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THE CRUSTACEANS

OF

SOUTH AUSTRALIA.

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Part II.

WITH ILLUSTRATIONS.

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Chapter VIII.—Order ISOPODA. The Sea-lice, Wood-lice or Pill-bugs, Sea-centipedes, and their Allies.

The body of a typical Isopod is more or less depressed and is somewhat oval in shape when viewed from above. The Slater (p. 336), so common under stones and rubbish in our gardens, is a familiar example of the order, although the members of some of the groups do not at all resemble this form—indeed, species of one family (Phreatoicidae) have much the appearance of Amphipods. Isopods are plentiful in our southern seas, but many of the species are of a somewhat retiring disposition and need to be searched for. The following distinguishing characters may be compared with those of the preceding order. As in the Amphipoda, there is never a distinct carapace, and the first thoracic somite is always completely fused with the head. Thus, only seven free somites of the thorax are apparent; in the descriptions the free somites are referred to as the first to seventh segments. Of these the first is sometimes immovably fixed to the head (and in one ex-Australian genus the second free segment also is coalesced). The eyes, when present, are never set on movable stalks but are sessile or elevated on immobile processes of the head. The first antennae have only one flagellum, or feeler, excepting in *Bathynomus*. The thoracic appendages of the first pair are modified as maxillipeds; the seven remaining pairs (legs or peraeopods) are often all similar and ambulatory or subprehensile

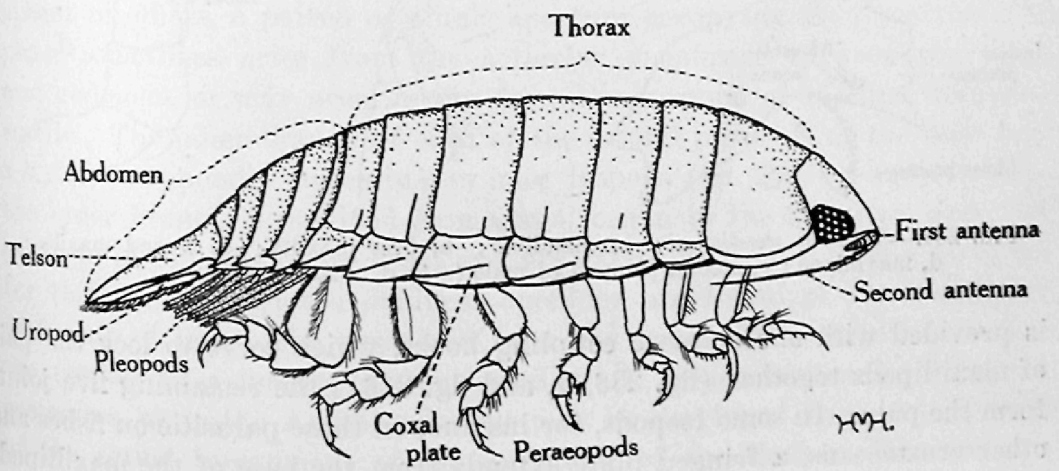

Fig. 232.—The Smooth Sea-louse, *Cirolana woodjonesi* (x 7).

in character, or are variously modified. The coxae of the legs are commonly expanded into coxal plates, which are generally fused with the thoracic somites, thus forming a lateral extension of the segments. In many Isopods the junction of these plates with the body is indicated by a suture on the second to seventh segments, but there is very rarely such suture on the first free somite. The telson is, as a rule, fused with the sixth abdominal somite, so that only five abdominal segments and a telsonic segment are apparent; in some families less than six segments are distinct owing to

further fusion. In typical forms the pleopods have two broad, lamellar branches; the second (and sometimes also the first) pair are commonly modified for sexual purposes in the male. The general external features, as indicated above, are illustrated in fig. 232 (the dorsal view of this common sea-louse is shown in fig. 240).

