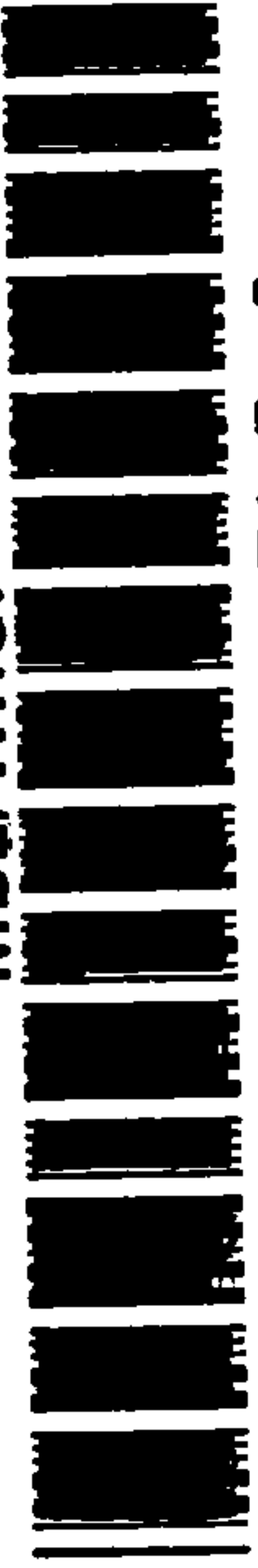




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# BULLETIN

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No. 54

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## MONOGRAPH ON THE ISOPODS OF NORTH AMERICA

BY

HARRIET RICHARDSON

COLLABORATOR, DIVISION OF MARINE INVERTEBRATES



WASHINGTON  
GOVERNMENT PRINTING OFFICE

1905









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# BULLETIN

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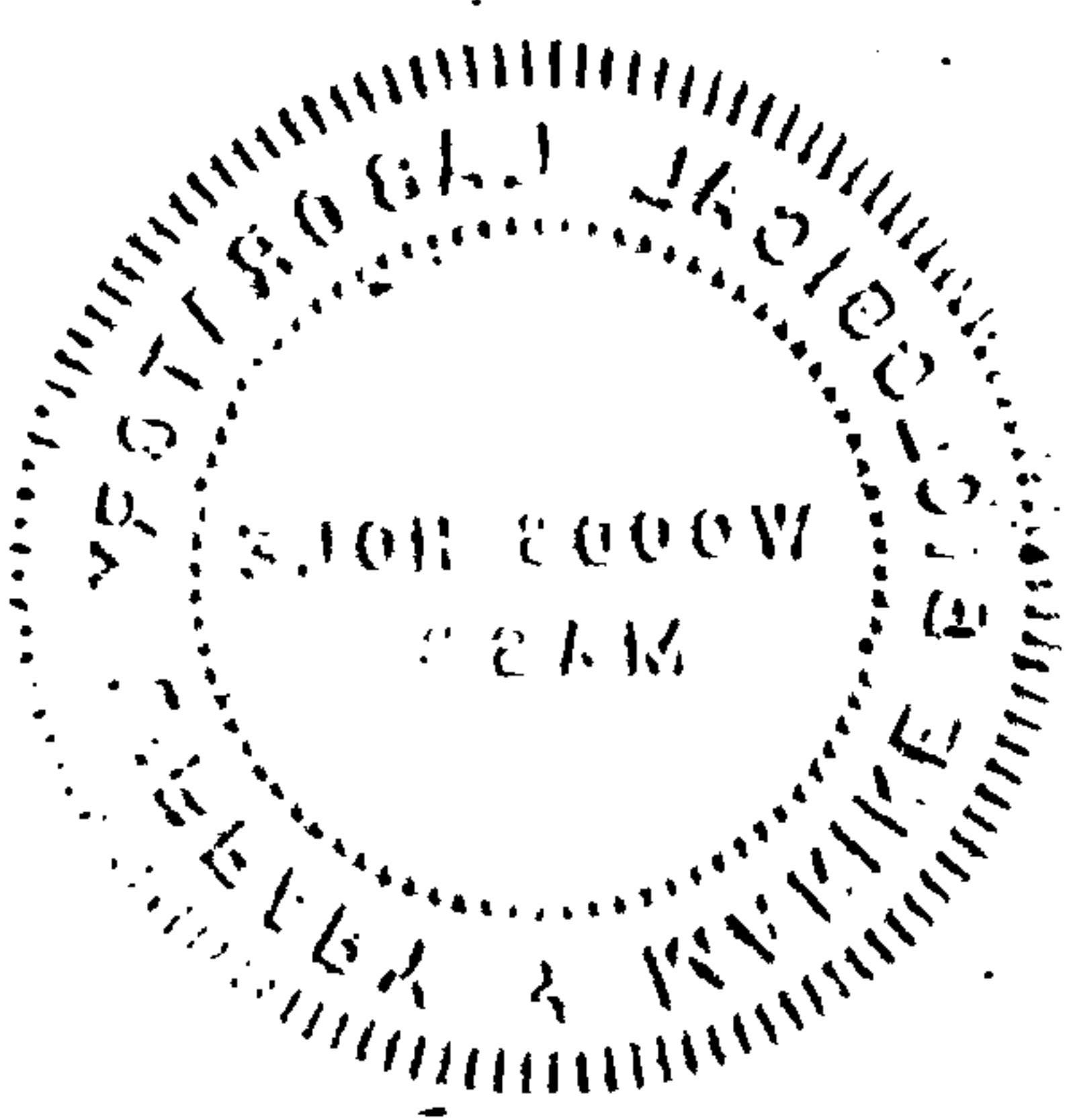
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No. 54



WASHINGTON  
GOVERNMENT PRINTING OFFICE

1905



## ADVERTISEMENT.

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This work (Bulletin No. 54) is one of a series of papers intended to illustrate the collections belonging to or placed under the charge of the Smithsonian Institution and deposited in the United States National Museum.

The publications of the National Museum consist of two series—the *Bulletin* and the *Proceedings*.

The *Bulletin*, publication of which was commenced in 1875, is a series of elaborate papers issued separately and based for the most part upon collections in the National Museum. They are monographic in scope and are devoted principally to the discussion of large zoological groups, bibliographies of eminent naturalists, reports of expeditions, etc. The bulletins, issued only as volumes with one exception, are of octavo size, although a quarto form, known as the Special Bulletin, has been adopted in a few instances in which a larger page was deemed indispensable.

The *Proceedings* (octavo), the first volume of which was issued in 1878, are intended primarily as a medium of publication for newly acquired facts in biology, anthropology, and geology, descriptions of new forms of animals and plants, discussions of nomenclature, etc. A volume of about 1,000 pages is issued annually for distribution to libraries, while a limited edition of each paper in the volume is printed and distributed in pamphlet form in advance.

In addition, there are printed each year in the second volume of the Smithsonian Report (known as the Report of the U. S. National Museum), papers, chiefly of an ethnological character, describing collections in the National Museum.

Papers intended for publication by the National Museum are usually referred to an advisory committee, composed as follows: Frederick W. True (chairman), William H. Holmes, George P. Merrill, James E. Benedict, Otis T. Mason, Leonhard Stejneger, Lester F. Ward, and Marcus Benjamin (editor).

S. P. LANGLEY,

*Secretary of the Smithsonian Institution.*

WASHINGTON, U. S. A., *December 1, 1905.*



# A MONOGRAPH

ON THE

# ISOPODS OF NORTH AMERICA

BY

HARRIET RICHARDSON

COLLABORATOR, DIVISION OF MARINE INVERTEBRATES

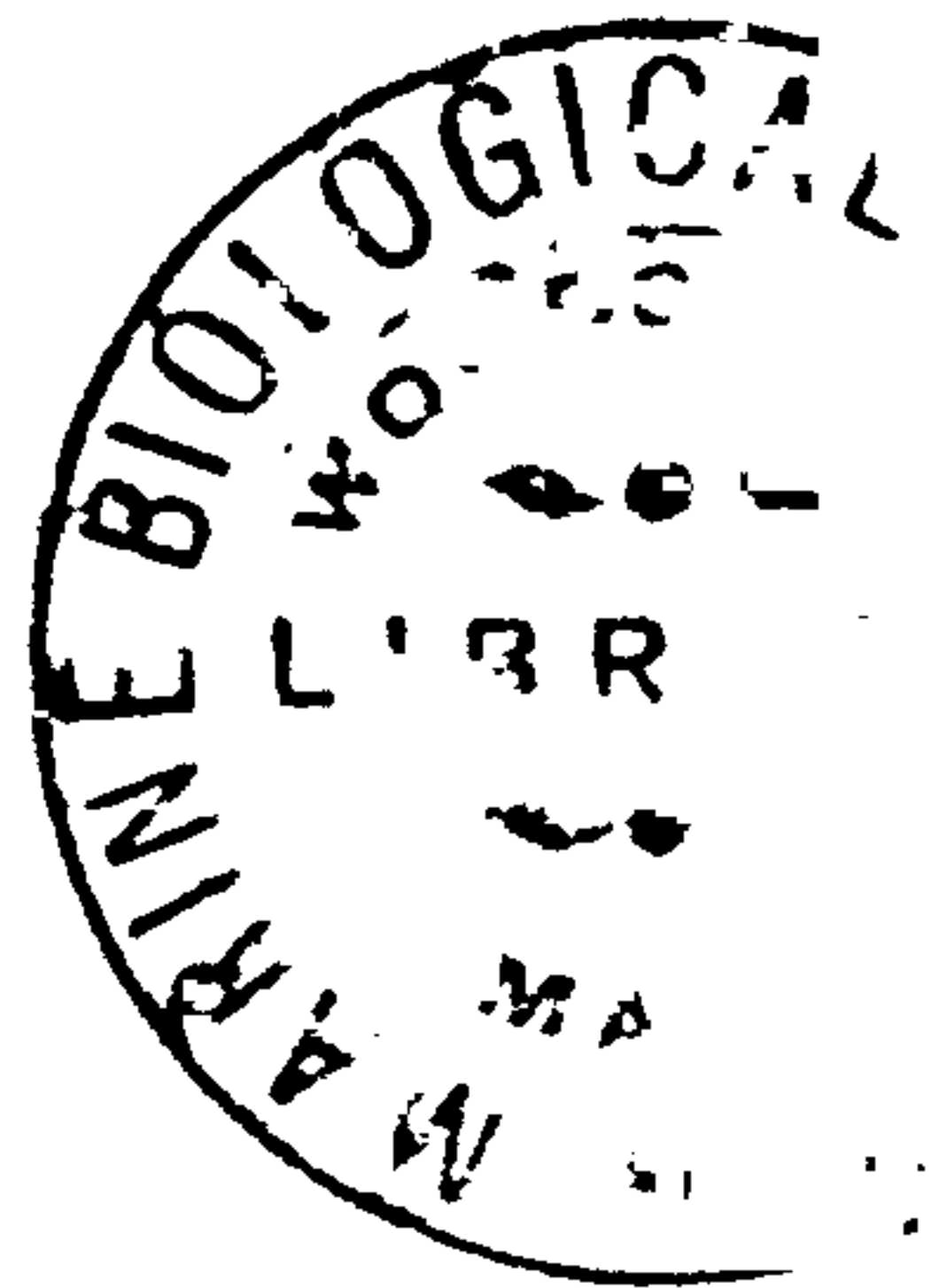


WASHINGTON

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1905





## PREFACE.

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After several years spent in the preparation of the present monograph, I now offer it to the scientific world, hoping it will meet with favorable consideration. Most of the work has been done in the United States National Museum, where an opportunity was afforded for carrying on the investigation through access to the rich collections and use of the library. The summer of 1904 was spent at Woods Hole, Massachusetts, and occupying a table in the Marine Biological Laboratory through the courtesy of the Carnegie Institution, I continued the studies which I had already begun in Washington.

It will be noticed that but few changes have been made in the classification. In a group where there are so many good workers, I have been glad to follow and adapt to my use what has been already done so well, and keys and synopses of genera have been freely introduced with references to those authors from which they have been taken.

Although I am indebted to many friends for their kind assistance, my obligations to Dr. Theodore Gill are especially great, for it was at his suggestion that the work was undertaken, and under his judicious guidance and supervision it has grown to its present form.

As is well known the natural habitat of the Isopods is in salt and fresh water, along the shore or in the interior of the country, usually in moist situations. They do, however, often occur in places most remote and unlooked for. Some have been found in warm springs and in subterranean streams, in caves and grottoes, pumps and wells, and far from human habitation. The littoral forms are seen around wharf piles, under rocks and stones, on ledges and cliffs, where they are not easily captured, for they seek refuge, with surprising activity, among the cracks and crevices.

The curious habitations sought for shelter and protection are the tubes of worms, the burrows of the crayfish, the nests of mollusks, and the nests of ants. Some live in siliceous sponges, others in coralines or among ascidians.

The parasitic Isopods attack other crustacea as well as fishes. The parasites of fish are found on the skin, fins, gills, and in the mouths of their hosts, and have even been known to bore holes in the body back of the fins. One of these, *Olencira prægustator*, attacks the menhaden

(*Brevoortia tyrannus*), in great numbers. In naming both species, the host and the parasite, Latrobe aptly and fancifully considered the case analagous to that of the ancient chief of state (*tyrannus*) and the taster (*prægustator*). The parasites of crustacea infest the shrimps and crabs or decapodous crustacea and the schizopods. When the parasite occupies the branchial cavity of the host, a large protuberance or swelling is apparent on whichever side the body is infested. The parasites are sometimes found in the visceral cavity or even in the incubatory pouch of their hosts.

The destructive habits of some of the marine and fresh-water species to submerged timber, such as wharfs and bridges, have been heretofore recorded,<sup>a</sup> but not until recently has attention been called to the fact that even the terrestrial forms may give cause for alarm in the nature of pests. Several common and well-distributed species have been found menacing young cotton plants, sugar beets, mushrooms, and cucumber vines.

The burrowing habits of some Isopods are interesting. Chilton says of *Scyphax ornatus* and *Actæcia euchroa* that they "are found on sandy beaches, either on the surface or burying themselves a little in the sand about high water mark or a little lower." Hay, in recently observing the habits of *Scyphacella arenicola*, finds that it also burrows in the sand. The Serolidæ, according to Studer, "live by preference on sandy ground, into which they burrow with their flat bodies up to the caudal plate."

Whitelegge speaks of the paguroid habits of certain Isopods, which "live in small univalve shells and in company with young hermit crabs." Mimicry of external appearance and similarity of habitat is probably very useful in the struggle for existence.

Many of the species found in North America also occur in other parts of the world. The terrestrial Isopods have a wide distribution as well as the parasites of fishes. The Arcturidæ form a rather restricted group. Benedict says of them, in explanation of this fact, that it is due to structure and habits. "The young are few in a brood and are cared for by the parent until well able to care for themselves, clinging to the mother's antennæ until ready to undertake a more independent existence, perhaps on the very object on which the mother is foraging for herself and brood. With habits of this kind the chances of a wide distribution for any one-species must be very much less than is the case where free-swimming young are produced in large numbers."

I have not attempted to give here a general account of the morphology, as the reader is supposed to be familiar with the sources

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<sup>a</sup>See Charles H. Snow, Marine Wood-Borers, Trans. Amer. Soc. Civil Engineers, XL, 1898, pp. 196-199, for notes in this connection.



where such an account can be found. In another place<sup>a</sup> a brief review of the Isopod structure has already been given.

It has not been considered worth while to encumber the legends with detailed explanation of many of the figures that have been taken from other authorities; students, however, who desire to learn the significance of the lettering not given in the illustrations, are referred to the original papers.

As a final suggestion I would like to say that my object in undertaking this work has been to assist the student in the determination of the forms by giving figures and descriptions of all the species. It is to be hoped, in case of omissions or errors, that leniency will be observed, for the task has not always been easy.

HARRIET RICHARDSON.

WASHINGTON CITY, *November 1, 1905.*

#### POSTSCRIPT.

Since this monograph has been printed, and within the last few days, Dr. H. J. Hansen's paper on the Propagation, Structure, and Classification of the Sphæromidæ has been received.<sup>b</sup> With a large amount of material, a comparison of types from various museums all over the world, and a thorough examination of specimens, Doctor Hansen has arrived at an excellent classification of this group, which has heretofore been in an extreme state of confusion and so recognized by all who have attempted to determine species or to refer them to their proper genera. In Doctor Hansen's paper new genera have been established and some old ones canceled. The changes which particularly affect the present paper and which I have not been able to make use of in the text, inasmuch as Doctor Hansen's paper was received too late, are as follows: The genus *Cassidisca*, new genus, must be canceled as being a synonym of Hansen's new genus *Cassidinidea*; *Cilicæa caudata*, *C. gilliana*, *C. sculpta*, and *C. cordata* must be referred to Hansen's new genus *Paracerceis*. The following list shows these relations more exactly: *Cassidisca ovalis* = *Cassidinidea ovalis*; *Cassidisca lunifrons* = *Cassidinidea lunifrons*; *Cilicæa caudata* = *Paracerceis caudata*; *Cilicæa gilliana* = *Paracerceis gilliana*; *Cilicæa cordata* = *Paracerceis cordata*; *Cilicæa sculpta* = *Paracerceis sculpta*.

While in New Haven last summer I examined the second pleopods of a number of cotypes of *Dynamene perforata* and found that the males and females of this species were similar, with the exception that

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<sup>a</sup>Contributions to the Natural History of the Isopods, by Harriet Richardson, Proc. U. S. Nat. Mus. XXVII, 1904, pp. 4-17.

<sup>b</sup>Quarterly Journal of Microscopical Science, XLIX, Pt. 1. 1905, new ser., pp. 69-135. (October number received here November 11.)

the endopod of the second pleopod in the male carried a stylet. The females had the transverse foramen, which constituted the proximal part of the abdominal notch, just as did the males. With this modification of Hansen's genus *Dynamenella*, of which he makes *Dynamene perforata* the type, I can then refer to it the following species: *Dynamene benedicti*, *Dynamene glabra*, and *Dynamene moorei*. The following shows these relations more exactly: *Dynamene perforata* = *Dynamenella perforata*; *Dynamene benedicti* = *Dynamenella benedicti*; *Dynamene glabra* = *Dynamenella glabra*; *Dynamene moorei* = *Dynamenella moorei*. Inasmuch as only females are known of *Dynamene angulata* and *Dynamene dilatata*, it can not be stated positively whether they should be referred to *Dynamenella* or *Paracerceis*. Doctor Hansen says that, judging from the aberrant shape of the antennulæ, *D. dilatata* must probably be established as the type of a new genus..

In regard to *Cilicæa linguicauda* and *Cilicæa granulosa*, Doctor Hansen says that the former is probably, the latter perhaps, a species of *Cymodoce*. Upon an examination of the pleopods subsequent to the printing of my paper and the publication of Doctor Hansen's I find that these two species not only should not be referred to the genus *Cymodoce*, but not even to the section Cymodocini or to the group Sphærominæ hemibranchiata. Both branches of the fourth pair of pleopods are similar, fleshy, with transverse folds, without plumose setæ, and the outer branch is not two-jointed. These two species, therefore, belong to the group Sphærominæ eubranchiata. In these species the exopod of the third pleopod has an articulation, and is therefore two-jointed. The character of the abdominal notch without paired denticles would seem to exclude them from the genus *Paracerceis* as restricted by Hansen. The character of the uropods, which are strongly altered, would exclude them from the genus *Cerceis* Milne Edwards. They can not be placed with *Haswellia* Miers, because they lack the large, mesial process on the sixth thoracic segment. It will be necessary to establish a new genus for these two species, for which I propose the name *Discerceis*, *C. granulosa* being the type.

Doctor Hansen does not mention *Cilicæa curinata* in his discussion of the species of this family. Upon examination, I find that the branches of the fourth pleopoda are similar, fleshy, crossed with transverse folds, the outer branch being unjointed. The outer branch of the third pleopod is also unjointed. Although the only specimen is a male, judging from the character of the uropods and their similarity to the males of other genera in this family, there is no stylet attached

to the inner branch of the second pleopod, in this respect being comparable to *Dynamene* (*Næsa*) Leach and *Ancinella* Hansen. I therefore make this species the type of a new genus *Dynameniscus*.

Doctor Hansen says that *Sphæroma yucatanum* has been established on females or young males of animals belonging to the genus *Cymodoce*. The only specimen is a young female.

Toward the end of his paper Doctor Hansen makes the statement that the species *Tecticeps convexus* was established on the female form of *Tecticeps alascensis*, and therefore cancels the first-named species. As Doctor Hansen had seen only the two sexes of *Tecticeps alascensis* and had not seen any specimens of *Tecticeps convexus*, this error was a natural one. Inasmuch as both sexes of both species are in the collection of the U. S. National Museum, it would be well to point out the sexual differences as perhaps I have not done sufficiently heretofore or even in the pages to follow. The females of both *Tecticeps alascensis* and *Tecticeps convexus* differ from the males in having the second pair of legs ambulatory and similar in structure to those following, while in the males the second pair of legs are subchelate. The female of *Tecticeps alascensis* has the exopod of the uropod not longer than the endopod, and thus differs from the male, which has the exopod longer than the endopod. In the species *T. convexus*, however, the exopod of the uropod is equal in length to the endopod in both sexes. The females of the two species are quite similar, both having the exopod of the uropod short, but they can easily be distinguished by the difference in the position of the eyes, the difference in the shape of the extremity of the terminal abdominal segment, and the difference in the length of the antennæ. Male specimens are compared in the pages to follow, and the differences given in the key are from a comparison of males. It is to be hoped that with these additional notes no difficulty will be found in distinguishing the two species, and that the validity of *Tecticeps convexus*, heretofore established, is correctly maintained.

H. R.

WASHINGTON CITY, December 1, 1905.



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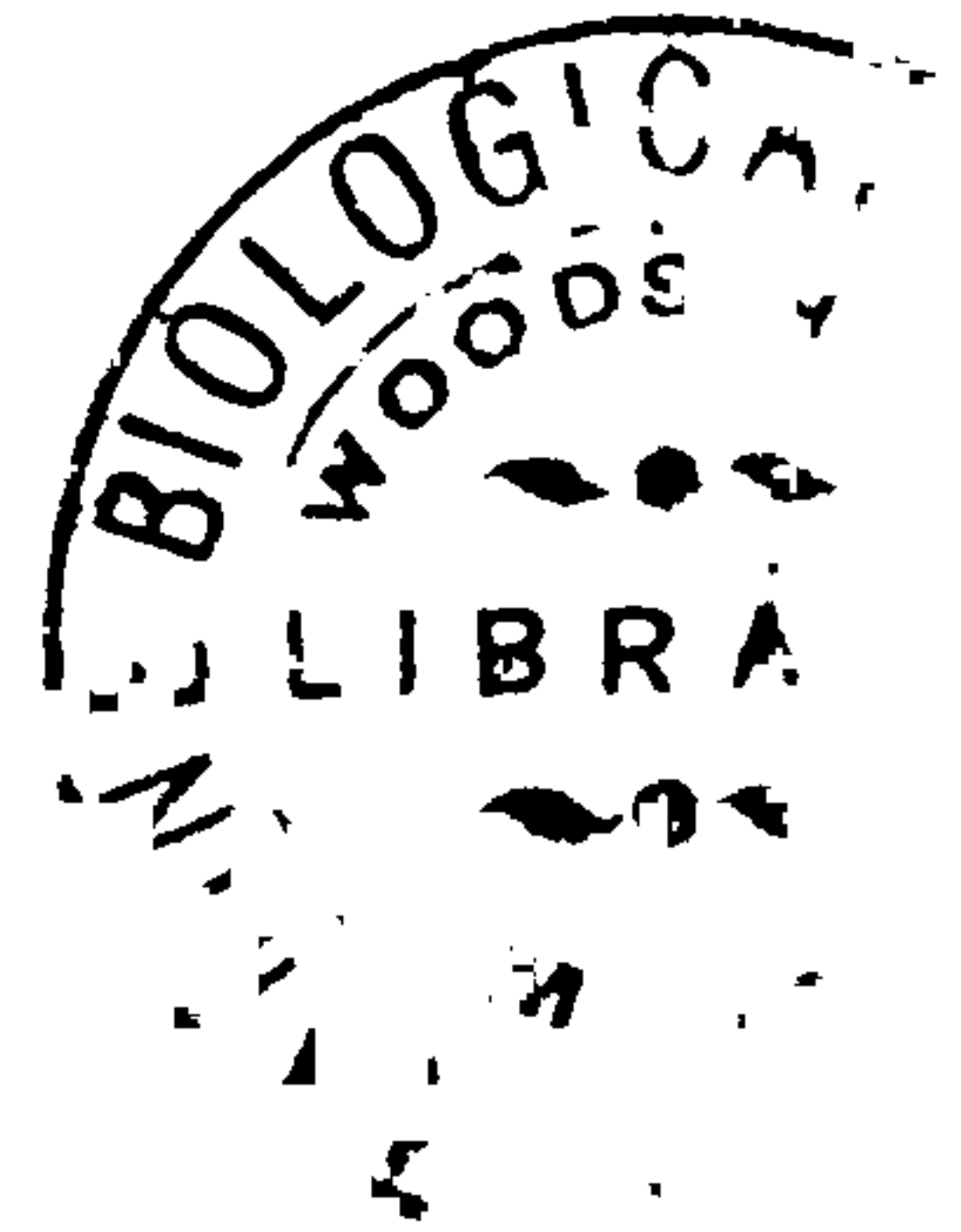
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# A MONOGRAPH ON THE ISOPODS OF NORTH AMERICA.

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## INTRODUCTION.

In the preparation of the present monograph my purpose has been to give descriptions and figures of all the species of isopodous crustacea, marine, terrestrial, and fresh-water, known to North America, with synopses, so as to assist the student in the identification of each species. The descriptions are made as concise and as nearly uniform as possible. The original descriptions have been prepared primarily from specimens in the collection of the U. S. National Museum, but have been supplemented by specimens from other museums. The collection from the Museum of Comparative Zoology at Harvard University, for the examination of which I am indebted to Prof. Walter Faxon; the collection in the Peabody Museum of Yale University, which I obtained through the courtesy of Prof. A. E. Verrill; the collection from the American Museum of Natural History, kindly loaned me by Prof. W. M. Wheeler; the collection from the University of Pennsylvania, which I obtained through the kindness of Dr. Philip P. Calvert and Dr. J. Percy Moore; the collection from the Academy of Natural Sciences of Philadelphia, including Say's valuable types, loaned to me by Doctor Pilsbry; the collection from the University of California, kindly sent by Dr. William E. Ritter, and specimens from the University of Cincinnati, obtained through the kindness of Prof. Joshua Lindahl, have been of great assistance in the preparation of this work. In addition to these valuable sources, specimens have also been sent me by Dr. Carl Eigenmann, of the University of Indiana, by the U. S. Bureau of Fisheries, the U. S. Department of Agriculture, and various others.

A large number of the North American species described are not represented in the museums of this country. The descriptions of these forms are quoted from various sources, the original description being given in some cases—in other cases a later description by another author, where the description seemed better. Where the descriptions are quoted, I have not seen or examined any specimens.

Synopses are given for the superfamilies, families, genera, and species. In some cases the synopses do not differ from those which I have previously published for this group. A number of them, however, have been modified. As stated heretofore in previous papers, the synopses of other authors have been used partly or entirely when possible. All the available sources have been investigated and the work of others introduced with few and only necessary changes, in order to adapt it to the material at hand. Schiødt and Meinert's keys for the Cymothoidæ and the Ægidæ, Hansen's keys for the Cirolanidæ and Exocorallanidæ, Budde-Lund's keys for the Oniscidæ and Armadillididæ, Stebbing's keys for the Anthuridæ and the Tanaidæ, Benedict's keys for the genus *Synidotea* and the genus *Arcturus* have been adapted or followed to a great extent. New species introduced into the keys have also caused many modifications. The works of G. O. Sars have been of great service in obtaining definitions of families and genera for use in the synopses and for diagnoses.

The geographical range included in the present paper is the Atlantic coast of North America to Panama, including Greenland, the West Indies, the Bahamas, and the Bermudas; the Pacific coast of North America to Panama, including Alaska; the fresh-water bodies in North America, and all the territory north of the Isthmus of Panama.

Most of the illustrations are original, but in many cases the figures of various authors have been reproduced, and due acknowledgments have been recorded in the text in every case. I take pleasure, however, in a collective expression of my thanks and obligations to each and all of the authors whose valuable monographs and memoirs have been utilized in this connection.

#### THE ISOPODA.

The body is dorso-ventrally flattened, and is divided into three parts—a head, a thorax composed of seven segments, and an abdomen of six segments. One or two of the segments of the thorax may be united with the head. The head appendages are two pairs of antennæ, a pair of maxillipeds, two pairs of maxillæ, and a pair of mandibles. The maxillipeds are often provided with an epignath on the outside. In the parasitic forms the mouth parts are strongly modified, some of the parts having entirely disappeared. The eyes which are usually present are paired, sessile and compound, sometimes contiguous, sometimes distant. The appendages of the thorax are seven pairs of legs; the last pair are sometimes wanting. The legs are of uniform structure and appearance in the terrestrial forms, but in a large number of forms the first pair, and even the second, third, and fourth pairs differ conspicuously in structure, length, and function from the succeeding pairs. There are six pairs of abdominal appendages, usually five pairs of pleopods and a pair of uropods. The pleopoda are in some cases



natatory, but their function is respiratory for the most part. Some or all of the segments of the abdomen may be united. The telson is very rarely free.

Marsupial plates are developed in the female, forming an incubatory pouch.

ANALYTICAL KEY TO THE TRIBES OR SUPERFAMILIES OF NORTH AMERICAN ISOPODA.<sup>a</sup>

- a.* Legs of first pair cheliform. Uropoda terminal. Pleopoda, when distinctly developed, exclusively natatory.....I. TANAIIOIDEA or CHELIFERA
- a'*. Legs of first pair not cheliform.
- b.* Uropoda lateral.
- c.* Uropoda forming together with the terminal segment of the abdomen a caudal fan. Pleopoda for the most part natatory.
- II. CYMOTHOIDEA or FLABELLIFERA
- c'*. Uropoda valve-like, inflexed, arching over the pleopoda, which to a great extent are branchial.....III. IDOTHEOIDEA or VALVIFERA
- b'*. Uropoda terminal.
- c.* Pleopoda not fitted for air breathing, exclusively branchial.
- d.* Pleopoda generally covered by a thin opercular plate (the modified first pair). Free forms .....IV. ASELOIDEA or ASELOTA
- d'*. Pleopoda never covered by an opercular plate. Parasitic forms.
- V. BOPYROIDEA or EPICARIDEA
- c'*. Pleopoda fitted for air breathing.....VI. ONISCOIDEA

I. TANAIIOIDEA or CHELIFERA.<sup>b</sup>

Head fused with the first and sometimes with the second segment of the thorax to form a carapace. Branchial cavity on each side of carapace. Following five or six segments of thorax distinctly defined with epimera small or inconspicuous.

Uropoda terminal, consisting of a short basal segment and one or two filamentary branches. First pair of legs terminate in a cheliform hand. Abdomen generally composed of six segments, usually distinct. First pair of antennæ furnished with one or two flagella. First maxillæ have a backward directed palp, situated in the posterior part of the carapace. Maxillipeds have a four-jointed palp, and a large backward directed branchial epignath, which passes into the branchial cavity. Pleopoda, when present, natatory.

ANALYTICAL KEY TO THE FAMILIES OF TANAIIOIDEA OR CHELIFERA.

- a.* Body scarcely attenuated behind. Mandibles without palp. Superior or first pair of antennæ with one flagellum (never two), which is sometimes absent, usually rudimentary, rarely well developed in female, and multiarticulate in male. Anterior maxillæ with only a single masticatory lobe and a one-jointed palp; posterior ones quite rudimentary. Second pair of legs ambulatory in character. Epignath of maxillipeds narrow, falciform .....Family I. TANAIIDÆ

<sup>a</sup> Sar's analytic key has been used with slight modifications. See his *An Account of the Crustacea of Norway*, II. Isopoda, 1899, p. 3.

<sup>b</sup> See Sars' *Crust. of Norway*, II, 1899, pp. 4, 5, and Norman and Stebbing, *Trans. Zool. Soc. London*, XII, 1886, pp. 78-79, for characters of superfamily.

*a'*. Body narrow, produced, depressed. Mandibles with a three-jointed palp. Superior or first pair of antennæ with two multiarticulate flagella. Anterior maxillæ with two masticatory lobes and a two-jointed palp; posterior ones well developed and setose. Second pair of legs with a large, broad, flat hand. Epignath of maxillipeds large, laminar, branchial in character.

Family II. APSEUDIDÆ

### Family I. TANAIDÆ.<sup>a</sup>

Body scarcely attenuated behind. First pair of antennæ simple, without any secondary filament or flagellum. Single flagellum sometimes absent, and generally rudimentary, rarely well developed in female, and multiarticulate in male. Second antennæ without a scale; flagellum usually rudimentary, rarely well developed. Mandibles without palp. Second maxillæ represented by minute rudimentary lobes. Anterior maxillæ with only a single masticatory lobe. Epignath of maxillipeds narrow, falciform. Second pair of legs not differing from the following peræopods. Gnathopods never furnished with palps or exopods. Pleopods with branches uniarticulate. Uropoda simple or furnished with two short filaments.

#### ANALYTICAL KEY TO THE GENERA OF TANAIDÆ.

- a*. Less than five pairs of pleopoda present. Uropoda simple, short, single-branched. Eyes present.
- b*. Only two pairs of pleopoda present. Abdomen composed of three segments. Uropoda composed of only two articles.....Genus *Pancolus* Richardson
- b'*. Only three pairs of pleopoda present. Abdomen composed of five to six segments. Uropoda composed of three to seven articles.  
Genus *Tanais* Audouin and Edwards
- a'*. Five pairs of pleopoda present. Uropoda double-branched.
- b*. Incubatory pouch formed only by two lamellæ issuing from bases of fourth pair of legs.....Genus *Cryptocope* Sars
- b'*. Incubatory pouch normal.
- c*. Inner branch of uropoda 2-3 jointed. Pleopoda in female very small, or rudimentary.....Genus *Leptognathia* Sars
- c'*. Inner branch of uropoda more than 2-3 jointed. Pleopoda well developed.
- d*. Gnathopods in male imperfectly chelate, without any finger, or with finger very short and immovable.....Genus *Heterotanais* Sars
- d'*. Gnathopods in male with chelæ fully developed.
- e*. Gnathopods in male very much elongated, with carpus attenuated, hand very large, oblong, fingers elongate and curved; immovable one strongly tuberculate within. Thoracic appendages not specialized into an anterior and a posterior series.....Genus *Leptocheilia* Dana
- e'*. Gnathopods in male with chelæ very stout, the distal section of the penultimate joint extremely broad, with a toothed margin. Thoracic appendages specialized into an anterior and a posterior series.  
Genus *Neotanais* Beddard

<sup>a</sup> See Sars' Crust. of Norway, II, 1899, pp. 10, 11, and Norman and Stebbing, Trans. Zool. Soc. London, 1886, XII, pp. 102-103, for characters given below.

## 1. Genus PANCOLUS Richardson.

Eyes present, distinct. First pair of antennæ composed of three articles. Second pair of antennæ composed of five articles. First thoracic segment permanently united with the head to form a carapace. The following six segments are free and distinctly separated. The abdomen is composed of only three segments, two segments anterior to the terminal segment. There are but two pairs of well-developed pleopoda. The uropoda are single branched and consist of a peduncle and a branch composed of a single article. The first pair of legs are chelate. All the following six pairs are ambulatory.

## PANCOLUS CALIFORNIENSIS Richardson.

*Pancolus californiensis* RICHARDSON, Proc. U. S. Nat. Mus., XXVIII, 1905, pp. 367-369.

*Locality*.—Monterey Bay, California.

Body narrow, elongate,  $5\frac{1}{2}$  mm. long, and almost  $1\frac{1}{2}$  mm. wide.

Head as wide as long,  $1\frac{1}{2}$  mm. :  $1\frac{1}{2}$  mm., with the anterior margin somewhat triangular between the eyes, which are placed in the

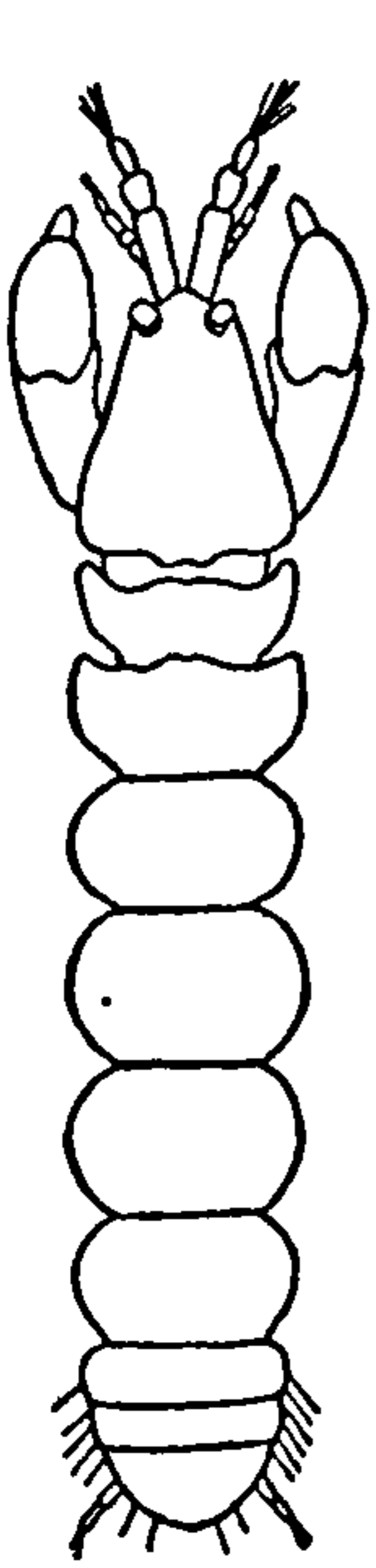


FIG. 1.—PANCOLUS CALIFORNIENSIS.  $\times 9$ .

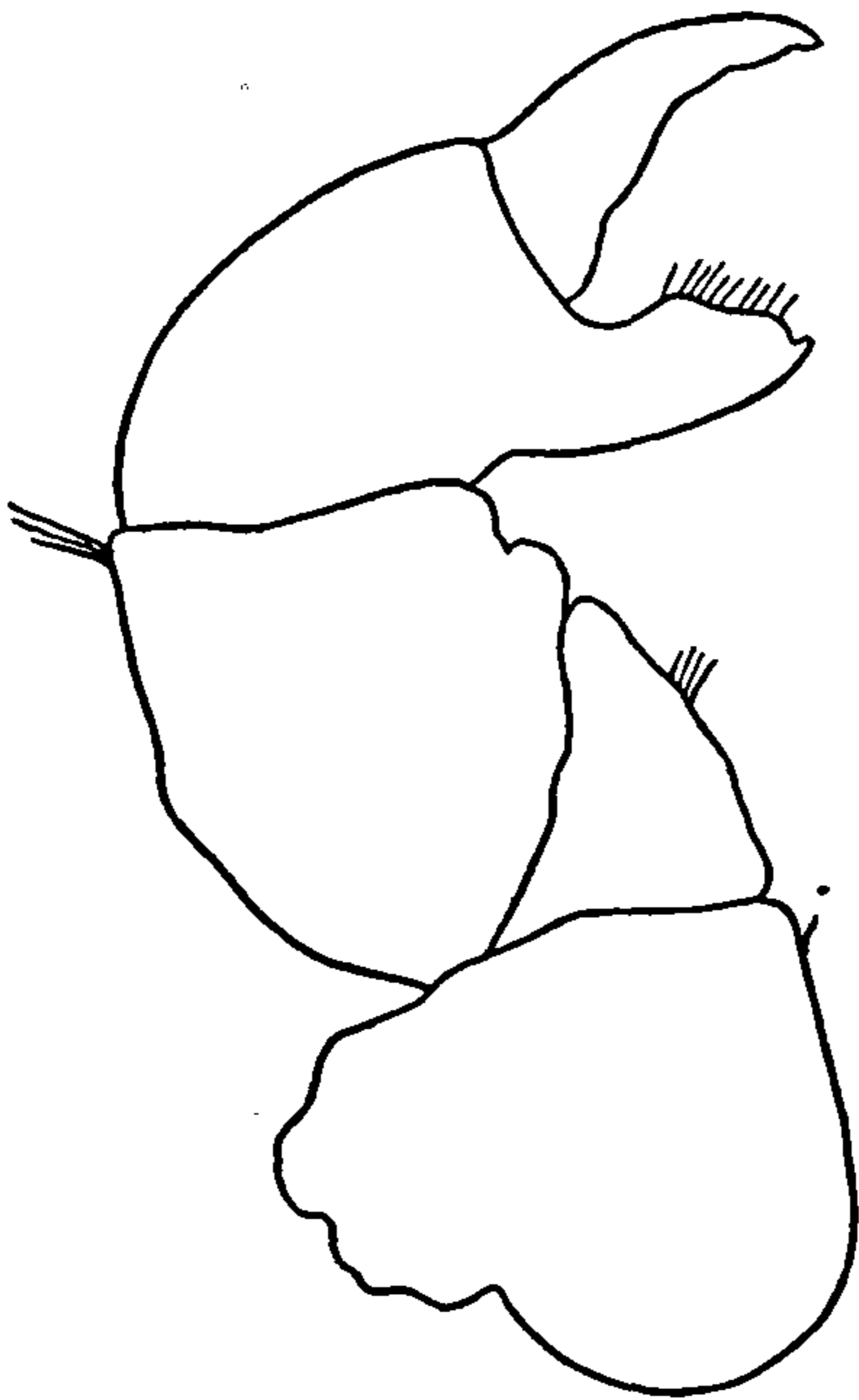


FIG. 2.—PANCOLUS CALIFORNIENSIS. FIRST GNATHOPOD.  $\times 20$ .

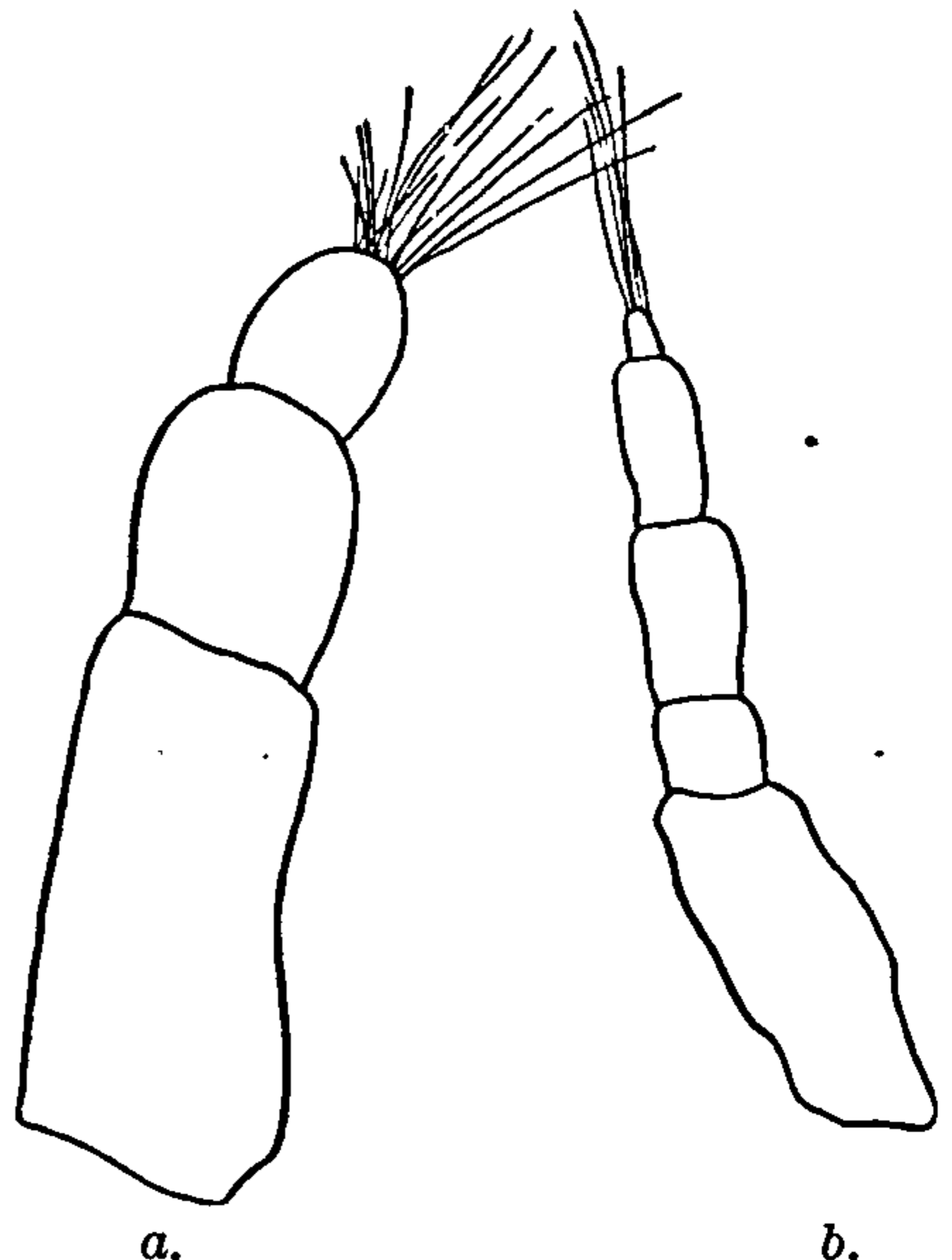


FIG. 3.—PANCOLUS CALIFORNIENSIS. *a*, FIRST ANTENNA.  $\times 44$ . *b*, SECOND ANTENNA.  $\times 44$ .

extrême antero-lateral angles. The head anteriorly is about half as wide as it is posteriorly. The first pair of antennæ have the first article large and robust, about half as wide as long; the second article is half as long as the first; the third is a little shorter than the second and terminates in a bunch of hairs. The second pair of antennæ are shorter than the first, reaching only to the end of the second article of the first pair of antennæ. The first article is longest, being three times longer than the second; the third is about twice as long as the

second; the fourth is more than one and a half times longer than the second; the fifth is minute and terminates in a bunch of hairs.

The first segment of the thorax is coalesced with the head to form a carapace. The second or first free segment is a little shorter than any of those following. The third and fourth or second and third free segments are subequal; the last three are subequal, and each is a little longer than either of the two preceding segments.

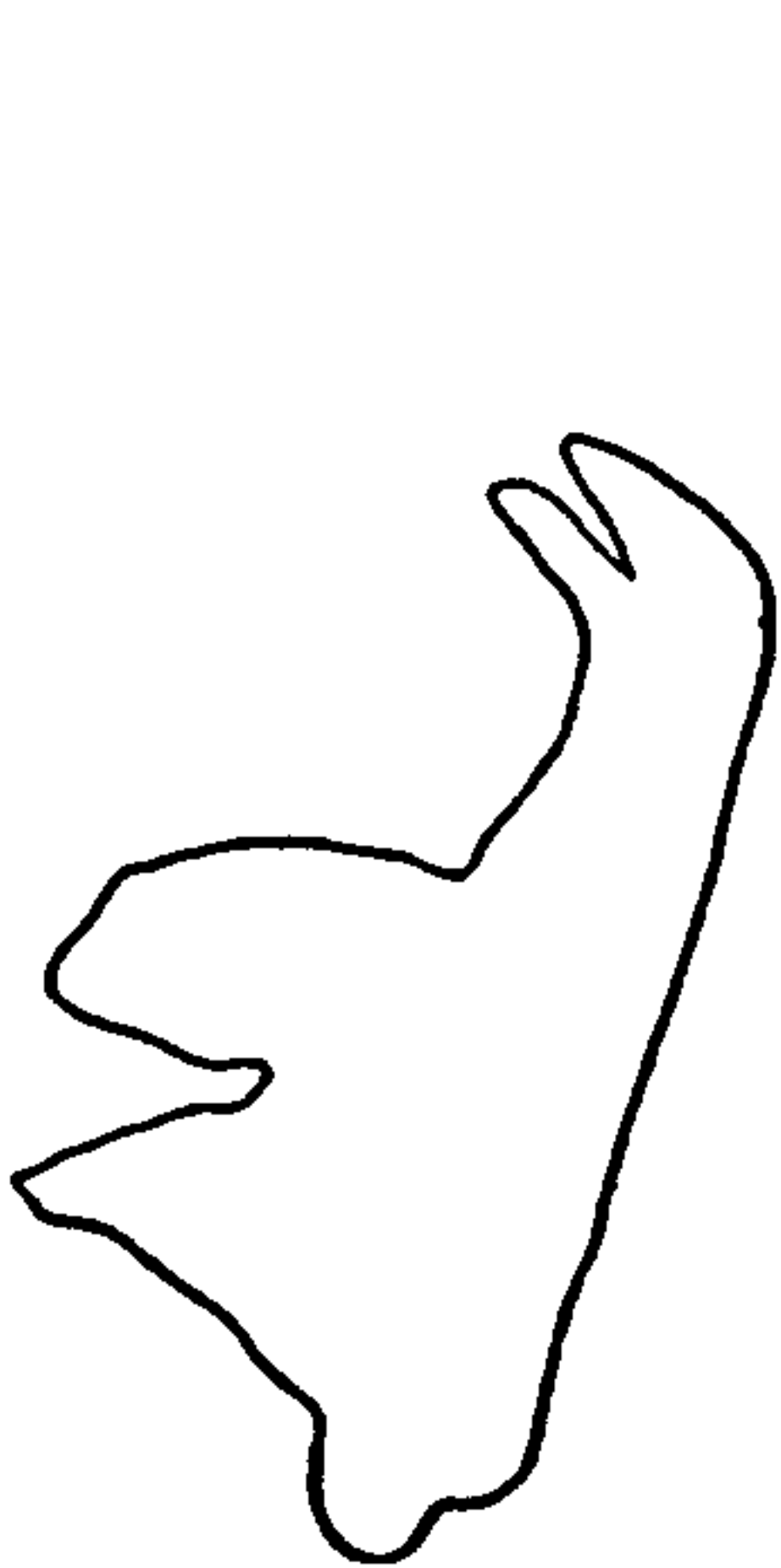


FIG. 4.—PANCOLUS CALIFORNIENSIS. MANDIBLE.  $\times 44$ .

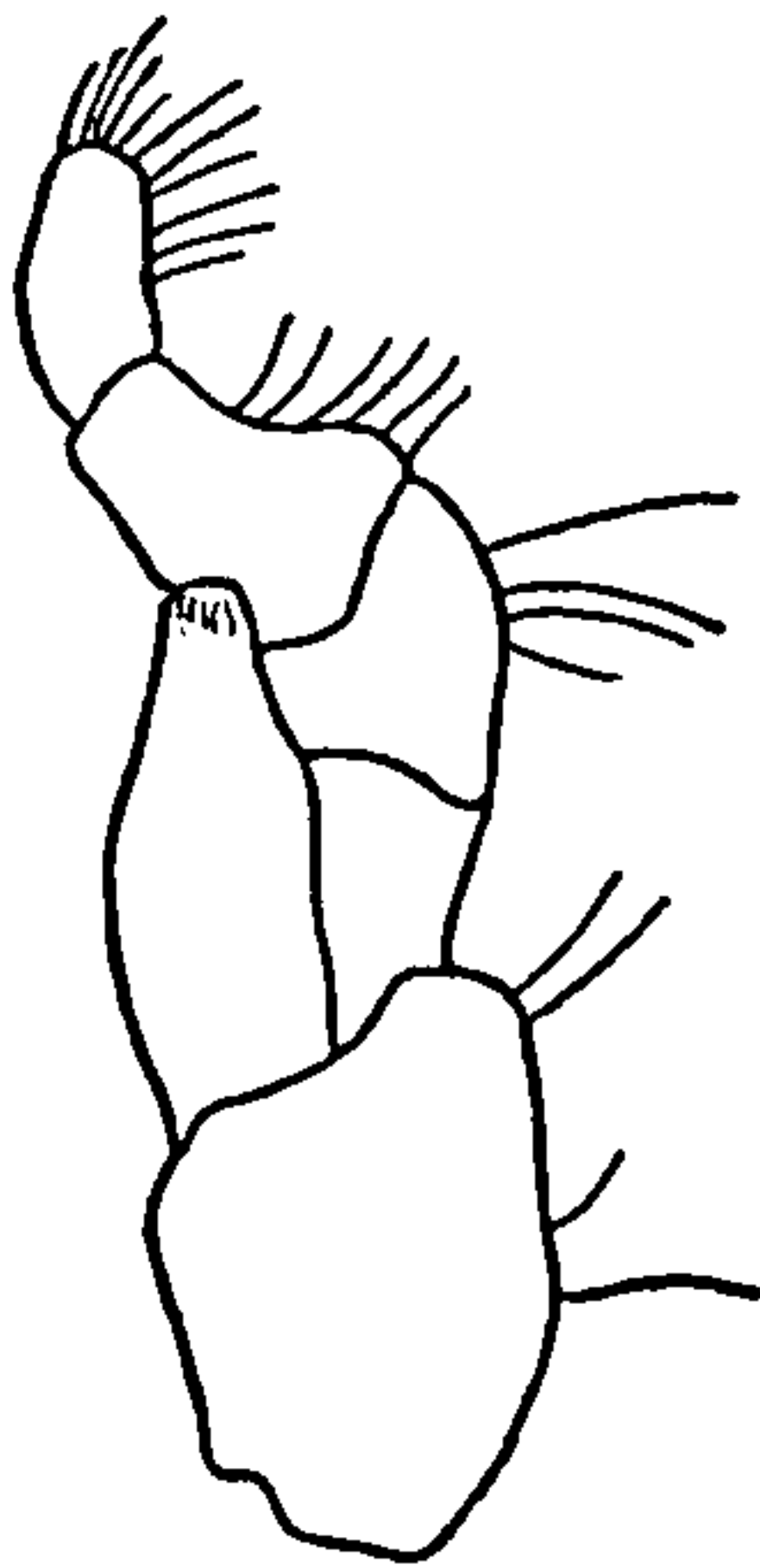


FIG. 5.—PANCOLUS CALIFORNIENSIS. MAXILLIPED.  $\times 44$ .

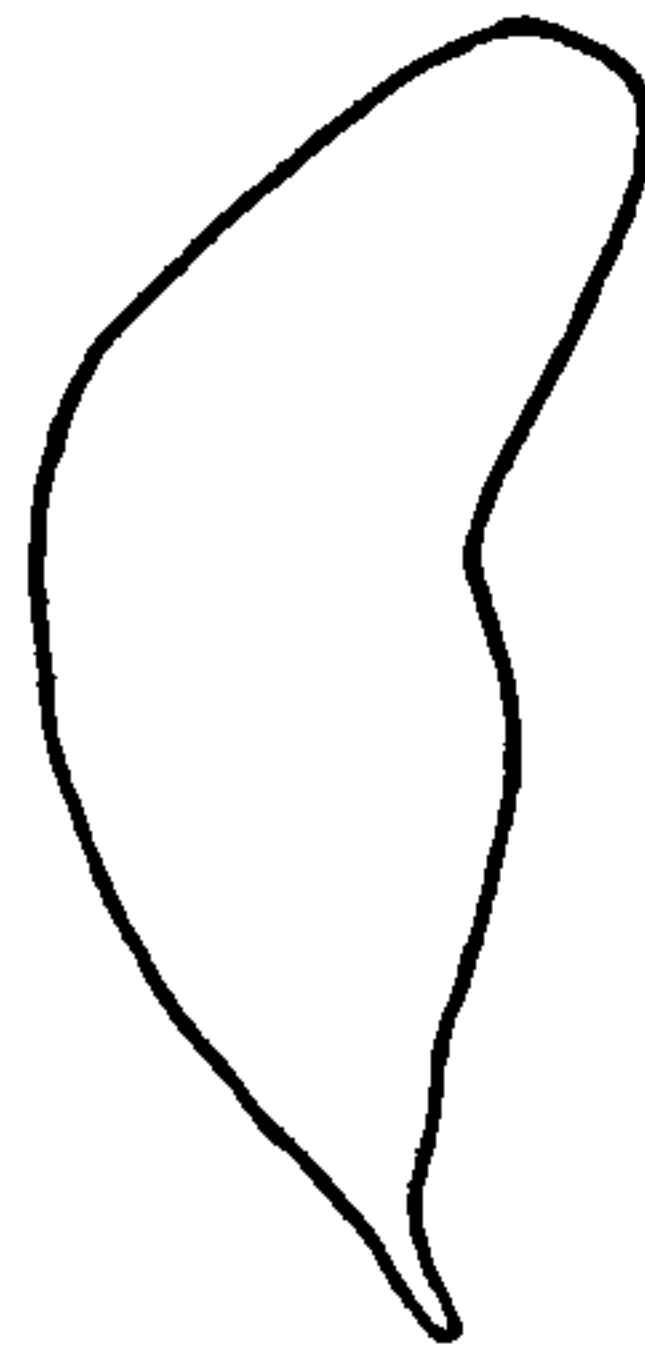


FIG. 6.—PANCOLUS CALIFORNIENSIS. EPIGNATH OF MAXILLIPED.  $\times 44$ .

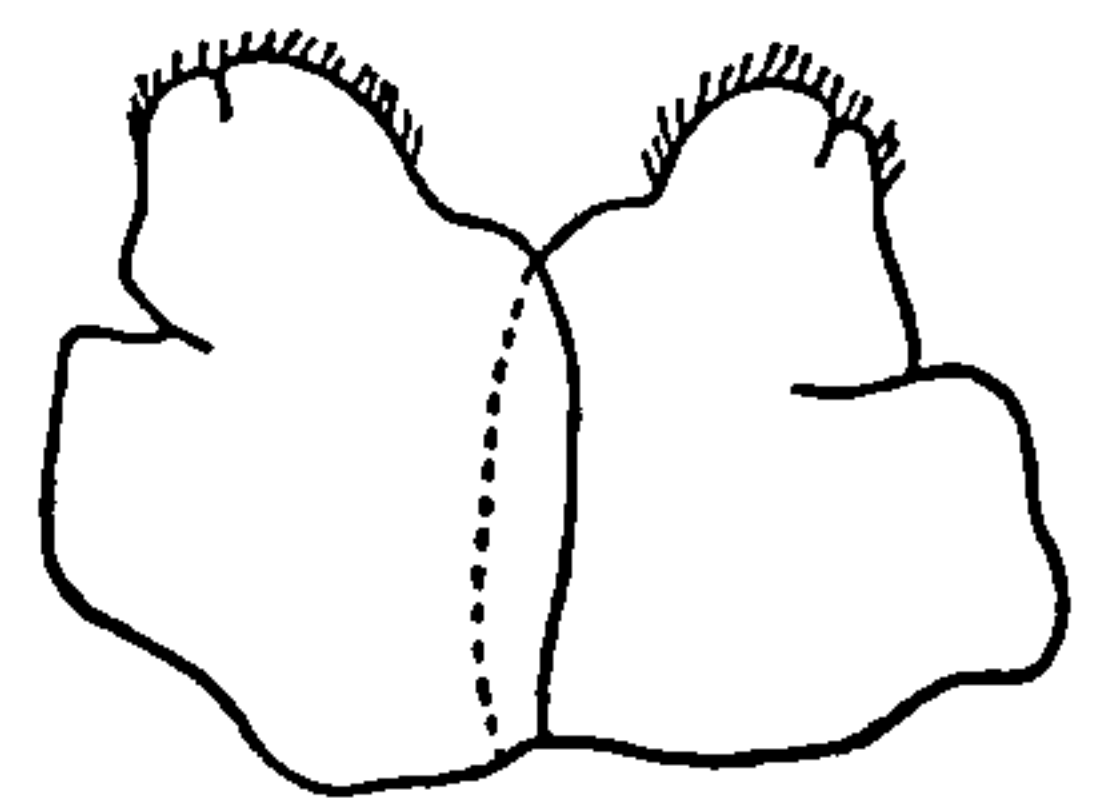


FIG. 7.—PANCOLUS CALIFORNIENSIS. POSTERIOR LIP.  $\times 44$ .

The abdomen is composed of three segments, two short ones followed by the terminal segment, which is rounded posteriorly. The uropoda are single branched. The peduncle is short. The branch consists of a single article, tipped with long hairs. There are but two pairs of well-developed pleopoda.



FIG. 8.—PANCOLUS CALIFORNIENSIS. FIRST MAXILLA.  $\times 44$ .

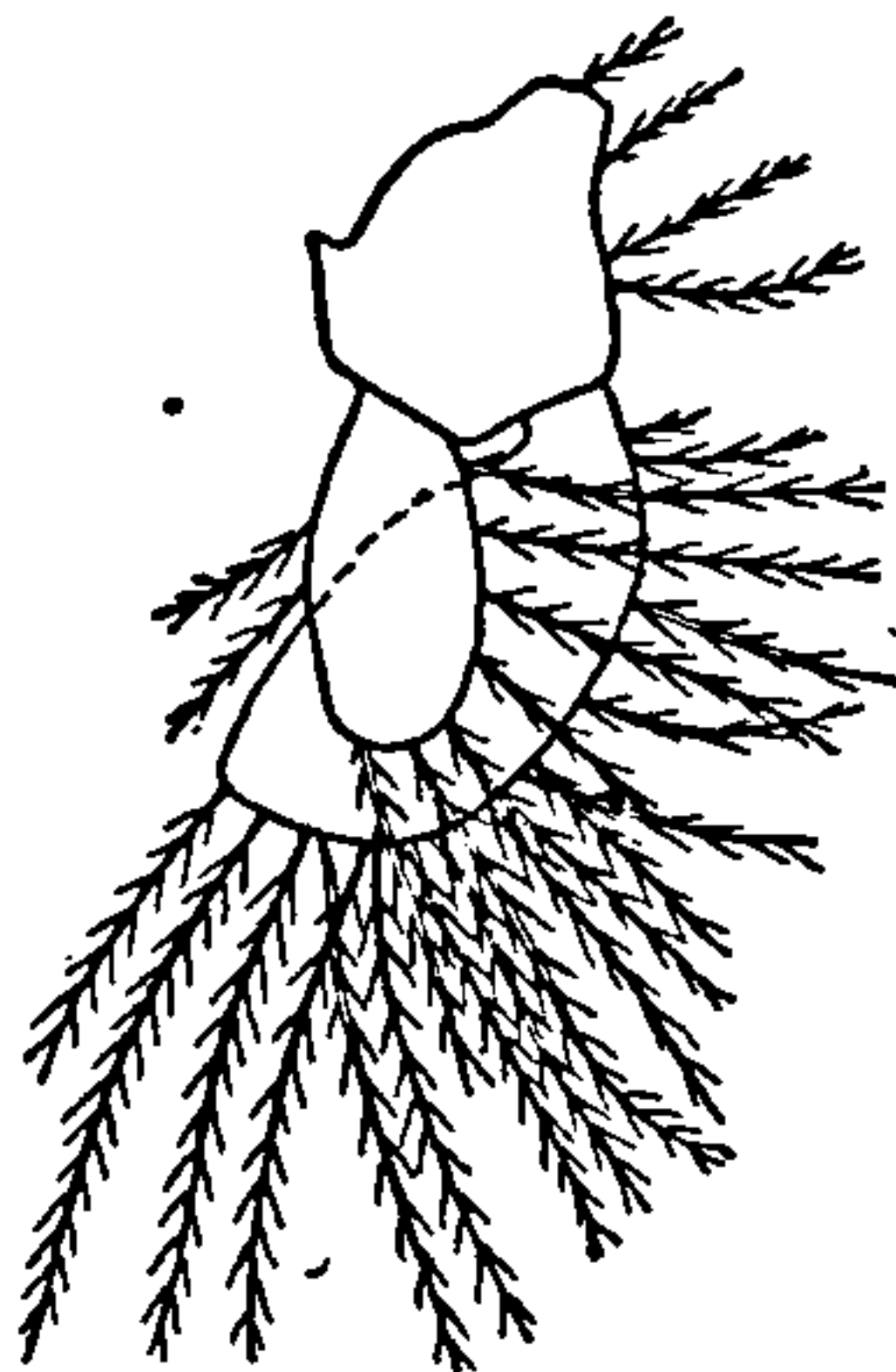


FIG. 9.—PANCOLUS CALIFORNIENSIS. FIRST PLEPOD.  $\times 44$ .

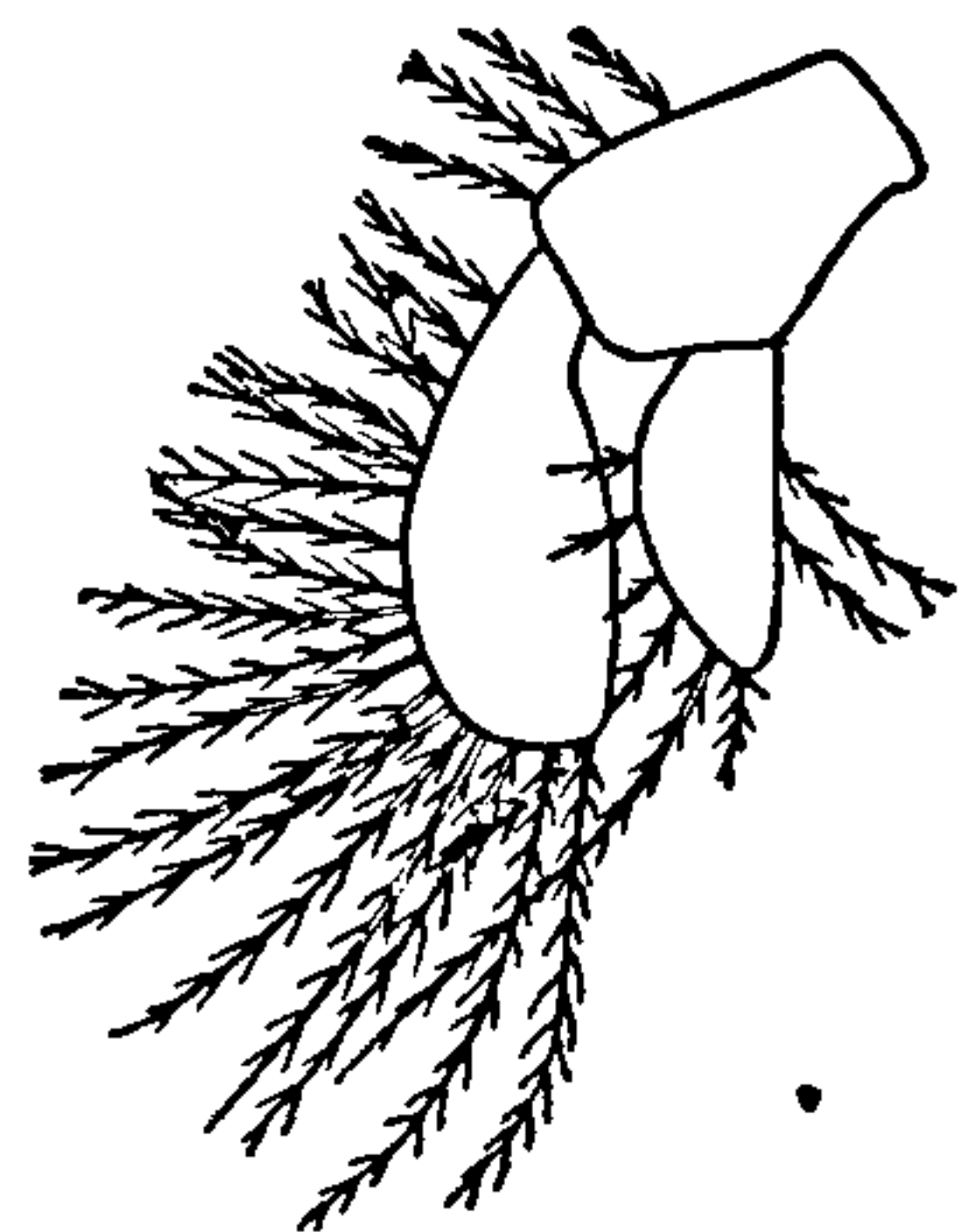


FIG. 10.—PANCOLUS CALIFORNIENSIS. SECOND PLEPOD.  $\times 44$ .

