

is not much developed; the dactylus has the form of a little, short claw, not reaching the end of the palmary margin of the preceding article.

The abdomen, in the median part, is very short and very slender; its entire size comes from the extraordinary development of its

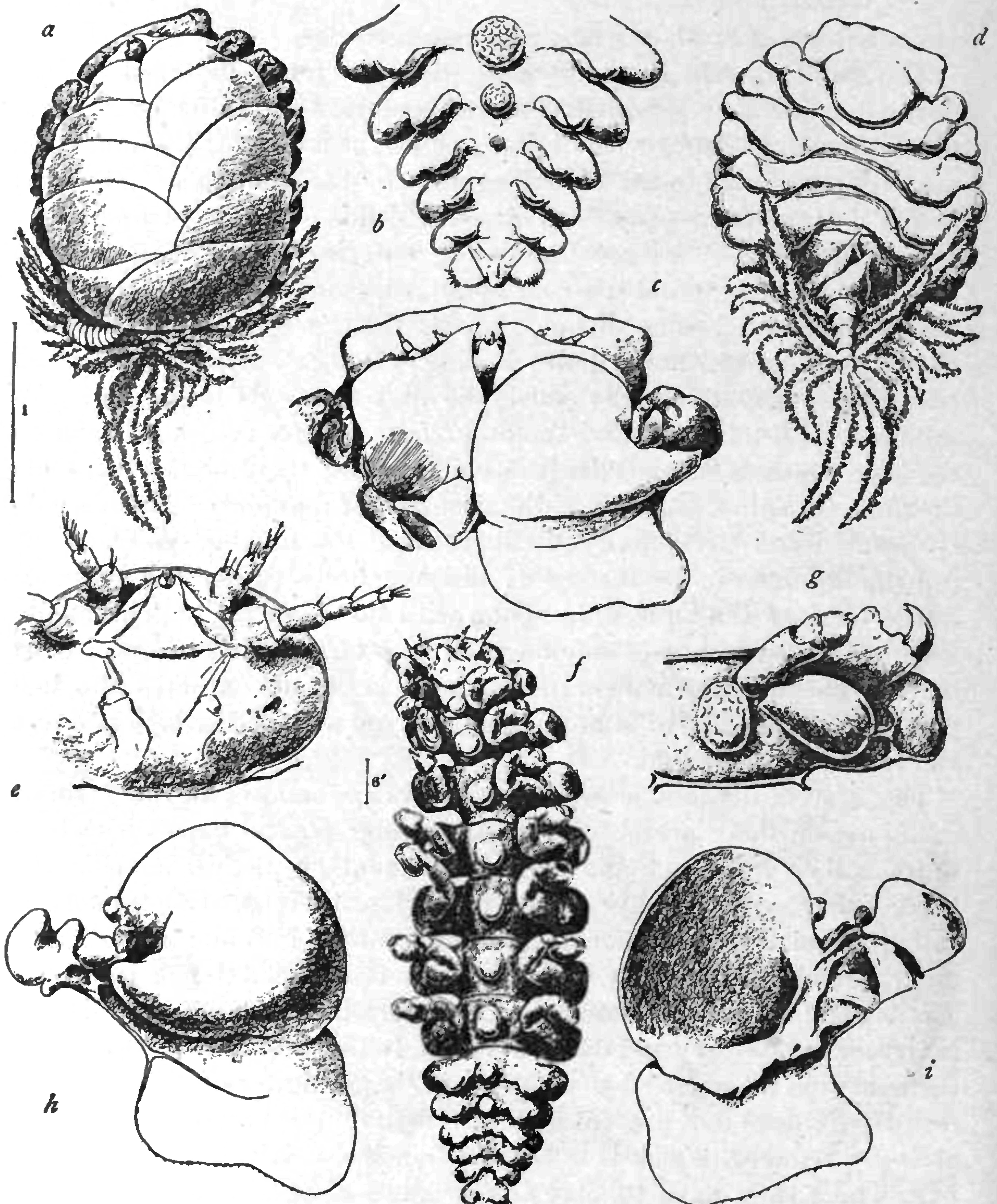


FIG. 561.—GRAPSICEPON EDWARDSI (AFTER BONNIER). *a*, VENTRAL VIEW OF FEMALE. *b*, ABDOMEN OF MALE (VENTRAL VIEW). *c*, VENTRAL VIEW OF HEAD OF FEMALE (FIRST RIGHT INCUBATORY LAMELLA REMOVED). *d*, DORSAL VIEW OF FEMALE. *e*, HEAD OF MALE (VENTRAL SIDE). *f*, VENTRAL VIEW OF MALE. *g*, SEVENTH THORACIC SEGMENT OF MALE (VENTRAL SIDE). *h*, FIRST LEG WITH INCUBATORY LAMELLA. *i*, THE SAME (INNER FACE).

pleural prolongations and of their appendages. The first form long lamellæ which rise parallel toward the anterior part of the body and



the edges of which are formed of a considerable and dense quantity of long digitations, some of which are subdivided into secondary digitations; these prolongations are especially developed on the first segments of the abdomen; they decrease in length on the last segments. The

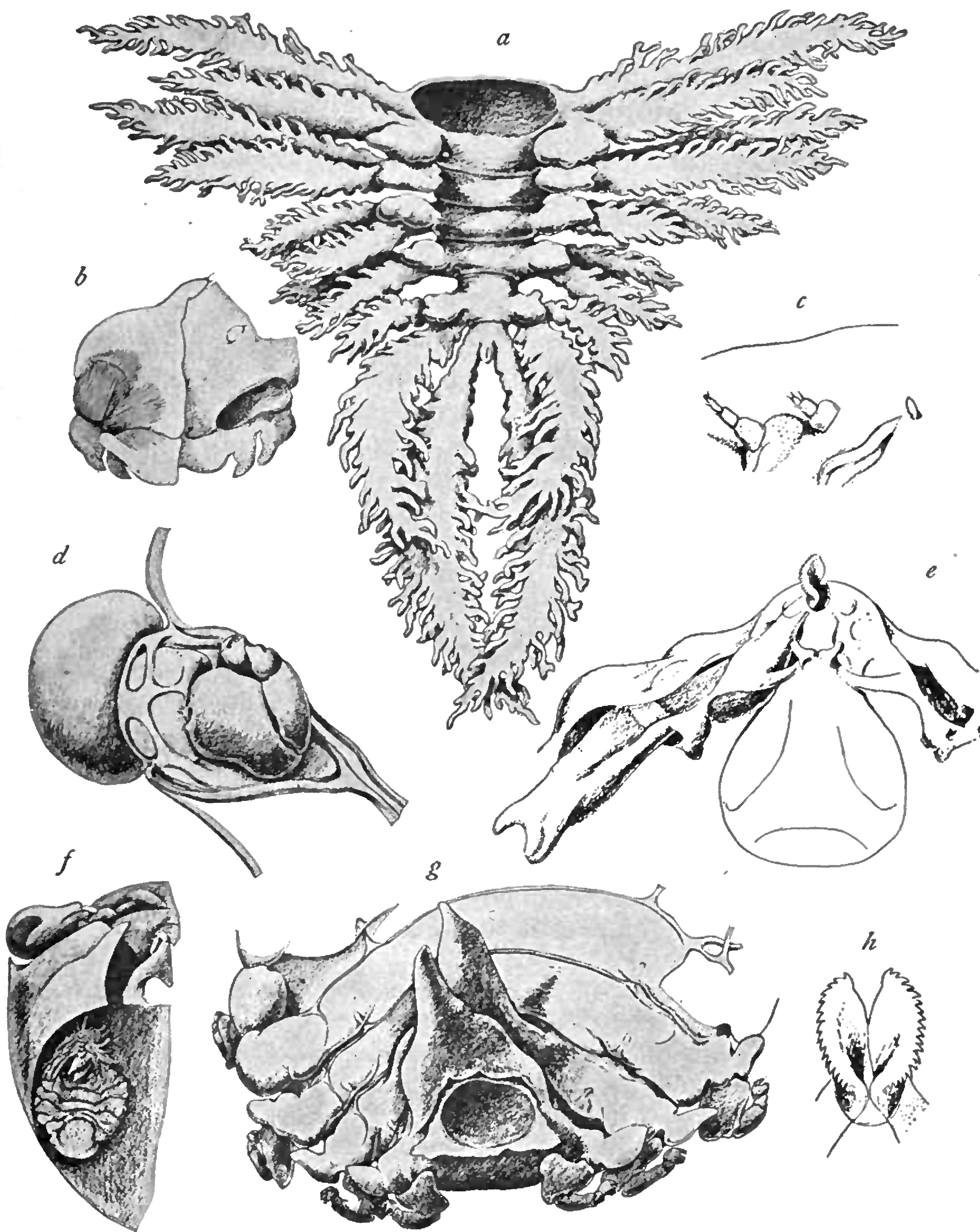


FIG. 562.—GRAPSIPEPON EDWARDSI (AFTER BONNIER). *a*, VENTRAL VIEW OF ABDOMEN. *b*, INFERIOR PART OF HEAD WITH RIGHT MAXILLIPED. *c*, BOTH ANTENNAE. *d*, RIGHT LEG OF FOURTH PAIR (FEMALE). *e*, ROSTRUM WITH RIGHT MANDIBLE IN SITU. *f*, PARASITE IN BRANCHIAL CAVITY OF HOST. *g*, LAST THORACIC SEGMENTS (DORSAL VIEW). *h*, EXTREMITIES OF THE MANDIBLES.

outer branches of the pleopods present exactly the same form as the pleural parts, but they increase in length in an inverse order, from the first to the fifth segment, where they are the longest; the inner branches are reduced to large tubercles with irregular surface, fixed



to the base of the insertion of the pleopods. The last segment of the abdomen bears only two uropods, of the same conformation as the pleural lamellæ and the outer branches of the pleopoda of the preceding segments, but they are of a length exceeding the longest of these appendages. Turned back and laid on the dorsal surface, they extend to the middle of the thorax.

The male, unknown in the other species of the genus, recalls a great deal, in its general form, that of the genus *Cancericepon*. It measures in its greatest dimension 0.55 mm. The first antennæ are composed of three articles, the second antennæ of five articles, the most of which are furnished with stiff hairs; there are no maxillipeds. In the median line of the thorax are spherical tubercles which are also present in the same place on the first three segments of the abdomen; their external surface is covered with little pectinate scales. The legs are short, robust, and terminate in a pointed claw. The genital openings are visible on both sides of the ventral tubercle of the seventh thoracic segment, and in a clear area lighter than the rest of the cuticle. Rudiments of pleopods are seen on the first five segments of the abdomen, and the uropods are represented on the sixth segment only by two little bunches of stiff hairs.

In general there is but a single adult male on a female; I ought, however, to note as rather frequent the presence of several males on the same female; I have counted just four of them between the pleopods and the pleura, and, a curious thing, all of them having absolutely the same form, they do not have the same size. One of them was a little more than half the size of the largest, the other two were of intermediate size. The ventral bosses appeared in the three individuals of smaller size on the five segments of the abdomen, while in the largest specimen they actually were present only on the first three. It is probable that the number of these bosses decrease with age. The same fact is equally true of *Cancericepon elegans*.<sup>a</sup>

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

La femelle adulte a une forme générale globuleuse, aplatie sur la surface dorsale et terminée à son extrémité postérieure par un bouquet d'appendices effilés à bords digités; elle mesure, du bord frontal au sixième somite du pléon, 1 mm., 9. La tête forme une masse unique et saillante qui est entourée antérieurement et sur les côtés par une large lame antérieure flottante; à la face interne se trouvait, à une assez grande distance, l'une de l'autre, les antennules très petites et tri-articulées; les deux derniers articles portent quelques petites soies et leur surface est squameuse; les antennes sont également courtes, le premier article est large, à moitié soudé au céphalon et les quatre autres articles diminuent d'importance jusqu'au dernier qui porte quelques soies; leur surface présente le même aspect que celui de l'antennule. Le rostre est proéminent et particulièrement net; de la pointe échancrée de la lèvre inférieure on voit sortir l'extrémité des mandibules qui est en forme de cuilleron à bord finement denticulé. Le maxillipède possède un palpe allongé terminé par de petites soies très courtes. Le bord inférieur du céphalon est découpé de part et d'autre par



## 85. Genus MUNIDION Hansen.

Body of female somewhat asymmetrical.

Ovarian bosses present on all the segments of the thorax; they are in the form of petiolated processes. Epimera very large, placed on the lateral margins of all the segments, where they occupy the entire lateral margin.

Abdomen with the segments distinctly defined; lateral parts of the first five segments lamellarly expanded in elongated lobes. Sixth or terminal segment small, not lamellarly expanded, in the form of a petiolated process.

The pleopoda are five pairs of double-branched well-developed appendages. The uropoda are a pair of double-branched appendages.

There are five pairs of incubatory lamellæ, not quite overlapping in the median ventral line; the first lamellæ have the distal part produced posteriorly in a small lobe. All seven pairs of legs are present.

The male has all the segments of the thorax distinct. The segments of the abdomen are fused. Uropoda absent. Pleopoda wanting. Branchial parasites.

une paire de petites lamelles, à peu près d'égale importance, à cuticule squameuse et à extrémité mousse.

Les quatre premiers somites thoraciques sont large et en forme de bourrelets; sur leurs bords latéraux sont de fortes bosses pleurales à contours assez indistincts et à lame pleurale rudimentaire; les trois autres segments sont beaucoup plus étroits, leur lame pleurale est assez nette et les surfaces dorsales des sixième et septième somites s'érigent en pointes très accentuées sur la ligne médiane du corps. La face ventrale du thorax est complètement cachée par la cavité incubatrice, qui est très régulièrement développée; le premier des oostégites a une crête interne avec quelques larges digitations et sa partie postérieure ne présente pas de bord découpé ou échancré. Les péreiopodes sont très réduits, ce qui est en rapport avec le rôle à peu près nul qu'ils ont à jouer dans la fixation du parasite, solidement maintenu en place par toute la carapace de l'hôte. Le quatrième de ces appendices est figuré pl. ix, fig. 5; sous le bord latéral arrondi, le coxopodite montre une très solide armature chitineuse, destinée à mouvoir l'oostégite qui s'y rattache par sa nervure médiane; le basipodite est très large, aplati et presque carré; l'ischiopodite est beaucoup plus étroit; les deux articles suivants sont soudés et le propodite est peu développé; le dactylopodite a la forme d'une petite griffe courte, n'atteignant pas le bout du bord palmaire de l'article précédent.

Le pléon, dans sa partie centrale, est très court et très mince; toute son importance vient de l'extraordinaire développement de ses prolongements pleuraux et de ses appendices; les premiers forment de longues lamelles qui remontent parallèlement vers la partie antérieure du corps et dont les bords sont formés d'une quantité considérable et dense de longues digitations dont quelques-unes se divisent elles-mêmes en digitations secondaires; ces prolongements sont surtout développés sur les premiers somites du pléon; ils diminuent de longueur sur les derniers somites. Les endopodites des pléopodes présentent tout à fait la même forme que les parties pleurales, mais ils augmentent leur longueur en sens inverse, du premier au cinquième somite, où ils sont le plus long; les endopodites sont réduits à de gros tubercules à surface irrégulière, fixés à la base d'insertion des pléopodes. Le dernier somite du pléon ne porte que deux uropodes, de la même conformation que les lames pleurales et les exopodites



## MUNIDION PARVUM Richardson.

*Munidion parva* RICHARDSON, Proc. U. S. Nat. Mus., XXVII, 1904, pp. 81-82.

*Locality*.—Straits of Fuca, on *Munida quadrispina* Benedict.

Head large, broader anteriorly than posteriorly, with wide frontal border. Eyes wanting. Anterior margin nearly straight, posterior margin narrowly rounded.

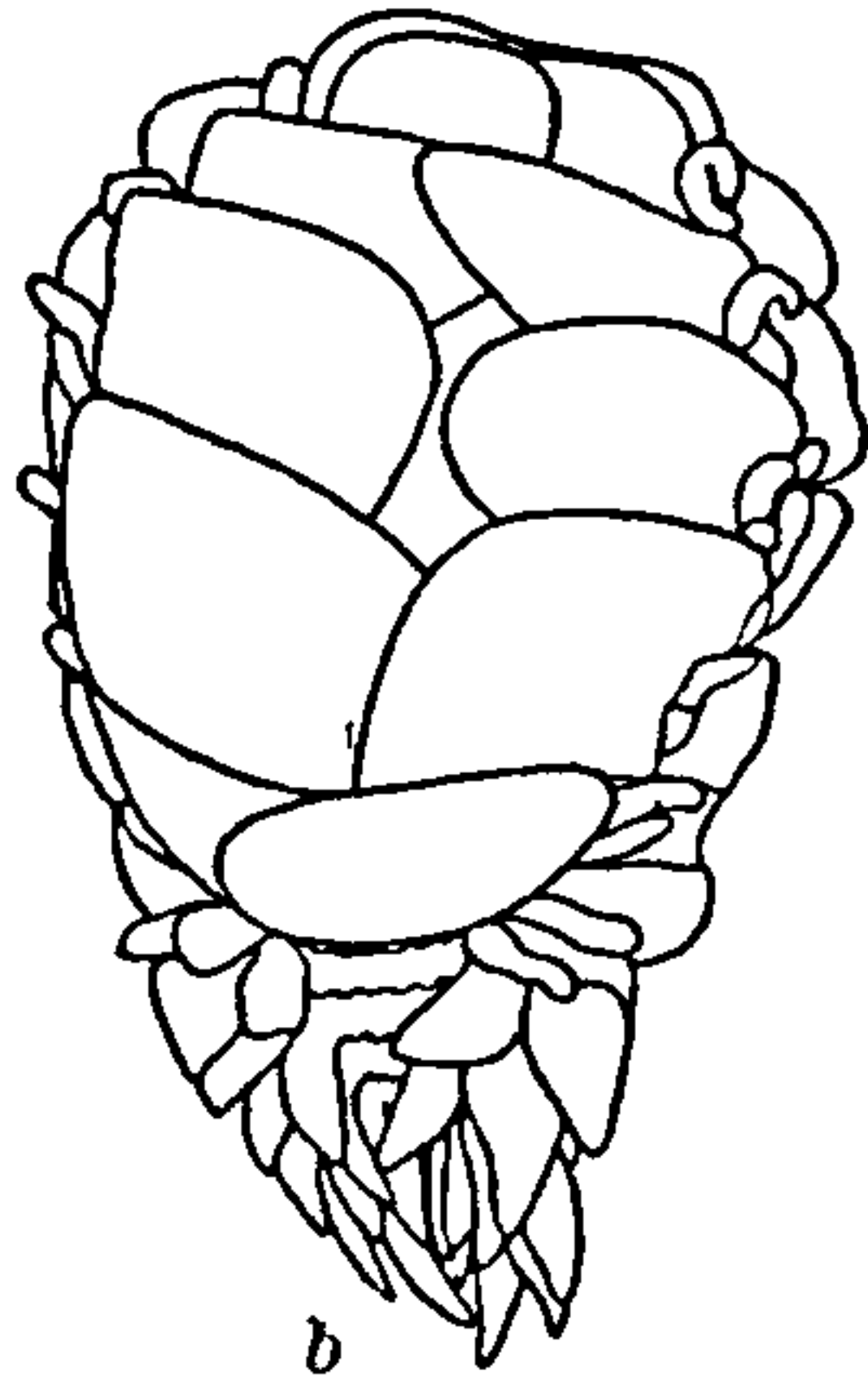
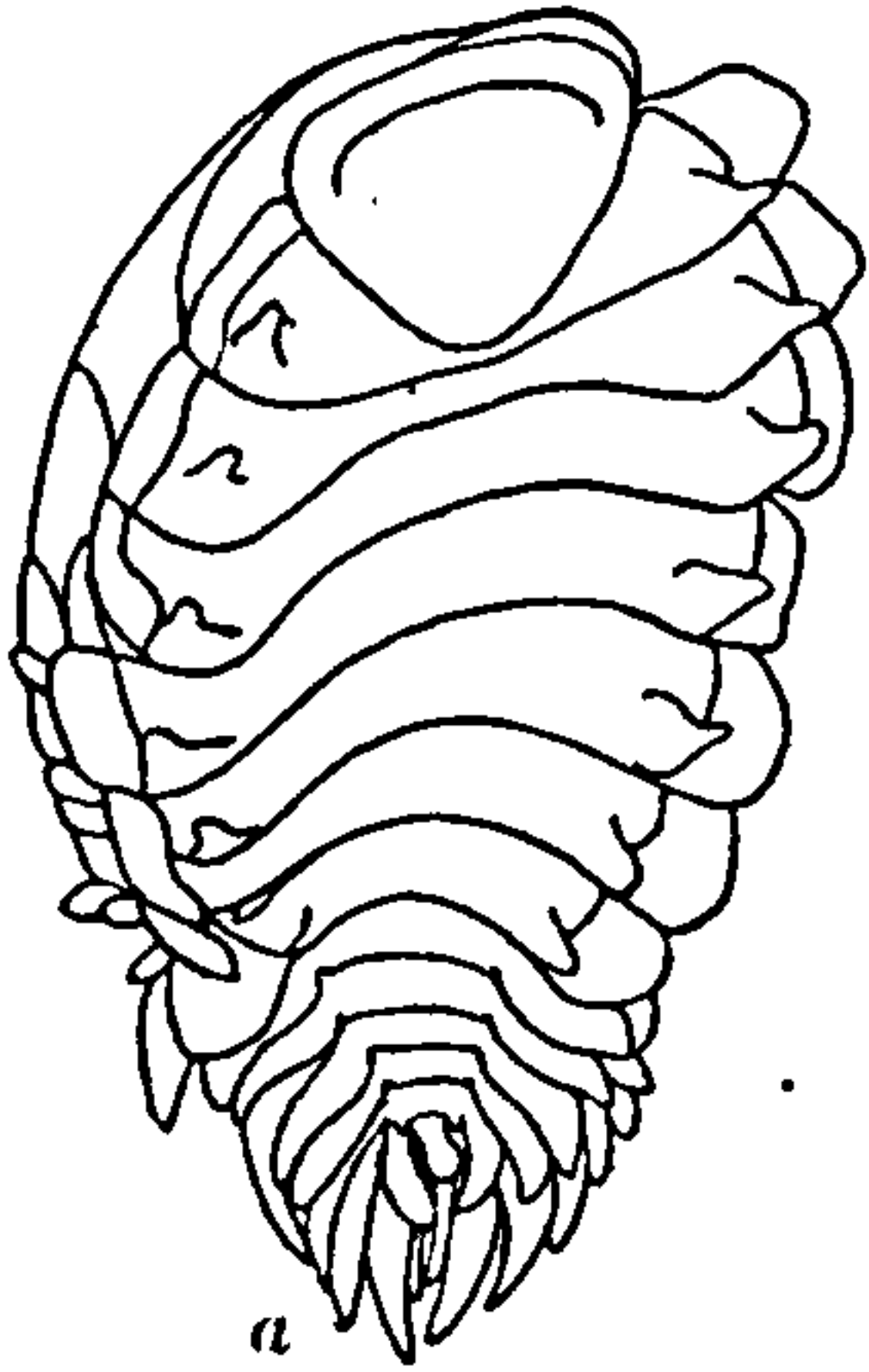


FIG. 563.—MUNIDION PARVUM. a, DORSAL VIEW OF FEMALE. b, VENTRAL VIEW OF SAME.  $\times 8$ .

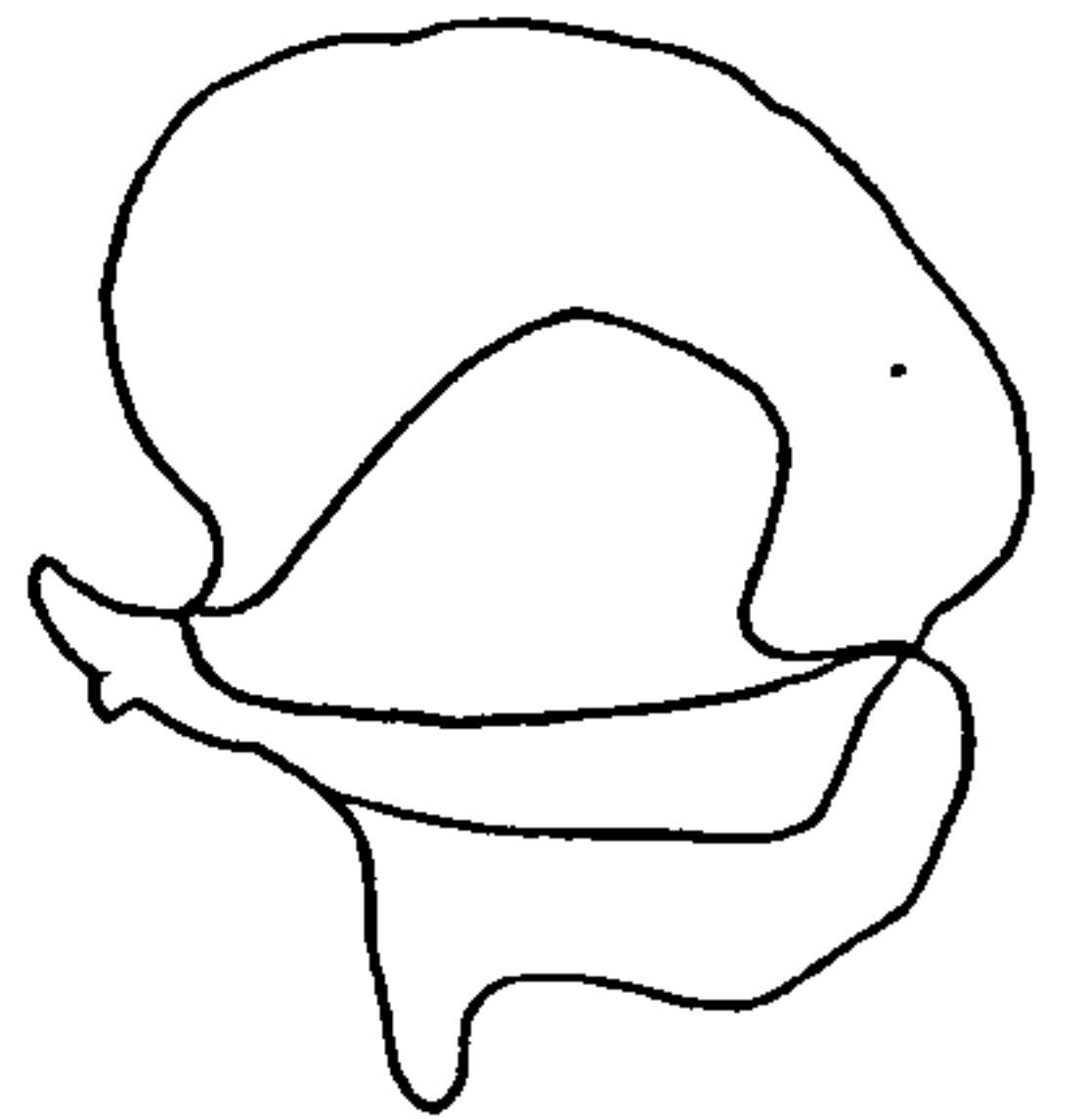


FIG. 564.—MUNIDION PARVUM. FIRST LAMELLA OF MARSUPIUM.  $\times 14\frac{1}{2}$ .

