than half that of the basipodite. The rami of uropods III are equal in length, shorter than half the basipodite, broadened proximally, and with acutely stretched apices.

Distribution: Widely distributed in the tropical and subtropical waters of the three oceans as well as in the Mediterranean Sea. It penetrates far into the temperate latitudes: up to 42° N. in the Atlantic Ocean and 52° N. in the Pacific Ocean. In the Southern Hemisphere it rarely penetrates up to the Antarctic Convergence. It lives in a wide range of depths (0–1,600 m); however, it is rarely found at depths greater than 500 m and occurs more often in the 50–500 m layer. There are references to its diurnal vertical migrations (Brusca, 1967a; Thurston, 1976b). The main reproduction period is probably in autumn, though females with eggs are found throughout the year (Brusca, 1967b).

SUPERFAMILY PHRONIMOIDEA DANA, 1852

The antennae originate from the frontal part of the head, are short in females and long and filiform in males. Chelae or subchelae may be developed not only on pereopods I–II, but on other pairs also; pereopods V often have the strongest ornamentation. As an exception (family Dairellidae), all the pereopods are simple. The telson is free.

XI. Family HYPERIIDAE Dana, 1852

The body is generally darkly pigmented. The head is large, spherical to a variable extent, but always higher and longer than somite I of the pereon.
260 The eyes are generally very large, occupy most of the lateral surface of the head, and dorsally touch each other; as an exception they are small but still distinct and darkly pigmented (genus *Bougisia*). antennae I are well developed; the flagellum has a large conical proximal segment, the distal part in females is usually short and often not segmented, while in sexually mature males it is multisegmented, long, and thin. Antennae II are relatively short and reduced to a variable extent in females, but in males generally have a thin multisegmented flagellum and are barely shorter than antennae I. The mandibles, with some exceptions, have a three-segmented palp, that may be absent in females, and always have a developed (sometimes strongly) dentate process. Maxillae I have a one-segmented flat palp while maxillae II are bilobate. The maxillipeds have narrow outer lobes and are reduced to a variable extent.

The pereon somites are free or somites I–V may be fused. The coxal plates are free or fused with the pereon. Pereopods I and II are simple, with a subchela or chela, and always with a broadened 5th segment. Pereopods V are simple or have a poorly developed subchela formed by the short claw and the 6th segment. The gills are located on somites II–VI and the oostegites on somites II–V of the pereon. The uropods have free rami. the telson is small or medium in size, but always shorter than the basipodite of uropods III.

The family Hyperiidae was separated in 1852. Bovallius (1889) gave a detailed description of each of the species known at that time. In spite of the fact that a number of researchers worked on the taxonomy of the family Hyperiidae (Vosseler, 1901; Stephensen, 1924; yang, 1960; and others), it was not subjected to a serious revision for a long time. Consequently, the synonymy of the whole family and the main genera (first and foremost, of all *Hyperia* and closer genera) became highly confused, a situation further aggravated by sharply expressed sexual and, in some groups, age-related dimorphism. The genera *Parathemisto* and *Hyperia* were revised by Bowman in 1960 and the whole family in 1973. In the process, with adequate reasons, a number of new genera were identified and the composition of other genera was changed. We have followed the basic generic characteristics proposed by Bowman and subscribe to his diagnoses.

The contemporary family Hyperiidae includes 14 genera.

KEY TO GENERA OF FAMILY HYPERIIDAE

1. Eyes large, occupy almost entire lateral surface of head .... 2.
— Eyes small, less than 1/4 height of head .... 8. ***Bougisia*** Laval.
2. All somites of pereon free. Coxal plates free, not fused with somites of pereon .... 3.
— Somites I and II, sometimes even other somites of pereon completely or only dorsally fused. Coxal plates fused with somites of pereon .. .. 9.
3. Interantennal lobe almost not developed. Eyes distinctly faceted. First segment of flagellum of antennae I in females conical, almost straight .... 4.
— Head with highly developed interantennal lobe. Eyes not faceted. First segment of flagellum of antennae I in females petaloid, curved like a boomerang .... 7. ***Pegohyperia*** Barn.
4. Body and extremities smooth, glabrous. Coxal plates flat .... 5.
— Body and at least pereopods I and II covered with thin short setae. Anterior coxal plates with projecting pectinate fold ....3. ***Iulopis*** Bov.

261 5. Distal process of 5th segment of pereopods I and II almost identical in structure and length .... 6.
— Distal process of 5th segment of pereopods II better developed than in pereopods I .... 7.
6. Distal process of 5th segment in pereopods I and II knife-shaped, constricting distally and stretched into a cusp ....4. ***Hyperoche*** Bov.

— Distal process of 5th segment of pereopods I and II petaloid, broad, not tapering distally, almost rectangular .... 5. ***Laxohyperia*** Vinogradov and Volkov, gen. n.
7. Pereopods III and IV simple .... 8.
— Pereopods III and IV with subchela formed by broadened 5th and slightly curved virgate 6th segment ....6. ***Parathemisto*** Boeck
8. Pereopods III–VII approximately equal in length or III–IV slightly longer than V and VI ....1. ***Hyperia*** Latr.
— Pereopods V or V and VI longer than III and IV .... 2. ***Hyperiella*** Bov.
9. First two somites of pereon fused in sexually mature females and males .... 12.
— First three, four, or five somites of pereon fused in sexually mature females; first two, three, or four somites fused in sexually mature males .... 10.
10. Pereopods V–VII approximately equal in length although pereopods VI may be somewhat longer than V or VII. Length of telson approximately equal to width at base..... 10. ***Lestrigonus*** M.-Edw.
— Pereopods V much shorter or much longer than pereopods VI and VII. Telson very short .... 11.
11. First three somites of pereon fused in both sexes. Pereopods V much shorter than VI and VII .... 13. ***Hyperionyx*** Bowm.
— First five somites of pereon fused in both sexes. Pereopods V significantly longer than VI and VII ....12. ***Themistella*** Bov.
12. Pereopods II with strong chela formed by process of strong 6th segment and claw. Pereopods III– VII prehensile .... 14. ***Phronimopsis*** Claus
— Pereopods II with weak chela formed by distal processes of 5th and 6th segments. Pereopods III–VII not prehensile 13
13. Antennae II of females relatively long, curved. Mandibles with denticulate cutting margin. Maxillipeds with well-developed inner lobe. Exopodite of uropods III with denticles on outer margin ....9. ***Hyperioides*** Chevr.
— Antennae II in females rudimentary. Mandibles with smooth cutting margin. Maxillipeds with rudimentary inner lobe. Exopodite of uropods III with smooth outer margin .... 11. ***Hyperietta*** Bowm.

1. Genus *Hyperia* Latreille, In Desmarest, 1823

Desmarest, 1823: 138; Bowman, 1973: 5.

Medium size crustacenas, 10–30 mm in length.

The body is strong, with broadened pereon, especially in females. All somites of the pereon are free. The head is large, spherical and without rostrum. The eyes occupy almost the entire surface of the head.

Antennae I have a three- segmented peduncle; the proximal segment of the flagellum is long and conical. Antennae II of females are four- to five-segmented. The mandibles have a strong cylindrical dentate process and a palp is present in both sexes. In maxillae I the outer lobe bears five terminal spinules. In the maxillipeds the inner lobes are well
262 developed and generally bear two terminal setae. The coxal plates are free. The distal process of the 5th segment of pereopods I forming a chela is weakly developed, but in pereopods II is well developed and spoon-shaped. Pereopods III–IV are longer than V–VII.

Type species: *Cancer medusarum* O.F. Müller, 1776.

The genus includes seven species, some of which are very close and difficult to distinguish.

KEY TO SPECIES OF GENUS HYPERIA[1]

1. Marginal and submarginal setae along posterior margin of 5th and 6th segments of pereopods III–IV unequal in length and may even be absent on 6th segment .... 2.
— Setae along posterior margin of 5th and 6th segments of pereopods III–IV equal in length, short........ 4. ***H. spinigera*** Bov.
2. Outer lobes of maxillipeds oval, armed with short setae along entire inner margin .... 3.
— Outer lobes of maxillipeds sharply taper distally; long, strong spines situated along their inner margin, replaced by short setae only in proximal third .... 6.
3. Coxal plate IV not acuminate, not protruding laterally. Distribution not confined to the Antarctic .... 4.
— Coxal plate IV acuminate, protruding laterally in adult individuals. Distribution confined to the Antarctic .... 3. ***H. macrocephala*** (Dana).
4. Endopodite of uropods III twice or more times longer than wide... .... 5.
— Endopodite of uropods III less than twice longer than wide .... 5. ***H. crassa*** Bowm.
5. Posterior margin of 6th segment of pereopods I and II covered with spines ....2. *H. medusarum* (Müller).
— Posterior margin of 6th segment of pereopods I and II not covered with spines .... 1. ***H. galba*** (Mont.).

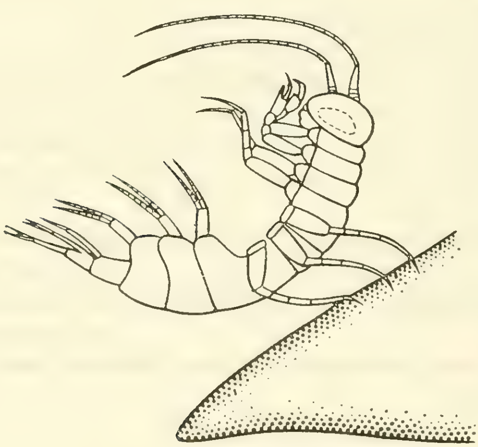
[1] After the book had gone to press, we found a new species, Hyperia sp., close to *H. leptura*, which lives in large numbers on the jelly fish *Chrysaora placamia* in the coastal 200-mile zone of northern Peru. (See addendum).

6. Distal process of 5th segment of pereopods II does not extend to half length of 6th segment. Inner lobes of maxillipeds apically bear one spine. Sixth segment of pereopods V–VII not armed ....
.... 6. ***H. leptura*** Bowm.

— Distal process of 5th segment of pereopods II extends more than half length of 6th segment. Inner lobes of maxillipeds bear two spines apically. Sixth segment of pereopods V–VII bears submarginal row of long setae, especially well developed in pereopods VII ....
.... 7. ***H. bowmani*** Vinogr.

263 All species of *Hyperia* as well as those of some other genera of the family Hyperiidae live on jellyfish or ctenophorans as ectoparasites and commensales. They feed on the residual food of the jellyfish (Hollowday, 1948; and others) and eat away their tissues: tentacles, oral part, manubrium (Browman *et al.*, 1963; white and Bone, 1972; Sheader, 1974), and gonads (Romanes, 1877; Metz, 1967). Young *H. galba* and *H. macrocephala* were found which had penetrated into the mesogloea right up to the gastrovascular system of the jellyfish (Metz, 1967).

Direct observations on the male *H. galba* revealed that the crustaceans attach themselves on the dorsal surface of the bell of the jellyfish, close to its edge after turning back on it, and remain attached by pereopods V–VII (Fig. 128). The crustaceans pass most of their time in such a position (Bowman *et al.*, 1963) and thus can grab the catching filaments or oral tentacle of the jellyfish with their free pereopods and eat them. Probably, such a nature of feeding is associated with the



262 Fig. 128. Characteristic pose of male *Hyperia galba* on the bell of a jellyfish (after Bowman and Gruner, 1973).

presence of a large number of nematocysts in the gut of the crustaceans. Different species of Hyperia are associated with different species of jellyfish. For example, the cold-water *H. galba* is generally found on the scyphomedusae *Cyanea arctica* (= *C. capillata*), but in some regions on *Aurelia aurita, Rhizostoma octopus, Pelagia* or *Chrysaora*, while its young have additionally been found on hydromedusae *Melicertum* and on ctenophores *Beroe*. *Hyperia medusarum* lives on the same species
264 of medusae. In the North Atlantic *H. spinigera* lives exclusively on the deepwater jellyfish *Periphylla periphylla* from the order Coronata, but the Antarctic *H. macrocephala* lives on the jellyfish *Desmonema gaudichaudi* (Thurston, 1977).

1. ***Hyperia galba*** (Montagu, 1815) (Figs. 129, 130)

Montagu, 1815: 4 (*Cancer gammarus*); Guérin, 1825: 771; Bovallius, 1889: 180; Stephensen, 1923: 17; 1924: 81; Chevreux and Fage, 1925: 401; Dunbar, 1963: 3; Schellenberg, 1942: 241; Bowman, 1973: 10.—*spinigera* (non Bovallius, 1889): Norman, 1900: 129.

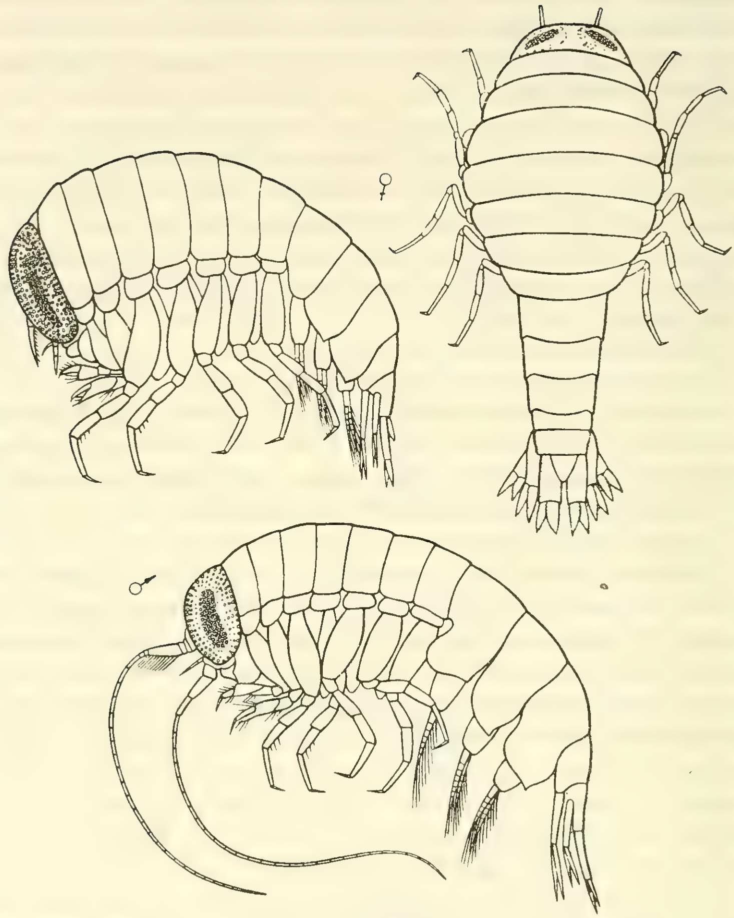
Length of sexually mature specimens 10–24 mm.

The head is shorter than somites I and II of the pereon together. The lower posterior angle of epimeron III terminates in minute denticles; its posterior margin is quite convex. The outer lobes of the maxillipeds bear several short setae along the inner margin; the inner lobes are 3/4 the length of the outer lobes. The 5th and 6th segments of pereopods I–II are surfacially covered with numerous setae. The 5th segment of pereopods III–IV bears a few short setae; the posterior margin of the 6th segment is unarmed, denticulate. The 2nd segment of pereopods V–VII is quite narrow, in pereopods V without setae, but in pereopods VI and VII with a fascicle of setae in its distal angle.

Distribution: An Arctic-boreal, far-neritic species; it lives in the seas of the Polar basin and North Atlantic, including the Baltic Sea, penetrating south up to Chesapeak Bay along the western coast and up to the coasts of England, Spain, and the Azore Islands along the eastern coast. In the Pacific Ocean it penetrates up to the coasts of Hokkaido along the western coast and up to Alaska and Kodiak along the eastern coast. References to finds of *H. galba* in the tropical and notal regions are obviously erroneous.

2. ***Hyperia medusarum*** (O.F. Müller, 1776) (Fig. 131)

Müller, 1776: 196 (*Cancer*); Bovallius, 1889: 147; Stephensen, 1923: 15; Bowman, 1973: 6.—*latreillei* Milne-Edwards, 1830: 388;
266 Bovallius, 1889: 164.—*gaudichaudi* Milne-Edwards, 1840: 77; Bate, 1862: 289 (*Lestrigonus*); Stebbing, 1888: 1394; Bovallius, 1889: 175; Dick, 1970: 55; Bowman, 1973: 13.—*hystrix* Bovallius,

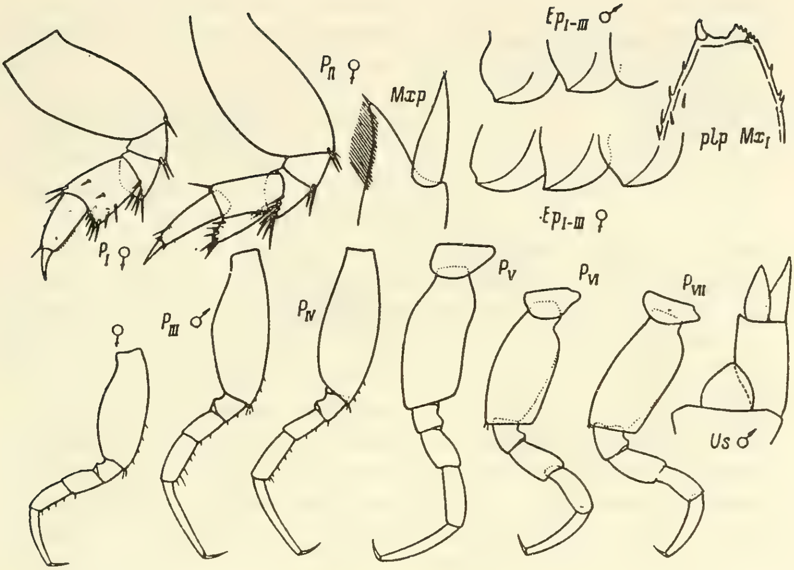


263 Fig. 129. *Hyperia galba* (Montagu) (after Sars, 1890).

1889: 159.—*spinigera* (non Bovallius, 1889); Barnard, 1930: 412; Thorsteinson, 1941: 87.

Length of sexually mature specimens in the Arctic seas up to 20 mm, in Antarctic waters exceeds 20 mm, and in the remaining part of the species' area of distribution ranges from 9–15 mm.

The head is equal in length to the first two somites of the pereon. The interantennal lobe is developed to a variable extent. The flagellum of antennae I in females is uncinate, but in antennae II very thin. The length ratio of the segments of the palp of the mandibles is 10:17:21 and the distally tapering 3rd segment is almost straight.



264 Fig. 130. *Hyperia galba* (Montagu) (after Bowman, 1973).

The 6th segment of pereopods I and II bears many strong setae on the lateral surface; this ornamentation is especially well developed in large specimens. In f. *medusarum* the setae extend to the apical end of the claw while in f. *hystrix* they are relatively shorter and the claw is longer. The posterior margin of the 6th and 7th segments is denticulate; this denticulation, however, is not readily discernible in f. *medusarum* because masked by the setae and unevenness of the posterior margin. The distal part of the 4th and 5th segments of pereopods III–IV bears a row of long and short spines, the long spines extending to half the width of the segment; in males these spines are fewer and may even be totally absent on the 4th segment; the 6th segment is finely denticulate, the anterior margin generally not armed, but sometimes bears a few spinules. Pereopods V–VII are approximately equal in length in females but in males pereopods V are somewhat longer than the identical pereopods VI and VII. The lower posterior angles of the epimerons are produced into denticles, especially well developed in epimeron III.

Notes: Populations from different regions of the area of distribution exhibit small morphological differences. Individuals from the Polar Basin, Bering Sea, and the Pacific Ocean coast of Canada (typical *H. medusarum*) are much larger, with much longer setae on pereopods I and II. Populations from the southern part of the area of distribution (for example, coastal areas between San Diego and Vancouver and off Japan)

265 Fig. 131. *Hyperia medusarum* (O.Müller).

Dotted portion—shape of *medusarum*; rest—shape of *hystrix* (after Bowman, 1973).

are smaller and exhibit morphological differences which led Bovallius (1889) to describe them as a separate species, *H. hystrix.* Stephensen (1924) studied the syntypes of Bovallius and treated *H. hystrix* as a synonym of *H. medusarum.* bowman (1973) analysed vast material and found specimens incorporating characters of both forms, which compelled him to support the opinion of Stephensen. Living in notal waters, *H. gaudichaudi* M.-Edw. is morphologically identical to the northern H. medusarum f. *hystrix* and recognition of its specific separate identity can only be based on its scattered area of distribution.

Distribution: A bipolar species. Cold-water and moderately cold-water regions for both Hemispheres. It is more oceanic than *H. galba* and is absent in the Baltic Sea. In the Atlantic Ocean it is not found farther south than the North Sea, but in the Pacific Ocean along the American coast is common up to 30° N. In the Southern Hemisphere it is found in the southern coastal areas of Africa, Australia and South America (to 8° S 80° 32′ W on the Pacific coast). There are doubtful references about its occurrence in the Ross Sea.

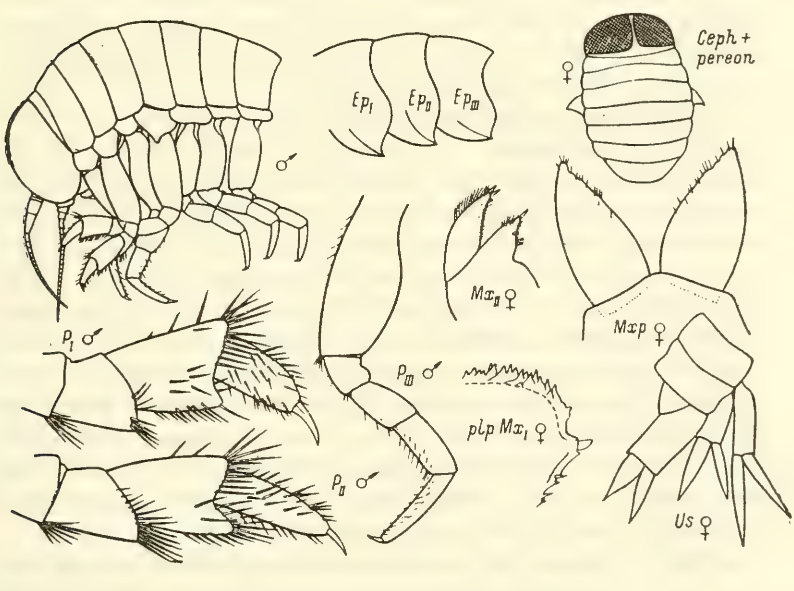
3. ***Hyperia macrocephala*** (Dana, 1853) (Fig. 132)

Dana, 1853: 988 (*Tauria*); Bate, 1862: 296; Bovallius, 1889: 81 (*Tauria*); Spandl, 1927: 156; Shoemaker, 1945b: 291; Bowman, 1973: 13.

Length of adult specimens up to 29 mm.

The height of the head is more than half the length of the pereon and its length equal to somites I and II together. Antennae I and II in females
267 are approximately equal in length and half the height of the head. The outer lobes of the maxillipeds are armed with only short setae and the inner lobes are shorter than the outer.

Coxal plates IV in adult specimens are acute and project sideward. Pereopods I and II are approximately equal in length; the 2nd segment is broadened; the 3rd and 4th segments are short and the posterior distal angle of the 4th produced into a small lobe, which is better developed in pereopods II; the 5th segment is broadened, with a straightly truncate distal margin, and obconical; the 6th segment is approximately equal to the 5th in length but much narrower; the claw is straight. Pereopods III and IV are much longer than pairs I and II; the 2nd segment is broadened;



267 Fig. 132. *Hyperia macrocephala* (Dana)

(♂—after Shoemaker, 1945b; ♀—after Bowman, 1973).

the 5th segment is somewhat shorter than the 3rd and 4th segments together; the 6th segment is narrower but distinctly longer than the 5th; the claw is straight, thin, 1/4 to 1/3 the length of the 6th segment, and its anterior margin finely denticulate. Pereopods V and VI are approximately equal in length, pereopods VII somewhat shorter; the 2nd segment is broadened in the distal part, especially so in pair VI; the 5th segment is longer than the 4th (in pairs V and VII) or equal to it (in pair VI); the 6th segment is narrower and longer than the 5th; the claws are short and strong; setae, except for small fascicles on the anterior lower angle of the 2nd segment, are absent. The posterior angles of the epimerons are acute and the posterior margin of epimeron III is highly convex.

Uropods I are longer than uropods II or III, their inner ramus equal to the peduncle and the outer ramus shorter. The rami of uropods II are somewhat longer than the peduncle. Uropods III have a broad peduncle and petaloid rami. The telson is roundish-triangular, its length equal to width in males and less than width in females.

Distribution: A high Antarctic species, found in the coastal regions of the Antarctic (Oates Coast; McMurdo sound in the Ross Sea) and environs of the South Georgia Islands.

Absent in our collections.

268 4. ***Hyperia spinigera*** Bovallius, 1889 (Fig. 133)

Bovallius, 1889: 191; Barnard, 1932: 273 (part. female = *H. crassa*); Shoemaker, 1945b: 238; Hurley, 1955: 140; Brusca, 1967a: 388; 1967b: 452; Bowman, 1973: 20; Thurston, 1977: 502.—antarctia Spandl, 1927: 153; Hurley, 1969: 33; Bowman, 1973: 18.

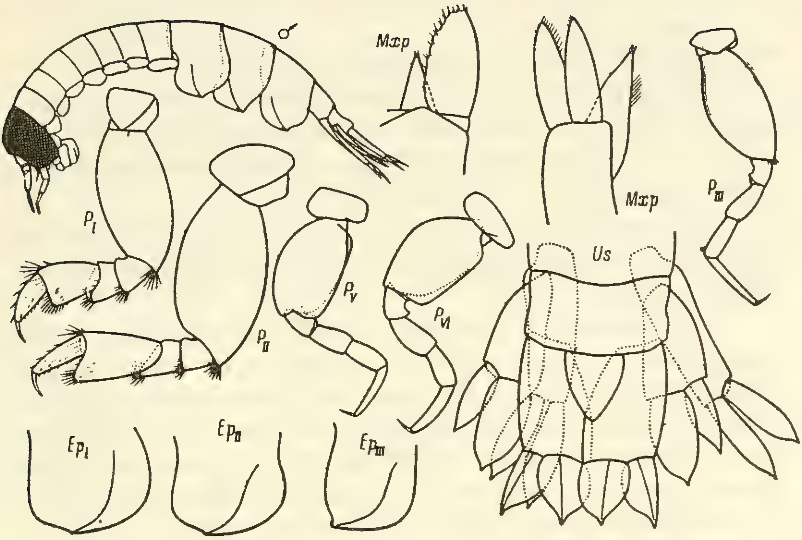
Length of sexually mature specimens up to 21 mm.

The body is thickset[2]. The segments of the mandibular palp are approximately equal in length and the 3rd segment is almost straight. The outer lobes of the maxillipeds are longer than the inner; the setae on the outer and inner lobes are shorter and sparser than in *H. medusarum.*

The setae on the distal segments of pereopods I and II are short, much shorter than in other species of *Hyperia.* The posterior margin of the 4th–6th segments of pereopods III–IV is armed with short thin setae. The 2nd segment of pereopods V–VII is broad. The anterior margin of the 4th and 5th segments of pereopods V is armed with thin short setae. The distal anterior angle of the 2nd segment of pereopods VII bears a fascicle of setae. The posterior margin of epimeron III is convex. The inner rami of uropods II and III are broadly lanceolate. The telson is elongated, its length more than its width at the base.

Notes: Bovallius (1889) separated this species from *H. medusarum* on the basis of ornamentation of pereopods I and II, but from *H. galba*

[2] Desctiption after Bowman, 1973.



268 Fig. 133. *Hyperia spinigera* Bovallius, male
(Us—after Shoemaker, 195a; rest—after Bowman, 1973).

on the basis of structure of uropods III. However, following Norman (1900), who had erroneously related his studied specimen of *H. galba* to *H. spinigera*, many authors considered these species synonymous. Bowman, who examined the specimens of *H. spinigera* of a number of earlier authors, showed that in some cases the identifications were not credible and that *H. spinigera* is clearly distinguished from *H. galba*. On the other
269 hand, the identity of *H. spinigera* and *H. antarctica* has also been argued (Thurston, 1977).

Distribution: A widely distributed, mainly moderately cold-water species. It is known from the northern (Iceland, southern Greenland, Newfoundland), tropical (Bermuda Islands, Antilles, Gulf of Guinea), and southern (up to 50° S) Atlantic; Indian oceanic coastal regions of south Africa; Indian oceanic sector of the Antarctic; and northern (Bering Sea, Gulf of Alaska, coastal regions of California) and southern (South Island New Zealand) part of the Pacific Ocean.

It is found at depths from 25 to 2,000 m. In the North Atlantic it is most abundant in the 600–900 m layer where most populations of the host jellyfish *Periphylla periphylla* concentrate (Thurston, 1977). It accomplishes vertical migrations of very small intensity, probably together with the host jellyfish.

5. ***Hyperia crassa*** Bowman, 1973 (Fig. 134)

Bowman, 1973: 23.

Length of sexually mature crustaceans 12–15 mm.

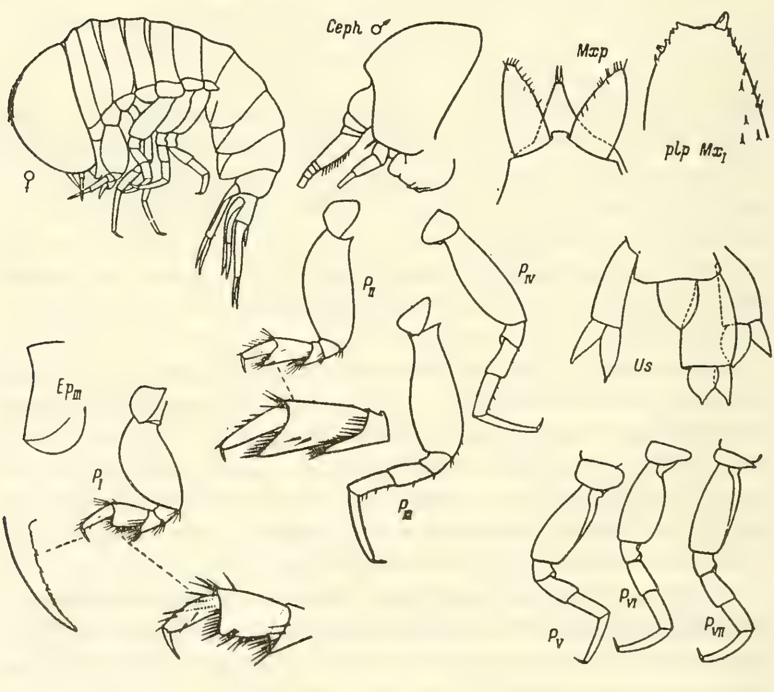
The head is unusually large, longer than somites I–III of the pereon together, its height notably more than its length. The somites of the pereon are highly differentiated in height— II being the highest, VII the lowest, and II–IV with a transverse fold.

The 1st segment of the mandibular palp is significantly shorter than the 2nd or 3rd segment. The inner lobes of the maxillipeds are long, with long apical spines.

270 The 2nd segment of pereopods I is broad and has a highly convex anterior margin. Solitary spinules are present on the posterior margin of the 4th–5th segments of pereopods III–IV. Pereopods V–VII are not armed and have a comparatively narrow 2nd segment. The posterior margin of epimeron III is almost straight and only in the distal part slightly convex. Uropods II and III have very broad basi- and endopodites.

Distribution: Gulf of Guinea and Cape Verde Islands.

Absent in our collections.



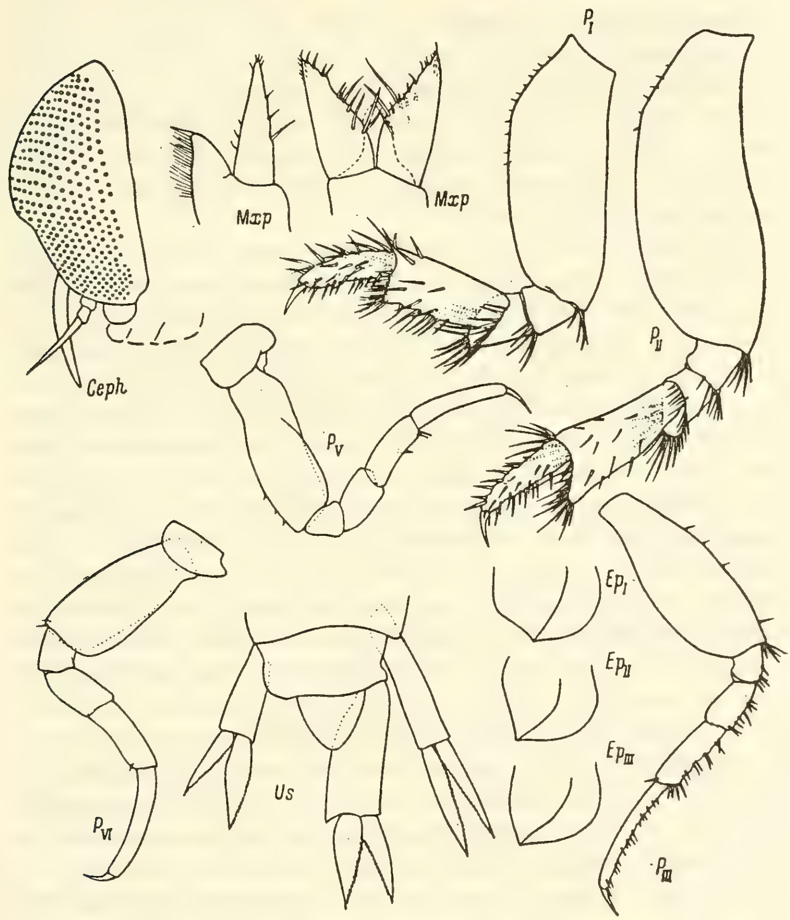
269 Fig. 134. *Hyperia crassa* Bowman, female (after Bowman, 1973).

6. ***Hyperia leptura*** Bowman, 1973 (Fig. 135)

Bowman, 1973: 23.

The head is longer than somites I and II of the pereon together. The outer lobes of the maxillipes have many long submarginal setae; the inner lobes are half the length of the outer; their anterior surface is densely covered with setae, with one strong spine at the apex.

The 2nd segment of pereopods I and II is comparatively narrow, 2.5 times longer than wide, and in the proximal part of the anterior
272 margin armed with short setae; the 5th and 6th segments are long and narrow and armed with numerous setae. Pereopods III and IV are long;



270 Fig. 135. *Hyperia leptura* Bowman, female (after Bowman, 1973).

the posterior margin of the 3rd–6th segments is armed with spinules and in the 6th segment is additionally finely denticulate. Pereopods V–VII have only solitary setae. The posterior margin of epimeron III is slightly convex. Uropods I–III are thin and long and their rami narrowly lanceolate, especially in uropods I. The telson is less in length than its width at the base.

Notes: *H. leptura* is close to *H. macrocephala* but distinguished from it by smaller size, different shape of coxal plate IV, structure of the maxillipeds and epimeron III, and much narrower basipodite of uropods III.

Distribution: Only one specimen is known and was recovered from the Gulf of California.

7. ***Hyperia bowmani*** Vinogradov, 1976 (Fig. 136)

Vinogradov, 1976: 134.

Length of the sexually mature female 14.5 mm.

The length of the head is slightly less than its height and equal in length to somites I–III of the pereon. The cone of the antennal gland has a round apex. The posterior margin of epimeron III is slightly convex and the apex slightly acute.

The outer lobes of the maxillipeds are narrow, the inner margin concave and armed with short setae along its entire length, and the inner lobes armed with two short apical spinules. The coxal plates are flat. The 2nd segment of pereopods I and II is comparatively narrow, with short setae in the proximal part of the convex anterior margin. The distally broadened 5th segment of pereopods I is armed with a few spines along the posterior and straight distal margins; the oval 6th segment bears many long setae on the anterior margin and row of four strong submarginal spines along the finely denticulate posterior margin. The 5th segment of pereopods II has a long and narrow distal process extending to 3/4 the length of the 6th segment; the narrowly oval 6th segment bears setae on the anterior margin and three–four submarginal spines along the posterior margin. Pereopods III–IV are well developed; the 4th segment is shorter than the 5th and 6th segments which are almost equal in length; both distal segments bear a long row of submarginal setae; the claw is thin, almost straight, and relatively longer than in other species of *Hyperia*. In pereopods V–VII the claws are thin, long, and almost straight. The posterior margin of epimeron III is slightly convex and the apex slightly acute. The uropods are much broader than in *H. leptura*. The telson is slightly longer than its width at the base.

Notes: *H. bowmani* is very close to *H. leptura* but is distinguished from it by the round lower posterior angle of epimeron II, details of ornamentation of the maxillipeds, and much shorter distal (5th and 6th) segments of pereopods I and II.

271 Fig. 136. *Hyperia bowmani* Vinogradov, female (after Vinogradov, 1976).

Distribution: The solitary specimen was found in the eastern equatorial part of the Pacific Ocean (0°01′ N, 154°48′ W) in a through catch at 0–800 m.

2. Genus *Hyperiella* Bovallius, 1887

Bovallius, 1887a: 19; 1887c: 565; 1889: 241; Stebbing, 1888: 1403; Bowman, 1973: 26.

Crustaceans of medium size, length about 10 mm.

The body, especially in females, has a broadened pereon. All the somites of the pereon are free. The head is very large, spherical, its height more than its length; the anterior surface is almost flat and the interantennal lobe is not developed. The eyes occupy almost the entire
273 surface of the head. In sexually mature females antennae I and II have

four segments. The mandibles have a palp in both sexes. The outer lobes of maxillae I bear five terminal spinules. The inner lobes of maxillipeds are well developed, with two apical setae.

The coxal plates are free. pereopods I have a weakly developed chela; the 5th segment is triangular, broadened distally, and its posterior distal corner produced into a triangular lobe. Pereopods II have a chela formed by the 6th segment and process of the 5th segment. In pereopods III and IV the 5th segment is linear. Pereopods V (or V and VI) are distinctly longer than the other pairs. Pereopods VII (or VI and VII) are approximately equal in length and not longer than pairs III and IV.

Type species: *Hyperiella antarctica* Bovallius, 1887.

Hyperiella is closer to *Hyperia* because of the large head, thickset body, and structure of pereopods I and II, but its long pereopods V and narrow elongated uropods bring it closer to *Parathemisto*.

This exclusively Antarctic genus includes three close species that are not well distinguished from each other.

KEY TO SPECIES OF GENUS HYPERIELLA

1. Pereopods VI a little longer than *V. Basipodite* of uropods III twice longer than telson .... 3. ***H. macronyx*** (Walker).

— Pereopods V notably longer than VI. Basipodite of uropods III more than twice longer than telson .... 2.

2. Lower posterior angle of epimerons I–III stretched and acuminate. Distal anterior angle of 2nd, 3rd, and 4th segment of pereopods V–VII stretched into acute denticles. Telson same length as urosomite III .. .. 2. ***H. dilatata*** Stebb.

— Lower posterior angle of epimerons II–III only slightly acuminate. distal anterior angle of 2nd, 3rd, and 4th segments of pereopods V–VII straight, not stretched. Telson shorter than urosomite III .... 1. ***H. antarctica*** Bov.

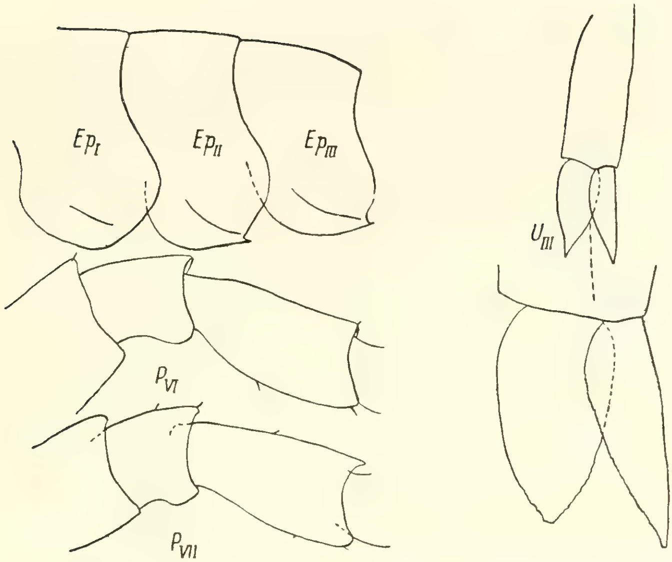
1. ***Hyperiella antarctica*** Bovallius, 1887 (Fig. 137)

Bovallius, 1887a: 20; 1887c: 566; 1889: 242; Stebbing, 1888: 1407; Barnard, 1932: 275; Hurley, 1969: 32.

Length of sexually mature specimens 6–8 mm.

The description is based on a male. The body is thickset and the integument thick and hard. The head is distinctly higher than the pereon, broad, and longer than the first three somites together.

Antennae I in males extend only to somite V of the pereon; the flagellum has ten segments, its oval-conical 1st segment is twice longer than the whole peduncle, and the other segments are narrow and short. Antennae II are somewhat longer than antennae I but do not extend to



274 Fig. 137. *Hyperiella antarctica* Bovallius, male (after Bowman, 1973).

somite VI of the pereon; the flagellum consists of 9–10 thin segments. The mendibles have a denticulate cutting edge and an accessory plate on the left mandible. The outer lobe of maxillae II is somewhat longer than the inner lobe and apically bears two strong spines. The outer lobes of the maxillipeds have a denticulate inner margin; the fused inner lobes are very short.

The 2nd segment of pereopods I is almost linear; the 5th segment is flat, highly broadened distally, and its length equal to its maximum width; the elongated-oval 6th segment is longer than the 5th, its anterior margin convex, the posterior margin almost straight and finely denticulate; the claw is strong, slightly curved, and denticulate along the posterior margin, its length 2/3 the 6th segment. Pereopods II are somewhat shorter than
274 pair I; the 5th segment is highly broadened distally, its lower distal angle stretched into a narrow lobe equal to the body of the segment in length, its anterior side is chisel-like and apically bearing four strong setae; the 6th segment is narrower than in pereopods I and longer than the distal process of the 5th segment, its anterior margin slightly convex, the posterior margin straight and finely denticulate; the claw is less than half the length of the 6th segment and denticulate along the posterior margin. The 5th segment of pereopods III and IV is longer than the 4th but equal to it in width, its anterior margin convex and the posterior margin straight, finely denticulate and armed with spiniform setae; the slightly curved 6th segment is much narrower than the 5th and equal in length to the 4th and 5th segments together; the thin claw is half the

length of the 6th segment and bears many short setae in the proximal part of the inner margin. Pereopods V are distinctly longer than all the other pairs, equal in length to the head, the pereon, and somite I of the pleon together; the 4th segment is distally broadened and 1/3 longer than the 3rd; the 5th segment is twice longer than the 4th, just barely shorter than the 2nd, its anterior margin straight, and the posterior margin slightly convex; the 6th segment is almost straight, much narrower than the 5th, and distinctly longer than it; the strong claw is 1/4 the length of the 6th segment; the anterior margin of the 6th segment and proximal part of the anterior margin of the claw are armed with thin short setae. Pereopods VI and VII are 1/3 shorter than pereopods V and just slightly shorter than pereopods III and IV; the 2nd segment is the same shape as in pair V; the 5th segment is the same width as the 4th and barely longer than it; the 6th segment is only slightly narrower and slightly longer than the 5th; the claw is less than 1/3 the length of the 6th segment.

The somites of the pleon have a broadly rounded posterior lower angle. The basipodite of uropods I is somewhat longer than the lanceolate endopodite and the exopodite is shorter and narrower than the endopodite. The basipodite of uropods II broadens distally and is almost equal in length to the broadly lanceolate endopodite; the exopodite is much narrower and somewhat shorter than the endopodite. The basipodite of uropods III is broader and longer than in uropods I and II and twice longer than the broadly oval endopodite; the exopodite
275 is almost twice narrower than the endopodite but just barely shorter. The triangular-galeiform telson has an acute apex, is distinctly shorter than urosomite III, and less than 1/3 the length of the basipodite of uropods III.

Distribution: A circum-Antarctic species. It is found from the northern border of the pack ice to the Antarctic Convergence, but at places goes farther north, right up to the Subtropical Convergence.

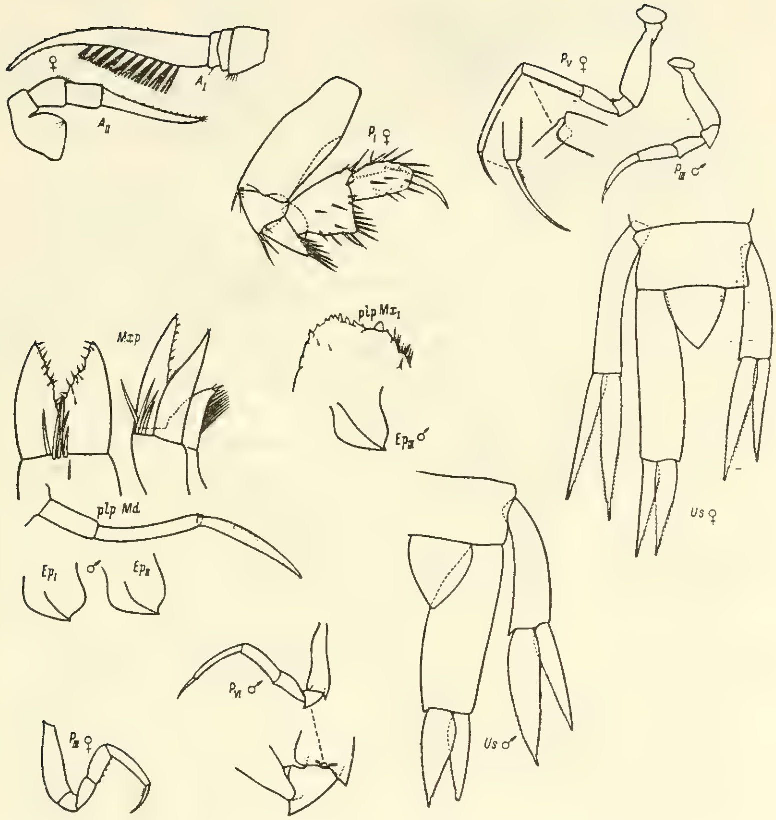
2. ***Hyperiella dilatata*** Stebbing, 1888 (Fig. 138)

Stebbing, 1888: 1403; Bovallius, 1889: 247; Spandl, 1927: 162; Barnard, 1932: 274; Hurley, 1969: 33; Bowman, 1973: 27.

Length of adult specimens 6–8 mm.

This species is very close to the preceding one and is distinguished from it only by some structural details.

The head is less in length than the first three somites of the pereon together. Pereopods V are shorter than the head and pereon together. The anterior distal angle of the 2nd and 4th segments of pereopods V–VII is stretched into a small acute denticle. The 6th segment of pereopods VII is distinctly longer than the 5th. The lower distal angle of epimerons I–III are stretched backward and are apically acute. The endopodite of uropods III is narrowly oval with a sharply acute apex.



138 Fig. 138. *Hyperiella dilatata* Stebbing (after Bowman, 1973).

The telson is the same length as urosomite III and only slightly less than half the length of the basipodite of uropods III.

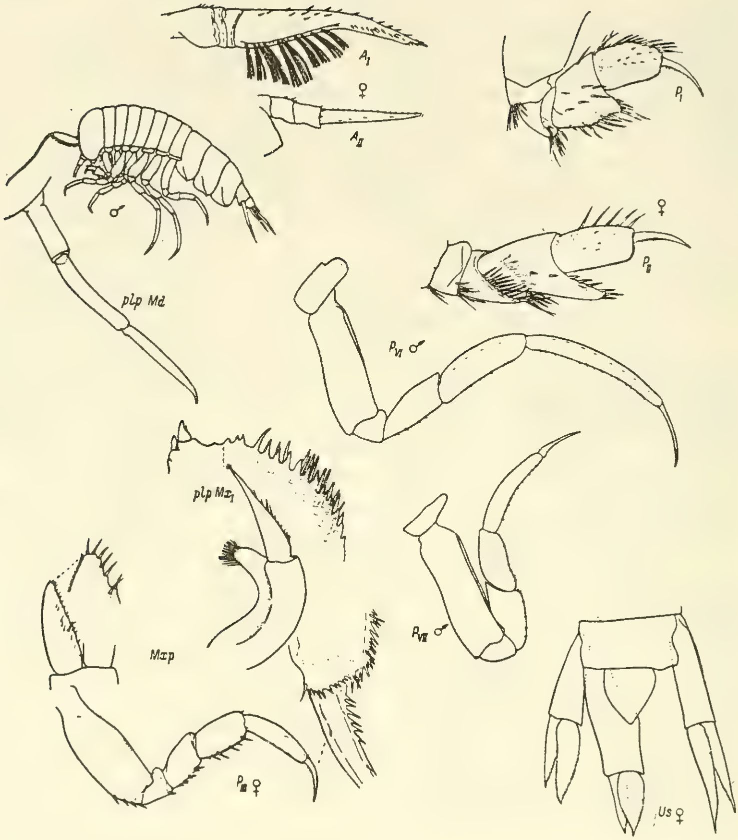
Notes: The original descriptions of the two species examined above were based on specimens of different sexes (*H. antarctica*, male; *H. dilatata*, female). The differences between them are not very distinct and possibly lie within the limits of intraspecific variation.

Distribution: Circum-Antarctic; found from the coasts of Antarctica to the Antarctic Convergence.

3. ***Hyperiella macronyx*** (Walker, 1906) (Fig. 139)

Walker, 1906: 452, 1907: 7 (*Hyperia*); Barnard, 1930: 412 (*Hyperia*); Hurley, 1969: 33 (*Hyperia*); Bowman, 1973: 30.

Length of sexually mature specimens up to 13 mm.



277 Fig. 139. *Hyperiella macronyx* (Walker) (after Bowman, 1973).

The pereon of females is not as bulged as in other species of the genus. The outer lobe of maxillae II has three apical spines. The maxillipeds do not have groups of spines in the distal part of the basal segment.

Pereopods I–IV are similar to those in other species of the genus. Pereopods V are somewhat longer than the head and pereon together. Pereopods VI are slightly longer than V and significantly longer than pereopods VII, which are approximately equal to pereopods III and IV in length. The anterior distal angle of the 2nd and 4th segments of pereopods V–VII is not stretched into a well-developed acute denticle. The 6th segment of pereopods III–VII is longer and narrower than the 5th.

Epimeron III has an acute denticle on the posterior distal angle. The telson is somewhat longer than its width at the base and its apex extends to the middle of the basipodite of uropods III.

Distribution: Known from the Ross Sea.

Absent in our collections.

278 3. Genus *Iulopis* Bovallius, 1887

Bovallius, 1887a: 17; 1889: 116.

Small crustaceans, 4–8 mm in length.

The body has a broadened pereon. The surface of the body and pereopods is covered with short thin setae. All the somites are free and somites V–VII resemble transverse rollers. The head is large, round, and without a rostrum. The eyes occupy almost the entire surface of the head. The flagellum of antennae I in females slightly exceeds the length of the three-segmented peduncle. Antennae II in females are two-segmented. The mandibles retain a palp only in males. The maxillipeds have rudimentary, almost imperceptible inner lobes. The coxal plates are free. pereopods I have a poorly developed subchela; pereopods II have a chela. Pereopods III–VII are approximately equal in length. The 5th segment of pereopods III and IV is not broadened distally.

Type species: *Iulopis loveni* Bovallius, 1887.

Sexual dimorphism is much more strongly expressed in *Iulopis* than in other genera of the family. In addition to differences in the structure of the antennae and a much broader pereon in females, sexual dimorphism is also evident in the structure of the last three pairs of pereopods; these are modified in sexually mature females for firm attachment to the tissues of the host. Males and young females are probably free-living.

In general appearance and structure of pereopods I and II, *Iulopis* occupies an intermediate position between *Hyperoche* and *Hyperia*.

The genus includes two species.

KEY TO SPECIES OF GENUS IULOPIS

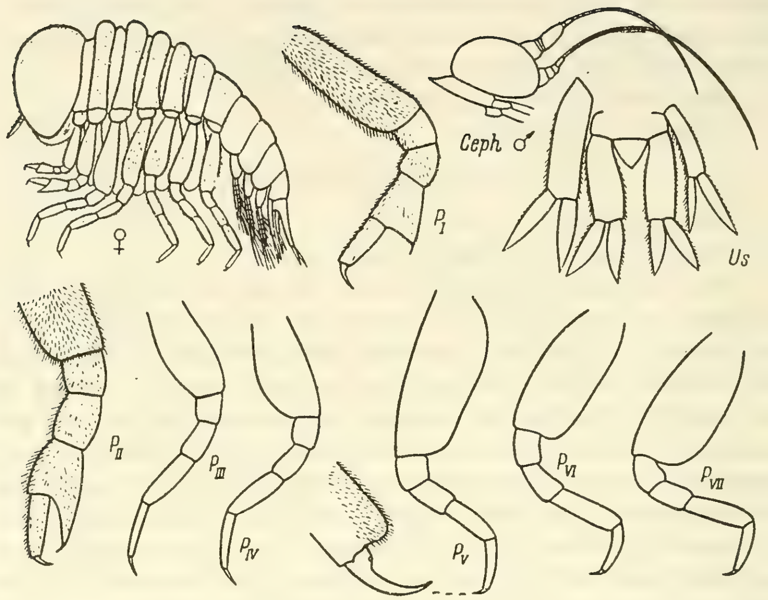
1. Distal margin of 5th segment of pereopods I straightly truncate, not forming protruding lobe. Fifth segment of pereopods I and II, in addition to short thin setae on distal surface, armed with spines along posterior margin .... 2. ***I. mirabilis*** Bov.

— Posterior distal angle of 5th segment of pereopods I produced, forming a small lobe. Marginal spines absent on posterior margin of 5th segment of pereopods I and II...................... 1. ***I. loveni*** Bov.

1. ***Iulopis lovenii*** Bovallius, 1887 (Fig. 140)

Bovallius, 1887a: 17, 1889: 118.

Length of sexually mature specimens 4–6 mm.



279 Fig. 140. *Iulopis loveni* Bovallius (♀, Ceph ♂ P_{I-II}—after Bovallius, 1889; rest—after Spandl, 1927).

Male: The body is somewhat compressed laterally, the pleon is shorter than the pereon, the posterior angles of epimerons I–III are round, and the entire body, especially its anterior part, is covered with thin setae, which are solitary on the pleon and urosome.

The head is somewhat shorter than the first three somites of the pereon, large, round, and its height more than its length. The entire surface of the head is covered with thin setae, located in the angles of the facets of the eyes.

Antennae I are shorter than antennae II; the 1st segment of the peduncle is strong, its length just a little more than its width, and both distal segments half the length of the 1st; the 1st segment of the flagellum is equal to the entire peduncle of the antennae and, like the remaining segments (12), is densely armed with thin setae. Antennae II are attached to the lower anterior angle of the head; the flagellum consists of 13 segments.

The mandibles have a broad denticulate cutting edge and a three-segmented palp; the left manndible has an accessory—small plate. The narrow outer lobes of the maxillipeds taper sharply distally and the fused inner lobes are barely discernible.

The 2nd segment of pereopods I is equal in length to all the other
segments together; the 4th segment slightly broadens distally and its
279 lower distal angle is straight; the 5th segment is highly broadened distally
and its lower distal angle stretched into a very short chisel-like process
bearing a long and strong terminal spine; the narrowly oval 6th segment
has a slightly curved posterior margin compactly pressed against the
distal margin of the 5th segment to form the subchela; the claw is strong,
curved, with short setae in the middle of its concave posterior margin.
Pereopods II are somewhat longer than pereopods I; the 2nd segment is
shorter than all the successive segments together; the short 5th segment
has a well-developed distal process exceeding the length of the segment,
its posterior margin bearing numerous short spinules, and the anterior
side, with a dolabriform depression bearing a long strong terminal spine;
the 6th segment is almost linear and three times longer than wide; the
claw is deeply curved. Pereopods III and IV are equal in length; the 2nd
segment is broadened distally and twice wider than at the base; the 5th
segment is somewhat longer than the 4th; the 6th segment is equal to
the 5th, only slightly narrower, its posterior margin straight; the claw
is weakly curved and 1/4 the length of the 6th segment; the surface
of the segments is covered with short setae, particularly abundant in
the proximal parts of the legs. Pereopods V, VI, and VII are similar in
structure and equal in length; the 5th segment is longer than the 4th but
much shorter than the 3rd and 4th segments together; the 6th segment is
shorter than the 5th but only slightly narrower; the claw is strong and 1/3
the length of the 6th segment; the surface of the segments, particularly
in the proximal part of the pereopods, is covered with numerous setae.

Both margins of the basipodite of uropods I bear strong setae; the
rami are narrowly lanceolate, the outer ramus somewhat longer than the
inner. The basipodite of uropods II is half as narrow as uropods I and the
exopodite longer than the endopodite and equal to the basipodite. The
broad basipodite of uropods III has a slightly curved outer margin and a
straight inner margin; the exopodite is longer than the endopodite and 3/4
280 the length of the basipodite. The telson is triangular, its width at the base
equal to its length, which is half that of the basipodite of uropods III.

Female: The body is somewhat broader than in the male. The head
is larger and in length equal to the first three somites of the pereon, but
its height almost two times its length. The 1st segment of the pedun-
cle of antennae I is large, semicircular, much longer than the next two
segments together; the one-segmented flagellum somewhat exceeds the
peduncle in length. Antennae II are rudimentary and consist of just two
small segments.

Pereopods I and II are identical in structure to the male. Pere-
opods III and IV are somewhat longer; the 2nd segment is much longer

than in pereopods II, narrows proximally, and is almost 2.5 times broader in the distal part; the 5th segment is longer than the 4th; the 6th segment is shorter and much narrower than the 5th; the curved claw is 1/3 the length of the 6th segment. Pereopods V–VII are shorter than III and IV; the 6th segment broadens distally; the strong curved claw together with the braodened part of the 6th segment forms a unique prehensile organ. The basipodite of uropods I is relatively broader than in the male and three times longer than wide. The structure of the other legs does not differ significantly in the two sexes.

The oostegites are located on somites II– V of the pereon, irregularly triangular in shape, and much longer than the gill sacs.

Distribution: A surfacial circumtropical species known from the tropical regions of the Atlantic Ocean, the Mediterranean and Red seas, and tropical waters of the Indian and Pacific oceans.

2. ***Iulopis mirabilis*** Bovallius, 1887 (Fig. 141)

Bovallius, 1887a: 17; 1889: 125; Spandl, 1927: 159; Shoemaker, 1945a: 238.

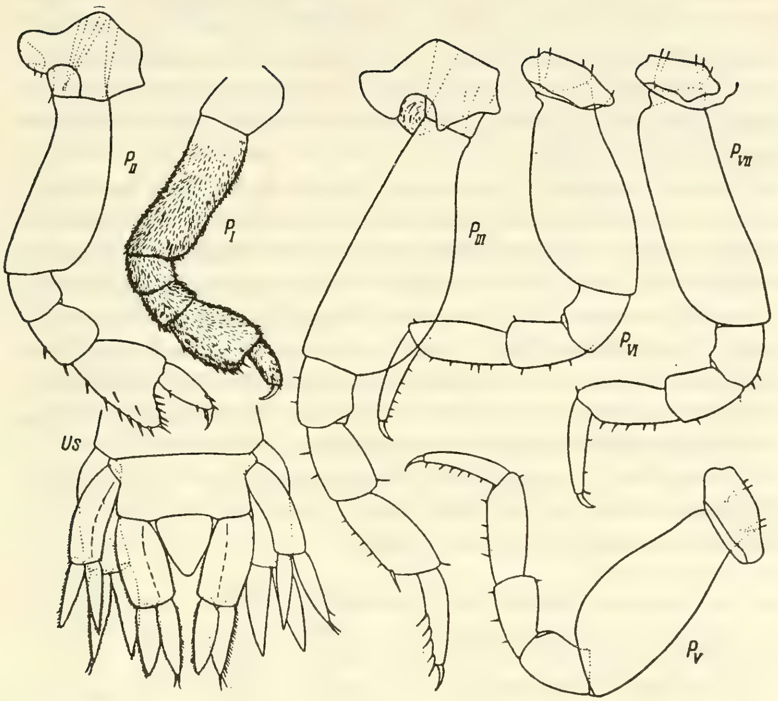
Length of sexually mature males 6–8 mm, of females 6–7 mm.

Male: The body is not laterally compressed and the pleon is the same length as the pereon. The entire body integument is covered with thin setae but the integument is not as thick as in *I. loveni* and the setae are shorter and coarser.

The head is equal in length to the first three somites of the pereon. The eyes occupy the entire surface of the head; their facets are much smaller and more numerous than in *I. loveni*. The "hairy" cover is reduced to a small number of minute setae on the upper part of the head.

Antennae I and II are equal in length in sexually mature males; the 1st segment of the peduncle is thick, almost semicircular, and three times longer than the next two segments together; the 1st segment of the flagellum is strong, conical, much longer than all the segments of the peduncle, end consists of more than 20 segments. Antennae II are attached to the lower anterior angle of the head; the flagellum consists of 20 segments.

The 2nd segment of pereopods I is linear and equal in length to the 3rd, 4th, and 5th segments together; the 4th segment is wider than long and its lower distal angle round; the 5th segment is dolioform, its lower distal angle rounded and bears many short setae; the 6th segment is elongated-conical, shorter and narrower than the 5th, its anterior margin slightly convex, with dentiform spinules, and the segment compressed to the distal margin of the 5th to form a subchela; the claw is deeply curved and half the length of the 6th segment, its posterior margin densely covered with dentiform spinules. Pereopods II are somewhat longer than pereopods I; the 2nd segment is equal in length to the 3rd, 4th, and



281 Fig. 141. *Iulopis mirabilis* Bovallius, female (after Shoemaker, 1945a).

5th together; the distal lobe of the 5th segment is well developed but nonetheless shorter than the body of the segment; the lobe has an almost straight posterior margin armed with strong short setae, a dolabriform depression anteriorly, and is apically broadly rounded, without a terminal
281 spine but with long strong setae; the distal process of the 5th segment barely reaches the middle of the posterior margin of the 6th segment; the conical 6th segment is three times longer than its basal width and its anterior and posterior margins armed with close-set minute spinules; the claw is curved and armd along the posterior margin with several dentiform spinules. Pereopods III and IV are equal in length; the 2nd segment is conspicuously flatter than in *I. loveni*, its length less than twice its maximum width; the 5th segment is longer than the 4th; the 6th segment is notably narrower than the 5th; the slightly curved claw is 1/3 the length of the 6th segment. Setae are almost absent on the surface of the segments. Pereopods V, VI, and VII are identical in structure and length; the flat 2nd segment of pereopods VII is almost linear while in

pereopods V and VI it slightly tapers or broadens distally, its length twice its width; the 5th segment of pereopods V and VI is the same length as the 3rd and 4th together, of pereopods VII somewhat shorter; the 6th segment of pereopods V and VI is somewhat shorter than the 5th, of pereopods VII approximately the same length; the claw is 1/5 the length of the 6th segment.

The margins of the basipodite of uropods I are finely denticulate; the rami are narrowly lanceolate, approximately equal in length, but the exopodite shorter than the endopodite. The basipodite and rami of uropods II are shorter than in uropods I. The margins of the basipodite of uropods III are finely denticulate and the rami lanceolate, almost equal in length, and less than half the length of the basipodite. Setae are absent on the surface of the uropods. The telson is triangular, with a round apex, its length equal to it width at the base; it may be shorter or somewhat longer than half the length of the basipodite of uropods III.

Distribution: A surfacial, warm-water species known from the trop-
282 ical regions of the Pacific (central and equatorial regions, the Gulf of Panama) and Atlantic (Bermudas) oceans.

4. Genus *Hyperoche* Bovallius, 1887

Bovallius, 1887a: 18; 1889: 83; Stebbing, 1888: 1398.

Crustaceans of medium size, 4–15 mm.

The body is similar in shape to *Hyperia*. All the somites of the pereon are free. The head is large and semicircular. The eyes occupy the entire lateral surface of the head and are dorsally contiguous. The interantennal lobe is not developed. Antennae I have a three-segmented peduncle, in females longer than antennae II; antennae II in females are four-segmented. The mandibles have a strong dentate process and a three-segmented palp in both sexes. Maxillae I have a very broad leaflike palp. The maxillipeds have large well-developed inner lobes.

The coxal plates are free. Pereopods I and II have a chela formed by the 6th segment and distal process of the 5th segment; in pereopods I and II the process of the 5th segment is laterally compressed, knife-shaped, and denticulate along the anterior margin. Pereopods V–VII are approximately equal in length.

Type species : *Metoecus medusarum* Kröyer, 1838.

The genus is close to *Hyperia* but readily distinguished from it by the shape of the process of the 5th segment of pereopods I and II.

Most of the species are rare and known from just a few specimens. Therefore, the systematics of the genus is not well worked out.

At present the genus includes seven species but the validity of some requires verification.

KEY TO SPECIES OF GENUS HYPEROCHE

1. Posterior distal angle of epimerons II and III slightly stretched and acute .... 2.
— Posterior distal angle of epimerons II and III round or straight, may be finely denticulate, but not acute .... 5.
2. Anterior distal angle of 6th segment of pereopods I and II not stretched above claw .... 3.
— Anterior distal angle of 6th segment of pereopods I and II stretched above claw .... 4.
3. Posterior margin of 5th and 6th segments of pereopods III and IV denticulate................................ 1. ***H. medusarum*** (Kröyer).
— Posterior margin of 5th and 6th segments of pereopods III and IV armed with setae but not denticulate ..... 7. ***H. luetkenides*** Walker.
4. Distal process of 6th segment spoon-shaped, slightly curved, lower distal angle of 4th segment not stretched ....5. ***H. picta*** Bov.
— Distal process of 6th segment of pereopods I and II almost straight, lower distal angle of 4th segment stretched into narrow triangular lobe .... 6. ***H. capucinus*** Barn.
5. Lower distal angle of 4th segment of pereopods I stretched into long process reaching almost to base of distal process of 5th segment .. .. 6.
— Lower distal angle of pereopods I bears very short process .... 4. ***H. martinezi*** (Muller).
6. Claw of pereopods II free, not retractile into body of 6th segment. Posterior distal angle of epimerons II and III round ....2. ***H. mediterranea*** Senna.
283 — Claw of pereopods II retractile. Posterior distal angle of epimerons II and III acute .... 3. ***H. cryptodactylus*** Stebb.

1. ***Hyperoche medusarum*** (Kröyer, 1838) (Fig. 142)

Kröyer, 1838: 288 (Metoecus); Hansen, 1888: 58; Pirlot, 1929: 118; Hurley, 1955: 144—*abyssorum* Boeck, 1870: 6 (*Metoecus*)—*medusarum, abyssorum* Boeck, 1872: 82 (*Tauria*)—*kroeyeri, tauriformis, prehensilis, abyssorum, luetkeni* Bovallius, 1889: 87–97—*kroeyeri* Sars, 1895: 9; Chevreux and Fage, 1925: 405

Maximum length of sexually mature individuals from the Arctic seas up to 15 mm (female) but generally does not exceed 5–6 mm.

Male: The body is elongated. The integument is thick and smooth, as if polished. The length of the head is equal to the length of the first two somites of the pereon. The eyes occupy the entire surface of the head.

The flagellum of antennae I is barely shorter than the body and longer than the flagellum of antennae II; its oval-conical 1st segment is

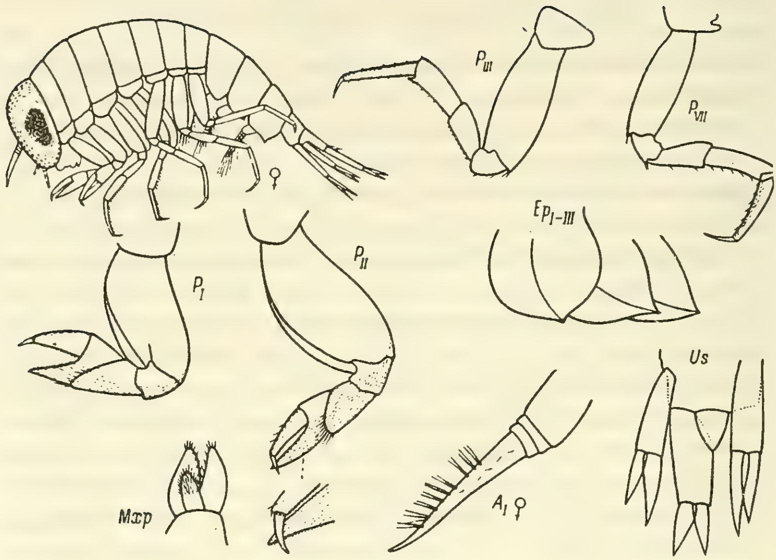


Fig. 142. *Hyperoche medusarum* (Kröyer), female (after Sars, 1890; Hurley, 1955).

half the length of the head and considerably longer than the peduncle of the antennae. The segments of the peduncle of antennae II are narrower than in antennae 1; the flagellum consists of 25–30 segments. The antennae in young males are markedly shorter than in sexually mature adults.

The mandibles have a denticulate cutting edge; the dentate process is well developed and resembles a triangular plate. The outer lobes of the maxillipeds are oval, with a round apex, and denticulate in the distal part of the inner margin; the fused inner lobes are large and apically bear short setae.

The 2nd segment of pereopods I is broadened, with a convex anterior margin, its width about half its length, and its length equal to all the other segments together; the distal lobe of the 5th segment is acuminate and denticulate along the convex anterior margin, almost extends to the
284 distal end of the oval-conical 6th segment, and has a finely denticulate posterior margin; the slightly curved claw also has a denticulate posterior margin. Pereopods II are slightly longer than pair I; the 2nd segment is relatively narrower; the lobe of the 5th segment is narrower and exceeds the 6th segment in length; the ventral and partially the lateral surface of the 3rd–5th segments bear short tender setae; the claw is free, not stretched, and has a denticulate posterior margin. In pereopods III and IV the posterior margin of the 5th and 6th segments is finely denticulate and

the 6th segment additionally bears a few short setae; the posterior distal angle of the 5th segment is produced into a small triangular denticle that is more prominently developed in pereopods III; the almost straight claw is 1/3–1/4 the length of the 6th segment. Pereopods V–VII are similar but the 2nd segment of pereopods VII is somewhat broader than in the preceding ones and its posterior margin more convex; the strong claw is half the length of the 6th segment.

Epimeron I is oval and has a keel on the distal surface; epimerons II and III are more or less triangular, with an acute posterior angle. The uropods have narrowly lanceolate rami with finely denticulate margins. The peduncle of uropods III is approximately twice longer than the telson. The telson is triangular, with a round or acute apex, and 1/3 the length of the basipodite of uropods III.

Female: The body is broader and more thickset than in males. Antennae I are shorter than the head; the flagellum consists of two segments (in antennae II, only one segment). Pereopods I and II are much stronger; the 2nd segment is broad; the lobe of the 5th segment is broader than in males, slightly curved, and in both pairs extends to the distal end of the 6th segment or exceeds it in length. All the uropods, especially pair III, are much broader than in males.

Notes: In the seas of the North Atlantic this species parasitizes the ctenophoran *Pleurobrachia pileus* (Evans and Sheader, 1972) and possibly some coelenterates.

Distribution: A bipolar species, found in the Central Polar Basin, in the North Atlantic where it penetrates southward to La-Mancha, western Ireland, and Labrador; in the North Pacific it has been found in the Bering, Okhotsk, and Japan seas, the Kuril-Kamchatka region, and the coastal regions of Alaska. In the Southern Hemisphere it was found in the South Georgia Islands, the cold coastal waters of southwest Africa south of 25° S lat., and off the southern tip of New Zealand.

It is a surfacial species.

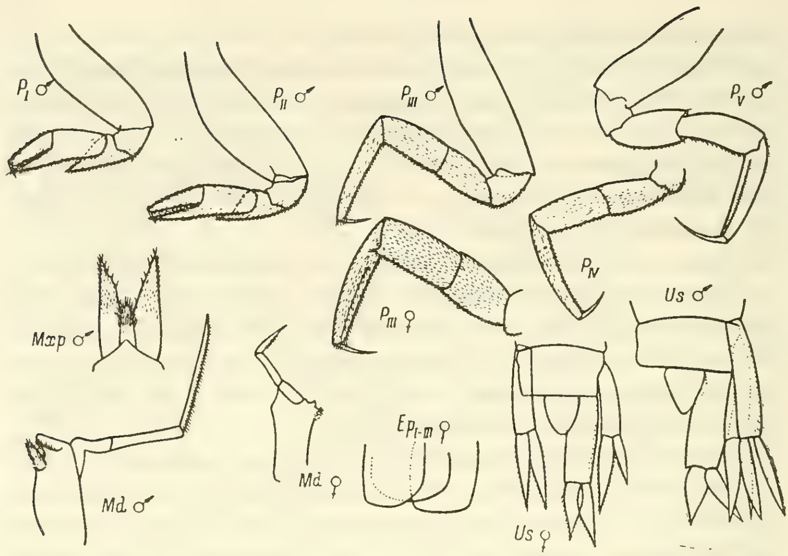
2. ***Hyperoche mediterranea*** Senna, 1908 (Fig. 143)

Senna, 1908: 159; Hurley, 1955: 147.

Length of the known specimens 3–5 mm.

In males antennae I and the much longer antennae II distinctly exceed the body length. In females the one-segmented flagellum of antennae I exceeds by 1/3 the length of the peduncle; the flagellum of antennae II is the same length.

The mandibles have a thin palp, longer than the mandibular body in males, much shorter in females; the dentate process is small, narrowly triangular, and covered with setae. The outer lobes of the maxillipeds are lanceolate, with an acute apex and slightly concave outer margins.



285 Fig. 143. *Hyperoche mediterranea* Senna (after Hurley, 1955).

The 2nd segment of pereopods I is barely broadened, its maximum width 1/3 its length; the process of the 5th segment in both sexes slightly exceeds the length of the 6th segment; the process of the posterior distal angle of the 4th segment is narrow, acute, and reaches the base of the process of the 5th segment; the claw is thin and its posterior margin is smooth. Pereopods II are similar in structure. The entire surface of the
285 4th, 5th, and 6th segments of pereopods I, but especially of pereopods II, is covered with short thin setae. Pereopods III and IV are similar to those in *H. medusarum* but the posterior distal angle of the 5th segment does not have a triangular process and the posterior margin is not denticulate but does bear short setae; the surface of the 4th–6th segments is covered with short thin setae. Pereopods V–VII are identical in structure; the 2nd segment is slightly shorter than the 4th and 5th segments together; the 6th segment tapers distally and is equal to the 2nd segment; the strong claw is half the length of the 6th segment.

The epimeral plates are roundish and their posterior angle is not stretched into a cusp, although it may be slightly denticulate. The uropods and telson are the same as in other species of the genus. The margins of the uropods are more prominently denticulate in females than in males.

Distribution: A bipolar species, found in the Mediterranean Sea and the southern coastal region of New Zealand. It lives in shallow coastal waters.

Absent in our collections.

3. ***Hyperoche cryptodactylus*** Stebbing, 1888 (Fig. 144)

Stebbing, 1888: 1399.

Length of the only known specimen (male) about 10 mm.

The head is short, approximately equal to the first two somites of the pereon, and its anterior side flat or slightly concave. The structure of the antennae is the same as in other species of the genus; in males the 1st segment of the flagellum of antennae I is broadly conical, equal in length to the pendunclе, and its lower margin bears long tender setae. Antennae II lack ornamentation.

In the mandibles the palp is strong, exceeds the mandibular body in length, and the cutting edge is short and denticulate. The outer lobes of the maxillipeds are oval, with an acute apex and a convex outer margin, the inner lobes are very small.

The 2nd segment of pereopods I has a convex anterior margin and its width is 2/3 its length; the lower distal angle of the 4th segment is stretched into a round lobe bearing strong marginal setae; the lobe of the 5th segment is acute, denticulate along the convex anterior margin, and almost reaches the distal end of the narrowly oval 6th segment; the claw is strong and denticulate along the posterior margin. The lobe of the 4th segment of pereopods II is far less developed; the lobe of the 5th segment has an almost straight, finely denticulate anterior margin, and its length somewhat exceeds that of the conical 6th segment; the distal end of the 6th segment is round; the claw is thin, almost straight, and with smooth

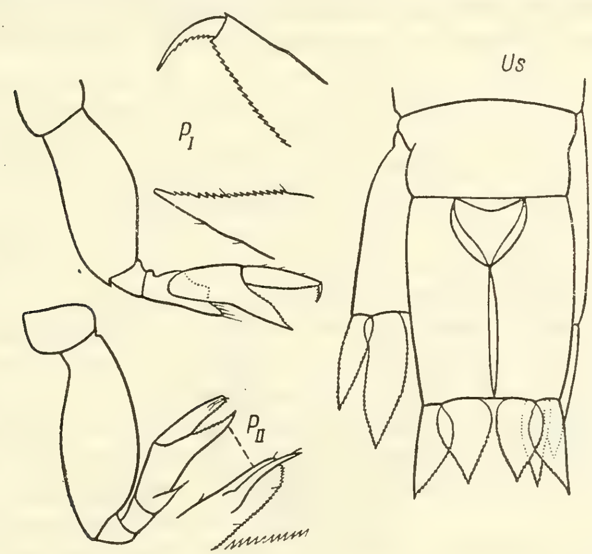


 Fig. 144. *Hyperoche cryptodactylus* Stebbing, male (after Stebbing, 1888).

margins; it may be almost entirely retracted into the body of the 6th segment, which immediately distinguishes *H. cryptodactylus* from other species of the genus as they do not have retractile claws. The posterior distal angle of the 5th segment of pereopods III has a small triangular process, which is not present in pereopods IV; in the 5th segment of pereopods III and IV the posterior margin is not denticulate, although it bears short marginal setae. The 2nd segment of pereopods VII is stronger than in pereopods V and VI and longer than the 4th and 5th segments together; the 6th segment tapers distally and is almost half the length of the 2nd segment.

The posterior angle of epimerons I–III is acute. The uropods are strong and have a long peduncle; the rami of uropods III are half the length of the peduncle. The telson is roundish-triangular, with convex lateral margins and rounded apex, and 1/3 the length of the peduncle of uropods III.

Distribution: Found in a surfacial catch near the Cape of Good Hope. Absent in our collections.

4. ***Hyperoche martinezi*** (Müller, 1864) (Fig. 145)

Müller, 1864: 54 (*Hyperia*); Bovallius, 1887a: 20; 1889: 107.

Length of males 5–6 mm.

Male: The head is equal to the first two somites of the pereon in length and wider than long. The two pairs of antennae are approximately equal in length. The 1st segment of the peduncle of antennae I is
287 twice longer than the next two segments together; the 1st segment of the flagellum is cylindrical and approximately the same length as the head;

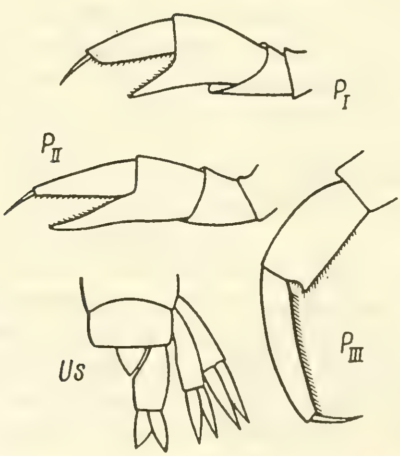


Fig. 145. *Hyperoche martinezi* (Müller) male (after Bovallius, 1889).

the flagellum consists of 18–20 segments. The flagellum of antennae II consists of 12–15 segments.

The 2nd segment of pereopods I is almost linear; the lobe of the 5th segment is narrow, has a concave and denticulate anterior margin, and is distinctly shorter than the 6th segment; the claw is almost straight and more than half the 6th segment in length. Pereopods II are somewhat longer than pereopods I; the 2nd segment has a straight posterior margin; the 5th segment is distinctly shorter than in pereopods I, with a narrow distal lobe, and almost straight denticulate anterior margin, and extends to the distal end of the 6th segment; the claw is free, straight, and dentculate along the posterior margin. Pereopods III and IV are equal in length; the 5th segment is barely longer than the 4th and its posterior distal angle strethed and acute; the 6th segment is longer and narrower than the 5th segment and its posterior margin armed with long setae; the claw is almost straight and 1/3 the length of the 6th segment. Pereopods V–VII are equal in length and slightly longer than pereopods III and IV; their slightly curved claw is half the length of the 6th segment.

The posterior lower angles of epimerons I–III are not acute. The uropods are relatively shorter and broader than those in *H. medusarum*. Uropods I do not reach the apex of pair III. The basipodite of uropods III is distinctly broader than in uropods I and II, its length less than twice its width; the lanceolate outer rami are broader than the inner. The roundish-triangular telson falls short of the base of the basipodite of uropods III.

Distribution: Coastal regions of Brazil.

Absent in our collections.

5. ***Hyperoche picta*** Bovallius, 1889 (Fig. 146)

Bovallius, 1889: 111; Senna, 1906: 168.

Length of males 4 mm.

The body is elongated but in males the pereon is broader and more massive than in other species of the genus. Somite I of the pereon is almost half the length of somite II. The head is large, massive and almost equal in length to the first three somites of the pereon. The eyes occupy the entire dorsolateral surface of the head and are intense red.

Antennae I are approximately the same length as the entire body; the 1st segment of the peduncle is long and strong, its length three times that of the succeeding segments together; the 1st segment of the flagellum is very large and broad and about three times longer than the entire peduncle. Antennae II are somewhat shorter than antennae I; the segments of the peduncle are large and cylindrical; the flagellum consists of 15 segments.

The 2nd segment of pereopods I is broad, the anterior margin convex, and the posterior margin straight; the distal margin of the 4th segment is straight and the lower distal angle not spoon-shaped as in other

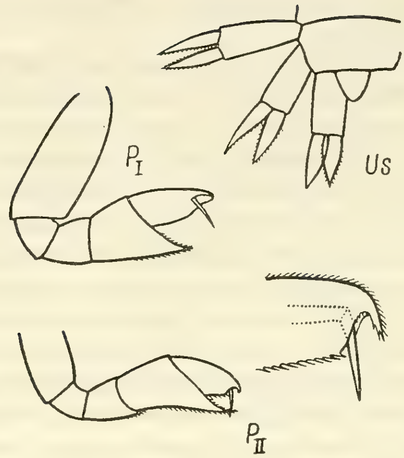


Fig. 146. *Hyperoche picta* Bovallius, male (after Bovallius, 1889).

species of the genus; the 5th segment is broad, has a short, sharply tapering distal process terminating in a spiniform cusp, and is notably shorter than the posterior margin of the 6th segment; the 6th segment is broad, its anterior margin straight, and a spoon-shaped extension covers the claw for over half its length; the claw is thin, straight, and more than half the 6th segment in length. Pereopods II are the same length
288 as pereopods I; the 2nd segment is narrower than in pair I, its width 1/3 its length, and the anterior and posterior margins are almost straight and smooth; the lower distal angle of the 4th segment does not form a spoon-shaped process; the 5th segment is not as broad as in pair I but the distal projection is broad, terminating in a spiniform cusp, and extends to the distal end of the 6th segment; the 6th segment, compared to other species of the genus, is very broad, its anterior margin slightly convex, and the spoon-shaped extension above the claw is much shorter and narrower than in pair 1; the claw is thin, straight, and approximately half the length of the 6th segment. Pereopods III and IV are equal in length; the 2nd segment is narrow, its width less than 1/3 its length; the 5th segment is somewhat longer than the 4th, broadens distally, and its posterior distal angle is straight and not stretched into a denticulate process; the 6th segment is somewhat shorter than the 4th and 5th segments together and its surface covered with setae; the claw is straight and 1/3 the length of the 6th segment. Pereopods V–VII are about the same length as pereopods III–IV; the 2nd segment is narrow and linear; the 5th segment is significantly longer than the 4th; the 6th segment

is longer than the 5th but relatively shorter than the 6th segment of pairs III and IV; the claw is straight.

The rami of uropods I are approximately equal in length. The basipodite of uropods II is slightly longer than the endopodite, which is shorter than the exopodite. The basipodite of uropods III is broad, linear, and somewhat longer than the endopodite, which is equal to the exopodite in length. The elongated-triangular telson is half the length of the basipodite of uropods III.

Distribution: Found in the tropical Atlantic, from 20° to 35° N (Casablanca region) and the Mediterranean Sea. It is a surfacial species.

Absent in our collections.

6. ***Hyperoche capucinus*** Barnard, 1930 (Fig. 147)

Barnard, 1930: 416.—*luetkenides* (non Walker, 1906); Monod, 1926: 49.

Sexually mature male 14 mm in length.

The 3rd segment of the mandibular palp is shorter than the 1st and 2nd segments together. The flagellum of antennae I and II in the sexually mature male consists of 23–24 segments.

In pereopos I and II the 2nd segment has minute denticles and setae along the anterior margin; the 4th segment has a posterior distal angle that stretches into a narrow triangular lobe; the anterior margin of the 4th–6th segments is armed with minute setae and the anterior distal angle of the 6th segment is stretched into a cusp about 1/4 the claw in length. In pereopods III and IV the 2nd segment has a slightly denticulate anterior margin; the 5th segment is longer than the 4th (more so than in H. medusarum) and its posterior margin is armed with strong setae; the 6th segment bears minute setae along the posterior margin. In pereopods V and VI the 2nd–6th segments bear minute setae along the anterior margin

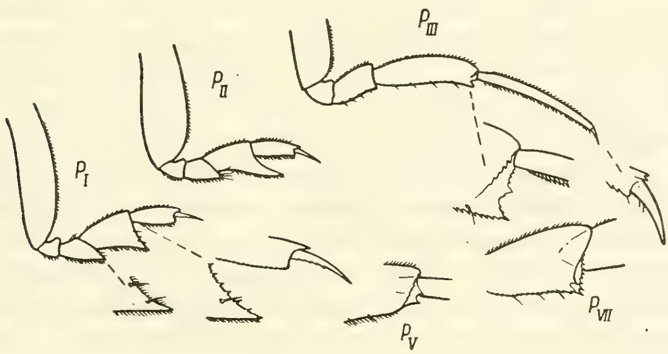


Fig. 147. *Hyperoche capucinus* Barnard, male (after Barnard, 1930).

and the 3rd–6th along the posterior margin as well; the posterior margin of the 2nd segment is finely denticulate. Pereopods VII are similar to pereopods V and VI in structure and about the same length as pereopods III and IV. The lower distal angle of epimerons I–III is acute. Both sides of the basipodite of uropods I but only the outer side in uropods II and III bear minute setae. Both margins of the rami of all the uropods,
289 except the outer side of the outer ramus, are denticulate. The telson is triangular, with an acute apex.

Distribution: Known from Antarctic waters at high latitudes.

7. ***Hyperoche luetkenides*** Walker, 1906

Walker, 1906: 453.

Male 12 mm in length.

The 3rd segment of the mandibular palp is equal in length to the 1st and 2nd segments together. In pereopods III the 4th segment has a process on the posterior margin which resembles a strongly denticulate tooth; in pereopods IV this process is smaller and not denticulate but the curved part of the distal margin of the 4th segment between the process and the base of the 5th segment is denticulate. In pereopods IV the posterior margin of the 4th and 5th segments is not denticulate; in pereopods V the 5th segment is curved. The telson is triangular, with a rounded apex, its length more than its width at the base and equal to half the length of the basipodite of uropods IV.

Distribution: The only known specimen was found in the Pacific sector of the Antarctic (57°25′ S, 151°43′ E).

5. Genus *Laxohyperia* Vinogradov and Volkov, gen. n.

Small animals, less than 5 mm in length.

All the somites of the pereon are free, somites V–VII being lower and narrower than the preceding ones. The epimerons are not well developed, due to which the posterior part of the body appears thin. The head is higher than the pereon, its height more than its length, and longer than somites I and II of the pereon together. The interantennal lobe is not developed. The eyes are large, occupy the lateral surface of the head, and are dorsally contiguous. Antennae I in females have a three-segmented peduncle and a one-segmented, narrowly conical flagellum; antennae II are four-segmented. A mandibular palp is present in females. Maxillae I bear short apical spines on the outer lobes. The maxillipeds have developed inner lobes that are only slightly smaller than the outer in length. The coxal plates are free. Pereopods I and II have a poorly developed chela formed by the petaloid distal process of the 6th segment and the petaloid posterior part of the 6th; the claws are attached subapically. Pereopods III and IV are somewhat longer and stronger than pereopods V and VI; pereopods VII are distinctly shorter.

Type species: *Laxohyperia vespuliformis* Vinogradov and Volkov, sp. n.

290 The genus is undoubtedly very close to the genus Hyperoche, but readily distinguished from it by smaller size, the unique structure of the 5th and 6th segments of pereopods I and II, and very poorly developed epimerons.