The mouth parts, as in the Amphipoda, consist of a pair of mandibles, two pairs of maxillae, and one pair of maxillipeds; these parts are much modified in some species in accordance with their habits. The typical mandible has an incisor process with a serrated cutting-edge, a palp, a molar process, and a movable lacinia (fig. 233, a); as in the previous order the last-named may be present on the left mandible only. The coxa, or basal joint, of the maxillipeds is short, and on the outer side bears a plate-like epipod; the basis is produced distally into an inner plate or lobe which

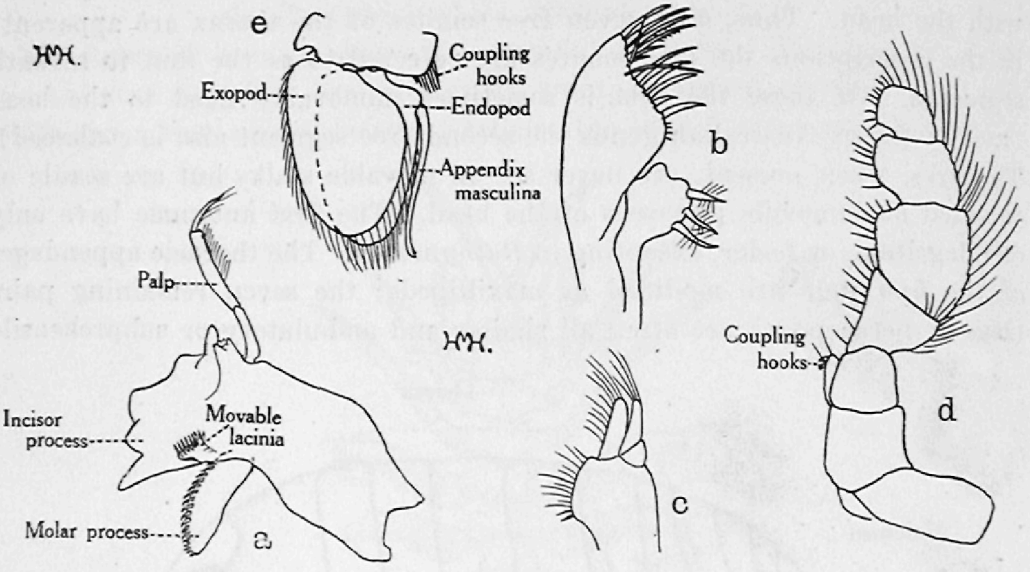

FIG. 233.—*Cirolana woodjonesi*: a, mandible; b, first maxilla; c, second maxilla; d, maxilliped; e, second pleopod of male (a to d, x 20; e, x 10).

is provided with one or more coupling hooks, which serve to lock the pair of maxillipeds together (fig. 233, d, and fig. 316); the remaining five joints form the palp. In some Isopods, for instance in those parasitic on fishes and other crustaceans, a fringed plate extends from the base of the maxillipeds of the egg-bearing female into the brood-pouch, and the epipod and inner plate are expanded (fig. 253); this enlarged and flattened maxilliped causes a current of water to flow through the pouch containing eggs or young.

Respiration.—Respiration is effected by means of some or all of the pleopoda, of which there is usually a pair on each of the first five abdominal somites. Each pleopod consists of a short base (protopod) from which spring two lamellar, overlapping branches (endo- and exopod); these plates are thin and vascular and act as gills (fig. 233, e). The five pairs are in many cases all similar (excepting for those modified in the male)

and are often used for swimming as well as for respiratory purposes. When the pleopods are used as natatory organs they are fringed with fine hairs and the inner side of the base of each pair is furnished with coupling-hooks (fig. 254). In some families the anterior pairs are used only for swimming while the posterior pairs are exclusively respiratory. The pleopods of the large Cymothoids of the genus *Bathynomus* (not represented in South Australia) bear tufted gills. Certain other forms, when adult, have the abdominal appendages very small, altogether absent, or even developed as branched gills. A branchial chamber in which the respiratory pleopods are protected is found in some Isopods. In the Isopoda-Valvifera a gill-chamber is formed by the arched telson above and closed in below by the much modified uropods (fig. 10, C). In most genera of the family Anthuridae (Isopoda-Flabellifera) a somewhat similar chamber is closed in by the operculiform first pleopods below, by the thickened bases of the uropods laterally, and by the telson above. The overlapping, greatly enlarged and curved outer branches of the first pleopods of the interesting Cymothoid *Ourozeuktes* constitute the bottom of a gill-chamber which is roofed above by the abdomen, the segments of which are all fused together. Other modificatioons are noted in place.

