

Other Central-Australian mammals most probably occur in the Spinifex country of the far interior of Australia. *Antechinomys spenceri* has been obtained from Central South Australia. A small jumping pouched mouse, said to exist in the rocky hills round Laverton, might be referable to this species.

TACHYGLOSSUS ACULEATUS INEPTUS Thos. (Text-fig. 277, p. 847.)

Widely distributed over Western Australia except in the extreme south-west; recorded from Kojonup, but seldom seeming to extend south of the rocky country around York and Beverley. Although nowhere plentiful it appears to be more numerous in the North-West than elsewhere.

Generally frequenting dry and rocky situations. Sluggish in its movements, curling up like a hedgehog if irritated. Apparently a great wanderer, often turning up in districts where it has seldom if ever been observed before, even by natives.

Although the claws are very powerful and well adapted for digging, they seem to be used chiefly for tearing up anthills, and the animal does not seem to be truly fossorial; but when disturbed in sandy country it is said to be able to bury itself underground like a mole, quickly disappearing from sight, while if the country happens to be hard or rocky, it will cling to the surface so tightly that it is quite difficult to dislodge it. If placed in water it is a quick and powerful swimmer.

Doubtfully described from Barrow Island.

5 specimens collected. Southern Cross (Parker's Range); Gascoyne River.

Native Porcupine of Colonists.

'Ningan' (S.W.), 'Bokaboi' (N.W.), of natives.

2. Notes on some Amphipoda from the North Side of the Bay of Biscay. Families PLEUSTIDÆ and EUSIRIDÆ. By E. W. SEXTON*.

[Received September 20, 1909.]

(Plates LXXX. & LXXXI.†, and Text-figures 278 & 279.)

I am indebted to Dr. Allen for the opportunity of examining the collection of Amphipoda taken by the S.S. 'Huxley' from the north side of the Bay of Biscay in August, 1906; and for specimens most kindly sent me for comparison I have to thank Dr. Hansen, Professor Sars, Dr. Scharff and the Trustees of the Dublin Museum, Mr. Tattersall, and Dr. Vanhöffen.

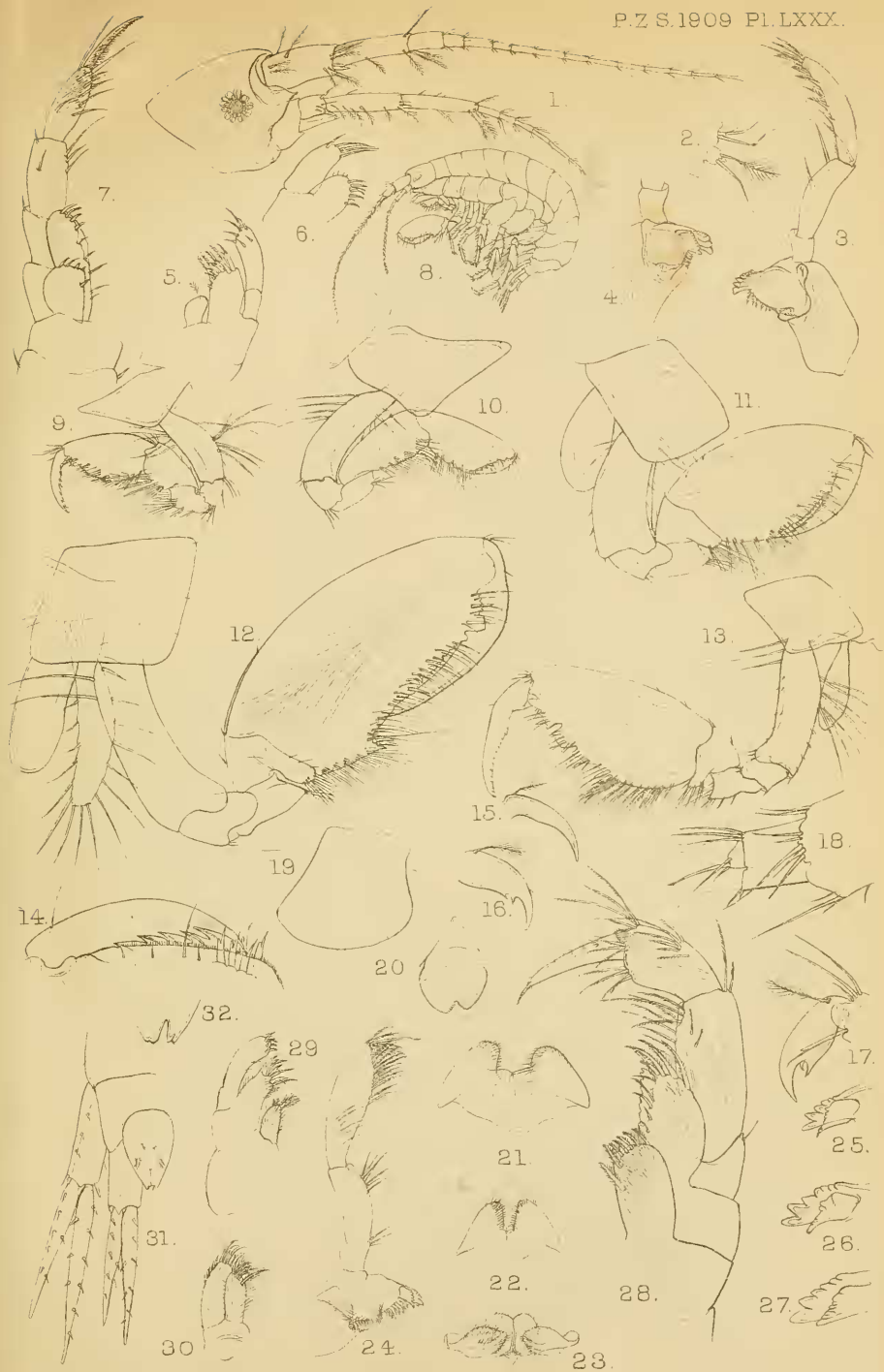
Variations due to Sex and Age.

The collection, though small, proved of great interest.

In some species several stages of development were found,

* Communicated by Dr. W. T. CALMAN, F.Z.S.

† For explanation of the Plates see p. 878.

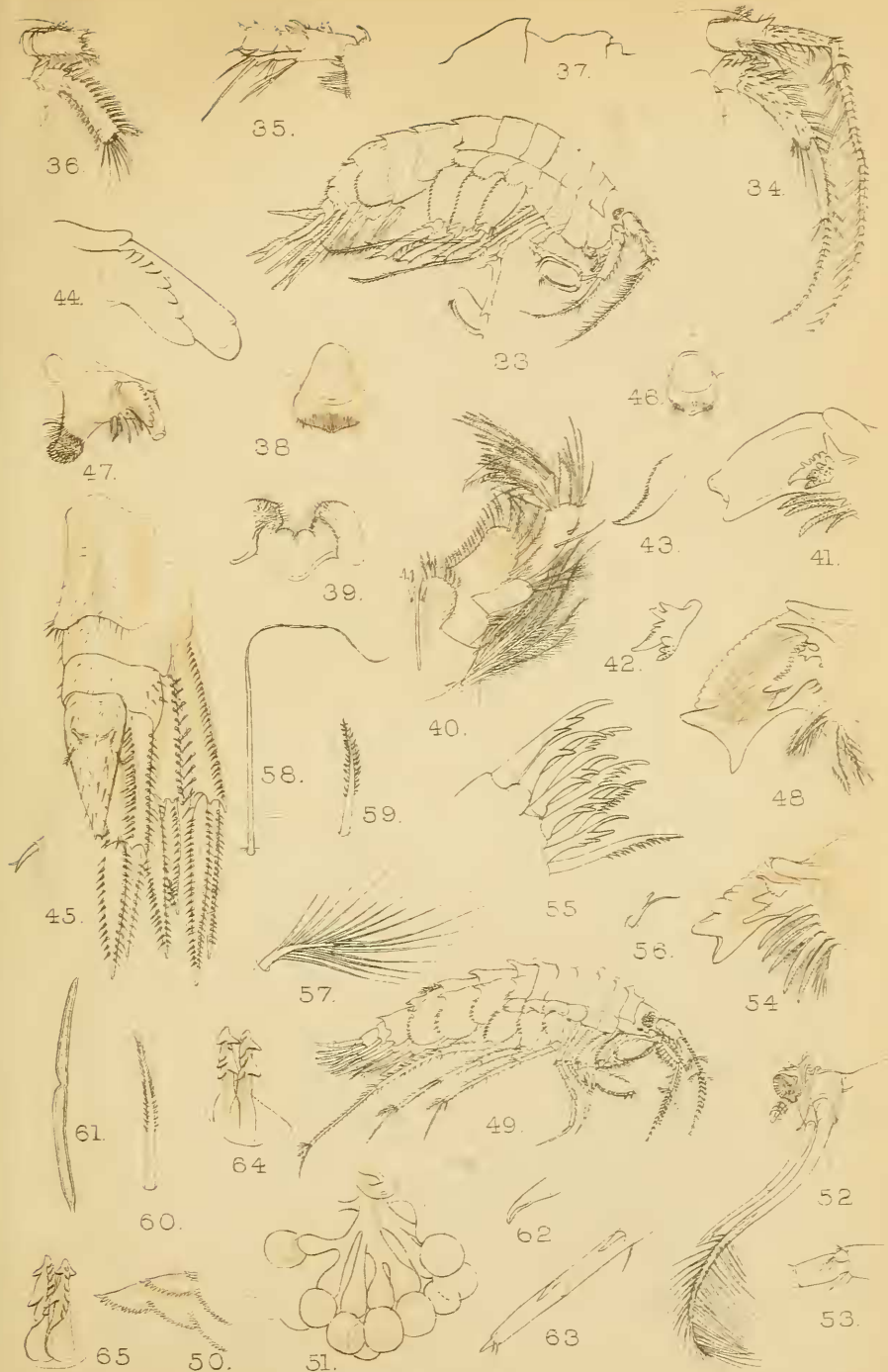


W. Sexton del.

Huth, London

1-7. PARAPLEUSTES GRACILIS, Buchholz.