The first pair of legs or gnathopods are chelate. The second pair of legs are long and feeble, and similar to those following, which are ambulatory, but more robust. The dactyli in the last three pairs are curved.

Six specimens of this species were collected by Mr. Harold Heath at Monterey Bay, California.

The types are in the U. S. National Museum. Cat. No. 30614, U.S.N.M.

## 2. Genus TANAIS Audouin and Edwards.

Eyes present and well developed. Abdomen composed of five or six segments. Only three pairs of pleopoda present, all fully developed. Uropoda simple, single-branched. Incubatory pouch formed of two lamellæ issuing from the base of the fifth pair of legs. Mandibles strong with the molar expansion well developed.

## ANALYTICAL KEY TO THE SPECIES OF THE GENUS TANAIS.

- a. Pereiopoda having the first three joints short and broad, affixed to the sides of the pereion like plates of mail. Inferior antennæ scarcely half the length of the superior antennæ..... *Tanais loricatus* Spence Bate
- a'. Pereiopoda with joints not dilated, slender. First and second antennæ of nearly equal length.
- b. Abdomen composed of five segments.
- c. Uropoda composed of three articles, a basal article, and a bi-articulate branch. First and second abdominal segments with transverse setiferous bands.  
*Tanais cavolinii* Milne Edwards
- c'. Uropoda composed of seven articles, a basal article, and a branch composed of six articles. First and second segments of abdomen without setiferous bands..... *Tanais alascensis* Richardson
- b'. Abdomen composed of six segments.
- c. Uropoda composed of four articles, the peduncle, and a branch composed of three articles. Body robust. Last three segments of abdomen not abruptly narrower than three preceding segments. Posterior end of head about two and a half times wider than anterior end. First pair of legs with chelæ strong and powerful, the dactylus strongly arched, finger and thumb widely separated in male ..... *Tanais robustus* Moore
- c'. Uropoda composed of six articles, the peduncle, and a branch composed of five articles. Body narrow, elongate. Last three segments of abdomen abruptly narrower than three preceding segments, about half as wide. Posterior end of head not greatly wider than anterior end. First pair of legs with finger and thumb not widely separated.  
*Tanais normani* Richardson

## TAN AIS LORICATUS Spence Bate.

*Tanais loricatus* SPENCE BATE, Lord's Naturalist in British Columbia, II, 1866, p. 282.—RICHARDSON, Proc. U. S. Nat. Mus., XXI, 1899, p. 819; Ann. Mag. Nat. Hist. (7), IV, 1899, p. 159; American Naturalist, XXXIV, 1900, p. 210.

*Locality*.—Esquimault Harbor, British Columbia.

Found in the hollow of a sponge.

“Exemplum imperfectum; inferiores antennis semi-breviores quam superiores habens; gnathopodum primi paris propoda ovata dactylo breve et tumido; pereopodum primis tribus articulis brevibus et latis sunt, loricis ad pereionem adherentibus.

“The only specimen in the collection is imperfect. The first segment of the pereion appears to be imperfectly fused with the cephalon; inferior antennæ scarcely half the length of the superior. First pair of gnathopoda having the propodus ovate; dactylos short and tumid, shorter and less pointed than the digital process of the propodos.

Periopoda having the first three joints short and broad, being affixed to the side of the pereion like plates of mail (hence the specific name); they terminate in short, pointed dactyli, and have the propodi armed with two lateral rows of strong, black, pointed teeth.

“This species was taken from the hollow of a sponge dredged in Esquimault Harbor, at the depth of about ten fathoms.”—SPENCE BATE.<sup>a</sup>

TANAIS CAVOLINII <sup>b</sup> Milne Edwards.

*Tanais cavolinii* MILNE EDWARDS, in Audouin and Milne Edwards Précis d'Entomologie, I, 1829, pl. xxix, fig. 1; Hist. Nat. des Crust., III, 1840, p. 141, pl. xxxi, fig. 6.

*Tanais tomentosus* KRØYER, Nat. Tidsskrift, IV, 1842, p. 183.

*Crossurus vittatus* RATHKE, Nova Acta Academiae Cæsareæ Leopoldino-Carolinæ Naturæ Curiosorum, XX, 1843, p. 39, pl. i, figs. 1-7.

*Tanais tomentosus* KRØYER, Nat. Tidsskrift (2), II, 1847, p. 412; Voy. en Scand., Crust., 1849, pl. xxvii, figs. 2 a-q.—LILLJEBORG, Öfvers. Vet. Akad. Forh., Årg., VIII, 1851, p. 23.

*Tanais hirticaudatus* BATE, Rep. Brit. Assoc., 1860, p. 224, 1861.

*Tanais vittatus* LILLJEBORG, Upsala Univ. Arsskr., Math. og Naturv., I, 1865, pp. 29-30.—BATE and WESTWOOD, Brit. Sess. Crust., II, 1866, p. 125.—STEBBING, Trans. Devon. Assoc., 1874, p. 7.—MCDONALD, Trans. Linn. Soc. (2), I (Zoology), p. 67, pl. xv.—STEBBING, Ann. Mag. Nat. Hist. (4), XVII, 1876, p. 78; Trans. Devon. Assoc., 1879, p. 6.—HARGER, Proc. U. S. Nat. Mus., II, 1879, p. 162; Report U. S. Fish Comm., 1880, Pt. 6, pp. 418-419, pl. xiii, figs. 81-82.

*Tanais tomentosus* SARS, Archiv. for Math. og Naturvid., 1882, pp. 22-23.—SCOTT, Ann. Scottish Nat. Hist., 1898, pp. 218-219.—G. O. SARS, Crust. Norway, II, 1899, p. 12, pl. v.

*Tanais cavolinii* DOLLFUS, Bull. Soc. Zool. France, XXII, 1897, p. 207; Mém. Soc. Zool. France, XI, 1898, p. 35.—NORMAN, Ann. Mag. Nat. Hist. (7), III, 1899, pp. 332-333. (See Norman for synonymy.)—RICHARDSON, Proc. U. S. Nat. Mus., XXIII, 1901, p. 501; Trans. Conn. Acad. Sciences, XI, 1902, p. 278.

*Localities.*—Noank, Connecticut; Long Island Sound; Greenland; Castle Harbor, Bermudas, in dead coral; also west coast of Norway; British Isles; Bay of Fayal; West France; Azores; in the Atlantic at Ile Dumet, near Croisac; Guétharry; St. Jean de Luz; Hendaye; in the Mediterranean at Banyuls; Cette; Bandol; Cannes; Ile Rousse; Porto Vecchio; St. Eugène; Lake of Bizerte; Sousse.

*Depth.*—Occurs on piles and among algæ and eel-grass (Harger.) 1-6 ft. (Verrill).

Found in sponges, algæ; on *Pinna*; on *Balanus*; on *Laminaria*; on oysters.

Body elongate, four times longer than wide, 1 mm.: 4 mm. Head about as wide at the base as it is long, 1 mm.: 1 mm., becoming gradually narrower from the base to the anterior end, where it is about

<sup>a</sup>Lord's Naturalist in British Columbia, II, 1866, p. 282.

<sup>b</sup>See Harger for more complete description of this form.

one-half mm. wide; the anterior margin is somewhat triangularly produced, with apex very obtuse. The eyes are small, composite, and situated at the antero-lateral angles of the head. The first pair of antennæ have the basal article very long and about equal to two-thirds the length of the head; the second article is half as long as the first; the third is almost as long as the second; the terminal article is minute. The first pair of antennæ are about 1 mm. in length. The second antennæ have the first article long; the second article is about half as long as the first; the third is a little longer than the first; the fourth is half as long as the third; the fifth article is minute. The second antennæ are more slender and are shorter than the first pair, extending only to the end of the second article of the first pair. The maxillipeds have a palp of four articles. The palp of the mandibles is wanting.

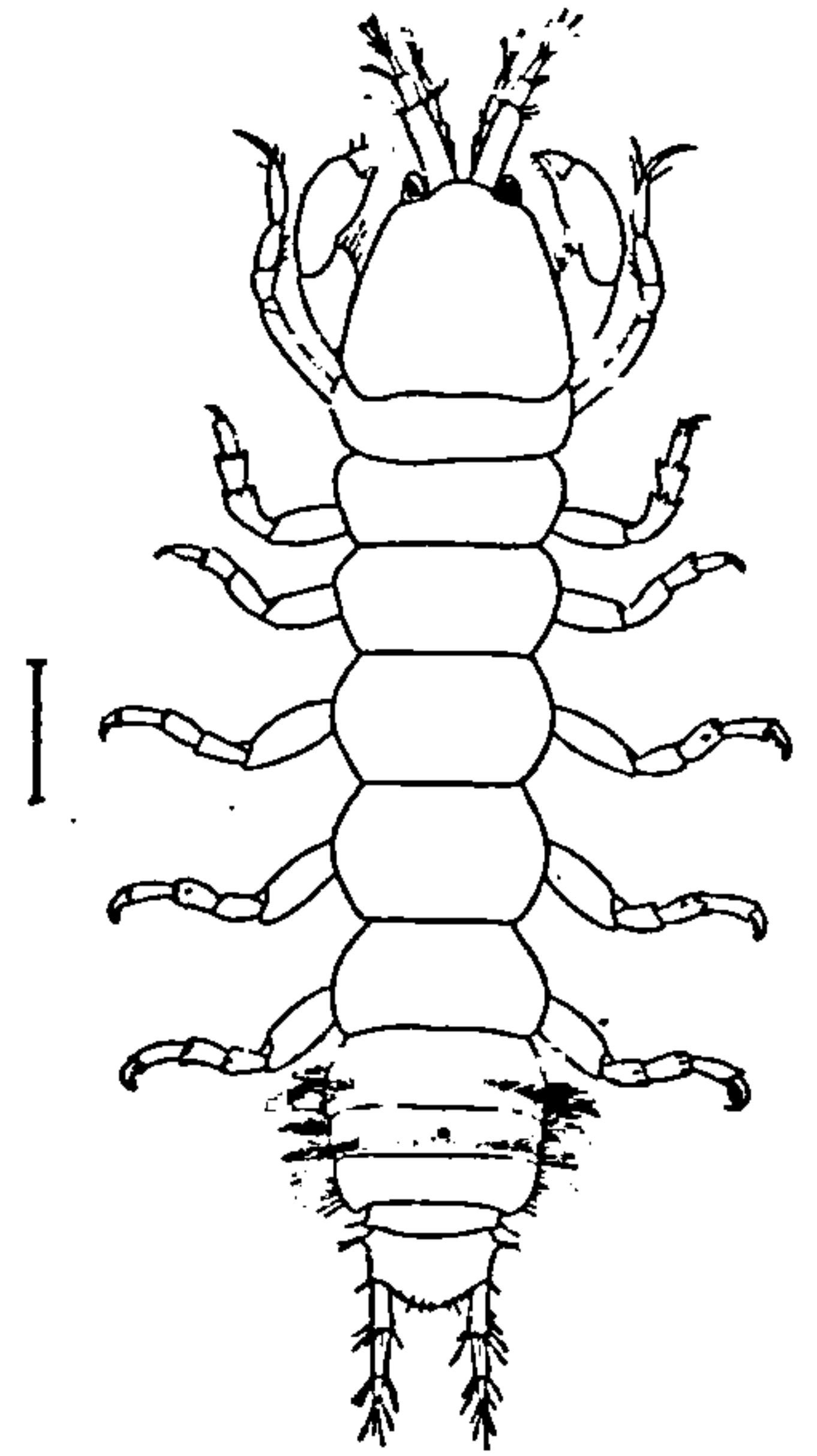


FIG. 11.—TANAIS CAVOLINII  
(AFTER HARGER). × 8.

The first segment of the thorax is united with the head to form a carapace. The second and third segments are subequal, and each is a little shorter than any of the four following, which are about equal in length.

The abdomen is composed of five segments, four anterior to the terminal segment. The first two have a transverse row of long plumose hairs fringing the posterior margins. The fourth segment is

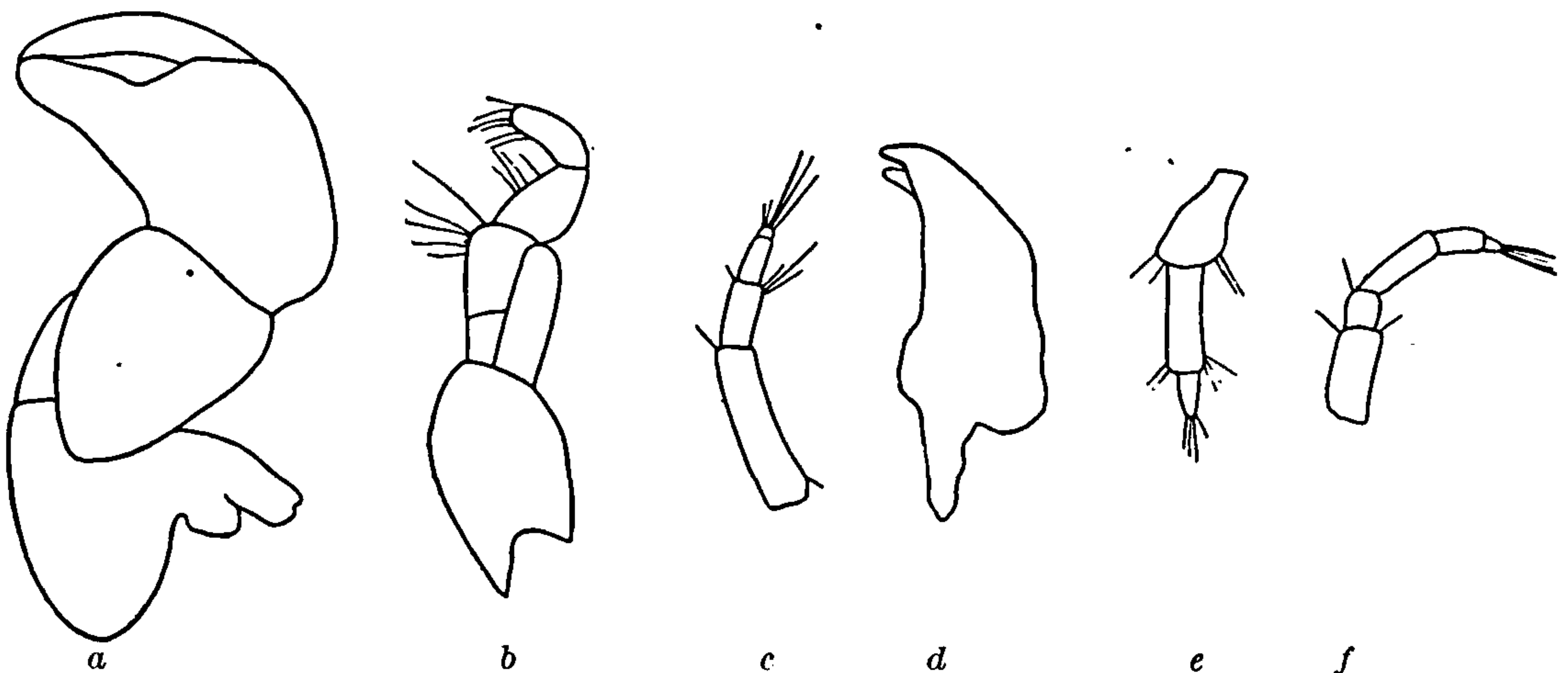


FIG. 12.—TANAIS CAVOLINII. *a*, FIRST LEG. *b*, MAXILLIPED. *c*, FIRST ANTENNA. *d*, MANDIBLE.  
*e*, UROPOD. *f*, SECOND ANTENNA.

very short, not more than half as long as any of the three preceding segments. The terminal segment has the posterior margin obtusely pointed. The uropoda are composed of three articles, a basal article or peduncle and two others, which form a single branch. The second article of the single ramus is half as long as the first article.

The first pair of legs are chelate; the other six pairs are ambulatory. There are three pairs of pleopoda.

## TANAIS ALASCENSIS Richardson.

*Tanais alascensis* RICHARDSON, Proc. U. S. Nat. Mus., XXI, 1899, pp. 819-820; Ann. Mag. Nat. Hist. (7), IV, 1899, pp. 159-160; American Naturalist, XXXIV, 1900, p. 211.

*Locality*.—Kyska Harbor, Alaska.

*Depth*.—6-12 fathoms, in sand and mud.

Body three and a half times longer than broad.

Head large, narrowed anteriorly. Frontal margin almost straight. First pair of antennæ short, stout, consisting of three joints, the first joint being the longest, and a rudimentary flagellum of two joints. Second pair of antennæ more slender, a little longer, consisting of five articles, the first joint being longest, and a rudimentary flagellum of one joint. Eyes small and pedunculated.

The first segment of the thorax is confluent with the head. The second, third, fourth, and fifth segments increase slightly in length; the fifth and sixth are about equal; the seventh is not quite so long as the preceding one.

The abdomen is composed of five segments, the first three of which are subequal; the fourth is short, about half as long as any of the others and also narrower; the terminal segment is as long as the two preceding ones together, and is rounded posteriorly, with a slight median notch. The segments of the abdomen decrease in width gradually from the first to the terminal segment. The terminal filaments

are seven-jointed—the peduncle forming the first article—and single-branched, and are furnished at their extremities with a few long hairs. There are three pairs of pleopoda attached to the first three segments.

The first pair of legs are stout and chelate; the propodus is produced into a strong immovable finger, irregular in shape, having its central portion raised and truncate on its upper surface, which is distinctly serrate. The dactylus is likewise serrate on its inner surface. The other legs are slender, with a gradual increase in stoutness.

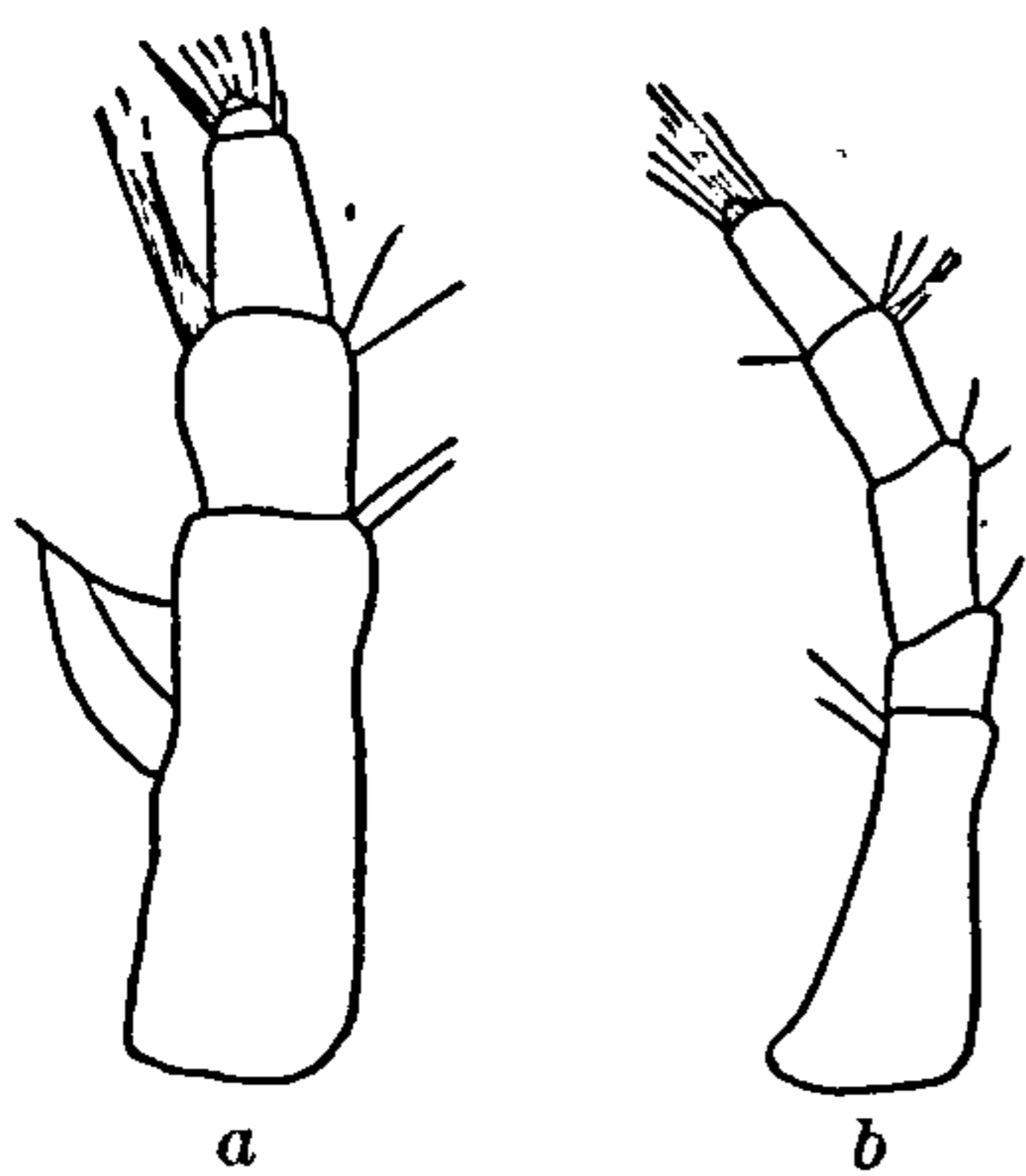


FIG. 13.—TANAIS ALASCENSIS.  
a, FIRST ANTENNA.  $\times 39$ . b,  
SECOND ANTENNA.  $\times 39$ .

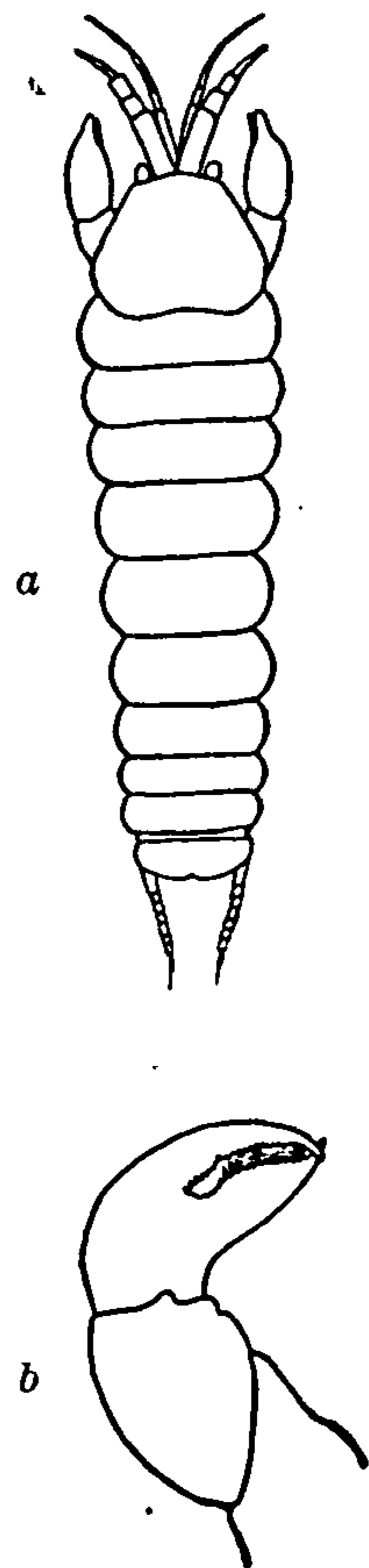


FIG. 14.—TANAIS ALASCENSIS. a, DORSAL VIEW.  $\times 8$ . b, LAST JOINTS OF LEG OF THE FIRST PAIR.



Color brown, marked in some specimens with a darker brown, and having oval patches of the darker color on the head.

Kyska Harbor, Alaska; Dr. W. H. Dall, collector; depth, 6 to 12 fathoms.

*Type*.—Cat. No. 22563, U.S.N.M.

#### TANAIS ROBUSTUS Moore.

*Tanais robustus* MOORE, Proc. Acad. Nat. Sci. Phila., 1894, pp. 90-94, pl. v.—  
RICHARDSON, American Naturalist, 1900, XXXIV, p. 211; Proc. U. S. Nat. Mus., 1901, p. 501.

*Locality*.—New Jersey.

Found "inhabiting minute tubes in the crevices between the scales of the turtle's (*Thalassochelys caretta*) carapace. When unmolested these little crustaceans could be seen crawling carefully about among their fellow voyagers or lying at the mouths of their domiciles with only the head and chelæ projecting; when disturbed they promptly retreated out of sight."—MOORE.

"It is quite robust for the family, being less than  $3\frac{1}{2}$  times as long as broad. The carapace, which is the broadest portion of the body, is terminated anteriorly by a minute rostrum, whilst its posterior border is somewhat concave in the middle line. In front of the origin of the great gnathopods the lateral outline is strongly concave, but opposite the bases of these limbs it becomes swollen. When viewed dorsally, the carapace appears in general figure top-shaped. Two grooves, one on each side, indicate upon the dorsal surface the inner boundary of the branchial chamber. Behind the carapace the breadth of the body becomes gradually less with each successive segment. The fourth free segment of the peræon, is the longest, slightly exceeding the third, which is in turn longer than the fifth.

"The pleon is composed of six distinct segments, of which the fourth and fifth are much shorter than the others and the sixth is terminated posteriorly by a blunt median projection. The body is constricted at the joints and the segmentation is distinctly marked. The dorsal surface is furnished laterally with a few setæ, which on the first and second segments of the pleon form a short row on each side, but never form a transverse band crossing the segment.

"The eyes and eye-lobes are large, the latter being let into deep recesses in the anterior lateral portion of the carapace.

"The antennulæ consist of three joints, of which the basal one is somewhat longer than the other two combined. A small knob (rudimentary flagellum) terminates each. In the male the antennulæ usually about equal in length the carapace with the first free segment, but are sometimes considerably longer. In the female they are about equal to the carapace alone.

“The antennæ lie close beneath the antennulæ, by which they are slightly exceeded in length in both male and female. They are five-jointed, the fourth joint being the longest, slightly exceeding the second; the fifth, third, and first following in the order named, the last mentioned being very short. Each antenna is terminated by a densely setiferous rudimentary flagellum, considerably longer than that of the antennules and sometimes imperfectly articulated.

“The mandibles are of the usual form, curved inward at the tip, where each bears a pair of horny teeth, shaped like the limbs of the letter U. Proximad of the middle a stout transverse column passes mediad bearing at its end an oval plate transversed by a series of parallel ridges with deep grooves between. Under a high power each ridge appears to be broken up by shallow indentations into a series of rounded teeth.

“The first maxillæ consist of a stout forwardly directed column and a posteriorly directed palpus, bearing at its end a brush of seven or eight long setæ. The anterior ramus is stout and curved toward the median line, bearing at its tip a group of about eight stout, curved spines, each with two series of fine, apically directed denticuli. A brush of stiff setæ lies near the base, and laterad of, the spines. A smaller group of spines lie on one face near the tip; these are not denticulate and lack the brown color of those in the apical group.

“The maxillipeds are adherent basally by means of short, stout hooks. The basal joints are prolonged on their anterior or oral aspects into plate-like processes, which are coupled together in the median line. Each basal joint bears a flattened palpus, consisting of four joints, the terminal three being furnished with long setæ. The distal joint is strongly flexed on the penultimate. A somewhat falci-form branchial epipod is attached to the maxilliped at its base by means of a slender stalk.

“The first gnathopods are strongly chelate in both sexes, but especially so in the males. The ‘thumb’ of the propodite is terminated by a horny tooth, and external to and just within this is a sharp-edged tubercle; the tooth of the dactylopodite bites between the two. Fig. 15, *f* and *g*, on page 13, show the gnathopods of male and female side by side, and give a better idea of their appearance than can be gained from a description.

“The limbs of the first free segment of the peræon are long and slender, their terminal claws being but slightly curved. The two succeeding pairs are stouter, with the dactylopodite and claw shorter than in the first pair. The last three pairs are still stouter; the dactylopodite bears a strongly hooked claw with a comb-like series of minute, curved teeth on each side, and the distal end of the propodite bears a row of stout setæ. All the limbs except those of the first free segment have the distal end of the carpopodite crowned with a

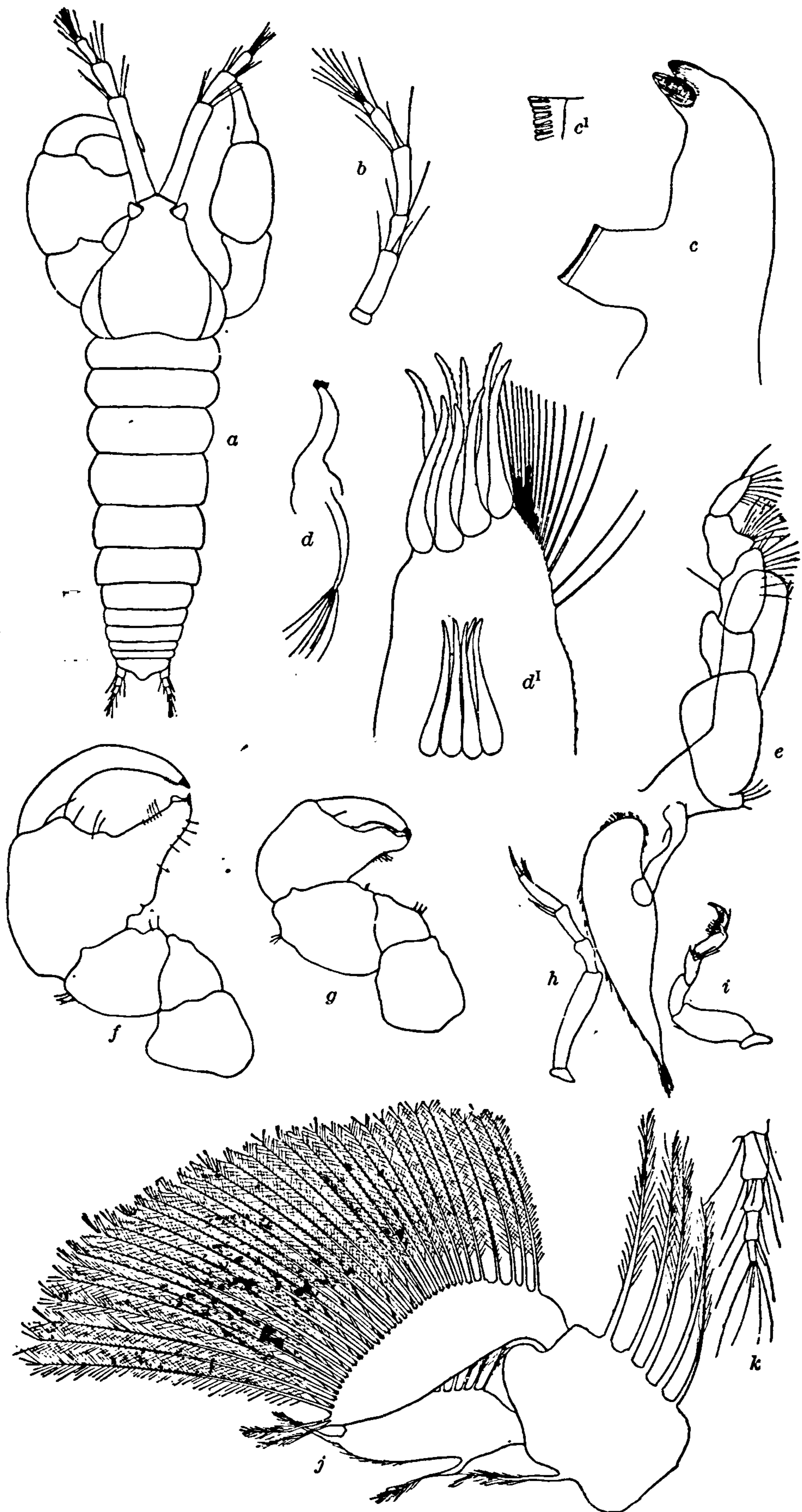


FIG. 15.—TANAIS ROBUSTUS (AFTER MOORE). *a*, GENERAL FIGURE. *b*, SECOND ANTENNA. *c*, MANDIBLE. *c*<sup>1</sup>, DETAIL OF MANDIBLE. *d*, ANTERIOR (FIRST) MAXILLA. *d*<sup>1</sup>, TIP OF FIRST MAXILLA. *e*, MAXILLIPED. *f*, FIRST GNATHOPOD OF MALE. *g*, FIRST GNATHOPOD OF FEMALE. *h*, FIRST PEREIOPOD. *i*, LAST PEREIOPOD. *j*, PLEOPOD. *k*, UROPOD.

few stout spines, some bifid, others serrulate. Only the anterior three segments of the pleon bear limbs (pleopods). Each of these consists of a flat basal piece (protopodite), to which are attached two one-jointed blades, furnished on their outer edges with long pinnate setæ, the exopodite bearing about 35, the endopodite about 15. Both protopodite and endopodite bear a single stout seta on their inner edge.

“The last segment bears a pair of four-jointed setose limbs (uropods), the segments of which are cylindrical and increase in length from base to tip. The marsupia of the female are thin-walled pouches attached to the ventral wall of the sixth thoracic segment (fourth free segment). They increase in size with the development of the eggs and in some specimens extend over segments five to seven, to which, however, they are not attached.

“The largest specimens collected measure from rostrum to tip of pleon 4.7 mm. and in width 1.4 mm. The ground color in alcoholic specimens is pale yellow. Upon the carapace this is heavily mottled with brownish pigment, excepting over about thirty elliptical and subelliptical areolæ symmetrically arranged toward the middle line. The dorsal surfaces of the chelæ are similarly marked. The portion of the body and the limbs behind the carapace are much paler, being usually concealed in the tubular dwelling.”—MOORE.<sup>a</sup>

The type specimens of this species were sent me from the University of Pennsylvania. As the bottle in which they were placed had been accidentally broken and the specimens allowed to dry up, they were not in a condition to redescribe, so I have quoted Doctor Moore's description, which is very full and accurate.

#### TANAIS NORMANI Richardson.

*Tanais normani* RICHARDSON, Proc. U. S. Nat. Mus., XXVIII, 1905, pp. 369-370.

*Locality*.—Monterey Bay, California.

Body narrow, elongate, 4 mm. long. :  $\frac{3}{4}$  mm. wide.

Head as wide as long, with the anterior margin triangulate between the eyes, which are situated at the extreme antero-lateral angles. The head is half as wide anteriorly as it is posteriorly. The eyes are small, but distinct. The first pair of antennæ are composed of three articles, and have the first article longest, about two and a half times as long as wide; the second article is half as long as the first; the third is a little shorter than the second, and terminates in a bunch of long hairs. The second pair of antennæ are composed of five articles and have the first article about three times as long as the second; the third is twice as long as the second; the fourth is one and a half times longer than the second; the fifth article is minute and terminates in a bunch of hairs.

<sup>a</sup> Proc. Acad. Nat. Sci. Phila., 1894, pp. 90-94.

The first segment of the thorax is united with the head to form a carapace. The second or first free segment is the shortest of all; the third and fourth or second and third free segments are nearly equal in length, the third being perhaps a little longer; the fifth and sixth or fourth and fifth free segments are subequal and are the longest; the sixth or seventh free segment is about equal in length to the third free segment.

The abdomen is composed of six segments. The first three are subequal in length and carry on the ventral side three pairs of well-developed pleopoda. The two following segments are subequal, and each is about one-half as long as any of the three preceding segments and about one-half as wide, being abruptly narrower. These segments do not carry pleopoda. There are thus only three pairs of

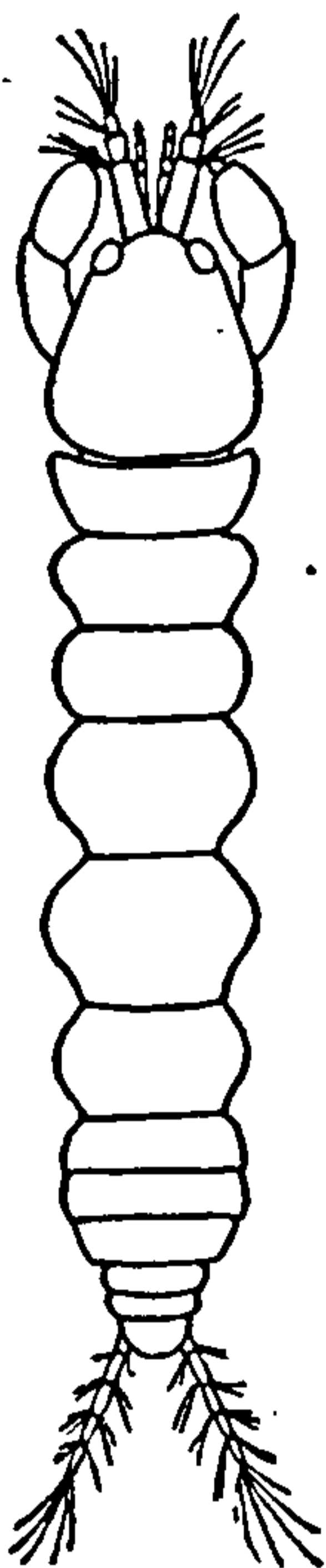


FIG. 16.—TANAIS NORMANI.  $\times 11\frac{1}{2}$ .

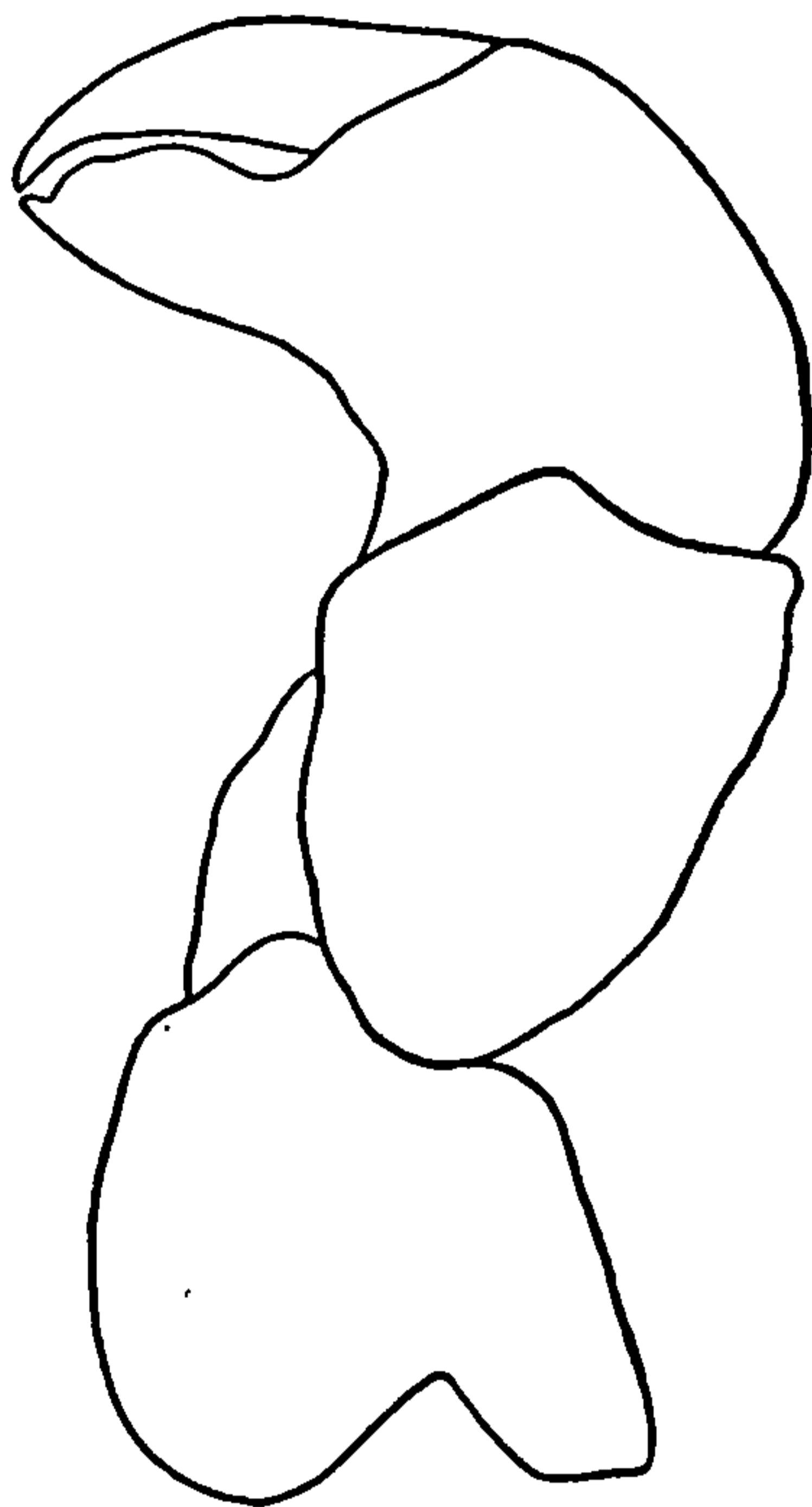


FIG. 17.—TANAIS NORMANI. FIRST GNATHOPOD.  $\times 44$ .

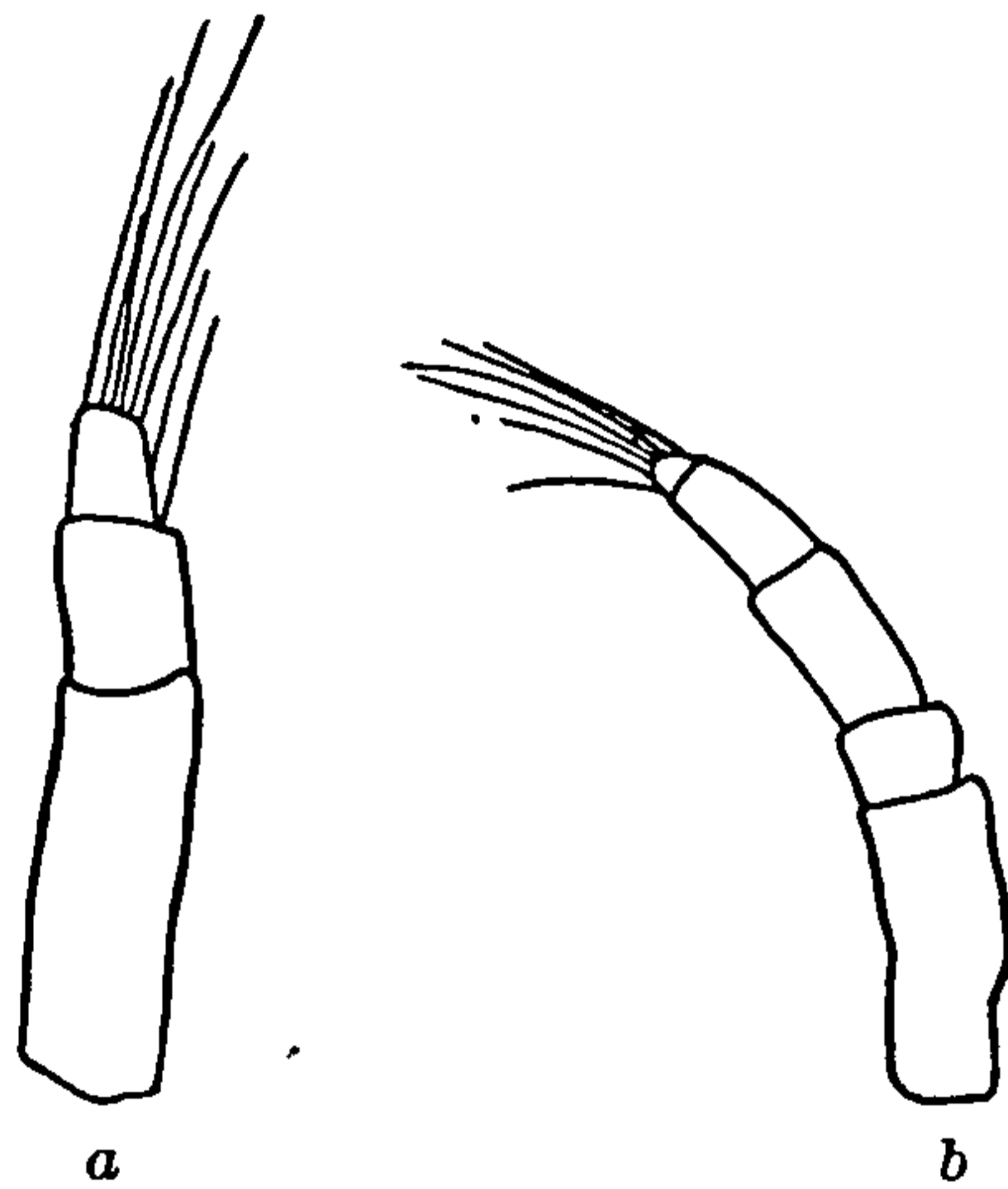


FIG. 18.—TANAIS NORMANI. a, FIRST ANTENNA.  $\times 44$ . b, SECOND ANTENNA.  $\times 44$ .

pleopoda. The sixth or terminal segment is as wide as the two preceding segments and is rounded posteriorly. The uropoda are single branched; the peduncle is followed by a five-articulate branch.

The first pair of legs or gnathopods are chelate; the following six pairs of legs are ambulatory.

Only three specimens of this species were collected by Mr. Harold Heath at Monterey Bay, California.

The types are in the U. S. National Museum. Cat. No. 30615, U.S.N.M.

This species differs from *Tanais alascensis* Richardson in having the abdomen composed of six segments, while in *T. alascensis* it is composed of five segments; in having the uropoda composed of a peduncle

and five articles, while in *T. alascensis* the uropoda are composed of a peduncle and six articles; and in the smaller size of the specimens.

It is named in honor of Rev. A. M. Norman, the distinguished carcinologist.

### 3. Genus CRYPTOCOPE Sars.<sup>a</sup>

Eyes wanting. Abdomen composed of six segments. Pleopoda in female very small and rudimentary; those in the male well developed. Incubatory pouch formed of two lamellæ issuing from the bases of the fourth pair of legs. Uropoda in female short, biramose, rami very unequal; those in male much more fully developed. First gnathopods strong and similar in structure in both sexes. Mandibles well developed, with the cutting edge coarsely dentated, and having on the right mandible a rather large secondary lamella; molar expansion well defined.

#### CRYPTOCOPE ARCTICA Hansen.

*Cryptocope arctica* HANSEN, *Dijmphna-Togt. zool.-bot. Udb.*, 1887, p. 209, pl. XXI, fig. 4; *Vidensk. Meddel. Fra. den Naturh. Foren. i Kjöbh.*, 1887-88, p. 180, pl. VII, fig. 1-1c.—STEBBING, *Ann. Mag. Nat. Hist.* (7), V, 1900, p. 12.—RICHARDSON, *American Naturalist*, XXXIV, 1900, p. 211; *Proc. U. S. Nat. Mus.*, XXIII, 1901, p. 502.

*Localities.*—Greenland; Kara Sea; latitude 72° 20' north, longitude 59° 39' west.

*Depth.*—100-170 fathoms.

*Description of female.*—The body is subcylindrical, about four and a half times longer than wide.

The head becomes gradually narrower toward the front, with the

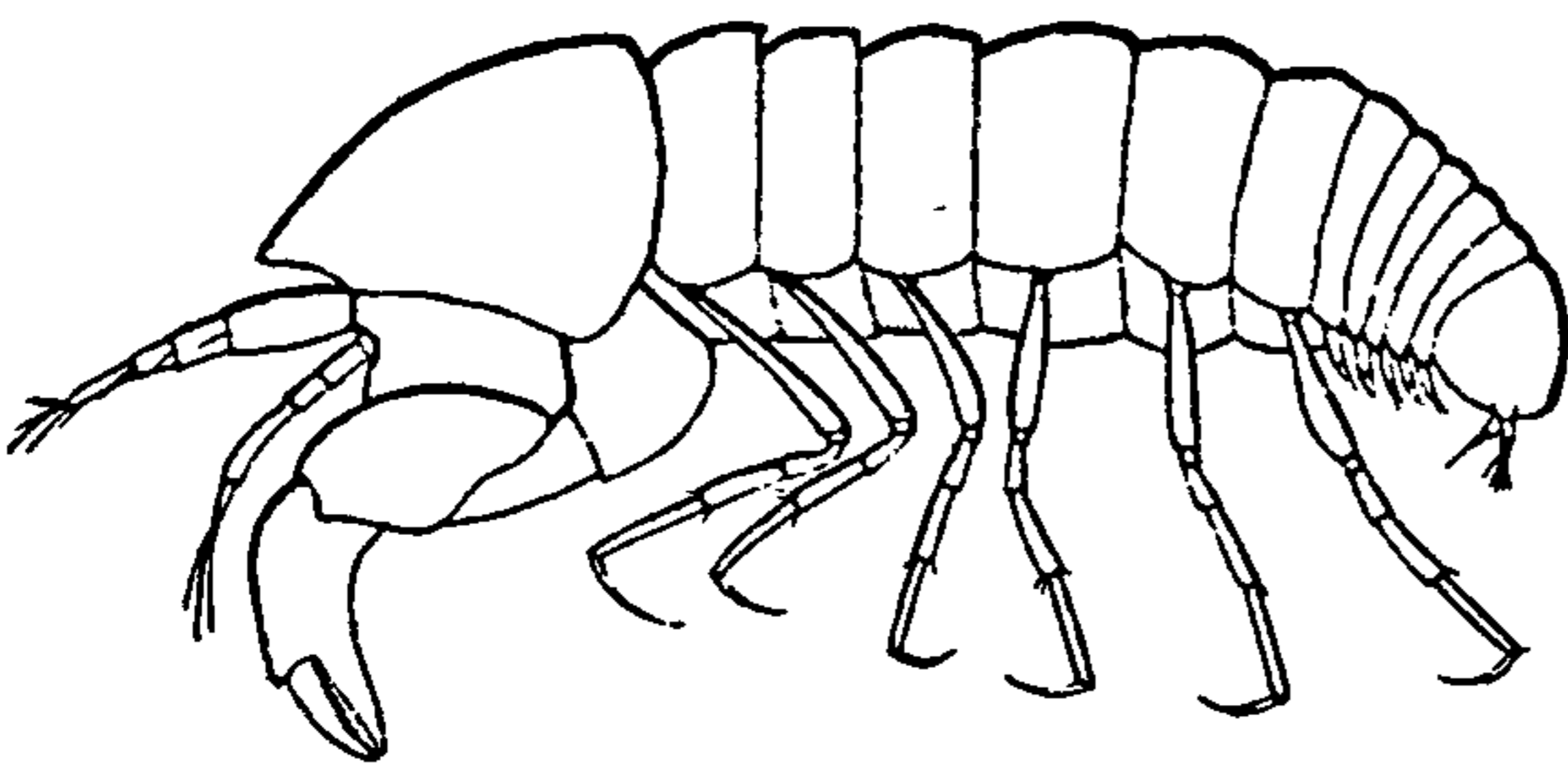


FIG. 19.—CRYPTOCOPE ARCTICA (AFTER HANSEN).  
(ENLARGED.)

anterior margin somewhat produced, the apex being obtuse. Eyes absent. The first pair of antennæ are composed of four tapering articles, and are one-fourth shorter than the head; the basal article is two-fifths the length of the antennæ, is cylindrical when seen from the side—

seen from above, gradually stouter toward the base; the second article is more than one-half times longer than the third and somewhat shorter than the fourth article. Each article is furnished with setæ at the distal end of the external angle. The apex of the fourth article is furnished with numerous long setæ. The second pair of antennæ are slender, composed of five articles, and are somewhat shorter than the antennæ of the first pair.

<sup>a</sup>See Sars for characters of genus.

The first three free segments of the thorax are subequal; taken together, somewhat shorter than the head and twice as long as the fourth free segment.

All the segments of the abdomen are present and visible. The last segment is tapering, widely rounded, and more than twice as wide as long.

The first pair of legs are robust; the chelæ are more than half as short as the head; the fingers are a little shorter than the hand, the thumb serrate almost to the apex. The ambulatory legs are all subequal, slender. The pleopoda are very short, and furnished with a few short setæ.

The uropoda are very short, double-branched, both branches being composed of two articles, the inner branch being twice as long as the outer branch, and stouter.

The marsupium is composed of two large lamellæ issuing from the base of the fifth pair of legs.<sup>a</sup>

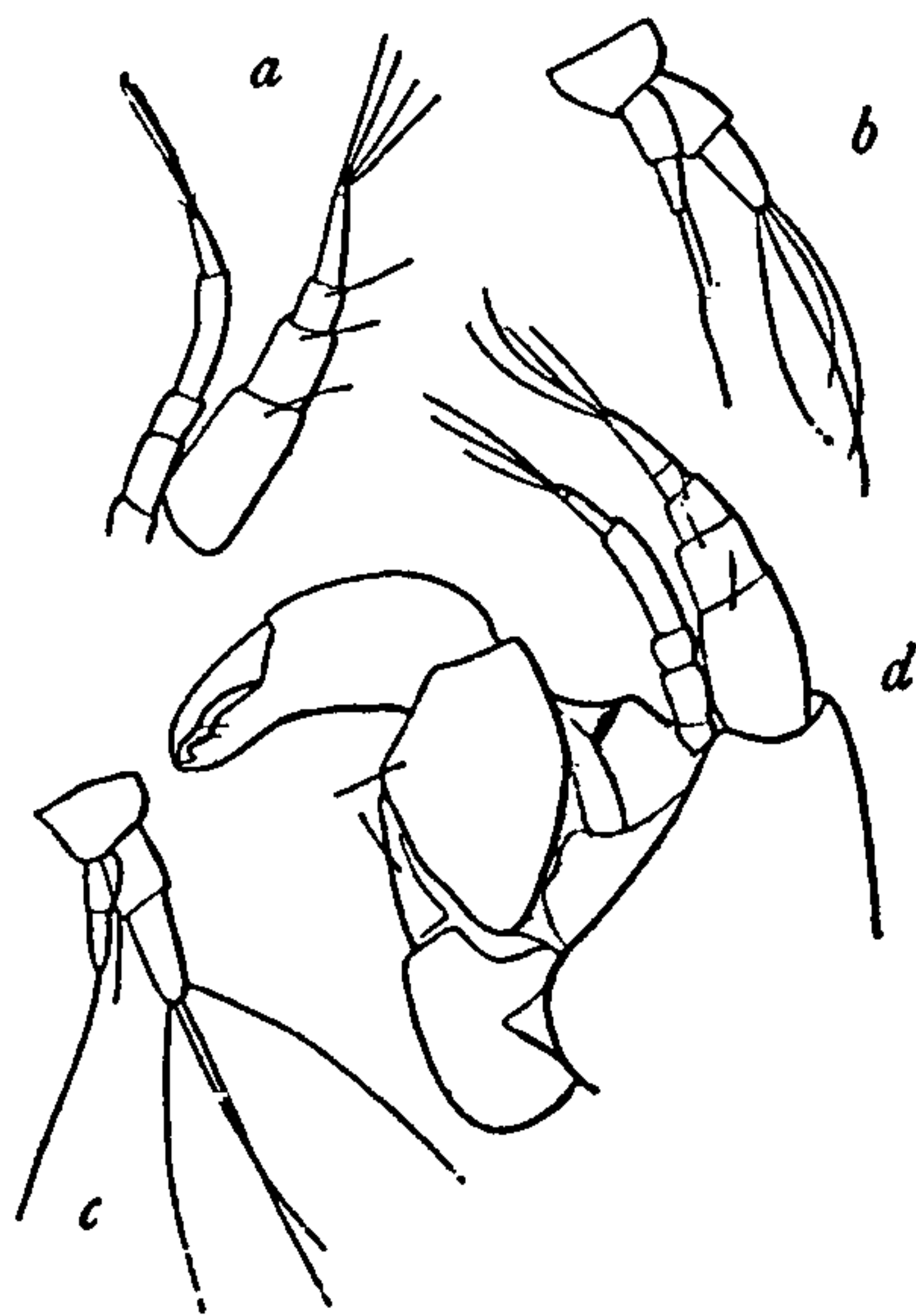


FIG. 20.—CRYPTOCOPE ARCTICA (AFTER HANSEN). *a*, ANTENNÆ OF FEMALE. *b*, UROPOD OF FEMALE. *c*, UROPOD OF MALE. *d*, ANTERIOR PART OF BODY OF MALE. (ENLARGED.)

#### 4. Genus LEPTOGNATHIA Sars.<sup>b</sup>

Eyes wanting. Pleopods in female small and sometimes wanting; those in male well developed. Abdomen composed of six segments. Uropoda usually biramous, sometimes apparently simple, the outer

<sup>a</sup> The above description is adapted from the following description of Hansen's:

*Femina*.—Corpus subcylindricum, circiter quadruplo et dimidio longius quam latius. Scutum cephalothoracicum ad frontem versus sensim angustatum, margine anteriore aliquantum producto et apice obtuso. Segmenta tria libera anteriora inter se subæqualia, simul sumpta scuto cephalothoracico aliquanto breviora et segmento quarto libero duplo longiora. Segmenta caudæ omnia manifesta; segmentum ultimum declive et valde rotundatum, plus duplo latius quam longius. Oculi nulli. Antennæ primi paris quadriarticulatae, anguste conicæ; scuto cephalothoracico quarta parte breviores; articulus basalis duas quintas partes antennæ explens, a latere visus cylindricus, pronus ad basin versus sensim incrassatus; articulus secundus articulo tertio plus quam dimidio longior et articulo quarto nonnihil brevior; articulus uterque seta in angulo exteriori apicali instructus; apex articuli quarti setis compluribus longis ornatus. Antennæ secundi paris tenues, quinque-articulatae, antennis primi paris nonnihil breviores. Pedes primi paris (chelipedes) robusti; chela scuto cephalothoracico plus quam dimidio brevior; digiti manu paulo breviores, pollice prope apicem serrato. Pedes gressorii omnes inter se subæquales, tenues. Pleopoda brevissima, setis nonnullis brevioribus instructa. Uropoda brevissima, biramea, ramis ambobus biarticulatis, ramo interno quam externo duplo longiore et crassiore. Marsupium e laminis duabus magnis, ad pedes quinti paris affixis, formatum est. Long. 1.67 mm.—HANSEN, *Dijmphna-Togt. zool.-bot. Udb.*, 1887, p. 209.

<sup>b</sup> See Sars for characters of genus.

branch not being distinctly defined from the peduncle, branches unequal, inner one larger and biarticulate, outer one composed of one or two articles. Incubatory pouch normal. Mandibles small and feeble in structure, cutting part narrow, molar expansion forming a thin acuminate lappet armed at the tip with a few small denticles.

ANALYTICAL KEY TO THE SPECIES OF THE GENUS LEPTOGNATHIA.

- a.* In female the inner branch of the uropoda is twice as long as the outer. The second or first free segment of the thorax is about two-thirds as long as the third, which in turn is about equal to the fourth and fifth. Sixth and seventh segments progressively somewhat shorter. Propodus of first pair of legs less robust than carpus..... *Leptognathia caeca* (Harger)
- a'.* In female the inner branch of the uropoda is more than three times as long as the outer. The second or first free segment of the thorax is about the same size as the last one, both being shorter than the others. Propodus of the first pair of legs scarcely smaller than the carpus..... *Leptognathia longiremis* (Lilljeborg)

LEPTOGNATHIA CÆCA (Harger).

*Paratanais caeca* HARGER, Am. Jour. Sci. (3), XV, 1878, p. 378.

*Leptocheilia caeca* HARGER, Proc. U. S. Nat. Mus., II, 1879, p. 164; Report U. S. Commissioner of Fish and Fisheries, 1880, Pt. 6, pp. 427, 428; pl. XIII, fig. 91.

*Leptognathia caeca* SARS, Archiv for Math. og naturvid., 1882, p. 45.—NORMAN and STEBBING, Trans. Zool. Soc. Lond., XII, 1886, Pt. 4, p. 110.—RICHARDSON, American Naturalist, XXXIV, 1900, p. 211; Proc. U. S. Nat. Mus., XXIII, 1901, p. 502.

*Localities.*—Massachusetts Bay, off Salem; Provincetown, Massachusetts.

*Depth.*—Surface to 48 fathoms in soft mud.

“This species is at once recognized among our Tanaids by the absence of eyes. The enlarged chelate claws joined to the united head and first thoracic segment, and the six-jointed pleon serve to distinguish it as belonging to the present genus.

“Body slender, elongated, and rather loosely articulated; head narrow in front, not broader than the bases of the antennulæ; eyes wanting; antennulæ distinctly four-jointed in the type specimen, first segment forming less than half the length of the organ, second segment longer than the third, last segment about as long as the second, slender, tapering, and tipped with setæ; antennæ attaining the tip of the third antennular segment. The first pair of legs are robust, but less so than in the preceding species (*Leptocheilia filum*); they extend forward in the natural position about to the tips of the antennæ; they have the basal segment subquadrate, the hand or propodus less robust than the carpus, with a serrated digital process; dactylus short.

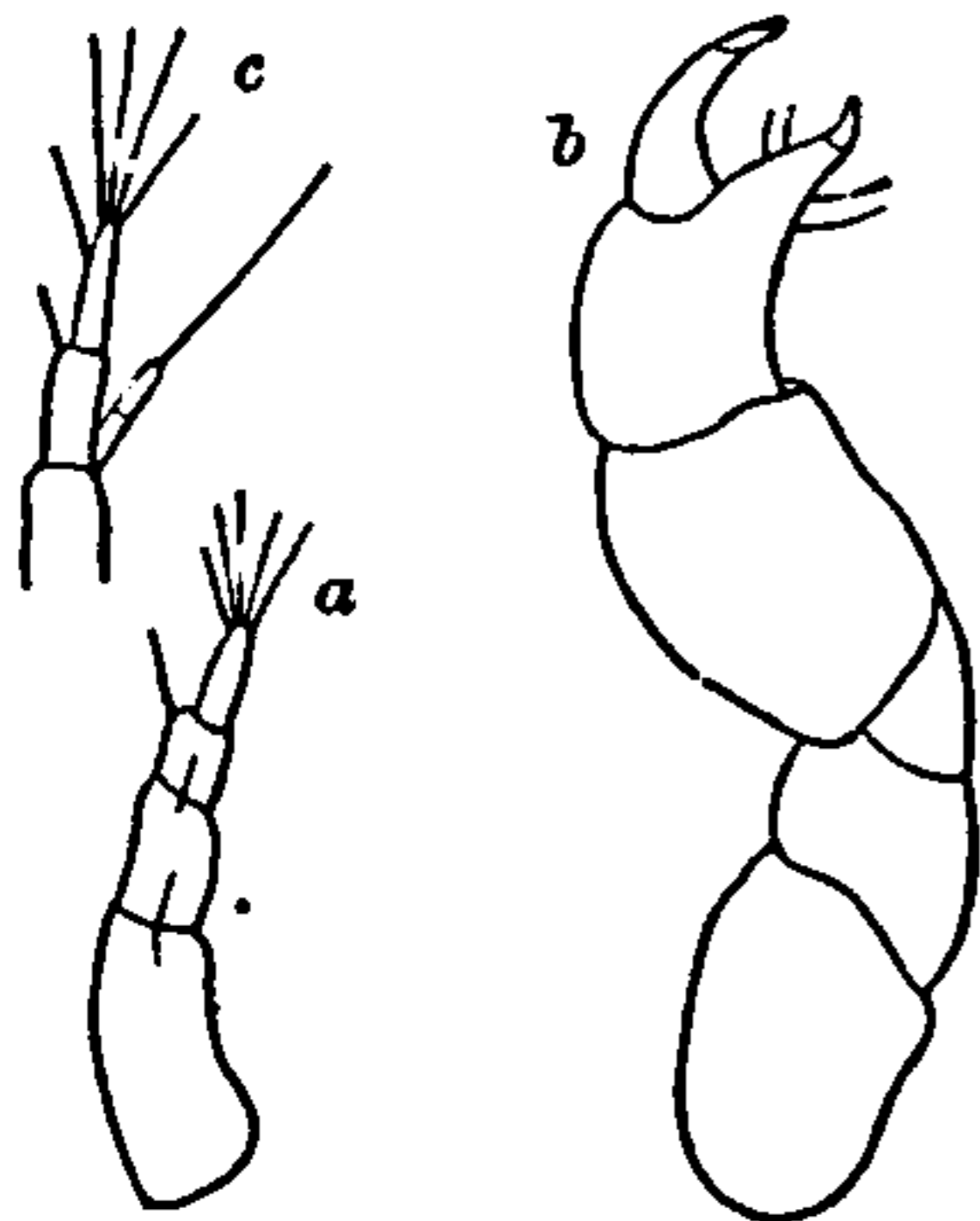


FIG. 21.—LEPTOGNATHIA CÆCA (AFTER HARGER).  
*a.*, FIRST ANTENNA. × 50.  
*b.*, LEG OF FIRST PAIR. × 50.  
*c.*, UROPOD. × 50.

antennæ attaining the tip of the third antennular segment. The first pair of legs are robust, but less so than in the preceding species (*Leptocheilia filum*); they extend forward in the natural position about to the tips of the antennæ; they have the basal segment subquadrate, the hand or propodus less robust than the carpus, with a serrated digital process; dactylus short.



“The second or first free thoracic segment is about two-thirds as long as the third; this in turn is about equal to the fourth and to the fifth segments, while the sixth and seventh segments are progressively somewhat shorter. The second pair of legs are scarcely more slender than the following pairs, and the basal segments are not curved around the base of the first pair.

“The uropods are short and biramous; each ramus two-jointed. The outer ramus is more slender than the inner, half its length, and bears a long bristle at the tip.

“Length, 2.5 mm.; color, white.”—HARGER.<sup>a</sup>

#### LEPTOGNATHIA LONGIREMIS (Lilljeborg).

*Tanais longiremis* LILLJEBORG, Upsala Univ. Arsskr., Math. og Naturv., I, 1865, p. 23-25.

*Tanais islandicus* G. O. SARS, Archiv for Math. og Naturv., Christiania, II, 1877, p. 346.