The segments of the thorax are distinct, the first two of which are short in the median dorsal line; the other five segments are about equal in length. Ovarian bosses present on all the segments, occupying the posterior portion of the sublateral part of the segment. On

des segments précédents, mais ils sont d'une longueur dépassant les plus longs de ces appendices; retournés et appliqués sur la surface dorsale, ils attendraient jusqu'au milieu du thorax.

Le mâle, inconnu dans les autres espèces du genre, rappelle beaucoup, par sa forme générale, celui du genre précédent (*Cancericepon*); il mesure dans sa plus grande dimension 0 mm. 55. Les antennules sont triarticulées; les antennes comptent cinq articles, dont la plupart sont garnis de poils raides; il n'y a pas de maxillipèdes. Sur la ligne médiane du thorax se trouvent des tubercules sphériques que l'on retrouve également, à la même place, sur les trois premiers somites de l'abdomen; leur surface externe est couverte de petites écailles pectinées. Les péreiopodes sont courts, robustes et terminés par une griffe aiguë. Les ouvertures génitales sont visibles de part et d'autre du tubercule ventral du septième somite thoracique, et au milieu d'une petite aire plus claire que la reste de la cuticule. Les rudiments des pléopodes se voient sur les cinq premiers somites du pléon, et les uropodes ne sont plus représentés, sur le sixième, que par deux petits bouquets de poils raides.

En général le mâle adulte est unique sur la femelle; je dois pourtant noter, comme assez fréquente, la présence de plusieurs mâles sur une même femelle; j'en ai compté jusque quatre, entre les pléopodes et les pleura et, chose curieuse, tout en ayant absolument la même forme, ils n'avaient pas la même taille; l'un d'eux était un peu plus de la moitié du plus grand et les deux autres étaient de tailles intermédiaires; les bosses ventrales se voyaient, dans les trois individus de taille moindre, sur les cinq somites de pléon, tandis que dans le plus grand, ils n'existaient véritablement que sur les trois premiers, d'où il résulte probablement que le nombre de ces bosses diminue avec l'âge. Le même fait se présente également chez *Cancericepon elegans*.—JULES BONNIER, Travaux de la Station zoologique de Wimereux, VIII, 1900, pp. 263-266.



all the segments they are in the form of petiolated processes. The epimera are large plates which occupy the whole of the lateral margin of the segments. These plates are larger on the posterior segments than on the anterior ones.

The abdominal segments are all distinct. The first five are produced laterally in epimeral lobes, elongated and leaf-shaped, decreasing in size gradually from the first to the fifth segments. These lobes do not cover the dorsal surface of the abdomen, or obscure the small terminal segment, which is visible dorsally as a small rounded petiolated process.

The pleopoda are five pairs of double-branched elongated leaf-like appendages; the inner branches are smaller than the outer. The uropoda consist of a pair of biramous appendages, each with one large outer and one small inner branch, similar in shape to the branches of the pleopoda.

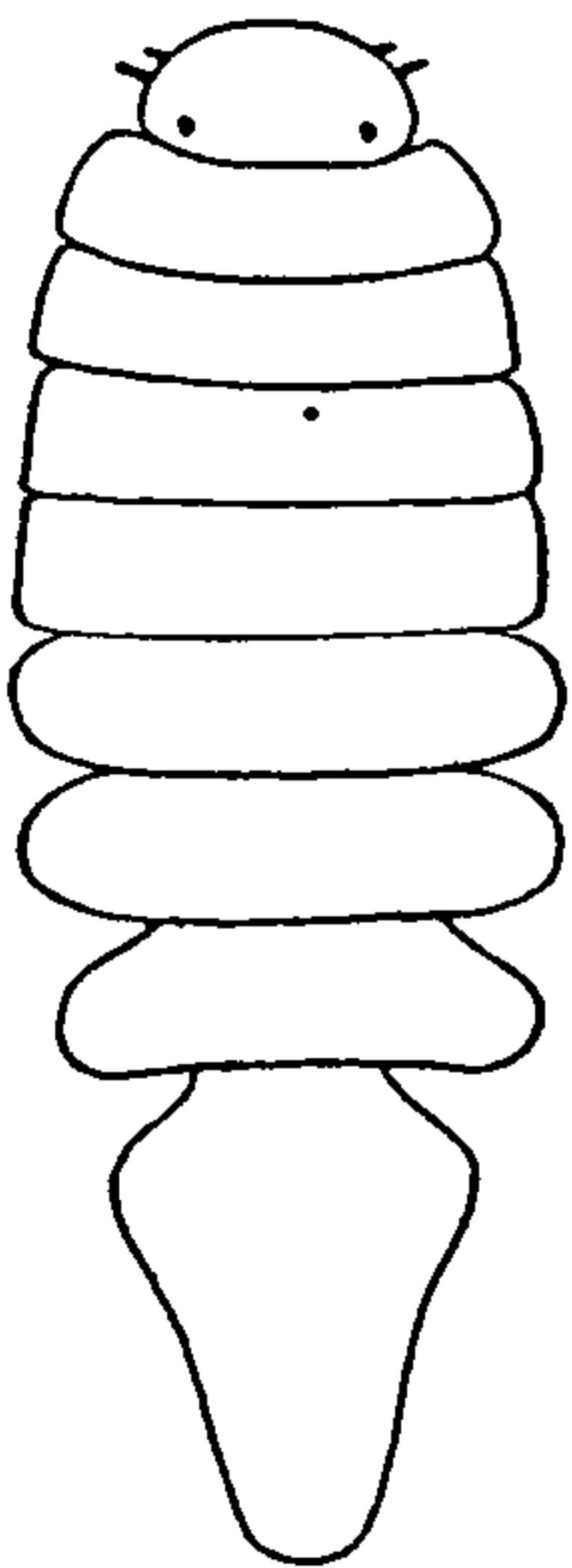
The ventral side of the abdominal segments is keeled on the posterior margin. The pleopoda and abdominal epimera are somewhat carinated on both surfaces.

The marsupium is bounded by five pairs of incubatory lamellæ, the third pair of which do not overlap in the median ventral line, so that a small opening is left into the incubatory pouch. The terminal lobe of the distal segment of the first pair is very small, but well defined.

The seven pairs of legs are all similar; the basis is furnished with an extremely high expansion, the anterior end of which is twice as high as the other end.

The male has all the segments of the thorax distinct. The segments of the abdomen are fused into a single piece. There is no indication of the coalesced segments on the lateral margins of the abdomen, these margins being entire. The posterior portion of this segment is narrower than the anterior portion, its apex, however, being widely rounded. Its length is about one and one-half times its greatest breadth. Eyes are present.

FIG. 566.—MUNIDION  
PARVUM. MALE.  
× 23.



Only one specimen comes from the Straits of Fuca, taken by the U. S. Bureau of Fisheries steamer *Albatross* at a depth of 152 fathoms. Parasitic on *Munida quadrispina*.

*Type*.—Cat. No. 29095, U.S.N.M.

This species is a very much smaller one than the type species of the genus described by Dr. Hansen,<sup>a</sup> being less than half the size of *Munidion princeps*. The present species differs from the type species in its much smaller size; in the relatively larger and differently shaped

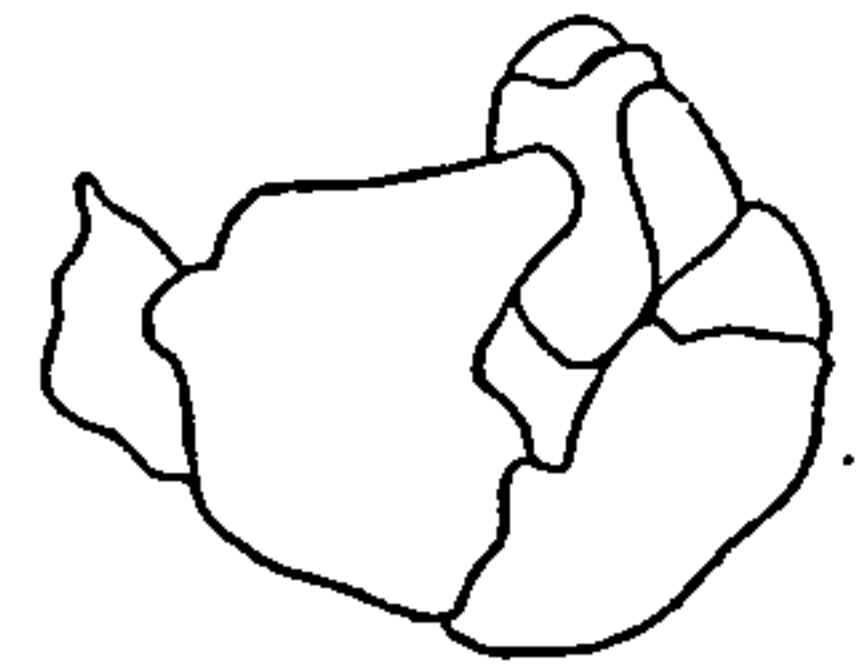


FIG. 565.—MUNIDION  
PARVUM. LEG OF  
SIXTH PAIR OF  
ADULT FEMALE.  
× 20½.

<sup>a</sup> Bull. Mus. Comp. Zool. Harvard College, XXXI, 1897, pp. 115-117.



head; in the larger thoracic epimera (pleural plates); in the differently shaped ovarian bosses; in the smaller and differently shaped abdominal epimera, which do not conceal the abdominal segments dorsally as in that species; in the differently shaped carina on the basis of all the legs; in the absence of the sinuous lateral margins of the abdomen of the male; and in the broader apex and greater length compared with the width of the abdomen of the male.

### 86. Genus CRYPTIONE Hansen.

Body of female somewhat asymmetrical.

Ovarian bosses present on the first four thoracic segments. Epimera well developed and distinct on the first four segments, occupying the anterior portion of the lateral margin; those of the last three segments are not distinct from the segments.

Segments of the abdomen distinct; the lateral parts of the first five segments are well developed; the sixth or terminal segment is small and has the lateral parts not developed.

The uropoda are simple, single-branched, and consist of a pair of elongated lamellæ.

The pleopoda consist of five pairs of double-branched lamellæ.

There are five pairs of incubatory lamellæ which do not completely inclose the incubatory pouch.

All seven pairs of legs are present.

The male has all seven segments of the thorax distinct.

The segments of the abdomen are also distinct. The sixth or terminal segment has the post-lateral angles produced backward on either side.

There are five pairs of simple sac-like pleopoda.

Branchial parasites.

### CRYPTIONE ELONGATA Hansen.

*Cryptione elongata* HANSEN, Bull. Mus. Comp. Zool., Harvard College, XXXI, 1897, pp. 112-115, pl. III, figs. 5-5a; pl. IV, figs. 1-1g.—RICHARDSON, Proc. U. S. Nat. Mus., XXI, 1899, p. 869; Ann. Mag. Nat. Hist. (7), IV, 1899, p. 338.—BONNIER, Trav. de la Station Zool. de Wimereux, VIII, 1900, pp. 285-287.—RICHARDSON, Proc. U. S. Nat. Mus., XXVII, 1904, p. 87.

*Locality*.—Near the Galapagos Islands on *Nematocarcinus agassizii* Faxon, which occurs as far north as Acapulco, Mexico.

Body of female somewhat elongated, asymmetrical. Length 19 mm.: width 11 mm.

Head a little wider than long, 4 mm.:  $5\frac{1}{2}$  mm., with the anterior and posterior margins widely rounded or arcuate, and the lateral margins produced in a small lobe on either side about the middle. Eyes absent. The first pair of antennæ are composed of three articles, the last of



which is minute. The second pair of antennæ are composed of four articles.

The seven segments of the thorax are distinct. The first four have well-developed epimera, occupying the anterior half of the lateral margins, each epimeron being placed lateral to the ovarian bosses and produced into an anterior and a posterior lobe. The epimera of the last

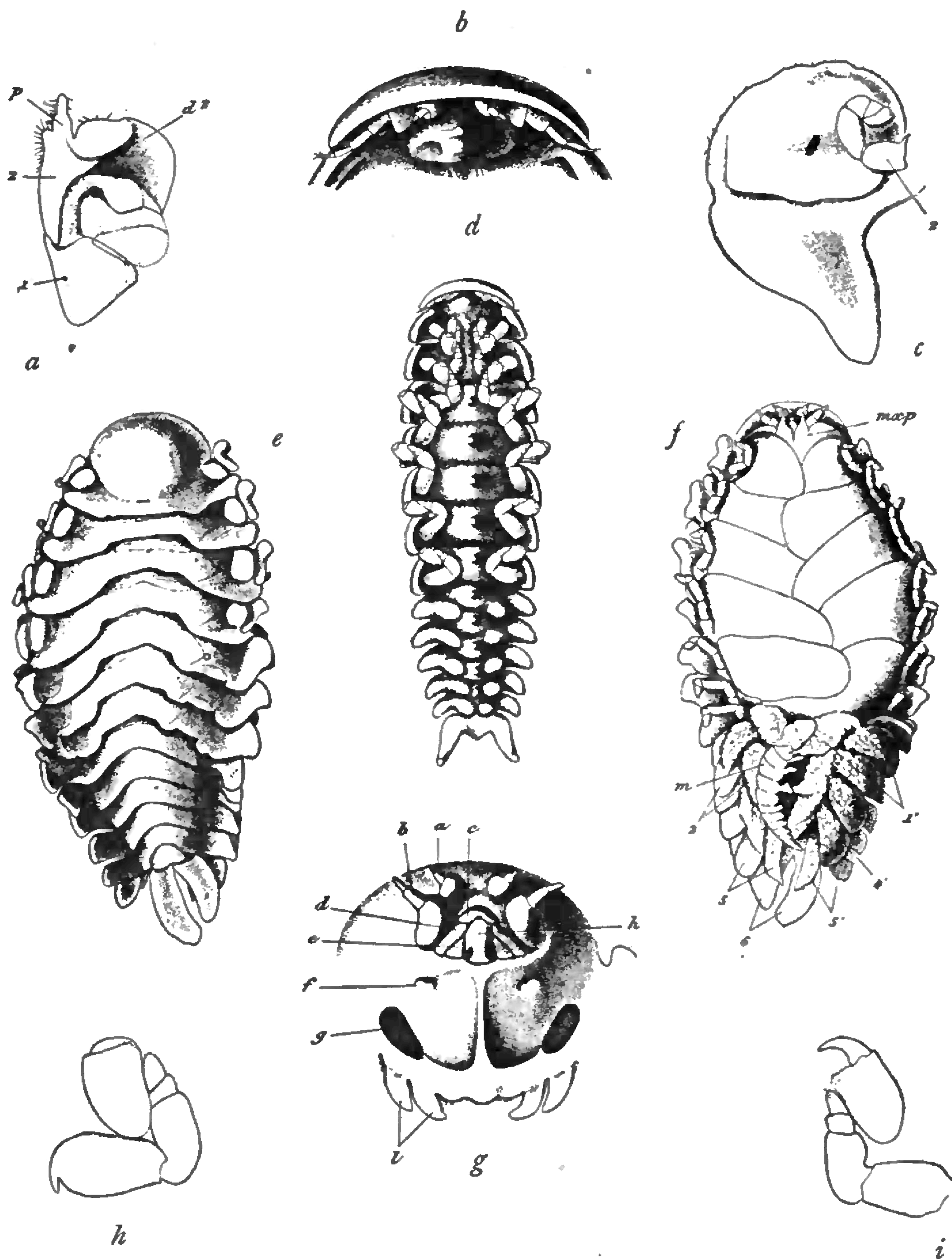


FIG. 567.—CRYPTIONE ELONGATA (AFTER HANSEN). *a*, MAXILLIPED OF FEMALE. *b*, HEAD OF MALE (VENTRAL VIEW). *c*, FIRST INCUBATORY LAMELLA OF FEMALE AND FIRST LEG. *d*, VENTRAL VIEW OF MALE. *e*, DORSAL VIEW OF FEMALE. *f*, VENTRAL VIEW OF FEMALE. *g*, HEAD OF FEMALE WITH BOTH MAXILLIPEDS OMITTED (SEEN FROM BELOW). *h*, FIRST LEG OF MALE. *i*, FIFTH LEG OF MALE.

three segments are not distinct from the segments. The anterior portion of the last three segments is produced into a large lobe which occupies the entire lateral margin, the posterior portion of the segment being small and sublateral, i. e., it lies on the inner side of the anterior portion. The anterior lobes are larger on one side of the body than they are on the other side, and they have an additional small,



rounded process developed at the anterior end. These processes are almost rudimentary on the other side.

All six segments of the abdomen are distinct. The lateral parts of the first five segments are well developed. The sixth or terminal segment is small, and has the lateral parts not developed. The uropoda are simple, single-branched, and consist of two elongated lamellæ.

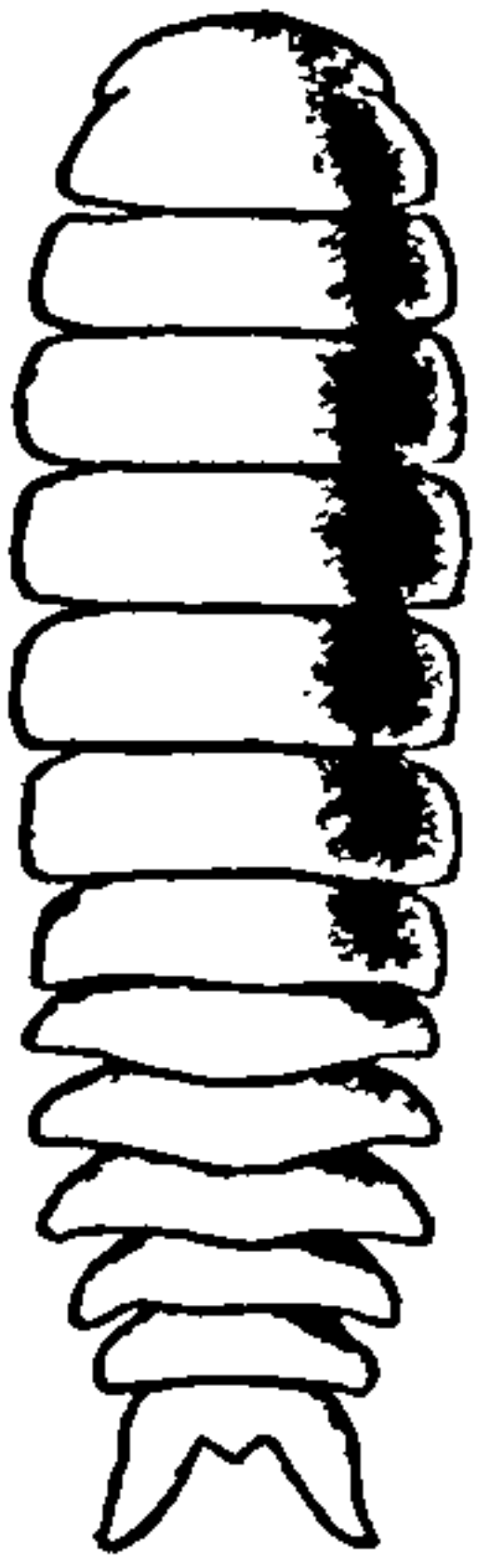


FIG. 568.—CRYPTIONE ELONGATA (AFTER HANSEN). DORSAL VIEW OF MALE.

The pleopoda are five pairs of double-branched lamellæ, which are elongated and tapering, leaf-like and covered with tubercles. The ventral side of the first five abdominal segments has the posterior margin produced into numerous small elongated processes.

There are five pairs of incubatory lamellæ, which do not completely inclose the marsupial cavity.

The legs are all similar and prehensile, and have no carinæ on the basis.

The male is  $4\frac{1}{2}$  mm. long (not including the uropoda) and  $1\frac{1}{2}$  mm. wide. The head is without eyes and has the frontal margin widely rounded. The first pair of antennæ are composed of three articles. The second pair of antennæ are composed of eight articles, the last four being minute and rudimentary.

All seven segments of the thorax are distinct. The seven pairs of legs are prehensile.

All six segments of the abdomen are distinct. The sixth or terminal segment has the post-lateral angles produced in an elongated process on either side, which probably represent the uropoda. Between the uropoda the posterior margin of the terminal segment is triangularly produced. There are five pairs of simple sac-like pleopoda.

#### 87. Genus PSEUDIONE Kossmann.<sup>a</sup>

Body of female oval, somewhat asymmetrical.

Segments of abdomen distinct. Epimera well defined, not contiguous. Lateral parts of abdominal segments lamellar, more or less projecting.

Terminal segment of abdomen small, with sides not lamellarly produced.

Incubatory plates meet in the median ventral line, concealing the incubatory pouch and the eggs; first pair with the distal segment usually produced in a lobe.

All seven pairs of legs present. Pleopoda well developed, double-branched. Uropoda simple, consisting of a pair of lanceolate lamellæ.

Male with the segments of thorax and abdomen distinct. Pleopoda present in the form of five pairs of small rudimentary sac-like bodies, a pair for each of the first five segments. The uropoda are wanting.

Branchial parasites.

<sup>a</sup>See G. O. Sars for characters of genus, Crust. of Norway, II, 1899, pp. 200-201.



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

- a. Lateral parts or pleural lamellæ of abdomen of female elongated, and covering to a great extent the pleopods.
- b. Distal segment of the first lamella of the marsupium produced posteriorly in a lobe.
- c. Inner branch of the pleopoda much larger than outer branch, elongate, and pointed; surface roughened by irregularly transverse rugæ. Pleural plates of the last three segments of the thorax not developed as lamellæ. First incubatory lamellæ with the distal segment produced in a lobe which is small and strongly curved inward ..... *Pseudione giardi* Calman
- c'. Inner branch of the pleopoda a little larger than the outer branch, triangular or ovate; surface smooth. Pleural plates of the last three segments of the thorax developed as lamellæ. First incubatory lamellæ with the distal segment produced in a lobe which is large and directed straight backward.  
*Pseudione galacanthæ* Hansen
- b'. Distal part of the first lamella of the marsupium not produced posteriorly in a lobe ..... *Pseudione furcata* Richardson
- a'. Lateral parts or pleural lamellæ of abdomen of female not elongated, but reduced in size and short, not covering to a great extent the pleopoda.  
*Pseudione curtata* Richardson

## PSEUDIONE GIARDI Calman.

*Pseudione giardi* CALMAN, Ann. N. Y. Acad. Sci., XI, 1898, pp. 274-281, pl. xxxiv, fig. 5.—RICHARDSON, Proc. U. S. Nat. Mus., XXI, 1899, p. 869; Ann. Mag. Nat. Hist. (7), IV, 1899, p. 337; American Naturalist, XXXIV, 1900, p. 309.—BONNIER, Trav. de la Station Zool. de Wimereux, VIII, 1900, pp. 299-300.—RICHARDSON, Proc. U. S. Nat. Mus., XXVII, 1904, p. 78.

*Locality.*—Puget Sound on *Pagurus ochotensis* (Brandt).

“*Description of female.*—The single specimen, measuring 12 mm. in length, was taken from the right branchial cavity of its host (*Pagurus ochotensis* (Brandt)), and it is accordingly a dextral individual (*Bopyre droit* Giard and Bonnier), though the outline of its body seems at first sight to indicate a sinistral curvature from the concavity of the right margin in the region of the posterior thoracic segments. Closer examination, however, shows that the head and the abdominal region are turned toward the left and that the pleopods of the right side are longer than those of the left, as in a normal dextral individual, so that the peculiar curvature of the body is in all probability merely an accidental variation.

“The specimen shows no traces of pigmentation. The dorsal surface is flat or slightly concave; the ventral is convex, and is covered, except in the region of the abdomen, by the greatly developed brood-pouch. The dorsal swelling of the cephalic region which marks the position of the stomach (*cephalogaster*) is very slight. An irregularly oval, somewhat convex area, the ‘ovarian bosse,’ is marked off by a groove on each side of the first four thoracic segments on the dorsal surface.