8-32. SYMPLEUSTES GRANDIMANUS, Chevreux.



E. W. Buxton del.

Hutch. London

33-45 *EUSIRUS BISCAYENSIS*, Bonnier46-48. *RHACHOTROPIS ROSTRATA*, Bonnier.49-65. *RHACHOTROPIS HELLERI*, Boeck.

which appear to prove conclusively that not only do these animals become sexually mature before attaining their full growth, but that *in both sexes* the secondary sexual characters undergo considerable modification *after* sexual maturity is reached, the character most affected being the second gnathopod. Hitherto it has been accepted as a general rule amongst Amphipods that the male only has been modified, and that it is subject to variation in a far greater degree than the female; but an examination of this material shows that the female undergoes quite as much modification as the male, though owing to the usually smaller size of its gnathopods, the changes are less noticeable. (For an example of diversity in the shape of the gnathopod hand of an ovigerous female see *Sympleustes grandimanus*, Pl. LXXX. figs. 11 & 12.) In some species the degree of difference between the stages of development is negligible; in others it is of remarkable extent, so much so that the two extremes of a series of stages might be taken for absolutely distinct species. Further knowledge on this point will lead to a considerable revision of specific nomenclature.

The variation in the gnathopod of the male has been noted by many writers, the first to discuss it being Fritz Müller (20) pp. 16-18. Müller figured two forms of the hand of the male of *Orchestia darwini*, and stated that there were "nur zwei durch keinerlei Zwischenglieder verbundene Formen." He considered it a case of true dimorphism. Darwin quoted Müller's observations in support of his argument for Sexual Selection, (12) vol. i. p. 332, vol. ii. p. 215. Faxon also refers to them, (14) p. 43, (15) pp. 12 and 111, and suggests as explanation, that the two forms may be, as in *Cambarus*, alternating periods in the life of the individual, one form being assumed during the pairing season, and the second form during the intervals between the pairing seasons. Della Valle (13) p. 508, attributes the differences in the two forms of the male of *Orchestia darwini* to development; so also Stebbing (40) p. 545, where the animal is described from Müller's drawings. Geoffrey Smith (33) in a series of observations on *Orchestia deshayesi* and *O. gammarellus* has made the important discovery "that the males of these species, when breeding is not going on, assume a semi-hermaphrodite condition of a quite indubitable kind"; and that it is during this period of sexual suppression that active growth takes place. He states (p. 91) that "the antagonism that exists between the functional activity of the sexual organs and growth of the body . . . appears to result in the phenomena of high and low dimorphism *only in the male sex*." It should be noted, however, that Boulenger (5) has recently questioned these conclusions.

The development of the female would appear to proceed on totally different lines, and to follow a steady course from immaturity to full growth. In one species, *Rhachotropis helleri* Boeck (*infra*, p. 869), I was able to examine a large number of specimens, about 250, and to trace a continuous series of stages of development. The stages are easily observed in this species because

of the great modification of the chitinous cuticle of the body with age. In the young from the incubatory pouch, 2.25 mm. long, the dorsum is perfectly smooth, but, under a high power, a microscopic sensory setule can be seen, inset at each point where later either a carina or a hump is developed. The first dorsal hump of the pereon does not develop till the animal has attained a length of 5 mm., and not until two stages later, when it is a little more than half-grown, can the sexes be distinguished. At this stage, 8-9 mm. in length, with three dorsal humps developed, the young female shows the incubatory lamellæ just budding as small excrescences, and the young male carries the characteristic masses of sensory filaments on the antennæ. At the next stage in the female, 10 mm. length, with four dorsal humps developed, breeding has commenced, the eggs are extruded and carried in a large mass attached to the 5th segment, but the lamellæ are not more than half-grown, and only cover about half the egg-mass. In other animals at this same stage, presumably older, measuring 10.5 mm., the incubatory lamellæ are fully expanded and closed to form the pouch. All the remaining stages, to the full-grown female with seven well-marked dorsal humps, carry eggs, and all have the lamellæ fully expanded.

Sexual dimorphism is a common feature of the Amphipoda, the second gnathopod being the organ generally affected. One species in the 'Huxley' collection, *Sympleustes grandimanus* Chevreux, displays a very unusual and marked type of dimorphism, the side-plates and pereopods differing widely in the sexes, as well as both the gnathopods (*infra*, p. 857).

An examination of the present material shows that the mouth-organs are practically constant through the various stages, only the number of spines and setæ increasing with age; they would appear to be the safest characters on which to base specific distinctions. The antennæ and gnathopods, from which such characters are usually drawn, are the parts always the most affected by sex and development. But it is in the sensory equipment of the animal that most change is to be seen after sexual maturity is reached: the ommatidia increase in number; the flagella of the antennæ increase in length, those of the male to a far greater degree than those of the female; the calceoli, sensory filaments ("olfactory cylinders," "Riechzapfen"), &c. develop in both sexes; and the peduncles of the antennæ in the male become covered with masses or thick tufts of sensory filaments or sensory setæ.

There seems to be surprisingly little individual variation in the different stages, taken under the same conditions, though animals in the same stage of development but captured in different localities show considerable variation in size. I examined over 100 individuals of one stage of *Rhachotropis helleri* Boeck, from the S.W. of Ireland, taken in one haul, and they differed from each other neither in size, nor proportions, nor even in the

number of the setæ and spines with which they were provided; but on comparing them with Norwegian specimens at the same stage, taken in shallower water, a difference in size was at once perceived, the Norwegian specimens measuring 12 mm. in length as against the 10 mm. of the Irish ones.

The classification followed is that of Stebbing's 'Das Tierreich: Amphipoda.'

The measurements of the whole animal in all cases are taken from the tip of the rostrum to the tip of the telson.

FAM. PLEUSTIDÆ.

Genus PARAPLEUSTES Buchholz, 1874.

- Syn. 1859. *Paramphithoë* (part) Bruzelius (7).
 1860. " Boeck (1).
 1865. " Goës (16).
 1870. " Boeck (2).
 1874. *Parapleustes* Buchholz (8).
 1876. *Pleustes* Boeck (3).
 1882. *Paramphithoë* G. O. Sars (27).
 1887. " Hansen (17).
 1893. " G. O. Sars (29).
 1906. *Neopleustes* Stebbing (40).

In 1874 Buchholz founded the genus *Parapleustes* on the type species *P. gracilis*. He recognised its near relation to the older genus *Paramphithoë* Bruz., and stated (p. 337) that he had hesitated as to the identity of his species *P. gracilis* with Boeck's species *Paramphithoë glabra*, but had decided that the differences in the form of the body and more particularly of the mandibles justified the institution of a new genus for it*. His account of the genus, apart from the description of the mandibles which was founded on error, agrees in every particular with *Paramphithoë*. The type species was later identified by Hansen (17) with *Paramphithoë brevicornis* Sars. That this identification is correct, and that Buchholz's description and figures of the mandibles are erroneous, I have been enabled to prove, thanks to the courtesy of Dr. Vanhöffen and Dr. Hansen, by dissecting one of Buchholz's type specimens of *Parapleustes gracilis* and comparing it with one of Sars's type specimens of *Paramphithoë brevicornis*. Sars, however, identified *P. gracilis* with Boeck's species *glaber*, altering Buchholz's generic definition of the mandibles from "völlig ohne Spur eines Kauhöckers" to

* "Ich muss gestehen, dass es mir etwas zweifelhaft bleibt, ob die nachstehend beschriebene kleine Art von Ostgrönland mit den angeführten Synonymen [? an: *Amphithopsis glaber* Boeck; ? *Paramphithoë exigua* Goës; *Paramphithoë glabra* Boeck] identisch ist, da die sehr kurzen Angaben von Boeck und Goës hierüber beträchtliche Zweifel bestehen lassen. Ich ziehe daher vor, sie als neue Art zu beschreiben und glaube sie mit der vorigen, wegen der ziemlich beträchtlichen Abweichungen in der Bildung der Mandibeln und Körperformen, nicht in derselben Gattung vereinigen zu können." Buchholz (8) p. 337.

"molar expansion well-developed and of cylindrical form, exhibiting the usual fluted triturating surface" (29) p. 357. The two species are, however, absolutely distinct, as will be seen on comparison of the detailed figures of *P. gracilis* given below with Sars's figures of *P. glaber* in vol. i. of the 'Crustacea of Norway', pl. 126. fig. 1, *gracilis* having the typical molar of the *Paramphithoë* degraded and almost rudimentary, while that of *glaber* is well-developed and cylindrical.

Stebbing (40) has retained the generic name of *Paramphithoë* Bruz., for *Acanthosoma hystrix* Owen and allied species, substituting the new generic name of *Neopleustes* for *Paramphithoë pulchella* Kröyer and its allies. The type species of *Parapleustes* Buch. being now proved to be a true *Paramphithoë* in the sense in which Sars uses the name, and the genus *Parapleustes* thus becoming a synonym of *Paramphithoë*, the generic name *Parapleustes* must take precedence over *Neopleustes* Stebbing, and this latter name must therefore be cancelled.

The species *glaber* Boeck falls into line with the *Amphithoë latipes* M. Sars, and for these, with *Amphithopsis pulchella* G. O. Sars, *A. olrikii* Hansen, and *A. grandimana* Chevreux, Stebbing (39) proposed in 1899 the generic name of *Sympleustes*.

PARAPLEUSTES GRACILIS Buchholz, 1874. (Plate LXXX. figs. 1-7.)

Syn. 1874. *Parapleustes gracilis* Buchholz (8), pp. 269, 299, & 398, Taf. vii. fig. 1.

1882. *Paramphithoë brevicornis* Sars (27), p. 98, Taf. iv. fig. 11.

1887. " *gracilis* Hansen (17), p. 124.

1893. " *brevicornis* Sars (29), pp. 353, 359, pl. 124. fig. 2.

1906. *Neopleustes brevicornis* Stebbing (40), p. 313, and *Parapleustes gracilis* p. 320.