1. ***Laxohyperia vespuliformis*** Vinogradov and Volkov, sp. n. (Fig. 148)*

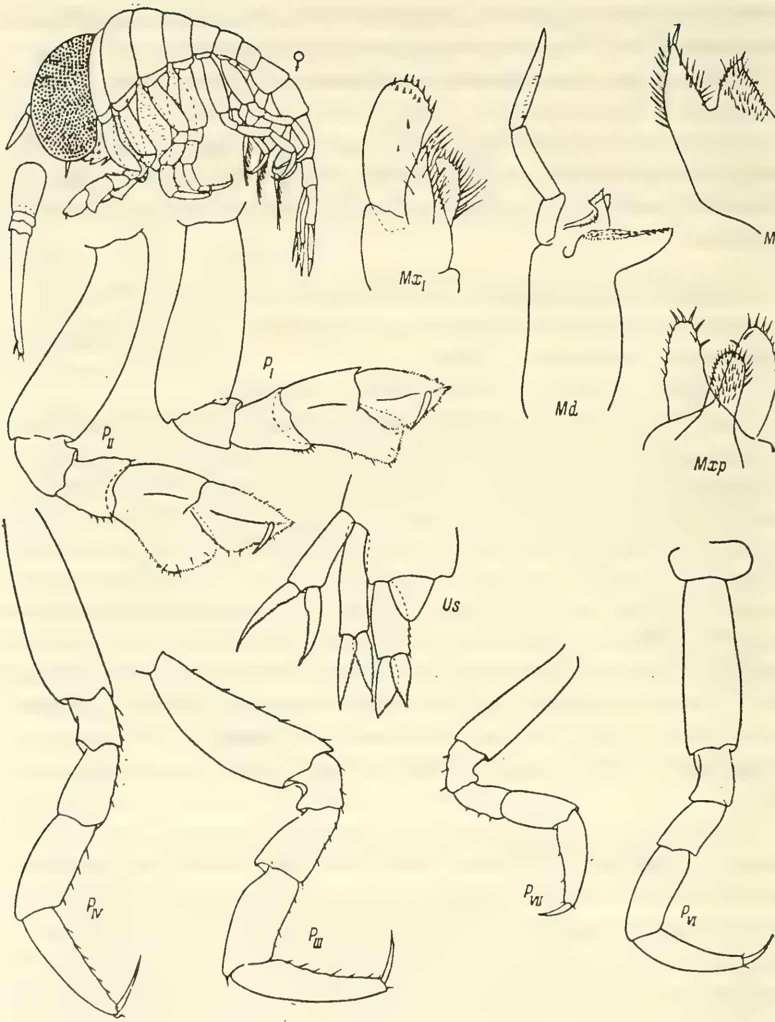
The type specimen is preserved in the Institute of Oceanography of the Academy of Sciences, USSR.

Length of females 3.5–4 mm. Male not known.

The pereon is broadened in the anterior part but tapers in the poste-
291 rior part; the pleon is as narrow and low as the last somites of the pereon. Antennae I have a narrowly conical flagellum exceeding the peduncle in length. Antennae II are half the length of antennae I; the flagellum has a linear distal segment. The mandibles are small, with a short denticulate cutting edge, and an accessory plate; the palp is three-segmented and shorter than the mandibular body. Maxillae I have a petaloid, slightly distally broadened palp and a strong outer lobe armed with long spines and setae. The outer lobe of maxillae II bears one strong apical seta. The outer lobes of the maxillipeds are narrowly oval and armed with a few strong setae in the distal part; the inner lobes extend to 2/3 the length of the outer and are pubescent with numerous short setae in the distal part.

Pereopods I and II are short and identical in structure; the 2nd segment is slightly broadend distally and shorter than all the other segments together; the 4th segment is trapezoid, expanding distally in such a way that its maximum width slightly exceeds its length; the 5th segment has a broad, almost rectangular, and nontapering leaflike lobe that exceeds half the length of the 6th segment in pereopods I, but does not quite reach here in pereopods II; the 6th segment has an almost straight anterior margin, a roundedly convex posterior margin, acute apex, and is flat and leaf like in the posterior part; the anterior and posterior margins of the 6th segment and distal lobes of the 5th are armed with numerous tender and short setae as well as rows of somewhat longer submarginal setae; the claw is long, straight, thin, and attached subapically. Pereopods III and IV are simple; the 2nd segment is almost linear; all the segments bear a few marginal setae along the posterior margin; the claw is long, thin, and almost straight. Pereopods V and VI are somewhat shorter and

* According to the first publication of the Russian text, this and other new species should be considered as described in 1982



290 Fig. 148. *Laxohyperia vespuliformis* Vinogradov and Volkov, sp.n., female.

weaker than pairs III and IV; they are not armed with marginal setae and their claws are slightly curved. Pereopods VII are similar in structure to the preceding pairs but weaker and shorter.

The inner margin of the rami of all the uropods as well as the outer margin of the endopodite of uropods II and III are finely denticulate. The endopodite of uropods I is sickle-shaped in the distal part. The roundish-triangular telson is half the length of the basipodite of uropods III.

Distribution: All specimens (three females) were found in a catch taken at a depth of 0–100 m in the central part of the Pacific Ocean (22° N, 114° W).

6. Genus *Parathemisto* Boeck, 1870

Boeck, 1870: 87; Bovallius, 1889: 248; Barnard, 1930: 419; Bowman, 1960: 344.—*Themisto* Guérin, 1825: 772; Stephensen, 1923: 19; 1924: 94.—*Euthemisto* Bovallius, 1887a: 21; 1889: 275.

The body is elongated and laterally compressed. All the somites of the pereon are free. The head is large and round, its height exceeding its length. The eyes occupy the entire dorsolateral surface of the head. In antennae I the flagellum has a long narrowly conical segment.Antennae II have few segments and are about the same length as antennae I. The mandibles in both sexes bear a palp and a strong dentate process. The outer lobe of maxillae I has two strong apical spines. The inner lobes of the maxillipeds are well developed. Pereopods I are simple. Pereopods II have a chela formed by the 6th segment and the narrow grooved process of the 5th segment. In pereopods III and IV the 5th segment is broadened and together with the 6th segment forms an indistinct subchela. Pereopods V–VII are longer than pereopods III–IV.

Type species: *Parathemisto abyssorum* Boeck, 1870.

Boeck (1870) separated *Parathemisto* from the genus *Themisto*
292 Guérin on the basis of the approximately equal length of the pereopods V–VII; in *Themisto* pereopods V are significantly longer than pairs VI or VII. Subsequently, Bovallius (1887a) noted that the name *Themisto* was already occupied and accordingly renamed the genus *Themisto* as *Euthemisto*. Stephensen (1924) showed that the differences between the genera, as listed by Boeck, are not significant since based on the ratio length of the legs, the male of some species could be related to the genus Euthemisto but the female to the genus *Parathemisto*. Barnard (1930) and subsequent authors considered *Parathemisto* and *Euthemisto* subgenera of the single genus *Parathemisto*.

The following features are characteristic of the subgenus Parathemisto: absence of dorsal denticles on the somites of the pereon and the pleon, thil ald straight flagellum of antennae I in females, just slightly broadened 5th segment of pereopods III and IV, and highly stretched inner distal angle of the basipodite of uropods III.

In representatives of the subgenus *Euthemisto*, dorsal denticles may be present on the somites of the pereon or the pleon; the flagellum of antennae I in females is generally strongly curved and more massive than in *Parathemisto* (with the exception of P. (*E. libellula*); the 5th segment of pereopods III and IV is highly broadened; pereopods V are generally significantly longer than pereopods VI and VII; and the inner distal angle of the basipodite of uropods III is only slightly stretched.

Although recently subjeced to a special revision (Bowman, 1960), the systematics of the genus is quite confused since investigations continue to appear which change the concept of the validity of some species (Sheader and Evans, 1974). At present the genus includes six species.

KEY TO SPECIES OF GENUS PARATHEMISTO

1. Pereopods V and VI approximately equal in length or pair VI slightly longer than V .... 2.
— Pereopods V significantly longer than pair VI .... 5.
2. Maxillipeds with row of setae in distal part of basal plate........ 3.
— Maxillipeds without row of setae in distal part of basal plate....... .... 1. ***P. (P.) abyssorum*** Boeck.
3. Antennae I in females narrow, straight. Claws of pereopods V-VI bear setae in proximal part of anterior margin.................... 4.
— Antennae I in females broad, curved. Claws of pereopods V–VI smooth, without setae .... 6. ***P. (E.) australis*** (Stebb.).
4. Antennae I and II in females equal in length. Length of adult females 4.5–8.5 mm............................ 3. ***P. (P.) pacifica*** (Stebb.).
— Antennae II in females longer than antennae I. Length of adult females 9–17 mm .... 2. ***P. (P.) japonica*** Bov.
5. Claws of pereopods V–VII bear setae in proximal part of anterior margin ....4. ***P. (E.) libellula*** Licht.
— Claws of pereopods V-VII smooth, without setae ....5. ***P. (E.) gaudichaudi*** (Guérin).

All representatives of the genus *Parathemisto* lead a free mode of life. They inhabit the surfacial and medium-deep layers of the pelagic zone in cold-water and moderately cold-water regions. Some species play a significant role in the plankton of cold-water and moderately cold-water regions of the peripheral seas and oceans where they hold 3rd and 4th place in terms of biomass, after copepods, chetognaths and euphausiids; sometimes they form huge congregations. For example, in the northwestern part of the Pacific Ocean, within 10 minutes of trawling the surface water with a small pleusiton net we were able to catch more than 1.5 kg of minute *Parathemisto pacifica*. In Antarctic waters concentrations of *P. gaudichaudi* sometimes clog the water-intake strainers of ships, while
293 in New Zealand dead crustaceans thrown up by storms have covered large areas of the coast (Gray and McHardy, 1967). Expectedly, *Parathemisto* play a significant role in the food of several plankton-feeding fishes.

1. ***Parathemisto (Parathemisto) abyssorum*** Boeck, 1870 (Figs. 149, 150)

Boeck, 1870: 87; Sars, 1883: 75; Bovallius, 1887c: 566; Stephensen 1923: 20 (*Themisto*); 1924: 95; Schellenberg, 1927: 629; Barnard, 1959: 125; Bowman, 1960: 368.—*oblivia* Bovallius, 1889: 251; Sars, 1895: 10; Vosseler, 1901: 80.

Length of sexually mature specimens 10–21 mm.

The head is equal in length to the first two somites of the pereon. In antennae I the peduncle is three-segmented and short; the flagellum in females is just barely longer than the head, narrowly conical, and not distinctly divided into segments; in sexually mature males the flagellum consists of 13–15 segments and extends to the end of the pereon.

The mandibles have a narrow denticulate cutting edge and an accessory plate is present in the left mandible; the dentate process is strong and broad; the 2nd segment of the thin palp is approximately twice longer than the 1st and 1.5 times the 3rd segment. The outer lobe of maxillae I bears a row of setae in addition to two strong apical spines and the palp is broader than long. The outer lobe of maxillae II is narrow and apically armed with two spines; the much broader inner lobe bears only one apical spine. The outer lobes of the maxillipeds are narrow, sickle-shaped, and unarmed along the convex outer margin; the inner lobes form a plate with a straight or concave distal margin; the basal plate is unarmed.

The 6th segment of pereopods I is shorter than the 5th and its posterior margin very finely denticulate with a few submarginal short setae; the claw bears a group of short setae in the proximal part of the inner margin. Pereopods II are somewhat longer than pereopods I; the 5th segment has a spoon-shaped process extending to 2/3 the length of the 6th

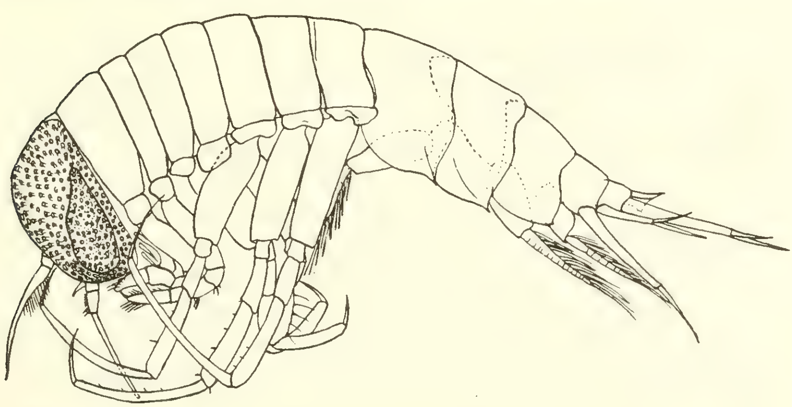
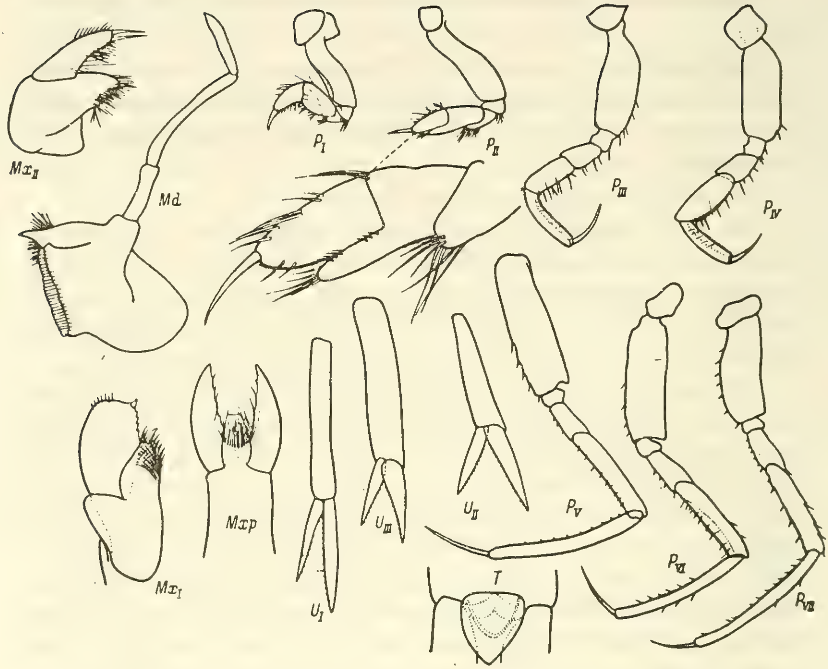


Fig. 149. *Parathemisto (Parathemisto) abyssorum* Boeck, female (after Barnard, 1959).



294 Fig. 150. *Parathemisto (Parathemisto) abyssorum* Boeck, female (after Barnard, 1959).

segment and apically bearing a few long setae; the 6th segment has a finely denticulate posterior margin; the claw is straight and smooth. In pereopods III and IV the 4th segment is identical in structure and slightly broadens distally; it is 1/2–2/3 the length of the narrowly oval, almost linear 5th segment; the 6th segment of pereopods III is 1.2-1.5 times longer than the 5th but in pereopods IV almost equal to the 5th segment; the claws are long and smooth. Pereopods V–VII are similar in structure and almost equal in length; the 4th segment is approximately half the length of the linear 5th segment, which in turn is about 2/3 the length
294 of the much thinner 6th segment; the claws are thin, almost straight and smooth, and 2/7–2/5 the length of the 6th segment. The anterior margin of the 5th and 6th segments of pereopods V is smooth while in pereopods VI and VII it is pubescent with short and tender setae.

The basipodites of all the uropods are considerably longer than the rami; the outer margin of the rami is smooth and the inner margin finely denticulate. The oval-triangular telson has an acute apex, is 1/3 the length of the basipodite of uropods III, and slightly longer than its own width at the base.

Distribution: Arctic seas and Central Polar Basin; it mainly lives in the upper 100 m layer. In the western part of the Atlantic Ocean it moves with cold waters south up to Gulf of Maine, while in the eastern part individuals were found in the Bay of Biscay but only at a depth of a few hundred meters. It does not penetrate farther south than the Bering Strait and is not found in the Pacific Ocean.

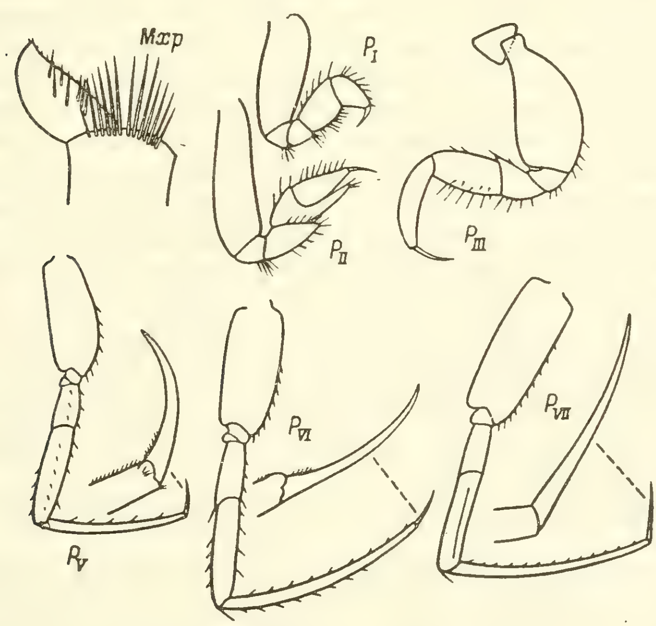
The life cycle covers two years; the crustacean dies after reproduction. The period of reproduction is protracted and probably stretches from February to August.

295 2. ***Parathemisto (Parathemisto) japonica*** Bovallius, 1887 (Fig. 151)

Bovallius, 1887a: 21; 1889: 258; Behning, 1939: 362; Bowman, 1960: 365.

Length of sexually mature females 9–17 mm; males somewhat smaller.

This species is quite close to *P. abyssorum* and differs from it only in a few secondary structural details. The structure of the antennae is the same as in *P. abyssorum* but in the female antennae II are distinctly longer than antennae I, being about equal to the length of the head and the first three somites of the pereon. In the distal part of the basal plate



295 Fig. 151. *Parathemisto (Parathemisto) japonica* Bovallius, female (P_{I-II}—after Behning, 1939; rest—Bowman, 1960).

of the maxillipeds a row of strong setae occurs, which are much longer in the middle, becoming shorter towards the ends; there are no setae on the outer margin of the outer lobes of the maxillipeds.

The 6th segment of pereopods I is shorter than the 5th, its posterior margin finely denticulate and without submarginal setae; the claw is finely denticulate in the proximal part of the inner margin. pereopods III and IV are identical in structure; the short 4th segment broadens distally and the oval 5th segment is 1.5–2 times longer than it; the 5th segment bears long strong setae along the inner margin; the slightly curved 6th segment is barely longer than or equal to the 5th segment; the claw is long, slightly curved, and smooth.

Unlike in *P. abyssorum*, of the last three pairs of pereopods, pair V is the shortest and pair VI the longest; the difference in total length of these pereopods depends mainly on the length of the 6th segment, which is 1.5 times longer than the 5th in pair V and two times longer in pair VI; the posterior distal angle of the 5th segment in pereopods VI and VII bears one long strong seta; the claws of pereopods V–VI or V–VII are 2/11–2/9 the length of the 6th segment and bear a small fascicle of short setae in the proximal part of the anterior margin.`The triangular-oval telson is 2/5–1/2 the length of the basipodite of uropods III.

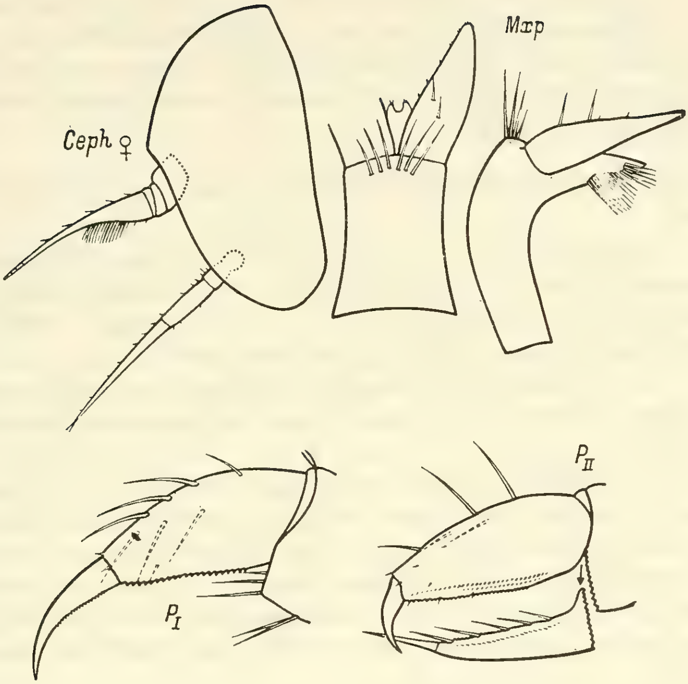
Distribution: This is an abundant species in the Sea of Japan and the Sea of Okhotsk. How far it penetrates into the ocean is not known as most researchers have not separated it from the very closely related species,
296 *P. pacifica* (discussed below), which lives in the subarctic waters of the Pacific Ocean. There are references to its detection in the ocean in the coastal areas of northern Japan and the South Kuril Islands. The young of *P. japonica* live mainly in the upper 50 m layer but adults are found at greater depths as well—right up to 500 m and, in the Sea of Japan, even deeper than 1,000 m, up to the near-benthic layer ($\sim 3,000$ m). In the Sea of Japan crustaceans larger than 5 mm perform intensive diurnal migrations with an amplitude of about 400 m (Semenova, 1974).

3. ***Parathemisto (Parathemisto) pacifica*** Stebbing, 1888 (Fig. 152)

Stebbing, 1888: 1420; Bovallius, 1889: 263; Bowman, 1960: 345.—*oblivia* Holmes, 1904: 233.—*abyssorum* (non Boeck, 1870); Shoemaker, 1930: 132 (Themisto part.); Thorsteinson, 1941: 90.—*japonica* Vinogradov, 1956: 211 (part.).

Length of sexually mature females 4.5–8.5 mm; males somewhat smaller.

P. pacifica differs from *P. japonica* in much smaller size of sexually mature individuals and antennae II in females do not exceed antennae I in length as they are somewhat shorter than the head and two subsequent somites of the pereon. Moreover, the pereopods of *P. pacifica* are armed with much weaker and sparser setae than in *P. japonica*.



296 Fig. 152. *Parathemisto (Parathemisto) pacifica* Stebbing, female (after Bowman, 1960).

Notes: Remarkably close to *P. japonica*; most authors, commencing with Barnard, have considered *P. pacifica* a synonym of the former. However, Bowman studied in detail the fauna of the genus *Parathemisto* in the northern part of the Pacific Ocean and showed that there are constant, albeit insignificant, differences between these two species. In those few regions where the areas of distribution overlap, the affinity of the crustaceans to one or the other species can be adequately and definitely established.

Distribution: Sub-Arctic waters of the northern part of the Pacific Ocean and the Bering Sea. Apparently, it is absent in the Sea of Japan. It is not known whether *P. pacifica* penetrates into the Sea of Okhotsk and
297 how far. It mainly inhabits surfacial waters and only solitary specimens are found deeper than 200 m (at least in the summer). The depth of habitation of the population changes in different seasons: the crustaceans live closer to the surface in summer than they do in winter. Sometimes they form huge concentrations near the surface film of the water.

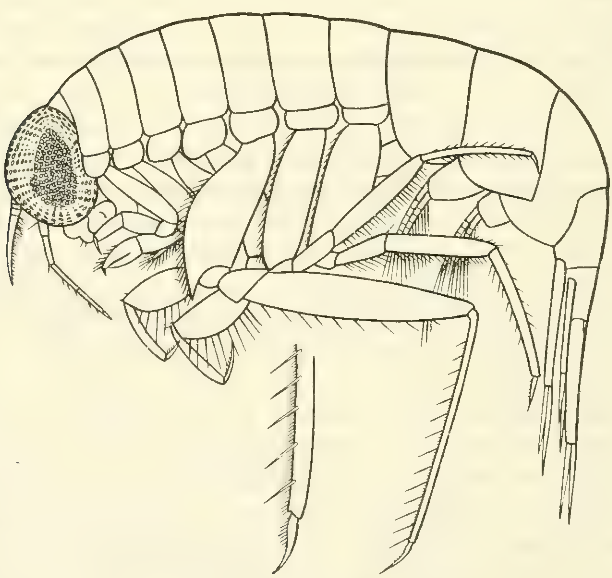
The period of reproduction of *P. pacifica* is quite protracted. According to Bowman (1960), during the course of their life the crustaceans reproduce at least twice and, possibly, oftener. The number of eggs in the brood pouch varies from 20 to 60, whereas in the much larger *P. japonica* may be as high as 200.

4. ***Parathemisto (Euthemisto) libellula*** (Lichtenstein, 1822) (Figs. 153, 154)

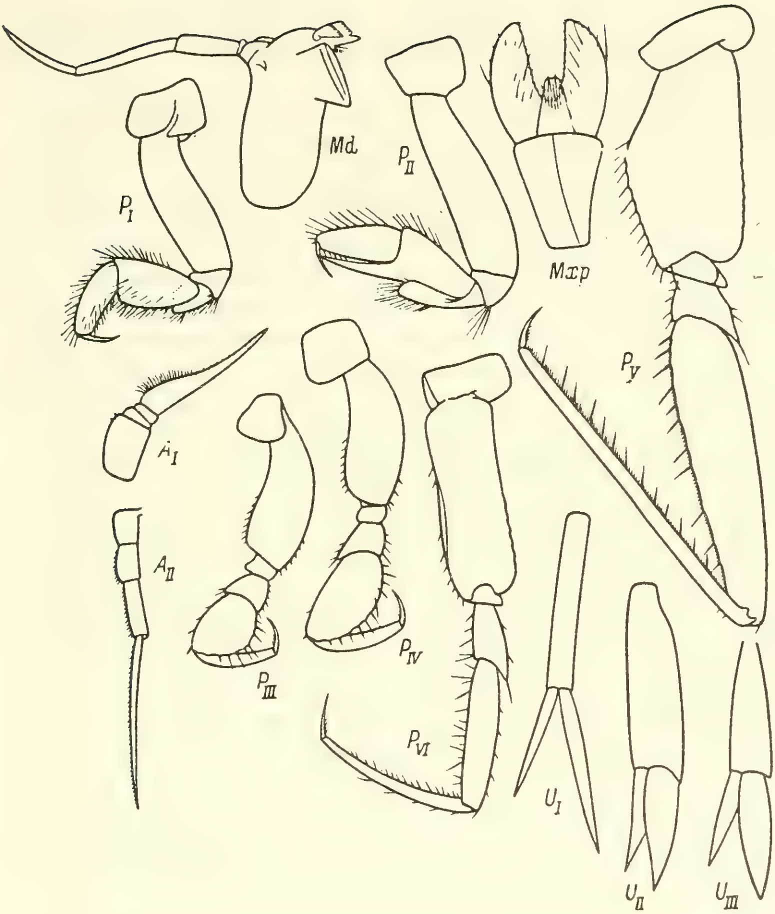
Lichtenstein, 1822: 32 (*Gammarus*); Goës, 1866: 533 (*Themisto*); bovallius, 1889: 281 (*Euthemisto*); Sars, 1893: 13; Stephensen, 1923: 24 (*Themisto*); Schellenberg, 1927: 627; Vinogradov, 1956: 211 (*Euthemisto*); Barnard, 1959: 123; Bowman, 1960: 382.

This is a much larger species of the genus. Sexually mature specimens are generally up to 30 mm in length but females sometimes up to 60 mm.

The somites of the pereon and pleon are without dorsal denticles. The head is spherical and the lower frontal angle round. Antennae I and II in females are approximately equal in length; the flagellum of antennae I is conical and the thin distal part not curved. In young males antennae I are almost the same in structure as in females and their flagellum unsegmented. Antennae II in females and young males are somewhat



297 Fig. 153. *Parathemisto (Euthemisto) libellula* (Linchtenstein), female (after Sars, 1890).



298 Fig. 154. *Parathemisto (Euthemisto) libellula* (Liichtenstein), female.

longer than antennae I, their flagellum thin and unsegmented, and the total length somewhat greater than the length of the head.

The mandibles have a narrow denticulate cutting edge (the left mandible has an accessory plate) and a strong dentate process; the 1st segment of the palp is 2/3 the length of the 2nd and barely shorter than the slightly curved 3rd segment. Maxillae I have a strong spine on the distal margin of the outer lobe and the inner margin of the palp is denticulate almost throughout its length. The outer lobe of maxillae II is narrower than the inner and apically bears two strong spines. The outer lobes of the maxillipeds are somewhat broader than in other species of the genus, the inner margin is finely denticulate but the outer convex

298 margin bears one or several long setae; much shorter setae are present also on the surface of the lobe; the basal segment bears a row of setae along the anterior margin.

Pereopods I are strong; the conical 6th segment is somewhat shorter than the distally broadened 5th segment, and both segments bear numerous setae on the anterior and posterior margins and on the surface; the claw is strong, slightly curved, and very finely denticulate in the distal part of the inner margin. The distal process of the 5th segment of pereopods II extends to the distal end of the 6th segment, both its margins bear short and strong setae, and the process terminates in a short and strong apical spine; the conical 6th segment bears long setae on the anterior margin. The 2nd segment of pereopods III is broad and tapers in the proximal part; the 4th segment is short and trapezoid; the 5th segment is braodly oval, its maximum width 2/3 its length; the narrow 6th segment is slightly curved, and equal to or somewhat longer than the 5th; the claw is strong and bears a fascicle of short setae in the proximal part of the posterior margin. Pereopods IV are longer but the 5th segment relatively narrower. Pereopods V are significantly longer than all the other legs; the broad 2nd segment has a straight posterior margin while its anterior margin is concave in the proximal part; the 3rd and 4th
299 segments are very short; the strong 5th segment is broad in the proximal part, gradually tapers distally, and is sometimes club-shaped, the narrow 6th segment is straight, and equal in length to the 3rd, 4th, and 5th or the 4th and 5th segments together; the anterior margin of the 5th and 6th segments bears a row of sparse strong setae of equal length with a pecten of numerous very short and thin setae between them; the claw is slightly curved, 1/10–1/6 the length of the 6th segment, and bears a fascicle of short setae in the proximal part of the anterior margin. Pereopods VI and VII are almost identical in length and structure; the 2nd segment is broad and linear or its margins are concave in the middle part; the 4th segment is almost half as wide as long; the 5th segment is linear and equal to or slightly shorter than the much narrower 6th segment; the claws have a fascicle of setae on the anterior margin.

The uropods are long and narrow; the endopodites of uropods I and II are equal to the basipodites while the exopodites are shorter. The rami of uropods III are broad and shorter than the basipodite; the inner distal angle of the basipodte is acute and stretched. The margins of the rami have fine denticulation which is poorly noticeable. The oblong-triangular telson has an acute apex.

Distribution: A circumpolar cold-water species. It inhabits the Central Polar Basin, where it was found right up to the Polar region and peripheral Arctic seas. In the Atlantic Ocean it moves with cold waters along the coasts of America up the Gulf of St. Lawrence and coasts of

Newfoundland; in the eastern part of the ocean it is not found south of Iceland and Nordkapp. In the Pacific Ocean it is numerous in the much colder water regions of the Bering and Okhotsk seas, occupied by the "arctic" plankton complex. In the cold season of the year it is found in small numbers on the oceanic side of the North Kuril Islands and in the eastern coastal regions of Kamchatka. The crustaceans mainly concentrate in the upper 100 m layer but individuals are found in deeper waters also, up to 500 or even up to 1,000 m.

Dunbar (1946, 1957) presumes that the life cycle of *P. libellula* covers two years (the Canadian Arctic). Reproduction takes place in the autumn and winter of the second year of life and the crustaceans die thereafter; however, some of the crustaceans may commence reproduction at the end of the first year of life.

5. ***Parathemisto (Euthemisto) gaudichaudi*** (Guérin, 1825) (Figs. 155, 156)

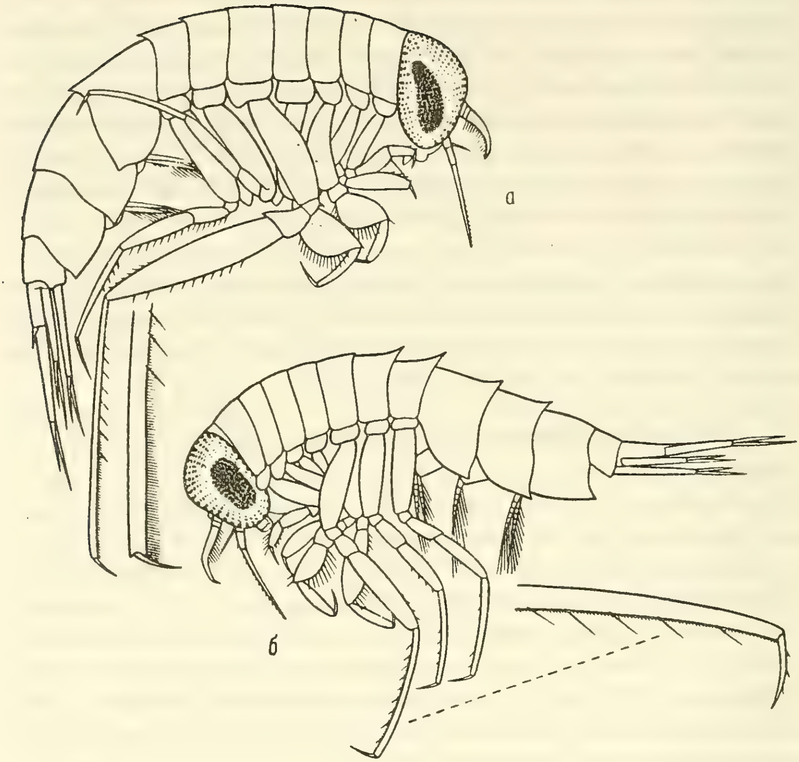
Guérin, 1825: 744 (*Themisto*); Bovallius, 1889: 299; Barnard, 1930: 420; 1932: 280; Stephensen, 1933: 63; 1944: 10; 1947: 76 (*Themisto*); Pirlot, 1939: 39; Hurley, 1955: 161; Bowman, 1960: 379; Kane, 1963: 35; Sheader and Evans, 1974: 915.—*gracilipes*, (?) obliva Norman, 1869: 287 (*Hyperia*).—*gracilipes* Stephensen, 1924: 97 (*Themisto*).—*compressa* Stephensen, 1924: 103 (*Themisto*); Chevreux, 1935: 191 (*Euthemisto*).—*bispinosa* Chevreux, 1935: 191 (*Euthemisto*).—*antarctica* Ealey and Chittleborough, 1956: 22 (*Euthemisto*).

A highly variable species. Length of sexually mature specimens ranges from 4 to 28 mm.

Somites VI and VII of the pereon and somites I and II of the pleon bear dorsal denticles developed to a various degree. In females and young males the flagellum of antennae I is conical, with a curved and narrow distal part not divided into segments. In sexually mature males the proximal segment of the flagellum is oval-conical and twice the length of the peduncle; the remaining 12–15 segments are thin, virgate. Antennae II are thin and much longer than antennae I; as males mature the flagellum of antennae II becomes segmented, elongates, and in sexually mature specimens consists of 15–20 segments; in females the flagellum is much shorter and not divided into segments.

The structure of the mouthparts does not differ significantly from other species of the genus. Maxillae I have a small, poorly developed inner lobe.

300 The 5th segment of pereopods I is elongated-oval, the 6th conical and slightly curved; the distal part of the 6th segment is finely denticulate; the strong curved claw is half the length of the 6th segment and the



300 Fig. 155. *Parathemisto (Euthemisto) gaudichaudi* (Guérin, females (after Sars, 1890).
a—*f. bispinosa*; b—*f. compressa.*

proximal part of its posterior margin is finely denticulate. Pereopods II are longer than pereopods I; the 5th segment is distally broadened and its distal process extends to 1/2–4/5 the length of the slightly tapering 6th segment; both margins of this process bear long strong setae and a much stronger seta occurs at the apex; in the 6th segment the posterior margin is very finely denticulate; the strong, almost straight claw is half the length of the 6th segment and finely denticulate in the proximal part of its posterior margin. The 4th segment of pereopods III is notably narrower and about half the length of the broadly oval 5th segment; the maximum width of the 5th segment is 1/2 its length in males and 2/3 in females, and the posterior margin more convex and armed with strong setae; ornamentation of the 5th segment is weaker in females than in males; the 6th segment is much narrower, slightly curved and approximately the same length or somewhat longer than the 5th segment;

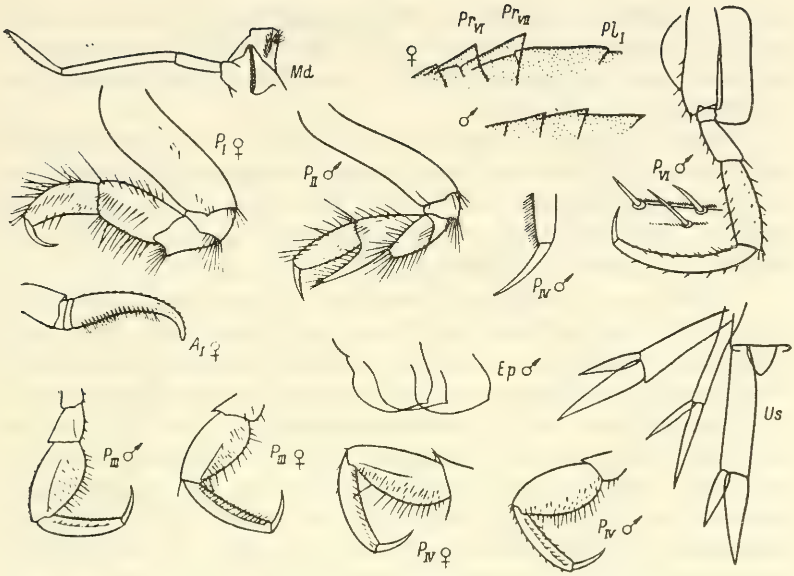


Fig. 156. *Parathemisto (Euthemisto) gaudichaudi* (Guérin) (after Hurley, 1955).

the claw is almost straight, smooth, and 1/3 to 2/5 the length of the 6th segment. Pereopods IV are similar in structure but the 5th segment is relatively broader and in males its maximum width may be more than half its length. Pereopods V are longer than all the other legs; the 2nd segment is broad and shorter than the narrowly lanceolate 5th segment or almost equal to it; the thin, straight or slightly curved 6th segment is longer than the 5th segment, and armed along its anterior margin with sparse submarginal setae with a row of dense short and tender setae
301 between them (in *f. bispinosa* these setae, especially in the distal part of the segment, are notably longer than in *f. compressa*); the claw is almost straight, its anterior margin neither armed nor denticulate, and 2/3 the length of the 6th segment is young specimens but only 1/10–1/6 in sexually mature specimens. Pereopods VI and VII are identical in structure but pereopods VII somewhat longer than VI; the 6th segment is somewhat (1.2–1.5 times) longer than the 5th segment and equal to or somewhat longer than the 2nd; the claw is smooth and almost straight.

The posterior margin of the exopodites and the anterior margin of the endopodites are finely denticulate in all the uropods. The inner distal angle of the basipodite of uropods III is stretched into a denticle. The inner margin of both rami of uropods II has a sharp concavity in the proximal part; in this concavity both rami bear numerous minute tender setae on the ventral surface. The exopodites of the uropods are shorter than the basipodites, constituting in the young about 3/4, but in sexually mature individuals about 1/2 their length. The triangular-oval telson has an obtuse apex and extends to 1/5–1/3 the length of the basipodite of uropods III.

Notes: Two forms—*compressa* and *bispinosa*—have been identified within the species, which are distinguished by the degree of development of the dorsal denticles on somites VI–VII of the pereon and somites I–II of the pleon, the shape and ornamentation of the segments of the pereopods, and by the relative length of pereopods V and VI.

Distribution: A bipolar, circum-Antarctic, moderately cold-water species. In the Northern Hemisphere it inhabits cold-water and moderately cold-water regions of the Atlantic Ocean from 76° to 40° N It penetrates farther south in small numbers and is found in the bermuda and Canary Islands and in the Mediterranean Sea. it is not found in the Central Polar Basin. In the northern part of the Pacific Ocean it is reported only from the Yellow and East China seas (identification doubtful), but is absent in farther northern regions. In the Southern Hemisphere it inhabits the entire South Ocean from the coastal pack
302 ice to the zone of the Antarctic Convergence. Together with the cold Antarctic currents it also penetrates farther north, where it has been found in Cape Town (37° S) western Australia (18–25° S), 107–108° E), southern coastal areas of Australia (41° S), and in the Pacific oceanic coastal areas of South America (the Juan Fernandez Islands).

In the Southern hemisphere *P. gaudichaudi* is one of the numerous species of the Antarctic plankton, forming at places vast concentrations in the surfacial layer of the water, often together with concentrations of *Euphausia superba*. During the day the main mass of crustaceans remains deeper of 25–50 m, including layers at 100–200 and 200–500 m, but at night the major part of the population ascends to lesser depths, right up to the very surface. Farther north of the Antarctic Convergence it is confined mainly to cold Antarctic intermediate waters.

6. ***Parathemisto (Euthemisto) australis*** (Stebbing, 1888) (Fig. 157)

Stebbing, 1888: 1417 (*Euthemisto*); Barnard, 1930: 421; Hurley, 1955: 164; Vinogradov, 1962: 27.

Length of sexually mature specimens 5–10 mm.

This species is close to *P. gaudichaudi* and distinguished from it only by some structural details.

The body is without denticles on the somites of the pereon and the pleon.

In males the 5th segment of pereopods III is almost trapezoid, highly broadened distally, its width in the distal part 4/5 its length; the 4th and 5th segments are covered along the posterior margin and adjacent surface area with a woolly mass of short tender setae; in females the

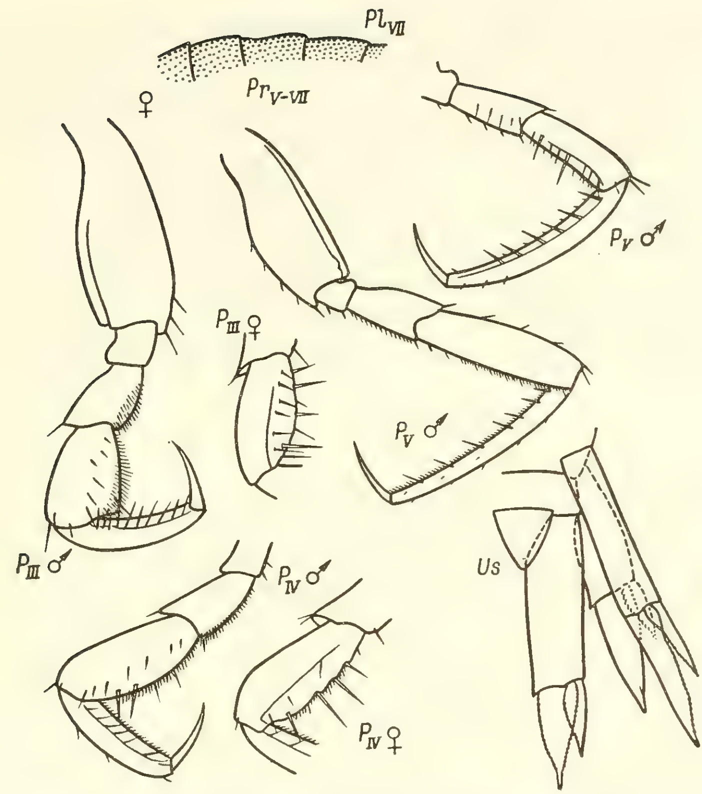


Fig. 157. *Parathemisto (Euthemisto) australis* (Stebbing) (after Hurley, 1955).

303 5th segment is much narrower, elongated-oval, and without a setose (or setaceous) cover; the 6th segment is narrow, almost linear, and somewhat longer than the 5th; the claw is strong, almost straight, and approximately half the length of the 6th segment. The 5th segment of pereopods IV is elongated-oval, with strong setae along the posterior margin, and almost identical in males and females; the 6th segment is equal in length to the 5th. Pereopods V are longer than the preceding ones; the 2nd segment is relatively short, broad, and almost equal to the linear 5th in length but twice longer than the distally broadened 4th segment; the linear 6th segment is straight and approximately 1.5 times longer than the 5th; the claw is strong and almost straight. Pereopods VII are somewhat shorter than pereopods V; the 4th segment is 3/4 the length of the 5th and both are almost linear; the 6th segment is narrower but 1.5 times longer than the 5th and both bear a row of strong setae on the posterior surface; the claw is strong, almost straight, and about 1/3 the length of the 6th segment.

The posterior margin of the exopodites and the anterior margin of the endopodites are finely denticulate in all the uropods. In addition, the posterior margin of the endopodite and the distal part of the posterior margin of the basipodite of uropods III are also denticulate. The exopodite of uropods III is 3/4 the length of the endopodite. the roundish-triangular telson extends to 1/3 the length of the basipodite of uropods III.

Distribution: Sub-antarctic regions of the Pacific Ocean: the open ocean (46–52° S, 163° E, 80° W), coastal waters north of New Zealand (31°09′ S, 176°03′ W), southeastern coastal areas of New Zealand as well as southwest of Melbourne (39°45′ S, 140°40′ E), southern coastal areas of Australia, and Bass Strait. Found from the surface to a depth of 200 m.

7. Genus *Pegohyperia* Barnard, 1931

Barnard, 1931: 429; Hurley, 1960: 112.

The body is strong and elongated. The pleon is almost as wide as the pereon. All the somites of the pereon are free. The integument is compact and pigmented. The head is longer than somite I of the pereon. The interantennal lobe is well developed. The eyes are large and without facets. All the coxal plates are free and III–V are much larger than the others. Antennae I have a large, flat, and curved one-segmented flagellum in females. Antennae II are well developed in females. The mandibles have a palp in both sexes. The inner lobes of the maxillipeds are short. Pereopods I and II have a well-developed chela; pairs V and VI are longer than the others.

Type species: *Pegohyperia princeps* Barnard, 1931.

1. ***Pegohyperia princeps*** Barnard, 1931 (Fig. 158)

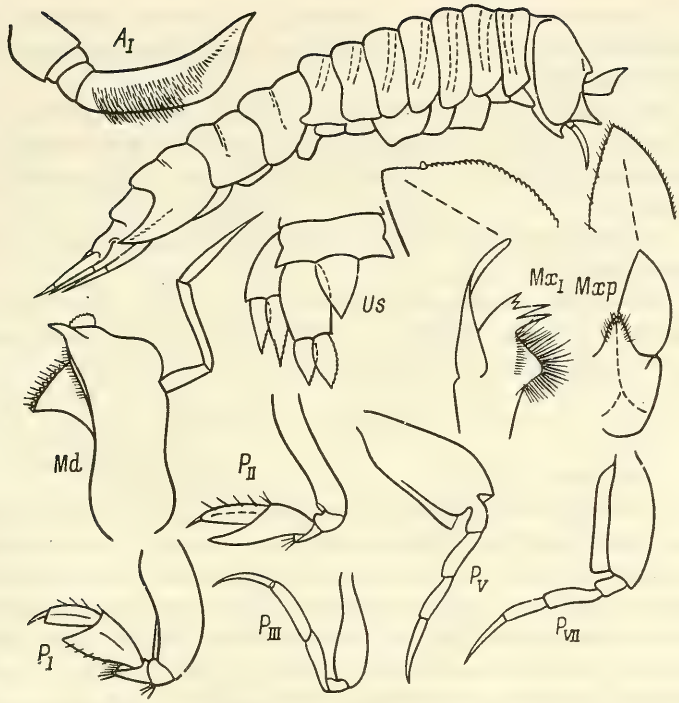
Barnard, 1931: 430; 1932: 277; Hurley, 1960: 112.

Length of sexually mature specimens 28–35 mm.

The head is large and its anterior part produced into two acute lobes, of which the lower (interantennal) is larger than the upper. Like the entire body, the eyes are also shagreen and not divided into facets.

Antennae I in females have a large, thin, platelike one-segmented flagellum, whose inner surface bears numerous thin setae. The one-segmented flagellum of antennae II bears thin setae along its anterior margin.

The mandibles have a well-developed cutting edge and an accessory plate; the dentate process is a triangular lamella. The outer lobe of maxillae I is strong, with denticles along the distal margin and the palp very short, petaloid. The inner lobes of the maxillipeds are armed
304 with numerous thin setae, the outer lobes oval, and the apex acuminate. The somites of the pereon are almost equal in length, each with a



304 Fig. 158. *Pegohyperia princeps* Barnard, females (after Barnard, 1932).

low transverse roller. The lower posterior angles are rounded in all the somites while the anterior angles in somites I and VI–VII are slightly stretched forward but not acute. The coxal plates of somites I and II are small and low, both with a horizontal keel. Somites III–V are high while somites VI–VII are low.

Pereopods I and II have a chela formed by the 5th and 6th segments. The distal posterior angle of the 5th segment of pereopods I is stretched into a broad and acute lobe, extending in females to 3/4 the length of the 6th segment and in males, to its distal end; the 6th segment is oval, with a straightly truncate distal margin, and its distal posterior angle stretches into a small lobe. The lobe of the 5th segment of pereopods II is narrower than in pereopods I and extends to the distal end of the 6th segment; the 2nd segment is narrower than in pereopods I. the 2nd segment of pereopods III and IV is distally broadened, clavate; the 6th segment is thin, slightly curved; the claw is very small. Pereopods V–VI are somewhat longer than pereopods IV; the 2nd segment abruptly broadens distally; the 6th segment is narrowly conical, slightly curved; the claw is very small and weak. Pereopods VII are similar to pair VI in structure but shorter. Epimerons I–III have a slanted keel; the posterior lower angle of epimeron III is stretched into a long acute lobe directed backward.

The uropods have a short broad peduncle and lanceolate rami, which are narrow in I and II and broad in III. The telson is galeiform, with an acute apex extending almost to the distal end of the penduncle of uropods III.

Live specimens are blackish-violet, the eyes black with a yellow or white broad rim.

Distribution: Southeastern Atlantic (33° 07′ S., 4° 30′ E.), the Antarctic (63°51′ S, 54°16′ E); 13°35′ N, 101°45′ E, Pacific (north-central waters and 13°33 N 101°45′ W).

305 8. Genus *Bougisia* Laval, 1966

Laval, 1966: 217.

The width of the pereon is more than its height. Somites I and II of the pereon are fused. The head has a rostrum and a well-developed narrow interantennal lobe. the small, highly pigmented eyes are situated laterally on the head. The mandibles have a palp in both sexes as well as a strong dentate process. The outer lobe of maxillae I has two apical spines. The maxillipeds have rudimentary inner lobes. The coxal plates are free. Pereopods I and II have a subchela; pereopods III–VII are approximately identical in length; pereopods V have a distally broadened 2nd segment.

Type species: *Bougisia ornata* Laval, 1966.

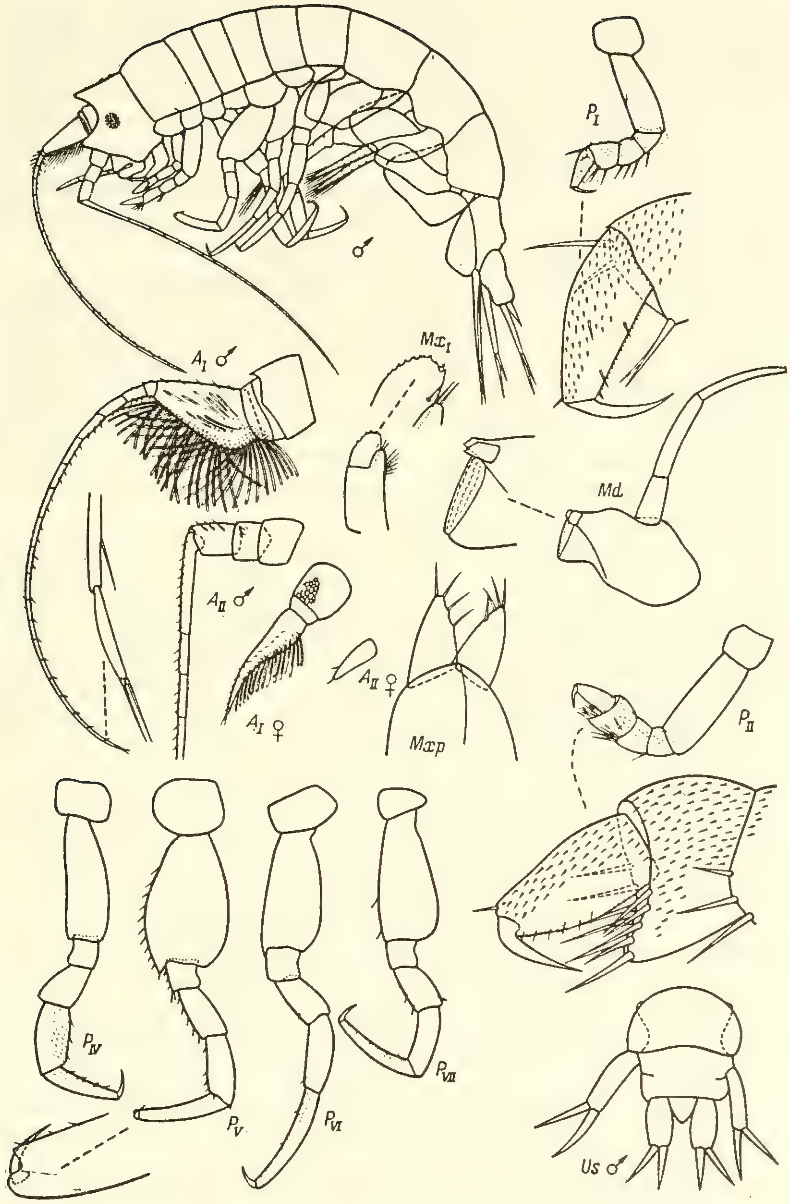
In structure of the head and especially of the eyes, as well as the unique alveolate structure of the integument, *Bougisia* resembles some hyperiideans of Physosomata from the superfamily Lanceoloidea. However, the structure of the antennae, the oral appendages, and the pereopods undoubtedly indicates the affinity of this genus to the family Hyperiidae. In some characters (presence of an interantennal lobe, compact integument) *Bougisia* is closer to *Pegohyperia*, but in the structure of the oral appendages (except for the mandibles) and the pereopods, it is closer to *Hyperia* or *Iulopis*. However, Laval is inclined to consider this similarity as convergent, because ecologically *Bougisia* is very close to *Hyperia*, which probably accounts for the morphological similarity among their representatives.

1. ***Bougisia ornata*** Laval, 1966 (Fig. 159)

Laval, 1966: 210.

Length of sexually mature specimens 3–4 mm.

The pereon is broader than the head and the pleon is somewhat longer than the pereon. Urosomites II and III are fused. The head is somewhat shorter than the first two somites of the pereon, its upper side



306 Fig. 159. *Bougisia ornata* Laval (after Laval, 1966).

slightly concave and below the level of the dorsal border of the first somites of the pereon. The rostrum is small, obtuse.

Antennae I in males are half the body length, the peduncle three-segmented, and the flagellum has 14 segments. The conical 1st segment of the flagellum has a convex posterior margin that is 1.5 times longer than the peduncle and its lower and inner surfaces bear numerous long sensory setae. In females the peduncle of antennae I has two segments, the flagellum is one-segmented, conical, and armed with a few sensory setae. Antennae II in males are longer than antennae I, the segments of the peduncle are short, and the flagellum is 13-segmented. Antennae II in females are rudimentary and one-segmented.

The mandibles have a very narrow denticulate cutting edge and an accessory plate (on the left mandible); the dentate process is strong, straight, with a tubercular masticatory surface. The palp of maxillae I is broad, denticulate along the anterior margin, and has a strong short spine on the inner distal angle. The inner lobe of maxillae Ii is broad and short. The basal segment of the maxillipeds is notably longer than the conical outer lobes, which have a smooth outer margin while the inner margin bears a few setae in the distal part.

The 5th segment of pereopods I is slightly broadened distally and the anterior margin straightly truncate; the 6th segment is conical and half as thick but 1.5 times longer than the 5th; the claw is strong and exceeds half the length of the 6th segment; the 4th–6th segments bear numerous short setae on the anterior surface. Pereopods II are somewhat longer than pereopods I; the 5th segment is broadened distally but its lower distal angle is stretched into a short spoon-shaped lobe armed along the
307 margin with numerous strong setae; the 3rd–6th segments bear numerous short setae on the anterior surface. Pereopods IV are somewhat longer than pereopods III; the 5th segment is almost twice longer than the 4th, its anterior margin convex, the posterior margin straight; the 6th segment tapers distally and is notably narrower and somewhat longer than the 5th segment; the claw is almost straight and the proximal part of its posterior margin denticulate; the posterior surface of the 5th and 6th segments is covered with very minute setae. Pereopods V are equal to pereopods IV; the 2nd segment is highly broadend, with convex anterior and posterior margins, its anterior distal angle stretched into a small denticle; in the narrow linear 6th segment the anterior distal angle resembles a straight tooth, which forms a chela with the claw curving tightly toward the anterior margin. Pereopods VI are slightly longer than pereopods V; the 2nd segment is slightly broadened and has a poorly developed posterior lobe; the 5th segment is the same length as in pair V but the 6th segment longer; the claw is less than 1/4 the length of the 6th segment. Pereopods VII are equal in length to pereopods V and the length ratio of the segments identical.

The peduncle of uropods I is linear and the same length as the rami; the rami are narrow, with an acute apex; the endopodite is slightly longer than the exopodite. The peduncle of uropods III is broadened and slightly longer than the rami; the rami are narrow, with an acute apex, and about equal in length. The telson is roundish-triangular, its width at the base greater than its length and half the length of the peduncle in uropods III.

Distribution: A few specimens of this species were caught on the Leptomedusae *Phialidium* in an expedition of the biological station Villefranche (the Mediterranean Sea). Although all the specimens were found in the catches taken in the upper 50 m layer, Laval suggests that this is a deep-water form, appearing incidentally in the surface layer due to upwelling.

Absent in our collections

9. Genus *Hyperioides* Chevreux, 1900

Chevreux, 1900: 143; Pirlot, 1929: 124.—*Parahyperia* Vosseler, 1901: 56.

Small species, only 5–8 mm in length.

The body is laterally compressed, more so than in *Hyperia*. The head is round and without a rostrum. The eyes occupy almost the entire surface or only the upper part of the head. Somites I and II of the pereon are fused in both sexes. In females antennae I are two- to three-segmented and antennae II one-segmented. The mandibles have a strong cylindrical dentate process; the mandibular palp is absent in females. The outer lobe of maxillae I bears three terminal spines. The basal segment of the maxillipeds is very long, the inner lobes small, with two apical spines. the coxal plates are fused with the somites of the pereon. Pereopods I and II have a weakly developed chela; the distal process of the 5th segment is spoon-shaped. Pereopods V–VI are longer than pereopods III–IV and VII. The claws of pereopods V–VII are long.

Type species: *Hyperioides longipes* Chevreux, 1900.

The genus includes two species.

KEY TO SPECIES OF GENUS HYPERIOIDES

1. Eyes occupy only dorsal surface of head. Antennae I in females three-segmented. Distal process of 5th segment of pereopods II extends to middle of 6th segment .... 1. ***H. longipes*** Chevr.

— Eyes occupy not only dorsal but also lateral surface of head. Antennae I in females two-segmented. Distal process of 5th segment of pereopods II extends to 1/4 length of 6th segment ....
....2. ***H. sibaginis*** (Stebb.).

308 1. ***Hyperioides longipes*** Chevreux, 1900 (Fig. 160)

Chevreux, 1900: 143; Lo Bianco, 1901: 422, 447; 1904: 43; Walker, 1903: 229; Chevreux and Fage, 1925: 407; Bowman, 1973: 33.

Length of adult specimens 5–7.5 mm.

The head is equal in length to five somites of the pereon, trapezoid, with the frons overhanging the base of antennae I. The eyes occupy only the dorsal surface of the head. Antennae I in females are very short, extending only to the site of attachment of antennae II; the flagellum is one-segmented and conical in females and multisegmented in males. Antennae II in females are very small, rudimentary, but longer than half the length of antennae I; in males the flagellum of antennae II is multisegmented and much longer than in antennae I.

The 5th segment of pereopods I is equal in length and width and the posterior distal angle is stretched into a narrow lobe extending to half the length of the broadly oval 6th segment. Pereopods II are somewhat longer than pereopods I; the lobe of the 5th segment extends to 2/3 the length of the narrowly oval 6th segment. Pereopods III and IV are longer than pereopods II; the 6th segment is somewhat longer than the 5th; the claw is strong and half the length of the 6th segment. Pereopods V–VI are much longer than pereopods III–IV; the 2nd segment is relatively broader; the 6th segment is distinctly longer than the 5th. The 2nd segment of pereopods VII is approximately the same length as in

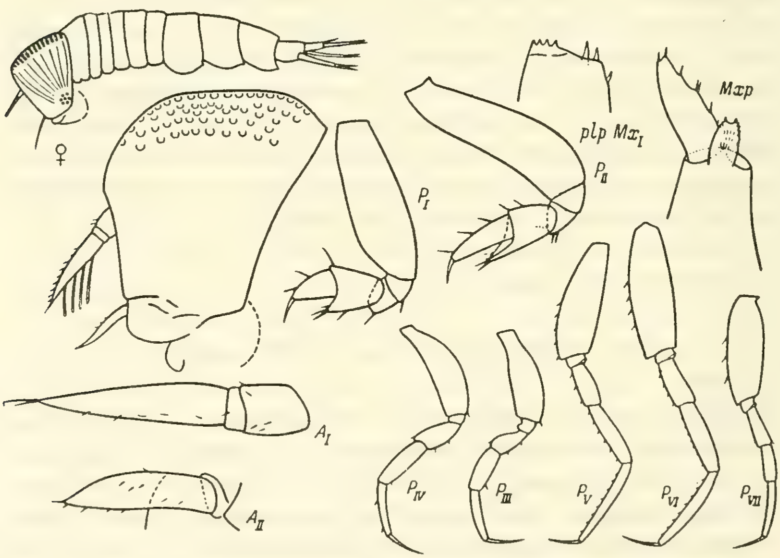


Fig. 160. *Hyperioides longipes* Chevreux, female (after Bowman, 1973).

pereopods V and VI but the distal segments (4th–5th) are shorter, due to which pereopods VII are significantly shorter than pereopods V or VI.

The rami of the uropods are narrowly lanceolate and the exopodites denticulate along the anterior margin. The rami of uropods I are approximately equal to the peduncle in length but in uropods II and III somewhat smaller; the peduncle is half as wide as long. The telson is semicircular, its length less than its width at the base.

Distribution: A circumoceanic warm-water species. It occurs in the Atlantic Ocean northward up to Ireland and southward to 37° 30′ S in the Mediterranean Sea, and tropical regions of the Indian Ocean. It is
309 found in the Pacific Ocean from 40° N to 51° S. The species inhabits the waters of epi- and partly mesopelagic layers from the surface to depths of 200–300 m, but smme individuals are also found in deeper waters, up to 500–600 m.

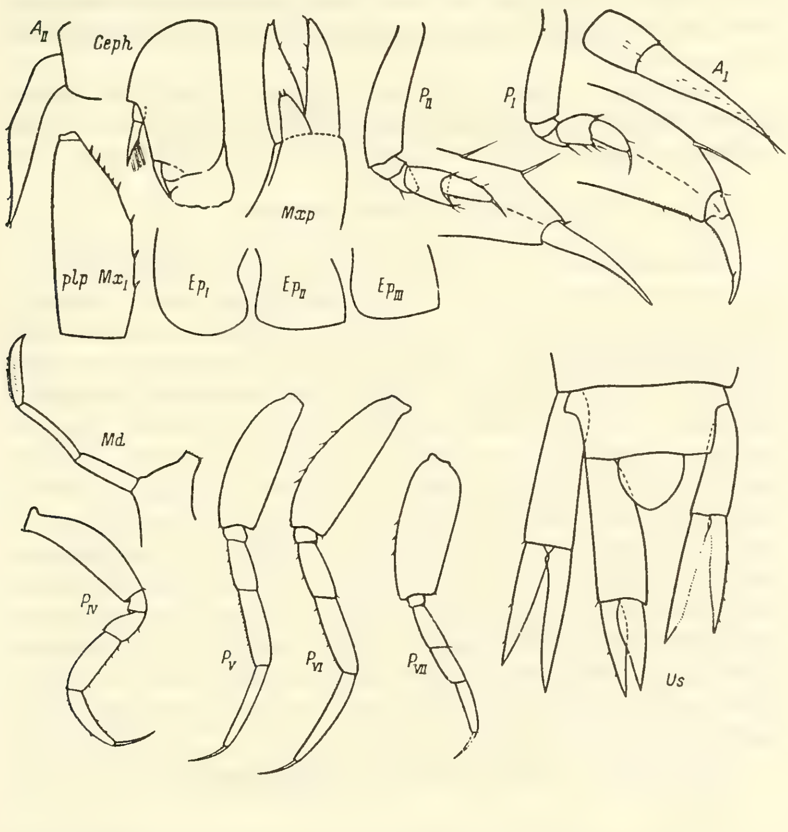


Fig. 161. *Hyperioides sibaginis* (Stebbing), female (after Bowman, 1973).

2. ***Hyperioides sibaginis*** (Stebbing, 1888) (Fig. 161)

Stebbing, 1888: 1379 (*Hyperia*); Bovallius, 1889: 201; (?) Pirlot, 1930: 18; Bowman, 1973:33.

Length of adult specimens 4–6 mm.

The head is round and longer than the first three somites of the pereon together. The eyes occupy not only the dorsal, but also the greater part of the lateral surface of the head.

In females antennae I are two-segmented and antennae II one-segmented; their length is approximately the same. Pereopods I and II are the same as in the preceding species,but the distal process of the 5th segment of pereopods II is shorter and does not extend to half the length of the 6th segment. The 5th and 6th segments of pereopods V and VI bear not only sparse spines on the anterior margin, but also a dense row of short thin setae. Pereopods VII are the same in structure as in *H. longipes*.

The posterior distal angle of epimeron I is round but in epimerons II and III acute. The uropods are much longer and thinner; the basipodite of uropods III is almost 1/3 as wide as long and 1.5 times longer than the exopodite.

310 *Distribution*: Found in the tropical waters of the Pacific Ocean: northern, central, and equatorial regions, of the Philippines, Line Islands, and the Gulf of Panama. It lives mainly in the upper 200 m layer.

10. Genus *Lestrigonus* Milne-Edwards, 1830

Milne-Edwards, 1830: 392; 1840:81; Bowman, 1973: 33.

A minute species (2–5 mm) with a highly bulged pereon. The head is spherical and the eyes occupy most of its surface. The anterior somites of the pereon [I–III (V) in females and I–II (IV) in males] are fused; the number of fused somites is specific to each species and the number always more in females than in males. Antennae I in females are two-segmented; antennae II are one-segmented and rudimentary. The epistome projects and is convex anteriorly. The mandibular palp is absent in females. The outer lobe of maxillae I bears three apical spines. The outer lobes of the maxillipeds are long and fairly narrow while the inner lobes are comparatively larger. The coxal plates are fused with the somites of the pereon. Pereopods I have a subchela or a poorly developed chela. Pereopods II have a chela and the distal process of the 5th segment is spoon-shaped. Pereopods V–Vii are generally longer than pairs III–IV. Pereopods VI are generally longer than the mutually equal pereopods V and VII.[3]

Type species: *Lestrigonus fabrei* Milne-Edwards, 1830.

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[3] Diagnosis of the genus and description of its constituent species are after Bowman (1979), with some emendations.

The genus *Lestrigonus* and genera *Hyperietta* and *Hyperionyx* were separated by Bowman from the genus *Hyperia*, to which they were affiliated by most authors as the subgenus *Parahyperia*. The type species of the genus *Lestrigonus*, accepted as a monotype, was designated by Milne-Edwards as *L. fabrei*. Unfortunately, the single type specimen has been lost and its sketches and description are so scanty that it cannot be identified as any of the modern species.

The systematics of the genus is highly confused due to the great sex and age variability of these crustaceans. Geographic variability and scanty sketches and descriptions of the older species further compound the problem. Various authors have attempted to revise the genus (or subgenus *Parahyperia*) (Vosseler, 1901; Yang, 1960; and others) and each has given his own scheme of synonymy or recognized the validity of different species. The last revision of the genus *Hyperia* was by Bowman (1973), but he also mentions that the division into species suggested by him is far from indisputable.

The genus includes six species (excluding *L. fabrei*).

KEY TO SPECIES OF GENUS LESTRIGONUS
(after Bowman, 1973, with emendations)

Females

1. Only somites I–III of pereon fused .... 3.
— Not just somites I–III of pereon fused .... 2.
2. Somites I–IV of pereon fused..................................... 4.
— Somites I–V of pereon fused .... 6. ***L. bengalensis*** Giles.
3. Antennal gland (at base of antennae II) acute, projecting downward beyond mouth cone. Spine on distal margin of 6th segment of pereopods VI–VII thin, without denticles ....1. ***L. schizogeneios*** (Stebb.).
— Antennal gland round, not extending to lower margin of mouth cone. Spine on distal margin of 6th segment of pereopods VI–VII thick, with one–two denticles on anterior margin .... 3. ***L. crucipes*** (Bov.).

311 4. Length of head more than 1/2 its height. Antennal gland extends to lower margin of mouth cone or projects beyond it. Telson extends to middle of basipodite of uropods III ....4. ***L. macrophthalmus*** (Vos.).
— Length of head half or less* than half its height. Antennal gland not extending to lower border or mouth cone. Length of telson 3/5 length of basipodite of uropods III .... 5.

* Changed from Russian text by authors—Eds.

5. Fused somites of pereon divided dorsally by groove. Sixth segment of pereopods I and II with one spine on anterior margin .... 2. ***L. shoemakeri*** Bowm.
— Fused somites of pereon not divided dorsally by groove. Sixth segment of pereopods I and II with one–two spines on anterior margin .. .. 5. ***L. latissimus*** (Bov.).

Males

1. Only somites I and II of pereon fused .... 2.
— Somites I–IV of pereon fused .... 6. ***L. bengalensis*** Giles.
2. Curved denticulate tooth present on distal margin of 6th segment of pereopods V–VII .... 3. ***L. crucipes*** (Bov.).
— Distal margin of 6th segment of pereopods V smooth; smooth spine present on pereopods VI–VII .... 3.
3. Apex of antennal gland round, not extending to lower margin of mouth cone .... 4.
— Apex of antennal gland acute, extending to or almost reaching lower margin of mouth cone .... 1. ***L. schizogeneios*** (Stebb.).
4. Length of head more than half its height .... 4. ***L. macrophthalmus*** (Vos.).
— Length of head less than half its height .... 5.
5. Additional mandibular plate with seven–eight denticles. Outer lobes of maxillipeds with two apical setae ..... 2. ***L. shoemakeri*** Bowm.
— Additional mandibular plate with ten denticles. Outer lobes of maxillipeds with three apical setae .... 5. ***L. latissimus*** (Bov.).

1. ***Lestrigonus schizogeneios*** (Stebbing, 1888) (Fig. 162)

Stebbing, 1888: 1391 (*Hyperia*); Bouallius, 1889: 221 (*Hyperia*); Chevreux, 1892: 233 (*Hyperia*); 1900: 139 (*Hyperia*); Vosseler, 1901: 66 (*Hyperia*); Stephensen, 1924: 86 (*Hyperia*); Chevreux and Fage, 1925: 402 (*Hyperia*); Irie, 1957: 351 (*Hyperia*); Yang, 1960: 15 (Hyperia); Vives, 1966: 19 (*Hyperia*); Yoo, 1971: 56 (*Hyperia*); Bowman, 1973: 39.—*promontorii* Stebbing, 1888: 1385 (*Hyperia*); Bovallius, 1889: 214 (*Hyperia*); Dakin and Colefax, 1940: 207 (*Hyperia*).—*zebui* Stebbing, 1888: 1394 (*Hyperia*).—*bengalensis* (non Giles, 1887); Pirlot, 1939: 35 (Hyperia); Hurley, 1955: 137 (*Hyperia*); Reid, 1955: 17 (*Hyperia*); Kane, 1962: 299 (*Hyperia*).

Length of sexually mature males 3.5–4.5 mm, of females 2.2–3.5 mm.

The length of the head is half its height and half the length of the pereon. Somites I–III of the pereon are fused in females, somites I–II in males. The cone of the antennal gland is well discernible in females, apically acute and projects beyond the mouth cone; in males it is more obtuse and does not extend to the lower border of the mouth cone. The mandibles have eight denticles on the cutting edge and six-eight denticles

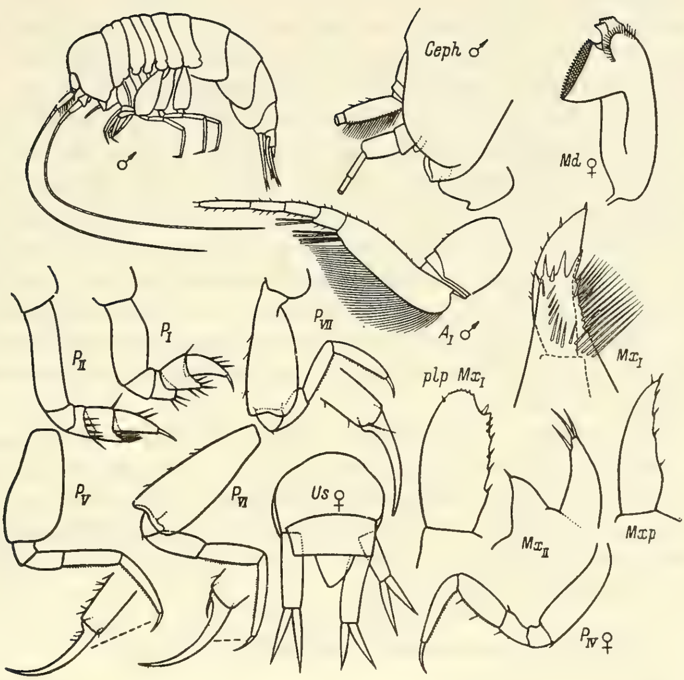


Fig. 162. *Lestrigonus schizogeneios* (Stebbing) (after Bowman, 1973).

on the accessory plate. The lower lobe of maxillae II has one subterminal and two terminal spines; the inner lobe has a short terminal spine. The outer lobes of the maxillipeds are conical, their length three times their width, and bear three–four spines along the inner margin.

312 The 2nd segment of pereopods I has a fairly convex anterior margin; the 4th segment has two–three (rarely four) spines on the posterior distal angle; the distal process of the 5th segment has five–six spines; the 6th segment has two–three spines on the anterior margin. The distal process of the 5th segment of pereopods II extends to half the length of the 6th segment; the 6th segment has one–two spines on the anterior margin. The 2nd segment of pereopods V–VII is distally broadened; the anterior margin of the 5th–6th segments is armed with a row of dense short thin setae. The 6th segment of pereopods VI–VII bears a strong spine on the distal margin. The telson in females extends to approximately 1/2, in males 2/5 the length of the basipodite of uropods III.

Notes: The degree of ornamentation of the pereopods changes with age in these crustaceans. In the young the number of spines is less but in adults, more. Small variations have been noted in the number of spines for specimens from the Pacific versus the Atlantic Ocean. the number of fused somites of the pereon also changes with age. In embryonal forms (from the brood chamber of females) all the somites of the pereon are free. According to Laval (1968a), in larvae which have just changed over to a free mode of life and at subsequent larval stages, somites I–V are fused. In females with rudimentary oostegites, somites I–IV are fused but in sexually mature females, somites I–III. In young males with an as yet unsegmented flagellum of the antennae, somites I–IV are fused but in sexually mature males, only somites I–II. As shown by Laval, the post-larval development of *L. schizongeneios* generally includes eight stages in males and six stages in females; however, the number of stages may vary. The entire cycle of development up to an adult animal takes less than three months in tropical waters, but at much lower temperatures is significantly retarded.

Distribution: A circumtropical species. Tropical and warm-water regions of the Atlantic Ocean from 47° N to 45° S, the Mediterranean
313 Sea, the Indian Ocean, and tropical and subtropical regions of the Pacific Ocean. It inhabits the upper 200 m layer. It is found everywhere on the Leptomedusae *Phialidium* and the juvenilles(~ 2 mm) specimens sometimes on Syphonophozae *Lensia*.

2. ***Lestrigonus shoemakeri*** Bowman, 1973 (Fig. 163)

Bowman, 1973: 43.

Length of sexually mature males 3.5–4.0 mm, of females 2.3–2.7 mm.

The length of the head is less than half its height and 1/3 the length of the pereon. In females somites I–IV of the pereon are fused, but furrows remain between them in the dorsal part; somites I and II are fused in males.

The antennal gland (lateral view) covers the epistome but does not extend to the lower margin of the mouth cone. The mandibles bear eight–nine denticles on the cutting edge and seven–eight denticles on the accessory plate. The outer lobe of maxillae II has two terminal and one subterminal spine and the inner lobe has a short terminal spine. The outer lobes of the maxillipeds are conical and have five submarginal and two terminal spinules.

The 2nd segment of pereopods I has a humped anterior margin; the distal process of the 5th segment bears five–six spines; the 6th segment has a spine in the distal part of the anterior margin. The distal process of the 5th segment of pereopods II exceeds half the length of the 6th segment; the latter has one–two spines on the anterior margin.
314 Pereopods III–IV are comparatively thin; the 5th segment bears two and the 4th one spine on the posterior margin. The 2nd segment of pereopods V–VII is distally broadened; In pereopods VI–VII very distinct

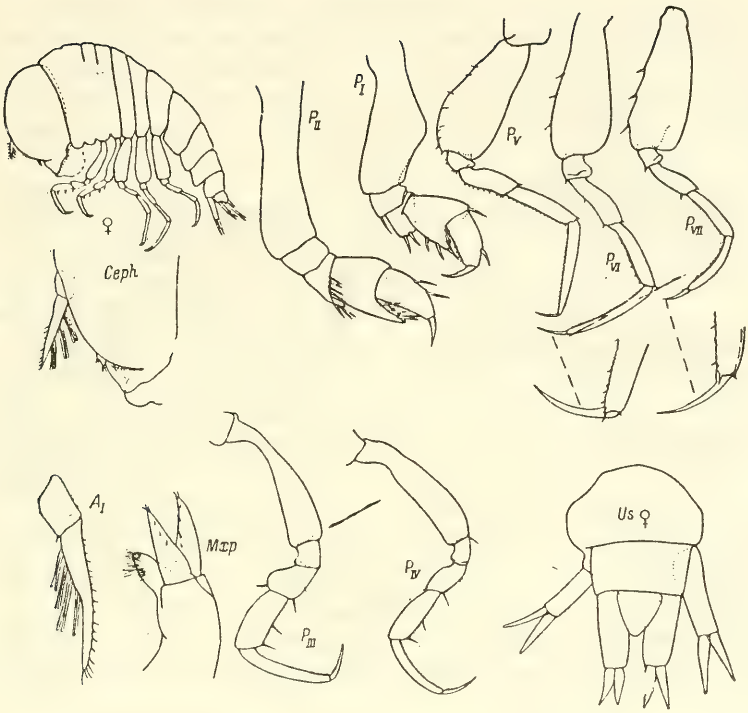


Fig. 163. *Lestrigonus shoemakeri* Bowman (after Bowman, 1973).

spines occur on the distal margin of the 6th segment. The telson in females is 3/5, in males 1/2 the length of the basipodite of uropods III.

Distribution: This species is found in tropical and equatorial regions of the Pacific Ocean. It is common in the upper 200-m layer during the day but at night at the very surface.

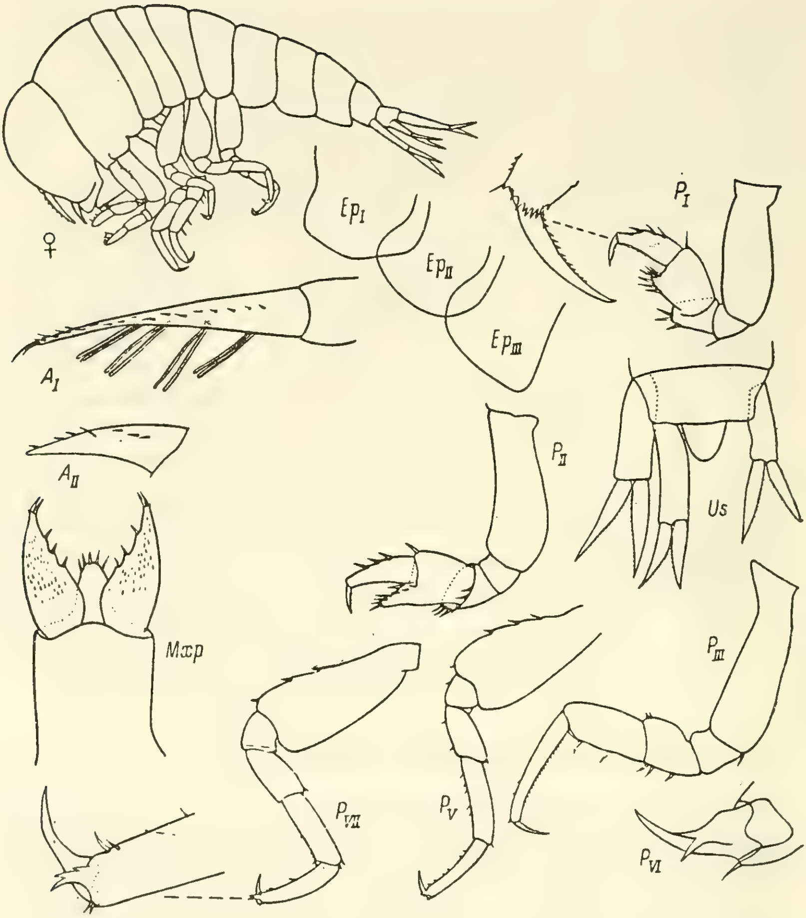
3. ***Lestrigonus crucipes*** (Bovallius, 1889) (Fig. 164)

Bovallius, 1889: 225 (Hyperia); Laval, 1968a: 64 (Hyperia); Bowman, 1973: 43.

Body length about 4 mm.

The body is thickset. Somites I-III of the pereon are fused in females but only somites I-II in males.

Compared to other species of the genus, antennae I and II are well developed; the cone of the antennal gland is obtuse, its apex directed forward and sidewards. The mandibles have a broad dentate process. The inner lobe of maxillae I bears five apical spines. The outer lobes of
315 the maxillipeds have three spines along the inner margin and two apical



314 Fig. 164. *Lestrigonus crucipes* (Bovallius), female (after Bowman, 1973).

spines each; the inner lobes extend to half the length of the outer and are armed with five apical spines.

The 6th segment of pereopods I and II bears three–four spines on the anterior margin; the distal process of the 5th segment of pereopods II extends to the middle of the 6th segment. pereopods III and IV are longer than pereopods V–VII; the 4th and 5th segments have two–three spines on the posterior margin; the 6th segment is armed with short and dense setae on the posterior margin. The 2nd segment of pereopods V–VII is distally broadened; the 6th segment on the distal margin has a large curved tooth with one–two spiniform denticles on the convex side.

Epimerons I–III have a round posterior angle. The telson is somewhat less long than its width at the base and does not reach the middle of the basipodite of uropods III.

Distribution: Warm-water regions of the Atlantic and Indian Oceans, including the Arabian Sea.

Absent in our collections.

4. ***Lestrigonus macrophthalmus*** (Vosseler, 1901) (Fig. 165)

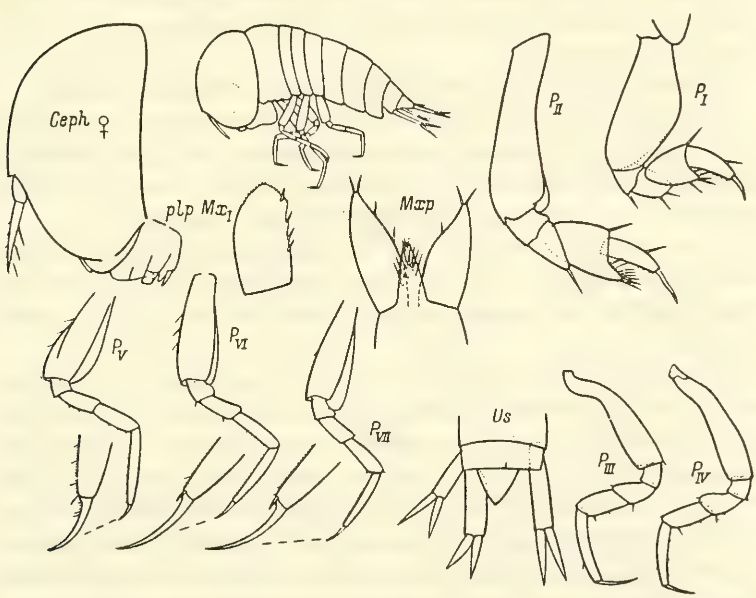
Vosseler, 1901: 70 (*Hyperia*); Yang, 1960: 19 (*Hyperia*); Bowman, 1973: 48. —(?) *hydrocephala* [(non Vosseler, 1901: 74 (*Hyperia*)] ; Dakin and Colefax, 1940: 121 (*Hyperia*).

Length of sexually mature males 3–4 mm, of females 2–3.5 mm.

The head is more spherical than in other species of the genus, its length more than half its height, and in females even exceeds the length of the fused somites of the pereon. In females somites I–IV, in males somites I–II of the pereon are fused.

The cone of the antennal gland is rounded at the bottom and in females reaches the lower margin of the mouth cone and even projects beyond it, but in males is shorter.

The mandibles have seven denticles on the cutting edge. The outer lobes of the maxillipeds are narrow, with two apical setae and two–three setae on the inner margin; the inner lobes have two apical spines.



315 Fig. 165. *Lestrigonus macrophthalmus* (Vosseler), female (after Bowman, 1973).

316 The 2nd segment of pereopods I has a sharply humped anterior margin; the distal process of the 5th segment bears five–six spines; the 6th segment in females bears one, in males two spines on the anterior margin. The distal process of the 5th segment of pereopods II extends to midlength of the 6th segment; the 6th segment in females bears one, in males two spinules on the anterior margin. The claw of pereopods V is 1/4–1/3 the length of the 6th segment and 3/4 the length of the claw of pereopods VI and VII. The 6th segment of pereopods VI and VII has one spine on the distal margin.

The triangular telson has an acute apex in females and constitutes half, in males less than half the length of the basipodite of uropods III.

Notes: This species is quite close to *L. latissimus* but is distinguished from it by smaller size, spherical head, and that the antennal gland covers the epistome to a lesser extent. Moreover, the claw of pereopods V and the basipodite of the uropods in *L. macrophthalmus* are relatively longer.

Distribution: A circumtropical species living in the warmest water regions of all the three oceans in the upper 100 m layer.

5. ***Lestrigonus latissimus*** (Bovallius, 1889) (Fig. 166)

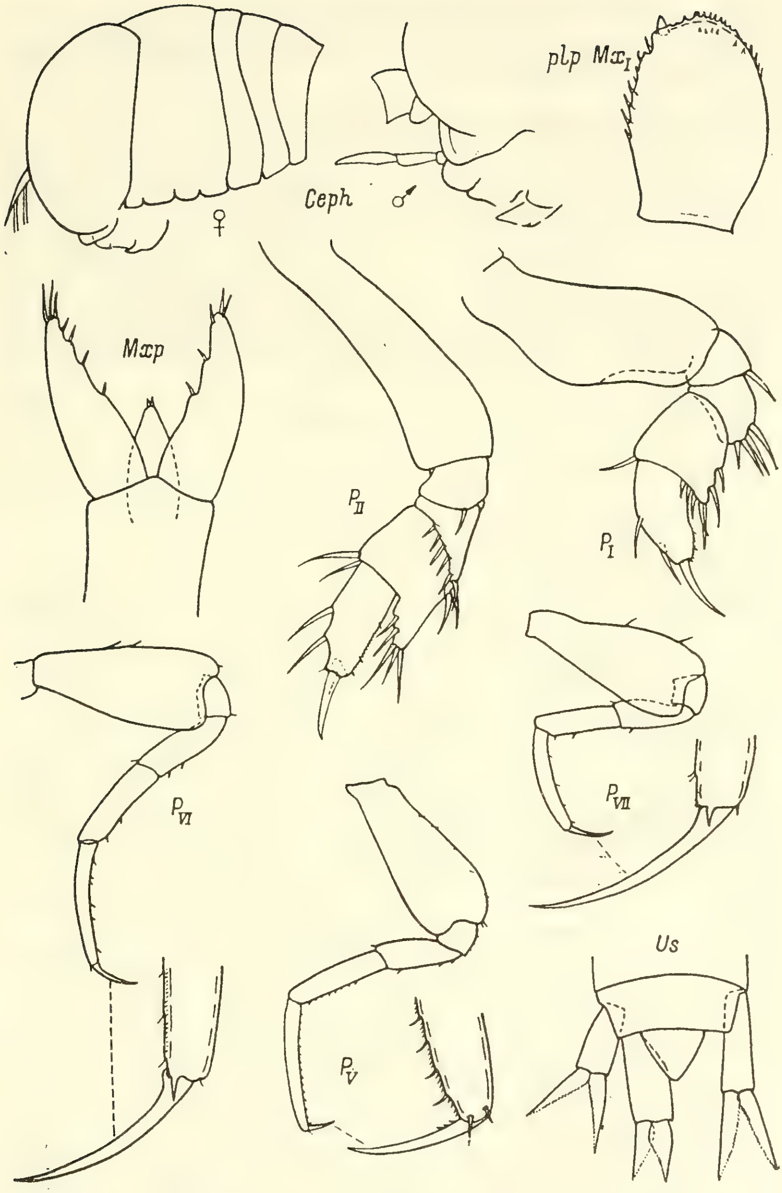
Bovallius, 1889: 299 (*Hyperia*); Chevreux and Fage, 1925: 404 (*Hyperia*); Stephensen, 1928: 590 (*Hyperia*); Bowman, 1973: 50.—*hydrocephala* Vosseler, 1901: 74 (*Hyperia*); Stephensen, 1924: 91 (*Hyperia*).—*bengalensis* (non Giles, 1887); Shoemaker, 1945a: 238; 1948: 12 (*Hyperia*).