Reproduction and Development.—The vasa deferentia of the male terminate in two little processes (penes) usually situate one on each side of the middle of the posterior margin of the last thoracic somite; these processes are fused together to form a single penis in some groups and are absent in others, a paired or single aperture occupying their position. The penes sometimes arise from the articular membrane between the thorax and abdomen, or may even spring from the sternum of the first abdominal somite. The inner branch of each of the second pleopods of the male bears a stylet, or appendix masculina, in most Isopods (fig. 233, e), and sometimes the inner branch is modified as a sexual organ in the first pair also. The oviducts of the female are short and are rarely dilated to form a receptacle for the male sperm; the oviducal openings are found at the base of the fifth pair of legs. The eggs, and later the young Isopods, are carried by the mother in a marsupium or brood-pouch, which is usually formed of oostegites, as in the Amphipods, but may be developed from invaginations of the actual integument of the underside of the thorax. The oostegites arise from the sides of the ventral segments, at the bases of the legs. As a rule, four pairs of overlapping plates are present, one pair on each of the first to fourth, or second to fifth somites; in some cases a greater or lesser number of plates occur.

Excepting in parasitic forms, the young on leaving the brood pouch of the mother, have much the general appearance of the adult, but differ in never having the last pair of legs developed. The aforementioned parasites are free-swimming symmetrical creatures in their young stages, but after permanently attaching themselves to some host or other, gradually assume the often much distorted adult shape.

South Australian Isopoda have received more attention than have our Amphipods; all of the six suborders into which the order is split up are represented.

a. Uropoda hinged to sides of telsonic segment.
  b. Uropoda forming a tail fan with telsonic segment FLABELLIFERA.
  bb. Uropoda not forming a tail fan with telsonic segment but modified as a pair of covers, folding under abdomen and enclosing the pleopoda .. .. VALVIFERA.
aa. Uropoda styliform, not forming a tail fan with telson, but hinged to or near terminal end of telsonic segment, or absent.
  c. Aquatic species. Pleopoda branchial.
    d. Free forms.
      e. Abdominal somites all fused together in species occurring in South Australia. Peduncle of second antennae composed of six segments. Body more or less depressed .. .. ASELLOTA.
      ee. Abdominal somites free. Peduncle of second antennae composed of five segments. Body more or less compressed (amphipod-like) .. .. PHREATOICIDEA.
    dd. Forms parasitic on other Crustacea .. .. EPICARIDEA.
  cc. Almost always terrestrial species. Pleopoda almost always fitted for air breathing .. .. ONISCOIDEA.

Only one of the South Australian Oniscoidea is aquatic; this species (*Haloniscus searlei*) is dealt with on p. 334.

Suborder FLABELLIFERA.

Members of this suborder are distinguished from other Isopoda in that the uropods are attached to the side of the pleon, and form a more or less distinct caudal fan with the last, or telsonic, segment, which, it will be remembered, usually consists of the telson fused with the sixth abdominal somite in the Isopoda. Ten families are represented in our waters. Of these the families Eurydicidae, Corallanidae, Phoratopodidae, Aegidae, and Cymothoidae form a connected series, known collectively as the Cymothoid group. The species of these families range from forms which are parasitic upon fishes to free-swimming predators, which attack and destroy living marine creatures, or which act as scavengers.