The specimen described below is an adult ovigerous female, measuring 6.75 mm.; the specimen of *Paramphithoë brevicornis* Sars, with which I have been able to compare it, is also an ovigerous female but smaller, measuring only 3.75 mm. Sars gives the average length of the adult female as "scarcely attaining 4 mm.," but he appears to have had only young specimens to examine, which, while sexually mature, were not full-grown.

Hansen (17), p. 124, says that the single specimen he examined agreed with both Buchholz's and Sars's descriptions and figures, excepting in one or two trifling details: viz., the superior antennæ were rather longer than these authors stated, and the 2nd joint of the peduncle was very little shorter than the 1st, agreeing with Buchholz's figure, Sars on the other hand showing it as considerably shorter than the first joint. The same difference occurs in the two specimens I have examined, and the proportions of the joints of the first gnathopod also differ somewhat, but apart from these small details, due entirely to age

and development, the specimens are in absolute agreement on every point.

The mouth-parts are figured afresh, Buchholz's figures and descriptions not being accurate. In my opinion a great many inaccuracies arise from the custom some authors have of mounting their specimens before describing or figuring them. This appears to be a case in point. I could not at first discover how Buchholz could possibly have overlooked the molar (which, small and degraded as it is, can be plainly seen under the 1 in. obj.), until I tried placing the mandible in the position represented by him and mounting it. The exact effect of his figure was immediately obtained, through the weight of the cover-glass flattening and depressing the delicate pellucid molar ridge to such an extent as to render it indistinguishable from the body of the mandible.

Side-plates.—The hind margin of the first three side-plates is entire with 3 or 4 setules inset, and a single denticle at the inferior angle, not 3 sharp teeth as described by Buchholz who apparently mistook the insertions of the setules for incisions of the margin.

Head (fig. 1).—Lateral corners more pointed in Buchholz's specimen.

Antennæ. Superior.—1st and 2nd joints of the peduncle subequal; 3rd joint half the length of the 2nd. In Sars's specimen the 1st joint equals in length the 2nd and 3rd combined. The first two joints carry extremely fine ciliated hairs. *Primary flagellum.*—Buchholz gives 15–16 joints; Sars, "12 articulations only." Buchholz's co-type had 12 joints, Sars's, 13 joints. The 1st joint of the flagellum is shorter than the 2nd. All the joints carry delicate setæ, with long thread-like tips, and in addition to these setæ, the alternate joints beginning with the 2nd are each provided with a very long, hyaline sensory filament, inset on the inner surface in a line with the accessory flagellum. The *accessory flagellum* (fig. 2) is present in both co-types, but quite rudimentary and microscopic in size. It consists of a minute pellucid flat joint carrying one ciliated hair and one long thread-tipped seta. I have found this microscopic accessory flagellum in all the other members of the family I have examined, distinct in *Sympleustes latipes*, but too small to be of any value in classification in the others.

Inferior.—The proportions of the peduncle joints are as given by both authors, but the peduncle is longer in proportion to the flagellum in Buchholz's specimen. *Flagellum* 6-jointed.

Oral parts.—Upper lip unequally bilobed, incision oblique.

Lower lip.—Outer lobes very large and rounded; inner lobes not projecting. Both lips covered with fine downy hair; the outer lobes of the lower lip each with a cluster of 5 or 6 stronger hairs.

Mandibles (figs. 3 & 4).—The anterior portion of the mandibles forms a scoop-like projection, almost triangular, with the

apex of the triangle at the insertion of the palp; the strong ridge which runs down from this point to the posterior end of the spine-row carries the molar on its inner surface at the base. When the mandible is in position, this ridge hides the molar from view; in the figures both mandibles are turned to show the molar. The *molar* is oval, the crown indented in the middle, with faintly marked but distinct transverse ridges. *Cutting-plate* on the right mandible (fig. 3) strong and curved, divided into 8 teeth, the terminal tooth broad and truncate, the 2 above large and pointed, and the 5 upper ones small and rounded; no accessory plate. On the inner surface the cutting-plate is so ridged as to give the appearance of the teeth being coalesced for nearly the whole length of the plate; the apices of the teeth are considerably bevelled also, presenting a broad, ridged edge. Buchholz considered the formation to be due to the accessory plate having become coalesced with the cutting-plate in both mandibles. The left mandible (fig. 4) possesses a well-developed *accessory plate*, the margin of which is divided into 9 teeth, the lowest tooth being the largest. The cutting-plate is strongly curved, the upper half arching over almost at right angles to the lower portion; the upper portion has 5 or 6 very small rounded teeth, the lower being divided into 3 large, rounded teeth, bevelled and ridged as in the right mandible. The two plates are set very closely together; Buchholz in his figure confused them, and represented them as one plate, with 2 rows of teeth on the margin. There are 4 spines in the left *spine-row*; 6 in the right. The spines are short, stout, and have a downy appearance, being covered with microscopic spinules; behind each spine a few fine hairs are inset. The *palp* is exceedingly large; the 2nd joint lightly curved, with 2 strong spines; the terminal joint the longest, falciform, and covered on the outer surface with minute spinules. It carries on the inner margin 5 feathered spines in the right mandible, 4 in the left.

Maxilla 1 (fig. 5).—*Outer plate* broad, with 2 rows of strong spines at the apex; 5 in one row, graduated in size, curved and bifurcate; 4 in the other row, longer, more slender, and finely serrated. The *inner plate* is small and rounded, widening at the apex, and provided with 1 plumose seta, in place of 5 setæ figured by Buchholz. *Palp* long and slender; the apex of the terminal joint carries 7 simple spines, 4 on the margin and 3 inset submarginally.

Maxilla 2 (fig. 6).—Buchholz's description is incorrect. Both plates are broad and rounded; the *outer* is longer and only slightly narrower than the inner, and carries 1 short and 5 long stiff setæ apically; the *inner plate* has shorter curved setæ on the inner margin and a few fine hairs.

Maxillipeds (fig. 7).—Plates small and narrow. The *inner plate* has the inner margin straight, with 1 strong tooth inset, the outer margin convex, and the apex truncate and beset with 2 small teeth and 2 small setiform spines. The *outer plate* only

reaches to a little above the base of the 2nd joint of the palp, not to the middle, as Buchholz says; it is furnished with 9 lightly curved setiform spines, the apical ones inset considerably within the margin. The *palp* is long, the joints not greatly differing from each other in length. The 2nd is a little longer than the 1st; the 3rd and 4th are subequal, and longer than the 2nd; the 3rd is slightly attenuated distally; the 4th forms a strong, almost straight claw, with a row of spinules along its inner margin. The greater part of the claw and the upper half of the 3rd joint are covered with these spinules, and, in addition, the 3rd joint carries a number of strong setæ on the inner surface, the apical ones nearly as long as the succeeding joint.

Gnathopods—exactly alike in both specimens with the exception of a slight difference in the length of the joints of the first gnathopod in Buchholz's specimen, due, I consider, to age and fuller development. In this specimen the first gnathopod is slightly longer than the second; the 2nd and 6th joints are subequal to each other in length (as in Sars's specimen) but longer in proportion to the side-plate; the hand is a little longer than the hand of the second gnathopod, but agrees with it in all details.

Peræopoda—exactly alike in both specimens. The terminal joints are more curved in the hinder peræopods than in the anterior: all are provided with a plumose seta proximally. The 2nd joints of the hinder peræopods are beset with small spines anteriorly and are serrated posteriorly, each serration having a setule inset.

The *incubatory lamellæ* are attached to the second gnathopod and the first three peræopods. The two anterior lamellæ are exceedingly large and wide, and deeply hollowed; that of the 3rd peræopod is very small and narrow, with the hind margin straight.

The *branchial vesicles* are small, that attached to the second gnathopod being the smallest; they increase rapidly in size to the 4th peræopod.

Pleopods.—*First pleopod*; the outer margin of the peduncle is fringed with long plumose setæ, about 14 in number; outer ramus 9-jointed, inner ramus 8-jointed, with 2 cleft spines on the 1st joint; 1st joint very large in both rami. *Second pleopod* with only 1 or 2 setæ on the peduncle; outer ramus 8-jointed; inner 7-jointed, with two cleft spines. *Third pleopod* with 1 cleft spine.

Uropods.—*First uropod*; rami subequal to the peduncle in length; inner ramus scarcely longer than the outer. Outer ramus in *second* and *third uropods* two-thirds the length of the inner.

Telson.—Exactly as figured by Sars, in both specimens. It carries 2 simple setæ near the apex, and a pair of long mobile ciliated hairs on either side.

Genus SYMPLEUSTES Stebbing.

Syn. 1860. *Amphithopsis* (part) Boeck (1), p. 661.

1893. *Parapleustes* Sars (29), p. 357.

1899. *Sympleustes* Stebbing (39), p. 209.

1900. *Dautzenbergia* Chevreux (10), p. 73.

1906. *Sympleustes* Stebbing (40), p. 317.

Two species of this genus were taken by the 'Huxley'—*S. latipes* M. Sars, 3 specimens; and *S. grandimanus* Chevreux, 5 specimens.

SYMPLEUSTES LATIPES M. Sars.

For synonymy see Stebbing (40), p. 317.

Three specimens, measuring respectively 7.5 mm., 4.5 mm., and 2.5 mm.

This species has been recorded once before from the Bay of Biscay, one specimen, an adult male, having been taken by the 'Caudan' Expedition of 1895.

The 'Huxley' specimens are all young forms, the largest, 7.5 mm., agreeing very closely with Sars's description and figures of the adult (29. p. 360); the other two differing in degree only. These latter have the palm margin of the second gnathopod hand almost straight and the dorsal processes scarcely perceptible. As Hansen pointed out (17. p. 135) the development of the dorsal processes, and the emargination of the palm of the second gnathopod are characters of maturity; to these may be added another character, taken from the epimera of the 3rd pleon segment: in the adult the postero-lateral corner is produced to an obtuse angle, while in the young form it is deeply notched with a setule inset. The accessory flagellum of the superior antenna, first noted by Bonnier (4. p. 646) is well-developed in all three specimens.