Length of sexually mature males 3–4 mm, of females 2–3 mm.

The length of the head in females is less than half the length of the fused somites of the pereon. In females somites I–IV of the pereon are fused, in males, somites I–II. The antennal gland is round at the apex and does not extend to the lower margin of the mouth cone.

The mandibles have ten denticles on the cutting edge. The outer lobes of the maxillipeds are thin, with three apical setae and two–four setae along the inner margin; the inner lobes have two very short apical spinules.

Pereopods I have 2nd segment with a humped anterior margin; the 6th segment has one–two spines on the anterior margin. The distal process of the 5th segment of pereopods II reaches half the length of the 6th segment; the 6th segment has two spines on the anterior margin. The claw of pereopods V is 1/5–1/4 the length of the 6th segment and 1/3 the length of the claws of pereopods VI and VII. The 6th segment of pereopods V–VII has one spine on the distal margin. The triangular telson in females is 3/5 the length of the basipodite of uropods III, in males 1/2.



317 Fig. 166. *Lestrigonus latissimus* (Bovallius), female (after Bowman, 1973).

Notes: This species is very close to *L. shoemakeri*. The differences between them pertain only to certain structural details, of which the main one is the absence of dorsal grooves between the fused somties of the pereon in *L. latissimus* (grooves present in *L. shoemakeri*).

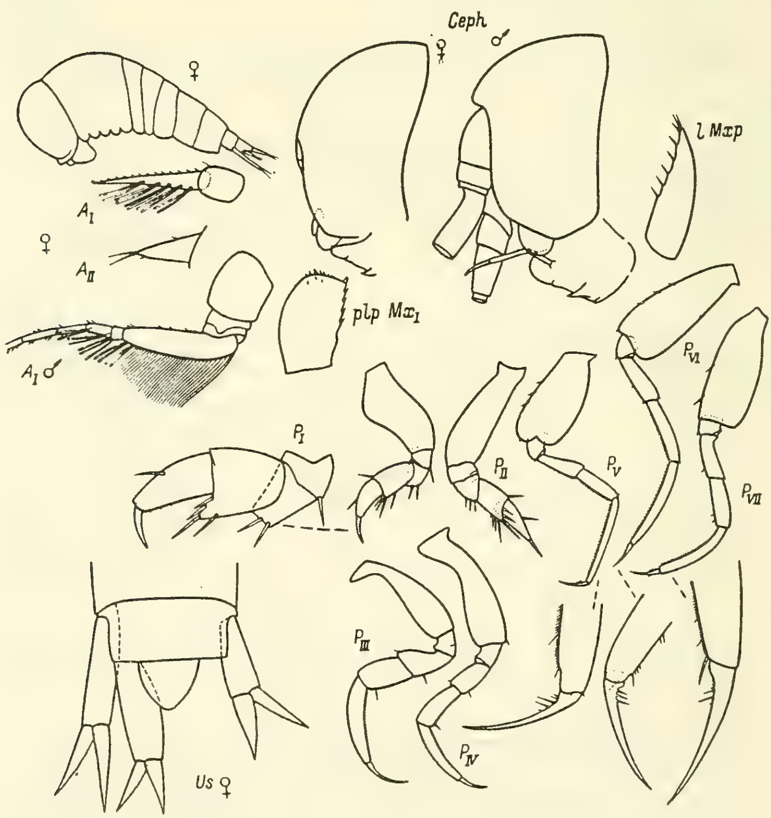
Distribution: Eastern part of the tropical and South Atlantic and northern tropical regions of the Pacific Ocean. It lives in the upper 100 m layer.

Absent in our collections.

6. ***Lestrigonus bengalensis*** Giles, 1887 (Fig. 167)

Giles, 1887: 224; bovallius, 1889: 199 (*hyperia*); Nayar, 1959: 46 (*Hyperia*); Bowman, 1973; 50.—*dysschistus* Stebbing, 1888: 1381 (*Hyperia*); bovallius, 1889:204 (*Hyperia*); Spandl, 1924: 265 (*Hyperia*). —*thoracica* Bovallius, 1889: 233 (*Hyperia*); Vosseler, 1901: 73 (*Hyperia*); Stephensen, 1924: 91 (*Hyperia*).—*gilesi* Bovallius, 1889: 236 (*Hyperia*). —*atlantica* Vosseler, 1901: 67 (*Hyperia*); Yang, 1960: 28 (*Hyperia*).—*latissima* (non Bovallius, 1889); barnard, 1930: 410 (*Hyperia*).

318 Length of males 2.8–3.4 mm, of females 2–2.5 mm.



318 Fig. 167. *Lestrigonus bengalensis* Giles (after Bowman, 1973).

The length of the head in females is 1/2, in males 5/8 of its height. In females somites I–V of the pereon are fused and in males somites I–IV.

The cone of the antennal gland in females is directed forward and downward, covers the epistome and projects forward; its apex is rounded and the lower edge is parallel to the body axis. The antennal gland in males is stretched downward in the form of a round plate.

The mandibles have eight denticles on the cutting edge. The outer lobe of maxillae II has one subapical and two long apical spines; the inner lobe has a short apical spine.

The 2nd segment of pereopods I has a humped anterior margin; the 5th segment has one–two spines on the posterior margin and three spines on the distal process; the 6th segment has one spine on the anterior margin. The distal process of the 5th segment of pereopods II is somewhat less than half the length of the 6th segment and has seven marginal spines. The 2nd segment of pereopods V–VII Is comparatively broad and armed with two–four spines on the anterior margin; the 5th and 6th segments have a row of minute thin setae on the anterior margin. The claw
319 of pereopods V is almost the same length as the claw of pereopods VI and VII. The 6th segment of pereopods VI and VII has a spine on the distal margin. The telson in females is somewhat longer than half, in males less than half the length of the basipodite of uropods III.

Notes: The species is quite variable and the possibility is not excluded that the present collections comprise several independent species. In fact, those specimens which distinctly differ in ornamentation of the pereopods but have five (female) or four (male) fused somites of the pereon are now affiliated to *L. bengalensis.*

Distribution: A circumtropical surfacial species moving into the coastal waters of continents or oceanic islands but also found in the central regions of tropical gyzes.

11. Genus *Hyperietta* Bowman, 1973

Bowman, 1973: 55.

Minute species (2–5 mm) in which the body is highly flattened laterally. The head is quite short and the eyes occupy a major part of its surface. Somites I and II of the pereon are fused in both sexes. In females antennae I are two-segmented, antennae II one-segmented, and both rudimentary. The mandibles have a smooth cutting edge and a narrow dentate process; in females the palp is absent. The outer lobe* of maxillae I has three terminal spines. In the maxillipeds the outer lobes are fused medially and the inner lobes are rudimentary. The coxal plates are fused with the somites of the pereon. Pereopods I are simple and

* Changed from Russian original by authors—Eds.

have a subchela or a poorly developed chela. Pereopods II have a chela; the distal process of the 5th segment is spoon-shaped. The distal margin of the 6th segment of pereopods VI and VII and sometimes V also, is produced as a small plate armed with spines. Pereopods VII are not armed. Pereopods III–VII are approximately equal in length[4].

Type species: Hyperia luzoni Stebbing, 1888.

The genus includes five species.

KEY TO SPECIES OF GENUS HYPERIETTA

1. Fifth segment of pereopods V–VII with strong spine on anterior distal angle .... 3.
— Fifth segment of pereopods V–VII without strong spine on anterior distal angle .... 2.
2. Second segment of pereopods I with highly convex anterior margin. Width of 2nd segment of pereopods V, 3/4 its length .... 2. ***H. vosseleri*** (Stebb.)
— Second segment of pereopods I deeply concave in distal part of anterior margin. Width of 2nd segment of pereopods V, 2/3 its length .... 1. ***H. luzoni*** (Stebb.)
3. Anterior margin of head uniformly rounded. Pereon not more than two–three times longer than head .... 4.
— Anterior margin of head (lateral view) flat below place of attachment of antennae I. Pereon four times longer than head .... 5. ***H. parviceps*** Bowm.
4. Fifth segment of pereopods I with spine in middle part of posterior margin. Sixth segment of pereopods I and II with one spine on anterior margin. Maxillipeds with solitary spinules along inner margin of outer lobes .... 4. ***H. stephenseni*** Bowm.
320 — Fifth segment of pereopods I without spine in middle part of posterior margin. Sixth segment of pereopods I and II with two spines on anterior margin. Maxillipeds with spines on anterior surface of outer lobes, but apical part covered with minute setae .... 3. ***H. stebbingi*** Bowm.

1. ***Hyperietta luzoni*** (Stebbing, 1888) (Fig. 168)

Stebbing, 1888: 1382 (*Hyperia*); Bovallius, 1889: 212 (*Hyperia*); Lo Bianco, 1903: 278 (*Hyperia*); Stephensen, 1924: 84 (*Hyperia*); Hurley, 1969: 19 (*Hyperia*); Bowman, 1973: 55; non Vosseler, 1901: 64 (*Hyperia*); Stebbing, 1904: 33 (*Hyperia*).

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[4] Diagnosis of the genus and description of its constituent species are given after Bowman (1973) with some emendations.

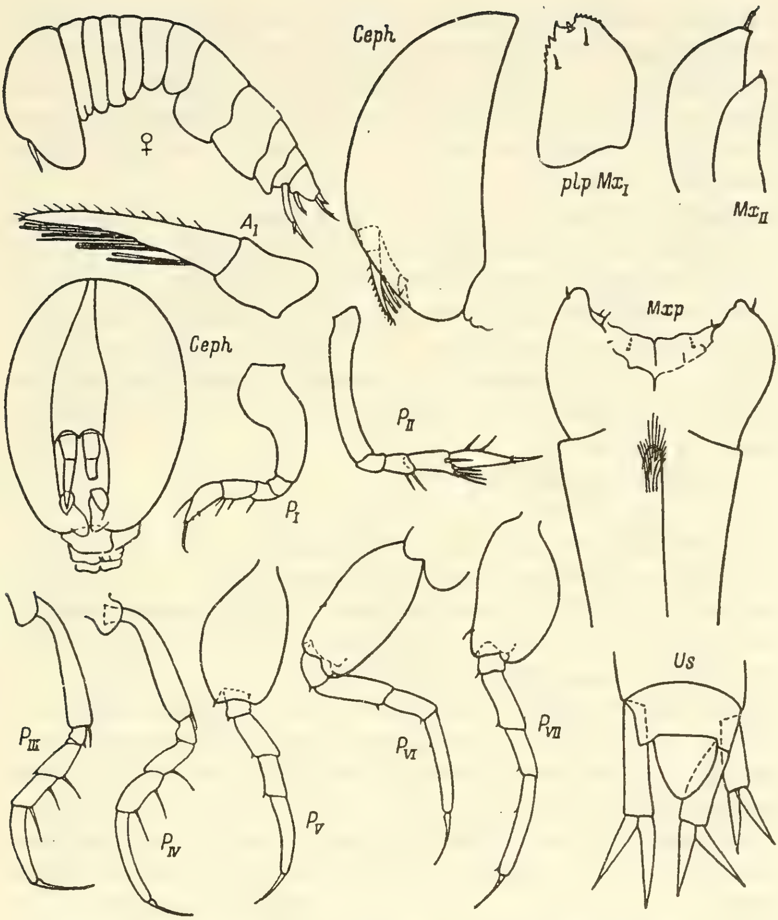


Fig. 168. *Hyperietta luzoni* (Stebbing), female (after Bwoman, 1973).

Length of sexually mature males 3–4 mm, of females 2–3 mm.

The length of the head is approximately half its height and half the length of the pereon. The cone of the antennal gland extends to the lower margin of the head or projects beyond it. The outer lobes of the maxillipeds are short and broad bear a small number of setae.

321 The 2nd segment of pereopods I projects sharply forward in the proximal part of the anterior margin and the distal part of the segment is much narrower than the proximal; the 5th segment is twice longer than wide and armed with one spine in the middle and two spines in the distal part of the posterior margin; the 6th segment has one spine in the middle of the anterior margin. Pereopods II are thin; the 2nd segment is six times

longer than wide; the distal process of the 5th segment is 1/3 the length of the 6th segment. Pereopods III–IV are very thin. Pereopods V–VII are much stronger; the 2nd segment is broadly oval; the 4th and 5th segments do not bear long spines. The triangular telson is somewhat longer than its width at the base; in females it is 5/6, in males 1/2 the length of the basipodite of uropods III.

Notes: *H. luzoni* is very close to *H. stebbingi* and *H. stephenseni* described below. Therefore, to which of these species the specimens of *H. luzoni* of earlier authors actually belong, is not known.

Distribution: Found near the Philippines, central and southeastern part of the Pacific Ocean (38°06′ S, 88°02′ W), coastal areas of California, and Gulf of California. It is possible that this species has been found at some stations in the tropical Atlantic and the Mediterranean Sea.

Absent in our collections.

322 2. ***Hyperietta vosseleri*** (Stebbing, 1904) (Fig. 169)

Stebbing, 1904: 33 (*Hyperia*); Stewart, 1913: 225 (*Hyperia*); Chevreux, 1935: 189 (*Hyperia*); Bowman, 1973: 58.—*fabrei* Bovallius, 1889: 206 (*Hyperia*); Vosseler, 1901: 58 (*Hyperia*); Stephensen, 1924: 83 (*Hyperia*); Yang, 1960: 33 (*Hyperia*).

Length of sexually mature males 3–4 mm, of females 2–3 mm.

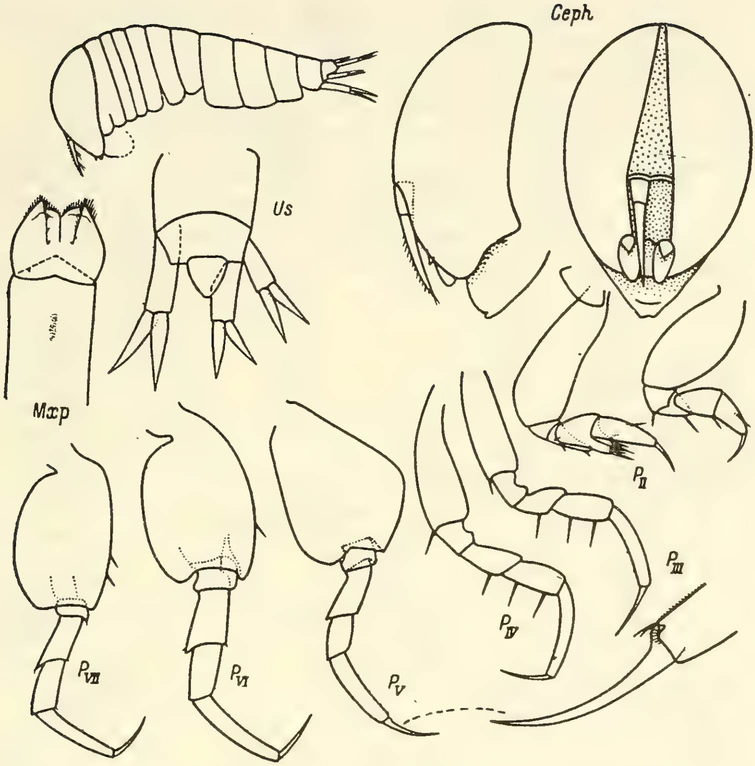
The height of the head is slightly more than twice its length; viewed laterally, the head tapers downward more significantly than in other species of this genus.

Antennae I of females project beyond the lower margin of the head. In a lateral view the antennal gland appears to project on the mouth cone.

The mandibles have a smooth cutting edge and the left mandible an additional plate. The outer lobes of the maxillipeds are short and broad, their distal part narrowed and covered with minute setae, and the distal margin is rugose.

The 2nd segment of pereopods I is oval, its width half its length, and its anterior margin convex; the 6th segment bears one submarginal spine on the anterior margin. The distal process of the 5th segment of pereopods II almost reaches the middle of the posterior margin of the
323 6th segment. The 2nd segment of pereopods V–VII is very broad, has a convex anterior margin, and its posterior distal angle forms a round lobe. The roundish-triangular telson in females extends to 2/3, in males almost 1/2 the length of the basipodite of uropods III.

Distribution: A warm-water circumtropical species inhabiting the upper 200 m layer.



321 Fig. 169. *Hyperietta vosseleri* (Stebbing), female (after Bowman, 1973).

3. ***Hyperietta stebbingi*** Bowman, 1973 (Fig. 170)

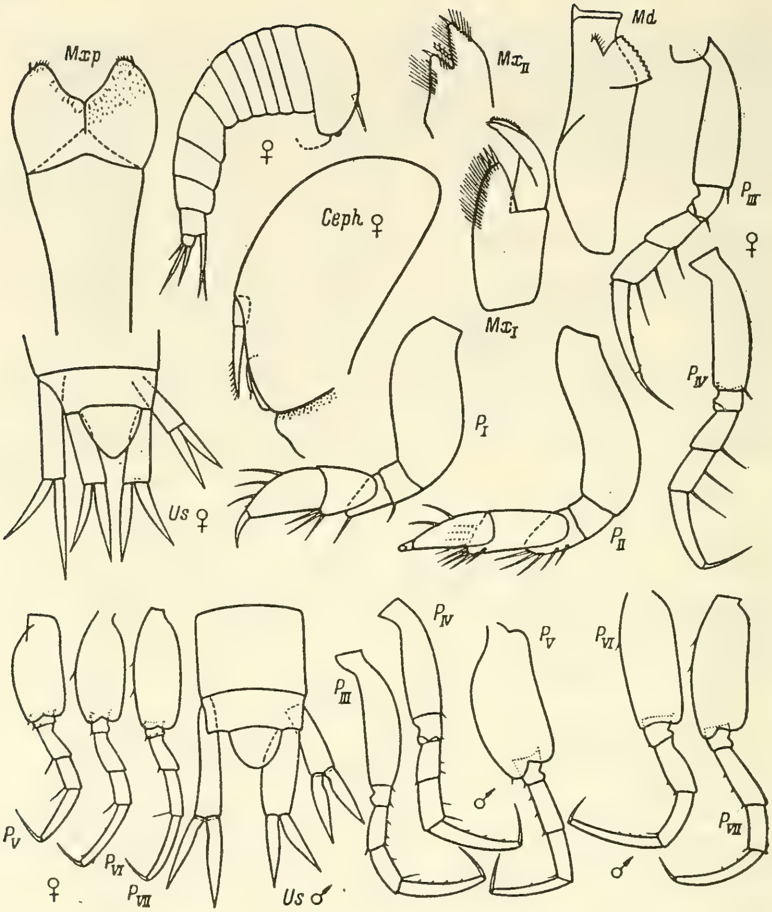
Bowman, 1973: 61.—luzoni (non Stebbing, 1888); Vosseler, 1901: 64 (Hyperia).

Length of sexually mature males 3–4 mm, of females 2–3 mm.

The height of the head is twice its length; it is uniformily rounded anteriorly. Antennae I in females extend to the lower margin of the head. The antennal gland also reaches the lower margin of the head, is broadly rounded, and viewed laterally, is separated from the epistome.

The outer lobes of the maxillipeds are 1/3 longer than wide, with minute spinules on both sides near the distal margin, and scattered minute setae in the distal part of the inner margin.

324 The oval 2nd segment of pereopods I is more than twice longer than wide; the 5th segment has a small distal process armed with three-four spines; the 6th segment is twice longer than wide. The 6th segment of pereopods II bears two spines on the anterior margin. Pereopods VI are



322 Fig. 170. *Hyperietta stebbingi* Bowman (after Bowman, 1973).

somewhat longer than pereopods V or VII. The 2nd segment of pereopods V is somewhat broader than in pereopods VI and VII; in pereopods V its anterior margin is devoid of ornamentation, in pereopods VI bears one spinule, and in pereopods VII has two spinules. The 5th segment of pereopods V in females always bears a long spine on the anterior distal angle, while in males this spine is small.

The telson is somewhat less in length than its width at the base; in females the length is 2/3, in males slightly less than 1/2 the length of the basipodite of uropods III.

Distribution: Surface waters of the tropical regions of the Atlantic, Indian, and Pacific oceans. It also penetrates the transitory zone between the tropical and boreal regions.

Absent in our collections.

4. ***Hyperietta stephenseni*** Bowman, 1973 (Fig. 171)

Bowman, 1973:61.

Length of sexually mature males 3–3.5 mm, of females 2 mm.

The height of the head is twice its length. Antennae I in females extend to the lower margin of the head. The antennal gland reaches the lower margin of the head, is round (lateral view), and separated from the epistome. The maxillipeds are the same as in *H. luzoni*.

The 2nd segment of pereopods I is 2.2 times longer than wide and its anterior margin convex in the proximal part and concave in the distal part;

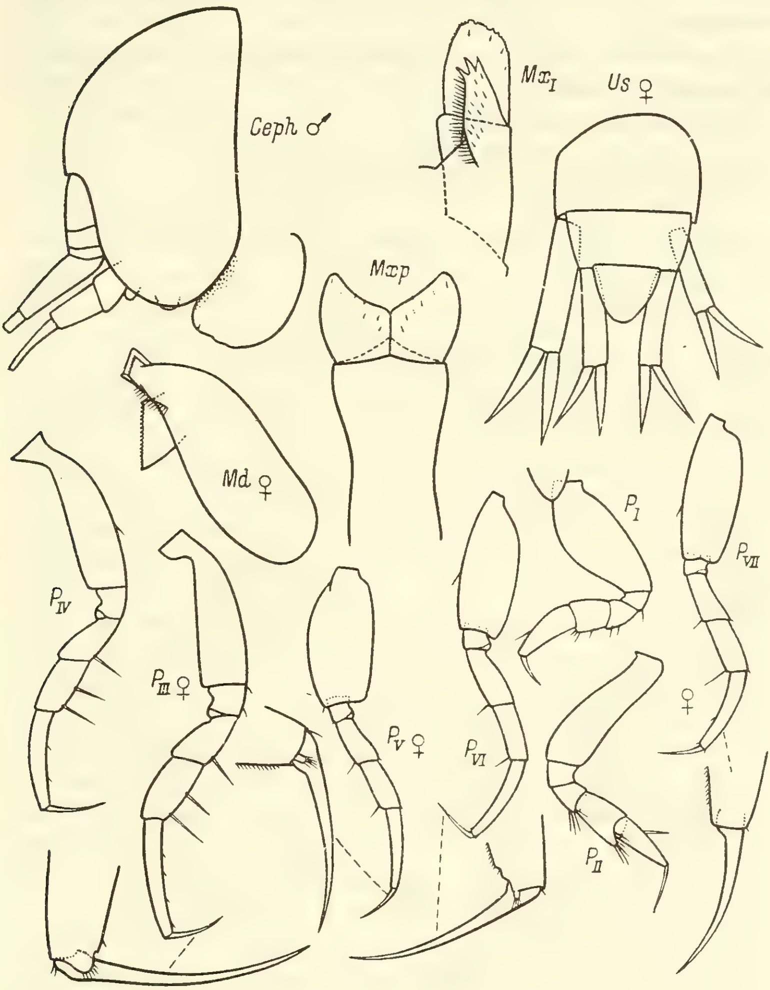


Fig. 171. *Hyperietta stephenseni* Bowman (after Bowman, 1973).

the 5th segment bears one spine on the posterior margin and three spines on the posterior distal angle; the 6th segment is three times longer than wide its anterior margin is armed with one spine in females and one-two spines in males. The 6th segment of pereopods II is similarly armed. Pereopods VI are somewhat longer than pereopods V and VII. The 2nd segment of pereopods V is slightly broader than in pereopods VI or VII; its anterior margin in pereopods V is convex without ornamentation, in pereopods VI and VII is almost straight and with one spine in females but two spines in males. The telson is somewhat shorter than its width at the base, its length somewhat more than half the length of the basipodite of uropods III.

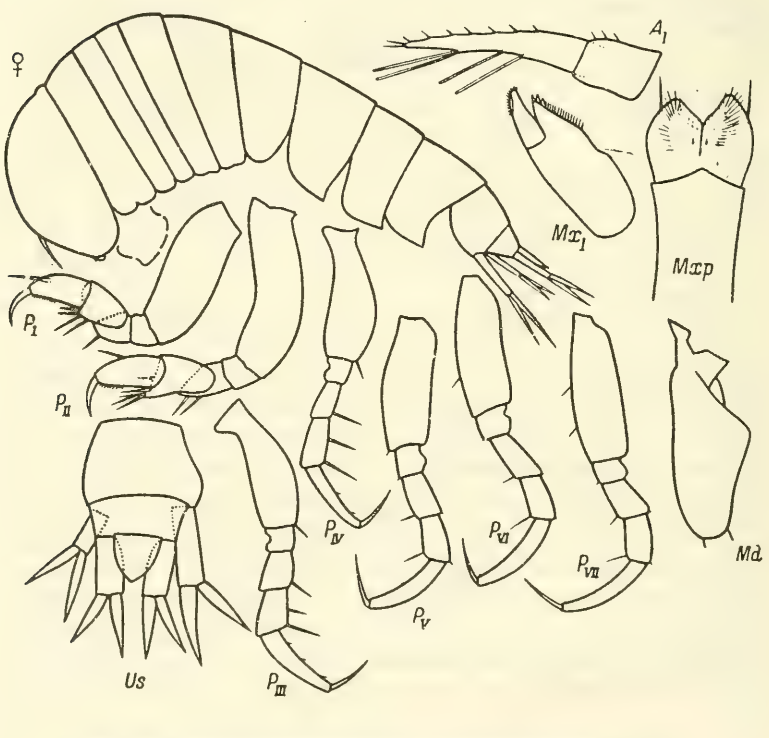
Distribution: A warm-water circumtropical species which lives in the upper 200 m layer.

Absent in our collections.

5. ***Hyperietta parviceps*** Bowman, 1973 (Fig. 172)

Bowman, 1973: 63.

Length of sexually mature males 3–3.5 mm, of females 2–2.5 mm.



325 Fig. 172. *Hyperietta parviceps* Bowman (after Bowman, 1973).

The head and pereon are broader than in other species of the genus; the width of the head is 1.6 times and its height two times more than its length; viewed laterally, the anterior margin is straight below the place of attachment of antennae I. The antennal gland is round, well discernible (lateral view), and separated from the epistome. The lobes of the maxillipeds bear thin setae on the anterior surface and one long submarginal spine each on the outer margin.

The 2nd segment of pereopods I is slightly longer than twice its width; the 5th segment has a small distal process bearing three spinules and one spinule on its posterior margin; the 6th segment has one long spine on the anterior margin. The distal process of the 5th segment of pereopods II is 1/4 the length of the 6th segment and bears six spinules. Pereopods III- VII are strong. Pereopods V–VII bear one strong spine on the anterior distal angle of both the 4th and 5th segments in females
325 but only on the 5th segment in males. The telson is equal in length to its width at the base; the length in females is 4/5, in males 1/2 the length of the basipodite of uropods III.

Distribution: Northern tropical (28° N., 155° W.), western (Kuroshio) and eastern (coastal regions of California, Nasca ridge) regions of the Pacific Ocean. It is an epipelagic species.

12. Genus *Themistella* Bovallius, 1887

Bovallius, 1887a: 22; 1889: 312; Bowman, 1973: 63.

Minute (4 mm) crustaceans with a fairly broad pereon. The head is large, its height somewhat exceeds its length, and is flat from the anterior side. The eyes occupy almost the entire surface of the head. Somites I- V of the pereon are fused in both sexes. Antennae I in females have two segments, antennae II one segment, and both are rudimentary. The cone of the antennal gland is small. The mandibles have a denticulate cutting edge, the mandibular palp is absent in females. The outer lobe of maxillae I bears four apical spines. The outer lobes of the maxillipeds are narrow and drawed distally; the inner lobes are totally absent. The coxal plates are fused with the somites of the pereon. Pereopods I and II have a weakly developed chela formed by the distal process of the 5th and 6th segments. The 2nd segment of pereopods V–VII is distally broadened. The pereopods V–VII distinctly longer than III–IV. Pereopods V are longer than VI and VII.

Type species: *Themistella steenstrupi* Bovallius, 1887.

In general appearance, structure of the head, ratio of length of pere-
326 opods III- VII, and structure of pereopods II, the genus Themistella is similar to the genus *Parathemisto*, but in presence of a chela in pereopods I and the structure of pereopods III–IV it is much closer to Hyperiella.

This is a monotypic genus.

1. ***Themistella fusca*** (Dana, 1852) (Fig. 173)

Dana, 1852: 983 (*Lestrigonus*); Bate, 1862: 291; Bovallius, 1887a: 20 (*Hyperiella*); Bowman, 1973: 67.—*steenstrupi* Bovallius, 1887a: 23; 1889: 313.—*thoracica* Vosseler, 1901: 73 (*Hyperia*).

Length of males 4 mm.

The anterior part of the body is very short; the head and the pereon together are shorter than the pleon. The somites of the pleon are very large. The integument is thin and transparent. The anterior part of the head is flat and the lower part rounded.

Antennae I in males exceed the length of the head, pereon, and pleon together; the 1st segment of the peduncle is thick and longer than the next two segments together; the conical 1st segment of the flagellum is the same length as the entire peduncle; the number of segments in the flagellum exceeds 20. Antennae II are somewhat longer than the entire body of the crustacean; the number of segments in the flagellum reaches 21. Antennae I in females are equal to the head in length.

Fig. 173. *Themistella fusca* (Dana), female (after Bowman, 1973).

The process of the 5th segmet of pereopods I is very slightly shorter than half the length of the 6th segment; the 6th segment is longer than the body of the 5th segment, its anterior margin convex and smooth, the posterior margin straight and finely denticulate. Pereopods II are somewhat longer than pereopods I; the distal process of the 5th segment is 3/4 the length of the posterior margin of the 6th segment; the narrowly conical 6th segment is somewhat longer than the 5th segment; the claw is almost straight and twice shorter than the 6th segment. Pereopods IV are
327 somewhat longer than pereopods III; the 2nd segment broadens distally; the 5th segment of pair III is shorter than in pair IV; the 6th segment is narrow, linear, and has short setae along the posterior margin; the claw is slightly curved and 1/3 the length of the 6th segment. Pereopods V are longer than the other pairs; the 5th segment is longer than the 3rd and 4th together; the narrow 6th segment is equal to the 4th and 5th together; the 4th–6th segments bear short equidistant setae along the anterior margin; the claw is approximately 1/6 the length nf the 6th segment. Pereopods VI and VII are similar in structure; in contrast to pair V the 6th segment is shorter than the 4th and 5th together; the claw is 1/4 the 6th segment in length and appears as if broken in the distal part.

The lower posterior angle is broadly rounded in epimerons I and II, in epimeron III stretched and rounded at the apex. The basipodites of the uropods are twice longer than the rami; the rami are narrowly lanceolate and have an acute apex. The roundish–triangular telson is equal in length and width, its length 1/5 that of the basipodite of uropods III.

Distribution: Tropical (Canary Islands) and equatorial (Barbados Island, Bay of Guinea) regions of the Atlantic Ocean, the Arabian Sea, and tropical part of the Pacific Ocean (central regions of the Gulf of California, coastal regions of Nicaragua and Guatemala).

It is a surface species.

13. Genus *Hyperionyx* Bowman, 1973

Bowman, 1973: 71.

The head is spherical and the eyes occupy most of its surface. Somites I–III of the pereon are fused in both sexes.

Antennae I in females are two-segmented; antennae II are one-segmented and thinner and slightly shorter than antennae I. The mandibular palp is absent in females. Maxillae I have an apical spine on the outer lobe. The outer lobes of the maxillipeds are large, broadly oval, and almost devoid of ornamentation, while the inner lobes are narrowly triangular and without ornamentation. The coxal plates are fused with the somites of the pereon. Pereopods I have a subchela; the 2nd segment is broadened. Pereopods II have a chela formed from the spoon-shaped process of the 5th segment and the posterior margin of the 6th segment. Pereopods III–VII have strong claws devoid of ornamentation. Pereopods III– IV are approximately equal in length, pereopods V are distinctly shorter, and pair VII are somewhat longer.

Type species: *Hyperia macrodactyla* Stephensen, 1924.

Hyperionyx is the only genus in Hyperiidae in which the three somites of the pereon are fused in both sexes. Like *Themistella*, this genus too has a very short telson; as in *Hyperioides*, antennae II in females are relatively longer but the cone of the antennal gland is small. As for other characters, *Hyperionyx* differs significantly from the aforementioned genera.

The genus includes just one species.

1. ***Hyperionyx macrodactylus*** (Stephensen, 1924) (Fig. 174)

Stephensen, 1924: 90 (Hyperia); Yang, 1960: 35; Bowman, 1973: 71.

Very minute crustaceans, 2–3 mm in length.

The pereon is longer than the pleon. The head in females is approximately the same length as the fused somites of the pereon.

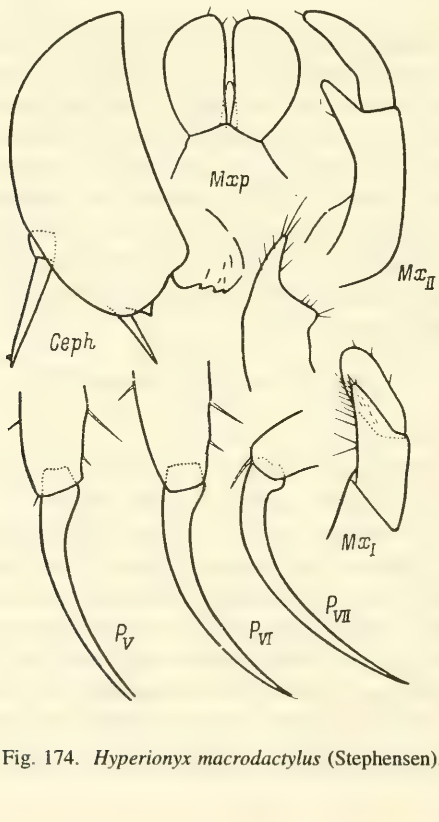


Fig. 174. *Hyperionyx macrodactylus* (Stephensen).

The mandibles are rudimentary and the mandibular palp absent in females and, possibly, in males also. In maxillae I the palp is elongated-
328 oval, petaloid, and longer than the outer lobe. The outer lobes of the maxillipeds are petaloid, round, and bear a pair of short thin setae on the distal margin; the inner lobes are narrowly triangular and almost half the outer lobes in length.

The 2nd segment of pereopods I is distally broadened and has a convex anterior margin; the 5th segment is triangular and has a straightly truncate distal margin that is three times broader than the base of the 6th segment and articulates with the anterior part of the 6th segment; the 6th segment is narrowly conical; the claw is only barely smaller than the 6th segment. The 2nd segment of pereopods II is narrow and the distal process of the 5th segment half the length of the 6th segment. Pereopods V are significantly shorter than pairs III- IV and VI–VII and have an unusually long, slightly curved claw equal in length to the 6th segment; the 5th segment is somewhat shorter but notably stronger than the 6th segment. Pereopods VI and VII have the same length ratio among the segments and the claws are equally long in both pairs. Their length greater than the length not only pereopods V, but also of pairs III–IV.

Distribution: A circumtropical species. It is known from the tropical Atlantic (coastal areas of Florida), South Atlantic (coastal regions of South Africa), the Mediterranean Sea, and the tropical part of the Pacific Ocean (28° N, 155° W, the Fiji Islands).

Absent in our collections.

14. Genus *Phronimopsis* Claus, 1879

Claus, 1879a: 63; Bovallius, 1887: 23; 1889: 318; Stebbing, 1888: 1373; Vosseler, 1901: 51.

The body of males is narrow while in females the pereon is broadened and flat. The height of the head exceeds its length and the eyes occupy most of the cephalic surface. Somites I and II of the pereon are fused in both sexes. Antennae I in females have a one-segmented peduncle and one-segmented flagellum and are longer than the head. The mandibles have a strong dentate process; the palp is absent in females. The outer lobe of maxillae I bears apical spines. The maxillipeds have narrow outer and long inner lobes. The coxal plates are fused with the somites of the pereon. Pereopods I are simple and the claw is densely covered with setae. Pereopods II have a strong chela, formed by the distal process of the hypertrophied 6th segment and the claw. Pereopods III–VII are thin and have a poorly developed subchela, formed by the process of the 6th segment and the claw. Pereopods III–IV and VI are equal in length; pereopods V are distinctly shorter.

Type species: *Phronimopsis spinifera* Claus, 1879.

Phronimopsis markedly differs from other genera of the family in the structure of the pereopods, especially pair II, and the "phronimid" type of body in females, which is why even Claus (1879a) related it to the
329 family Phronimidae. However, the general plan of structure undoubtedly indicates the affinity of *Phronimopsis* to the family Hyperiidae.

Various authors have described several species of this genus which were later considered synonyms; at present the genus includes just one species.

1. ***Phronimopsis spinifera*** Claus, 1879 (Fig. 175)

Claus, 1879a: 64; Bovallius, 1889: 326; Chevreux and Fage, 1925: 408; Shoemaker, 1945a: 242.—*sarsi* Bovallius, 1887a: 23; 1889: 320.—*tenella* Stebbing, 1888: 1347.—*tumida* Vosseler, 1900: 9.

Length of sexually mature specimens 3–6 mm.

The integument is thin and transparent. The body of males is well proportioned; in females the pereon is thickset but the pleon is very narrow. The first two somites of the pereon are fused in the dorsal part and higher than the next two somites, which in turn are higher than the posterior three somites. The head in females is longer than two, in males longer than three somites of the pereon. The antennal socket is well developed and hence the anterior side of the head is flat while the lower side is round. The interantennal lobe is absent.

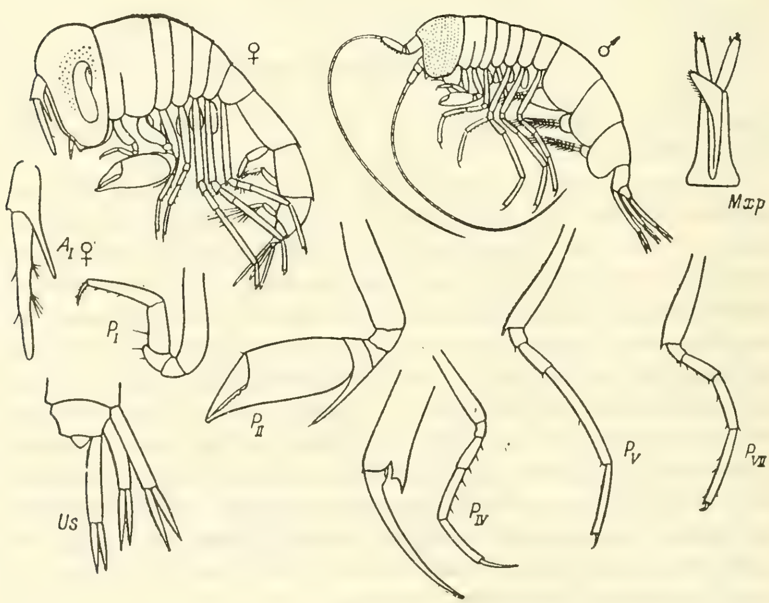


Fig. 175. *Phronimopsis spinifera* Claus (after Bovallius, 1889).

Antennae I and II in males are approximately equal in length, flagelli-form, and only slightly shorter than the body. In antennae I the Ist segment of the peduncle is thick and cylindrical while the next two segments are very short; the Ist segment of the flagellum is conical; the 2nd segment is strong, with a spoon-shaped process in the lower part of the distal margin; the flagellum has 17 segments. The flagellum of antennae II likewise has 17 segments. Antennae I in females are barely longer than the head; the lower distal angle of the only segment of the peduncle is stretched into a long wedge-shaped process that is longer than the segment; the flagellum is elongated-conical and much longer than the peduncle. Antennae II are slightly longer than the peduncle of antennae I and the flagellum one-segmented, conical, and approximately the same length as the peduncle.

330 The epistome is conical and distinctly larger than in other genera of the family. The mandibles have a narrow body, sharply denticulate cutting edge, an accessory plate (left mandible), a broad dentate process similar to that in representatives of the genus *Parathemisto*, and (in males) a fairly strong three-segmented palp. In maxillae I the palp broadens distally and has a round apex; the outer lobe is conical, armed with strong spines, and its surface covered with thin short setae. The outer lobe of maxillae II is longer and narrower than the Inner. The basal segment of the maxillipeds is narrow and long, longer than the narrowly lanceolate outer lobes, and the fused inner lobes more than half the length of the outer lobes.

The 6th segment of pereopods I is narrowly conical and 1.5 times longer than the 5th; the claw is strong, slightly curved, and bears numerous thin setae on the surface; the 5th and 6th segments together are longer than the 2nd segment. Pereopods II are longer and stronger than pereopods I and devoid of any ornamentation; the 5th segment is cupolate and its round upper lobe and acute lower lobe cover the proximal part of the broad and strong 6th segment; the 6th and 7th segments form a well-developed strong chela. Pereopods III and IV are similar in structure and notably longer than pereopods II; the linear 2nd segment is somewhat shorter than the 5th and 6th segments together; the 4th and 5th segments are armed with strong setae on the posterior margin; the 6th segment is slightly curved, thin, and the posterior distal angle stretched into an acute denticle which together with the long thin claw forms a poorly developed chela. Pereopods V–VII are almost identical in length, notably longer than pereopods III–IV, and devoid of any ornamentation; the 6th segment is somewhat broadened in the distal part, its posterior distal angle stretched into a denticle, which together with the highly curved claw forms a small chela.

The peduncle of the uropods is thin and long; the rami are narrow, lanceolate, and approximately equal in length. The telson is small, its apex round, the margins concave in the distal part.

Distribution: A circumtropical species known from the tropical regions of the Atlantic, Indian, and Pacific oceans, the Mediterranean and Red seas. It is found in surface layers up to a depth of 300–500 m.

XII. Family DAIRELLIDAE Bovallius, 1887

Small crustaceans, highly transparent, and with a flat rounded head. The eyes occupy almost all of the head and are divided into dorsal and ventral groups of ocelli. In females the flagellum of antennae I is reduced to a single virgate segment and antennae II are absent. The oral appendages are partially reduced: the mandibles lack a palp, maxillae I lack an inner lobe, maxillae II are not bifurcated to the end, and the maxillipeds are in the form of a single plate.

The pereon is more or less flat dorsoventrally and somites I and II are fused. The coxal plates are fused with the pereon. The most characteristic morphological feature is the uniformity of structure of all the thoracic legs: not one pair has a chela or subchela and the segments are cylindrical and contain transparent glandular inclusions. The gillls are located on somites II- VI of the pereon and the oostegites on pereon somites II–V. The rami of the uropods are free. The telson is very small.

The family includes one genus.

331 ### 1. Genus *Dairella* Bovallius, 1887

Bovallius, 1887b: 24; 1889: 332; Stebbing, 1888: 1342.

The head is spherically bulged. Antennae I in females are shorter than the head, in males longer. The labrum is asymmetrical: one lobe is higher than the other and the notch of the distal margin is narrow. In the mandibles the cutting plate is small, triangular, and has a straight denticulate edge; the masticatory process has a rectangular flat apex, a tuberculate grinding surface, and a broad dentate collar. The maxillae are very small: the outer lobe of maxillae I has denticles on the apex and is incurved such that it touches the lobe of the opposite maxilla; the palp resembles a broad round plate with unevenly denticulate distal and inner margins. Maxillae II are represented by basally broadened plates, narrowing toward the apex and bearing one–three small spinules. The maxillipeds are in the form of quadrangular plates, with rounded distal angles, and armed with some small spinules. All the mouthparts are slender and weakly chitinized.

The fusion of pereon somites I and II is not complete: they are ventrally separated and the coxal plates of the corresponding pereopods are also separated. All the coxal plates are short, narrow, and not touching each other.The 2nd segment of the pereopods diverges from its distal margin and not from the inner surface, as in most hyperiids. The pereopods are of the ambulatory type, differ little in length, and are absolutely monotypic in structure: the segments are narrow, the 2nd and 5th segments are the longest, and the 6th segment in all pairs is shorter and narrower than the 5th.

The pleon is shorter than the pereon and the pleopods have a massive base. The epimeral plates have rounded margins. The rami of uropods III are attached to the basipodite and considerably separated from each other.

Notes: Separation of the two undoubtedly closely related species of *Diarela* is difficult since the charaters separating them fall in the range of age and sex variation and possibly future investigation will show that these two species are identical.

Type species: *Paraphronima californica* Bovallius, 1885.

*KEY TO SPECIES OF GENUS DAIRELLA**

1. Pereopods V slightly longer than pereopods IV, 2nd segment not longer than 5th. Rami of uropods III narrowly lanceolate .... 1. ***D. californica*** (Bov.).

— Pereopods V noticeably longer than pereopods IV, 2nd segment much longer than 5th. Rami of uropods III broadly lanceolate .... 2. ***D. latissima*** Bov.

1. ***Dairella californica*** (Bovallius, 1885) (Fig. 176)

Bovallius, 1885b: 11 (*Paraphronima*); 1887a: 24; 1889: 333.

Length of females 9 mm. Male not known.

The head is greatly bulged, appreciably elevated above the dorsal line of the pereon, and equal in length to the first three pereon somites; its height is slightly more than its length and the length and width identical. The upper groups of ocelli are more numerous than the lower and are dorsally separated by a broad space. Antennae I are more than half the length of the head; the Ist segment of the peduncle is somewhat longer
332 than the next two together; the lone segment of the flagellum is finger-shaped, twice longer than the peduncle, and medially densely pubescent with setae.

The pereon is slightly less than twice as long as the pleon; the somites are low; the border between somites I and II is seen only

* Changed from Russian text by authors—Eds.

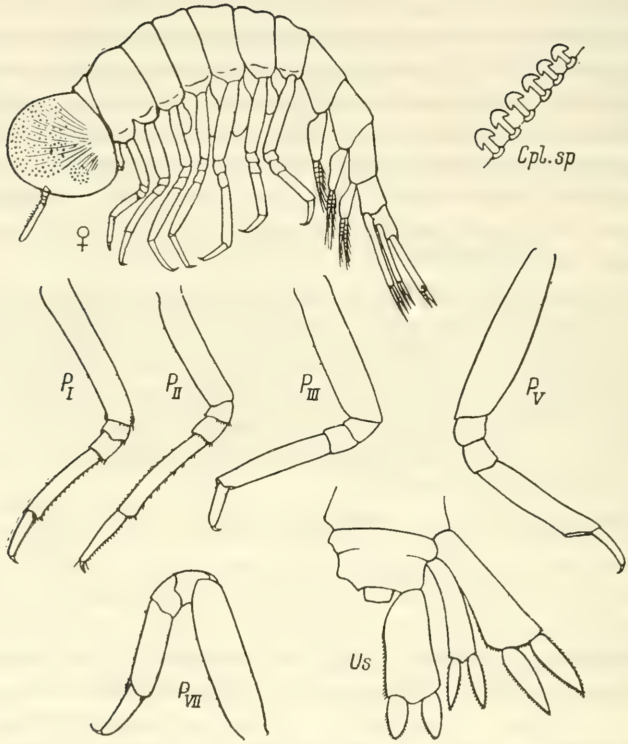


Fig. 176. *Dairella californica* (Bovallius) (after Bovallius, 1889).

in a ventral view; somite I has a small fold on its anterior margin. Somite III is shorter than the fused somites I and II and is equal to somite IV; somites V and VI are slightly longer and somite VII is equal to somite III. The 2nd segment of all the pereopods is narrow. In pereopods I the 2nd segment is five times longer than wide and roughly equal to the next three segments together; the 3rd segment is less in length than width; the 4th segment is considerably longer than the 3rd; the 5th segment is narrow, slightly more than half the length of the 2nd segment, its posterior margin weakly incurved and with short, equidistant spinules; the 6th segment is somewhat narrow, slightly more than half the length of the 5th, gradually narrows distally, and with spinules on the posterior margin; in the 2nd–6th segments the distal margin is finely denticulate; the claw is almost straight, about 1/5 the length of the 6th segment, and has five denticles at its base. Pereopods II are identical to pereopods I but slightly longer; the 5th segment is 2/3 the length of the 2nd segment; the 6th segment bears short sparse marginal spinules. Pereopods III–IV are similar to the preceding two pairs but lack spinules;

the 2nd segment is almost five times longer than wide; the 5th segment is roughly the same length as the 2nd and twice as long as the 6th; the claw is weakly curved and 1/4 the length of the 6th segment. Pereopods V–VII have similar proportions, slightly shorter than pereopods III-IV. The 2nd segment of pereopods V–VI is roughly five times longer than wide, in pereopods V equal to, and in pereopods VI- VII considerably longer than the next three segments together. The 6th segment of pereopods V is shorter than, and in pereopods VI–VII slightly longer than half the length of the 5th segment; the claw is 1/3 the length of the 6th segment.

333 The pleon is slightly shorter than the last four pereon somites together. The basipodites of the pleopods are considerably longer than the rami and are armed with six copulative hooks aligned in a straight row. The urosome is longer than the last pleon somite. Urosomite I is somewhat broader and slightly longer than the last (geminate) one, the maximum width of which is almost twice its length. Uropods I pass beyond the tips of the rami of uropods III; the basipodite is almost twice broadened distally compared to the proximal part, its inner margin is denticulate; the length of the rami is more than half the length of the basipodite; the rami are equal in length, lanceolate, and strongly denticulate. Uropods II reach the middle of the rami of uropods III; the basipodite is considerably narrower than that of uropods I and less broadened distally, its length four times its maximum width and twice the length of the rami, its inner margin denticulate; the rami are elongated-lanceolate and denticulate; the exopodite is slightly longer than the endopodite. The basipodite of uropods III is broad, narrowed only at the place of articulation, its length roughly twice its width and more than twice the length of the rami, its inner margin denticulate; the rami are elongated-oval and wide-set; the endopodite is denticulate on both sides, the exopodite only on the inner margin. The telson is roundish-trapezoid, its length less than its width and less than 1/3 the length of the last urosomite.

Distribution: Known from the waters of southern California, although the species is probably widely distributed.

2. ***Dairella latissima*** Bovallius, 1887 (Fig. 177)

Bovallius, 1887a: 24; 1889: 336; Vosseler, 1901: 51; Stephensen, 1924: 112; Reid, 1955: 19.—*bovallii* Stebbing, 1888: 1343.

Body length 6–8 mm.

The integument is very thin, sometimes with punctate reddish chromatophores on the sides of the pereon and pereopods III–VII. The head is broad (width much more than height, and height slightly more than length); it is slightly longer than the first geminate somite of the pereon but shorter than it and the next somite together. The upper group of ocelli occupy the dorsal surface of the head and descend to the lateral;

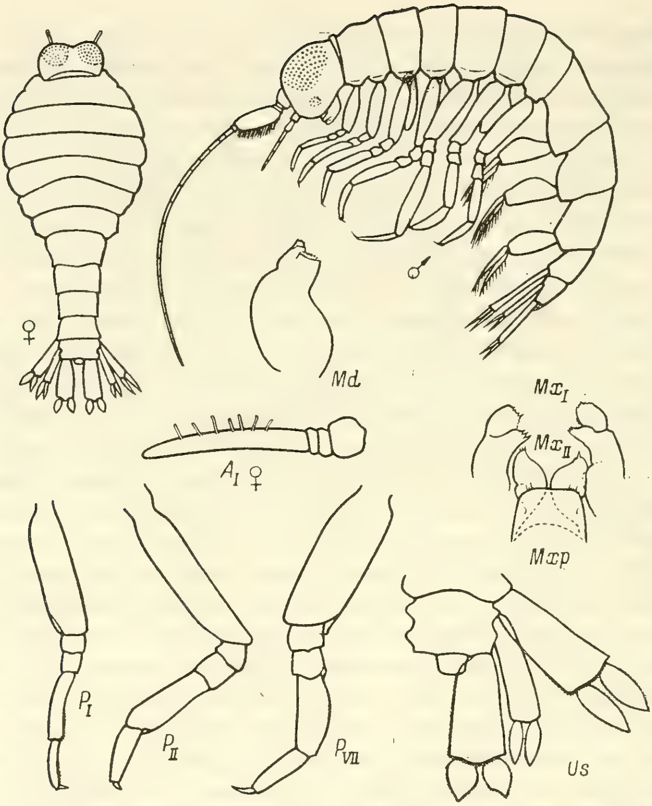


Fig. 177. *Dairella latissima* Bovallius (after Stebbing, 1888).

the lower group is approximately the same size, located laterally, and reaches the frontal surface where, however, the ocelli do not adjoin, leaving a free median part. Antennae I have a short, three-segmented peduncle and are slightly bulged in males; the 1st segment is equal in length and width; the 2nd-3rd segments are strongly reduced; the 1st segment of the flagellum broadens proximally, tapers distally, is slightly longer than the peduncle, and densely pubescent ventrally and medially; the distal part of the flagellum consists of small cylindrical segments. Antennae I in females are thin and short and the lone virgate segment of the flagellum has an obtuse tip. Antennae II in males with fused 1st–2nd segments; the 5th–6th segments are the longest. Antennae I and II are almost equal in length.

The pereon is slightly longer than the pleon; the dorsal line is not even; the place of fusion of the coxal plates with the pereon is marked by a shallow groove. The Ist (geminate) somite of the pereon is longer than the mutually equally long somites III–IV and is equal

to somite V, somites VI–VII are slightly shorter. The pereopods differ slightly in length; pereopods V are the longest; pereopods I–II are slightly shorter than pereopods III–IV, which in turn are the same length as pereopods VI–VII. The 2nd segment of pereopods I is slightly longer than the next three segments together and, like them, ornamented with one–two rows of very fine denticles; the 3rd segment is equal in length and width; the 4th segment is slightly longer and posteriorly does not lean over the base of the 5th segment; the 5th segment is elongated, slightly curved, and half the length of the 2nd segment; the 6th segment is shorter and twice as narrow as the 5th; the claw is 1/4 the length of
334 the 6th segment; grandular inclusions are particularly noticeable in the long 2nd and 5th segments. Pereopods II are slightly longer than pereopods I due to elongation of the distal segments. Pereopods III–IV have similar proportions: the 2nd and 5th segments are the longest; the 5th slightly longer than the 2nd and finely denticulate distally; the claws are short. The 2nd segment of pereopods V–VII is slightly broader than in the preceding pairs; the 2nd segment of pereopods V is longer than the 5th segment; the 6th segment is slightly longer than half the length of the 5th; the claw is slightly curved and proximally broadened. The 5th segment of pereopods VI–VII is shorter than the 2nd and only slightly longer than the 6th.

The basipodites of pleopods I and II are longer than the rami, In pleopods III the same length as the rami. The basipodite of pleopods I in males bears 8–12 copulatory hooks, in females five hooks; an increase over the normal (2–4) number of copulatory hooks is accompanied by a simplification of structure—each hook has only one pair of apical denticles, the subapical denticles being absent.

The basipodites of uropods I and III are broad, of uropods II much narrower. The basipodite of uropods I is distally broadened, its length 2.5 times its width; the rami are lanceolate and more than half the length of the basipodite. The basipodite of uropods II is slightly shorter and half as broad as the basipodite of uropods I; the rami are narrowly lanceolate and half the length of the basipodite. The basipodite of uropods III is sharply broadened in the proximalmost part, thereafter its margins parallel, its length twice its width; the rami are lanceolate, in males broadly
335 lanceolate, and 2/5–1/3 the length of the basipodite. The rami of all pairs are equal in length with wide-set bases. The inner and distal margins of the basipodites as well as the margins of the rami are finely denticulate.

Distribution: Distribution in the Atlantic Ocean from 57° N up to 37°33′ S in the Mediterranean Sea. In the Pacific Ocean it was found at 14°52′ S, 76°47′ W (1 male). The species is rare; reports usually pertain to isolated finds.

XIII. Family PHRONIMIDAE Dana, 1852

Crustaceans of 10–40 mm in length, with thin transparent integument. the head is very high and its longer axis perpendicular to the longitudinal axis of the body; in a lateral view it is conical. The eyes occupy almost the entire volume* of the head. The ocelli are divided into dorsal and lateral groups. Antennae I In females are two-segmented, in males the peduncle is three-segmented and the flagellum multisegmented. Antennae II are absent in females, in males reduced or well developed; in the latter case they have a thin multisegmented flagellum. The mandibles lack a palp. maxillae I lack an inner lobe. Maxillae II are bilobate. The maxillipeds have completely fused inner lobes while the outer lobes are narrow and tapered.

The pereon somites are free (*Phronima*) or the first two somites are partly fused (*Phronimella*). The height of the pereon somites is less than the height of the head; the last somite is the narrowest and longest. The coxal plates are fused with the pereon. Pereopods V have a strong, broad subchela or (*Phronimella*) long 5th–6th segments armed with spines, which in the folded state form a less perfect subchela. The gills are located on somites IV–VI and the oostegites on somites II–V narrow, with non-contacting margins. The pleon is narrow. The rami of the uropods are free. Uropods II are usually smaller than the others and in the genus Phronimella rudimentary. The telson is small.

All phronimids live in the surface zone of the ocean. Most of them inhabit the tropical waters of the three oceans and with rare exceptions do not cross the limits of the Subtropical Convergences. Females with eggs or embryos are found in the plankton throughout the year. Seasonal investigations have revealed, however, that some species multiply predominantly in the spring and autumn (Repelin, 1970).

The phronimids are often found in transparent barrel-shaped cuirasses; hence they have been named "marine diogenes" or "tonneliers de la mer" (marine coopers). These cuirasses are wide open on both sides and composed of shells from the covers of pelagic tunicates (salpids, doliolids and pyrosomids), siphonophores or even heteropods (*Firoloida*). The *Phronima* eat the viscera of the prey and free the transparent cover of all types of "architectural surpluses"—internal and external outgrowths, keels, septa and so on. Later the crustacean uses the cuirass as a hideout against enemies and for rearing the brood. Attaching by the short pereopods V–VII to the inner wall, the *Phronima* create a current of water by the energetic movement of the pleopods and thus bring into motion their floating home. Meeting with an obstacle,

* [sic]; more correctly, the eyes occupy almost the entire surface of the head—General Editor.

the crustacean makes an about-turn inside the shelter and treading with the pleopods reverses the course of its movement. Being weak swimmers, the *Phronima* feed on less mobile zooplankton. Observing the behavior of these crustaceans in the laboratry, laval (1968b) offered them hydromedusae, ctenophorans, salpids, small pyrosomids, and pteropods as food, which were readily consumed by them. On the other hand, the stomachs of freshly caught phronimids of different species revealed (Shih, 1969) the remains of crustaceans and even large diatoms, which evidently shows that phronimids have a broad food spectrum. Generally,
336 having caught and held the prey by pereopods I–IV, the phronimid pulls it inside the home and eats it there. If the prey is too large to pass through the opening of the home, the phronimid holds it at the entrance and consumes it there. The home itself can serve as a reserve store: during food shortage in the surrounding environment, the crustacean intensively eats the walls of the shelter and then abandons it. Observations have shown that pereopods V, with such impressive subchelae, do not actively participate in hunting and capture of prey; possibly they have a greater role to play in defensive reactions of the crustaceans (Laval, 1968b).

Shih (1969, 1971a, 1971b) and Laval (1968b, 1970) have provided a revision of the family and together collected information on the distribution and biology of individual species.

The family includes two genera.

KEY TO GENERA OF FAMILY PHRONIMIDAE

1. Pereopods V with powerful subchela; 5th segment strongly broadened and chitinized, with process on distal margin; 6th segment in folded state touches distal margin of 5th segment and is also strongly chitinized. Uropods II is both sexes only slightly smaller than rest of uropods .... 1. ***Phronima*** Latreille.

— Pereopods V with weak subchela; 5th segment long, weakly broadened, with denticles on anterior margin; 6th segment weakly chitinized, when folded touches anterior margin of 5th. Uropods II in males less than half as long and narrower than rest of uropods, in females reduced to very small unsegmented appendage .... 2. ***Phronimella*** Claus.

1. Genus *Phronima* Latreille, 1802

Latreille, 1802: 38; Vosseler, 1901: 10; Shih, 1969: 1-100.—*Bivonia* Cocco, 1832: 208.

The head is large and dorsally bulged. All the pereon somites are free. Somites I–II are very short and appreciably higher than the following ones; somites III–V are the broadest (seen from above). Somite VI is narrow and the long somite VII is the narrowest, forming a "wasp waist" so characteristic of the external appearance of the species of *Phronima*. The border of the coxal plates is discernible with difficulty only on somites III–V. The 5th segment of pereopods V is broadened and strongly chitinized, and together with the 6th segment forms a powerfully developed subchela; thus the crustacean resembles a scrawny boxer sporting oversized boxing gloves. The structure of the subchela of the adult crustacean is important in determining the species affinity; here special attention is paid to the structures of the distal margin of the 5th segment, which in various species may be highly developed or absent; the anterior distal angle is generally extended in the form of a tooth (anterior distal tooth); the distal margin is raised in the middle as a tubercle with its apex often furcate, the anterior projection is generally pointed (medial denticle of the distal margin), the posterior projection (medial protuberance of the distal margin) is usually rounded and often with additional tubercles on the posterior margin. The posterior margin of the 5th segment is more or less bulged, sometimes with a projecting posterior proximal angle. The uropods have virgate basipodites and lanceolate rami. Uropods II are well developed in both sexes but are shorter than the rest.

This genus, as accepted by us, includes eight species.

Type species: *Cancer sedentarius* Forskål, 1775.

337 *KEY TO SPECIES OF GENUS PHRONIMA*

1. Pereon somite VII shorter than pleon somite I...................... .... 4. ***P. stebbingi*** Voss.
— Pereon somite VII longer than or equal to pleon somite I .... 2.
2. Endopodite of uropods II at least half length of exopodite. Second segment of pereopods V S-shaped (in females more so than in males)..5. ***P. curvipes*** Voss.
— Endopodite of uropods II more than half length of exopodite or roughly equal in length. Second segment of pereopods V straight .. .. 3.
3. Length of 5th segment of pereopods V of female much more than its width; anterior distal tooth almost of same length as segment itself or slightly shorter; medial protuberance of distal margin of segment high and triangular, medial denticle absent. Male with reduced antennae II................................. 1. ***P. sedentaria*** (Forskål).
— Length of 5th segment of pereopods V of female slightly more than its width or equal to it; length of anterior distal tooth less than half lenght of segment; structures of distal margin different. Male with well-developed antennae .... 4.

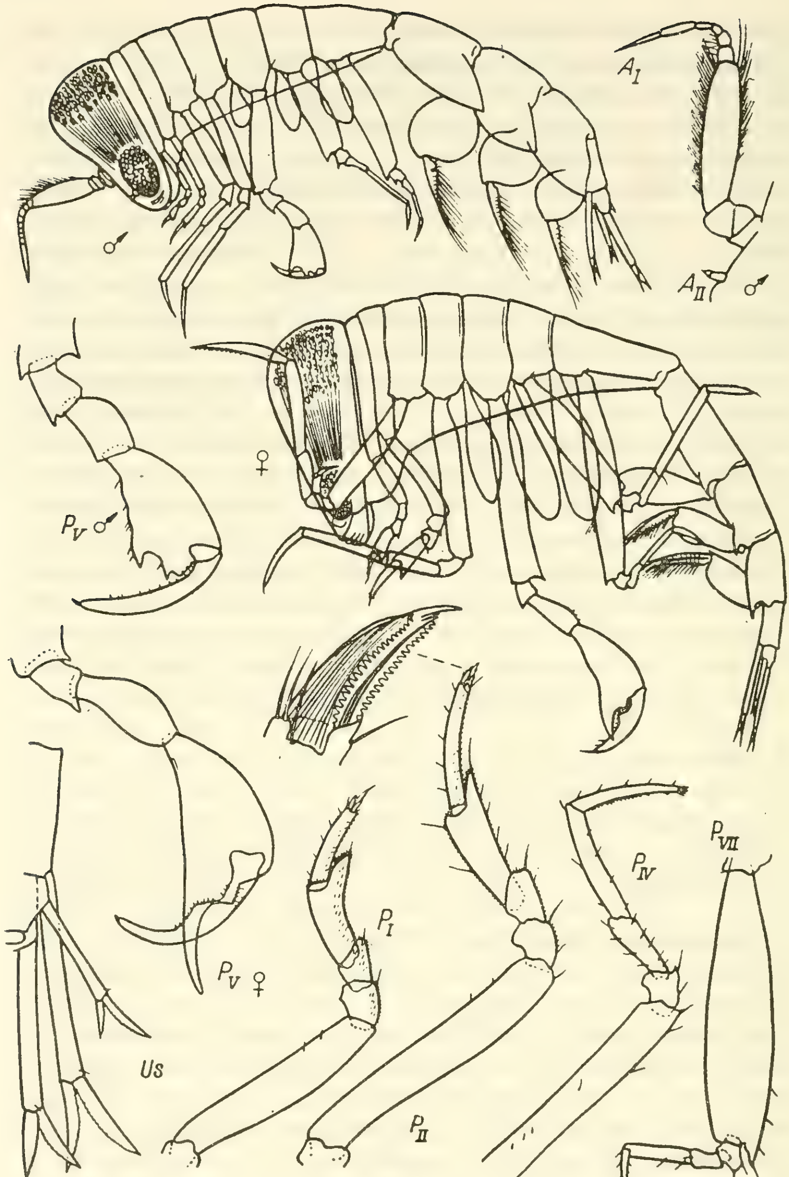
4. Pereopods III shorter than pereopods V .... 5.
— Pereopods III slightly longer than pereopods V.................. 6.
5. Distal margin of 5th segment of pereopods V of female besides medial protuberance bears medial denticle; length of this segment in male equals maximum width .... 2. ***P. atlantica*** Guérin-Mén.
— Distal margin of 5th segment of pereopods V of female without medial denticle; length of this segment in male more than width... .... 3. ***P. solitaria*** Guérin-Mén.
6. Width of 4th segment of pereopods V of female more than its length. Medial protuberance of distal margin of 5th segment of pereopods V of male with dentate apex; anterior, largest denticle separated from rest by notch. Basipodite of uropods II of male distally broadened .. .. 7. ***P. pacifica*** Streets.
— Width of 4th segment of pereopods V of female less than its length. Medial protuberance of distal margin of 5th segment of pereopods V of male with dentate apex; anterior denticle not separated from other smaller ones. Basipodite of uropods II of male linear .... 7.
7. Fifth segment of pereopods V of female almost rectangular, its posterior proximal angle projects roundly along bulged margin of 4th segment; length and width of 4th segment roughly equal. Maximum width of 4th segment of pereopods V of male in proximal third. First gills much shorter than half length of 2nd segment of pereopods IV .... 6. ***P. colletti*** Bov.
— Fifth segment of pereopods V of female roughly triangular, posterior proximal angle not projecting; length of 4th segment considerably more than its width. Maximum width of 4th segment of pereopods V of male in middle. First gills longer than half length of 2nd segment of pereopods IV .... 8. ***P. bucephala*** Giles.

1. ***Phronima sedentaria*** (Forskål, 1775) (Fig. 178)

Forskål, 1775: 95 (*Cancer*); Schousboe, 1802: 11 (*Gammarus*); Latreille, 1803: 291; Vosseler, 1901: 14; Shih, 1969: 10; 1971: 288.—*custos* Risso, 1816: 121.—*atlantica* (non Guérin-Méneville, 1836); White, 1847: 91.—*borneensis* Bate, 1862: 318.—*novaezealandiae* Powell, 1875: 284.—neozelanica Thomson and Chilton, 1886: 150.—*spinosa* Bovallius, 1887a: 25; 1889: 370.—*tenella* Stebbing, 1888: 1354.—*affinis* Vosseler, 1901: 20; Pirlot, 1929: 112; Shih, 1969: 25.

339 The largest species of the genus. Adult females reach 25–42 mm, males 12 mm.

Antennae II in males are two-segmented and short, especially in the specimens from the Atlantic and eastern part of the Pacific Ocean. Pereon somite VII is slightly longer than pleon somite I. Length of 4th segment of pereopods V is more than its width (in females it is almost twice the width); length of the 5th segment is more than its width; the posterior



338 Fig. 178. *Phronima sedentaria* (Forskål)

(♀, ♂—after Vosseler, 1901; P_v, $A_{I–II}$ (♂—after Shih, 1969; $P_{I–II,IV,VII}$, Us—after Pillai, 1966).

proximal angle does not project; the anterior distal tooth in females is almost the same length as the segment itself and is slightly curved;

the medial protuberance is high and triangular; the medial denticle is absent in adult females; in young individuals and adult males the medial denticle is developed while the medial protuberance is lower than that in females; in males the anterior distal tooth on the 5th segment is reduced: its tip barely reaches the level of the distal margin. The 6th segment of pereopods V in both sexes extends far beyond the anterior margin of the 5th segment; it is uniformly curved and in females bears a protuberance in the middle of the anterior margin.

The rami of the uropods of females are approximately equal in length. The exopodite of uropods II of males is longer than the endopodite.

Distribution: Widely distributed in the tropics and subtropics of the three oceans and in the Mediterranean Sea. From warm waters it enters into the temperate latitudes: found south of Iceland, in the Bering Sea, Gulf of Alaska, and south of New Zealand.

2. ***Phronima atlantica*** Guérin-Méneville, 1836 (Fig. 179)

Guérin-Méneville, 1836: 7; Bate, 1862: 318; Bovallius, 1889: 374; Stebbing, 1888: 1351; Vosseler, 1901: 21; Chevreux and Fage, 1925: 395; Pirlot, 1929: 112; Shoemaker, 1945a: 236; Shih, 1969: 14.—*sedentaria* (non Forskål, 1775): Claus, 1872: 331; Chun, 1889a: 378.

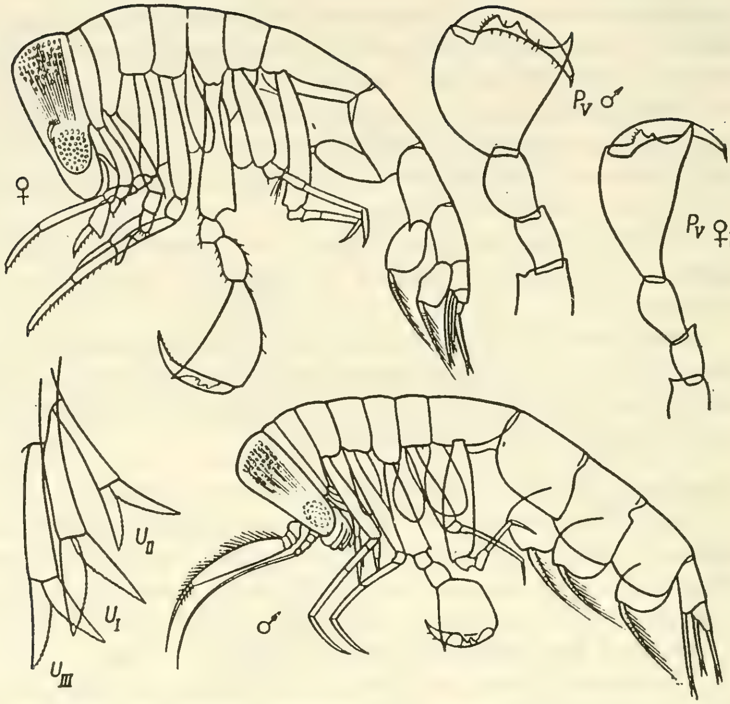
340 Length of adult females 12–25 mm, of males 8–11 mm.

The antennae in males are well developed. Antennae I have a seven-segmented flagellum. Antennae II are generally longer, the flagellum 11- to 12-segmented.

Pereopods V have an elongated 4th segment;length of the 5th segment in females is more than its width, in males the length is roughly equal to the maximum width: the posterior proximal angle of this segment in males roundly protrudes, in females without protrusion; the anterior distal tooth of the 5th segment is medium in size, much shorter than the segment itself, its apex approximately at the same level of the apex of the medial protuberance or somewhat higher; the posterior side of the medial protuberance is finely denticulate, the medial denticle is developed in both sexes. The 6th segment of pereopods V projects beyond the anterior margin of the 5th segment (with closed subchela) by not more than 1/3 its length.

The rami of the uropods I in males are approximately equal in length, in females the exopodite is slightly shorter. The exopodite of uropods II is longer than the endopodite. The rami of uropods III are equal in length in both sexes.

Distribution: Dirstributed in the tropics and subtropics of the Atlantic and Indian oceans, and in the Mediterranean Sea. Common in the western and eastern parts of the tropical zone of the Pacific Ocean; rare in the



339 Fig. 179. *Phronima atlantica* Guérin-Méneville
(♀, ♂, Us—after Vosseler, 1901; P_V, (♀, ♂—after Shih, 1979).

central part. Enters higher latitudes: reported south of New Zealand, up to 55° S.

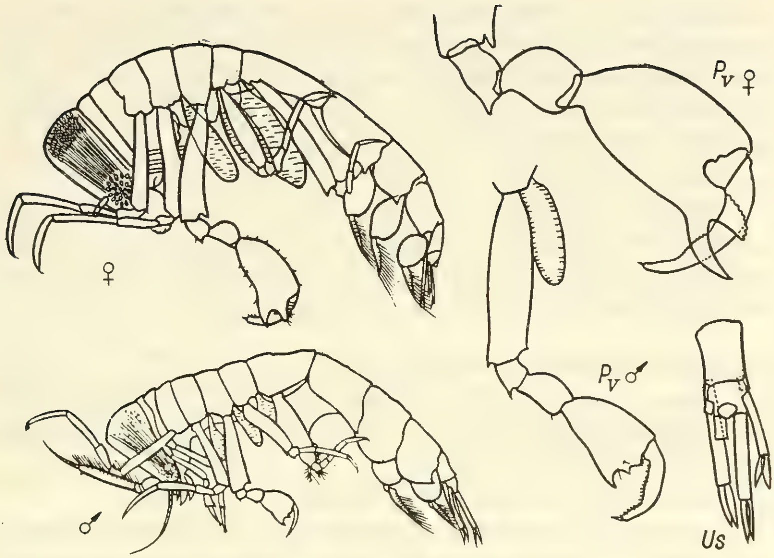
3. ***Phronima solitaria*** Guérin-Méneville, 1836 (Fig. 180)

Guérin-Méneville, 1836:7; Bovallius, 1889: 372; Vosseler, 1901: 23 (*atlantica* var.); Pirlot, 1929: 112 (*atlantica* var.); Shih, 1969: 16; 1971: 28. —*custos* Bate, 1862: 318. —*megalodous* Stebbing 1988 : 1353.

Length of adult females up to 24 mm, of males 19 mm.

The antennae in males are well developed. The length of antennae I is approximately equal to the height of the head; the flagellum is seven-segmented. Antennae II are somewhat shorter than antennae I (reaching the tip of the 5th segment of the flagellum of antennae I), their flagellum nine-segmented.

The last pereon somite in females is appreciably, in males slightly longer than pleon somite I. Pereopods V have a slightly elongated 4th segment in females, appreciably elongated in males; length of the 5th



340 Fig. 180. *Phronima solitaria* Guérin-Méneville
(♀,—after Vosseler, 1901; P_V,—after Shih, 1969)

341 segment approximately 1.5 times its width, the anterior margin is straight in males and slightly bulged in females, the posterior margin bulged, the proximal angle not produced, and the maximum width of the segment occurs in the distal part; the anterior distal tooth is strong, curved, in females reaches, in males does not reach the level of the tip of the medial protuberance; the medial denticle of the distal margin is absent in females, in males developed and separated from the medial protuberance by a shallow notch; the medial protuberance in females is strong, high, triangular, and has a tuberculate posterior margin; in males it is not high and has three-four poorly discernible tubercles; the 6th segment has a weakly developed protuberance in the middle of the anterior margin, and in a bent position extends beyond the anterior margin of the 5th segment by not more than 1/3 its length in females and 1/4 its length in males. The rami of the uropods are approximately equal in length.

Notes: *Phronima solitaria* is close to *P. atlantica* in body proportions, but in structure of the 5th segment of pereopods V to *P. sedentaria*; however, unique morphological features enable identification of even juvenile crustaceans. The possible hybrid nature of this crustacean has also been suggested (Shih, 1969). However, relatively recently the same author (Shih, 1971a) identified and described the male *P. solitaria* and confirmed the independent status of the species. The males of this species are similar to those of *P. sedentaria* but have well-developed antennae II (although much smaller than antennae I) and a much shorter anterior distal tooth on the 5th segment of pereopods V; the 6th segment of pereopods V is also relatively shorter than in *P. sedentaria* or *P. atlantica*, in which it projects beyond the anterior margin of the 5th segment by more than 1/3 its length.

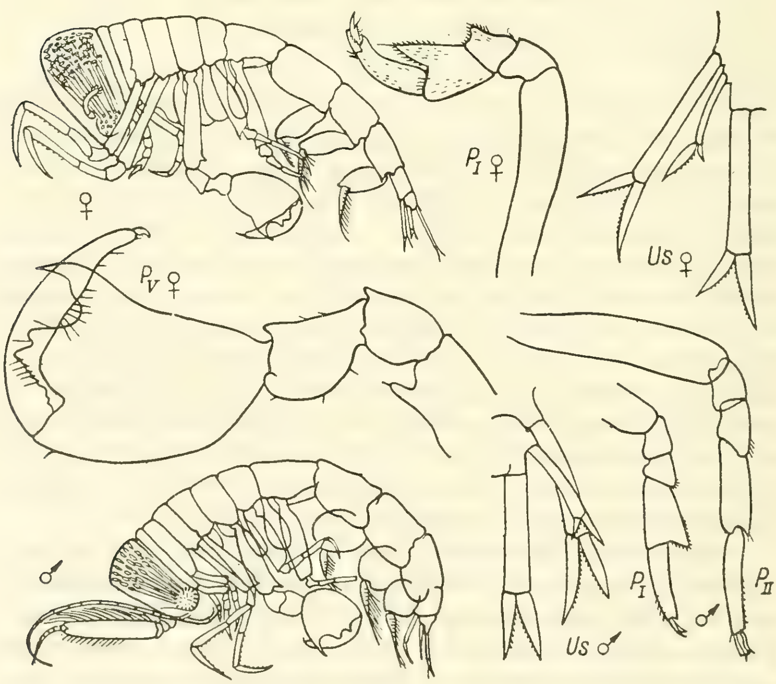
Distribution: Atlantic Ocean, particularly its eastern part; western part of the Mediterranean Sea, Indian Ocean, western and southern parts of the Pacific Ocean. In temperate and high latitudes it does not cross beyond the limits of the Subtropical Convergences.

342 4. ***Phronima stebbingi*** Vosseler, 1901 (Fig. 181)

Vosseler, 1901: 36; Chevreux and Fage, 1925: 397; Pirlot, 1929: 115; Shih and Dunbar, 1963: 3; Shih, 1969: 29. —*pacifica* Stebbing, 1888: 1348; Bovallius, 1889: 382.

Size of adult females 6–9 mm, of males up to 7.7 mm.

Antennae II of males are well developed. The distinctive feature of this species is the relatively short pereon, particularly its last somite,



341 Fig. 181. *Phronima stebbingi* Vosseler (after Vosseler, 1901).

which is shorter than pleon somite I, whereas in other species of *Phronima* this relation is reversed. In structure of pereopods V, *P. stebbingi* is close to *P. atlantica*: the posterior distal angle of the 2nd segment has a small but well-defined triangular process; the length of the 4th segment in females is more than its width, while in males the length and breadth are equal, and the posterior margin is bulged, almost semicircular; the 5th segment in females is approximately triangular, its length more than its width, while in males the length and width of the 5th segment are equal and the posterior margin is highly bulged proximally; the anterior distal tooth is medium in size; the medial tooth and the medial protuberance of the distal margin are close-set.

Uropods II are much (in females almost half) narrower and shorter than the rest and with a small endopodite.

Distribution: Found in tropical waters of the three oceans and in the western part of the Mediterranean Sea. It is most common in the Atlantic Ocean and in the eastern equatorial Pacific Ocean.

5. ***Phronima curvipes*** Vosseler, 1901 (Fig. 182)

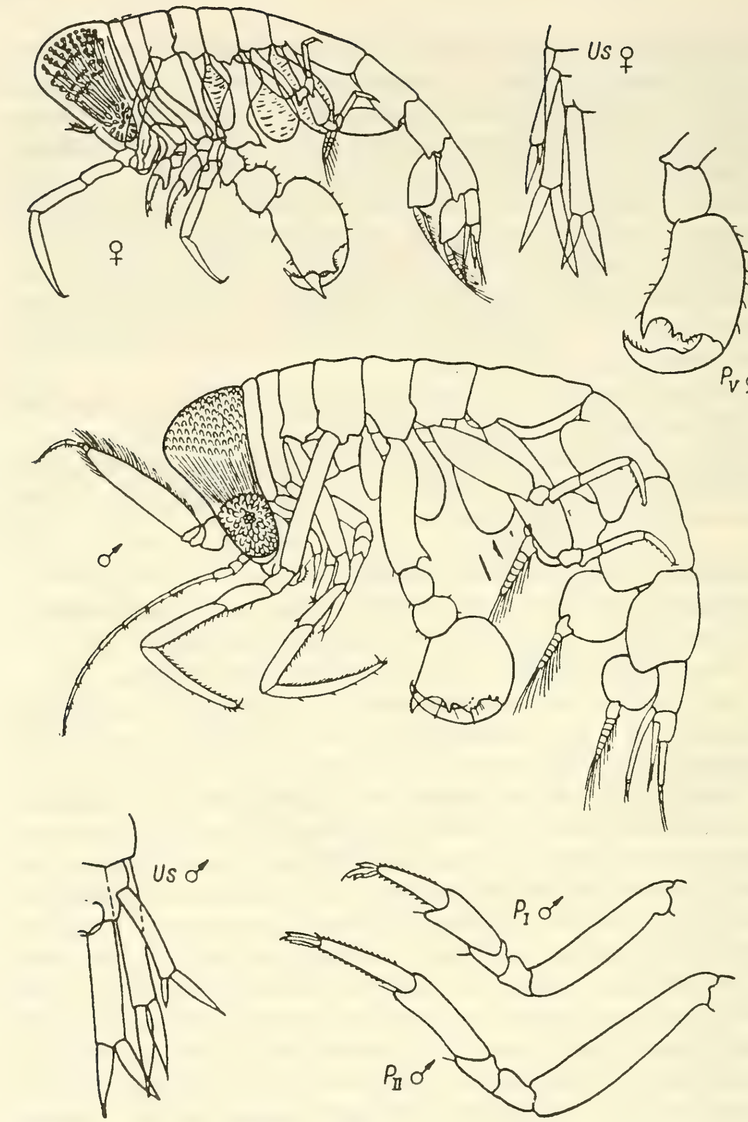
Vosseler, 1901: 27; Pirlot, 1929: 114; Shih and Dunbar, 1963: 2; Shih, 1969: 26; Laval, 1970: 51.—*colletti* Stephensen, 1924: 126 (part.).

Length of adult females 8.5–17 mm, of males 6.0–9.2 mm.

The antennae are well developed in males. The flagellum of antennae I is five- to seven-segmented, in antennae II seven- to nine-segmented and equal to antennae I in length.

Pereopods V have an S-shaped 2nd segment, which is particularly noticeable in females; the posterior distal angle of this segment extends behind and is acute; the 4th segment in females is almost spherical, in males the width of the segment is more than its length; the 5th segment is trapezoid, in females its length is more than its width, in males the relation is reversed: the maximum width along the distal margin is more than the length; the posterior proximal angle of the 5th segment projects roundly, particularly in males in which the length of the posterior margin is more than twice the length of the anterior margin; the anterior distal tooth is strong, slightly curved and exceeds the height of the medial protuberance of the distal margin; the medial protuberance is triangular in females, more or less roundish in males, and uniformly denticulate posteriorly; the medial denticle is developed only in males. The 6th segment of pereopods V in females passes slightly beyond the anterior margin of the 5th segment, in males is almost the same length as the distal margin of the 5th segment; a low protuberance is noticeable in the distal part of the 6th segment.

Uropods II are appreciably narrower and shorter than the rest, with a very short endopodite, which in males is at least half the length of the exopodite.



343 Fig. 182. *Phronima curvipes* Vosseler

(♀, P_V of ♀, Us—after Vosseler, 1901; rest—after Laval, 1968b).

Notes: The males of *P. curvipes* are quite similar to the males of *P. colletti* and *P. pacifica* (for the family Phronimidae greater similarity between males than between females of various species is generally characteristic and at times has led to erroneous identifications). The distinguishing features of males of *P. curvipes* are the structural details of the subchela and uropods II.

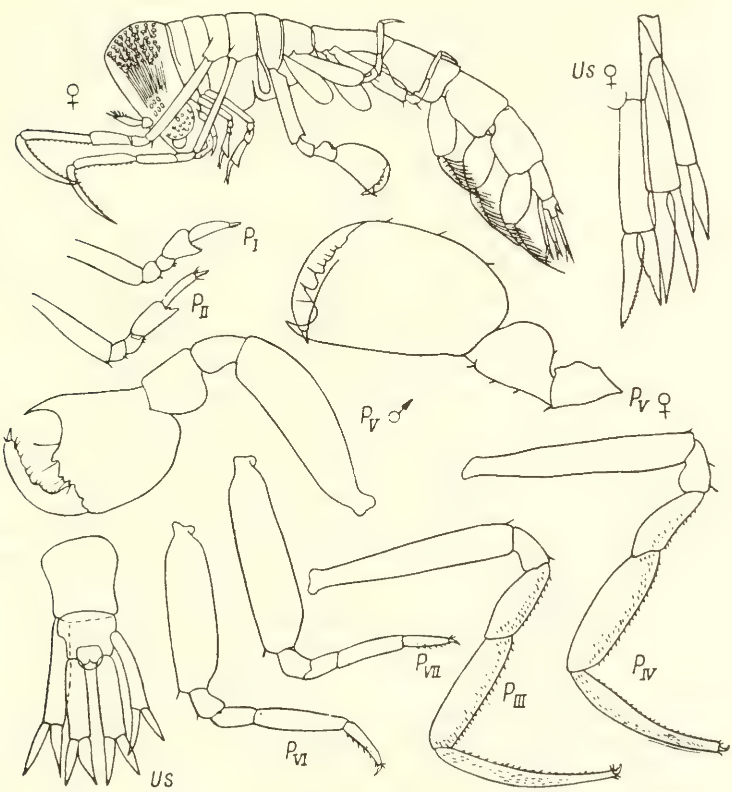
Distribution: Distributed in the tropics and subtropics of the World Ocean and in the Mediterranean Sea; reports are lacking from the central part of the Pacific Ocean although the species is common in the Indo-West Pacific region.

343 6. ***Phronima colletti*** Bovallius, 1887 (Fig. 183)

Bovallius, 1887a: 25; 1889: 378; Vosseler, 1901: 32; Chevreux and Fage, 1925: 396; Shih and Dunbar, 1963: 2; Shih, 1969: 21; Laval, 1970: 47. —*diogenes* Chun, 1889a: 527.—*gasti* Dudich, 1926: 134.

Size of females 6.5–18 mm, of males 6.3–8.5 mm.

The body is delicate and thin, particularly in females. The antennae in males are well developed. Antennae I have a five- to six-segmented flagellum; antennae II are approximately 1.5 times longer and the flagellum 11- to 17- segmented. The head is generally bent ventrally; its crown is more bulged than in other species.



344 Fig. 183. *Phronima colletti* Bovallius

(♀ P_V of ♀, Us of ♀, and P_{I-II},—after Vosseler, 1901; rest—after Laval, 1970).

Pereopods III–IV are thin and approximately 1/3 longer than pereopods V. The 2nd segment of pereopods V is at least 1/4 shorter than that of pereopods III and considerably shorter than the 2nd segment of pereopods IV. The length and breadth of the 4th segment of pereopods V are
344 equal in females, while in males the width is greater than the length due to the strongly bulged posterior margin, with the result that the maximum width of the segment is seen in its proximal third; the width of the 5th segment is more than its length in males, while in females the segment is almost rectangular and generally narrower than in males; the posterior proximal angle of the 5th segment projects roundly along the posterior margin of the 4th segment; the anterior distal tooth is somewhat higher than the medial protuberance; the medial protuberance of the distal margin is not high, with three–four close-set denticles on the posterior side; the medial denticle is developed in both sexes; the 6th segment does not project beyond the anterior margin of the 5th segment. The first pair of gills is greatly reduced and approximately half the second pair in size.

The exopodite of uropods II is equal in length to the endopodite or slightly longer. The basipodites of all uropods have parallel margins.

Distribution: This species is known from the tropics of the Atlantic and Indian Oceans, the Mediterranean Sea, the Indo-West Pacific, and eastern part of the tropical waters of the Pacific Ocean.