a. The adult has six pairs of legs, only five pairs of which are apparent .. .. GNATHIIDAE.
aa. The adult usually has seven pairs of legs, all of which are apparent.
  b. Uropods lateral and superior, the outer branch arching over base of telson .. .. ANTHURIDAE.

bb. Uropods lateral, not arching over base of telson.
c. Abdomen almost always composed of six segments (in one genus all segments are fused in the adult).
d. Uropods with both branches well developed.
e. Palp of maxillipeds free, the last two joints furnished with hairs, but not hooks.
f. Distal part of mandibles usually stout and conspicuous. Inner lobe of first maxillae expanded at apex and furnished with three or four spines; outer lobe wide, and capped with many strong spines. Second maxilla with three free, setose lobes.
g. Last four pairs of legs ambulatory, with normal finger and claw; the three penultimate joints of the fourth and fifth pairs not greatly expanded.. .. .. EURYDICIDAE.
gg. Last four pairs of legs natatory, with dactylus rudimentary or absent; in the fourth and fifth pairs the three penultimate joints are greatly expanded and flattened, each of these joints being about twice as wide as long.. .. .. PHORATOPODIDAE.
ff. Distal part of mandibles narrow, partly or quite concealed by upper and lower lips. Inner lobe of first maxillae without spines; outer lobe narrow, tapering, armed with a few spines. Second maxilla not having three distinct lobes, usually with apex simple .. .. CORALLANIDAE.
ee. Palp of maxillipeds embracing cone formed by distal parts of mouth organs; the inner upper margin and apex never with hairs, at least, the apex furnished with curved hooks in males and non-ovigerous females.
h. Both pairs of antennae with well-defined peduncle and flagellum.. .. .. AEGIDAE.
hh. Antennae reduced, without clear distinction between peduncle and flagellum CYMOTHOIDAE.
dd. Uropods with one of the branches rudimentary . LIMNORIIDAE.
cc. Abdomen composed of two or four segments.
i. Abdomen composed of two segments.
(1) Uropods with one branch fixed and immovable.. .. .. SPHAEROMIDAE.
ii. Abdomen composed of four segments. Uropods with both branches movable. SEROLIDAE.

(1) In all known Australian species.

Family GNATHIIDAE.

This family includes some truly remarkable creatures. The sexes of the species are so unlike when adult that the male and female at one time were not associated, and were actually placed in separate families. The pleopods are not modified for sexual purposes in the male. The first free thoracic segment is fused with the head, but the suture may be distinct. A striking feature is that the first and last segments of the thorax are very small, and that the last pair of legs remains undeveloped throughout life. It has already been mentioned that young Isopods in general lack the posterior legs when very young, but in most cases these limbs are developed soon after the juveniles abandon their parent.

GNATHIA (Leach).

In their earlier, or larval, stages the tiny "Sea-mites" lead a parasitic life, and are then commonly found in numbers on such fishes as rays and skates. The mouth parts project in front of the head, and are apparently modified for puncturing the skin of fishes, and for extracting the "juices" underlying

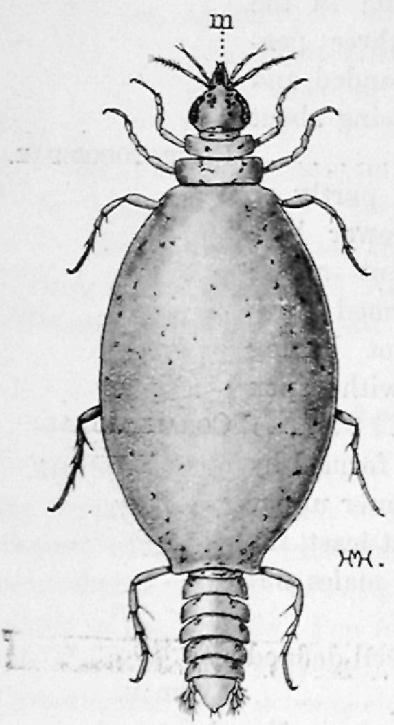

FIG. 234.—Praniza larva of *Gnathia mulieraria*; m, projecting mouth parts (x 21).

