

II. On *Splanchnotrophus*, an undescribed Genus of Crustacea, parasitic in Nudibranchiate Mollusca. By ALBANY HANCOCK, F.L.S., and the Rev. ALFRED MERLE NORMAN, M.A.

(Plates XV. & XVI.)

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IN the 'Monograph of the British Nudibranchiate Mollusca,' Messrs. Alder and Hancock briefly described and figured three or four new forms of Entomostraca which had been found infesting the Nudibranchs. This was done partly to illustrate the history of these beautiful Mollusca, but mainly with the view of directing the attention of those naturalists who might be interested in the subject to the parasites. It was therefore unnecessary on that occasion to go into much detail; and, indeed, the material then at disposal was too limited to enable this to be done. Recently, however, Mr. Hancock has obtained a fresh supply of specimens of two of the forms; and as their characters are very abnormal, and consequently possess much interest to the systematist, we propose to give in this communication as complete a description of them as we are able—though this description must still be imperfect in many anatomical details, since the number of specimens even now at our command is not great.

The species which occurred in *Doris tuberculata*, figured plate 45. fig. 10, as well as that which was taken on *Antiopa cristata*, were referred in the monograph to *Ergasilus*. Leydig has, however, constituted a genus under the name of *Doridicola**, to which these parasites would appear more properly to belong. We hope, however, hereafter to have the opportunity of giving a more detailed account of these animals, which are active little beings, and have been observed flitting about from place to place on the surface of the infested animals, or resting and anchoring themselves by their long prehensile antennæ amidst the gills of *Doris* or the papillæ of *Eolis*, there, no doubt, to seek their required nourishment.

It is not, however, with such neat, agile, and sprightly forms that we have to do on the present occasion. The creatures which now claim our attention are ill-formed and monstrous-looking; they live constantly attached to one place, and are almost motionless.

Two species of these curious animals have occurred. Both are internal parasites, lying buried within the visceral chamber of their victims. The minute caudal extremity and the ovigerous sacs of the female, however, appear at the surface.

The one species was obtained in *Doris pilosa* from the coast of Devonshire, and has since also occurred in *Idalia aspersa*, taken on the west coast of Ireland, either at the Isles of Arran or Birterbury Bay. The other species has been found in *Eolis rufibranchialis* and *Doto coronata*, captured on the shores of Northumberland. Mr. H. T. Mennell and Mr. Hancock found three individuals of the latter species in April of last year, which

* Leydig, "Neuer Schmarotzerkrebs auf einem Weichthier," Zeitschr. f. wiss. Zool. vol. iv. (1853) pp. 377-382.
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were infesting the *Doto* in rock-pools at Cullercoats; and it is chiefly from these specimens that the description of the species has been drawn up.

These two animals are so unlike all known forms, that it is necessary to establish a new genus for their reception, which we propose thus to characterise:—

Fam. CHONDRACANTHIDÆ.

Genus SPLANCHNOTROPHUS*, n. g.

Femine cephalothorax uni- vel bi-annulatus, appendicibus utrinque elongatis, simplicibus, cylindricis instructus. Antennæ primæ minutæ; secundæ majores, prehensiles. Maxillipedes cum mandibulis maxillisque juxta os positi. Pedum thoracorum duo paria non natatoria, unguiculata. Abdomen biannulatum; annulus posterior appendicibus caudalibus stiligeris confectus. Ova externa, in sacculos ellipticos aggregata.

Mas perpusillus, a femina cephalothorace quadriannulato, appendicibus lateralibus carente differt. Species nobis cognitæ Molluscorum Nudibranchiatorum viscera habitant.