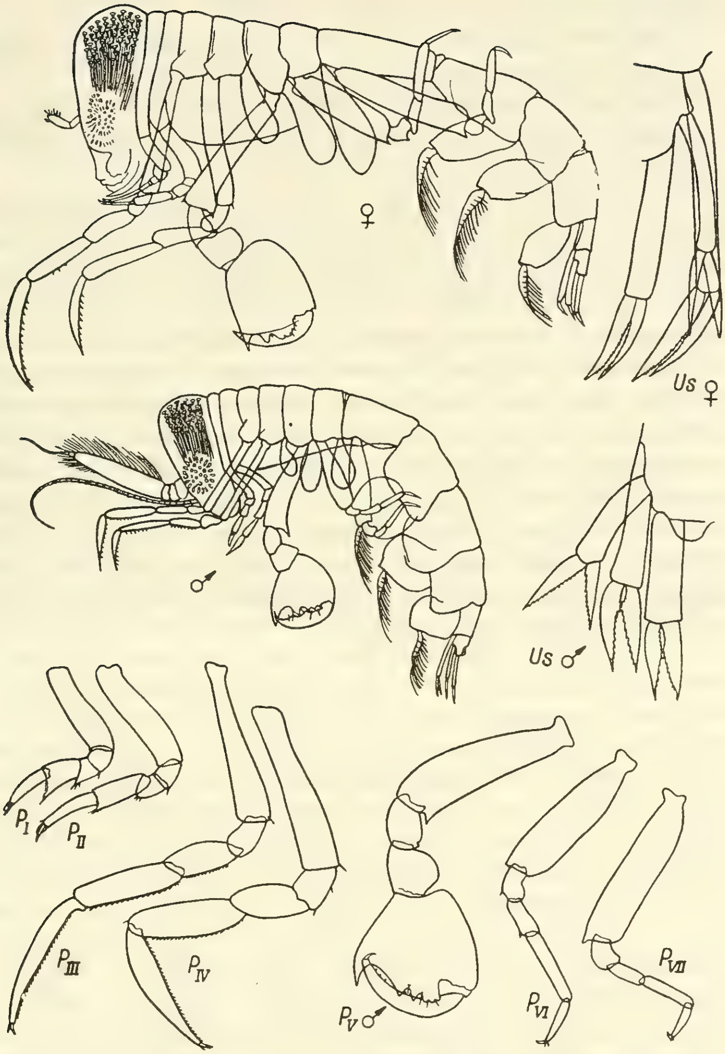
7. ***Phronima pacifica*** Streets, 1877 (Fig. 184)

Streets, 1877: 128; 1882: 6; Vosseler, 1901: 29; Shih and Dunbar, 1963: 3; Shih, 1969: 18; Laval, 1970: 56.—*sedentaria* Claus, 1872: 335.—*colletti* Vosseler, 1901: 29 (part.); Chevreux and Fage, 1925: 396 (part.); Irie, 1957: 348 (part.); Laval, 1968b: 354 (part.).

Length of females 6.5–14.5 mm, of males 6.5–8.5 mm.

The antennae are well developed in males. Antennae II are approximately 1.5 times as long as antennae I and 13- to 18-segmented.

345 Pereopods V are shorter than pereopods‘ III; the 4th segment in both sexes is strongly broadened and with highly bulged posterior margin, its width considerably greater than its length; the 5th segment is broad, trapezoid, with roundly projecting posterior proximal angle; in females the segmental length is equal to its width, while in males the width is more than the length; the anterior distal tooth not higher than the medial protuberance of the distal margin; the medial protuberance is identical in structure in both sexes, with four denticles on the posterior margin, the anterior of which is separated by a notch from the others, especially distinct in males, which makes it possible to distinguish them from males of close species—*P. colletti* and *P. bucephala*. The medial denticle is developed in both sexes; the 6th segment does not project beyond the anterior margin of the 5th segment and its anterior margin has a low protuberance.



345 Fig. 184. *Phronima pacifica* Streets

(♀, ♂, Us of ♀, ♂—after Vosseler, 1901; P_{I-VII}—after Shih, 1969).

The first pair of gills, as in *P. bucephala*, are only slightly smaller in size than the second pair. The epimeral plate of somite I of the pleon is strongly truncate below. Uropods II have a distally slightly broadened basipodite; the endopodite is shorter than the exopodite.

346 *Distribution*: Tropical zone of three oceans. In the Pacific Ocean enters north up to the latitude of Japan.

8. ***Phronima bucephala*** Giles, 1887 (Fig. 185)

Giles, 1887: 215; Laval, 1970: 47.—*colletti* Shih, 1969: 21 (part.).

Length of females up to 9 mm, of males 6–7 mm.

The body is thin, especially in females, with a delicate integument. The head is weakly bulged and dorsally almost inconspicuous. Both pairs of antennae are well developed in males.

The 2nd segment of pereopods V is longer than the analogous segment of pereopods III; the length of the 4th segment in females is more than its width, while in males the length and breadth are approximately equal , the maximal width in the middle of the segment; the 5th segment of pereopods V in females is almost triangular and the posterior proximal angle does not project; in males this segment is almost rectangular or slightly trapezoid, with a rounded posterior proximal angle which, however, does not project proximally along the margin of the 4th segment; the length of the segment along the anterior margin (including the anterior distal tooth) is more than the maximum width of the segment; the medial structures of the distal margin of the 5th segment are close to those in *P. colletti* and are identical in both sexes: the medial protuberance is not high and has close-set denticles on its posterior margin; the medial denticle is also developed.

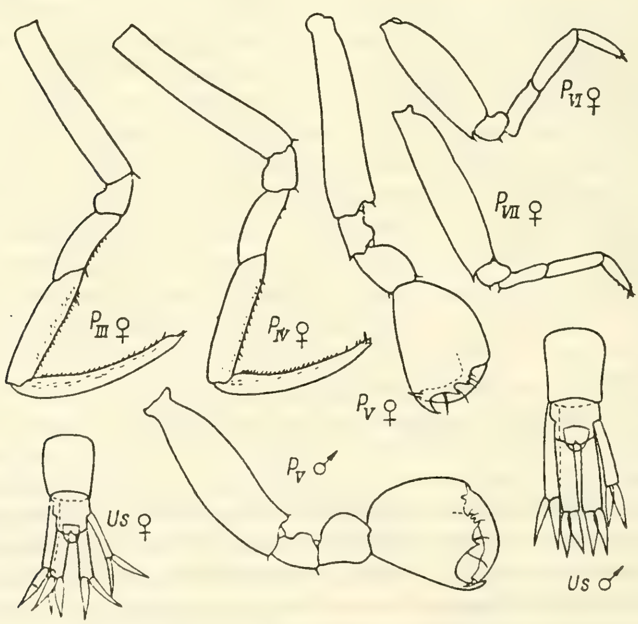


Fig. 185. *Phronima bucephala* Giles (after Laval, 1970).

The first pair of gills are less reduced than in *P. colletti* although they are slightly smaller in size than the second pair, being nearly 3/4 its length and 4/5 its width.

The basipodite of the uropods have parallel sides. The rami of uropods II are approximately equal in length.

Notes: This species is very close to *P. colletti* and for a long time was considered a geographic variety of the latter; however, Laval (1970) convincingly proved the independent status of the species *P. bucephala*.

Distribution: Northern and western parts of the Indian Ocean and also Indo-West Pacific and east part of the Pacific (Nasca ridge).

347 2. Genus *Phronimella* Claus, 1872

Claus, 1872: 467; Streets, 1882: 7; Stebbing, 1888: 1361; Bovallius, 1889: 386; Vosseler, 1901: 39; Chevreux and Fage, 1925: 399; Pirlot, 1929: 116; Shih, 1969: 30; Bowman and Gruner, 1973: 38.—*Archylonix* Streets, 1877: 130.

The body is very thin with long, thin extremities. The head is conical and less high than in the species of the genus *Phronima*; a very short neck is formed at the articulation with the pereon, which is quite distinct in males (in *Phronima* the posterior margin of the head is straight from the crown to the oral sinus but sometimes curved).

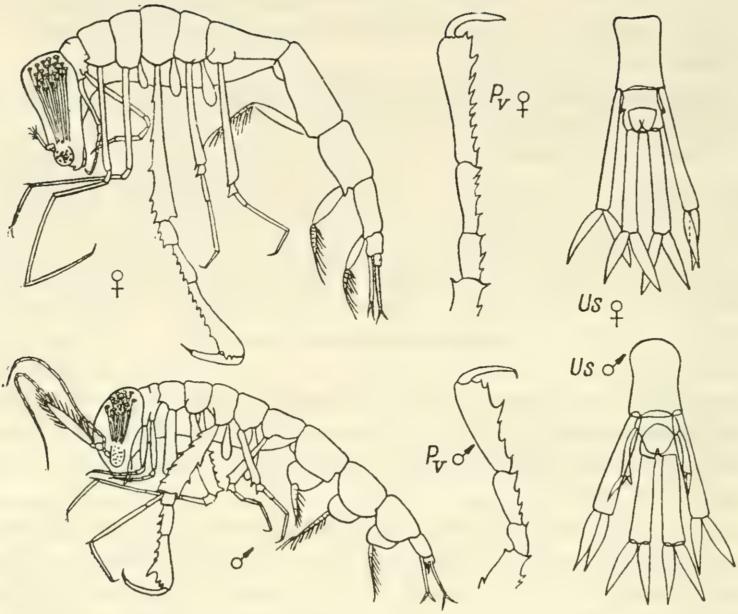
The pereon is the same length as the pleon; the height of the pereon somites is half that of the head. The first two pereon somites are partly fused on the dorsal side. Somite VII is shorter than somite I of the pleon. Pereopods III- IV are exceptionally long and thin. Pereopods V have a weakly developed subchela; the 5th segment is elongated, weakly broadened, and together with the movably articulated 6th segment forms a clasping structure. The anterior margin of the 2nd–5th segments bears coarse denticles which are particularly well developed on the 5th segment.

Uropods I and III are well developed, with narrow basipodites and acute rami. Uropods II in males are very small, in females represented generally by a small unsegmented appendage. The telson is very small, semicircular, and shifted to the dorsal side of the last urosomite so that distally it does not project beyond its limits.

Type species: *Phronima elongata* Claus, 1862.

1. ***Phronimella elongata*** (Claus, 1862) (Fig. 186)

Claus, 1862: 193 (*Phronima*); 1871: 149; Stebbing, 1888: 1362; Bovallius, 1889: 398; Vosseler, 1901: 40; Stephensen, 1924: 130; Chevreux and Fage, 1925: 399; Pirlot, 1930: 116; Barnard, 1932: 286; Shih and Dunbar, 1963: 2; Shih, 1939: 30.—*hamatus* Streets, 1877: 131 (*Anchylonix*). —*hippocephala* Giles, 1867: 217.



347 Fig. 186. *Phronimella elongata* (Claus)
(after Shih and Dunbar, 1963; Us of ♀, ♂—after Shih, 1969).

348 Size of females 9–20 mm, of males 7.5–12 mm.

Antennae I and II are well developed in males, their flagellum 14–to 16-segmented. antennae II are slightly shorter than antennae I.

Pereopods III are the longest; the 2nd segment bears two–three denticles on the posterior margin, in males often without denticles; the 6th segment in males is longer than the 2nd, in females these segments are approximately equal. The 2nd segment of pereopods IV has three–four denticles on the posterior margin. Pereopods V In females are long and narrow, longer than pereopods IV; pereopods V are stronger, broader, and shorter in males than in females, and slightly shorter than pereopods IV; the anterior margin of the 2nd–5th segments of the pereopods is armed with strong denticles and denticles are also developed on the distal margin of the 5th segment; the 6th segment is bent forward and is half the length of the 5th (in males it may be longer).

Somite I of the pleon is longer than the last somite of the pereon. Uropods II in females are reduced to an acute appendage falling far short of the distal margin of the last urosomite. Uropods II in males are considerably shorter and thinner than uropods I and III, biramous, and have a very short endopodite. Sometimes males are found with reduced uropods II, as in females (Shih, 1969).

Distribution: Tropical regions of the World Ocean and the Mediterranean Sea. For high latitudes only one report is known, from 63° S, 82° E (Mogk, 1927), which evidently could be explained as a casual ingress with warm current flows.

XIV. Family PHROSINIDAE Dana, 1853

Small-sized crustaceans (10–30 mm) with a rounded somewhat bulged head, almost entirely occupied by the eyes, a flattened compact body, thick integument, strong, prehensile extremities, and a characteristic "tail fan" formed by the flattened and strongly broadened basipodites of the uropods, which are devoid of rami.

The height of the head is more than its length; the rostrum is very short or absent. The antennae are attached to the frontal part of the head; antennae I in females are reduced to a peduncle and a one-segmented flagellum; in males the flagellum is multisegmented. Antennae II are absent in females or rudimentary; in males they have a long multisegmented flagellum. Maxillae I lack an inner lobe; maxillae II are bilobate. The mandibles in females lack a palp. The maxillipeds have thin acute outer lobes and a high medial lobe.

The somites of the pereon are free or the first two somites fused. The coxal plates are separated from the somites of the pereon. Pereopods I–II are simple, pereopods III–VI or only pereopods V have a strong denticulate subchela. The basal segments of pereopods V–VII are strongly broadened. The distal part of pereopods VII is sometimes reduced. The gills are located on somites II–VI of the pereon and the oostegites on somites II–V. The pleon is massive and with relatively weak pleopods. The uropods are flattened leaflike, without rami, and could serve as effective locomotory organs in a water column. The telson is not longer than half the length of uropods III.

The family includes three genera.

KEY TO GENERA OF FAMILY PHROSINIDAE
(after Bowman and Gruner, 1973)

1. Pereon somites I and II separate. Pereopods III–IV simple .... 3. ***Primno*** Guérin-Mén.
— Pereon somites I and II fused. Pereopods III–IV with subchela .... 2.
349 2. Head with short, pointed, two-tipped rostrum. Pereopods VII with broadened 2nd and sometimes rudimentary 3rd segment .... 1. ***Phrosina*** Risso.
— Head roundish, without rostrum. Pereopods VII with all segments .. .. 2. ***Anchylomera*** M.-Edw.

1. Genus *Phrosina* Risso, 1822

Risso, 1822: 244; Stebbing, 1888: 1424; Bovallius, 1889: 421; Chevreux and Fage, 1925: 413; Spandl, 1927: 168; Bowman and Gruner, 1973: 39. —*dactylocera* Latreille, 1829.

The head is high and tapered ventrally. The rostrum is very short, in the form of two acute horns originating from the frontodorsal part of the head. Antennae I in females are very short; antennae II are absent. The dorsal side of the body is without acute projections. The first two pereon somites are fused. Pereopods I–II are simple; pereopods III–VI have subchelae, their 6th segment is long, clawlike, while the 7th segment (claw) is greatly reduced, often not at all perceptible. The 2nd segment of pereopods VII is broadened leaflike and the distal part of the extremity reduced.

The pleon is shorter than the pereon, with massive high somites, the last of which is the longest. The posterior distal angles of the epimeral plates are strongly pointed and in somite III are considerably stretched backward. The urosomites are very short and together the same length as somite III of the pleon. The basipodites of the uropods are basally close-set, broadly oval, or with a broader distal part. The telson is rounded at the tip, its width at the base almost equal to the width of the distal margin of the last urosomite.

Type species: *Phrosina semilunata* Risso, 1822.

The genus is monotypic.

1. ***Phrosina semilunata*** Risso, 1822 (Fig. 187)

Risso, 1822: 245; Stebbing, 1888: 1425; Bovallius, 1889: 426; Vosseler, 1901: 89; Chevreux and Fage, 1925: 413; Spandl, 1927: 168; Pillai, 1966: 219.—*pacifica* Stebbing, 1888: 1430.—*australis* Stebbing, 1888: 1431.

Size of females up to 30 mm, average about 10 mm; males are smaller.

The head is dorsally bulged and equal in length to somites I–III of the pereon. antennae I are attached directly under the rostrum and in females are not longer than the rostrum, in males longer. Antennae II are developed only in males and may be longer than antennae I; they are attached to the anterior part of the head at 1/3 the distance from its lower margin.

The pereon is almost the same length as the pleon and urosome together. The boundary of fusion of somites I–II of the pereon is perceptible as a faint groove. Pereopods I–II are simialar; pereopods II are somewhat longer, their segments neither broadened nor armed; the 2nd segment of both pairs of pereopods is longer than the rest together. The 2nd segment of pereopods III is as long as the 3rd–5th segments

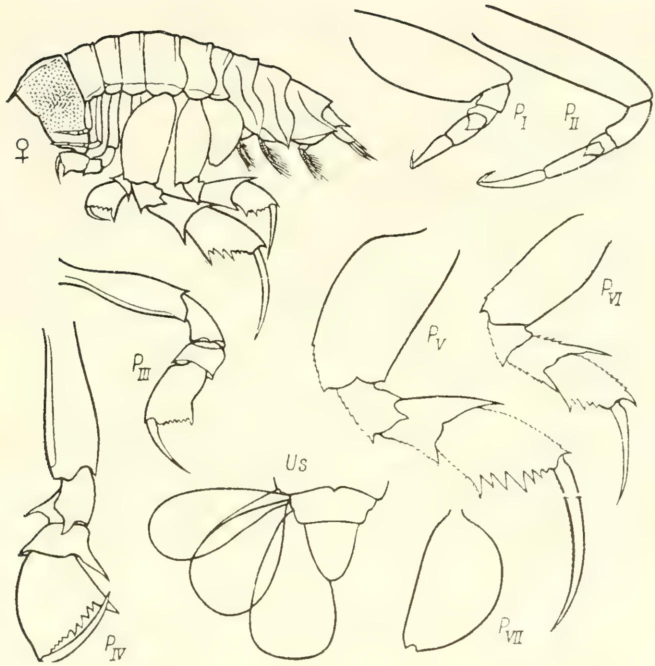


Fig. 187. *Phrosina semilunata* Risso (after Bovallius, 1889).

together and distally slightly broadened; the 5th segment is longer than wide, distally likewise broadened, and the 6th segment articulates with its anterior distal angle to form a subchela with the 5th segment; with a closed subchela the 6th segment projects beyond the posterior distal angle of the 5th segment by a produced denticle; the distal margin of the 5th segment is finely denticulate; the claw is rudimentary and conical. Pereopods IV are longer and stronger than pereopods III. Pereopods V are exceptionally well developed and in length comparable to the size of the crustacean itself; the corresponding somite of the pereon is also appreciable longer than the rest. The 2nd segment of pereopods V has a bulged and slightly distally projecting anterior margin; the posterior margin is almost straight; the length of the segment is roughly 1.5 times its width and less than the total length of the 3rd–5th segments; the distal angles of the 3rd–4th segments is sharply extended below; the 5th segment is slightly elongated and anteriorly and distally incised with coarse uneven denticles; the 6th segment is almost equal in length to the two preceding segment, narrow, and smoothly curved. Pereopods VI are identical to pereopods V but weaker than they, reaching the end of the 5th segment of pereopods V; the 2nd segment is weakly broadened; the anterior margin is almost straight, with a small distal projection; the anterior distal angle of the 3rd–4th segments and the posterior distal angle of the 4th–5th segments are stretched below and highly acuminate; the 5th segment is anteriorly unevenly denticulate; the 6th segment is narrow, clawlike, and slightly longer than the 5th. Pereopods VII have a large, greatly broadened 2nd segment, slightly shorter than the analogous segment of pereopods VI; the distal part of the extremity is totally reduced or a short rediment of the 3rd segment is present.

The pleon is the same length as the last four somites of the pereon together. The urosomites have an indistinct dorsal keel which forms a small denticle on the posterior margin of the somite. The uropods are broadly rounded at the tip.

Distribution: Tropical, subtropical, and temperate waters of all the oceans. It is found from the surface down to 1,000 m, rarely deeper, and often forms local concentrations in the surface zone. It does not exhibit distinct diurnal migrations although migration at night of part of the population to the surface layers of the water has been reported (Thurston, 1976b).

2. Genus *Anchylomera* Milne-Edwards, 1830

Milne-Edwards, 1830: 394; Stebbing, 1888: 1453; Bovallius, 1889: 408; Chevreux and Fage, 1925: 414; Spandl, 1927: 167; Bowman and Gruner, 1973: 39.

The head is roundish, its height twice its length and considerably more than the height of the somites of the pereon. Antennae I in females are three-segmented, antennae II in the form of a small tubercle directly
351 below the base of antennae I. In males the head is relatively small, the antennae well developed, with a multisegmented flagellum.

The dorsal side of the body is devoid of keels and denticles. The pereon and pleon are approximately the same length and height. Somites I–II of the pereon are completely fused. Pereopods I–II are small, with a clinging distal part; the 6th segment is conically narrowed distally while the claw may be bent at an acute angle to it. Pereopods III–V have a subchela, particularly well developed in pereopods V. Pereopods VI are also of the prehensile type because of the movable articulation between the 6th and weakly broadened 5th segment which, with some approximation, could be considered an imperfect subchela. Pereopods VII are fully segmented.

The epimeral plates have rounded margins. The urosome is shorter than the pleon. The uropods have ovally broadened basipodites. The telson is small and rounded.

Type species: *Anchylomera blossevillei* Milne-Edwards, 1830.

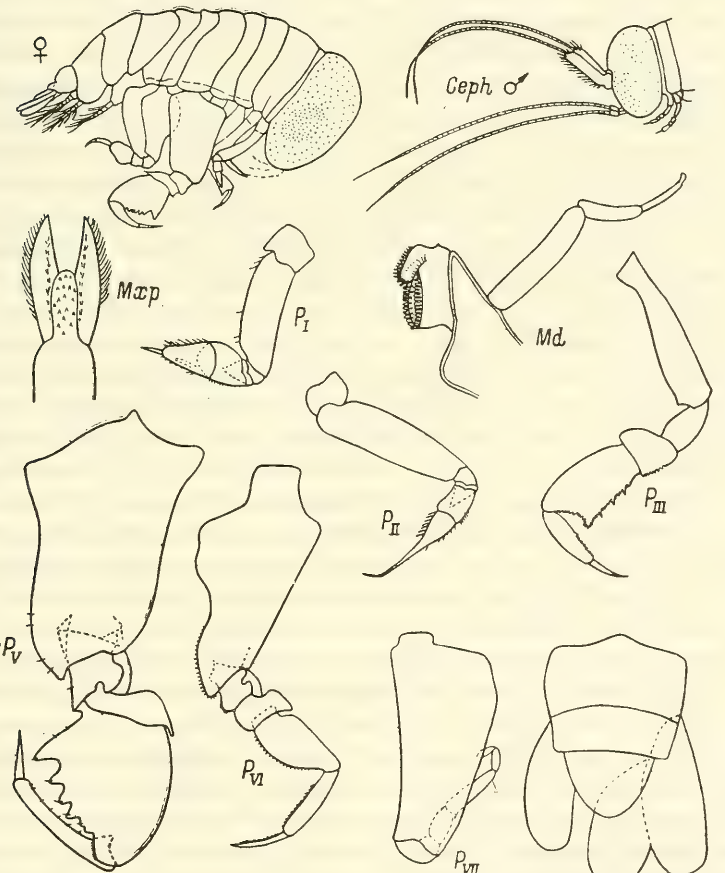
The genus is monotypic.

1. ***Anchylomera blossevillei*** Milne-Edwards, 1830 (Fig. 188)

Milne-Edwards, 1830: 394; Stebbing, 1888: 1453; Bovallius, 1889: 412; Vosseler, 1901: 88; Stephenson, 1924: 134; Chevreux and Fage, 1925: 414; Spandl, 1927: 167; Pillai, 1966: 218.

Size of adult crustaceans up to 11 mm, average 6–8 mm.

The head is large, slightly flattened anteroposteriorly, bulged dorsally and especially ventrally. antennae I are attached almost in the middle of the frontal side of the head; in females they are short, with a two-segmented peduncle and a one-segmented flagellum; in males the



352 Fig. 188. *Anchylomera blossevillei* Milne-Edwards

(Ceph ♂—after Bovallius, 1889; ♀—after Chevreux and Fage, 1925; rest—after Bowman and Gruner, 1973).

penduncle is three-segmented and longer than the multisegmented flagellum, the proximal segment of which is large and elongated, with a projection in the distal part, and pubescent, bearing thin setae. Antennae II in males are attached considerably below antennae I; they are thin and very long.

The first (geminate) somite of the pereon is larger than somite III. Somite V is the best developed. Pereon somites VI–VII are the shortest. The narrow 2nd segment of pereopods I is longer than the rest of the segments together; the 5th segment is distally broadened and somewhat bulged; the 6th segment, on the contrary, is conically narrowed distally, covered with thin setae, and movably articulates with the small claw. The 2nd segment of pereopods II is longer than the rest of the segments together; the 6th segment is about 2/3 the length of the 2nd and medially conically narrowed; the claw is small, quite movable. The 2nd segment of pereopods III–IV is narrow and the same length as the 3rd–5th segments together; the 5th segment is elongated and distally broadened, its anterior distal angle articulates with the 6th segment, while the posterior distal angle projects as a triangular lobe which is best developed in pereopods IV; the 6th segment is thin, shorter than the 5th, and with a closed subchela projects beyond the distal margin of the 5th segment for almost half its length; the claw is slightly curved, longer than half the length of the 6th segment. Pereopods V are very massive and much longer than the other extremities; the 2nd segment is broad, especially proximally, its length more than 1.5 times its width, the anterior margin slightly curved in the middle, distally with a round projection above the base of the 3rd segment, the posterior margin projecting roundly proximally; the 4th segment is broad, spoon-shaped, supporting the subchela; the 5th segment is broadened and very well developed, the posterior margin bulged, the anterior margin short and straight, the distal margin strongly truncated anteriorly and uniformly denticulate, the denticles blunt and increasing in size toward the anterior margin; the 6th segment is thin, weakly curved, and with a closed subchela almost not projecting beyond the margin of the 5th segment; the claw constitutes about half the length of the 6th segment. The 2nd segment of pereopods VI is irregular in shape—narrow
352 at the base, sharply broadened in the proximal half and again narrowing from the middle, its anterior margin slightly overhanging the base of the 3rd segment; the 5th and 6th segments do not form a developed subchela but provide prehensity to the leg because of the movable joint between them, allowing the 6th segment to fit snugly into the proximally bulged anterior margin of the 5th segment; the two segments are equal in length; the claw is almost straight. Pereopods VII have a narrow 2nd segment, the maximum width of which occurs in the proximal part; the anterior margin is weakly curved, the posterior margin almost straight; the distal

part of the leg is shorter than the 2nd segment and tucked under it; the 5th segment is the longest of the distal segments, the 7th segment is shortest, bud-shaped, with small spines at the end.

The urosome is shorter than the last two somites of the pleon; moreover, the last (geminate) urosomite is almost half the length of the first. The telson is roundish or roundish-triangular, its width at the base almost equal to the length of the distal margin of the last urosomite.

Distribution: Widely distributed in the tropical, subtropical, and temperate waters of the World Ocean. It often forms local swarms near the surface. It lives in the surface zone and performs diurnal vertical migrations, rising to the surface at night (Thurston, 1976b).

353 3. Genus *Primno* Guérin-Méneville, 1836

Guérin-Méneville, 1836: 2; Stebbing, 1904: 38; Bowman and Gruner, 1973: 40; Bowman, 1978: 2.—*Euprimno* Bovallius, 1889: 397; Stephensen, 1924: 143; Pirlot, 1929: 129.

The head has a small rostrum. Antennae I in females are slightly longer than the head and three-segmented. Antennae II are rudimentary. In males both antennae have a long, multisegmented flagellum.

Somites I and II of the pereon are free. All the pereopods except for pair V are simple. the 2nd segment of pereopods I has a well-developed gland, the duct passing through all the segments and opening at the tip of the claw. Pereopods V have a powerful subchela; the 5th segment is broadened and has a complex denticulation all along the entire anterior margin; the 6th segment is shorter than the 5th and may be completely clung close to the anterior margin of the 5th segment. Pereopods VII are completely segmented, the last segment having an obtuse apex. Somite VII of the pereon and the first two somites of the pleon bear medium-sized, backwardly directed dorsal teeth.

The pleon is massive and higher than the pereon. The posterior distal angle of the epimeral plates is stretched posteriorly and in somite III is very acute. None of the urosomites are longer than somite III of the pleon. The basipodite of all the uropods is broadened, with an acute end, and its margins sometimes denticulate. The telson is small, roundish-triangular, and much narrower at the base than the last urosomite.

Type species: *Primno macropa* Guérin-Méneville, 1836.

Notes: Until recently the genus Primno was considered monotypic. In 1978, Bowman published a revision of the genus, substantiating, his assumption that *P. macropa* is, in reality, a species aggregate. He described two new species—*P. brevidens* and *P. johnsoni*—and restored the independent status of the species *P. latreillei* Stebbing, which together with the type species, *P. macropa* Guérin-Méneville, constitute the new content of the genus *Primno* as proposed by Bowman. It must be pointed out immediately that *P. johnsoni* is similar to *P. latreillei* in all features except for the larger size attained by sexually mature females (9 mm and 6.5 mm respectively). Furthermore, his illustrations depict no significant differences between these species. Nor does Bowman provide a description of *P. johnsoni*, confining himself to a brief note about the similarity of the two. Hence we cannot consider *P. johnsoni* an independent species and relegate it to a synonym of *P. latreillei*.

The species *P. brevidens* has several characteristic features differentiating it from the other species of the genus. In distribution, it is partially sympatric with *P. macropa* in the northeastern part of the Pacific Ocean, while in warmer water regions it is sympatric with *P. latreillei*. Such a distributional pattern also supports its species independence.

KEY TO SPECIES OF GENUS PRIMNO
(after Bowman, 1978, with alterations)

1. Large denticles on anterior margin of 5th segment of pereopods V equal in length to 1/3 width of segment.....2. ***P. brevidens*** Bowm.
— Large denticles on anterior margin of 5th segment of pereopods V almost equal in length to total width of segment .... 2.
2. In pereopods V denticulation of proximal part of anterior margin of 5th segment begins with group of small denticles ....1. ***P. macropa*** Guérin-Mén.
— In pereopods V denticulation of proximal part of anterior margin of 5th segment begins with much larger denticle, followed by group of smaller ones ....3. ***P. latreillei*** Stebb.

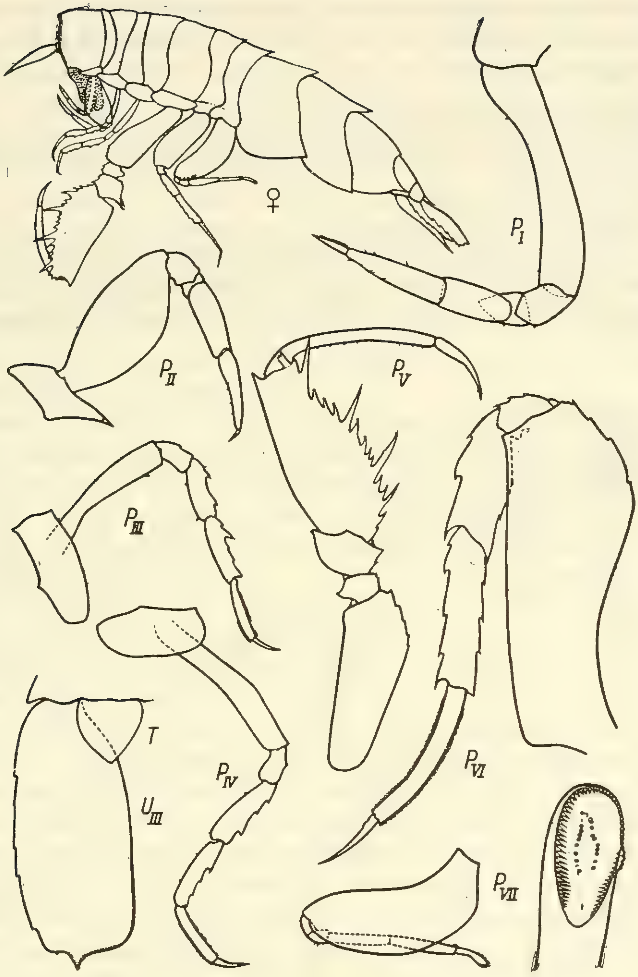
354 1. ***Primno macropa*** Guérin-Méneville, 1836 (Fig. 189)

Guérin-Méneville, 1836: 4; Bovallius, 1887a: 28; Barnard, 1930: 424; 1932: 287 (part.); Thorsteinson, 1941: 93; Hurley, 1955: 172; Vinogradov, 1956: 209; 1962: 22; Bowman, 1978: 3.—*ménevillei* Stebbing, 1888: 1447.—*antarctica* Stebbing, 1888: 1448.

Length up to 21 mm.

The body is laterally compressed. The rostrum (top view) is bluntly truncate. The pereon is approximately 3.3 times as long as the head and slightly longer than the pleon. The median dorsal teeth are coarser and longer than in other species of the genus. the same is true of the posterior denticle on epimeral plate III. The oral sinus occupies nearly 2/3 the height of the head.

The length of the 2nd segment of pereopods V is approximately three times its width; the 5th segment is slightly longer than the 2nd; the proximal denticles on the anterior margin are small, the larger denticles on the anterior margin are slightly shorter than the width of the segment, the smaller denticles approximately the same length as the width



354 Fig. 189. *Primno macropa* Guérin-Méneville (after Bowman, 1978).

of the slightly curved 6th segment. The length of the 2nd segment of pereopods VI is slightly less than twice its width; the proximal part is narrowed and concave on the anterior margin; the 3rd, 4th, and 5th
355 segments are narrower than in other species of the genus; the 6th segment is armed with spinules on the anterior margin and by still smaller spinules on the posterior margin. The 2nd segment of pereopods VII is approximately the same length as the rest of the segments together.

Uropods III have a well-developed medial fold.

Distribution: Distributed in the Atlantic, the Antarctic, south of Australia, waters of New Zealand, and Chile. In the northern part of the

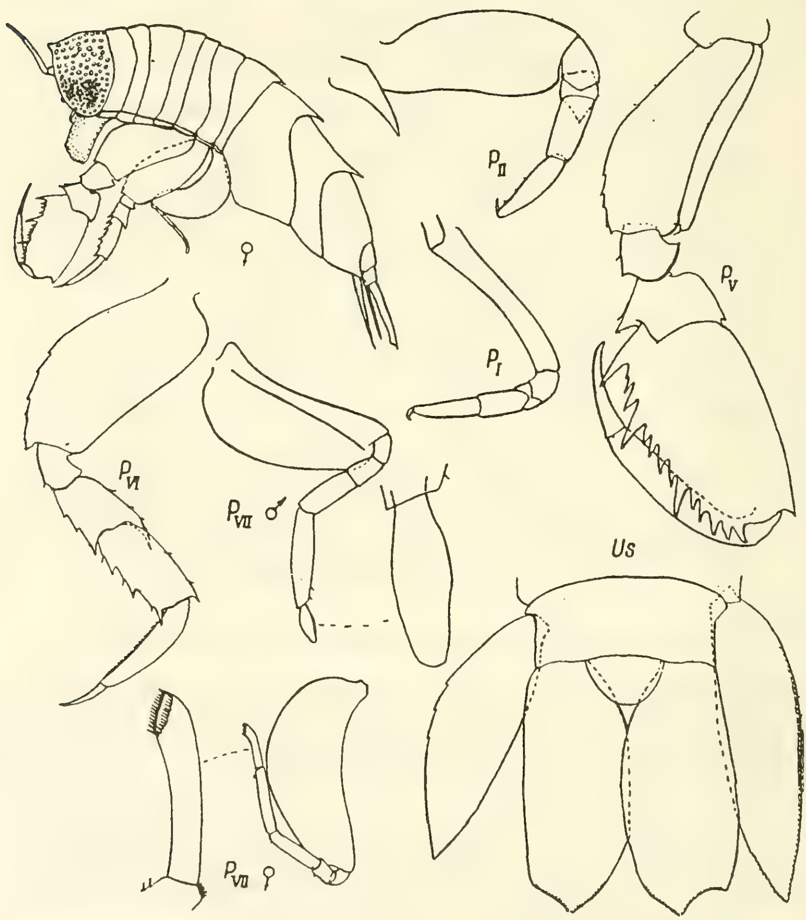
Pacific Ocean it inhabits the Sea of Japan, the Bering Sea, the Sea of Okhotsk, Gulf of Alaska and along the coast of North America right up to northern California.

2. ***Primno brevidens*** Bowman, 1978 (Fig. 190)

Bowman, 1978: 8.—*macropa* (non Guérin-Méneville, 1836); Stebbing, 1888: 1441.

Length up to 9 mm.

The body is thickset. The rostrum is very short and anteriorly rounded (top view). The pereon is 2.5–3 times longer than the head and approximately the same length as the pleon. The length of antennae I is



355 Fig. 190. *Primno brevidens* Bowman (after Bowman, 1978).

equal to the length of the head. The oral sinus occupies nearly half the height of the head.

The length of the 2nd segment of pereopods V is slightly more than twice its width; the 5th segment is approximately the same length as
356 the 2nd segment; the proximal denticle on the anterior margin is large; the length of the larger denticles is approximately 1/3 the width of the segment and that of the smaller denticles approximately half the width of the 6th segment; the 6th segment is weakly curved. The length of the 2nd segment of pereopods VI is twice its width, and the anterior margin is uniformly bulged; the posterior margin of the 6th segment has very fine spinules, noticeable only under high magnification. the 2nd segment of pereopods VII is approximately the same length as the rest of the segments together.

The tip of uropods III is less sharply stretched than in *P. macropa.*

Distribution: Warm-water and temperate regions of the Pacific Ocean. Also found in the southeastern part of the Gulf of Guinea. Apparently lives in warmer waters than *P. macropa* but unlike *P. latreillei*, is not confined to tropical and subtropical waters and even enters temperate zones.

3. ***Primno latreillei*** Stebbing, 1888 (Fig. 191)

Stebbing, 1888: 1445.—johnsoni Bowman, 1978: 15.

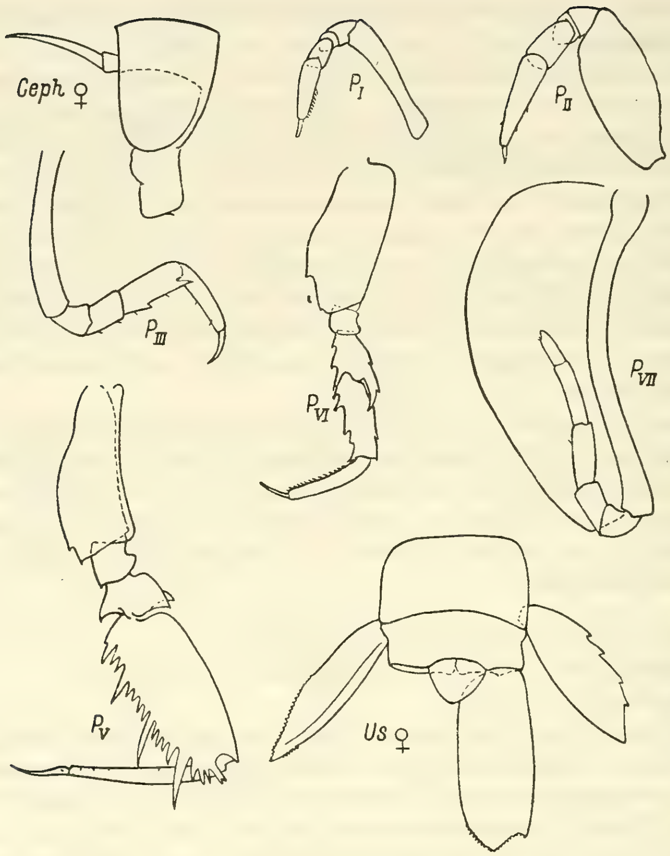
Length up to 9 mm.

The body is well proportioned. The rostrum is short and pointed. The pereon is 3.5 times longer than the head and approximately the same length as the pleon. Antennae I in females are almost 1/3 the length of the head. The oral sinus occupies nearly half the height of the head.

The length of the 2nd segment of pereopods V is slightly less than 3 times its width; the 5th segment is approximately the same length as
357 the 2nd segment; the proximal denticles on the anterior margin are large, the length of the largest denticles of the anterior margin almost equal to the width of the segment, the length of the smaller denticles equal to the width of the 6th segment; the 6th segment is almost straight. The 2nd segment of pereopods VII in females is longer than the rest of the segments together; in males it is roughly equal to them.

Uropods III are the same shape as in *P. brevidens* and the tip less stretched than in *P. macropa.*

Notes: Primno macropa and *P. latreillei* differ in: 1) size—*P. macropa* reaches 21 mm; 2) sequence of smaller and larger denticles on the 5th segment of pereopods V; and 3) geographic distribution—*P. latreillei* inhabits tropical and subtropical waters while *P. macropa* replaces it in temperate and subpolar regions. The remaining differences are less significant. In such a situation it would appear that *P. macropa* and *P. latreillei* are cold- and warm-water subspecies of the same species.



356 Fig. 191. *Primno latreillei* Stebbing (after Bowman, 1978).

Actually, in the cold-water regions the period of maturation of the crustaceans could be protracted and before achieving full maturity, they might undergo several more molts to reach much larger sizes (the number of segments in the rami of the pleopods in the illustration of *P. macropa* by Bowman is more than in *P. latreillei*, which confirms the greater number of molts through which the former species passed). Further, with an increase in number of molts, additional denticles could appear in the basal part of the subchela of pereopods V. Generally, ornamentation with denticles, spines, and setae in hyperiids is subject to wide variation. This applies also to the ornamentation of the posterior margin of the 6th segment of pereopods VI with small setae; this is "very distinctly seen" in *P. macropa* while in *P. latreillei* this margin is "distinctly smooth, the smallest setae seen only under high magnification" (Bowman, 1978).

Naturally, in larger crustaceans all the structural details appear coarser than in smaller ones. The absence of sympatry in the distribution of the above two species (even in the narrow Californian region they are allopatric) also does not preclude the suggestion of the possible subspecific nature of their differences. The ultimate resolution of the status of *P. macropa* and *P. latreillei* requires investigations of the character and range of variation of the morphological features in the genus Primno. In the present key we include *P. latreillei* in the same form as was described by Bowman.

Distribution: Found along the Australian coasts, in the region of California, southeastern part of the Gulf of Guinea, eastern part of the Mediterranean Sea, the Red Sea, and in the central part of the Atlantic. Possibly the distribution is circumtropical.

SUPERFAMILY LYCAEOPSOIDEA CHEVREUX, 1913

Antennae I originate from the frontal part of the head and are short and few-segmented in both sexes; in males the distal segments of the flagellum apically articulate with the broadened basal segment. Antennae II originate from the ventral part of the head and are short and curved in males; they are absent in females. The pereopods are not armed with chelae or subchelae. The telson is free.

XV. Family LYCAEOPSIDAE Chevreux, 1913

The body is well proportioned and weakly curved ventrally.

Antennae I in males have four-segmented flagellum, the distal segments of which articulate subterminally with the basal segment; in females the flagellum is short. Antennae II are present only in males; they are short, curved, and five-segmented. The mandibular palp is present
358 only In males. Pereopods I and II are simple. The 4th–6th segments of pereopods V are very thin and long, in males with highly broadened 2nd and 4th segments while in females the 4th segment is normal. The 2nd segment of pereopods VII is narrow or oval and its distal segments are not reduced.

The rami of all uropods are free; the telson is not fused with the last urosomite.

The family includes one genus.

1. Genus *Lycaeopsis* Claus, 1879

Claus, 1879b: 41; 1887: 66; Bovallius, 1887: 29; Stebbing, 1889: 1458; Chevreux, 1913: 17; Chevreux and Fage, 1925: 417; Spandl, 1924: 27;

1927: 213; Bowman and Gruner, 1973: 41.—*Phorcus* Milne-Edwards, 1830: 385; Claus, 1887: 66; Bovallius, 1887: 28.—*Phorcorrhaphis* Stebbing, 1888: 1451.

The pereon and pleon are approximately equal in length, their height in females identical while in males the pereon is not quite half the height of the pleon. somite I of the pereon in males is equal in length to the next two somites together.

The 2nd segment of pereopods I and II is generally shorter than the distal segments together. The 2nd segment of pereopods V and VI is highly broadened but not operculiform. The anterior margin of the 5th and 6th segments of pereopods VI is denticulate.

The telson is shorter than the last urosomite.

Type species: *Lycaeopsis themistoides* Claus, 1879

KEY TO SPECIES OF GENUS LYCAEOPSIS

1. Telson triangular, with rounded tip and smooth bulged margins. Endopodite of uropods III lanceolate, with pointed apex and uniformly denticulate margins .... 1. ***L. themistoides*** Claus.

— Telson bottle-shaped, its margin bulged in proximal part and concave in distal part. Endopodite of uropods III with characteristic notch in anterior margin, generally not denticulate .... 2. ***L. zamboangae*** (Stebb.).

1. ***Lycaeopsis themistoides*** Claus, 1879 (Fig. 192)

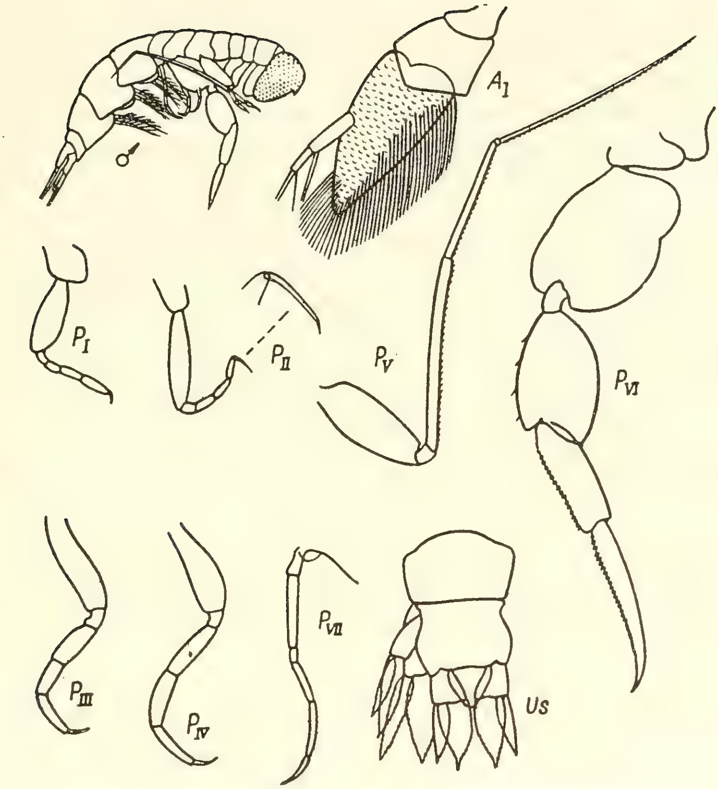
Claus, 1879b: 42; 1887: 67; Chevreux, 1913: 16; Chevreux and Fage, 1925: 417; Spandl, 1924: 21; 1927: 213; Stephensen, 1925a: 153; Barnard, 1930: 425.—*reynaudi* Milne-Edwards, 1830: 392 (*Phorcus*).—*hyalocephalus* Dana, 1852: 1006 (*Phorcus*).—*lindbergi* Bovallius, 1887: 29.—*loveni* Bovallius, 1887: 29 (*Phorcus*).—*edwardsi* Stebbing, 1888: 1455 (*Phorcorrhaphis*).—*pauli* Stebbing, 1888: 1459.

Length of adult males and females up to 5 mm.

The head is oval in shape, its height much more than its length. Somite I of the pereon in males is equal in length to the next two somites together; in females these somites differ less in length.

The 1st segment of the flagellum of antennae I is thicker in males, with a pointed apex; the distal segments are articulated with it in the upper part at a distance of half the length of the segment from the apex; the apical segment is very thin.

The 2nd segment of pereopods I is weakly broadened; the 3rd–5th segments are short; the claw is almost half the length of the 6th segment; the 3rd–7th segments together are longer than the 2nd segment. The 2nd segment of pereopods II is almost linear and straight, and slightly shorter



359 Fig. 192. *Lycaeopsis themistoides* Claus, male (after Stebbing, 1888).

than the 3rd–6th segments together; the strong, slightly curved claw is equal to the 6th segment in length. The margins of pereopods I-IV are smooth, without spines or setae. The 2nd segment of pereopods V In males is weakly broadened; the 3rd segment is short; the 4th–6th are
359 very thin and straight, with a denticulate anterior margin; the distal segments together are four–five times longer than the 2nd segment; claw is rudimentary. the 2nd segment of pereopods V in female is strongly broadened; its anterior margin is almost straight, the posterior margin bulged, the anterior distal process large, denticulate; the 3rd–7th segments together are only twice longer than the 2nd; the 4th segment is the largest of the distal segments, with large, sparse denticles on the anterior margin and a pointed posterior distal process; the anterior margin of the 5th and 6th segments is serrate; the claw is short. The structure of pereopods VI in males and females also differs sharply. The 2nd segment in males is almost oval, with a medially curved posterior margin, its

length 1.2 times its width, the margins denticulate or the anterior margin in the distal part may have some uneven denticles; the 4th segment in length and.width is only slightly smaller than the 2nd, its anterior margin and sometimes the posterior margin may be sparsely denticulate; the 5th and 6th segments are usual in shape, with a denticulate anterior margin; the claw is short, often with a split apex. In females pereopods VI are usual in structure; the 2nd segment is oval; the 4th–6th segments are almost linear; the claw may also be split; the anterior margin of the 2nd and 4th–6th segments have sparse uneven denticles. Pereopods VII in males consist of a thin 2nd segment and the 3rd+7th segments together are much longer than it; in females the 2nd segment has bulged margins and is sometimes oval; the distal segments together are equal in length to the 2nd segment or slightly longer than it.

The rami of all uropods are lanceoloate and denticulate. The telson has bulged margins, a rounded tip, and is approximately half the length of the last urosomite; the length and width of the last somite are almost equal.

The species is known from the tropical zone of the Atlantic, Indian, and Pacific oceans, and from the Mediterranean and Red seas. It inhabits the upper layers of the pelagic. Fairly rare.

2. ***Lycaeopsis zamboangae*** (Stebbing, 1888) (Fig. 193)

Stebbing, 1888: 1452 (*Phorcorrhaphis*); Chevreux, 1900: 148 (*Phorcorrhaphis*); 1913: 22; Spandl, 1924: 27.—*neglecta* Pirlot, 1929: 144.

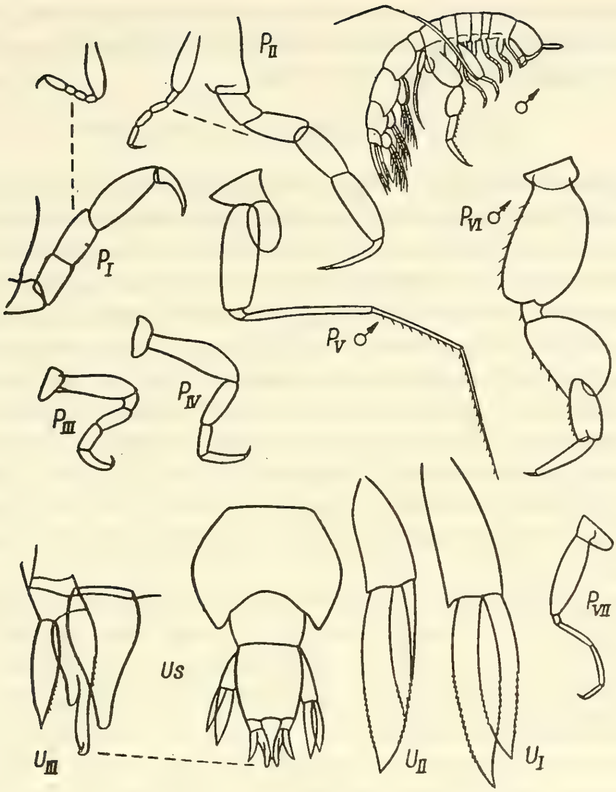
Length of adult specimens up to 5 mm.

This species is close to *L. themistoides* but the males exhibit several significant structural differences: the posterior margin of the 2nd segment of pereopods VI is not medially concave and the 5th segment has bulged margins. The last urosomite is approximately 1.2 times longer than wide. The endopodite of uropods III is not lanceolate and has a characteristic notch in the anterior margin. The telson is bottle-shaped; thus its margins are bulged near the base and curved in the distal part.

Distribution: Known from the Pacific Ocean (Kuroshio, the Philippines) and the Red Sea. It inhabits the upper layer of the pelagic. It is very rare in catches.

SUPERFAMILY PLATYSCELOIDEA BATE, 1862

Antennae originate from the ventral part of the head. Antennae I, have a large in males-curved basal segment of the flagellum, with which a small number of distal segments articulate, most often subterminally. Antennae II in males consist of five highly elongated segments (three-segmented base and two-segmented flagellum), set zigzag. Antennae II



360 Fig. 193. *Lycaeopsis zamboangae* (Stebbing) (after Stebbing, 1888).

in females are more or less reduced. Pereopods I–II may be armed with chelae or subchelae, which may be present sometimes on
361 pereopods III–IV also. Pereopods VII often have a greatly reduced distal part which may sometimes be rudimentary. The telson is free or fused with the urosome.

Bowman and Gruner (1973) conducted a revision of the families and genera of hyperiids, including the superfamily Platysceloidea. They have provided a compact diagnosis of the families, which we shall use below. However, in several cases the genera and families proposed by these authors are not acceptable. In particular, the inclusion of the genera *Brachyscelys* and *Euthamneus* as well as *Tryphana* in the family Lycaeidae seems rather artificial. These genera, in our opinion, constitute separate families, namely, Brachyscelidae (for the first two genera) and Tryphanidae (for the third genus). At the same time, the inclusion of the genus *Anapronoe* in an independent family and several less significant changes in the traditional arrangement (composition) of families of this group appear completely justified.

XVI. Family PRONOIDAE Claus, 1879

Small, medium and large crustaceans ranging in length from 4 to 20 mm, with a thick integument which is smooth for the most part but sometimes covered with a reticulate structure. The body is compact, somewhat compressed laterally, and curved ventrally. The eyes are large, occupying a large part of the surface of the head. The head is large, higher than the pereon, in individual cases equal to it in length, in males laterally distally tapered, in females uniformly rounded. The mandibles in females and males bear a palp; maxillae I and II are relatively well developed.

Antennae I in females have a three-segmented, in males four-segmented flagellum, the basal segment of which is large and strongly curved forward or short. Antennae II in females are absent or rudimentary; in males they have a long, folded four times or rudimentary flagellum.

The coxal plates are not fused with the pereon somites. Pereopods I are usually simple, sometimes with a subchela. Pereopods II in most species have a finely denticulate chela, sometimes (in *Pronoe* and *Paralycaea*) they are simple. Pereopods V are longer than the rest, their basal segments broadened and generally oval, and the distal segments articulate with them terminally or subterminally. In pereopods VI the basal segments are strongly broadened but not operculiform. The 2nd segment of pereopods VII is quite broad, the distal segments rudimentary, usually one or two, but in anomalous situations this number may be more. All rami of the uropods are well developed; the endopodites of uropods II and III are free except in the genus Paralycaea. The telson is not fused with the last urosomite.

The family includes four genera.

KEY TO GENERA OF FAMILY PRONOIDAE

1. Pereopods II with chelae .... 3.
— Pereopods II without chelae .... 2.
2. Telson longer than last urosomite. Endopodite of uropods III fused with basipodite .... 4. ***Paralycaea*** Claus.
— Telson approximately half the last urosomite in length. Rami of uropods free .... 2. ***Pronoe*** Guérin-Méneville.
3. Length and width of last urosomite approximately equal. Rami of uropods II and III with rounded tips and smooth margins .... 1. ***Eupronoe*** Claus.

— Length of last urosomite much more than its width. Rami of uropods II and III lanceolate, with stretched tips and denticulate margins .... 3. ***Parapronoe*** Claus.

362 1. Genus *Eupronoe* Claus, 1879

Claus, 1879b: 26; 1887: 50; Stebbing, 1888: 1509; Chevreux and Fage, 1925: 425; Stephensen, 1925a: 156.—*Pronoe* Dana, 1852: 1015.

Antennae I and II in females are short, barely perceptible, and consist of six and four segments respectively. Antennae II zigzag four times; their basal segment is long and the apical segment very short.

Pereopods I are simple. Pereopods II have a chela whose immovable part is denticulate on both sides. Pereopods V–VII have a broad flat 2nd segment, which in pereopods V is oval, and in pereopods VI and VII more broadened in the proximal part; the 4th–6th segments of pereopods V and VI have a finely denticulate anterior margin; the 4th segment of pereopods VI has a distal process extending beyond the middle of the 5th segment. Pereopods VII are two-segmented and the distal segment is rounded; they are similar in structure in all species of the genus.

The rami of uropods I are lanceolate with serrate margins and pointed tips. The rami of the other uropods are thinner, with a more or less rounded tip and smooth margins. The tips of uropods III project far beyond the tip of the telson. The endopodites of uropods II and III are not fused with basipodites. The triangular telson is shorter than the last urosomite.

Type species: *Eupronoe maculata* Claus, 1879.

The genus comprises four species.

KEY TO SPECIES OF GENUS EUPRONOE

1. Fifth segment of pereopods II with massive distal process and obtuse tip; 6th segment also massive and broad ..... 4. ***E. laticarpa*** Steph.
— Distal process of 5th segment of pereopods II tapers into more or less distinct cusp; 6th segment gradually narrows distally .... 2.
2. Fifth segment of pereopods I broader than 4th segment. Margins of telson slightly concave in distal part, hence it is galeiform .... 1. ***E. maculata*** Claus.
— Fifth segment of pereopods I narrower than 4th segment. Margin of telson straight, slightly convex in distal part, tip of triangular telson rounded .... 3.
3. Distal process of 4th segment of pereopods I reaches middle of 5th segment or even base of 6th. Posterior margin of 5th and 6th segments of pereopods III and IV smooth. Second segment of pereopods VI

with straight or slightly concave distal margin; distal process of 4th segment reaches base of 6th segment; 5th segment without distal process .. ..2. ***E. minuta*** Claus.

— Distal process of 4th segment of pereopods I small, not reaching middle of 5th segment. Posterior margin of 5th and 6th segments of pereopods III and IV denticulate. Second segment of pereopods VI with rounded distal margin and one or few low denticles; distal process of 4th segment not reaching base of 6th; 5th segment also with small but distinct distal process ....3. ***E. armata*** Claus.

1. ***Eupronoe maculata*** Claus, 1879 (Fig. 194)

Claus, 1879b: 28; 1887: 52; Stephensen, 1925a; 156.—*inscripta* Stebbing, 1888: 1510.

363 Length of adult males and females 8–12 mm.

The body is elongate and the pereon equal in length to the first two somites of the pleon. The head in males is drawn out and appreciably narrowed at the end; its length is more than its height.

In pereopods I the 3rd–7th segments together are longer than the 2nd segment; the 4th segment is distally broadened and is almost triangular in shape, its length and width equal, the posterior margin finely denticulate in the distal part; unlike in *E. minuta* and *E. armata*, the 5th segment is broader than the 4th, its posterior margin sharply bulged and finely denticulate; the 6th segment is distally narrowed, its posterior margin generally denticulate, but may be smooth; the claw is half the length of the 6th segment. The 2nd segment of pereopods II is shorter than the distal segments together; the 4th segment is distally broadened and its width more than the length; the 5th segment is broader than the 4th, its distal process denticulate on both margins, and the pointed tip reaches the base of the claw; the 6th segment and the claw are the same as in pereopods I. The margins of the segments in pereopods III and IV are smooth. The 2nd segment of pereopods V is oval, its length twice its width, the distal margin generally smoothly rounded but sometimes bearing a few less distinct and inconspicuous denticles; the anterior margin of the 4th–6th segments is denticulate; the claw is 1/3 the length
364 of the 6th segment. The 2nd segment of pereopods VI is more than 1.5 times longer than wide, the other segments together slightly shorter than it; the distal process of the 4th segment is equal to the 5th segment in length; the 4th–6th segments have a pectinate anterior margin.

Uropods I have pointed rami and denticulate margins; the exopodite is narrower and somewhat longer than the endopodite. The basipodite of uropods II is much narrower than in uropods I; the rami have smooth margins and broadly rounded tips. The basipodite of uropods III is equal in length and width; both rami are distally broadened, their tips rounded, the margins not denticulate. The telson is somewhat shorter than the last

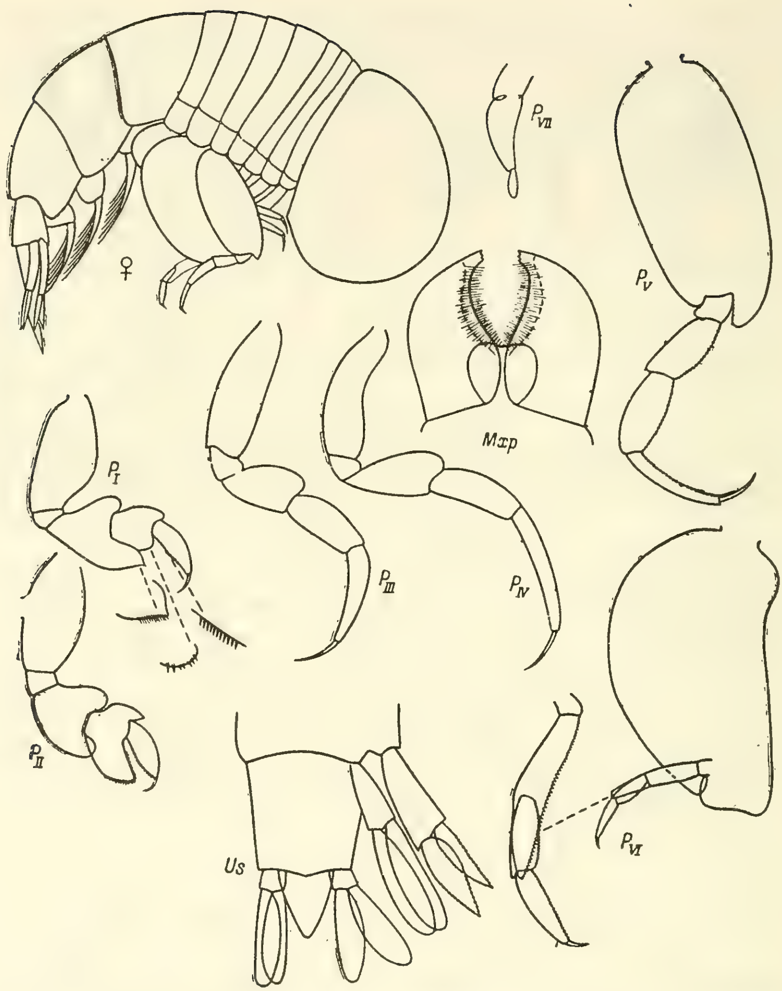
363 Fig. 194. *Eupronoe maculata* Claus (Us, U_{I-III}—after Stephensen, 1925a).

segment of the urosome; its length is somewhat more than its width at the base; the apex of the telson is stretched, its tip in males pointed, in females rounded.

Distribution: A warm-water species. In the Atlantic Ocean it is distributed south of 40° N; in the Indian Ocean it is known from the region of Zanzibar; in the Pacific Ocean it is found in the region of Kuroshio, Australia, New Zealand, and in the eastern, central, and western equatorial parts; common for the Mediterranean Sea. Lives in the upper layers (0–200 m) and found at the surface at night.

2. ***Eupronoe minuta*** Claus, 1879 (Fig. 195)

Claus, 1879b: 28; 1887: 52; Stebbing, 1888: 1516; Stephensen, 1925a: 160.—*brunnea* Dana, 1852: 1015.—*macrocephalata* Bovallius,



365 Fig. 195. *Eupronoe minuta* Claus.

1887a: 41.—*ornata* Bovallius, 1887a: 41.—*atlantica* Stebbing, 1888: 1513.—*pacifica* Stebbing, 1888: 1519.

Length of adult females 6–8 mm, of males 5–6 mm.

The head is large and high; in females it is generally equal to the length of the pereon but in larger specimens may be even longer; in males the head is slightly shorter and anteriorly tapered.

The 2nd segment of pereopods I is equal to or slightly longer than the next three segments together; the 4th segment is strongly broadened in the distal part and forms two distal processes, of which the anterior one is shorter and the posterior greatly variable in length—sometimes this process reaches only the middle of the 5th segment, sometimes its distal end; the 5th segment is 2/3 the length of the 4th, equal in length and width, and bears spines along the posterior margin; the 6th segment attains maximum width in the middle, has a bulged anterior margin, and an almost straight and finely denticulate posterior margin; the claw is long and thin. The 2nd segment of pereopods II is slightly broadened; the 4th segment is wider than long and has rounded anterior and posterior processes in the distal part, of which the latter is somewhat larger; the 5th segment is somewhat broader than the 4th, its length less than half its width; the anterior distal process is pointed and terminates in a spine; the posterior distal process constitutes the immovable part of the chela, has denticulate margins, and its pointed tip falls slightly short of the base of the claw; the 6th segment attains maximum width in the middle, narrows toward the tip, and both its margins are bulged. The 2nd segment of pereopods V is oval and twice longer than wide; in front of the base of the next segment there is a distal projection which reaches the base of the 4th segment; the 4th and 5th segments are equal in width but the 5th is longer; the claw is thin, curved, and slightly shorter than half the length of the 6th segment. The anterior margin of the 2nd segment in pereopods VI is straight but with a rounded projection in its proximal part, the posterior margin bulged, and the distal margin straight or slightly concave; the 3rd–7th segments together are half the length of the 2nd segment; the 4th segment has a distal process with a rounded tip that reaches the base of the 6th segment; the claw is short; the 4th–6th segments have a denticulate anterior margin.

Both rami of uropods I have a pointed tip and denticulate mar-
365 gins; the endopodite is somewhat longer than the exopodite. The rami of uropods II and III have a smooth rounded tip, are broadened in the distal part, weakly developed, and not denticulate.

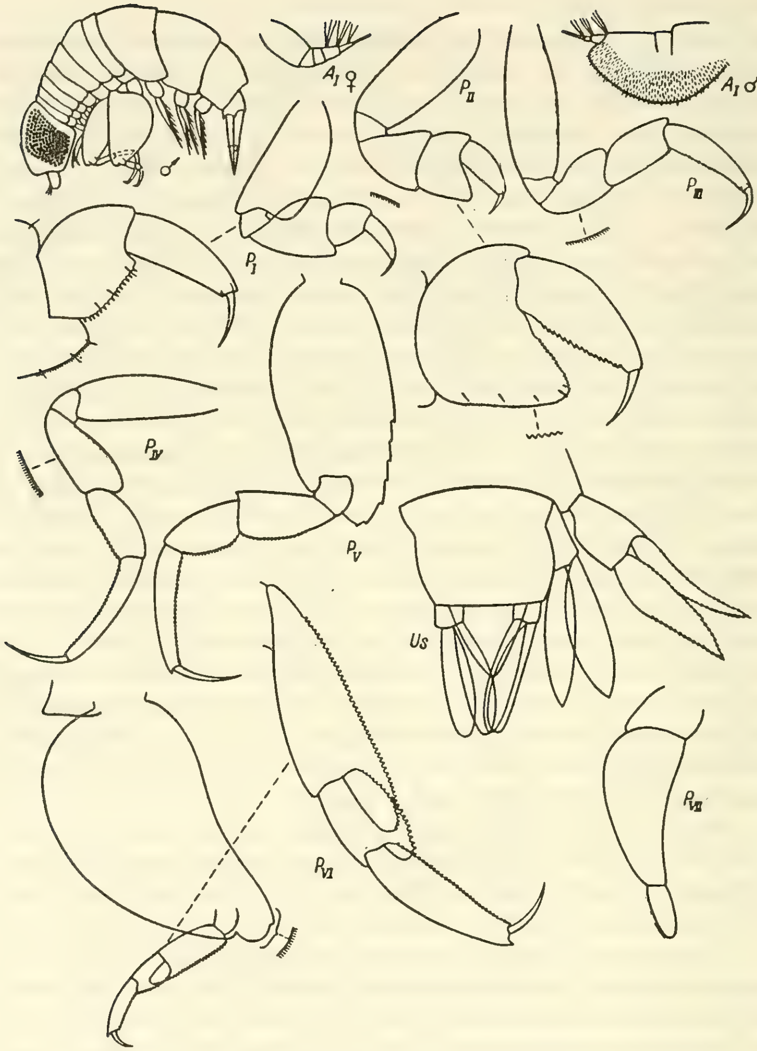
The telson is triangular, with a rounded tip and weakly bulged margins; its length is somewhat more than its width at the base and almost half that of the last urosomite, whose length and width are equal.

Distribution: Often found in the surface waters of the tropical zone of the World Ocean. It is known from the Atlantic (south of 38° N., region of the Canary Islands, Gibraltar), Indian (northwestern Australia), and Pacific (north of New Zealand, equatorial part, Hawaiian Islands, Kuroshio) oceans, and the Mediterranean Sea. It inhabits the upper 100 m layer.

367 3. ***Eupronoe armata*** Claus, 1879 (Fig. 196)

Claus, 1879b: 28; 1887: 52; Stephensen, 1925a: 159; Spandl, 1927: 224.—*serrata* Claus, 1879b: 28.—*intermedia* Stebbing, 1888: 1517.

Length of adult animals up to 8 mm.



366 Fig. 196. *Eupronoe armata* Claus.

The head is smaller than in *E. minuta*; in females it is anteriorly rounded, its length less than the height and equal to the first five pereon somites; in males the head is narrowed, its length more than the height.

The pereon is equal in length to the first two somites of the pleon.

Pereopods I and II are the same as in *E. minuta* but the 4th segment of pereopods I has a very short distal process; in pereopods II the distal process of the 5th segment has a rounded tip and is usually considerably shorter than the 6th segment. Pereopods III and IV are identical in structure but the latter are longer; the 4th segment bears small spinules (perceptible under high magnification) on the posterior margin; the 5th and 6th segments have a denticulate posterior margin; the claw is thin and long, more than half the length of the 6th segment. The 2nd segment of pereopods V is oval, twice as long as wide, and bears five–seven readily perceptible denticles in the distal part of the anterior margin; the 4th–6th segments have a denticulate anterior margin; the claw is long, more than half the length of the 6th segment. The 2nd segment of pereopods VI has a slightly concave anterior margin, a bulged posterior margin, and a rounded lobe in the distal part that bears one–three well-noticeable marginal denticules; the 3rd–7th segments together are 2/3 the length of the 2nd segment; the 4th segment is the longest and broadest, its anterior margin cristate, and the distal process falls slightly short of the base of the 6th segment; the 5th segment is short and broad. Of all the known species of the genus *Eupronoe* only in *E. armata* does the 5th segment have a small but always distinct rounded distal process; the 5th and 6th segments have a denticulate anterior margin; the claw is about half the length of the 6th segment.

The last urosomite is wider than long.

The rami of uropods I are denticulate on both margins but sometimes the anterior margin of the exopodite is smooth. The rami of uropods II and III have smooth margins that often taper distally.

The telson is triangular, with a rounded tip and weakly bulged margins, and its width at the base is greater than its length.

The body may be densely pigmented with stellate cells. Both the pereon and the pleon are striated, having fine transverse furrows.

Distribution: A surface warm-water, apparently circumtropical species. It is known from the Atlantic (south of 43° N), Indian (environs of Madagascar, Zanzibar), and Pacific (Kuroshio, Hawaiian Islands, eastern tropical part) oceans.

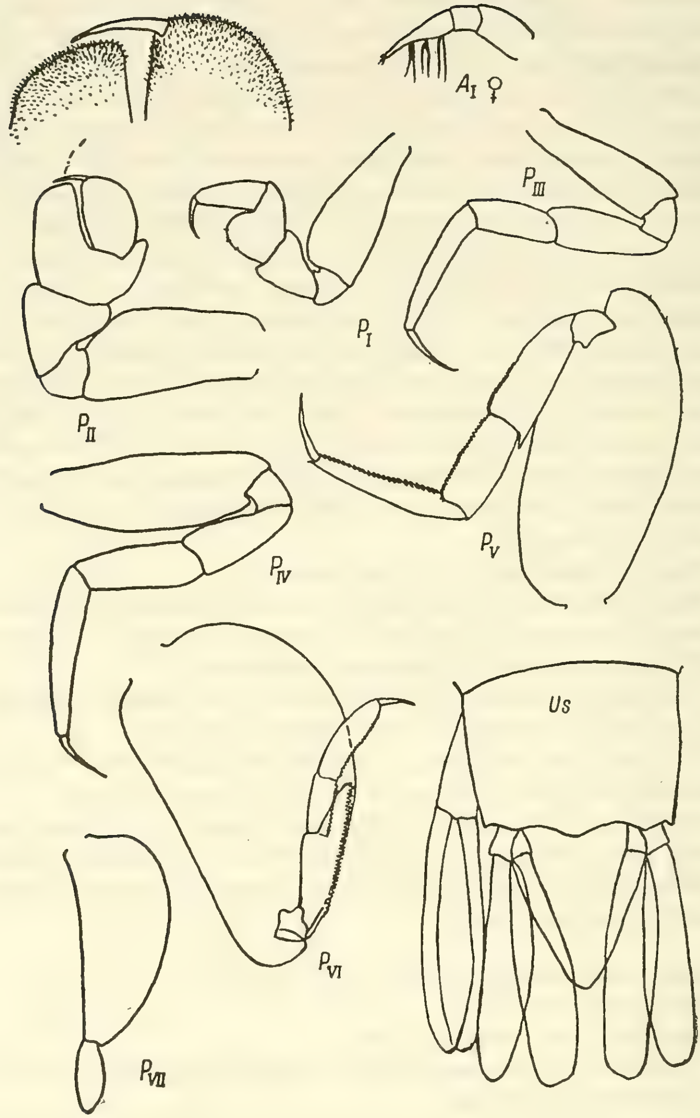
4. ***Eupronoe laticarpa*** Stephensen, 1925 (Fig. 197)

Stephensen, 1925a: 161.

Length of adult animals 4.5 mm.

The head is approximately 1.5 times higher than its width and anteriorly rounded, not stretched.

The 4th segment of pereopods I lack distal processes and is highly broadened in the distal part; the 5th segment is slightly broader than the 4th and its posterior distal process in the form of a rounded lobe; the claw is half the length of the 6th segment. The 2nd segment of pereopods II is much broader throughout its length; the 4th segment also lacks distal processes; the 5th segment has a perceptible anterior distal process and a strong posterior process that constitutes the immovable part of the chela. Unlike the other species of this genus, in *E. laticarpa* the chela



369 Fig. 197. *Eupronoe laticarpa* Stephensen, female.

is massive, and the distal process of the 5th segment is neither pointed
368 nor narrowed but instead has a bluntly truncated tip; the 6th segment
is also broad and not narrower in the distal part than at the base. This
character, i.e., the structure of pereopods II, makes *E. laticarpa* readily

distinguishable from other species of the genus. The 2nd segment of pereopods V is oval, its length twice its width; in front of the base of the 3rd segment a distal lobe occurs; the 4th–6th segments are denticulate; the claw is long, half the length of the 6th segment. The 2nd segment of pereopods VI is notably longer than the remaining segments together; the distal process of the 4th segment reaches the base of the 6th segment. The distal segment of pereopods VII is more elongated than in other species of the genus.

The telson is triangular, somewhat longer than wide, and its tip reaches slightly beyond the middle of the rami of uropods III.

Distribution: Only isolated individuals have been found in the Atlantic (31°48′ N, 14°22′ W and 34°23′ N, 15°31′ W), in the eastern part of the Indian, and tropical zone of the Pacific oceans.

2. Genus *Pronoe* Guérin-Méneville, 1836

Guérin-Méneville, 1836: 6; Claus, 1879b: 23; 1887: 48; Stebbing, 1888: 1507.

The flagellum of antennae I is three-segmented in males; antennae II are fairly short, the flagellum only two-segmented. Pereopods I and II are simple; the 2nd segment of pereopods I is very strongly broadened, in pereopods II narrower. The 2nd segment of pereopods V is barely broadened, in pereopods VI and VII strongly so. The 4th segment of pereopods VI lacks distal processes. Pereopods VII have one distal segment in the shape of a claw. The endopodite of uropods II and III is not fused with the basipodite. The basipodite of uropods III is longer than wide. The telson is short and has a rounded tip.

Type species: *Pronoe capito* Guérin-Méneville, 1836.

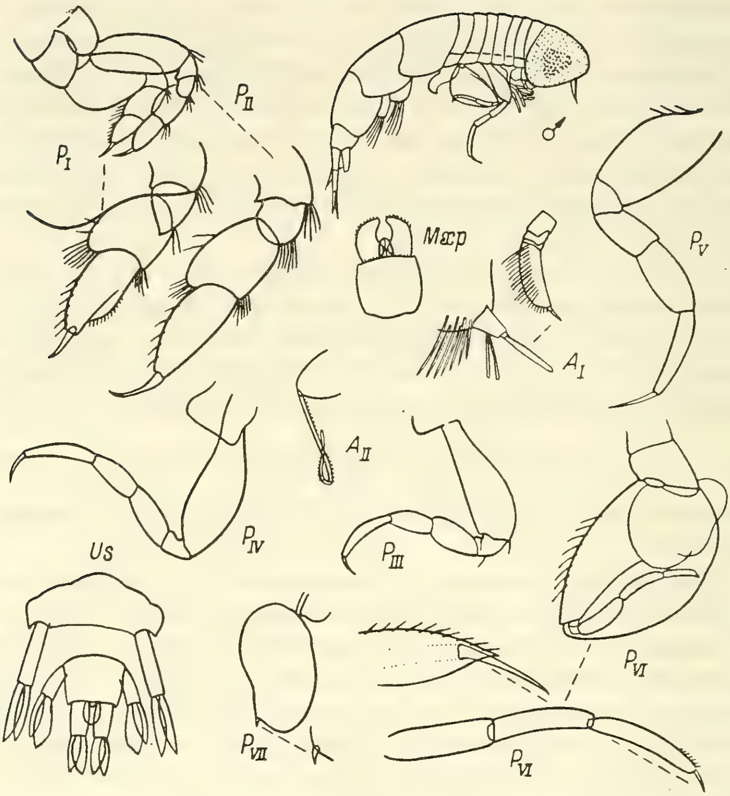
1. ***Pronoe capito*** Guérin-Méneville, 1836 (Fig. 198)

Guérin-Méneville, 1836: 7; Claus, 1879b: 25; 1887: 50; Stebbing, 1888: 1508; Spandl, 1924: 34.

Length of adult males 10–14 mm. Female not described.

The head is anteriorly tapered and approximately equal in height and length.

The peduncle of antennae I is three-segmented in males, the 1st segment equal in length and width, and the 2nd and 3rd segments much shorter; the flagellum is three-segmented, the 1st segment broad and long and weakly bent forward only in the distal part; the 2nd segment is equal in length and width; the 3rd segment is linear and narrow, twice longer than the 2nd, and bears a few short spines apically. Antennae II in males are short and weak compared to other species of the family Pronoidae; they are five-segmented, folded only twice, and the shortest, 3rd segment,



370 Fig. 198. *Pronoe capito* Guérin-Méneville
(Us—after Claus, 1887; rest—after Stebbing, 1888).

is located at the place of bending; the anterior margin of all the segments is pubescent but with fairly sparse setae.

Pereopods I and II are short and without chelae. The 2nd segment of pereopods I is highly broadened, especially in the proximal part, 1.5 times longer than wide, the posterior margin almost straight, and the anterior margin markedly bulged; the 5th segment is the broadest of the distal segments, almost equal in length and width, and both distal angles bear a few spines; the 6th segment is narrower than the 5th but longer, the anterior margin is serrate and bears several submarginal setae, and the posterior margin is almost straight in the proximal part, then bends sharply and forms a serrate projection; the claw apparently varies greatly in length but is usually equal to the 6th segment. The 2nd segment of pereopods II is less broad than in pereopods I, its margins in the middle part almost straight or even slightly concave, and more than 2.5 times

longer than wide; the 5th segment is somewhat longer than wide; the 2nd–5th segments are pubescent as in pereopods I; the 6th segment is longer than the 5th, smoothly narrowed in the distal part, the anterior margin denticulate and also bears a few submarginal setae, and the posterior margin smooth, without the projection seen in pereopods I; the claw is long. The 6th segment of pereopods III and IV has a denticulate posterior margin; the claw is somewhat shorter than the 6th segment. The 2nd segment of pereopods V has a bulged anterior margin, almost straight posterior margin, and is almost twice longer than wide; the 6th segment is slightly longer than the 5th but half as narrow; the 5th and 6th segments have a finely denticulate anterior margin; the claws are long and thin, more than half the length of the 6th segment. The 2nd segment of pereopods VI is markedly broadened, almost 1.5 times longer than wide and the anterior margin barely, the posterior margin notably bulged; the 4th, 5th, and 6th segments are approximately equal in length but each successive segment is narrower than the one before; the 6th
370 segment terminates in a cusp, the anterior margin in the distal part often densely pubescent, bearing fine hairs, and the posterior margin bears short sparse setae; the claw is thin, almost straight, and less than half the length of the 6th segment. Pepeopods VII have a markedly broadened 2nd segment and a very small clawlike distal segment; the 2nd segment in the proximal part of the anterior margin is highly bulged and in the distal part is concave, giving the segment a characteristic shape.

The peduncle and rami of uropods I are equal in length; the rami are lanceolate, with a pointed tip and denticulate margins. The rami of uropods II are longer than the basipodite and the endopodite longer and broader than the exopodite. The basipodite of uropods III is the same length as in uropods II but broader; the rami are 1.3–1.5 times longer than the basipodite; the endopodite is less broad in the proximal part and its tip smoothly rounded; the exopodite is lanceolate, has a slightly stretched and pointed tip, and the posterior margin is finely denticulate. The telson is triangular with a rounded tip and approximately equal in length and width.

Distribution: A rare species. It is known from the Atlantic (south of 20° N), Indian (Zanzibar), and Pacific (Moluccas, near the coast of Chile, southern tropical part, region of New Zealand) oceans. It inhabits the upper 200 m layer.

3. Genus *Parapronoe* Claus 1879

Claus, 1879b: 29; 1887: 55; Stebbing, 1888: 1521; Bowman and Gruner, 1973: 44.—*Sympronoe* Stebbing, 1888: 1533; Bowman and Gruner, 1973: 44.

371 The head is more rounded in females than in males. Antennae II of males have a zigzag folded flagellum in which the length of the distal section is 1/3–1/2 that of the preceding section; the apical segment is very short.

Pereopods I are simple. The 5th segment of pereopods II has a posterior distal process capable of forming a chela. The 2nd segment of pereopods V and VI is strongly broadened. The 2nd segment of pereopods V is oval and the 3rd segment articulates with it subapically at some distance from the distal margin; the 4th–6th segments have a denticulate anterior margin. The 2nd segment of pereopods VI is somewhat larger than in pereopods V, narrowed distally, its anterior margin concave and the posterior margin bulged; the 3rd segment articulates with the 2nd subapically and from this place the 2nd segment extends as two distal lobes, of which the anterior is concave with a blunt distal margin and the posterior one has a convex margin; the 4th segment has a distal process; the 4th–6th segments have a serrated anterior margin. Pereopods VII have a triangular 2nd segment and two very short distal segments. In some cases, with anomalous development, the number of distal segments may be more—up to five. The last urosomite is longer than wide.

Type species: *Parapronoe crustulum* Claus, 1879.

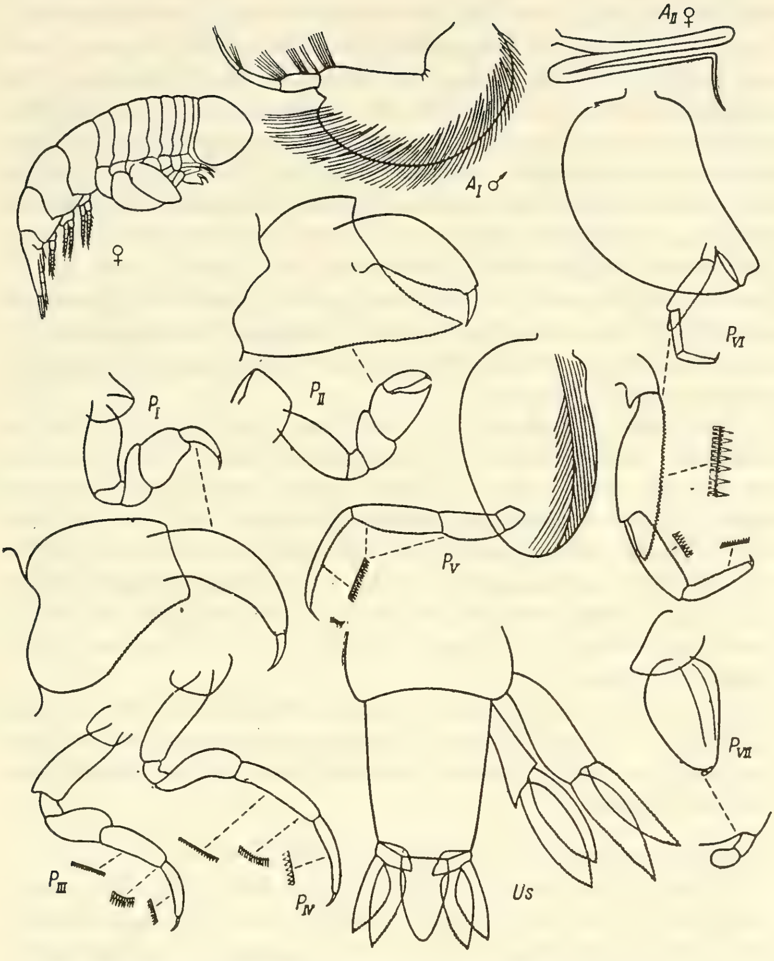
The genus includes four species.

KEY TO SPECIES OF GENUS PARAPRONOE

1. Telson approximately same length as uropods .... 2.
— Telson not longer than half length of uropods III .... 3.
2. Anterior margin of distal process of 5th segment of pereopods II concave. Telson 1/2 to 2/3 length of last urosomite .... 1. ***P. crustulum*** Claus.
— Anterior margin of distal process of 5th segment of pereopods II straight or slightly convex. Telson same length as last urosomite or slightly shorter .... 3. ***P. campbelli*** Stebb.
3. Distal process of 5th segment of pereopods II not extending beyond middle of 6th segment. Last (geminate) urosomite 1.2–1.3 times longer than wide. Rami of uropods III broadly oval ....2. ***P. parva*** Claus.
— Distal process of 5th segment of pereopods II reaching 3/4 length of 6th segment. Last urosomite almost twice longer than wide. Rami of uropods III narrowly oval, almost lanceolate .... 4 ***P. elongata*** Semenova.

1. ***Parapronoe crustulum*** Claus, 1879 (Fig. 199)

Claus, 1879b: 31; 1887: 55; Stebbing, 1888: 1530; Shoemaker, 1945a: 246.—*atlantica* Bovallius, 1887a: 42.—*clausi* Stebbing, 1888:



372 Fig. 199. *Parapronoe crustulum* Claus(♀—after Stbbing, 1888).

1526.—*clausoides* Stebbing, 1888: 1529.—stebbingi Spandl, 1927: 220.—*similis* Spandl, 1927: 221.

Length of sexually mature females up to 20 mm, of males up to 15 mm.

The body is curved dorsoventrally. The integument is thick. The head is high and anteriorly rounded. In antennae II of males the 1st and 2nd segments are approximately equal in length.

The 2nd segment of pereopods I is rather short, its length twice its width; the maximum length of the 4th segment is half its width; the

broad 5th segment is narrowed distally, its posterior margin concave in the distal part and serrate, the anterior margin bulged; the 6th segment is narrow and curved. The 2nd segment of pereopods II is the same as in
372 pereopods I; the 4th segment is wider than long; the distal process of the 5th segment forms the immovable part of the chela and extends slightly beyond the base of the claw; both margins are denticulate, the anterior one slightly concave; both margins of the 6th segment are convex, the posterior margin, like the distal process, denticulate. Pereopods III and IV are identical in structure; the 5th–6th segments have a denticulate posterior margin. The 2nd segment of pereopods V is oval, 1.5–1.8 times longer than wide, and the outer surface grooved in the anterior part. The 2nd segment of pereopods VI is markedly broadened and 1.5 times longer than wide; the distal process of the 4th segment reaches the middle of the 5th segment.

The rami of uropods I are denticulate, slightly longer than the basipodite, and lanceolate. The basipodite of uropods II is narrower; the rami are shorter and their anterior margin denticulate only in the
373 distal part. The basipodite of uropods III is wider than long; the rami have a smooth anterior margin and a denticulate posterior margin. The last urosomite narrows gradually, is 1.3–1.5 times longer than wide, and has straight lateral margins. The telson is half the length of the last urosomite, its length 1.5 times its width, and its tip may be slightly rounded or pointed.

Distribution: Known from the North (Bermuda Islands) and South (south of 19° S, region of Lagos, tropical zone), Atlantic, Indian (Zanzibar), and Pacific (northeastern Australia, northern New Zealand and Kuroshio) oceans.