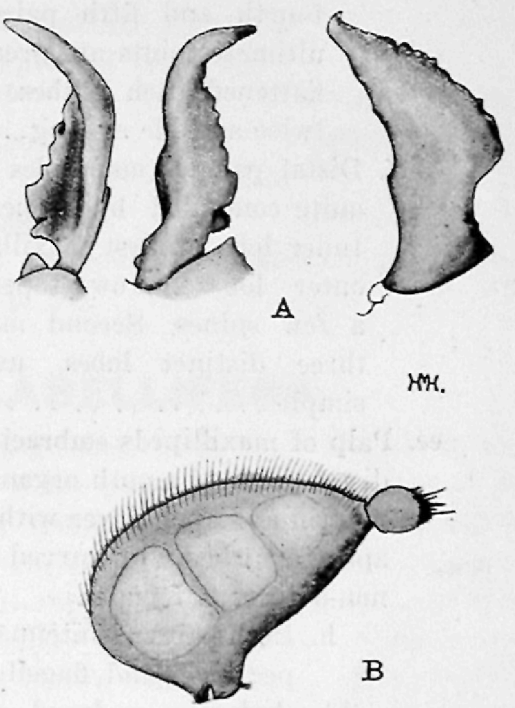

FIG. 235.—A, Dorso-interior, ventral and lateral views of right pseudo-mandible of male of *Gnathia mulieraria*: B, first leg of same animal (x 30).

the epidermis (fig. 234). As the creatures leave their host and mature, the male assumes an astonishing form (fig. 236 and 237). The head becomes massive and quadrate, and a pair of powerful pseudo-mandibles is developed (fig. 235, A). These organs are attached to the front of the head, and at least one of their functions appears to be that of holding the female

during mating. The first "legs" are much modified, two-jointed, flattened, and opercular (fig. 235, B), so that only five pairs of walking legs are evident. The female does not differ from the larva in general appearance to such an extent as the male; the head is small, subtriangular in shape, and the mouth-parts are much reduced. The semi-transparent thorax of the adult female becomes greatly swollen with contained eggs, and later with young. The fourth and fifth thoracic segments—and sometimes the sixth segment also—are fused, and the divisions are sometimes indiscernible. It is necessary to have males in hand for the determination of the species, as the larvae and females are of little use in this connection. Adult specimens may be dredged in weed, and in some cases may be found in sponges. Two species have been recorded, and females of at least one other, and larger, form have been taken in St. Vincent Gulf.

a. Head with large and small tubercles on anterior third; remainder with large and distinct areoles. Fifth and sixth thoracic segments not medianly divided dorsally . . . . . *mulieraria.*

aa. Head almost wholly covered with small granules, without areoles. Fifth and sixth thoracic segments medianly divided dorsally . . . . . *pustulosa.*

Big-jawed Mite. *Gnathia mulieraria* (Hale). (a lover).

In the male the head is large and almost square, with a broad furrow on the front part of the upper surface. There is a large median tubercle in this excavation, on each side of which are rounded tubercles; to the rear

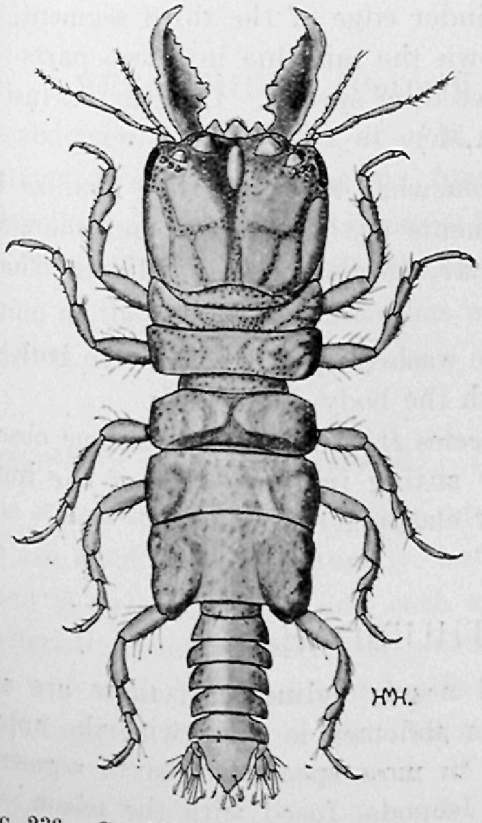

FIG. 236.—*Gnathia mulieraria*, male (x 20).