“The abdominal segments, six in number, are distinctly separated from each other. The ventral surface of the abdominal segments and



of the last two or three thoracic segments is roughened by longitudinal rugæ, which are most marked on the adjacent margins of the segments. These rugæ are neither so conspicuous nor so regularly disposed as in the case of the allied *Palaegyge borrei*, described by

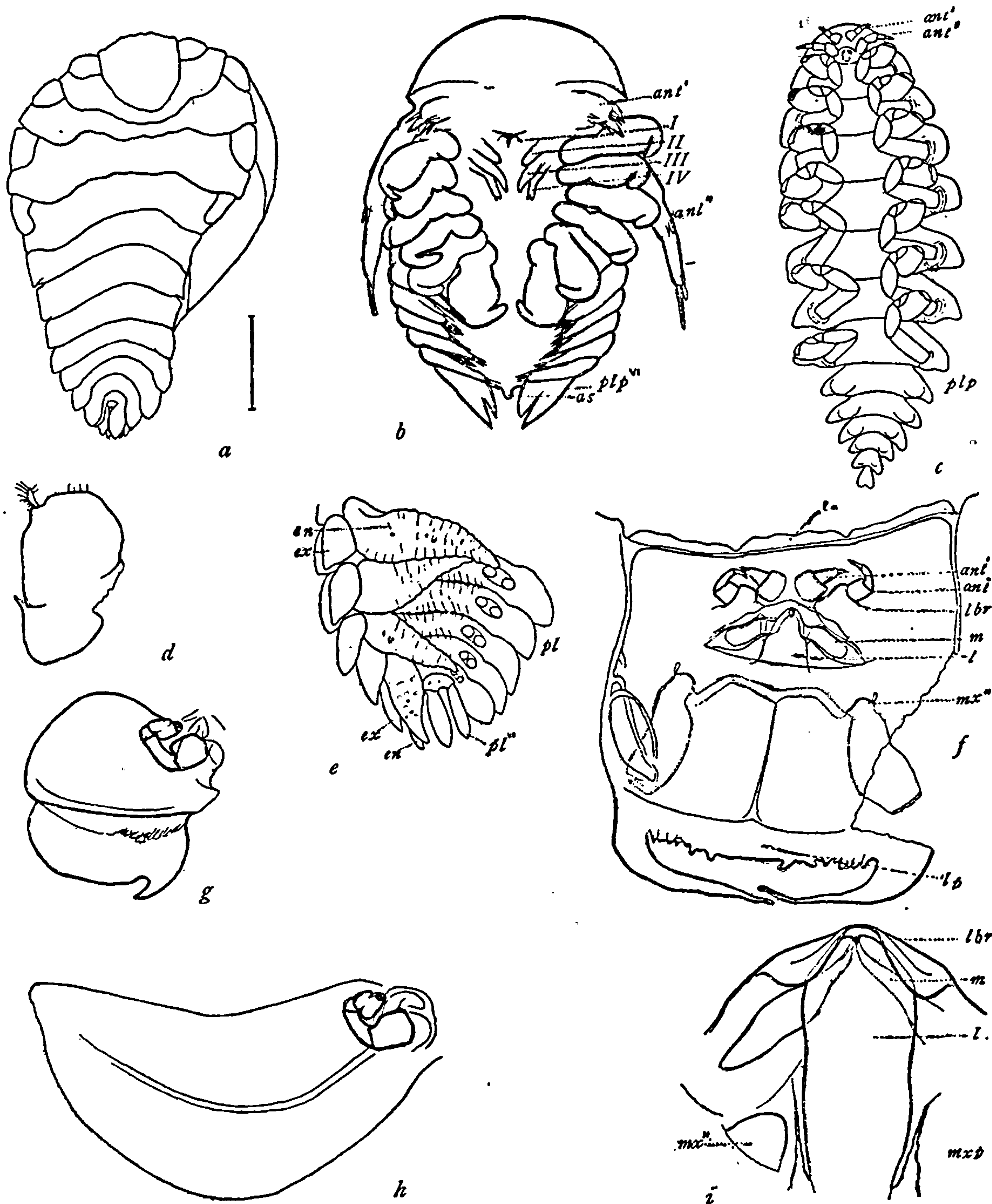


FIG. 569.—PSEUDIONE GIARDI (AFTER CALMAN). a, DORSAL VIEW OF FEMALE. b, EMBRYO. c, VENTRAL VIEW OF MALE. d, MAXILLIPED. e, ABDOMEN. f, UNDER SURFACE OF HEAD. g, FIRST INCUBATORY LAMELLA WITH PEREIOPOD. h, SECOND PEREIOPOD. i, MOUTH PARTS.

Giard and Bonnier (Bull. Scient. Fr. et Belg., XIX, 1888, p. 68.) The anterior margin of the head is bordered by a narrow membranous expansion (*limbe antérieur*, G. & B.), which shows a distinct notch and several fainter undulations on each side of the middle line. No trace



could be discovered on the thoracic segments of the pleural lamellæ, which in *Palægyge* are said to be 'rudimentaires et à peine visibles.'

"The antennules (inner antennæ) are short, conical, composed of three joints and bearing a few minute setæ at the tip. The antennæ (outer antennæ) are composed of five joints, of which the first is indistinctly marked off from the lower surface of the head; the third is longer and much more slender than the second, the fifth is very minute. The mandibles, which are embraced by the upper and lower lips to form the characteristic 'beak' of the *Epicaridea*, are of the usual shape. The first pair of maxillæ appear to be absent. After a careful examination we have been unable to find any distinct rudiments of them, though the triangular areas between the base of the mandibles and the lower lips on each side bear some resemblance to the rudiments of these organs in *Palægyge* (Giard and Bonnier, in the work mentioned, pl. v, f. 2). The rudiments of the second maxillæ are to be detected further back on the under surface of the head. Immediately in front of each a relatively large opening leads into a capacious tube lined by an invagination of the chitinous cuticle, the protuberance interpreted as the rudiment of the second maxilla forming the lower or posterior lip of this orifice.

"Unfortunately, these tubes were not discovered till the soft parts of the head had been removed by caustic potash, so that we are unable to say anything as to their connections inside the body. This is the more to be regretted since we know of nothing analagous to these organs, not only in the *Epicaridea* but even among the *Malacostraca*.

"The maxillipeds are similar to those of *Palægyge*, but somewhat narrower. Each consists of a flat, roughly quadrangular plate partially divided into two parts by an oblique line. The posterior part has its external angle rounded and pointed as in *Palægyge borrei*, and the antero-internal angle is produced. The anterior margin of the maxilliped bears a few setæ, and at its inner angle is articulated the small 'palp,' also setose.

"Posteriorly, the lower surface of the head terminates in a freely projecting lamina, the '*limbe postérieur*' of Giard and Bonnier. In the present species this lamina is cut up into a fringe of digitate processes, commencing on each side a little way from the middle line and increasing in size outwards. Externally, on each side the lamina is produced into a long process, narrowing gradually from its base to a rounded tip, turned inwards and extending beyond the middle line. In *Palægyge* there are two pairs of shorter processes and no fringe of minute digitations.

"The thoracic legs are all similar and of the usual structure. The 'adhesive cushions' present on the proximal segments of the first pair in *Palægyge* are here absent. The oöstegites or brood lamellæ were unfortunately injured in the single specimen found. The usual five



pairs are present and are much larger than in *Palægyge borrei*, all the pairs except, perhaps, the third and fourth, overlapping across the median line. The first pair are, as usual, of somewhat complex form. Roughly quadrilateral in shape, the posterior corner is produced into a hook-like process directed inward. A little behind the middle of its length the lamella is crossed by a transverse fold, forming on its outer or lower surface a deep groove, the anterior margin of which is produced as an overlapping ridge. On the inner, or, in its natural position, upper, face of the lamella the fold projects as a strong ridge which for part of its length is fringed with digitate processes. The front edge of the second pair of oöstegites is received into the groove on the lower surface of the first pair. The last two pairs are strongly fringed with setæ on the posterior edge.

“Five pairs of biramous pleopods are present, successively diminishing in size posteriorly, those of the right side being, as already mentioned, considerably larger than those of the left. In the first pair the exopodite (lobe *b*, according to the nomenclature of Giard and Bonnier) is roughly quadrilateral in shape and much smaller than the endopodite (lobe *c*), which is long and pointed. In the posterior pairs the exopodite approaches more closely in size and shape to the endopodite. The last segment of the abdomen is very small, and bears articulated to its posterior margin a pair of lanceolate lamellæ, of which the right is broader and slightly longer than the left. These lamellæ may possibly represent the sixth pair of pleopods, but a comparison with Giard and Bonnier’s figure of the corresponding region in *Palægyge borrei* suggests that we have here to do with the rudimentary pleural lamellæ (lobe *a* of Giard and Bonnier), which, separated by a distinct suture from the fifth and sixth segments in the last-named species, are here only distinct on the sixth segment. If this view be adopted the sixth pair of pleopods are entirely absent.<sup>a</sup> In all the pleopods the surface of the endopodite is roughened by irregularly transverse rugæ, which are most distinct on the anterior pairs.

“*Male*.—A male individual about 3 mm. long was found under the pleopods of the female. The body is symmetrical, lanceolate in outline, the fourth thoracic segment being the widest. A pair of eyes are present near the posterior corners of the head. Both antennules and antennæ are well developed, the former having three, the latter five segments. As in the female, no distinct rudiments of the first maxillæ could be identified. The second maxillæ have the form of rather large, rounded tubercles. The maxillipeds are present as long, slender processes, each tipped by a single seta, inserted on each side close to the base of the lower lip. The seven pairs of thoracic feet are all similar and of the usual form, with powerful subchelate terminations.

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<sup>a</sup>These lamellæ, attached to the sixth abdominal segment, are the uropoda.—H. R.



“The six abdominal segments are distinct, regularly diminishing in size posteriorly, and the first five show rudiments of pleopods in the form of slight rounded eminences on the ventral surface. In *Palægyge borrei*, Giard and Bonnier describe the male as having rudiments of pleopods on the first three abdominal segments only (p. 70), but in a later paper the same authors speak of the abdominal segments of the male in the genus *Palægyge* as being *all* furnished with these rudiments. (Bull. Scient., XXII, 1890, p. 373.) The last segment of the abdomen is very small, cordate in form, being very narrow anteriorly, and having its hinder margin notched; its greatest breadth is about equal to the length.”—CALMAN.<sup>a</sup>

A description of the first larval stage of this form follows; as it is characteristic of this stage in other *Epicaridea* it is not necessary to quote the description.

#### PSEUDIONE GALACANTHÆ Hansen.

*Pseudione galacanthæ* HANSEN, Bull. Mus. Comp. Zool. Harvard College, XXXI, 1897, pp. 118-120, pl. v, fig. 22 *i*.—RICHARDSON, Proc. U. S. Nat. Mus., XXI, 1899, p. 869; Ann. Mag. Nat. Hist. (7), IV, 1899, p. 338.—BONNIER, Trav. de la Station Zool. de Wimereux, VIII, 1900, pp. 304-306.—RICHARDSON, Proc. U. S. Nat. Mus., XXVII, 1904, p. 78.

*Localities*.—Gulf of California, in the branchial cavity of *Galacantha diomedix* var. *parvispina* Faxon; near Flattery Rocks, Washington, on *Munnida quadrispina* Benedict.

Body of female somewhat asymmetrical. Length 11 mm. Width 8 mm.

Head as wide as long, 3 mm. : 3 mm., with the anterior margin straight. The posterior margin is rounded. Eyes absent. The first pair of antennæ are composed of three articles. The second pair are composed of five articles.

All the seven thoracic segments are distinct. The lateral parts of the first four segments are divided into a large anterior lobe and a small posterior lobe. Ovarian bosses are present on the first four segments, situated on the anterior portion of the lateral parts of these segments. The epimera are not distinctly separated on any of the segments, but occupy the small posterior lobe of the lateral margin of the first four segments and the entire lateral margin of the last three segments. All six segments of the abdomen are present. The first five have the lateral parts well developed and produced in elongated lamellæ, which almost entirely conceal the underlying pleopoda. The sixth or terminal segment is small, and has the lateral parts undeveloped. The uropoda are simple, single-branched, elongated lamellæ, attached to the sixth abdominal segment. The pleopoda are five pairs of double-branched elongated lamellæ attached to the first five

<sup>a</sup>Ann. N. Y. Acad. Sci., XI, 1898, pp. 274-281.



abdominal segments on the underside. The posterior margins of the abdominal segments and the anterior as well as the posterior margins of the last two thoracic segments are, on the ventral side, produced in small round lamellæ or knots. There are five pairs of incubatory lamellæ, the first pair of which have the distal portion produced on the posterior margin in a small lobe.

All the seven pairs of legs are prehensile, and have a low rounded carina on the basis.

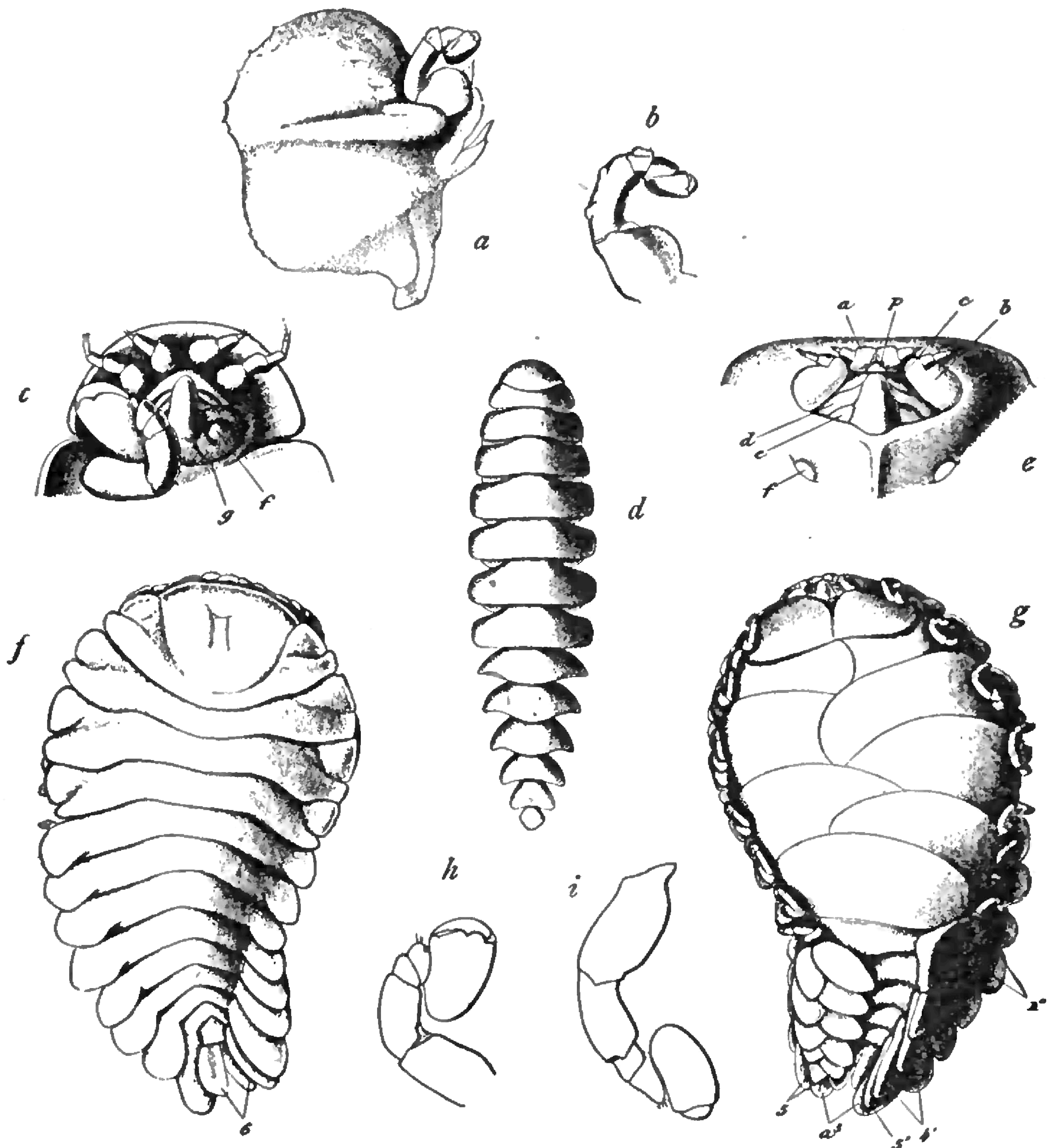


FIG. 570.—PSEUDIONE GALACANTHÆ (AFTER HANSEN). *a*, FIRST LEG WITH INCUBATORY LAMELLA. *b*, SIXTH LEG OF FEMALE. *c*, HEAD OF SMALLER MALE. *d*, DORSAL VIEW OF MALE. *e*, HEAD OF FEMALE (VENTRAL VIEW). *f*, DORSAL VIEW OF FEMALE. *g*, VENTRAL VIEW OF FEMALE. *h*, FIRST LEG OF MALE. *i*, SEVENTH LEG OF MALE.

The male is narrow, elongate, 4.8 mm. long and about 1.2–1.4 mm. wide. Eyes small, distinct. Anterior margin of head rounded. The first pair of antennæ are composed of “three” articles. The second pair of antennæ are composed of “five” articles. All seven segments of the thorax are distinct. The seven pairs of legs are prehensile. The six segments of the abdomen are distinct. The sixth or terminal segment is small, with the posterior margin truncate. There are no uropoda. The pleopoda are five pairs of small, simple, sac-like bodies, almost rudimentary, a pair attached to each of the first five abdominal segments.



## PSEUDIONE FURCATA Richardson.

*Pseudione furcata* RICHARDSON, Proc. U. S. Nat. Mus., XXVII, 1904, p. 79.

*Locality*.—Eastern shore of Virginia.

Body of female longer than broad, more or less ovate.

Head with frontal border; anterior margin nearly straight; posterior portion narrowly rounded. Head small and deeply immersed in thorax.

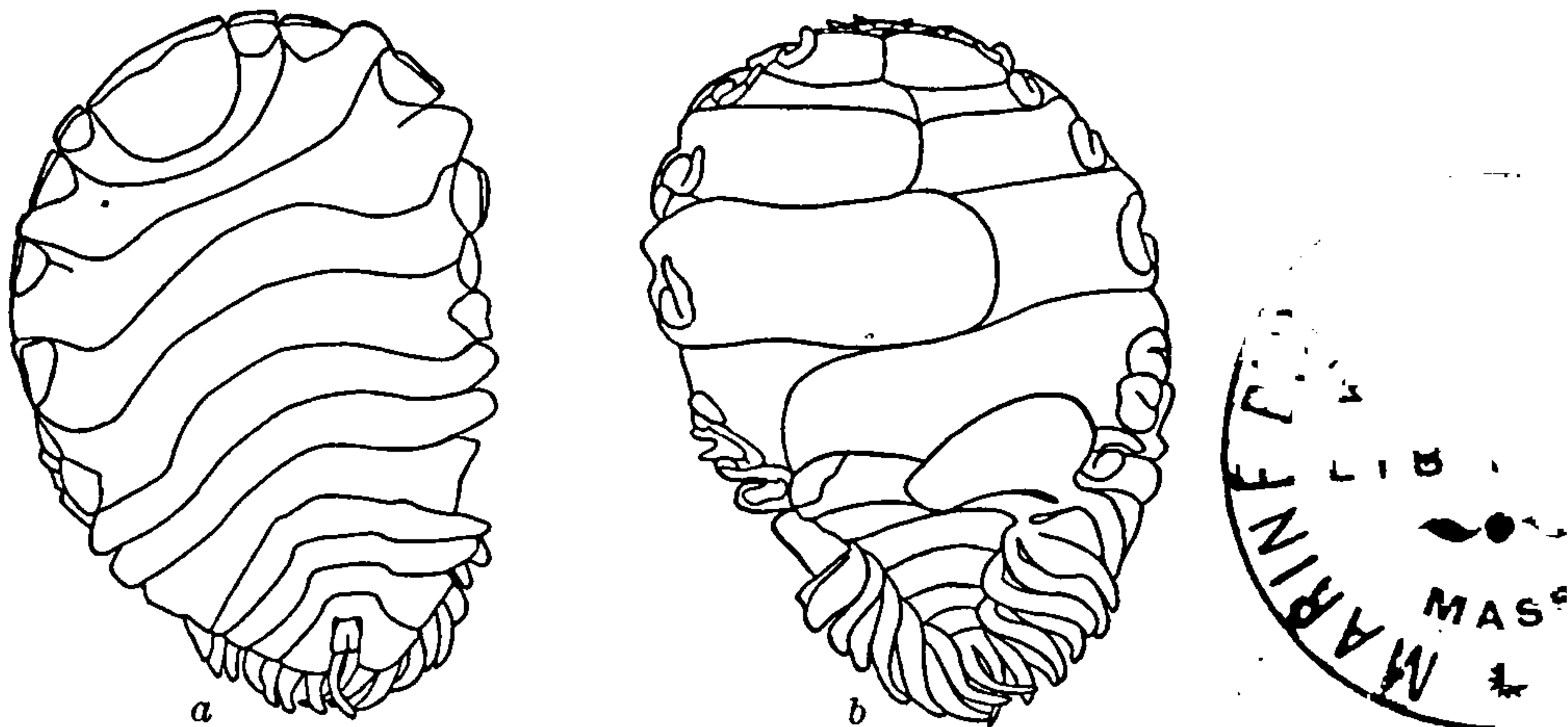


FIG. 571.—PSEUDIONE FURCATA. *a*, DORSAL VIEW OF FEMALE. *b*, VENTRAL VIEW OF SAME.  $\times 4$ .

Mouth parts and antennæ concealed by first lamellæ of marsupium. The first antennæ are composed of three, the second of four joints.

The thorax has all the segments distinct. Ovarian bosses are large and prominent on the first four segments. The epimera on these segments are represented by narrow ridges lateral to the ovarian bosses; those of the three last segments occupy all of the lateral margin.

The segments of the abdomen are all distinct with the epimera produced in wide plates on either side of the narrow middle portion of the segment.

The sixth or terminal segment is without epimera, and terminates posteriorly in two small, rounded lobes. The pleopoda are five pairs of smooth, narrow, elongated, biramous appendages, all similar and equal in size, with the exception of the inner branch of the first pair, which is exceedingly large



FIG. 572.—PSEUDIONE FURCATA. FIRST LAMELLA OF MARSUPIUM.

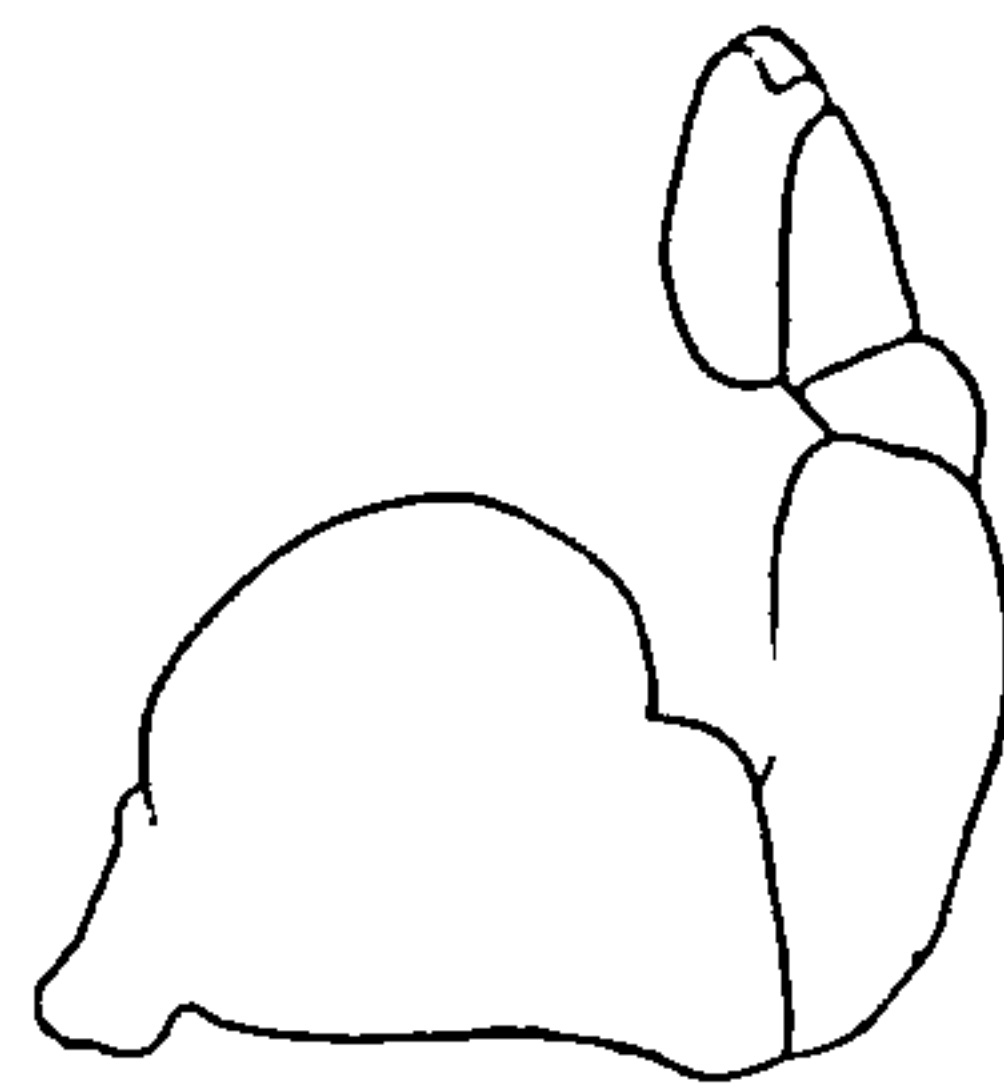


FIG. 573.—PSEUDIONE FURCATA. LEG OF SIXTH PAIR OF ADULT FEMALE.  $\times 20\frac{1}{2}$ .

and is inwardly directed, meeting the corresponding branch of the opposite side in the median ventral line, just below the incubatory pouch. All the remaining branches are directed post-laterally. The surfaces of all the lamellæ are quite smooth. The uropoda consist of a single pair of simple appendages, similar in shape and size to the pleopoda.

The incubatory pouch consists of five pairs of large lamellæ, over-



lapping in the median line. The terminal lobe of the first pair of plates is not defined.

There is a high and widely rounded expansion or carina on the basis of all the legs.

Male unknown.

Four specimens were collected on the eastern shore of Virginia by Prof. H. E. Webster. Host unknown. They were sent from Union University to the U. S. National Museum.

*Type*.—Cat. No. 29093, U.S.N.M.

**PSEUDIONE CURTATA** Richardson.

*Pseudione curtata* RICHARDSON, Proc. U. S. Nat. Mus., XXVII, 1904, pp. 80–81.