2. ***Parapronoe parva*** Claus, 1879 (Fig. 200)

Claus, 1879b: 31; 1887: 55; Stebbing, 1888: 1533 (*Sympronoe*); Stephensen, 1925a: 162 (*Sympronoe*); Pirlot, 1930: 32 (*Sympronoe*).—7-*articulata* var. Stephensen, 1925a: 162 (*Sympronoe*).—*septenarticulata* subsp. Pirlot, 1930: 33 (*Sympronoe*).—*propinqua* Stebbing, 1888: 1537 (*Sympronoe*).—*anomala* Shoemaker, 1925: 42 (*Sympronoe*).

Length of adult females up to 8 mm, of males up to 7 mm.

The 2nd segment of pereopods I is distally broadened and the anterior margin more bulged than the posterior margin; the 4th segment is twice wider in the distal part than in the proximal and somewhat wider than its length, its posterior margin pectinate, and the denticles very small; the 5th segment is narrower, almost 1.5 times longer than the 4th, and has a bulged anterior margin and almost straight, finely denticulate posterior margin; the 6th segment is somewhat shorter than the 5th and twice as broad; the claw is short. The 2nd segment of pereopods II is slightly longer than pereopods I and slightly broadened; the 4th segment

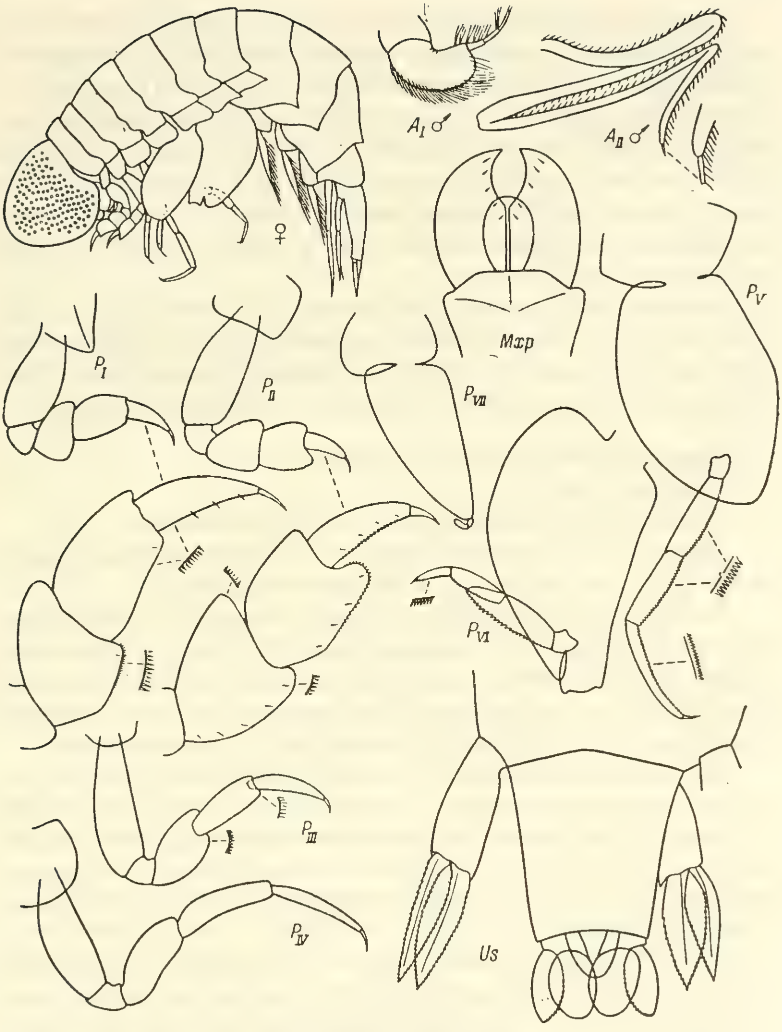


Fig. 200. *Parapronoe parva* Claus.

is longer than wide and its distal angle is finely denticulate; the distal process of the 5th segment does not reach the middle of the 6th segment, resembles a rounded lobe, and has a denticulate margin; the 6th segment has a bulged anterior margin and an almost straight and denticulate posterior margin. The 2nd segment of pereopods V is strongly broadened and 1.5 times longer than wide. The 2nd segment of pereopods VI forms two processes (lobes) in the distal part, of which the posterior is rounded and the anterior has a truncate distal margin, is bulged in the middle part, and slightly stretched angles.

The basipodite of uropods I sometimes has a finely denticulate distal part in the anterior margin; the rami are lanceolate and equal in length to the basipodite. The rami of uropods II are lanceolate; both margins of the endopodite are denticulate, in the exopodite only the posterior margin. The basipodite of uropods III is half as long as wide; the endopodite is oval and has smooth margins; the exopodite is narrower and has a smooth anterior and denticulate posterior margin. The telson is short, has a rounded tip, is approximately equal in length and width, its length 1/4 that of the last urosomite.

Distribution: A circumtropical species. It is found in the Atlantic (south of 34° N), Indian (Zanzibar), and Pacific (Gulf of California, Peruvian region, northeastern Australia, New Zealand, Hawaiian Islands, Sulu Sea, Kuroshio, South China Sea) oceans, and in the Mediterranean Sea.

3. ***Parapronoe campbelli*** Stebbing, 1888 (Fig. 201)

Stebbing, 1888: 1522.

Length of adult females up to 15 mm, of males 10 mm.

The body is less massive than in *P. crustulum* and better proportioned; in females the head is slightly narrowed anteriorly.

The distal process of the 5th segment of pereopods II has straight denticulate margins, and its tip reaches the base of the claw. The 2nd segment of pereopods V is highly bulged, oval, and more than 2.2 to 2.5 times
374 longer than wide. The 2nd segment of pereopods VI is more elongated than in pereopods V and its length almost twice its maximum width.

The basipodite of uropods I is shorter than the rami; the rami are thin and long; the exopodite has a smooth anterior margin. The exopodite of uropods III has a smooth anterior margin and a denticulate posterior margin; both margins of the endopodite are smooth. The telson is broadly lanceolate, its length twice its width and about 2/3 the length of the last urosomite.

Notes: Shoemaker (1945a) suggested that Stebbing had described some sexually immature specimens of *P. crustulum* as a new species,
375 *P. campbelli*. However, we found a male 10 mm in length and a gravid female 15 mm in length in the collections from the environs of New Zealand. These specimens completely accord with the description and drawing given by Stebbing and differ sharply from *P. crustulum* in structure of pereopods II and proportions of pereopods V and VI, the uropods, and the telson.

Distribution: Known from the Indian (eastern part) and Pacific (south of 35° N in the zone of Kuroshio, environs of New Zealand) oceans.

4. ***Parapronoe elongata*** Semenova, 1981 (Fig. 202)

Semenova, 1981: 1581.

Size of males 5.5–6.6 mm. Female not known.

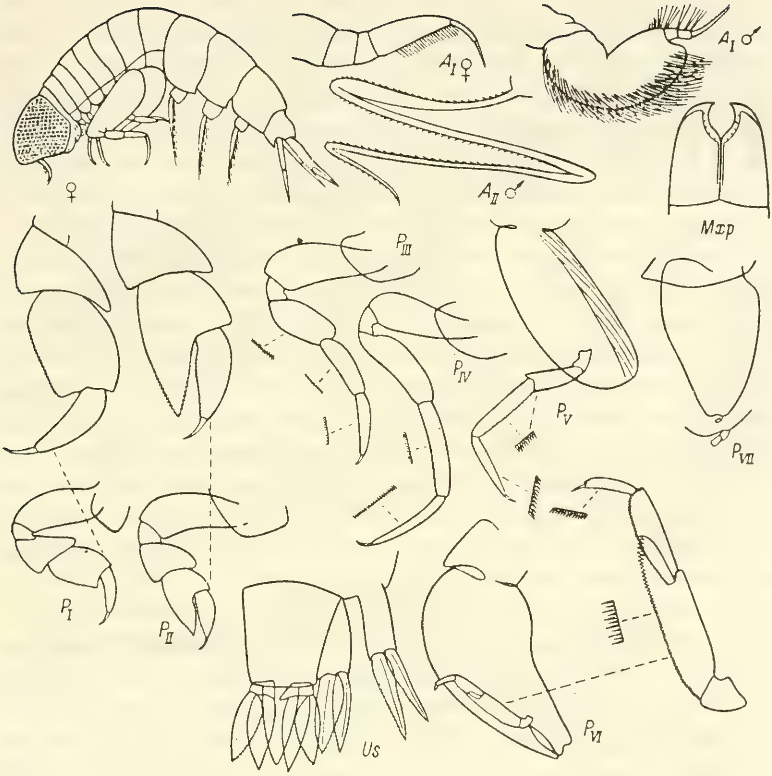
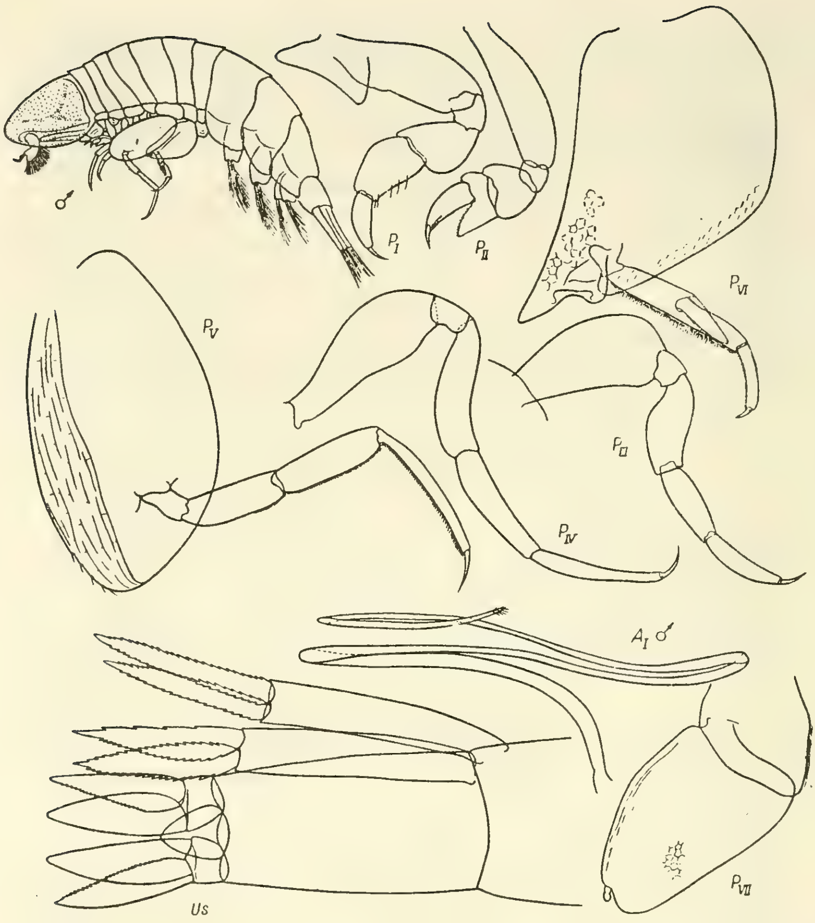


Fig. 201. *Parapronoe campbelli* Stebbing.

The body is laterally compressed. the head is longer than the first four pereon somites together, anteriorly rounded, and slightly overlaps the base of antennae I. The eyes are faintly pigmented. Antennae I have a highly bent basal segment and are densely pubescent below; three small distal segments are articulated with the basal segment subapically, of which the middle one is the longest; the terminal segment is finger-shaped and without ornamentation; the rest of the segments bear sensillae. Antennae II are relatively long: the anterior elbow reaches the base of antennae I, while the posterior reaches the base of pereopods II; the 1st segment of antennae II is bent and slightly shorter than the 2nd; the 2nd–3rd segments are long,
376 thin, slightly thickened at the ends, and faintly S-shaped; the 4th segment is slightly shorter than half the 3rd in length, distally narrows, and apically bears the rudiment of the 5th segment.

The pereon is somewhat shorter than the pleon. somite II is the shortest and somites V–VI are the largest. The 2nd segment of pereopods I has a slightly bulged posterior margin and its length is twice its width;



376 Fig. 202. *Parapronoe elongata* Semenova (after Semenova, 1981).

the 4th segment broadens distally, protrudes distally, its length approximately equal to its maximum width, the anterior margin straight, and the posterior markedly bulged; the 5th segment is slightly longer than the 4th, slightly broadens proximally, and distally narrows to half; the 6th segment is narrower and slightly shorter than the 5th and has a bulged anterior margin; the claw is slightly curved. Pereopods II are equal to pair I in length; the 2nd segment is narrow and slightly longer than the rest of the pereopods; the 4th segment is broader than long, broader than the 2nd segment, has bulged margins, and the anterior margin projects beyond the base of the short 5th segment; the process of the posterior margin of the 5th segment is longer than the basal part of the segment

377 and reaches 3/4 the length of the 6th segment, and the inner margin of the process is slightly bulged with fine denticles terminating in a rounded tip; the 6th segment is narrow, 1/3 the 5th in width, narrows distally, and is 2.5 times longer than wide; the claw is almost straight and 1/3 the length of the 6th segment. Pereopods III are longer than pereopods II by the length of the 6th segment; the 2nd segment is distally twice broader compared to the proximal part and strongly bulged posteriorly, especially distally; the 4th–6th segments are equal in length, each successive segment narrower than the preceding one; the 4th segment projects distally by its anterior margin and has a slightly S-shaped posterior margin; the claw is thin and less than half the length of the 6th segment. In pereopods IV the segments are relatively narrower and longer than in pereopods III. Pereopods V are the longest; the 2nd segment is almost perfectly oval, 1.5 times longer than its maximum width, and the anterior margin, less bulged than the posterior, bears a few denticles; the remaining segments are articulated with the 2nd segment from the ventral side, slightly short of its distal margin; the 4th–5th segments are approximately equal and 2.5–3 times longer than their maximum width; the 6th segment is 1.5 times longer than the 5th and much narrower; the anterior margin of the 5th–6th segments and the distal part of the anterior margin of the 4th segment are very finely denticulate; the claw is 1/3 the length of the 6th segment. The 2nd segment of pereopods VI markedly broadens basally, narrows distally and is 1.3 times longer than its maximum width; the anterior margin is barely concave and distally forms a triangular process with an obtuse tip; the posterior margin is markedly bulged, especially proximally, and the distal margin has a rounded lobe in the posterior part; the rest of the segments are articulated with the 2nd segment on the ventral side, slightly short of its distal margin; of these, the 4th segment is the longest and reaches 3/4 the length of the 5th segment; the 5th–6th segments are equal in length, the 6th slightly narrower; the claw is 1/4 the length of the 6th segment; the anterior margin of the 4th–6th segments bears complex denticulation (longer denticles followed by thinner and shorter ones). Pereopods VII are small, with a highly reduced distal part; the 2nd segment proximally in the posterior margin has a rounded lobe and its anterior margin bulges slightly; the rudiment of the 3rd segment is reniform with an indistinct constriction in the middle.

Epimeral plate I has an angular projection on the lower margin. The urosome is approximately equal in length to the last two pleon somites together. Urosomite I (viewed from the top) is equal in length and width; urosomite II (geminate) is almost twice longer than wide. The telson is roundish-triangular, not longer than 1/4 urosomite II in length, and its width at the base is slightly less than its length. The basipodite of uropods I–II is 3.5 times longer than wide. The exopodite of uropods I is slightly longer than the endopodite and very slightly shorter than the basipodite; both rami are narrowly lanceolate with denticulate margins. The tip of the basipodite of uropods II extends beyond the tip of the basipodite of uropods I but does not reach the tip of the last urosomite; the rami are shorter than the basipodite, equal in length, and narrowly lanceolate; the outer margin of the exopodite has sparse appressed denticles, while the other margins of the rami are denticulate as in uropods I. The basipodite of uropods III barely reaches 2/3 the length of the telson and its width is 1.5 times its length; the rami are equal in length and five times longer than the basipodite; the exopodite has a pointed tip, an almost straight outer margin, and a finely denticulate inner margin; the endopodite has a rounded tip, smooth margins, and is three times longer than wide.Uropods III are three times longer than the telson.

Distribution: Tasman Sea near Lord Howe Island.

4. Genus *Paralycaea* Claus, 1879

Claus, 1879b: 40; 1887: 63; Stebbing, 1888: 1567; Bowman and Gruner, 1973: 43.

378 Pereopods I and II are simple, the 5th segment lacking a distal process. The 2nd segment of pereopods V is broadened and much shorter than the 3rd–7th segments together; the 4th–6th segments are linear. The 2nd segment of pereopods is much longer than the distal segments together; the 4th segment has a distal process; the 4th and 5th segments have a denticulate anterior margin. The endopodite of uropods II and III is fused with the basipodite. The telson is triangular and fairly large.

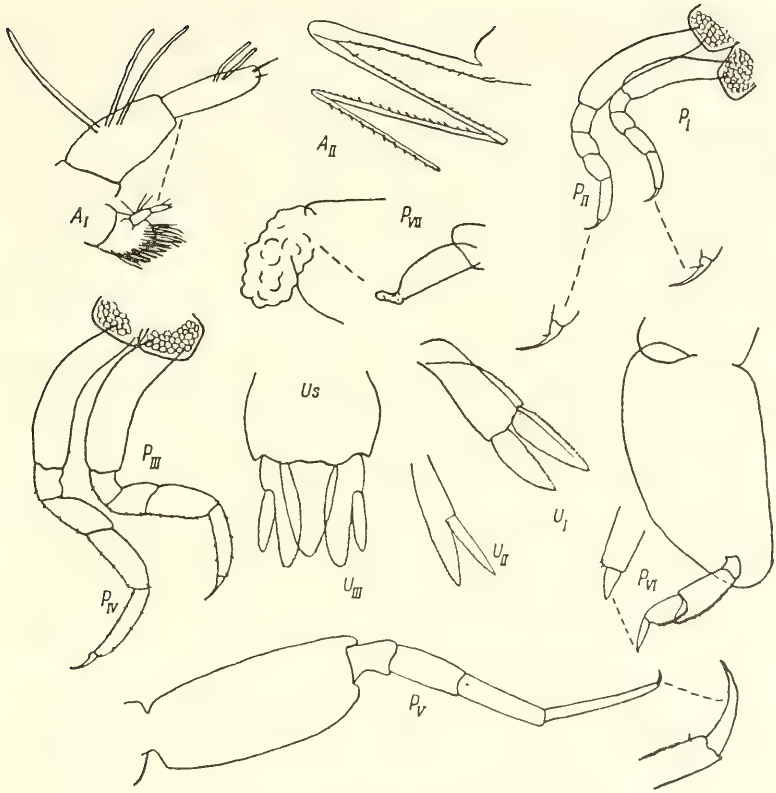
Type species: *Paralycaea gracilis* Claus, 1879.

1. ***Paralycaea gracilis*** Claus, 1879 (Fig. 203)

Claus, 1879b: 40; 1887: 63; Bovallius, 1887a: 33; Stebbing, 1888: 1568; Stephensen, 1925a: 165; Pirlot, 1930: 30 (*newtoniana* subsp.); Hurley, 1955: 175.—*newtoniana* Bovallius, 1887a: 33.—*hoylei* Stebbing, 1888: 1570.

Length of adult specimens 4–5 mm.

The head in males is slightly narrowed anteriorly while in females it is smoothly rounded, its length and width approximately equal. The body surface is reticulately sculptured. The 1st segment of the flagellum of antennae I in males is short, its length more than its width, the distal
379 part rounded and covered with fine hairs; the distal segments of the flagellum are articulated with the 1st segment subapically. Antennae II in males are long, folded zigzag four times with a short basal segment, the anterior margin of which is straight and the posterior margin bulged; are distal segment only 1/4–1/3 shorter than the preceding segment.



378 Fig. 203. *Paralycaea gracilis* Claus, male.

Pereopods I and II are identical in structure, simple, their segments not broadened and without distal processes, and the claws are long and thickened at the base. The 2nd segment of pereopods V is broad, its length 2–2.5 times its width; the 4th–6th segments are straight, the 6th the longest and thin. The 2nd segment of pereopods VI has an almost straight anterior margin, a bulged posterior margin, and a rounded distal margin; the distal segments together are less than 2/3 the length of the 2nd segment and are articulated with it subapically; the 4th segment is the longest and has a distal process reaching the middle of the 5th segment; the 4th and 5th segments have a denticulate anterior margin; the 6th segment is narrow and short; the claw is Very small. Pereopods VII have a slightly broadened 2nd segment and usually one to two rudimentary distal segments; however, specimens may be encountered with a full complement of segments.

Uropods I are the largest; the basipodite reaches the base of the telson and its anterior margin is denticulate; the rami are lanceolate; the exopodite is longer than the endopodite but shorter than the basipodite. The endopodite of uropods II is fused with the basipodite and its margins denticulate; the exopodite is slightly larger than the endopodite but much narrower than it and has a smooth anterior margin. In uropods III the basipodite is short and fused with the endopodite, which has finely denticulate margins, a rounded tip, and extends slightly beyond the tip of the telson; the exopodite is shorter and narrow. The telson is triangular, with a rounded tip, its length more than the width at the base and equal to the length of the last urosomite.

Distribution: Known from the Atlantic (south of 59° N), Indian (eastern part), and Pacific (region of Australia and New Zealand) oceans, and the Mediterranean Sea.

XVII. Family ANAPRONOIDAE Bowman and Gruner, 1973

The body is slightly thickened and not compressed laterally. The head is roundish and the large eyes occupy almost all of its surface. Antennae I and II are weakly developed in both sexes, their flagellum short and few-segmented. The mandibles in both sexes lack a palp. Maxillae I and II are relatively well developed.

The coxal plates are free. The 2nd segment of pereopods I and II is strongly broadened. Pereopods I have a subchela while pereopods II have a chela. Pereopods V are longer than pereopods VI. The 2nd segment of pereopods V and VI is broadened but not operculiform. Pereopods VII have a full complement of segments. The endopodites of uropods II and III are not fused with the basipodites nor the telson with the last urosomite.

The genus *Anapronoe* has been included by all authors in the family Pronoidae. However, Bowman and Gruner (1973) noted differences from the other genera of this family, the most significant being the absence of a mandibular palp in both sexes and a full complement of segments in pereopods VII. On this basis they included the genus Anapronoe under a separate family.

1. Genus *Anapronoe* Stephensen, 1925

Stephensen, 1925a: 163; Spandl, 1927: 217; Bowman and Gruner, 1973: 45.

The 2nd segment of pereopods I and II is broad, distally broadened, and not longer than the rest of the segments together. Pereopods V are the longest, the 3rd segment articulated apically with the distal margin
380 of the 2nd, and the width of the 4th and 5th segments more than their
length. The distal segments of pereopods VI are articulated with the

2nd segment subapically but are not directed upward as in the family Pronoidae, but downward as in the family Lycaeidae. The rami of the uropods are lanceolate.

Type species: *Anapronoe reinhardti* Stephensen, 1925.

1. ***Anapronoe reinhardti*** Stephensen, 1925 (Fig. 204)

Stephensen, 1925a: 163; Spandl, 1927: 217.

Length of sexually mature specimens 5-6 mm.

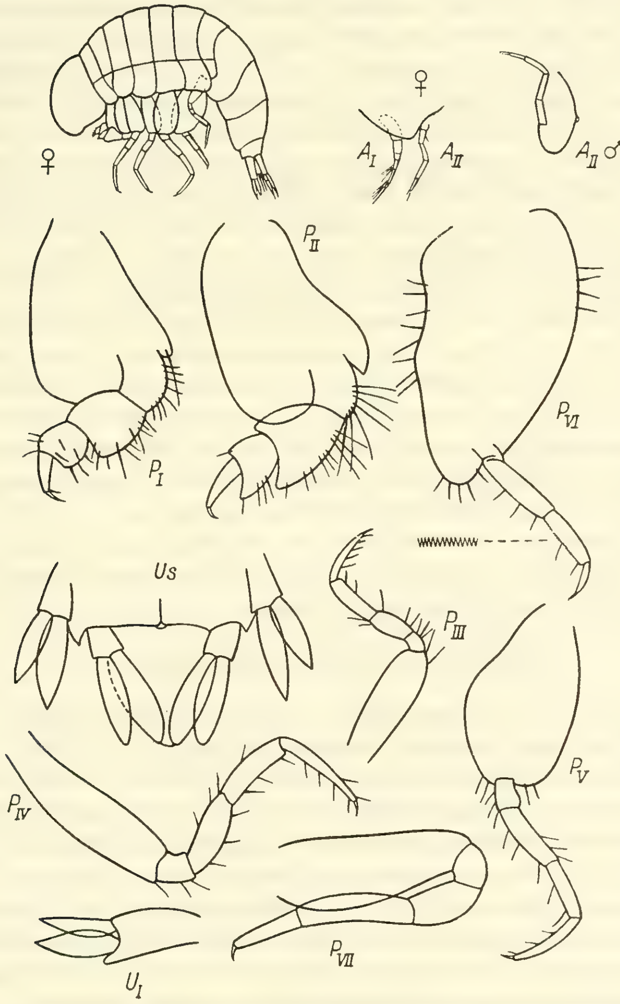


Fig. 204. *Anapronoe reinhardti* Stephensen (♀, A_{I-II} of ♀, A_{II} of ♂—after Bowman and Gruner, 1973; rest—after Spandl, 1927).

The width of the head is twice its length. The body integument has reticulate sculpture with hexagonal cells. Antennae I in females consist of a three-segmented peduncle and three-segmented flagellum; antennae II are shorter and five-segmented. Antennae II in males are also five-segmented.

The 2nd segment of pereopods I and II is markedly broadened distally and has slightly bulged margins; the 4th segment is short and somewhat broader than the 3rd; the posterior distal angle of the 5th segment is in the form of a roundish lobe in pereopods I and a pointed projection in pereopods II; the inner margin of the chela and subchela is finely denticulate; all the segments are rather densely pubescent, with fine setae.
381 The 2nd segment of pereopods V and VI has a distally bulged anterior margin and is slightly concave proximally. The 3rd–7th segments of pereopods V are much longer than the 2nd segment. The 4th segment of pereopods VI is linear and somewhat longer than the 5th; the 6th segment is barely less than half the 5th in length and thin; the 5th segment has a finely denticulate anterior margin; the 3rd–7th segments together are always shorter than the 2nd. Pereopods VII have a rather narrow 2nd segment which is 2/3 the length of the distal segments.

The mutually fused urosomites II and III are twice wider than their length. The endopodites of the uropods are somewhat longer than the exopodites. The basipodite of uropods I is denticulate in the distal part of its anterior margin; the endopodite is equal in length to the basipodite. The basipodite of uropods II and III is half as long as the endopodite; the rami of uropods III reach the tip of the telson. The telson is equal in length to its width at the base and its tip rounded.

Distribution: The species is known from the Atlantic Ocean (5° N, 23° W and 36° S, 8° E), the Mediterranean Sea, and the Pacific Ocean (40° S, 163° E and region of California).

XVIII. Family LYCAEIDAE Claus, 1879

Crustaceans 5–10 mm long, with a thick and smooth integument. The body is compact. The pereon is more or less bulged. The eyes are large and occupy almost the entire surface of the large head, which is higher than the pereon; the head is equal in length to the first three–five somites of the pereon. Antennae I have a three-segmented flagellum; the basal segment of the flagellum is straight in females and armed with a few apical setae; in males it is larger, strongly bent forward, and its posterior surface is densely pubescent, with hairs. Antennae II are generally absent or rudimentary in females; in males they are long, with a short peduncle, and a flagellum that is folded three times in a zigzag manner.

The mandibles have a palp in males but not in females. Maxillae I and II are present but rudimentary.

The coxal plates are not fused with the somites of the pereon. Pereopods I are simple or have a subchela. Pereopods II have a subchela with finely denticulate or smooth margins. The 2nd segment of pereopods V–VII is broadened but not operculiform and the distal segments are articulated with it apically. The 2nd segment of pereopods V and VI is much shorter than the distal segments. Pereopods VII have four–five rudimentary distal segments.

The telson is fused with the last urosomite. The endopodite of uropods III is fused with the basipodite; such a fusion is sometimes seen in uropods II also.

The family includes two genera.

KEY TO GENERA OF FAMILY LYCAEIDAE

1. Pereopods I simple. Distal margin of 5th segment of pereopods II approximately half length of the segment .... 2. ***Simorhynchotus*** Stebb.
2. Pereopods I with subchela. Distal margin of 5th segment of pereopods II not shorter than segment .... 1. ***Lycaea*** Dana.

1. Genus *Lycaea* Dana, 1852

Dana, 1852: 1017; Claus, 1879b: 37; 1887: 61; Stebbing, 1888: 1563; Spandl, 1924: 30; Chevreux and Fage, 1925: 429; Stephensen, 1925a: 167; Bowman and Gruner, 1973: 46.—*Metalycaea* Stephensen, 1925a: 183.

The head is large and higher in females than in males. The pereon is longer than the pleon. Somites I and II of the pereon are narrower than the next ones. The posterior distal projection of the 5th segment of pereopods I is more or less developed. The 5th and 6th segments
382 of pereopods VI have a denticulate anterior margin. The 2nd segment of pereopods VII is strongly broadened and relatively somewhat shorter than in pereopods VI; the distal segments are rudimentary and together are always much shorter than the 2nd segment.

The basipodite of uropods I is straight, almost linear, not less than twice the length of the rami, and its anterior margin is finely denticulate throughout most of its length; the rami are equal in length. The endopodite of uropods II is longer than the exopodite; in L. nasuta it is fused with the basipodite. The endopodite of uropods III is always fused with the basipodite, its tip reaching the tip of the telson or slightly beyond it. The telson has a rounded tip.

Type species: *Lycaea ochracea* Dana, 1853.

KEY TO SPECIES OF GENUS LYCAEA

1. In males head with rounded bump anteriorly. Endopodite of uropods II fused with basipodite .... 3. ***L. nasuta*** Claus.
— In males head gently rounded anteriorly, bumplike prominence absent. Endopodite of uropods II not fused with basipodite ...... 2.
2. Tip of posterior distal angle of 5th segment of pereopods I and II not extended into cusp .... 3.
— Tip of posterior distal angle of 5th segment of pereopods I and II extended into cusp .... 4.
3. Posterior distal angle of 5th segment of pereopods I reaching base of claw with closed subchela, in pereopods II reaching beyond middle of 6th segment. Second segment of pereopods V more than twice longer than wide. Second segment of pereopods VI and VII oval, with uniformly bulging margins ....6. ***L. lilia*** Volkov, sp. n.
— Posterior distal angle of 5th segment of pereopods I and II slightly falling short of middle of 6th segment. Second segment of pereopods V, 1.5 times longer than wide. Anterior margin of 2nd segment of pereopods VI and VII barely bulged or straight, posterior margin highly bulged, particularly in proximal half ....5. ***L. pachypoda*** (Claus).
4. Posterior and distal margins of 5th segment of pereopods I and II form an angle of 120°. Claw equal to or longer than half length of 6th segment .... 4. ***L. serrata*** Claus.
— Posterior and distal margins of 5th segment of pereopods I and II almost form a right angle. Claw not longer than half length of 6th segment .... 5.
5. Posterior margin of 5th segment of pereopods I denticulate. Claws of pereopods III and IV long. Distal segments of pereopods VII together approximately 1/3 length of 2nd segment. Basipodite of uropods I 3.5 to 4 times as long as rami .... 1. ***L. pulex*** Marion.
— Posterior margin of 5th segment of pereopods I smooth. Claws of pereopods III and IV short. Distal segments of pereopods VII together almost 2/3 length of 2nd segment. Basipodite of uropods I only twice as long as rami .... 2. ***L. pauli*** Stebb.

1. ***Lycaea pulex*** Marion, 1874 (Fig. 205)

Marion, 1874: 13; Stebbing, 1888: 1567; Chevreux, 1900: 156; Spandl, 1924: 31; Chevreux and Fage, 1925: 429; Stephensen, 1925a: 167.—*robusta* Claus, 1879b: 40; 1887: 63.—*similis* Claus, 1879b: 39; 1887: 63. —*longicornuta* Giles, 1887: 220 (*Amphypronoe*).—*vincentii* Stebbing, 1888: 1563.—*bovallii* Chevreux, 1900: 157.—*gracilis* Spandl, 1924: 30. —*bajensis* Shoemaker, 1925: 46.—*bovallioides* Stephensen, 1925a: 169.

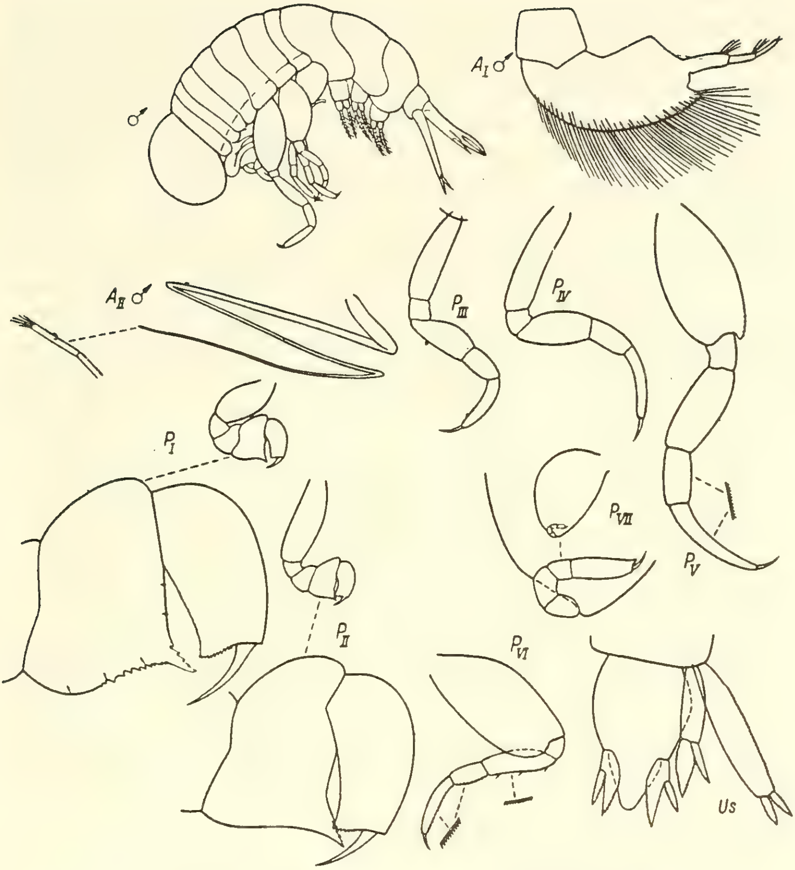


Fig. 205. *Lycaea pulex* Marion (♂—after Stebbing, 1888).

383 Length of sexually mature crustaceans up to 7 mm.

The head is higher than the pereon and anteriorly smoothly rounded; its length is less than its height.

The 2nd segment of pereopods I is 1.5–2 times longer than wide and has bulged anterior and posterior margins; the 4th segment is markedly broadened distally; the subchela is well developed; the projecting apex of the posterior distal angle of the 5th segment extends beyond the base of the claw, the angle per se (without its projecting apex) is equal to or somewhat longer than the straight posterior margin, the distal part of the anterior margin is denticulate; the 6th segment likewise has a well-developed posterior distal angle in which the margins are denticulate, and the posterior margin of the segment finely denticulate; the claw is

long and may be up to half the length of the 6th segment along its anterior margin. Pereopods II differ from pereopods I in a longer 2nd segment and the absence of denticles on the posterior margin of the 5th segment. Pereopods III and IV have long claws. The 2nd segment of pereopods V is oval, its length almost twice its width; the 4th segment is large and has bulged margins; the 5th segment is narrower than the 4th and about half its length; the 6th segment is somewhat longer than the 4th; the 5th and 6th segments have a finely denticulate anterior margin; the claw is long and thin. The 2nd segment of pereopods VI is oval and
384 has a more bulged posterior margin; the 3rd–7th segments are the same as in pereopods V but smaller; the 4th–6th segments have a denticulate anterior margin. The 2nd segment of pereopods VII bulges more at the posterior margin than the anterior and is 1.3–1.5 times longer than wide; the distal segments together are shorter than half the length of the 2nd segment.

The basipodite of uropods I is long and straight and has slightly bulged margins; the rami are 1/5–2/7 the length of the basipodite. The basipodite of uropods II is half the length of that in uropods I and may be denticulate in the distal part of the posterior margin; the endopodite is only slightly shorter than the basipodite. The endopodite of uropods III has a straight or bulged anterior margin and a bulged posterior margin.

The last urosomite is somewhat wider than long. The triangular telson is about equal in length to its width at the base and 2/3 the length of the last urosomite.

Distribution: A circumtropical species, it enters the Mediterranean Sea; lives in the 0–500 m layer.

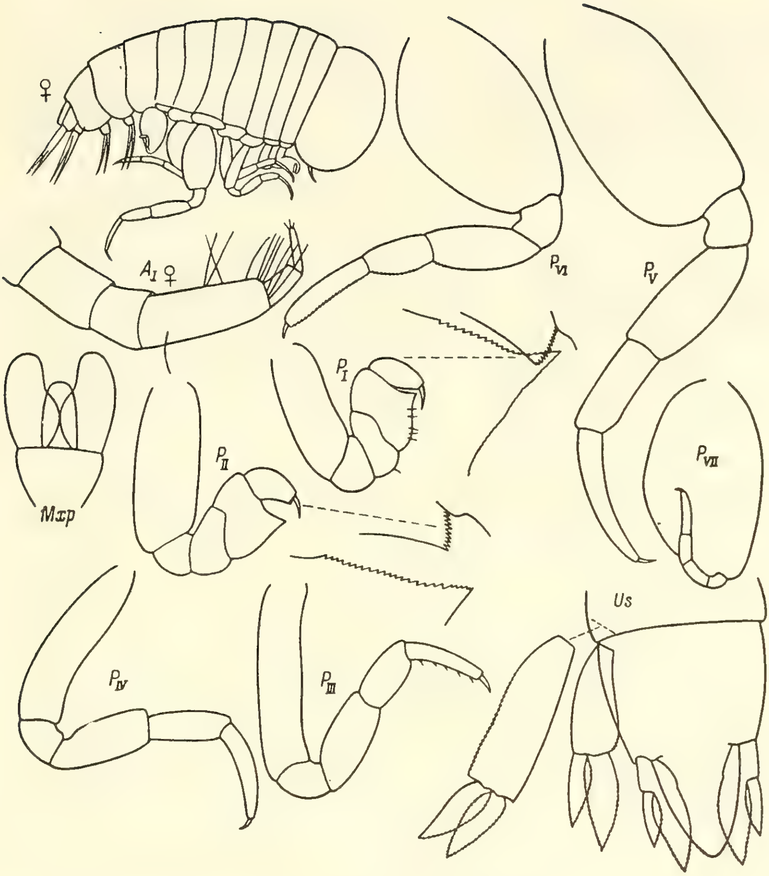
385 2. ***Lycaea pauli*** Stebbing, 1888 (Fig. 206)

Stebbing, 1888: 1566.

Length of sexually mature crustaceans up to 7.5 mm.

In antennae I of males the 1st segment has no posterior distal projection. Pereopods I and II differ from the same in *L. pulex* in that the posterior margin of the 5th segment of pereopods I is smooth, and the distal process of the anterior margin of the 5th segment of both pereopods I and II is uniformly denticulate and over a greater distance; the posterior margin of the 6th segment is smooth. The claws of pereopods III and IV are short. Pereopods V and VI are the same as in *L. pulex* but the claws are shorter and in pereopods V the 5th and 6th segments have smooth margins. In pereopods VII the distal segments together are longer than half the 2nd segment.

The last urosomite is much wider than long. The basipodite of uropods I is twice as long as the rami. The basipodite of uropods II is 2/3 the length of that in uropods I; the endopodite is somewhat shorter than the basipodite. The endopodite of uropods III has bulged margins



384 Fig. 206. *Lycaea pauli* Stebbing.

and a shallow notch occurs at the place of fusion of the basipodite with the endopodite. The triangular telson is longer than its width at the base but somewhat shorter than the last urosomite.

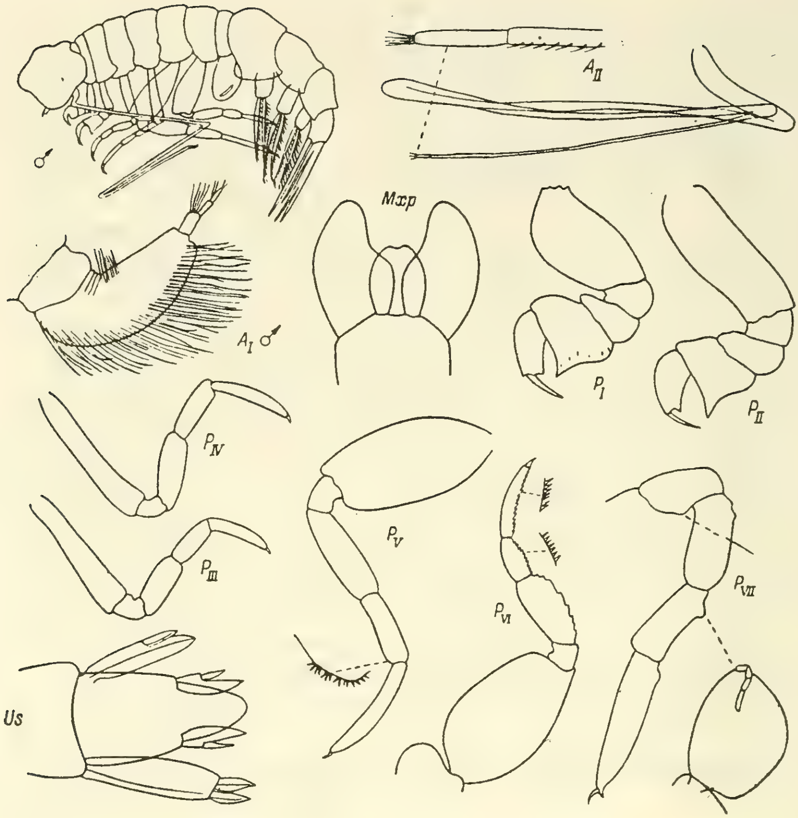
Distribution: Found in the Atlantic (1° N, 23° W) and the Pacific (north of New Zealand) oceans.

3. ***Lycaea nasuta*** Claus, 1879 (Fig. 207)

Claus, 1879b: 39; 1887: 62.

Length of sexually mature males and females up to 7.5 mm.

The body is more elongated than in the preceding species; the pereon is lower than the pleon. The head is approximately equal in length and height, anteriorly bears a rounded spiniform process, and is dorsally



386 Fig. 207. *Lycaea nasuta* Claus (♂, Us—after Claus, 1887).

galeiform. In antennae I the 1st segment of the flagellum does not have a projecting distal angle.

Pereopods I and II are the same as in *L. pulex* but the margins of the 5th and 6th segments are smooth and the claws are somewhat longer. Pereopods III– VI have very short claws. Pereopods V have an oval 2nd segment that is longer than wide; of the distal segments the 4th is the broadest and the 6th the longest; the margins of the distal segments are smooth but the distal part of the anterior margin in the 5th segment is armed with small spines. In pereopods VI the 4th segment is broad and its anterior margin armed with sparse smoothened denticles; the 5th and 6th segments are armed along the anterior margin with rather dense pointed denticles. Pereopods VII have a very strongly broadened 2nd segment; the distal segments together are half the length of the 2nd segment.

The last urosomite is equal in length and width. The basipodite of uropods I is 3.5 times longer than the rami. The endopodite of uropods II is fused with the basipodite and 2/3 its length. The margins of the basipodite of uropods I and II are not denticulate. The endopodite of uropods III has a straight anterior margin and a bulged posterior one. The telson is less than 2/3 the length of the last urosomite.

Distribution: Known from the Indian (region of Zanzibar) and Pacific (region of New Zealand) oceans.

4. ***Lycaea serrata*** Claus, 1879 (Fig. 208)

Claus, 1879b: 39; 1887: 63; Stephensen, 1925a: 168; Shoemaker, 1945a: 243.—*stebbingi* Bovallius, 1887a: 33.—*globosa* Stephensen, 1925a: 183 (*Metalycaea*).—sp. Spandl, 1927: 212.

Length of sexually mature females up to 10.5 mm, of males up to 8 mm.

The head is anteriorly smoothly rounded and its height more than its length; in females its length is equal to the first five somites of the pereon,
386 in males somewhat shorter. The pereon in females is high and dorsally dolioform, in males still narrower. The last somites of the pereon and one or two somites of the pleon may have an upcurved posterior margin. In antennae I the 1st segment of the flagellum in males has a posterior distal projection, almost equal in length to the 2nd segment.

In coxal plates III–V the anterior distal angles project forward and form processes with a rounded tip. Pereopods I and II are identical in structure and have a subchela; the length of the 5th segment along the anterior margin exceeds its width and is equal to the distal margin; the posterior distal angle of the 5th segment (without extended tip) is more than 120° and the tip stretched and pointed; the 4th and 5th segments are armed along the posterior margin with numerous very small marginal and submarginal spines; the margins of the subchela are not denticulate; the claw is generally longer than 2/3 the length of the 6th segment. The 2nd segment of pereopods V has barely bulged margins and is twice longer than wide; on the 4th segment the denticles are smoothened and sparse, on the 5th and 6th segments somewhat dense and pointed. The 2nd segment of pereopods VI is shorter and broader than in pereopods V. The 2nd segment of pereopods VII is large and strongly broadened; the distal segments together are 1/4 the length of the 2nd segment; the claw is often absent.

387 The basipodite of uropods I is 2–2.5 times longer than the rami, its anterior margin denticulate throughout its length, and the posterior margin either smooth or with denticles in the distal part. The basipodite of uropods II may have denticles in the distal part of the posterior margin; the endopodite is not shorter than the basipodite. The endopodite of uropods III is usually fused with the basipodite. The last urosomite is

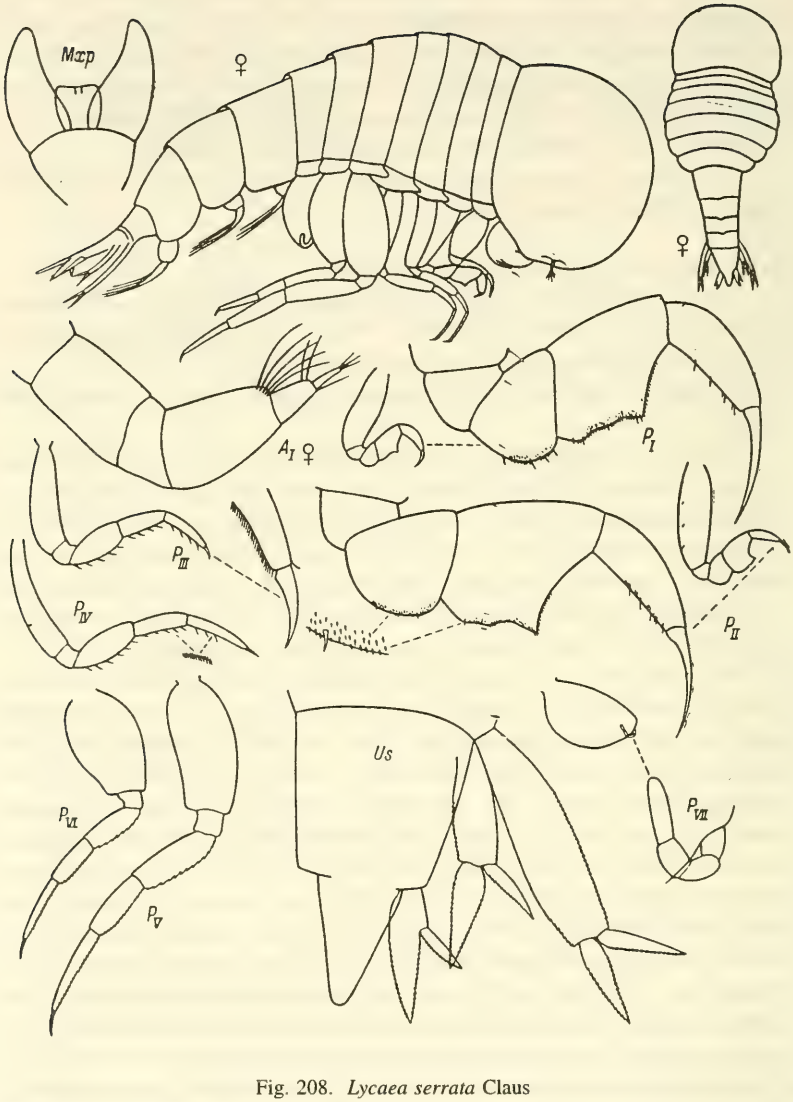


Fig. 208. *Lycaea serrata* Claus

equal in length or slightly shorter than its maximum width. The telson is thin, 1.5 times longer than its width at the base, and 2/3 the length of the last urosomite.

388 *Distribution*: A circumtropical species, known from the Atlantic (tropical zone, region of Bermuda, near the equator), Indian (eastern part), and Pacific (equatorial zone) oceans, and the Mediterranean Sea.

5. ***Lycaea pachypoda*** (Claus, 1879) (Fig. 209)

Claus, 1879b: 41 (*Pseudolycaea*); 1887: 64 (*Pseudolycaea*); Stephensen, 1925a: 169 (*Pseudolycaea*); Chevreux and Fage, 1925: 430 (*Pseudolycaea*); Spandl, 1927: 215 (*Pseudolycaea*).

Length of sexually mature specimens 7 mm.

The head is anteriorly rounded, its height more than its length by 1.3 times in males and 1.5–1.7 times in females.

The subchelae of pereopods I and II are not well developed. The 2nd segment of pereopods II is longer; the distal segments are identical in structure; the 4th segment is twice broader than long; the 5th segment is somewhat narrower than the 4th, its width more than the length of its anterior margin, its posterior distal angle has a blunt tip that does not reach 1/3 the length of the 6th segment, and the posterior margin is

Fig. 209. *Lycaea pachypoda* (Claus).

denticulate in the distal part but armed throughout its length with sparse
389 marginal and submarginal spines; the margins of the subchela are smooth; the claw is short. The 2nd segment of pereopods V is broad but not oval and its margins slightly bulged; the 4th segment is the broadest of the distal segments, the 5th shorter, and the 6th equal in length to the 4th; the 5th and 6th segments have a smooth anterior margin. The 2nd segment of pereopods VI is not longer than in pereopods V but slightly broader in the proximal part; the 4th segment is broad, especially in the distal part; the 5th and 6th segments are denticulate all along the anterior margin, the 4th only in the distal part; the claw is very small. The 2nd segment of pereopods VII is distally narrowed, its anterior margin straight, and the posterior margin bulged; the distal segments together are half the length of the 2nd segment.

The last urosomite is much wider than long. Urosomites II and III are fused and lateral furrows occur at the place of fusion. In urosomite III the lateral margins are bulged. The basipodite of uropods I is straight and twice as long as the rami. The basipodite of uropods II is denticulate in the distal part of the posterior margin; the endopodite is longer than the exopodite but slightly shorter than the basipodite. The endopodite of uropods III is twice as long as the exopodite. The telson is approximately 2/3 the length of the last urosomite, triangular, with a rounded tip, and slightly longer than its width at the base.

Distribution: Known from the Atlantic (tropical zone), Indian (region of Zanzibar), and Pacific (eastern part north of 20° S, north of New Zealand) oceans, and the Mediterranean Sea. It inhabits the upper warmed water layers.

6. ***Lycaea lilia*** Volkov, sp. n. (Fig. 210)

The type specimen is preserved in the Pacific Ocean Scientific Research Institute of Fisheries and Oceanography (TINRO).

Length of sexually mature specimens up to 9 mm.

The head is large and anteriorly rounded; in females its length is equal to the length of the first four pereon somites, in males somewhat shorter; the height is 1.5 times the length.

The pereon is almost 1.5 times longer than the pleon.

The 2nd segment of pereopods I is very short, broadened, its width 2/3 its length; the 4th segment is twice wider than long; the 5th segment is broader than the 4th and the subchela well developed; the posterior distal angle of the 5th segment is straight, without an extended tip, and the margins are not denticulate; the 6th segment has a smooth posterior margin but in the distal part is armed with very fine submarginal setae; the claw is very short. The 2nd segment of pereopods II is 1.5 times longer than in pereopods I; the 4th segment is equal in maximum width to that of the 5th; the 5th segment is narrower than in pereopods I and

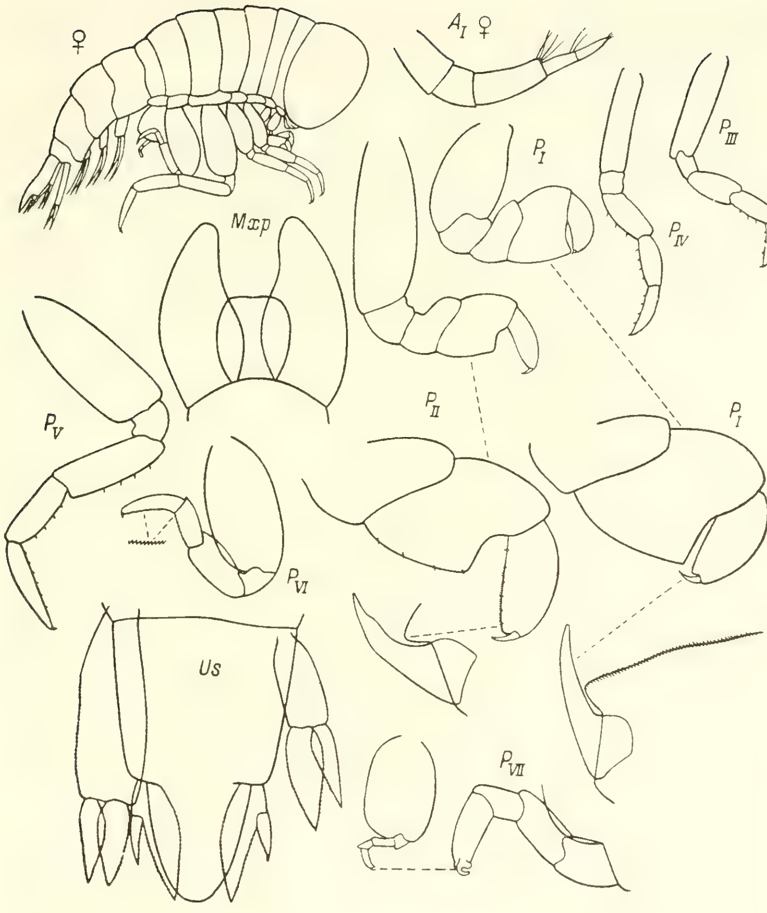


Fig. 210. *Lycaea lilia* Volkov, sp.n.

its posterior distal angle is rounded and only slightly extends beyond the middle of the 6th segment; the subchela is not denticulate but the posterior margin of the 6th segment bears small frequent marginal and larger sparser submarginal spines. The 6th segment of pereopods I and II has a small posterior distal process, reaching 1/3 the length of the claw. The claws of pereopods III and IV are short.

The width of the 2nd segment of pereopods V is 2/5 its length; the 4th segment is broad and longer than the 5th; the 6th segment is equal to the 4th in length; the 4th–6th segments have a smooth anterior margin armed with sparse short marginal spines. The 2nd segment of pereopods VI is oval; the 4th segment is broad with bulged margins; the

5th and 6th segments are finely denticulate along the anterior margin. The 2nd segment of pereopods VII is oval; the distal segments together are equal to 2/3 the length of the 2nd segment.

The basipodite of uropods I is almost linear and has a denticulate anterior margin; the rami are equal in length and half the length of
390 the basipodite. The exopodite of uropods II is equal to the basipodite in length but shorter than the endopodite. The endopodite of uropods III has a bulged anterior margin and a straight posterior one. The last urosomite is less in length than its maximum width. The telson is shorter than the last urosomite and its length more than its width at the base.

Distribution: Found in the eastern part of the Pacific Ocean (8° S, 90° W; 13° S, 86° W) in the 0–100 m layer of water.

2. Genus *Simorhynchotus* Stebbing, 1888

Stebbing, 1888: 1572; Spandl, 1927: 211; Bowman and Gruner, 1973: 53.—*Simorhynchus* Claus, 1879b: 42; 1887: 65; Bovallius 1887a: 34.

The body is slightly compressed laterally. The head is shorter and higher than the pereon, rounded, without narrowing in the distal part in females, in males narrowed anteriorly. The coxal plates are free. Pereopods I and II have a poorly developed subchela; their linear 2nd segment is much longer than the rest of the segments together; the length of the 5th segment is much more than its width. Pereopods VII have a full complement of segments. urosomites I and II are fused, their width more than their length. The telson is broad, triangular. The uropods are as in *Lycaea*.

Type species: *Simorhynchus antennarius* Claus, 1871.

391 Earlier, most authors included the genus *Simorhynchotus* in the family oxycephalidae. However, it would be logical to consider it, as proposed by Spandl (1927), under the family Lycaeidae to which it is closer than to Oxycephalidae in external appearance (compact body, head almost without rostrum), small size of representatives, structure of the legs (simple pereopods I and poorly developed subchela of pereopods II), as well as in morphological type of gills and oostegites. The only important character bringing *Simorhynchotus* close to Oxycephalidae is the complete reduction of the maxillary apparatus (Barnard, 1930; Fage, 1960; Bowman, 1973). As is known, however, the genus *Metalycaea* Stephensen, initially included in the family Oxycephalidae because of the highly reduced maxillae, was later combined with the genus *Lycaea* and accordingly transferred to the family Lycaeidae (Bowman, 1973). Thus *Simorhynchotus* would not be the only genus with reduced maxillae in the family Lycaeidae. In this regard Barnard's remark (1930) is interesting: in all the specimens of *Simorhynchotus* examined by him from the

collection of the "Terra Nova" expedition, the maxillae were totally rudimentary or absent. Thus one cannot rule out the retention, in some cases, of a rudimentary maxillary apparatus; consequently this character, with precedence from *Metalycaea globosa*, does not preclude the inclusion of *Simorhynchotus* in the family Lycaeidae. The artificiality of inclusion of *Simorhynchotus* in Oxycephalidae was noted by other authors as well. In particular, Pillai (1960) wrote that only lack of unanimity of opinion among leading specialists on Hyperiidea cautioned him against transference of this genus to the family Lycaeidae. Undoubtedly, however, the families Lycaeidae and Oxycephalidae are phyletically linked and the genus *Simorhynchotus* might well be the link between them.

1. ***Simorhynchotus antennarius*** (Claus, 1871) (Fig. 211)

Claus, 1871: 156 (*Simorhynchus*); 1879b: 43 (*Simorhynchus*); 1887: 65 (*Simorhynchus*). —Stebbing, 1888: 1572; Stephensen, 1925a: 185; Spandl, 1972: 211.—*lilljeborgii* Bovallius, 1887a: 34.—*stebbingi* Bovallius, 1890: 48.

Length of sexually mature specimens 5–7 mm.

The head does not form a rostrum. The 1st segment of the flagellum of antennae I in males has a characteristic projection in the distal part of the anterior margin, while the posterior distal process reaches the end of the 2nd segment. Antennae II in males are the same as in Lycaea. The 2nd segment of pereopods I has a bulged anterior margin and a straight posterior one; the 4th segment is barely broadened distally; the 5th segment is somewhat broader than the 4th, has bulged margins, and is twice as long as wide; the 5th and 6th segments have smooth margins; the claw is very short. The 2nd segment of pereopods II is longer than the distal segments together by almost 1.5 times; the 5th segment is distally broadened and its posterior distal angle straight, the apex with closed subchela reaching the middle of the 6th segment; the subchela has smooth margins armed with sparse setae. Pereopods V are the longest; the 2nd segment is oval, twice longer than wide, and the anterior margin bears sparse marginal setae; the 6th segment is longer than the 5th, narrow, and slightly curved; the margins of the segments are not denticulate. The 2nd segment of pereopods VI is strongly broadened in the proximal part, the anterior margin almost almost straight, and the posterior margin bulged; the 4th segment is twice as long as the 5th and equal to the 6th; the 6th segment bears sparse fine denticles along its anterior margin. The 2nd segment of pereopods VII is broadened, the anterior margin straight or barely curved, and the posterior margin markedly bulged; the distal segments together are slightly longer than half the length of the 2nd segment.

The basipodite of uropods I is generally shorter than the endopodite and has smooth margins. The basipodite of uropods II and III is fused
392 with the endopodite. The rami of all the uropods have pointed tips;

Fig. 211. *Simorhynchotus antennarius* (Claus).

the exopodites are shorter than the endopodites. The endopodite of uropods III has a concave anterior margin and a bulged posterior margin. The last geminate urosomite is almost 1.5 times broader than long. The telson has a pointed or blunt tip, is longer than the last urosomite, and fused with it.

Distribution: Circumtropical and enters the Mediterranean Sea. Found in the 0-500 m layer.

XIX. Family TRYPHANIDAE Bovallius, 1887

Small (up to 6 mm) animals. The body is compact, highly curved ventrally, and better proportioned in males. The head is anteriorly rounded,

large, and its entire surface occupied by the eyes. In antennae I the basal segment is broad and bulging in males but narrow and linear in females. Antennae II in males are well developed, long and thin and folded zigzag four times. The mandibles in females have a two-, in males a three-segmented palp. The maxillae are relatively poorly developed. Pereopods I and II are simple with notably broadened basal segments. The 2nd segment of pereopods V and VI is broadened but not operculiform, shorter than the distal segments and articulated terminally. Pereopods VII have a broadened 2nd segment and five distal segments.
393 The endopodites of the uropods are not fused with the basipodites nor the telson with the last urosomite.

Bovallius (1887a) included the genera *Tryphana, Brachyscelus (Thamyris), Euthamneus (Thamneus), Lycaea, Paralycaea, Pseudolycaea, and Simorhynchotus (Simorhynchus)* in the family Tryphanidae. Later, the genera *Lycaea* and *Pseudolycaea* were placed by him in the family Lycaeidae, *Euthemneus* and *Brachyscelus* in the family Euthamneidae, *Paralycaea* transferred to the family Pronoidae, *Simorhynchotus* to the family Oxycephalidae, and *Tryphana* and *Lycaeopsis (Phorcorrhaphis)* to the family Lycaeopsidae. Chevreux and Fage (1925), Stephensen (1925a), and Hurley (1955) included the genus *Tryphana* in the family Lycaeidae together with genera *Lycaea* and *Pseudolycaea*. Bowman and Gruner (1973) also included the genus *Tryphana* in the family Lycaeidae.

Inclusion of the genus *Tryphana* in these different families is artificial to a considerable extent since its only representative, *T. malmi*, on the one hand has certain features of similarity with representatives of each family, and on the other differs substantially from them in several structural features of the extremities and other body parts. For example, pereopods I, the uropods, and the telson are almost identical in structure to *Pronoe*, pereopods V and VI to *Lycaea*, and the flagellum of antennae II of males to *Brachyscelus*. At the same time, in structure of antennae I and the peduncle of antennae II in males, and structure of the distal segments of pereopods II, *Tryphana* differs from the related families and cannot be included with adequate reliability in any of them. Hence we consider it expedient to separate an independent family, Tryphanidae, to include the lone genus *Tryphana*.

1. Genus *Tryphana* Boeck, 1870

Boeck, 1870: 9; Stebbing, 1888: 1538; Stephensen, 1923: 36; Bowman and Gruner, 1973: 48.

The head is higher than the pereon. The flagellum of antennae I in females is two-segmented, in males three-segmented. Antennae II are folded five times; the distal segment longer. Pereopods I and II are simple, with a short and strongly broadened 2nd segment. The claws are large, especially of pereopods II, and almost equal in length to the 6th segment. The 2nd segment of pereopods V and VI is broadened but not operculiform. Pereopods VII have a full complement of segments and well-developed claws. The margins of the basipodites of the uropods are not denticulate; the endopodites of uropods II and III are not fused with the basipodites. The telson is small, with an acute tip.

Type species: *Tryphana malmi* Boeck, 1870.

1. ***Tryphana malmi*** Boeck, 1870 (Fig. 212)

Boeck, 1870: 9; Stephensen, 1923: 36; Schellenberg, 1927: 654. —*nordenskioldi* Bovallius, 1887a: 30. —*boecki* Stebbing, 1888: 1539.

Length of sexually mature females up to 6 mm, of males up to 5 mm.

The head in males is 1.5 times, in females 1.2 times as high as the pereon; in males the head is slightly but noticeably narrowed anteriorly. Antennae I in females have a two-segmented flagellum, the 1st segment of which is armed with a few long apical spines; the 2nd segment is slightly shorter than the 1st, narrow, and armed with two apical setae. Antennae I in males have a three-segmented flagellum in which the length of the basal segment does not exceed its width, and the posterior surface is highly bulged and densely covered with fine long hairs; the 2nd segment is straight and narrow, with a long and pointed posterior distal process; the 3rd segment is very thin and bears three long setae at the base, which reach the tip of the distal process. The basal segment of antennae II in males has bulged margins and the distal segment is 1/3 the length of the preceding one.

394 The 2nd segment of pereopods I has an almost straight posterior margin and a greatly bulged anterior margin so that the length and width of the segment are almost equal; the 3rd and 4th segments are short; the 5th segment is broadened and has a bulged anterior margin; the 6th segment narrows distally, its margins are armed with spines and setae, and the posterior distal angle forms a denticulate process; the claw is denticulate and pubescent and half the length of the 6th segment. The 2nd and 5th segments of pereopods II are narrower than in pereopods I; the claw is strong and long, equal to the 6th segment in length, and densely covered with small spines. The 2nd segment of pereopods V is 1.5 times longer than wide and both its margins bulged, more so in the distal part; the 4th and 5th segments are broad; the 5th and 6th segments have a denticulate anterior margin; the claw is generally not less than half the length of the 6th segment. Pereopods VI are identical to pair V in structure but the 2nd segment is oval and the distal segments are smaller. Pereopods VII consist of an oval 2nd segment and well-developed distal

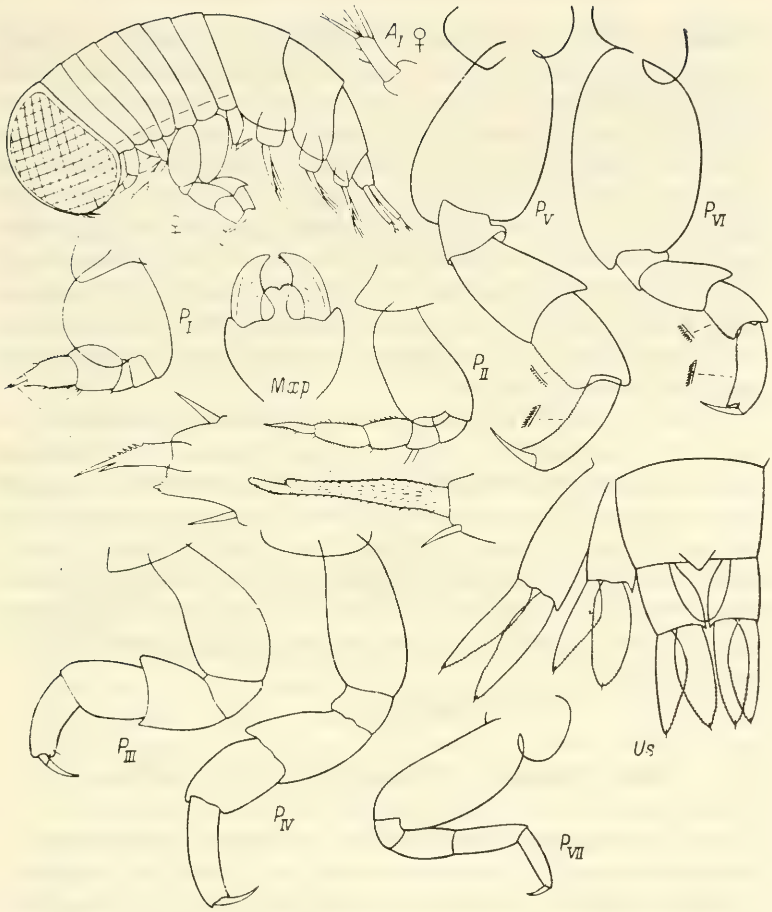


Fig. 212. *Tryphana malmi* Boeck.

segments, whose total length is generally not less than that of the 2nd segment.

The rami of uropods I and II are equal to the basipodite in length but in uropods III longer. The length of the last urosomite is 2/3 its width. The tip of the telson reaches the base of the rami of uropods III.

Distribution: A temperate warm-water, possibly antiequatorial
395 species. It is known from the Atlantic (18° N, 67° 30′ S), Indian (north of 51° S, but absent in the equatorial zone), and Pacific (Kuroshio, New Zealand, environs of northern chile) oceans, and Mediterranean Sea. It lives in warmed waters of the 0–200 m layer.

XX. Family BRACHYSCELIDAE Stephensen, 1923

Crustaceans of 5–20 mm in length. The body is oblong and laterally compressed. The eyes are large and occupy almost the entire surface of the head. The flagellum of antennae II in males has a short apical segment or it is rudimentary. The mandibles in males have a palp, which is absent in females. Maxillae I and II are markedly reduced. The subchelae of pereopods I and II are well developed, broad, with coarsely denticulate margins; moreover, the largest denticles often also have denticulate margins. Pereopods V and VI differ less in length; the 2nd segment is broad but not operculiform. Pereopods VII consist of a broadened 2nd segment and generally 3rd–7th distal segments. The rami of all the uropods are free and have denticulate margins and a pointed tip. The telson is not fused with the last urosomite.

Claus (1879b; 1887) placed the genus *Brachyscelus (Thamyris)* in the family Lycaeidae along with the genera *Lycaea, Simorhynchotus, Paralycaea*, and *Pseudolycaea*; Stebbing (1888) included the genera *Euthamneus* and *Brachyscelus* in the family Tryphanidae together with the genera *Tryphana, Lycaea, Paralycaea*, and *Simorhynchotus*. In structure of pereopods I, II, V and VI, *Brachyscelus* and *Euthamneus* occupy an intermediate place between the families Lycaeidae and Oxycephalidae. Hence their inclusion in an independent family (Stephensen, 1923) seems justified to us.

The family includes two genera.

KEY TO GENERA OF FAMILY BRACHYSCELIDAE

1. Head of male flattened and anteriorly extended into short pointed rostrum. Antennae II in males rudimentary, not longer than antennae I. Pereon dolioform. Second segment of pereopods VI approximately half length of remaining segments together .... 2. ***Euthamneus*** (Bov.).

— Head of male may be narrowed anteriorly but not forming pointed rostrum. Antennae II in males long, folded four times, longer than antennae I. Pereon not dolioform. If 2nd segment of pereopods VI shorter than remaining segments together, very slightly so .... 1. ***Brachyscelus*** Bate.

1. Genus *Brachyscelus* Bate, 1861

Bate, 1861: 7; Stebbing, 1888: 1543; Stephensen, 1923: 37; Chevreux and Fage, 1925: 426.—*Thamyris* Claus, 1879b: 32; 1887: 56.

The head is large, in females anteriorly smoothly rounded and higher, in males anteriorly more or less narrowed, its height generally not more than half its length. The flagellum of antennae II in males is folded four times and the apical segment short.

The 2nd segment of pereopods I in females is almost linear and straight, in males has a sharply curved posterior margin; the 5th segment is broader than the 4th; both margins of the distal process of the 5th segment and the posterior margin of the 6th are denticulate. The 2nd segment of pereopods II is straight and in both males and females longer than in pereopods I; the structure of the distal segments is the same as in pereopods I. Pereopods V are slightly longer than pereopods VI. The 2nd segment of pereopods V–VII is strongly broadened. Pereopods VI have a full complement of segments. The rami of all the uropods are lanceolate and the endopodite is not fused with the basipodite.

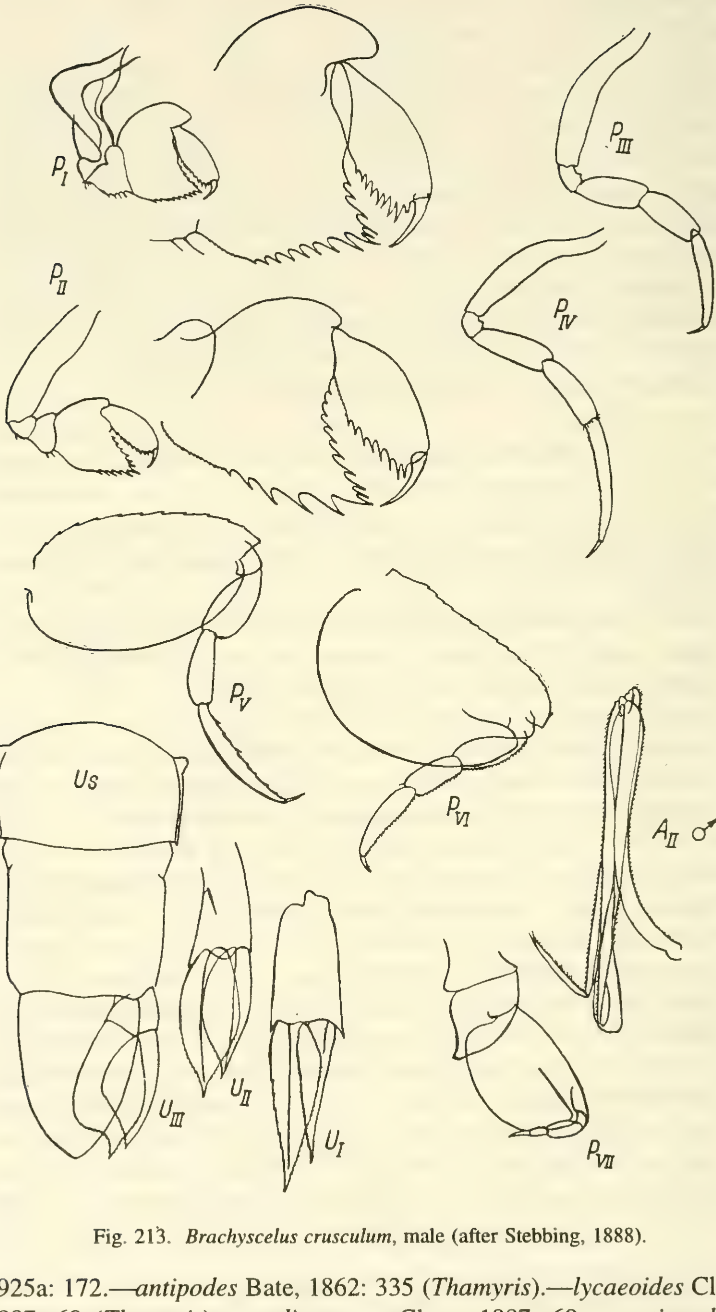
Type species: *Brachyscelus crusculum* Bate, 1861.

396 *KEY TO SPECIES OF GENUS BRACHYSCELUS*

1. Head in males anteriorly narrowed. Lobe of antero-distal angle of 4th segment of pereopods I well developed. Telson longer than wide at base. .... 2.
— Head in males anteriorly rounded, same as in females. Lobe of antero-distal angle of 5th segment of pereopods I poorly developed. Telson approximately equal in length to width at base. .... 3.
2. Basal segment of antennae II in males not shorter than following segment. Distal segments of pereopods VII together shorter than 2nd segment. Rami of uropods III (especially endopodite) strongly broadened distally. Last urosomite equal in length and width .... 1. ***B. crusculum*** Bate.
— Basal segment of antennae II in males much shorter than following segment. Distal segments of pereopods VII together almost equal to 2nd segment. Rami of uropods III almost not broadened distally. Length of last urosomite 2/3 its width..........3. ***B. rapax*** (Claus).
3. Head equal to pereon in length. Anterior distal process of 2nd segment of pereopods VI with straight lower margin, only slightly extending beyond 3rd segment. Telson 2/3 length of last urosomite and shorter than width at base..........4. ***B. macrocephalus*** Steph.
— Head not longer than first five somites of pereon. anterior distal process of 2nd segment of pereopods VI smoothly rounded, reaching middle of 4th segment. Telson longer than last urosomite, its length equal to width at base2. ***B. globiceps*** (Claus).

1. ***Brachyscelus crusculum*** Bate, 1861 (Fig. 213)

Bate, 1861: 7; 1862: 333; Stebbing, 1888: 1544, 1547; Spandl, 1924: 32; Chevreux and Fage, 1925: 427; Shoemaker, 1925: 45; Stephensen,



397 Fig. 213. *Brachyscelus crusculum*, male (after Stebbing, 1888).

1925a: 172.—*antipodes* Bate, 1862: 335 (*Thamyris*).—*lycaeoides* Claus, 1887: 60 (*Thamyris*).—*mediterranea* Claus, 1887: 60.—*acuticaudatus* Stebbing, 1888: 1555.

Length of sexually mature female up to 21 mm, of male up to 17 mm.

The head is large, in females anteriorly smoothly rounded, its height 1.5 times its length; in males the head is anteriorly narrowed, its length and height approximately equal.

The 1st segment of the flagellum of antennae I in males is broad and upcurved; the three distal segments are thin and short. Antennae I in females are very small, the flagellum three-segmented. The distal segment of antennae II in males is 1/5 the length of the preceding one. The pereon is somewhat longer than the pleon.

The 2nd segment of pereopods I in males is sharply curved in the middle, in females almost linear; the 4th segment is 1.5 times wider than long; the anterior distal angle of the 5th segment forms a galeiform process with small denticles on the rounded apex, the posterior angle forms an acutely angled lobe whose posterior margin is straight and generally bears eight–nine denticles, its anterior margin with five–seven denticles; both margins in the 6th segment are bulged and the posterior one denticulate in the distal part; the claw is strong and approximately half the length of the 6th segment. The 2nd segment of pereopods II is straight in both males and females; the 5th segment is much narrower than in pereopods I, the anterior galeiform process is absent, the posterior distal lobe well developed, and the posterior margin is armed with five–six,
397 the anterior margin with five–eight denticles. The 2nd segment of pereopods V on average is 10/17 as wide as long and its anterior margin may bear up to 10–15 smoothened denticles with short spines; the 4th and 5th segments are equal in length; the 6th segment is longer than the 5th. The 2nd segment of pereopods VI is equal to the 5th in length but broader and its anterior margin armed as in pereopods V; the 3rd–7th segments together are not longer than the 2nd; the 4th–6th segments have a denticulate anterior margin; the 6th segment is longer than the 5th. The 2nd segment of pereopods VII is 1.3 times longer than wide and its posterior margin more bulged than the anterior one; the distal segments together are only slightly longer than half the 2nd segment; the 4th segment is almost twice as broad and longer than the 5th.

The basipodite of uropods I is shorter than the narrow lanceolate rami; the endopodite is longer than the exopodite. The rami of uropods II
398 are broadened in the middle part and lanceolate. The basipodite of uropods III is short, the rami broadened in the distal third, especially the endopodite. The last urosomite is equal in length and width. The telson is longer than its width at the base and equal in length to the last urosomite; the tip of the telson in females is extended, often pointed, in males rounded.

Distribution: A warm-water species. It is distributed in the Atlantic (from 51° N to 32° S), Indian (almost everywhere in the tropics, the Great Australian Gulf), and Pacific (south of 40° N, Kuroshio, Hawaiian Islands, Nasca ridge, New Zealand) oceans, and in the Mediterranean Sea. It inhabits predominantly the surface to 300–400 m layer.

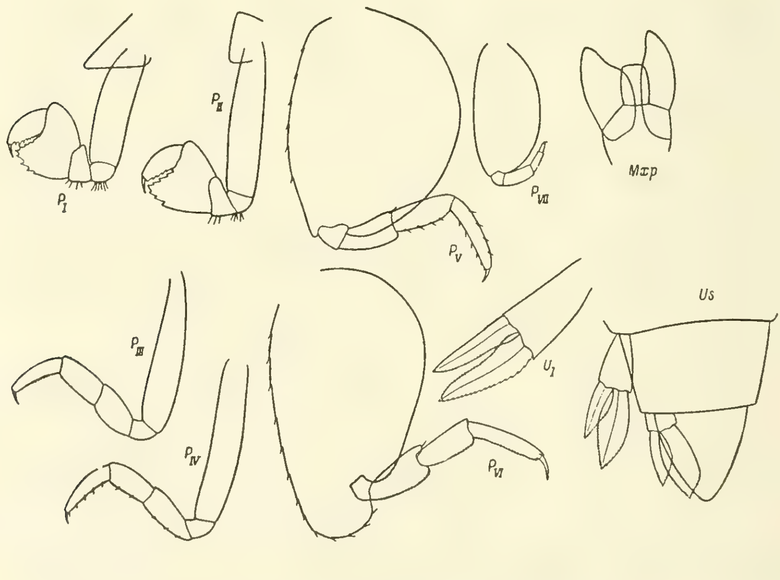
2. ***Brachyscelus globiceps*** (Claus, 1879) (Fig. 214)

Claus, 1879b: 36 (*Thamyris*); 1887: 59; Stephensen, 1925a: 176.—*bovallii* Stebbing, 1888: 1553.—*latipes* Stebbing, 1888: 1550.—*inaequipes* Stebbing, 1888: 1549.

Length of sexually mature specimens up to 12 mm.

The head is short, rounded, anteriorly not narrowed in either males or females, and its height 1.3 times its length. The basal segment of antennae II in males is longer, and equal to the 2nd segment; the distal segment of the flagellum is 1/5 the length of the preceding segment.

The 2nd segment of pereopods I in males is curved, as in *B. crusculum*, in females linear; the 4th segment is markedly broadened distally; the 5th segment is wider than long, its anterior distal process short, the posterior distal angle only slightly less than a right angle, and
399 both margins bear three–four low teeth each, whose margins are also finely denticulate; the 6th segment has bulged margins and the posterior one bears three–five denticles. The 2nd segment of pereopods II is longer



398 Fig. 214. *Brachyscelus globiceps* (Claus), female.

than in pereopods I; the subchela is the same as in pereopods I. The 2nd segment of pereopods V is strongly broadened, slightly longer than wide, and the anterior margin throughout its length bears short and sparse spines; the 3rd–7th segments together are longer than the 2nd. The 2nd segment of pereopods VI is narrower and longer, the anterior margin armed with sparse spines, the anterior distal process large and in the form of a rounded lobe that reaches the middle of the 4th segment; the 4th–5th segments are distally broadened, the 4th with short anterior and posterior distal processes; the 4th–6th segments have a denticulate anterior margin; the 6th segment is 1.5 times longer than the 5th; the claw is denticulate. The 2nd segment of pereopods VII is oval and its width half its length; the distal segments together are half the length of the 2nd segment; the 4th segment is broader and 1.5 times longer than the 5th.

The last urosomite is 1.5 times wider than long. The endopodite of uropods I is equal to the peduncle in length and the exopodite somewhat shorter. The exopodite of uropods II is equal to the basipodite in length and 2/3 the length of the endopodite. The basipodite of uropods III is
400 wider than long and the endopodite is broadened, but less so than in *B. crusculum*. The telson is triangular and has a rounded tip; its length and width are equal to the length of the last urosomite.

Distribution: Probably a circumtropical species. Known from the Atlantic and Pacific (Kuroshio, Nasca ridge) oceans.

3. ***Brachyscelus rapax*** (Claus, 1879) (Fig. 215)

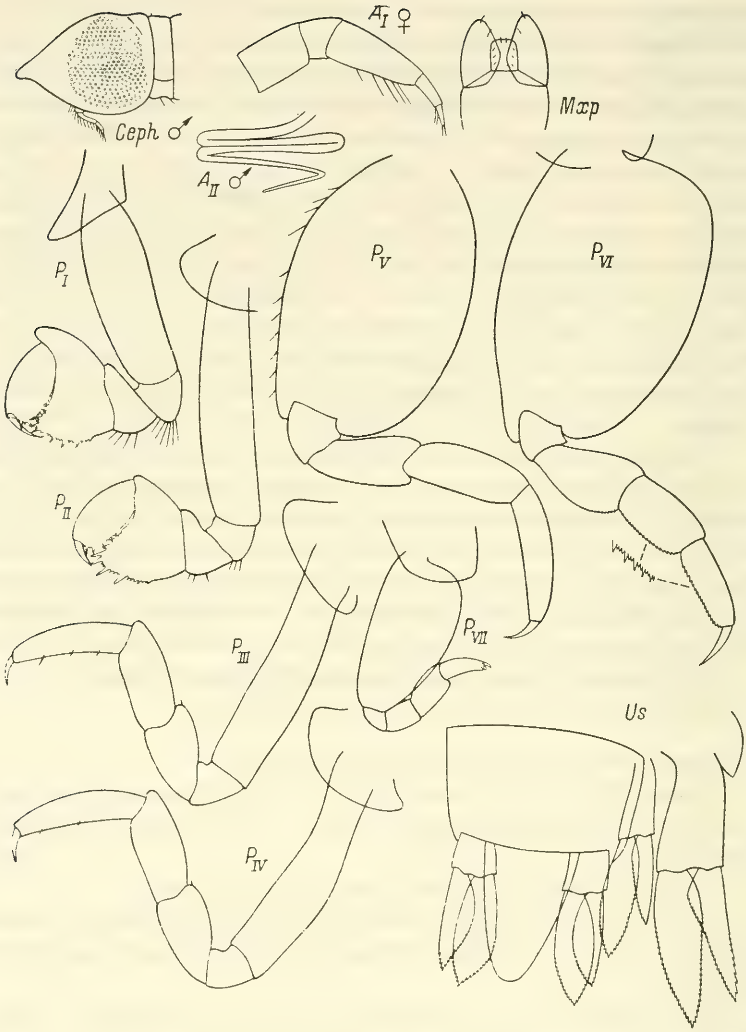
Claus, 1879b: 36 (*Thamyris*); 1887: 59 (*Thamyris*); Stebbing, 1888: 1555.—*elegans* Bovallius, 1887a: 31.—*rapacoides* Stephensen, 1925a: 179.

Length of sexually mature specimens about 10 mm.

The head in females is smoothly rounded and its height 1.5 times its length; in males it is anteriorly narrowed and its length more than its height.

The basal segment of antennae II in males is considerably smaller than the 1st segment of the flagellum; the distal segment is 1/5 in adults, 1/3–1/2 in young ones, the length of the preceding segment.

The 2nd segment of pereopods I in males is strongly curved, in females almost straight; the strongly broadened 4th segment has a straight distal margin; the galeiform process of the anterior distal angle of the 5th segment is well developed and straight, not curved as in *B. crusculum*; the posterior distal angle of the 5th segment marginally bears a few long narrow denticles, between each of which two–three short denticles occur. The 2nd segment of pereopods II is linear and longer than in pereopods I; the anterior distal angle of the 5th segment does not form a galeiform process. The 2nd segment of pereopods V is oval, 1.5 times



399 Fig. 215. *Brachyscelus rapax* (Claus).

longer than wide, and its anterior margin armed with short spines; the distal segments together are 1.5 times longer than the 2nd segment and their anterior margin is smooth. The 2nd segment of pereopods VI is equal in length to the 2nd segment of pereopods V; the distal segments together are longer than the 2nd segment by the length of the claw; the 4th–6th segments have a denticulate posterior margin; the 6th segment is just barely longer than the 5th; the claw is denticulate. The 2nd segment of pereopods VII is twice longer than wide; the distal segments together are slightly shorter than the 2nd; the 4th segment is shorter than the 5th, unlike in the preceding species.

The last urosomite is 1.5–1.7 times wider than long. The basipodite of uropods I is shorter than the rami and in uropods II approximately equal to the exopodite. The endopodite of uropods III is almost not broadened. The telson has a rounded tip, is equal to or slightly longer than the last urosomite, and its length equal to its width at the base.

Distribution: Known from the Atlantic (Cape of Good Hope), Indian (Bay of Bengal), and Pacific (eastern equatorial part, New Zealand) oceans, and the Mediterranean Sea.

4. ***Brachyscelus macrocephalus*** Stephensen, 1925 (Fig. 216)

Stephensen, 1925a: 177.

Length of specimens 5–6 mm.

The head is very large, in females its length equal to that of the pereon and its height more than its length; in males it is relatively less smoothly rounded anteriorly. Antennae the same as in *B. crusculum*.