*Leptognathia longiremis* G. O. SARS, Archiv for Math. og Naturv., 1882, p. 41; Norwegian North Atlantic Expedition, 1876-1878, Crustacea, I, 1885, pp. 79-82, pl. VII, figs. 17-28; II, 1886, p. 26.—HANSEN, Dijnphna-Togtets zoologisk-botanske Udbytte, 1887, p. 185; Vidensk. Meddel. fra den Naturh. Foren. i Kjøbh., 1887-88, p. 179, pl. VI, figs. 9-9b. (See Hansen for synonymy.)—SCOTT, Ann. Scottish Nat. Hist., 1898, p. 220.—SARS, Crust. Norway, II, 1899, p. 27, pl. XII.—RICHARDSON, American Naturalist, XXXIV, 1900, p. 211; Proc. U. S. Nat. Mus., XXIII, 1901, p. 502.—AXEL OHLIN,<sup>b</sup> Bihang till K. Sv. Vet.-Akad. Handl., XXVI, Afd. iv, No. 12, 1901, pp. 15-16.

*Localities.*—Kekertak, Greenland; Scotland; Norway; Iceland; Denmark; latitude 77° 9' north, longitude 14° 40' east, off Ice Islands; latitude 74° 35' north, longitude 18° 23' west, off Little Pendulum Island.

*Depth.*—7-200 fathoms; also shallow water.

Found in soft gray clay, in sandy mud and algæ.

“Body of female rather slender and elongated, more than seven times as long as it is broad; cephalosome about the length of the first two segments of mesosome combined, with the proximal half of uniform breadth, the distal one abruptly attenuated; first free segment of mesosome about same size as the last one, both being shorter than the others; metasome well developed, exceeding in length the last two segments of mesosome combined, terminal segment nearly occupying

<sup>a</sup> Report U. S. Commissioner of Fish and Fisheries, 1880, Pt. 6, pp. 427-428.

<sup>b</sup> Hansen in Ohlin (Bihang till K. Sv. Vet.-Akad. Handl., XXVI, Afd. iv, No. 12, 1901, pp. 16-17, footnote) considers *Leptognathia longiremis* Sars as distinct from *Leptognathia longiremis* (Lilljeborg). He proposes to call it *Leptognathia sarsi* and considers that it differs in having the last segment of the abdomen armed on each side with a small denticle, in having the basal part of the uropoda rather short, the inner branch long, composed of two articles, the other branch short, composed of two joints, the hand of the chelipeds dentated on the inferior margin.

one-third of the length of metasome, and armed on each side with a minute deflexed denticle. Body of male much broader than in female, being scarcely more than five times as long as it is broad; cephalosome rather broad in proportion to its length; all free segments both of mesosome and metasome of about equal length, the terminal one narrowly produced at the tip. Superior antennæ in female gradually

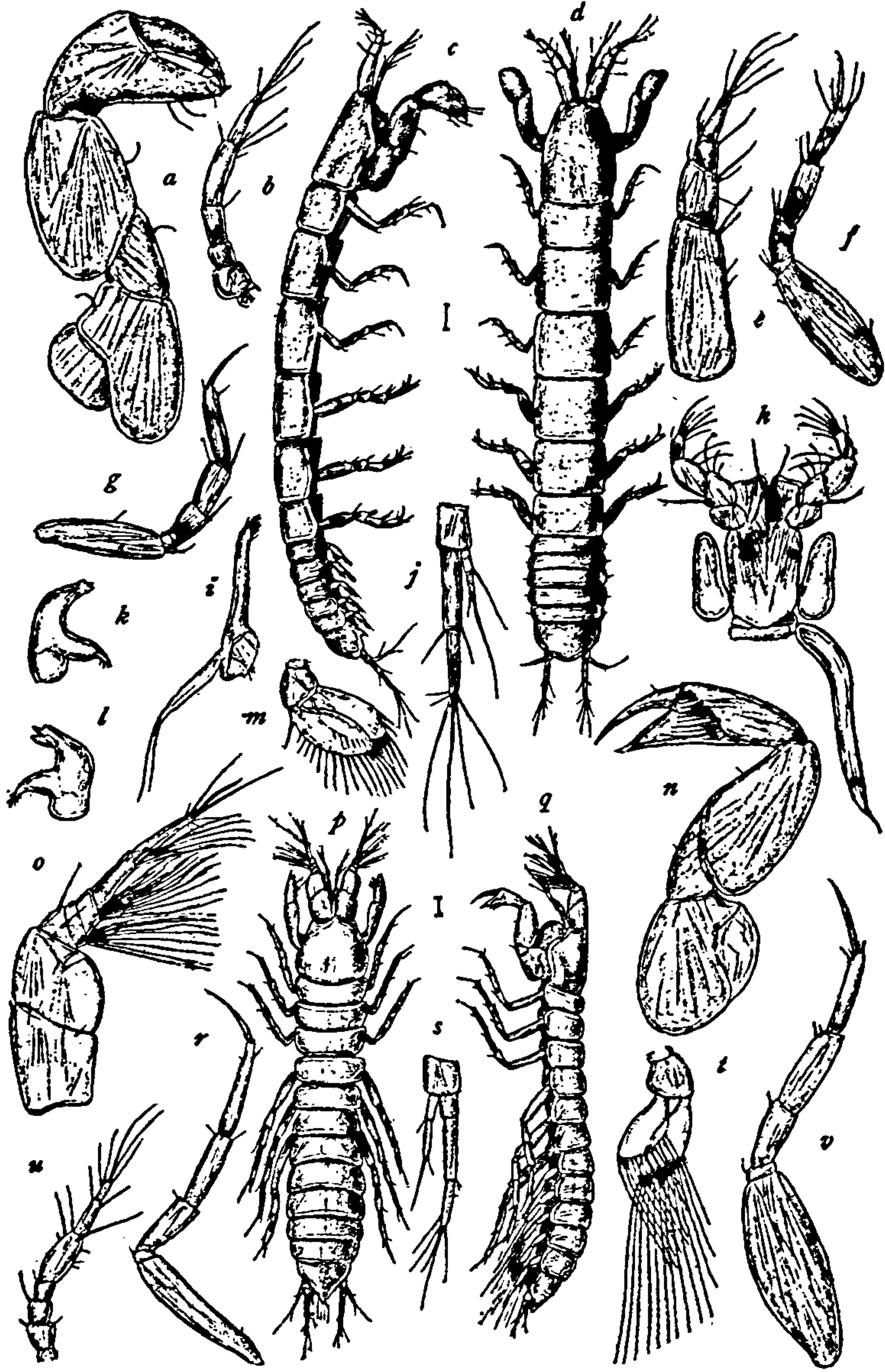


FIG. 22.—LEPTOGNATHIA LONGIREMIS (AFTER SARS). *a*, FIRST LEG OF FEMALE. *b*, SECOND ANTENNA OF FEMALE. *c*, LATERAL VIEW OF FEMALE. *d*, DORSAL VIEW OF FEMALE. *e*, FIRST ANTENNA OF FEMALE. *f*, SEVENTH LEG OF FEMALE. *g*, SECOND LEG OF FEMALE. *h*, MAXILLIPEDS. *i*, ANTERIOR (FIRST OR INNER) MAXILLA. *j*, UROPOD OF FEMALE. *k*, MANDIBLE (RIGHT). *l*, LEFT MANDIBLE. *m*, PLEOPOD OF FEMALE. *n*, FIRST LEG OF MALE. *o*, FIRST ANTENNA OF MALE. *p*, DORSAL VIEW OF MALE. *q*, LATERAL VIEW OF MALE. *r*, SECOND LEG OF MALE. *s*, UROPOD OF MALE. *t*, PLEOPOD OF MALE. *u*, SECOND ANTENNA OF MALE. *v*, SEVENTH LEG OF MALE.

tapering distally, basal joint about equaling in length the other three combined, second joint shorter than the outer two taken together; those in male attaining in length one-fourth of the body, the first two joints of the peduncle large and expanded, flagellum about the length of the peduncle, and having the two outer joints much longer than the

other two. Chelipeds in female rather strong, with the hand considerably dilated, oval triangular in form, and scarcely smaller than the carpus, with a slight dentated crest in front at the insertion of the dactylus, the latter crested along the middle, thumb distinctly serrated at the end inside; those in male with the hand much narrower than in female, and furnished inside with a transverse row of about ten flattened spines increasing in length behind, fingers quite simple, pointed, the immovable one quite short. Uropoda in female attaining half the length of the metasome, both rami biarticulate, the inner one more than three times as long as the outer, and tipped by rather long setæ; inner ramus in male distinctly triarticulate. Length of female 3.75 mm., of male 2.55 mm."—G. O. Sars.<sup>a</sup>

### 5. Genus HETEROTANAIS Sars.<sup>b</sup>

Eyes distinct. Abdomen with all six segments well defined. Pleopoda normal, all five pairs present. Uropoda biramous, outer branch small, inner elongate and composed of four to five articles. Incubatory pouch normal. First gnathopods in female normal, in male very different, being imperfectly chelate, thumb very short, or transformed to a posteriorly-pointing lappet.

#### HETEROTANAIS LIMICOLA (Harger).<sup>c</sup>

*Paratanais limicola* HARGER, Am. Jour. Sci., (3) XV, 1878, p. 378.

*Leptocheilia limicola* HARGER, Proc. U. S. Nat. Mus., II, 1879, p. 163; Report U. S. Commissioner of Fish and Fisheries, 1880, Pt. 6, p. 424, pl. XIII, figs. 87-88.

*Heterotanais limicola* Sars, Archiv for Math. og Naturvid., 1882, p. 31.—NORMAN and STEBBING, Trans. Linn. Soc. London, XII, 1886, Pt. 4, p. 109.—HANSEN, Videnskabelige Meddelelser fra den naturhistoriske Forening in Kjøbenhavn, 1887-1888, pp. 178-179.—RICHARDSON, American Naturalist, XXXIV, 1900, p. 212; Proc. U. S. Nat. Mus., XXIII, 1901, p. 503.

*Localities*.—Massachusetts Bay, off Salem; Godthaab, Greenland (Hansen).

*Depth*.—Forty-eight fathoms in soft mud; 40-60 fathoms.

Body narrow, elongate, 2 mm. long and less than  $\frac{1}{2}$  mm. wide.

Head a little longer than wide, gradually becoming narrower from the base to the anterior end. Eyes "small and inconspicuous." The first pair of antennæ have the first article very long; the second article is only one-fourth as long as the first; the third is almost twice as long as the second. The second pair of antennæ have the first two articles short and subequal; the third article is as long as the first two taken together; the fourth is about half as long as the third. The

<sup>a</sup> Crust. of Norway, II, 1899, p. 27.

<sup>b</sup> See Sars for characters of genus, Crust. of Norway, II, 1899.

<sup>c</sup> See Harger for description of this form.

second pair of antennæ are shorter than the first pair, not extending much beyond the end of the second article of the first pair.

The first free segment of the thorax is a little shorter than any of those following. The second and third free segments are subequal, and each is a little longer than the first segment. The fourth and fifth free segments are subequal, and each is longer than either of the two preceding segments. The last free segment is shorter than either of the two preceding segments, and is about as long as the second and third segments.

The abdomen is composed of six segments, five short, subequal ones anterior to the terminal segment, which has the posterior margin rounded.

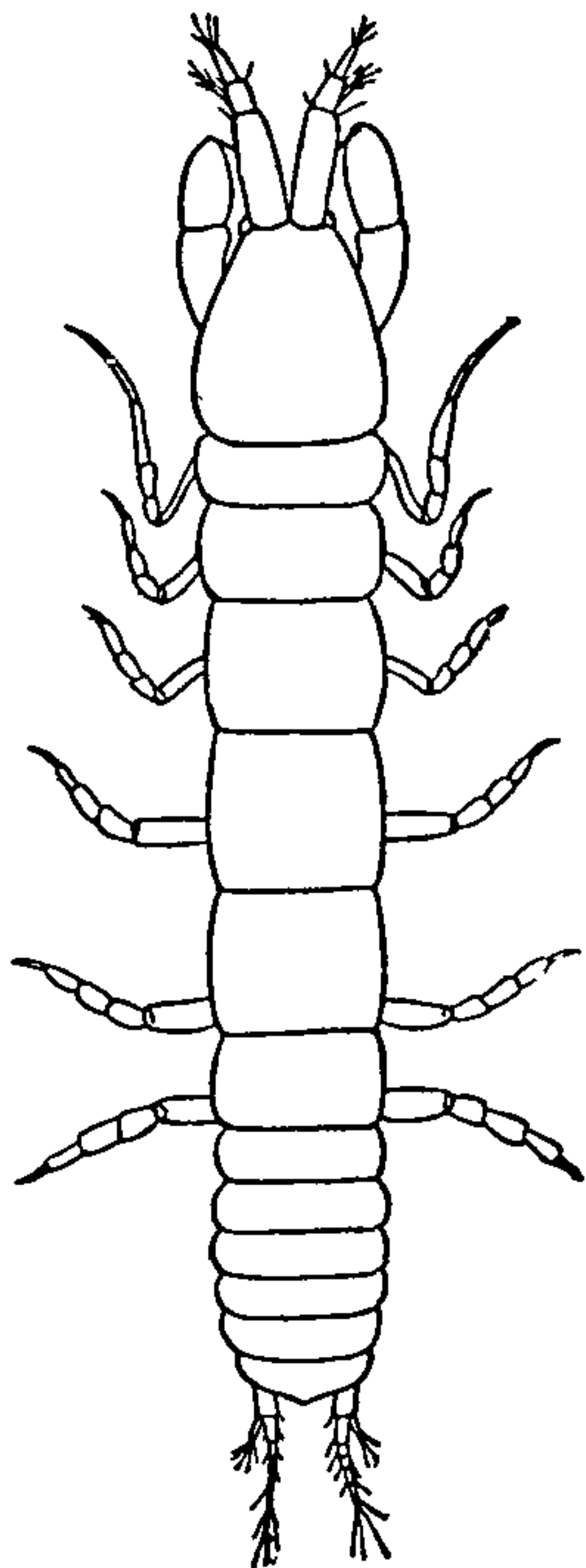


FIG. 23.—HETEROTANAIS LIMICOLA (AFTER HARGER). FEMALE.  $\times 20$ .

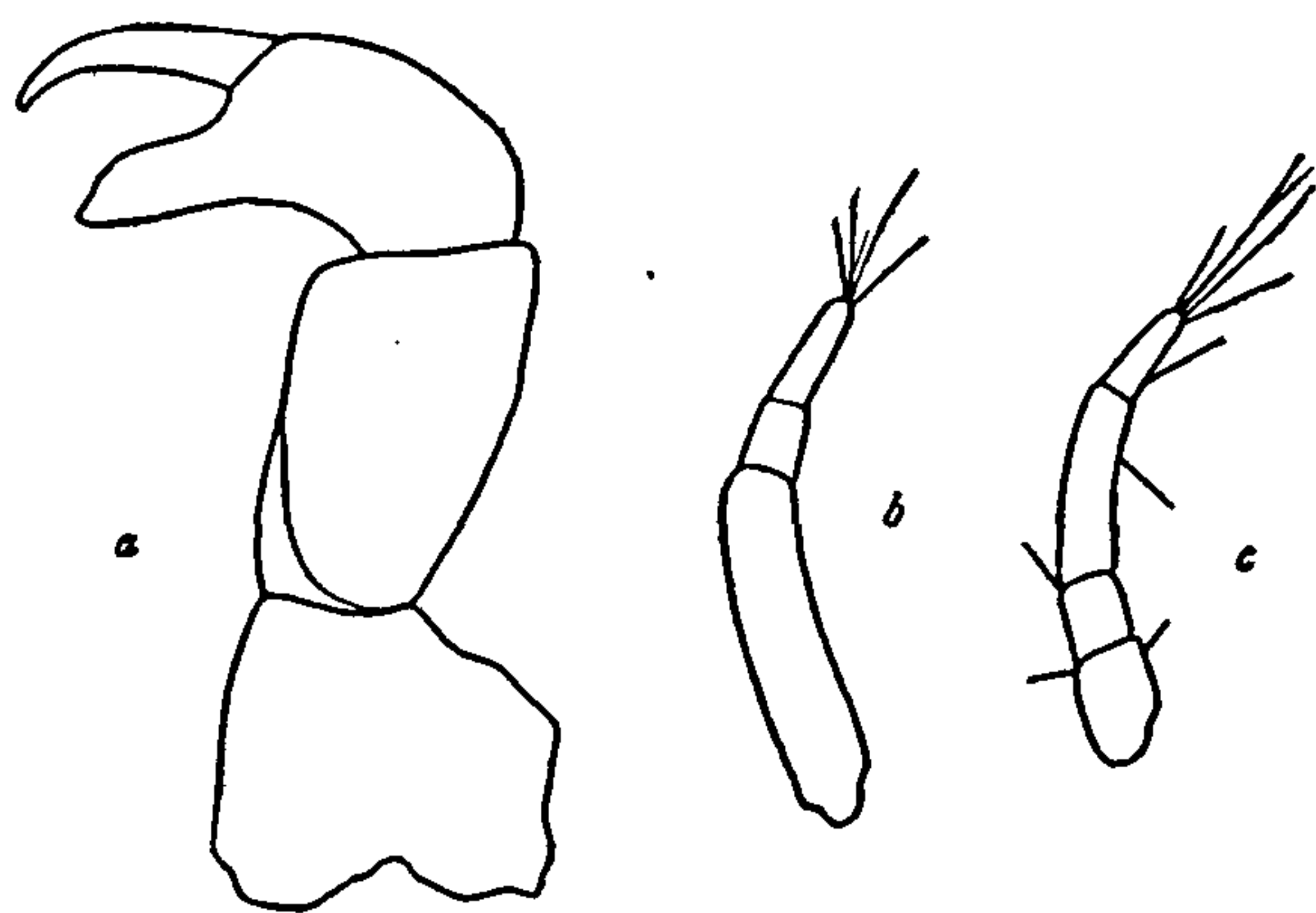


FIG. 24.—HETEROTANAIS LIMICOLA. *a*, FIRST LEG OF FEMALE.  $\times 77\frac{1}{2}$ . *b*, FIRST ANTENNA. *c*, SECOND ANTENNA.  $\times 77\frac{1}{2}$ .

The uropoda are double-branched. The inner branch is composed of five articles; the outer branch has two articles.

The first pair of legs or gnathopods are chelate. All the other six pairs are ambulatory. The dactylus of the second pair of legs is longer than the propodus.

There are five pairs of well-developed pleopoda.

I have seen only one rather imperfect specimen.

#### 6. Genus LEPTOCHELIA Dana.<sup>a</sup>

Gnathopods in male with chelæ fully developed, very much elongated; fingers elongate and curved, with immovable one strongly tuberculate within. Marsupium of female composed of eight large lamellæ issuing from the first four free segments. Eyes present. Five pairs of pleopoda present. Uropoda double-branched; inner branch multiarticulate; outer branch composed of one or two articles. Gnathopods in female strong. First pair of antennæ in female composed of three articles and a rudimentary flagellum. First antennæ in male much more elongated and with a multiarticulate flagellum.

<sup>a</sup> See Stebbing for characters of genus, Trans. Zool. Soc. London, 1886, XII, p. 108.

## ANALYTICAL KEY TO THE SPECIES OF THE GENUS LEPTOCHELIA.

- a. Outer branch of uropoda composed of two articles. — *Leptochelia forresti* (Stebbing)
- a'. Outer branch of uropoda composed of one article.
- b. Inner branch of uropoda composed of six articles. — *Leptochelia savignyi* (Krøyer)
- b'. Inner branch of uropoda composed of less than six articles.
- c. Inner branch of uropoda composed of five articles.
- d. First pair of antennæ in male with basal segment about one-third the length of organ, or about two-thirds as long as the body. Chelipeds in male with digital process of propodus armed with two teeth. Carpus extends to the extremity of basal article of first pair of antenna.  
*Leptochelia dubia* (Krøyer)
- d'. First antennæ in male with basal article one-half the length of entire organ. Chelipeds in male with digital process armed with one low, obtuse tooth near the base and one more prominent one near the tip. Carpus of chelipeds more than half the length of the body, longer than the peduncle of the first antennæ and about half as long as the body.  
*Leptochelia rapax* Harger
- c'. Inner branch of uropoda composed of three or four joints.  
*Leptochelia? filum* (Stimpson)<sup>a</sup>

## LEPTOCHELIA FORRESTI (Stebbing).

*Dolichocheilia forresti* STEBBING, Ann. Mag. Nat. Hist. (6), XVII, 1896, pp. 49–56.

*Leptochelia minuta* STEBBING, Ann. Mag. Nat. Hist. (6), XVII, 1896, pp. 156–160.—

RICHARDSON, Proc. U. S. Nat. Mus., XXIII, 1901, pp. 503–504.

*Leptochelia forresti* STEBBING, Willey's Zool. Results, 1902, p. 615.

*Locality.*—West Indies.

*Depth.*—Shallow water.

“The front margin of the head shield projects but slightly, forming a very obtuse angle, the corners being shallowly excavate for the ocular lobes. The part of the shield to which the first gnathopods (or chelipeds) are attached is wider than the front. The pleon at its base is as wide as the trunk, but narrows distally with a gentle curve; the sixth segment, which is very little longer than that preceding it, ends in an obtuse angle similar to that of the frontal margin.

“The eye lobes have a convex outer margin and are not very sharply pointed in front. The pigment is black in the mounted specimen.

“*First antennæ.*—These are as long as the animal from the front of the head to the apex of the pleon. The first joint is dilated at the base, for the rest slender, its length forming two-fifths of the whole antenna. The second joint is rather less than three-fourths the length of the first. The third is a fifth of the length of the second, and so slender as to look like a part of the flagellum, among the eight

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<sup>a</sup>The uropoda are described as four to five jointed. If the peduncle is counted as the first one of these the branch is then three to four jointed. Nothing is known of the outer branch, but in the table I have placed it with those species in which the outer branch is one-jointed, as this is the case with the larger number of species in this genus.

joints of which the first is the shortest. The joints carry two or three setæ apiece, giving an appearance very unlike that produced by the conspicuous sensory filaments in the adult males of *Leptocheilia* and *Heterotanais*.



FIG. 25.—LEPTOCHELIA FORRESTI (AFTER STEBBING). *a*, SECOND GNATHOPOD. *b*, FRONT OF HEAD WITH EYES. *c*, UPPER ANTENNA. *d*, THIRD LEG. *e*, FOURTH LEG. *f*, FIFTH LEG. *g*, SIXTH LEG. *h*, SEVENTH LEG. *i*, GENERAL FIGURE. *j*, LOWER ANTENNA. *k*, FIRST GNATHOPOD OF RIGHT SIDE. *l*, TERMINAL PORTION OF ABDOMEN WITH UROPODA. *m*, PLEOPOD.

“*Second antennæ*.—The first three joints are very small, together not equal to the fourth. The fifth is two-thirds the length of the

fourth and is distally armed with a seta. The minute tubercle which represents the flagellum carries two setæ. The whole antennæ is shorter than the flagellum in the first pair.

“*First gnathopods*.—These chelipeds are remarkable, both for the threatening gape of the chela and for their length, which is double that of the animal's body. The second joint is the stoutest, yet not much dilated, a little longer than broad. The third joint is short, almost triangular. The fourth is of great length, narrowest near the base, and nowhere very wide. The fifth is still longer, with a curvature at its base, adapted for the folding together of these long slender joints; its narrow immovable digit forms less than half of the total length of the joint and ends in a sort of pointed claw over which three setules are distributed, another setule occupying a small prominence of the inner margin near the base of the claw. The movable finger is somewhat longer than the immovable one, slender, pointed, curved, with irregular margins.

“*Second gnathopods*.—As usual in this group, these are gnathopods only in name, and differ but slightly from the following ambulatory feet. They are scarcely, if at all, larger than the fifth peræopods, having the second joint narrower, but the fourth and fifth joints a little wider than is the case in that pair.

“*Peræopods*.—The general structure is the same in all. The second joint is the longest, in the last three pairs somewhat dilated. The third joint is very short, the fifth joint is a little longer than the fourth, and the sixth considerably longer than the fifth. There are some spinules about the distal end of the sixth joint. In the first and second pairs the finger is small, in the other three pairs it is nearly as long as in the second gnathopod.

“*Pleopods*.—All the five pairs are constructed as in *Leptocheilia*.

“*Uropods*.—The peduncles are a little longer than broad. The inner branch has six joints, of which the first is the widest, the fourth the longest. The outer branch has two joints, together not equaling the length of the first joint of the inner branch. All the joints of the branches are setiferous.

“*Length*.—From head to tail the specimen measured less than a tenth of an inch. From an unmounted specimen with which Mr. Forrest has favored me since the above description was passed for press, it appears that the lateral margins of the head anteriorly are slightly concave; that the first three free segments of the peræon are very decidedly shorter and a little broader than the following three; that, viewed dorsally, there is a constriction between the third and fourth and between the fourth and fifth free segments, and that the first five segments of the pleon are slightly broader than the immediately preceding segments of the peræon. In both specimens the mouth parts appear to be in a very rudimentary condition.”—STEBBING.<sup>a</sup>

<sup>a</sup> Ann. Mag. Nat. Hist. (6), XVII, 1896, pp. 49–56.

## LEPTOCHELIA SAVIGNYI (Krøyer).

*Tanais savignyi* KRØYER, Nat. Tidsskrift, IV, 1842, p. 168, pl. II, figs. 1-12 (female).

*Tanais edwardsii* KRØYER, Nat. Tidsskrift, IV, 1842, p. 181, pl. II, figs. 13-19 (male).

*Leptochelia edwardsii* BATE and WESTWOOD, Brit. Sessile-eyed Crustacea, II, 1866, p. 134 (male).

*Tanais filum* HARGER (not Stimpson), Report U. S. Comm. of Fish and Fisheries, Pt. 1, 1873, p. 573 (male and female).

*Paratanais algicola* HARGER, Am. Journ. Sci. (3), XV, 1878, p. 377 (both sexes).

*Leptochelia algicola* HARGER, Proc. U. S. Nat. Mus., II, 1879, p. 162; Report U. S. Comm. of Fish and Fisheries, Pt. 6, 1880, pp. 421-423 (male and female).

*Paratanais savignyi* DELAGE, Arch. zool. expérim., 1881, p. 134, pl. XI, figs. 1-8 (female).

*Leptochelia savignyi* SARS, Archiv. for Math. og Naturvid., 1882, p. 25.

*Leptochelia dubia* SARS (not Krøyer), Archiv. for Math. og Naturvid., 1882, p. 26.

*Leptochelia savignyi* G. O. SARS, Archiv. for Math. og Naturvid., Christiania, XI, 1886, p. 326, pl. IX, figs. 4-8 (male and female).

*Leptochelia dubia* SARS (not Krøyer), Archiv. for Math. og Naturvid., Christiania, XI, 1886, p. 317, pls. X, XI (male and female).

*Leptochelia savignyi* DOLLFUS, Mém. de la Soc. zool. de France, XI, 1898, pp. 40-43.

*Leptochelia algicola* DOLLFUS Mém. de la Soc. zool. de France, XI, 1898, pp. 41-43.

*Leptochelia savignii* NORMAN, Ann. Mag. Nat. Hist. (7), III, 1899, p. 333.

*Leptochelia savignyi* RICHARDSON, Proc. U. S. Nat. Mus., XXIII, 1901, p. 503.

*Leptochelia dubia* RICHARDSON (not Krøyer), Proc. U. S. Nat. Mus., XXIII, 1901, p. 504.

*Localities.*—Provincetown, Massachusetts; Woods Hole, Massachusetts; Vineyard Sound; Noank, Connecticut; Long Island Sound;

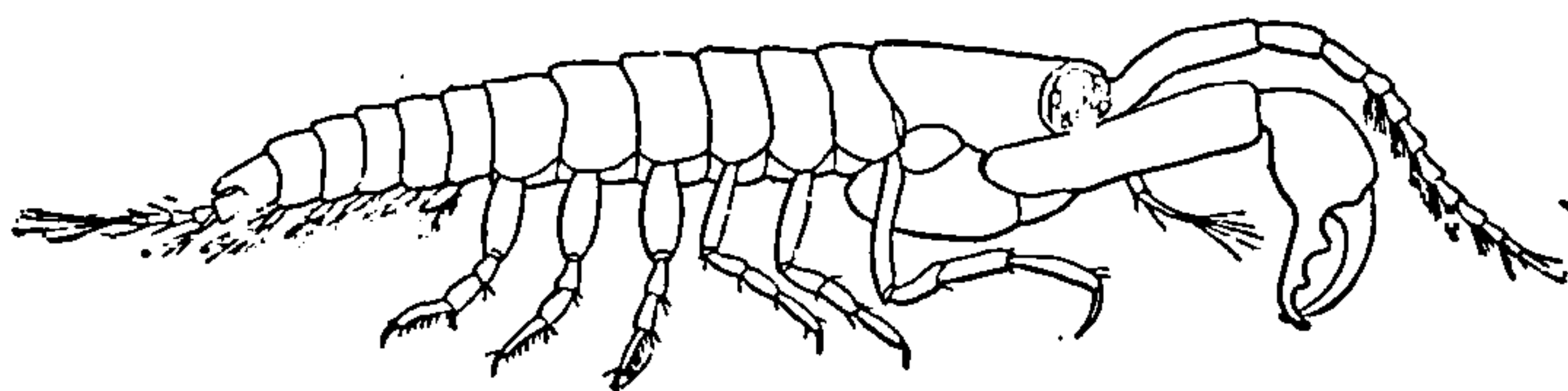


FIG. 26.—LEPTOCHELIA SAVIGNYI (AFTER HARGER). MALE.  
× 20.

Great Egg Harbor, New Jersey; also England; Belgrave Bay, Guernsey; Sark; Jersey; Naples; Trieste; Spezia; Messina; Syracuse; Atlantic coast from Brit-

tany to Senegal; Birterbuy Bay, Ireland; Falmouth Harbor; Valentia, Ireland; France; Azores; Mediterranean; Madeira.

*Depth.*—Found on surface, among eelgrass and algæ.

There seems to be no sufficient reason for keeping *L. algicola* Harger and *L. savignyi* (Krøyer) distinct. The female of *L. algicola* agrees with Krøyer's description of *L. savignyi* in having the inner branch of the uropoda six-jointed. The first pair of antennæ are usually composed of three articles, but some specimens from Long Island Sound in the U. S. National Museum have the last articles of the first antenna sometimes divided into two articles. The male of *L. algicola*



Harger agrees with the male of *L. savignyi* described as *L. edwardsii* by Krøyer in having the first pair of antennæ composed of eleven articles. Some of the specimens have the first antenna composed of only ten articles. Krøyer describes the uropoda as having the inner branch seven-jointed, but the specimen sent to Professor Harger from Rev. A. M. Norman and labeled *L. edwardsii* agreed with the specimens of *L. algicola* in having the inner branch of the uropoda six-jointed. Dollfus points out that the two teeth on the propodus of the chelipeds are nearer together in the males of *L. algicola* than in the males of *L. savignyi*, but further states that this character may be due to a difference in the state of development, and not be of real specific value.

*Description of male.*—Body narrow, elongated, 2 mm. long,  $\frac{1}{2}$  mm. wide.

Head a little longer than wide, with the anterior portion narrower than the posterior portion. Eyes large, distinct. First pair of antennæ greatly elongated. The basal article is very long and narrow, and is about equal to the length of the head. The second article is a little more than one-third as long as the basal article. The third is one-half as long as the second. The flagellum is composed of seven or eight articles. The second pair of antennæ are short, and do not reach the extremity of the basal article of the first pair of antennæ.

The first segment of the thorax is coalesced with the head. The second or first free segment is the shortest. The third and fourth or second and third are subequal and each is a little longer than the first. The fifth and sixth or fourth and fifth free segments are the longest and are subequal; they are nearly twice as long as the first segment. The seventh or sixth free segment is shorter than either of the two preceding segments and about equal in length to the third free segment.

The abdomen is composed of six segments, five subequal ones anterior to the terminal segment, which posteriorly is triangular, with apex rounded. There are five pairs of well-developed pleopoda. The

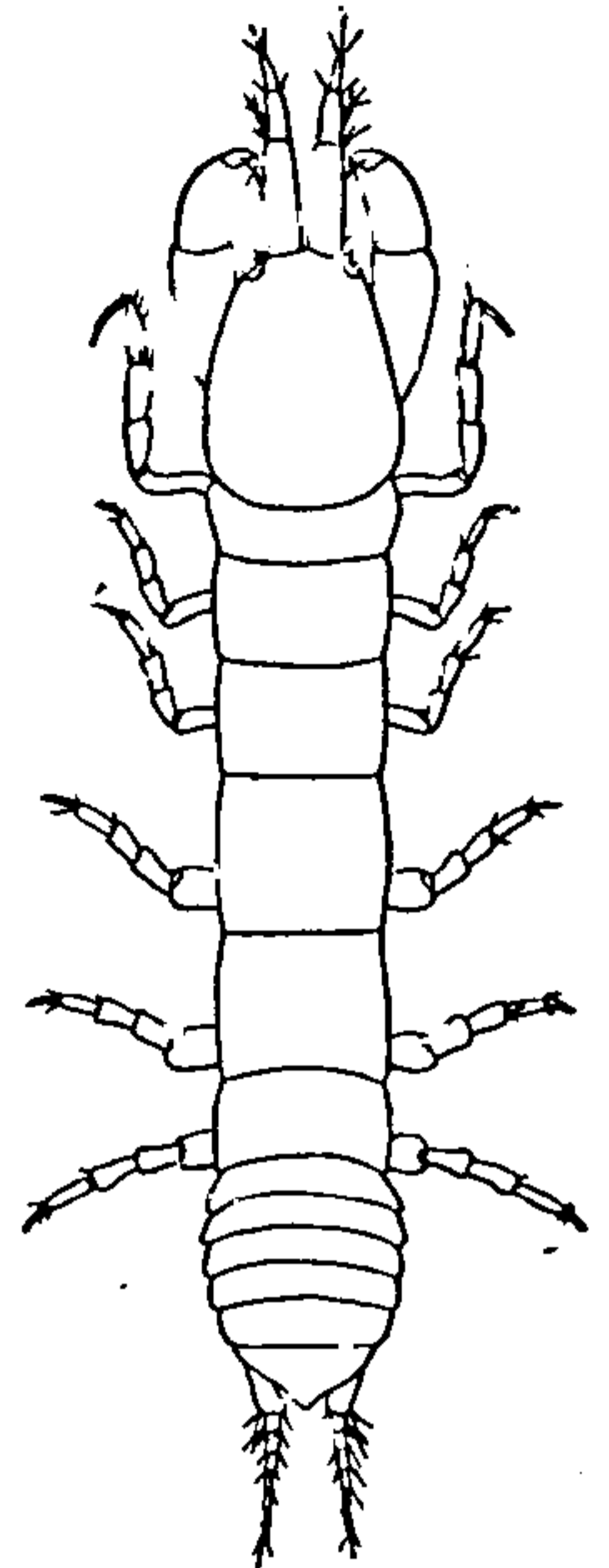


FIG. 27.—LEPTOCHELIA SAVIGNYI (AFTER HARGER). FEMALE.  $\times 20$ .

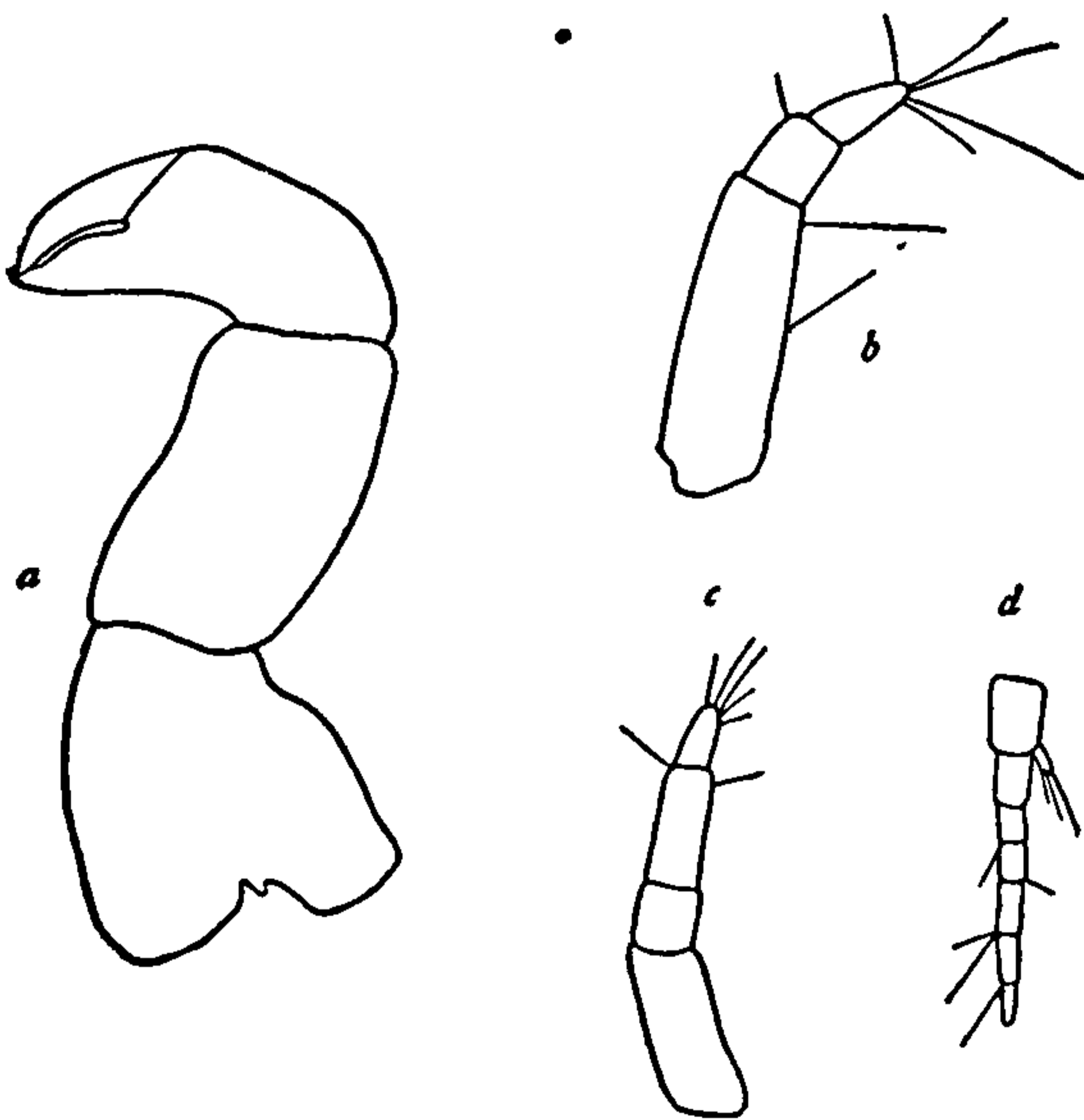


FIG. 28.—LEPTOCHELIA SAVIGNYI. FEMALE. *a*, FIRST LEG. *b*, FIRST ANTENNA. *c*, SECOND ANTENNA. *d*, UROPOD.  $\times 77\frac{1}{2}$ .

uropoda are double branched, the inner branch being composed of six articles, the outer one being composed of one short article.

The first pair of legs are greatly elongated and extend some distance in front of the head. The carpus is long and narrow and extends to the end of the basal article of the first pair of antennæ. The propodus has the distal extremity produced in a long, narrow, strongly curved process or thumb, which is armed within on the inner side with two triangular processes or teeth. The dactylus is also long and narrow, strongly curved, and furnished with stiff hairs on the inner margin. All the other legs are ambulatory.

*Description of female.*—Body narrow, elongate, about five times longer than wide,  $\frac{1}{2}$  mm.:  $2\frac{1}{2}$  mm.

Head longer than wide, becoming gradually narrower from the base to the anterior end. The anterior margin is very slightly produced in an obtuse point. The eyes are small, round, composite, and situated at the antero-lateral angles of the head. The first pair of antennæ have the first article long and robust; the second is less than half as long as the first; the third is a little longer than the second. This article in some specimens is subdivided. The second pair of antennæ are shorter than the first pair. The first article is long; the second article is less than half as long as the first; the third is twice as long as the second; the fourth is half as long as the third.

The first segment of the thorax is united with the head to form a carapace. The following six segments are free. The first free segment or second thoracic segment is a little shorter than the two following, which are subequal. The fourth and fifth free segments or the fifth and sixth segments are a little longer than either of the two preceding ones. The last segment is a little shorter than any of the four preceding segments, but is as long as the first segment.

The abdomen is composed of six segments, five short ones, subequal in length, anterior to the terminal segment, which has the posterior margin rounded. The uropoda are composed of a peduncle with two branches. The inner branch is composed of six articles. The outer branch has only one article.

There are five pairs of well-developed pleopoda.

The first pair of legs are chelate. The other six pairs are ambulatory. The dactylus of the second pair of legs is longer than in those following, but is not as long as the propodus.<sup>a</sup>

#### LEPTOCHELIA DUBIA (Krøyer).

*Tanais dubius* KRØYER, Nat. Tidsskrift, IV, 1842, p. 178, pl. II, figs. 20–22.

*Leptochelia dubia* RICHARDSON, Trans. Conn. Acad. Sciences, XI, 1902, p. 279.

*Leptochelia incerta* MOORE, Bull. U. S. Comm. of Fish and Fisheries, Pt. 2, XX, 1902, pp. 165–166.

<sup>a</sup> See Harger for full description of this species.

*Localities.*—Brazil (Krøyer); Bermudas, at Castle Harbor (Richardson); Arroyo and Culebra, Porto Rico (Moore).

Found in dead coral.

This species seems to agree with *Leptochelia savignyi* (Krøyer), with the exception that both males and females have the inner branch of the uropoda composed of five articles instead of six.

It seems best to keep this species distinct from *Leptochelia savignyi*, although they are hardly to be distinguished except for the difference

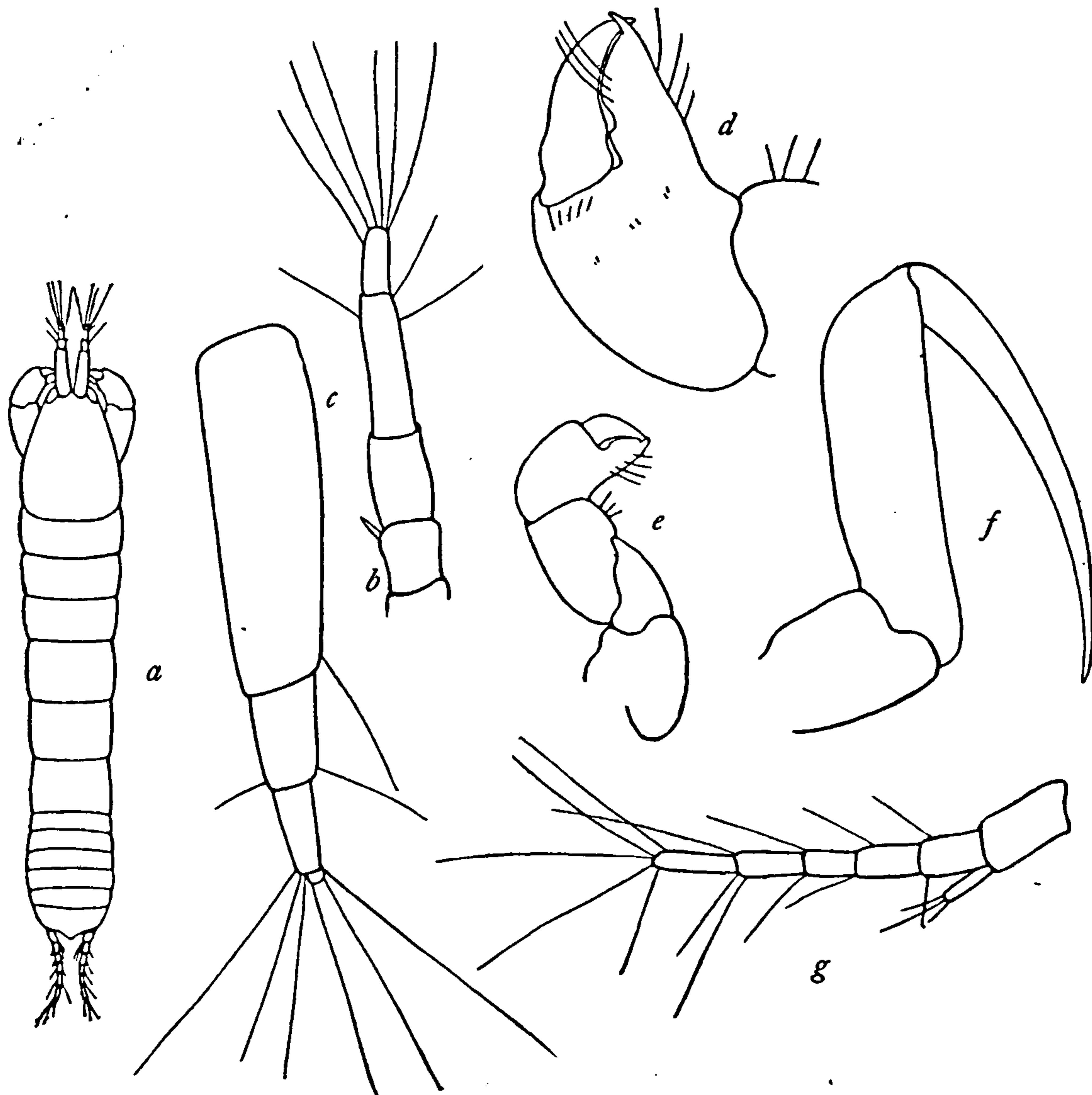


FIG. 29.—LEPTOCHELIA DUBIA (AFTER MOORE). *a*, GENERAL FIGURE.  $\times 14$ . *b*, FIRST ANTENNA.  $\times 77$ . *c*, SECOND ANTENNA.  $\times 77$ . *d*, CHELA.  $\times 77$ . *e*, CHELIPED.  $\times 33$ . *f*, END OF SECOND LEG.  $\times 77$ . *g*, UROPOD.  $\times 77$ . (Female).

in the number of articles to the inner branch of the uropoda. The female of *L. algicola* has been placed in the synonymy of *L. dubia* by various authors, notably Sars and Norman, and I have also previously followed their example. Now, however, I am inclined to think, with Dollfus, that both the male and female of *L. algicola* should be placed in the synonymy of *L. savignyi*, inasmuch as they both agree in having the inner branch of the uropoda six-jointed in both sexes, whereas *L. dubia* in both sexes has the inner branch of the uropoda composed of only five articles.

LEPTOCHELIA RAPAX Harger.<sup>a</sup>

*Leptochelia rapax* HARGER, Proc. U. S. Nat. Mus., II, 1879, p. 163; Report U. S. Commissioner of Fish and Fisheries, 1880, Pt. 6, pp. 424-426, pl. XIII, figs. 89, 90.—SARS, Archiv. for Math. og Naturvid., 1882, p. 28.—RICHARDSON, American Naturalist, XXXIV, 1900, p. 212; Proc. U. S. Nat. Mus., XXIII, 1901, p. 503; Trans. Conn. Acad. Sciences, XI, 1902, p. 279.

*Localities.*—Annisquam, Massachusetts; and the Bermudas.

*Depth.*—3 ft. on muddy bottom;  $\frac{1}{2}$  fathom. Lives in tubes.

Body narrow, elongate, about four times as long as wide, 1 mm.: 4 mm.

Head as wide as long, 1 mm.:1 mm., with the anterior margin between the eyes triangularly produced. The eyes are small, round, composite, and situated on the produced anterolateral angles of the head. The first pair of antennæ are extremely long in the male; the first article is  $1\frac{1}{2}$  mm. long, or longer than the head; the second article is one-half as long as the first; the third is one-half as long as the second. The flagellum is composed of seven articles. The second pair of antennæ are very short and feeble as compared with the first antennæ, and extend only half the length of the first article of the second antennæ. The first article of the second antennæ is about equal in length to the second; the third is a little shorter than the second, and is furnished with hairs at the tip.

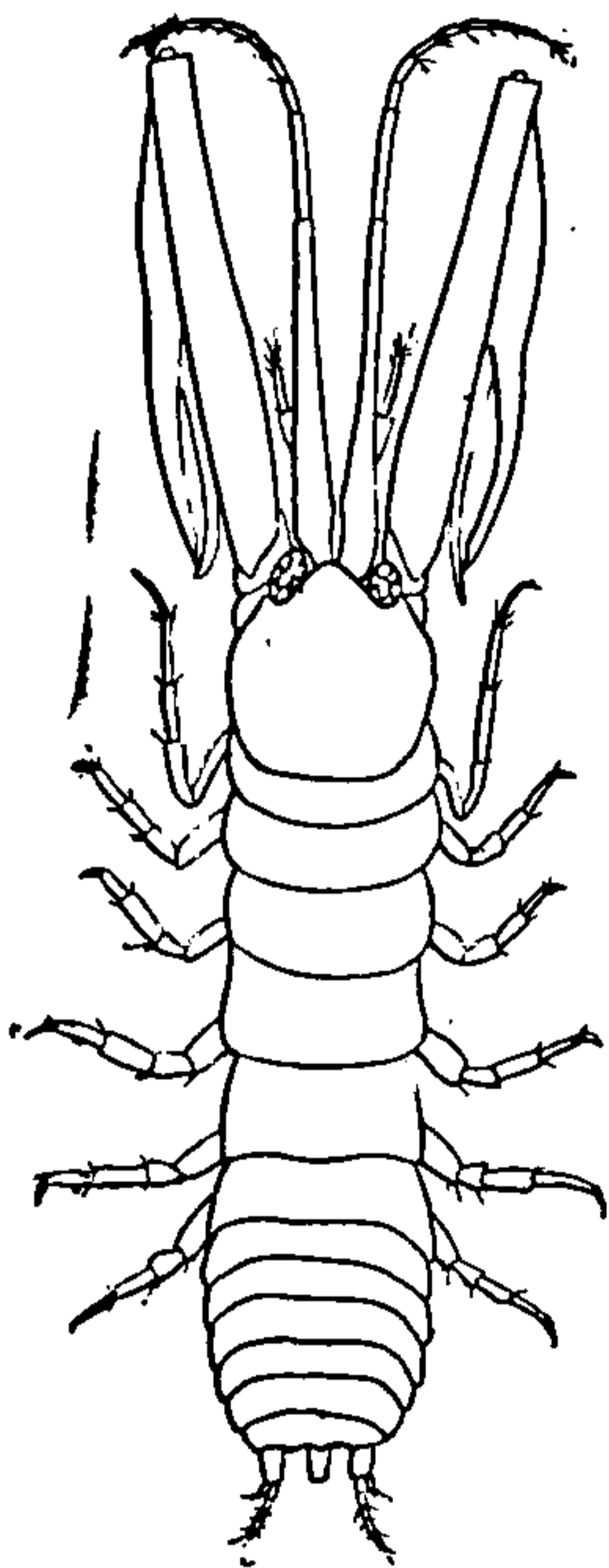


FIG. 30.—LEPTOCHELIA RAPAX (AFTER HARGER). MALE.  $\times 12$ .

The first segment of the thorax is coalesced with the head. The six following free segments are about equal in length, with the exception of the first, which is a little shorter than any of the others.

The abdomen is composed of six segments, subequal in length, the last segment not having the lateral parts developed as in the five preceding segments. The uropoda are double branched. The inner branch is composed of five articles. The outer branch is composed of only one article. The peduncle of the uropoda is about as long as wide. There are five pairs of well developed pleopoda attached to the first five segments of the abdomen. Between the uropoda and arising from the ventral side is a long narrow plate, probably attached to the fifth abdominal segment; it terminates in a rounded extremity.

The first pair of legs in the male are very much elongated and extend a great distance in front of the head. The carpus is about half the length of the entire body; the propodus is as long as the carpus, the digital process being more than half the length of the carpus, and armed on the inner side near the base with a small triangular process

<sup>a</sup> See Harger for more detailed description of this species.

and near the distal end with a larger process; the dactylus is more than half the length of the propodus and is strongly curved. The six following pairs of legs are small and similar in shape, the dactylus in the second pair being only about twice as long as in any of the other five pairs. The dactylus in the last three pairs is more curved than in the three preceding pairs.

In the female the first pair of antennæ are not elongated; the second and third articles are subequal and each is about half as long as the first. There is no flagellum. The first pair of legs is not elongated; the second pair have the dactylus elongated as in the male.

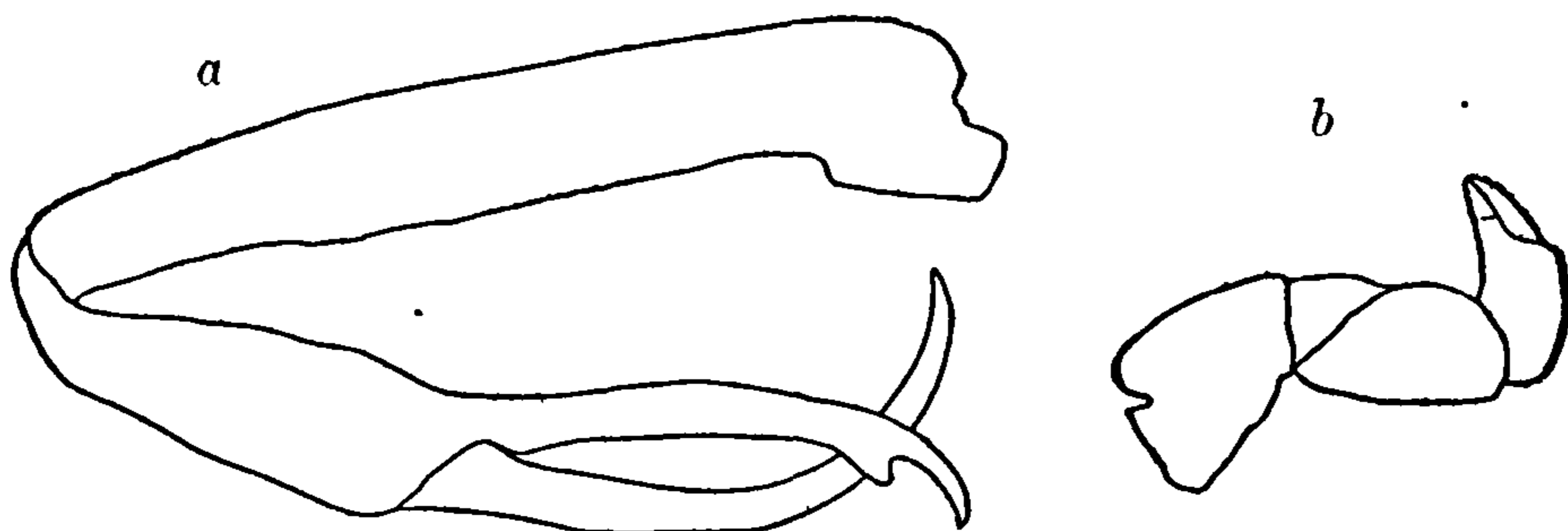


FIG. 31.—LEPTOCHELIA RAPAX. *a*, FIRST LEG OF MALE.  $\times 27\frac{1}{2}$ . *b*, FIRST LEG OF FEMALE.  $\times 27\frac{1}{2}$ .

#### LEPTOCHELIA? FILUM (Stimpson).

*Tanais filum* STIMPSON, Smithsonian Contributions to Knowledge, VI, 1853, p. 43.—HARGER, Am. Jour. Sci., (3) XV, 1878, p. 378.

*Leptochelia filum* HARGER, Proc. U. S. Nat. Mus., II, 1879, p. 164; Report U. S. Comm. of Fish and Fisheries, 1880, Pt. 6, p. 427.—SARS, Archiv for Math. og Naturvid., 1882, p. 28.—RICHARDSON, American Naturalist, XXXIV, 1900, p. 212; Proc. U. S. Nat. Mus., XXIII, 1901, p. 504.

*Localities*.—The Hake Bay, Grand Menan; Gulf of St. Lawrence.

*Depth*.—Eight fathoms, on a sandy bottom; 20 fathoms among *Ascidia callosa*.

“Very minute, slender, rounded on the back, white, looking very much like a short piece of thread. Head small, and rather narrowed in front; first thoracic segment of great length; the second half as long as the third, which is about equal in length with the fourth, fifth, and sixth; the seventh being a little shorter than the sixth. The segments of the abdomen are well defined, the first five equaling each other in length, and the terminal one longer than the fifth, but narrower, and rounded behind. Antennæ short and thick, without flagella, with blunt tips crowned with few hairs, as are also their articulations. The inner ones are directed forward, and much the stoutest, especially toward their bases; while the outer ones are more slender and curve outward and backward. First pair of legs exceedingly thickened, with very large ovate hands and strong curved fingers. They are generally closely applied against the breast. The remaining thoracic feet are very slender, terminating in sharp, slender fingers, which in the second pair are very long and nearly straight,

and in the other pairs short. The legs of the posterior pair are a little the longest and thickest. The ambulatory feet, in five pairs, are of great length and resemble those of the Amphipods. The caudal stylets are in length about four-fifths that of the abdomen, and consist of four or five articles with few hairs, each article becoming narrower, the last one with a tuft of few hairs at its extremity. Length, .15 inch; breadth, .02. Dredged among *Ascidia callosa* in 20 fathoms in the Hake Bay."—STIMPSON.<sup>a</sup>

#### 7. Genus NEOTANAIS Beddard.<sup>b</sup>

First pair of antennæ (in the male) with a three-jointed peduncle and a flagellum of four joints. Second pair of antennæ with a five-jointed peduncle and a short four-jointed flagellum. Chelæ fully developed and of normal structure in male. Exopodite of uropoda two-jointed; endopodite eight-jointed. Thoracic appendages specialized into an anterior and posterior series; in the three anterior thoracic appendages the distal joint is a simple, elongated, somewhat curved claw; in the posterior appendages this terminal joint is furnished at its extremity with a circlet of stout spines and a long, mesially placed, slender hair.

#### ANALYTICAL KEY TO THE SPECIES OF THE GENUS NEOTANAIS.

- a.* Rostrum blunt. Ocular lobes minute but separate. . . *Neotanais americanus* Beddard  
*a'*. Rostrum sharp. Ocular lobes not distinct.  
*Neotanais hastiger* (Norman and Stebbing)

#### NEOTANAIS AMERICANUS Beddard.

*Neotanais americanus* BEDDARD, Proc. Zool. Soc. Lond., 1886, pp. 117–118; Challenger Report, XVII, 1886, pp. 124–125, pl. xvi, figs. 4–6.—RICHARDSON, American Naturalist, XXXIV, 1900, p. 212; Proc. U. S. Nat. Mus., XXIII, 1901, p. 504.

*Localities.*—Southeast of New York; latitude 38° 34' north, longitude, 72° 10' west; and latitude 35° 39' south, longitude 50° 47' west.

*Depth.*—1,240 fathoms.

“The present species is the only representative of this new genus. The specific as well as the generic characters depend upon the examination of two male specimens, each of which measures about 6 mm. in length.

“The body is depressed and elongated, everywhere of approximately the same diameter. It is smooth both dorsally and ventrally, with no hairs or spines.

“The cephalothorax is pear-shaped, narrower anteriorly and wider posteriorly; it is about as long as the first two segments of the thorax

<sup>a</sup> Smithsonian Contributions to Knowledge, VI, 1853, p. 43.

<sup>b</sup> See Beddard for characters of genus.

taken together; the anterior margin terminates in the middle line in a very short, blunt rostrum; on either side of the shallow excavations which lodge the basal joints of the antennules are the minute but separate ocular lobes; these are rounded, oval in front, the anterior end being pointed and prolonged; there is no trace of any ocular structures. The first free thoracic segment is shorter, rather more than half the length of the four succeeding segments, which are subequal; the last thoracic segment is shorter than the foregoing; each of these segments is rather narrower anteriorly where it articulates with the segment in front; the general shape of the segment is short, oblong, with rounded angles; this does not apply to the first or to the last free segment of the thorax, which are broader than they are long.

“The five anterior segments of the abdomen are equal in length and in diameter, only the first one being a trifle longer than the rest.

“The terminal segment of the abdomen is longer and wider than the rest; it has a pair of lateral projections with which the uropoda articulate; posteriorly it is rounded and a minute median triangular process projects from the extremity; on either side of this the posterior margin of the abdomen is slightly concave.

“The antennules are considerably stouter than the antennæ; the peduncle has three joints, of which the proximal one is much the longest and stoutest; it is furnished with a tuft (three or four) of slender spines on the outer side, near to its articulation with the second joint; the second joint is about one-fourth of the length of the first, and like it has a tuft of slender spines occupying a similar position to those of the basal joint, and one slender hair-like spine upon the opposite side; the third joint of the peduncle is stouter again, with one or two short slender spines upon the inner as well as the outer margin just before its articulation with the flagellum; the latter consists of four joints, of which the first is very much the longest, as well as broader than the succeeding joints; each of the three distal joints is furnished with a single olfactory hair.

“The antennæ are considerably more slender and shorter than the antennules; the peduncle consists of five joints; the basal joint is short and oval, much stouter than any of the succeeding joints, which are of equal thickness; the second joint is moderately long, the third stouter, the fourth and fifth subequal to each other and to the second joint; the flagellum has four joints which decrease gradually in diameter, the first being the widest; the first joint of the flagellum is also the longest, the two middle ones are shorter and subequal, the fourth shorter still and provided at its extremity with a tuft of fine hairs.

“As the only specimen was mounted on a slide in Canada balsam it is impossible to describe in a detailed manner the mouth appendages, which do not appear, as far as could be seen, to present any marked differences from those of other species.

“The chelæ are short and very stout; the second joint is particularly stout, as compared with the others; the third joint as usual is very small, a portion of the fourth coming to articulate directly with the second; in the fifth joint the palm is straight for the first half, the margin being

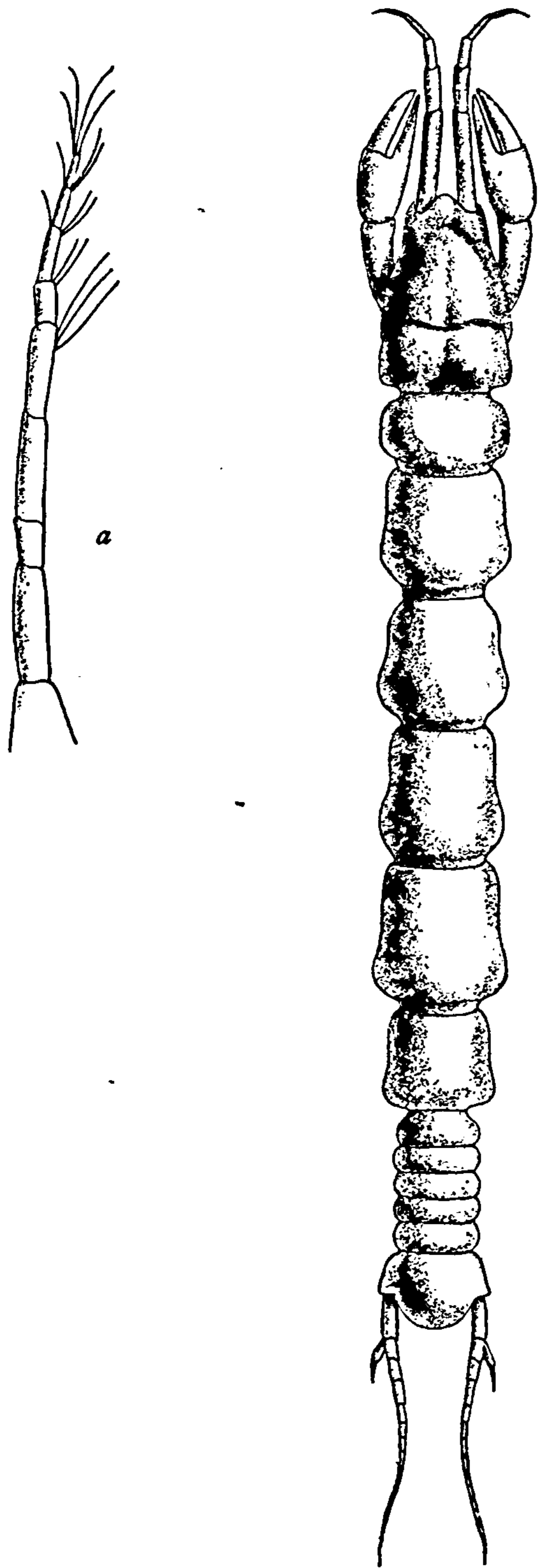


FIG. 32.—NEOTANAÏS AMERICANUS (AFTER BEDDARD). *a*, SECOND ANTENNA. *b*, GENERAL FIGURE.

fringed with fine, closely-set denticles; the distal half is furnished with blunt tooth-like processes, and is bent downward at an oblique angle; it terminates in a short pointed extremity which is bent upward; toward the distal extremity are a few slender hairs scattered here and there; the finger gradually narrows toward its termination in a curved pointed extremity; the inner margin is provided with a number of low tooth-like processes, each terminating in a sharp point which is directed forward.

“The remaining thoracic limbs are more or less similar to each other; there is no difference in size between the anterior and posterior series, but a slight difference in structure; the proximal joint is very long, the second extremely short; the third is about half the length of the proximal joint, the fourth and fifth are rather shorter and subequal; the terminal joint of the limb has the form of a long slender spine; the inner margin of the penultimate joint has a row of stout spines, of which the distal one or two are serrate; on the opposite side of the joint are a number of more slender hair-like spines; the antipenultimate joint has a similar structure, but the spines are not so strong;

the distal joints are nearly smooth, having only a very few slender hairs developed at the point of articulation with the succeeding joints. The above description applies to the first three pairs of ambulatory limbs. The fourth, fifth, and sixth pairs of thoracic appendages differ slightly in their structure from the anterior pairs; this differ-



ence mainly concerns the terminal joint of the limb, which is considerably more elongated than in the anterior appendages; it terminates in a fringe of short spines and mesially in a long slender spine which is of about half the length of the joint.

“On the abdomen all the appendages are present, but they present no special features of interest, with the exception of the uropoda, which have a typical structure.

“The basal joint of the uropoda is very stout and long, and with it articulates the minute two-jointed exopodite, as well as the long slender endopodite, which is made up of eight separate joints, all of which have tufts of hairs near to their articulation with the succeeding joints. Both the endopodite and the exopodite end in a tuft of slender hairs; the length of the uropoda is nearly equal to that of the abdomen.

“Another example of this species was dredged in the North Atlantic from a depth of 1,250 fathoms; it presents certain slight differences from the above-described species; these differences have reference to the proportionate length of the thoracic segments. Seeing, however, that the two specimens come from widely distant localities, it appears to be unnecessary to found a specific distinction between the two individuals, at least for the present. The present specimen is stouter and more robust than the last, but of equal length; the cephalothorax is nearly as long as the first three segments of the thorax taken together; the thoracic segments gradually increase in length up to the fourth; the fifth and sixth segments are subequal and about as long as the third.”—BEDDARD.<sup>a</sup>

#### NEOTANAIS HASTIGER (Norman and Stebbing).<sup>b</sup>

*Alaotanais hastiger* NORMAN and STEBBING, Trans. Zool. Soc. Lond., XII, 1886, Pt. 4, pp. 113, 114, pl. XXIII, fig. 2.—HANSEN, Videnskabelige Meddelelser fra den naturhistoriske Forening i Kjøbenhavn, 1887–1888, p. 178.—RICHARDSON, American Naturalist, XXXIV, 1900, p. 212; Proc. U. S. Nat. Mus., XXIII, 1901, p. 502.