*Locality*.—Key West, on *Petrolisthes sexspinosus* (Gibbes).

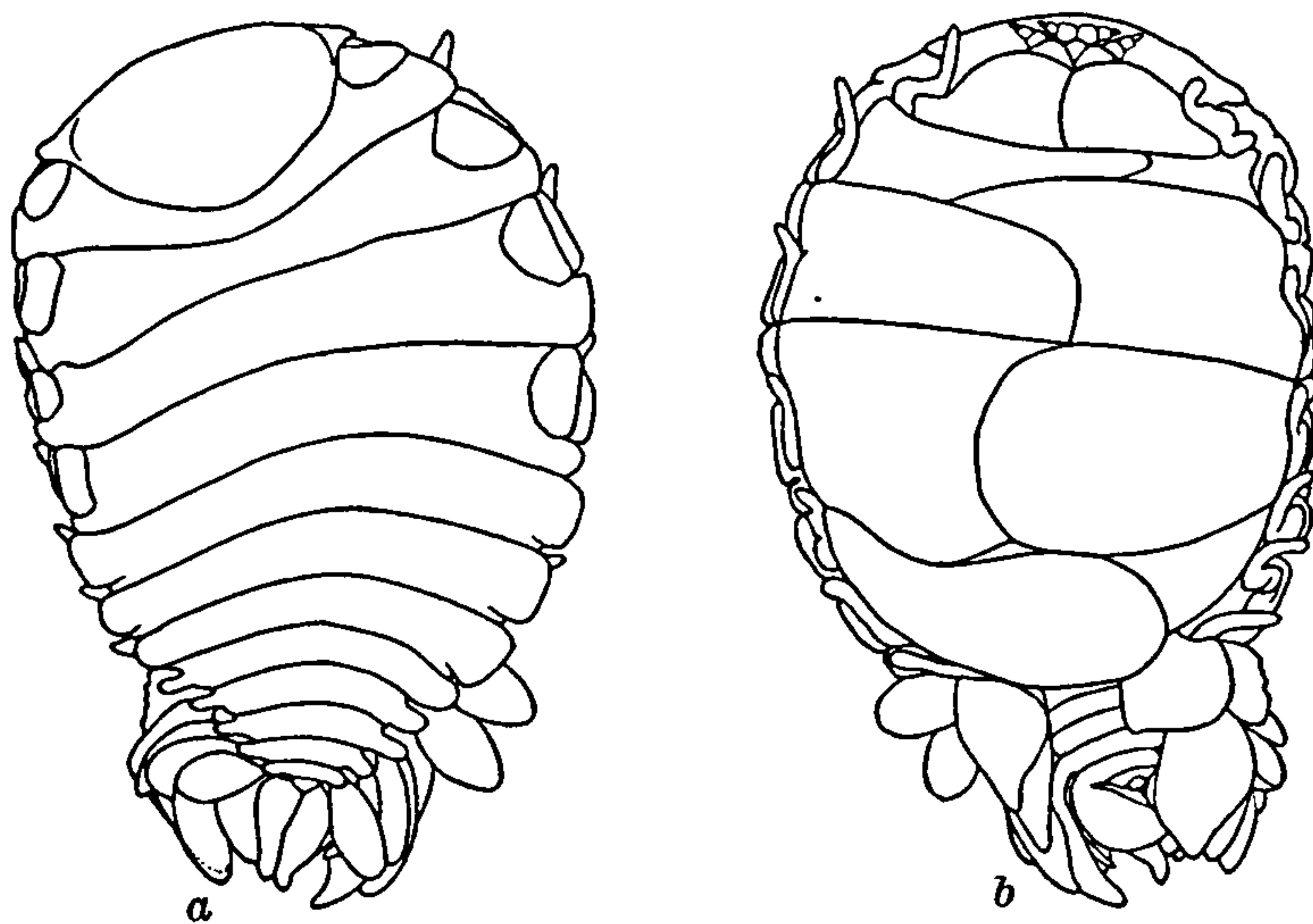


FIG. 574.—PSEUDIONE CURTATA. *a*, DORSAL VIEW OF FEMALE. *b*, VENTRAL VIEW OF SAME.  $\times 8$ .

Head very large, with wide anterior margin, almost straight; no frontal border. Antero-lateral portion produced in a small process on either side. Posterior portion widely rounded. Eyes wanting.

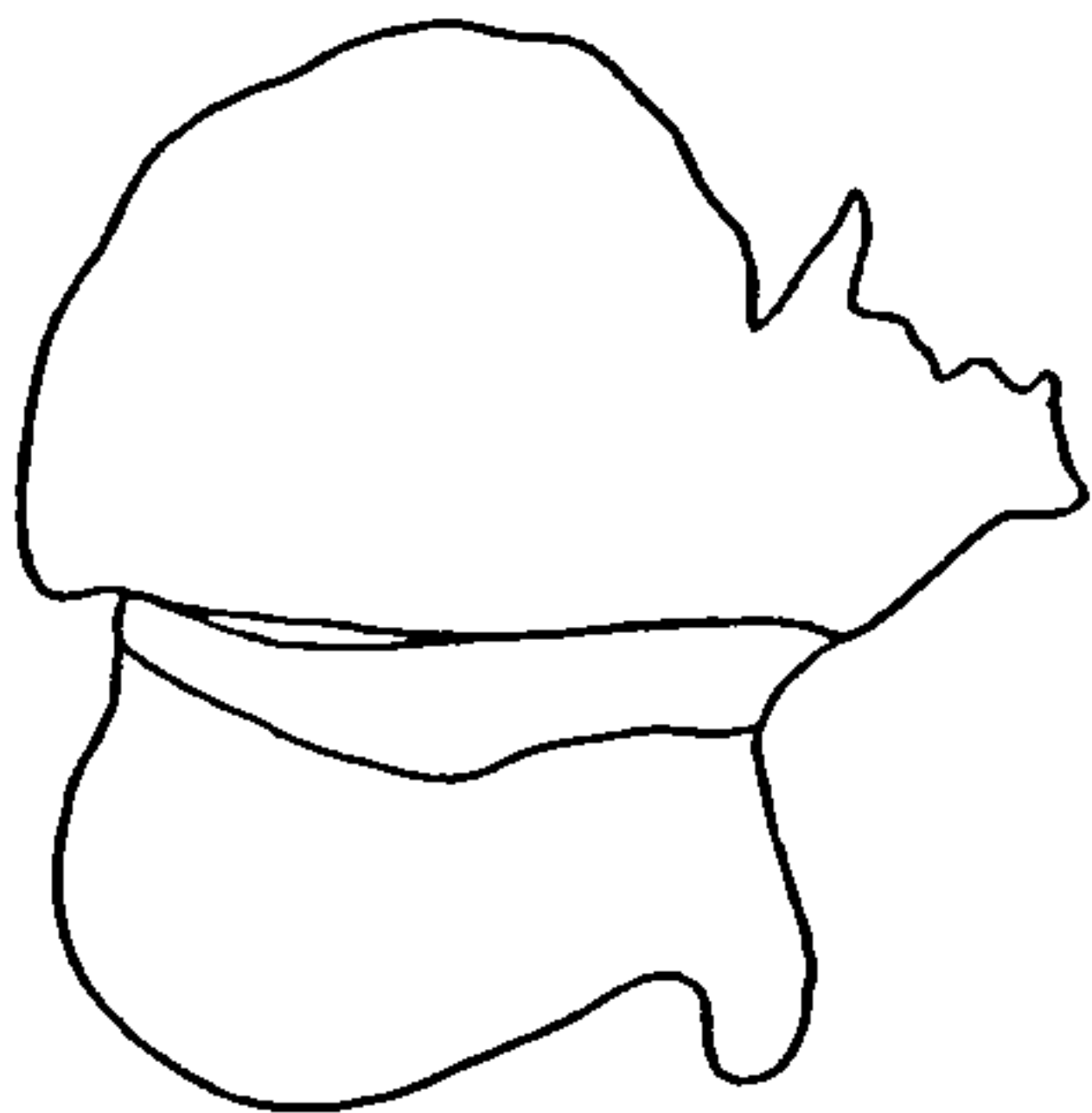


FIG. 575.—PSEUDIONE CURTATA. FIRST LAMELLA OF MARSUPIUM.  $\times 14\frac{1}{2}$ .

The segments of the thorax are distinct. The epimera are distinct as narrow plates on the extreme lateral margin of the anterior portion of the first four segments. Ovarian bosses are prominent on the anterior portion of the first

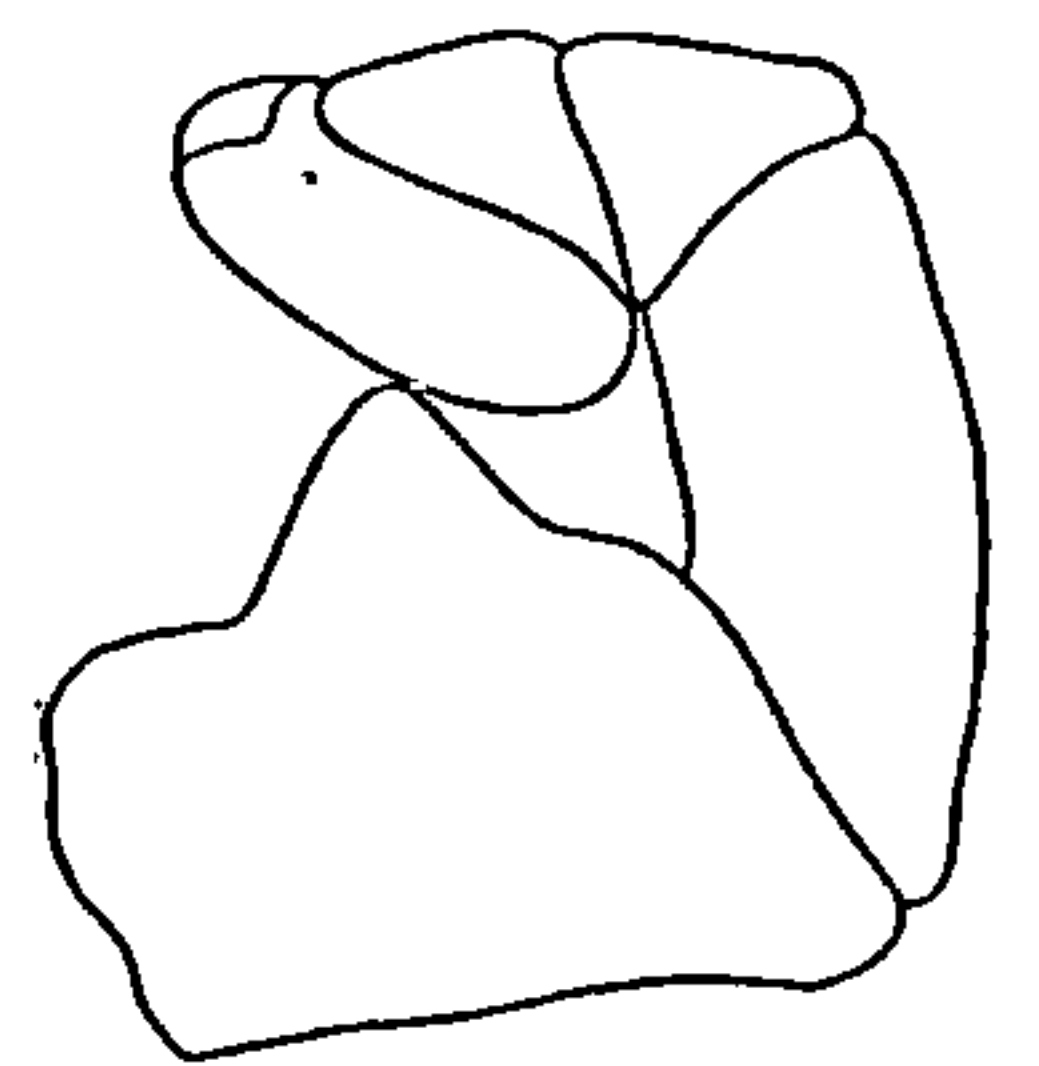


FIG. 576.—PSEUDIONE CURTATA. LEG OF SIXTH PAIR OF ADULT FEMALE.  $\times 39$ .

four segments. The epimera occupy almost all of the lateral margin of the three posterior segments.

The abdomen has the six segments distinct. All are produced laterally in small rounded epimera with the exception of the last, or terminal segment which is very small and rounded posteriorly.



The pleopoda are five pairs of large, broad, smooth, leaf-like, double-branched appendages not concealed on the dorsal side by the small epimeral plates of the abdominal segments, from which they project in full view. The uropoda are a pair of single-branched, simple appendages, similar in shape to the branches of the pleopoda.

The marsupium is formed of five pairs of incubatory lamellæ, which overlap so as to completely encompass the ventral surface of the body; the first pair have the terminal lobe of the distal segment small, but well defined.

There are seven pairs of small legs, all similar in size and structure; a high triangularly shaped expansion or carina is present on the basis.

Color uniformly light yellow.

Male, two and one-third times longer than broad, with all seven segments of the thorax and all six segments of the abdomen distinct. Eyes present. Abdomen occupies one-fourth of the entire length of the body.

Only one specimen was found at Key West by Henry Hemphill. Parasitic on *Petrolisthes sexspinosus* (Gibbes).

*Type*.—Cat. No. 29094, U.S.N.M.

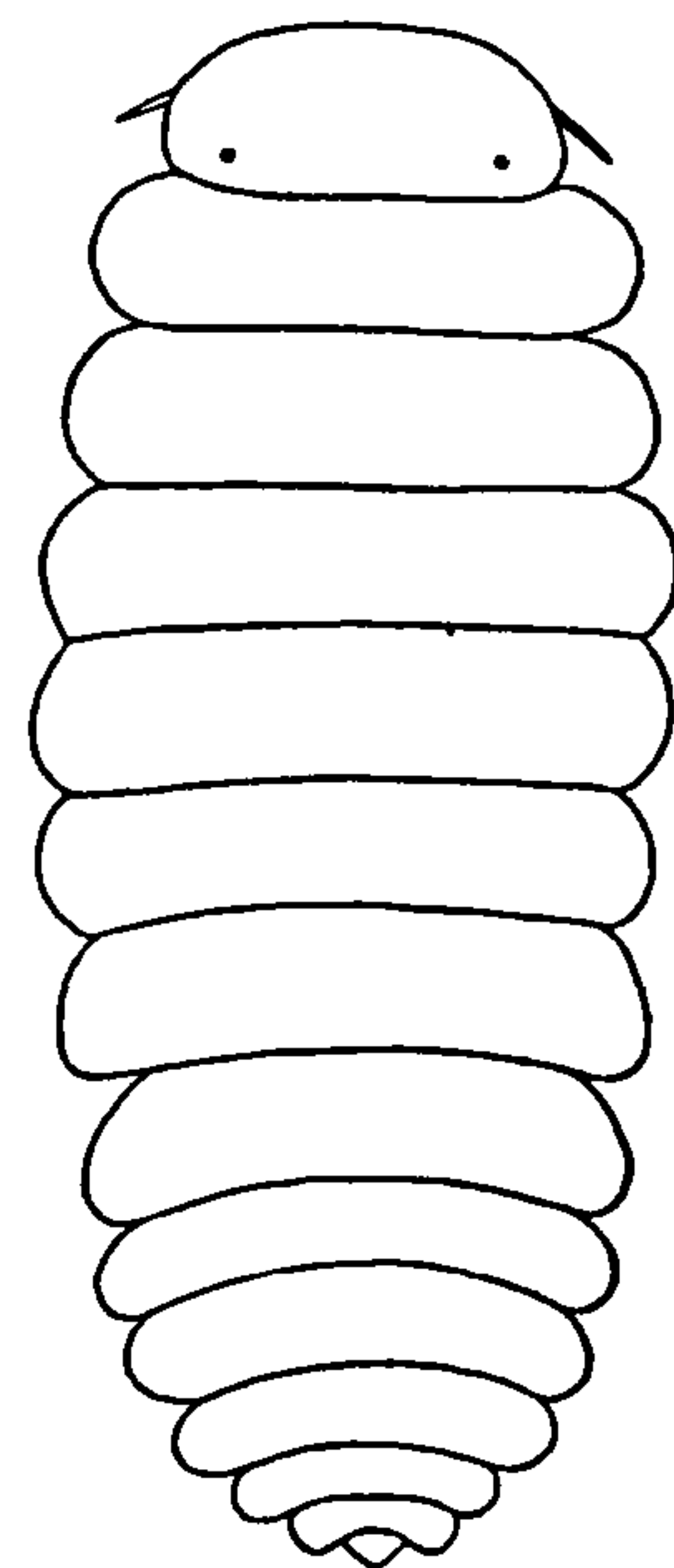


FIG. 577.—PSEUDIONE CURTATA. MALE. X 23.

#### 88. Genus STEGOPHRYXUS Thompson.<sup>a</sup>

Branchial parasites.

Female with the sixth segment of the thorax greatly longer than any of the other segments.

Abdomen with all six segments distinct; lateral parts or pleural lamellæ not developed.

There are five pairs of tri-ramous pleopods.

Uropoda consist of a pair of small, rounded, oval bodies, between which is a small conical process.

Male with all the segments of the thorax distinct.

Abdomen ovoid, without appendages or traces of segmentation.

<sup>a</sup> See Thompson for characters of genus, Bull. U. S. Fish Comm., XXI, 1902, p. 56.



## STEGOPHRYXUS HYPTIUS Thompson.

*Stegophryxus hyptius* THOMPSON, Bull. U. S. Fish Comm., XXI, 1902, pp. 53-56, pls. IX, X.—RICHARDSON, Proc. U. S. Nat. Mus., XXVII, 1904, p. 59.

*Localities.*—Great Harbor, Woods Hole; Hadley Harbor, Naushon; Edgartown and Warwick, Rhode Island, on *Pagurus longicarpus*.

*Description of adult female.*—“Broad in proportion to length, marsupium very large; abdomen about half the length of thorax, distinct from it, six-jointed, with five pairs of triramous pleopoda and a pair of oval uropoda. Length about 9.1 mm. Color yellowish-white, opaque. Ovaries, when full of ripe eggs, orange-yellow.

“Head, from the dorsal side appears as an oblong elevation, ending anteriorly in a blunt lobe, which represents the median portion of the much-reduced front. As the lateral portions of the front are almost wholly obsolete, appearing only as two inconspicuous lobes, the greater part of the antennules, antennæ, and tip of rostrum is visible dorsally. The antennules are three-jointed and consist of a large globose basal joint, surmounted by a small cylindrical second and a minute third joint; outer joints bristle-tipped. Each antenna arises along the side of rostrum as a columnar ridge whose distal end is visible dorsally. From this ridge a four-jointed flagellum arises, its proximal joint stout, the three distal joints slender; all the joints bristle-tipped. Ventral surface of head broader than dorsal surface and sharply elevated at posterior border, giving a strong antero-dorsal slope, so that the erect hypopharynx points almost anteriorly. At sides of posterior border three curved processes arise, and in the midline are two thin foliaceous plates. Rostrum conical. Mandibles slender, with expanded tips, the edges of which are incurved so that pressed together they form a sucking tube. Near the bases of mandibles appear the oval maxillulæ. Hypopharynx erect, highly keeled, and plays no part in formation of rostrum. Maxillipeds large; each consists of a foliaceous anterior and a somewhat thicker posterior blade; during life these organs keep up a rapid fanning motion. There is no trace of a palpus.

“The thorax is concealed ventrally by an enormous marsupium, built up of five pairs of thin brood-plates, each strengthened by a median chitinous rod. The posterior or fifth pair lie externally to the others and form the major part of marsupium; they are attached along the border of fifth and sixth thoracic segments. The posterior angle of each forms a shallow pouch. Nearly concealed by these plates, and almost closing the marsupium anteriorly, are the third and fourth pairs of plates, similar to each other in shape and having an oral ventral and a rounded dorsal portion. This dorsal part conceals the legs of the parasite. The second pair of plates are oblong and are hidden under the others. The first pair consists of a rather oval anterior and a triangular posterior blade. The latter is strengthened



along its outer (longest) border and across its base by a chitinous rod. The anterior blades, in company with the dorsal portions of the third pair of plates, form the funnel-like anterior end of the marsupium.

“The details of the thoracic segments are shown in fig. 578*c*. The first five are crowded together, their fleshy lateral portions strongly

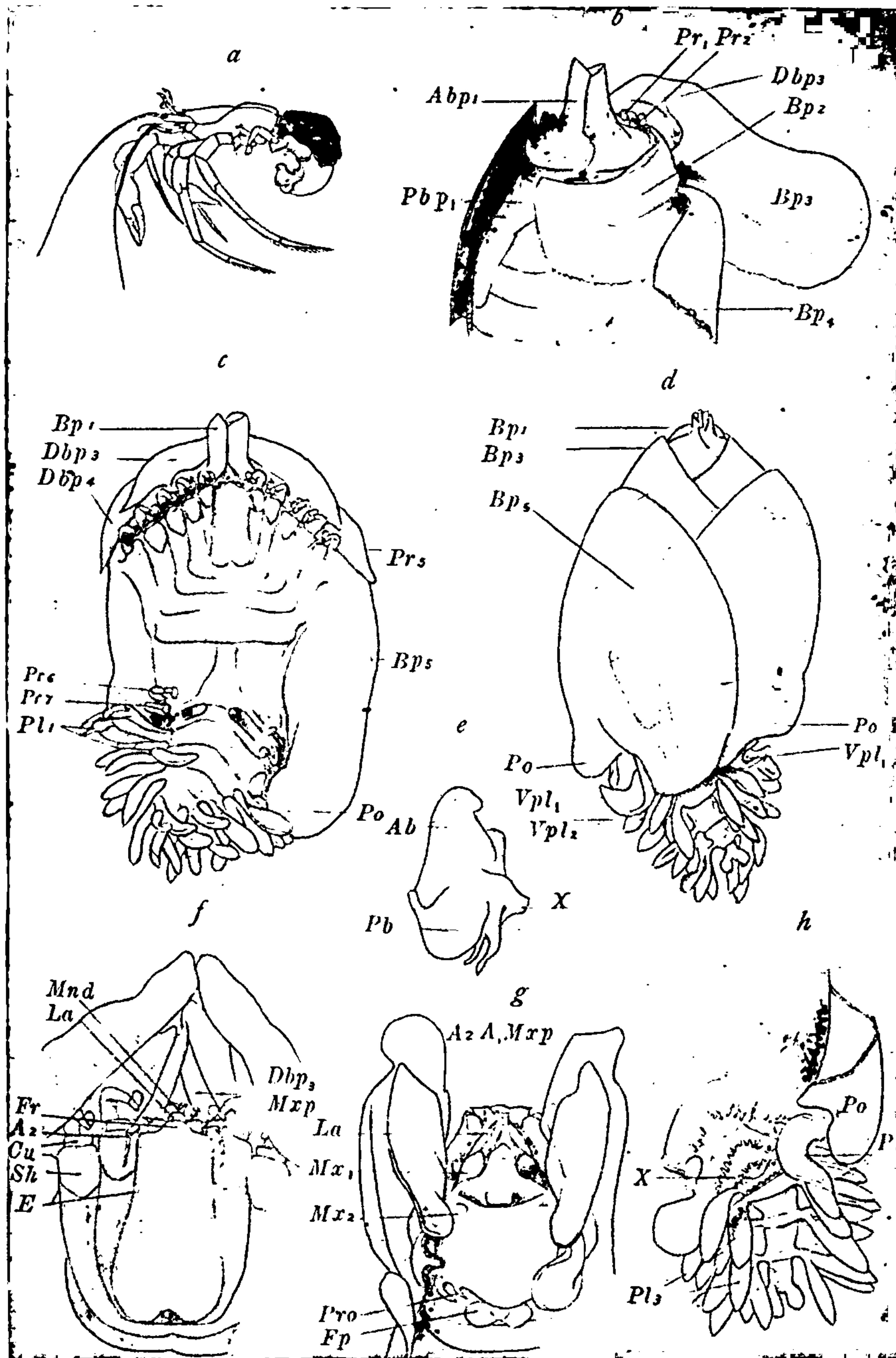


FIG. 578.—STEGOPHRYXUS NYPTIUS (AFTER THOMPSON). *a*, HERMIT CRAB WITH PARASITE ATTACHED.  $\times \frac{3}{4}$ . *b*, ANTERIOR PORTION OF HEAD OF FEMALE (VENTRAL SIDE). *c*, DORSAL VIEW OF ADULT FEMALE.  $\times 5\frac{1}{2}$ . *d*, VENTRAL VIEW OF SAME.  $\times 4\frac{1}{2}$ . *e*, LEFT MAXILLIPED OF ADULT FEMALE.  $\times 10$ . *f*, HEAD OF ADULT FEMALE (DORSAL VIEW).  $\times 11\frac{1}{2}$ . *g*, HEAD OF ADULT FEMALE (VENTRAL SIDE). *h*, ABDOMEN AND POSTERIOR PART OF THORAX OF ADULT FEMALE (VENTRAL VIEW).  $\times 5\frac{1}{2}$ .

bent toward the head. The lateral parts of first four segments end in a small roughened boss or cushion, on which the roughened third joint of the pereopod impinges. This cushion may represent a modified epimeron. Internally to this cushion is a flat shield-shaped area which comes in contact with the abdomen of the host. The



lateral portions of fifth segment end in a sharp crest, and there is no 'shield.' The sixth segment is very long; it narrows posteriorly, has a fleshy median keel and only slightly developed lateral portions. The seventh segment is short, fleshy, about as wide as sixth