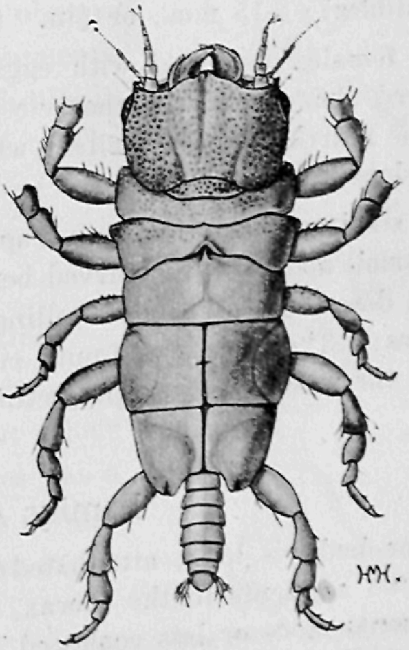

FIG. 237.—*Gnathia pustulosa*, male (x 20).

of the last are three tiny projections. The "jaws" are large and prominent, almost as long as the head, scoop-shaped, with the upper margin thickened and the inner lower edge cut into irregular teeth. None of the thoracic segments is divided medianly; the first is as wide as the second but is very short. The side portions of the abdominal segments are rather prominent. During life the antennae, legs, mandibles and head tubercles were white. The areoles on the upper surface of head and thorax were yellow, and the interspaces were closely dotted with brown colour cells. The first five abdominal segments were yellow, the remainder semi-transparent. Length (exclusive of mandibles): 4·1 mm., or $\frac{1}{6}$in. (S.A.M.)

The Praniza larva of this species is shown in fig. 234. When alive this had the head pale brown with a few black spots. The thorax and the greater part of the abdomen were milk-white with some scattered black colour-cells. The little creature was found amongst *Zostera* dredged in St. Vincent Gulf. The Gnathiae are not to be confused with the true aquatic mites (Hydrachnidae), some species of which are marine.

Sponge-mite. *Gnathia pustulosa* (Hale). (with pimples).

In the male the head is much wider than long, with a median furrow on the upper surface, which is almost covered with small granules. The "jaws," which are not very large and prominent, are scoop-shaped, and have a notch in the upper margin. The first segment of the thorax is small and inconspicuous, less than half as wide as the second, and has a granulate surface. The front part of the fourth segment is furnished with a median tooth which fits into the thickened hinder edge of the third segment. The fifth and sixth segments are split down the mid-line into two parts. The legs are much stouter than in the preceding species. Length (exclusive of mandibles): 3·15 mm., or $\frac{1}{8}$in. (S.A.M.)

A female, distended with eggs, somewhat resembles the Praniza larva figured above. All the thoracic segments are discernible, but the sutures of the fourth to sixth somites (which are swollen) are indistinct. The legs are slender.

A single pair was found in a sponge washed up at Glenelg. In both sexes the small abdomen was curved beneath the body during life.

In describing a sponge-dwelling species from South Africa, one observer writes: "The male was found either sitting in the mouth of the burrow with the mandibles just projecting or clasping the female."

Family ANTHURIDAE.

The body is long, attenuated and nearly cylindrical; there are seven distinct segments in the thorax. The abdomen is short with the anterior segments more or less coalesced, but in most species the sixth segment is not, as in the great majority of the Isopoda, fused with the telson. The