*Locality*.—Latitude 59° 11' north, longitude 50° 25' west.

*Depth*.—1,750 fathoms.

“This species comes very near to the last (*N. serratispinosus*). It differs from it in having the eye processes relatively larger, and in the massiveness of the hand and finger of the first gnathopods; in these organs all the parts are thickened and straightened without any proportionate increase in length. The effect of this is to make the inner edge of the thumb and finger overlap when closed all along the line, except for a small triangular space near the root of the thumb. The uropods have the inner branch nine, the outer two-jointed.

<sup>a</sup> Challenger Report, XVII, 1886, pp. 124–125.

<sup>b</sup> Stebbing says that without doubt *Alaotanais* is a synonym of *Neotanais*. Hist. Crust., 1893, p. 324.

“But the characters which at once distinguished this species from all others known to us are to be found in the microscopic armature of the limbs. All the peræopods are everywhere beset with long, very slender spines, the whole of which, under high powers, are found to be covered with minute prickles. There are no toothed spines, such as are found in *Alaotanaïs serratispinosus*, the corresponding limb to which in *A. hastiger* has the finger long, narrow, and curved, and surrounded by a series of long, very slender spines, which all have the character of being beset irregularly all around with little prickles.

“The hinder peræopods have a finger which, so far as we are aware, is absolutely unique in structure; the propodus is cleft at the end to some depth, the cleft portions are rounded at the extremities and cre-

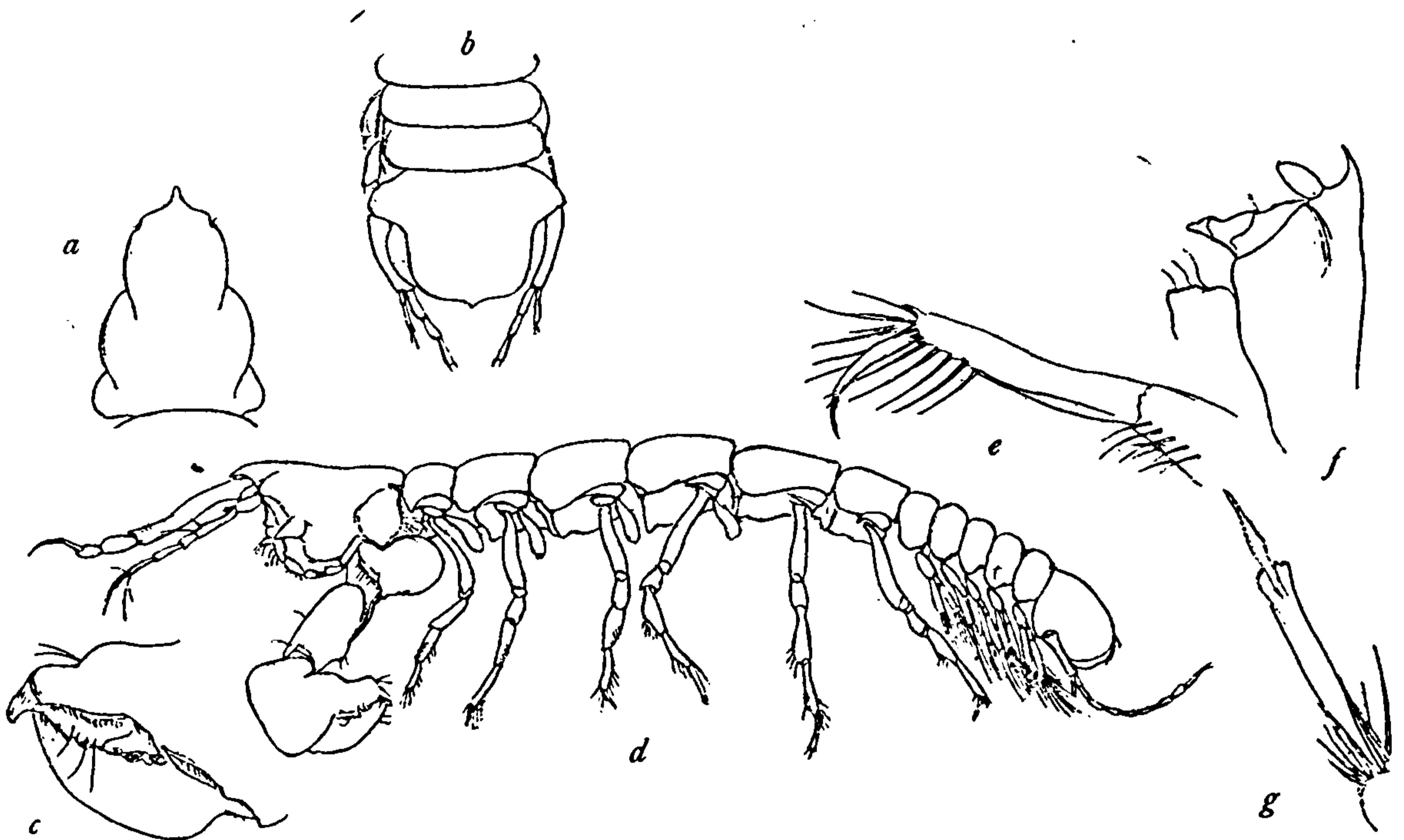


FIG. 33.—NEOTANAÏS HASTIGER (AFTER NORMAN AND STEBBING). *a*, OUTLINE OF CARAPACE FROM ABOVE. *b*, ABDOMEN. *c*, THUMB AND FINGER OF FIRST GNATHOPOD. *d*, LATERAL VIEW. *e*, SECOND PERÆOPOD. *f*, PORTION OF CARAPACE, SEEN FROM THE SIDE. *g*, LAST PERÆOPOD (TERMINAL JOINTS).

nated or serrulated; the finger articulates at the base of the cleft, and is exactly spear-shaped, with serrated edges. A comparison of the fifth peræopod with the figures of the hinder peræopods of *Alaotanaïs serratispinosus* (the fourth peræopod) will at once give characters sufficient to distinguish these species.

“The carapace, seen from above, is much narrower in front than behind, and has a short rostrum; the sides are very flexuous, and present two constrictions.

“The telson is shield-shaped; the upper corners of the shield (that is, the sides of the base of the telson) are very protuberant. Length, 5 millimeters.”—NORMAN and STEBBING.<sup>a</sup>

<sup>a</sup>Trans. Zool. Soc., Lond., XII, 1886, Pt. 4, pp. 113-114.

Family II. APSEUDIDÆ.<sup>a</sup>

Body attenuated behind. First pair of antennæ with two unequal multiarticulate flagella. Second pair of antennæ usually furnished with a scale at the end of the second article of the peduncle. Mandibles with palp. Anterior maxillæ with two masticatory lobes. Posterior maxillæ well developed and setose. Epignath of maxillipeds large, laminar, branchial in character. Two anterior pairs of legs, usually provided at the base with minute, two-jointed exopods (exopodites). Second pair of legs fossorial in character. Uropoda double-branched; branches multiarticulate.

## ANALYTICAL KEY TO THE GENERA OF APSEUDIDÆ.

- a.* Second pair of antennæ with a scale articulated to the end of the second article. Head and first thoracic segment coalesced.
- b.* Exopods present on both pairs of gnathopods.
- c.* Five pairs of pleopoda present, with branches uniarticulate. Abdomen composed of six segments ..... Genus *Apseudes* Leach
- c'.* Only four pairs of pleopoda present, with one of the branches two-jointed. Abdomen composed of six segments ..... Genus *Parapseudes* Sars
- b'.* Exopods absent on both pairs of gnathopods. Five pairs of pleopods present, in which one of the branches is two-jointed. Eyes absent.  
Genus *Typhlapseudes* Beddard
- a'.* Second pair of antennæ without a scale. Head and first two thoracic segments coalesced. Eyes absent ..... Genus *Sphyrapus* Norman and Stebbing

## 8. Genus APSEUDES Leach.

Second antennæ with a scale articulated to the end of the second article. Exopods present on both pairs of gnathopods. Five pairs of pleopoda present, in which the branches are uniarticulate. First pair of legs in male larger than in female. First pair of antennæ usually alike in the two sexes.

## ANALYTICAL KEY TO THE SPECIES OF THE GENUS APSEUDES.

- a.* Head with rostrum short, produced to a mere point. Body without spiny armature. Flagellum of first antenna of same length as secondary filament.  
*Apseudes espinosus* Moore
- a'.* Head with distinct rostrum. Body with spiny armature. Secondary appendage of first antenna shorter than flagellum.
- b.* Basal article of peduncle of first antenna unarmed. Secondary appendage of first antenna one-fourth as long as flagellum. Long spiny processes on either side of head, one pair at the place of fusion of the first thoracic segment with the head, the other pair anterior to these, being the produced outer angles of the ocular lobes. Last segment of abdomen with posterior margin slightly emarginate, a small lobe being placed in the center of the emargination.  
*Apseudes gracilis* Norman and Stebbing

<sup>a</sup>See Sars, Crust. of Norway, II, 1899, p. 5, and Norman and Stebbing, Trans. Zool. Soc., London, XII, 1886, p. 79, for characters given below.

- b'. Basal article of peduncle of first antenna armed with numerous spines. Secondary appendage of first antenna about one-half as long as flagellum. No spines at side of head at place of fusion of first segment of thorax with the head. Ocular spines small. Last segment of abdomen with the posterior margin triangularly produced.
- c. Basal article of peduncle of first antenna armed with four spines on the inner lateral margin. Rostrum in form like a spear point, on either side of which is a small acute process within the ocular alæ. Last thoracic segment with a ventral spine. Lateral margins of five anterior segments of abdomen not produced in acute processes.....*Apseudes triangulatus* Richardson
- c'. Basal article of peduncle of first antenna armed with three spines on the inner lateral margin. Rostrum produced in a long, acute deflected process, on either side of which the lateral margin is expanded and evenly curved. All six segments of thorax armed with ventral spines. Lateral margins of five anterior segments of abdomen produced in acute processes.

*Apseudes propinquus* Richardson

### APSEUDES ESPINOSUS Moore.

*Apseudes espinosus* MOORE, Bull. U. S. Fish Commission, XX, Pt. 2, 1902, pp. 164-165, pl. VII, figs. 1-6.

*Locality*.—Porto Rico, off St. Thomas.

*Depth*.—20 fathoms, in coral bottom.

“Cephalothorax short, less than length of first three segments of thorax, slightly wider than long; rostrum short, produced to a mere point; eyestalks short, projecting but slightly beyond sides of head. First three segments of thorax subequal to one another in length and breadth, approximately equal to head in breadth. Last three segments narrower; fourth segment longer than segments two and three combined; fifth free segment about equal to them; sixth segment about three-fourths as long as fifth. Epimera of first three segments not evident, none of the segments with lateral spines; epimera of last three segments small, in dorsal view projecting slightly from beneath each segment near its articulation with its successor. Abdomen narrower than last segment of thorax, but not abruptly so; the first five segments equal in length and successively slightly narrower; collectively about as long as sixth thoracic segment; lateral margins rounded, somewhat produced posteriorly. Telson about as broad as long, slightly narrower than fifth segment of pleon, bilobate posteriorly.

“Peduncle of antennule as long as head, first joint stout, longer than other three joints combined, second joint not half as long as first, two following joints successively shorter; two flagella of equal length, and longer than peduncle, the outer somewhat shorter, with seventeen joints, inner flagellum with fifteen joints.

“Antennæ about two-thirds as long as antennules; peduncle short, consisting of five joints, first and second joints stout, second furnished with a scale beset with long setæ, last three joints short. Flagellum about as long as flagella of antennule, consisting of thirteen setiferous joints.

“Mandibles stout, with a five-dentate cutting edge and a three-jointed palp. First maxillæ tipped with a number of brown spines. Maxillipeds with a stout four-jointed palp, of which the second joint is very

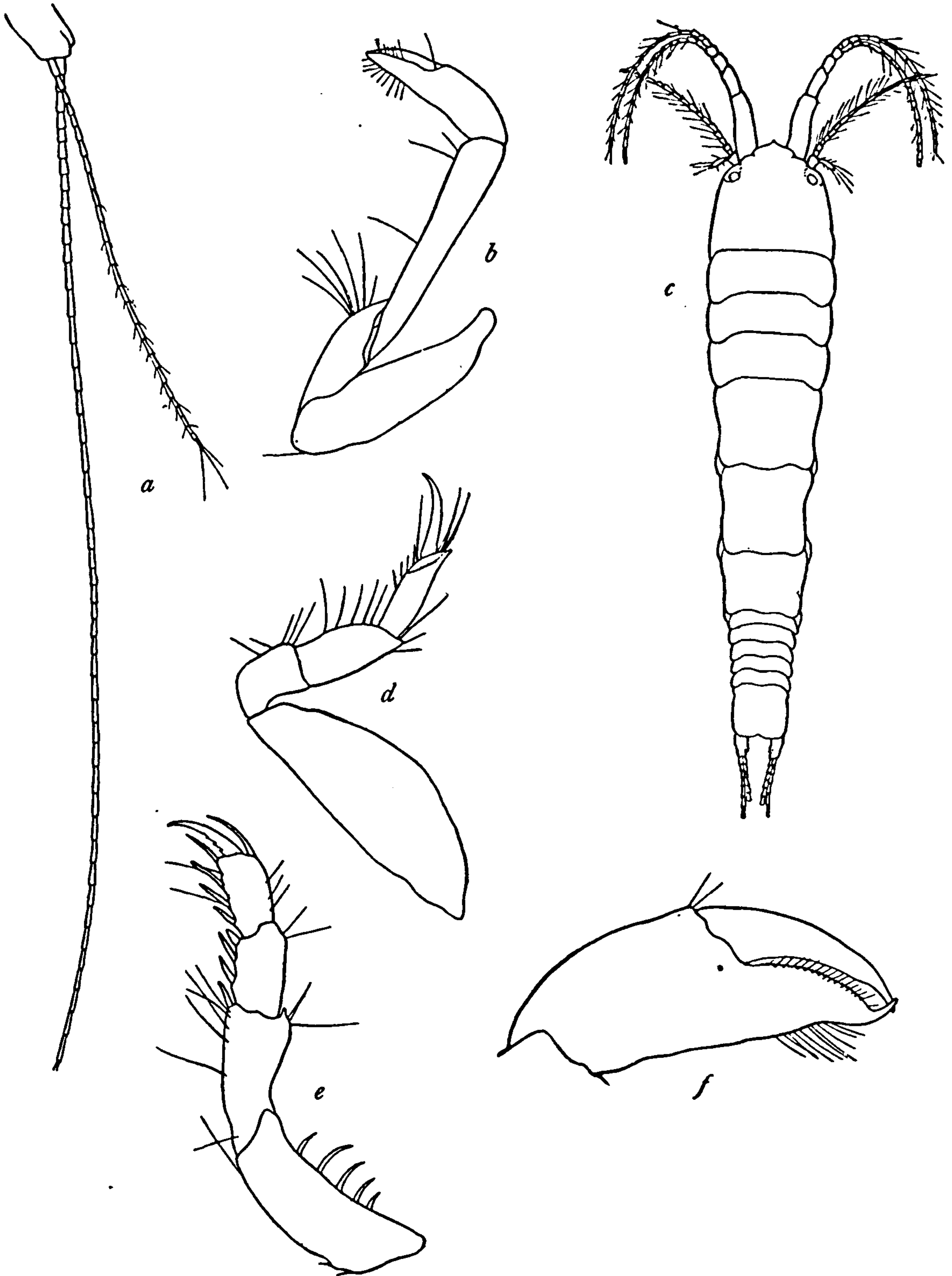


FIG. 34.—APSEUDES ESPINOSUS (AFTER MOORE). *a*, UROPOD. *b*, FIRST LEG. *c*, GENERAL FIGURE. *d*, SEVENTH LEG. *e*, SECOND LEG. *f*, CHELA. (ALL ENLARGED.)

large and stout. Details in relation to the oral parts are not known, as there was but one specimen mounted in balsam and not dissected.

“The chelipeds in the females are long and slender, the fifth joint being the longest and the second almost as long, but stouter. The

third joint is prolonged distally into a curved process furnished with five or six long hairs on the convex margin; the sixth joint, with the seventh, constituting a slender chela; no molar tubercles; curved margin of 'thumb' of sixth joint with a row of slender bristles; a row of blunt spines on cutting edge.

"The second pair of limbs have the joints stout and furnished with strong spines. The second joint or basis has five or six stout, curved spines on its outer margin. It is longer than the other joints. The terminal claw is flanked on each side by a strong spine attached to sixth joint. There appear to be but five free joints to this and the following limbs, but this appearance may be due to defects in the mounting; following pairs of limbs more slender, the last pair having a second joint almost as long as all the rest, and with an oblique row of small spines near distal end of posterior face of sixth joint.

"There are five pairs of pleopods with both branches one-jointed.

"Uropods biramous, the inner ramus with about fifty joints; outer ramus less than one-half as long, with about twenty-five joints. The joints of both are of irregular length.

"One specimen, female, from station 6079, 20 fathoms, 6 mm. by 1.4 mm."—MOORE.<sup>a</sup>

#### APSEUDES GRACILIS Norman and Stebbing.

*Apseudes gracilis* NORMAN and STEBBING, Trans. Zool. Soc., Lond., XII, 1886, Pt. 4, pp. 95-97, pl. xx.—HANSEN, Videnskabelige Meddelelser fra den naturhistoriske Forening i Kjøbenhavn, 1887-1888, p. 178.—RICHARDSON, American Naturalist, XXXIV, 1900, p. 212; Proc. U. S. Nat. Mus., XXIII, 1901, p. 505.

*Localities*.—Davis Strait, latitude 59° 10' north, longitude 50° 25' west; also in the North Atlantic.

*Depth*.—1,750 fathoms.

"The carapace has the frontal margin produced into a long slender acute rostrum, which is half as long as the basal joint of the upper antennæ, and has a bulbous process on each side at its origin; ocular processes or alæ having their outer sides prolonged into an acute spine-like termination projecting forward and slightly outward. On each side of the carapace, at the junction of the first coalesced segment of the peræon with the cephalon, there is another pair of spinous processes closely assimilating in form to those of the alæ just described.

"The peræon has the segments remarkably long, more produced than in any other known species, especially the last four; each segment bears a pair of lateral acute spinous processes, and in front of these a pair of small tubercles, while on the ventral surface there is a large acute curved spine near the hinder margin, and near the front margin a small tubercle bearing two or three minute cilia. The epistoma is tumid, arched, carinate, and armed with a small spine near the mouth.

<sup>a</sup> Bull. U. S. Fish Commission, XX, Pt. 2, 1902, pp. 164-165.

“The pleon is of great length, the five front segments subequal, and each as long as the first free segment of the peræon; epimera



FIG. 35.—APSEUDES GRACILIS (AFTER NORMAN AND STEBBING). *a*, UPPER ANTENNA. *b*, LATERAL VIEW. *c*, LOWER ANTENNA. *d*, SIDE VIEW OF MOUTH PARTS AND AN ABNORMALLY DEVELOPED FIRST GNATHOPOD. *e*, MANDIBLE. *f*, FIRST GNATHOPOD. *g*, ANTERIOR PART OF BODY, FROM ABOVE. *h*, FIFTH LEG. *i*, PLEOPOD. *j*, LAST SEGMENT OF ABDOMEN. *k*, SECOND GNATHOPOD.

only slightly produced, terminating in small spines, a central ventral spine on each segment; last segment as long as the preceding three, having a number of minute tubercles about it; termination slightly

emarginate, with a small, rounded projection occupying the center of the emargination.

“Upper antennæ with the basal joint moderately stout, a tactile seta halfway up the outer margin; second and third joints subequal, their combined length scarcely more than half that of the first joint; filament consisting of about 17, secondary appendage of 4 articulations. Lower antennæ reaching to the end of the peduncle of the upper; the scale smaller than usual, only reaching to the middle of the fourth joint, and bearing only four setæ, two on the exterior margin and two apical, and none on the interior margin.

“The first gnathopods are slender and weak, and without much character; wrist very long, two and a half times as long as meros; with many cilia on the front margin; hand with the basal portion slender, and scarcely wider than the wrist; thumb and finger long, without any tubercular processes on the inner margin, the distal portion of that of the thumb bearing a series of microscopic flattened teeth, and short, stiff, obtusely ending cilia; finger having about five short stumpy spine-like teeth just before the unguis commences.

“Second gnathopods strongly built, basos naked; meros having the front margin ciliate, and bearing a distal spine, upper margin with a distal bunch of cilia; wrist unusually short, scarcely more than half the length of meros, above with many cilia and a large distal spine, below with four cilia and two or three spines; hand widely ovate, rather longer than the wrist, upper margin with two spines and a few cilia; palm closely set all round with ten stout spines, but no cilia; all the spines of the limb are stout, but quite simple in character; finger strong, with four denticulations on the margin.

“Last peræopods slender, basos naked, the three succeeding joints having one or two minute cilia on the front margin, except that the carpus (which is slightly longer than the meros and hand, which are subequal to each other) has a long slender distal spine on the front; hand with a distal spine above and two slender spines on the palm, and passing obliquely across the last half of the joint, commencing beyond the middle of the palm and terminating at the upper margin of the origin of the finger, is a pectinated series of lancet-shaped spines, of which the margins are apparently simple. Finger of most unusual length, half as long again as the hand, the unguis especially being very greatly produced.

“Pleopods greatly developed, the peduncle long.

“Uropods with one branch consisting of about 7, the other of 18, articulations.

“The foregoing is a description of the females, one of which has incipient growths of the marsupial sac at the base of the second, third, fourth, and fifth peræopods.



“The males, which are known by the cylindro-columnar sexual organ situated between the last peræopods, where it takes the place of the ventral spine of the other sex, differ in having the lateral spines of the peræon-segments, and both epimeral and ventral spines of the pleon, so much reduced in size as to become almost obsolete, while the ventral spines of the earlier segments of the body are as large as in the female, and the hand of the first legs is not more largely developed than in the other sex. All these points are contrary to what is usual, and not what might have been expected to characterize the male. \* \* \* Length half an inch.”—

NORMAN and STEBBING.<sup>a</sup>

#### APSEUDES TRIANGULATUS

Richardson.

*Aapseudes triangulata* RICHARDSON,  
Trans. Conn. Acad. Sciences,  
XI, 1902, pp. 280-281, pl.  
xxxvii, figs. 1-5.

*Locality.*—Harrington Sound, Bermudas.

Body narrow, elongated, surface smooth.

Head with frontal margin produced at the middle in a rostrum like a spear point, the sides of which near the base are excavated below the lateral expansion of the rostrum. On either side of the excavation thus formed the margin is acutely produced in a small anterior process. Lateral to this process is the ocular process, which is produced anteriorly about the same distance. The eyes are distinct and black and occupy almost the whole surface of the ocular lobe.

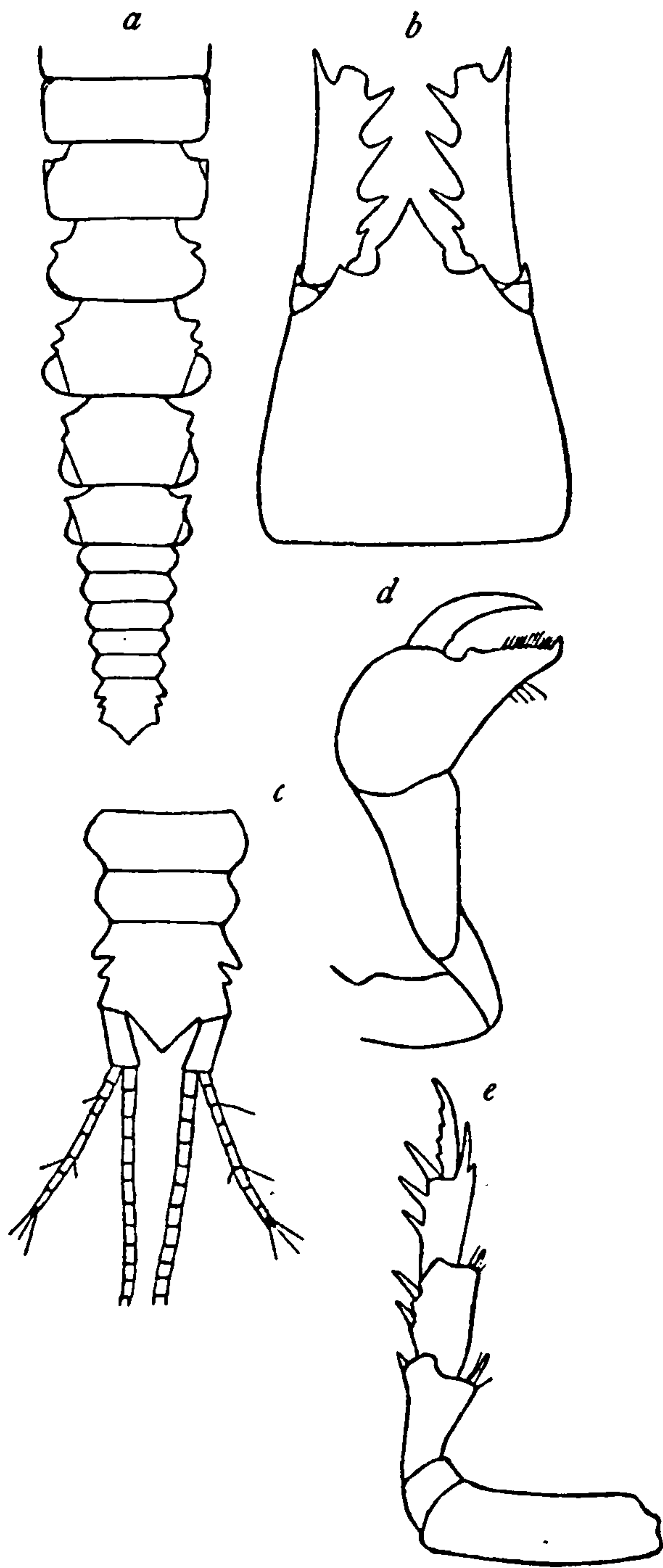


FIG. 36.—APSEUDES TRIANGULATUS. a, SEGMENTS OF THORAX AND ABDOMEN. b, HEAD.  $\times 35$ . c, SEGMENTS OF ABDOMEN AND PART OF UROPODA. d, FIRST GNATHOPOD. e, SECOND GNATHOPOD.

<sup>a</sup>Trans. Zool. Soc. Lond., XII, 1886, Pt. 4, pp. 95-97

The first pair of antennæ have the first joint of the peduncle long, the inner lateral margin of which is armed with three long spines and one small one; the outer margin, with one large spine near the apex. The second joint is one-third the length of the first joint and is unarmed. The third joint is one-half as long as the second joint. The flagellum is composed of about fourteen joints; the secondary appendage of about seven joints. The peduncle of the second pair of antennæ extends to the end of the first joint of the peduncle of the first pair, and has an exopod developed at the base of the third joint. The flagellum is composed of about ten joints, and extends about half the length of the flagellum of the first pair of antennæ. There is a prominent spine on the epistome.

The first free segment of the thorax is shortest, the two following ones being longer, the next two the longest, and the last but little longer than the first. The first segment is as wide as the head, the others decrease in width gradually. The antero-lateral margins of all the segments except the first are produced into one acute process, of the fourth and fifth free segments into two acute processes. The last segment bears a ventral spine.

The abdominal segments gradually decrease in width backward. The sixth or terminal segment is produced on either side near the base into two acute processes. Beyond the last process the segment widens slightly for the attachment of the uropoda, and ends posteriorly in a triangular process. The uropoda are very long, the inner branch being half the length of the body, and composed of about twenty-five joints. The outer branch is composed of seven joints.

First gnathopods with the upper distal margin of the propodus, finely serrate and armed with a tooth near the articulation of the dactylus. Second gnathopods have the merus armed with one spine at the distal extremity on the posterior margin, and one on the anterior margin; the carpus armed with two spines on the posterior and one on the anterior margin at the distal extremity; the margin of the propodus armed with three spines on the posterior margin, and one large spine and one small one at the distal extremity on the anterior margin. The dactylus is serrate on the inner margin. Exopods are present on both first and second gnathopods. The other legs are beset with spines.

The specimen is a female and has a large marsupium filled with eggs, extending the length of the first four free segments of the thorax.

Only one individual was collected by Prof. A. E. Verrill and party, in Harrington Sound, Bermudas.

Type specimen in Peabody Museum, Yale University. Cat. No. 3192.

## APSEUDES PROPINQUUS Richardson.

*Apseudes propinquus* RICHARDSON, Trans. Conn. Acad. Sciences, XI, 1902, pp. 281-283, pl. XXXVII, figs. 6-9.

*Localities.*—Bailey Bay and Castle Harbor, Bermudas; Gulf of Mexico.

Found on surface.

Body narrow, elongated, surface smooth.

Head with frontal margin produced in the middle in a long, acute, deflected process, from base of which on both sides there is an abrupt lateral expansion, the margin forming an outward curve which extends to the base of the ocular lobe and then proceeds straight to the lateral margin of the head. Ocular lobe produced in an acute process. Eyes large, black, occupying the whole of the ocular lobe.

First pair of antennæ with first joint of peduncle long, and armed on the inner lateral margin with two large spines and one small one near the base, and on distal end of outer margin with one large spine. Second joint less than one-third the length of first joint and unarmed. Third joint one-half as long as second joint. Flagellum composed of sixteen joints. Secondary appendage composed of eight joints. Second pair of antennæ with an exopod at base of third joint of peduncle; flagellum composed of ten joints. There is a conspicuous spine on the epistome.

First two free segments of the thorax about equal in length, the three following ones longer, increasing in length, the last segment a little longer than the first two. The antero-lateral margins of all the segments are acutely produced, those of the fourth and fifth free segments have two antero-lateral angulations. There is an anteriorly directed curved spine on the ventral surface of the first free segment. On the ventral surface of the second segment there is a straight spine directed posteriorly. The third, fourth, and fifth segments bear each a ventral curved spine directed anteriorly. The sixth segment has on the ventral surface a large, stout process.

The lateral margins of all the first five abdominal segments are drawn out in acute processes.

The terminal segment has two lateral angulations above the attachment of the uropoda. The posterior margin is triangulate. The inner branch of the uropoda is very long, equal in length to half the body, and is composed of thirty-four joints. The outer branch consists of eleven joints.

The first gnathopods have a tooth on the distal margin of the propodus near the articulation of the dactylus. There is a conspicuous spine on the posterior margin of the basis.

The second gnathopods have one spine at the distal end of the merus on the anterior margin; one spine at the distal end of the carpus on the anterior margin, and two spines on the posterior margin of the

same joint; four spines on the posterior margin of the propodus and two on the anterior margin at the distal extremity; the dactylus is serrate along the inner margin. Exopods are present on both first and second gnathopods. The other legs are beset with spines.

A few specimens, both males and females, were collected by Prof. A. E. Verrill and party at Bailey Bay and Castle Harbor, Bermudas, in 1898.

Type specimen from the Bermudas is in the Peabody Museum, Yale University. Cat. No. 3194.

This species is very closely related to *Apseudes intermedius* Hansen<sup>a</sup> but differs in the following points:

1. The first joint of the peduncle of the first pair of antennæ is armed with three spines on the inner margin, and one spine on the outer margin at the distal end. In *A. intermedius* this joint is unarmed.

2. In the increased number of joints in the flagella of both pairs of antennæ, there being sixteen joints in the flagellum of the first pair of antennæ, eight in the secondary appendage, and ten in the flagellum of the second pair of antennæ, while in Doctor Hansen's species the flagellum of the first pair of antennæ is composed of seven joints, the secondary appendage of three joints, and the flagellum

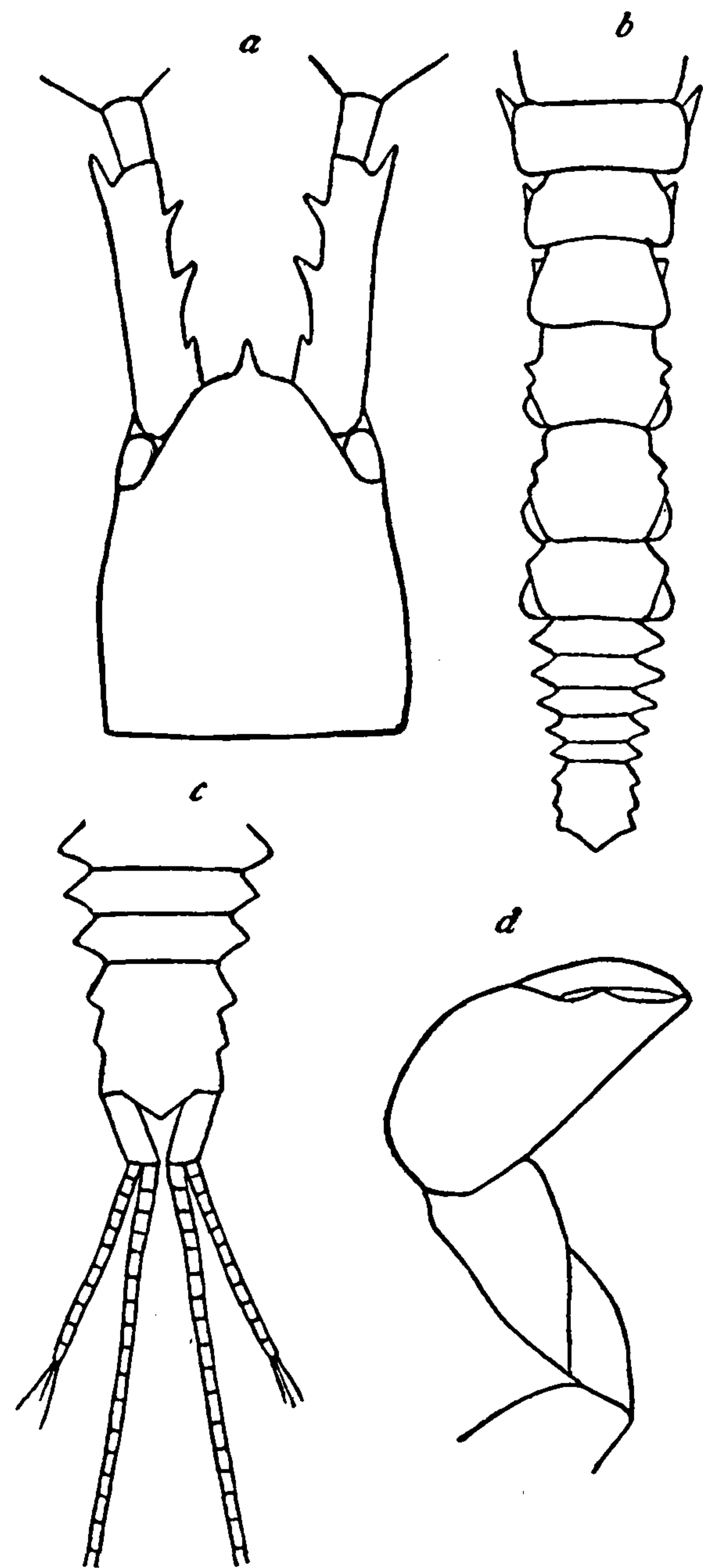


FIG. 37.—APSEUDES PROPINQUUS. a, HEAD. b, SEGMENTS OF THORAX AND ABDOMEN. c, LAST FOUR SEGMENTS OF BODY AND PART OF UROPODA. d, FIRST GNATHOPOD.

of the second pair of antennæ of four joints.

3. In the much greater length of the uropoda, the inner branch of which in *A. propinquus* is half the length of the body and composed of thirty-four joints, the outer branch consisting of eleven joints,

<sup>a</sup>Isopoden, Cumaceen, und Stomatopoden der Plankton-Expedition, 1895, p. 49-50, pl. v. fig. 10-10b; pl. vi, fig. 1.

while in *A. intermedius* the outer branch has only four joints, and the inner branch is only twice the length of the terminal abdominal segment and is composed of only fifteen joints.

9. Genus PARAPSEUDES Sars.

Exopods present on both pairs of gnathopods. Only four pairs of pleopoda present, with one of the branches two-jointed. Second pair of antennæ with a scale articulated to the end of the second article.

PARAPSEUDES GOODEI Richardson.

*Parapseudes goodei* RICHARDSON, Trans. Conn. Acad. Sciences, XI, 1902, pp. 283-284, pl. XXXVII, figs. 10-14.

*Locality*.—Castle Harbor, Bermudas.

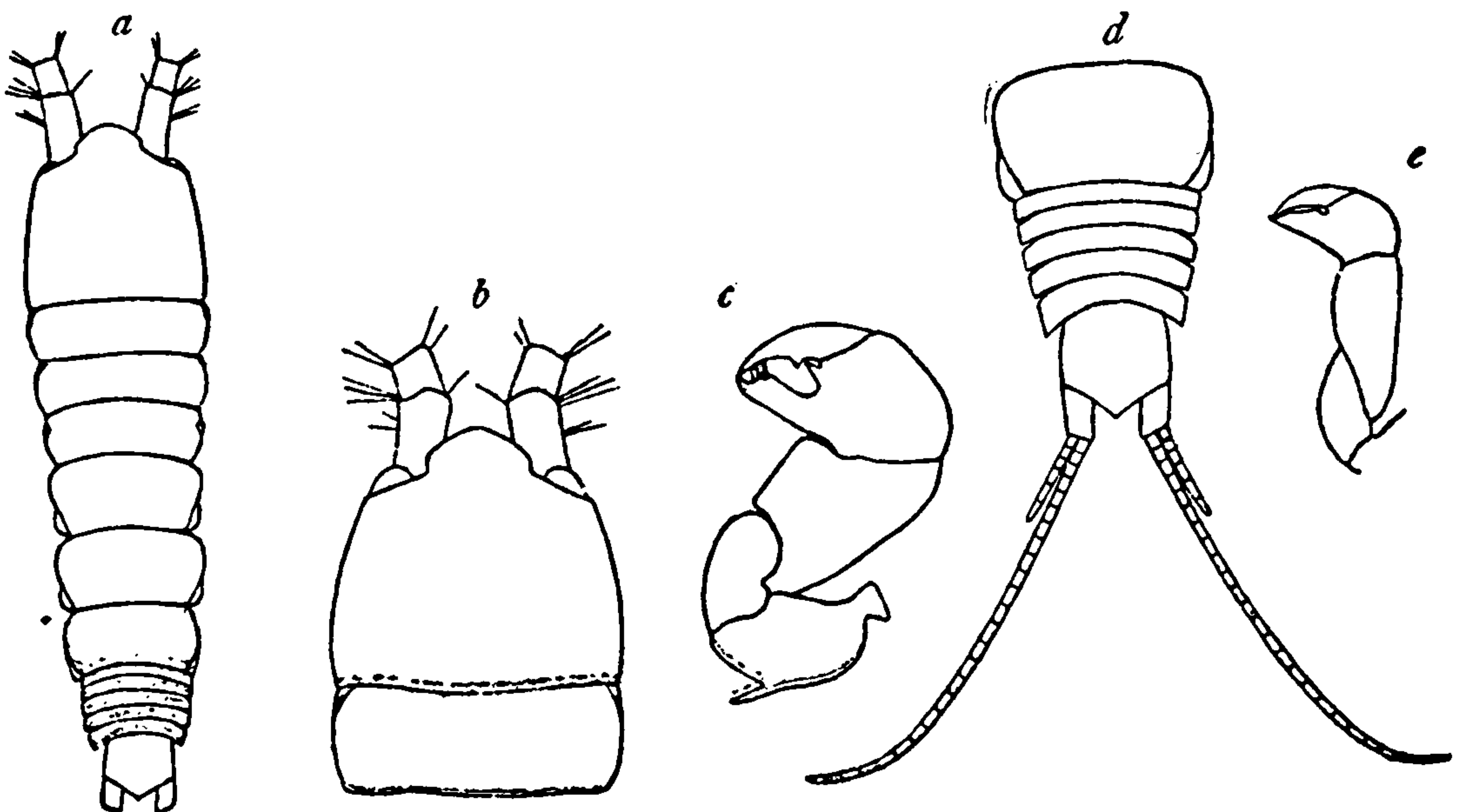


FIG. 38.—PARAPSEUDES GOODEI. *a*, GENERAL FIGURE. *b*, HEAD AND FIRST THORACIC SEGMENT. *c*, FIRST GNATHOPOD OF MALE. *d*, ABDOMEN WITH UROPODS AND LAST THORACIC SEGMENT. *e*, FIRST GNATHOPOD OF FEMALE

Surface of body smooth; color light yellow.

Head but slightly narrowed anteriorly. Eyes with large, brown ocelli and placed on ocular processes, articulated to the head. Frontal margin with a rostrum projecting between the basal joints of the first pair of antennæ. The base of the rostrum is constricted, the anterior margin broadly rounded.

The first pair of antennæ have the peduncle short, the first joint twice as long as the second; the third half as long as the second; all three with margins smooth, unarmed, but fringed with long hairs. The flagellum consists of seven joints; the secondary appendage of four joints. The second pair of antennæ extend only to the end of the peduncle of the first pair; the flagellum consists of five joints; a scale is articulated to the peduncle.

The first, second, and third free thoracic segments are about equal in length, the following three being longer than the first three, and subequal. The first and second segments have a small epimeral lobe on the antero-lateral margin. The third segment has a small lobe about the center of the lateral margin. The lobes of the three following segments are situated post-laterally.

The abdomen is very short; all the segments together not equaling in length the last two thoracic segments. The first five segments have the margins produced at the sides, with deep lateral incisions between the segments.

The terminal segment is triangulate posteriorly with the apex acute. The uropoda are quite half the length of the body, the inner branch consisting of about twenty-five joints, the outer and smaller branch consisting of six joints. There are but four pairs of pleopoda.

The first pair of legs in the female are much more slender than those of the male. In the male there is a deep excavation on the distal margin of the propodus near the articulation of the dactylus, while in the female this excavation is comparatively small. In the male there is a spine within this excavation and one on the dactylus, both situated at the articulation of the dactylus and the propodus. Exopods are present on both pairs of gnathopods. All the other legs are very spinulose.

A few specimens (types) were collected by Prof. A. E. Verrill and party in 1898, at Castle Harbor, Bermudas, and one specimen was collected by Dr. G. Brown Goode at the Bermudas in 1876-77.

Type in Peabody Museum, Yale University. Cat. No. 3222.

Named in honor of the late Dr. G. Brown Goode.

This species has a close resemblance to *Parapseudes latifrons* (Grübe),<sup>a</sup> but differs in the following characters: in *P. goodei* the first pair of gnathopods are more robust; the propodus has a deep excavation near the articulation of the dactylus, within which is a large spine. There is also a spine on the dactylus.

The rostrum is constricted at the base in *P. goodei*, while in *P. latifrons* the line is unbroken from the apex of the rostrum to the lateral margin of the head.

The secondary appendage of the flagellum of the first antennæ is composed of four joints in *P. goodei* while in *P. latifrons* this appendage is composed of seven joints. The flagellum of the second pair of antennæ consists of five joints in *P. goodei*, while in Grübe's species it consists of eight joints.

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<sup>a</sup> *Rhoëa latifrons* Grübe, Die Insel Lussin und ihre Meeresfauna, 1864, p. 75.

*Parapseudes latifrons* G. O. Sars, Archiv for Math. og Naturvidenskab, XI, 1886, p. 304, pl. VIII.

10. Genus TYPHLAPSEUDES Beddard.<sup>a</sup>

Eyes absent. No exopodite present on the first two pairs of thoracic appendages. All five pairs of pleopoda present. Abdomen composed of six distinct segments. Antennæ with a rudimentary exopodite, consisting of a single long joint. Pleopoda well developed, the exopodite bi-articulate.

## TYPHLAPSEUDES NEREUS Beddard.

*Typhlapseudes nereus* BEDDARD, Proc. Zool. Soc. Lond., 1886, Pt. 1, p. 115; Report on the Scientific Results of the Expl. Voyage of H. M. S. *Challenger*, Zool., XVII, 1886, pp. 112–113.—RICHARDSON, Proc. U. S. Nat. Mus., XXIII, 1901, p. 505.

*Locality*.—Off Sombrero Island.

*Depth*.—450 fathoms.

“This species is represented by a number of individuals dredged in the North Atlantic from a depth of 450 fathoms. The average length of the species is about 10 mm. The body is flattened and depressed, smooth, without any covering of hairs even on the abdomen; it is wider anteriorly and gradually narrows to the posterior extremity.

“The head and the first segment of the thorax, which are of course fused together and form a cephalic shield, is flattened in front, but convex laterally and behind. The frontal margin projects as a short, sharp rostrum; behind the insertion of the antennary organs is a triangular ocular lobe pointed in front; it has no trace of any optic structures; behind this again is another shorter, triangular, pointed process; more posteriorly the lateral margins of the cephalic shield are convex outward.

“The free thoracic segments diminish gradually in breadth, but increase in length up to the fifth; the sixth is not only narrower, but shorter than the fifth. They are all furnished with very minute epimera, those of the first segment are larger, and project anteriorly in the form of a short spine. The lateral margins of all but the first two segments are furnished with a short spine, very broad at its base, which is situated about halfway between the articulation of the limbs and the anterior margin of the segment. In the sixth (and last) segment of the thorax this spine is almost obsolete. In the ventral surface of the thoracic segments is a median spine.

“In the female the first four of the free thoracic segments have ovigerous lamellæ. Of the abdominal segments the first pair are subequal, but diminish gradually in breadth; they are furnished with small epimera, terminating in a pointed extremity and directed backward.

<sup>a</sup> See Beddard for characters of genus. Challenger Report, XVII, 1886, pp. 111–112.

“The terminal segment of the abdomen equals in length any four of the anterior abdominal segments; it is cylindrical in form, becoming gradually wider toward the extremity; it terminates in a truncated straight posterior margin, and in the middle line in a short oval prolongation.

“The antennules are stouter, as well as longer, than the antennæ; they are about as long as the cephalothoracic shield and the first segment of the thorax taken together. The basal joint is long and stout, the second joint is very much shorter, the third and fourth shorter

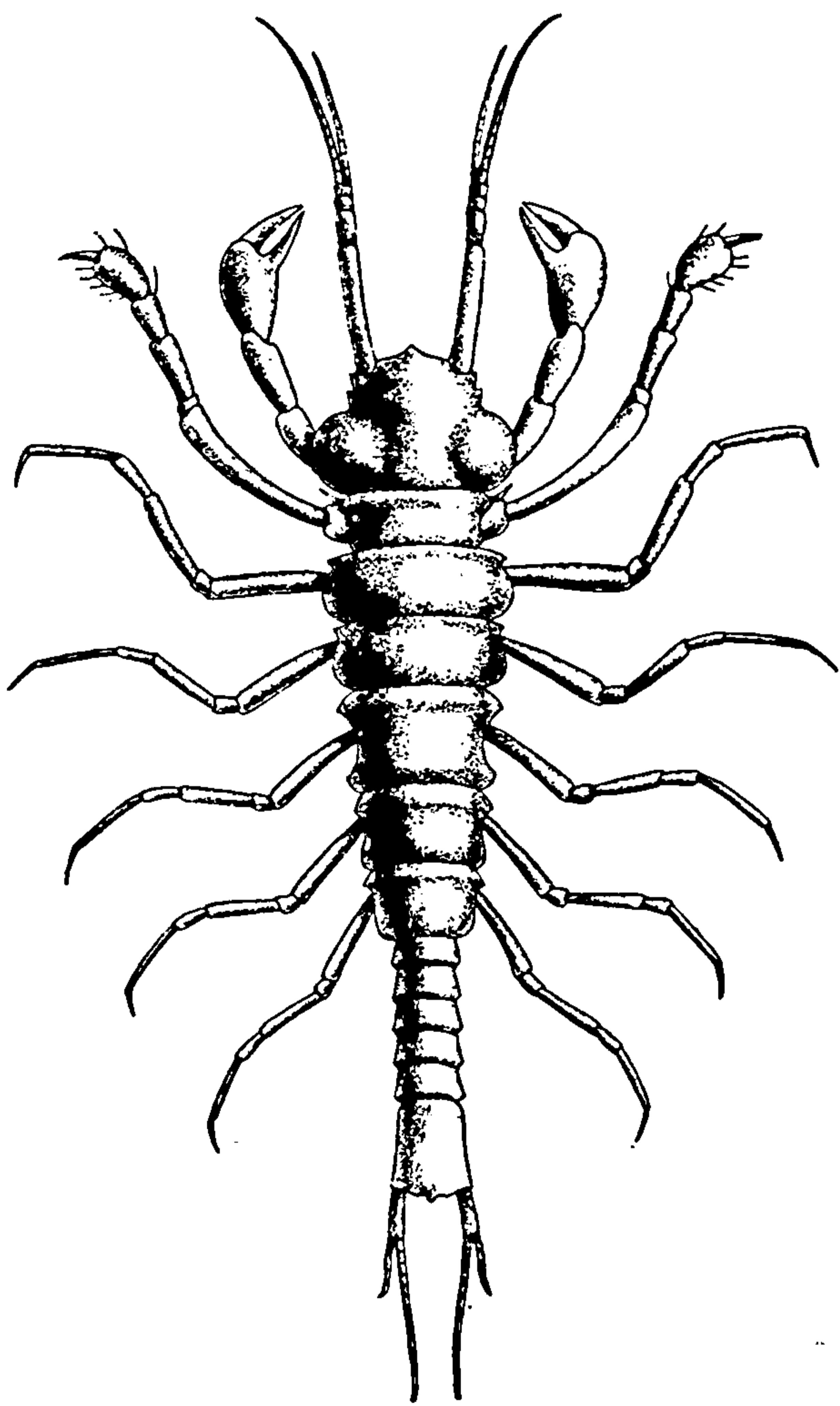


FIG. 39.—TYPH LAPSEUDES NEREUS (AFTER BEDDARD).

still; from the last joint of the peduncle arise the two flagella, of which the outer is longer as well as stouter than the inner; the outer flagellum is made up of ten joints, of which the first is very much the longest; it diminishes gradually in width toward the extremity; the inner flagellum has four or five narrow elongated joints.

“The antennæ have a five-jointed peduncle and a flagellum about as long as the last two joints. The first joint of the peduncle is short, the second long, with a short, cylindrical, setose exopodite articulated at its extremity; the third joint is very short, the fourth and fifth long and subequal.

“I have not had a sufficient amount of material at my disposal to give an accurate account of the mouth appendages.

“The chelæ are not remarkable in any way except for the absence of an exopodite; they appear to be perfectly similar in both sexes, and agree very closely with those of the genus *Sphyrapus* (female), etc. The first joint is very much stouter than any of the succeeding joints; the second is short and narrow and bears a spine on the inner side just before its articulation with the next joint, which is extremely minute and might easily be overlooked; it is wedged in between the second and third joints, and is only apparent on the inner side of the limb. The fourth joint is longer and stouter and has a number of hairs along the inner margin. The two fingers cross at their extremity; they are serrate along the margins which come in contact.



“The fossorial limbs, which form the second pair, are much longer and stouter than the succeeding abdominal limbs. The first joint is long and curved, the second is very minute, the third and fourth are subequal and rather less than one-half of the length of the basal joint; the first two joints have no spines, the third has a single strong spine on the inner margin just before it articulates with the succeeding joint, and a tuft of hairs on the corresponding opposite side; the fourth joint has two strong spines on the inner and a single spine on the outer side, besides hairs and more slender spines; the fifth is shorter than either of the preceding, its inner margin is fringed with five stout spines, increasing in length toward the extremity of the joint, and two strong spines besides more slender ones on the outer side; the terminal joint of the limb is elongated and claw-like, toothed along the inner margin. These appendages like the preceding have no exopodite, and they do not differ in the two sexes to any appreciable extent.

“The succeeding thoracic appendages are similar to each other and very much more slender than the preceding limbs; the proportionate length of the joints is, however, the same, the second being, as in the fossorial limbs, extremely minute. The spines with which the terminal joints of these limbs are ornamented are also more slender than those of the second pair of thoracic appendages.

“The abdominal appendages, with the exception of the uropoda, are similar to each other; all the five pairs consist of an elongated basal joint and of two subequal, rather shorter setose rami; the exopodite is divided by a suture into two joints.

“The uropoda are short and biramose, with an elongated basal joint and two rami, the outer is the shorter.

“Station 23, off Sombrero Island, March 15, 1873; latitude,  $18^{\circ} 24'$  north, longitude,  $63^{\circ} 28'$  west; depth, 450 fathoms; Pteropod ooze.”—**BEDDARD.**<sup>a</sup>

#### 11. Genus SPHYRAPUS Norman and Stebbing.<sup>b</sup>

First two segments of thorax fused with the head to form a carapace. Eyes absent. Second pair of antennæ without scale. Exopods present on first two pairs of legs. Gnathopods in male with carpus and merus much more elongated than in female. Second pair of legs in male of extraordinary length. Pleopoda well developed, with both branches bi-articulate. Flagellum of first antennæ in male with dense bunches of sensory hairs.

<sup>a</sup> Challenger Report, XVII, 1886, pp. 112–113.

<sup>b</sup> See Sars' Crustacea of Norway, II, 1899, pp. 8–9, and Norman and Stebbing, Trans. Zool. Soc. London, XII, 1886, p. 97, for characters of genus. Sars says that only the first thoracic segment is fused with the head.

## SPHYRAPUS MALLEOLUS Norman and Stebbing.

*Sphyrapus malleolus* NORMAN and STEBBING, Trans. Zool. Soc. London, XII, 1886, pp. 98-99, pl. XXII, figs. 2-3.—BONNIER, Ann. de l'Univers. de Lyons, XXVI, 1896, p. 665, pl. XXXI, fig. 1.—RICHARDSON, American Naturalist, XXXIV, 1900, p. 212; Proc. U. S. Nat. Mus., XXIII, 1901, p. 505.

*Localities.*—South of Cape Farewell, Greenland; also latitude  $39^{\circ} 39'$  north, longitude  $9^{\circ} 39'$  west, off coast of Portugal; latitude  $45^{\circ} 57'$  north, longitude  $6^{\circ} 21'$  west; latitude  $44^{\circ} 36'$  north, longitude  $4^{\circ} 25'$  west; south of Rockall; Bay of Biscay; Bay of Gascony; latitude  $57^{\circ} 11'$  north, longitude  $37^{\circ} 41'$  west.

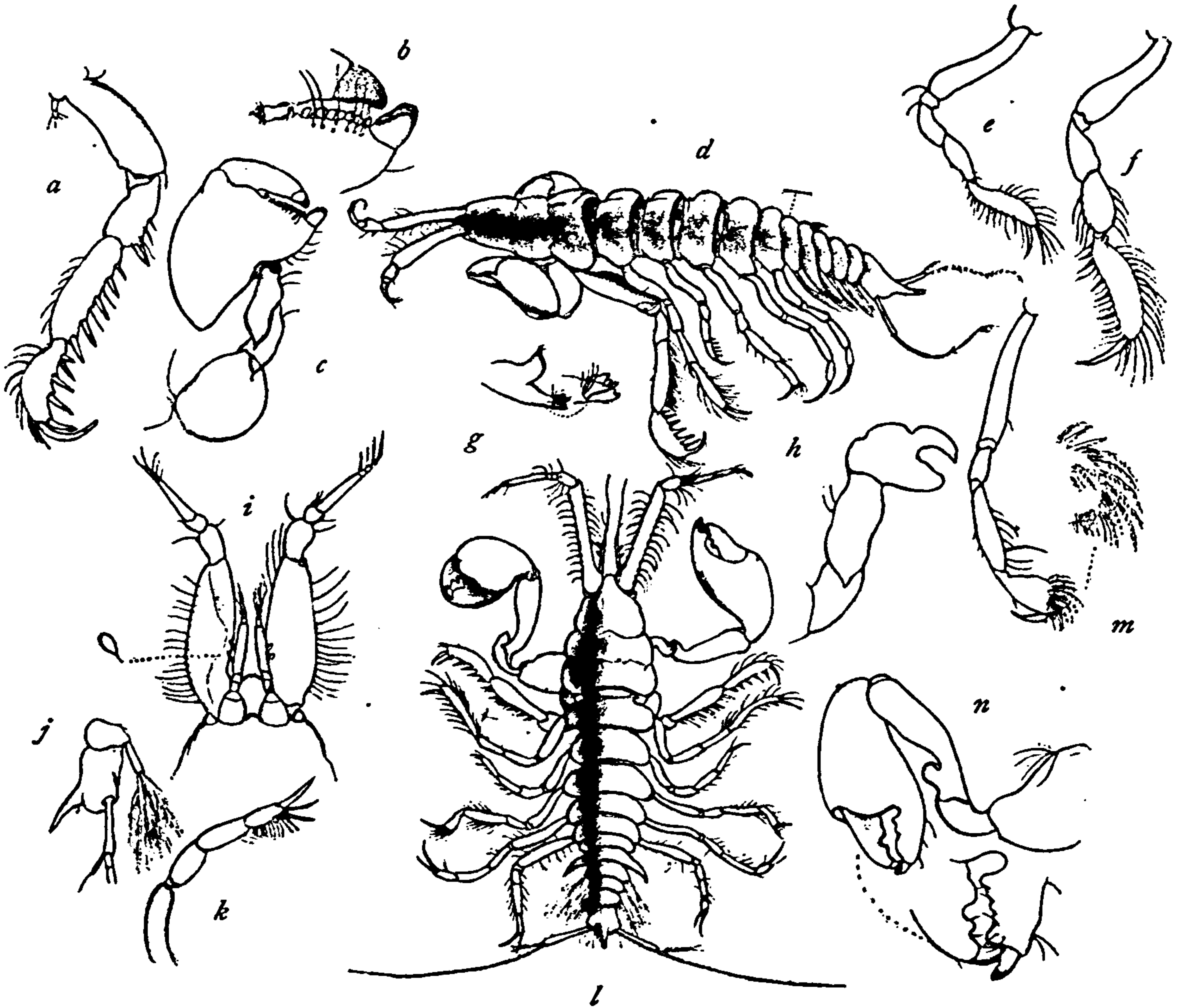


FIG. 40.—SPHYRAPUS MALLEOLUS (AFTER NORMAN AND STEBBING). *a*, SECOND LEG OR GNATHOPOD. *b*, FIRST LEG OR GNATHOPOD. *c*, FIRST LEG. *d*, MALE, SEEN OBLIQUELY FROM ABOVE. *e*, FOURTH LEG OR SECOND PEREOPOD. *f*, THIRD LEG OR FIRST PEREOPOD. *g*, MANDIBLE. *h*, FIRST LEG OR GNATHOPOD OF FEMALE. *i*, ANTENNAE, SEEN FROM BELOW. *j*, TERMINAL SEGMENT OF ABDOMEN WITH PLEOPOD AND BASE OF UROPODS, SEEN FROM THE SIDE. *k*, SEVENTH LEG OR FIFTH PEREOPOD. *l*, FEMALE, SEEN FROM ABOVE. *m*, FIFTH LEG OR THIRD PEREOPOD. *n*, FIRST LEG OR GNATHOPOD OF FEMALE.

*Depth.*—1,450 fathoms; 1,410 meters and 650 meters; 740 fathoms.

“Rostrum short and obtusely pointed. Ophthalmic processes minute, shaped like a baker’s cap, and more easily seen from below than from above. The confluent segments are both wider than the head, and the second wider than the first; to the rear of these the

animal tapers irregularly, the center peræon-segment being narrower than its neighbor, as is also the case in *S. tudes*, and the pleon tapers more suddenly than the peræon as far as the base of the sixth segment, the sides of which diverge to the point of insertion of the uropods and then suddenly converge to a central and somewhat upturned, much produced, apical process. Of the peræon-segments the last two are the shortest. The first five segments of the pleon are nearly equal in length to one another; only the second has lateral spine-like processes, but here they are large, produced, and very conspicuous.

“The upper antennæ have the basal joint large, in the male stout, shorter than the cephalic plate, in the female dilated at the base, longer than the cephalic plate, in both ciliated on the margins; the second joint is short, dilated distally; the third is about half the length and breadth of the second; the flagellum consists of one long, succeeded by four short, articulations; the secondary appendage is rudimentary and represented by only one minute articulation. The lower antennæ have the basal joint as broad as it is long, the three following joints short, the fifth long and slender, carrying on the outer side two pear-shaped vesicles; the flagellum is three jointed, the second and third joints furnished with long cilia.

“The first gnathopods have the soldered coxal portion folded beneath; the basos broad and short, the ischium wanting; the meros narrow at the base, then dilated, and ending in a point; the carpus in the male is a little longer than the meros, which it overlaps; it is pointed distally, its sinuous margins are nearly parallel; upon it the huge hand is set hammer-wise. In shape the hand is roughly triangular; a line from the base of the finger to the stout horny thumb may be considered the base of the triangle; along this (palm) margin is set a row of flat little teeth, all but one or two of them lying closely side by side; one of the sides of the triangle runs from the thumb-nail backward, receiving the wrist in a sinuosity about the middle; the remaining side is formed by the curved line running from the hinder extremity of the last-described side to the base of the finger; the finger, which is short and stumpy, with a nail like the thumb-nail, doubles closely down upon the palm. In the female the wrist is considerably longer than in the male, and is of the same breadth at both ends, but has a narrow neck near its base; the hand in this sex is attached to the wrist by the apex of the triangle; the thumb is a long process projecting from the base of the triangle and causing the finger to project in like manner, and the hand is thus of very different form from that of the male, being ovate; the inner margins of both thumb and finger are irregular; the thumb is truncate and has the horny nail set close to the outer margin; the nail of the finger closes down into the cavity within the thumb-nail and on the truncated end of the thumb.

“The second gnathopods resemble those of *Sphyrapus tudes*, but the basos is narrower, being only slightly broader than the following joints; the meros has one distal spine on the front margin, the wrist a row of five spines, and the hand the same number; the finger is much curved, slender, and its margin smooth.

“In the first peræopods the wrist is a little dilated, the hand flat, long, curved, with seven slight spines on the front margin and much ciliated on both margins.

“The second peræopods are shorter than any except the last; the third have the hand short, distally dilated, and then surrounded by a fence of biserrate spines of varying lengths. The fourth and fifth pairs are similar in form, but the fifth is smaller than the fourth; the wrist is longer than the hand, which is small, ciliated, and has two long spines near the base of the finger.

“The uropods have the peduncle as long as the segment, minus its produced apex, and a little dilated distally; the inner branch is long, with about 15 articulations, which vary irregularly in length; the outer branch is very slight and composed of 3 articulations. Judging from the spirit-preserved specimens the uropods in this species would seem to be carried divergently, not following behind parallel to each other.

“*Sphyrapus malleolus* may at once be distinguished from its allies, not only by the form of the gnathopods, but by the rudimentary condition of the inner flagellum of the upper antennæ, which is reduced to an unjointed minute tubercle and by the spine-formed wings of the second segment of the pleon.”—NORMAN and STEBBING.<sup>a</sup>

## II. CYMOTHOIDEA or FLABELLIFERA.

Legs of the first pair not cheliform. Uropoda lateral and forming with the last segment of the abdomen a caudal fan. Pleopoda for the most part natatory.

### ANALYTICAL KEY TO THE FAMILIES OF THE CYMOTHOIDEA OR FLABELLIFERA.

- a. Legs in the adult in six, apparently only in five pairs.... Family III. GNATHIDÆ
- a'. Legs in the adult usually in seven pairs.
  - b. Uropoda lateral and superior, outer branch arching over base of telson. Body cylindrical, narrow, elongated ..... Family IV. ANTHURIDÆ
  - b'. Uropoda lateral.
    - c. Abdomen usually composed of six segments.
    - d. Uropoda with both branches well developed; mostly lamelliform.
      - e.<sup>b</sup> Maxillipeds with the palp free, the margins of the last two articles more or less setose, never furnished with hooks.

<sup>a</sup> Trans. Zool. Soc. Lond., XII, 1886, pp. 98-99.

<sup>b</sup> Hansen's analytical key as translated by Stebbing has been inserted between points *e* and *d'*. See Hansen, Vidensk. Selsk. Skr., 6th ser., natur. og Math. Afd. V, 1890, p. 317, and Stebbing, Hist. of Crustacea, 1893, pp. 340-341.

- f.* Mandibles with the distal half stout, very conspicuous, or with only the anterior margin concealed; from the base toward the middle directed forward and a little outward.
- g.* Mandibles with the rather broad, more or less tridentate, cutting edges meeting squarely behind the large upper lip; the secondary plate and peculiar equivalent for the molar well developed. First maxillæ having the plate of the first joint armed with three spines, that of the third with many. Second maxillæ of moderate size, the three free plates very setose. Maxillipeds with the palp rather broad, very setose.....Family V. CIROLANIDÆ
- g'.* Mandibles with the distal part produced into a long prominent process, the pair much overlapping; the secondary plate and molar evanescent. First maxillæ having the plate of the first joint unarmed, of the third carrying one very long spine. Second maxillæ bifid, small and feeble, the free plates almost rudimentary, with few setæ. Maxillipeds with the palp narrowed, the antepenultimate joint elongate.....Family VI. EXOCORALLANIDÆ
- f'.* Mandibles with the distal half narrow, most or all of it concealed by the upper and lower lips; from the base toward the apex gradually directed inward. Mandibles usually without molar process. Apex of second maxillæ simple. Antepenultimate joint of maxillipeds not elongate.....Family VII. CORALLANIDÆ
- e'.* Maxillipeds with the palp embracing the cone formed by the distal parts of the mouth organs, the inner upper margin and apex never setose, the apex and sometimes the inner upper margin, at least in the males and females without eggs, being furnished with outward curved hooks.
- f.* Antennæ of both pairs with well-defined peduncle and flagellum. Mandibles with the secondary plate very often visible; palp with no inflated joint. Maxillipeds with the palp commonly composed of five articles, sometimes composed of two articles, the last article in the latter case rather short, obtuse.....Family VIII. ÆGIDÆ
- f'.* Antennæ much reduced, without clear distinction between peduncle and flagellum. Mandibles with no secondary plate; palp in adults with first joint or both first and second joints inflated. Maxillipeds always with palp composed of two joints, last joint rather long and narrow, subacute.....Family IX. CYMOTHOIDÆ
- d'.* Uropoda with one of the branches almost obsolete or rudimentary—not lamelliform.....Family X. LIMNORIIDÆ
- c'.* Abdomen composed of less than six segments.
- d.* Abdomen composed of two segments. Uropoda with one branch fixed, immovable.....Family XI. SPHÆROMIDÆ
- d'.* Abdomen composed of four segments. Uropoda with both branches movable.....Family XII. SEROLIDÆ

### Family III. GNATHIIDÆ.<sup>a</sup>

Thorax with only five pairs of normal walking legs in the adult. Last pair of legs wanting. First pair of legs modified; in male they are valve-like, arching over the ventral side of the head; in the female they are smaller and more distinctly segmented; in the larval form

<sup>a</sup>See Sars's Crustacea of Norway, II, 1899, p. 50, and Harger, Report U. S. Comm. of Fish and Fisheries, 1880, Pt. 6, pp. 408-410, for characters given below.

they terminate in a strong hook. Head of adult male armed with powerful forward-projecting curved jaws or mandibles. First segment of thorax is united with the head, but separated by a suture line. Seventh thoracic segment small, resembling those of abdomen. Abdomen abruptly narrower than thorax and composed of six segments. Mandibles wanting in female. No true incubatory pouch present. Oral parts in female reduced to maxillipeds only; in male to mandibles and maxillipeds. Sexes very different in appearance. Body of male depressed and dilated in front; that of female more or less fusiform. Larval form also different, but resembling female.