The structure of pereopods I and II has been described by Stephensen (1925a, p. 177) thusly: "The 3rd segment of pereopods I on the posterior margin bears 10 setae; the 4th segment has four setae. The 5th segment is much broader than long, the upper angle (galeiform process) is noticeable but not distinctly developed. The distal process of the 5th segment

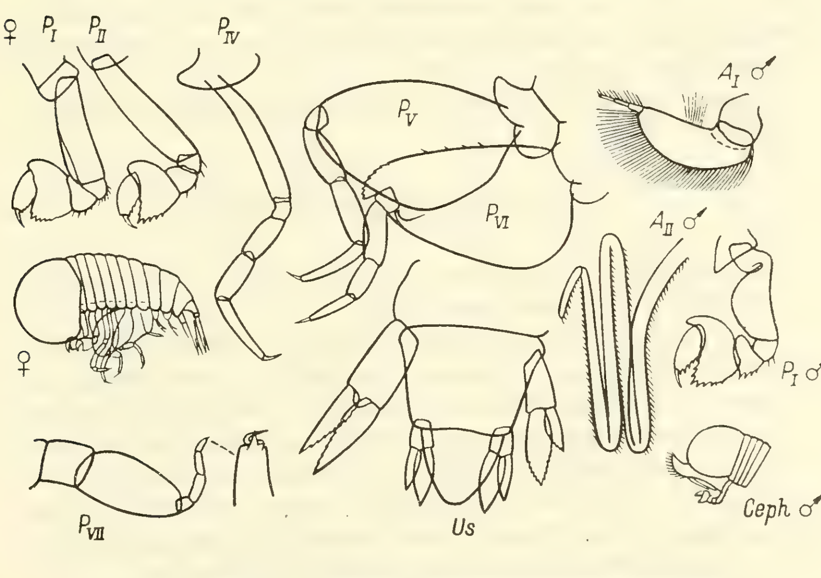


Fig. 216. *Brachscelus macrocephalus* Stephensen (after Stephensen, 1925a).

has a highly rounded contour (contour of the denticles tips), with eight triangular denticles. The 6th segment has four denticles on the posterior margin. The 3rd and 4th segments of pereopods II on their posterior mar-
401 gin have only two setae; the distal process of the 5th segment is more pointed than in pereopods I and the 6th segment has only three denticles." The 2nd segment of pereopods V is oval, 1.5 times longer than wide, and equal in length to the distal segments together; the 4th–6th segments have denticulate margins. The 2nd segment of pereopods VI is triangular but not larger than in pereopods V and its width only slightly more than half its length; the anterior distal angle of the 2nd segment is not strongly developed but forms a well-developed rounded process armed with five low denticles; the distal segments together are shorter than the 2nd segment; the 4th–6th segments have a denticulate anterior margin; the 5th segment is shorter and narrower than the 4th but equal to the 6th in length. The 2nd segment of pereopods VII is twice longer than wide, the anterior margin almost straight, and the posterior one bulged; the distal segments together are 3/4 the length of the 2nd segment; of these, the 4th is the longest and the anterior margin of the 5th is armed with very fine denticles.

The last urosomite is almost 1.5 times longer than wide. The basipodite of uropods I is equal to the endopodite in length; the exopodite is shorter. The basipodite of uropods II is shorter than the endopodite but longer than the exopodite. Uropods III are somewhat longer than the telson and the rami are not broadened distally. The tip of the telson is broadly rounded, its length less than the width at the base, and about 2/3 that of the last urosomite.

Distribution: Known from the Atlantic Ocean (region of Bermuda Islands).

2. Genus *Euthamneus* Bovallius, 1890

Bovallius, 1890: 19.—*Thamneus* Bovallius, 1887a: 31; Stebbing, 1888: 1558; Bowman and Gruner, 1973: 48.

The body is compact and slightly flattened dorsoventrally. The head is flattened and in males is anteriorly stretched into a short, broad, and upwardly bent rostrum. The pereon is strongly broadened, bulged, dolioform. Antennae II are rudimentary in males, much shorter than the head. The 2nd segment of pereopods I and II is barely broadened. The 2nd segment of pereopods V–VII is slightly broadened; the distal segments of pereopods V and VII are twice the length of the 2nd segment. The rami of uropods I and III extend beyond the tip of the telson.

Type species: *Thamneus rostratus* Bovallius, 1887.

402 1. ***Euthamneus rostratus*** (Bovallius, 1887) (Fig. 217)

Bovallius, 1887a: 31 (*Thamneus*).—*debilis* Dana, 1852: 991 (*Daira*).—*platyrrhynchus* Stebbing, 1888: 1558 (*Thamneus*); Stephensen, 1925a: 180.—*recurvirostris* Chevreux, 1900: 154 (*Thamneus*).

Length of adult females up to 10 mm, of males up to 6 mm.

The body is flattened; the pereon is strongly broadened in the middle part, as if bulged, dolioform, and twice as long as the pleon. The head in males is laterally sharply narrowed, terminating in a pointed rostrum, dorsally broad, truncate anteriorly, the width of the frontal margin approximately half that at the base, and the width of the head much more than its length. The head in females is also narrowed but anteriorly evenly rounded and its height less than its length. The 1st segment of the flagellum of antennae I in males is bent upward, thick, and relatively short; the 2nd segment is highly flattened; the 3rd and 4th are narrower and short. Antennae I of females are weaker and shorter than in males. Antennae II are rudimentary in males, five-segmented, and not longer than antennae I.

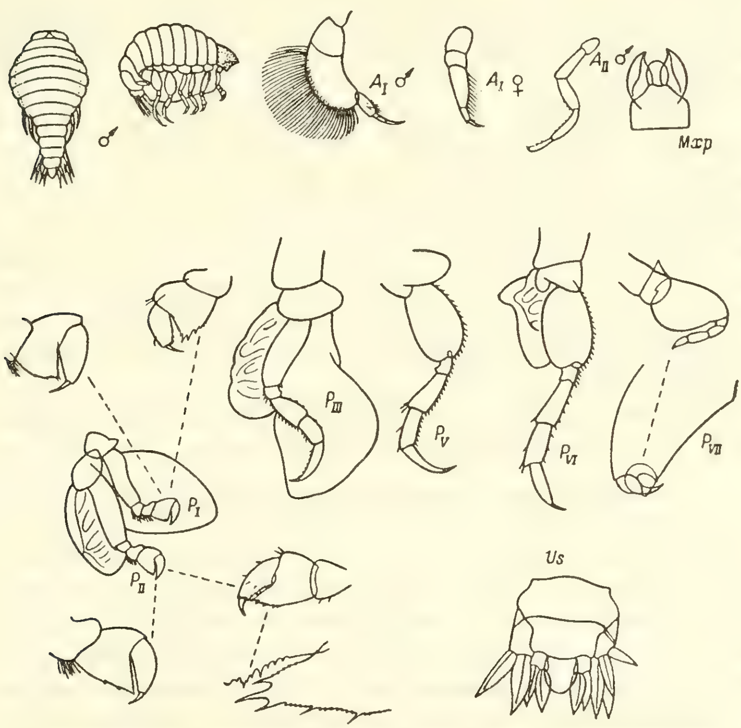


Fig. 217. *Euthamneus rostratus* (Bovallius) (after Stebbing, 1888).

The 2nd segment of pereopods I is straight; the 4th segment is strongly broadened in the distal part; the 3rd and 4th segments are densely pubescent, with fine setae, along the posterior margin; the anterior distal angle of the 5th segment forms a small rounded process; the posterior distal angle of the 5th segment is only slightly less than a right angle, and its margins bear a few high teeth between which smaller denticles may occur; the 6th segment also has a denticulate posterior margin; the claw is strong but rather short. Pereopods II are longer than pair I; the anterior angle of the 5th segment does not form a process while the posterior one is more pointed and longer than in pereopods I but with similar ornamentation. The 2nd segment of pereopods V is oval and almost half
403 the length of the distal segments together; the 2nd–5th segments are armed with spines along the anterior and sometimes even the posterior margin. Pereopods VI are equal in length to pair V; the 2nd segment is approximately half the length of the distal segments together; the 4th–6th segments have a denticulate anterior margin. Moreover, the 2nd–6th segments are armed with spines along the anterior margin and the 4th and 5th segments with lateral spines. Pereopods VII have a strongly broadened 2nd segment in which the posterior margin is much more bulged than the anterior; the distal segments together are somewhat shorter than the 2nd segment.

The first urosomite has bulged, the last urosomite concave lateral margins; the last urosomite is half as long as its maximum width. The endopodite of uropods I is 1.5 times longer than the basipodite and both rami extend beyond the telson by half their length. The endopodite of uropods II is more than twice as long as the basipodite, the exopodite shorter. The rami of uropods III are barely broadened in the middle part and the endopodite extends over the tip of the telson by half its length. The telson is roundish, slightly longer than wide, and equal in length to the last urosomite.

Distribution: Known from the Atlantic (50° N. to 6° S.), Indian (8° N. to 12° S.), and Pacific (north of 40° S.) oceans.

XXI. Family OXYCEPHALIDAE Bate, 1861

The external appearance of these crustaceans is unique and a vivid example of adaptation to a purely pelagic mode of life. The integument is thin, semitransparent or absolutely transparent, sometimes colored in dull brown tones. The body is more or less elongated, cylindrical, or laterally compressed, sometimes slightly bulged in the thoracic region or strongly tapered. The head is stretched forward, its length (with the rostrum) appreciably more than the width and height. In some cases the head is demarcated from the body by a narrow neck. The eyes are very well developed, occupying the entire head, and are sometimes so hypertrophied that constitute the most massive part of the crustacean body. The rostrum is well developed, pointed and projects in front of the eyes, sometimes greatly elongated, and constituting in length a considerable part of the body. Antennae I are articulated with the ventral side of the base of the rostrum; in males their basal segments are thickened, curved, and densely pubescent; the flagella are three- to four-segmented. Antennae II are reduced in females, in males greatly elongated, folded zigzag and articulated with the ventral part of the head. The mandibles have a three-segmented palp, developed only in males. The maxillae are absent. The maxillipeds are very small, with short outer lobes and a median lobe barely reaching the middle of the outer.

Pereopods I and II have chelae or subchelae. The 2nd segment of pereopods V–VII is ovavtely broadened, but not modified into a covering plate, as in the family Platyscelidae. Pereopods III–IV have narrow virgate segments. The distal part of pereopods VII is normally developed, rarely reduced to one–three segments. The coxal plates in representatives of various genera may be fused with the pereon or may be free. The pleopods are relatively weak and cannot ensure a high speed of swimming. Uropods I have free rami; the endopodites of uropods II–III are sometimes fused with the basipodites. The telson is fused with the last urosomite; sometimes a faint border is discernible between them.

An interesting morphological peculiarity of Oxycephalidae is the heteromorphic development of the gills, which has been related to their active role in the formation of brood chambers (Fage, 1960). In males the gills are elongated and folded, which increases their contact surface; in females only the last pair of gills are similar structure while the anterior gills are modified into thin, smooth, broadly oval plates. The gills are
404 usually developed on pereon somites II–VI, but sometimes absent or rudimentary on somites II–IV. The oostegites (on somites II–V or III–V) are too narrow to form a snug closed chamber. This is achieved by the simultaneous action of the gills and oostegites but the role of these two organs in the formation of the brood pouch [chamber] varies in different representatives of the family.

The family comprises eight genera, of which five are monotypic and the rest include a few species.

KEY TO GENERA OF FAMILY OXYCEPHALIDAE

1. Body very long and thin; piliform rostrum and urosome together 2/3 total body length .... 8. ***Rhabdosoma*** white.

— Body weakly elongated; rostrum triangular, not piliform, and together with urosome 1/4 total body length .... 2.

2. Rami of all uropods free .... 3.
— Endopodites of uropods III or of II and III fused with basipodites ..
.... 5.
3. All coxal plates separated from pereon .... 2. ***Streetsia*** Stebb.
— All coxal plates or some of them fused with corresponding pereon somites .... 4.
4. All coxal plates fused with pereon. Body thickset, with dense, often highly calcinated integument. Pereopods I with subchela, pereopods II with chela .... 7. ***Cranocephalus*** Bov.
— Coxal plates of pereopods VII fused with pereon, other plates free. Body thin, transparent. Pereopods I and II with chelae ....
.... 6. ***Glossocephalus*** Bov.
5. Head longer than pereon. Geminate urosomite 3–4 times longer than urosomite I .... 6.
— Head shorter than pereon. Geminate urosomite less than 2 times length of urosomite I .... 7.
6. Rostrum proximally with broad lateral keels. Coxal plates fused with pereon. Second segment of pereopods VII elongate, approximately same length as distal part of leg....... 4. ***Calamorhynchus*** Streets.
— Rostrum without lateral keels. Coxal plates separate from pereon somites. Second segment of pereopods VII roundish, equal in length and width, and much exceeds length of distal part of leg ....
.... 3. ***Leptocotis*** Streets.
7. Coxal plates fused with pereon. Pereopods I and II with chelae; pereopods VII well developed. Second segment equal to or slightly shorter than five-segmented distal part of leg.......................
.... 1. ***Oxycephalus*** M.-Edw.
— Coxal plates separate from pereon somites. Pereopods I and II with subchelae; pereopods VII small, reaching only middle of 2nd segmented of preceding pair. Second segment twice as long as three-segmented distal part of leg .... 5. ***Tullbergella*** Bov.

1. Genus *Oxycephalus* Milne-Edwards, 1830

Milne-Edwards, 1830: 396; Stebbing, 1888: 1576; Bovallius, 1890: 54; Stephensen, 1925a: 186; Spandl, 1927: 179; Fage, 1960: 29; Pillai, 1966: 173; Bowman and Gruner, 1973: 49.—Orio Cocco, 1832: 205.—*Ornithorhamphus* Natale, 1850: 12.—*Natalius* Costa, 1864: 88.

The body is elongate. The head is shorter than the pereon, bulged, smoothly terminating in pointed rostrum that constitutes about 1/3 the
405 head length; the maximum height of the head is more than the height of somite I of the pereon; the posterior part of the head forms a short neck. The pereon is equal to or somewhat longer than the pleon. The

coxal plates of the pereopods are fused with the pereon somites. Pereopods I and II are shorter than the rest, with well-developed chelae. Pereopods III–IV have thin virgate segments. Pereopods V are the longest; the 2nd segment of Pereopods V–VII is broadened, leaf-shaped, but broadest in pereopods VI. The last pereopods are well developed and equal in length to pereopods III. The urosome is shorter than the pleon. Uropods I are the longest; the endopodites of uropods II and III are fused with the basipodites. The telson is large, triangular, with a pointed tip, and equal to or shorter than the last urosomite.

Type species: *Oxycephalus piscatoris* Milne-Edwards, 1830.

Notes: Fage (1960), based on vast material, showed that except for *O. longipes* (known from a lone specimen) all the remaining Oxycephalus could be grouped into three species: *O. piscator, O. clausi*, and *O. latirostris*. Of these three species, *O. piscator*, *O. clausi* are close to each other morphologically as well as in the presence of dimorphism in females; *O. latirostris* differs from them in a more fragile build, smaller body size, and some characteristic morphological details. Moreover, dimorphism has not been observed in the females of the last species.

KEY TO SPECIES OF GENUS OXYCEPHALUS

1. Distal part of pereopods VII stylet-shaped, longer than 2nd segment due to highly elongated 6th segment, which is equal to 2nd segment in length .... 4. ***O. longipes*** Spandl.

— Distal part of pereopods VII not longer than 2nd segment; 6th segment only slightly longer than short 5th segment .... 2.

2. Epimeral plates without denticles, chelae with finely serrate ornamentation .... 3. ***O. latirostris*** Claus.

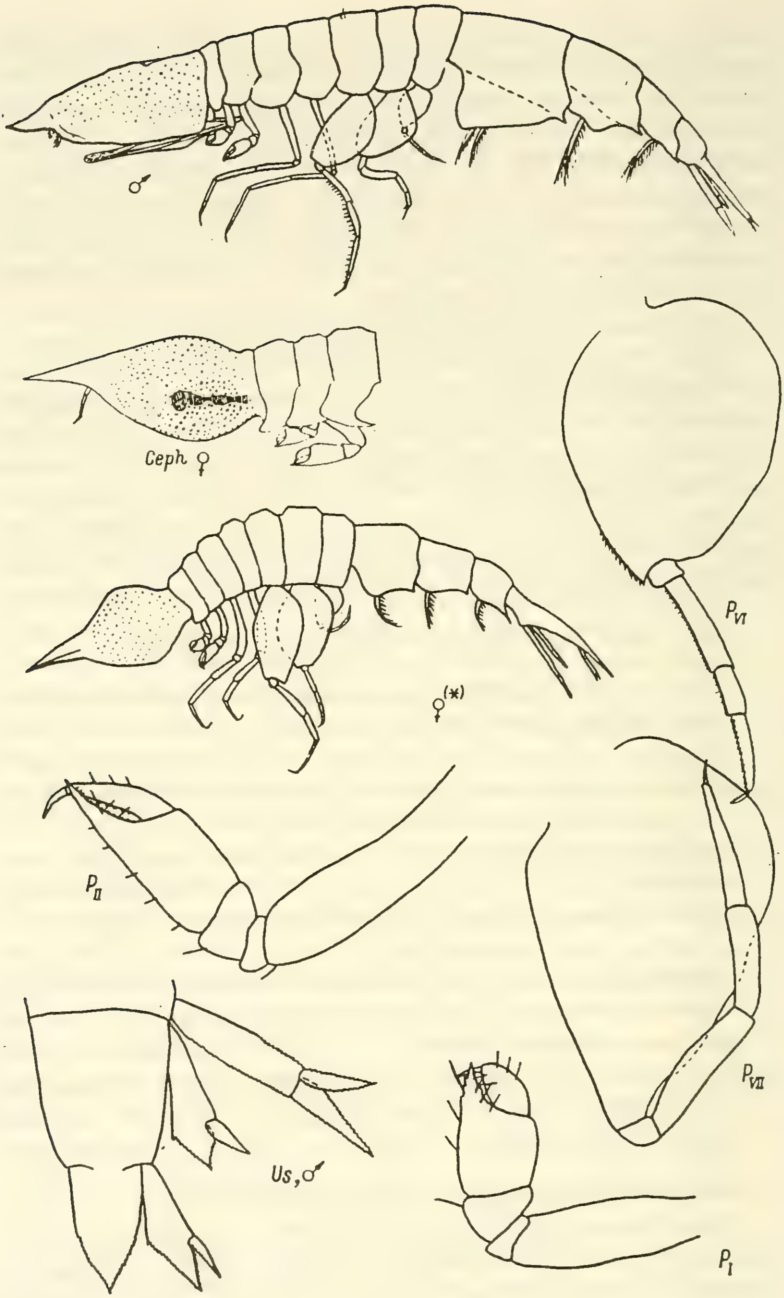
— Epimeral plates with denticles, chelae with coarse sparse denticles .. .. 3.

3. Epimeral plates with one denticle each in lower posterior angle. Fifth segment of pereopods I and II without sharply pointed projections in distal part of anterior margin ....1. ***O. piscator*** M.- Edw.

— Epimeral plates with two denticles in middle of distal margin and in lower posterior angle. Anterior distal part of 5th segment of pereopods I and II acuminate ....2. ***O. clausi*** Bov.

1. ***Oxycephalus piscator*** Milne-Edwards, 1830 (Fig. 218)

Milne-Edwards, 1830: 396; Bovallius, 1890: 56; Stephensen, 1925a: 186; Spandl, 1927: 180; Shoemaker, 1945a: 246; Fage, 1960: 14; Pillai, 1966: 176.—ornithorhamphus. Cocco, 1832: 205 (Urio).—oceanicus Guérin-Méneville, 1836: 10.—coccoi Natale, 1850: 12 (Ornithorhamphus). —candidissimus Costa, 1864: 88 (Natalius).—bulbosus Streets, 1878: 280.—similis Claus, 1879b: 193.—edwardsi Thomson, 1883: 238.



406 Fig. 218. *Oxycephalus piscator* Milne-Edwards
(Ceph of ♀, large form—after Fage, 1960).

Length of females up to 30.5 mm, of males up to 27 mm.

Dimorphism is observed among females due to earlier or later sexual maturity. A smaller form (10–15 mm) exists, which has been described by Streets (1878) as *O. bulbosus*, and the large "typical" form described by Claus as *O. similis* (Claus, 1879b), in which the females mature at a body length of more than 20 mm (Fage, 1960). The smaller form differs in the almost spherical head, the dorsal part of which projects strongly; the head tapers sharply toward the rostrum; its maximum height is 2/3 the length with rostrum. In the larger form the head is developed more
407 proportionately, smoothly extends into the rostrum, and is almost not projected dorsally. The length of the head with rostrum is more than twice its maximum height. Males do not differ in body shape and are closer to f. *typicus*, although sexual maturity may set in at greatly varying sizes. The rostrum constitutes half the total length of the head.

The 2nd segment of pereopods I is longer than the rest of the leg, has parallel margins, and is twice longer than wide; the 5th segment is almost squarish and has weakly bulged margins; the distal margin is anteriorly rounded, posteriorly extended and pointed, and the inner part of the process is coarsely denticulate; the entire posterior margin up to the tip of the process and the analogous margin of the 4th segment are finely denticulate and bear isolated setae; the 6th segment has a bulged posterior and straight denticulate anterior margin; fine dense setae occur on the posterior surface and a few setae in the distal part of the anterior margin; the process of the 5th segment is basally covered with fine dense setae. Pereopods II are longer than pair I; the 2nd segment is the same width as in pereopods I and the ratio of length to width is 4:1; the 5th segment has almost parallel margins, is somewhat longer than wide, and the anterior margin is not stretched distally; the process of the chela is longer than half length of the segment and reaches the base of the claw; the 6th segment bears a few strong short marginal setae; the 5th segment bears similar setae on the posterior margin as does the inner side of the process; the chela has strong blunt-tipped denticles on the inner side. In pereopods III–IV the posterior margin is armed with sparse setae, the anterior margin smooth, and setae occur only in the distal part of the 4th–6th segments. In pereopods V the 2nd segment is ovally broadened, 1.5 times longer than wide, equal to the total length of the 3rd–5th segments, with the maximum width in the middle part of the segment; the 4th segment is equal to the 6th in length, the 5th shorter. The anterior margin of the 2nd segment has low sparse denticles and setae; the ornamentation of the 4th–6th segments is similar in pereopods IV. The 2nd segment of pereopods VI is strongly broadened, the posterior margin roundly bulged, especially proximally, its width almost equal to its length, the posterior margin smooth, and the distal half of the anterior margin with complex denticulation (groups of smaller denticles occur between regularly arranged, downcurved large denticles); the total length of 3rd–6th segments is equal to the 2nd; the 4th segment is the longest; the 4th–6th segments are armed along the anterior margin with sparse strong setae with a group of fine setae between them. The 2nd segment of pereopods VII is broadened proximally and markedly narrowed distally; the rest of the leg is equal in length to the 2nd segment and consists of virgate unornamented segments; the 4th segment is the longest.

The lower distal angles of the epimerons are extended and pointed and medial denticles absent on the lower margins of the epimeral plates. The basipodite of uropods I is denticulate distally on both sides, reaches the proximal part of uropods III*, and considerably extends beyond the basipodite of uropods II. The endopodites of all the uropods are longer and broader than the exopodites. The endopodite of uropods III is almost the same length as the basipodite. The telson is elongated-triangular, with denticulate sides.

The body proportions of *O. piscator* vary considerably depending on the size and sex of the crustacean: the head constitutes nearly 1/4 the body length; the pereon may be equal to or somewhat longer than the pleon; the urosome in males is about 1/5 the body length, in females slightly shorter; and the last urosomite is 1.5 times longer than the telson.

The gills are normal in development; the oostegites are likewise well developed and so arranged as to form a compact brood chamber under pereon somites V–VI.

Distribution: Circumtropical species, found in three oceans and in the Mediterranean Sea. The form *O. bulbosus* is more high-temperature demanding and avoids waters with very high salinity; hence it is not
408 found in the Mediterranean Sea where the typical form is common.

2. ***Oxycephalus clausi*** Bovallius, 1887 (Fig. 219)

Bovallius, 1887a: 35; 1890: 60; Stebbing, 1888: 1578; Stephensen, 1925a: 188; Spandl, 1927: 180; Pirlot, 1938:193; Shoemaker, 1945a: 251; Fage, 1960: 20; Pillai, 1966: 174.—*tuberculatus* Streets, 1878: 276.—*piscator* Claus, 1879b: 190.—*erythraeus* Cecchini, 1929: 6.—*mancinii* Cecchini, 1929: 7.

Length of females up to 38 mm, of males up to 27 mm.

As in *O. piscator*, dimorphism has been observed among females, which is linked with periods of sexual maturity. This difference, however, is not so striking to the eye as in the preceding species. In smaller forms the head is almost spherical and strongly bulged ventrally; the rostrum constitutes half the total length of the head, dorsally merges smoothly

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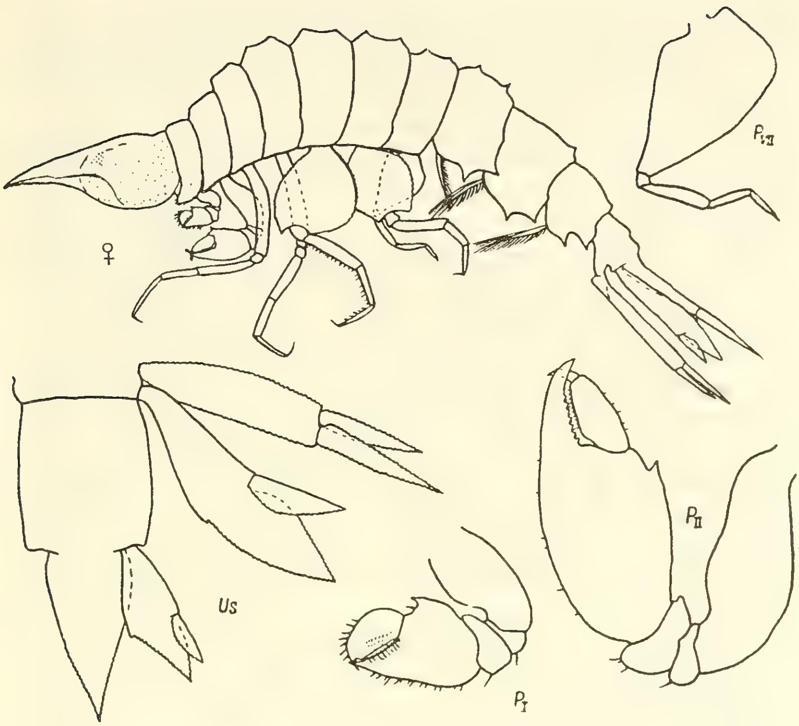
* Changed from Russian text by authors—Eds.



408 Fig. 219. *Oxycephalus clausi* Bovallius.

with it, but ventrally transits abruptly. In large females the head is ovate and the height 1/2–2/3 its length; the rostrum constitutes 1/3 the length of the head and merges smoothly with it. In males dimorphism is not manifest, although sexual maturity is attained at highly varying sizes.

The 2nd segment of pereopods I has convex margins and is shorter than the distal part of the leg; the 5th segment is broad, being broadest in the distal
409 part. A morphological detail characteristic of the species and differentiating *O. clausi* from the closely related *O. piscator* is the sharply projecting and slightly stretched anterior distal angles of the 5th segment and sometimes with seta located at its base. The pointed process of the posterior margin of the 5th segment is finely denticulate on the outer margin and more coarsely so on the inner margin; the 6th segment is shorter than the 5th and has a strongly bulged anterior margin and straight denticulate posterior one; the claw is small and barely curved. The 2nd segment of pereopods II is shorter than the rest of the leg and has a barely bulged posterior margin; the 5th segment, without the process, is longer than wide; the anterior distal angle

projects more than in pereopods I and the tip is stretched; the process of the chela is long, markedly extending beyond the base of the claw, its tip bent such that it makes a cross with the claw when the chela is closed; the 6th segment has a slightly bulged anterior margin and straight denticulate posterior one; the inner margin of the chela is armed with not very high, strong, blunt-tipped denticles arranged uniformly, with small setae between them; on closure of the chela the denticles of the distal margin of the 5th segment fit snugly into the corresponding notches of the posterior margin of the 6th. The maximum width of the flat 2nd segment of pereopods V–VII is shifted proximally. The 2nd segment of pereopods V is 1.5 times longer than wide, the posterior margin bulged, the anterior margin almost straight, weakly denticulate and armed with spiniform setae; the 4th–6th segments also bear setae along the anterior margin. The width of the 2nd segment of pereopods VI is appreciably more than its length, the posterior margin abruptly bulged, the anterior indistinctly denticulate, and distally bears sparse setae; the 4th–5th segments are armed anteriorly with setae; the setaceous ornamentation of the 6th segment is finer and more uniform. The 2nd segment of pereopods VII is broadened, pyriform, and equal to or slightly shorter than the rest of the leg, which consists of narrow virgate segments.

Ornamentation of the epimerons is characteristic of this species: besides posterior distal denticles, the epimeral plates have a medial denticle on the lower margin, especially noticeable in females, less so in males.

The basipodite of uropods I is much longer than that of uropods II and, similar to the rami, is finely denticulate on both sides; the endopodite is slightly longer than the exopodite. The exopodite of uropods II and III is shorter than the endopodite and smooth on the outer side. The telson is approximately equal in length to the last urosomite, gradually narrows towards the tip, and proximally has smooth margins becoming denticulate distally.

The body proportions are fairly stable: the head is relatively shorter than in *O. piscator*, constituting in females about 1/5 the body length, in males slightly more. The pereon in females is always longer than the pleon, in males the two are equal in length. The urosome constitutes 2/9–1/4 the total body length. The brood chamber is almost bordered by pereon somites V and VI.

Distribution: Widely distributed in tropical regions of the ocean and lives at the surface to a depth of 100 m, rarely deeper. The smaller form, evidently, is confined to equatorial waters.

3. ***Oxycephalus latirostris*** Claus, 1879 (Fig. 220)

Claus, 1879a: 71; Bovallius, 1890: 66; Pirlot, 1938: 367; Fage, 1960: 26.—*pectinatus* Bovallius, 1890: 64.—*notabilis* Spandl, 1927: 182.

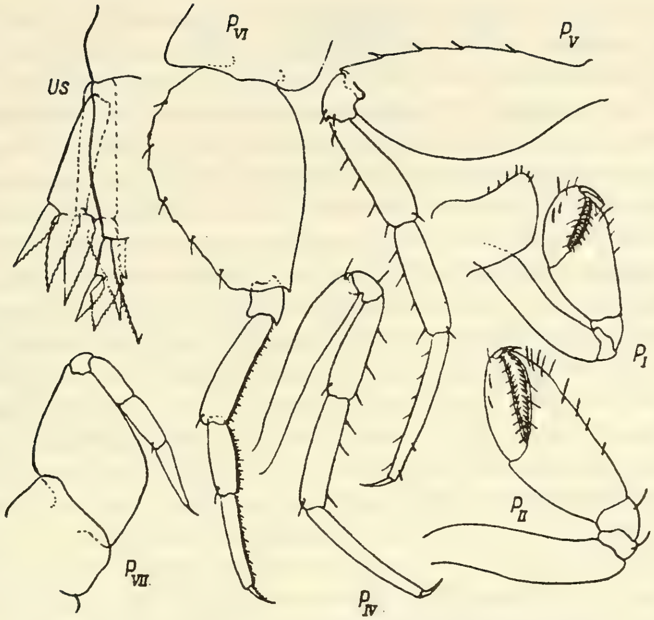


Fig. 220. *Oxycephalus latirostris* Claus, females (after Pillai, 1966).

The size of adult specimens rarely exceeds 20 mm, average 12–15 mm.

The body has a thin integument. The head is bulged, dorsally slightly so, ventrally bulged most in the proximal part. The rostrum constitutes half the total length of the head, is basally broad, and uniformly narrows
410 towards the tip; the tip is less attenuated than in the two preceding species and terminally blunt. Dimorphism is not observed in females of this species.

The 2nd segment of pereopods I is narrow, slightly S-shaped, especially along the anterior margin, its width about 1/4 its length, and its length equal to the rest of the leg; the width of the 5th segment is distally more than twice its width at the base and equal to the length of its anterior margin; the process of the posterior margin falls slightly short of the base of the claw and its tip is stretched and curved; the inner margin of the chela is finely serrate with strong submarginal setae; the claw is about 1/3 the 6th segment in length. The 2nd segment of pereopods II is almost straight and slightly shorter than the rest of the leg; the 5th segment is appreciably longer than its width and its width in the distal part 1.5 times than at the base; ornamentation of the chela is similar to pereopods I; the posterior margin of the 5th segment is armed with setae and the tip of the process highly stretched, reaching beyond the base of

the claw; the 6th segment has almost parallel margins, its length is 3.5 times its width, and the distal half of the anterior margin bears a few setae. The 4th–6th segments of pereopods III–IV bear sparse setae along the posterior margin. The 2nd segment of pereopods V is broadened, the anterior margin is almost straight and bears four equidistant denticles, the posterior margin bulged; the maximum width of the segment occurs in the middle, is equal to half length of the segment and length is equal to the total length of the 3rd–5th segments together; the 4th–6th segments are medially armed with a few setae each. In pereopods VI the maximum width of the 2nd segment is shifted proximally and is 2/3 the length; the anterior margin is smooth, slightly bulged proximally, and straight in the distal half; the posterior margin is strongly bulged, indistinctly denticulate, and has a few regularly arranged setae; the 4th and 6th segments are equal in length, the 5th shorter, and all three anteriorly finely denticulate with groups of fine denticles separating the larger ones. The 2nd segment of pereopods VII is almost rhombic, distally less narrowed than
411 in *O. piscator* and *O. clausi*, its length slightly more than its maximum width (in proximal part) or equal to it; the distal part of the leg is equal in length to the 2nd segment; the 4th–6th segments are equal in length and each successive segment is narrower than the preceding one.

The end of the basipodite of uropods I does not extend beyond the end of the basipodite of uropods II and the distal 2/3 of the inner margin is denticulate; the exopodite is shorter than the endopodite, its inner margin and both margins of the endopodite are denticulate. The basipodite of uropods II is 1.5 times longer than the endopodite and its margins, as also the outer margin of the exopodite, are smooth. The basipodite of uropods III is the same length as the endopodite and the ornamentation of the rami similar to that of uropods I and II. The telson is triangular, with straight margins, denticualte in the distal part, and has a pointed tip.

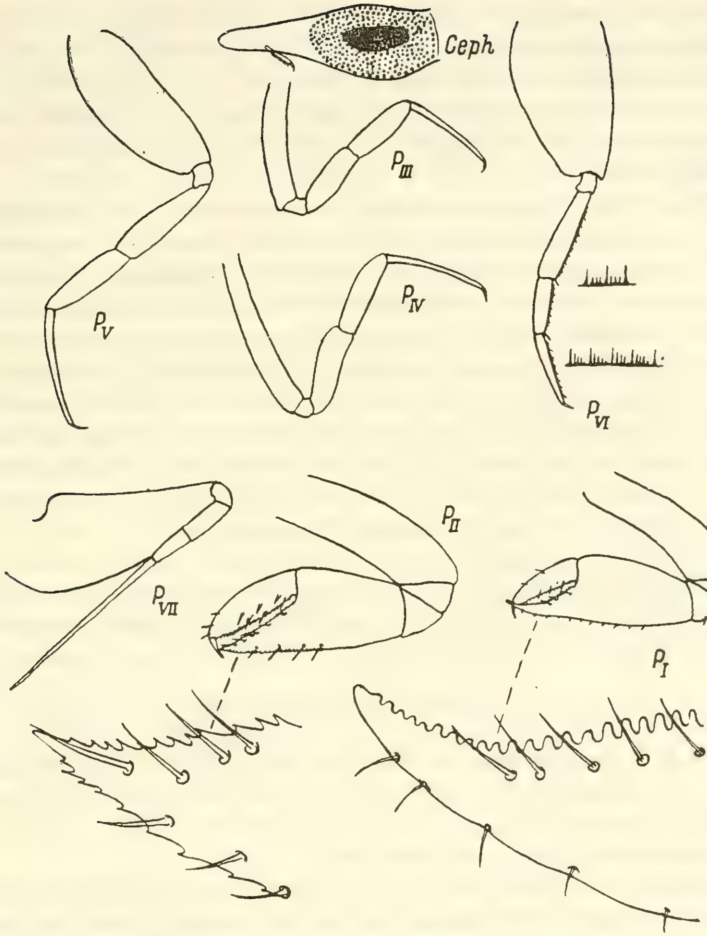
The body proportions vary little; the head constitutes 1/4 the total body length; the pereon in males is equal in length to the pleon, in females somewhat longer. The urosome constitutes 1/4 the total body length in females, in males is relatively smaller, i.e., up to 1/5 the body length. The telson is half the length of the last (geminate) urosomite, its tip reaching the tips of the rami of uropods III.

Distribution: A less numerous species, distributed in the tropical waters of the three oceans; it is rarer in the Atlantic Ocean than in the Pacific and Indian Oceans. It is also found in the Red Sea.

412 4. ***Oxycephalus longipes*** Spandl, 1927 (Fig. 221)

Spandl, 1927: 181.

Size of females 11–12 mm. Male not known.



411 Fig. 221. *Oxycephalus longipes* Spandl, female (after Spandl, 1927).

The 5th segment of pereopods I is serrate in the distal part of the posterior margin and bears lateral setae; the anterior margin of the process is also serrate and bears submarginal setae; the posterior margin of the 6th segment is similarly ornamented. The process of the 5th segment of pereopods II extends beyond the distal margin of the 6th segment; the posterior margin is smooth, not serrate, and bears small isolated setae, while the anterior margin of the process is serrate and bears submarginal spiniform setae; the posterior margin of the 6th segment is denticulate and also bears submarginal setae, while the anterior margin is armed with two–three setae. The 2nd segment of pereopods V is slightly broadened, the other segments elongated and without ornamentation. The 2nd segment of pereopods VI is much broader; the 4th segment is distally slightly broadened and anteriorly denticulate; the same is true of the next two segments. The structure of pereopods VII is characteristic of the species; the main distinguishing feature is the highly elongated 6th segment which is equal in length to the 2nd. The urosome and telson are generally fused.

Notes: Since the species was not included earlier in the synonymy and has certain morphological differences that compel its recognition as an independent taxon, we also accept its independence. Possibly, the author had examined young specimens of some other larger species (shape of the head and less broadened 2nd segment of pereopods I–II are characteristic of very young specimens of *Oxycephalus*). The structure of the chelae of pereopods I–II is also the same as in O. clausi; however, the styletlike distal part of the pereopods VII separates *O. longipes* from other species of the genus. It is not clear whether this is due to deviation in individual development or whether Spandl actually came across a new, very rare species of the genus *Oxycephalus*.

Absent in our collections.

Distribution: *Oxycephalus longipes* was described in 1927 by Spandl (Spandl, 1927) from the tropical part of the Atlantic. Since that time, this species has not been reported again.

2. Genus *Streetsia* Stebbing, 1888

Stebbing, 1888: 1603; Bovallius, 1890: 46; Senna, 1902: 19; Stephensen, 1925a: 192; Spandl, 1927: 184; Pirlot, 1938: 368; Fage, 1960: 70; Bowman and Gruner, 1973: 53.

The body is very slightly elongated.

The head is relatively large, equal to or longer than the pereon, its maximum height in the proximal part; a neck is usually absent (exceptions are the females of *S. mindanaonis* with a rather long neck and males of the same species with a dorsal depression in the head, not always well developed, however). The rostrum is acuminate and generally shorter than the proximal part of the head, which is occupied by the eyes.

The pereon is generally longer than the pleon, or the two are equal in length. The coxal plates are separated from the pereon. Pereopods I have a subchela, pereopods II a more or less developed chela. The last three pairs of the pereopods have a broadened 2nd and narrow distal segments. Pereopods VII are well developed; the 2nd segment is as long as the distal part of the limb or somewhat longer.

The urosome is generally shorter than the pleon but sometimes (*S. challengeri*) longer than it. The length of the 2nd (geminate) urosomite exceeds its width, sometimes notably. All the uropods have free rami of equal length or the endopodite is slightly longer than the

413 exopodite. Uropods II are shorter than uropods I. None of the tips of the rami of all the uropods reaches the tip of the telson. The telson is narrowly triangular and approximately the same length as the geminate urosomite.

Type species: *Streetsia challengeri* Stebbing, 1888.

According to the modern interpretation of the genus, it includes four species.

KEY TO SPECIES OF GENUS STREETSIA

1. Body compact, with thick integument. Head less than 1/3 total body length. Length of last (geminate) urosomite slightly more than width .... 3. ***S. porcella*** (Claus).

— Body with thin integument. Head long, not less (often more) than 1/3 total body length. Length of last urosomite twice or more its width .... 2.

2. Process of 5th segment of pereopods II not reaching tip of 6th segment. Epimeral plates with large cuticular pore in middle .... 4. ***S. mindanaonis*** (Stebb.).

— Process of 5th segment of pereopods II long, reaching base of claw. Epimeral plates without noticeable cuticular pore .... 3.

3. Length and width of 5th segment of pereopods I approximately equal, its posterior distal angle coarsely denticulate, apical denticle directed distally and differs little from neighboring ones in size. Posterior margin of 2nd segment of pereopods II in adult females stretched distally into stiff triangular lobe. Body length up to 48 mm .... 1. ***S. challengeri*** Stebb.

— Fifth segment of pereopods I elongate, apical denticle on posterior distal angle large and directed at an angle to posterior margin of segment. Second segment of pereopods II without lobe. Body length up to 12.5 mm .... 2. ***S. steenstrupi*** (Bov.).

1. ***Streetsia challengeri*** Stebbing, 1888 (Fig. 222)

Stebbing, 1888: 1591; Bovallius, 1890: 82; Stephensen, 1925a: 194; Spandl, 1927: 186; Barnard, 1932: 295; Pirlot, 1938: 369; Fage, 1960: 51; Pillai, 1966: 189;—*pronoides* Bovallius, 1890: 84.—*stebbingi* Chevreux, 1900: 161.—*washingtoni* Senna, 1903: 15.—*subada* Colosi, 1918: 218. —*gaussi* Spandl, 1927: 184.

Size of females up to 48.5 mm, of males up to 32.5 mm. Sexual maturity may set in at considerably smaller sizes (10–12 mm).

The body is well proportioned; the head is very large, cylindrical or slightly conically tapering to the rostrum, in females over 1/3 the total body length (in the largest specimens up to 2/5), mostly because of

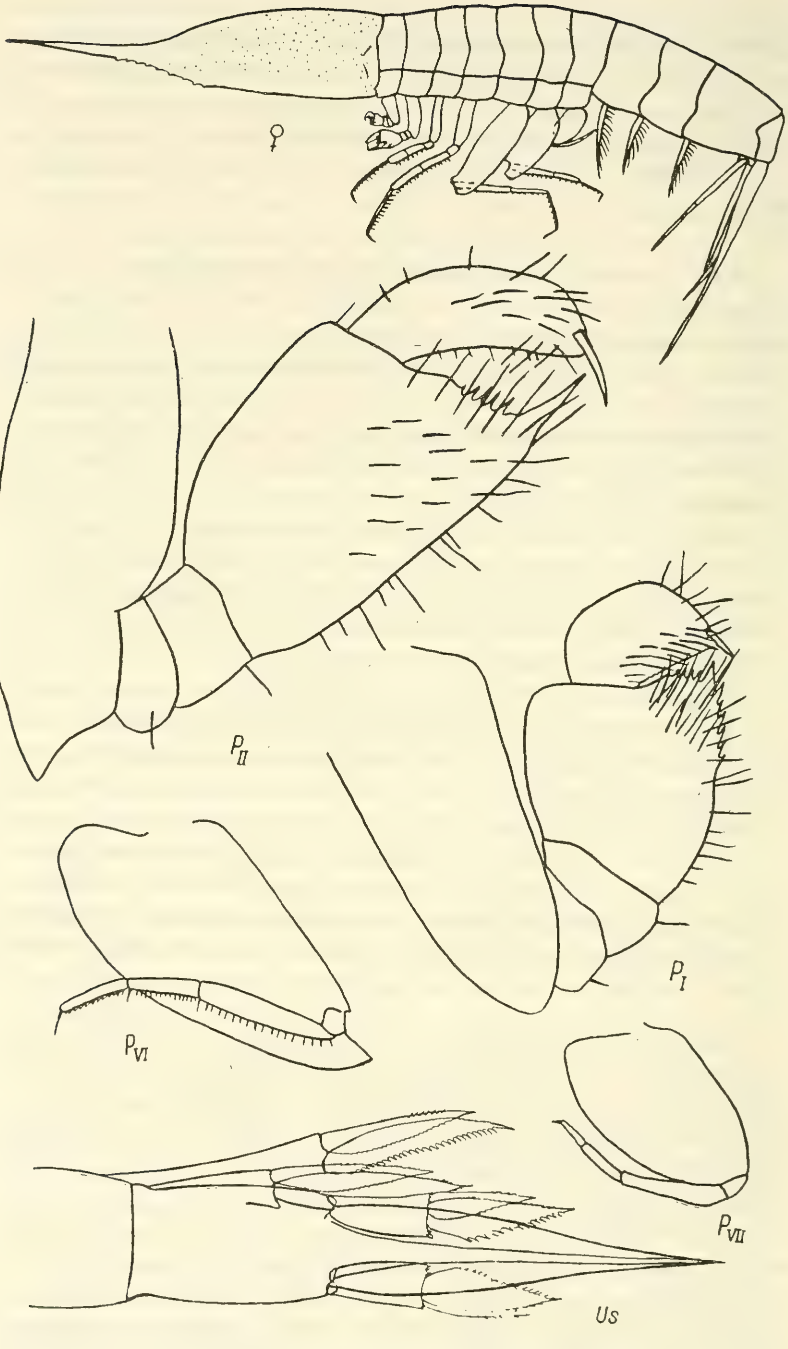


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Fig. 222. *Streetsia challengeri* Stebbing (US—Stebbing, 1888).

the elongation of the rostrum, in males slightly less than 1/3 the body length. The rostrum is denticulate along the lower margin, somewhat shorter than the proximal part of the head occupied by the eyes, and the transition from head to rostrum is smooth; the maximum height of the head occurs at the place of its articulation with the pereon.

The pereon somites are less in height than the head; the first somites and last ones differ little in size. The 2nd segment of pereopods I has a bulged anterior margin and an almost straight posterior one, and its length is somewhat more than the total length of the 3rd–5th segments; the 5th segment is distally broadened, its maximum width about equal to its length, and the posterior distal angle is denticulate and armed with setae; the 6th segment has a strongly bulged anterior margin, the distal part of which forms an acute projection extending beyond the base of the claw; the posterior margin is straight and finely denticulate and the surface of the segment bears setae. The structure of pereopods II of sexually mature females is characteristic of the species: in the 2nd segment the distal part of the posterior margin is highly extended and forms an acute triangular projection, which in young females and males
415 is poorly developed; the 5th segment has a straight posterior margin, a barely bulged anterior margin, is distally slightly broadened, and its maximum width is approximately equal to the length of its anterior margin. But if the 5th and 6th segments of pereopods I form a subchela, the strong distal tooth of the 5th segment of pereopods II together with the denticulate posterior margin of the 6th segment forms a well-developed chela which is denticulate adjacent to the marginal tooth; the posterior distal part of the 5th segment as well as the surface of the 6th segment bears fine setae; the 6th segment has a uniformly bulged anterior margin and a straight posterior one; the claw is equal to half the length of the 6th segment. Pereopods III–IV are thin, especially pereopods IV; the 2nd segment has a bulged posterior margin, a weakly concave anterior margin, and is somewhat longer than the 3rd–4th segments together; the 4th and 5th segments are equal in length, the 6th is somewhat longer; the 4th–6th segments bear fine setae on the posterior margin. Pereopods V have a spiniform process at the base of the 2nd segment; the 2nd segment is less than the total length of the remaining segments, its anterior margin straight or barely concave and denticulate, the distal part projecting in the form of a denticle, and the posterior margin uniformly bulged; the 4th–6th segments are narrow and bear fine setae along the anterior margin. The 2nd segment of pereopods VI is just barely longer than the rest of the leg, proximally strongly broadened, and its posterior margin forms a roundish lobe that projects proximally over the place of articulation of the segment; distally this margin is also strongly bulged as an acutely angled projection extending far beyond the base of the 4th

segment, while the anterior margin is straight or concave and distally denticulate; the 4th segment is longer than the 5th and 6th and the anterior margin of all three segments is finely denticulate. The 2nd segment of pereopods VII has a roundish lobe on the posterior margin that projects proximally above the place of articulation; the segment per se is longer than the rest of the leg, ovate or oval, and slightly longer than wide.

Epimeral plates I and II are posteriorly pointed, especially in large specimens, but roundish in young specimens. Epimeral plates III have a pointed and often extended posterior angle. The second (geminate) urosomite is approximately twice longer than wide. The telson is the same length or longer and has a strongly extended pointed tip. The basipodite of uropods I has parallel sides and reaches the base of the telson. The basipodite of uropods II is half as long and distally broadened. The basipodite of uropods III is distally broadened, relatively short, its length not more than twice its width. The endopodites of all uropods are broader and longer than the exopodites; in the last two pairs they are the same length as the basipodite; the tips of the rami do not reach the tip of the telson.

Notes: The long head, distal projection of the posterior margin of the 2nd segment of pereopods II, and the pointed distal lobe of the posterior margin of the 2nd segment of pereopods VI readily distinguish this species from other species of the genus.

Distribution: The species is more widely distributed in the warm waters of all oceans than *S. steenstrupi* and *S. mindanaonis*, penetrating up to 45° N and S; it is common in the Mediterranean Sea. It is encountered down to a depth of 1,000 m but more often in the 0–300 m layer. Females with eggs or embryos have been reported in all seasons; apparently the species does not have a definite season for reproduction.

2. ***Streetsia steenstrupi*** (Bovallius, 1887) (Fig. 223)

Bovallius, 1887a: 37 (*Oxycephalus*); 1890: 89; Fage, 1960: 42; Pillai, 1966: 191.—*longiceps* Stebbing, 1888: 1591 (*Oxycephalus*).

Length of sexually mature crustaceans 9–12.5 mm.

The body has a thin integument and weak, relatively short limbs. The head is longer than the pereon and 1/3 or more the total body length;
416 the height of the head is barely more than that of the pereon somites; the rostrum is relatively short, about 1/4–1/3 the total length of the head, anteriorly pointed, sometimes slightly bent downward; rarely light lateral keels are noticeable. Antennae II of males have a distally thickened 1st segment.

The pereon in females is always longer than the pleon, in males shorter. The 2nd segment of pereopods I is the same length as the distal part of the limb; the 5th segment is much longer than its width and the posterior distal angle stretched and pointed; when the subchela is

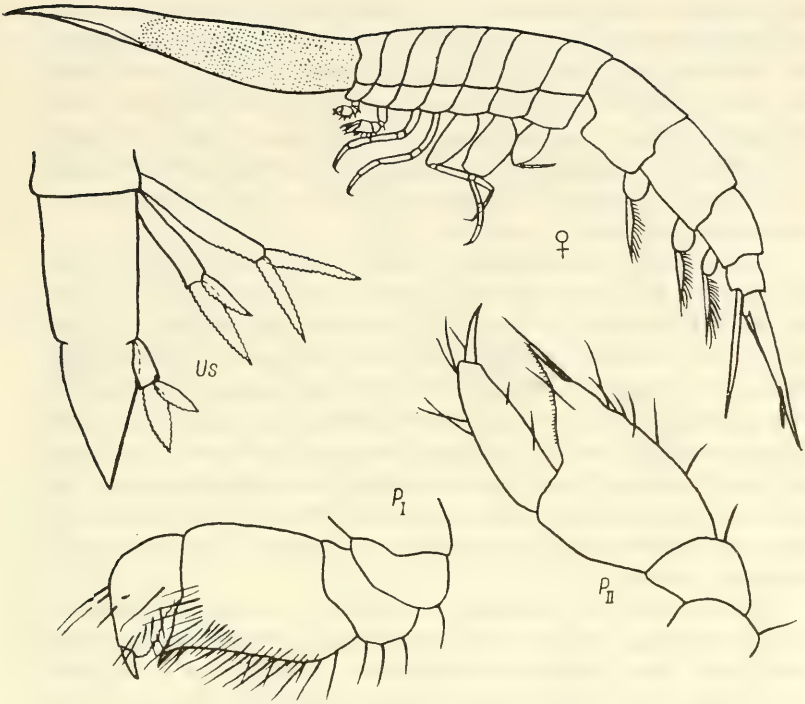


Fig. 223. *Streetsia steenstrupi* (Bovallius).

closed this denticle extends beyond the base of the claw. The 2nd segment of pereopods II has straight margins, its width is 1/4 its length, and its length equal to the remaining segments together; the 5th segment is distally broadened and together with the narrow 6th segment forms a well-developed chela; the process of the 5th segment reaches the base of the claw, the width of the process at the base is more than half that of the distal margin, its surface, like that of the 6th segment, covered with thin setae, and its distal part denticulate. The 2nd segment of pereopods III–IV is shorter than the 3rd–5th together; the 4th–7th segments bear short setae along the posterior margin. Between the coxa of pereopods V and the 2nd segment a stiff, backwardly directed spine occurs; the 2nd segment has a straight anterior and bulged posterior margin and its length is twice its width; the 4th segment is equal to the 6th in length, the 5th segment shorter; the 2nd and 3rd segments are armed along the anterior margin with both spinules and sparse setules, the 4th–6th segments only with sparse short setules. The 2nd segment of pereopods VI has a straight anterior margin, a proximally highly bulged posterior margin, and both margins are distally somewhat produced; the 4th segment

has a small pointed projection in the distal part of the posterior margin; the distal part of the legs is equal in length to the basal segment; the 4th–6th segments are armed along the anterior margin with spines; the claw is short. Pereopods VII have an elongated 2nd segment which
417 is broadest in the proximal part and smoothly tapers distally, its length 1.5–2 times its maximum width and somewhat more than the total length of the remaining segments. The epimeral plates are produced and pointed posteriorly (especially in epimeron III).

Urosomite I is approximately equal in length and width, and has bulged sides; the second (geminate) urosomite is at least twice longer than wide. The basipodite of uropods I is narrow, reaching the base of the telson. The basipodite of uropods II is half the length of the basipodite of pair I and distally broadened; the tip of the endopodite reaches the base of the rami of uropods III. The basipodite of uropods III is slightly broadened distally and slightly longer than wide; the rami do not reach the tip of the telson. In all uropods endopodites are slightly broader and larger than the exopodites; the margins of the rami and distal parts of the inner margins of the basipodites are denticulate. The telson has an elongated pointed tip.

The gills are well developed, in males with numerous folds on the surface, in females smooth except for the last pair, which are structured as in males. The oostegites are narrow, not touching, and not offering reliable protection to the developing brood. Undoubtedly they are assisted in this role by the first four pairs of gills.

Distribution: Tropics and subtropics; usually does not cross the limits of the Subtropical Convergences. It is a relatively eurythermic species, found at 10.7° C along the southern coast of Africa. Reproduction is not confined to a specific season and females with eggs are found throughout the year (Fage, 1960).

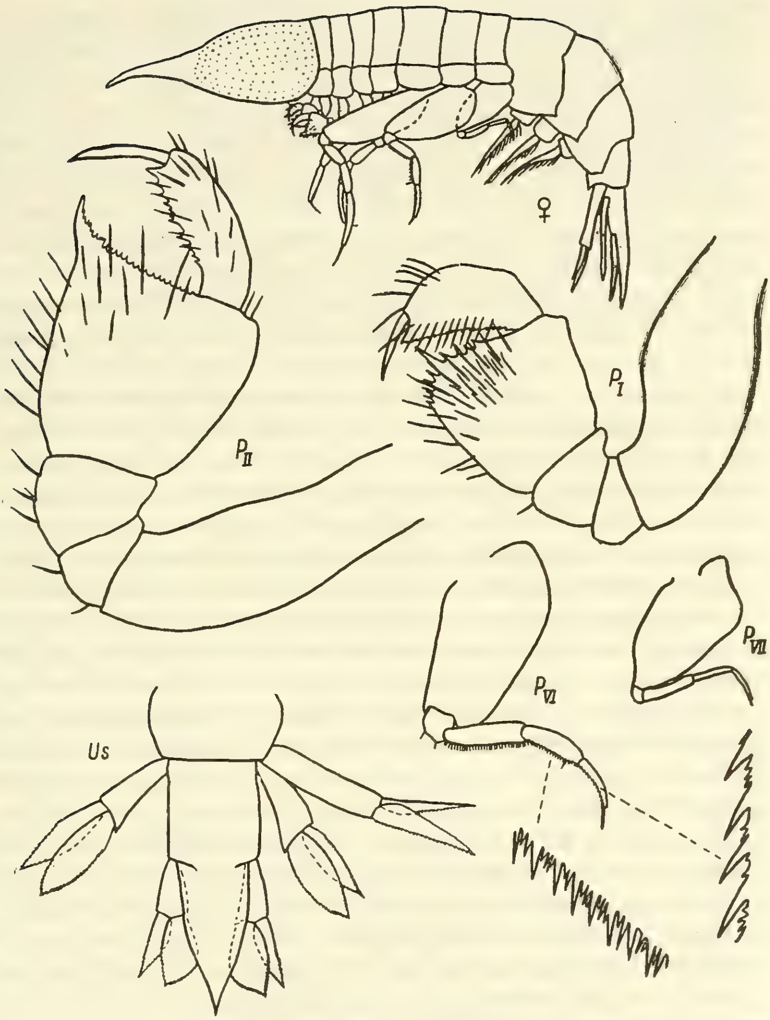
3. ***Streetsia porcella*** (Claus, 1879) (Fig. 224)

Claus, 1879b: 48 (*Oxycephalus*); 1877: 71 (*Oxycephalus*); Bovallius, 1887a: 36 (*Oxycephalus*); Stebbing, 1888: 1587 (*Oxycephalus*); Bovallius, 1890: 81; Stephensen, 1925a: 192; Barnard, 1930: 435; Pirlot, 1938: 370; Shoemaker, 1945: 255; Fage, 1960: 63; Pillai, 1966: 188.—*intermedia* Spandl, 1927: 188.—*nyctiphanes* Fage, 1934: 1631.

Length of sexually mature females 8.5–18 mm, of males 8–17 mm.

The body is compact, with a thick integument. The head is less than 1/3, in larger females less than 1/4 the total body length, and sometimes with a dorsal depression. The maximum height of the head lies in the proximal part, which is occupied by the eyes. Antennae II of males have a distally thickened 1st segment.

The height of the pereon is less than that of the head, its length equal to or slightly exceeding the length of the head; the last pereon somites



418 Fig. 224. *Streetsia porcella* (Claus).

are somewhat longer than the first ones. The 2nd segment of pereopods I has weakly bulged sides, and its length is the same as the rest of the limb; the 5th segment is barely wider than its length, the posterior distal angle forms a small roundish lobe with unevenly denticulate margins, the denticles on its tip larger than those on the margins, and the lobe together with the 6th segment forms a subchela; the 6th segment has a uniformly bulged anterior margin, a straight denticulate posterior margin, and bears on its surface, like the posterior side of the preceding segment,

short setae; the claw is more than half the 6th segment in length. The 2nd segment of pereopods II has a straight or somewhat S-shaped anterior margin and a bulged posterior one; the 5th segment is wider than its length and its posterior distal angle is extended into a triangular lobe that terminates in a stiff apical denticle and is distally denticulate; with the chela closed the lobe reaches the end of the 6th segment; the 6th segment is narrow, with almost parallel sides, its surface armed, like the posterior distal part of the preceding segment, with short setae; the claw is more than half the length of the 6th segment. The 2nd segment of pereopods III–IV is shorter than the total length of the 3rd–5th segments; the
418 4th and 5th segments are approximately equal in length; the 6th segment is much narrower and longer; ornamentation is poor, with only sparse setae present on the posterior margin of the distal segments; the claw is long, almost straight, and about half the preceding segment in length. The 2nd segment of pereopods V has a spiniform process at the place of articulation of the coxal plate, a straight or bulged anterior margin, and a uniformly bulged posterior margin; the 4th and 5th segments are about equal in size; the 6th segment is much narrower and almost twice as long as the 5th; the claw is about 1/3 the 6th segment in length; the 4th–6th segments have sparse short setae along the anterior margin. The 2nd segment of pereopods VI is broadened and has a proximally strongly bulged posterior margin that distally forms a small roundish lobe that overhangs the 3rd segment but does not reach its end; the anterior margin of the 2nd segment is straight, sometimes distally denticulate; the 4th and 5th segments are equal in length or the 5th longer, and the 6th segment is narrower and somewhat shorter; the distal segment are finely
419 denticulate along the anterior margin, the denticles especially prominent on the 4th segment; the claw is about half the length of the 6th segment. The 2nd segment of pereopods VII is ovally broadened, about equal to the total length of the remaining segments, its maximum width shifted to the proximal most part, and the posterior margin has a roundish proximal lobe that projects over the place of articulation of the leg; the 4th, 5th, and 6th segments are approximately equal in length.

The pleon is slightly shorter than the pereon but its somites are relatively massive and high—almost twice as high as the somites of the pereon. The epimeral plates are slightly stretched and pointed posteriorly. The urosome is less than 1/4 (at times almost 1/5) the total body length. The basipodite of uropods I has parallel margins and is approximately twice longer than wide; the rami are equal in length; the endopodite is very slightly broader than the exopodite. The basipodite of uropods II does not reach the end of the basipodite of uropods I but terminates at the level of articulation of uropods III, is distally broadened, and approximately twice longer than its maximum width; the rami are longer than the basipodite, broadly lanceolate, and equal in length; the endopodite is very slightly broader than the exopodite. The basipodite of uropods III is distally broadened and short, its length equal to its maximum width; the rami, especially the endopodite, are strongly broadened and longer than the basipodite. The rami of all uropods have denticulate margins and their tips fall somewhat short of the tip of the telson. The telson is triangular, with a long pointed tip, and variable in length but closer to the length of the last urosomite.

Distribution: Warm waters of the Atlantic, Pacific, and Indian oceans from 37° S to 35° S. It is common in the Mediterranean Sea. It prefers depths of 0–300 m. Females with brood in the brood chamber are found almost year round.

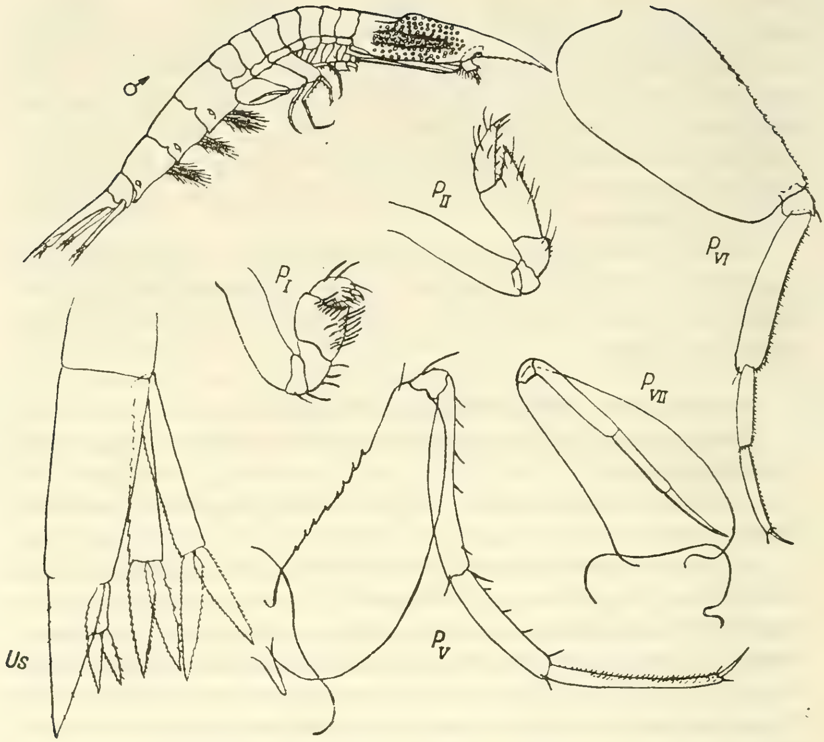
4. ***Streetsia mindanaònis*** (Stebbing, 1888) (Fig. 225)

Stebbing, 1888: 1598 (*Leptocòtis*); Bovallius, 1890: 93; Fage, 1960: 45; Pillai, 1966: 192.

Length of adult crustaceans up to 12.5 mm but generally not more than 11 mm.

The head is very large and 1/3 or more the total body length. The rostrum in males is about half the length of the head, in females somewhat shorter, stretched and pointed, with its tip sometimes bent downward. The head attains maximum height in the medial part and tapers strongly but smoothly in females anteriorly at the place of transition to the rostrum and posteriorly on transition to the neck; in males a shallow dorsal depression occurs at this site but the constriction per se is barely noticeable.

The body is narrow and the pereon approximately the same length as the pleon. The 2nd segment of pereopods I is about equal in length to the remaining segments together; the 5th segment is almost squarish, with a denticle in the anterior distal angle not reaching the tip of the 6th segment; the 6th segment has a strongly bulged anterior margin and an almost straight posterior margin that is sometimes indistinctly denticulate; the 5th–6th segments are armed on the posterior surface with numerous setae. Pereopods II are longer and thinner than pair I; the 2nd segment is approximately equal in length to the distal segments together; the 5th segment is elongated, distally slightly broadened, and 1.5 times longer than wide; the process of the distal margin falls far short of the tip of the 6th segment; the 6th segment is narrow and its length 2–2.5 times its width; the claw is very slightly more than 1/3 the length of the 6th segment. The 2nd segment of pereopods III–IV is shorter than the 4th and 5th segments together; the 3rd–6th segments bear sparse short setae on the posterior margin and the distal part of the 6th segment has a fine pecten of setae. In pereopods V a pointed, backwardly directed, spiniform process occurs between the coxa and the 2nd segment; the 2nd



420 Fig. 225. *Streetsia mindanaònis* (Stebbing) (after Pillai, 1966).

segment is barely broadened, its anterior margin straight or slightly concave and unevenly denticulate, and the maximum width of the segment occurs in its proximal part; the successive segments are narrow and long,
420 the 5th the shortest of them; the 4th and 6th segments are about equal in length; the 4th and 5th bear sparse short setae on the anterior margin, while the anterior part of the 6th segment is covered with tiny setules. The 2nd segment of pereopods VI is more strongly broadened than in pereopods V, its anterior margin straight or weakly bulged and indistinctly denticulate, and the posterior margin strongly bulged proximally; the 3rd segment has a somewhat downwardly projecting anterior margin; of the remaining segments, the 4th is the longest and the anterior margin has complex denticulation (the denticles are grouped and their size increases distally within each group); the 5th–6th segments have a uniformly denticulate anterior margin. The 2nd segment of pereopods VII is broadest proximally, its length twice its width and equal to the total length of the remaining segments, each of which is narrower and shorter than the preceding one.

Epimeral plates I–II have rounded margins. Epimeral plate III has an extended and pointed posterior distal angle. Each plate has one large cuticular pore (as in *Cranocephalus scleroticus*), whose functional importance is not clear. Urosomite I (top view) is almost square. Urosomite II (geminate) is long, somewhat tapered distally, and its length not more than twice its width. The basipodite of uropods I is narrow, not reaching the base of the telson, its margins parallel, and the inner one denticulate. The basipodite of uropods II terminates at the same level as the basipodite of uropods I, the distal part is slightly broadened, its length
421 less than twice its width, and the inner margin denticulate. The rami of all the uropods are equal in length and denticulate on both sides, their tips falling markedly short of the tip of the telson. The telson is elongated-triangular, shorter than the last urosomite, and its tip pointed, often stretched.

The gills are large and in males with a folded surface, as is the last pair in females. The oostegites are narrow; during formation of the brood chamber they are supplemented by the first four pairs of gills, which in females are roundly broadened with a smooth surface.

Distribution: Circumtropical in all oceans. Its area of distribution almost does not cross the limits of 30°N and S.

3. Genus *Leptocotis* Streets, 1877

Streets, 1877: 136; Stebbing, 1888: 1593; Bovallius, 1890: 47, 110; Stephensen, 1925a: 191; Bowman and Gruner,1973: 52.—*Dorycephalus* Bovallius, 1890: 46, 75.

The body is elongated and has a thin integument. The head is almost 1/3 the body length. The rostrum is long, tapered toward the tip, and bent downward; the lower part of the head and rostrum bears small setae but keels and denticles are absent. The head is much higher than the first somite of the pereon but forms a short constriction at the place of articulation with the pereon. The pereon is slightly larger than the pleon or the two equal in length. The coxal plates are free. The pereopods are short and weak; pereopods I and II have subchelae; pereopods VII have a strongly broadened 2nd segment, are reduced distally, and three- to five-segmented.

The urosome is equal in length to the pleon. The rami of uropods II are free in males, but the endopodite fused with the basipodite in females. The endopodite of uropods III is fused with the basipodite in both sexes. The last (geminate) urosomite is fairly long—2.5–3 times the length of the telson. Uropods I–II are long, uropods III are very short. The telson is elongated-triangular with a highly pointed tip.

Type species: *Leptocotis spinifera* Streets, 1877.

The genus is monotypic.

1. ***Leptocotis tenuirostris*** (Claus, 1871) (Fig. 226)

Claus, 1871: 155 (*Oxycephalus*); Bovallius, 1890: 113; Stephensen, 1925a: 191; Fage, 1960: 37; Pillai, 1966: 181.—*spinifera* Streets, 1877: 137.—*lindstroemi* Bovallius, 1887a: 38; 1890: 76 (*Dorycephalus*). Colosi, 1918: 218 (*Dorycephalus*).—*ambobus* Stebbing, 1888: 1594; Colosi, 1918: 218 (*Dorycephalus*); Spandl, 1927: 203 (*Dorycephalus*).—*similis* Spandl, 1927: 204.

Body length 9–10 mm; sometimes males are larger, upto 12.5 mm.

The head in females has a weakly developed neck, in males the basal constriction of the head is sharply defined on the dorsal side. Weak sexual dimorphism has been observed in the structure of the head: in males it is higher and the rostrum thinner and pointed; in females the head merges smoothly into the rostrum. The basal segment of the flagellum of antennae I in males has an extended outer distal angle; the other segments (small and narrow) originate from the middle of the distal margin of this segment.

The 2nd segment of pereopods I is bulged on both sides and equal in length to the rest of the leg; the 5th segment is distally broadened,

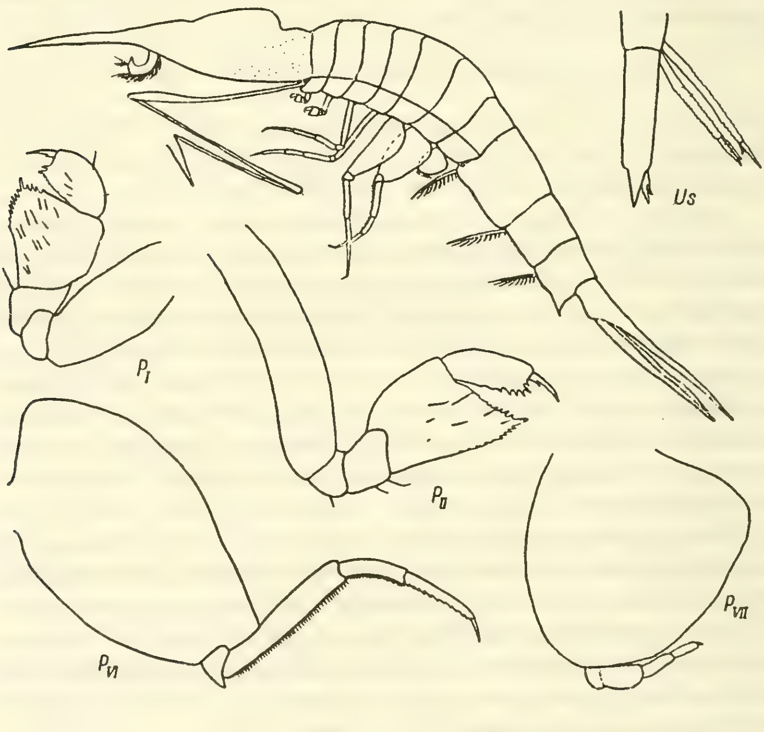


Fig. 226. *Leptocotis tenuirostris* (Claus), male.

its width on the distal margin twice that at the base, and equal to the length of segment; the posterior distal angle is roundly extended and armed with stiff denticles, of which the apical is the largest; the 6th segment is relatively broad, its anterior margin strongly bulged, and its posterior margin distally denticulate, straight, or slightly bulged distally; the claw is slightly curved and has a denticle in the middle of the posterior
422 margin; the 5th–6th segments bear spiniform setae on the posterior side. The 2nd segment of pereopods II has a barely bulged anterior margin and is longer than the rest of the leg; the projection of the posterior distal margin of the 5th segment is pointed and the apical spine reaches the distal margin of the 6th segment; the 6th segment is relatively narrow (width much less than half the maximum width of the 5th segment) and the margins are parallel. The ornamentation of pereopods II is similar to that in pereopods I.

The 2nd segment of pereopods V is elongated-oval, its maximum width occurring in the proximal part, the anterior margin straight, the posterior one bulged, and isolated setae arranged regularly on both sides; the 4th–6th segments have finer setae on the anterior margin, while in each successive segment the setae are denser. The 2nd segment of pereopods VI is broader than in pereopods V, oval or ovate, smooth, has a uniformly bulged anterior and proximally bulged posterior margin, and is equal in length to the rest of the leg; ornamentation of the 4th segment is quite specific: a pecten of fine stiff denticles; the 6th segment has larger spines on the anterior margin separated by groups of smaller ones. Pereopods VII usually have a full complement of segments, but sometimes the distal part of the leg consists of just three segments; the coxal plate is almost the same size as the 2nd segment and its lower angle extended backward. The shape of pereopods VII is highly variable, of no taxonomic significance, and cannot serve as a criterion for separating infraspecific categories or independent species.

Epimeral plates I–II are roundish and the posterior distal angle of epimeral plate III is extended and pointed. Urosomite I is almost square; the geminate urosomite is very long.

423 The basipodite of uropods I is narrow, reaching the base of the telson, extending beyond the end of the basipodite of uropods II, and its sides denticulate, the inner margin more finely so than the outer; the exopodite is lanceolate and similar in denticulation to the basipodite; the endopodite is greatly reduced, 1/7–1/6 the length of the exopodite, and also has denticulate margins. The basipodite of uropods II is also denticulate; sexual dimorphism is manifest not only in fusion of the basipodite with the exopodite in females but even in the ornamentation of the endopodite: in females the margins of the endopodite have smooth denticles, while in males the denticles on the outer margin of

the endopodite are finely serrate on the outer side and smooth on the inner side. The margins of the exopodite in both sexes have simple denticles. The short basipodite of uropods III is fused with the longer endopodite and the reduced exopodite in the form of a small stiff spine; the endopodite is denticualte on both sides and its tip does not reach the tip of the telson. The telson is elongated-triangular, has an extended pointed tip, and is 2.5–3 times longer than its width at the base.

The oöstegites are narrow, poorly developed; the gills, contrarily, are broad and without doubt supplement the function of the oostegites in the formation of the brood chamber.

Distribution: Found in all oceans from 46° N up to 41° S. It is most common in the Indo-West Pacific region and absent along the western coast of Africa and in the Mediterranean and Red seas; it is fairly eurybiotic but not found at temperatures below 18.5° C and with a salinity above 37%.

4. Genus *Calamorhynchus* Streets, 1878

Streets, 1878: 285; Bovallius, 1890: 72; Stebbing, 1888: 1599; Spandl, 1927: 197; Bowman and Gruner, 1973: 50.

The body is elongate. The head is very large, 1/3 the total body length, and slightly constricted at the base in the form of a neck; the dorsal part of the head has a longitudinal medial keel; the rostrum constitutes half the total length of the head, with broad lateral and low ventromedial keels.

The pereon is approximately the same length as the pleon. Pereopods I and II have well-developed subchelae and the distal margin of the 5th segment is obliquely truncate, with an extended posterior angle. Pereopods VII are seven-segmented; the 2nd segment is broad and not smaller than in pereopods V–VI, being equal to or slightly longer than the distal part of the leg. The coxal plates are fused with the somites of the pereon. The urosome is relatively long, nearly 1/4 the total body length, and longer than the pleon. The last (geminate) urosomite is fairly long: its length is approximately three times its width, but if considered from the place of articulation of uropods II, urosomite II is very short. uropods I and II have free rami. The endopodite of uropods III is fused with the basipodite. The telson is elongated-triangular and has a pointed tip.

Type species: *Calamorhynchus pellucidus* Streets, 1878.

The genus is monotypic.

1. ***Calamorhynchus pellucidus*** Streets, 1878 (Fig. 227)

Streets, 1878: 285; Bovallius, 1890: 73; Spandl, 1927: 198: Pirlot, 1938: 371; Shoemaker, 1945a: 251; Fage, 1960: 31; Pillai, 1966: 182.—*rigidus* Stebbing, 1888: 1600; Stephensen, 1925a: 189.

Length of sexually mature females up to 22.5 mm, of males up to 18.5 mm.

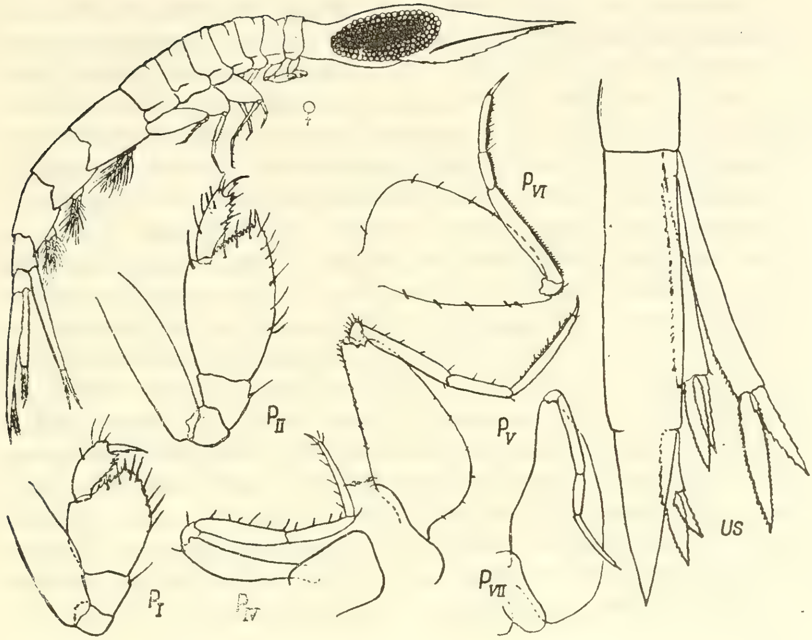


Fig. 227. *Calamorhynchus pellucidus* Streets (after Pillai, 1966).

In the head the longitudinal dorsomedial keel is better developed in the male than in the female. The lateral keels are slightly denticulate, due to them the maximal width of the head occurs at the base of the rostrum and the proximal part, occupied by the eyes, is somewhat narrower.

424 The 2nd segment of pereopods I is shorter than the rest of the leg and its anterior margin very slightly bulged; the 5th segment is markedly broadened, has bulged sides, and the posterior distal part of the segment forms a broad lobe with a stretched tip and is coarsely denticulate with spiniform submarginal setae; the 6th segment is somewhat narrowed proximally, has a bulged anterior and denticulate posterior margin, and bears sparse spiniform setae on the surface. The 2nd segment of pereopods II is narrow and shorter than the rest of the leg; the 5th segment is longer than wide, and has bulged margins; the distal margin is obliquely truncate and forms a broad uniformly denticulate lobe with stiff submarginal setae; the tip of this lobe has a pointed apical denticle; the 6th segment is narrower than in pereopods I and has almost parallel margins. The 4th–6th segments of pereopods III–IV bear sparse setae on the posterior margin. The 2nd segment of pereopods V is broadened and somewhat shorter than the distal part of the leg; the 4th–5th segments are narrow and bear isolated setae on the anterior margin; the 6th segment

in addition has a dense brush of fine setae in the distal part. The 2nd segment of pereopods VI is approximately the same length as the distal part of the leg, is proximally more markedly broadened than in pereopods V, and its anterior margin is barely bulged. The 2nd segment of pereopods VII gradually tapers distally and its length is approximately twice its maximal width. In the epimeral plates the posterior angle is stretched into a pointed tooth. The basipodite of uropods I extends far beyond the tip of the basipodite of uropods II, is denticulate on the inner side and smooth on the outer, and is eight–nine times longer than wide; the endopodite is appreciably longer than the exopodite and has denticulate margins. In uropods II the inner margin of the basipodite and the rami are denticulate and the tips of the rami reach the end of the basipodite of uropods III. Uropods III are shorter than the telson; the endopodite is almost the same length as the basipodite, whose length is twice its width. The telson is 2–2.5 times longer than its width at the base.

Distribution: A tropical species found in three oceans, where it is
425 distributed from 38° N to 41° S, and is relatively euryhaline. It is also found in the Mediterranean, Red, Sulu, and South China Seas. It inhabits the upper 100 m layer throughout its distribution, rarely penetrating deeper. Reproduction apparently occurs year round.

5. Genus *Tullbergella* Bovallius, 1887

Bovallius, 1887a: 38; 1890: 68; Bowman and Gruner, 1973: 53.

The body is compact with a broadened pereon. The head is spherically bulged, relatively short, and higher than the first somite of the pereon; the rostrum is about half the total length of the head. The neck is absent. All the coxal plates are separate from the somites of the pereon. Pereopods I and II terminate in subchelae formed by the distal margin of the markedly broadened 5th segment and the 6th segment. The 2nd segment of pereopods VI has a sharply stretched posterior distal angle. Pereopods VII have a reduced, three-segmented distal part.

The urosome is approximately the same length as the last two somites of the pleon together. Uropods I and II have free rami; the endopodite of uropods III is fused with the basipodite. The telson is small and triangular.

Type species: *Tullbergella cuspidata* Bovallius, 1887.

Notes: This genus differs from most other genera of the family Oxycephalidae in a thickset body broadened in the thoracic region and a thick integument. These features are evidently associated with the mode of life of *Tullbergella* which, according to Barnard (1931) live under the bell of medusae. Fage (1960) cites representatives of the genus *Hyperia* with an analogous shape and identical ecology.

The genus is monotypic.

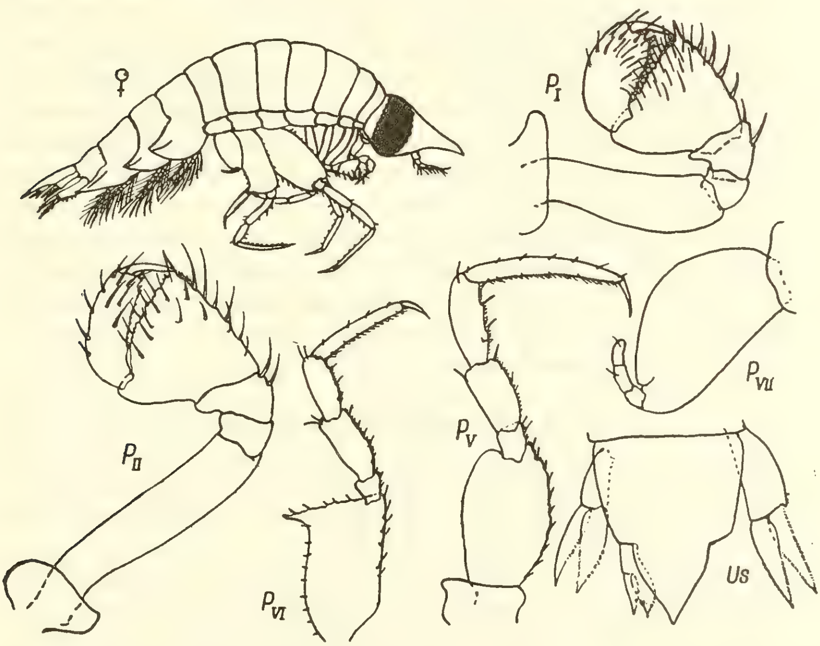
1. ***Tullbergella cuspidata*** Bovallius, 1887 (Fig. 228)

Bovallius, 1887a: 38; 1890: 69; Spandl, 1927: 191; Fage, 1960: 30; Pillai 1966: 179.

Length of sexually mature individuals up to 10 mm.

The head with rostrum is approximately equal to the total length of the first four pereon somites. Viewed dorsally, the rostrum is triangular, viewed laterally, it is sharply narrowed and pointed.

The 2nd segment of pereopods I has a straight anterior margin, a distally bulged posterior margin, and is equal in length to the rest of the leg; the 4th segment is distally broadened and posteriorly bears two distal setae; the 5th segment is almost triangular, its distal margin twice the width at the base and about equal to the length of segment along the posterior margin, and the posterior distal angle stretched into a pointed denticle; the subchela is formed by the denticulate posterior margin of the movably articulated 6th segment and distal margin of the 5th segment; the distal parts of the 5th–6th segments are covered with stiff setae. The 2nd segment of pereopods II is longer, and longer than the rest of the leg; the proportions and ornamentation of the subchela are similar; and the 6th segment is relatively longer and narrower than in pereopods I. In pereopods III–IV the posterior margin of the 4th–6th segments bears sparse



426 Fig. 228. *Tullbergella cuspidata* Bovallius (after Pillai, 1966; Bowman and Gruner, 1973).

setae with groups of small denticles between them. The 2nd segment of pereopods V is broadened, oval, 1.5 times longer than wide, and the anterior margin indistinctly denticulate with short spiniform setae; similar setae occur on the anterior margin of the remaining segments and are interspersed with groups of small denticles; the 6th segment is long and equal in length to the 3rd–5th segments together. The 2nd segment of pereopods VI has a characteristic shape: the anterior margin is proximally bulged, medially and distally straight and slightly denticulate, the distal margin straightly truncate, and the posterior distal angle sharply
426 stretched backward, pointed, and sometimes with a proximally bent tip; the distal segments are the same as in the preceding pereopods but the 6th segment is relatively shorter. Pereopods VII reach only the middle of the 2nd segment of pereopods VI and are five-segmented; the 2nd segment has a straight anterior margin, highly bulged posterior margin, and its width is 2/3 its length; the distal three-segmented part of the pereopods is almost half the length of the 2nd segment.

In the epimeral plates the posterior distal angle is pointed and strongly stretched. The basipodite of uropods I is distally denticulate on the outer margin; the rami are equal to the basipodite in length, almost do not differ mutually, their margins irregularly denticulate with large denticles alternating with groups of smaller ones, and the tips of the rami reach the tips of uropods III. Uropods II are shorter than uropods I, mainly because the basipodite is less than half as long as in pair I; the margins of the rami are denticulate; the endopodite is broader than the exopodite. Uropods III are the same length as the basipodite of uropods I; the basipodite is wider than its length but shorter than the rami; the endopodite is fused with the basipodite and strongly broadened proximally; the exopodite is narrower and somewhat shorter than it; the margins of the rami are denticulate. The telson has a pointed or blunt tip.

Distribution: A rare species. It is distributed in the surface waters of the Indo-west Pacific (Malayan Archipelago, Great Barrier Reef, northeastern part of the Indian Ocean).

6. Genus *Glossocephalus* Bovallius, 1887

Bovallius, 1887a: 35; 1890: 105; Steuer, 1911: 12; Stephensen, 1925a: 202; Chevreux and Fage, 1925: 432; Spandl, 1927: 196; Bowman and Gruner, 1973: 51.—*Elsia* Giles, 1887: 250.

The body has a thin integument. The head is relatively short, in females and young males spherically bulged, with a small roundish rostrum, and shorter than the first four somites of the pereon; in larger males
427 the head is elongated and not bulged, its length approximately equal to the first four somites of the pereon.

The first two somites of the pereon are very small, their total length equal to that of the third somite. The coxal plates are separated from the pereon except for the coxae of pereopods VII. Pereopods I–II are very small and have poorly developed chelae. Pereopods III–IV are remarkably thin and relatively long, equal in length or somewhat longer than pereopods V–VI. the 2nd–6th segments of pereopods V–VI are broadened and the claws very small. Pereopods VII are small and have an oval flat 2nd segment and virgate distal segments; the total length of the latter is less than or equal to the 2nd segment.

The pleon is shorter than the pereon. The urosome is short; urosomite I is more than twice wider than long; the second (geminate) urosomite is approximately equal in length and width and slightly tapers distally. The telson is roundish and fused with the last urosomite. The rami of all the uropods are free.

Type species: *Glossocephalus milneedwardsi* Bovallius, 1887.

The genus is monotypic.

1. ***Glossocephalus milneedwardsi*** Bovallius, 1887 (Fig. 229)

Bovallius, 1887a: 35; 1890: 106; Stephensen, 1925a: 202; Chevreux and Fage, 1925: 433; Spandl, 1927: 196; Shoemaker, 1945a: 253; Fage, 1960: 83; Pillai, 1966: 186.—*spiniger* Bovallius, 1887a: 35.—indica giles, 1887: 250 (Elsia).—*adriaticus* Steuer, 1911: 682.

Length of sexually mature crustaceans up to 17 mm.

The head in females and young males is strongly bulged in the proximal part and ventrally roundly projects downward and backward, covering the neck; dorsally the neck remains visible; the occipital part of the head is steeply elevated. The rostrum is rounded anteriorly, concave ventrally, and dorsally forms a straight line with the proximal part of the head occupied by the eyes (lateral view). The longer axis of the head forms a small angle with the longitudinal axis of the body, imparting a unique appearance to the crustacean.