Distribution :—

Norway: M. Sars, as *Amphithoë latipes* (30. p. 139), Hammerfest and Tromsø, 30–60 fms., on Hydroids; largest, 13 mm.

A. Boeck, as *Amphithopsis latipes* (3. p. 355): largest, 9 mm.

G. O. Sars, as *Parapleustes latipes* (29. p. 362), from Finmark to the Trondhjemsfjord: 30–100 fms., on Hydroids; largest, 12 mm.

Norman, as *Parapleustes latipes* (23. p. 481), Lang Fjord: 5–15 fms.

Greenland: Norman, as *Amphithopsis latipes* (22. p. 208), 175 fms.

Hansen, as *Amphithopsis latipes* (17. p. 135), Disko etc.; 100–160 fms., on Hydroids; and on clay bottom; largest, 16 mm.

Great Britain: Shetland Isles: Bate, as *Calliope fingalli* (adult) (35. p. 377) = *Amphithoë latipes*, p. 380.

Norman, as *Calliopius ossiani* and *C. fingalli* (21. pp. 280–281); 40–90 fms.

East coast, Banff, Berwick, Yorkshire:—Bate, as *Calliope ossiani* (young form) (36. p. 262).

Channel Is. : Norman, as *Sympleustes latipes* (24. p. 366).

S.W. of Ireland : Bourne, as *Amphithopsis latipes* (6. p. 317).

N. America : off Grand Manan : Holmes, as *Sympleustes latipes* (19. p. 490) ; 45 fms. ; 1 specimen, 15 mm.

Bay of Biscay : Taken by the 'Caudan' : Bonnier, as *Parapleustes latipes* (4. p. 645) : 45° 57' N., 6° 21' W. ; in 1410 m. ; bottom deposit "coraux et vase" ; 1 specimen, male, 10 mm.

Taken by the 'Huxley', 26. viii. 06 ; 48° 7½' N., 8° 12½' W. ; with the Agassiz trawl in 412 fms. ; bottom—sand, mud, and hard ground ; 3 specimens, immature.

SYMPLEUSTES GRANDIMANUS Chevreux. (Plate LXXX. figs. 8–32.)

Syn. 1887. *Amphithopsis grandimana* Chevreux, ♀, (9) pp. 570–580.

1893. *Acanthozone latipes* (part) Della Valle (13), p. 608.

1897. *Parapleustes megacheir* Walker, ♂, (42) p. 230, pl. 18. figs. 4–4 c.

1899. *Sympleustes* Stebbing (39), p. 209.

1900. *Dautzenbergia grandimana* Chevreux (10), pp. 73–75, pl. x. fig. 1.

1906. *Sympleustes megacheir* Stebbing (40), p. 217.

Sympleustes grandimanus ,, ,, p. 318.

Dautzenbergia grandimana ,, ,, p. 728.

This species furnishes a remarkable example of the modification of the "secondary sexual characters" after maturity is reached, especially in the female (see figures 11 & 12.) It is interesting also as an unusually pronounced type of sexual dimorphism. The male and female, which have been described as separate species, differ not only in both the gnathopods, but, what is more noteworthy, in the shape of the first four side-plates. These in the female are practically subequal, while in the male the 4th is nearly twice as deep as the 1st. Other unusual points of difference will be found in the pereopods ; the 4th joint in the female is shorter, in the male longer, than the 5th joint ; and the inner margins of the fingers are dentate in the female, entire in the male.

Sympleustes grandimanus is distinguished from the other known species of the genus by the comparatively small side-plates ; the great inequality in size of the gnathopods ; the serrate fingers of both gnathopods ; and the incised telson.

In 1887 Chevreux described the female of this species under the name of *Amphithopsis grandimana*, placing it near *Amphithopsis pulchella* Sars, among the *Paramphithoidæ*. In his later work, however, he formed a new genus *Dautzenbergia*, for its reception, classing this genus provisionally in the family Calliopidæ, provisionally because of the great inequality in size between the first and the second gnathopods. This same character and the difference in the form of the telson, are the reasons given for its removal from the *Paramphithoidæ*.

Sars afterwards, in his 'Crustacea of Norway,' placed his species *A. pulchella* in the genus *Parapleustes* Buchholz (now *Sympleustes*

Stebbing). Between the characters of this genus, as given by Sars, l. c. p. 357, and those given by Chevreux for *Dautzenbergia* I can find no essential difference; on two points only do the accounts vary—viz., the lower lip and the telson, and of these, the first is due to misapprehension on Chevreux's part, and the second, the difference in the shape of the telson, is only a character of specific value, and not of sufficient importance to justify the creation of a new genus. Chevreux founded his genus on a single specimen, always an unsafe proceeding, for even if, as in this case, the specimen be sexually mature, yet as these animals pass through several stages of development *after* reaching maturity (see *Rhachotropis helleri*), the presence of the incubatory pouch is no guarantee of its being fully adult. All the parts undergo more or less modification, and therefore characters drawn from a young specimen are of no value as distinguishing specific features.

Description.—5 specimens were taken by the 'Huxley,' measuring 3 mm., 5 mm., 5 mm., 5.5 mm., and 7.5 mm., respectively, all females. Three marked stages of growth are shown: 1 immature; 3 young females about the same stage of development as Chevreux's specimen (as will be seen by a comparison of his figures with mine); and 1 larger specimen older than the others, as shown by the further modification of the second gnathopod. The description of the male is taken from the type specimens of *Parapleustes megacheir* Walker, which, through the kindness of Dr. Scharff, I have been able to examine; the larger specimen measured 11 mm., the smaller 7 mm.

The *body* is compressed, smooth, almost pellucid, cuticle exceedingly thin; segments well-defined. Peraeon and 1st three pleon segments evenly rounded; 4th pleon segment with a marked dorsal depression. Chevreux in his first account says "les trois premières segments de l'abdomen présentent une légère carène"; this statement is omitted in his later work, and the pleon is figured as perfectly smooth and rounded. Owing to the transparency of the cuticle permitting the underlying terga of the 2nd and 3rd pleon segments to show through the overlapping posterior edges of the segments preceding them, a curious deceptive effect of dorsal teeth is produced with transmitted light (see fig. 8). Walker in describing the male (*P. megacheir*) says "second segment of pleon (metasome) having a small dorsal tooth," but in both sexes all the posterior margins are evenly curved and entire.

In the young specimens the first three pleon segments have each a small tooth at the postero-lateral corner; in the large specimens only the 2nd and 3rd are thus provided, and in a less degree than in the young; inferior margin of the 3rd segment in all, strongly curved.

Side-plates.—In the female the first four are subequal in depth; 1st produced anteriorly in an acute lobe, covering the post-antennal corner; the 4th the broadest, lightly excavate behind; 5th and 6th bilobed, much wider than deep. In the male, the 1st

and 2nd are small; the 3rd is considerably longer, but not much wider than the 2nd; and the 4th is the largest, inferior margin strongly curved, hind margin only a little concave (fig. 19).

Head nearly as long as the first two peraeonal segments; rostrum very small, recurved, more so in the female than in the male; lateral corners truncate, not much produced; post-antennal corners small and rounded.

Eyes large, oval; quite colourless in spirit specimens, and difficult to trace though they show clearly enough in photographs of the animal. Walker's statement, "eyes wanting," is not correct.

Antennae.—*Superior antennae* over two-thirds the length of the body, but the proportion varies with the age of the animal. *Peduncle*: 1st joint stout, as long as the 2nd and 3rd together; 3rd joint shorter and much more slender than the 2nd; in the young female 5.5 mm. long, and in Chevreux's first description the 3rd joint is only half the length of the 2nd. The peduncle carries some fine hyaline hairs, as well as 3 or 4 ciliated ones, but the construction of these and of the filaments and setae of the flagellum is exceedingly difficult to observe, even when magnified 500 times, because of their fragility and transparency; this probably accounts for Chevreux's description "presque absolument glabres." *Primary flagellum*.—All the flagella of the larger specimens were unfortunately broken, 34 joints remaining on one; 1st joint almost double the length of the 3rd joint of the peduncle, carrying 3 or 4 clusters of sensory filaments; the 10 succeeding joints short, each with a cluster of filaments; the remaining joints longer and thinner, provided each with small setae, and a long sensory filament. The rudimentary *accessory flagellum* is characteristic of the family; it consists of one minute, pellucid joint, flat and leaf-like, tipped with 2 or 3 hyaline cleft setae (fig. 18).

Inferior antennae much shorter than the superior. *Peduncle*: antennal cone large; 5th joint about one-sixth shorter than the 4th. This proportion appears constant, being the same in all the specimens examined; Chevreux in his second account has "beaucoup plus court" instead of the more correct "un peu plus court" of the original description. *Flagellum* in the young female with 14 joints; both flagella broken in the large female and in the males, 15 joints remaining in young male.

Oral parts.—*Upper lip* (fig. 20): Alike in both sexes. Apex unevenly bilobed, with the rather oblique incision characteristic of the genus; inner margin of the right lobe minutely crenate.

Lower lip (figs. 21, 22, and 23).—Inner lobes much broader than the outer lobes; a figure (fig. 23) is given to show the proportions as seen from above. In the older specimens the lip is flatter and the inner lobes larger in proportion to the outer ones than in the young animal. Sars gives as a generic character "posterior lip with the inner lobes scarcely projecting," while Chevreux has "lèvre postérieure simple, sans lobes internes." In the young animal the lower lip has a tendency to curl in on

itself, the outer lobes thus completely hiding the small inner ones; it requires to be straightened out before its true construction can be seen, and this, because of its extreme tenuity, is a difficult matter. This appears to be the explanation of Chevreux's statement; the specimen he examined was a young animal with the lower lip contracted.