## 12. Genus GNATHIA Leach.<sup>a</sup>

Head of male large, subquadrangular. Head of female rather small, subtriangular. Thorax composed of five well-developed segments, the other two segments being rudimentary, the first being fused with the head and the seventh placed between the projecting lateral parts of the fifth segment. First pair of legs in male operculiform, composed of two articles; those of female subpediform, being divided into three or four articles. There are five pairs of ambulatory legs. Abdomen much narrower than the thorax. Mandibles present in male, more or less flattened and projecting anteriorly beyond the head. Maxillipeds without epignath; palp composed of four articles.

### ANALYTICAL KEY TO THE SPECIES OF THE GENUS GNATHIA.

- a. Mandibles in male with the basal part ornamented on the superior margin with an elevated crest, which is irregularly dentate. Legs furnished with many spiny processes..... *Gnathia cristata* (Hansen)
- a'. Mandibles in male without elevated crest on the superior margin. Legs without spiny processes.
  - b. Mandibles in male with slight notch outside, inner edge obtusely produced in the middle, tip acute, slightly incurved. Front of head not produced in the middle beyond the antero-lateral angles..... *Gnathia elongata* (Krøyer)
  - b'. Mandibles in male carinate on outer side near the middle, the carina ending in a tooth-like process, irregularly and bluntly toothed near the base within, turned upward at apex. Front of head produced in the middle much beyond the antero-lateral angles..... *Gnathia cerina* (Stimpson)

### GNATHIA CRISTATA (Hansen).

*Anceus cristatus* HANSEN, Vidensk. Meddel. Naturh. Foren. i. Kjøbh., 1887-1888, p. 182, pl. VII, fig. 2-2a.

*Gnathia cristata* RICHARDSON, American Naturalist, XXXIV, 1900, p. 214; Proc. U. S. Nat. Mus., XXIII, 1901, p. 506.

*Locality.*—Latitude 72° 32' north, longitude 58° 51' west.

*Depth.*—116 fathoms.

<sup>a</sup> See Sars's Crustacea of Norway, II, 1899, p. 50, and Harger, Report U. S. Comm. of Fish and Fisheries, 1880, Pt. 6, pp. 408-410, for characters given below.

*Description of male.*—This species is closely related to *Gnathia hirsuta* (Sars), but differs from all other species of the genus in the structure of the mandibles.

The body is very short; the thorax is a little narrower than long in the median line. The fourth free segment of the thorax (fifth segment) is scarcely longer than the fifth segment. The fifth free segment (sixth segment) has large lateral areas, posteriorly very much elongated, with the posterior angles subrotund.

The abdomen in the specimen is almost entirely wanting.

The head and the first two free segments of the body are very rough and ornamented with acute processes and numerous tubercles; the third free segment (fourth segment) is ornamented with smaller tubercles at the anterior portion, but is smooth posteriorly; the fourth free segment (fifth segment) has large swollen lateral areas, ornamented with a few tubercles, the median part being smooth; the fifth free segment (sixth segment) is smooth. The eyes are rather large, manifest. The mandibles are large, ornamented on the basal half of the superior margin with a very high crest irregularly notched or dentated. The teeth of the crest have the apex rounded.

The legs are long, rather robust, furnished with many processes, for the most part, large. The body and the legs are furnished with a few hairs. Length of the head and thorax together 3.1 mm.

Only a single mutilated specimen.<sup>a</sup>

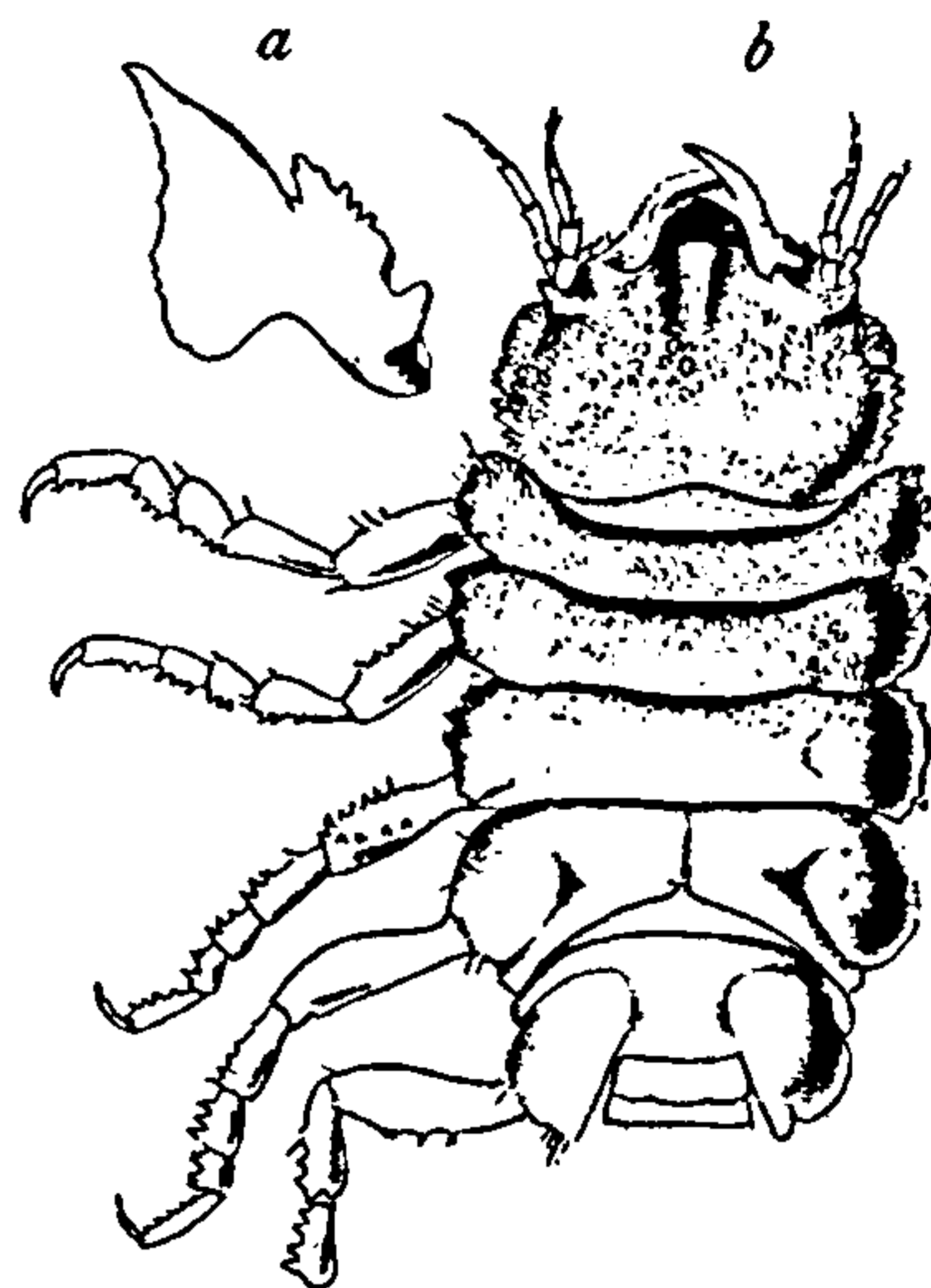


FIG. 41.—GNATHIA CRISTATA (AFTER HANSEN). *a*, RIGHT MANDIBLE (INNER SIDE). *b*, MALE (SOMEWHAT MUTILATED) (ENLARGED.)

<sup>a</sup> The above description is adapted from the following description of Hansen's:

Specimen singulum masculinum sat mutilatum vidi.—*Anceo hirsuto* G. O. Sars sat affinis, structura mandibularum a speciebus omnibus mihi cognitis diversus. Corpus brevius; truncus paulo augustior quam in linea media longior. Segmentum quartum liberum trunci segmento quinto vix longius; segmentum quintum areis lateralibus magnis, post valde elongatis, angulis posterioribus subrotundatis. (Cauda in specimine fere tota deest.) Caput et segmenta duo anteriora libera trunci scabra, processulis acutis et tuberculis permultis ornata; segmentum tertium liberum ante tuberculis minoribus instructum, postice glabrum; segmentum quartum area laterali magna, inflata, tuberculis nonnullis decorata, parte media glabra; segmentum quintum glabrum. Oculi sat magni, dilutiores. Mandibulae magnae, parte dimidia basali marginis superioris crista valde elevata et irregulariter inciso-dentata ornata; dentes cristae apice rotundato. Pedes longi, sat robusti, processulis multis, ex parte magnis, muniti. Corpus pedesque setis nonnullis instructa.—Long. capitis et trunci juncti 3, 1 mm.—HANSEN, Vidensk. Meddel. Naturh. Foren. i Kjøbh., 1887-88, p. 182.

## GNATHIA ELONGATA (Krøyer).

*Anceus elongatus* KRØYER, Voy. en Scand., Crust., 1849, pl. xxx, fig. 3a-g; Naturh. Tidsskr. (2), II, 1846-49, pp. 388-394.—HANSEN, Dijnphna-Togtets Zool.-bot. Udbytte, 1887, p. 205; Vidensk. Meddel. Naturh. Foren. i Kjøbh., 1887-88, p. 182.

*Gnathia elongata* G. O. SARS, Crust. of Norway, II, Isopoda, 1899, p. 55, pl. xxiii, fig. 1.—RICHARDSON, American Naturalist, XXXIV, 1900, p. 214; Proc. U. S. Nat. Mus., XXIII, 1901, p. 507.—AXEL OHLIN, Bihang till K. Sv. Vet.-Akad. Handl., XXVI, Afd. iv, No. 12, 1901, pp. 20-21.

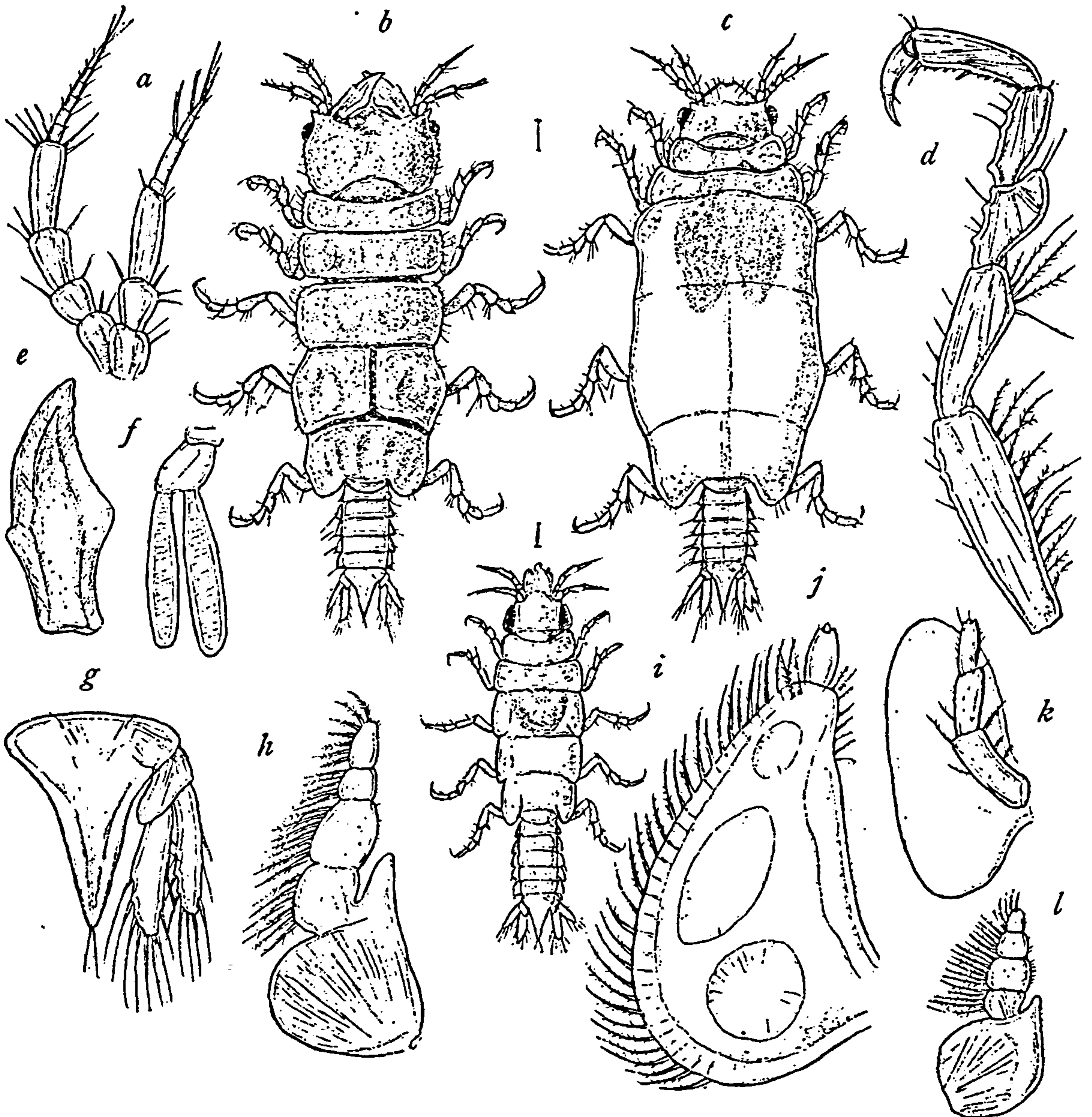


FIG. 42.—GNATHIA ELONGATA (AFTER SARS). *a*, FIRST AND SECOND ANTENNE. *b*, DORSAL VIEW OF MALE. *c*, DORSAL VIEW OF FEMALE. *d*, SECOND LEG. *e*, MANDIBLE. *f*, PLEPOD. *g*, LAST SEGMENT OF ABDOMEN WITH UROPODA. *h*, MAXILLIPED OF MALE. *i*, DORSAL VIEW OF YOUNG. *j*, FIRST LEG OF MALE. *k*, FIRST LEG OF FEMALE. *l*, MAXILLIPED OF FEMALE.

*Localities*.—West Greenland; also coast of Finmark; Lofoten Islands; Kara Sea; King Charles Island; Bremer Sound; latitude  $78^{\circ} 50'$  north, longitude  $29^{\circ} 39'$  east, King Charles Island (Ohlin).

*Depth*.—49-55 fathoms (Hansen)· 60-110 m. (Ohlin).



Found in soft clay with great stones; soft, black-grayish clay.

“Male: Body rather elongated, with the mesosome of nearly uniform breadth throughout, and the median constriction not very much pronounced. Cephalosome of moderate size, rounded quadrangular, with the supraocular processes well defined. Dorsal face of both cephalosome and mesosome very uneven, with irregular depressions, and clothed all over with minute spinules and short hairs. Penultimate pedigerous segment divided dorsally by a narrow longitudinal groove into two halves. Metasome comparatively narrow, and scarcely longer than the two posterior pedigerous segments combined; epimera small. Eyes well developed, though not very large. Mandibles comparatively small, with only a very slight notch outside; inner edge obtusely produced in the middle, tip acute, slightly incurved. Perio-poda with small tubercles inside the outer joints. Terminal segment of metasome considerably narrowed in its outer part, which is conical in shape. Uropoda with the rami comparatively narrow.—Female: Body much broader than in male, with the last three pedigerous segments well-defined, and together forming an oblong oval division about three times as long as that preceding it. Cephalosome with the frontal part slightly produced and bidentate at the tip. Pleopoda in both sexes with the rami quite smooth, forming narrow sac-like plates not fitted for swimming but apparently respiratory in character. Color of male grayish white, with a light bluish tinge; of female, yellowish, semipellucid, with scattered brown dots. Length in both sexes, 4 mm.”—G. O. Sars.<sup>a</sup>

Ohlin<sup>b</sup> also describes the color of the male as grayish white, that of the female wax-like yellow, and that of the larvæ yellowish-white or nearly white. The eyes are in all red-brownish.

Sars states that the adult animal is very sluggish in habit, the structure of the pleopoda showing it to be quite unable to swim. The larvæ, on the other hand, move through the water with great agility, and most probably at times lead a parasitic life on the skin of various fishes.

#### GNATHIA CERINA (Stimpson).<sup>c</sup>

*Praniza cerina* STIMPSON, Smithsonian Contributions to Knowledge, VI, 1853, p. 42, pl. III, fig. 31.

*Anceus americanus* STIMPSON, Smithsonian Contributions to Knowledge, VI, 1853, p. 42.

*Praniza cerina* VERRILL, Am. Jour. Sci. (3), VI, 1873, p. 439; VII, 1874, pp. 38, 41, 411, 502; Proc. Am. Assoc., 1873, pp. 350, 354, 358, 362 (1874).

*Gnathia cerina* HARGER, Proc. U. S. Nat. Mus., II, 1879, p. 162; Report U. S. Commissioner of Fish and Fisheries, 1880, Pt. 6, pp. 410–413, pl. XII, figs. 75–79.—RICHARDSON, American Naturalist, XXXIV, 1900, p. 214; Proc. U. S. Nat. Mus., XXIII, 1901, p. 507.

<sup>a</sup>Crust. of Norway, II, 1899, p. 55.

<sup>b</sup>Bihang till K. Sv. Vet.-Akad. Handl., XXVI, Afd. iv, No. 12, 1901, pp. 20–21.

<sup>c</sup>See Harger for excellent description of male, female, and larva.

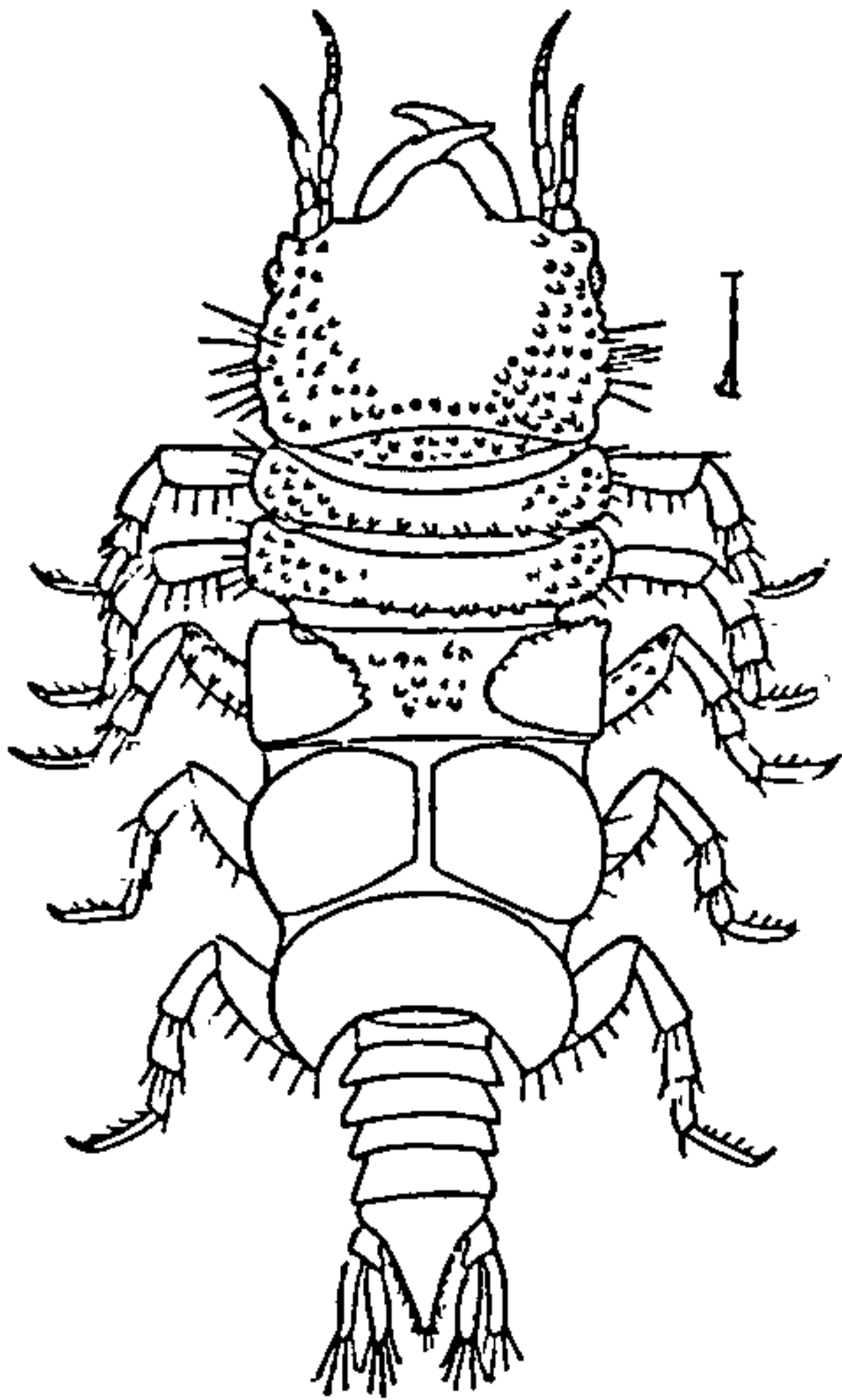
*Localities.*—Bay of Fundy; Massachusetts Bay; off Salem; Gulf of Maine; Casco Bay; Gulf of St. Lawrence; Eastport, Maine; off Sable Island; La Have Bank; South of Martha's Vineyard.

*Depth.*—10–487 fathoms, in mud, gravel, stones, sand, and rocky bottom. On sculpin, on cod, and on *Lophohelia* (Harger).

*Description of male.*—Body oblong-ovate, more than twice as long as wide,  $1\frac{1}{2}$  mm.:4 mm.

Head large, a little wider than long, 1 mm.:  $1\frac{1}{2}$  mm., with the anterior margin produced in a prominent rounded median lobe and the anterolateral angles acutely produced. The eyes are small, round, composite, and situated at the sides of the head at the base of the anterolateral lobes. The first pair of antennæ have the first two articles subequal; the third article is as long as the first two taken together. The flagellum is composed of four articles. The first pair of antennæ extend to the middle of the fourth article of the second antennæ. The first two articles of the second pair of antennæ

FIG. 43.—GNATHIA CERINA  
(AFTER HARGER). MALE.



are subequal; the third article is a little longer than the second; the fourth is nearly twice as long as the third. The flagellum is composed of seven articles. The mandibles are large and powerful and extend conspicuously in front of the head. The palp of the maxillipeds is composed of four articles.

The first segment of the thorax is small and almost inconspicuous,

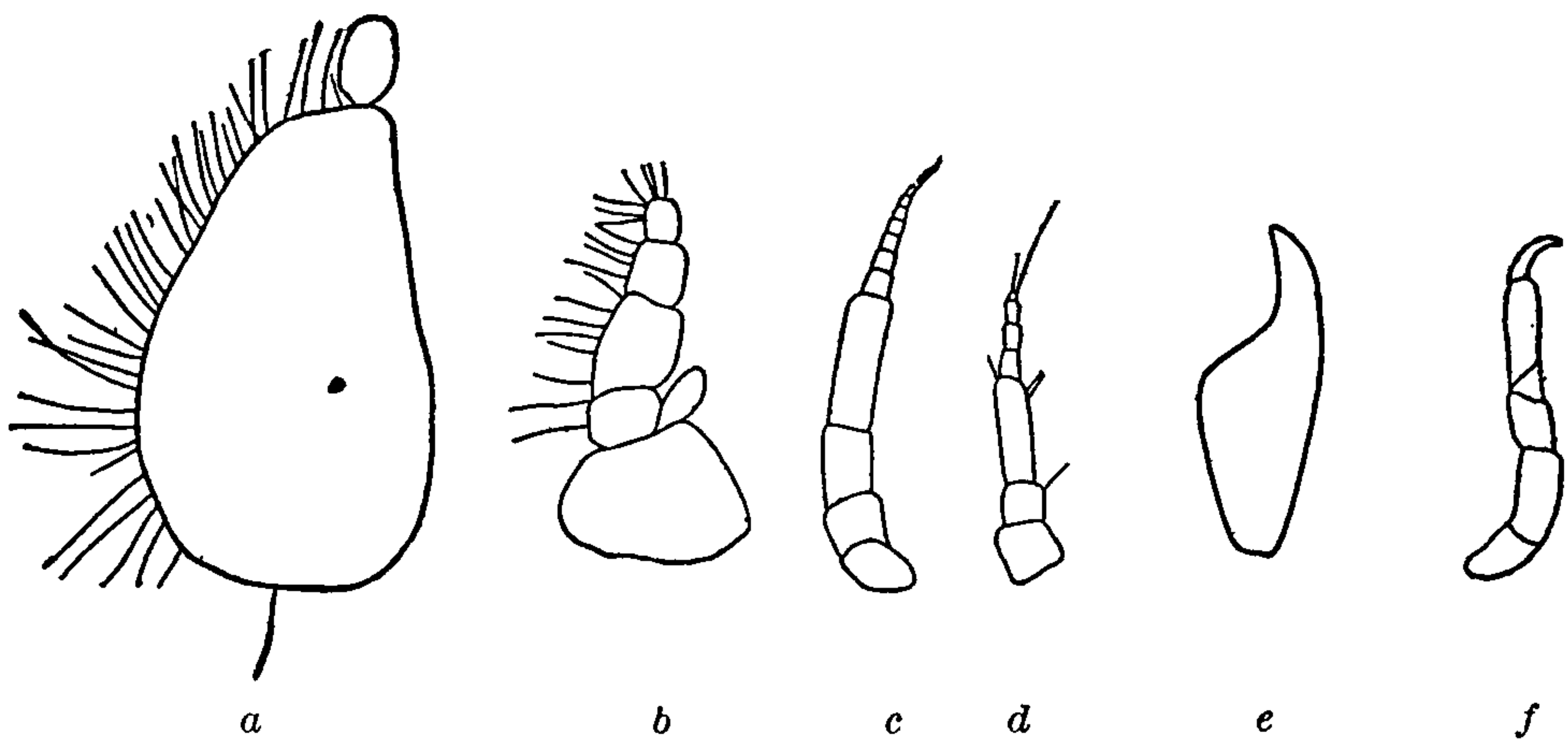


FIG. 44.—GNATHIA CERINA. *a*, LEG OF FIRST PAIR OF MALE.  $\times 51\frac{2}{3}$ . *b*, MAXILLIPED.  $\times 51\frac{2}{3}$ . *c*, SECOND ANTENNA (MALE).  $\times 51\frac{2}{3}$ . *d*, FIRST ANTENNA.  $\times 51\frac{2}{3}$ . *e*, MANDIBLE.  $\times 51\frac{2}{3}$ . *f*, FIRST LEG OF LARVA.  $\times 51\frac{2}{3}$ .

rudimentary, and consolidated with the head. The second and third segments of the thorax are subequal; the fourth segment is a little longer than either of the two preceding segments; the fifth and sixth are subequal, and are both longer than the fourth segment; the seventh segment is abruptly narrower than the sixth segment and is very

short, being only as long as the first abdominal segment, and narrower, about one-third as wide as the sixth thoracic segment; it could easily be taken for one of the abdominal segments.

The first five segments of the abdomen are short, distinct, and subequal in length; they are but little wider than the seventh thoracic segment, but abruptly narrower than the sixth thoracic segment. The sixth or terminal segment is triangular in shape, with apex very acute. The uropoda extend to the extremity of the abdomen. The inner branch is a little wider and a very little longer than the outer branch. Both are narrow, elongate, with extremities obliquely truncate, the post-lateral angles being rounded.

There are apparently only five pairs of thoracic legs. The first pair are modified and opercular, and are composed of only two articles. The seventh pair are wanting. The remaining five pairs are ambulatory.

*Description of female.*—Body ovate, about twice as long as wide, 2 mm.:4 mm. Head smaller than in male, with the front produced in a lobe which is emarginate in the middle. Eyes small, round, composite, and situated at the post-lateral angles of the head. Antennæ of both pairs as in male.

The first segment of the thorax is short and narrow and almost inconspicuous, appearing as a small lobe back of the head. The thorax becomes wider with the second thoracic segment. The second and third segments are short and about equal in length. The fourth and fifth are very long, many times longer than the preceding segments and scarcely to be distinguished, being somewhat fused dorsally. They are nearly subequal. The sixth segment is about half as long as the preceding segment, and becomes gradually narrower from the anterior to the posterior extremity. This segment is also somewhat fused dorsally with the preceding segment. The seventh segment is very short and narrow and not to be distinguished from the abdominal segments, being of the same length as the five anterior abdominal segments, but narrower.

The abdomen is similar to that in the male. The five posterior pairs of walking legs are similar to those in the male. The first pair of legs are composed of three articles and terminate in a minute rounded lobe. There is a delicate membranous plate attached to the base of the first pair of legs.

The eggs are very clearly seen in the cavity of the thorax, which they almost completely fill.

Body of female smooth throughout its entire length.

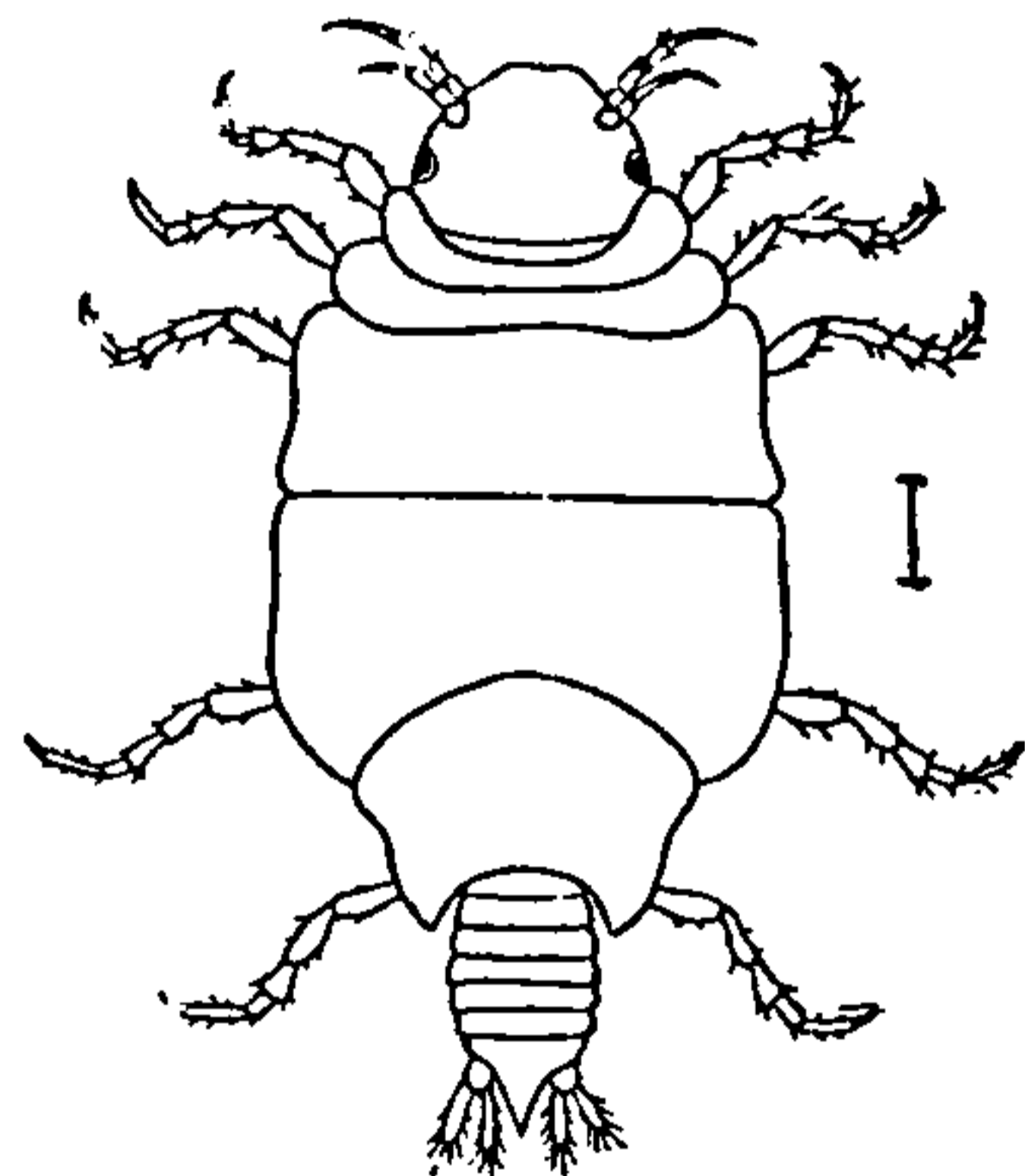


FIG. 45.—GNATHIA CERINA (AFTER HARGER). FEMALE.

*Description of larva.*—Body oblong-ovate, three times as long as wide,  $1\frac{1}{2}$  mm. :  $4\frac{1}{2}$  mm.

Head small, about  $\frac{1}{2}$  mm. long and  $\frac{1}{2}$  mm. wide at the base, with the front produced in a small truncated lobe. The eyes are large, round, compositē, situated at the sides of the head and occupying almost the whole of the lateral margin. The first and second antennæ are about as in the male.

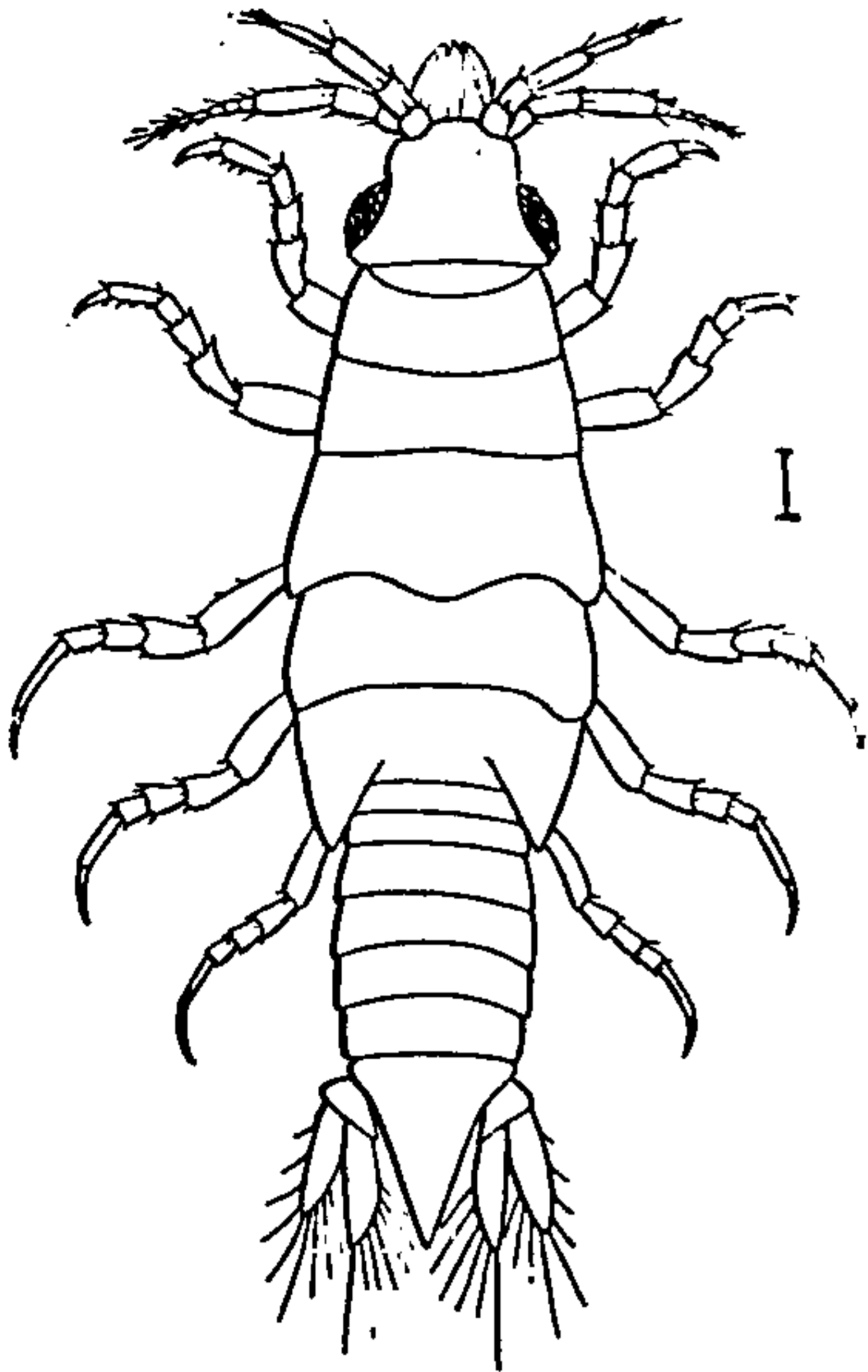


FIG. 46.—GNATHIA CERINA  
(AFTER HARGER). LARVA.

The first segment of the thorax is rudimentary and consolidated with the head. The second and third segments of the thorax are short and subequal; the fourth and fifth segments are united into one extremely long segment, which is also wider than the two preceding segments. The sixth segment is short and gradually decreases in width, at its anterior extremity being almost as wide as the preceding elongated segment, but at its posterior extremity being almost as narrow as the abdomen. The seventh segment is similar to the abdominal segments.

The abdomen is about  $\frac{1}{2}$  mm. wide. The first five segments are subequal. The sixth or terminal segment and the uropoda are as in the male.

There are apparently but five pairs of legs. The first pair of legs are small and surround the mouth; they are composed of six articles. The seventh pair is wanting.

The mouth parts project conspicuously in front of the head.

#### Family IV. ANTHURIDÆ.<sup>a</sup>

Body long and narrow, nearly cylindrical in form. Head comparatively small. Segments of thorax well defined and without distinct epimera. Abdomen comparatively short, with the anterior segments sometimes completely or partially fused. Mouth parts modified for suction. First pair of legs larger and stronger than the others and subchelate; the two following pairs also subchelate, but smaller and more feeble; the four posterior pairs ambulatory. First pair of pleopoda large and expanded, more or less covering the others, especially in female. Uropoda with the outer or superior branch arching over the base of the telson.

<sup>a</sup> See Sars, Crust. of Norway, pp. 43–44, and Norman and Stebbing, Trans. Zool. Soc. Lond., XII, 1886, Pt. 4, pp. 119–120, for characters of family.

ANALYTICAL KEY TO THE GENERA OF THE FAMILY ANTHURIDÆ.<sup>a</sup>

- a.* Labium terminating in two rounded lobes. Mandibles with cutting edge composed of two or three blunt teeth. First maxillæ simple, terminating in conspicuous and well-developed teeth. Maxillipeds with palp composed of one to four articles.
- b.* First five segments of abdomen coalesced into a single segment in the female. Maxillipeds with palp composed of two articles. Flagella of both pairs of antennæ rudimentary in both sexes. Flagellum of first pair not greatly developed in male ..... Genus *Cyathura* Norman and Stebbing
- b'.* Segments of abdomen distinct in the female.
- c.* Maxillipeds with the palp composed of a single article. Flagella of both pairs of antennæ in the female composed of only a few articles. In the male the first pair has a multi-articulate flagellum. Mandible with a one-jointed palp ..... Genus *Ptilanthura* Harger
- c'.* Maxillipeds with a palp composed of four articles. Flagella of both pairs of antennæ multi-articulate; that of first pair in the male developed into a remarkable brush-like organ. Mandible with a three-jointed palp.  
Genus *Anthelura* Norman and Stebbing
- a'.* Labium terminating in two points, acuminate. Mandibles without teeth, terminating in an acutely pointed lancet-like organ. First maxillæ simple, spear-like, terminal part armed with recurved teeth. Maxillipeds with basal part narrow, oblong; palp composed of three articles. Segments of abdomen distinct in female.
- b.* All seven pairs of legs present in adult. Seventh thoracic segment normal, well developed.
- c.* Both pairs of antennæ in both sexes with multi-articulate flagella.  
Genus *Calathura* Norman and Stebbing
- c'.* First pair of antennæ in both sexes have the flagellum multi-articulate. Second pair of antennæ in both sexes have a rudimentary flagellum composed of a single article..... Genus *Paranthura* Bate and Westwood
- b'.* Seventh pair of legs absent in adult. Seventh thoracic segment very short, abruptly narrower than preceding sixth segment and not as wide as the abdominal segments. First pair of antennæ composed of four articles, the last article being the rudimentary flagellum. Second pair of antennæ composed of five articles..... Genus *Colanthura* Richardson

13. Genus CYATHURA Norman and Stebbing.<sup>b</sup>

First five segments of abdomen coalesced into a single segment in the female. Flagella of both pairs of antennæ rudimentary. Maxillipeds with a palp composed of two articles. Mouth parts otherwise as in *Ptilanthura* and *Anthelura*.

CYATHURA CARINATA (Krøyer).<sup>c</sup>

? *Anthura gracilis* DE KAY, Zool. New York, Crust., 1844, p. 44, pl. ix, fig. 34.

*Anthura carinata* KRØYER, Naturh. Tidsskr. (2), II, 1846-49, p. 402; Voy. en Scand., 1849, pl. xxvii, fig. 3.

<sup>a</sup> Norman and Stebbing's key has been used with slight modifications. See Trans. Zool. Soc. Lond., XII, 1886, Pt. 4, pp. 121-122.

<sup>b</sup> See Norman and Stebbing, Trans. Zool. Soc., Lond., XII, 1886, Pt. 4, p. 121, for characters of genus.

<sup>c</sup> Norman and Stebbing give an excellent description of this form.

*Anthura polita* STIMPSON, Proc. Acad. Nat. Sci., Phila., VII, 1856, p. 393.

*Anthura carinata* SCHIÖDTE, Naturh. Tidsskr. (3), X, 1875-76, p. 211, pl. iv, figs. 1-14.

*Anthura brunnea* HARGER, with VERRILL, Report U. S. Commissioner of Fish and Fisheries, Pt. 1, 1873, p. 572 (278); p. 426 (132).

*Anthura carinata* SCHIÖDTE, Ann. Mag. Nat. Hist. (4), XVIII, 1876, p. 253.—MEINERT, Naturh. Tidsskr. (3), XI, 1877, p. 77.

*Anthura polita* HARGER, Proc. U. S. Nat. Mus., II, 1879, p. 162; Report U. S. Commissioner of Fish and Fisheries, Pt. 6, 1880, pp. 398-402, pl. xi, figs. 68-69.

*Anthura carinata* MEINERT, Naturh. Tidsskr. (3), XII, 1880, p. 470.

*Cyathura carinata* NORMAN and STEBBING, Trans. Zool. Soc. Lond., XII, 1886, Pt. 4, pp. 124-125.

*Anthura carinata* KUHLGATZ, Wissenschaftliche Meeresuntersuchungen, III, 1898, pp. 148-149, pl. iii, figs. 4-19.

*Cyathura carinata* RICHARDSON, American Naturalist, XXXIV, 1900, p. 215; Proc. U. S. Nat. Mus., XXIII, 1901, p. 508.

*Localities.*—Norfolk, Virginia; Great Egg Harbor, New Jersey; Long Island Sound; Noank Harbor, Connecticut; off Block Island; East Providence, Rhode Island; Vineyard Sound; Gloucester, Massachusetts; Greenland; Denmark; Kielerbucht, Germany (Karl Moebius).

*Depth.*—Surface to 19½ fathoms, in shells and mud, eel-grass and algæ, sand and stones. (Harger.)

Body very narrow, elongate, a little more than seven times longer than wide, 2 mm. : 15 mm.

Head a little wider than long, 1 mm. : 1½ mm., with the anterior margin excavate on either side of a small median point. Eyes small, distinct. The first pair of antennæ have the first two articles about equal in length; the third article is a little shorter than the second; the fourth or flagellar article is about half as long as the third. The first antennæ extend to the end of the fourth article of the second antennæ. The second pair of antennæ have the basal article short; the second article is about twice as long as the first; the third article is half as long as the second; the fourth is a little shorter than the third; the fifth is one and a half times longer than the fourth; the sixth or flagellar article is very short and is about half as long as the fifth. The second antennæ

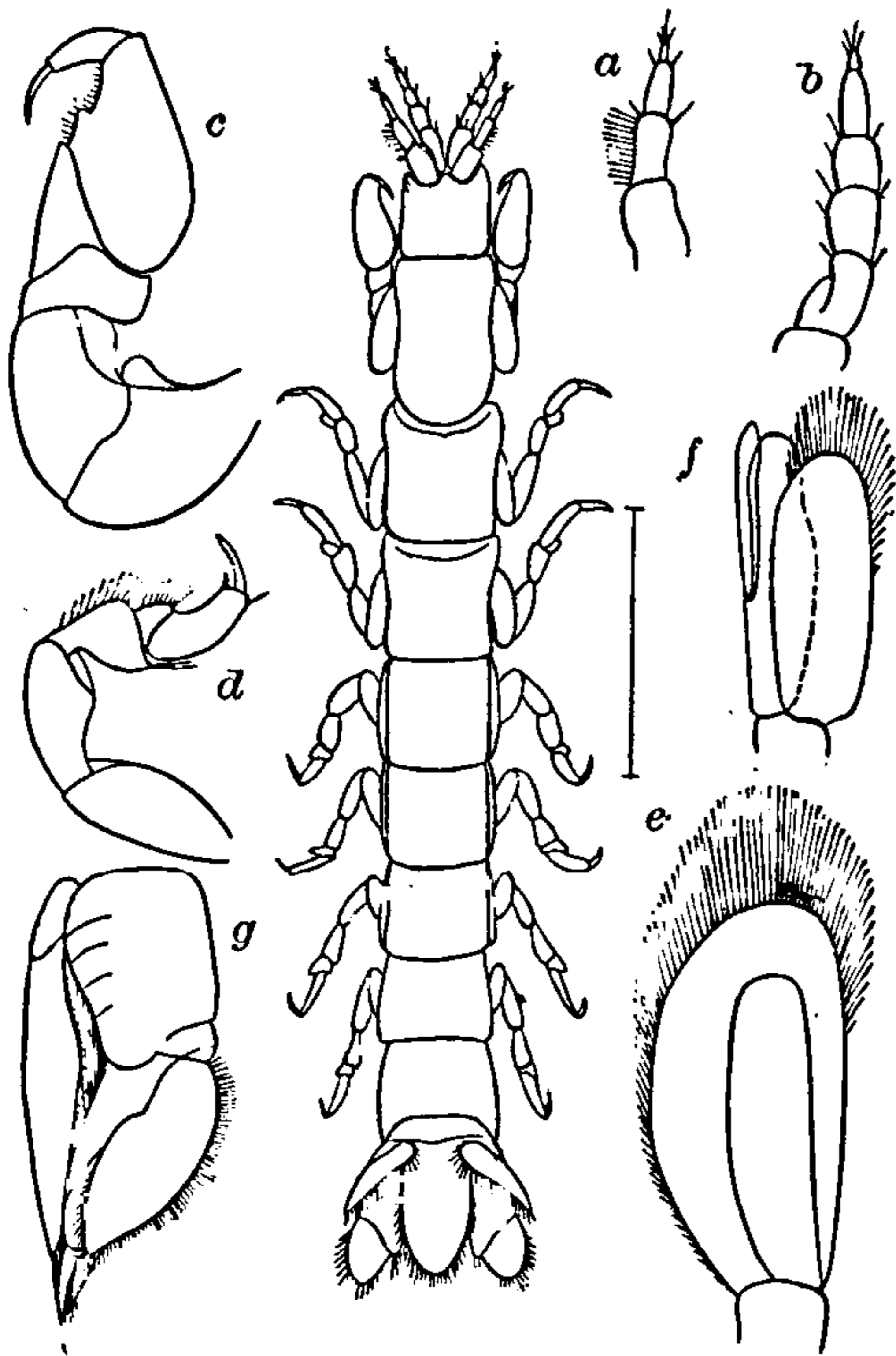


FIG. 47.—CYATHURA CARINATA (AFTER HARGER). *a*, FIRST ANTENNA.  $\times 10$ . *b*, SECOND ANTENNA.  $\times 10$ . *c*, FIRST LEG.  $\times 8$ . *d*, THIRD LEG.  $\times 8$ . *e*, FIRST PLEOPOD.  $\times 8$ . *f*, SECOND PLEOPOD OF MALE.  $\times 8$ . *g*, LATERAL VIEW OF ABDOMEN.  $\times 6$ .

very short and is about half as long as the fifth. The second antennæ

are  $1\frac{1}{2}$  mm. long. The maxillipeds have a palp of two articles. The palp of the mandibles is composed of three articles.

The first, fourth, and fifth segments of the thorax are 2 mm. in length. The second and third segments are  $1\frac{1}{2}$  mm. long. The sixth and seventh segments are each  $1\frac{1}{2}$  mm. long. The epimera are long and extremely narrow plates extending the entire length of the segments and not separated off by distinct sutures.

The entire length of the abdomen is  $3\frac{1}{2}$  mm., or a little less than one-fifth the entire length of the body. The first six segments are fused into a single segment about  $1\frac{1}{2}$  mm. long, which has no trace of suture lines. The seventh segment or tel-

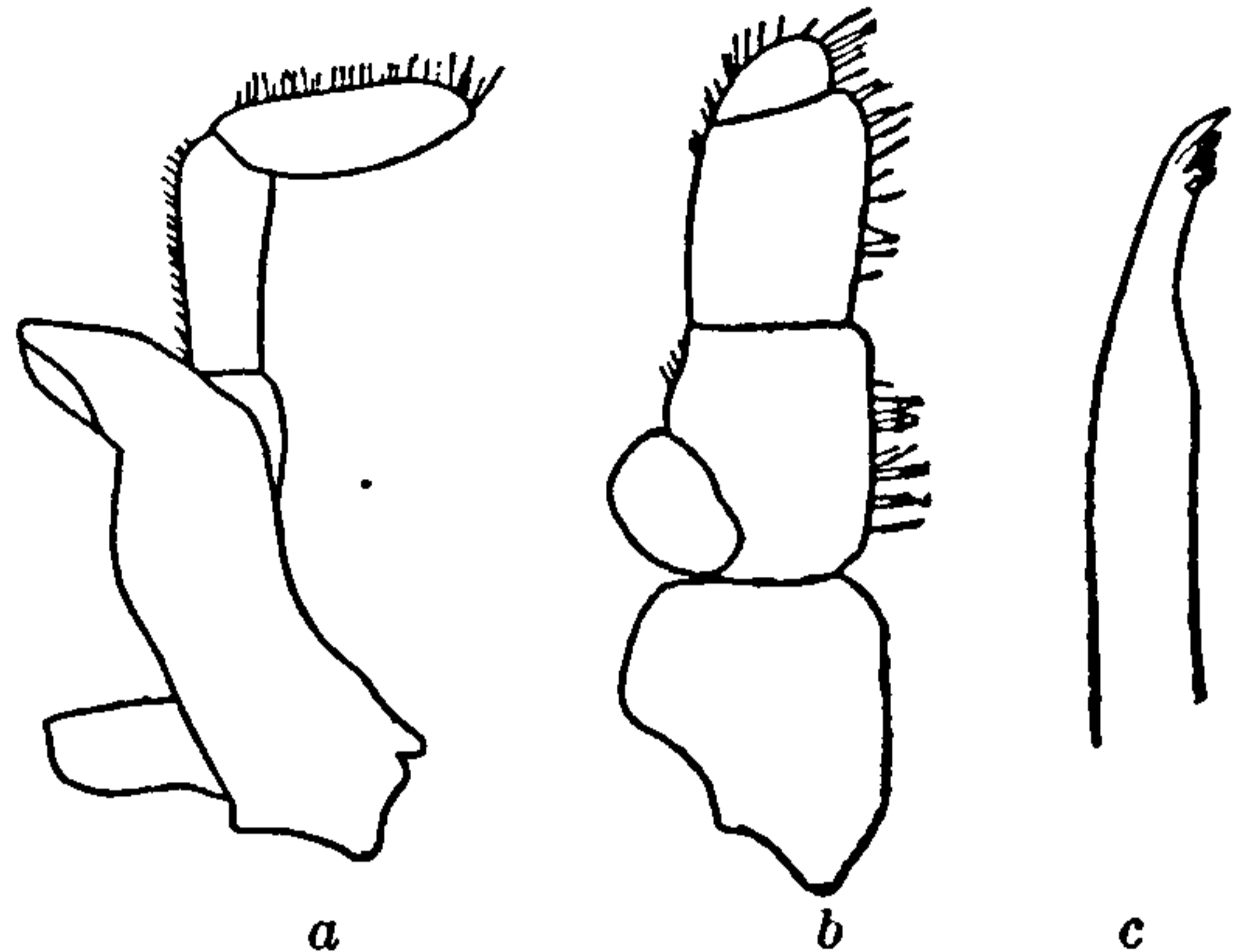


FIG. 48.—CYATHURA CARINATA. a, MANDIBLE.  $\times 51\frac{1}{2}$ . b, MAXILLIPED.  $\times 51\frac{1}{2}$ . c, FIRST MAXILLA.  $\times 51\frac{1}{2}$ .

son is narrow, elongate, and rounded posteriorly. The peduncle of the uropoda is as long as the superior branch and extends two-thirds the length of the telson. The inner, lateral branch is placed at the posterior end of the peduncle and is rounded posteriorly; it extends the remaining third of the length of the telson and reaches the extremity of that segment. The dorsal or superior branch does not arch over the telson, but lies directly upon its dorsal surface; it extends to the end of the peduncle, is somewhat triangular in shape, narrow and elongate, with apex acute.

The first three pairs of legs are prehensile. All the others are ambulatory in structure. The first pair are larger and stronger than the two following pairs, and there is a tooth on the inferior margin of the propodus.

Three specimens—one from Marco, Florida, another from Cedar Keys, Florida, and a third from off South Carolina—differ from the other specimens in the collection, in having the last article of the first pair of antennæ as long as the third; in having a

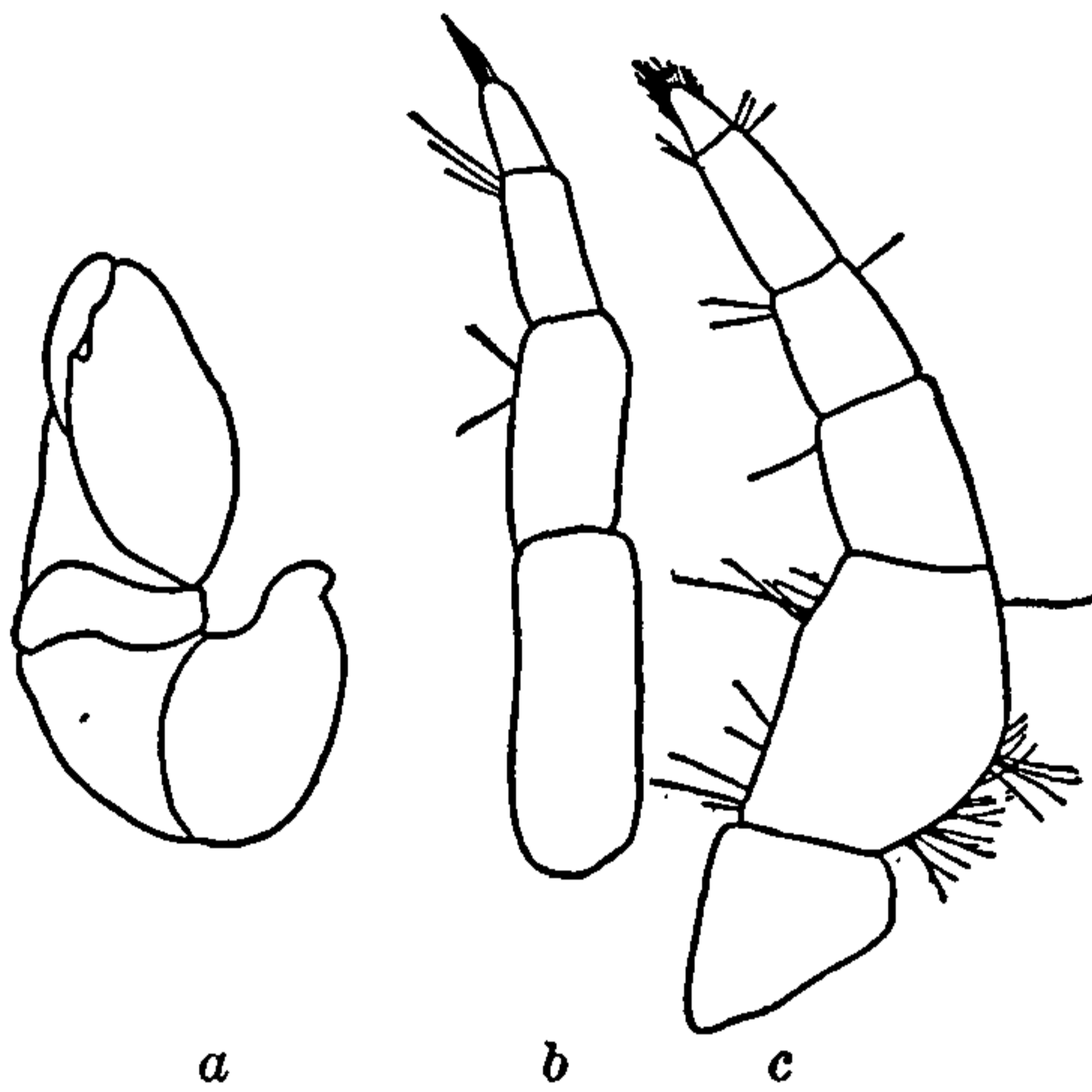


FIG. 49.—CYATHURA CARINATA. a, FIRST LEG.  $\times 11\frac{1}{2}$ . b, FIRST ANTENNA.  $\times 20\frac{1}{2}$ . c, SECOND ANTENNA.  $\times 20\frac{1}{2}$ .

rounded prominence instead of a tooth on the propodus of the first pair of legs; in having the anterior segments of the abdomen quite apparent at the sides, though fused and not apparent in the middle of the dorsal surface; in having the peduncle of the uropoda about half the length of the telson instead of two-thirds its length, the inner branch being as long as the peduncle; in having the fourth, fifth, and

sixth segments of the thorax subequal and each about one-half mm. longer than any of the other segments, which are about subequal, and in having the second article of the palp of the maxillipeds quadrate and as large as the first article of the palp.

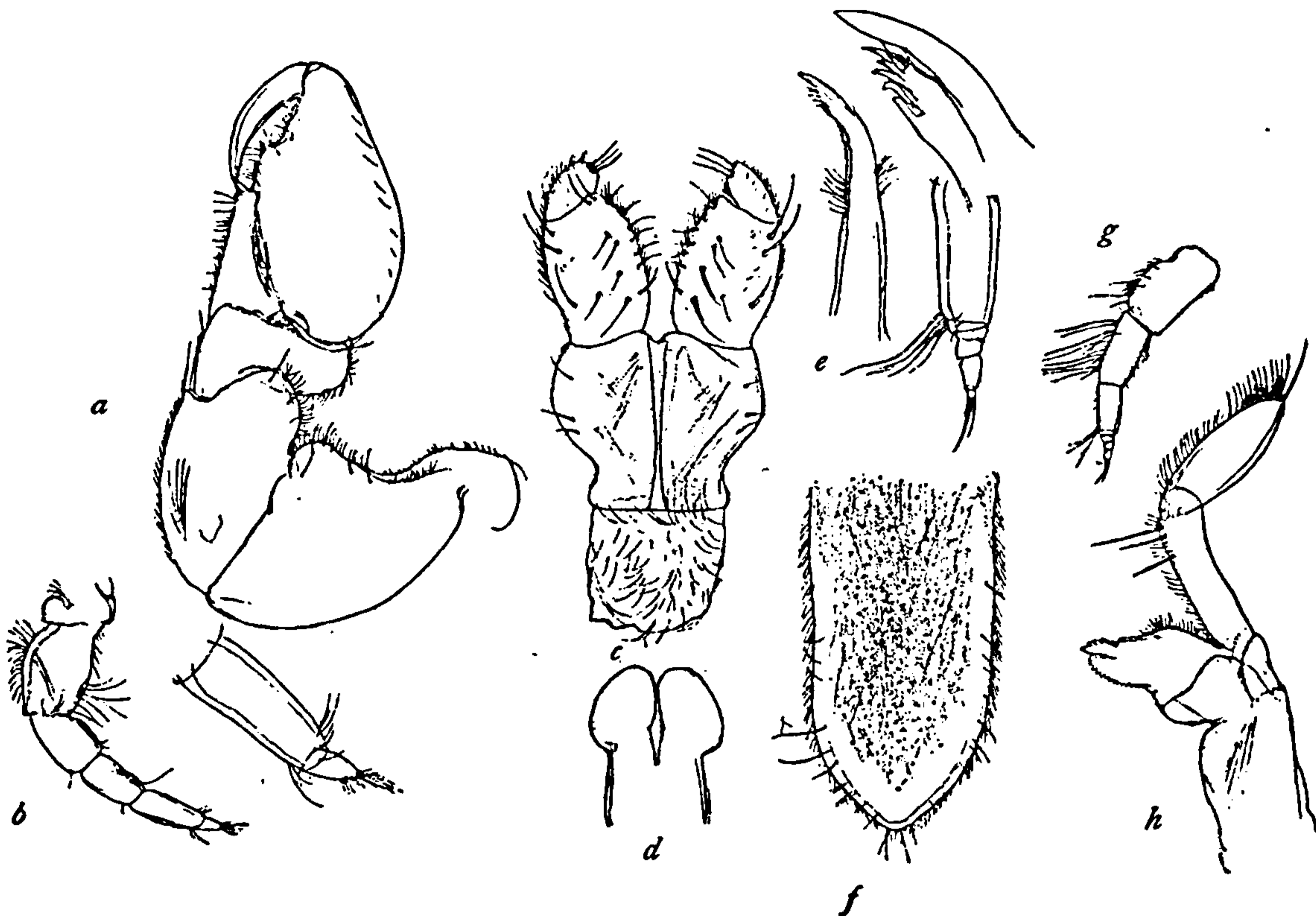


FIG. 50.—*CYATHURA CARINATA* (AFTER NORMAN AND STEBBING). *a*, FIRST GNATHOPOD. *b*, LOWER ANTENNA. *c*, MAXILLIPED. *d*, LABIUM. *e*, FIRST MAXILLA. *f*, END OF TELSON. *g*, UPPER ANTENNA. *h*, MANDIBLE AND PALP.

#### 14. Genus *PTILANTHURA*<sup>a</sup> Harger.

First five segments of abdomen distinct in the female and in the male. The flagella of both pairs of antennæ in the female are composed of only a few articles. In the male, the first pair has a multiarticulate flagellum. The maxillipeds have a palp of one article, which is broad and flattened and similar to the basal article; epignath small, rounded. Labium terminating in two broadly rounded lobes. First maxillæ terminating in well-developed teeth. Mandibles with a palp composed of a single article.

#### *PTILANTHURA TENUIS* Harger.<sup>b</sup>

*Ptilanthura tenuis* HARGER, Am. Jour. Sci. (3), XV, 1878, p. 377; Proc. U. S. Nat. Mus., 1879, II, p. 62; Report U. S. Commissioner of Fish and Fisheries, 1880, Pt. 6, pp. 406–408, pls. XI, XII, figs. 71–74.

<sup>a</sup>See Harger, Report U. S. Commissioner of Fish and Fisheries, 1880, Pt. 6, pp. 405–406, for characters of genus.

<sup>b</sup>See Harger for complete description of this species.



*Anthura tenuis* NORMAN and STEBBING, Trans. Linn. Soc. London, XII, 1886, Pt. 4, p. 124.—RICHARDSON, American Naturalist, XXXIV, 1900, p. 215; Proc. U. S. Nat. Mus., XXIII, 1901, p. 508.

• *Ptilanthura tenuis* STEBBING, Willey's Zool. Results, 1902, p. 619.

*Localities*.—Noank Harbor, Connecticut; Long Island Sound; off Watch Hill, Rhode Island; off Block Island; Waquoit, Vineyard Sound; Casco Bay, Maine; Bay of Fundy; Grand Menan, New Brunswick.

*Depth*.—Surface to 19 fathoms. Taken on muddy bottom; in sand, mud, and stones; at low water, in sand.

Body extremely narrow, elongate, about eight times longer than wide, 1 mm.:  $8\frac{1}{2}$  mm. Head about as wide as long, with the anterior margin triangularly produced in a small median process. Eyes small, round, distinct, and situated in the antero-lateral angles of the head. The second pair of antennæ have the basal article short; the second article is twice as long as the first; the third and fourth are short and subequal, both together being as long as the basal article; the fifth is twice as long as the fourth; the flagellum is composed of four articles, the first of which is about half as long as the last peduncular article. The second pair

of antennæ extend to the end of the fourth article of the peduncle of the first pair of antennæ. The first pair of antennæ have the first article long; the second and third are subequal and each is a little longer than the first. The first article of the flagellum is very short, about one-third as long as the second peduncular article; the second article of the flagellum is about twice as long as the first. The flagellum is composed of twenty-one articles, which are furnished with long hairs. The first antennæ are  $2\frac{1}{2}$  mm. long. The maxillipeds have a palp of one article. The palp of the mandibles is composed of one article.

The first, second, third, and sixth segments of the thorax are subequal, each being 1 mm. in length. The fourth and fifth segments are a little longer. The seventh segment is half a mm. long.