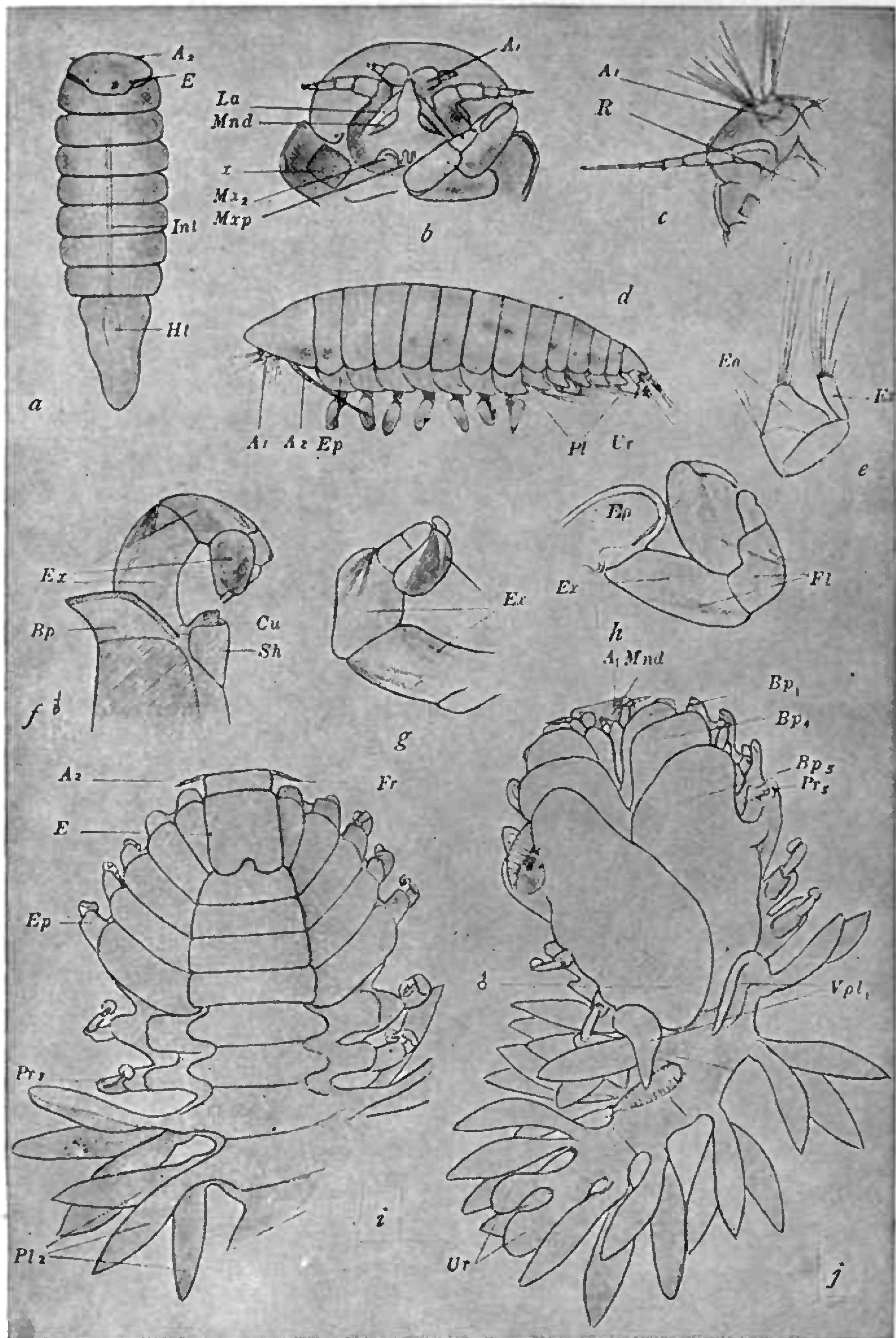


FIG. 579.—STEGOPHRYXUS HYPTIUS (AFTER THOMPSON). *a*, DORSAL VIEW OF ADULT MALE.  $\times 12$ . *b*, VENTRAL SIDE OF HEAD OF SAME.  $\times 22$ . *c*, VENTRAL VIEW OF HEAD OF CRYPTONISCID.  $\times 110$ . *d*, CRYPTONISCID FROM YOUNG FEMALE (LATERAL VIEW).  $\times 58$ . *e*, PLEOPOD OF THIRD ABDOMINAL SEGMENT OF CRYPTONISCID.  $\times 70$ . *f*, MUSCULATURE OF ONE OF FIRST FOUR PEREIOPODA (ADULT FEMALE).  $\times 20$ . *g*, MUSCULATURE OF ONE OF SIXTH OR SEVENTH PEREIOPODA OF FEMALE.  $\times 20$ . *h*, MUSCULATURE OF PEREIOPOD.  $\times 40$ . *i*, DORSAL VIEW OF LARVAL FEMALE.  $\times 12$ . *j*, VENTRAL VIEW OF SAME.  $\times 6\frac{1}{2}$ .

and similar to it, except that it is not keeled. Ventral surface of thoracic segment fleshy, posterior borders of sixth and seventh modified into complex elevated keels. Pereiopoda of the sixth and seventh segments are alike and quite simple in construction; those of the other



five segments are modified, the last three joints being twisted to one side. Extensor muscles enormously developed.

“The abdomen consists of six fleshy segments, five of which bear a pair of pleopoda. Each pleopod has three oval blades arising from a short common base. Two of these are subequal and extend in a lateral direction; the third is smaller and points ventrally. This ventral ramus is broadly expanded in the pleopoda of the first abdominal segment, especially on the right side. The first segment has ventral keels similar to those on the last thoracic segments. Between the oval uropoda of the sixth segment is a minute conical prominence.”

*Description of adult male.*—“Three and two-thirds longer than broad. Abdomen unsegmented, about a third of entire length. Color dull yellowish. Around the heart in the abdomen is an orange-colored area, and a narrow streak of same color runs forward along the mid-dorsal line. Sometimes splashes of black occur on the sides of the head and thorax. Length about 3 mm.

“Head oval, elevated in center, the margin entire and not inflexed. Eyes minute. On the under side is a shallow central depression, in front of which arise the three-jointed antennulæ. From the depression the eight-jointed antennæ and the conical rostrum take their origin. First joint of antennæ elbowed, the others cylindrical, the distal ones bristle-tipped. Sixth, seventh, and eighth joints very small, together scarcely equalling the fifth in length. Rostrum prominent, built up dorsally by the labrum and ventrally by the hypopharynx. Apex of latter conceals tips of mandibles and median part of labrum. Mandibles slender, with thick bases and sharp chitinous tips. I have not found maxillulæ. Between the maxillæ and extending forward from a transverse ridge are the three-jointed maxillipeds. The thorax consists of seven fleshy segments. It narrows slightly posteriorly and is moderately convex. Sides subparallel, somewhat deflexed, epimera not distinct. First segment notched for reception of head. Seven pairs of pereopoda, whose structure and musculature can be understood by reference to the plate. Abdomen ovoid or sometimes pear-shaped, shows no sign of segmentation, and has no traces of appendages.”—M. T. THOMPSON.<sup>a</sup>

#### 89. Genus STEGIAS Richardson.

Body of female with sixth segment of thorax not greatly longer than any of the others.

All six segments of abdomen distinct; lateral parts or pleural lamellæ not developed. First three pairs of pleopods triramous; last two pairs biramous. Uropoda consist of a pair of elongated lamellæ, without a conical process between the two.

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<sup>a</sup>Bull. U. S. Fish Commission, XXI, 1902, pp. 53-56. Consult this reference also for description of immature forms.



## STEGIAS CLIBANARII Richardson.

*Stegias clibanarii* RICHARDSON, Proc. U. S. Nat. Mus., XXVII, 1904, pp. 59-60.

*Locality*.—Bermudas, on *Clibanarius tricolor*.

Head deeply set in thorax, broader posteriorly than anteriorly, longer than broad, and with straight frontal margin. First pair of antennæ visible on dorsal surface, just anterior to front, as two small lobes, each antenna terminating in a minute joint. Second pair of antennæ also visible on dorsal surface, lying on either side of first pair of antennæ, each antenna terminating in a flagellum composed of several minute joints.

Thorax divided into seven distinct segments. The first three surround the head, and are closely crowded together. The other four are very much longer and are of nearly equal length, the fifth being much

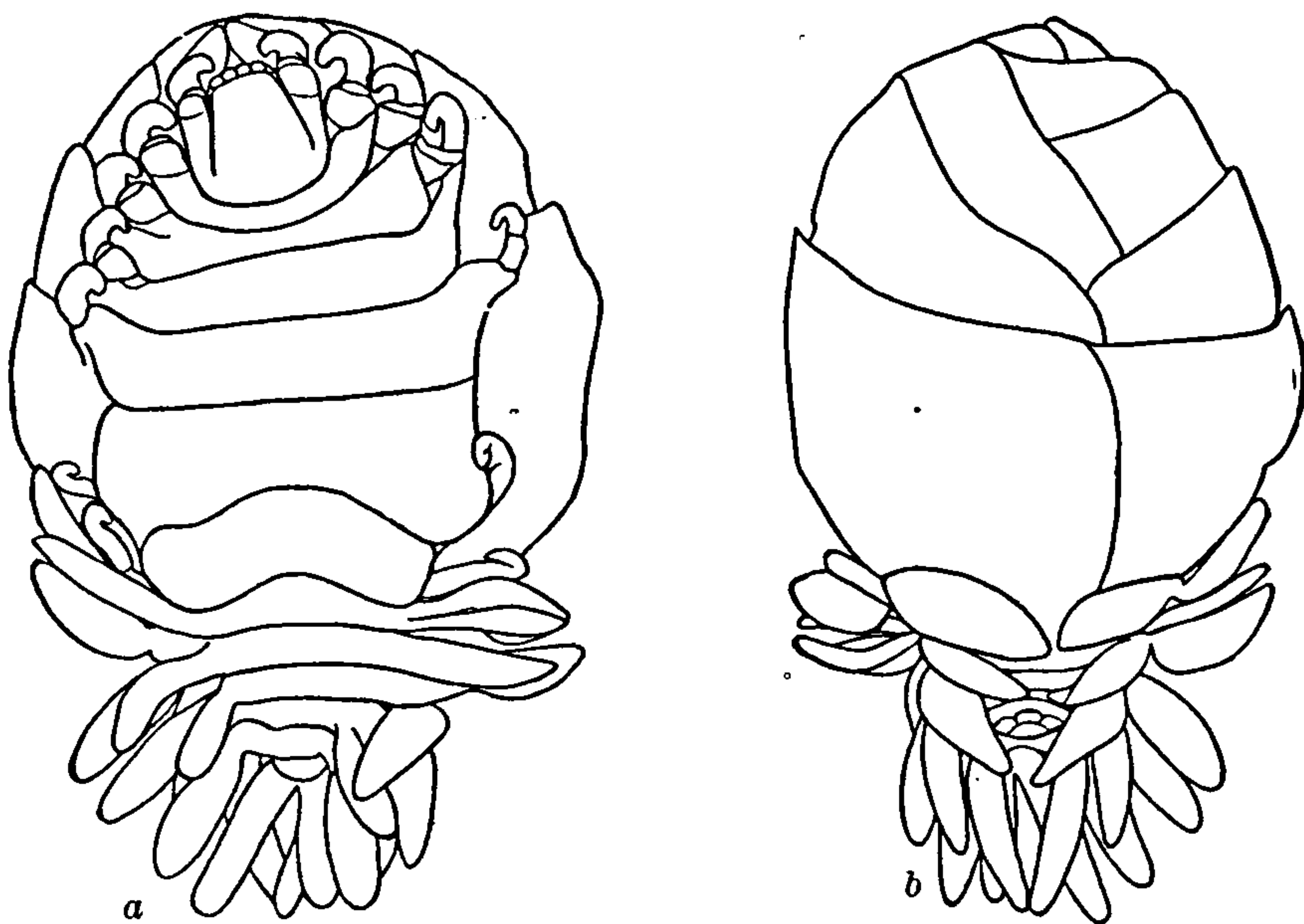


FIG. 580.—STEGIAS CLIBANARII. a, DORSAL VIEW OF FEMALE. b, VENTRAL VIEW OF FEMALE. × 8.

longer at the sides than the others. The first five segments at the sides are directed forward, the five pairs of legs all extending in an anterior direction. A considerable space separates the fifth pair of legs from the sixth pair. The sixth pair of legs, as well as the seventh pair, are placed at the posterior extremity of the sixth and seventh segments, respectively. The epimera of the first four segments are distinct as narrow ridges on the lateral margins of each segment. The ovarian bosses are also present on these segments.

The abdomen is composed of six distinct segments, the first three of which are provided with a pair of triramous pleopods—two dorsal branches and one ventral branch to each pleopod; the next two segments, the fourth and fifth, are each provided with a pair of biramous pleopods, both branches of each pleopod being dorsal, the ventral branch, corresponding to that of the first three segments, not being represented; the sixth segment of the abdomen is furnished with a



pair of simple elongated uropoda, equaling in length the dorsal branches of the pleopoda of the other abdominal segments.

The marsupium is composed of five pairs of lamellæ, the lamellæ of the fifth pair being very large, and occupying almost half of the ventral side of the thorax.

Male unknown.

Only one specimen was collected by Dr. G. Brown Goode at the Bermudas in 1876-77. The parasite was found attached to *Clibanarius tricolor*.

Type in the Peabody Museum, Yale University.

This genus differs chiefly from *Stegophryxus* Thompson, to which it is closely related in having the pleopoda of the fourth and fifth abdominal segments biramous instead of triramous; in having the uropoda long and leaf-like, similar in shape and size to the branches of the pleopoda, while in *Stegophryxus hyptius*, the type species of the genus, the uropoda are small, rounded, and knob-like, with a minute conical prominence between them; and in not having the sixth thoracic segment greatly longer than the others.

#### 90. Genus BATHYGYGE Hansen.

Body of female asymmetrical, the abdomen being turned to one side in a marked degree. Epimeral plates, consisting of large oval lamellæ, anteriorly very much produced and attached near the inner posterior margin.

Segments of the abdomen distinct; lateral parts or pleural lamellæ not developed. Abdomen small.

The pleopoda consist of five pairs of double-branched lamellæ, the two branches being unequal in size, and arising from a common peduncle attached to the lateral margin of the segment.

The uropoda are double-branched.

Male with the abdominal segments fused; abdomen ovate in outline.

Pleopoda and uropoda absent. Segments of thorax distinct.

Branchial parasites.

#### BATHYGYGE GRANDIS Hansen.

*Bathygyge grandis* HANSEN, Bull. Mus. Comp. Zool. Harvard College, XXXI, 1897, pp. 122-124, pl. VI, figs. 2-2e.—RICHARDSON, Proc. U. S. Nat. Mus., XXI, 1899, p. 869; Ann. Mag. Nat. Hist. (7), IV, 1899, p. 338.—BONNIER, Travaux de la Station Zool. de Wimereux, VIII, 1900, pp. 291-292.

*Locality*.—Off Acapulco, in the branchial cavity of *Glyphocrangon spinulosa* Faxon.

“Only a male, and the posterior part of a female have been sent to me.

“(a) *Female*.—The rudiment consists of the posterior part of the thorax, bearing three legs on one and two on the other side, and the abdomen.



“Thorax: The pleural plates are very large oval lamellæ, only connected with the segment by somewhat less than the posterior half of their interior margin, and this result is due to the fact that they anteriorly are very much produced, highly overlapping each other, and posteriorly rather shortly produced. The legs are tolerably slender; the second joint not expanded; the fifth joint elongate, in the last pair as long as the hand.

“Abdomen: It is turned to the left in a startling degree and is proportionally small—perhaps very small. The dorsal surface is soft-

skinned, the segments more or less distinctly separated. Pleural plates are not developed. The pleopods quite soft, of medium size, decreasing conspicuously in size from before backward and attached to the lateral margin; each pleopod consists of a short peduncle and two lamellar oblong rami; the outer ramus much larger than the inner one. The uropods biramous; the outer ramus a little smaller than the outer of the fifth pleopod, the inner ramus very short, almost rudimentary. The pleopods are curled to such a degree that it would have been impossible without much construction to draw a sketch of the abdomen.

“(b) *Male*.—The body is a little more than three times longer than broad, and from the fourth thoracic segment it decreases in breadth towards both ends. (Fig. 581*b*.)

“Head: The dorsal surface rather convex; the median portion of the anterior margin almost straight. No eyes. The frontal border bent slightly downward. (Fig. 581*a*.) The antennulæ rather short, three-jointed; the basal joint tol-

erably thick and partly overlapped by the rostrum; the second joint slender and rather short; the third very small. The antennæ comparatively long, seven-jointed; the four proximal joints of about the same length, but decreasing much in breadth from the rather thick basal joint to the fourth one; the fifth joint is short and very slender, the last two joints exceedingly small. The mouth forms a rostrum, which, when seen from below, is triangular, considerably depressed, and directed forward, reaching almost to the frontal margin

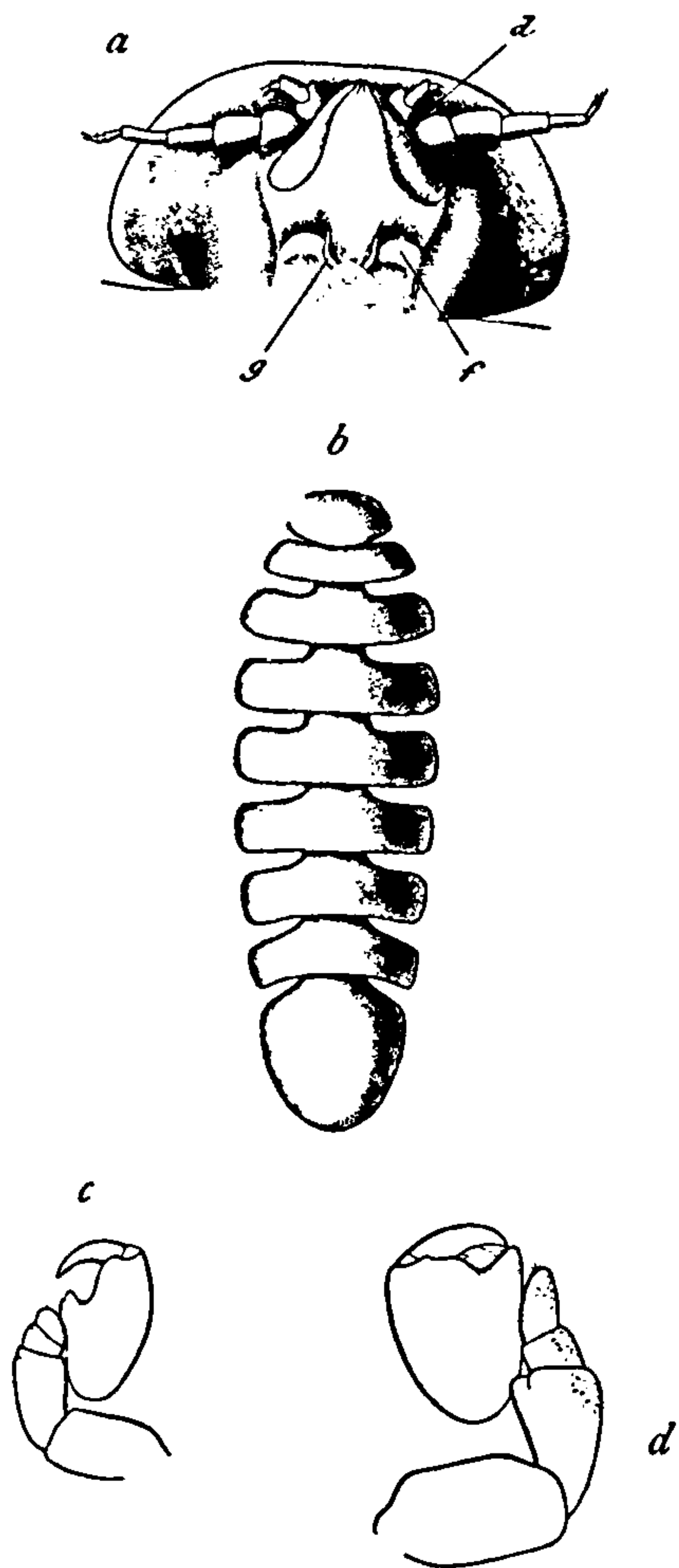


FIG. 581.—BATHYGYGE GRANDIS (AFTER HANSEN). *a*, HEAD OF MALE (VENTRAL VIEW). *b*, DORSAL VIEW OF MALE. *c*, FIRST LEG OF MALE. *d*, FIFTH LEG OF MALE.



of the head. The hypopharynx is very large, and just outside it is seen the very oblong lateral part of the labrum (*d*), the median part of which is concealed by the hypopharynx. At first I believed that these oblong organs were the mandibles, but a closer examination gave the result mentioned, while the mandibles, being needles with brown apex, were discovered within the rostrum. Maxillulæ are not observed; the maxillæ (*f*) are small semicircular lobes lying considerably behind the posterior edge of the labrum. The maxillipeds (*g*) are short, extremely slender, almost styliform.

“Thorax: The segments are rather convex, the incisions between them comparatively broad and very deep; the lateral margins are much curved when seen from the side. The legs increase considerably in length and very much in thickness from the first (fig. 581*c*) to the fifth pair (fig. 581*d*), which is robust, with the hand very large; the two posterior pairs again decrease somewhat in size. The terminal margin of the hand is deeply concave, thus differing considerably from the preceding forms.

“Abdomen: It occupies scarcely one-fourth of the length of the animal; it is narrower than the last thoracic segment, shortly ovate in outline, without the slightest rudiment of segmentation or abdominal feet; both the ventral and especially the dorsal surface are very convex.

“Size: Uncommonly large, being 7 mm. long and 2.3 mm. broad.”—HANSEN.<sup>a</sup>

#### 91. Genus PHYLLODURUS Stimpson.

“Feminae pedes thoracis sat validi, toti ancorales, unguiculati; appendicibus branchialibus carentes. Appendices abdominis branchiales; superiores laterales, laminis duabus æquis magnis elongatis; inferiores papilliformes. Abdominis segmentus primus setis dorsalibus unguiculatis instructus.”—STIMPSON.<sup>b</sup>

Abdominal parasites.

Body of female is almost symmetrical.

Ovarian bosses present. Posterior portion of lateral margins of thoracic segments not produced. Epimera present on all the segments, not distinctly separated on the last two; they occupy the anterior part of the lateral margin on the first four segments; on the fifth segment they are placed between the anterior and posterior divisions of the segment; on the last two segments they occupy the posterior portion of the lateral margin.

The abdomen is distinctly segmented, becoming gradually and rapidly narrower from the first to the terminal segment; lateral parts of segments or pleural lamellæ not developed. On the dorsal surface of

<sup>a</sup> Bull. Mus. Comp. Zool. Harvard College, XXXI, 1897, pp. 122-124.

<sup>b</sup> Bost. Journ. Nat. Hist., VI, 1857, pp. 511-513.



the first segment of the abdomen close to the anterior margin are two large papillose processes, one on either side of the median line.

There are five pairs of double-branched pleopoda, the branches in the adult being similar and subequal, and both branches being in the form of long, narrow lamellæ, issuing from a common peduncle attached to the lateral margins of the segments and forming a border surrounding the abdomen.

The uropoda are simple, in the form of two long, narrow, cylindrical lamellæ attached to the sixth abdominal segment. All seven pairs of legs are present.

The abdomen of the male is distinctly segmented. The first abdominal segment has two large rounded papillæ close to the anterior margin, one on either side of the median line. The sixth or terminal segment is posteriorly produced at the apex in a long pointed process. There are five pairs of single-branched pleopoda, in the form of long, narrow-sacs, attached one on each side close to the lateral margins of the segments. The uropoda are a pair of small, simple processes, attached one on either side of the terminal segment of the abdomen.

All seven segments of the thorax are distinct.

#### PHYLLODURUS ABDOMINALIS Stimpson.

*Phyllodurus abdominalis* STIMPSON, Bost. Jour. Nat. Hist., VI, 1857, pp. 511-513.—LOCKINGTON, Proc. Cal. Acad. Sci., VII, 1877, Pt. 1, p. 57; Ann. Mag. Nat. Hist. (5), II, 1878, pp. 299-300.—RICHARDSON, Proc. U. S. Nat. Mus., XXI, 1899, p. 868; Ann. Mag. Nat. Hist. (7), IV, 1899, p. 337.—BONNIER, Trav. de la Station Zool. de Wimereux, VIII, 1900, p. 250.—RICHARDSON, Proc. U. S. Nat. Mus., XXVII, 1904, p. 78.

*Localities*.—Puget Sound on *Upogebia*; Tomales Bay on *Upogebia pugettensis* (Lockington); San Francisco Bay.

*Description of female*.—Body ovate, a little longer than wide, about one and a half times longer than wide, 10 mm.: 14 mm.

Head a little wider than long, 3 mm.: 4½ mm., bilobate, with the frontal margin produced in a rounded border. Eyes absent. The first pair of antennæ are small, usually inconspicuous from a dorsal view, composed of three articles, the terminal article being minute, the first article large and dilated. The second pair of antennæ are partly visible from a dorsal view. They are composed of five articles, the terminal article being minute.

The seven segments of the thorax are distinct. The anterior portion of the lateral margins of the segments is occupied by the ovarian bosses. Lateral to the ovarian bosses on the first four segments are the narrow epimeral plates. The posterior lobe of the lateral margin is small on the first segment, becoming larger on the three following segments. On the fifth segment the epimeral plate lies between the ovarian boss and the posterior lobe, being lateral partly to both. On



the last two segments the epimera occupy the post-lateral margin and are not separated from the segment.

The abdomen is composed of six distinct segments. The first segment is provided on either side near the antero-lateral margin with a papillose process. This segment is nearly twice as long as any of the following segments. The segments of the abdomen are successively narrower, gradually and rapidly tapering to the sixth or terminal segment which is produced posteriorly in a long, narrow, tapering process.

On either side of the lateral margins of the first five abdominal segments are attached two long, narrow processes, arising from a common stem or peduncle. These are probably the pleopoda, which may be considered as double-branched. There are thus ten of these on either side, or twenty in all—i. e., five pairs of double-branched pleopoda. On either side of the

sixth or terminal segment the uropoda are attached. They are single-branched, each consisting of one long, narrow cylindrical process. The ventral side of the last two thoracic segments is produced on the posterior margins in keels. The ventral side of the abdominal segments is slightly keeled.