Pereopods I–II do not reach the middle of the 2nd segment of pereopods III; their 2nd segment is longer than the distal segments together; the chelae formed by the process of the 5th segment and the 6th segment are weak; the 5th segment is less broadened and its process in pereopods I does not reach, in pereopods II reaches the base of the claw; often the process is additionally ornamented with a group of short spiniform setae at the base or on the inner side. Pereopods III–IV are unusually thin and longer than the other legs. Pereopods III are longer than pereopods IV, their 2nd segment the same length as the 4th–5th segments together; of the distal segments, the 4th is the longest; the claws are very small; all the segments are armed with short setae. Pereopods V–VI are identical and have broadened segments, especially in pereopods V. The 2nd segment of pereopods V is 2.5–3 times longer than wide and narrow at the

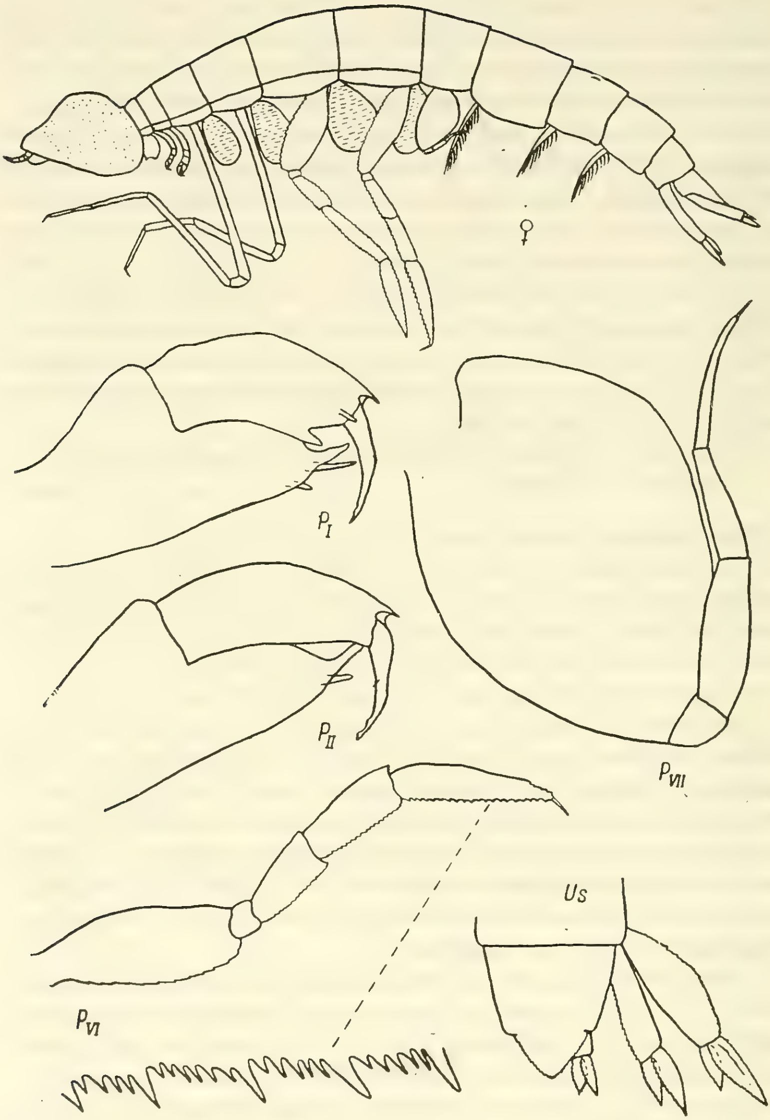


Fig. 229. *Glossocephalus milneedwardsi* Bovallius.

base; the 4th segment is elongated but shorter than the next one and distally broadened; the 5th and 6th segments are flat, the 6th somewhat shorter than the 5th, which is equal to the 2nd in length; the claw is small. The 2nd segment of pereopods VI has the same proportions as in pereopods V; the 4th and 5th segments are equal in length and the 6th;

1.5 times longer than the 5th; the claw is small. Pereopods VII are short and have an oval, broadened 2nd segment which is longer than wide; the distal part of the leg is usually bent upward, the segments virgate, and the 4th segment the largest.

The pleon is about 2/3 the pereon in length, but massive and higher than the latter. In the epimeral plates the posterior angle is sometimes slightly stretched but always rounded at the tip. In uropods I the basipodite is 2.5–3 times longer than its width and the margins barely
428 bulged; the exopodite is twice as long and wide as the endopodite. In uropods II the basipodite is narrower and terminates almost at the same level [with basipodite of uropods I], with distal projecting angles; the endopodite is 3/4 the length of the exopodite. The basipodite of uropods III is short, narrowed at the base, and its width greater than its length; the rami are longer than the basipodite and the exopodite slightly longer than the endopodite. The tips of the rami of all the uropods extend beyond the tip of the roundish telson. The margins of the rami and the telson are finely denticulate.

The first pair of gills is absent in males; in females the number of gills is normal but the first two pairs are small. Only three pairs of oostegites are present, the fourth pair totally undeveloped; functionally this is partially compensated by the strong enlargement of the third pair, which adjoins the last pair of gills.

Distribution: Circumtropically distributed from 30° N up to 40° S; found in the Mediterranean and Red seas.

429
7. Genus *Cranocephalus* Bovallius, 1890

Bovallius, 1890: 96; Pirlot, 1938: 370; Shoemaker, 1945a: 251; Fage, 1960: 72; Pillai, 1966: 184; Bowman and Gruner, 1973: 51.—*Stebbingella* Bovallius, 1890: 97.

The body is massive and cylindrical and the pereon somewhat bulged. The integument is compact and in larger specimens strongly calcified (whence the name of the only species of the genus, *scleroticus*). The head is large, variable in shape, about 1/4 the total body length, sharply tapered at the base, and has a short but distinct neck. The rostrum is broad at the base, approximately half the head in length, and has a weak dorsal keel. In younger individuals the head is spherically bulged and the rostrum is pointed, relatively short, and sharply tapers to a stretched tip.

The pereon is longer than the pleon and its dorsal surface uneven because the somites have shallow transverse furrows. The coxal plates are fused with the pereon and the border of the fusion is noticeable. The first two pereopods have subchelae. The 2nd segment of pereopods V–VII is strongly broadened and has a series of cuticular pores on the surface. Such pores are also present on the surface of the somites of the pereon and the pleon. Pereopods VII have a full complement of segments; the distal part is shorter than the 2nd segment and sometimes bent upward. The pleon is massive, its height less than that of the middle somites of the pereon. The urosome is shorter than the pleon and about 1/6–1/5 the total body length. The geminate somite is much longer than its width. The rami of all the uropods are free. The basipodite of uropods I extends beyond the base of the telson. Uropods II are shorter than uropods I and uropods III the shortest: the basipodite and rami are approximately equal in length and the tips of the rami do not reach the tip of the telson. The telson is narrowly triangular and fused with the urosome.

Type species: *Cranocephalus goesi* Bovallius, 1890.

1. ***Cranocephalus scleroticus*** (Streets, 1878) (Fig. 230)

Streets, 1878: 281 (*Oxycephalus*); Bovallius, 1880: 98 (*Stebbingella*); Shoemaker, 1945a: 251; Fage, 1960: 72; Pillai, 1966: 184;—*typhoides* Claus, 1879b: 195 (*Oxycephalus*); 1887: 72 (*Oxycephalus*); Bovallius, 1890: 100 (*Stebbingella*); Stephensen, 1925a: 199 (*Stebbingella*); Spandl, 1927: 193 (*Stebbingella*).—*goesi* Bovallius, 1890: 95.—*theelii* Bovallius, 1890: 101 (*Stebbingella*).

Length of sexually mature crustaceans varies from 5.8 to 17 mm and even 21 mm.

The head in smaller specimens narrows sharply toward the rostrum, which constitutes less than half the entire head length; in larger specimens the transition to the rostrum is smooth and the rostrum itself is relatively longer than the proximal part of the head occupied by the eyes.

The first and last somites of the pereon are approximately equal in height to the head, the middle somites appreciably higher, especially in females in which the pereon is massive due to the strong broadening of the 2nd segment of pereopods V–VII. In pereopods II–IV the anterior margin of the coxal plates projects roundly, while that in pereopods V projects roundly on both sides and is armed in the middle with a sharp pointed process directed backward. The 2nd segment of pereopods I is bulged on both sides and equal in length to the rest of the leg; the 5th segment is wider than its length, the posterior distal angle slightly stretched into a pointed denticulate process, and the anterior distal angle projects; the 6th segment has a strongly bulged anterior margin; the claw is slightly curved. The 2nd segment of pereopods II has barely bulged margins; the 5th segment is approximately equal in length and width and the distal projection of the posterior margin denticulate in larger individuals but smooth in younger ones; the 6th segment has a
431 barely bulged anterior margin and its length is twice its width. The 2nd segment of pereopods V is broader, the anterior margin barely bulged, the posterior margin distally with a rounded projection, the proximal part also roundly projecting, and the maximum width of the segment occurs in

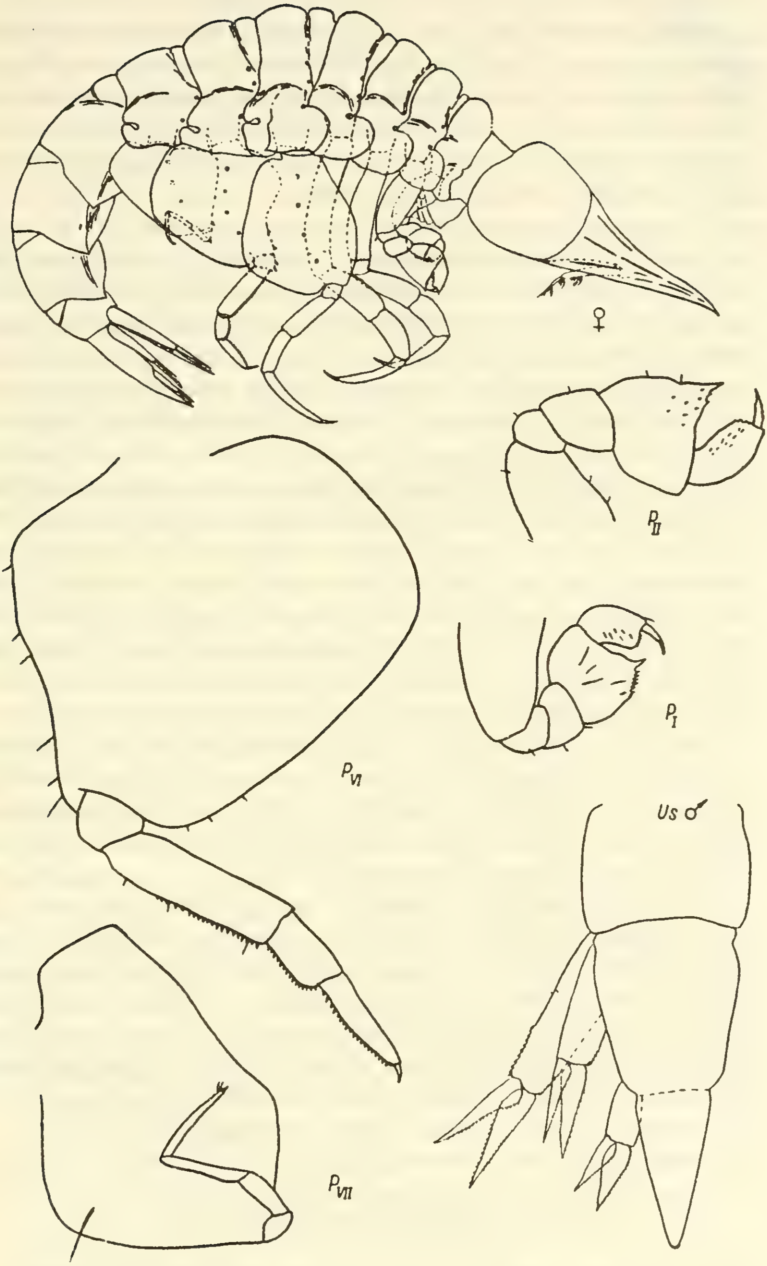


Fig. 230. *Cranocephalus scleroticus* (Streets)
(♀—after Shoemaker, 1945a; Us of ♂—after Fage, 1960).

the distal part. In pereopods VI the maximum width of the 2nd segment is shifted proximally and exceeds its length; the remaining segments together are equal in length to the 2nd segment. In pereopods VII the anterior margin of the 2nd segment is strongly bulged, the posterior margin proximally stretched as an angle and distally straightly truncate or slightly concave; the remaining segments are virgate and their total length is less than that of the 2nd segment.

The epimeral plates in smaller individuals are roundish, in larger ones have a pointed posterior angle. Urosomite I is shorter than the geminate urosomite and very slightly wider than long. The basipodite of uropods I extends beyond the base of the telson and is denticulate in the distal part; the exopodite has denticulate margins; the endopodite is very slightly broader at the base than the exopodite, somewhat longer than it, and denticulate on both sides. The basipodite of uropods II is shorter than in uropods I, in males approximately the same width, in females much narrower, and the distal part of the inner margin denticulate. The basipodite of uropods III is short, its length not more than twice its width, and equal to the length of the rami; the exopodite is shorter than the endopodite; the tips of the rami do not reach the tip of the telson. The telson is the same length as the last urosomite (especially in indivduals smaller than 13 mm) or shorter than it (in larger individuals). The tip of the telson is stretched and pointed in younger crustaceans and females, but the telson narrowly triangular with a blunt tip in larger males.

The three anterior pairs of gills in females are large and roundly broadened, the two posterior pairs are elongated and folded, as in males. The oostegites are reduced and narrow. Closure of the brood chamber is effected by the combined action of the anterior gills, the oostegites, and the broad basal segments of pereopods V–VII.

Notes: The disposition of cuticular pores on the body integument is fairly constant: each of the somites of the pereon has one–three pores on each lateral side of the anterior margin. Somite I, in addition to these pores, sometimes has one pore on the posterior margin. One pore also occurs on each side of the ventral margin in every somite of the pleon. The number of pores and their linear disposition on the surface of the basal segments of pereopods V–VII are variable: in larger individuals the usual number of pores is respectively 4, 4, 3, and in smaller individuals 3, 3, 2.

Distribution: Broadly circumtropical; its farthest report are from 40° N and S. It is not found in the Red Sea.

8. Genus *Rhabdosoma* White, 1847

White, 1847: 138; Stebbing, 1895: 366; Spandl, 1927: 207; Fage, 1960: 87; Bowman and Gruner, 1973: 52.—*Xiphocephalus* Bovallius, 1890: 118, 125.—*Macrocephalus* Bate, 1858.—*Rhabdonectes* Bovallius, 1887: 39.

The body is exceptionally thin and long. The head together with the neck and rostrum is longer than the pereon and often larger than the pereon and pleon together. The neck is very narrow, of the same length as the central part of the head occupied by the eyes, or very slightly longer. The rostrum is acicular and very long.

The pereon is just shorter than or equal to the pleon in length. The pereon somites are low, the boundaries between them sometimes not clearly developed. The coxal plates are completely fused with the pereon. The pereopods are thin, relatively short and weakly armed. Pereopods VII are greatly reduced, sometimes one- to two-segmented; however, this character is variable and there are specimens of the same species, sex, and size in which the degree of reduction of pereopods VII varies significantly—from greatly reduced to completely segmented.

432 The urosome is longer than the pleon, with highly elongated and tapered somites and uropods. The endopodites of uropods II–III are fused with the basipodites. The telson may be long, acicular, or relatively short, virgate. It is generally separated from the last urosomite, rarely fused with it.

Type species: *Oxycephalus armatus* Milne-Edwards, 1840.

Notes: Representatives of the genus *Rhabdosoma* appear so grotesque, and in some morphological features so far removed from the most "typical" genera of the family Oxycephalidae (*Oxycephalus, Streetsia*) that Bovallius (1890) and later Stebbing (1895) and Spandl (1927) thought it possible to include them in an independent family (Xiphocephalidae—according to Bovallius, and Rhabdosomidae—other authors). At present, the majority of investigators, following Stephensen (1925a), include the genus *Rhabdosoma* in the family Oxycephalidae. Stephensen convincingly showed that some characters used by Bovallius and Stebbing to include this genus in an independent family (shape of pereopods VII, separation or fusion of the telson and urosome) are subject to variation, while other characters are simply the result of confusion (absence of brood plates in females), and still others have a very wide range of variation for the family Oxycephalidae, exhibiting its extreme manifestations (strong elongation of the body with tapered rostrum and urosome).

The genus includes four species.

KEY TO SPECIES OF GENUS RHABDOSOMA

1. Body size up to 7–15 cm. Telson pointed at tip, longer than uropods II. Females with five pair gills at base of pereopods II–VI .. .. 2.

— Body size rarely exceeding 2.5 cm. Telson broadly rounded at tip, much shorter than uropods II. Females with two pairs of gills at base of pereopods V–VI .... 3.

2. Exopodites of uropods II–III rudimentary. Process of 5th segment of pereopods I with additional tooth on posterior margin. Male with three pairs of gills at base of pereopods IV–VI ....1. ***R. armatum*** (M.-Edw.)

— Exopodites of uropods II–III well developed; additional tooth on process of 5th segment of pereopods I absent. Males with two pairs of gills at base of pereopods V–VI .... 2. ***R. whitei*** Bate.

3. Length of telson not less than half length of last urosomite, reaching tips of uropods II................................ 4. ***R. minor*** Fage.

— Telson much shorter than half length of last urosomite, falling far short of tips of uropods II.............. 3. ***R. brevicaudatum*** Stebb.

1. ***Rhabdosoma armatum*** (Milne-Edwards, 1840) (Fig. 231)

Milne-Edwards, 1840: 451 (*Oxycephalus*); Bovallius, 1890: 119 (*Xiphocephalus*); Spandl, 1927: 210; Pirlot, 1938: 374; Fage, 1960: 88; Pillai, 1966: 196.—*sanzoi* Cecchini, 1929: 12.

Tshe actual size of the crustacean is difficult to measure since in capturing, the tapered ends of the rostrum and telson break off. The maximum size of sexually mature females reaches 152 mm, of males 80 mm.

The rostrum is longer in females than in males, piliform, and tapered toward the tip; the height of the middle part of the head, occupied by the eyes, is almost equal to the height of the pereon.

Pereopods I and II are very small and their 2nd segment is very
433 slightly shorter than the remaining segments together. In pereopods I the structure of the chela is characteristic for the species: the maximum width of the 5th segment is more than its length; the distal process is large, its length half the posterior margin of the segment, and reaches the base of the claw; the 6th segment is short, has a bulged anterior margin, and the distal part of the posterior margin also forms a pointed triangular process that does not reach the tip of the claw and is denticulate on both sides. The 5th segment of pereopods II is somewhat elongated and has a narrow distal process that almost reaches the tip of the claw and is denticulate on the inner side; the 6th segment is elongated and its distal process reaches almost the middle of the claw. The 4th segment of pereopods III–IV is broader and longer than all the others and the 5th segment approximately half the length of the 4th. Pereopods V are the longest; the 2nd segment is strong, linear, of the same width as the 4th but appreciably longer. Pereopods VI are much shorter than pair V; the 2nd segment is barely broadened and the remaining segments virgate. Pereopods VII are reduced, generally in the form of unsegmented

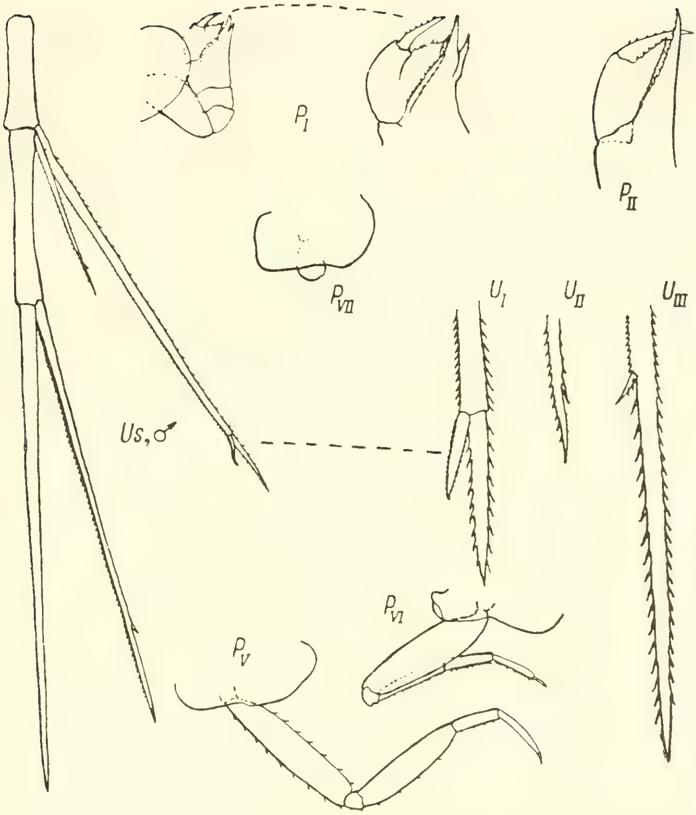


Fig. 231. *Rhabdosoma armatum* (Milne-Edwards) (after Pillai, 1966; Us of ♂—after Fage, 1960).

roundish appendages, but sometimes the reduction is not that great and the leg is three-to five-segmented; rarely, an asymmetry is discernible in the development of the right and left limbs of this pair. Males have three pairs of gills, located on somites IV–VI of the pereon.

In adult individuals the pleon is shorter than the pereon, especially in males; in younger individuals they are equal in length. The pleopods are short and poorly developed. Urosomite II (geminate) is 1.5–2 times longer than urosomite I. The uropods and telson are very long. Uropods I
434 extend far beyond the base of the telson; the endopodite is shorter and narrower than the exopodite. Uropods II in adult crustaceans do not reach the base of the telson. Uropods III are the longest (especially in females). In uropods II–III the exopodites resemble short spiniform setae. The telson in females is pointed and its length equal to the pereon and the pleon together; in males it is blunt-tipped and about half the total length

of the pereon and the pleon. The telson is much longer than uropods III in adult females, in males slightly so. In longer individuals the telson may be shorter than uropods III or equal to it in length.

Distribution: Found in the tropics and subtropics of the Pacific, Indian and Atlantic oceans; it has not been reported in the Mediterranean Sea. Everywhere not numerous. The preferred depths are 25–50 m. Reproduction occurs year round.

435 2. ***Rhabdosoma whitei*** Bate, 1862 (Fig. 232)

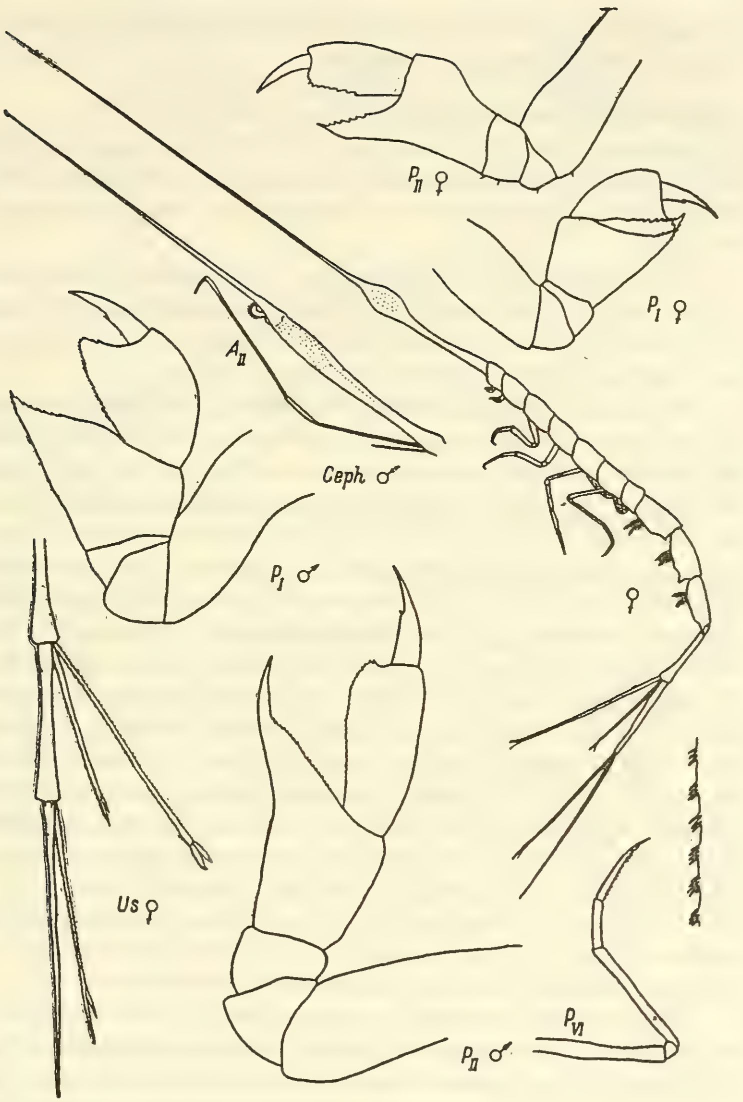
Bate, 1862: 345; Bovallius, 1890: 118, 125 (*Xiphocephalus*); Stephensen, 1925a: 207; Spandl, 1927: 208; Pirlot, 1938: 373; Shoemaker, 1945a: 255; Fage, 1960: 97; Pillai, 1966: 194.—*armatum* Claus, 1887: 74; Stebbing, 1888: 1607.—*investigatoris* Giles, 1887: 219.—*lilljeborgi* Bovallius, 1890: 119 (*Xiphocephalus*).

Length of females up to 74 mm, of males up to 62 mm.

The body proportions in general are identical to those in *R. armatum*. The rostrum is approximately 1/3 and the pereon and the pleon together 1/4 the total body length.

The 5th segment of pereopods I is distally broadened and the posterior distal angle projects as a triangular lobe with a sharp pointed tip, extending in females beyond the base of the claw, and in males shorter; the 6th segment has a bulged anterior margin and the posterior margin in females has a distally pointed process reaching the middle of the claw, while in males the process is rounded; the processes of the 5th–6th segments are denticulate. The 5th segment of pereopods II is elongated and the distal process of the posterior margin is narrow, extending in females beyond the base of the claw, in males not reaching it; the length of the 6th segment is twice its width and the posterior margin projects distally, forming in females a triangular, in males a rounded low projection. The 4th segment of pereopods III–IV is longer but broader than the rest. In pereopods V–VI the segments are also narrow and the distal ones of pereopods VI bear thin spines on the anterior margin. Pereopods VII are reduced to unsegmented oval plates. Males have only two pairs of gills, located on somites V–VI of the pereon. In females the oostegites are in the form of narrow separated plates.

Unlike in *R. armatum*, the pleon in adult females is very slightly longer than the pereon. The pleopods are poorly developed. The urosome is long and thin. Urosomite II is somewhat longer than urosomite I. Uropods I extend much beyond the base of the telson and have approximately equally developed narrowly lanceolate rami. In uropods II–III the endopodites are longer than the exopodites. Uropods II are appreciably longer than the last urosomite. Uropods III are the longest but do not reach the tip of the telson. The telson is pointed in both sexes.



434 Fig. 232. *Rhabdosoma whitei* Bate.

Distribution: The most widespread and very commonly found species of the genus Rhabdosoma. It is known from the tropics and subtropics of the Pacific, Indian, and Atlantic oceans (from 40° N to 40° S), and inhabits the Caribbean, Mediterranean and Red seas. Preferred depths are up to 200 m, although it may be found deeper also. Reproduction reported as year round; apparently, several successive egg-layings are possible since females are encountered with formed embryos in the brood chamber simultaneous with eggs in the ovaries, ready for oviposition.

3. ***Rhabdosoma brevicaudatum*** Stebbing, 1888 (Fig. 233)

Stebbing, 1888: 1612; Bovallius, 1890: 118 (*Xyphocephalus*); Garbowsky, 1895: 199 (*Pseudanurus*); Stebbing, 1895: 366; Spandl, 1924: 271; Stephensen, 1925a: 205; Fage, 1960: 104.—? *brachyteles* Stebbing, 1895: 369.

Length of females up to 32 mm; sexually mature male not described.

The rostrum is thin, fragile, and in adult crustaceans equal in length to the rest of the head, pereon, and pleon together. The neck is thin, long, and basally with a pointed ventral projection.

Pereopods I and II are identical to those in R. whitei; the process of the 5th segment of pereopods I appreciably extends beyond the base of the claw, in pereopods II reaches the middle of the claw but may exceed
436 the length of the segment itself; the process of the 6th segment is less developed than in *R. whitei* and its margins finely and unevenly denticulate. The 2nd segment of pereopods III–IV is narrow; the 4th segment is broadened and, unlike in *R. armatum*, shorter than the 2nd; the distal segments are narrow with fine spinules posteriorly. Pereopods V–VI are similar to those in *R. whitei*; the 2nd and 4th segments in pereopods V are approximately equal in length and width; the 2nd segment of pereopods VI is somewhat longer and much broader than the narrow 4th; the 3rd–6th segments in both pereopods V–VI bear fine spinules along the anterior margin. Pereopods VII are usually unsegmented leaf-shaped appendages but in some individuals have a full complement of segments; in the latter case the total length of the five distal segments is less than the length of the 2nd segment and the claw is deeply curved.

The pleon is always somewhat longer than the pereon. In the epimeral plates the posterior distal angle is acute and in plates II–III even more stretched, especially in the latter.

The urosome is long and the telson relatively short. Urosomite II is 1.5–2 times longer than urosomite I. All the uropods are longer than the telson. The basipodite of uropods I extends beyond the tip of the telson; the rami are free; the exopodite is more than twice longer than the lanceolate endopodite. Uropods II are very thin; the distal end of the basipodite barely extends beyond the base of the telson; the exopodite resembles a small spine; the endopodite is fused with the basipodite and its tip extends beyond the tip of the telson. Uropods III are longer and almost the same length as uropods I; the endopodite is equal in length to the basipodite and fused with it; the exopodite resembles a small spine. The telson of adult crustaceans is 1/6–1/4 the length of the geminate urosomite and in very young individuals is like a round bud,

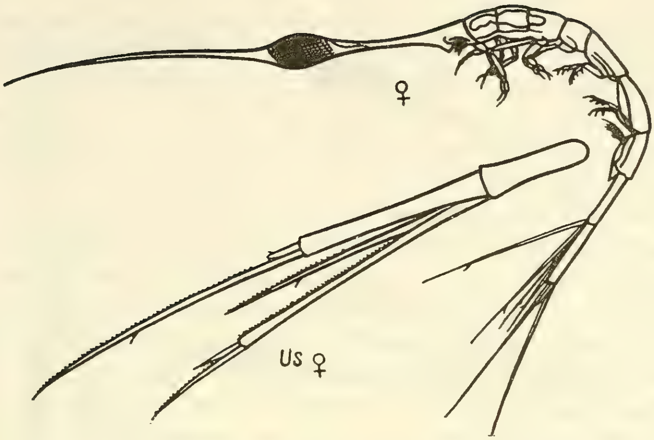


Fig. 233. *Rhabdosoma brevicaudatum* Stebbing (Us—after Fage, 1960).

not differing from the last urosomite. The telson has a rounded tip armed with short setules.

The gills are usually located only on somites V–VI of the pereon; however, a mature female had five pairs of gills (Fage, 1960).

Notes: Exceptionally rare records of males served as the basis for the suggestion of possible parthenogenesis in this species (Fage, 1954, 1960); however, this suggestion requires further investigation.

Distribution: Found in subtropical waters of the northern and southwestern parts of the Pacific Ocean, in the Atlantic Ocean from the equator up to 40° N, and in the Mediterranean Sea. It is not reported from the Indian Ocean (where the closely related species *R. minor* is distributed). Reproduction occurs year round.

437 4. ***Rhabdosoma minor*** Fage, 1954 (Fig. 234)

Fage, 1954: 661; 1960: 107.

Length of adult females up to 22.5 mm. Male not known.

The rostrum is piliform and approximately the same length as in *R. brevicaudatum*; the central part of the head, occupied by the eyes, is appreciably more bulged than in larger species of the genus, the neck is long.

Pereopods I–II are small, not strong, but have well-developed chelae. The 2nd segment of pereopods I is shorter than the distal segments together, has a slightly curved anterior margin, a bulged posterior margin, is distally slightly broadened, and its maximum width is equal to half its length; in the 5th segment the maximum width is much more than the length (on the posterior margin), the process is broader at the

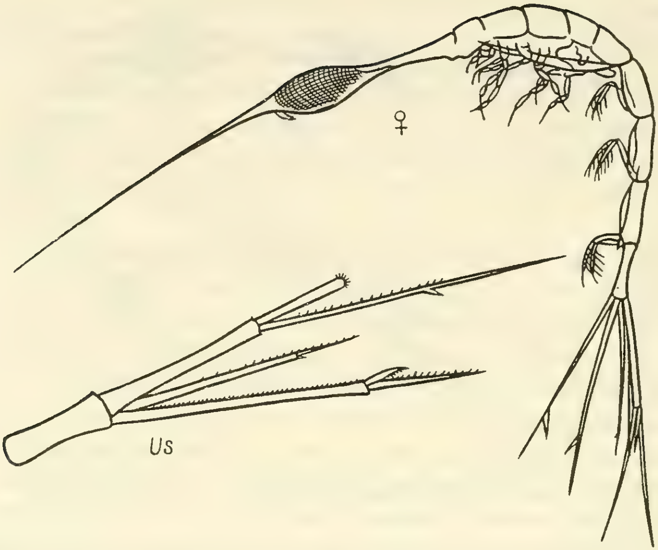


Fig. 234. *Rhabdosoma minor* Fage (Us—after Fage, 1960).

base than the remaining part of the distal margin of the segment and extends beyond the base of the claw, the apical denticle is slightly bent, and the margins of the process finely and unevenly denticulate; the 6th segment is anteriorly bulged and posteriorly straight, its length slightly more than its width, and has a roundish, slightly denticulate lobe in the posterior distal angle at the base of the claw; the claw is longer than half the 6th segment, slightly curved, and with a denticle in the middle of the posterior margin. The 2nd segment of pereopods II is equal to the total length of the 3rd–5th segments, its anterior margin is almost straight and the posterior slightly bulged; in the 5th segment the maximum width is equal to or very slightly less than its length (along the posterior margin), the pointed distal process longer than the segment itself, extending to the middle of the claw, and its width at the base equal to or very slightly less than the remaining part of the distal margin of the segment; the 6th segment is approximately equal to the 5th (without the process) in length, twice longer than wide, with a barely bulged anterior and almost straight posterior margin, the latter finely and unevenly denticulate, forming a roundish, slightly denticulate lobe at the base of the claw; the claw is barely curved and has a small denticle in the middle of the posterior margin, and is about 3/4 the length of the 6th segment. The 2nd segment of pereopods III is equal to the 4th in length, its length 3–5 times its width, and slightly curved; the 4th segment is somewhat broader than the

2nd, has barely bulged margins, the posterior one with sparse uniformly distributed spinules; the 5th segment is shorter and narrower than the preceding one; the 6th segment is longer than the 5th and approximately
438 equal to the 4th; the claw is barely curved and less than half the length of the 6th segment. Pereopods IV are somewhat longer than pereopods III, mainly because of the longer 2nd segment. Pereopods V are the longest; the 2nd segment is straight and four–five times longer than wide; the 5th–6th segments are virgate, the 6th longer than the 5th but somewhat shorter than the 4th and slightly curved; the claw is somewhat shorter than half the length of the 6th segment. Pereopods VI are identical to pereopods V but all the segments are somewhat shorter, especially the 4th–6th, and the 2nd is very slightly broader. The 2nd segment of pereopods VII is articulated with the inner side of the coxal plate and the distal part of the pereopod does not protrude from under it; the apical 3rd segment is rudimentary; evidently as in other species of the genus, the structure of pereopods VII may vary.

The pleon is somewhat longer than the pereon. In epimeral plates I–II the ventral and posterior margins diverge at an obtuse angle; the tip of the posterior distal angle of epimeron III is strongly stretched backward.

Urosomite I is more than half the length of urosomite II (geminate) and often equal in length to the telson. The basipodite of uropods I reaches the tip of the telson and is 2–2.5 times as long as the exopodite; the endopodite is narrowly lanceolate and approximately half the exopodite in length. Uropods II are narrower and shorter than other pairs, reaching the tip of the telson; the exopodite resembles a small spine. Uropods III are much longer than the telson; the endopodite is not shorter than the telson; the exopodite resembles a spine. The telson is not less than half the last urosomite in length, its tip rounded and with fine denticles.

Gills are present only on somites V–VI of the pereon. The oostegites, as in R. brevicaudatum, are also poorly developed.

Notes: *Rhabdosoma minor* and *R. brevicaudatum* are so close morphologically and in some respects biologically (almost complete absence of males in the population) that the separation of *R. minor* as an independent species raises certain doubts. Knowing that the range of variation in morphological characters (particularly the size proportions of various structures) in the family Oxycephalidae is generally large, it is possible to visualise the described species as extreme forms of manifestation of such variation at the borderline of subspecific differentiation. The notable allopatric area of distribution of *R. minor* and *R. brevicaudatum* also tends to confirm subspecific differentiation. The data presently available on the biology and distribution of these forms do not suffice for resolution of this question.

Distribution: *R. minor* is more widely distributed than *R. brevicaudatum*. It is found circumtropically; in the Atlantic Ocean has been reported up to 60° N. in the region of the Irminger [*sic*] Sea. Though rather common in the eastern half of the Atlantic Ocean, there are no reports from the western part along the American coastline. Neither has it been reported from the Mediterranean Sea. Reproduction occurs year round.

XXII. Family PLATYSCELIDAE Bate, 1862

Mostly very small (4–6 mm) crustaceans. The body is wide, generally has a thick integument, and is flattened dorsoventrally. The pleon is narrower than the pereon and may bend underneath it. In this case the operculiform 2nd segment of pereopods V and VI close the unprotected space from the ventral side of the body and the crustacean assumes the shape of a compact smooth egg. The head is high, short, somewhat broader than the pereon, with a small beak-shaped roundish triangular process in the ventral part. The large eyes occupy a large part of the surface of the head. Antennae I of males have a three-segmented peduncle and a four-segmented flagellum; the 1st segment is strongly bulged, curved in the middle part anteriorly, and is uniform in width almost throughout its length. Antennae II in males are long, thin, and folded five times, in
439 females short and few-segmented. The mandibles are short and have a broad cutting edge; only the males have a palp. Maxillae I and II have large wide lobes.

Pereopods I and II are simple or have subchelae or chelae. The 2nd segment of pereopods V and VI is markedly broadened and operculiform, especially in pereopods VI; in pereopods VI this segment has a groove into which the edges of the telson and uropods fit when the crustacean folds itself; the distal segments are small and together several times shorter than the 2nd segment. Pereopods VII consist of a twisted 2nd segment and one–two rudimentary distal segments. The endopodite of uropods III is usually fused with the basipodite. The telson is broad, triangular, and usually fused with the last urosomite.

The family includes five genera.

KEY TO GENERA OF FAMILY PLATYSCELIDAE

1. Pereopods I and II with chelae .... 2.
— Pereopods I and II without chelae .... 4.
2. Distal process of 5th segment of pereopods I and II with smooth margins; posterior margin of 6th segment bears large pointed tooth. Pereopods VI seven-segmented. Telson not fused with last urosomite .. .. 5. ***Amphithyrus*** Claus.

— Distal process of 5th segment of pereopods I and II with denticulate margins; posterior margin of 6th segment without tooth. Pereopods VI six-segmented. Telson fused with last urosomite .... 3.

3. Height of head much less than width. Third segment of pereopods V articulated with 2nd subterminally. Pereopods VI consist of a broadened 2nd segment and one-two distal segments .... 1. ***Platyscelus*** Bate.

— Height of head equal to width. Third segment of pereopods V articulated with distal margin of 2nd segment. Pereopods VII consist of only broadened 2nd segment .... 2. ***Hemityphis*** Claus.

4. Second segment of pereopods I broadened distally. Sixth segment of pereopods I and II with deep notch on distal end; 5th segment without distal process. Pereopods VI seven-segmented .... 4. ***Tetrathyrus*** Claus.

— Second segment of pereopods I almost linear. Sixth segment of pereopods I and II without notch on distal end; 5th segment with distal process. Pereopods VI six-segmented .... 3. ***Paratyphis*** Claus.

1. Genus *Platyscelus* Bate, 1861

Bate, 1861: 4; 1862: 329; Chevreux and Fage, 1925: 419; Stephensen 1925a: 213; Bowman and gruner, 1973: 55.—*Typhis* Risso, 1816: 122.—*Eutyphis* Claus, 1879b: 150; 1887: 31.—*Eutyphes* Bovallius, 1887a: 45.

The head is high and broad, ventrally passes into a beakshaped process, and is smoothly rounded anteriorly. Each of the two distal segments of antennae II in males is shorter than half the length of the preceding.

Pereopods I and II have chelae; the distal process of the 5th segment constitutes the immovable part of the chela and both margins are denticulate; the posterior margin of the 6th segment is denticulate. The 3rd segment of pereopods V is articulated subterminally with the inner surface of the 2nd segment. The 2nd segment of pereopods VI is not less than three times longer than the rest of the segments together; the distal segments are articulated with the 2nd segment at some distance from its
440 distal margin, and of these the 4th segment is the largest; the anterior margin of the 4th and 5th segments is denticulate; the 6th segment is thin, virgate, sometimes clawlike; the claw is absent or barely noticeable; the groove for the telson is almost straight. Pereopods VII consist of a broadened 2nd segment and one-two distal segments; the length of the apical segment may vary considerably.

The outer margin of the basipodite of uropods I is denticulate and the rami are pointed. The basipodite of uropods II is much shorter than the rami and the margins are smooth for the most part. Uropods III are the shortest; the basipodite is fused with the endopodite; the exopodite is shorter and narrower than the endopodite. The telson is fused with the last urosomite and together they form a regular triangle; the margins of the telson are straight and the tip is rounded.

Type species: *Typhis ovoides* Risso, 1816.

KEY TO SPECIES OF GENUS PLATYSCELUS

1. Coxal plates V form spiniform lateral processes, variably developed but always noticeable .... 2. ***P. armatus*** (Claus).
— Coxal plates V do not form spiniform process .... 2.
2. Abdomen tucked under pereon* and pereopods under body so that crus-tacean acquires on oval shape. In pereopods I and II, 6th segment denticulate at least in distal half of anterior margin 1......... .... ***P. ovoides*** (Risso).
— Generally abdomen and pereopods not tucked under body and crustacean not oval in shape. Sixth segment of pereopods I and II smooth along anterior margin 3.
3. Distal process of 5th segment of pereopods I not reaching middle of 6th segment. Second segment of pereopods V with undulating anterior margin. Second segment of pereopods VI with one notch each in distal and proximal parts of anterior margin .... 4. ***P. crustulatus*** (Claus).
— Distal process of 5th segment of pereopods I reaches 2/3 length of 6th segment. Second segment of pereopods V and VI with smooth anterior margin .... 3. ***P. serratulus*** Stebbing.

1. ***Platyscelus ovoides*** (Risso, 1816) (Fig. 235)

Risso, 1816: 122 (*Typhis*); Claus, 1879b: 9 (*Eutyphis*); 1887: 35 (*Eutyphis*); Stebbing, 1888: 1463; Chevreux and Fage, 1925: 420; Stephensen, 1925a: 213.—*ferus* Milne-Edwards, 1830: 395 (*Typhis*).—*intermedius* Thomson, 1879: 244.—*globosus* Claus, 1879b: 13; 1887: 38 (*Eutyphis*).

Length of sexually mature specimens up to 20 mm.

The body is very compact, the integument thick, the abdomen tucked under the belly and the pereopods under belly the body so that the crustacean acquires an egg shape (whence the name of the species). The 2nd segment of pereopods V and VI forms a compact strong shell on the ventral side, under which the female rears eggs and young . The head in height is twice its length and thrice its width. The pleon is high and broad, its width more than its length. Somites I and II of the pereon together are equal in length to somite III.

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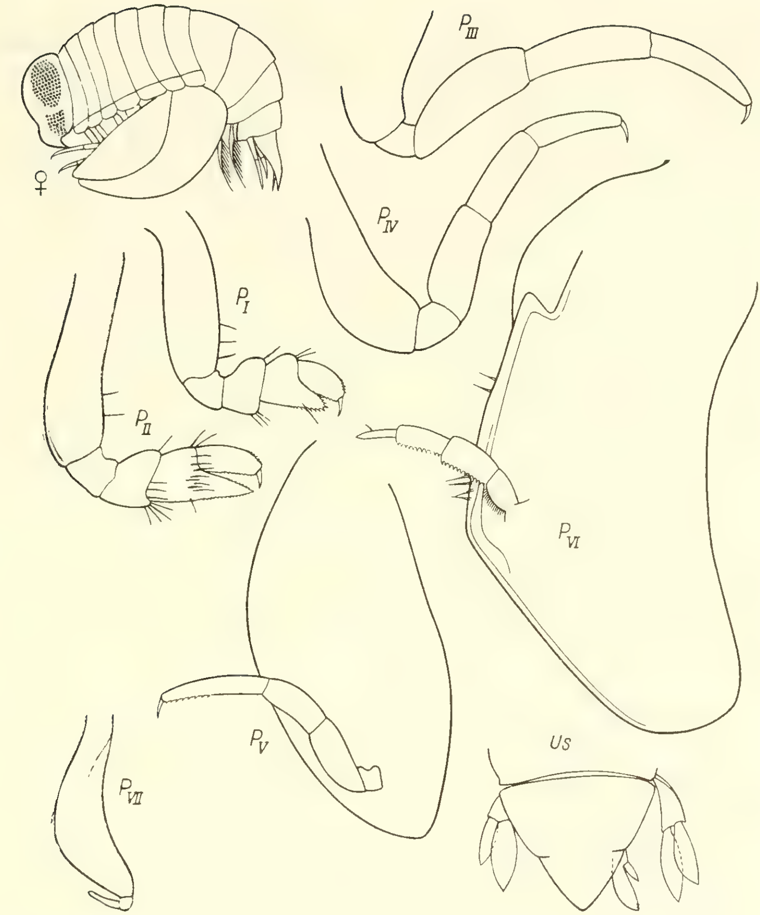
* [sic]; here and subsequently—General Editor.



441 Fig. 235. *Platyscelus ovoides* (Risso).

The 2nd segment of pereopods I and II is almost linear and has parallel margins; the distal segments together are shorter than the 2nd segment and all the segments are fairly short; the 4th segment is distally broadened, its length less than its width; the distal process of the 5th segment has denticulate margins, is pointed, and its tip reaches the base of the 6th segment, but in pereopods II is longer than in pereopods I; the 5th segment without the distal process is wider than long; the 6th segment has a denticulate anterior margin, at least in the distal half. Pereopods III and IV are simple, relatively thin, and long; the posterior margin of the
441 5th–6th segments of pereopods IV is denticulate. The 2nd segment of

pereopods V is narrowed in the distal part and much longer than the distal segments together; the 5th and 6th segments have a denticulate anterior margin although denticulation often does not occur throughout its length. The 2nd segment of pereopods VI is the largest, the anterior margin is concave, and the distal segments together equal to 1/3 its length; the 4th and 5th segments have a characteristic pecten along the anterior margin; the distal process of the 5th segment is weak or absent; the 6th segment is half as narrow as the 5th and virgate; the claw is generally absent. The 2nd segment of pereopods VII is curved like a boomerang; one or two distal segments may be present, in which case the length of the apical segment may vary strongly.

The basipodite of uropods II is short, its width almost equal to its length; the margins of the exopodite are smooth; the endopodite is much longer than the exopodite. The endopodite of uropods III has denticulate margins, is almost twice broader and longer than the exopodite, and its tip extends slightly beyond the tip of the telson.

Distribution: Generally circumtropical. It is found in the Mediterranean Sea, the Atlantic (south of 50° N), Indian (eastern part), and Pacific (Kuroshio, central waters, equatorial zone, region of New Zealand) oceans. It inhabits mostly the upper 200 m layer but is sometimes found deeper, particularly in the Mediterranean Sea, where it has been recovered to a depth of 800 m.

442 2. ***Platyscelus armatus*** (Claus, 1879) (Fig. 236)

Claus, 1879b: 10 (*Eutyphis*); 1887: 36 (*Eutyphis*); Bovallius, 1887a: 45 (*Eutyphes*); Stebbing, 1888: 1464; Spandl, 1927: 229.—*inermis* Claus, 1887: 37 (*Eutyphis*).

Length of sexually mature specimens 12–16 mm.

The head is approximately 2.5 times higher than long, its width four times its length. The flagellum of antennae I in males consists of a broad basal segment (the lower surface of which is densely pubescent with long hairs while the segment itself is bent upward) and three distal segments, of which the first is also rather densely pubescent in the distal part. Antennae II in males is folded zigzag four times; moreover, the two distal segments are almost 1/4 the length of the two proximal segments.

All somites of the pereon and the pleon bulge from the dorsal side. Coxal plates V and VI are longer than the rest; coxal plates V have a pointed lateral process whereby *P. armatus* can be readily distinguished from other species of the genus.

The 2nd segment of pereopods I has a bulged anterior margin bearing rather sparse setae and an almost straight posterior margin; the 5th segment without the distal process is longer than its width (in the other species of the genus, vice versa); the distal process is broader than

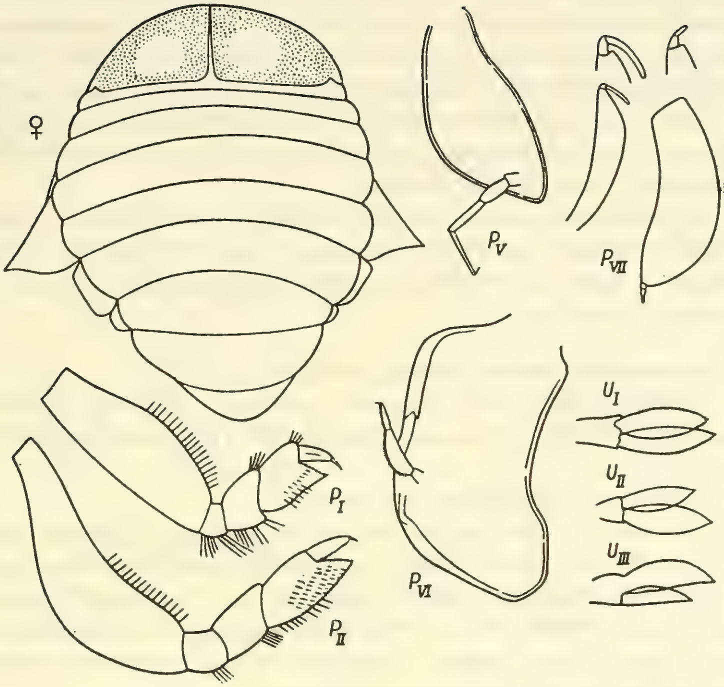


Fig. 236. *Platyscelus armatus* (Claus).

in other species of the genus and its margins form an angle of 60–80°; the 6th segment is shorter than the 5th and its anterior margin is smooth; the 3rd–5th segments are rather densely pubescent with marginal setae but the distal process and the posterior part of the 5th segment bear lateral setae. The 2nd segment of pereopods II has a concave anterior and a bulged posterior margin; the other segments of pereopods II are the same as in pereopods I and have similar ornamentation. Pereopods V are similar to those in *P. ovoides*. The 2nd segment of pereopods VI has a characteristic configuration: the anterior margin is straight in the distal part but concave proximally and the width of the segment the same over much of its length, unlike in *P. ovoides* where it begins to taper almost
443 from the place of articulation of the distal segments. Pereopods VII consist of a broadened 2nd segment with a concave anterior and bulged posterior margin, and two distal segments: a very short 3rd and longer and recurved 4th segment.

The basipodite of uropods I is much shorter than the rami; the two rami are almost similar in shape and length but the exopodite is very slightly shorter. The basipodite of uropods II is still shorter; the exopodite is much smaller than the endopodite; the rami have smooth margins and their tips are stretched into a cusp. The basipodite of uropods III is fused with the endopodite, rarely indistinctly separated; the endopodite is about 1.5 times as long as the exopodite and its margins finely denticulate; the exopodite has a smooth anterior margin; both rami have a straight anterior margin and a bulged posterior one.

Distribution: Known from the Atlantic (northern tropical part), Indian (Zanzibar), and Pacific (Kuroshio, region of Chile-Peru, New Zealand) oceans. It lives in surface water layers but may be found to depths of 500–800 m.

3. ***Platyscelus serratulus*** Stebbing, 1888 (Fig. 237)

Stebbing, 1888: 1470; Chevreux and Fage, 1925; 422.—*dubius* Shoemaker, 1925: 51.—*serratus* Claus, 1879b: 11 (*Eutyphis*); 1887: 37 (*Eutyphis*).

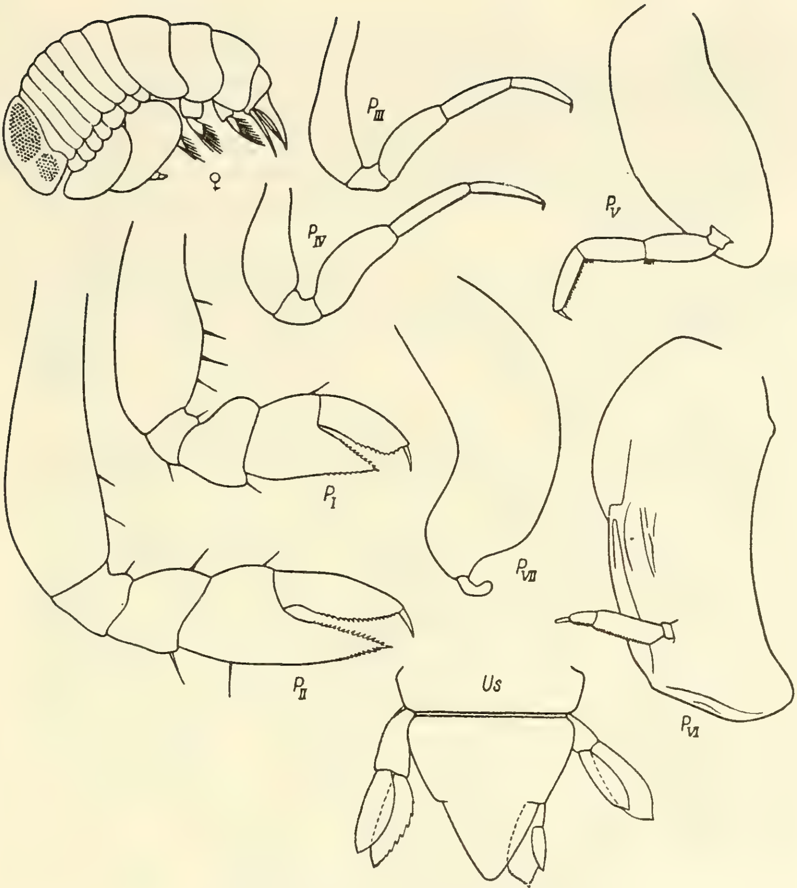
Length of adult specimens 6–7 mm.

The body is high and compact but the abdomen is generally not tucked under the pereon. The head is more than twice higher than long, anteriorly rounded, and ventrally terminates in a beak-shaped process that is much smaller than in the preceding species. In antennae II of males the two distal segment of the flagellum are only slightly shorter than half the length of the proximal segments.

The 2nd segment of pereopods I is relatively short and the anterior margin more bulged than the posterior one, and bears a few marginal setae; the distal segments together are equal to the 2nd in length or longer; the 4th segment is wider than its length; the 5th segment without the distal projection is also wider than its length; the distal projection has straight denticulate margins and its tip does not reach the tip of the 6th segment; the 6th segment has a smooth anterior margin. The 2nd segment of pereopods II has an almost straight anterior margin and a bulged posterior one; the 4th segment is far less broadened distally than in pereopods I; the distal process of the 5th segment is long and narrow and its tip reaches the base of the claw. Pereopods V are the same as in the preceding species. The 2nd segment of pereopods VI has a concave anterior margin, while the posterior margin is bulged in the proximal part and almost straight in the distal. The 2nd segment of pereopods VII is curved forward, the two small distal segments are bent backward.

The uropods and telson are similar to those in *P. armatus*.

Distribution: Known from the Mediterranean and Red seas, and the Atlantic (south of 50° N), Indian (Zanzibar, Bay of Bengal), and Pacific (Kuroshio, southeastern part, equatorial zone, region of New Zealand) oceans.



444 Fig. 237. *Platyscelus serratulus* Stebbing.

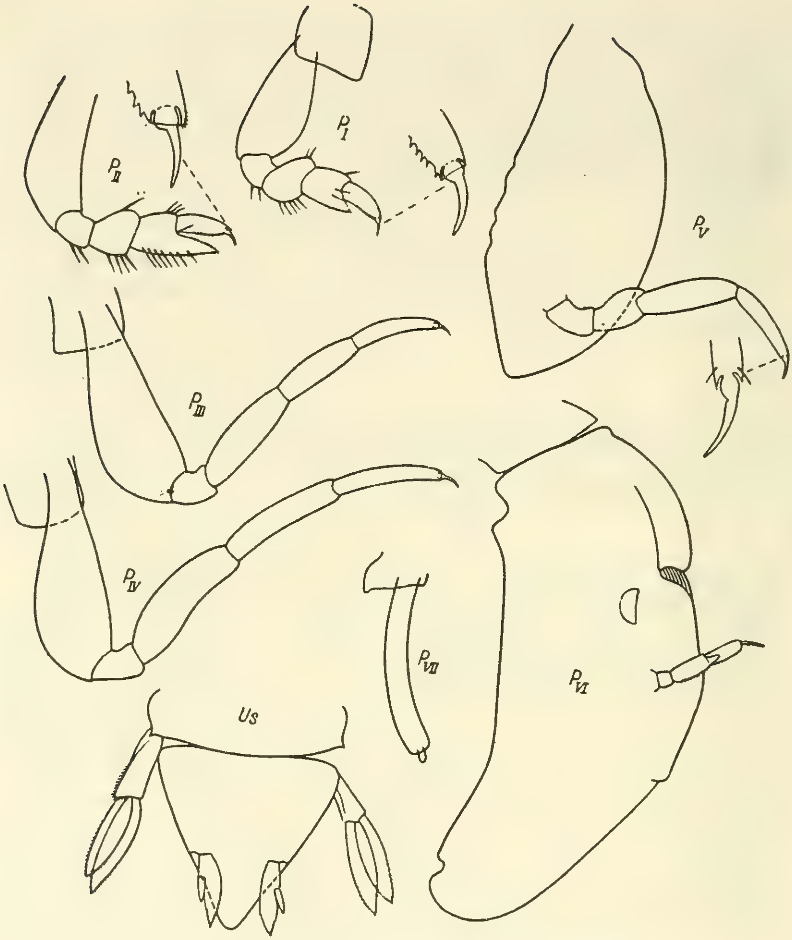
4. ***Platyscelus crustulatus*** (Claus, 1879) (Fig. 238)

Claus, 1879b: 12 (*Hemityphis*); 1887: 39 (Hemityphis).—*crustulum* Bovallius, 1887a: 46 (*Dithyrus*).—*stellatus* Bovallius, 1887a: 48 (*Dithyrus*).

Length of adult females up to 6 mm, of males up to 5 mm.

The body is compact and the telson may be tucked under the pereon, but not to the extent as in *P. ovoides*. The head is anteriorly smoothly rounded and ventrally terminates in a short beak-shaped process. The
444 distal segments of the flagellum of antennae II in males are longer than in other species of the genus, and 2/3 the length of the proximal segments.

The 2nd segment of pereopods I has a bulged anterior margin and a straight posterior one; the distal segments together are longer than



445 Fig. 238. *Platyscelus crustulatus* (Claus), female.

the 2nd segment; the 5th segment without the distal process is equal in length and width; the distal process has straight denticulate margins and its tip barely reaches the middle of the 6th segment. The 2nd segment of pereopods II has an almost straight or slightly curved anterior margin and a bulged posterior one; the denticulate distal process falls slightly short of the tip of the 6th segment. The 2nd segment of pereopods III and IV has a rather strongly bulged posterior margin and an almost straight anterior one. The 2nd segment of pereopods V is broadly lanceolate and the middle part of the anterior margin undulating. The 2nd segment of pereopods VI has a concave anterior margin with a characteristic notch in both the proximal and the distal part; in females the distal part of the

2nd segment, starting from the place of articulation of the 3rd segment, is longer than the proximal part, but in males shorter; the distal segments together are 1/4 the length of the 2nd segment; the 4th segment with its distal process reaches 1/3 the length of the 5th segment. The 2nd segment
445 of pereopods VII is bent forward and its length may be three–seven times its width; the distal part of the pereopods consists of one–two short rudimentary segments.

The rami of uropods I and II are lanceolate, the endopodites somewhat longer than the exopodites. The endopodite of uropods III is fused with the basipodite, its tip slightly extending beyond the tip of the telson; the exopodite is half the length of the endopodite and much narrower than it.

Notes: Claus (1879b, 1887), Bovallius (1887a), and Spandl (1927) placed this species in the genus *Hemityphis* (*Dithyrus*). However, a comparison of certain characters of the type species of the genera *Platyscelus* and *Hemityphis* reveals an undisputable similarity between the described species and the species of *Platyscelus* but significant differences from the species of *Hemityphis*. Thus in pereopods I and II the margins of the chelae are denticulate as in *Platyscelus*; the 3rd segment of pereopods V is articulated with the 2nd segment submarginally as in *Platyscelus* and not marginally as in *Hemityphis*; pereopods VII have one–two rudimentary distal segments, which is characteristic of *Platyscelus*, whereas in
446 *Hemityphis* these segments are absent. Finally, the shape of the head (front view) is also the same as in *Platyscelus*, i.e., width considerably more than length and rather large beak-shaped process in the ventral part; in *Hemityphis* the height and width of the head are equal and the beak-shaped process barely discernible. Based on the foregoing comparison, retainig this species in the genus *Platyscelus* appears better justified.

Distribution: Known from the Atlantic (equatorial region), Indian (Zanzibar), and Pacific (Kuroshio) oceans. It is found in the upper 200 m layer.

2. Genus *Hemityphis* Claus, 1879

Claus, 1879b: 4; 1887: 31; Stebbing, 1888: 1471.—*Dithyrus* Bovallius, 1887: 46.

The body is compact, the pereon bulged, and the head ventrally terminates in a small beak-shaped process. The width and height of the head are equal, unlike in species of the genus *Platyscelus* in which the width is much greater than the height. The distal segments of antennae II in males are more than half the length of the proximal segments.

Pereopods I and II have chelae; the distal projection of the 5th segment of pereopods I is shorter than or equal to half the length of the 6th segment, in pereopods II only slightly extends beyond its middle;

the 6th segment has a few low, highly smoothened denticles on the posterior margin. The 3rd segment of pereopods V is articulated with the distal margin of the 2nd, but not submarginally as in species of the genus Platyscelus. The 6th segment of pereopods VI is modified into a long and almost straight claw and the 7th segment, i.e., the true claw, is absent. Pereopods VII consist only of a distally narrowed and forwardly bent 2nd segment; apical segments are absent.

Type species: *Hemityphis tenuimanus* Claus, 1879.

1. ***Hemityphis tenuimanus*** Claus, 1879 (Fig. 239)

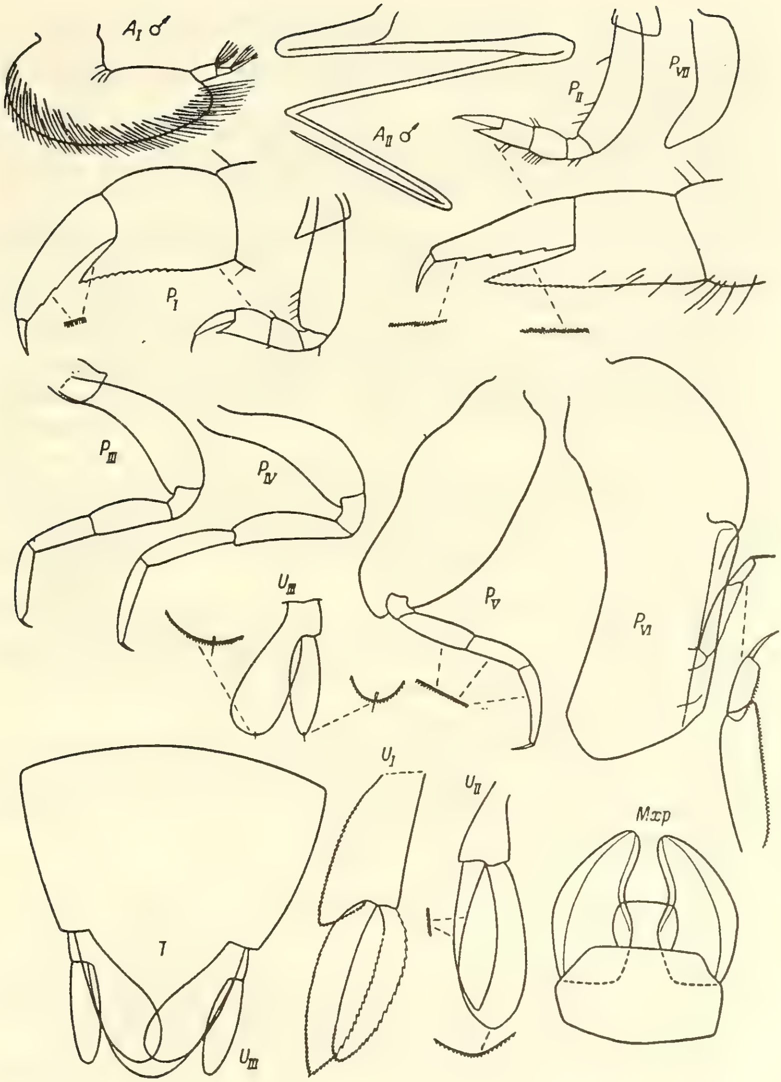
Claus, 1879b: 12; 1887: 38; Bovallius, 1887a: 46 (*Dithyrus*); Stebbing, 1888: 1472.

Length of males up to 5 mm, of females up to 7 mm.

The head is short and high, its length 1/3 its height, and its width equal to its height. The flagellum of antennae I consists of a curved basal segment, which is densely pubescent with long hairs on the lower surface, and three distal segments: the first is armed with four straight apical setae, the second with two. Antennae II in males are folded zigzag five times and the length of their apical segment is 2/3 that of the preceding segment.

The 2nd segment of pereopods I and II is slightly broadened distally, equal in length to the remaining segments together, and bears a few fine setae on its anterior margin; the 4th segment is somewhat longer than wide; the 5th segment without the distal process is also longer than its width; the distal process is narrow and has straight and finely denticulate margins; the 6th segment narrows smoothly distally and in pereopods I its posterior margin bears two denticles, in pereopods II four low and smoothened denticles, often armed with frequent very fine spines. The 2nd segment of pereopods V has a uniformly bulged posterior margin, while its anterior margin bulges abruptly in the middle part; the length of the 2nd segment is almost equal to that of the distal segments together. The 2nd segment of pereopods VI has a concave anterior margin while the posterior margin is bulged in the distal part and later becomes straight; the distal segments together are almost half the length of the 2nd segment; the 4th is the largest of the distal segments and has a small distal process; the 4th and 5th segments have a denticulate anterior margin in the form
448 of a pecten; the 6th segment is modified into a pseudoclaw but the true claw is reduced. Pereopods VII consist of only the 2nd segment which tapers distally and is strongly curved forward.

The rami of uropods I are lanceolate and the exopodite is somewhat larger than the endopodite. The exopodite of uropods II is lanceolate and the larger endopodite is broadened distally and rounded. The endopodite of uropods III is fused with the basipodite, strongly broadened distally,



447 Fig. 239. *Hemityphis tenuimanus* Claus.

and broadly rounded; the exopodite is narrower but also has a rounded tip. The last urosomite is somewhat longer than the telson.

Distribution: Known from the Atlantic (18° N, Cape of Good Hope), Pacific (Kuroshio, New Zealand, Nasca ridge), and Indian (eastern part of southern Australia) oceans. It inhabits the upper 100 m layer but may be found deeper, up to 200 m.

3. Genus *Paratyhis* Claus, 1879

Claus, 1879b: 13; 1887: 39; Stebbing, 1888: 1476; Stephensen, 1925a: 220.

Small animals. The body is compact, the head higher than long, its length approximately equal to its width. The two distal segments of antennae II in males are about half the length of the 2nd and 3rd segments. Pereopods I are simple; pereopods II have poorly developed chelae. The 2nd segment of pereopods I and II is narrow and long, the 3rd–7th segments together are shorter than the 2nd segment; the 5th segment, if broadened, is only slightly so; the posterior distal process of the 5th segment is small or absent. The 2nd segment of pereopods V is oval and the 3rd segment is articulated with its distal margin. The 2nd segment of pereopods VI is operculiform; among the distal segments the 4th is the largest and has a small distal process; the 4th and 5th segments have a fine pecten long the anterior margin; the 6th segment is clawlike; the claw is absent. The 2nd segment of pereopods VII is barely broadened; the distal segments vary from one to four but sometimes are totally absent.

The basipodite of uropods I has a denticulate anterior margin. The endopodite is fused with the basipodite or is indistinctly separated from it. The telson has a rounded tip and is fused with the last urosomite.

Type species: *Paratyphis maculatus* Claus, 1879.

Only a comparatively small number of representatives of *Paratyhis* are known to date and thus the significance of specific characters cannot be assessed definitively. Hence the subdivision of the genus *Paratyphis* into species still remains somewhat arbitrary.

KEY TO SPECIES OF GENUS PARATYPHIS

1. Second segment of pereopods V uniformly rounded at distal end, without notch for 3rd segment. Lateral "fissure" of 2nd segment of pereopods VI longer than 1/4 length of 2nd segment .... 3. ***P. spinosus*** Spandl.

— Second segment of pereopods V with notch in distal end accommodating 3rd segment. "Fissure" of 2nd segment of pereopods VI semilunar, much shorter than 1/4 length of segment .. .. 2.

2. Fifth segment of pereopods II with denticulate posterior distal process, reaching 1/3 length of 6th segment .... 2. ***P. parvus*** Claus.

— Fifth segment of pereopods II without posterior distal process or process small, shorter than 1/3 length of 6th segment and with smooth margins .... 3.

3. Distal process of 5th segment of pereopods II totally absent, if present, rounded. Width of 5th segment of pereopods VI 1/3 its length ....4. ***P. promontori*** Stebb.

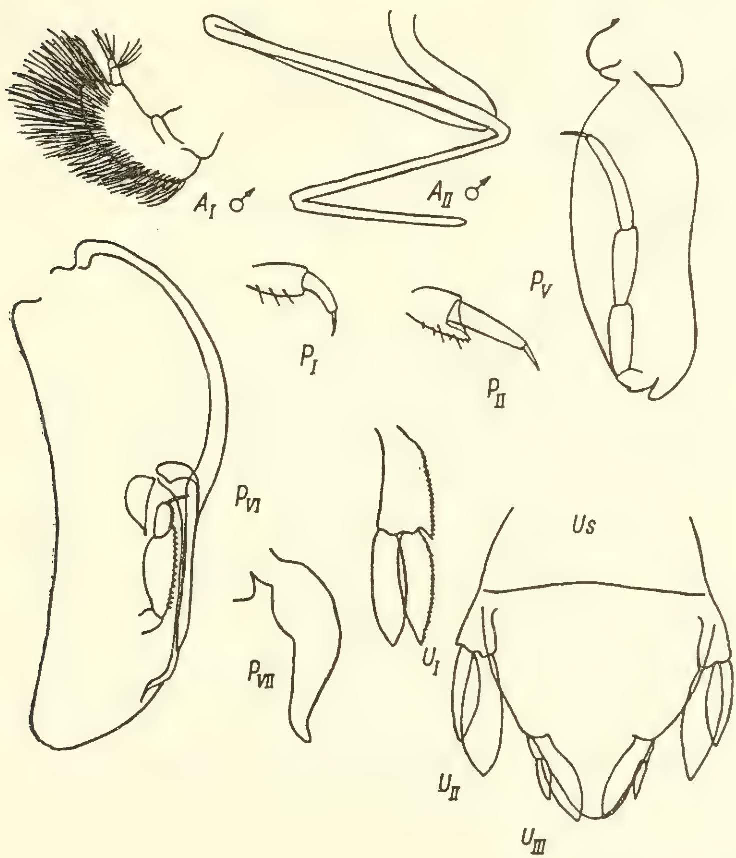
449 — Distal process of 5th segment of pereopods II pointed. Width of 5th segment of pereopods VI 2/5–1/2 its length ....1. ***P. maculatus*** Claus.

1. ***Paratyphis maculatus*** Claus, 1879 (Fig. 240)

Claus, 1879b: 14; 1887: 39; Stephensen, 1925a: 223.

Length of adult specimens 2–4 mm.

The 1st segment of the flagellum of antennae I in males is uniformly broadened almost throughout its length and its bulged distal margin forms a rounded protuberance which is equal in length to the next segment.



449 Fig. 240. *Paratyphis maculatus* Claus (after Claus, 1887).

The 5th segment of pereopods I has no distal process, is weakly broadened, and the posterior margin armed with a few submarginal setae; the 6th segment is slightly recurved. The 5th segment of pereopods II has a small pointed posterior distal process 1/4 the length of the 6th segment and the posterior margin is also armed with a few submarginal setae; the 6th segment is straight and longer than the 5th. The 2nd segment of pereopods V is oval and has a medially bulged anterior margin, with
450 a notch in the distal margin into which the 3rd segment fits. The distal segments of pereopods VI together are shorter than the 2nd segment; the 2nd segment has a short semilunar lateral "fissure", its anterior margin is bulged, and the posterior margin bulged in the proximal part but straight in the distal; the 4th segment has a short distal process. Pereopods VII consist only of the 2nd segment, which is strongly tapered distally; apical segments are absent.

The rami of all the uropods are lanceolate and equal in length in uropods I. The endopodite of uropods II and III is larger than the exopodite and fused in uropods III with the basipodite, twice longer than the exopodite and thrice broader. The telson is approximately 2/3 the last urosomite in length.

Distribution: The species is known from the Mediterranean Sea and the Atlantic (between 7 and 22° N, environs of Cape of Good Hope) and Indian (eastern part) oceans.

Absent in our collections.

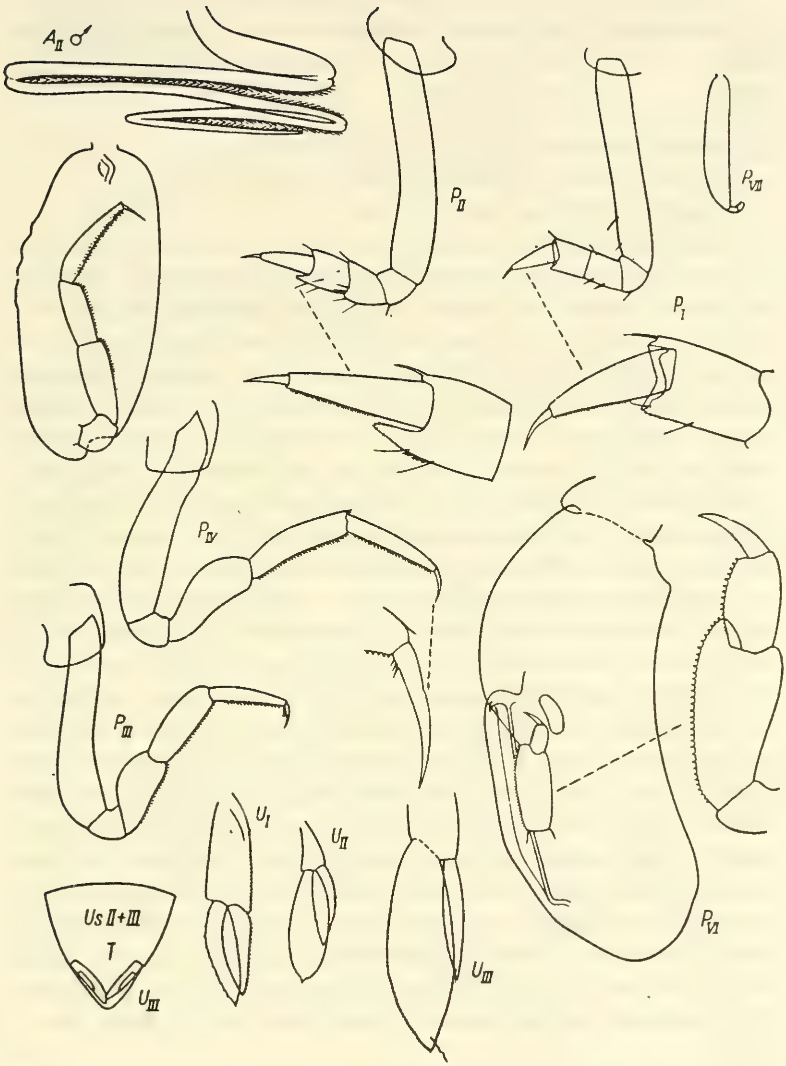
2. ***Paratyphis parvus*** Claus, 1887 (Fig. 241)

Claus, 1887. 40.—*pacificus* Stebbing, 1888: 1479.

Length of adult specimens up to 4 mm.

The height of the head is approximately twice its length. The 2nd and 3rd segments of antennae II in males are the same length; the 4th segment 2/3 and the 5th segment 1/2 their length.

The 2nd segments of pereopods I is linear, narrow, and long; the 3rd–7th segments together are almost 2/3 the 2nd segment in length; the 4th and 5th segments are approximately equal in length; the posterior distal process of the 5th segment of pereopods I is very short and looks like a barely stretched angle with a finely denticulate posterior margin, while in pereopods II this process is narrow, 1/3 the length of the 6th segment, and both its margins are denticulate; the 6th segment of pereopods I and II tapers distally, its margins are almost straight, and the posterior margin very finely denticulate. The 2nd segment of pereopods V is oval, has a notch on the distal margin into which the 3rd segment fits, and the anterior margin is medially undulating; the 3rd–7th segments together are almost equal to the 2nd segment; the 4th and 5th segments have a finely pectinate anterior margin; the 6th segment is armed with very fine marginal and submarginal spinules. The 2nd segment of pereopods VI



451 Fig. 241. *Paratyphis parvus* Claus, male.

has a concave anterior margin, the posterior margin is bulged in the proximal part and straight medially, and the semilunar fissure 1/10–1/7 the segment in length; the distal segments are 3/7–1/2 the 2nd segment in length; the 4th segment is distally broadened, has a rounded anterior and a posterior distal process; the anterior margin is 1/2, the posterior 1/3 the 5th segment in length. Pereopods VII consist of a fairly narrow 2nd segment and one–two rudimentary distal segments.

The uropods and telson are as in *P. maculatus*.

Distribution: The species is known from the Atlantic (region of Lagos) and Pacific (southern Hawaiian Islands, Kuroshio, Nasca ridge) oceans.

3. ***Paratyphis spinosus*** Spandl, 1924 (Fig. 242)

Spandl, 1924: 36.—clausi Stephensen, 1925a: 221.

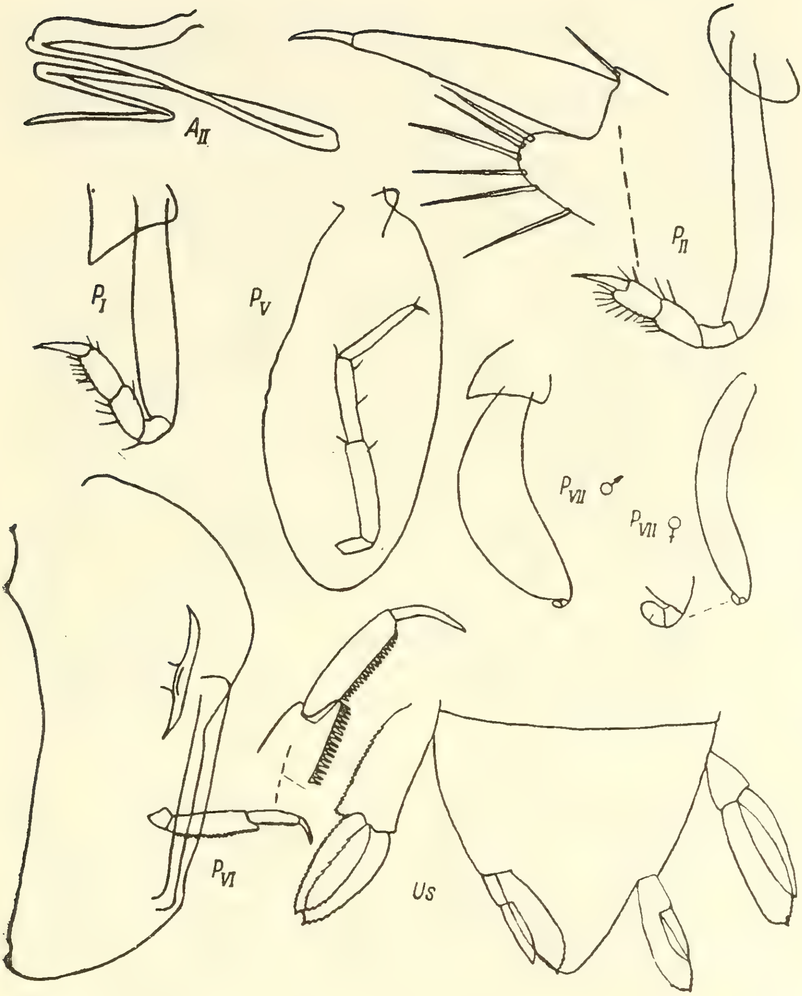
Length of adult specimens 5–6 mm.

Antennae I in males are the same as in *P. maculatus*. The basal segment of antennae II in males is half the 2nd segment in length, the 4th less than half the 3rd, and the 5th slightly longer than the 4th.

The 2nd segment of pereopods I is 1.5 times longer than the rest together; the 4th segment is slightly broadened and bears two long setae along each of its margins; the 5th is longer than the 4th, its margins slightly bulged, the anterior bearing two–three, the posterior five–six setae, and the distal process is absent. The 2nd segment of pereopods II is longer than in pereopods I; the 4th segment bears three setae on its posterior margin; the 5th segment has a rounded distal process 1/4–1/3
452 the length of the 6th segment, its anterior margin armed with two setae, and the posterior margin together with the distal process has about ten marginal and submarginal setae. The 2nd segment of pereopods V is oval, without a distal notch, with even margins, and 2–2.3 times longer than wide; the 3rd–7th segments together are shorter than the 2nd; the 4th–6th segments are armed with two–three setae on the anterior margin; the claw is short and almost straight. The 2nd segment of pereopods VI has a barely bulged anterior margin, with one shallow notch each in the proximal and distal parts, the posterior margin is strongly bulged in the proximal part and almost straight in the distal, the lateral fissure extended, narrow and not so long, only 2/7–1/4 the segment in length; the 4th segment has a distal process that is narrower than that in either *P. parvus* or *P. maculatus*. Pereopods VII consist of a 2nd segment that is broadened and strongly bent forward and one–three rudimentary distal segments; the 2nd segment is more stretched in females than in males.

In uropods I the anterior margin of the basipodite is denticulate; the rami are lanceolate; the endopodite is equal to the basipodite in length but somewhat longer than the exopodite. The basipodite of uropods II is equal in length and width; the endopodite is distally narrowed and longer
453 and broader than the exopodite. The endopodite of uropods III is fused with the basipodite and sharply narrowed in the distal part. The telson is smoothly rounded or has a stretched tip.

Distribution: Known from the Mediterranean and Red seas, eastern region of the Indian Ocean, and Peruvian region of the Pacific Ocean.



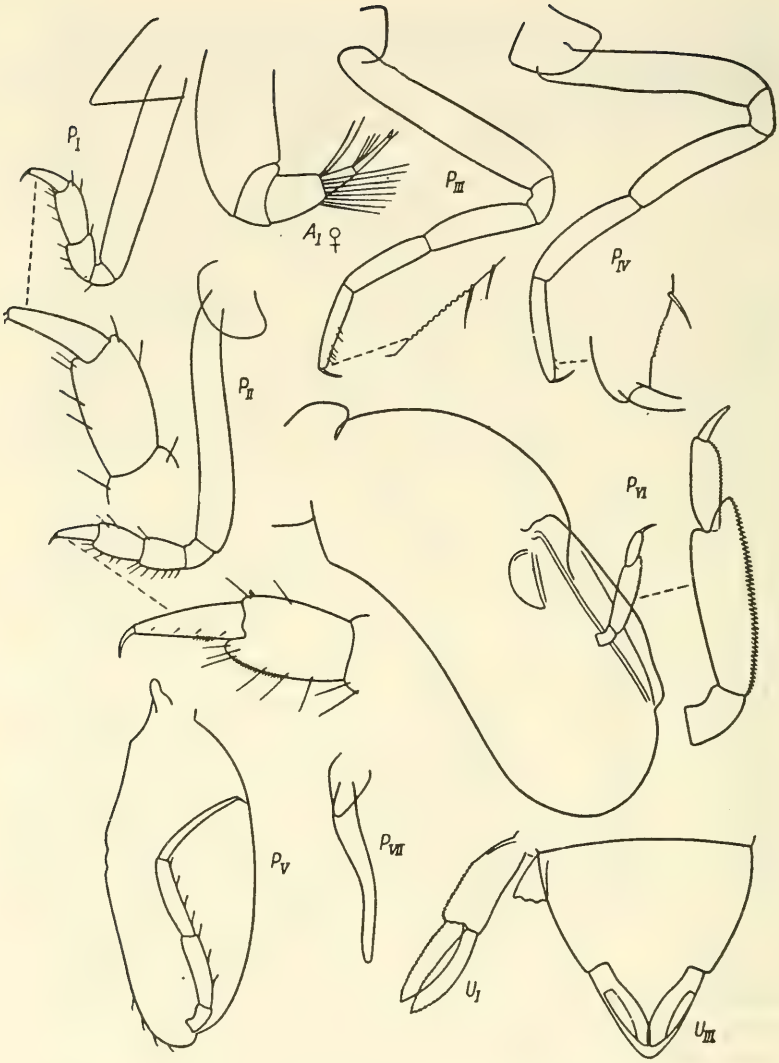
452 Fig. 242. *Paratyphis spinosus* Spandl.

4. ***Paratyphis promontori*** Stebbing, 1888 (Fig. 243)

Stebbing, 1888: 1476; Stephensen, 1925a: 222.—*theelii* Bovallius, 1887a: 47.—sp. Stephensen, 1925a: 223.—*maculatus* Spandl, 1927: 243.

454 Length of adult specimens about 5–6 mm.

The 2nd segment of pereopods I is linear and straight; the 3rd–7th segments together are 2/3 the 2nd in length; the 4th segment is distally broadened, its anterior margin armed with one setae, the posterior with three setae; the 5th segment is longer and slightly narrower than the



453 Fig. 243. *Paratyphis promontori* Stebbing, female.

4th, its anterior margin armed with two setae, the posterior with four setae, and the posterior distal process poorly developed and rounded; the 6th segment is very slightly recurved; the claw is short and almost straight. The 2nd segment of pereopods II is longer than in pereopods I; the 4th segment is distally almost not broadened, its anterior margin armed with one submarginal seta, the posterior with five–seven setae;

the 5th segment is slightly longer than the 4th but equal to it in width, its rounded distal process 1/5 the length of the 6th segment, its anterior margin armed with two, the posterior with five–six setae; moreover, the distal part of the 5th segment is armed with very fine spinules; the 6th segment is narrowed distally, with straight margins, the posterior margin armed medially with very fine spinules, and the segment additionally with several longer lateral spines; the claw is longer than in pereopods I. The 2nd segment of pereopods V is oval, twice longer than wide, its anterior margin undulating in the middle part and armed with a few setae in the distal part, and a notch occurs at its tip into which the 3rd segment fits; the 3rd–7th segments together are much shorter than the 2nd segment, and of these the 6th is the longest. The 2nd segment of pereopods VI is the same as in *P. parvus* but lacks a shallow notch on the anterior and posterior margins; the 4th and 5th segments are narrower than in *P. parvus* and *P. maculatus*; in the 4th segment the anterior distal process extends slightly beyond the middle of the 5th segment; the 6th segment is clawlike, half the length of the 5th segment. Pereopods VII vary markedly in structure; they may have just one strongly extended and narrow basal segment or, in addition, two–three rudimentary distal segments.

The uropods and telson are the same as in *P. maculatus*.

Distribution: Known from the Atlantic (Cape of Good Hope, 35° N, 7° W) and Pacific (southeastern part) oceans and the Red Sea.

4. Genus *Tetrathyrus* Claus, 1879

Claus, 1879b: 14; 1887: 31; Stebbing, 1888: 1481; Stephensen, 1925a: 224; Chevreux and Fage, 1925: 422; Spandl, 1927: 240.

Small animals, not more than 5 mm in length.

The basal segment of the flagellum of antennae I in males is markedly curved forward and somewhat longer than the three distal segments together. Antennae II in males are folded zigzag five times and the last two segments only slightly shorter than the two preceding ones.

Pereopods I and II are identical in structure: in pereopods I the 2nd segment is distally broadened and has a notably bulged anterior margin; of the distal segments, the 4th is the broadest; the 6th segment has a notch at the tip, such that together with the claw it forms a chela like structure. The 2nd segment of pereopods V has a bulged posterior margin and a straighter anterior margin; the 3rd segment is articulated with the 2nd segment subterminally. The 2nd segment of pereopods VI has a curved anterior margin; the 4th segment has a distal process; the 6th segment is normal, not modified into a claw; the anterior margins of the 4th–6th segments is denticulate; the claw is short. Pereopods VII consist of a broadened 2nd segment and usually one markedly reduced distal segment. The basipodite of uropods I has a denticulate anterior margin; the rami of uropods I–III are lanceolate; the endopodite of uropods II and III is fused with the basipodite or is free. The telson is fused with the last urosomite.

Type species: *Tetrathyrus forcipatus* Claus, 1879.