The first six segments of the abdomen are short, distinct, and subequal, with the exception of the last, which is about half as long as any of the five preceding ones. The seventh segment or telson is long

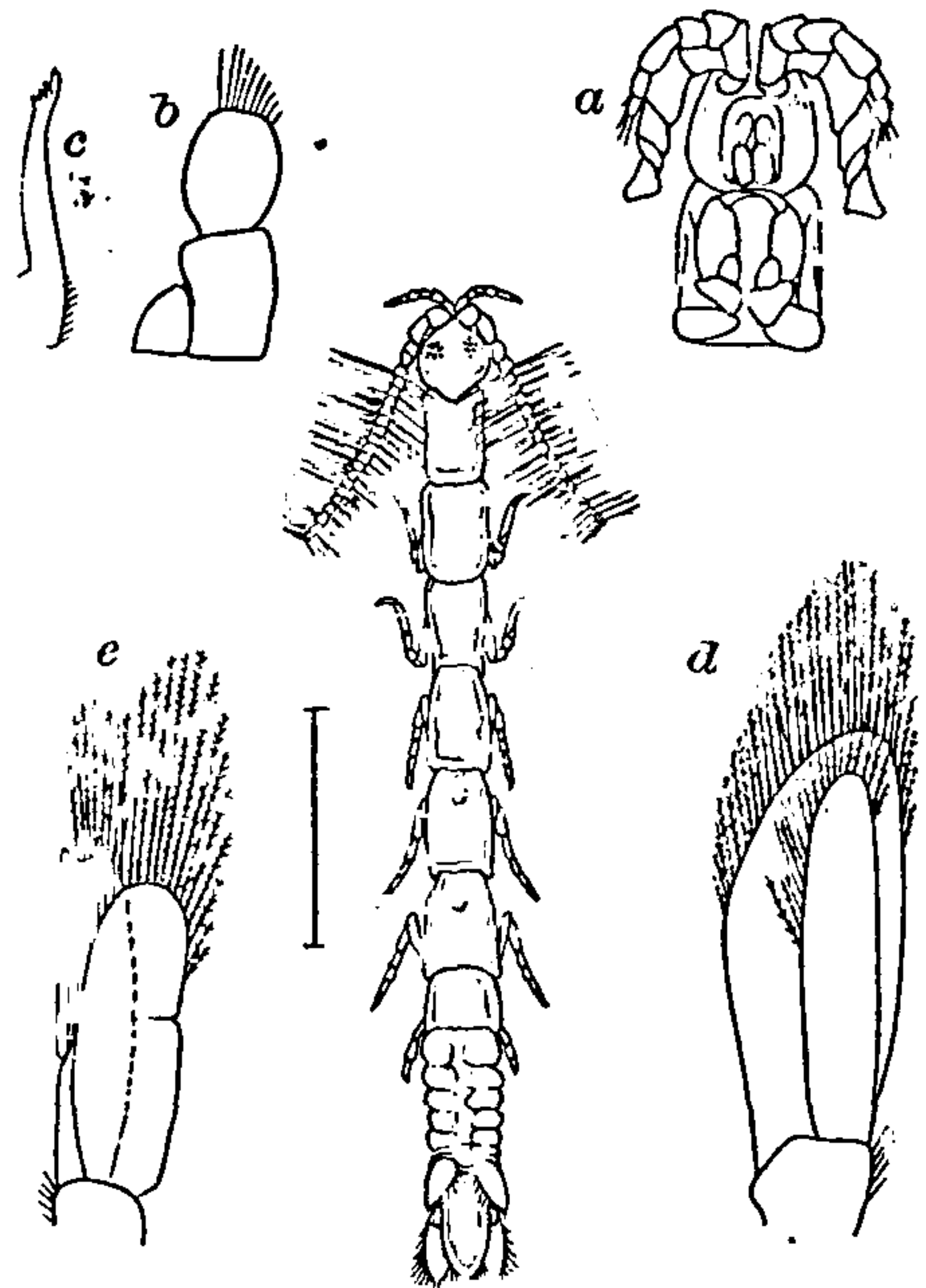


FIG. 51.—PTILANTHURA TENUIS (AFTER HARGER). a, HEAD WITH ANTENNAE AND FIRST THORACIC SEGMENT (VENTRAL SIDE).  $\times 8$ . b, MAXILLIPED.  $\times 50$ . c, FIRST MAXILLA. d, FIRST PLEOPOD.  $\times 20$ . e, SECOND PLEOPOD OF MALE.  $\times 20$ .

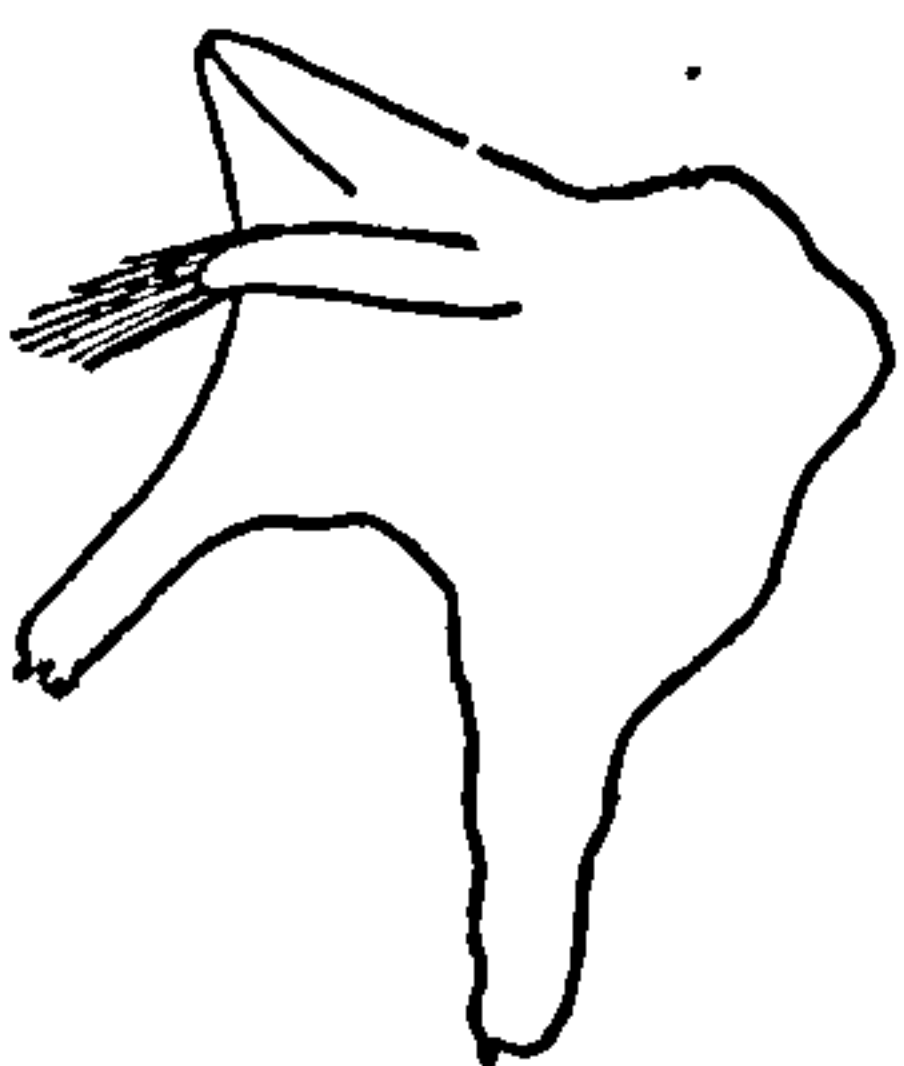


FIG. 52.—PTILANTHURA TENUIS. MANDIBLE.  $\times 77\frac{1}{2}$ .

and narrow, with the extremity rounded. The peduncle of the uropoda is short and extends only half the length of the telson. The inner lateral branch is placed at the extremity of the peduncle; it does not quite reach the extremity of the telson, and is posteriorly rounded.

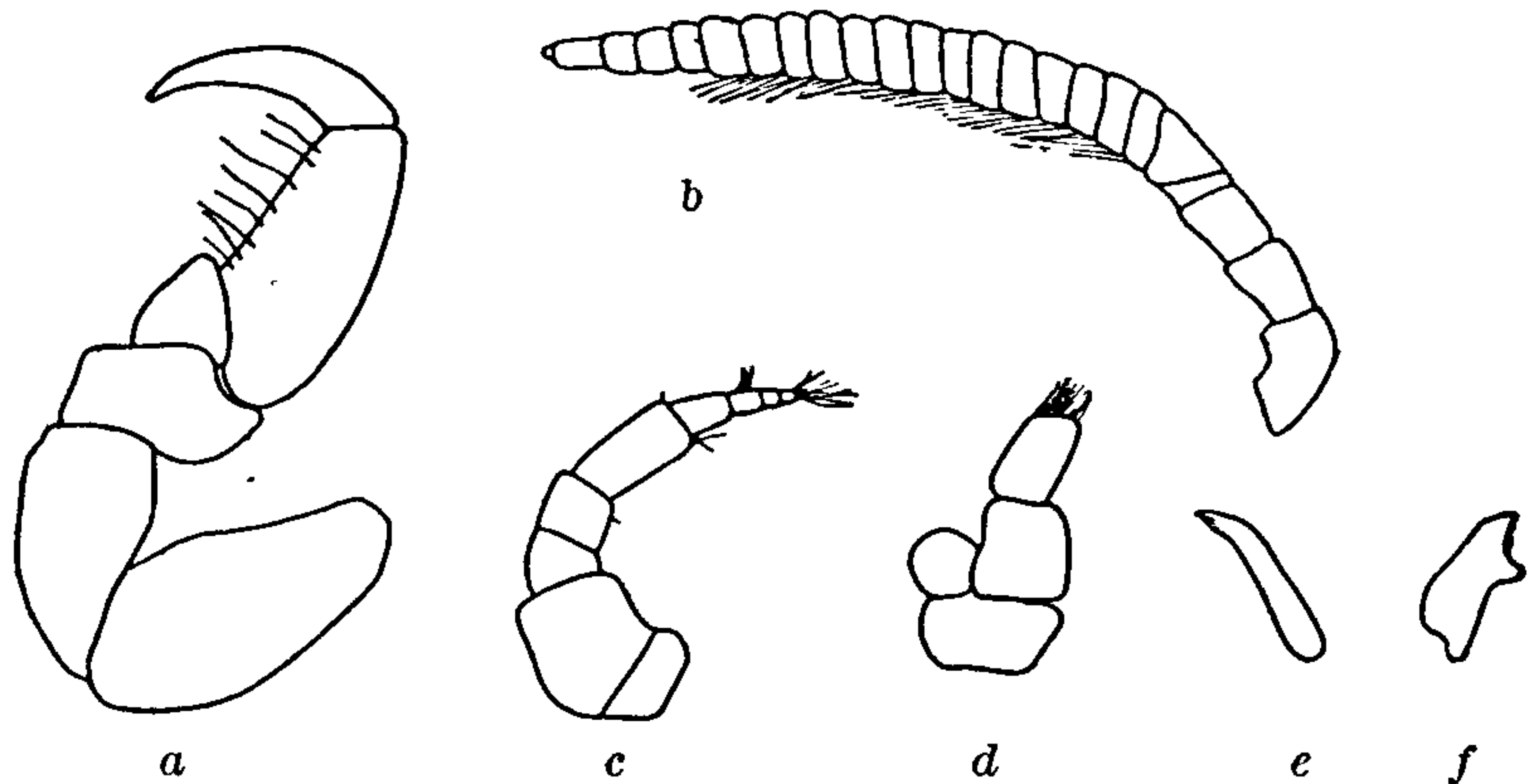


FIG. 53.—PTILANTHURA TENUIS. *a*, FIRST LEG.  $\times 51\frac{2}{3}$ . *b*, FIRST ANTENNA.  $\times 27\frac{1}{2}$ . *c*, SECOND ANTENNA.  $\times 51\frac{2}{3}$ . *d*, MAXILLIPED.  $\times 51\frac{2}{3}$ . *e*, FIRST MAXILLA.  $\times 51\frac{2}{3}$ . *f*, MANDIBLE (WITHOUT PALP).  $\times 51\frac{2}{3}$ .

The outer and superior branch extends to the end of the peduncle and is somewhat triangular in shape, with apex acute.

The first three pairs of legs are prehensile, the first pair being much larger and stouter than the two following pairs. All the others are ambulatory.

### 15. Genus ANTHELURA Norman and Stebbing.<sup>a</sup>

Segments of abdomen distinct in female. Flagella of both pairs of antennæ multi-articulate; that of first pair "in the male developed into a remarkable brush-like organ nearly equal in length to half the animal, and composed of very numerous, short, broad, and densely ciliated joints." Maxillipeds with a palp composed of four articles. Mouth parts otherwise as in *Cyathura*.

#### ANALYTICAL KEY TO THE SPECIES OF THE GENUS ANTHELURA.

- a*. Uropoda with the outer and upper plates wide apart dorsally, broadly triangular or spear-shaped, nearly as long as the inner plate, which is similar in form but narrower. Telson broadly lanceolate, apex rather acute, about equal in length to the uropods.....*Anthelura abyssorum* Norman and Stebbing
- a'*. Uropoda with the outer and superior branches meeting dorsally, long, oval in form. Inner branch with posterior margin widely rounded. Telson narrowly linguiform, roundly triangular at the apex. Outer and superior branch as long as telson. Inner branch extending beyond telson...*Anthelura affinis* Richardson

<sup>a</sup>See Norman and Stebbing for characters of genus. Trans. Zool. Soc., Lond., XII, 1886, Pt. 4, p. 121.

## ANTHELURA ABYSSORUM Norman and Stebbing.

*Anthelura abyssorum* NORMAN and STEBBING, Trans. Zool. Soc. Lond., XII, 1886, Pt. 4, pp. 127-128, pl. xxvii, fig. 2.—HANSEN, Videnskabelige Meddelelser fra den Naturhistoriske Forening i Kjøbenhavn, 1887-1888, p. 181.—RICHARDSON, American Naturalist, XXXIV, 1900, p. 215; Proc. U. S. Nat. Mus., XXIII, 1901, p. 508.

*Localities.*—Near entrance of Davis Straits; latitude  $59^{\circ} 10'$  north, longitude  $50^{\circ} 25'$  west.

*Depth.*—1,750 fathoms.

“Head and peræon of nearly equal width throughout; second segment of the latter scarcely at all constricted behind. The whole of the segments smooth above, and devoid of all furrowing and pitting; last segment of peræon half as long as the preceding segments of pleon, very clearly defined, and (exclusive of telson) subequal in length to penultimate segment of peræon.

“The antennæ have the joints of the peduncle in both pairs flattened, the lower pair touching each other with the compressed inner margins, and appearing between the upper pair, as in *Anthelura elongata*; flagella of both pairs many jointed.

“First gnathopods having basos short and very thick; ischium scarcely longer, and not so broad; cup of meros well rounded; carpus small as usual, bearing five or six spine-like setæ; hand about twice as long as greatest breadth; palm concave, bearing about eight slender spine-like setæ.

“Second gnathopods having basos and ischium more slender than in first pair; meros of similar form; carpus edged with several spine-like setæ and one spine; hand elongate-ovate, palm with three spines and a few setæ.

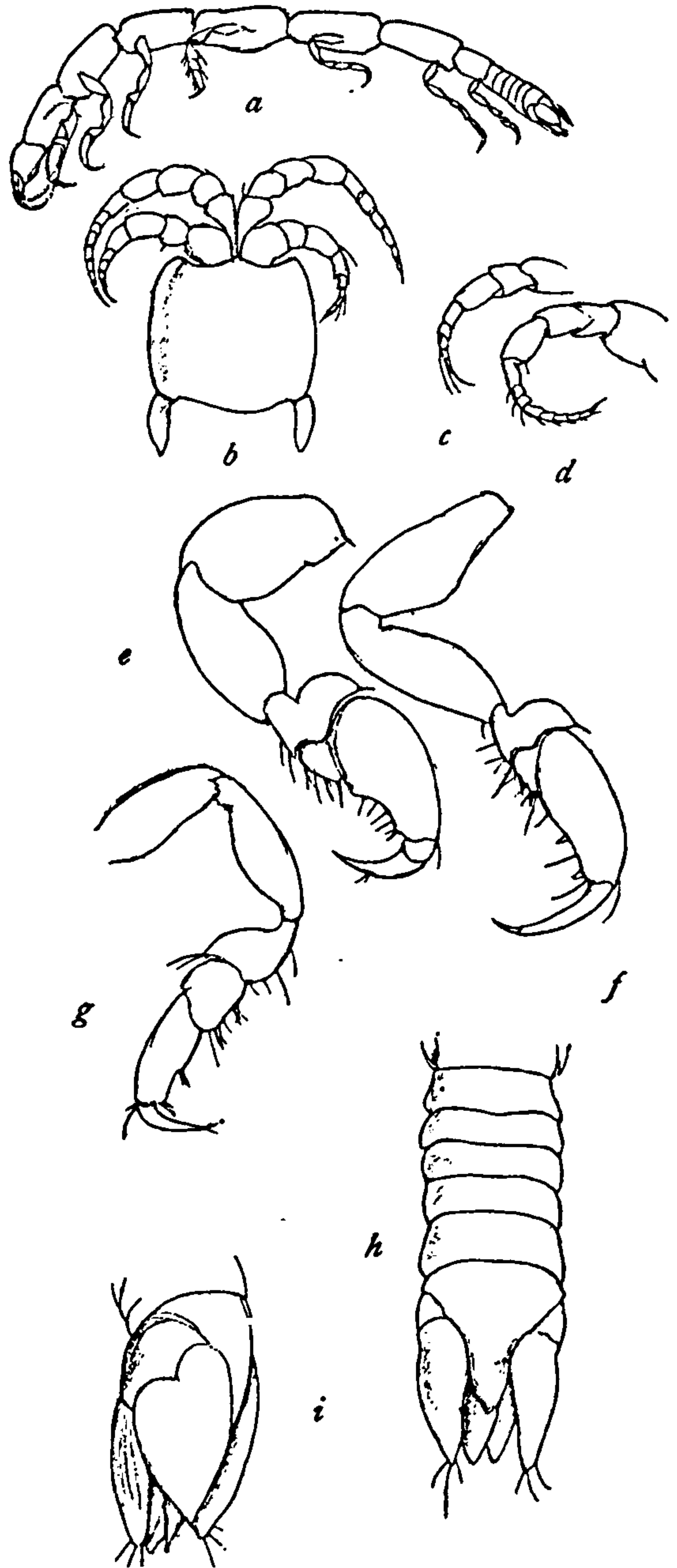


FIG. 54.—ANTHELURA ABYSSORUM (AFTER NORMAN AND STEBBING). a, LATERAL VIEW. b, HEAD (FROM ABOVE). c, UPPER ANTENNA. d, LOWER ANTENNA. e, FIRST GNATHOPOD. f, SECOND GNATHOPOD. g, FIFTH PEREPOD. h, ABDOMEN (FROM ABOVE). i, ABDOMEN (FROM THE SIDE).

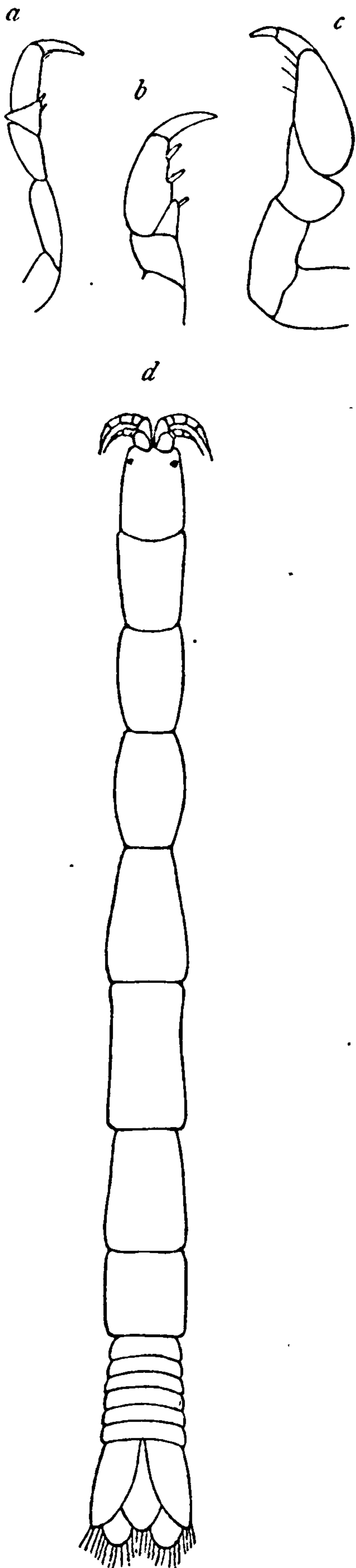


FIG. 55.—ANTHELURA AFFINIS. *a*, SIXTH PERIOPOD. *b*, SECOND GNATHOPOD. *c*, FIRST GNATHOPOD. *d*, GENERAL FIGURE.

“Last peræopods having the propodus half as long again as the carpus, and the dactylos subequal to the carpus; carpus and propodus each furnished with two forked spines on their anterior margin.

“First pleopods large, covering the whole of the remaining pleopods, against which they are closely pressed.

“Uropods with outer and upper plates wide apart dorsally, broadly triangular or spear-shaped, longer than wide, and as long or nearly as long as the inner plate, which is very similar in form but narrower, with well-rounded extremities; both are tipped with a few setæ, which are, however, very easily abraded.

“Telson much depressed, broadly lanceolate, apex rather acute, about equal in length to the uropods.

“Length, 9 mm., or about three-sixteenths of an inch.”—NORMAN and STEBBING.<sup>a</sup>

#### ANTHELURA AFFINIS Richardson.

*Anthelura affinis* RICHARDSON, Trans. Conn. Acad. Sciences, XI, 1902, pp. 288–289, pl. xxxviii, figs. 29–32.

*Locality*.—Bermudas.

Body narrow, elongate. Head with small median point. Eyes distinct, situated in antero-lateral angulations.

Antennæ of both pairs with flagella consisting of several joints, and fringed with long hairs at the tip. Maxillipeds consist of five joints.

First three thoracic segments about equal in length. Three following segments somewhat longer, and subequal. Seventh segment fully half the length of preceding segment.

All the segments of the abdomen distinctly defined. Terminal segment narrowly linguiform, roundly triangulate at the apex and with smooth margins.

Outer superior branch of uropoda long, oval, reaching quite to the extremity of

<sup>a</sup>Trans. Zool. Soc. Lond., XII, 1886, Pt. 4, pp. 127–128.

the terminal abdominal segment, and arching over the telson. Inner branch with posterior margin widely rounded and extending beyond telson. Both branches have the margins smooth, entire.

First gnathopods with small hand. Dactylus short. Free inner margin of propodus furnished with hairs. Second gnathopods and first pereopods similar in shape to, but smaller in size than first pair of gnathopods. The free inner margin of the propodus is beset with two spines, the carpus with one spine. The remaining pereopods have a single spine at the distal margin of the propodus and two spines on the carpus.

One specimen, a female, was collected by Prof. A. E. Verrill at the Bermudas in 1901.

Type in Peabody Museum of Yale University. Cat. No. 3349.

This species differs from *A. elongata* Norman, in the shape of the outer branch of the uropoda; in the length of both branches, as compared with the terminal abdominal segment, and in the fact that the margins of the outer branch in this species are smooth and not crenulate, as in *A. elongata*.

#### 16. Genus CALATHURA Norman and Stebbing.<sup>a</sup>

Abdomen short with the segments not very distinctly defined in the male, but distinct in the female. Both pairs of antennæ in both sexes with multi-articulate flagella. Buccal mass projecting, cone-shaped. Anterior lip terminating in an obtusely conical point. Posterior lip slightly bifid at the tip. Anterior maxillæ simple, spear-like; terminal part armed with recurved teeth. Maxillipeds with the basal part narrow, oblong; palp composed of three articles; epignath small, rounded. Mandibles terminating in an acutely-pointed lancet-like organ.

##### ANALYTICAL KEY TO THE SPECIES OF THE GENUS CALATHURA.

- a.* Eyes not conspicuous. First pair of antennæ with flagellum twelve jointed, not longer than the length of the head. Second pair of antennæ with the flagellum twelve jointed. First three segments of thorax bounded laterally by carinæ. Terminal segment of body triangular, acute at apex, margin not crenulate. Superior or outer branch of uropoda oval in form, slightly dentated. Inner branch acutely triangular..... *Calathura branchiata* (Stimpson)
- a'.* Eyes conspicuous. First pair of antennæ with flagellum seventeen jointed, more than twice as long as the length of the head. Second pair of antennæ with the flagellum twenty-three jointed. First three segments of thorax not bounded laterally by carinæ. Terminal segment of body linguæ, rounded posteriorly, with crenulate margin. Superior or outer branch of the uropoda narrow, elongated, not dentated. Inner branch rounded.

*Calathura crenulata* Richardson

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<sup>a</sup>See Sars, Crust. of Norway, II, 1899, pp. 44-45, and Norman and Stebbing, Trans. Zool. Soc. Lond., XII, 1886, Pt. 4, p. 122, for characters of genus.

CALATHURA BRANCHIATA (Stimpson).<sup>a</sup>

- Anthura branchiata* STIMPSON, Smithsonian Contributions to knowledge, VI, 1853, p. 43.
- Paranthura norwegica* G. O. SARS, Vidensk. Selsk. Forhandl., 1873, p. 88.
- Anthura branchiata* VERRILL, Am. Jour. Sci. (3), V, 1873, p. 101; VII, 1874, pp. 42, 411, 502; Proc. Amer. Assoc., 1874, pp. 350, 357.—HARGER, with VERRILL; Report U. S. Commissioner of Fish and Fisheries, Pt. 1, 1873, pp. 511 (217), 573 (279).—SMITH and HARGER, Trans. Conn. Acad. Sci., III, 1874, p. 16.
- Paranthura arctica* G. O. SARS, Archiv for Math. og Naturv., 1877, p. 347.—HELLER, Denk. Ak. Wien, XXXV, 1878, p. 38-39, pl. iv, figs. 9-12.
- Paranthura branchiata* HARGER, Report U. S. Commissioner of Fish and Fisheries, Pt. 6, 1880, pp. 402-405, pl. xi, fig. 70.
- Calathura branchiata* NORMAN and STEBBING, Trans. Linn. Soc. Lond., XII, 1886, Pt. 4, pp. 131-133, pl. xxvi, fig. 1.
- Paranthura branchiata* HANSEN, Dijnphna Togtets zool.-bot. Udbytte, 1887, pp. 203-204.
- Calathura branchiata* HANSEN, Vedenskabelige Meddelelser fra den naturhistoriske Forening i Kjøbenhavn, 1887-1888, p. 181.

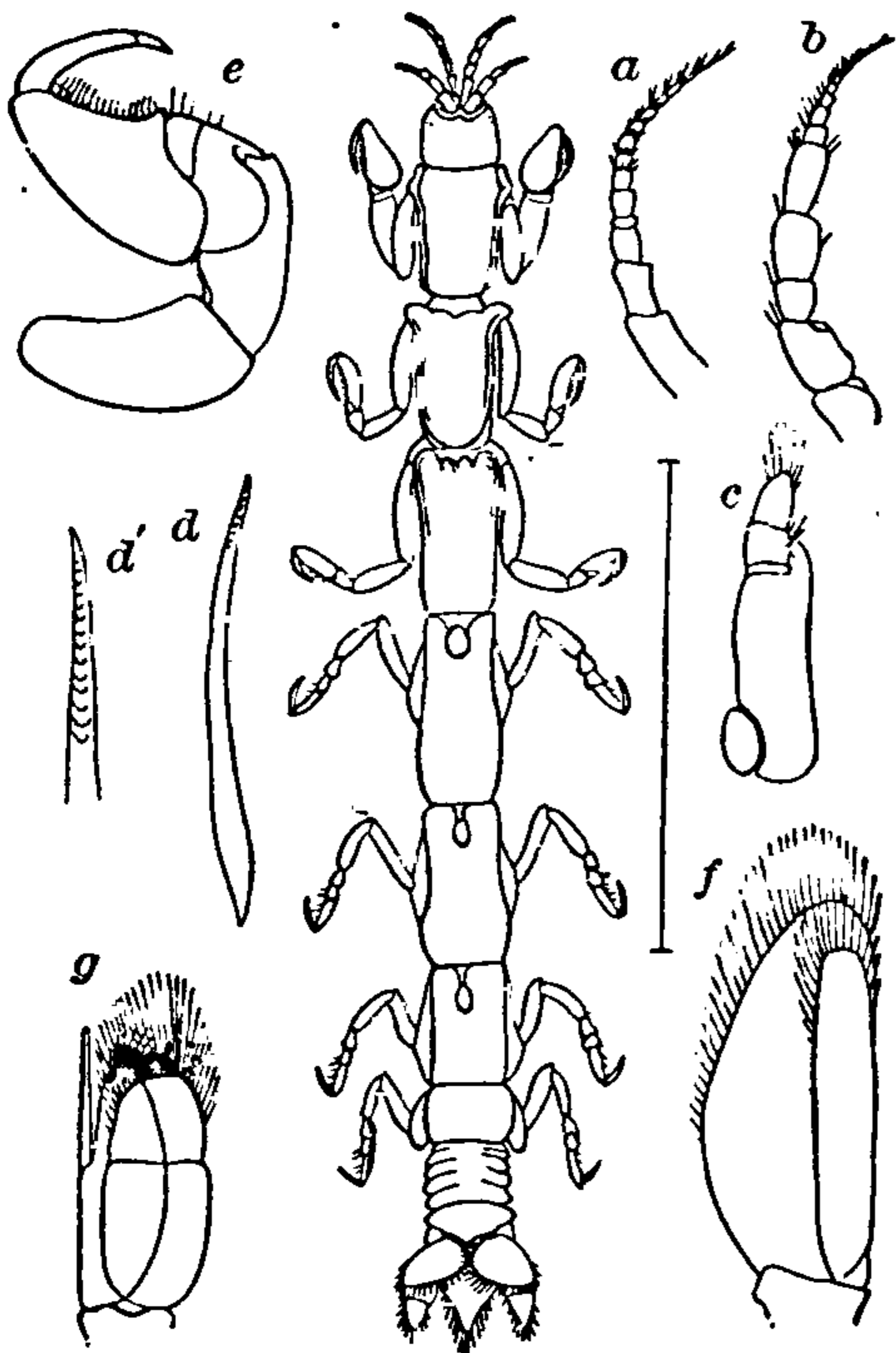


FIG. 56.—CALATHURA BRANCHIATA (AFTER HARGER). *a*, FIRST ANTENNA.  $\times 8$ . *b*, SECOND ANTENNA.  $\times 8$ . *c*, RIGHT MAXILLIPED.  $\times 16$ . *d*, FIRST MAXILLA.  $\times 16$ . *d'*, DISTAL END OF SAME.  $\times 50$ . *e*, FIRST LEG.  $\times 8$ . *f*, FIRST PLEOPOD.  $\times 8$ . *g*, SECOND PLEOPOD OF MALE.  $\times 8$ .

*Paranthura branchiata* AXEL OHLIN, Akademisk Afhandling, XXII, 1895, pp. 12-13.

*Calathura branchiata* SARS, Crust. Norway, II, 1899, pp. 46-47, pl. XIX, fig. 2.—STEBBING, Ann. Mag. Nat. Hist. (7), V, 1900, p. 13.—RICHARDSON, American Naturalist, XXXIV, 1900, p. 215; Proc. U. S. Nat. Mus., XXIII, 1901, p. 509.—AXEL OHLIN, Bihang till K. Sv. Vet.-Akad. Handl., XXVI, Afd. iv, No. 12, 1901, pp. 17-20.

*Localities*.—Bay of Fundy; Vineyard Sound; Georges Bank; Eastport, Maine; Gulf of Maine; west of Jeffreys Ledge; Casco Bay; Nova Scotia; between Misaine Bank and Middle Ground; off Head Harbor; between Middle Ground and Halifax; southeast from Cape Sable; latitude  $70^{\circ} 8'$  north, longitude  $74^{\circ} 20'$  west; also Franz Josefs Land, Kara Sea, Greenland, Jan Mayen, Spitzbergen, off Norway, Scotland, Ireland, and between England and the Bay of Biscay; latitude  $70^{\circ}$  north, longitude  $58^{\circ} 38'$  west; Umanak; latitude  $71^{\circ} 10'$  north, longitude  $58^{\circ} 56'$  west; latitude  $72^{\circ} 20'$  north, longitude  $59^{\circ} 39'$  west (Hansen); latitude  $71^{\circ} 35'$  north, longi-

<sup>a</sup> See Norman and Stebbing for more detailed description.

tude  $22^{\circ} 47'$  east, between Norway and Beeren Island; latitude  $73^{\circ} 27'$  north, longitude  $23^{\circ} 11'$  east, between Norway and Beeren Island; latitude  $77^{\circ} 25'$  north, longitude  $27^{\circ} 30'$  east, north of Hope Island; latitude  $76^{\circ} 46'$  north, longitude  $15^{\circ} 22'$  east, off Horn Sound, West Spitzbergen; King Charles Island, Bremer Sound; latitude  $78^{\circ} 50'$  north, longitude  $27^{\circ} 39'$  east, King Charles Island; latitude  $78^{\circ} 50'$  north, longitude  $29^{\circ} 39'$  east, King Charles Island; latitude  $81^{\circ} 14'$  north, longitude  $22^{\circ} 50'$  east, northeast of Seven Islands; latitude  $79^{\circ} 58'$  north, longitude  $9^{\circ} 30'$  east; 19'–20' north of Danish Island; latitude  $73^{\circ} 3'$  north, longitude  $18^{\circ} 30'$  east, between Beeren Island and Norway (Ohlin); latitude  $71^{\circ} 31'$  north, longitude  $49^{\circ} 12'$  east (Stebbing).

*Depth.*—10–250 fathoms; 20–460 m., in mud, clay, gravel, stones, rocks, barnacles, sand, and shells.

Body extremely narrow and elongate, about ten and a half times longer than broad,  $2\frac{1}{2}$  mm.: 26 mm.

Head a little wider than long,  $1\frac{1}{2}$  mm.: 2 mm., becoming slightly narrower toward the anterior end, which is  $1\frac{1}{2}$  mm. wide, and has the frontal margin excavate on either side of a small median point. The eyes are absent. The first pair of antennæ have the three peduncular articles about equal in length but decreasing in size, the basal one being the largest. The flagellum is composed of ten articles, and extends to the end of the peduncle of the second pair of antennæ. The second pair of antennæ have the basal article short; the second is nearly twice as long; the third is half as long as the second; the fourth is twice as long as the third and about as long as the second, but more slender; the fifth is a little longer than the fourth, about one and a third times longer. The flagellum is composed of eleven articles. The second pair of antennæ are about 3 mm. long. The maxillipeds have a palp of three articles. The palp of the mandibles is composed of three articles.

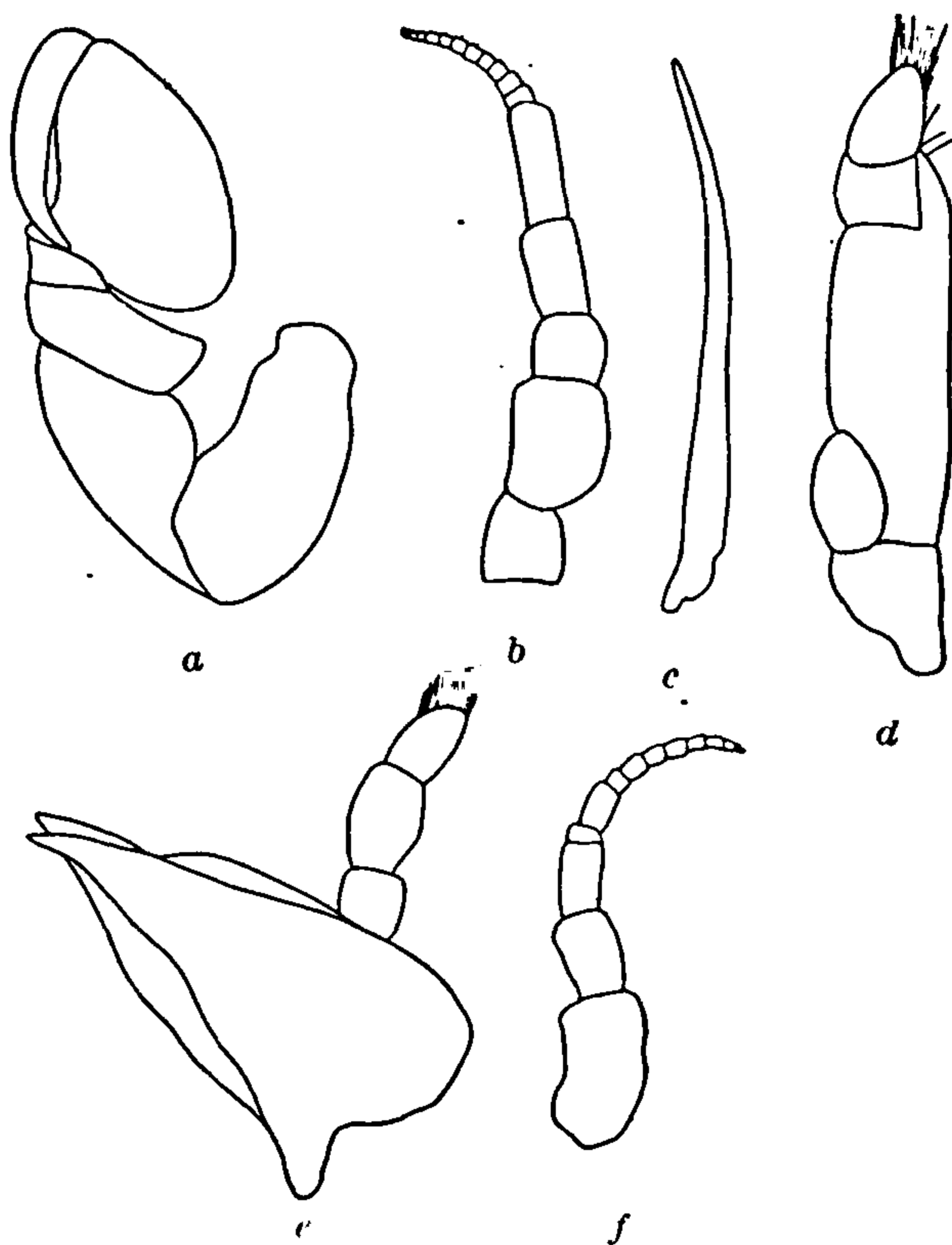


FIG. 57.—*CALATHURA BRANCHIATA*. *a*, FIRST LEG.  $\times 11\frac{1}{2}$ . *b*, SECOND ANTENNA.  $\times 20\frac{1}{2}$ . *c*, FIRST MAXILLA.  $\times 39$ . *d*, MAXILLIPED.  $\times 39$ . *e*, MANDIBLE.  $\times 39$ . *f*, FIRST ANTENNA.  $\times 20\frac{1}{2}$ .

<sup>a</sup> Basal article of palp not shown in drawing.

The first segment of the thorax is  $2\frac{1}{2}$  mm. long; the second and third are subequal and each is 3 mm. in length; the fourth segment is 4 mm. long; the fifth segment is 3 mm. long; the sixth is  $2\frac{1}{2}$  mm.; the seventh is 1 mm. in length. The segments are long and narrow and have no epimera separated off. The second and third segments have each at the anterior end two small tubercles, one on either side of the median line. The fourth, fifth, and sixth segments have each a small depression at the anterior end in the median line.

The abdomen is short, being only 4 mm. in length, or less than one-sixth the entire length of the body. The first six segments are indistinctly defined, and are more or less fused in the median dorsal line. The seventh and last segment or telson is triangular in shape with apex acute. The peduncle of the uropoda is broad and extends two-thirds the length of the terminal abdominal segment. The inner lateral branch is small and placed at the posterior end of the peduncle and extends the remaining third of the length of the terminal abdominal segment, reaching the extremity of that segment. The outer or superior branch is dorsally placed and arches over the telson, meeting the branch of the opposite side in the median dorsal line; it is about twice as broad as long and is posteriorly truncate.

The first three pairs of legs are prehensile, the first pair being much the larger and stouter. The four remaining pairs are ambulatory.

#### CALATHURA CREMULATA Richardson.

*Calathura crenulata* RICHARDSON, Proc. U. S. Nat. Mus., XXIII, 1901, pp. 509-510.

*Localities.*—Between Nassau and Andros Island, Bahamas; Cape Catoche, Yucatan.

*Depth.*—21 fathoms. Found in gulf weed.

Head half as long as first thoracic segment, frontal margin with

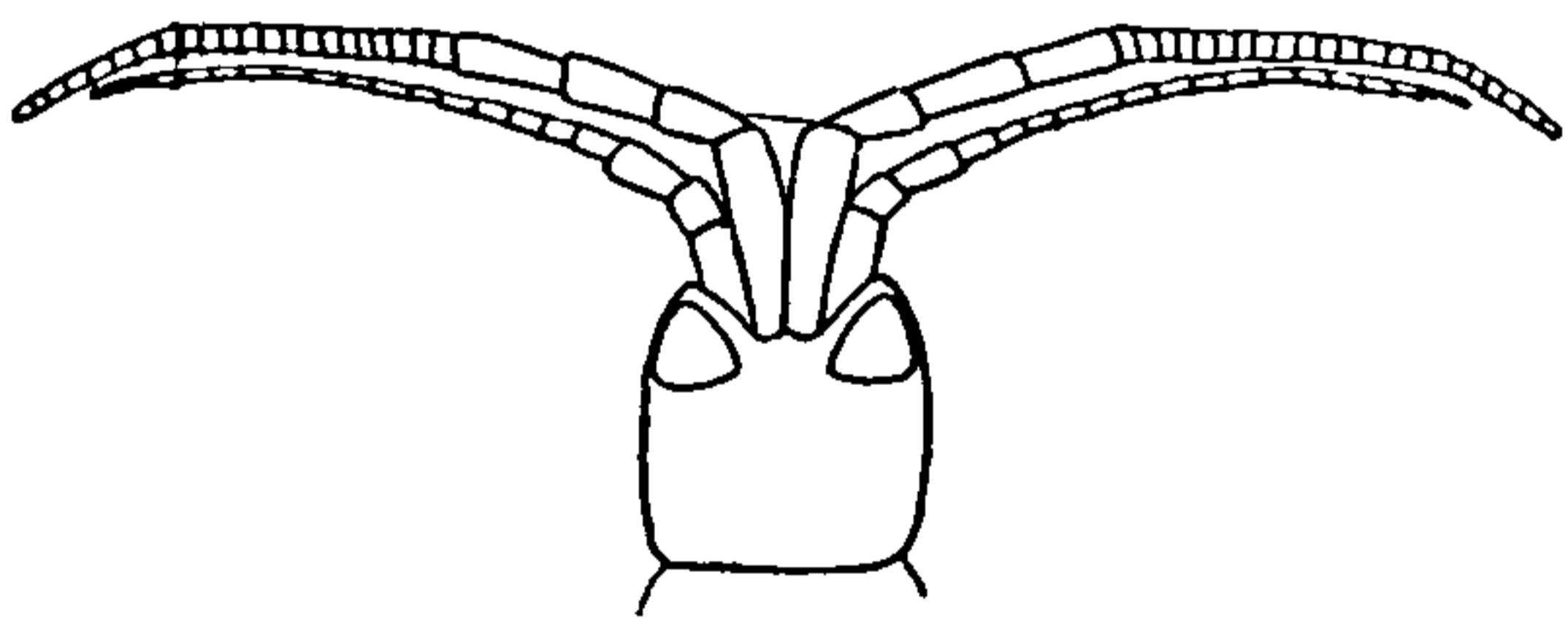


FIG. 58.—CALATHURA CREMULATA. HEAD.

small median point and prominent lateral angles. Eyes large, distinct, and very black. First pair of antennae more than twice as long as the length of the head; flagellum about seventeen jointed. Second pair of antennae somewhat longer than first pair, with joints of flagellum stouter; flagellum about twenty-three jointed.

First six thoracic segments long and narrow; second segment narrower posteriorly than anteriorly; last segment very short, one-third shorter than preceding segment. Abdomen with all the segments distinct. Terminal

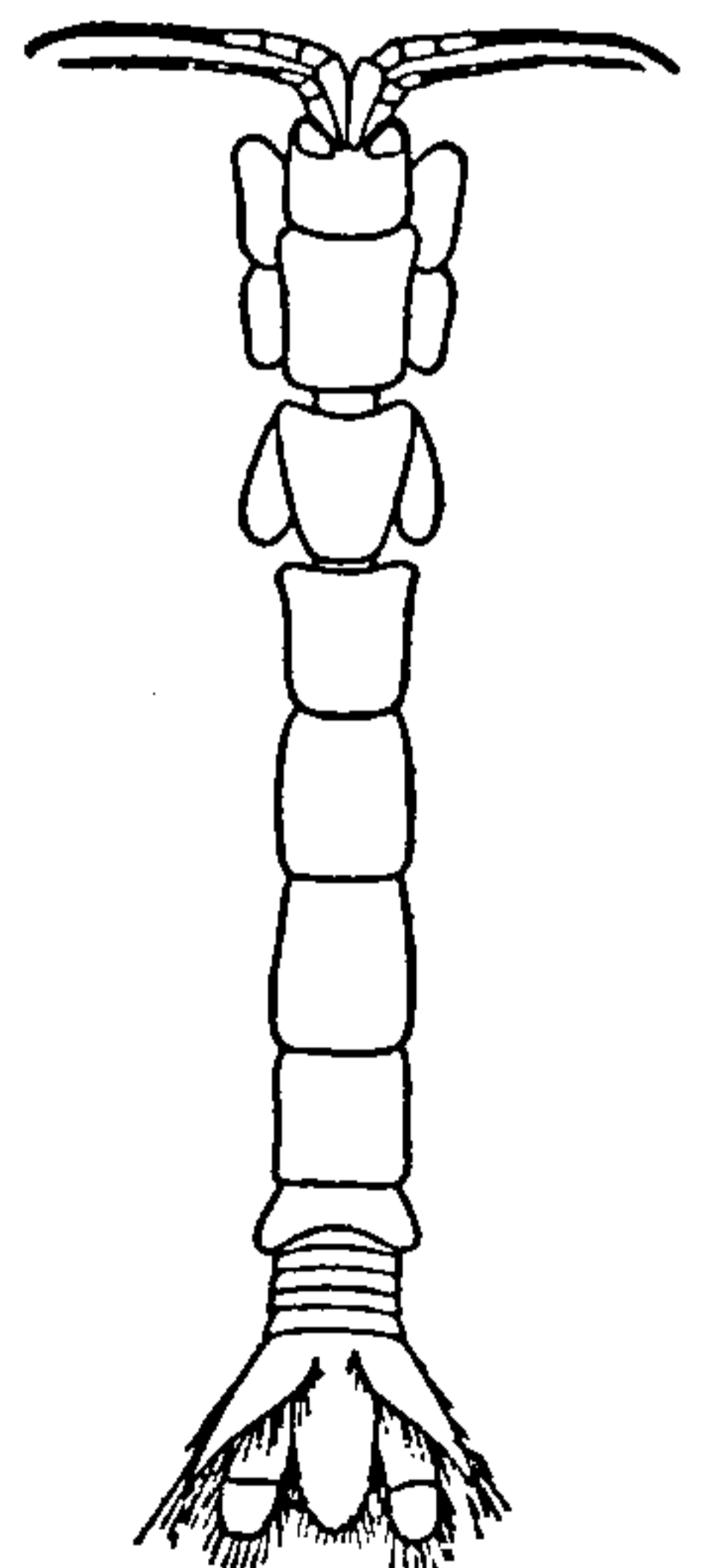


FIG. 59.—CALATHURA CREMULATA.



segment long, lingulate in shape, rounded posteriorly with crenulate margin. Outer branches of the uropoda arch over telson, but do not meet in center; narrow, elongated. Inner branches of the uropoda extend beyond telson, are rounded posteriorly, and shorter than peduncular joint; inner margins crenulate. Abdomen about equal in length to fifth and sixth thoracic segments taken together.



FIG. 60.—CALATHURA CRENU-LATA. FIRST GNATHOPOD.

First pair of gnathopods large, subchelate; second pair of gnathopods and first pair of pereopods subchelate, small. Other pereopods ambulatory, slender.

One specimen (type) sent by Mr. F. Stearns to the U. S. National Museum comes from between Nassau and Andros Island, Bahamas. Another specimen was taken by the U. S.

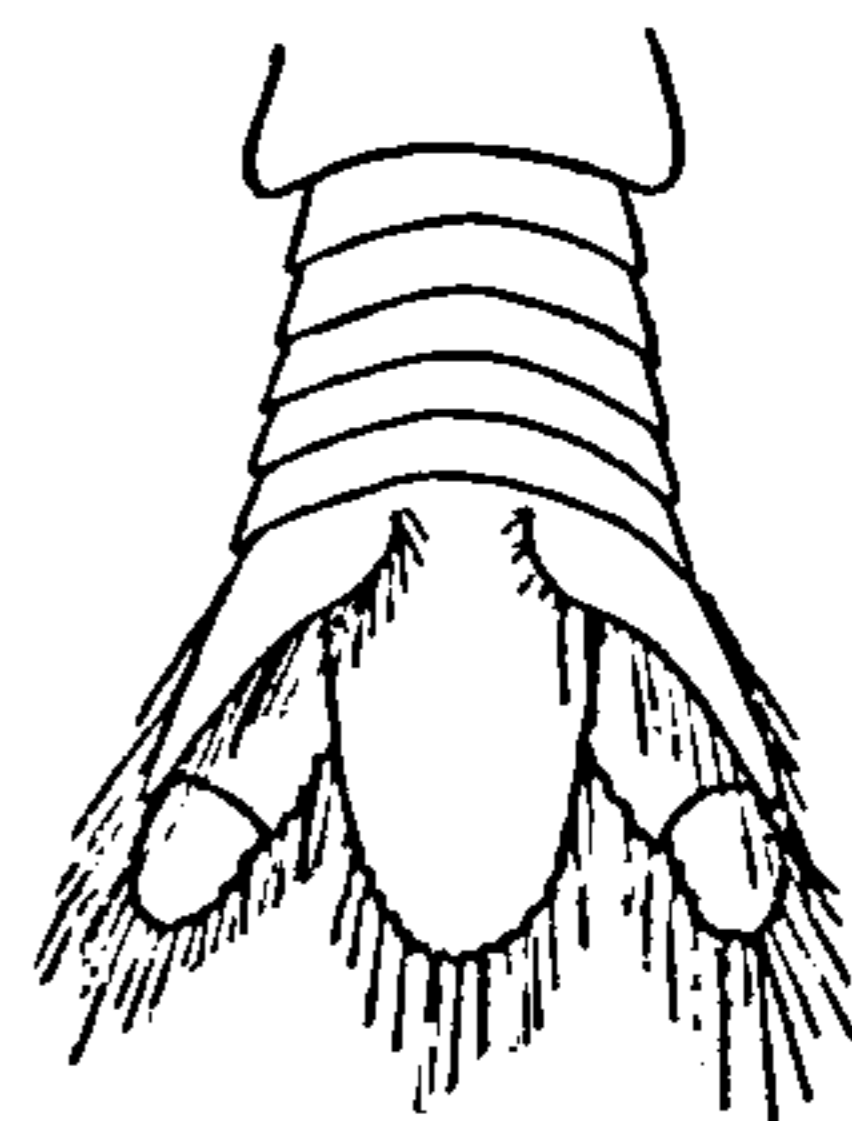


FIG. 61.—CALATHURA CRENU-LATA. ABDOMEN.

Bureau of Fisheries steamer *Albatross* off Cape Catoche, Yucatan.

*Type*.—Cat. No. 23900, U.S.N.M.

17. Genus PARANTHURA Bate and Westwood.

Segments of abdomen distinct in both sexes. First pair of antennæ have the flagellum multiarticulate in both sexes. Second pair of antennæ in both sexes have a rudimentary flagellum consisting of a single article.

Mouth parts as in *Calathura*.

ANALYTICAL KEY TO THE SPECIES OF THE GENUS PARANTHURA.

*a.* Flagellum of first pair of antennæ composed of nine articles. First three segments of thorax of equal length; the three following subequal and each one-third shorter than either of first two. First five segments of abdomen one-half the length of seventh thoracic segment. Last abdominal segment funnel-shaped; posterior margin coarsely denticulate and truncate.

*Paranthura infundibulata* Richardson

*a'.* Flagellum of first pair of antennæ composed of six to seven articles. First five segments of thorax of equal length; sixth segment somewhat shorter than any of preceding segments. First five segments of abdomen as long as seventh thoracic segment. Last abdominal segment long and narrow, rectangular in shape, with margins entire.....*Paranthura verrillii* Richardson

## PARANTHURA INFUNDIBULATA Richardson.

*Paranthura infundibulata* RICHARDSON, Trans. Conn. Acad. Sciences, XI, 1902, pp. 284-286, pl. xxxviii, figs. 15-20.

*Locality*.—Bermudas.

*Male*.—Body narrow, elongate; color yellow, with markings of black.

Head with antero-lateral angles prominent, between which the frontal margin is excavate for the reception of the antennæ, the

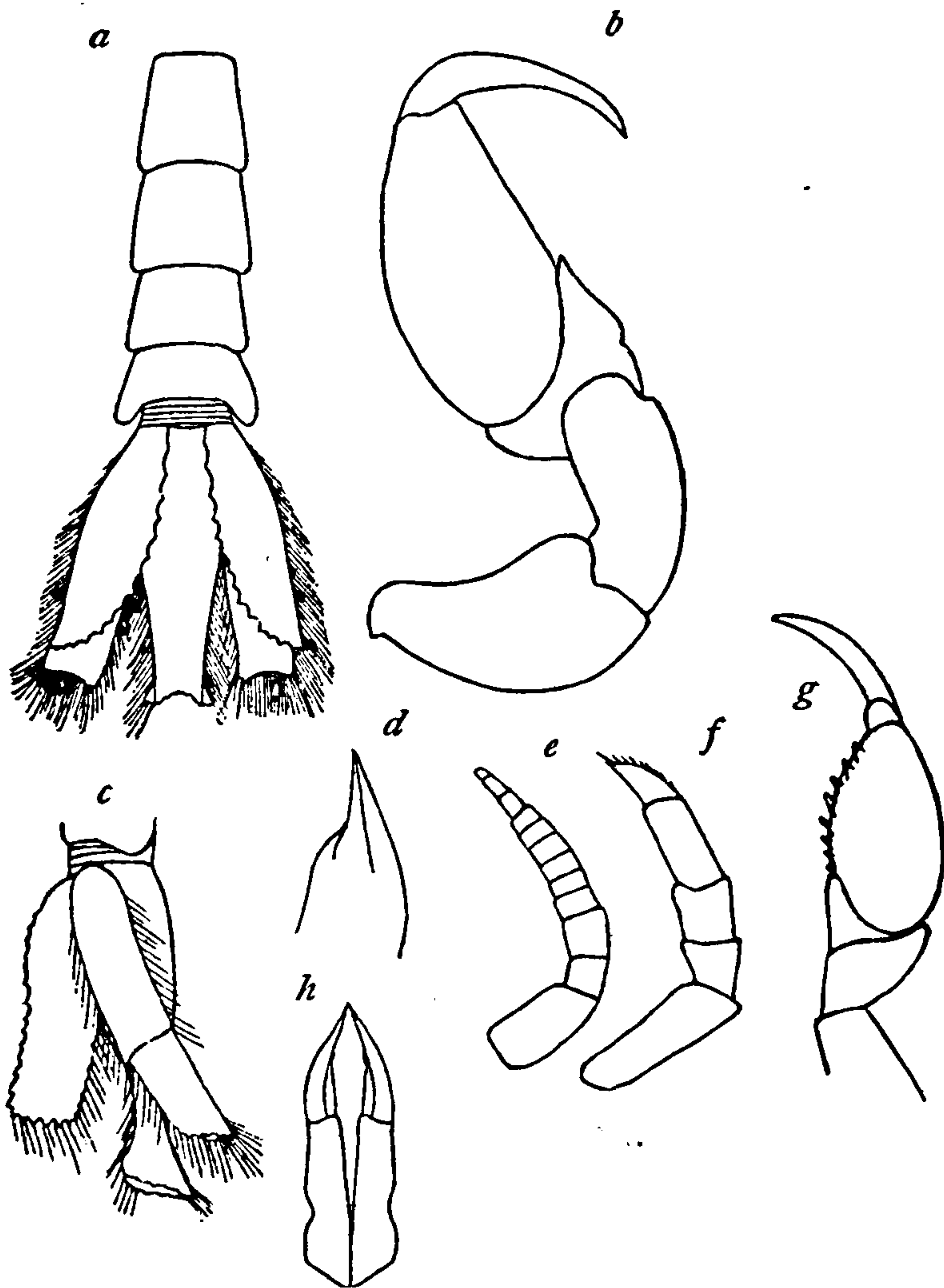


FIG. 62.—PARANTHURA INFUNDIBULATA. *a*, LAST FOUR THORACIC SEGMENTS AND ABDOMEN. *b*, FIRST GNATHOPOD. *c*, LATERAL VIEW OF ABDOMEN. *d*, MANDIBLE. *e*, ANTENNA OF FIRST PAIR. *f*, ANTENNA OF SECOND PAIR. *g*, SECOND GNATHOPOD. *h*, MAXILLIPEDS.

middle being produced in a conspicuous median point. The eyes are situated in the antero-lateral prolongations.

The first pair of antennæ have the basal joint long, oblong in shape, the other two joints of the peduncle being short and about equal in length; the flagellum consists of nine joints.

The second pair of antennæ have the second joint of the peduncle very long, slightly exceeding in length the first and second peduncular

joints of the first pair of antennæ. The second antennæ are geniculate at the articulation of the second and third joints. The other three joints following the second are of nearly equal length. The flagellum consists of a single tapering joint, furnished with hairs.

The first three thoracic segments are about equal in length, elongate, the first two having their posterior angles rounded. The fourth, fifth, and sixth segments are equal in length and one-third shorter than the first three. The seventh segment is about half as long as the preceding one, and has the posterior angles produced downward.

The segments of the abdomen are distinct and very short, all five anterior to the terminal segment being no longer than half the length of the seventh thoracic segment. The terminal segment is long and narrow, of the same width throughout its length, except at the apex, where the lateral margins are abruptly drawn out into processes, which curve upward, giving a funnel-shaped appearance to the posterior end of the segment, which is very concave. The posterior margin is truncate and coarsely denticulate.

The inner branches of the uropoda do not quite reach the extremity of the terminal abdominal segment. The basal joint is about half the length of the terminal abdominal segment. The inner branch is extremely concave, with its entire margin denticulate, its ventral surface having a longitudinal carina. The outer and superior branch is long and narrow, quadrangular and somewhat narrowed posteriorly, and from the middle slightly curving upward, coarsely denticulate on its inner lateral and posterior margin, the teeth being rather widely separated. The branches of the uropoda and the terminal abdominal segment are fringed with hairs.

The first, second, and third pairs of legs are subcheliform. The second and third pairs have the propodus similar in shape to the first pair, but more slender, and armed on their posterior margin with seven or eight large conspicuous spines. The other legs are longer and more slender, and armed with four spines on the anterior margin of both the carpus and the propodus.

A number of specimens, all males, were collected by Dr. George Brown Goode in 1876-77 at the Bermudas.

Type specimens in Peabody Museum, Yale University. Cat. No. 3207.

#### PARANTHURA VERRILLII Richardson.

*Paranthura verrillii* RICHARDSON, Trans. Conn. Acad. Sciences, XI, 1902, p. 286, pl. xxxviii, figs. 21-22.

*Locality*.—Bermudas.

Body narrow, elongate. Color dark brown, with scattered black dots.

Head with lateral angulations prominent, rounded, between which

the front is excavate on either side of a small median point. Eyes large, situated in the lateral angulations.

First pair of antennæ have the first joint of the peduncle oblong, the other two shorter and about equal in length, flagellum six to seven jointed. The second pair of antennæ have a five-jointed peduncle (the first joint being short and indistinct), of which the second and fifth joints are longest, the flagellum being consolidated into a single flattened, tapering joint, furnished with hairs.

The first five thoracic segments are of equal length. The sixth is somewhat shorter than any of the others, and the seventh is half as long as the sixth.

The abdominal segments are distinct, the first five taken together being no longer than the seventh thoracic segment. The terminal abdominal segment is long and narrow, rectangular in shape, with margins entire.

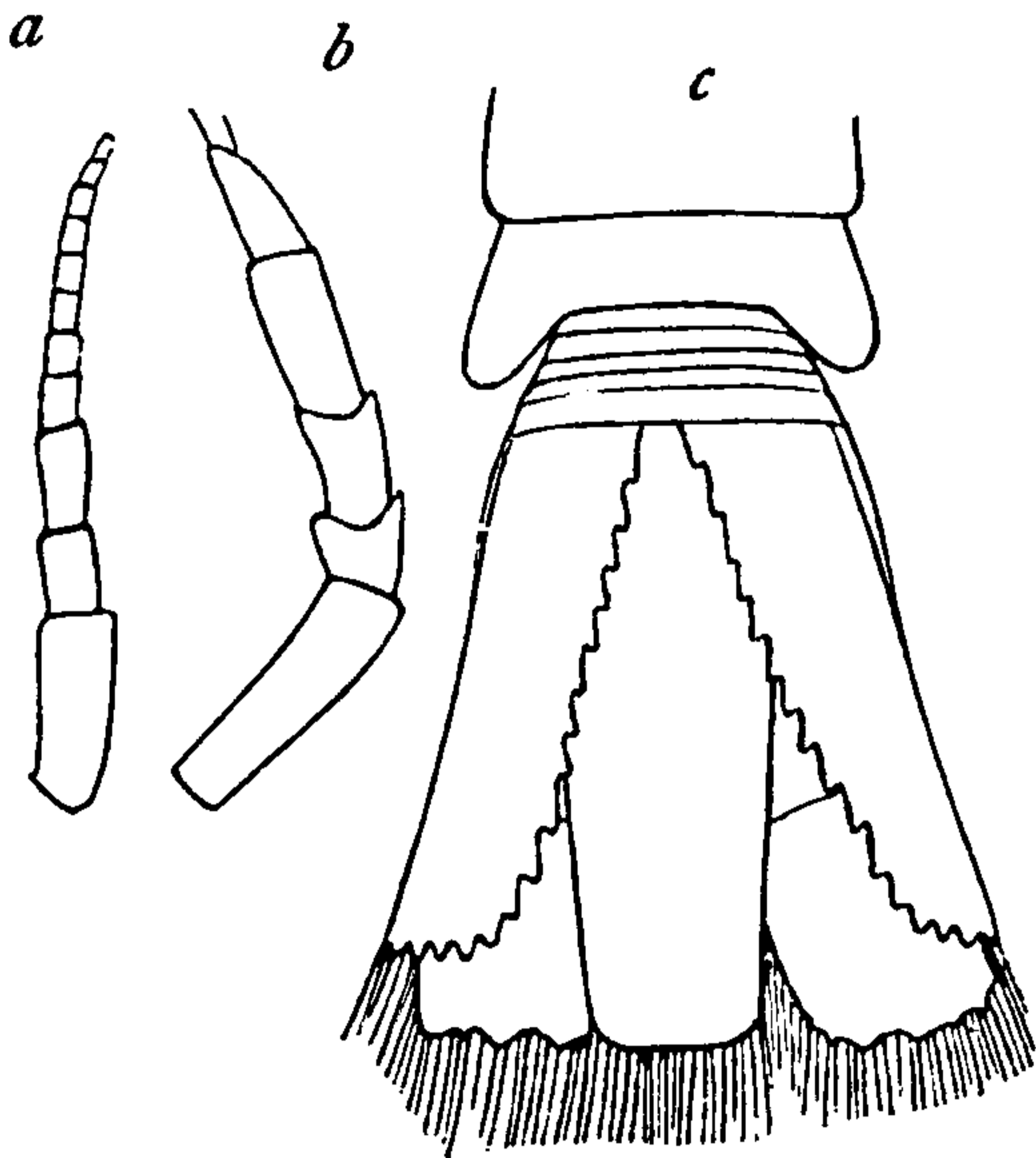


FIG. 63.—*PARANTHURA VERRILLII*. *a*, ANTENNA OF THE FIRST PAIR. *b*, ANTENNA OF THE SECOND PAIR. *c*, LAST TWO THORACIC SEGMENTS AND ABDOMEN.

The basal joint of the uropoda is half as long as the terminal segment of the abdomen; the inner branch is rectangular, coarsely denticulate, and reaches the apex of the telson. The outer superior branch is narrow, elongate, rectangular, with margins coarsely denticulate, the teeth being close together.

The branches of the uropoda and the terminal abdominal segment are fringed with long hairs.

The first three pairs of legs are subchelate. The second and third pairs have the posterior margin of the propodus armed with spines, as in the preceding species. In the four following pairs of legs the anterior margin of the propodus is armed with four spines.

A single female was collected by Prof. A. E. Verrill and party in 1898 at the Bermudas. Depth, 1-2 feet.

Type specimen in Peabody Museum, Yale University. Cat. No. 3186.

This species is named in honor of Prof. A. E. Verrill of Yale University.

#### 18. Genus *COLANTHURA* Richardson.

Body narrow, elongate. First pair of antennæ composed of four joints, the last joint being the flagellar joint. Second pair of antennæ composed of five joints, the terminal joint fringed with hairs.

The first six segments of the thorax large, the seventh very short,

abruptly narrower than the sixth, not as wide as the abdominal segments and devoid of legs.

The first three pairs of legs are subchelate, the three following pairs ambulatory.

The abdominal segments are well defined and distinct from one another. The terminal abdominal segment is rounded, entire. The inner branch of the uropoda is likewise rounded; the outer and superior branch arches over the telson.

This genus agrees with both *Hyssura* Norman and Stebbing and *Cruregans* Chilton in the absence of the seventh pair of legs, but differs from the first named in the structure of the antennæ, both pairs of antennæ in *Hyssura* having multi-articulate flagella; in the structure of the outer branch of the uropoda, which in *Hyssura* does not arch over the telson; and in the structure of the mouth parts. *Colanthura* differs from *Cruregans* in the presence of eyes, which are wanting in *Cruregans*, and in the structure of the outer branch of the uropoda, the outer branch in *Cruregans* being very narrow and not arching over the squamiform telson, while in *Colanthura* the outer branch is broad and arches over the rounded terminal segment. The structure of the mouth parts is the same as found in the genera *Paranthura*, *Calathura*, and *Cruregans*.

#### COLANTHURA TENUIS Richardson.

*Colanthura tenuis* RICHARDSON, Trans. Conn. Acad. Sciences, XI, 1902, pp. 287-288, pl. xxxviii, figs. 23-28.

*Locality*.—Bermudas.

Body narrow, elongate; surface smooth; color light yellow. Head with a prominent median process extending between the first pair of antennæ. Antero-lateral angles prominent, produced, reaching the distal end of the first joint of the peduncle of the first pair of antennæ. Eyes large, conspicuous.

First pair of antennæ consist of four joints, the terminal or flagellar joint being fringed with long hairs. The second pair of antennæ are composed of five joints, the terminal joint being fringed with hairs.

The first three thoracic segments are about equal in length. The fourth and fifth segments are each much longer than any of the three preceding segments, and are about alike in size. The sixth segment is short, not quite as long as any one of the first three segments. The seventh is very short, being one-third the length of the sixth segment, and in both specimens examined is devoid of legs.

The segments of the abdomen are distinct, the first five together not being as long as the sixth thoracic segment. The last thoracic seg-

ment is abruptly narrower than the sixth, and is likewise somewhat narrower than the abdominal segments.

The terminal segment of the body is linguiform, the posterior margin evenly rounded and smooth. The inner branch of the uropoda is likewise rounded posteriorly with a smooth margin. The outer and superior branch arches over the telson. Both branches, as well as the terminal abdominal segment, are fringed with hairs.