There are five pairs of incubatory plates. The distal part of the first lamellæ is posteriorly produced in a triangularly rounded lobe.

The seven pairs of legs are prehensile in character; the basis is not produced in a carina.

The young female has one of the branches (the inner one) of the pleopoda very much shorter than the other branch. The head is not bilobed, and has the front more circular in outline. I have examined three adult females, two young females, and two males. The two young females had rudiments of the incubatory lamellæ, the plates being larger in one specimen than in the other, and the inner branch of the pleopoda also larger. One specimen is a little older than the other.

Most of the specimens were kindly sent to me by Doctor Calman. They were sent to him from Columbia University, New York. Another specimen, a female, was sent to me later by Dr. William E. Ritter, of the University of California.

*Description of male.*—Body oblong-ovate, a little more than twice as long as wide,  $2\frac{1}{2}$  mm. : 6 mm.

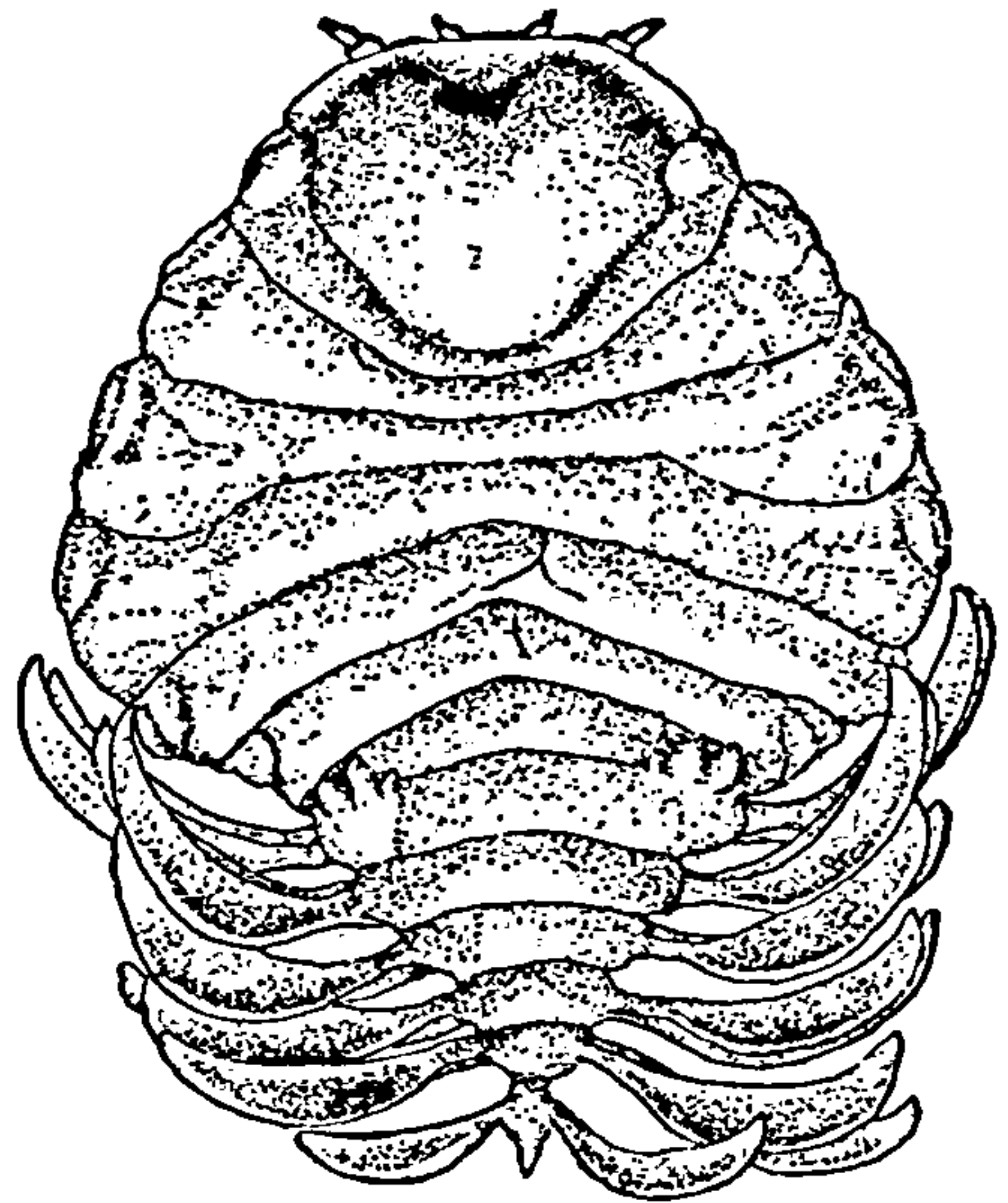


FIG. 582.—PHYLLOPORUS ABDOMINALIS. FEMALE (DORSAL VIEW).

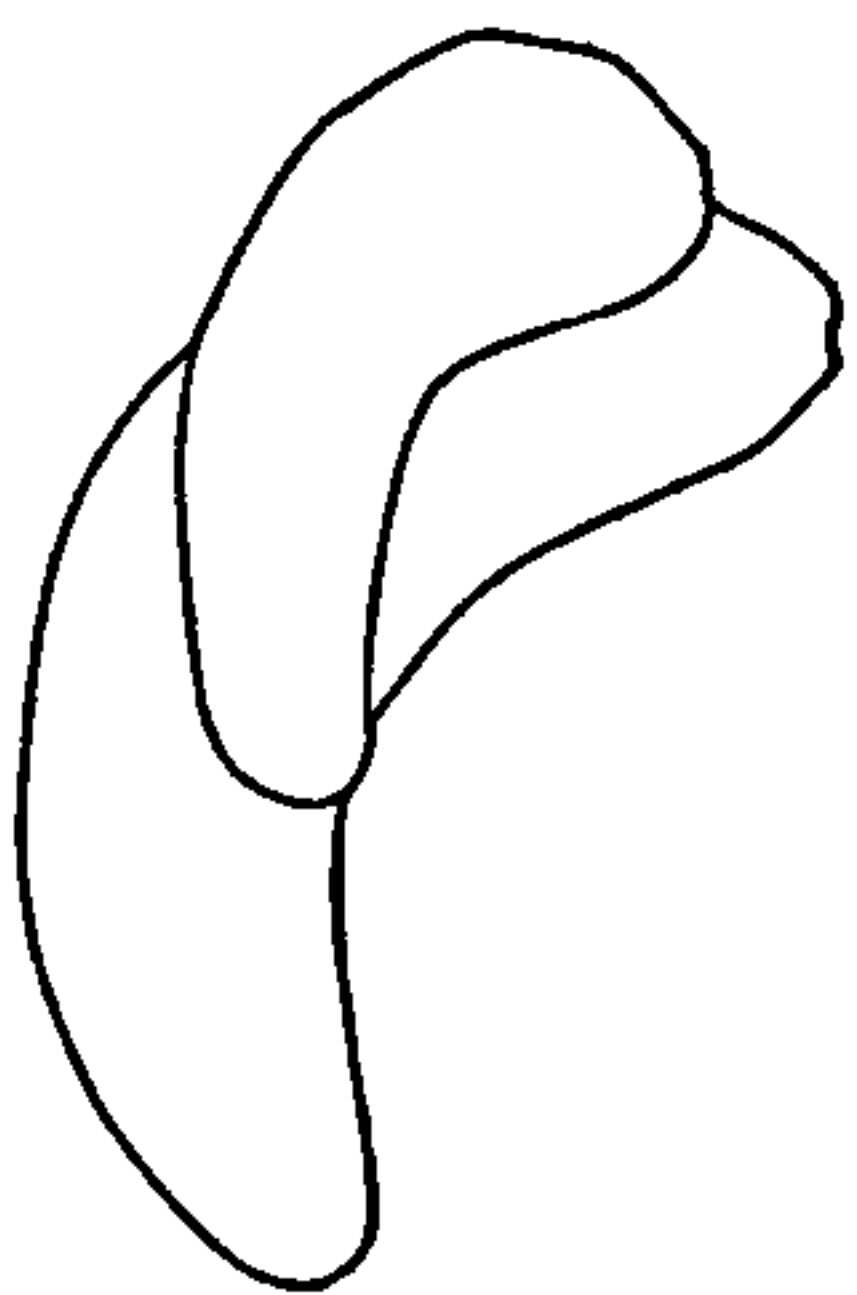


FIG. 583.—PHYLLOPORUS ABDOMINALIS. ONE OF BIRAMOUS PLEOPODS OF ADULT FEMALE.  $\times 7$ .



Head about twice as wide as long, with the anterior margin circular in outline, the posterior margin straight. The eyes are small, distinct, and situated on the posterior margin, at some distance from the sides of the head. The first pair of antennæ are short and are com-



FIG. 584.—PHYLLOPORUS ABDOMINALIS. *a*, FIRST INCUBATORY LAMELLA.  $\times 27\frac{1}{2}$ . *b*, MAXILLIPED.  $\times 27\frac{1}{2}$ . *c*, SEVENTH LEG.  $\times 15\frac{1}{2}$ .

posed of only three articles. The second pair are composed of five articles, the terminal article being tipped with hairs.

The seven segments of the thorax are distinct and taper gradually, becoming successively narrower.

The six abdominal segments are distinct. They taper gradually but rapidly to the small terminal segment which is posteriorly produced in a long, narrow process, which is a little longer than the basal

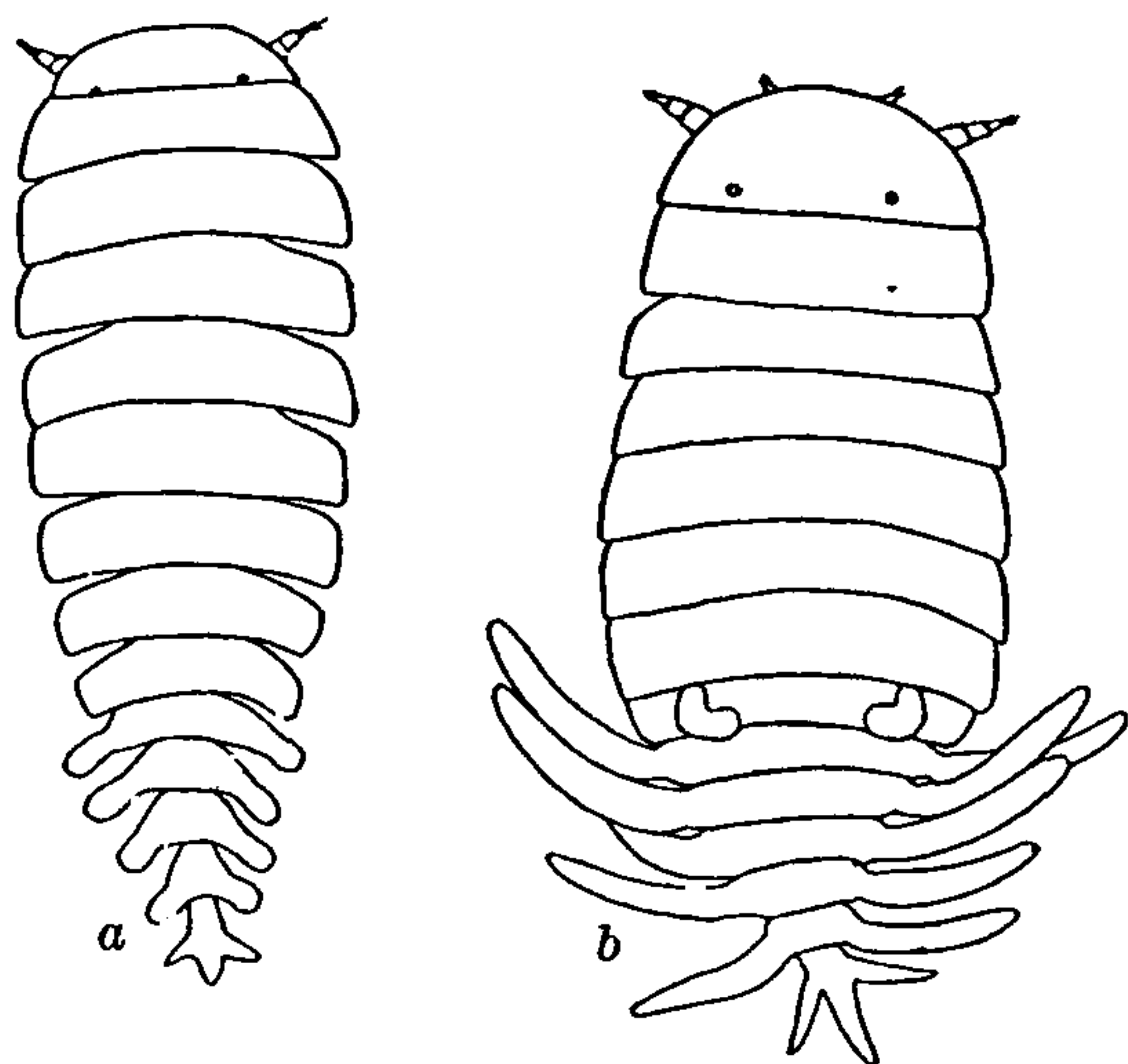


FIG. 585.—PHYLLOPORUS ABDOMINALIS. *a*, MALE. *b*, YOUNG FEMALE.

part of the segment. The uropoda consist of a small branch on either side of the sixth or terminal segment and are attached at the place where the basal part of the segment gives rise to the long, narrow terminal process.

There are five pairs of single-branched pleopoda, a pair for each of the first five abdominal segments. They are in the form of narrow, elongated sacs, rounded at the extremity, and attached, one on each side, close to the lateral margin of the segments.

The first abdominal segment bears on the dorsal surface two large rounded papillæ, one on either side, close to the lateral margin.

There are seven pairs of prehensile legs.

Dr. W. T. Calman says that he thinks it is characteristic for the males and females to be attached separately to the host. Only in one case did he find a male attached to the female. The label accompanying one male sent by Doctor Calman reads: "Found on the second pleopod of host."



The following description of the female is given by Stimpson:

This curious form of parasitic anisopods was found attached to and lying between the abdominal feet of the common *Gebia*, adhering by the sharp hook-shaped terminal joints of its feet, and perhaps aided in keeping its position by the sharp dorsal setæ of the abdomen. As might be expected from this external parasitism, the shape of the body is symmetrical, being never distorted, as is almost always the case in those forms which live in the usual position—in the confined space under the thoracic shield of the shrimp or crayfish.

In our species the thorax is somewhat cordate in shape, broadest behind, the short abdomen being set in the concavity. The thoracic segments are well separated and provided with distinct tumid epimera; the external envelope is soft, being even less hard and crustaceous than in *Argeia*. The head is somewhat broader than long, strongly tumid, and in the character of its appendages resembles somewhat that of *Ione*. The front projects abruptly, forming a horizontal margin to the head, beneath the anterior part of which the small inner antennæ are concealed. The outer antennæ arise laterally, and behind the inner ones, which they much exceed in length, being as long as half the width of the head. There are no thoracic branchial appendages. The thoracic feet are similar in character throughout; they gradually increase in length posteriorly, and are each provided with a small hand, the hooked finger of which is of moderate length, more than reaching the projecting inferior angle of the antepenultimate article.

The abdomen is triangular and consists of six deeply separated segments, the terminal one being very minute. The basal segment is much the largest, and bears upon its dorsal surface two papillæ, one on each side, which are provided with short, stiff, somewhat hooked setæ. The lateral extremities of the abdominal segments are split by a marginal furrow into superior and inferior rami; the latter being simply conical with two or three circular wrinkles; and the former (superior) each surmounted by a cylindrical pedicle which bears two large cultriform lamellæ. There are thus twelve pairs of these lamellæ, which are of large size, and being crowded, project in different directions, nearly concealing the posterior half of the animal. Each is about one-fifth as broad as long, compressed on the inner and thickened along the outer or convex edge. Only females of this species have as yet been found. The dimensions of one specimen are:

	Inch.
Length of body .....	0.58
Length of abdomen .....	.12
Length of superior abdominal appendages.....	.24
Breadth of thorax .....	.45

Several examples of this singular crustacean have been found on *Gebia* from Puget Sound and Tomales Bay.<sup>a</sup>

Lockington says: "The males do not live attached to the *Gebia*, but are free to rove." His description of the male is as follows:

Head semi-circular anteriorly, closely united to the succeeding segment. Third and fourth thoracic segments widest. Body oblong, boat-shaped, tapering slowly from the fourth to the seventh thoracic segment.

Outer antennæ 4-jointed; inner very small, reaching about to the middle of the second segment of the outer. Eyes too small to be distinguished by a Coddington lens. First abdominal segment a little narrower than last thoracic, but flat; succeeding segments tapering rapidly to the sixth or telson, which is pointed at the end and is provided on each side with a small lamella, giving the whole telson somewhat the appearance of a spearhead.

<sup>a</sup> Bost. Journ. Nat. Hist., 1857, pp. 511-513.



The lateral laminae of the first five abdominal segments round in sections instead of segmental as in the female, and considerably longer than the width of the segments to which they are attached.<sup>a</sup>

## 92. Genus ARGEIA Dana.

Body of female asymmetrical.

Ovarian bosses present on the first four segments of the thorax. Epimera present on all the segments; on the first four segments they are lateral to the ovarian bosses, and are in the form of narrow plates. The posterior portion of the lateral margins, in all the segments, are more or less produced, the length of the processes varying in each individual.

The segments of the abdomen are distinctly defined, and become gradually but rapidly narrower to the sixth or terminal segment, which is somewhat bilobed.

The pleopoda are five pairs of double-branched appendages; the outer branches are in the form of long, narrow lamellae attached close to the lateral margins of the segments and forming a border surrounding the abdomen. The inner branches are in the form of small, rounded lamellae, decreasing in size from the first to the last.

The uropoda are simple, in the form of two narrow, elongate lamellae attached to the terminal segment and similar to the outer branches of the pleopoda.

All seven pairs of legs are present.

The male has all the segments of the abdomen fused. The pleopoda and uropoda are wanting. All seven segments of the thorax are distinct.

Branchial parasites.

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

- a.* Thoracic processes present on all the segments. Head large. Inner branches of all the pleopoda present. Incubatory lamellae do not completely cover the marsupial pouch ..... *Argeia pugettensis* Dana
- a'*. Thoracic processes apparently absent on some of the anterior segments. Head smaller than in *A. pugettensis*, and bilobate. Inner branches of the first three pairs of pleopods present; others wanting ..... *Argeia pauperata* Stimpson.<sup>b</sup>

### ARGEIA PUGETTENSIS Dana.

*Argeia pugettensis* DANA, U. S. Expl. Exp., Crust., XIV, 1853, p. 804, pl. LIII, fig. 7.—STIMPSON, Bost. Jour. Nat. Hist., VI, 1857, p. 511.

*Argeia* sp.? CALMAN, Ann. N. Y. Acad. Sci., XI, 1898, p. 281.

*Argeia pugettensis* RICHARDSON, Proc. U. S. Nat. Mus., XXI, 1899, p. 868; Ann. Mag. Nat. Hist. (7), IV, 1899, p. 337; American Naturalist, XXXIV, 1900, p. 308.

<sup>a</sup> Proc. Cal. Acad. Sci., VII, 1877, Pt. 1, p. 57.

<sup>b</sup> The key is made from Stimpson's diagnosis of *Argeia pauperata*. I have seen no specimens of his species.



*Argeia calmani* BONNIER, Travaux de la Station Zool. de Wimereux, VIII, 1900, p. 329.

*Argeia pugettensis* BONNIER, Travaux de la Station Zool. de Wimereux, VIII, 1900, pp. 327-328.—RICHARDSON, Proc. U. S. Nat. Mus., XXVII, 1904, pp. 60-64; Bull. U. S. Fish Comm., XXIV, 1905, p. 220.

*Localities.*—On *Crago munita* (Dana), at Puget Sound; off Cape Beale, Vancouver Island. On *Crago alascensis* (Lockington), off Cape

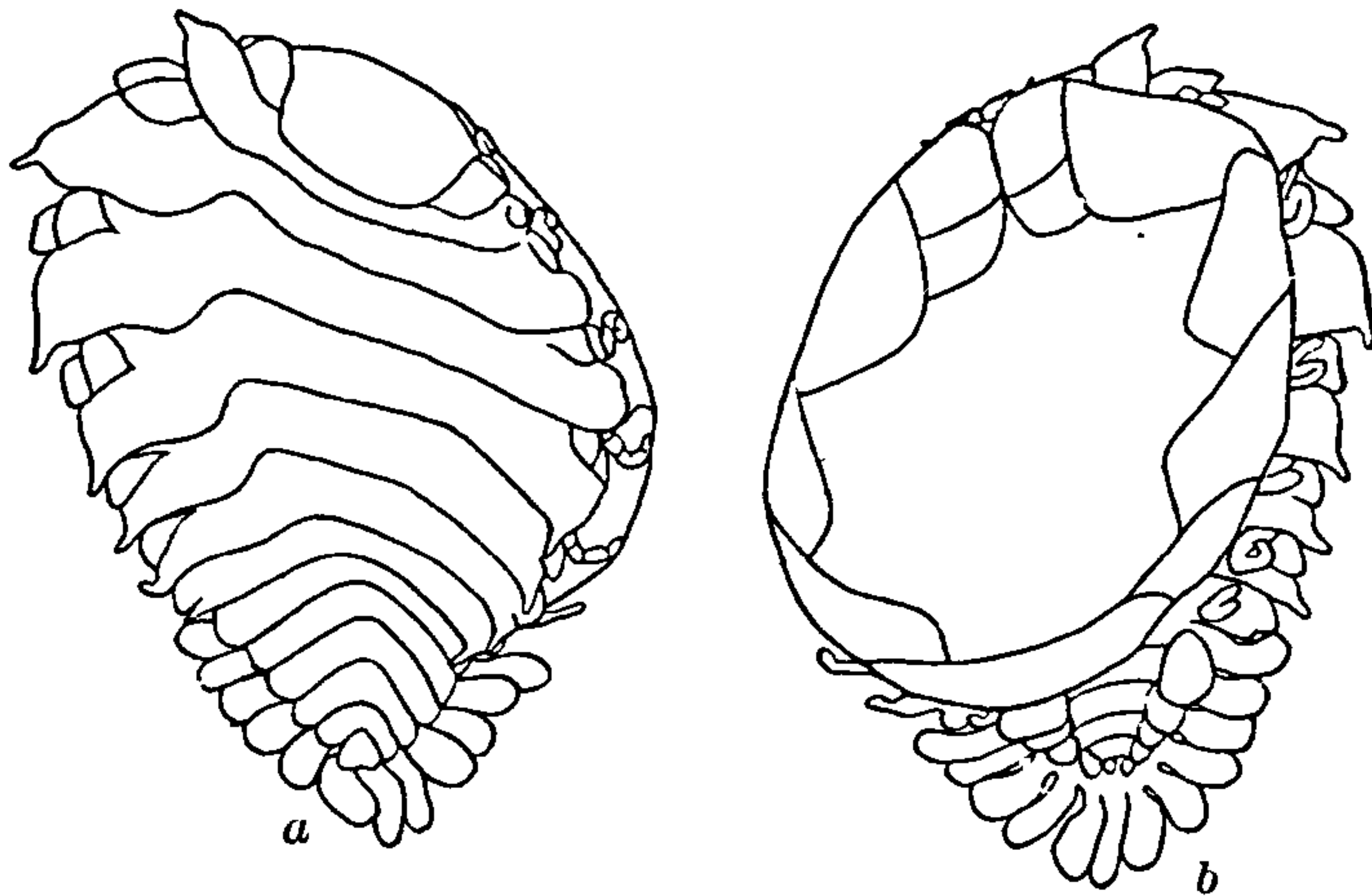


FIG. 586.—ARGEIA PUGETTENSIS. *a*, DORSAL VIEW OF ADULT FEMALE. *b*, VENTRAL VIEW OF ADULT FEMALE.  $\times 14\frac{1}{2}$ .