Mandibles strong (figs. 24, 25, 26, & 27). *Cutting-plate* of the *right mandible* in the large female with the margin divided into 7 teeth, the two below very large; *accessory plate* (fig. 26) large, almost as large as that of the left mandible, but of more delicate structure, produced below to a curved tooth, upper portion of the margin crenulated, with 2 small teeth. In the young female the cutting-plate has 6 teeth (the two uppermost ones being very small) and the margin of the accessory plate is much more dentate than in the older animal, probably less worn (fig. 25). The accessory plate being pellucid and lying flat against the cutting-plate, is no doubt the reason it escaped Chevreux's notice. In the male the cutting-plate is divided into 6 teeth; the accessory plate is of the same construction as that of the female but with the inferior margin straight, not curved (fig. 27).

Left mandible (fig. 24).—In both male and female the *cutting-plate* is divided into 6 teeth, the second lowest being the largest; the *accessory-plate* margin into 5 teeth. The figure given by Chevreux is scarcely accurate. The right *spine-row*, male and female, contains 7 spines, the left 8, each with a plumose brush-like seta behind; the spines have a downy appearance, being covered with microscopic spinules. *Molar* prominent, cylindrical; the crown is ridged transversely with small rows of teeth; it is surrounded with fine hairs, and carries a long ciliated hair posteriorly. In the female the crown of the left molar is ridged all over, but the anterior portion of the crown of the right molar is smooth. *Palp* very large; 3rd joint unusually long, much longer than the 1st and 2nd taken together; the distal half of its anterior margin is bordered with strong bristles (19 in the female, 17 in the male), the 5 apical ones set at a different angle from the others, and feathered on both sides, while the remaining ones are feathered on one side with cleft tips; the middle bristle in the apical group is twice the length of the others. In addition to these a diagonal row crosses the joint proximally on the outer side; and the tip of the joint is covered with minute spines. The 2nd joint is produced a little anteriorly, like, but in a less degree, to that of *S. latipes*; it carries a group of bristles distally.

First maxilla (fig. 29).—*Inner plate* small, with 2 long, and 2 minute plumose hairs; *outer plate* in the female with 7 spines, 4 large, strong, furcate, and the other 3 longer, each with about 6 small teeth. The male has the same number of spines, but fewer teeth on the spines. *Palp* biarticulate, longer than the outer plate; apex with a row of 5 feathered spines on the margin and 3 feathered setae submarginally.

Second maxilla (fig. 30).—Both plates covered with fine hairs; *inner plate* slightly the smaller, with a row of 4 plumose hairs on the inner surface, the proximal one the longest. The apices of both plates are provided with long stiff setæ, serrated for half their length.

Maxillipeds (fig. 28).—Female. *Inner plate*, apical margin straight with 2 small, broad teeth, and 5 setiform feathered spines; the inner margin carries 2 stout feathered spines. *Outer plate* reaching to the middle of the 2nd joint of the palp; a short, curved, flat spine with serrate edges is inset at the apex, with 3 setiform feathered spines on the right maxilliped and 4 on the left; the inner margin is produced beyond the row of spines into a delicate crenulated border (similar to that of the second gnathopod palmar border of the male). Male exactly as in female, except for an increased number of spines and setæ; 3 along the inner margin of the inner plate; and 5 setiform spines on the apical margin of both outer plates in addition to the curved spines. The immature specimen 3 mm. long has 3 on each outer plate and the curved spine at the inner angle is more slender; the construction and proportions are the same as in the adult. *Palp*, 2nd joint very large, much larger than the 3rd; 3rd produced a little anteriorly over the finger: 4th joint or finger longer than the 3rd, with a distinct nail, anterior margin edged with rows of minute spinules.

Gnathopods very unequal in size in the full-grown animal, though in the young there is not much difference between them. In the 'Huxley' specimens, the small 3 mm. one has the hand of the second gnathopod only one-fourth longer than the hand of the first; in the intermediate specimens 5-5.5 mm. the difference increases, the second being twice the length of the first; and the inequality is still greater in the largest specimen 7.5 mm. Of the two males examined the smaller one, 7 mm., has the second gnathopod hand twice the length of the first; the difference is greater in the larger specimen of 11 mm.

First gnathopod (figs. 9 & 10).—Female. 2nd joint large, curved, carrying proximally, on either side, several extremely long and delicate setæ; 4th joint cup-shaped; 5th large, produced to a transparent lobe at the posterior distal angle on the outer side, the anterior margin shorter than that of the 6th joint in all the specimens, more markedly so in the young. The shape of the 6th joint or hand varies with age; in the small 3 mm. specimen, the posterior margin is convex, palm defined by a sensory spine; but in the larger specimens the palmar angle is well produced, the hind margin is straight and about the same length as the palm. Chevreux, however, describes it thus, "son bord palmaire se confond avec le bord postérieur, et forme avec lui une courbe régulière." In examining the 'Huxley' specimens I found that the hand in the natural position is held turned inwards at an angle to the rest of the limb, bringing the palmar angle underneath, thus masking the real shape of the joint, and giving it the convex appearance described by Chevreux. In the figure (fig. 10)

I have bent the hand back to the level of the other joints, in order to show its true contour. The palm has a submarginal row of small setæ on the outer surface, and 2 or 3 clusters of longer setæ, and carries besides in all the specimens (male and female) a regular fringe of minute spinules on the margin, extending round the palmar angle. The sensory spines at the angle are notable for the great length of their apical filaments; the young female has 2 spines on the outside and 3 on the inside of the angle, the larger specimen more. Similar spines occur on the palm of the second gnathopod hand and on the peræopods. The posterior margins of the 5th and 6th joints are deeply inset with clusters of sensory setæ, and the under surfaces of both joints carry two longitudinal rows of groups of these setæ. The finger (fig. 14) is broad, curved, and serrated in all the stages, a setule being inset in each serration; the number of the serrations increases with age. The tip of the finger fits into a small groove on the inner surface of the palm between the two groups of spines at the angle.

Male (fig. 9).—The proportions of the 5th and 6th joints differ in the male. The anterior margin of the 5th joint is half as long again as the 6th, instead of only slightly longer as in the female; and the posterior margin of this joint is convex and not produced to a lobe at the distal angle. The shape of the hand is different in the two sexes, the hind margin being shorter than the palmar margin in the male, longer in the female. The finger also is longer in proportion, with more serrations.

Second gnathopod (figs. 11, 12, & 13) powerfully developed. 2nd joint broad and curved, with some of the long delicate setæ proximally on either side; both this and the succeeding joint are prolonged at the anterior angles in large rounded pellucid lobes. The 4th joint is produced posteriorly to a subacute lobe tipped with sensory setæ; the 5th is also produced posteriorly, to the same width as the 6th joint, its contour in the female forming one continuous line with the 6th; posterior margins of both inset with groups of sensory setæ, more in number in the larger specimens. The hand undergoes a remarkable amount of modification with the growth of the animal, especially in the female. Both the hand and the finger differ in the two sexes.

Female (figs. 11 & 12).—In the immature specimen 3 mm., the whole of the posterior margin is evenly curved, the palm, defined by 2 sensory spines, being the same length as the hind margin. In the young female 5.5 mm., sexually mature but not full-grown, the posterior margin is still convex, but the palm is half as long again as the hind margin, and the palmar angle is developed; while in the large female 7.5 mm., the palm is concave instead of convex, with the palmar angle acutely produced, and is more than twice the length of the hind margin. The palmar margin in the young female projects in a small subacute lobe at about one-third of its length from the finger articulation; the whole of the margin is crenate; and the tip of the finger fits into a small

hollow at the angle between the two large sensory spines. In the large female the palm is greatly elongated, the projecting lobe being one-fifth of the distance from the finger-articulation, with a deep indentation immediately following it; equidistant between this lobe and the palmar angle is a slighter indentation with a small projection following; the whole of the margin crenate. The palmar angle projects considerably beyond the palm-level, the tip of the finger impinging against the under surface of the palm some distance from the angle instead of meeting it, as in the young animal. The palm is bordered on either side with the sensory spines characteristic of this species, and with long cleft-tipped setæ, the under surface thickly setose. The finger is strong, curved and serrate; the serrations are very distinct in the immature specimen, 4 in number with a setule inset in each, as in the first gnathopod; much less distinct in the young female, 6 in number; and only visible in the large specimen under a high power, when they show as oblique incisions.

Male (fig. 13).—The hand in the young male is about twice as long as broad, with the palm half as long again as the hind margin. As in the female, transverse rows of sensory setæ are deeply inset along the hind margin, 5 in the female, 8 in the male. The palmar angle is as in the young female, the tip of the finger meeting it and fitting between the groups of sensory spines. Walker describes the palm margin (p. 231) as "divided into three lobes with crenate edges by two deep sinuses." The edges of these lobes are of very delicate structure, pellucid, with the sensory spines and setæ inset considerably within the margin. The finger is large, stout, with a deep indentation proximally on the inner edge; it has 14 of the oblique incisions in the young male. The larger male agrees with the one described, with the accentuation of the lobes and sinuses natural to the greater development.

Peræopods.—The 1st and 2nd peræopods are practically sub-equal in length; basal joints with some of the long setæ on either side, as in the gnathopods. Hinder peræopods not differing much in length, basal joints expanded, rounded oval, carrying small spines on the anterior margins, and minute setules on the posterior; 4th joints produced downwards at the posterior angle to long triangular lobes; 5th joints also produced but in a less degree. The female differs from the male in having the 4th joints shorter than the 5th, instead of longer; this difference is very slight in the first two peræopods, but marked in the hinder ones. Another difference lies in the terminal joints; those of the female being provided with two small teeth on the inner margin, while those of the male have the margin entire (figs. 15, 16, and 17). All the terminal joints carry a plumose hair on the outer curve. The finger of the 3rd peræopod in the female differs a little in form from the others; it is more hollowed underneath, and has the second auxiliary tooth much produced. The sensory spines are as in the gnathopods.

Branchial vesicles and *incubatory lamellæ* comparatively small. The large female had four eggs remaining in the incubatory pouch; the eggs very large in proportion to the animal's size, exceeding in length the head of the first gnathopod.

Pleopods very long. All the peduncles are provided with fine hairs; coupling-spines very small, apices recurved, with 2 small teeth on one side and 3 on the other. In the 1st and 2nd pairs the rami are longer than the peduncle, 12-jointed; 4 cleft spines on the inner ramus of the 1st pair, 3 on the 2nd. In the 3rd pair the rami are subequal in length to the peduncle, 10-jointed, 3 cleft spines on the inner ramus.