The first pair of legs are subcheliform, the propodus unarmed. The second and third pairs are also subcheliform, but smaller, with the propodus armed on the posterior margin with five spines. The three

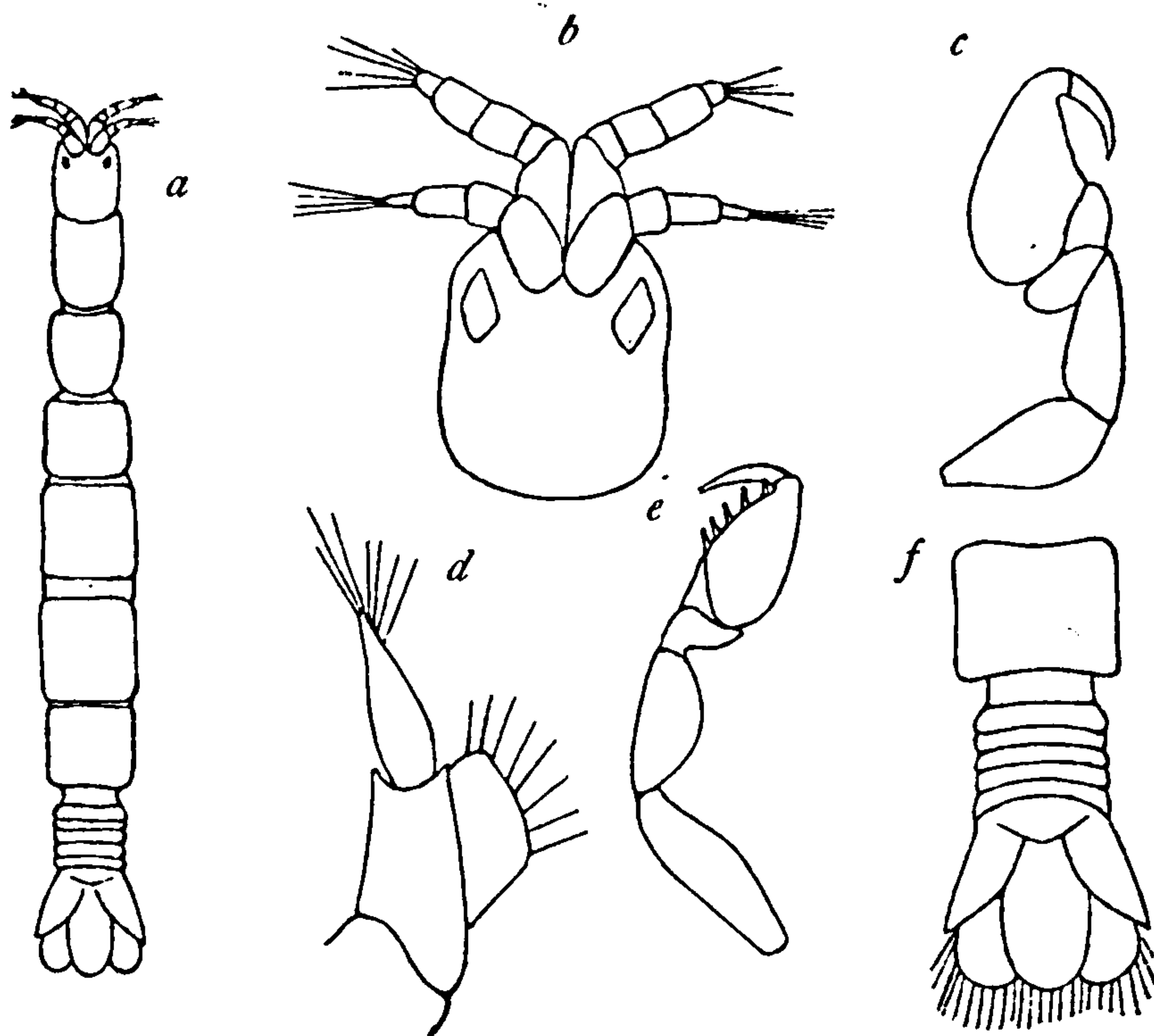


FIG. 64.—COLANTHURA TENUIS. *a*, GENERAL FIGURE. *b*, HEAD AND ANTENNAE. *c*, LEG OF FIRST PAIR. *d*, LATERAL VIEW OF UROPODA. *e*, LEG OF SECOND PAIR. *f*, ABDOMEN AND LAST TWO THORACIC SEGMENTS.

following pairs of legs are ambulatory in character. The seventh pair are wanting.

Two specimens were collected by Prof. A. E. Verrill and party at the Bermudas in 1898. Both specimens are adult females, the marsupium in one being very large and extending the entire length of the thorax, from the second segment.

Type specimen in Peabody Museum, Yale University. Cat. No. 3252.

Family V. CIROLANIDÆ.<sup>a</sup>

Body more or less semicylindrical in form. Epimera well defined on all the segments of the thorax, with the exception of the first. Abdomen usually composed of six distinct segments. Uropoda lateral, and forming, with the last segment of the abdomen, a caudal fan. Eyes usually small, lateral. Antennæ usually unequal in length, multiarticulate, with well-defined peduncle and flagellum. First three pairs of legs usually prehensile; last four pairs ambulatory. Pleopods well developed and adapted for swimming and breathing. Second pair of pleopods in the male with a stylet inside the inner plate. Incubatory pouch composed of five pairs of plates issuing from the bases of the first five pairs of legs.

Labrum large, two or three times wider than long.

Clypeus large, wide, short, triangular.

Mandibles wide throughout their entire length; the posterior part seen in position turned a little inward; the distal part directed inward, wide, but long, and covered for the most part; cutting part long, more or less trifid, the posterior apex always larger than the other apices; the movable lacinia is large, furnished with many spines; the molar part is elongate, triangular, furnished with triangular processes on the anterior margin.

The first pair of maxillæ are robust; the lacinia of the first article is inflated at the apex and furnished with three plumose processes; the lacinia of the third article is wide or very wide at the apex and is furnished with many robust spines.

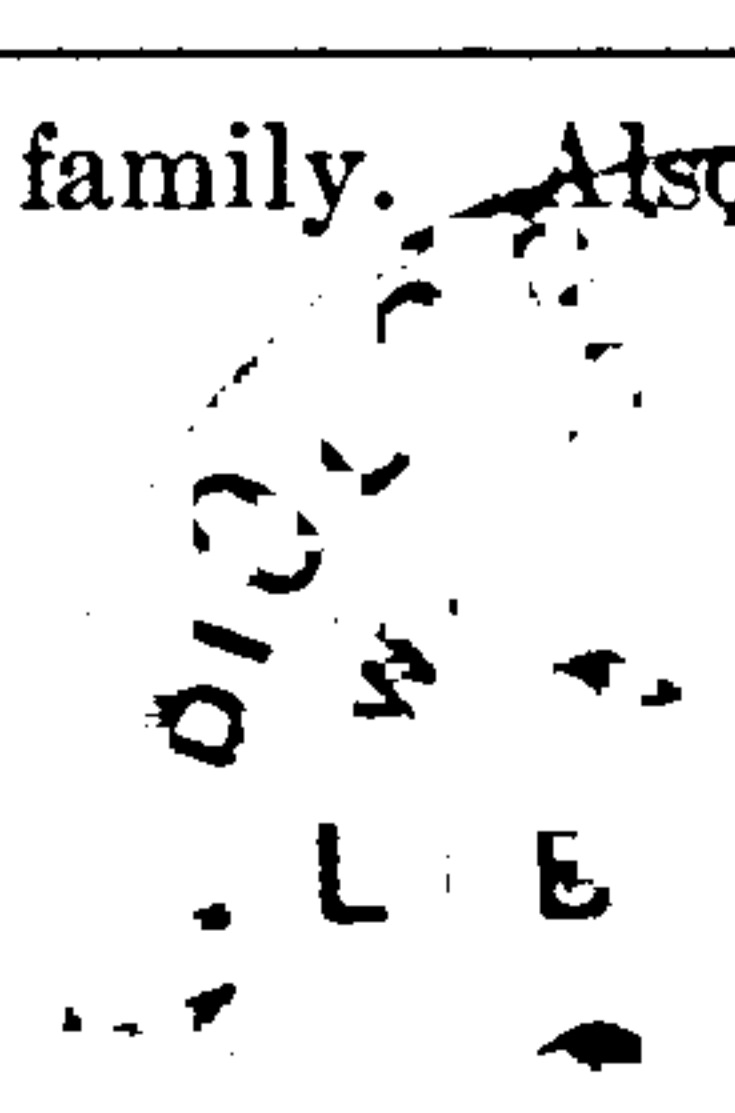
The second maxillæ are well developed; the lacinia of the second article is wide, free, and short, and furnished with many setæ; the lacinia of the third and fourth articles are much longer than wide, with the inner margin furnished with long setæ.

The maxillipeds are well developed; the margins of the articles of the palp are furnished with many setæ, but never furnished with hooks.

## ANALYTICAL KEY TO THE GENERA OF THE FAMILY CIROLANIDÆ.

- a. All six segments of abdomen distinct, not coalesced.
- b. No branchiæ developed at base of pleopoda. Eyes, when present, placed on superior and inferior side of head.
- c. Peduncle of the second pair of antennæ composed of five articles. Plate of the second joint of the maxillipeds furnished with hooks. First pair of antennæ with basal article of peduncle not placed at right angles to second article.
- d. First three pairs of legs prehensile. Last four pairs ambulatory. Uropoda with the inner angle of the peduncle produced.

<sup>a</sup>See Sars, *Crust. of Norway*, II, 1899, pp. 67-68, for characters of family. Also Hansen, *Vidensk. Selsk. Skr.* (6), V, 1890, pp. 310-311, 317, 318.



- e.* First and second pair of pleopods similar to each other, the inner branch being submembranaceous; the peduncle of the second pair of pleopods is somewhat wider than long.....Genus *Cirolana* Leach
- e'*. First and second pairs of pleopods not similar to each other; first pair of pleopods with both branches hard, and forming a large operculum. Second pleopods of the usual structure; the peduncle of the second pleopods is scarcely wider than long.....Genus *Conilera* Leach
- d'*. Only first pair of legs prehensile. The six following pairs are ambulatory. Uropoda with the inner angle of the peduncle not produced. Eyes wanting.....Genus *Cirolanides* Benedict
- c'*. Peduncle of the second pair of antennæ composed of four articles. Plate of the second article of the maxillipeds not furnished with hooks. First pair of antennæ with basal article of peduncle extended straight in front at a right angle to the remaining part of the antennæ.
- d.* Maxillipeds normal, composed of seven articles. Uropods not attached to underside of abdomen and not branchial in function.  
Genus *Eurydice* Leach
- d'*. Maxillipeds composed of two articles. Uropoda attached to the underside of abdomen, and branchial in function, being similar to the pleopods.....Genus *Branchuropus* Moore
- b'*. Supplementary ramified branchiæ developed at the base of the inner branches of the pleopoda. Eyes placed entirely on inferior side of head.  
Genus *Bathynomus* A. Milne Edwards
- a'*. Five anterior segments of abdomen fused to form a single segment anterior to large terminal segment.....Genus *Colopisthus* Richardson

### 19. Genus CIROLANA Leach.

First pair of antennæ with basal article of peduncle not extended straight in front at right angles to second article. Peduncle of the second pair of antennæ composed of five articles.<sup>a</sup>

The plate of the second article of the maxillipeds furnished with hooks.

Abdomen with all six segments distinct.

The first and second pairs of pleopods similar to each other, the inner branch being submembranaceous; the peduncle of the second pair of pleopods is somewhat wider than long.

The peduncle of the uropoda has the inner angle strongly produced.

#### ANALYTICAL KEY TO THE SPECIES OF THE GENUS CIROLANA.

- a.* Eyes present.
- b.* Fifth abdominal segment with lateral angles free, not covered by the fourth segment.
- c.* Body short. Sides of head angulated. First pair of antennæ short, reaching only to the posterior margin of the head. Frontal lamina forming a large rounded projection, extending beyond the apex of the head and separate from the frontal process. Inner branch of uropoda much longer than outer branch. Terminal abdominal segment tricarinated.

*Cirolana sphaeromiformis* Hansen

<sup>a</sup>Hansen recently states that in three species of *Cirolana* the peduncle of the second pair of antennæ is composed of six articles, *C. borealis* being one of these.



- c'*. Body oblong, ovate. Sides of head rounded. First pair of antennæ long, reaching to or beyond the posterior margin of the first thoracic segment. Head produced in front in a process continuous with frontal lamina. Inner branch of uropoda not longer than outer branch. Terminal abdominal segment not tricarinated.
- d*. First pair of antennæ extend to the posterior margin of the first thoracic segment. Second pair of antennæ extend to the posterior margin of the third thoracic segment, and are provided with a brush-like structure on flagellum. Inner branch of uropoda shorter than outer branch. Terminal abdominal segment smooth..... *Cirolana mayana* Ives
- d'*. First pair of antennæ extend to the posterior margin of the third thoracic segment. Second pair of antennæ extend to the posterior margin of the fifth thoracic segment, and are not provided with brush-like structure on flagellum. Branches of uropoda of equal length. Terminal abdominal segment with basal portion raised above posterior portion, with well-defined edge separating the two parts.
- e*. First pair of antennæ with joints of peduncle subequal. Terminal abdominal segment posteriorly rounded. Basal portion of terminal abdominal segment with median lobe produced in two points, one on either side of the median line..... *Cirolana linguifrons* Richardson
- e'*. First pair of antennæ with first article longer than second, and third article twice as long as second. Terminal abdominal segment posteriorly triangular, with apex acute. Basal portion of terminal abdominal segment with median lobe truncate... *Cirolana chiltoni*, new species
- b*. Fifth abdominal segment with lateral parts covered by the fourth segment.
- c*. Frontal lamina posteriorly or clypeus anteriorly produced horn-like, especially so when seen from the side..... *Cirolana minuta* Hansen
- c'*. Frontal lamina and clypeus unarmed, not produced horn-like; anterior margin of the clypeus manifestly united with the frontal lamina.
- d*. Frontal lamina narrow, elongate, from four to six times longer than broad.
- e*. Extremity of exterior margin of inner branch of the uropoda emarginate.
- f*. Terminal segment of abdomen emarginate at its extremity.  
*Cirolana concharum* (Stimpson)
- f'*. Terminal segment of abdomen not emarginate at its extremity, posterior margin entire.
- g*. Second pair of antennæ, with flagellum composed of twenty articles, extend to the posterior margin of the second thoracic segment. Terminal segment of abdomen furnished with spines. Outer branch of uropoda extends about six-sevenths of the length of the inner branch. Inner branch of uropoda, below emargination, is wide, posteriorly truncate or slightly emarginate. Epimera with impressed lines ..... *Cirolana impressa* Harger
- g'*. Second pair of antennæ, with flagellum composed of ten articles, extend to the middle of the first thoracic segment. Terminal segment of abdomen not furnished with spines. Outer branch of uropoda extends about three-fourths of the length of the inner branch. Inner branch of uropoda below emargination is narrow and posteriorly pointed. Epimera without impressed lines.  
*Cirolana polita* (Stimpson)
- e'*. Extremity of exterior margin of the inner branch of the uropoda not emarginate.
- f*. Eyes small, black, longer than wide. Branches of uropoda narrow, lanceolate, somewhat elongated; inner branch almost three times longer than wide. Clypeus even. Terminal segment posteriorly rounded.  
*Cirolana borealis* Lilljeborg

- f'*. Eyes large, brown, as long as wide. Branches of uropoda short; inner branch hardly twice as long as wide. Clypeus with margin raised all around and with a median rib, surrounding two impressed areas. Terminal segment truncated obliquely with apex acute.  
*Cirolana gracilis* Hansen
- d'*. Frontal lamina broad, short, scarcely twice as long as wide.
- e*. Terminal segment truncate..... *Cirolana obtruncata* Richardson
- e'*. Terminal segment not truncate, rounded.
- f*. Posterior margin of terminal abdominal segment armed with numerous (twenty-six) robust spines. Inner branch of uropoda with outer post-lateral angle rounded ..... *Cirolana harfordi* (Lockington)
- f'*. Posterior margin of terminal abdominal segment armed with a few (about eight) small spines. Inner branch of uropoda with outer post-lateral angle acute.
- g*. Body two and two-thirds times longer than wide. Second pair of antennæ extend to posterior margin of the fourth thoracic segment. Color light brown ..... *Cirolana parva* Hansen
- g'*. Body three and two-thirds times longer than wide. Second pair of antennæ extend to the posterior margin of the third thoracic segment. Color white ..... *Cirolana albida* Richardson
- a'*. Eyes wanting..... *Cirolana cubensis* Hay

#### CIROLANA SPHÆROMIFORMIS Hansen.

*Cirolana sphæromiformis* HANSEN, Vidensk. Selsk. Skr. (6), V, 1890, pp. 351-353, pl. IV, figs. 3-3g.—RICHARDSON, Proc. U. S. Nat. Mus., XXIII, 1901, p. 512.

*Locality*.—St. Thomas, West Indies.

Body short, subovate, twice as long as wide, rather convex.

Head forming at the sides a prominent angle, produced in front in a rather narrow but long frontal process, the margin between the lateral angle and the base of the frontal process being rather straight, forming a manifest carina on the surface of the head.

Eyes very small, appearing only on the superior margin of the head in an angulated process, formed of a few, rather convex ocelli.

The frontal lamina is exceedingly narrow at the basal part, is partly concealed under the end of the clypeus, becomes exceedingly dilated toward the apex, which is inflated and widely rounded, and later somewhat overhangs the frontal process and becomes united with that process.

The clypeus is very short, produced at the base in a very short, acute point. The first pair of antennæ are somewhat shorter than the peduncle of the second pair of antennæ; the peduncle is twice as long as the flagellum, and composed of three articles, the basal article being short; the flagellum is composed of about four articles, with the basal article elongate, the last three articles being very minute.

The second pair of antennæ extend a little beyond the posterior margin of the second thoracic segment; the peduncle is stout, with the fourth article much longer than the third article and somewhat shorter than the fifth article; the flagellum is composed of about twelve articles.

The mandibles have a wide cutting edge. The maxillipeds are almost as in *C. japonica*.

The segments of the thorax are subequal in length; the first segment is somewhat shorter than the head and somewhat longer than the fifth segment; the sixth and seven segments are subequal in length and ornamented near the anterior margin with a transverse furrow. The epimera are large, posteriorly produced, and obliquely carinated (the carina terminating in a fork, very wide particularly in the posterior epimera, and very deep, forming an excavation), becoming gradually wider posteriorly and more produced, the carina becoming higher and the posterior angle subacute; the epimera of the seventh pair extend in length as far as the first four segments of the abdomen.

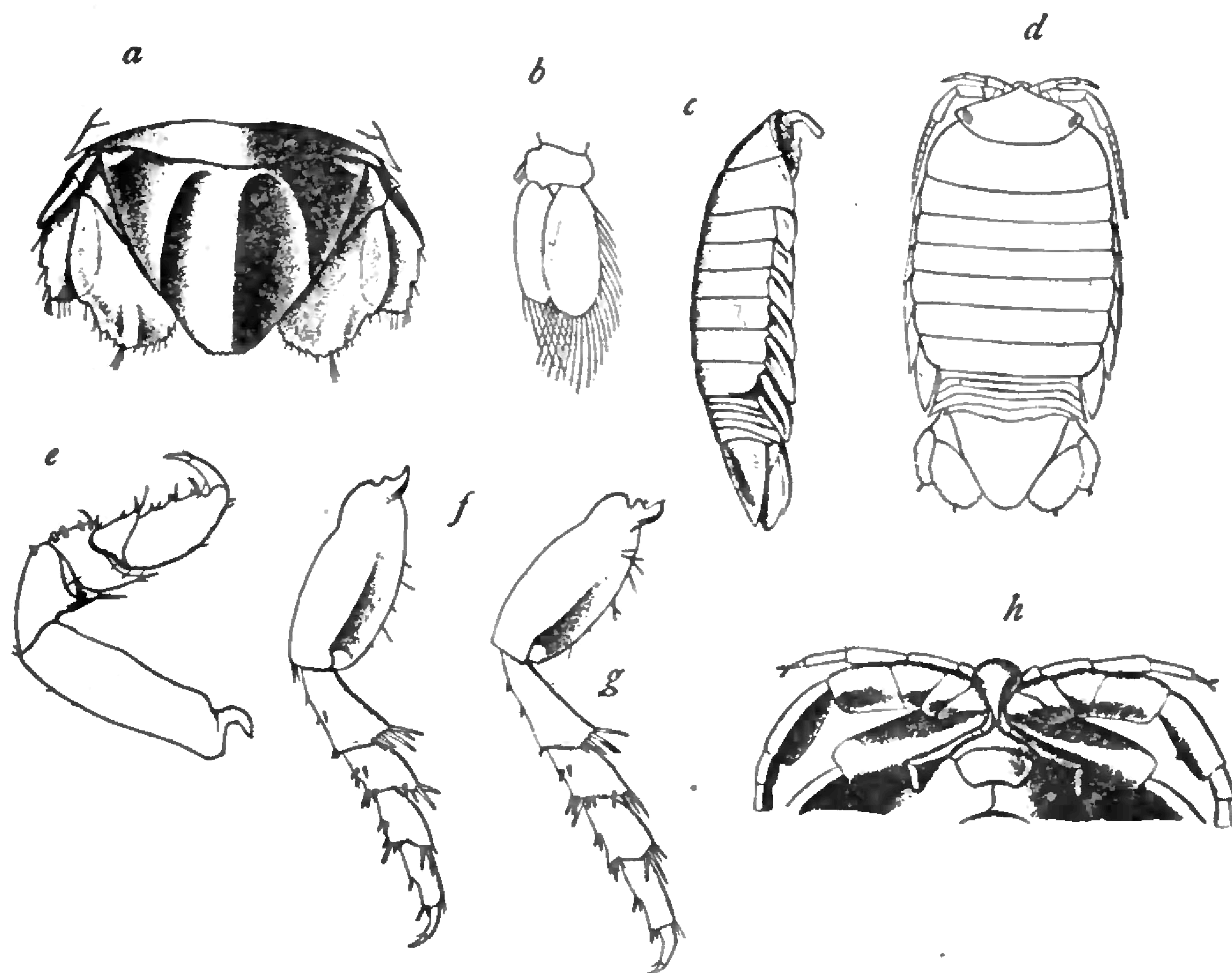


FIG. 65.—*CIROLANA SPHEROMIFORMIS* (AFTER HANSEN). *a*, POSTERIOR PART OF ABDOMEN. *b*, LEFT PLEOPOD OF SECOND PAIR. *c*, LATERAL VIEW OF FEMALE. *d*, DORSAL VIEW OF FEMALE. *e*, LEG OF SECOND PAIR. *f*, LEG OF FIFTH PAIR. *g*, LEG OF SEVENTH PAIR. *h*, ANTERIOR PART OF HEAD. (ENLARGED.)

The first three pairs of legs are rather robust, with the second article elongate, the fourth article very short with the exterior angle reaching beyond the apex of the fifth article; the legs of the second and third pairs have the sixth article much wider than in other species, long; about twice as long as wide.

The last four pairs of legs are short, rather robust; the sixth and seventh pairs of legs are subequal in length, the fifth pair of legs being a little longer.

The first five segments of the abdomen are exposed, are very short and very convex; the fifth segment has the lateral angles not covered by the fourth segment.

The anterior pairs of pleopods are furnished with long hairs.

The last segment of the abdomen is somewhat wider than long, subtriangular, with apex rather short, truncate, not furnished with spines, very convex, the dorsal surface being tricarinated and deeply and equally excavate between the carinæ; the two lateral carinæ are a little divergent posteriorly, and a little arcuate.

The uropoda are short, wide, and do not extend beyond the abdomen. The inner branch is more than twice as long as wide; the exterior margin is strongly curved, and somewhat angulate a little before the median line; the distal part is irregularly serrate, not furnished with spines; the posterior part of the inner margin is also strongly curved, almost angulate, and furnished with a few very short hairs; the apex forms a very obtuse angle, and is furnished with a few long hairs. The outer branch is much shorter than the inner branch, and similar in form to it. The peduncle has the inner angle not produced, and not reaching the middle of the inner branch.

The color is a brownish yellow, somewhat grayish.<sup>a</sup>

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<sup>a</sup>The above description is adapted from the following description of Hansen's:

Diagn. Corpus breve, duplo longius quam latius. Caput et in lateribus et ante angulatum. Lamina frontalis ante bullam magnam, apicem capitis paulo superantem, formans. Epimera majora, per paria postice plus producta et altius carinata, angulo posteriore subacuto. Segmenta 5 anteriora caudæ perbrevia. Segmentum ultimum caudæ uropoda vix superans, subtrigonum, apice subtruncato, dorso alte tricarinato et inter carinas excavato. Uropoda brevia, lata; ramus uterque margine exteriori valde excurvato ibique fere angulato, parte distali irregulariter incisoserrata, margine postero-interiore valde excurvato; ramus interior ramo exteriori multo longior.—Long. 4, 25 mm.

Corpus subovatum, duplo longius quam latius, sat convexum. Caput in lateribus angulum prominulum formans, ante in processum frontalem angustiore sat longum productum, margine inter angulum lateralem et basin processus frontalis subrecto, in superficie capitis carinam manifestam formante.

Oculi minuti, solum in latere superiore capitis in processu angulato inventi, ex ocellis paucis, sat convexis formati.

Lamina frontalis parte basali valde angustata, ex parte sub cornu clypei obtecta, ad apicem versus valde dilatata, alte prominens, parte apicali inflata, ante late rotundata, ultra processum frontalem nonnihil prominente et cum hoc processu conjuncta.

Clypeus perbrevis, a basi in cornu brevius, acutum productus.

Antennulæ pedunculo antennarum aliquanto breviores; pedunculus flagello duplo longior, 3-articulatus, articulo basali brevi; flagellum c. 4-articulatum, articulo basali elongato, articulis 3 ultimis perminutis.

Antennæ paulo ultra marginem posteriorem segmenti secundi trunci prominentes; pedunculus crassior, articulo quarto multo longiore quam articulo tertio et nonnihil brevior quam articulo quinto; flagellum c. 12-articulatum. Mandibulæ acie latiore. Maxillipedes fere ut in *C. japonica*.

Segmenta trunci longitudine minus inæqualia; segmentum primum capite nonnihil brevius et segmento quinto nonnihil longius; segmenta sextum et septimum longitudine subæqualia, stria transversa prope marginem anteriorem ornata. Epimera majora, postice producta, in obliquum carinata (carina furca imprimis in epimeris posterioribus latissima et profundissima, excavationem formante, definita), postice

## CIROLANA MAYANA Ives.

*Cirolana mayana* Ives, Proc. Acad. Nat. Sci. Phil., 1891, pp. 186-187, pl. vi, figs. 3-10.—RICHARDSON, Proc. U. S. Nat. Mus., XXIII, 1901, p. 512.—MOORE, Bull. U. S. Fish Comm., XX, Pt. 2, 1902, p. 166, pl. viii, figs. 1-5.

*Localities.*—Coast of Yucatan; Santa Marta, United States of Colombia; Boqueron Bay and Culebra, Porto Rico; Brandon's, Barbados Beach; San Francisco Bay, Lower California.

A large number of dried specimens from San Francisco Bay, Lower

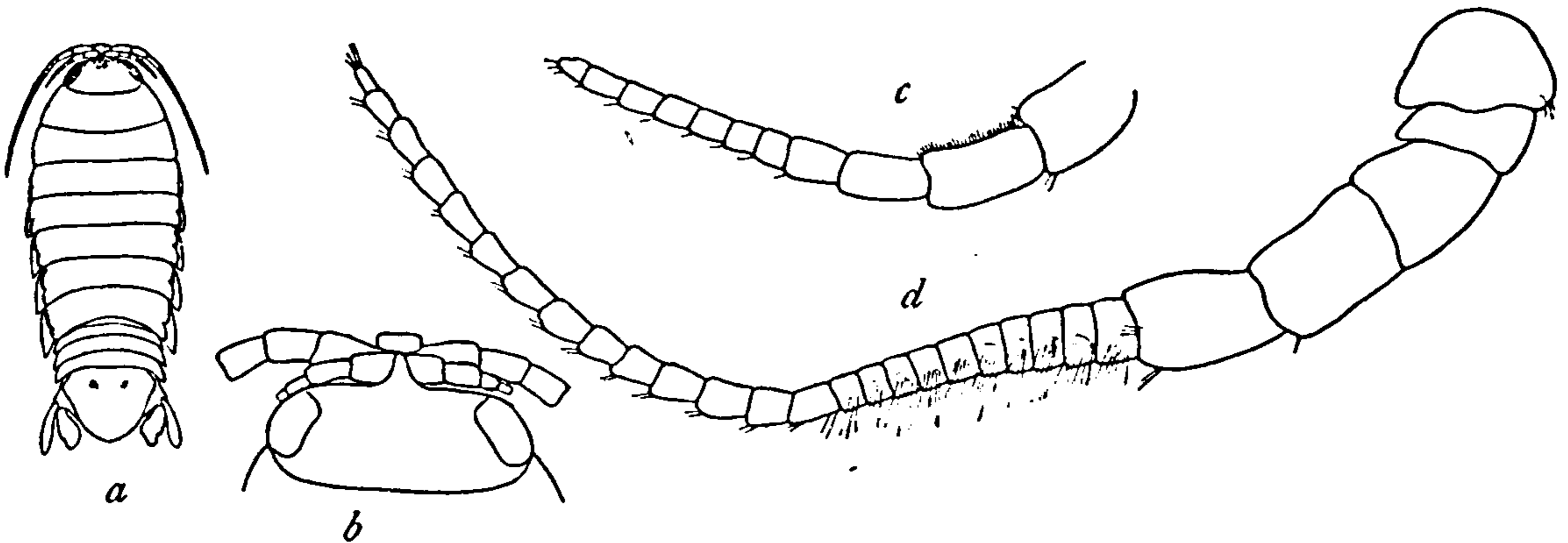


FIG. 66.—CIROLANA MAYANA (AFTER MOORE). *a*, GENERAL FIGURE. *b*, HEAD. *c*, FIRST ANTENNA. *d*, SECOND ANTENNA.

California, sent to me by Doctor Ritter, of the University of California, agree so perfectly with the specimens in the U. S. National Museum from localities above cited that I have not been able to separate them.

per paria latiora, plus producta, altius carinata, angulo posteriore subacuto; epimera septimi paris segmenta quattuor anteriora caudæ longitudine expleantia.

Pedes trium parium anteriorum sat robusti, articulo secundo elongato, quarto brevissimo angulo exteriori ultra apicem articuli quinti prominente; pedes secundi et tertii parium articulo sexto multo latiore quam in speciebus ceteris, longo, duplo longiore quam latiore.

Pedes parium quattuor posteriorum breves, sat robusti; pedes sexti et septimi parium inter se subæque longi, pedibus quinti paris paulo longiores.

Segmenta quinque anteriora caudæ detecta, brevissima, alte convexa; segmentum quintum angulis lateralibus non a segmento quarto tectis.

Pleopoda parium anteriorum setis longis instructa.

Segmentum ultimum caudæ aliquanto latius quam longius, subtrigonum, apice brevius, subrecte truncato, non spinoso, alte convexum, dorso alte tricarinato et inter carinas profunde et æqualiter excavato; carinæ duæ laterales postice paulum divergentes, paulum arcuatæ.

Uropoda brevia, lata, caudam non superantia. Ramus interior plus duplo longior quam latior; margo exterior valde excurvatus, paulum ante medium subangulatus, parte distali irregulariter serrata, non spinosa; margo postero-interior interum valde excurvatus, fere angulatus, setis nonnullis brevissimis instructus; apex angulum valde obtusum formans, setis nonnullis longioribus instructus. Ramus exterior ramo interiore multo brevior, huic forma similis. Scapus angulo interiore minus producto, non ad medium ramum interiorem prominente.

Color flavo-brunnescens, nonnihil grisescens.—HANSEN, Vidensk. Selsk. Skr., (6), V, 1890, pp. 351-353.

In one specimen examined the maxillipeds consisted each of two articles. This, of course, was an abnormality, as all the other specimens in the collection had maxillipeds composed of the usual number

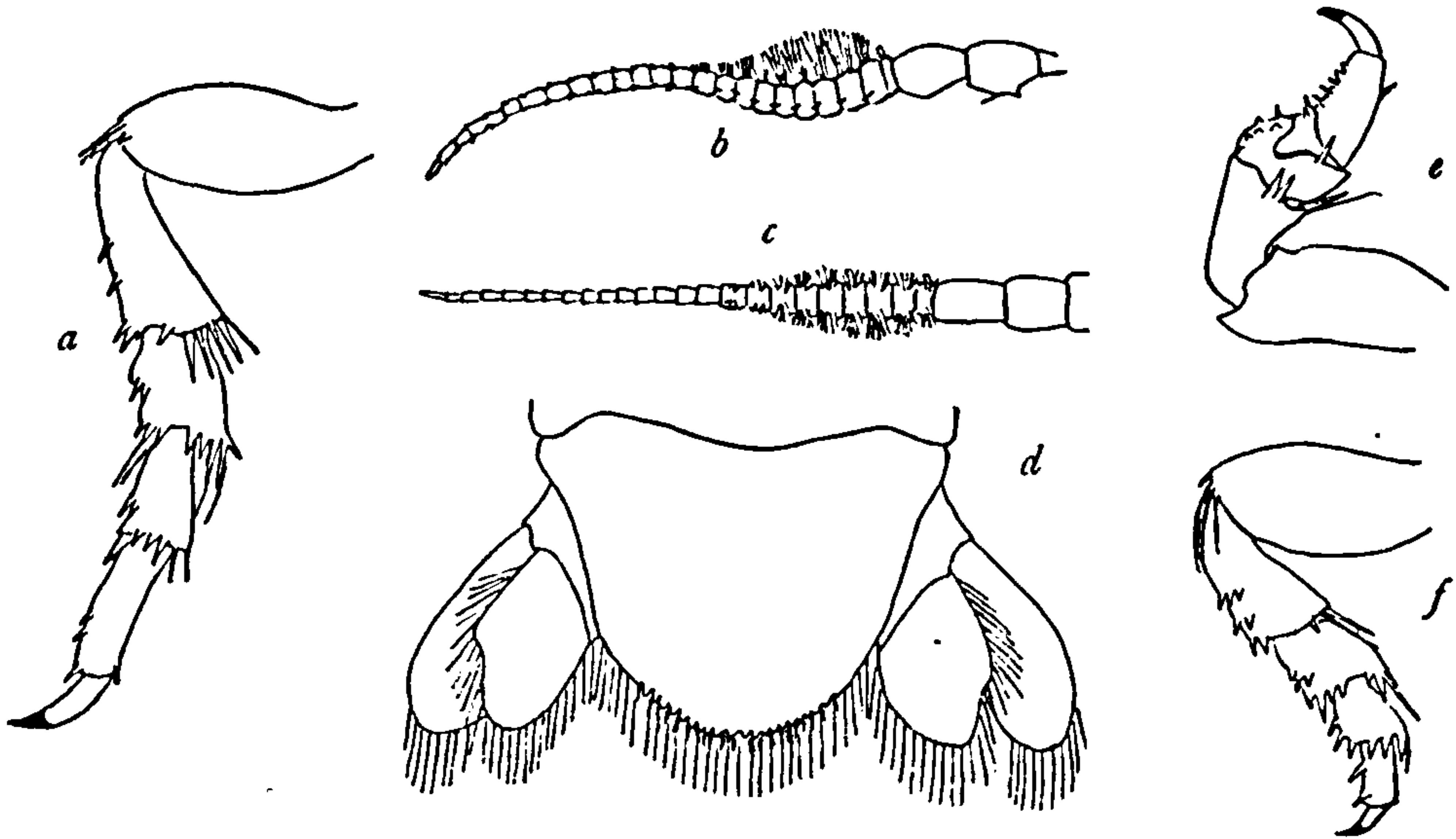


FIG. 67.—CIROLANA MAYANA (AFTER IVES). *a*, FIFTH LEG (RIGHT SIDE). *b*, DORSAL VIEW OF RIGHT ANTENNA OF SECOND PAIR. *c*, ANTERIOR VIEW OF SAME. *d*, LAST SEGMENT OF ABDOMEN WITH UROPODA. *e*, FIRST LEG (RIGHT SIDE). *f*, FOURTH LEG (RIGHT SIDE).

of articles. The genus *Branchuropus* Moore is characterized as having the maxillipeds two-jointed. Only one specimen of the species, *B. littoralis*, was obtained, and it seems as though there might be

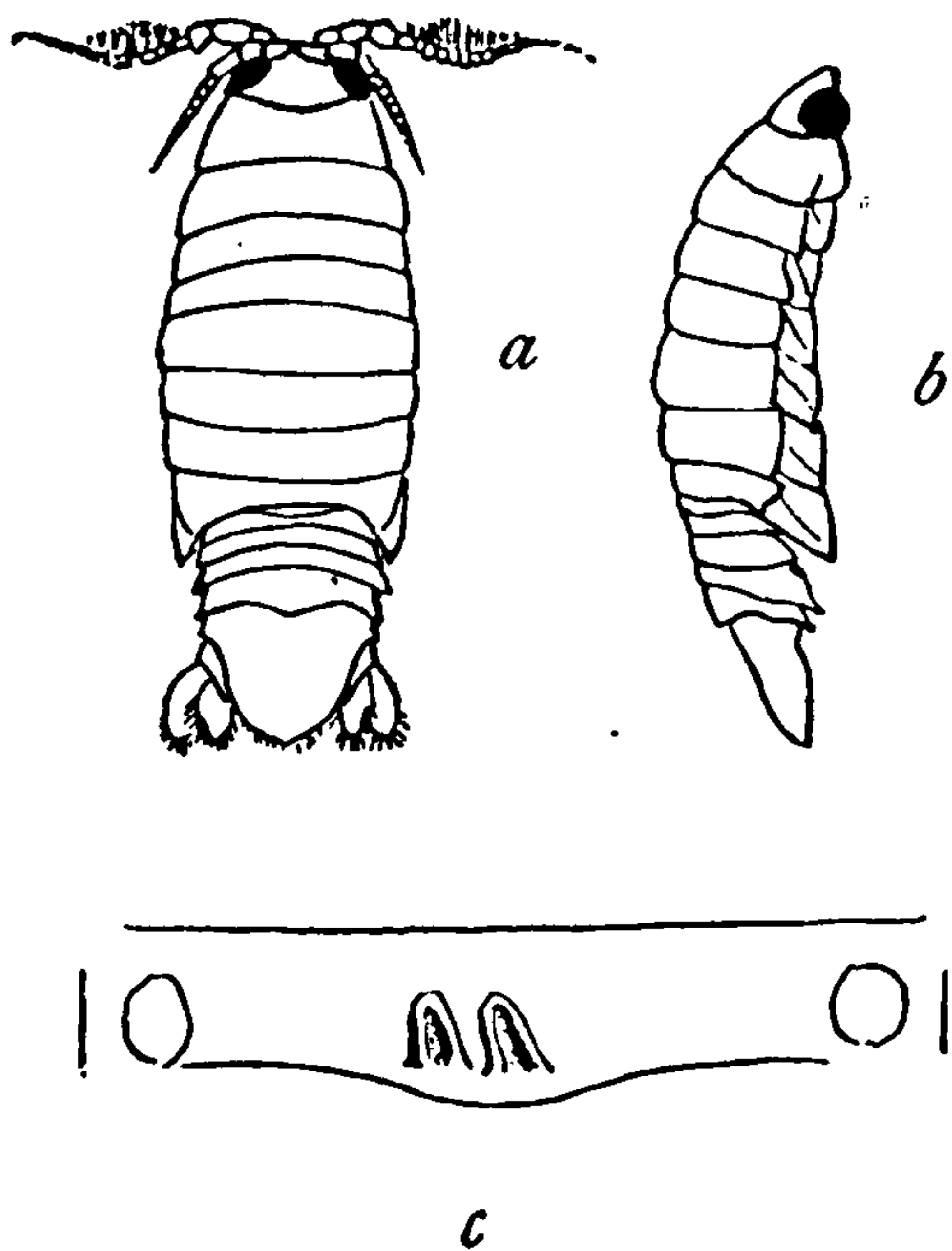


FIG. 68.—CIROLANA MAYANA (AFTER IVES). *a*, DORSAL VIEW.  $\times 4$ . *b*, RIGHT SIDE.  $\times 4$ . *c*, SEVENTH THORACIC SEGMENT WITH MALE APPENDAGE.

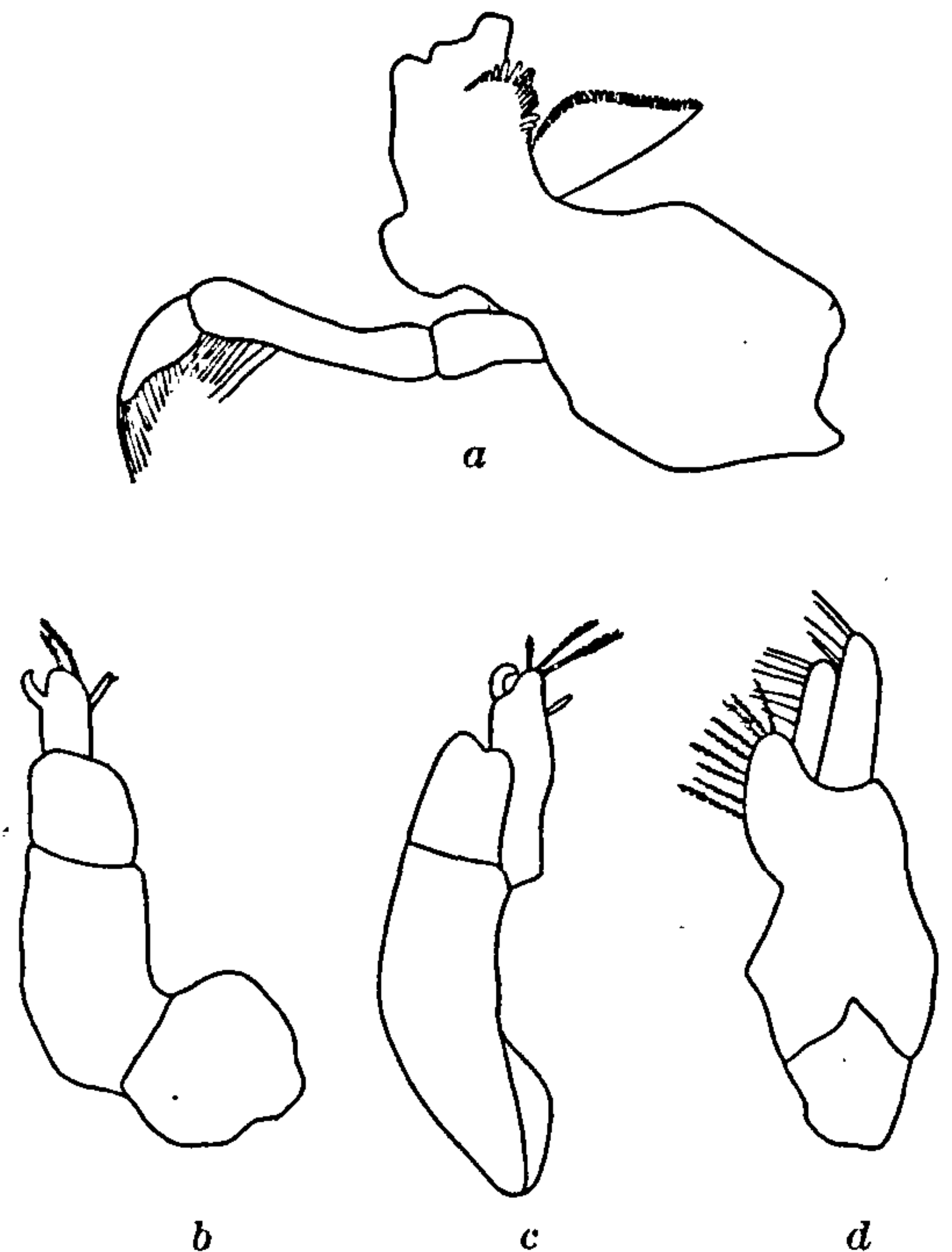


FIG. 69.—CIROLANA MAYANA. *a*, MANDIBLE.  $\times 39$ . *b*, *c*, ABNORMAL MAXILLIPED.  $\times 39$ . *d*, SECOND MAXILLA.  $\times 39$ .

some question as to its being normal in this respect. The genus *Anuropus* Beddard was also instituted because the type and only specimen had, among other characters, the one of having maxillipeds composed of two articles.

Body oblong-ovate, two and a half times longer than broad, 4 mm.: 10 mm.

Head two and a half times wider than long, 1 mm.:  $2\frac{1}{2}$  mm. Front produced in a long median point which separates the basal articles of the first pair of antennæ and meets and is coalesced with the anterior end of the frontal lamina, which arches over the second antennæ and forms a dorsal continuation of the median frontal process extending 1 mm. beyond the frontal margin of the head. The eyes are small, round, composite, and situated in the antero-lateral angles of the head. The first pair of antennæ have the first two articles short and subequal; the third article is half as long and narrower than either of the other two. The flagellum is composed of thirteen articles. The first pair of antennæ extend almost to the posterior margin of the first thoracic segment. The second antennæ have the peduncle apparently composed of only four articles; the first article is short and almost inconspicuous; the second and third articles are subequal; the fourth and fifth are also subequal and each is a little longer than the third. The flagellum is composed of twenty-three articles. The second antennæ extend to the posterior margin of the third thoracic segment. The first nine or ten articles of the flagellum have a tuft of hairs on the outer margin. The interantennal plate or frontal lamina is wide and conspicuous and arches over the second pair of antennæ meeting the anterior end of the frontal process. The clypeus has the anterior end produced over the posterior end of the frontal lamina and extends out from it. Maxilliped composed of seven articles. The mandible has a palp of three articles.

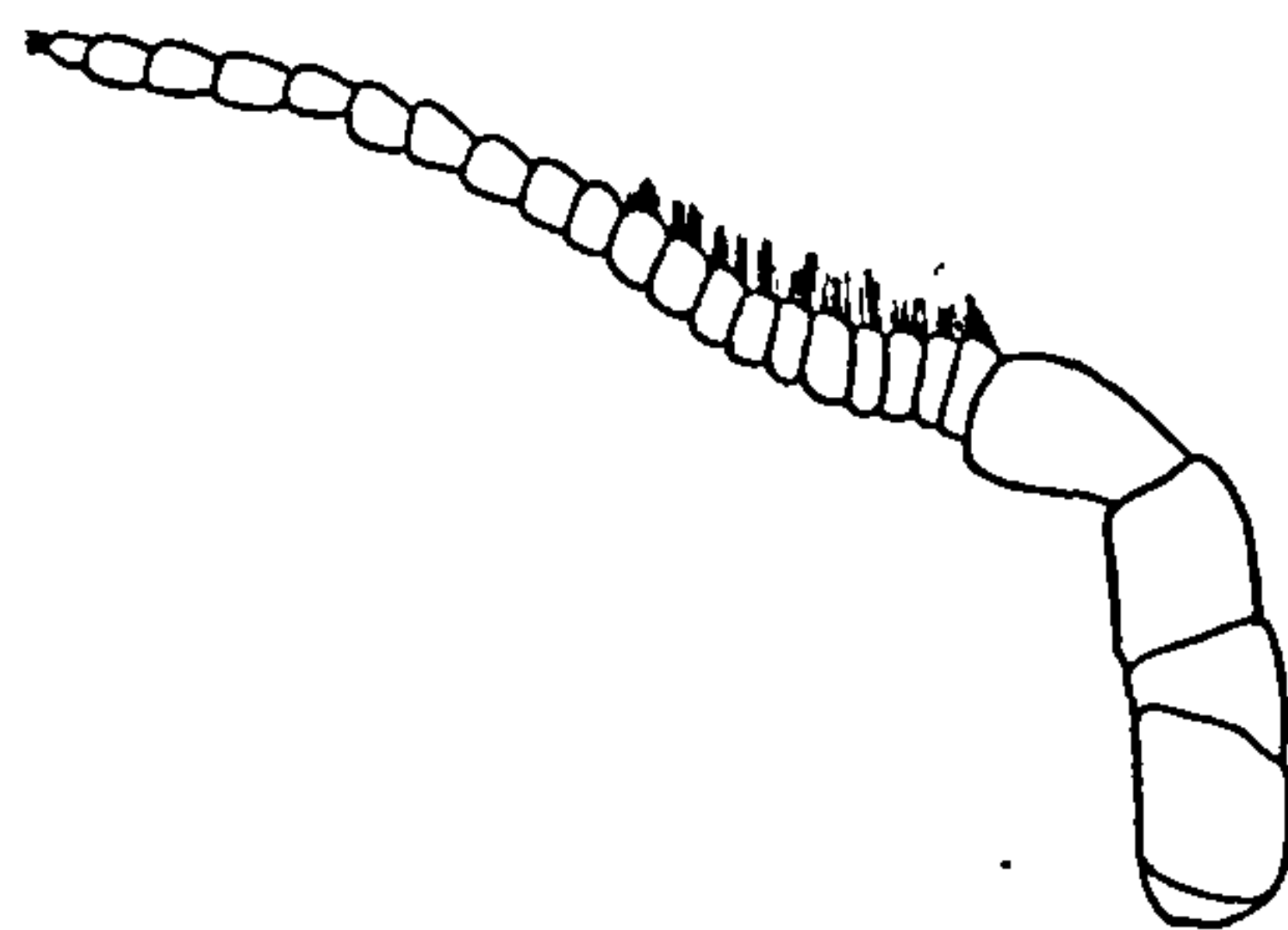


FIG. 70.—*CIROLANA MAYANA*. SECOND ANTENNA.  $\times 20\frac{1}{2}$ .

The first, fourth, and fifth segments of the thorax are a little longer than any of the others. The epimera of all the segments, with the exception of the first, are distinct. In the second and third segments they are narrow, increasing in width from those of the fourth to the seventh segments. The postero-lateral angles of the last three are acute and produced beyond the posterior margins of the segments. All the epimera are crossed by an oblique carina.

The first segment of the abdomen is almost entirely covered by the seventh thoracic segment. The fifth segment is as wide as the fourth, and is not covered at the sides by the lateral parts of the preceding segment. The sixth or terminal segment is rounded posteriorly. The inner branch of the uropoda is as long as the terminal segment of the body, and is slightly emarginate on its external margin. The outer branch is longer than the inner branch and is rounded posteriorly. The peduncle extends as far as the emargination on the exterior margin of the inner branch. Both branches are beset with spines.

The first three pairs of legs are prehensile. The propodus is armed with four spines, the carpus with three in the first legs, with two in the second and third pairs; the merus with six spines; and the ischium with three or four; the outer distal end of the merus is furnished with one long spine in the first pair of legs. The last four pairs of legs are also furnished with spines.

**CIROLANA LINGUIFRONS** Richardson.

*Cirolana linguifrons* RICHARDSON, Proc. U. S. Nat. Mus., XXI, 1899, p. 823; Ann. Mag. Nat. Hist. (7), IV, 1899, pp. 163-164.

*Locality.*—Monterey Bay, California.

Dug at mean tide mark from sandy shore.

Color, yellow, marked with scattered black dots. Body elongate-ovate, about five times longer than broad, greatly convex.

Head with the frontal margin produced in a long, straight process, rounded anteriorly and somewhat dilated. Eyes large, distinct. First pair of antennæ with the articles of the peduncle large; flagellum of fifteen short joints extends to the posterior margin of the third thoracic segment. Second pair of antennæ, with a flagellum of thirteen long articles, extend to the posterior margin of the fifth thoracic segment.

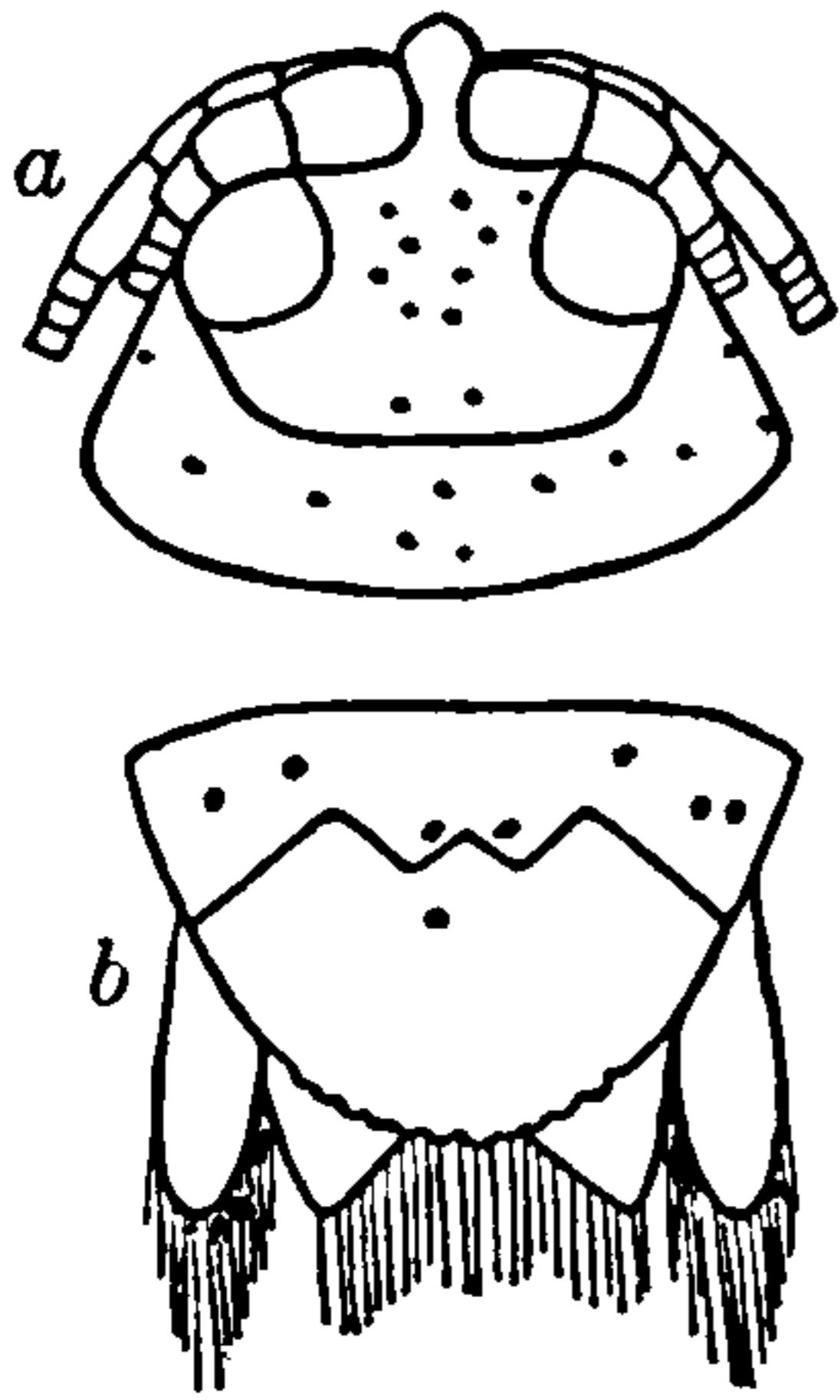


FIG. 71.—CIROLANA LINGUIFRONS.  $\times 13\frac{1}{2}$ . a, HEAD. b, TERMINAL SEGMENT.

The first three segments of the thorax are short; the other four segments are long. The epimera of the second, third, and fourth segments

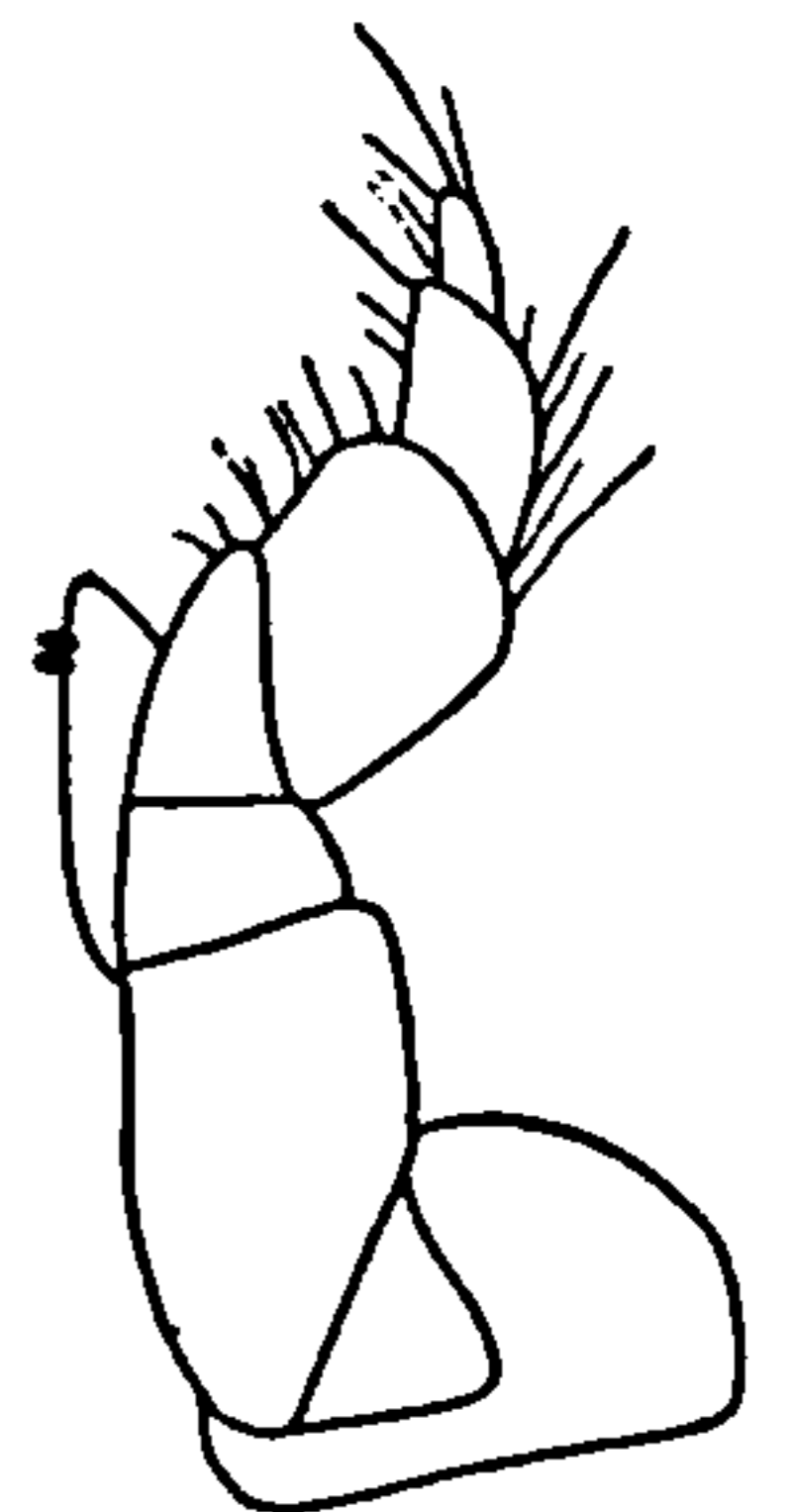


FIG. 72.—CIROLANA LINGUIFRONS. MAXILLIPED.  $\times 51\frac{1}{2}$ .

are not produced at the apex; those of the fifth, sixth, and seventh but slightly produced.

All the abdominal segments conspicuous, the first five being of equal length. The fifth segment is as wide as the fourth, and the lateral parts are not covered by the post-lateral angles of the preceding segment. The terminal segment is rounded posteriorly, faintly crenulate and fringed with long hairs. The base of this segment is raised above the other portion and has a well-defined edge with two points extending backward, one on either side of the median line. The uropoda extend beyond the tip of the abdomen; the inner branch is obliquely truncate; the outer branch is more rounded; both branches are fringed with long hairs.

The prehensile legs are short; the ambulatory legs are long and slender. The legs increase gradually in length from the first to the seventh pair.



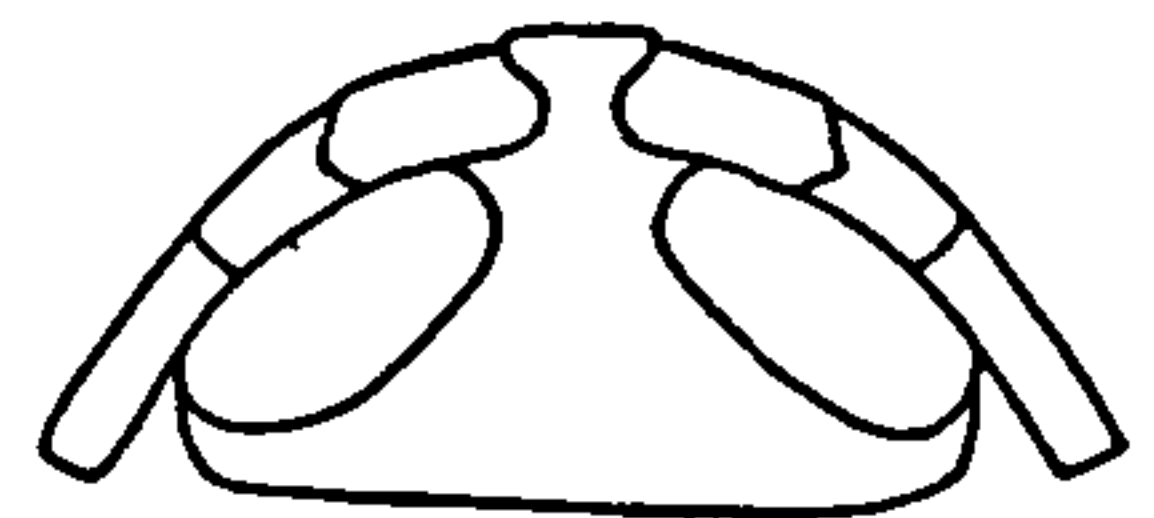
Two specimens, from Monterey Bay, California, collected by Mr. Heath from sandy shore at mean tide.

*Type*.—Cat. No. 22564, U.S.N.M.

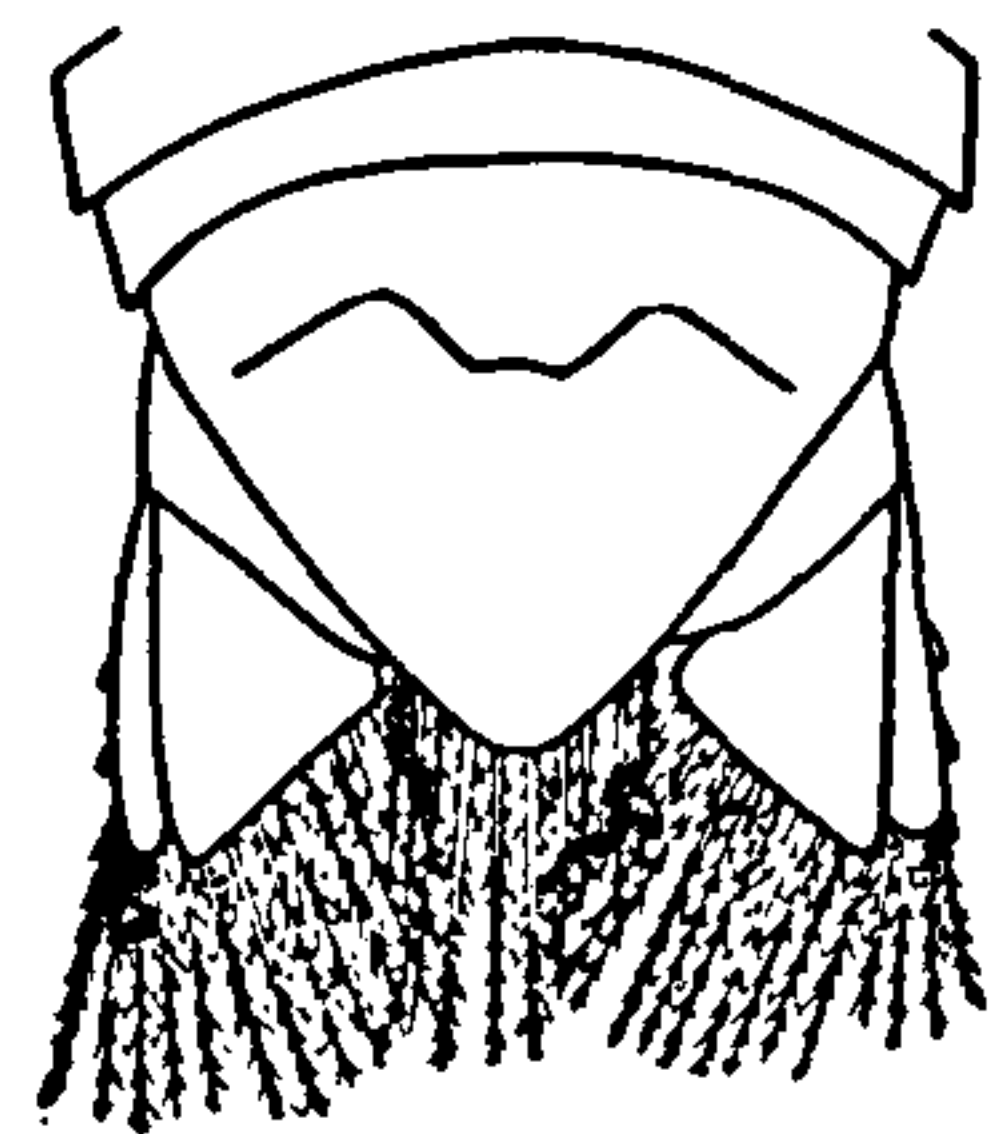
**CIROLANA CHILTONI**, new species.

Body oblong-ovate, a little more than twice as long as wide, 5 mm.: 11 mm.

Head wider than long, about twice as wide as long,  $1\frac{1}{2}$  mm.: 3 mm. with the front produced in a prominent process which widens anteriorly beyond the antennæ, arches over them and is confluent with the frontal lamina. The eyes are large, composite, and occupy the anterolateral corners of the head. The first pair of antennæ have the first article large, the second article somewhat shorter, and the third article about one and a half times longer than the second. The peduncle extends to the posterior margin of the head. The flagellum, which is composed of fifteen articles, extends to the posterior margin of the third thoracic segment. The second pair of antennæ have the first two articles extremely short and about equal in length; the third and fourth are subequal and each article is about as long as the first two taken together; the fifth article is twice as long as either of the two preceding articles. The peduncle of the second antennæ extends to the middle of the first thoracic segment. The flagellum is composed of thirteen articles and extends a little beyond the post-lateral angle of the fifth thoracic segment.



a



b

FIG. 73.—*CIROLANA CHILTONI*. a, HEAD.  $\times 9\frac{1}{2}$ . b, POSTERIOR PART OF ABDOMEN.  $\times 9\frac{1}{2}$ .

The seven thoracic segments are subequal in length. Epimera are distinct on the last six segments. The last three have the post-lateral angles slightly produced beyond the posterior margins of the segments.