Female. Head and thorax either blended into a single segment, the thoracic portion of which is furnished on each side with unarticulated arm-like appendages or lobes, or the first part only of the thorax is united with the head, and the last part forms a second, but comparatively minute, segment. In this case, however, all the thoracic appendages are attached to the first segment. First antennæ minute and few-jointed; second larger, in the form of prehensile hooks. Labrum large, overhanging the mandibles, which organs, together with the maxillæ and two pairs of foot-jaws, are minute and crowded round the mouth. Thoracic feet, two pairs, minute, simple or two-branched, terminating in hooks. Abdomen two-jointed, the last joint ending in two caudal appendages, which are furnished with one or two simple setæ. Oviparous sacs elliptical.

Male minute. Cephalothorax without lateral appendages, and divided into four segments, the first of which bears the two pairs of thoracic feet.

The species which have as yet been discovered inhabit the bodies of Nudibranchiate Mollusca, lodged beneath the skin, and feeding on the viscera.

The presence of true thoracic feet, and the extent of development of the abdomen in both sexes, and also the perfect segmentation of the thorax in the male, all point to the claim which *Splanchnotrophus* has to take its position at the head of the family to which we have assigned it.

The genus shows affinity to many allies in the development of its several organs. In the structure of the antennæ, and the general arrangement of the parts about the mouth—in the deficiency of segmentation of the thorax of the female, and the atrophy of the posterior pairs of feet—in the character of the egg-sacs, and in the vast disproportion of size between the sexes, we find our authority for associating *Splanchnotrophus* with the Chondracanthidæ. Again, in the presence of the curious produced appendages which take their origin from the sides of the thorax, we are reminded of *Chondracanthus* more especially, while the exact structure of the oral organs finds its nearest counterpart in the mouth of the male of that same genus, as will be more particularly pointed out in the specific descriptions; the presence of ambulatory thoracic feet is paralleled in

* σπλάγχνα, the viscera; τρέφειν, to nourish.

Kroyer's genus *Selius*; while a similarly well-developed abdomen is to be found in *Tucca impressa*.

The most remarkable characteristic, however, of this genus is to be found in the degree of development of the thorax of the male. Posterior to the two pair of foot-jaws, and, like them, attached to the first cephalothoracic segment, we find two pairs of feet, the representative appendages of two thoracic segments; and posterior again to these, and between them and the first abdominal or genital segment, there are three distinct segments, and these constitute therefore the third, fourth, and fifth of the thorax. We search in vain throughout the whole order of the Pœcilopoda for an analogous instance of thoracic development. Even among the Caligidae, where we meet with four pairs of thoracic appendages, the representative of the fifth segment cannot be distinguished, since that segment which is the seat of the external generative organs, from which issue the ovigerous sacs, and which has been regarded by Milne-Edwards and other authors as the last thoracic, is not so, but the first or, according to Dana, the equivalent of the first and second abdominal segments.

SPLANCHNOTROPHUS GRACILIS, n. s. (Pl. XV. & Pl. XVI. figs. 7-10.)

Parasite of *Doris pilosa*, Alder and Hancock, Brit. Nud. Moll. p. 26, pl. 45. figs. 6-9.

In *feminis* cephalothorax elongatus, gracilis. Appendices thoracicæ utrinque tres, longissimæ, maxime attenuatæ, toto corpore longiores dimidio. Pedes biramei (ramus unus perbrevis), articulati; ungues graciles. Annulus genitalis lageniformis, cephalothorace angustior, postice dilatatus, bilobatus. Appendices caudales minutæ, stilo uno non plumoso instructæ.

Long. vix $\frac{1}{4}$ uncia; lat. (appendicibus lateralibus computatis) $\frac{3}{4}$ uncia.

In *maribus* cephalothorax quadriarticulatus; annulus primus oblongus, pedum duobus paribus at non appendicibus lateralibus instructus; annulus secundus, tertius quartusque ejusdem latitudinis primoque segmento multo angustiores. Abdomen capitisque membra iisdem feminæ similia.

Long. $\frac{1}{16}$ unc.; lat. $\frac{1}{32}$ unc.

Sub pelle tectus *Doridis pilosæ* et *Idaliæ aspersæ* visceribus vescitur.

The Female.