455 *KEY TO SPECIES OF GENUS TETRATHYRUS*

1. Second segment of pereopods V not more than twice longer than wide. Endopodite of uropods II and III fused with basipodite. Telson shorter than last urosomite .... 1. ***T. forcipatus*** Claus.

— Second segment of pereopods V 2.3–2.8 times longer than wide. Endopodite of uropods II and III not fused with basipodite. Telson longer than last urosomite .... 2. ***T. arafurae*** Stebb.

1. ***Tetrathyrus forcipatus*** Claus, 1879 (Fig. 244)

Claus, 1879b: 14; 1887: 40; Stebbing, 1888: 1484; Chevreux, 1900: 150; Spandl, 1924: 38; 1927: 240; Chevreux and Fage, 1925: 422; Stephensen, 1925a: 224.—*inscriptus* Bovallius, 1887a: 47.—*rectangularis* Bovallius, 1887a: 47.—*moncoeuri* Stebbing, 1888: 1480.—*sanctijosephi* Shoemaker, 1925: 54.

Length of adult specimens 3.5–4.5 mm.

The head is laterally roundish-triangular, somewhat stretched anteriorly, and its length in the upper part approximately 2/3 that of the lower
456 part; there are no differences between males and females in size and shape of the head. The 2nd and 3rd segments of antennae II in males are equal in length, the 4th slightly shorter, and the 5th, 4/5 the length of the 4th segment.

The 2nd segment of pereopods I is shorter than the distal segments and the anterior margin more bulged than the posterior; the 4th segment is broadened; the 5th segment is narrower and shorter; the 6th segment is not longer than the 5th. The 2nd segment of pereopods II is longer than the distal segments, its anterior margin concave, and the posterior margin bulged; the distal segments are the same as in pereopods I. The 2nd segment of pereopods V is twice longer than wide, its anterior margin bulged only in the middle part, the posterior uniformly bulged over its entire length; the distal segments together are longer than the 2nd segment or equal to it. The 2nd segment of pereopods VI has a concave anterior margin and the posterior margin is almost straight in the middle part; the distal segments are 1/3–1/2 the 2nd segment in length; the 4th segment is linear, longer than the successive segments together; the distal process of the 4th segment reaches 1/3–1/2 the 5th

455 Fig. 244. *Tetrathyrus forcipatus* Claus.

segment in length. Pereopods VII generally com- prise a ıong 2nd segment that tapers smoothly apically and one distal segment in the shape of a small cusp. However, individuals with two-five distal segments are not so uncommon and served as the premise for describing a new species, later included in the synonymy.

457 The endopodite of uropods I is larger than the exopodite, its posterior margin smooth and the anterior denticulate. The endopodite of uropods II

and III is fused with the basipodite; the exopodite is smaller and not denticulate on the anterior margin. The telson is somewhat shorter than the last urosomite and its margins armed with sparse setae.

Distribution: A circumtropical species, found in the Atlantic (from 43° N. to the Cape of Good Hope), Indian (eastern part, Arabian Sea), and Pacific (Kuroshio, Californian, eastern-equatorial, and Peruvian regions, New Zealand) oceans, and in the Mediterranean and Red seas.

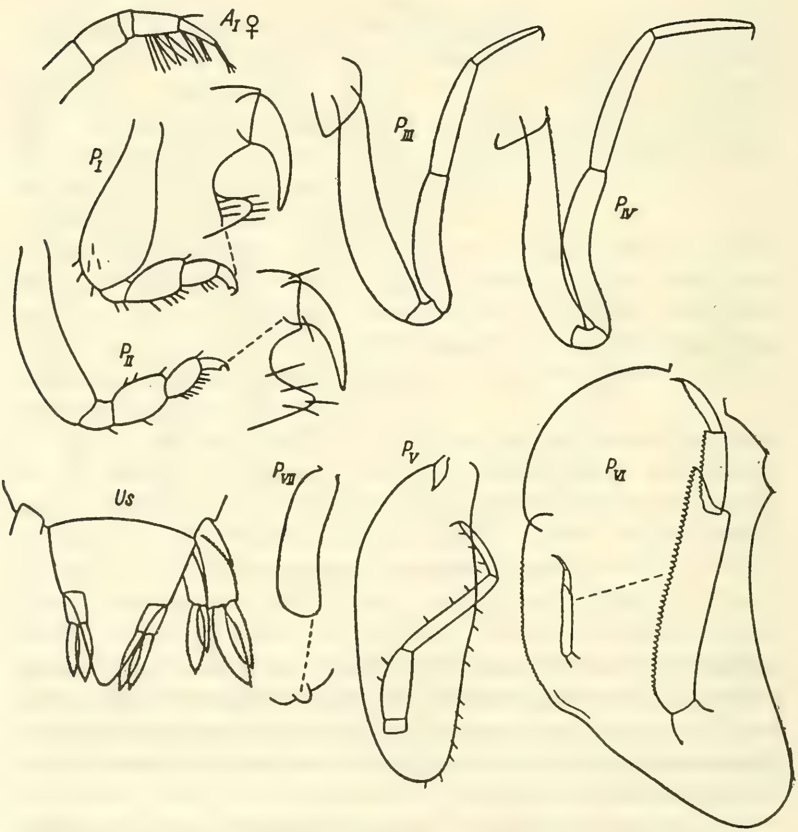
2. ***Tetrathyrus arafurae*** Stebbing, 1888 (Fig. 245)

Stebbing, 1888: 1483.

Length of adult animals not more than 5 mm.

The shape of the body and the head and the structure of pereopods I–IV almost do not differ from those in *T. forcipatus.*

The 2nd segment of pereopods V is 2.3–2.8 times longer than wide and its anterior margin has a bulge in the middle part and is generally



456 Fig. 245. *Tetrathyrus arafurae* Stebbing, female.

armed with sparse setae; the 3rd–7th segments together are shorter than the 2nd segment. The 2nd segment of pereopods VI is similar to that in *T. forcipatus* but its posterior margin finely denticulate in the middle part; the distal process of the 4th segment reaches the middle of the 5th. Pereopods VII consist of a 2nd segment in which the distal end is not narrowed but smoothly rounded, and a very short 3rd segment, not completely separated from the 2nd and in the shape of a small tubercle.

The rami of the uropods are lanceolate with denticulate margins and the endopodites are free. The telson is narrower than in *T. forcipatus* and longer than the last urosomite.

Distribution: Known from the Arafura Sea (surface catches) and the environs of New Zealand, Hawaii Islands, California bay.

5. Genus *Amphithyrus* Claus, 1879

Claus, 1879a: 4; 1887: 31; Stebbing, 1888: 1485; Spandl, 1927: 246; Bowman and Gruner, 1973: 55.

Very small animals, 3–5 mm in length.

The body is high and compact and the pereon much shorter than the pleon. The head is short and high, anteriorly smoothly rounded, and the same shape in females and males. The body surface of all species except *A. glaber* is covered with a reticulate or striate sculpture. The basal segment of antennae II in males is short, its anterior margin straight, and the posterior markedly bulged; the 1st–3rd segments of the flagellum are approximately the same in length but the 4th somewhat shorter.

Pereopods I and II are identical in structure, weak, and have chelae; the 2nd segment is barely broadened distally; the distal process of the 5th segment is pointed, narrow, and has smooth margins; the 6th segment has a pointed denticle on the posterior margin; the claw has a broad base and is bent backward. Coxal plates V have a process on the inner side. The 2nd segment of pereopods V is elongated-oval with a projection in the distal part; the 3rd segment is attached subterminally at the base of the projection: the 3rd–7th segments together are not shorter than the 2nd segment; the 4th–6th segments have a very finely denticulate anterior margin. The 2nd segment of pereopods VI is represented by a plate of complex shape, differing from the analogous segment in the other genera of the family: the anterior margin has a notch close to the base, the posterior margin is uniformly bulged, and the distal margin also has a notch, due to which the segment appears twin-peaked; the 4th segment has a distal process; the 4th and 5th segments have a denticulate anterior margin; the 6th segment is very narrow and weak; the claw is rudimentary and not pointed.

458 The rami of the uropods are lanceolate and the endopodites and exopodites equal in length. The endopodite of uropods III is generally

fused with the basipodite but in some species their indistinct division has been observed. The telson is not fused with the last urosomite.

Type species: *Amphithyrus bispinosus* Claus, 1879.

KEY TO SPECIES OF GENUS AMPHITHYRUS

1. Coxal plates V spiniform, acute and directed backward .... 1. ***A. bispinosus*** Claus.
— Coxal plates V usual, not spiniform .... 2.
2. Body surface without sculpture, smooth. Distal process of 5th segment of pereopods II almost reaches tip of denticle on posterior margin of 6th segment .... 4. ***A. glaber*** Spandl.
— Body surface with reticulate or striate sculpture. Distal process of 5th segment of pereopods II not reaching even base of denticle on posterior margin of 6th segment.................................... 3.
3. Pereopods VII with three–five rudimentary distal segments. Basipodites and rami of uropods sculptured ....5. ***A. sculpturatus*** Claus.
— Pereopods VII without distal segments or with single rudimentary one. Basipodites and rami of uropods not sculptured............. 4.
4. Telson galeiform, with acuminate tip, and about twice as long as last urosomite. In pereopods I and II notch between denticle and posterior margin of 6th segment smoothly rounded ....2. ***A. similis*** Claus.
— Telson with rounded tip, shorter than last urosomite. In pereopods I and II notch between denticle and posterior margin of 6th segment angular .... 3. ***A. muratus*** Volkov sp. n.

1. ***Amphithyrus bispinosus*** Claus, 1879 (Fig. 246)

Claus, 1879b: 15; 1887: 41; Stebbing, 1888: 1489; Spandl, 1927: 247.

Length of adult individuals 3.5–4 mm.

The body is high, compact, and markedly curved dorsoventrally. All the somites of the body, the telson, the coxal plates, the 2nd segment of pereopods V and VI, and the basipodites of the uropods have a distinct sculpture in the form of longitudinal furrows or polygons.

Pereopods I and II are short and weak. The 2nd segment of pereopods I is barely bulged distally and its anterior margin barely curved or straight; the 3rd–7th segments together are equal in length to the 2nd; the 4th and 5th segments are equal in length and the 4th is not broader than the 5th; the distal process of the 5th segment is shorter than half the 6th segment. The 2nd segment of pereopods II has a concave anterior margin and bulged posterior one; the 3rd–7th segments together are shorter than the 2nd; the 4th segment is broader than the 5th; the distal process of the 5th segment reaches the tip of the denticle on the posterior margin of the

459 Fig. 246. *Amphithyrus bispinosus* Claus.

6th segment. Coxal plate V is stretched into an acuminate spine directed backward and has a large pointed process on the inner side; the 2nd segment is 2.5 times longer than wide; the distal segments are 1.2–2.5 times the 2nd segment in length. The 2nd segment of pereopods VI has a rather deep notch in the anterior margin close to the base, the posterior margin is bulged, and the lateral fissure is crescent-shaped; the 5th segment is half the length of the 4th and has a similar distal process; the 6th segment is longer than half the 5th segment. Pereopods VII generally consist of a 2nd segment that is narrow, forwardly bent, and rounded at the tip; sometimes one–two rudimentary distal segments are present.

459 The basipodite of uropods II is somewhat shorter than the rami. The endopodite of uropods III is fused with the basipodite. The telson is triangular, with a pointed tip, its margin either slightly concave or straight, and its length 1.5–2 times its width. In some individuals the telson may be indistinctly separated from the urosome.

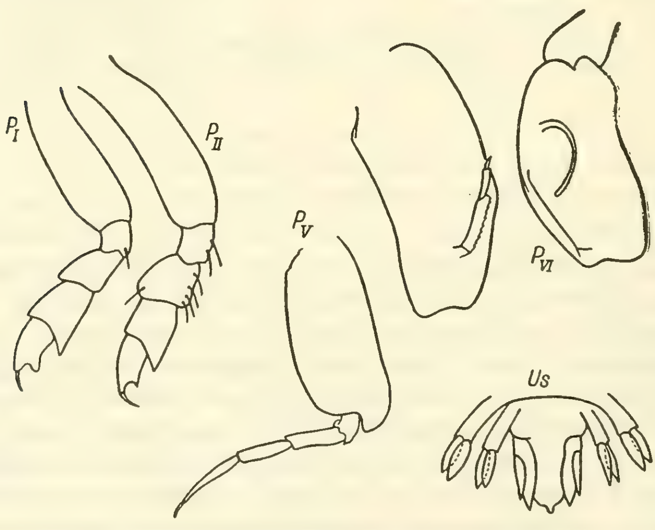
Distribution: A warm-water, circumoceanic species known from the Atlantic (south of 43° N), Indian (Bay of Bengal), and Pacific (South China Sea, Kuroshio, eastern tropical part) oceans, and the Mediterranean Sea. It inhabits the upper 200–300 m layer but is found more often in the warmed surface layer.

460 2. ***Amphithyrus similis*** Claus, 1879 (Fig. 247)

Claus, 1879b: 16; 1887: 42; Spandl, 1924: 39.—*bispinosus* Spandl, 1927: 247 (*similis* var.).

Length of adult individuals about 3 mm.

In external appearance and structure of the body sections and extremities, this species is close to *A. bispinosus*. Based on the similarity in structure of pereopods VI (shape of 2nd segment and lateral fissure), pereopods VII (consisting of one basal segment), and the telson (with pointed tip), Spandl (1927) considered *A. similis* a variety of *A. bispinosus*, bearing in mind that coxal plate V is not modified into a spine. However, a comparison of the description and drawings of both species revealed significant differences; the major ones are listed on the following page.



460 Fig. 247. *Amphithyrus similis* Claus, female (after Claus, 1887).

A. similis	*A. bispinosus*
1. Distal process of 5th segment of pereopods II reaches only 2/3 length of 6th segment.	1. Distal process of 5th segment of pereopods II reaches tip of denticle of 6th segment.
2. Inner process of coxal plate V rounded.	2. Inner process of coxal plate pointed.
3. In pereopods V, 2nd segment barely shorter than distal segments.	3. In pereopods V, 2nd segment 2/3 length of distal segments.
4. Telson galeiform, with stretched tip.	4. Telson triangular, with pointed tip.
5. Telson almost twice as long as last urosomite.	5. Telson only slightly longer than last urosomite.

The above differences permit us to consider A. similis an independent species.

Distribution: Known from the Atlantic Ocean (south of 38° N) and the Mediterranean and Red seas. It lives in the 0–200 m layer.

Absent in our collections.

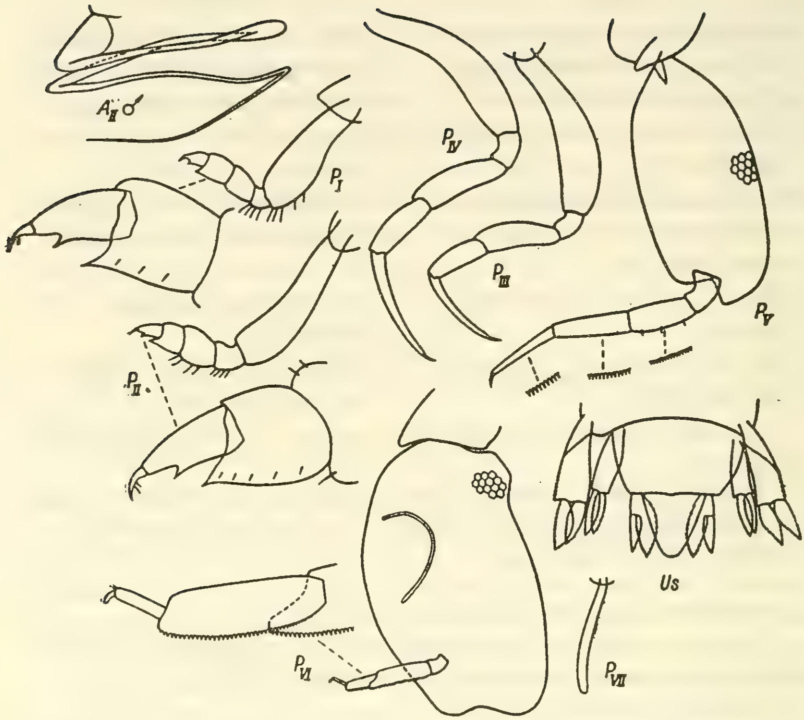
461 3. ***Amphithyrus muratus*** Volkov, sp.n. (Fig. 248)

The type specimen is preserved in the Pacific Ocean Scientific Research Institute of Fisheries and Oceanography (TINRO).

Length of adults up to 3.5 mm.

The body is identical in shape to *A. similis.* All the somites of the body, the telson and the 2nd segment of the pereopods are covered with a reticulate sculpture. The 2nd segment of pereopods VI has grooved sculpturing in the central part and a reticulate pattern along the periphery.

The 2nd segment of pereopods I has barely bulged margins and is only slightly longer than the distal segments together; the 4th segment is not broader than the 5th; the 5th segment has a short distal process and bears a few submarginal spines along its posterior margin. The 2nd segment of pereopods II is much longer than the distal segments together; the 4th segment has bulged margins and is broader than the 5th; in the 5th segment the distal process falls short of the base of the denticle on the posterior margin of the 6th segment and the posterior margin of the segment bears fine submarginal spines. Coxal plate V has an inner projection with a rounded tip and a denticulate lower margin. The 2nd segment of pereopods V is 2.1–2.2 times longer than wide; the distal segments together are approximately as long as the 2nd segment. The 2nd segment of pereopods VI is similar to that in *A. similis* but its
462 length only 1.4 times the width versus almost twice in *A. similis*; the shape and size of the lateral fissure are almost the same as in *A. similis* and *A. bispinosus*; the 4th segment is long, with parallel margins and a



461 Fig. 248. *Amphithyrus muratus* Volkov, sp.n., male.

rounded distal process reaching 1/3 the length of the 5th segment; the 5th segment is relatively longer than in *A. similis* and *A. bispinosus*; the 6th segment is shorter than the 5th. Pereopods VII consist of a single 2nd segment, which is narrow, with parallel margins, and almost not broadened.

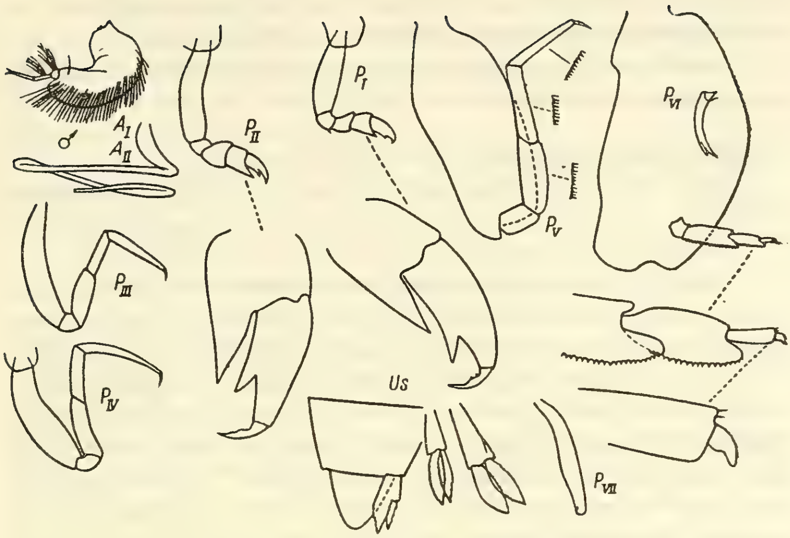
The basipodite of uropods I is almost half the length of the rami. The basipodite of uropods II is 1.2–1.3 times longer than the rami. The basipodite of uropods III is fused with the endopodite. The telson is shorter than the last urosomite, its length equal to its width at the base, and its tip rounded.

Distribution: Found in the waters of Kuroshio (34° N, 147° E) and Nasca ridge.

4. ***Amphithyrus glaber*** Spandl, 1924 (Fig. 249)

Spandl, 1924: 40.—*inermis* Bovallius, 1887a: 48.

Length of adult individuals 2.5–3.0 mm.



462 Fig. 249. *Amphithyrus glaber* Spandl, male.

The shape of the body is the same as in the preceding species. The body surface is smooth, without hexagonal or striate sculpturing.

The 2nd segment of pereopods I has barely bulged margins and is equal in length to the remaining segments together; the 4th and 5th segments are equal in width; the distal process of the 5th segment is narrow and long, reaching the base of the denticle of the 6th; in the 6th segment the denticle forms an acute angle with the posterior margin. The 2nd segment of pereopods II is longer than the distal segments; the 4th segment is broader than the 5th; the chelae are the same as in pereopods I but the distal process reaches the tip of the denticle of the 6th segment. The claws of pereopods I and II are appreciably thickened in the middle part. The 2nd segment of pereopods V is much shorter than the distal segments together; the 4th–6th segments are approximately equal in length and their anterior margin is denticulate. The lateral fissure of the 2nd segment of pereopods VI is much less curved than in *A. similis*; the 4th segment is 1.5 times longer than the 5th; the margins of the 5th segment are bulged; the 4th and 5th segments have a distal process but in the 5th segment the process is shorter; the 6th segment is distally broadened and half the length of the 5th. Pereopods VII consist of a
463 2nd segment that is stretched and almost straight and barely perceptible rudimentary distal segments.

The rami of uropods I are equal in length to the basipodite but in uropods II are longer. The endopodite of uropods III is fused with the basipodite. The telson has a rounded tip and is less in length than its width at the base and also the length of the last urosomite.

Distribution: Known from the Pacific Ocean (Kuroshio) and the Red Sea. It lives in the surface water layer.

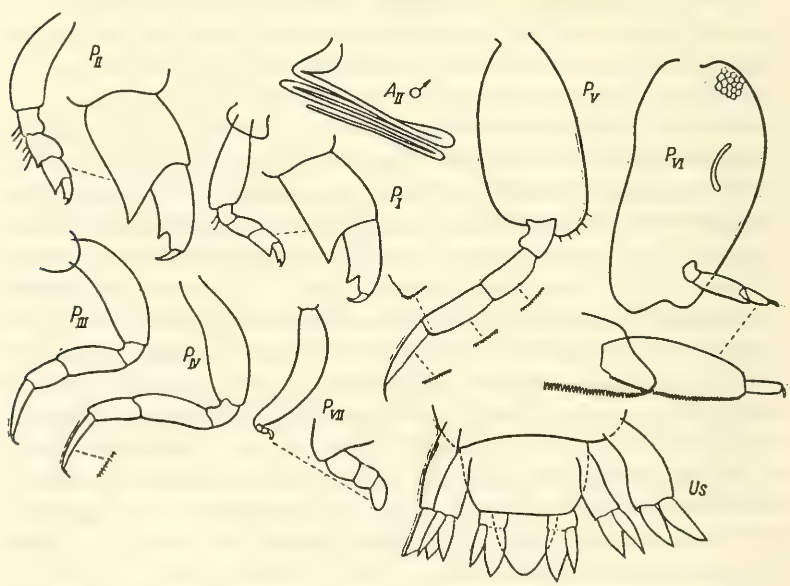
5. ***Amphithyrus sculpturatus*** Claus, 1879 (Fig. 250)

Claus, 1879b: 16.—orientalis Stebbing, 1888: 1485; Shoemaker, 1925: 58.

Length of adult females up to 5 mm, of males up to 3.5 mm.

Unlike other species of the genus, not only the surface of all the body somites has a reticulate sculpture, but even the surface of all the segments of pereopods V, the 2nd segment of pereopods VI, and the uropods.

The 2nd segment of pereopods I and II is equal in length to the distal segments together; in pereopods II the 4th segment is more broadened than in pereopods I; in both pereopods I and II the distal processes fall short of the base of the denticle of the 6th segment. The 2nd segment of pereopods V is much shorter than the distal segments together. The 4th segment of pereopods VI is 1.5 times longer than the 5th, its distal process short; the 5th segment has weakly bulged margins and lacks a distal process; the 6th segment is 1/3 or less the length of the 5th, straight, with parallel margins. Pereopods VII consist of a smoothly bent forward 2nd segment and three–five rudimentary distal segments.



463 Fig. 250. *Amphithyrus sculpturatus* Claus, male

The basipodite of uropods I is 1.5 times longer than the rami, in uropods II also longer than the rami. The endopodite of uropods III is
464 fused with the basipodite or indistinctly separated from it. The telson has a rounded tip and its length is less than its width at the base and the length of the last urosomite.

Distribution: Known from the Atlantic (south of 40° N), Indian (eastern part), and Pacific (Kuroshio) oceans, and the Mediterranean and Red seas. It inhabits the 0–100 m layer.

XXIII. Family PARASCELIDAE Claus, 1879

Small-sized (5–7 mm) animals. The body is broad, compact, and generally slightly flattened dorsoventrally. The pleon is generally narrower than the pereon and, together with the urosome, may be tucked under the belly. The head is short, broader than the pereon, and the anterior margin rounded. The eyes are large and occupy almost the entire surface of the head. However, the shape and proportions of the head and body differ significantly in different genera. For instance, in *Thyropus* and *Parascelus* the height of the head is more than its length and the
464 urosome and telson are tucked under the belly, while in *Euscelus* the height of the head is less than or equal to its length and the body is almost straight. Antennae II in females are short and few-segmented, in males thin, long, and folded five times. The mouth parts are stretched into a pointed cone. The mandibles are stretched, have a narrow cutting edge, and the mandibular palp is present only in males.

The coxal plates are free. Pereopods I and II are simple or have chelae. The basal segment of pereopods V and VI is strongly broadened and modified into an operculum, which in pereopods VI is always very large; in pereopods V the distal segments are articulated subterminally, and in pereopods VI more proximally. In pereopods VI the posterior margin of the basal segments generally has a longitudinal "telsonic" groove into which the edges of the uropods and the telson may be inserted so that the body during rolling acquires an oval shape. Pereopods VII generally (except for *Thyropus*) have a full complement of segments and the distal segments together are slightly shorter than, equal to, or longer than the basal segments. The endopodite of uropods II and III is fused with the peduncle or may be separated. The broad telson is fused with the last urosomite.

The family includes five genera.

KEY TO GENERA OF FAMILY PARASCELIDAE

1. Pereopods I and II simple .... 2.
— Pereopods I and II with chelae .... 3.

2. Pereopods I shorter than pereopods II; 5th segment slightly broadened, its distal angles stretched into small rounded lobes (posterior always more so than anterior) 1/6–1/5 length of 6th segment; 4th segment of pereopods VI with distal process. Endopodite of uropods I lanceolate, rather narrow .... 4. ***Parascelus*** Claus.

— Pereopods I longer than pereopods II or equal to them; 5th segment not broadened and without distal lobes; 4th segment of pereopods VI without distal process. Endopodite of uropods I strongly broadened distally .... 3. ***Thyropus*** Dana.

3. Pereopods I and II similar in structure, with chelae; anterior margin of posterior distal process of 5th segment denticulate only in distal part, and rather deep notch present between denticulate area and base of 6th segment .... 1. ***Euscelus*** Claus.

— Pereopods I and II dissimilar in structure, pereopods II with chelae; distal process, if present, short in pereopods I, and notch on anterior margin of posterior distal process absent .... 4.

4. Distal process of 5th segment of pereopods I short. Anterior margin of posterior distal process of 5th segment and posterior margin of
465 6th segment of pereopods II denticulate throughout length. Seventh segment of pereopods V very slightly shorter than 6th .... 5. ***Hemiscelus*** Stew.

— Distal process of 5th segment of pereopods I barely perceptible or absent. Distal process of 5th segment of pereopods II with a few subapical denticles on anterior margin; remainder of its anterior margin and posterior margin of 6th segment smooth. Seventh segment of pereopods V shorter than half length of 6th segment.............. .... 2. ***Schizoscelus*** Claus.

1. Genus *Euscelus* Claus, 1879

Claus, 1879b: 22; 1887: 43; Spandl, 1927: 251; Bowman and Gruner, 1973: 57.

The flagellum of antennae I in males in four-segmented and the length of the 1st segment just barely more than its width. The 2nd and 3rd segments of antennae II in males are longer than the next two segments. The 2nd segment of pereopods I and II is short and the anterior margin of the immovable part of the chelae curved proximally, but distally straight and denticulate. The 2nd segment of pereopods V and VI is markedly broadened. Pereopods VII have a full complement of segments. In uropods I, and more so in uropods II and III, the peduncle is shorter than the rami and the exopodites are shorter and narrower than the endopodites.

Type species: *Euscelus robustus* Claus, 1879.

1. ***Euscelus robustus*** Claus, 1879 (Fig. 251)

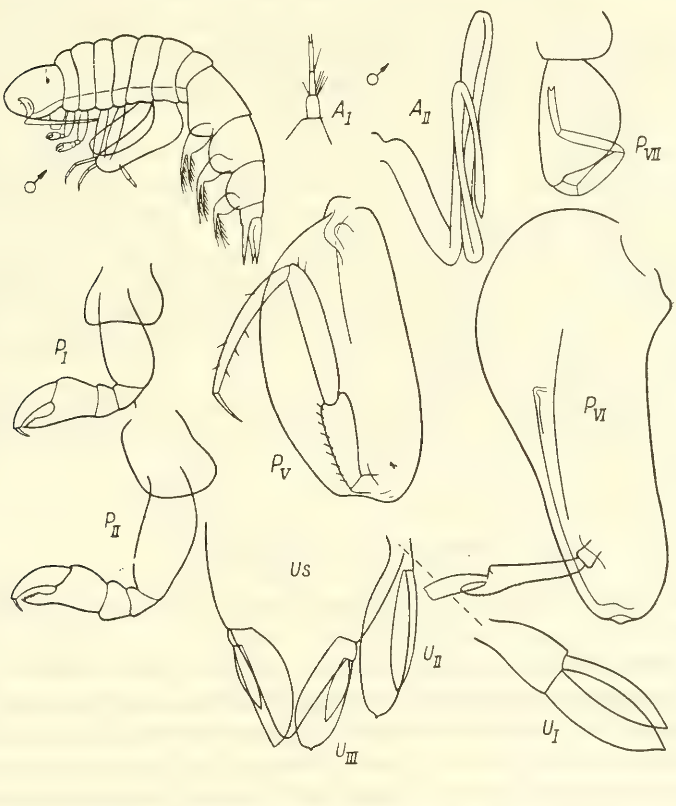
Claus, 1879b: 22; 1887: 43; Spandl, 1927: 251.

Length of males up to 6 mm. Female not described.

The head is oval and its length more than the height. The pereon is somewhat bulged and higher than the head. The pleon is somewhat shorter than the pereon.

The 1st segment of the flagellum of antennae I in males is the largest, the 2nd segment is broader than the 3rd but equal to it in length, and the 4th segment is linear, longer and narrower than the 3rd. The basal segment of antennae II is equal in length to half the 2nd segment, the 2nd and 3rd segments are equal, the 4th is slightly shorter than the 3rd, and the 5th half the 3rd in length.

The 2nd segment of pereopods I is twice longer than wide but its length less than the distal segments together; the 4th segment is distally broadened; the 5th segment has a well-developed process on the posterior distal angle that reaches the base of the claw; the distal process has



466 Fig. 251. *Euscelus robustus* Claus (after Claus, 1887).

a rather deep notch in the proximal part of the anterior margin while the distal margin is straight with a few low uniform denticles; the 6th segment is distally narrow and slightly curved; the 2nd–6th segments may be pubescent along the posterior margin with sparse short setae. Pereopods II differ from pereopods I only in a somewhat longer 2nd segment. The 2nd segment of pereopods V is twice longer than wide, its anterior margin almost straight, and the posterior bulged; the 3rd–7th segments are 1.5 times longer than the 2nd; the 4th segment is slightly broadened distally; the 5th segment is linear, longer, and narrow; the 6th segment is barely curved and equal in length to the 5th; the claw is thin, long, and almost straight. The basal segment of pereopods VI is longer than in pereopods V, narrows distally, its anterior margin almost straight and concave only in the proximal part, and the posterior margin sharply bulged in the proximal part but straight in the distal; the distal segments together are longer than half the 2nd segment; the 4th segment is longer and straight, its anterior distal process 1/3 the length of the 5th segment, which is shorter and narrower than the 4th; all these segments are denticulate throughout the length of the anterior margin; the claw is narrow and more than half the length of the 6th segment. Pereopods VII have a full complement of segments; the 3rd–7th segments together are longer than the 2nd; the claw is rudimentary.

466 The basipodite of uropods I is denticulate in the distal part of the anterior margin; the exopodite is longer than the basipodite but shorter and narrower than the endopodite; the tip of the latter reaches the tip of the telson. The basipodite of uropods II is very short, the rami are long, and the exopodite is shorter and narrower than the endopodite. Uropods III are somewhat longer than the telson; the basipodite is short; the endopodite is longer than the exopodite and two–three times broader than it. The tip of the telson is rounded.

Distribution: Known from the Atlantic (Azores), Pacific, and Indian (Zanzibar) oceans. It is found in total catches from 1,500 m to the surface.

Absent in our collections.

2. Genus *Schizoscelus* Claus, 1879

Claus, 1879b: 20; 1887: 43; Stebbing, 1888: 1504; Bowman and Gruner, 1973: 58.

Pereopods I are simple; pereopods II have long, narrow chelae. The 2nd segment of pereopods V–VI is markedly broadened. Pereopods VI are six-segmented; the 2nd segment has a very long "fissure"; the 3rd–6th segments together are much shorter than the 2nd; the 4th segment has an anterior distal process. Pereopods VII have a full complement of segments.

The endopodites of uropods II and III are fused with the basipodites.
Type species: *Schizoscelus ornatus* Claus, 1879.

467 1. ***Schizoscelus ornatus*** Claus, 1879 (Fig. 252)

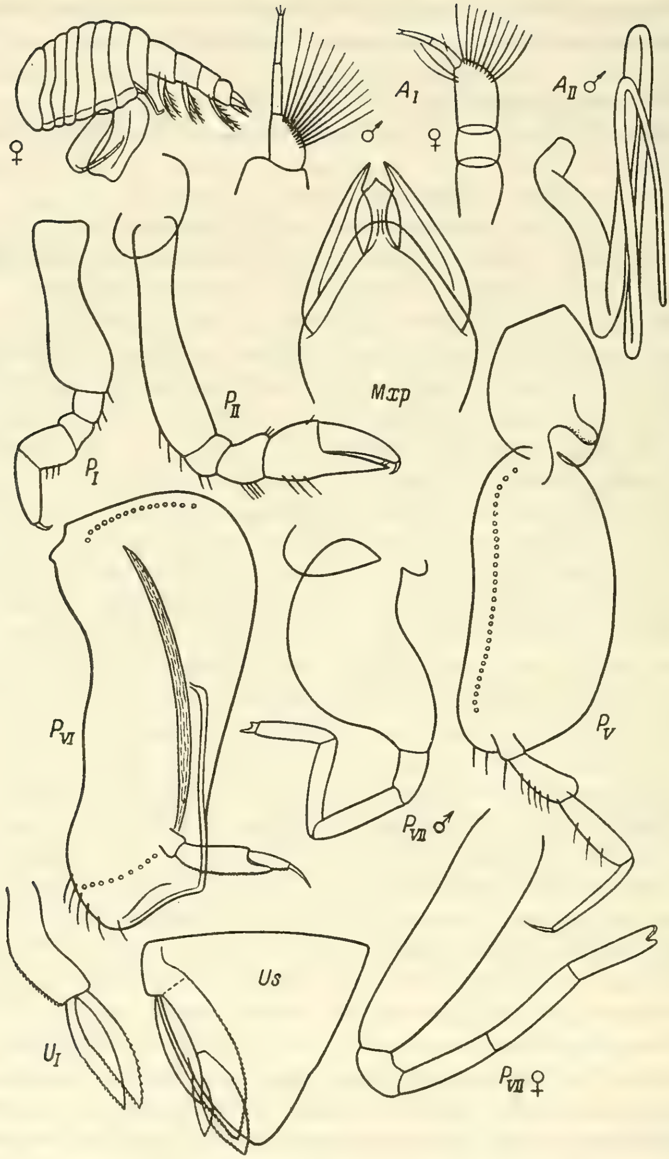
Claus, 1879b: 21; 1887: 44; Stebbing, 1888: 1504; Spandl, 1927; 255.

Length of sexually mature specimens 2.5–4 mm.

The head is short, in length equal to the first three somites of the pereon, its height is almost thrice the length. The pereon is bulged, high, and longer than the pleon; the pleon is half as high as the pereon.

The flagellum of antennae I in males is three-segmented; the 1st segment has a bulged posterior margin bearing long thin setae arranged in a fan; the 2nd and 3rd segments are straight and narrow. Antennae I in females are similar in structure but their peduncle narrower than in males. The basal segment of antennae II in males is 2/3 the length of the following segment antennae II are folded zigzag four times.

468 Pereopods I are simple; the 2nd segment is straight and equal in length to the successive segments together; the 5th segment is shorter than the two preceding together but broader and its posterior distal angle may form a small pointed process; the 6th segment is longer than the 5th and its margins smooth; the claw is deeply curved. Pereopods II have chelae; the 2nd segment is longer than in pereopods I; the 5th segment has a long posterior distal angle that reaches the base of the claw and has a pointed tip, while the distal part of the anterior margin has a few (generally three) denticles; the 6th segment is narrowly conical and slightly curved. The 2nd segment of pereopods V has a bulged posterior margin, slightly bulged anterior margin, and its width is half its length; the 3rd–7th segments together are equal to the 2nd in length; the 4th segment is distally broadened and has a more bulged posterior margin; the 5th segment is narrower and longer, its posterior margin almost straight, and the anterior slightly bulged in the distal part; the 6th segment is linear and longer than the 5th; the claw is thin and straight and 1/3 the length of the 6th segment. The 2nd segment of pereopods VI is 1.5–2 times longer than in pereopods V, its maximum width occurring in the proximal part, the anterior margin concave, with a low smoothened tubercle in the middle, the distal margin evenly rounded, the posterior margin markedly bulged in the proximal part but straight in the middle and distal parts, and the fissure on the inner surface of the segment very long; the distal segments together are 1/3 the length of the 2nd segment; the 4th segment has an anterior distal process that reaches the middle of the 5th segment; the 6th segment is notably narrowed; the claw is rudimentary. Pereopods VII have a full complement of segments; the 2nd segment in females is almost linear, its width 1/3 its length; the 4th and 5th segments are equal to each other but the 6th is shorter; the claw is



467 Fig. 252. *Schizoscelus ornatus* Claus (after, Claus, 1887).

very short. Pereopods VII in males differ in a broader 2nd segment with a markedly bulged posterior margin.

The basipodite of uropods I is curved and the distal half of its anterior margin pectinate; the rami are lanceolate, equal in length to the peduncle, and their tips extend beyond the tip of the telson. The basipodite of uropods II is very short and fused with the endopodite or indistinctly separated; the endopodite is lanceolate, very large, its tip almost reaching the tip of the telson; the exopodite is shorter and twice narrower than the endopodite. Uropods III are somewhat longer than the telson and the exopodite 2/3 the length of the endopodite. The tip of the telson is smoothly rounded, its length less than the width at the base and less than the length of the last urosomite.

Distribution: Known from the Atlantic (43° N to 14° S), Pacific (region of the Philippines), and Indian oceans, and the Mediterranean Sea. It inhabits the upper 200 m layer.

3. Genus *Thyropus* Dana, 1852

Dana, 1852: 1008; Stebbing, 1888: 1452; Spandl, 1927: 258.—*Tanyscelus* Claus, 1879b: 17; 1887: 45.

The head is flattened anteriorly, its length in the lower part more than in the upper. The pereon is broad and markedly bulged; somites I and II are short. The urosome and telson are tucked under the belly.

Pereopods I and II are simple; the 5th segment has no distal process. The 2nd segment of pereopods V is oval; in pereopods VI this segment is strongly stretched distally and much larger. Pereopods VI have a full complement of segments; the 4th segment has no distal process. Pereopods VII are short and weak; the number of distal segments varies from two to five.

The endopodites of uropods II and III are free. The telson is hemispherical.

Type species: *Thyropus diaphanus* Dana, 1852.

469 1. ***Thyropus sphaeroma*** (Claus, 1879) (Fig. 253)

Claus, 1879b: 17 (*Tanyscelus*); 1887: 45 (*Tanyscelus*).—Bovallius, 1887a: 43; Stebbing, 1888: 1496; Spandl, 1927: 259.—*diaphanus* Dana, 1852: 1013.—*atlanticus* Bovallius, 1887a: 43.—*danae* Stebbing, 1888: 1492.

Length of adult individuals up to 7 mm.

Antennae I in males with a four-segmented flagellum; the Ist segment is the largest, notably curved forward, and distally so narrows that its apical margin is equal in width to the base of the 2nd segment. Antennae II in males with a short, uncurved basal segment, with slightly bulged margins, its width 1/3 its length; the antennae are long and thin and folded zigzag five times; the 2nd segment is approximately four times longer than the basal; the 4th segment is much shorter than the 3rd and almost twice as long as the 5th.

469 Fig. 253. *Thyropus sphaeroma* (Claus).

Pereopods I are equal to or somewhat shorter than pereopods II; the 2nd segment is equal to the 4th and 5th together; the 5th segment is much shorter and narrower than the 4th, and the 6th 2/3 the length of the 5th; the claw is short. The 5th segment of pereopods II is shorter than in pereopods I and the 6th segment longer. Coxal plate V has a long spiniform process on the inner surface; the 2nd segment is oval and 1.6–1.7 times longer than wide; the distal segments together are somewhat shorter or longer than the 2nd segment; the 5th segment is linear and twice longer than the 4th; the 6th segment is shorter and narrower than the 5th but 1.5
470 times longer than the 4th. The 2nd segment of pereopods VI is almost twice longer than in pereopods V, broad, markedly narrowed proximally and distally, its anterior margin notably concave medially, the posterior margin bulged in the proximal half, and a small oval fissure occurs close

to the base of the segment; the 3rd–7th segments together are 1/4 the length of the 2nd; the 4th segment is straight and linear and without an anterior distal process; the 5th segment is straight, almost linear, and 2/3 the 4th in length and narrower than it; the 6th segment is 1/2 the length of the 4th; the claw is approximately 1/3 the length of the 6th segment. The 2nd segment of pereopods VII is 2.5 times longer than wide, the anterior margin concave, and the posterior convex; the number and length of the distal segments are highly variable but individuals with two short distal segments encountered more often.

The basipodite of uropods I is distally broadened and its anterior margin denticulate almost throughout its length; the exopodite is lanceolate and equal to the basipodite in length; the endopodite is broadly lanceolate, 1/3 the exopodite in length and twice as broad, and its tip does not reach the tip of the telson. The basipodite of uropods II is distally broadened; the rami are lanceolate; the exopodite is 1.5 times longer than the basipodite; and the endopodite is 1.5 times or more longer than the exopodite. The basipodite of uropods III is almost equal in length and width; the rami are broadly lanceolate; the endopodite is almost 2.5 times longer and also broader than the exopodite, its tip reaching somewhat beyond the tip of the telson. The last urosomite has slightly bulged lateral margins and its maximum width is almost twice its length. The telson is hemispherical, its length half its width at the base.

Distribution: This species is widespread in the tropical zone of all oceans. It is known from the Atlantic (between 47° N and 36° S, including the equatorial zone), Indian (Arabian Sea), and Pacific (Kuroshio, Hawaiian Islands, eastern part from 40° N to 30° S, equatorial zone) oceans. It inhabits the upper 200 m layer.

4. Genus *Parascelus* Claus, 1879

Claus, 1879b: 18; 1887: 45; Stebbing, 1888: 1496; Spandl, 1924: 42; Stephensen, 1925a: 208; Chevreux and Fage, 1925: 423; Hurley, 1955: 183.

This genus is very close to the genus *Thyropus*, a fact noted by many investigators, in particular Hurley (1955). He considered that the status of the genus *Parascelus* raises definite doubts and that there are serious premises for relegating it to a synonym of the genus *Thyropus*. These considerations notwithstanding, there are certain significant morphological features that dictate the isolation of group of species in a separate genus.

The basic differences between *Parascelus* and *Thyropus* are given as follows:

Parascelus	*Thyropus*
1. Peduncle of antennae I in males markedly curved at base and more than 1/3 length of Ist segment of flagellum.	1. Peduncle of antennae I in males straight, 1/4 length of Ist segment of flagellum.
2. Pereopods I shorter than pereopods II.	2. Pereopods I equal to or longer than pereopods II.
3. In pereopods I and II, 5th segments slightly broadened and their posterior distal angles form small but noticeable rounded processes.	3. In pereopods I and II, 5th segments narrower, without distal processes.
471 4. In pereopods VI, 4th segment with distal process.	4. In pereopods VI, 4th segment without distal process.
5. Telson triangular, with rounded tip.	5. Telson hemispherical.

Type species: *Parascelus edwardsi* Claus, 1879.

KEY TO SPECIES OF GENUS PARASCELUS

1. Second segment of pereopods I shorter than 3rd–7th segments together. Maximum width in proximal half of 2nd segment of pereopods VI 1.5–1.7 times maximum width in distal half. Endopodite of uro-pods II 1.3–1.5 times longer than exopodite..... .... 2. ***P. edwardsi*** Claus.

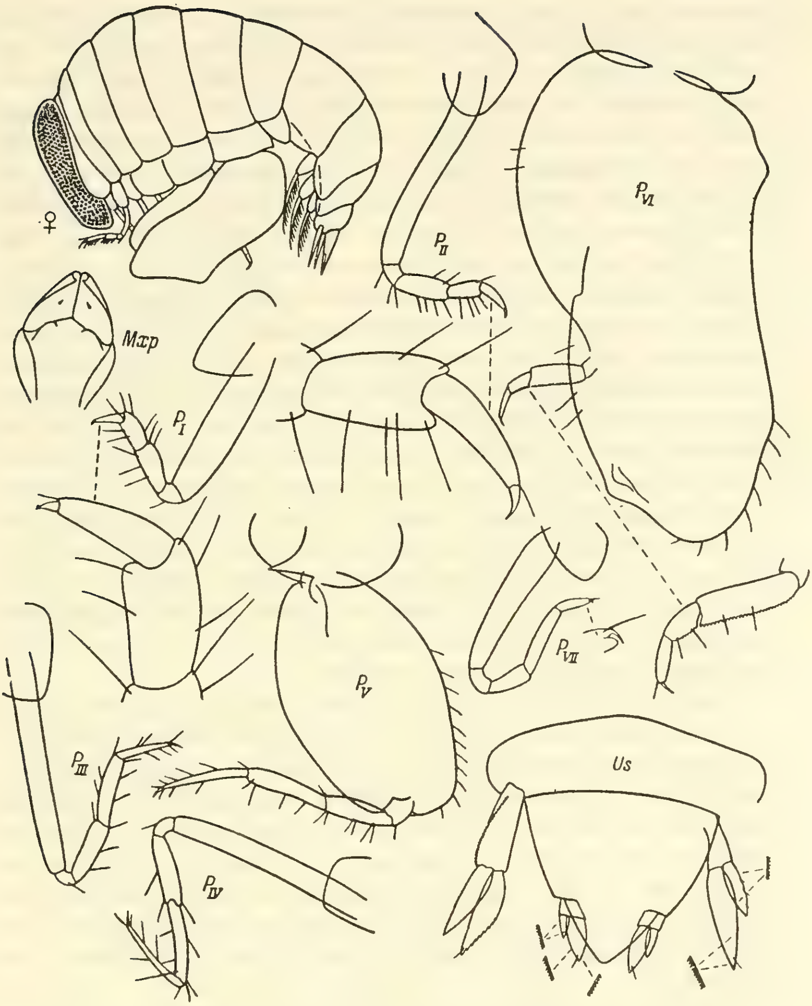
— Second segment of pereopods I much longer than 3rd–7th segments together. Maximum width in proximal half of 2nd segment of pereopods VI only 1.2–1.3 times maximum width in distal half. Endopodite of uropods II 1.7–1.9 times longer than exopodite .... 1. ***P. typhoides*** Claus.

1. ***Parascelus typhoides*** Claus, 1879 (Fig. 254)

Claus, 1879b: 19; 1887: 46; Spandl, 1924: 43; 1927: 262; Chevreux and Fage, 1925: 424; Hurley, 1925: 183.—similis Stephensen, 1925a: 211.

Length of adult individuals up to 7 mm.

The head is flattened anteriorly, its height four–five times its length and approximately equal to its width, and ventrally terminates in a small process that does not project forward. The pereon is broad, dorsally bulged, its first two somites together equal to somite III in length. The urosome and telson are tucked under the pereon.



472 Fig. 254. *Parascelus typhoides* Claus.

The 2nd segment of pereopods I is narrow, almost linear, and 1.2–1.3 times longer than the 3rd–7th segments together; the 5th segment is shorter than the 4th, its width about half its length, and its rounded posterior distal process small; the 6th segment is conical, almost equal to the 5th in length but much narrower, its anterior margin bulged, the posterior straight; the claw is short and thick. The 2nd segment of pereopods II is narrower and much longer than in pereopods I; the distal segments are the same as in pereopods I. The 2nd segment of pereopods III is linear, somewhat longer than in pereopods II, and straight or barely curved in front; the 4th segment is shorter than the 5th but longer than the 6th; the claw is thin. Pereo- pods IV are analogous in structure except that the 4th–6th segments are longer. In pereopods V the lower margins of the coxal plate are roundish, the inner process rather short and broad at the base; the 2nd segment is oval and 1.7–1.9 times longer than wide; the 3rd–7th segments together are equal to the 2nd in length; the 4th segment is much shorter than the 5th, the 6th segment longer than the 4th but shorter than the 5th. The 2nd segment of pereopods VI has a geminate tubercle in the proximal part of the anterior margin, the anterior margin is barely concave medially, and bears sparse long setae in the distal part; the posterior margin has bulged proximal and distal halves; the maximum width of the proximal half of the 2nd segment is 1.2–1.3 times the maximum width of the distal half; the 3rd–7th segments together are 1/4 the length of the 2nd; the 4th segment is linear and has a well-developed distal process; the 5th segment is narrower and almost half the length of the 4th; the 6th segment is equal to the 5th in length but much narrower; the claw is thin, pointed, and 1/3 the length of the 6th segment. Pereopods VII have a full complement of segments; the 2nd segment is narrow and long; the 3rd–7th segments together are much shorter than the 2nd but individuals are encountered in which the distal segments are almost equal to the 2nd segment in length.

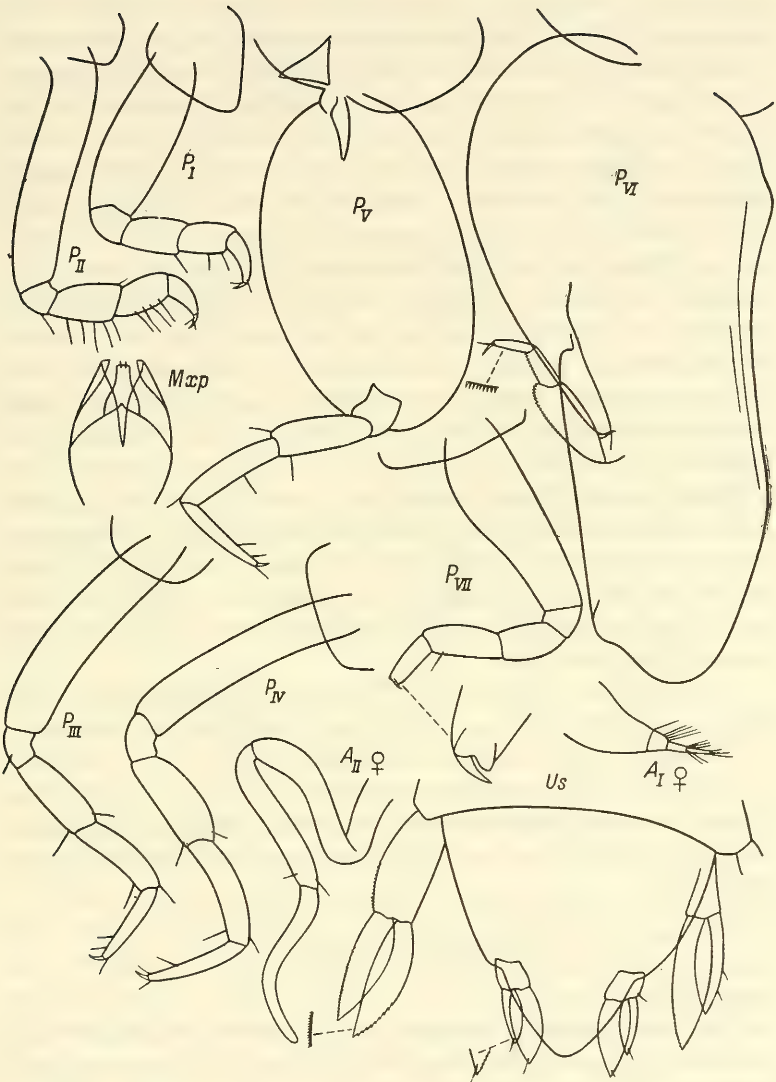
The basipodite of uropods I is distally broadened and its anterior margin denticulate almost throughout its length; the rami are lanceolate;
472 the endopodite is longer than the basipodite, and the exopodite is shorter. The basipodite of uropods II is half as long as in uropods I; the rami are lanceolate; the endopodite is almost twice as long as the exopodite and longer than the endopodite of uropods I. The basipodite of uropods III is wider than long; the endopodite is two–four times longer than the exopodite and its tip reaches slightly beyond the tip of the telson. The telson is triangular, has a rounded tip, and its length is 2/3 its width at the base.

Distribution: Known from the Atlantic (from 45° N to 36° S), Indian (Arabian Sea; 21° S, 58° E), and Pacific (Kuroshio, region of Peru, equatorial zone, eastern part, and north of New Zealand) oceans, and Mediterranean and Red seas. Inhabits the upper 200 m layer.

473 2. ***Parascelus edwardsi*** Claus, 1879 (Fig. 255)

Claus, 1879b: 18; 1887: 46; Spandl, 1924: 42; 1927: 264.—*parvus* Claus, 1879b: 20; 1887: 47; Stebbing, 1888: 1500; Stephensen, 1925a: 211. —*nasutus* Bovallius, 1887a: 44.—*zebu* Stebbing, 1888: 1496; Shoemaker, 1925: 46; Stephensen, 1925a: 211.—*typhoides* ? Hurley, 1955: 183.

Length of adult specimens 5–7 mm.



473 Fig. 255. *Parascelus edwardsi* Claus, female.

The shape of the head and body and the structure of the antennae are the same as in *P. typhoides*. The 2nd segment of pereopods I is relatively shorter and broader than in *P. typhoides*; the 3rd–7th segments together are longer than the 2nd; the 5th segment is shorter than the 4th and equal to the 6th; the posterior distal process of the 5th segment

is very small. Pereo- pods II are similar in structure to pereopods I but longer and the 3rd–7th segments shorter than the 2nd. The 2nd segment of pereopods III is much shorter than the successive segments together. Coxal plate V is similar in structure to that in *P. typhoides*; the 2nd segment of pereopods V is oval and 1.3 times longer than wide; the 3rd–7th segments together are equal in length to the 2nd; the 4th segment
474 is shorter than the 5th and equal in length to the 6th. The maximum width of the proximal half of the 2nd segment of pereopods VI is 1.5–1.7 times that in the distal part; the 3rd–7th segments together are less than 1/3 the length of the 2nd; the 4th segment has a small rounded distal process reaching 1/3 the length of the next segment; the 5th segment is almost half the length of the 4th but much narrower; the 4th–5th segments have a denticulate anterior margin, the 6th segment is equal to the 5th in length but narrower; the claw is slightly bent forward and 1/3 the length of the 6th segment. The shape and width of the 2nd segment of pereopods VII are highly variable: it may be broad with a convex posterior margin and concave anterior margin or very slightly broadened; the 3rd–7th segments together in individuals with a broad 2nd segment are 1/2–2/3 its length and in individuals with a narrow 2nd segment only slightly shorter or equal in length; the claw is small, curved, and firmly pressed to the distal margin of the 6th segment.

Uropods I are the same as in *P. typhoides*. The endopodite of uropods II, as also in uropods III, is 1.2–1.4 times longer than the exopodite.

The telson and the last urosomite are the same as in *P. typhoides*.

Distribution: Known from the Atlantic (34° N to 3° S), Indian (Sri Lanka), and Pacific (Philippines, New Zealand, Nasca ridge, region of eastern Australia) oceans, and the Mediterranean Sea. It lives in the upper 200 m layer.

5. Genus *Hemiscelus* Stewart, 1913

Stewart, 1913: 259.

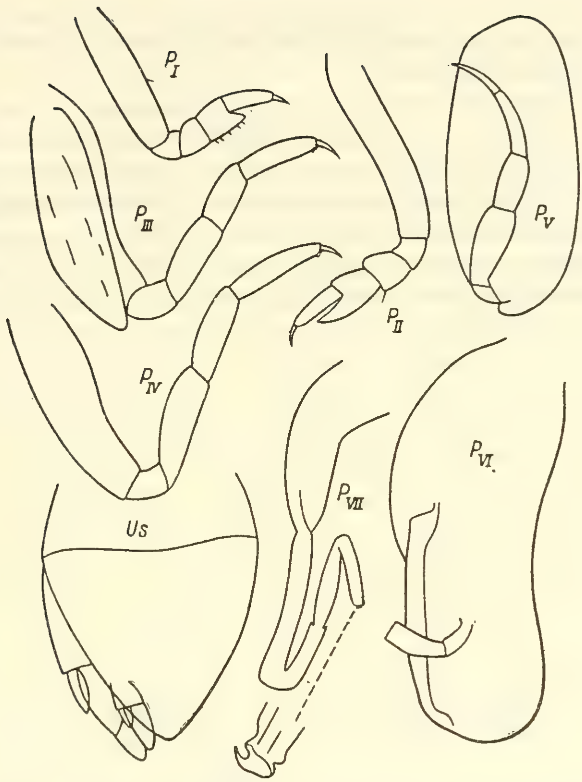
The genus *Hemiscelus* and its only species *H. diplochelatus* were
475 described by Stewart (1913) from a single 2 mm long female specimen; furthermore, the specimen was greatly damaged. No other investigator has come across this species since then. It is also absent in our collections.

Type species: *Hemiscelus diplochelatus* Stewart, 1913.

1. ***Hemiscelus diplochelatus*** Stewart, 1913 (Fig. 256)

Stewart, 1913: 259.

The body is wide and compact and the pereon is slightly bulged. The head is short, flattened anteriorly, and somewhat higher than the first somites of the pereon.



474 Fig. 256. *Hemiscelus diplochelatus* Stewart, female (after Stewart, 1913).

The 2nd segment of pereopods I is linear and equal in length to the distal 3rd–7th segments; the 4th segment is slightly broadened distally and equal in width and length; the posterior distal process of the 5th segment does not reach the middle of the 6th segment and the margins of the process are smooth; the claw is 1/3 the length of the 6th segment. The 2nd segment of pereopods II is longer than in pereopods I and also longer than the distal segments together; the 4th segment is longer than its width; the posterior distal process of the 5th segment is 2/3 the length of the 6th segment; the claw is half the length of the 6th segment. The 2nd segment of pereo- pods V is oval and its width 1/2 its length; the 7th segment appears to be a smooth continuation of the 6th segment and is almost the same length; the distal segments together are shorter than the 2nd segment. The 2nd segment of pereopods VI is slipper-shaped and has no lateral fissure; the distal segments are lost. The 2nd segment of pereopods VII is moderately broadened and shorter than the distal segments; in the drawing supplied by Stewart there is no border between the 3rd and 4th segments, and this fused segment is longer than the 5th–7th segments together.

The basipodite of uropods I and the lanceolate rami are equal in length; the tips of the rami extend beyond the tip of the telson. The basipodite of uropods II is longer than the rami; the endopodite is broader and almost twice longer than the exopodite. The endopodites of all the uropods are free. The telson has a smoothly rounded tip, is half the last urosomite in length, and its width exceeds its height.

Distribution: Reported once, from the tropical zone of the Atlantic Ocean (15°45′ S, 33° 11′ W).

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Supplement

By M.E. Vinogradov and T.N. Semenova
(translated by D. Siegel-Causey)

It has been ten years since the publication of this book in Russia. Since this time, there have been many presentations about the hyperiid fauna in the World Ocean, and some of these have made definitive changes to our knowledge. A few new species have been added, some other species have been better described and with new generic affinities. New findings of a series of species have introduced new information concerning their areas of distribution. Further, some hyperiids known to inhabit only one ocean now have been found in two or three other oceans, for example: *Pegohyperia princeps, Vibiliodes alberti, Vibilia alberti, Vibilia caeca, Megalanceola stephensi, Hyperia bowmani.* For a few of the species, information on the depths of collection were changed significantly. All of these changes made it necessary to provide a short supplement to the original text, which will make this translation more contemporary.

I. New species of Hyperiidea described since 1982.

1. *Hyperia curticephala* Vinogradov and Semenova, 1985 (Figure 1)
Sexually mature males, 11–12 mm; females, 10 mm.

H. curticephala is distinguished from other species in *Hyperia* by its particularly long head. By many other characters, it is very near to *H. leptura* and to a lesser extent to *H. bowmani,* although one can distinguish one from the other. From *H. leptura,* the difference is by the presence of two apical spines on the medial lamina of the maxilliped, strong distal widening of article 5 of pereopods I and II, greater length of the distal part of article 5 on pereopod II, pereopoda III and IV are weakly equipped with spines, as are the edges of the epimere I and the apex of the telson. From *H. bowmani,* it differs by its smaller size, coloration, the relative elongation of articles on pereopoda III and IV by 4 to 5 times, the distally wider article 5 on pereopod II, very short claws on pereopoda III and IV, and practically no armament on pereopoda V and VI, which on *H. bowmani* are covered by dense rows of long submarginal or marginal bristles. For convenience, a comparison of these three species is given in Table 1.

This species was collected mostly in association with the spheromedusid *Chrysaora plocamia* in the Pacific Ocean in the coastal waters of

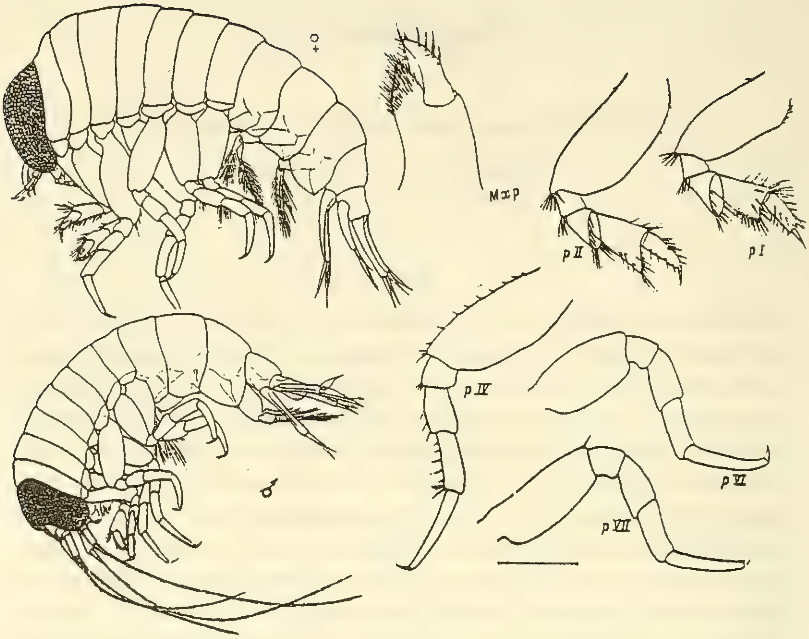

Fig. 1. *Hyperia curticephala* (after Vinogradov and Semenova, 1985).

Peru (up to 200 miles from shore), in the area of the Nasca ridge, and in the Indian Ocean near the shores of southeastern Africa.

2. *Lestrigonus ducrayi* Zeidler, 1992 (Figure 2)

Males 2.8 mm, females 3.3 mm.

This new species closely resembles *L. bengalensis,* but is most readily distinguished by its relatively shorter telson. In *L. bengalensis,* the ratio of the telson length to the peduncle of urosome III ranges from 0.45 to 0.66 with a mean of 0.54 ± 0.01 (95% CI, N = 50) for females and from 0.46 to 0.64 with a mean of 0.56 ± 0.01 (95% CI, N = 50) for males. Like *L. bengalensis,* mature males of *L. ducrayi* have relatively shorter telsons than females.

Other characters that distinguish the new species from *L. bengalensis* are as follows. Pereonites I through V are fused in both sexes. The dorsal curvature of the pereon is more even in *L. bengalensis.* The gnathopods of *L. bengalensis* have only one anterodistal spine on article 6 and the carpal process (article 5) of pereopod II is only about half as long as article 6.

Pereopoda III and IV of *L. bengalensis* usually have only one prominent posterodistal spine on article 5. Pereopods V–VII of *L. bengalensis* normally have a prominent spine overlapping the inner face of the dactyl;

Table 1. Diagnostic characters of three species of *Hyperia.*

Diagnostic Feature	*H. leptura*	*H. bowmani*	*H. curticephala*
Relative head length, female	Length longer than pereonites I+II	Length subequal to length of pereonites I+II+III	Length shorter than pereonites I+II
Relative length of maxilliped lobes	Medial lobe does not reach the middle of the lateral lobe	Medial lobe longer than the middle of the lateral lobe	Medial lobe longer than the middle of the lateral lobe
Apical armament of the medial lobe of the maxilliped	1 strong spine	2 spines	2 spines
Form of article 5 of pereopoda I and II	Almost linear	Distinctly broad-ened distally	Distinctly broad-ened distally
Distal projection of article 5 of pereopod II	25–33% the length of article 6	About 75% the length of article 6	About 40% the length of article 6
Armature of posterior edge of article 6 of pereopod IV	Slightly dentate with spines	With a row of long submarginal bristles	Smooth or with very small, indistinct teeth
Armature of article 6 of pereopoda VII	Unarmored	With a row of long, robust submarginal bristles	Unarmored

it is absent in *L. ducrayi.* The telson of *L. bengalensis* is generally more pointed than in *L. ducrayi,* especially in females. *Lestrigonus ducrayi* also seems to be a smaller species.

It has been found along the western shores of Queensland, Australia.

3. *Phronima bowmani* Shih, 1991 (Figure 3)

Length of females 7.0–9.5 mm, males 6.6–8.0 mm.

This species is morphologically close to *P. colletti* and *P. bucephala.* It is somewhat indistinct from *P. bucephala.* A few specimens have greater produced teeth on the posterior region on article 2 of pereopod VII, with a few even narrower grooves between the carpal projection and the first tooth in males, and weak variations in the arrangement of carpal teeth on pereopod V in females. The validity of this species is questionable.

Collected in the eastern tropical Pacific (83°35′ N 97°32′ W).

4. *Phronima dunbari* Shih, 1991 (Figure 4)

Length of sexually mature female, 8.6–11.0 mm, males 6.8–7.4 mm.

This species is very close to *P. stebbingi* and is distinguished from it by weakly expressed minor details in the structure of the teeth on the

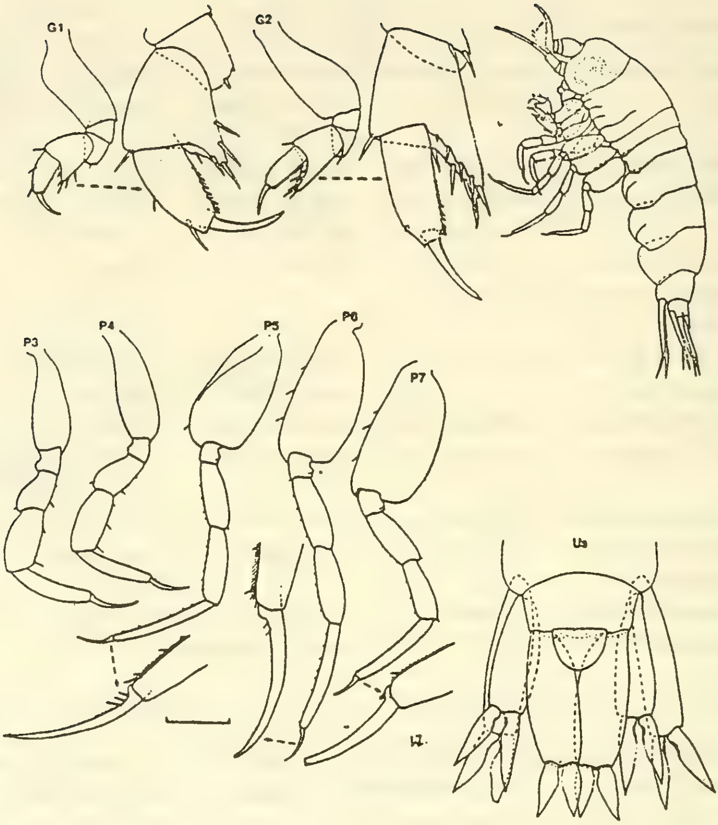

Fig. 2. *Lestrigonus ducrayi* (after Zeidler, 1992a).

body of pereopod V. The articles are relatively longer than wide (ratio is 1.3 in *P. dunbari* and 1.5 in *P. stebbingi*) and in the relative length of pereonite I to pereonite VII. In *P. stebbingi,* the ratio is 1.15 ± 0.05 in males and 1.25 ± 0.08 in females; in *P. dunbari* it is 1.01 ± 0.03 and 1.11 ± 0.03 respectively. The statistical significance of these measures were not been determined by the author.

Specimens were collected in the eastern tropical Pacific east of 150° W longitude.

5. *Streetsia palmaspinosa* G. Vinogradov, 1990a (Figure 5)

The length of a mature female is 15 mm, of a male is 13 mm.

This species has a compact appearance. The length of head exceeds that of the pereon by approximately 1/3 the length of the body. The

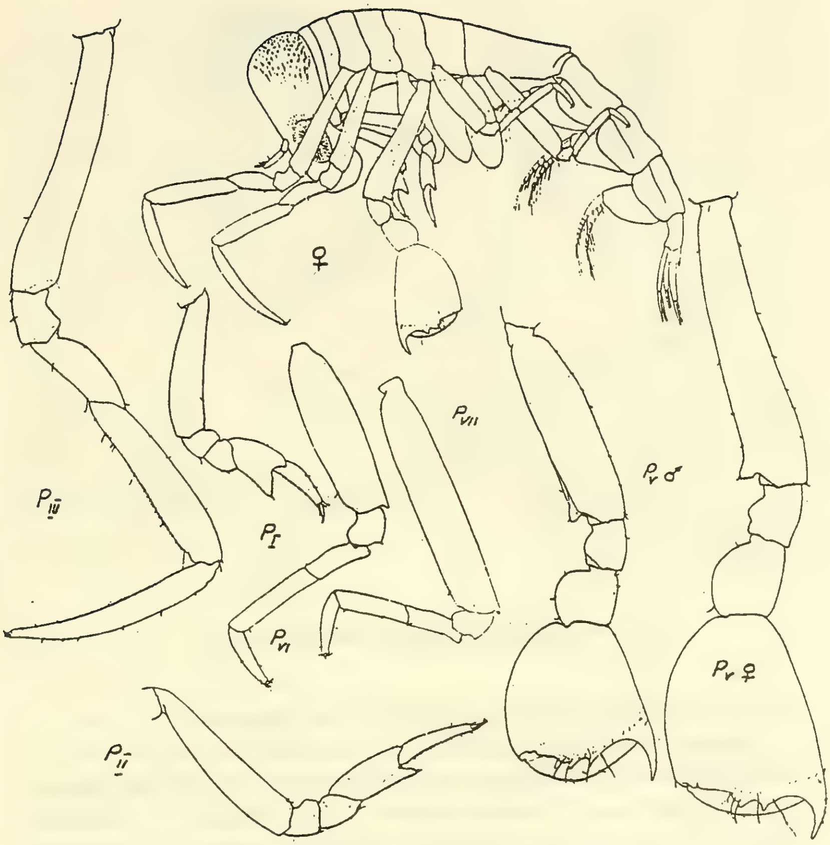

Fig. 3. *Phronima bowmani* (after Shih, 1991).

rostrum is wide and at the base of the head there is a weakly pronounced dorsal depression, barely exceeding the length of the first segment of the perion.

This species is closely affiliated with *S. challengeri* and especially to *S. porcella.* It is distinguished from the former by the absence of a distal acute-angled projection of article 2 of pereopod VI; from the latter by the structure of articles 5 and 6 of pereopod II, the palmar region of which has coarse, sharp teeth. None of the known species of *Streetsia* have a similar structure for pereopod II. A characteristic feature of *S. palmaspinosa* is a well-pronounced stepped notching along the lower edge of epimere III.

Specimens have been collected in the Pacific Ocean along the Nasca Ridge, and in the Indian Ocean along Sal de Malya and Walter's banks.

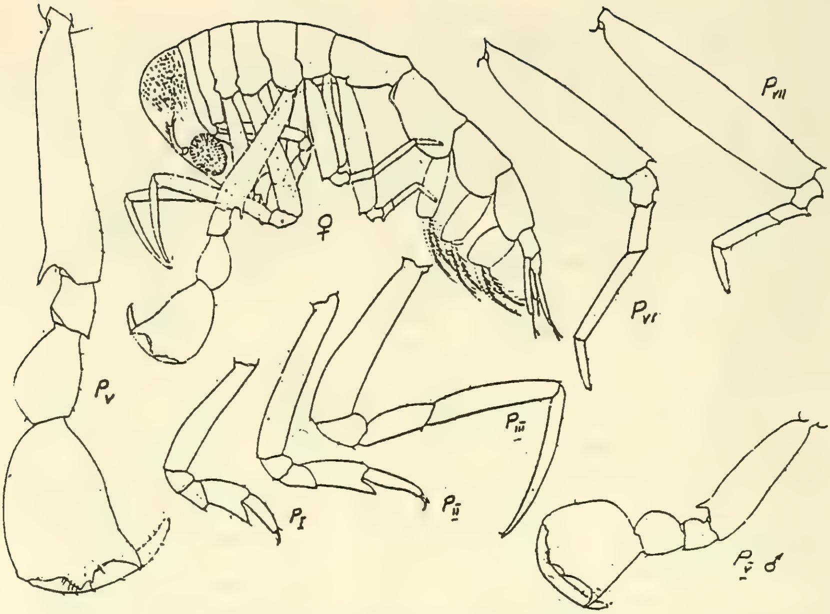

Fig. 4. *Phronima dunbari* (after Shih, 1991).

6. *Hemiscelus setosus* G. Vinogradov, 1990a (Figure 6)

Five specimens (all females) with length of 4 mm.

This species is easily distinguished from *H. diplochelatus* Stewart by the greater length of the posterodistal part of article 5 of pereopoda I and II, at least 2/3 that of article 6; dactyls of pereopoda I and II are greatly pronounced; the distal part of article 2 of pereopod V is uniformly curved; the dactyls of pereopoda III and IV are hook-shaped; and relatively greater length of the telson.

Specimens were collected in the Pacific Ocean in the region of the Nasca Ridge at depths of 50–300 mm and near the shores of Australia (Zeidler 1992b).

7. *Scina* spp.

Zeidler (1990) recorded four small species of Scina with length between 1.6 and 3.0 mm *(S. curvidactyloides, S. parasetigera, S. hurleyi, S. exospina).* All specimens were noted by the author as sexually immature females, indistinguishable from juvenile forms. No sexually mature specimens have been found. In working with our extensive collections, we also came across numerous examples of very small *Scina* which had only recently had left the marsupium of the female and had not yet acquired all of the morphological features of the adult form. We will

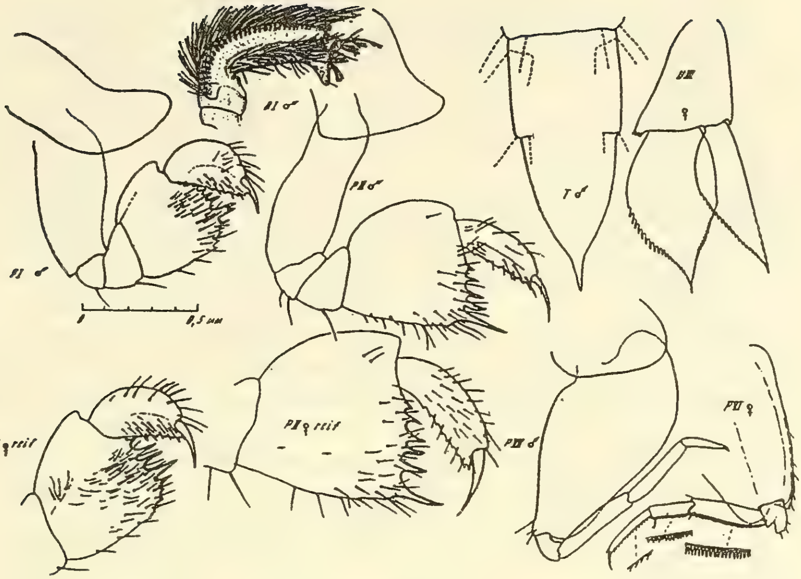

Fig. 5. *Streetsia palmaspinosa* (after Vinogradov, 1990a).

not scrutinize this problem in this Supplement, but the issue of evaluating juvenile forms needs to be clarified. The assessment of the validity of these species until then will require description of sexually mature specimens.

II. Revisions of the systematic position of several species of Hyperiidea

1. A authoritative revision of the genus *Primno* (Bowman 1985) established the fundamental result that *Primno macropa* Guérin-Méneville is an assemblage of species. Two species can be distinguished: *P. abyssalis* Bowman 1968, which occupies water of the northern Pacific, including the Bering, Japan, and Okhotsk seas; and *P. macropa,* which is found in southern waters (mainly farther south than 40° S) and primarily in the circumantarctic.

2. Serious revision is required for the genus *Lycea.* Harbison (1976) and Harbison and Madin (1976) substantiated the independence of *L. vincenti* Stebbing, *L. bovalli* Chevreux, *L. gracilis* Spandl, and *L. bajensis* Shoemaker, all of which we considered to be synonyms of *L. pulex* Marion. Besides which, *L. bovallioides* Stephensen, which we included in synonymy with *L. pulex* is also regarded as four distinct species. Unfortunately, the scarcity of material on this genus hasn't allowed any conclusions to be made concerning these questions.

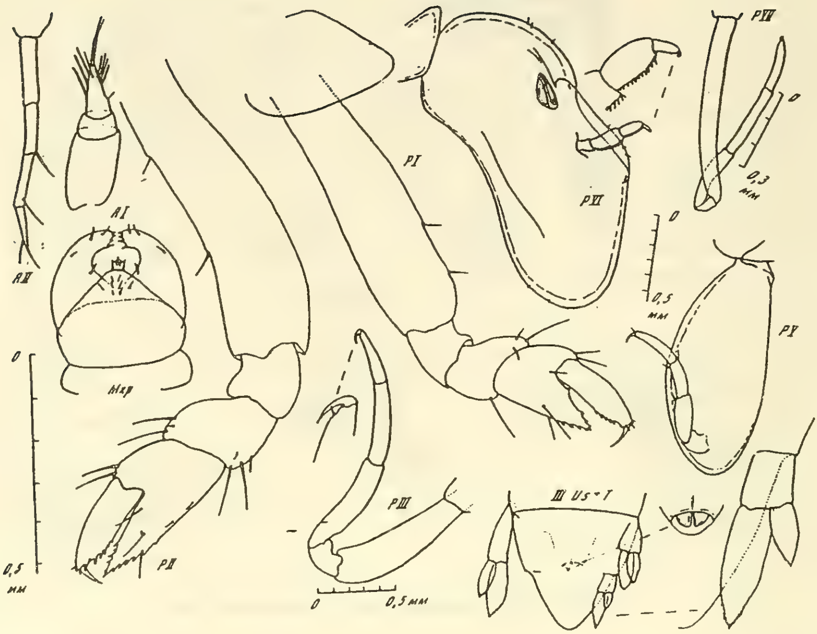

Fig. 6. *Hemiscelus setosus* (after Vinogradov, 1990a).

3. Nair (1993) studied the poorly known males of *Metalycaea globosa* Stephensen and established the validity of this genus, which earlier Bowman (1973) was transferred to *Lycaea* and considered to be closely allied to *L. serrata* Claus. There is one difficulty, however, with Nair's action to transfer this species into the family Oxycephalidae on the basis of the complete reduction of maxilla I and II. These maxilla are strongly reduced in *L. serrata.* The maxilla of the genus *Simorhynchotus* (similar to *Metalycaea*) are completely reduced, as they are in the recommended family Oxycephalidae. This lineage, considered in the book as allied with *Simorhynchotus,* is justified for *Metalycaea,* and we conclude that this genus should be included in the family Lyacaeidae.

4. Restoration of the genus *Themisto.* Bowman and Cohen (1982) restored the genus *Themisto,* which up until that time was called a junior homonym of the nudibranch *Themisto* Oken, 1815, and was renamed Parathemisto. But the name given by Oken was published in volume three of *Oken's Lehrbuch der Naturgeschichte* (Oken 1815). This book was placed on the Official List of Rejected Works by Opinion 417 of the International Commission on Zoological Nomenclature (1956), which

ruled that no name published in Oken's volume three acquired the status of availability. Consequently, the name *Themisto,* first made available by Guérin-Méneville and a senior synonym of *Parathemisto,* is the valid name of the amphipod genus.

III. Addenda to the distribution of several hyperiid species (not listed in the book)

Lanceola laticarpa—found in the central part of the Pacific Ocean (27°20′ N 117°31′ W); our collections.

Megalanceola stephenseni—Indonesia, Phillipine Islands at depths of 810–1040 m; Zeidler (1991).

Prolanceola vibiliformis—subantarctic waters of the Pacific Ocean (43° S 158°E); Barkhatov and Vinogradov (1988).

Mimonecteola diomedeae—South Pacific Ocean (41°21′ S 158° W) and eastern region (27°20′ N 117°31′ W).

Mimonecteola mixta—eastern Pacific Ocean (13°25′ N 104°45′ W)

Microphasma agassizi—eastern tropical regions of the Pacific Ocean (13°25′ N 101°45′ W; 27°20′ N 117°31′ W).

Mimonectes loveni—southern region of the Pacific Ocean (43° S 158° W; 40°21′ S 158° W).

Scina vosseleri—southern region of the Pacific Ocean (43° S 158° W)

Scina indica—southern region of the Pacific Ocean (43° S 158° W) .

Scina antarctica—found in nets at depths of 500–2000 m and even 0–200 m.

Scina oedicarpus—southern region of the Pacific Ocean (43° S 158° W).

Scina lepisma—found in Pacific Ocean, near the Nasca ridge (24° S 85° W).

Vibilia caeca—inhabits the Indian Ocean (10° N 85° E) and near Australia (Vinogradov 1990, Zeidler 1992).

Vibilia antarctica—it was verified that distributions are in antarctic waters. The species is circumpolar within the West Wind Drift, while the cold areas near the coast (area of the East Wind Drift) are avoided. In the antarctic sector of the Southern Ocean it is most numerous in the Bransfield Strait and Scotia Sea up to South Georgia Island, while eastward of South Georgia Island and in the Weddell Sea it is very rare (Weigmann-Haass, 1989).

Vibilioides alberti—Indian Ocean (33° S 45° E) and Pacific Ocean (22° S 83° W) (Vinogradov 1990a, b).

Cystisoma magna—eastern part of the Pacific Ocean (27°03′ S 117°52′ W).

Hyperia medusarum—in the zone of the eastern barrier currents of the Pacific Ocean, discovered in the equatorial zone (8°03′ S 80°32′ W).

Hyperiella macronyx—found in the Atlantic sector of the Southern Ocean: Weddell and Scotia seas (Weigmann-Haass 1989).

Hyperoche picta—Indian Ocean (41° S 58° E) (Grachev, pers. obs.).

Hyperoche capucinus—High Antarctic waters of the Atlantic sector of the Southern Ocean: Weddell and Scotia seas (Weigmann-Haass 1989).

Hyperoche luetkenides—mostly found in the Weddell and Scotia Seas (Weigmann-Haass 1989).

Pegohyperia princeps—central waters of the North Pacific (Shulenberger 1977) and in the eastern Equatorial Pacific Ocean (13°35′ N 101°45′ W), male 35 mm long, 0–1000 m (Vinogradov 1990a).

Dairella californica—Pacific Ocean, coastal Ecuador (4°08′ S 96°14′ W) and subantarctic waters (40°–50° S 158° W).

Phronima colletti—eastern Equatorial Pacific Ocean (8°50′ S 83°40′ W) (Vinogradov 1990a).

Lycaeopsis zamboangae—eastern part of the Pacific Ocean: Gulf of California (20°50′ N 109°06′ W) (Siegel-Causey 1982, Vinogradov 1993).

Parapronoe crustulum—eastern part of the Pacific Ocean: Gulf of California, equatorial zone, and Nasca ridge (Siegel-Causey 1982, Vinogradov 1990a).

Parapronoe campbelli—eastern part of the Pacific Ocean: Gulf of California, equatorial zone, and Nasca ridge (Siegel-Causey 1982, Vinogradov 1990a).

Brachyscelus rapax—eastern part of the Pacific Ocean: (09° N 90° W), Nasca ridge.

Platyscelus serratulus—southern part of the Indian Ocean (41° S 58° E) (Grachev, pers. obs.).

Paratyphis parvus—eastern part of the Pacific Ocean: Nasca Ridge (Vinogradov 1990a).

Tetrathyrus arafurae—Indian Ocean, Mozambique Gulf (Vinogradov 1991), Pacific Ocean: Gulf of California (Siegel-Causey 1982).

Amphithyrus muratus—eastern part of the Pacific Ocean: Nasca Ridge (Vinogradov 1990a).

Amphithyrus bispinosus—southern part of the Indian Ocean (41° S 60° E) (Grachev, pers. obs.).

Parascelus edwardsi—eastern part of the Pacific Ocean: Nasca Ridge (Vinogradov 1990a).

IV. New observations on life-history features.

1. Interesting observations were acquired for *Dairella californica,* which turned out to be a rather common species in the subantarctic Pacific Ocean. It seems that the live animals actually penetrate their substrate, and bury their abdomen, reminiscent of the behavior of hippoboscid flies (Vinogradov 1988) (Figure 7).

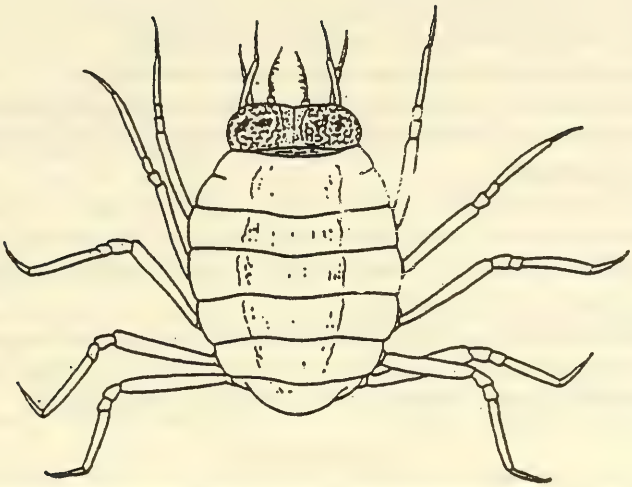

Fig. 7. *Dairella californica* (after Vinogradov, 1988). The typical pose of a living specimen.

2. Five sexually mature males of the uncommon *Lycaeopsis zamboangae,* previously considered as shallow-dwellers, were obtained from deep-water collection apparatus situated near two vents at a depth of 2640 m (20°50′ S 109°06′ W).
3. Characteristic movements of hyperiids under the influence of light indicated the speed of some Platysceloidea was on the order of 19 body lengths per second.
4. New knowledge about the natural coloration of hyperiids.

Lanceola pacifica—translucent brick-red or dark-cherry, sometimes the whole body is dark-cherry, and the abdomen is translucent red.

Scypholanceola aestiva—dark-cherry, monotone coloring of the body and pereopoda.

Prolanceola vibiliformis—opaque, monotone rose-red or dark wine-red

Mimonecteola diomedeae—the body is a translucent olive color; the pereopoda are rose-red.

Mimonectes sphaericus—males and females are deep red or cherry-red; juveniles with rosy medial mesosome, pereopoda I, II and the mouthparts are red; the rest of the pereopoda and body parts are translucent and colorless.

Mimonectes loveni—males are translucent rose-red or dark-red; females are colorless or translucent with dark rose spots and carmine-red eyes.

Scina vosseleri—carmine-red with colorless, translucent distal segments of the antennae.

Scina indica—the body and pereopoda are translucent
Scina oedicarpus—the body and pereopoda are red.
Scina tullbergi—the body and pereopoda are translucent
Vibilia stebbingi—chestnut-brown with numerous asterix-shaped violet-colored spots on body segments, coxal plates, and basal articles of the pereopoda
Paraphronima gracilis—glassy-translucent. The two upper rows of ocelli are bright red. The bases of the pereopoda beneath the pereonite surface have small round irridescent spots, incidentally reflecting orange or gold in males.
Dairella californica—glassy-translucent with brown-violet dactyls; pereopoda are partially tinted with the same color. The eyes are large and transparent, each with two dark nuclei in the interior.

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INDEX* OF LATIN NAMES[1]

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[1] Synonyms are printed in italics; taxa above the rank of genus and page numbers with diagnosis of the given form are printed in bold face; an asterisk against a page number denotes an illustration of the given form.

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