Uropods (fig. 31).—Apices reach to nearly the same level. The rami of the 1st pair are about subequal to the peduncle in length; the rami of the 3rd pair twice as long as the peduncle; inner rami of the 2nd and 3rd pairs longer than the outer; all the margins edged with small spines.

Telson (figs. 31 & 32) in the female cleft for one-quarter its length; apices each with a setule inset. In the male the cleft is slightly oblique, with the apices dehiscant. Just above the cleft on either side, a pair of mobile plumose hairs is inset, with a few scattered ones proximally. Chevreux first described the telson as rounded, but in the later account he describes and figures it as cleft.

FAM. EUSIRIDÆ.

For synonymy see Stebbing (40), p. 338.

Three of the four species of *Eusiridæ* collected by the 'Huxley' were taken in one haul at Station XII. in 246 fathoms. Two of these, *Eusirus biscayensis* Bonnier, and *Rhachotropis rostrata* Bonnier, are recorded for the first time since their discovery by the 'Caudan' Expedition in 1895. One specimen of the hitherto unknown male of *Eusirus biscayensis* was taken. Owing to the method of capture, the Agassiz trawl, all the specimens are more or less mutilated, the slender fragile pereopods especially suffering. The specimens of *Eusirus longipes* Boeck, the fourth species, taken at a much less depth, 109 fms., and by a different method, are in a good state of preservation; these were caught in a tow-net attached to the dredge working on the bottom.

Genus EUSIRUS Kröyer, 1845.

For synonymy see Stebbing (40), p. 338.

EUSIRUS LONGIPES Boeck, 1861.

Syn. Stebbing (40), p. 341.

Three specimens, males, the largest measuring 8 mm., were taken at Station IV. near La Chapelle Bank, 23. viii. 06, lat. 47° 48' N., long. 7° 25' W., in 109 fathoms; bottom deposit, coarse sand and broken shell.

This species has been recorded twice before from the Bay of

Biscay, trawled by the 'Hirondelle' at two closely adjoining stations about 110 miles to the S.E. of the 'Huxley' Station. (Chevreux (10), pp. 65, 171, 172.)

Distribution. Coast of Norway, 30–300 fms. Boeck (3), p. 504; Sars (29), p. 420.

Shetland Isles, 40–50 fms.; bottom deposit, sand. Norman as *E. helveticæ*, (21) p. 281.

Scotland, W. coast, 10–12 fms.; bottom—mud, gravel, broken shell. Robertson (25), p. 42; Scott (31), p. 173.

Channel Islands, off Guernsey, 25 fms. Walker & Hornell (41), p. 53.

Bay of Biscay, 166 & 180 m.; bottom deposit, muddy sand. Chevreux (10), pp. 65, 171, 172.

Bay of Naples. Della Valle as *E. cuspidatus* (13), p. 669.

Adriatic. Heller as *E. bidens*, (18) p. 32.

EUSIRUS BISCAYENSIS Bonnier, 1896. (Plate LXXXI. figs. 33–45.)

1896. *Eusirus biscayensis* Bonnier (4), pp. 651–653, pl. xxxix. fig. 1.

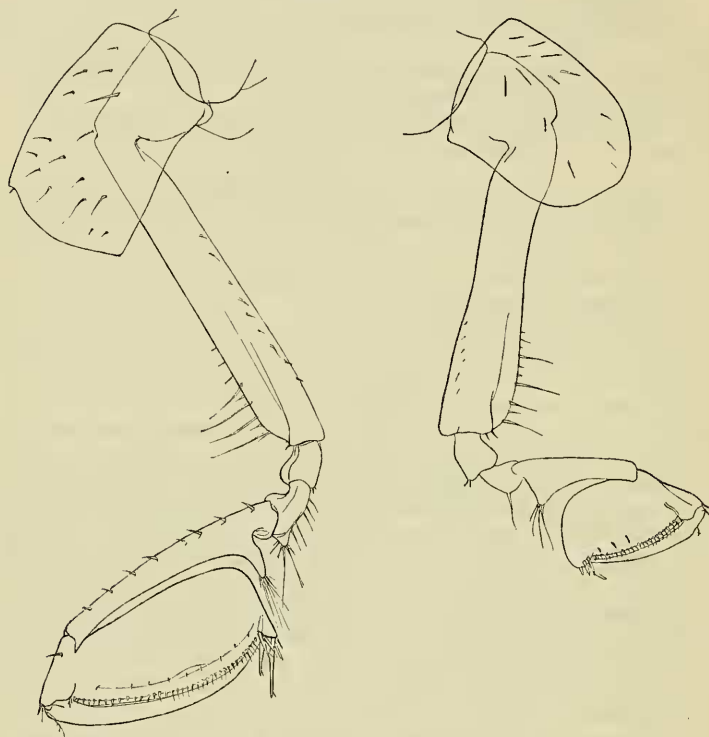
7 specimens, one male measuring barely 13 mm., and six females 12–13·5 mm. in length.

The original description was made by Bonnier from one specimen, a mutilated female, to which were lacking the superior antennæ (except the 1st joint), the terminal joints of the 5th pereopods, and the 3rd uropods. The description of a species from a single specimen is always a difficult matter, and with the arrival of fresh material, a modifying of the original account becomes necessary. Seven specimens were taken by the 'Huxley': one male, the first hitherto recorded, and six ovigerous females, all mutilated, as was to be expected from the method of capture, the Agassiz trawl. Two of the specimens, however, retained the antennæ and uropods in good condition, but in all, the hinder pereopoda were missing. A curious point is that two of the females have the 2nd gnathopod on the right side abnormal, much smaller than the corresponding gnathopod on the other side. In one the side-plate and 2nd joint are normal, the 5th, 6th and 7th joints very small; but in the other, though the branchial vesicles and incubatory lamellæ are the normal size, both the 2nd and 3rd side-plates are small and malformed, the 2nd gnathopod is much smaller (text-fig. 278, p. 866) and the 1st pereopod is only half the size of the one on the left side. It would almost appear to be due to some injury received while immature, before the development of the incubatory lamellæ. The male is easily distinguished from the female by its more slender form; by the antennæ with their dense fascicles of sensory bristles; the much shorter pereon; and by the 4th pleon segment (fig. 37), the anterior dorsal depression of which is more marked and the dorsal carina more developed.

The whole animal (fig. 33) is covered with microscopic spines and fine hairs, these last especially numerous on the pleon.

Superior antenna. Female (fig. 34).—First joint of the *peduncle* broad, with several dentiform apical projections; it carries a fan of fine setæ distally, and several sensory ciliated hairs; 4 long sensory hairs above and 7 or 8 small ones, and a transverse row of the small ones on its inner surface. The 2nd joint is longer than the 1st, also apically dentate, with curved spines; the 3rd

Text-fig. 278.

*Eusirus biscayensis* Bonnier.

Second gnathopods of the female, showing the abnormal right gnathopod.

joint small, widening distally, spines curved. *Primary flagellum.* In the two specimens examined the tips were broken, 32 joints remaining. The 1st joint is the largest; from the 9th–27th the joints vary in length, short ones carrying the long sensory filaments alternating with longer ones provided with small setæ only. The filaments are set in groups of 3 to 5 on the outer side of the antenna, the middle filament of each group being double the length of the others, equalling in length the six succeeding joints.

These groups occur on each joint from the 1st to the 9th, then on alternate joints to the 27th. The *accessory flagellum* (fig. 35): 1-jointed, narrowly laminar, with a large cleft spine and two divergent setæ at the apex.

Male (fig. 36).—Only the 1st joint of the *peduncle* remaining. This has the dentiform projections and sensory ciliated hairs as in the female, but is furnished posteriorly with 8 transverse rows or tufts of fine sensory bristles, extending partway round the inner side.

Inferior antenna. Female (fig. 34).—The 2nd and 3rd joints of the *peduncle* apically dentate; the 4th long and broad, with sinuous upper margin, thickly setose on its anterior surface, and produced at the posterior angle to a setiferous lobe; the 5th, subequal to it in length, is much narrower, with numerous small setæ anteriorly and several long fine ones distally. The *flagellum* consists of about 20 joints, each furnished anteriorly with a cluster of small setæ, those on alternate joints being longer than the others. I found no trace of the calceoli mentioned by Bonnier.

Male (fig. 36).—Only four joints of the *peduncle* remaining. The upper margin of the 3rd joint has four tufts of the sensory bristles in the right antenna, five in the left; the 4th joint carries twelve of these in the right and thirteen in the left antenna, the apical group being the largest, and containing also several long sensory ciliated hairs. This joint is produced at the posterior angle, as in the female, to a lobe bordered with long fine setæ; on the posterior margin are several clusters of the ciliated hairs, with a longitudinal row of 7 or 8 of the small ones proximally, each set in a little depression similar to those on the 1st joint of the superior antenna.

Upper and lower lips. Female (figs. 38, 39).—The figures given by Bonnier are not of the same magnification. *Inner lobes* of the lower lip covered with fine hairs.

Mandibles. Female (figs. 41, 42, 43, 44).—*Cutting-plates* greatly curved, with a strong obtuse tooth above, bidentate below in the right mandible, rounded and recurved in the left. These plates appear subject to great variation. Bonnier gives (*loc. cit.* p. 651) "apex allongé, robuste, sans denticulations; le processus accessoire est élargi et présente cinq à six dentelures sur l'un des appendices, tandis que sur l'autre il est rudimentaire, et tridenté; il est accompagné d'une rangée de cinq petits poils courts." In the three specimens examined I found the *accessory plate* of the left mandible with 8 teeth in two specimens (fig. 44), 9 in the other, 5 or 6 spines in the spine row, the *accessory plate* following the deep curve of the cutting-plate. In the right mandible the *accessory plate* is of a more complicated structure, divided below, the inner portion tuberculate with 3 or 4 strong teeth; the other portion variable as regards the number of teeth but with one above and one below strongly produced (figs. 41, 42). In one specimen the *accessory plate* was broken, leaving only the

inner tridentate portion intact; from Bonnier's description and figure I should imagine the same accident had occurred to his specimen. The spine-row in all three contained 4 spines. The bristles of the 2nd joint of the *palp* are plumose; those of the 3rd serrate, the two apical ones much longer than the others.