The body is elongated, slightly depressed, of nearly equal diameter throughout, and covered with a tough though yielding membrane. The cephalothorax, which occupies by far the greatest portion of the body, is produced at the sides into three pairs of lateral processes, placed a little apart from each other. These processes (Pl. XV. fig. 1 *b*) are inarticulate, soft, and cylindrical, very long and slender, being fully half as long again as the total length of the body, and gradually taper to fine points. The head, though blended with, is somewhat narrower than the thorax, and projects a little forwards. The posterior extremity of the thorax is prolonged backwards beyond the origin of the last pair of thoracic processes. The sides of this portion are concave (Pl. XV. fig. 2 *a*); and it is produced behind into two obtuse lateral lobes, and in some instances has the appearance of forming a distinct segment—a depressed line dividing it from the thorax at the

very point where analogy with *S. brevipes* would lead us to expect such a division. We should therefore perhaps be wrong to describe the cephalothorax as consisting of one segment only.

The first antennæ (Pl. XV. fig. 3 *a*), which are minute and concealed beneath the head, are three- or four-jointed. The basal and largest joint is furnished with three, and the second joint with one or two, stout spines on the inner margin. The second antennæ (Pl. XV. fig. 3 *b*) are comparatively large. They consist of a large, fleshy basal joint and a tapering, hook-formed second joint. The stout hook is bent inwards, and has on its outer margin two spines, that nearest to the extremity being the longer; at the base of the hook there is also a stout process, terminating in a short spine. The mouth lies between the second antennæ, and is provided with a largely developed subtriangular labrum. The rounded apex of the triangle (Pl. XV. fig. 3 *c*) is situated between the roots of the second antennæ, while the base overhangs the oral orifice, and to a considerable extent conceals the underlying mandibles with its produced and rounded angles. The mandibles (Pl. XV. fig. 3 *d*, and Pl. XVI. fig. 8) are small, and placed close to the sides of the mouth; the basal portion is soft and flexible, and, tapering a little, gives support to a flattened chitinous process, which is a little enlarged, obtuse, and recurved at the extremity, and bears three or four denticles. The maxillæ (Pl. XV. fig. 3 *e*), which are so minute as to be quite rudimentary, lie immediately behind and within the mandibles, in the form of ovate fleshy processes, bearing, though it could not always be seen, an exceedingly delicate styliform organ, slightly curved, and inclining inwards and forwards. The first pair of foot-jaws (Pl. XV. fig. 3 *f*, and Pl. XVI. fig. 9) are of about the same size as the mandibles. They project inwards and forwards, are soft and flexible at the base, which, after slightly tapering, is surmounted by a styliform process, a little curved at the point, and, as seen in some positions, appearing a little denticulated; but whether this was really the case could not be satisfactorily determined. The second pair of foot-jaws (Pl. XV. fig. 3 *g*) are very peculiar in character, and difficult to observe. They are small, like most of the other oral organs. At first they are considerably attenuated, but, passing inwards and forwards, they suddenly enlarge; their inner margins come into contact with each other, and are thus projected side by side between the first foot-jaws and maxillæ, until they almost reach the labrum. The extremity of each appears to be furnished with a curved process; but its exact form could not be ascertained.

There are two pairs of thoracic feet (Pl. XV. figs. 1 *a*, 5, & 6). These feet are of similar structure to each other. Those of each pair are widely separated. They are composed of three or four indistinct articulations, which gradually taper, the last joint being very slender and terminating in a delicate hook. The basal joint is stout and thick, and gives off from its inner margin a short, obtuse process (*a*, figs. 5 & 6), which represents the usual second branch or member of these feet; and the second or third is furnished with three or four minute spines.

The abdomen (Pl. XV. fig. 1 *c*) is composed of two articulations, the first of which (fig. 2 *b*), or genital segment, is somewhat flask-shaped, considerably narrower than the posterior extremity of the cephalothorax in front, but widening behind and produced into two blunt lobes on each side of the origin of the second abdominal segment. This

second segment is quite rudimentary, but suffices to give support to two extremely minute caudal appendages, each of which has a short terminal seta.