Seniavin, Alaska; at Davidson Bank, Alaska; east of Amak Island, Alaska; off Cape Strogonoff, Alaska; northwest of Unimak Island, Alaska; Kouloulak Bay, Alaska; off Columbia River, Oregon; Gulf of Georgia, British Columbia. On *Crago dalli* (Rathbun), south of Amak Island, Alaska. On *Crago alascensis elongata* (Rathbun), off Columbia River, Oregon. On *Nectocrangon ovifer* (Rathbun), off North Head, Akutan Island, Alaska; west of Pribilof Islands, Alaska. On *Crago franciscorum angustimana* (Rathbun), Straits of Fuca; Gulf of Georgia, British Columbia. On *Nectocrangon nigricauda* Stimpson, off Port Ano Nuevo, California. On *Nectocrangon crassa* Rathbun, off Cape Seniavin, Alaska; off Cape Newenham, Alaska; north of Bird Island, Shumagins, Alaska; Bering Sea, off the Pribilof Islands; Semidi Islands. On *Nectocrangon lar* (Owen), off Rakovaya Bay; Avatcha Bay; off Cape Strogonoff; off Kouloulak Bay and off Bristol Bay, Alaska; off Cape Menchikoff, Alaska; off Khoudoubine Islands, Alaska; off mouth of Yukon River. On *Nectocrangon alascensis* Kingsley, southwest of Hagemeister Island, Alaska; south and northwest of Unimak Island, Alaska; off Moorovskoy Bay, Alaska; Davidson Bank, Alaska; off North Head, Akutan Island, Alaska; south of San Diego Bay, California; off Rootook Island, Alaska; Petropaulovski, Kamchatka; off Kouloulak Bay, Alaska; between Bird and Nagai Islands; Unimak Pass; off Cape Johnson; southwest of Sannakh Islands, Alaska; off Grays Harbor, Washington; off Destruction

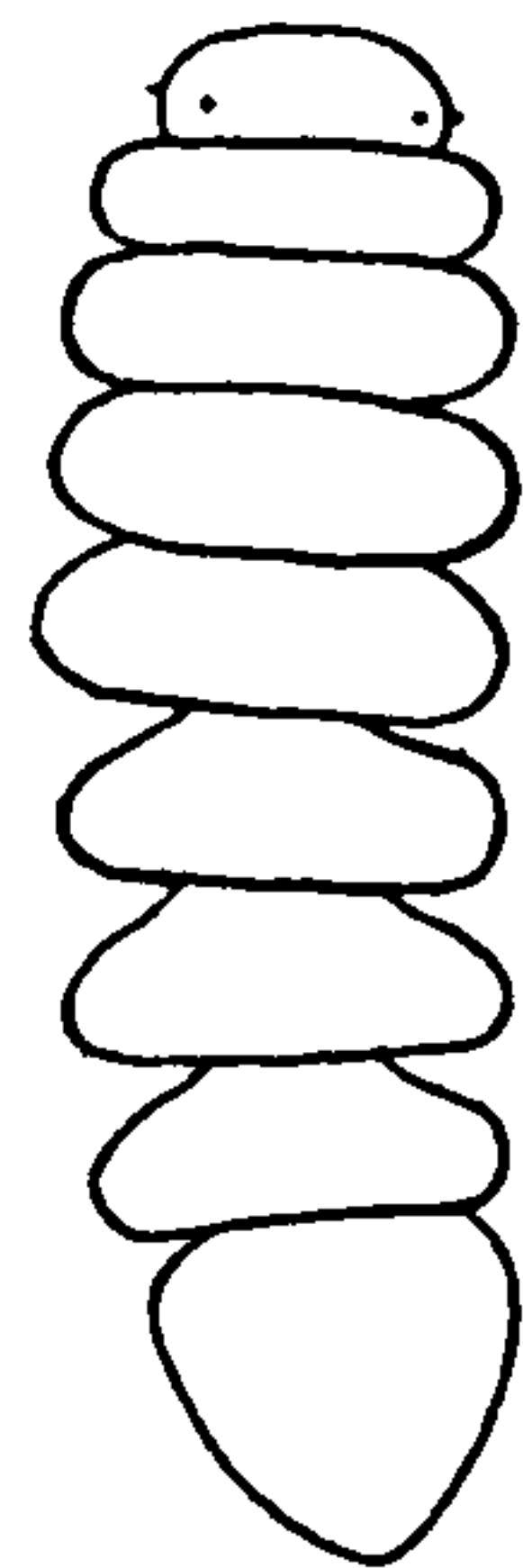


FIG. 587.—ARGEIA PUGETTENSIS. MALE.  $\times 22$ .



Island; Bering Sea, off Akutan Pass. On *Crago nigromaculata* (Lockington), at San Diego Bay, California; off Tillamook Rock, Oregon; Monterey Bay, California; off Cape Johnson. On *Crago communis* (Rathbun), off Grays Harbor, Washington; off Columbia River, Oregon; San Luis Obispo Bay, California; Iliuliuk Harbor, Unalaska; Straits of Fuca; south of San Diego Bay, California; off Rootook Island, Alaska; off Falmouth Harbor, Shumagins, Alaska; Bering Sea, off Akutan Island, northwest of Unimak

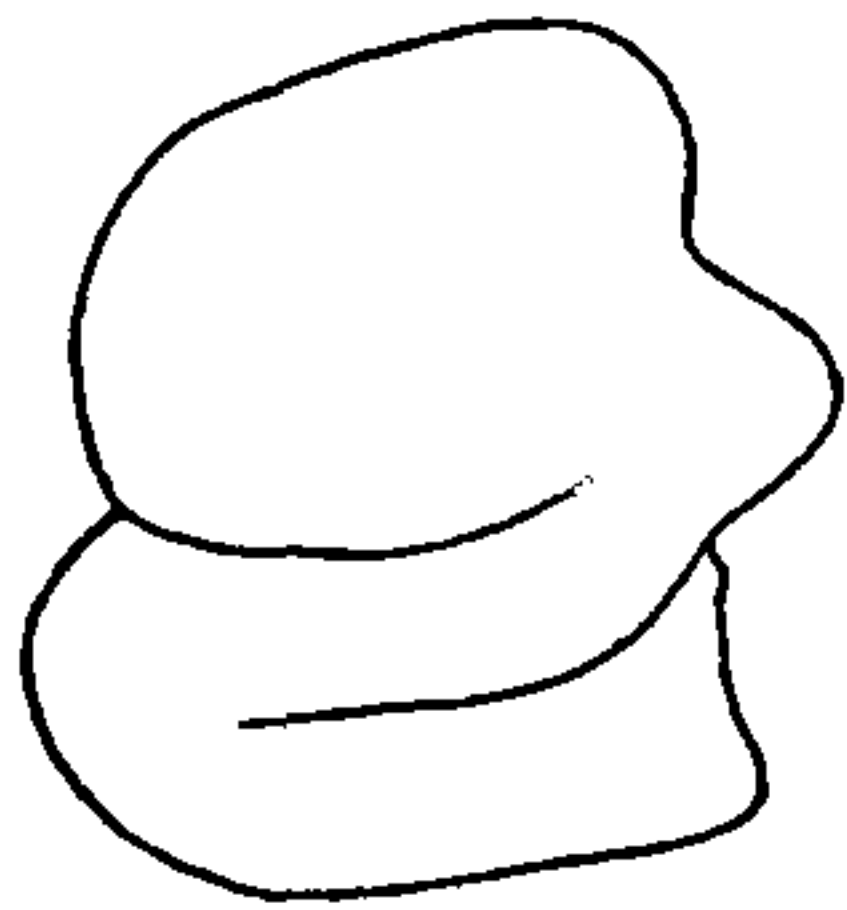


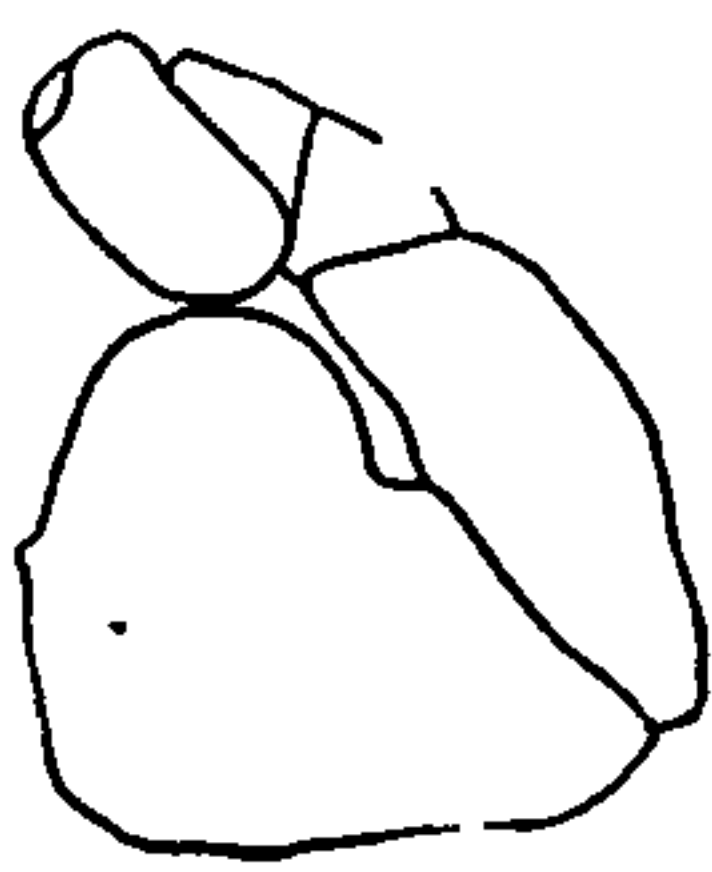
FIG. 588.—ARGEIA PUGETTENSIS. FIRST LAMELLA OF MARSUPIUM.  $\times 14\frac{1}{2}$ .

Island, Alaska; off Point Arena, California; Washington Sound, Straits of Fuca, Washington. On *Nectocrangon dentata* Rathbun, at Kyska Harbor, Unalaska; Mazan Bay, Atka; Port Etches, Alaska; Port Levasheff, Unalaska; Iliuliuk Harbor, Unalaska, off Round Island, Coal Harbor, Unga Island; off Sitkalidak Island, Alaska. On *Crago alba* (Holmes), south of San Diego Bay, California; Gulf of Georgia, off Nanaimo, Vancouver Island, British Columbia; Kilisut Harbor, near Port Townsend, on *Crago alas-*

*kensis* (Lockington); Admiralty Inlet, vicinity of Port Townsend, on *Crago alascensis* (Lockington) and *Crago communis* (Rathbun); vicinity of Naha Bay, Behm Canal, southeast Alaska, on *Crago communis* (Rathbun) and *Nectocrangon dentata* (Rathbun).

*Depth.*—16 to 89 fathoms.

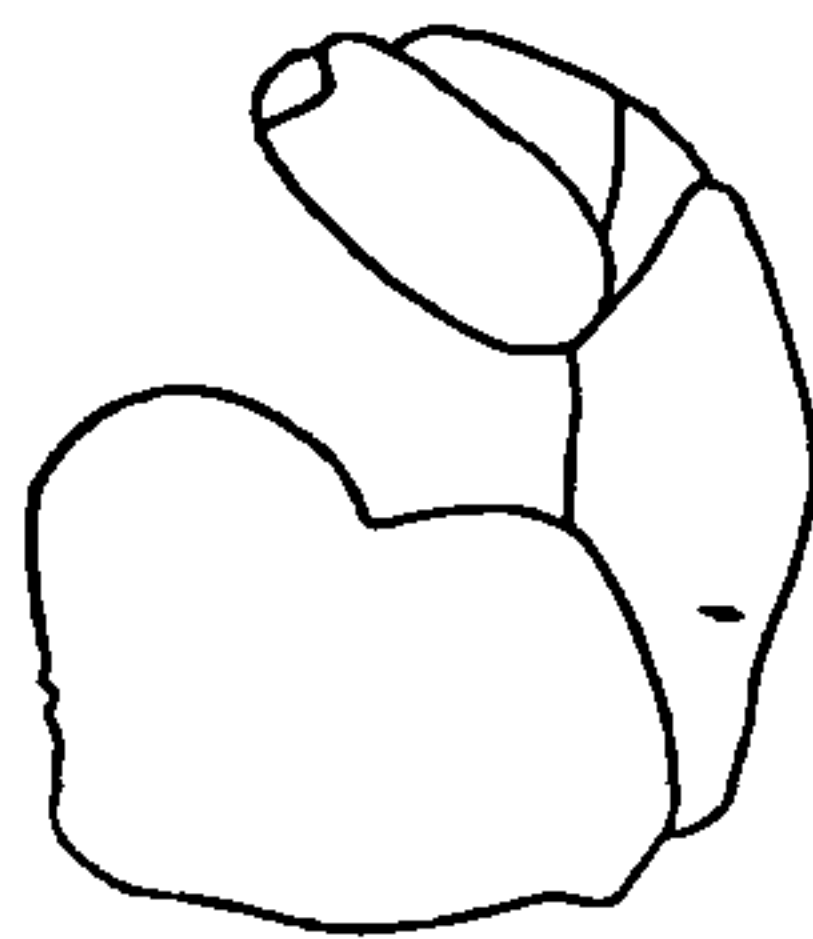
Immature specimens were found off Seal Islands, Alaska, on *Nectocrangon alascensis*; off Rootook Island, Alaska, on *Crago communis*; north of Bird Islands, Shumagins, Alaska; Gulf of the Farallones,



a



b



c



d

FIG. 589.—ARGEIA PUGETTENSIS. SIXTH LEG OF SPECIMENS FOUND ON: a, CRAGO NIGRICAUDA FROM OFF CAPE JOHNSON, WASHINGTON.  $\times 27\frac{1}{2}$ . b, CRAGO COMMUNIS FROM STRAITS OF FUCA.  $\times 27\frac{1}{2}$ . c, NECTOCRANGON CRASSA FROM OFF CAPE NEWENHAM, ALASKA.  $\times 27\frac{1}{2}$ . d, NECTOCRANGON CRASSA FROM ALASKA.  $\times 27\frac{1}{2}$ .

California, on *Crago nigromaculata*; Coal Harbor, Unga Island, on *Nectocrangon dentata*; Captains Harbor, Unalaska, on *Nectocrangon dentata*; Sanborn Harbor, Nagai, Shumagins, on *Nectocrangon lar*; Mazan Bay, Atka, on *Nectocrangon crassa*; southwest of Hagemeister Island, Alaska, on *Nectocrangon alascensis*; northwest and northeast of Unimak Island, Alaska, on *Nectocrangon alascensis*; Bering Sea, between Pribilof Islands and Cape Newenham, on *Nectocrangon lar*; Kouloulak Bay, Alaska, on *Nectocrangon lar*; between Bristol Bay



and Pribilof Islands, Alaska, on *Nectocrangon lar*; Arctic Ocean, on *Nectocrangon lar*; Popoff Straits, on *Nectocrangon crassa*; between Bird and Nagai Islands, on *Nectocrangon alascensis*.

List of Crangonidæ on which *Argeia pugettensis* is found parasitic:

<i>Nectocrangon ovifer</i> Rathbun.	<i>Crago dalli</i> (Rathbun).
<i>Nectocrangon lar</i> (Owen).	<i>Crago communis</i> (Rathbun).
<i>Nectocrangon alascensis</i> Kingsley.	<i>Crago propinqua</i> (Stimpson).
<i>Nectocrangon crassa</i> Rathbun.	<i>Crago nigricauda</i> (Stimpson).
<i>Nectocrangon dentata</i> Rathbun.	<i>Crago alascensis</i> (Lockington).
<i>Crago nigromaculata</i> (Lockington).	<i>Crago alascensis elongata</i> (Rathbun).
<i>Crago franciscorum angustimana</i> (Rath- bun).	<i>Crago alba</i> (Holmes).
	<i>Crago munita</i> (Dana).

*Immature forms.*—A female (probably in the first post-larval stage) has the thoracic processes well developed, sometimes only on one side.

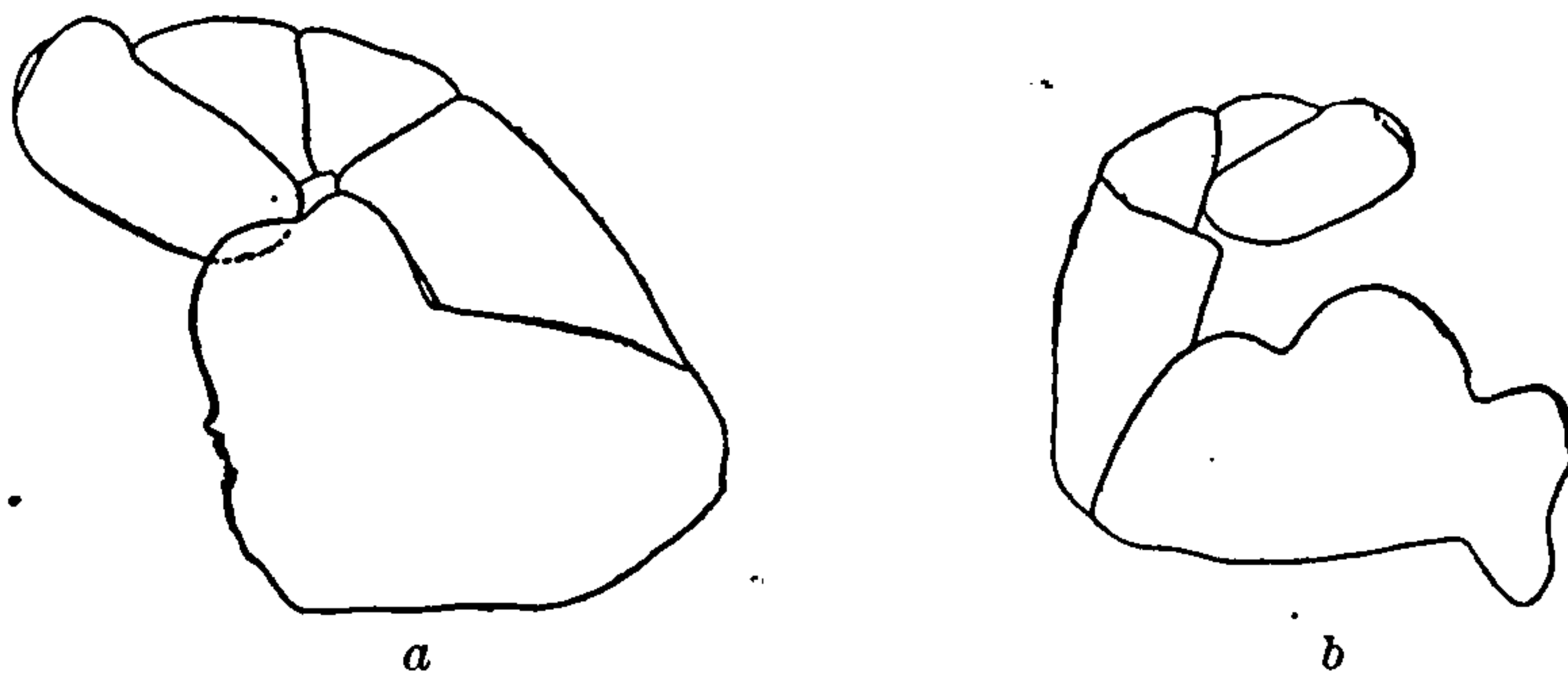


FIG. 590.—ARGEIA PUGETTENSIS. SIXTH LEG OF SPECIMENS FOUND ON: *a*, NECTOCRANGON DENTATA FROM AFOGNAK BAY, AFOGNAK ISLAND.  $\times 39$ . *b*, NECTOCRANGON CRASSA FROM CAPE NEWENHAM, ALASKA.  $\times 20\frac{1}{2}$ .

The inner pleopoda of the first pair are usually present; all the outer pleopoda, the other four inner pleopoda, and the uropoda are not

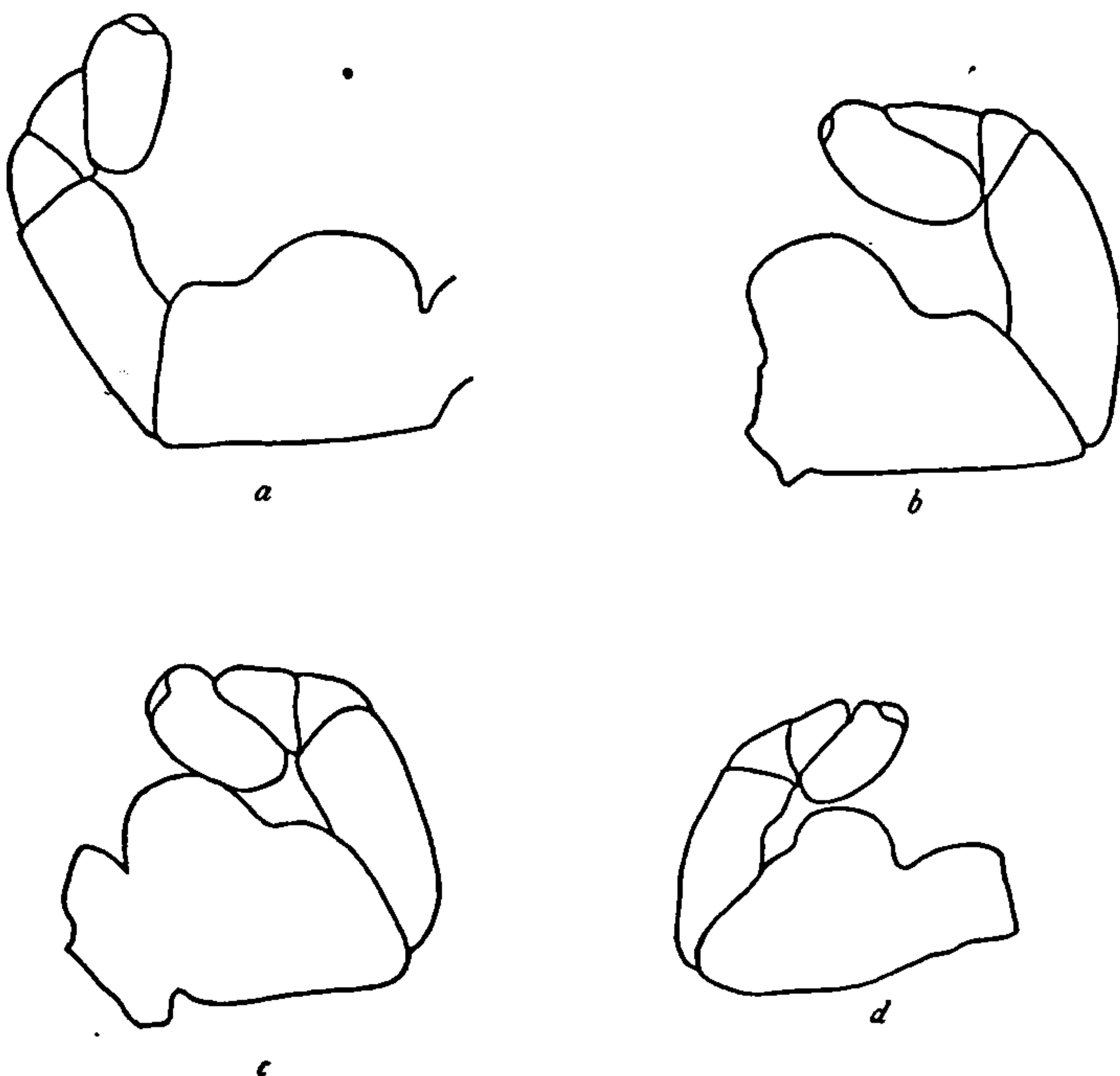


FIG. 591.—ARGEIA PUGETTENSIS. SEVENTH LEG OF SPECIMENS FOUND ON: *a*, NECTOCRANGON ALASCENSIS FROM SOUTHWEST OF SANNAKH ISLANDS, ALASKA.  $\times 41$ . *b*, CRAGO NIGROMACULATA FROM SAN DIEGO BAY, CALIFORNIA.  $\times 41$ . *c*, CRAGO DALLI FROM SOUTH OF AMAK ISLAND, ALASKA.  $\times 41$ . *d*, CRAGO COMMUNIS FROM AKUTAN ISLAND, BERING STRAIT.  $\times 41$ .



developed at this stage. The marsupial plates are small and just developing. The male is similar to the male found on adult female.

Immature female of a more advanced stage has the thoracic processes well developed, although perhaps not quite as long as in the preceding

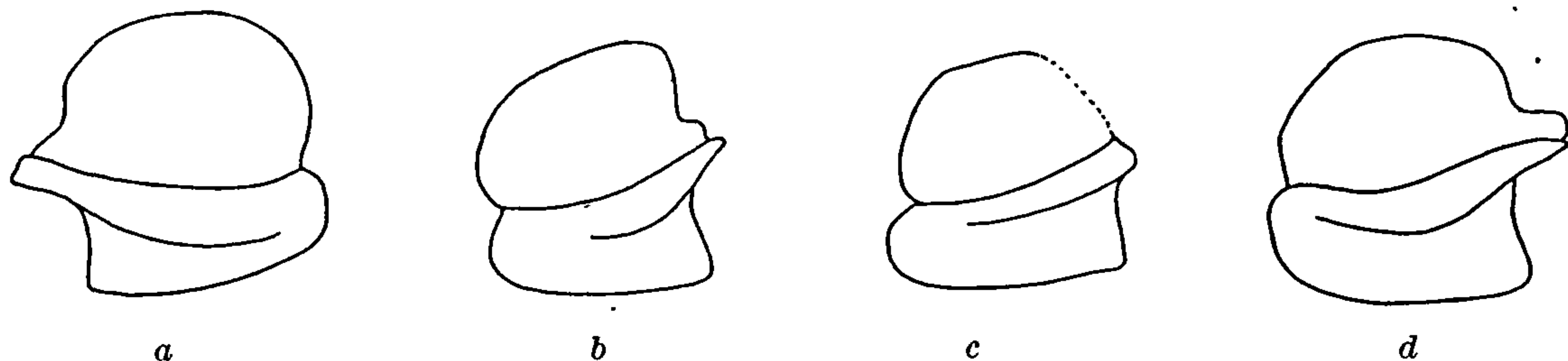


FIG. 592.—*ARGEIA PUGETTENSIS*. FIRST INCUBATORY PLATE FROM SPECIMENS FOUND ON: *a*, *NECTOCRANGON CRESSA* FROM OFF CAPE NEWENHAM, ALASKA.  $\times 9\frac{1}{2}$ . *b*, *NECTOCRANGON CRESSA* FROM ALASKA.  $\times 9\frac{1}{2}$ . *c*, *CRAGO NIGROMACULATA* FROM SAN DIEGO BAY, CALIFORNIA.  $\times 9\frac{1}{2}$ . *d*, *CRAGO NIGRICAUDA* FROM OFF CAPE JOHNSON.  $\times 9\frac{1}{2}$ .

stage. The outer pleopoda and uropoda are small, but all developed. The first two inner pleopoda are present; the other three may or may not be present. When present they are usually smaller than the first two, decreasing in size to the fifth pair, and sometimes difficult to

discern. The marsupial plates are larger than in the preceding stage, but not fully developed. The incubatory pouch never carries eggs in either of these stages. The male is similar to the male of the adult female.

Specimens of both immature stages were found on the same species and genera of host as the adult females.

A male in the cryptoniscan stage was found on one immature female (in first post-larval stage).