Maxilla 1. Female.—*Inner plate* with 2 large plumose setæ and several fine hairs; *outer plate* with 11 strongly denticulate spines, arranged in two rows on the apex, 6 in one row, longer than the others, with 4 or 5 teeth on each spine; the spines of the other row have only 1 or 2 teeth apiece (cf. *Rhachotropis rostrata*, fig. 55). Bonnier's specimen had "huit dents barbelées toutes semblables." On the inner margin of the *palp* the setæ are arranged in two parallel rows, bases contiguous, apices widely divergent.

Maxilla 2. Female.—Both plates nearly covered with fine hairs.

Maxillipeds. Female (fig. 40).—Resembling *E. propinquus*, as figured by Sars; easily distinguished from all the other species of *Eusirus* by the fan-shaped groups of exceedingly long, flexible, plumose setæ on the outer surface of the 1st and 2nd basal joints. Each seta has a broad pellucid shaft, with several longitudinal rows of delicate hairs running the whole length. There are two groups on each joint; those on the 1st joint containing 16 setæ in each fan and extending to beyond the middle of the 2nd joint of the *palp*; those on the 2nd joint each with 14 setæ, much smaller, set more closely together, only reaching to the 1st joint of the *palp*.

Gnathopods 1 & 2. Female.—The figure given by Bonnier is that of the first gnathopod, but through an error it is marked as the second. The second gnathopod (see text-fig. 278, p. 866) is longer than the first, the 2nd joint, for example, being as long as the 2nd and 3rd taken together of the first. The 4th joint is more produced posteriorly, forming a distinct lobe; both this and the more acute lobe of the 5th joint are provided with numerous finely serrate cleft bristles. The hand is longer though no wider than that of the first, the palm with a densely crowded row of small setæ on either side of the margin, about 60 on the inner side and 40 on the outer, with a few widely spaced setæ above. The posterior angle of the palm is bordered with 6 or 7 large sensory spines, and at the articulation of the finger is a large plumose specialised bristle (cf. also *E. longipes*, *Rhachotropis rostrata*, *R. helleri*, &c.). In the abnormal specimen there are only 25 small setæ on the inner margin and 27 on the outer.

First and second pereopods. Female.—Bonnier says of his specimen (p. 652): "le m eropodite n'est pas plus long que le carpopodite"; the 'Huxley' specimens differ from this, having the 4th joint longer than the 5th, as in all the other known species of *Eusirus*.

Third pleon segment. Female.—Hind margin nearly straight, with 23 down-turned serrations turning the corner; posterior angle rounded; lower margin produced to a strong denticle behind; 11 spinules inset submarginally.

Third uropods (fig. 45).—The peduncle as long as the telson; rami broad, subequal in length to the peduncle, the outer ramus a little the shorter; margins bordered with sensory spinules. The peduncle has three rows of these spinules.

Distribution. Taken by the 'Caudan' Expedition, 1895, 44° 17' N., 4° 38' W., in 940 metres; bottom deposit, mud.

By the 'Huxley,' August 26, 1906, at Station XII., 48° 7½' N., 8° 13' W., about 240 miles to the N.W. of the 'Caudan' station, in 246 fathoms; bottom deposit, fine sand.

Genus RHACHOTROPIS S. I. Smith, 1883.

For synonymy see Stebbing (40), pp. 347, 729.

RHACHOTROPIS ROSTRATA Bonnier, 1896. (Plate LXXXI. figs. 46–48.)

Rachotropis rostrata Bonnier (4), p. 653.

4 specimens, all males, measuring respectively: 10, 10, 9·5, and 9 mm.

I have only one or two points to add to the excellent description and figures given by Bonnier. On p. 655, he states: "la mandibule a un apex sans denticulations, avec un processus accessoire denticulé, bien développé sur l'un des appendices et rudimentaire sur l'autre." In these specimens, however, as will be seen by the figures (47, 48) the *cutting-plate* is elongate, incurved, with a strong tooth above, regularly crenulate in the right mandible, the lower end of which is bidentate, and having several irregular crenulations on the left mandible with the lower end rounded and deeply incurved. Both *accessory plates* are well developed; the margin of the left divided into 8 teeth; the right, as in *E. biscayensis*, of a more complicated construction, forming distally 2 strong broad teeth, with 13 serrations above, and having the upper part of the plate divided and its inner portion produced to a long falciform tooth (cf. *R. helleri*, fig. 54). The left spine-row has 3 spines, the right 2, each with a plumose brush-like bristle behind.

Distribution. Taken by the 'Caudan,' 1895, 44° 17' N., 4° 38' W., in 950 metres; bottom deposit, mud. 3 specimens male.

By the 'Huxley,' August 26, 1906, at Station XII., 48° 7½' N., 8° 13' W., in 246 fathoms; bottom deposit, fine sand.

RHACHOTROPIS HELLERI Boeck. (Plate LXXXI. figs. 49–65.)

For synonymy see Stebbing (40), p. 351.

20 specimens: 1 male measuring 8·75 mm.; 19 females from 10–12·5 mm. in length, one specimen with a young one 2·25 mm. long still remaining in the incubatory pouch.

These specimens showed several points of difference from the *R. helleri* figured by Sars (29), pl. 150, viz., all the segments of the pereon dorsally raised, the 7th pereonal segment with lateral carinae, and the first three pleon-segments with the

postero-lateral margins firmly serrate. On consulting Prof. Sars and Mr. Tattersall on the matter, they most kindly sent me specimens which prove these differences to be due to age. Mr. Tattersall's specimens, about 250 in number, all taken at one station by the 'Helga,' show a very interesting regular series of the stages of development, from the young in the incubatory pouch with the dorsum smooth to the full-grown female with all seven peræon-segments dorsally raised.

In this species the completion of sexual maturity in the female coincides with the development of the fourth dorsal peræon-hump at 10 mm. length. A previous stage, 8 mm., shows the incubatory lamellæ just starting as very small glabrous plates, but none of the specimens of this size had the lamellæ further expanded, nor carried eggs. Specimens 10 mm. long, with the 1st, 2nd, 3rd, and 7th peræon-humps produced, had the lamellæ half-grown, with two or three minute hairs near the apices, and carried large rounded masses of eggs protruding considerably beyond the lamellæ and flattened underneath against the body-wall. The eggs, about 60 in number, each measuring .25 mm., are supported on long bulbous stalks, branching from a short central stem by which the mass is attached to the 5th segment (see fig. 51). Specimens of 10.5 mm. length show the lamellæ fully developed, bordered with long hairs and closed to form the pouch. The eggs enclosed are separate from each other, fewer in number, and large, some measuring as much as 1 mm.

Most of the Irish specimens are at this latter stage of development, answering exactly to the description and figures given by Sars (pl. 150); the Norwegian specimens at this same stage are larger, averaging 12 mm. About 40 of the Irish specimens were larger than the rest, all ovigerous, all with the 1st, 2nd, 3rd, 6th, and 7th humps, and the lateral carinæ of the 7th segment, and in most cases with the 4th and 5th humps perceptible as slight swellings of the posterior margins.

Of the 'Huxley' specimens, 18 of the 19 females were full-grown, with all seven dorsal humps produced. The remaining female, of 10 mm. length, had only six humps, that of the 5th segment not being developed. This specimen is younger than the others, as is proved by the fact that the antennæ had only 10 joints in each flagellum, instead of the 12 joints of the larger animals.

The males are distinguishable from the females at a glance by the shorter, more compressed peræon, and the long filiform flagella of the antennæ. Unfortunately, none of them are full-grown, though sexually mature, as shown by the development of the antennæ. Of the Irish specimens, 14 measure 10 mm. In all these the 7th hump is large and the 1st very small, the other segments smooth; no trace of the lateral carinæ on the 7th; the antennal joints as Sars has figured them, the 4th joint of the peduncle of the inferior antenna being three-quarters the length of the 5th.

The single male specimen taken by the 'Huxley' measures 8.75 mm. and has apparently just undergone ecdysis, the integument being exceedingly thin and transparent and easily crumpled. The whole animal is much more slender and compressed than the Irish specimens, probably owing to its condition; it differs also in having well-marked carinæ on the 7th segment, while all the other segments are smooth, and in the number and proportions of the antennal joints. This latter point is probably due to immaturity, the length of the joints of the peduncle and the number of joints in the flagella increasing with age.

Integument (fig. 50).—The whole animal is covered with minute scale-like plates, with pectinate margins.

Pereon.—In the young from the incubatory pouch, 2.25 and 3 mm. long, the pereon is perfectly smooth, the dorsal processes and lateral carinæ of the 7th segment being represented by mobile sensory setules, each inset in a little depression of the cuticle. The 7th dorsal process appears to develop first, followed by the 1st, 2nd, and 3rd consecutively, then the 6th and 4th, the 5th being the smallest and the last to arrive. At about 5 mm. length the 7th hump commences as a slight rounding of the margin behind. At 7 mm. it is well developed and elevated as in the adult, and the 1st also can be seen. At 8–9 mm. the hump on the 2nd segment has appeared; and at 10 mm. the 1st, 2nd, 3rd, and 7th are well-marked, and the lateral carinæ of the 7th segment indicated by a rounding of the margin. In only the largest specimens, 11–13 mm., are all seven humps developed; lateral carinæ ending in denticles. The posterior angles of the hinder segments are produced backwards, those of the 7th acute and slightly serrate.

Side-plates overlapping considerably. Anterior lobe of the 5th broader than posterior; anterior lobe of 6th very small; 5th and 6th ridged laterally; in the young from the incubatory pouch the lateral ridges are distinctly though faintly indicated; 5th, 6th, and 7th serrate behind.