The first segment of the abdomen is short, being partly covered by the seventh thoracic segment. The second, third, and fourth segments are equal in length and width. The fifth segment is as wide as the preceding segment, and the lateral parts are not covered by the lateral angles of the fourth segment. This segment is a little longer than any of the three preceding segments in the middle of the dorsal surface. The sixth or terminal segment is posteriorly triangular, with apex acute. The inner branch of the uropoda is very broad and obliquely truncate, the outer and inner posterior angles being acute. The outer branch is narrow and posteriorly rounded; it extends to the outer posterior angle of the inner branch. Both branches, as well as the posterior margin of the terminal segment are fringed with long hairs. The base of the terminal abdominal segment is raised above

the posterior portion of the segment, and has the posterior edge sharply defined. This carina is in the form of three lobes, two lateral lobes and a median lobe, which is truncate.

The first three pairs of legs are short and prehensile; the four following pairs are ambulatory and densely spinulose.

Two specimens, both females, were collected at San Francisco, California, by Mr. T. G. Cary, jr. They were found in dead *Hippa*. The types are in the Museum of Comparative Zoology, Harvard University. Cat. No. 1621. M. C. Z.

This species is named for Prof. Charles Chilton, the distinguished carcinologist.

#### CIROLANA MINUTA Hansen.

*Cirolana minuta* HANSEN, Vidensk. Selsk. Skr. (6), V, 1890, pp. 347-348, pl. III, figs. 5-5d; pl. IV, figs. 1-1f.—RICHARDSON, Proc. U. S. Nat. Mus., XXIII, 1901, p. 512.—STEBBING, Willey's Zool. Results, 1902, p. 634.

*Localities*.—St. Thomas, West Indies; also Lifu, Loyalty Islands (Stebbing).

Body oblong-ovate, about two and a third times longer than wide, somewhat convex.

The head is formed almost as in *C. parva*.

The eyes are moderately large, larger than in other species, brownish, almost wider than long, the ocelli rather numerous, somewhat convex.

The frontal lamina is about two and a half times longer than wide, oblong-pentagonal, or almost hexagonal, with the apex anteriorly truncate, the basal part furnished with a moderately large acuminate tubercle. The clypeus is small, much shorter than the labrum.

The first pair of antennæ are somewhat elongate, extending somewhat beyond the peduncle of the second pair of antennæ; the peduncle is a little longer than the flagellum, and is composed of two articles; the flagellum is slender and is composed of seven articles.

The second pair of antennæ do not extend quite to the posterior margin of the fourth thoracic segment; the peduncle is slender, with the fourth article almost twice as long as the third article, and a little shorter than the fifth article; the flagellum is composed of seventeen or eighteen articles.

The mandibles have the cutting edge partly concealed by the labrum, seen at first rather narrow.

The maxillipeds are short, with the fifth article largest, wider than long, somewhat larger than both of the last articles.

The segments of the thorax are almost as in *C. parva*.

The epimera are moderately large, differing a little in size, and furnished with the two usual furcæ; the posterior epimera are a little produced posteriorly, with apex acute.

The legs are slender, with the second article somewhat elongate; the first pair of legs are manifestly stouter than the second pair of legs; the second and third pairs of legs have the fourth article produced on the exterior side to the middle of the fifth article; the fifth and seventh pairs of legs are subequal; the second pair are somewhat longer and the sixth pair a little shorter.

The anterior segments of the abdomen and the pleopoda are almost as in *C. parva*. The last segment of the abdomen is somewhat wider

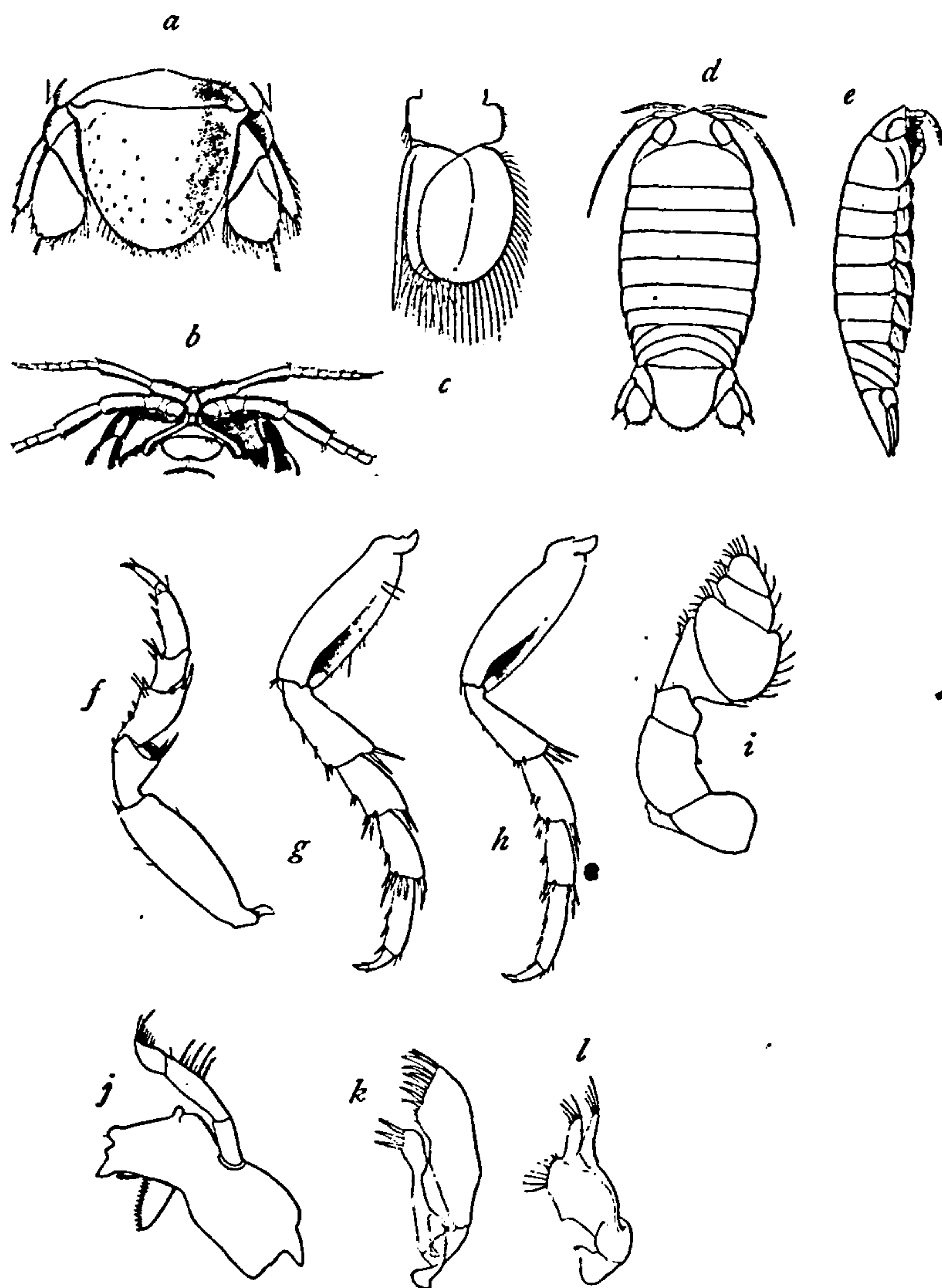


FIG. 74.—*Cirolana minuta* (AFTER HANSEN). *a*, POSTERIOR PART OF ABDOMEN. *b*, ANTERIOR PART OF HEAD (FROM BELOW). *c*, LEFT PLEPOD OF SECOND PAIR. *d*, ADULT MALE. *e*, LATERAL VIEW OF SAME. *f*, SECOND LEG. *g*, FIFTH LEG. *h*, SEVENTH LEG. *i*, MAXILLIPED. *j*, MANDIBLE. *k*, FIRST MAXILLA. *l*, SECOND MAXILLA. (ENLARGED.)

than long, extends a very little beyond the uropoda, is a little linguatate and evenly convex, with the posterior margin widely rounded and furnished with about eight spines.

The uropoda are short and wide. The inner branch is more than one-half longer than wide; the posterior part of the inner margin is strongly curved, and furnished with plumose cilia and a few spines; the apex forms a right angle, is bifid, and furnished with a few long simple hairs; the exterior margin is somewhat curved. The

outer branch is short, with apex bifid and furnished with long simple hairs. The peduncle has the inner posterior angle reaching a little beyond the middle of the inner branch.

The color of the specimens, preserved for a long time in alcohol, is a pale brown.

The male appendage extends a long distance beyond the inner branch, is narrow, straight, rather compressed, with apex acuminate.<sup>a</sup>

<sup>a</sup>The above description is adapted from the following one of Hansen's:

Diagn. Corpus oblongo-ovatum. Frons in processum, a fronte visum longiorem, sat angustum nonnihil circumflexum, cum lamina frontali conjunctum, producta. Lamina frontalis fere oblongo-hexagona, parte basali cornu instructa. Antennulæ pedunculo antennarum nonnihil longiores; pedunculus biarticulatus. Antennæ circiter medium truncum attingentes. Epimera mediocria, furcis solitis instructa. Pedes graciliores, simplices. Segmentum ultimum caudæ uropoda perpaulum superans, lingulatum, paulum et æqualiter convexum, margine posteriore late rotundato, spinis c. 8 ornato. Uropoda brevia, lata; ramus interior ramo exteriori multo longior, margine postero-interiore valde excurvato, apice bifido angulum subrecto formante. Long. maris 4, 3 mm., long. feminae 4, 8 mm.

Corpus oblongo-ovatum, circiter duplo et tertia parte longius quam latius, nonnihil convexum. Frons fere ut in *C. parva* formata.

Oculi mediocres, majores quam in speciebus ceteris, brunnescentes, fere latiores quam longiores, ocellis sat numerosis, nonnihil convexis.

Lamina frontalis circiter duplo et dimidio longior quam latior, oblongo-pentagona vel fere hexagona, apice anteriore truncato, parte basali cornu mediocri, acuminato instructa. Clypeus parvus, labro multo brevior.

Antennulæ nonnihil elongatæ, pedunculum antennarum nonnihil superantes; pedunculus flagello paulo longior, biarticulatus; flagellum gracilius; 7-articulatum.

Antennæ marginem posteriorem segmenti quarti trunci non attingentes; pedunculus gracilior, articulo quarto fere duplo longiore quam articulo tertio, paulo brevior quam articulo quinto; flagellum 17-vel 18-articulatum.

Mandibulæ acie ex parte a labro tecta, primo visu sat angusta. Maxillipedes breves, articulo quinto maximo, latiore quam longiore, aliquanto majore quam articulis ambobus ultimis.

Segmenta trunci fere ut in *C. parva*.

Epimera mediocria, magnitudine paulum inter se discrepantia, furcis binis solitis instructa; epimera posteriora postice paulum producta, apice acuto. Pedes graciliores, articulo secundo nonnihil elongato; pedes primi paris pedibus secundi paris manifesto crassiores; pedes secundi et tertii parium articulo quarto in latere exteriori haud ad medium articulum quintum producto; pedes quinti et septimi parium æquilongi, pedibus secundi paris nonnihil longiores et pedibus sexti paris paulo breviores.

Segmenta anteriora caudæ et pleopoda fere ut in *C. parva*. Segmentum ultimum caudæ nonnihil latius quam longius; cetera in diagnosi commemorata.

Uropoda brevia, lata. Remus interior plus quam dimidio longior quam latior; margo postero-interior valde excurvatus, ciliis mediocribus plumosis et spinis nonnullis instructus; apex angulum subrectum formans, bifidus, setis nonnullis longis, simplicibus instructus; margo exterior aliquantum excurvatus. Ramus exterior brevis, apice bifido, setis longis, simplicibus instructo. Scapus angulo postero-interiore paulum ultra medium ramum interiorem attingente.

Color in speciminibus diu in spiritu vini asservatis pallide brunnescens.

Appendix masculina ramum interiorem longe superans, recta, angusta, sat compressa, apice acuminato, acuto.—HANSEN, Vidensk. Selsk. Skr. (6), V, 1890, pp. 347-348.

## CIROLANA CONCHARUM (Stimpson).

*Æga concharum* STIMPSON, Smithsonian Contributions to Knowledge, VI, 1853, p. 42.—LÜTKEN, Vidensk. Meddel., 1859, p. 77.

*Conilera concharum* HARGER in VERRILL, Report U. S. Commissioner of Fish and Fisheries, 1873, Pt. 1, p. 572 (278); p. 459 (165).

*Cirolana concharum* HARGER, Proc. U. S. Nat. Mus., II, 1879, p. 161; Report U. S. Commissioner of Fish and Fisheries, 1880, Pt. 6, pp. 378-381, pls. ix-x, figs. 58-63; Bull. Mus. Comp. Zool., Harvard College, XI, No. 4, 1883, pl. 1, fig. 4; pl. II, figs. 4-4c.—RICHARDSON, American Naturalist, XXXIV, 1900, p. 216; Proc. U. S. Nat. Mus., XXIII, 1901, p. 513.

*Localities*.—Currituck, North Carolina; Charleston, South Carolina; Woods Hole, Massachusetts; Amagansett, Long Island; Vineyard Sound; off Fishers Island; off New Shoreham; Block Island; Long Island Sound; Halifax, Nova Scotia.

*Depth*.—Surface to 18 fathoms; muddy and sandy bottom.

From stomach of skate; under eye of *Pseudotriacis microdon*.

It feeds on the common blue crab. From a single crab as many as 108 specimens have been taken.

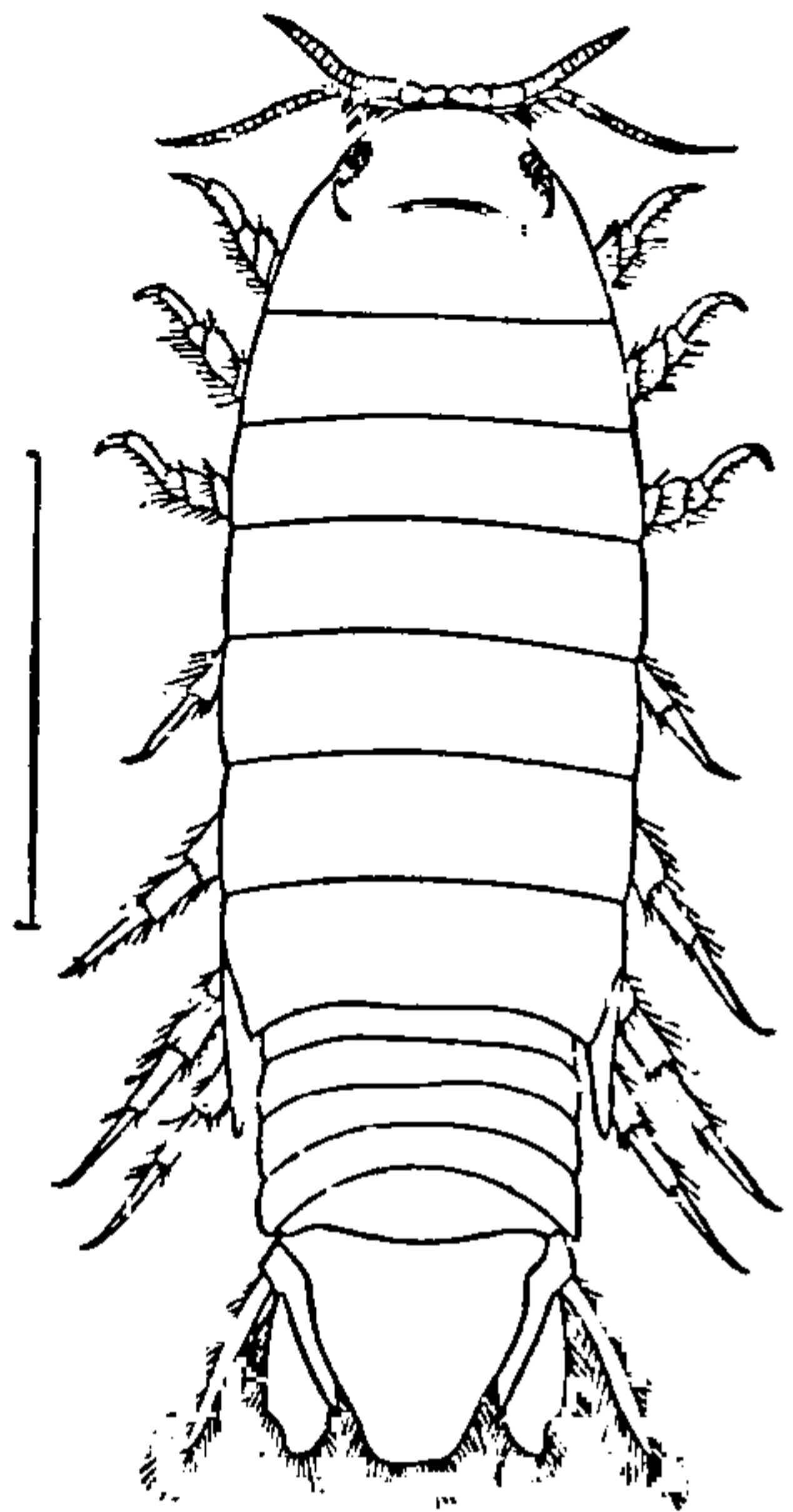


FIG. 75.—CIROLANA CONCHARUM (AFTER HARGER).

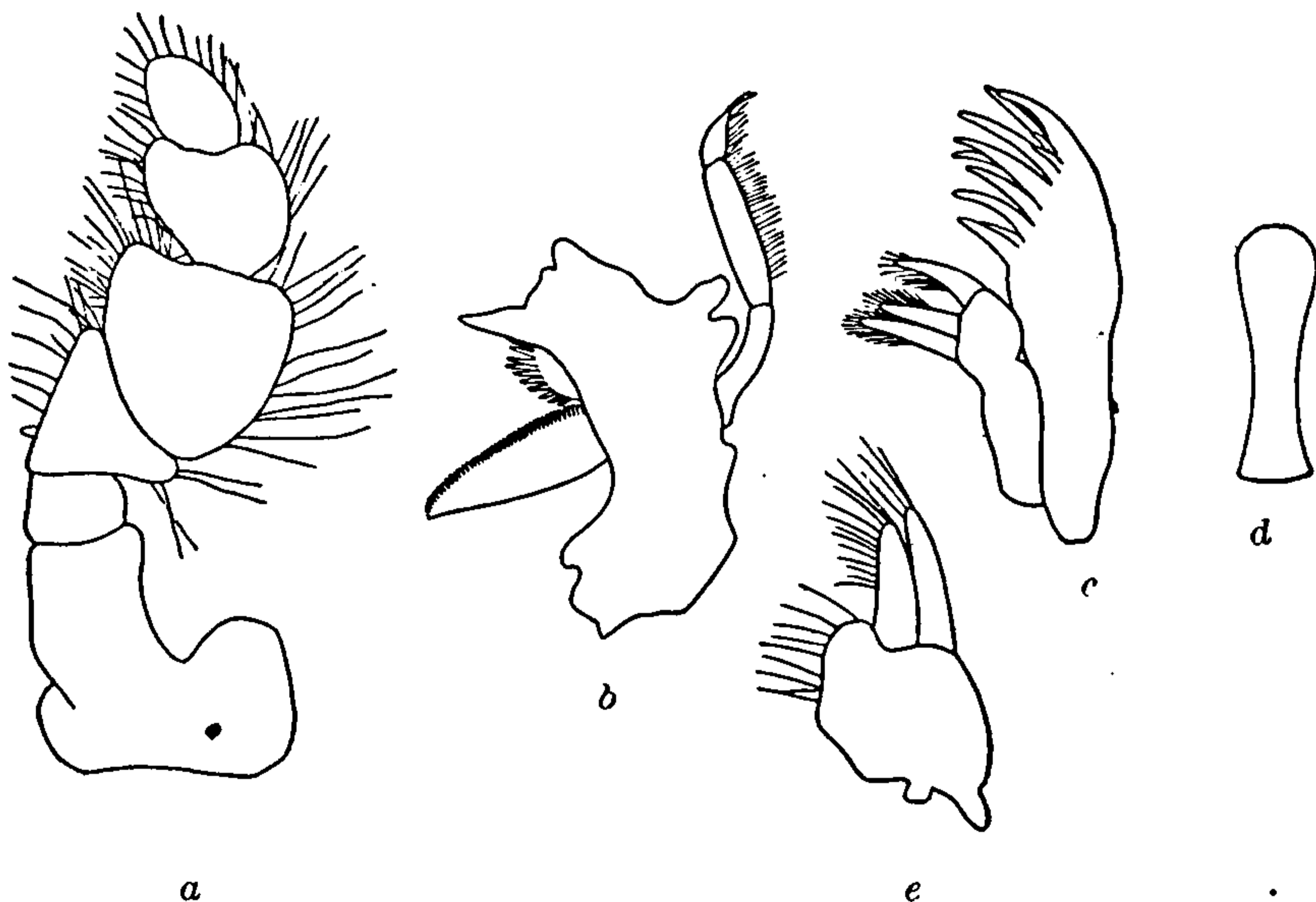


FIG. 76.—CIROLANA CONCHARUM. *a*, MAXILLIPED.  $\times 15\frac{1}{2}$ . *b*, MANDIBLE.  $\times 15\frac{1}{2}$ . *c*, FIRST MAXILLA.  $\times 15\frac{1}{2}$ . *d*, FRONTAL LAMINA.  $\times 27\frac{1}{2}$ . *e*, SECOND MAXILLA.  $\times 15\frac{1}{2}$ .

Body oblong-ovate, about three times longer than broad; 8 mm.: 23 mm.

Head wider than long, 3 mm.: 4 mm., with the anterior margin rounded and produced in a small median point. Eyes small, irregular in outline, composed of numerous ocelli, and situated in the antero-

lateral angles of the head. The first pair of antennæ have the first two articles short and subequal; the third is as long as the first two taken together. The flagellum is composed of seventeen articles and extends to the antero-lateral angles of the first thoracic segment. The second antennæ have the first two articles short and subequal; the third and fourth are subequal and each is as long as the first and second together; the fifth is a little longer than the fourth. The flagellum is composed of sixteen articles and extends to the posterior margin of the first thoracic segment: The maxillipeds are composed

of seven articles. The palp of the mandibles is composed of three articles.

The first, fourth, fifth, and sixth segments of the thorax are subequal in length, being each 2 mm. long. The second, third, and seventh are subequal and each is  $1\frac{1}{2}$  mm. in length. The epimera are distinctly separated from the segments on all but the first segment. In the epimera of the sixth and seventh segments the outer post-lateral angle is acutely produced beyond the posterior margin of the segments.

All six segments of the abdomen are distinct. The last segment is triangular, in shape, with

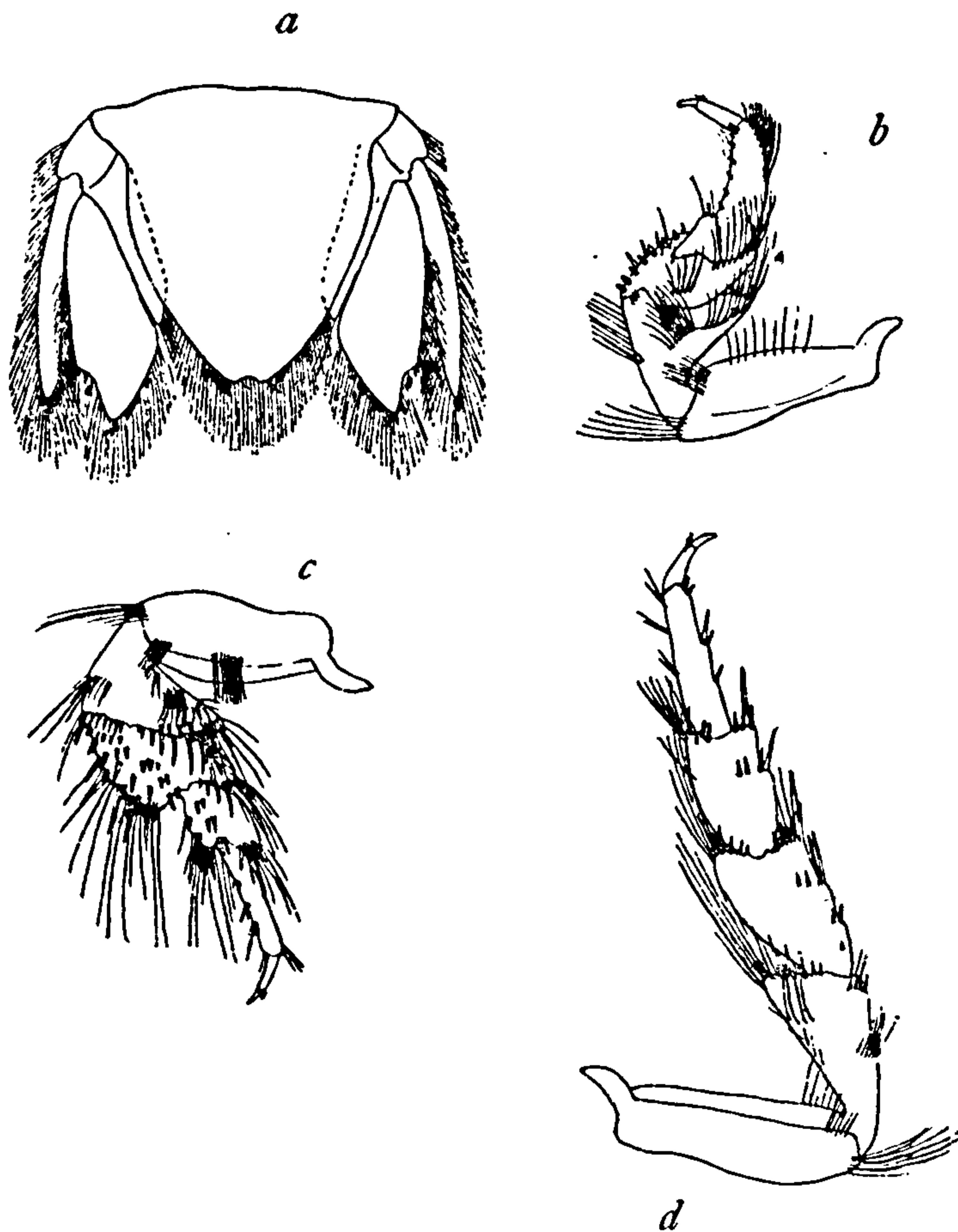


FIG. 77.—*CIROLANA CONCHARUM* (AFTER HARGER). *a*, LAST SEGMENT OF ABDOMEN WITH UROPODA.  $\times 6$ . *b*, LEG OF FIRST PAIR.  $\times 8$ . *c*, LEG OF FOURTH PAIR.  $\times 8$ . *d*, LEG OF SEVENTH PAIR.  $\times 8$ .

the apex notched. The uropods do not extend beyond the extremity of the terminal abdominal segment. Both are of equal length, the outer branch being only one-third as wide as the inner branch. There is a notch on the exterior margin of the inner branch near its posterior extremity. The inner angle of the peduncle of the uropoda is produced and extends two-thirds the length of the terminal abdominal segment.

The first three pairs of legs are prehensile; the last four pairs ambulatory.

## CIROLANA IMPRESSA Harger.

*Cirolana impressa* HARGER, Bull. Mus. Comp. Zool. Harvard College, XI, 1883, No. 4, pp. 93-95, pl. I, figs. 3-3d; pl. II, figs. 3-3c.—VERRILL, Report U. S. Commissioner of Fish and Fisheries, 1885, p. 559, pl. XXXVI, fig. 165.—RICHARDSON, American Naturalist, XXXIV, 1900, p. 216; Proc. U. S. Nat. Mus., XXIII, 1901, p. 513.

*Localities*.—Latitude  $40^{\circ} 2' 24''$  north, longitude  $70^{\circ} 23' 40''$  west; latitude  $40^{\circ} 3'$  north, longitude  $70^{\circ} 31'$  west; latitude  $39^{\circ} 57'$  north,

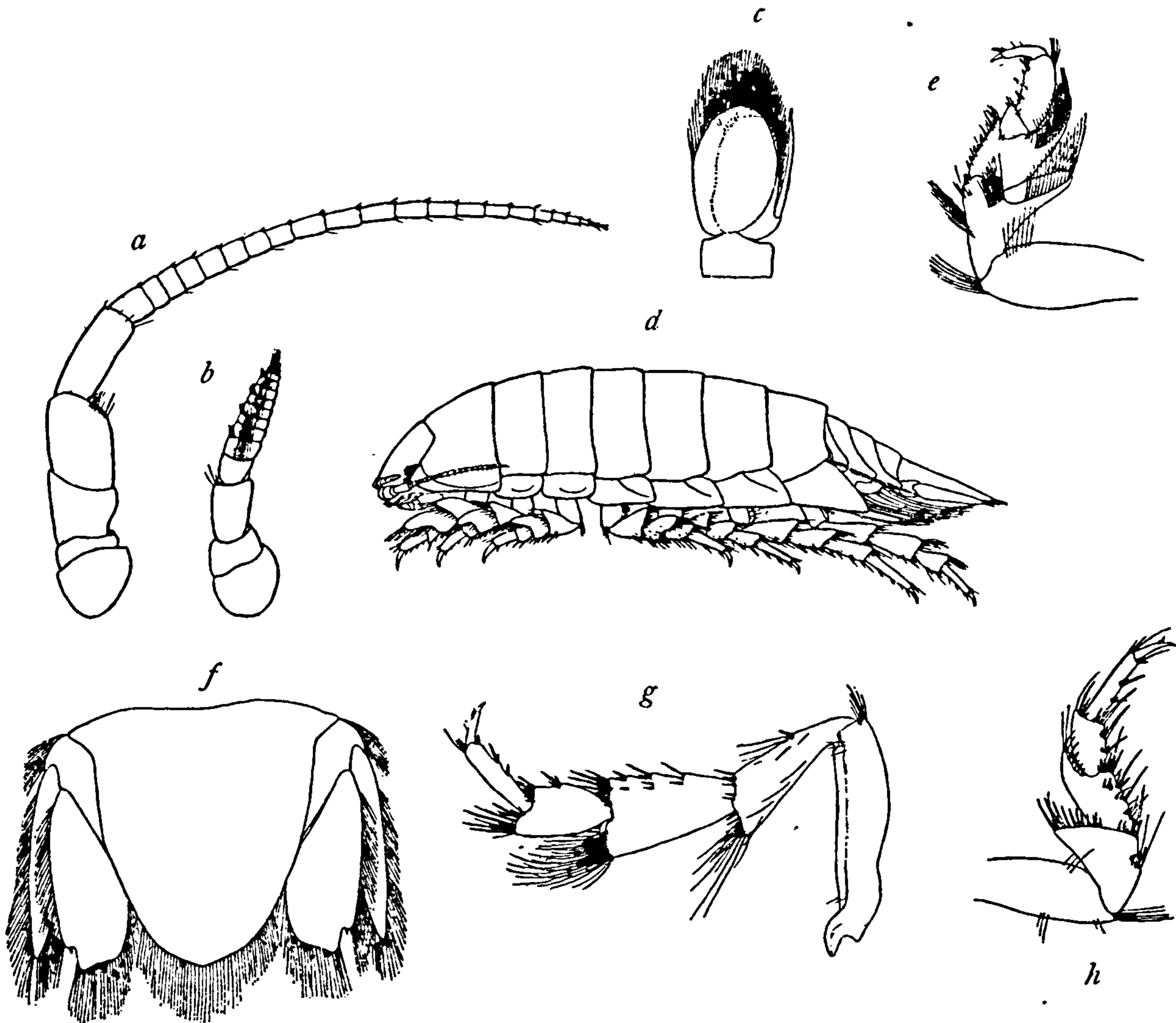


FIG. 78.—CIROLANA IMPRESSA (AFTER HARGER). *a*, SECOND ANTENNA.  $\times 12$ . *b*, FIRST ANTENNA.  $\times 12$ . *c*, SECOND PLEOPOD OF MALE.  $\times 8$ . *d*, LATERAL VIEW OF FEMALE.  $\times 3$ . *e*, LEG OF FIRST PAIR.  $\times 8$ . *f*, LAST SEGMENT OF ABDOMEN WITH UROPODA.  $\times 6$ . *g*, LEG OF SEVENTH PAIR.  $\times 8$ . *h*, LEG OF FOURTH PAIR.  $\times 8$ .

longitude  $69^{\circ} 47'$  west; latitude  $39^{\circ} 55' 28''$  north, longitude  $69^{\circ} 47'$  west; Chesapeake Bay; off Cape Hatteras.

*Depth*.—100-321 fathoms.

Body elongate, almost cylindrical, three and a half times longer than wide, 6 mm.: 21 mm.

Head wider than long,  $2\frac{1}{2}$  mm.:  $3\frac{1}{2}$  mm., with the anterior margin widely rounded and slightly excavate on either side of a small median

point. The eyes are small, composite, and situated in the antero-lateral angles of the head. The first two articles of the first pair of antennæ are short and subequal; the third article is as long as the first two taken together. The flagellum is composed of twelve short articles. The first antennæ extend to the antero-lateral angles of the first thoracic segment or to the end of the peduncle of the second pair of antennæ. The first two articles of the second antennæ are short and subequal; the third and fourth articles are subequal and each is as long as the first two taken together; the fifth is only a little longer than the fourth. The flagellum is composed of twenty articles. The second antennæ extend to the posterior margin of the second thoracic segment. The maxilliped is composed of seven articles. The palp of the mandibles is composed of three articles. The frontal lamina is narrow, elongate, and has the anterior margin rounded.

The first segment of the thorax is  $2\frac{1}{2}$  mm. long, and is longer than any of the following segments. The second and third are subequal,

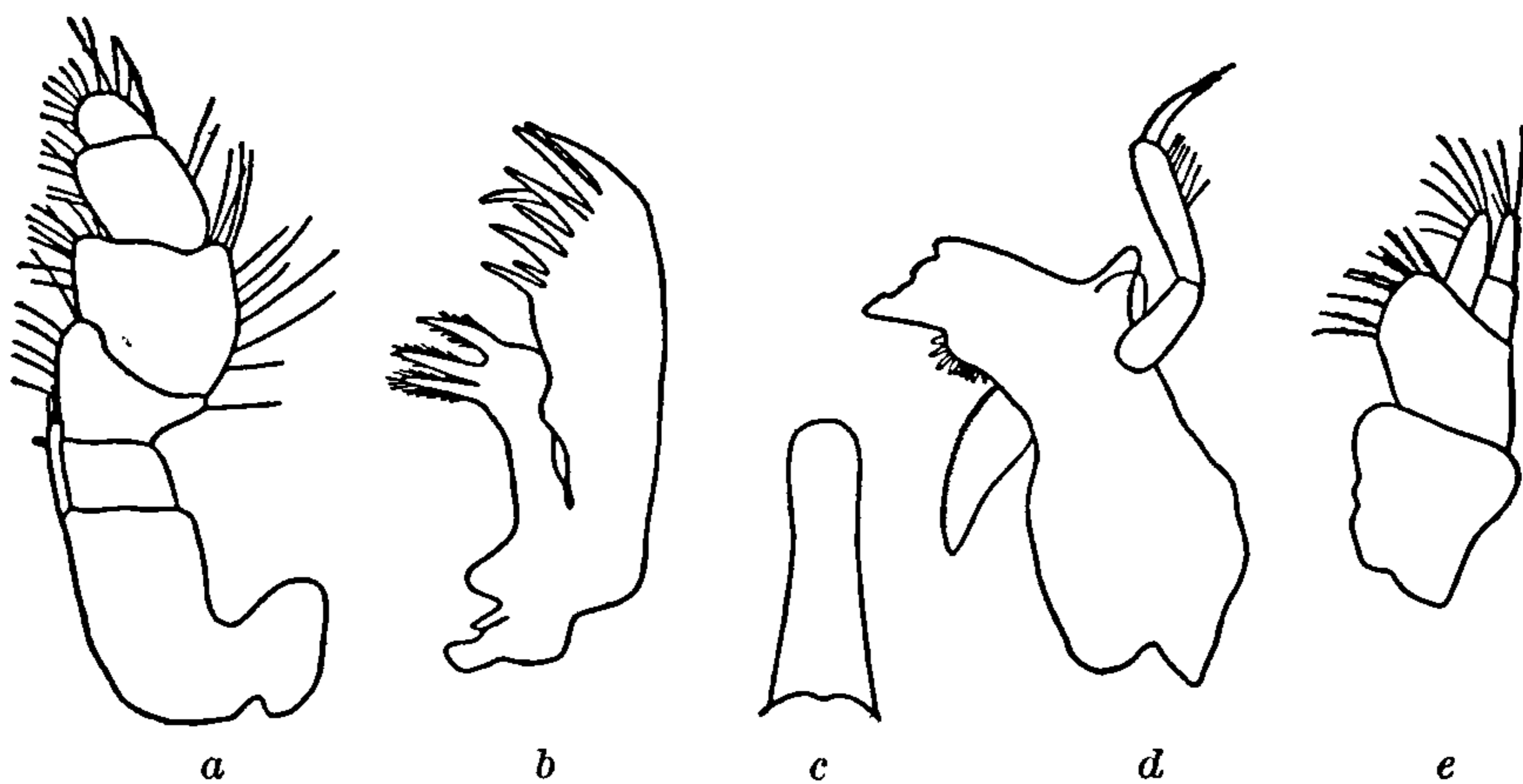


FIG. 79.—*CIROLANA IMPRESSA*. a, MAXILLIPED.  $\times 15\frac{1}{2}$ . b, FIRST MAXILLA.  $\times 15\frac{1}{2}$ . c, FRONTAL LAMINA.  $\times 27\frac{1}{2}$ . d, MANDIBLE.  $\times 15\frac{1}{2}$ . e, SECOND MAXILLA.  $\times 15\frac{1}{2}$ .

each being  $1\frac{1}{2}$  mm. long. The fourth, fifth, and sixth are subequal, being 2 mm. in length, and each a little longer than either the second or third segments. The seventh segment is  $1\frac{1}{2}$  mm. long. The epimera are distinct, separated on all the segments with the exception of the first. The first four have the outer post-lateral angles rounded; the last two have the outer post-lateral angles acutely produced beyond the posterior margins of the segments. There is a carina on all the epimera.

The first segment of the abdomen is entirely covered by the seventh thoracic segment. The sixth or terminal segment is rounded posteriorly and has the posterior margin crenulate and furnished with spines. The uropoda are as long as the terminal segment. The inner branch is a little longer than the outer branch, is emarginate on the exterior margin near the extremity and has one long spine in the emargination, and four long ones on the posterior margin; the exterior and posterior margins are crenulate. Below the emargination the inner branch is



wide and posteriorly truncate or slightly emarginate. The outer branch is about half as wide as the inner branch, and is furnished with one long spine at its posterior extremity. The inner angle of the peduncle extends about two-thirds the length of the terminal segment of the abdomen.

The first three pairs of legs are prehensile, the last four pairs ambulatory. The propodus of the first pair is armed with six spines, the carpus with one, the merus with twelve long ones on the inferior margin and one at the outer distal angle of the exterior margin. In the second and third pairs there are five spines on the propodus, four long ones on the carpus, and nine long ones on the inferior margin of the merus, with one long spine at the outer distal angle on the exterior margin.

**CIROLANA POLITA (Stimpson).**

*Ega polita* STIMPSON, Smith. Cont. to Knowl., VI, 1853, p. 41.—LÜTKEN, Vidensk. Meddel., 1859, p. 77.—VERRILL, Am. Jour. Sci. (3), V, 1873, p. 16.

*Conilera polita* HARGER, in Smith and Harger, Trans. Conn. Acad. Sci., III, 1874, pp. 3, 22.—VERRILL, Am. Jour. Sci., VII, 1874, p. 411.

*Cirolana polita* HARGER, Proc. U. S. Nat. Mus., II, 1879, p. 161; Report U. S. Commissioner of Fish and Fisheries, Pt. 6, 1880, pp. 381-382.—RICHARDSON, American Naturalist, XXXIV, 1900, p. 217; Proc. U. S. Nat. Mus., XXIII, 1901, p. 514.

*Localities.*—Bay of Fundy; Cape Cod Bay; Salem, Massachusetts; Georges Bank; east of Banquereau; off Long Beach, Grand Menan, New Brunswick.

*Depth.*—1-321 fathoms. Nature of bottom, coarse yellow sand; soft sandy mud.

Body narrow, elongate, about four times as long as wide, 4 mm. : 16 mm.; very convex, almost cylindrical.

The head is a little wider than long, 2 mm. : 3 mm.; its anterior margin is rounded, and produced in a small median point. The eyes are small, square, and composite, and situated in the antero-lateral angles of the head. The first pair of antennæ have the first two articles short and subequal; the third is twice as long as either of the other two. The flagellum is composed of twelve articles. The first pair of antennæ extend to the end of the peduncle of the second pair of antennæ or to the antero-lateral angles of the first thoracic segment. The second antennæ have the first two articles short and subequal; the third and fourth are subequal and each is as long as the first two taken together; the fifth is narrower than the preceding articles, a little more than half as wide, and is a little longer than the fourth. The flagellum is composed of ten articles.<sup>a</sup> The second pair of antennæ extend to the middle of the first thoracic segment. The maxillipeds are composed of seven articles. The mandibles have a palp of three

<sup>a</sup>In all the specimens examined.

articles. The frontal lamina is small, almost inconspicuous. The terminal lobe of the first article of the maxillæ of the first pair is drawn out into three elongated processes which are fringed with hairs.

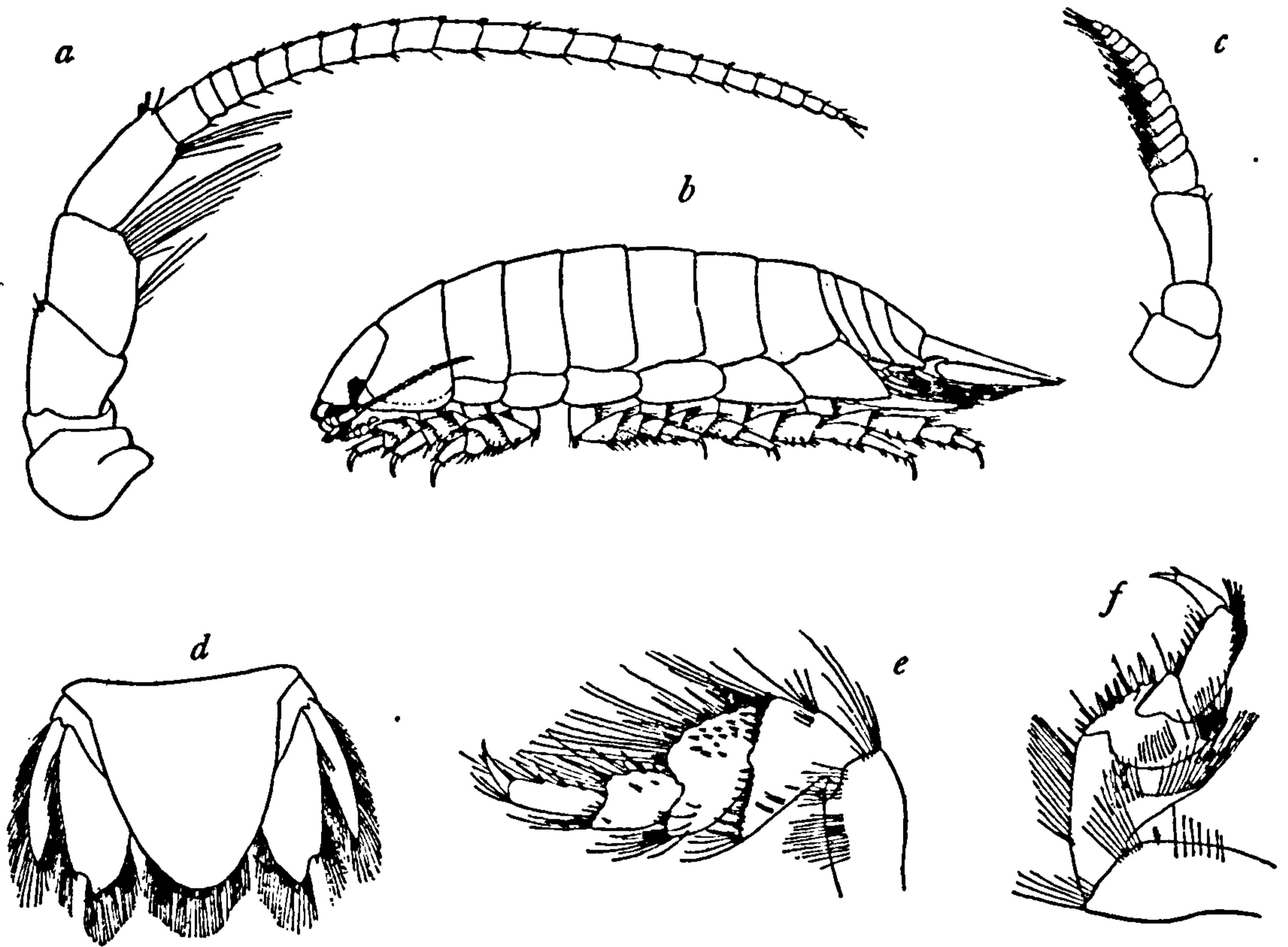


FIG. 80.—*CIROLANA POLITA* (AFTER HARGER). *a*, SECOND ANTENNA.  $\times 12$ . *b*, LATERAL VIEW OF FEMALE.  $\times 3$ . *c*, FIRST ANTENNA.  $\times 12$ . *d*, LAST SEGMENT OF ABDOMEN WITH UROPODA.  $\times 6$ . *e*, LEG OF FOURTH PAIR.  $\times 8$ . *f*, LEG OF FIRST PAIR.  $\times 8$ .

The fourth, fifth, and sixth segments of the thorax are a little longer than any of the others. The epimera are distinct on all but the first segment. They are narrow, oblong plates with the posterior angles of the last two acutely produced some distance beyond the posterior margin of the segments. All the segments of the abdomen are

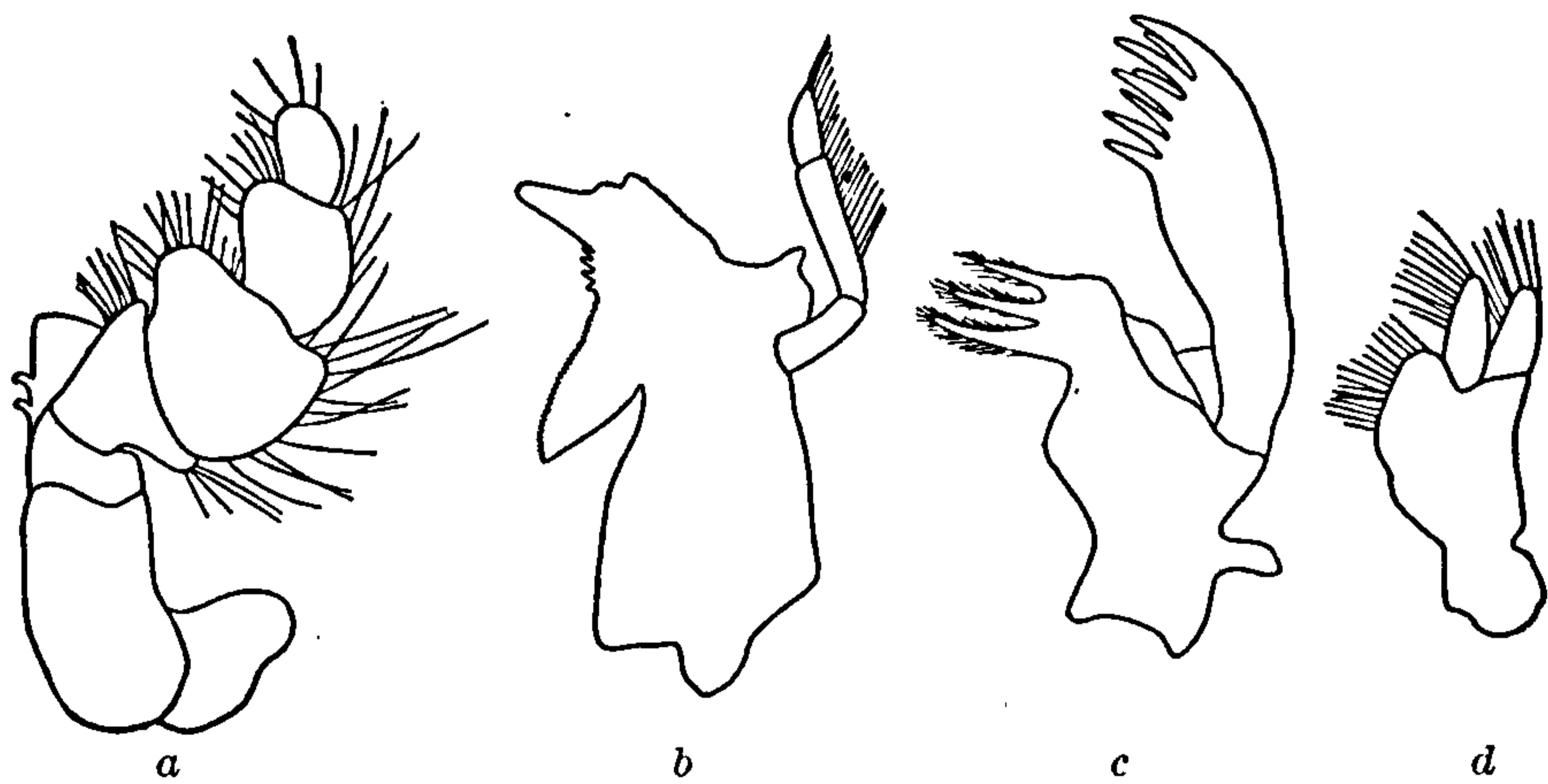


FIG. 81.—*CIROLANA POLITA*. *a*, MAXILLIPED.  $\times 27\frac{1}{2}$ . *b*, MANDIBLE.  $\times 27\frac{1}{2}$ . *c*, FIRST MAXILLA.  $\times 27\frac{1}{2}$ . *d*, SECOND MAXILLA.  $\times 27\frac{1}{2}$ .

distinct. The sixth or terminal segment is triangular in shape, with the apex crenulate. The inner branch of the uropoda is as long as the terminal segment of the body and has a slight emargination on the

exterior margin near the posterior extremity. The exterior margin of this branch is also crenulate above and below the emargination. Below the emargination the inner branch is narrow and posteriorly pointed. The outer branch is half as wide as the inner branch, is acutely pointed, and terminates in a single long spine. It extends as far as the emargination in the exterior margin of the inner branch.

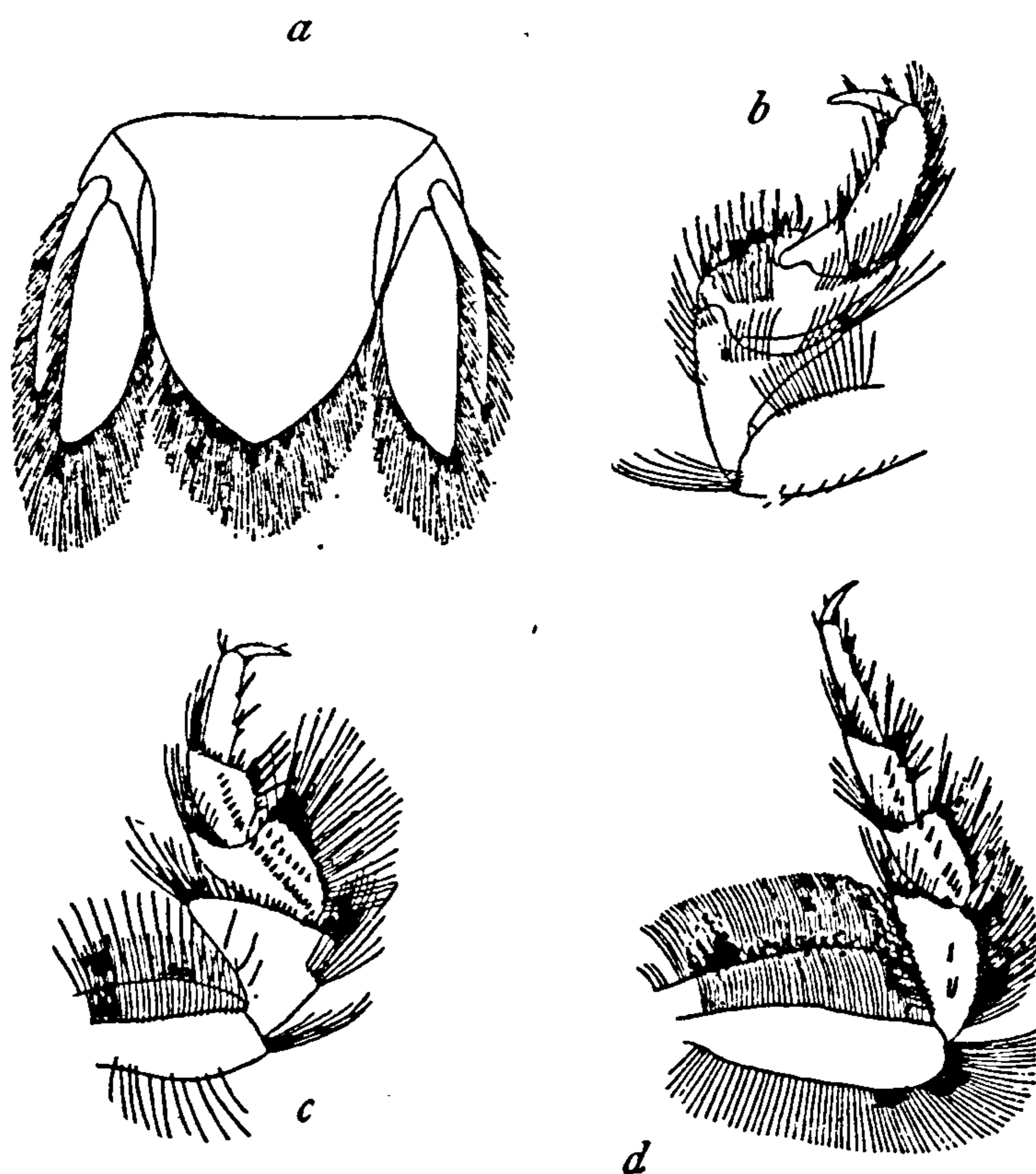


FIG. 82.—*CIROLANA BOREALIS* (AFTER HARGER) *a*, LAST SEGMENT OF ABDOMEN WITH UROPODA.  $\times 6$ .  
*b*, FIRST LEG.  $\times 8$ . *c*, FOURTH LEG.  $\times 9$ . *d*, SEVENTH LEG.  $\times 9$ .

The peduncle of the uropoda extends two-thirds the length of the last abdominal segment.

The first three pairs of legs are prehensile. In these legs the propodus is armed with five spines; the carpus with one spine in the first pair of legs and with three spines in the other two pairs; the merus with ten spines in the last two pairs and with thirteen in the first pair; at the distal extremity of the merus on the exterior side is a single long terminal spine. The last four pairs of legs are ambulatory and are beset with spines.

#### *CIROLANA BOREALIS* Lilljeborg.

*Cirolana borealis* LILLJEBORG, Öfvers. Vet. Akad. Förh., 1851, p. 23.

*Cirolana spinipes* BATE and WESTWOOD, Brit. Sessile-eyed Crustacea, II, 1868, p. 299.—HARGER, Bull. Mus. Comp. Zool., Harvard College, XI, No. 4, 1883, pp. 91-93, pl. I, figs. 2-2d; pl. II, figs. 1-1c.

*Cirolana borealis* HANSEN, Vidensk. Selsk. Skr. (6), V, 1890, pp. 321-322, pl. I, figs. 1-1v.—SCOTT, Ann. Scottish Nat. Hist., 1898, p. 222.—G. O. SARS, Crust.

of Norway, II, 1899, pp. 70-71, pl. xxix.—RICHARDSON, American Naturalist, XXXIV, 1900, p. 216; Proc. U. S. Nat. Mus., XXIII, 1901, p. 513.—OHLIN, Bihang till K. Svenska Vet.-Akad. Handl., XXVI, Afd. iv, 1901, No. 12, pp. 23-24.—DOLLFUS, Bull. Soc. Zool. France, XXVIII, 1903, pp. 5-6.—NORMAN, Ann. Mag. Nat. Hist. (7), XIV, 1904, p. 437.—HANSEN, Journ. Linn. Soc. London, XXIX, 1905, pp. 342-343.

*Localities.*—Off Cape Florida; Atlantic coast of North America; also British Isles; Shetland Isles; northern part of the western coast of France; latitude  $61^{\circ} 16'$  north, longitude  $1^{\circ} 18'$  east; Mediterranean at Villefranche and Naples; southern and western coast of Norway; Kattegat; latitude  $64^{\circ} 48'$  north, longitude  $6^{\circ} 32'$  east.

*Depth.*—30-300 fathoms; 140 m. to 1,210 m. (Dollfus); 808 fathoms (Norman).

Stebbing<sup>a</sup> says of this form: "It is a good swimmer, tenacious of life, a savage devourer of fish, and not to be held in the human hand with impunity."

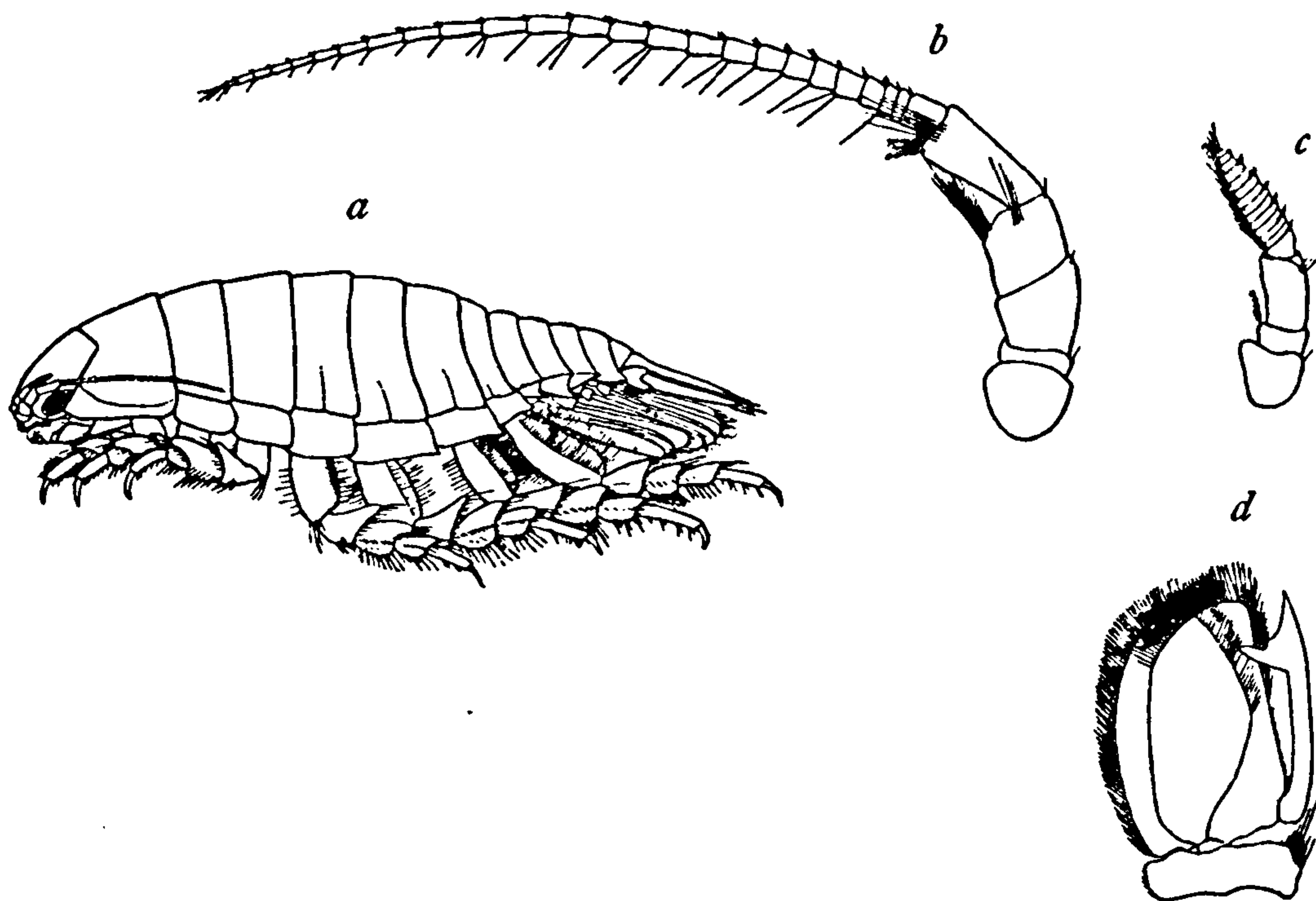


FIG. 83.—*CIROLANA BOREALIS* (AFTER HARGER). *a*, LATERAL VIEW.  $\times 3$ . *b*, SECOND ANTENNA.  $\times 10$ . *c*, FIRST ANTENNA.  $\times 10$ . *d*, PLEOPOD OF SECOND PAIR OF MALE.  $\times 8$ .

According to Sars, *C. borealis* is "one of the most effective scavengers of the sea, excelling in this respect even the most voracious species of *Anonyx* among the amphipoda."<sup>b</sup>

Body oblong-ovate, almost two and a half times longer than broad, 5 mm.:12 mm., very convex.

Head wider than long, 2 mm.:3 mm., with the anterior margin widely rounded and produced in a small median point. Eyes small, round, composite, and placed in the antero-lateral angles of the head. The first pair of antennæ have the first two articles short, the second

<sup>a</sup> Hist. of Crustacea, 1893, p. 343.

<sup>b</sup> Crust. of Norway, II, 1899, p. 71.

a little shorter than the first; the third is equal in length to the first two taken together. The flagellum is composed of twelve articles. The first antennæ extend to the end of the fourth article of the peduncle of the second antennæ. The first two articles of the second pair of antennæ are short; the second is shorter than the first; the third and fourth articles are about equal in length and each is as long as the first two taken together; the fifth article is one and a half times longer than the fourth. The flagellum is composed of twenty-four articles. The second antennæ extend to the posterior margin of the second thoracic segment. The maxilliped is composed of seven articles. The palp of the mandible is composed of three articles. The frontal lamina is narrow and elongate, with the anterior end rounded and more flattened than the posterior end, which is attenuated.

The first segment of the thorax is longer than any of those following. The seventh segment is shorter than any of the others. The

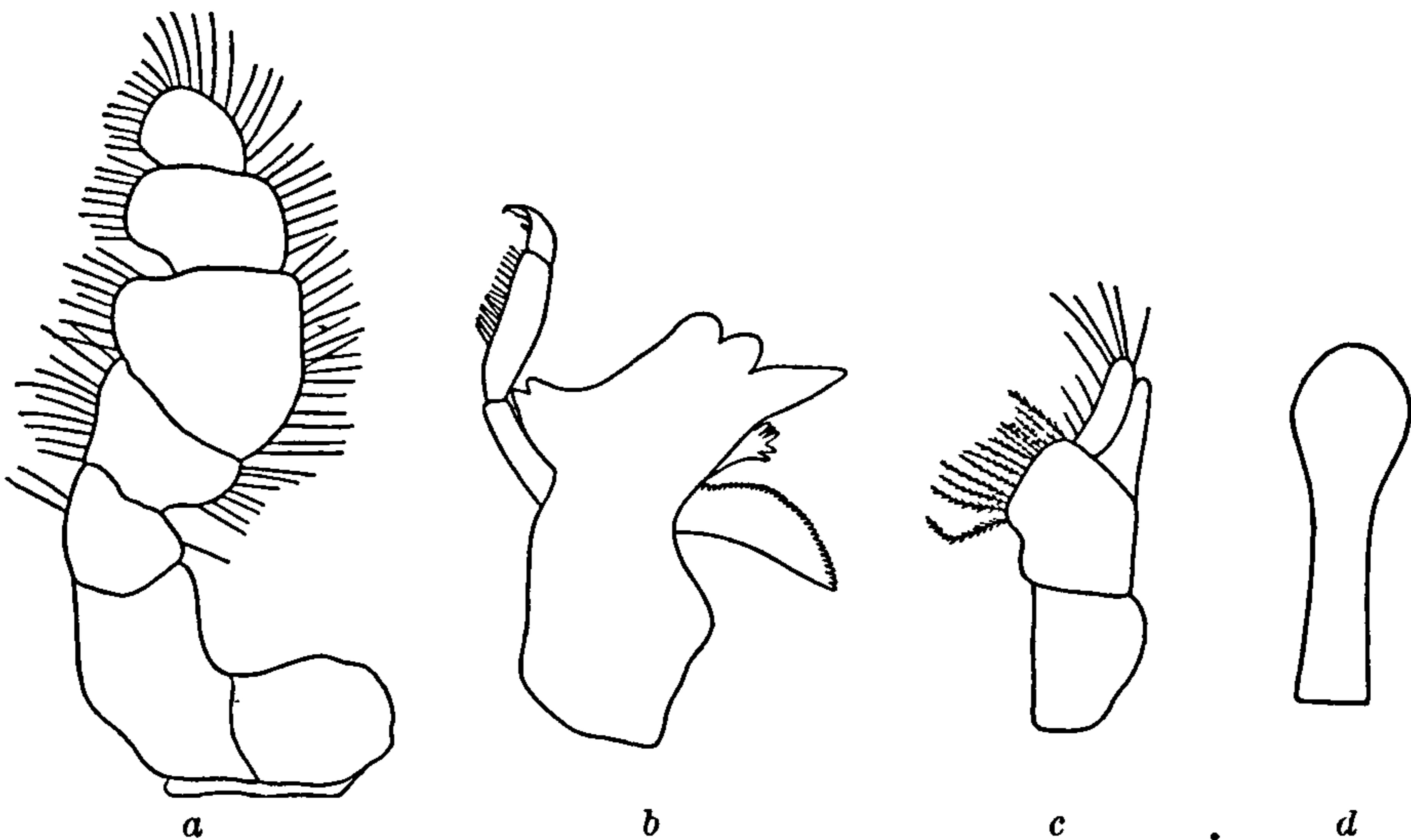


FIG. 84.—*CIROLANA BOREALIS*. *a*, MAXILLIPED.  $\times 27\frac{1}{2}$ . *b*, MANDIBLE.  $\times 27\frac{1}{2}$ . *c*, SECOND MAXILLA.  $\times 27\frac{1}{2}$ . *d*, FRONTAL LAMINA.  $\times 51\frac{1}{2}$ .

epimera are distinct on all the segments with the exception of the first. They are broad plates, the last four being wider than the first two and crossed obliquely by a carina. The outer post-lateral angles of the last three are produced beyond the posterior margin of the segment and are more acute than in the first three.

The first segment of the abdomen is partly concealed by the last thoracic segment. The sixth or terminal segment becomes narrower to a rounded extremity, which is crenulate and furnished with ten spines. The inner branch of the uropoda is wide and extends somewhat beyond the extremity of the last abdominal segment. Its outer post-lateral angle is slightly produced. The outer branch is half as wide as the inner branch, is a little shorter, and is produced to a pointed extremity. The margins of both branches are crenulate and armed with spines. The peduncle extends about two-thirds the length of the terminal abdominal segment.