*Thoracic processes of adult female.*—In the adult female the thoracic processes may be quite reduced. In some specimens these processes are well developed, though never in all the specimens examined were they found as long as in the very young female or as in the

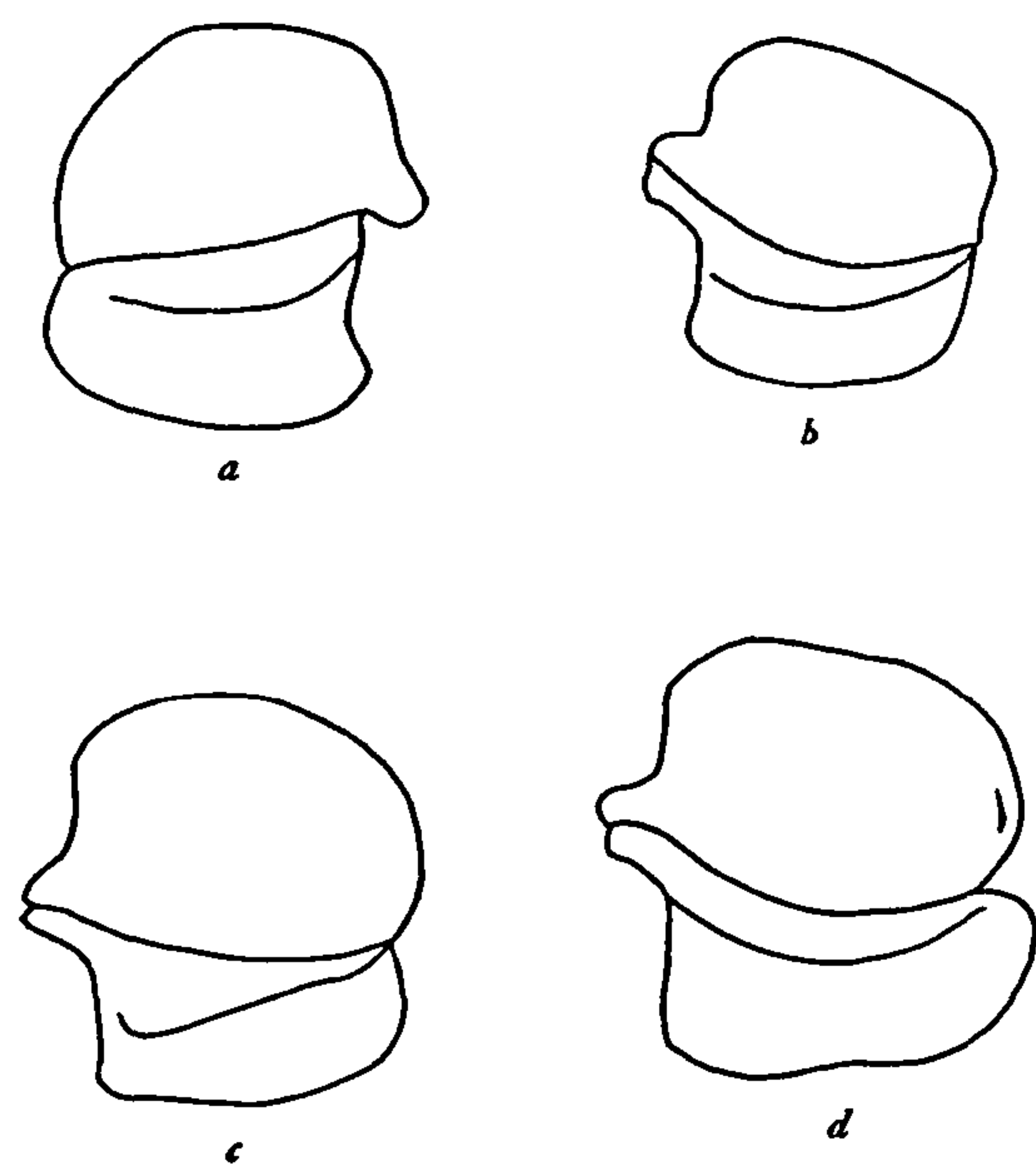


FIG. 593.—*ARGEIA PUGETTENSIS*. FIRST INCUBATORY LAMELLA FROM SPECIMEN FOUND ON: *a*, *CRAGO COMMUNIS* FROM STRAITS OF FUCA.  $\times 14$ . *b*, *CRAGO COMMUNIS* FROM AKUTAN ISLAND, ALASKA.  $\times 14$ . *c*, *NECTOCRANGON ALASCENSIS* FROM SOUTHWEST OF SANNAKH ISLANDS, ALASKA.  $\times 14$ . *d*, *CRAGO DALLI* FROM SOUTH OF AMAK ISLAND.  $\times 14$ .

figure given by Dana of the adult female. In other specimens these processes are very small, and yet in many they were not even present. Not only is this variation found in specimens taken from different species and genera of host, but it is also true of those found on the same species and genus of host. As a result of this observation on a



large number of these forms, the conclusion must be maintained that these thoracic processes, well developed in the young female, of varying size and shape and sometimes so reduced as to be practically absent in the adult female, have no specific value whatever. Giard and Bonnier have described their function as organs of fixation, which seems a reasonable conclusion and one capable of explaining why so much variation occurs in this respect with each individual parasite.

Body of adult female somewhat asymmetrical. Length, 14 mm.; width, 11 mm.

Head wider than long, 2 mm. : 3½ mm., somewhat bilobed, with a narrow frontal border, the anterior margin of which is slightly arched or rounded. The frontal border projects at the side in a small angular lobe. Eyes absent.

The first pair of antennæ are composed of two articles—a large basal article and a small terminal one. The second pair are composed of four articles. Both are small and not conspicuous on the dorsal side.

All seven segments of the thorax are distinct. Ovarian bosses are present on the first four segments, where they occupy the sub-lateral portion of the anterior part of the lateral margin. The epimera are narrow plates lateral to the ovarian bosses on the anterior part of the

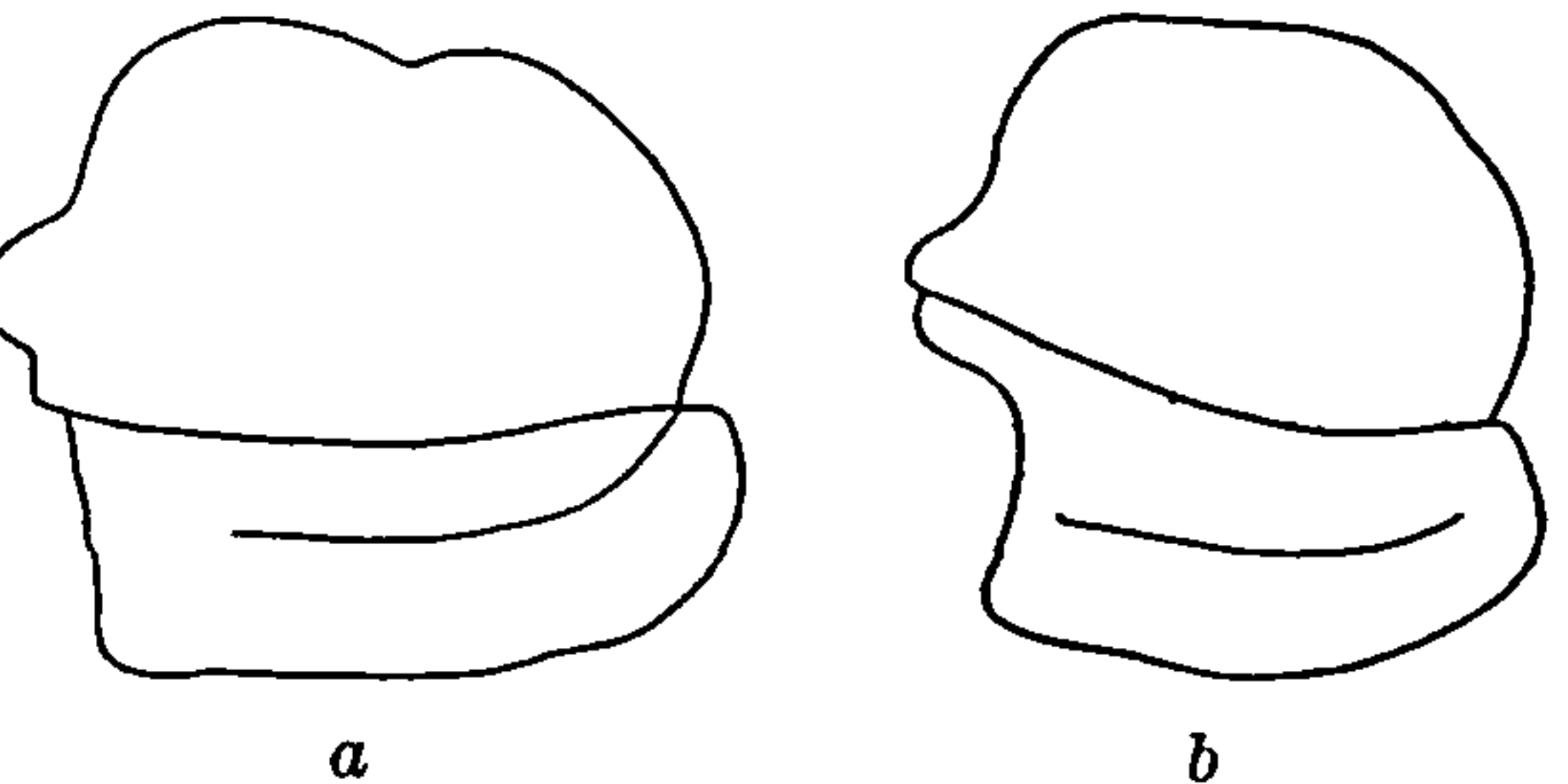


FIG. 594.—ARGEIA PUGETTENSIS. FIRST INCUBATORY LAMELLA FROM SPECIMENS FOUND ON: *a*, NECTOCRANGON DENTATA FROM AFOGNAK BAY, AFOGNAK ISLAND.  $\times 11\frac{1}{4}$ . *b*, NECTOCRANGON CRASSA FROM OFF CAPE NEWENHAM, ALASKA.  $\times 9\frac{1}{4}$ .

segments. The epimera also occupy the anterior part of the lateral margin of the last three segments, but the ovarian bosses are not present on these segments. The posterior lobes on all the segments are large and irregular in outline, and more or less produced in narrow, somewhat elongated processes, these processes being usually more developed on one side (the longer side) than on the other.

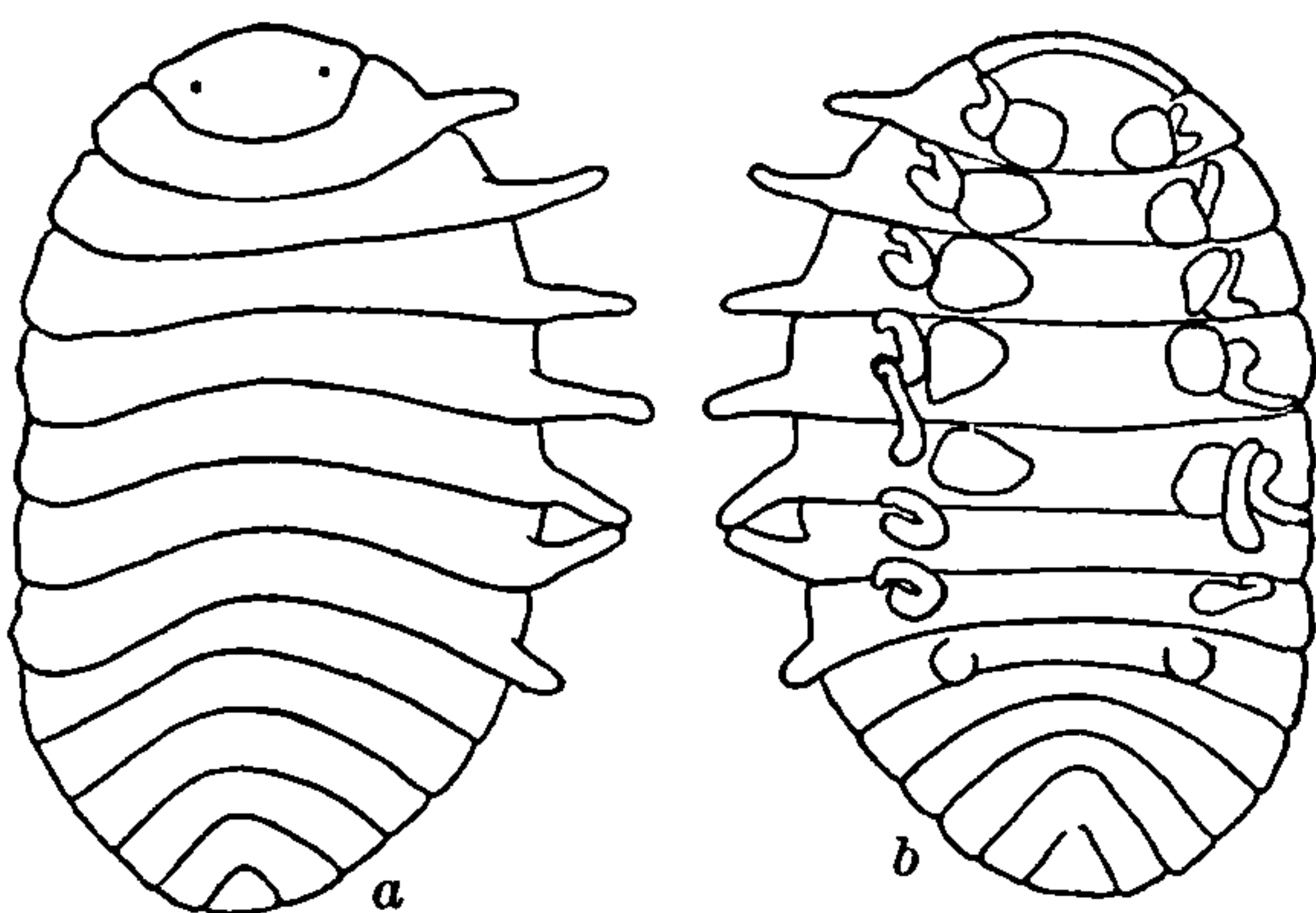


FIG. 595.—ARGEIA PUGETTENSIS. *a*, DORSAL VIEW OF IMMATURE FEMALE. *b*, VENTRAL VIEW OF SAME.  $\times 10$ . (FIRST POST-LARVAL STAGE.)

All six segments of the abdomen are distinct. The lateral parts are not developed in any of the segments. The sixth or terminal segment is small and posteriorly truncate. The uropoda are a pair of simple, single-branched lamellæ, somewhat elongated, with outlines irregular, and attached to the sixth abdominal segment. There are five pairs of double-branched pleopoda. The outer branches are clon-



gated lamellæ, similar in shape to the uropoda, and are placed close to the lateral margins of the segments on the underside, so that in a dor-

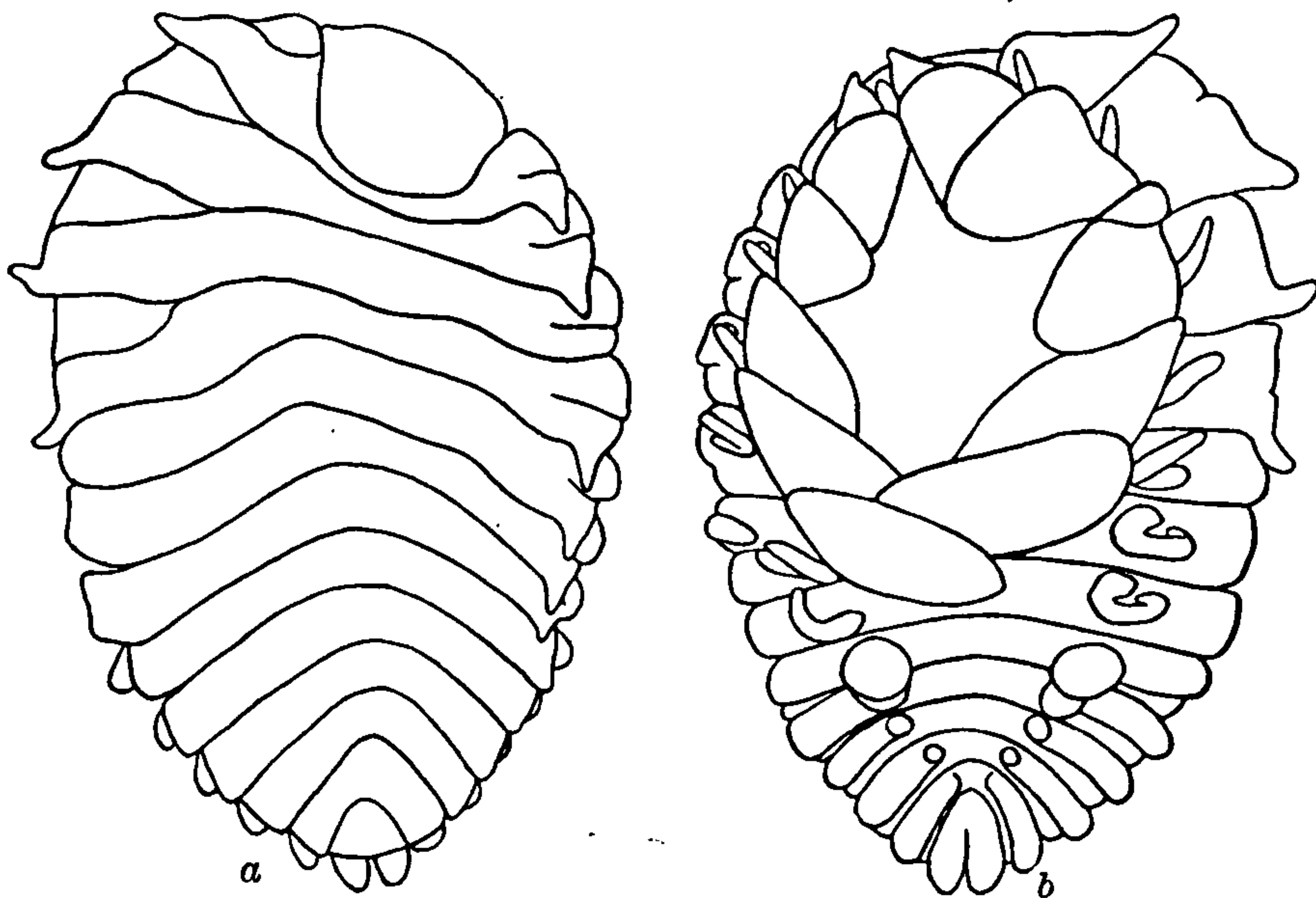


FIG. 596.—*ARGEIA PUGETTENSIS*. *a*, DORSAL VIEW OF IMMATURE FEMALE. *b*, VENTRAL VIEW OF SAME.  $\times 14\frac{1}{4}$ . (SECOND POST-LARVAL STAGE.)

sal view they appear attached to the lateral margins of the segments. They form a border around the abdomen. The inner branches are rounded, sac-like bodies, usually decreasing in size from the first to the last.

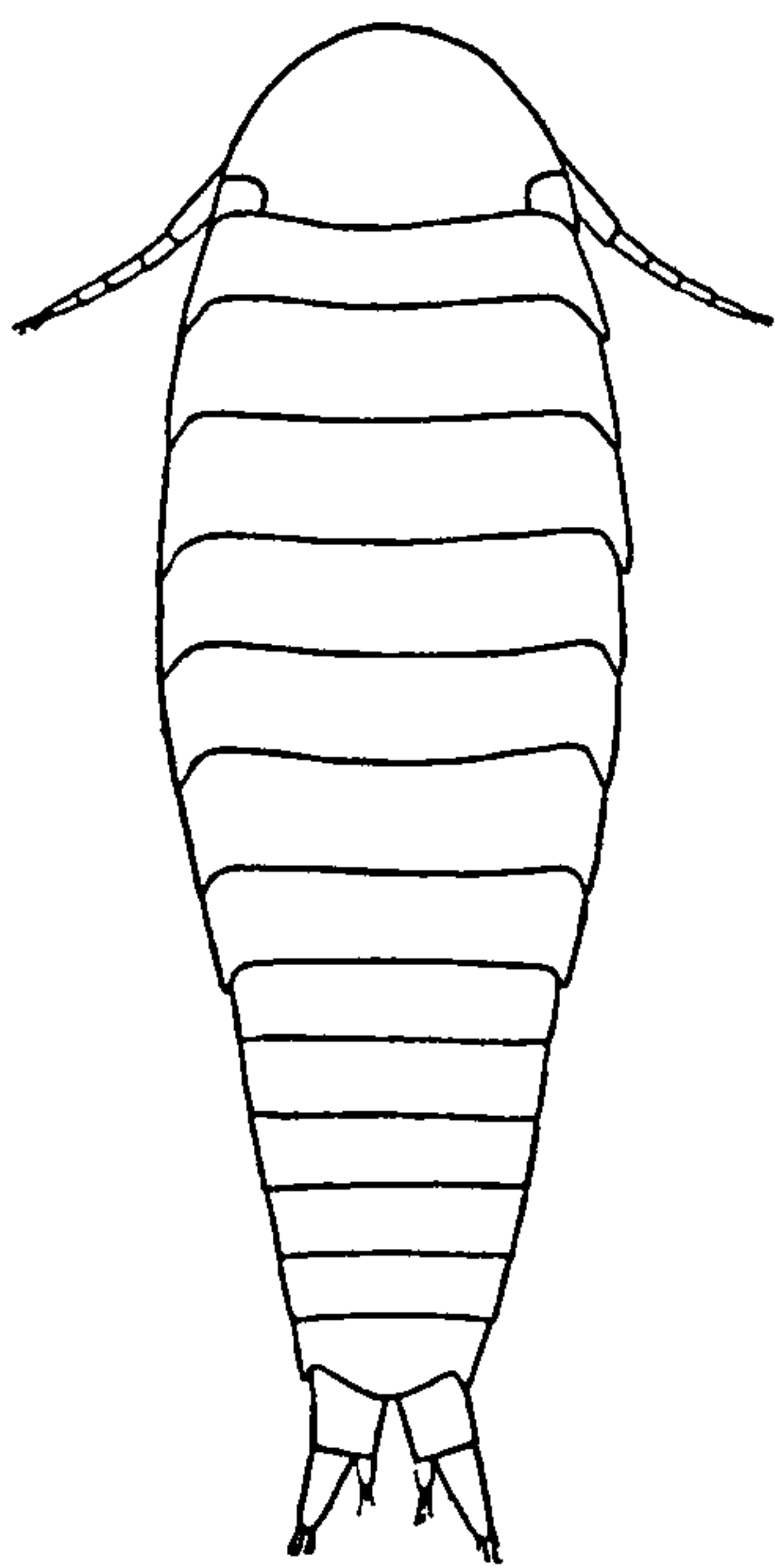


FIG. 597.—*ARGEIA PUGETTENSIS*. (CRYPTONISCAN STAGE.)

There are five pairs of incubatory lamellæ which do not completely inclose the marsupial pouch. The distal part of the first pair has the posterior margin not produced in a lobe.

The legs are all prehensile. The basis of all seven pairs is provided with a high rounded carina.

The male is narrow, elongate, symmetrical in outline,  $5\frac{1}{2}$  mm. long and  $1\frac{1}{2}$  mm. wide. Eyes are present. The anterior margin of the head is widely rounded. The first pair of antennæ are composed of three articles. The second pair are composed of four articles. All the thoracic segments are distinct. The lateral margins are straight, but not contiguous. All seven pairs of legs are prehensile. The segments of the abdomen are coalesced in a single segment, narrower than the thorax, which tapers to a point. It is 1 mm. wide and  $1\frac{1}{2}$  mm. long. There are no uropoda and no pleopoda.

The individual described was found in the branchial cavity of *Nectocrangon* lar.



## ARGEIA PAUPERATA Stimpson.

*Argeia pauperata* STIMPSON, Bost. Jour. Nat. Hist., VI, 1857, p. 511.

*Argeia depauperata*<sup>a</sup> RICHARDSON, Proc. U. S. Nat. Mus., XXI, 1899, p. 868; Ann. Mag. Nat. Hist. (7), IV, 1899, p. 337; American Naturalist, XXXIV, 1900, p. 308.

*Argeia pauperata* BONNIER, Trav. de la Station Zool. de Wimereux, VIII, 1900, p. 328.

*Argeia depauperata* RICHARDSON, Proc. U. S. Nat. Mus., XXVII, 1904, p. 64.

*Locality*.—San Francisco Bay, on *Crago franciscorum*.

“This species is somewhat larger than the preceding (*Argeia pugetensis* Dana); the head is comparatively smaller, more tumid, and bilobate; the egg-pouch covers the eggs more completely; and the thoracic branchial appendages are apparently absent in some of the anterior segments. The inner branches of the first three pairs of abdominal appendages are broader; those of the last three pairs are wanting. Length, 0.35; breadth, 0.23 inch. This description is taken from a female. Found in specimens of *Crago franciscorum*, from San Francisco Bay.”—STIMPSON.<sup>b</sup>

## 93. Genus PARARGEIA Hansen.

Branchial parasites.

Female with thoracic processes wanting on all the segments.

Abdomen without pleural lamellæ, the lateral parts not developed.

There are five pairs of biramous pleopoda; the outer branches are elongate and attached close to the lateral margins of the segments; the inner branches are small, oval.

Uropoda simple, single-branched.

Male with all the segments of the thorax distinct. The segments of the abdomen are fused in a large rounded, oval, terminal piece, which has a prominent median dorsal tubercle near the base.

## PARARGEIA ORNATA Hansen.

*Parargeia ornata* HANSEN, Bull. Mus. Comp. Zool. Harvard College, XXXI, 1897, pp. 120–122, pl. VI, figs. 1–2.—RICHARDSON, Proc. U. S. Nat. Mus., XXI, 1899, p. 869; Ann. Mag. Nat. Hist. (7), IV, 1899, p. 338.—BONNIER, Travaux de la Station Zool. de Wimereux, VIII, 1900, pp. 329–332.—RICHARDSON, Proc. U. S. Nat. Mus., XXVII, 1904, p. 64.

*Locality*.—Off Acapulco, Mexico, on *Sclerocrangon procar* Faxon.

Body of female somewhat asymmetrical; length 8 mm.; width 7 mm.

Head wider than long, 1½ mm.: 2 mm. Front of head with a marginal border somewhat upcurved and anteriorly arcuate. Eyes absent. The first pair of antennæ are composed of three articles, the last of which

<sup>a</sup>By error.

<sup>b</sup>Bost. Jour. Nat. Hist., VI, 1857, p. 511.