Pleon.—The postero-lateral margins of the first three segments firmly serrate, the serrations turning the corner; segments 1 and 2 more rounded in the female than in the male, the teeth of the lateral carinæ and the serrations downcurved; segment 3 rounded quadrate, evenly serrated, the lateral denticles and the 12–14 serrations upcurved. The 3rd segment in both male and female carries a row of long, plumose sensory hairs, set just under the projecting tooth of the dorsal carina of the 2nd segment. In the young the dorsal carinæ of segments 1–4 are indicated, as also the lateral carinæ of the 3rd, and in the place of the denticles which develop later, minute sensory setules, similar to those of the pereon, are inset. The apices of the telson and of the uropods are likewise provided with these setules.

Head about the length of the first two pereon segments in the female, of the first three in the male; rostrum broad and deflexed, not quite half the length of the 1st joint of the superior antenna.

Eyes large and prominent, and pyriform in the adult, with numerous small dark ommatidia. In the young the eyes are round; in one specimen, 4 mm., the very dark ommatidia numbered 22, arranged in 5 rows; in another, 8 mm., the shape was a rounded oval, the ommatidia numbering about 80.

Antennae: superior antenna, full-grown female.—1st joint of the peduncle not so long as the 2nd and 3rd together; 3rd nearly two-thirds the length of the 2nd; 1st and 2nd with apical teeth. *Primary flagellum* scarcely as long as the peduncle, each joint carrying a calceolus and a long sensory filament; 12-jointed in the largest specimens, 12.5 mm. long, with all 7 pereon-humps well developed, as in fig. 49. In slightly smaller specimens, 11 mm., with the 4th and 5th segment humps minute, the joints of the flagellum numbered 11, while in the smallest 'Huxley' specimen, 10 mm., there were only 10 joints in each flagellum. The *accessory flagellum* consists of 1 small joint with 1 long ciliated hair and 1 sensory cleft seta (fig. 52); the ciliated hair being inset on the under side, much lower than the seta, gives the appearance, when in position, of a minute apical joint.

Male. 'Huxley' specimen, 8.75 mm.—1st joint as long as the 2nd and 3rd together; 3rd not quite half the length of the 2nd. *Primary flagellum* 23-jointed; *accessory flagellum* as in female, tipped with long ciliated hair and 2 cleft setæ. The 1st joint of the primary flagellum is long and broad; the 2nd short; the following 8 successively a little longer and thinner, each with a calceolus and a dense group of sensory filaments (fig. 61) on the inner side; the next 4 joints are alternately long and short, the long ones with a cluster of setæ only, the short ones with a calceolus and sensory filaments. This alternation of long and short joints occurs also in the inferior antenna (cf. also *Eusirus biscayensis*). The remaining 9 joints are of equal length, with clusters of small filaments. The ciliated hairs on the peduncle are remarkable for the great length of the "feathering."

In the Irish specimens, 10 mm., the 1st joint of the peduncle is shorter than the 2nd and 3rd combined; 3rd joint about half the length of the 2nd. The *primary flagella* are all broken, 31 joints remaining on one.

The young in the incubatory pouch has the 1st and 2nd joints subequal in length, the 3rd half as long as the 2nd; primary flagellum of 4 joints not nearly so long as the peduncle; accessory flagellum (fig. 53) 1-jointed, tipped with 2 setæ and 1 sensory filament.

Inferior antenna. Full-grown female.—Agrees with Sars' description.

Male. 'Huxley' specimen.—4th joint of the peduncle broader and slightly shorter than the 5th; 3rd, 4th, and 5th posteriorly laminar. The *flagellum* subequal to the peduncle in length, 24-jointed; the first 4 joints each carry a calceolus and a cluster of long setæ; the next 8 are alternately long and short, the short ones with a calceolus and long setæ; the 14th, 17th, 20th, and

apical joint with long setæ, the others with only 3 or 4 small setæ apiece.

The Irish specimens of 8-9 mm. agree with the 'Huxley' one; the sensory filaments and calceoli are developed, though in much less degree than in the adult. The larger males, 10 mm., have the peduncle joints of the inferior antenna as figured by Sars; the 4th joint being three-quarters the length of the 5th, instead of subequal to it, as in the younger animals; flagellum 36-jointed.

In the young in the incubatory pouch the 4th and 5th joints of the peduncle, taken together, much exceed the flagellum in length.

The calceoli are of exactly the same construction as those figured by Bonnier for *R. rostrata*, but with the "cupule" much smaller in proportion to the "tube." They are a character of sexual maturity, appearing simultaneously with the incubatory lamellæ in the female, and with the antennal sensory filaments in the male, and increasing in size and number with the animal's growth.

Oral parts: upper lip.—The apex appears to be more produced in the male than in the female; apical margin covered with fine minute hairs, with a cluster of longer ones on either side.

Mandibles. Female (fig. 54): *Right mandible.*—*Cutting-plate* greatly curved; margin divided into 8 rounded teeth, with 1 large obtuse tooth above, and 2 very large teeth below. *Accessory plate* tridentate, upper tooth at a different level from the others, as appears usual in this genus. *Left mandible.*—*Cutting-plate* with 1 large tooth above, 7 small rounded ones, and 2 strong incurved teeth below. *Accessory plate* much stronger than that of the right mandible, margin divided into 6 teeth. 5 spines in the *spine-row*, each with a delicate brush-like seta behind. The spines are stout, and being covered with minute spinules, have a downy or furry appearance. *Molar* prominent, the small spines edging the crown of the same construction as those of the *spine-row*; crown surrounded with numerous long fine setæ.

Male.—*Cutting-plates* tridentate below, margin divided into 9 rounded teeth; *accessory plates* as in female. 4 spines in *spine-row* in 'Huxley' specimen, 5 in Irish specimens of 10 mm. length.

The terminal joint of the *palp* is covered on the outer side with a fur-like spinose armature. The margin is bordered with three series of spines; an apical group of 3 or 4, long and setiform; then a group of short, flat, strongly dentate spines (fig. 59), usually 5 on the right palp and 6 on the left; the third series extending along the rest of the margin, containing 18-20 spines of varying length, similar to but smaller than those at the apex (fig. 60). The spines of the 2nd joint are of the cleft-tipped variety, feathered for half their length.

Maxilla 1. Female and male.—*Outer plate* with 9 spines set in two rows; 5 with from 1-3 large auxiliary teeth; the other 4 longer, with from 4-12 small teeth (fig. 55). The number of spines

is the same on both maxillæ, but the number of the auxiliary teeth varies. Both plates and *palp* covered with fine hairs.

Maxillipeds.—The 2nd and 3rd basal joints with fan-shaped groups of long stout bristles on the outer side. 2nd and 3rd joints of the *palp* each carrying on the inner side a longitudinal row of cleft-tipped bristles and a number of small curved sensory spines, similar to those on the gnathopods; terminal joint in the male ending in a distinct nail.

Gnathopods.—Practically no difference between the gnathopods of the full-grown specimens and those figured by Sars. The basal joints in both gnathopods are considerably wider at the distal end; posterior margins convex, densely crowded with small curved sensory spines, with 6-9 longer ones at the distal angle. These spines develop at maturity, together with the calceoli and sensory filaments of the antennæ; young specimens, 4-5 mm., have none; older animals, 8 mm., carry a single row; while in the full-grown specimen the margin is thickly covered with a band of them, one overlapping the other. In the second gnathopod the 4th and 5th joints are produced to a strong denticle at the posterior angle. The curved finger is longer than the palm, the tip fitting into a groove on the inner side of the hand. The feathered spines on the outer side of the palmar margin are shorter and twice as numerous as those of the inner side, and are set in graduated oblique rows, the longest spine of each row the farthest from the margin; those of the inner side are also graduated in size, but set in a continuous line. The curious specialised bristles, characteristic of this family, are to be found on either side of the finger articulation, the dentate one on the outer side, and the plumose on the inner. These bristles are among the first to appear; in a small specimen, 4 mm., both are well developed.

Peræopods. Full-grown female.—Agreeing with Sars' figures; sensory armature more complete, as is to be expected. The 2nd peræopod is longer than the 1st; basal joint wider, the posterior margin densely crowded with sensory spines, as in the gnathopods, that of the 1st with only a single row. In the hinder peræopods, the anterior margins of the basal joints are armed with numerous small spines; the 4th and 5th joints carry a row of small deeply inset spines (fig. 56) on the outer side, in addition to the marginal groups, a double row on the 5th joint of the 5th peræopod. The under surface of some of the joints—4th of peræopod 3, 4th and 5th of peræopod 4, and the 4th, 5th, and 6th of peræopod 5—is provided with rows of very delicate, mobile, plumose hairs (fig. 57), about 6-8 in a row; a few scattered smaller ones occur on the basal joints. The terminal joints of all the peræopods are extremely long and slender, the first four with the tip recurved (fig. 62), the fifth with a distinct nail (fig. 63); all carry the long, stiff, feathered seta proximally, longest on the 5th. The 1st and 5th fingers are subequal to each other in length, the 2nd and 3rd a little longer, the 4th the longest.

Male. 'Huxley' specimen.—The basal joints of the hinder peræopods differ from those of the female in having the anterior portion much more produced downwards, forming in the 3rd and 4th peræopods, a large rounded pellucid lobe extending considerably beyond the level of the posterior expansion, and nearly covering the succeeding joint (text-fig. 279). On the under side of these joints is a slight longitudinal expansion setting out at right angles to the joint, and terminating distally in an acute projection tipped with 3 sensory spines, one of great length. The

Text-fig. 279.



Rhachotropis helleri Boeck.

Fourth peræopod of the male, showing the anterior lobe of the basal joint.

basal joint of the 5th peræopod is much larger than the preceding, with anterior and posterior lobes at the same level. A ciliated hair is found midway on the hind margin of peræopods 3-5, and peræopod 4 also carries a remarkably long ciliated hair proximally.

Pleopods. Male. 'Huxley' specimen.—Rami but little longer than the peduncle in the 1st pleopod, half as long again in the 3rd; coupling-spines large, more dentate on the left pleopod than on the right (see figs. 64, 65). The peduncle of the 1st pleopod