The ovigerous sacs have not been seen entire; but in most instances the remains of them were found adhering to the sides of the first abdominal segment, and in some cases they contained a few eggs of a yellow colour. The sacs were of an elongated-oval form, and the eggs agglomerated within,—an arrangement which appears to be as universal in the family of Chondracanthidæ as is the disposition of the ova in single file among the Caligidæ.

Length of the body nearly a quarter of an inch; breadth, from tip to tip of the lateral processes, upwards of three-quarters of an inch.

The Male.

The cephalothorax in the male (Pl. XV. figs. 7, 8) is composed of four articulations. The first of these is very large as compared with the rest, subquadrilateral in form, and having the posterior angles well rounded. The cephalic portion is narrower than the thoracic, and projects considerably forward. It is somewhat squared in front, and bears a single eye near the centre. The first antennæ (Pl. XVI. fig. 7) are similar to those of the female, except that there is a strong seta on the outer margin of the second or third, and several of less size on the terminal joint. The second antennæ and organs of the mouth (Pl. XV. fig. 9) are likewise similar to those of the female. The male, too, has two pairs of thoracic feet, which in position and character agree with the same organs in the other sex, only that they are relatively larger, and the second or rudimentary branch springing from the basal joint is more largely developed (Pl. XV. fig. 10 *a*), and the minute spines on the second and third joints have not been observed. The second, third, and fourth segments, in consequence of their greatly diminished size as compared with the first, both in length and breadth, and their close agreement in these respects with the segments posterior to them, might readily be mistaken for abdominal members, were it not that their position anterior to the genital segment clearly proves them to be thoracic. They are scarcely one-third the width of the first segment; the breadth of each slightly exceeds the length; and they are unprovided with appendages. Taken together with the abdominal segments, they form, as it were, a gradually tapering tail, appended to the greatly developed anterior segment.

The abdomen is two-jointed. On each side of the first of these segments, at its junction with the second, is seen a tubercular swelling, which is perforated, and through which a curved process—the male intromittent organ (Pl. XV. fig. 11 *e*)—is usually protruded. The last segment is small, tapers backwards, and supports two caudal processes, each of which terminates in a short, stoutish seta.

Length of body $\frac{1}{16}$ th of an inch; breadth of the same $\frac{1}{32}$ nd of an inch.

Several females of this species have been obtained from specimens of *Doris pilosa*, which had been taken on the Devonshire coast; and one has occurred in *Idalia aspersa*, from the West of Ireland. There is never more than one individual found in the same Nudibranch, and this invariably occupies the same position, resting upon the under surface of the liver-mass and embracing two-thirds of it with its long, attenuated lateral

processes. The under surface of the parasite is pressed to the liver, the anterior extremity forward, but the posterior extending as far back as the region of the branchial circle; here the two last segments of the body penetrate the skin of the Nudibranch, to which they are firmly attached, so that the parasite becomes thus fixed in its position. It is a remarkable fact that this penetration and attachment always take place within the branchial circle; and consequently the ovigerous sacs must float amidst the plumes, and be always exposed to the constant flow of water brought thither by the branchial cilia.

The males are found only in those mollusks in which the females have taken up their abode; and generally several of the former are associated with a single example of the latter: as many as a dozen are occasionally thus found with the female, though more generally three or four, and sometimes only one or two. They always live immediately beneath the skin, either adhering to the viscera (usually the liver-mass, consisting of the ovary and liver) or to the female, close to the vaginal openings of the first abdominal articulation. It is from these facts, and more especially from the circumstance of its frequent attachment to the body of the female, as is the case with the males of *Chondracanthus*, *Lerneonema*, *Brachiella*, *Ancorella*, *Lerneopoda*, and other allied genera, that this animal is assumed to be the male of the present species. The characters of its antennæ, oral organs, foot-jaws, and thoracic feet (all of which, as before shown, closely resemble those organs in the female) strongly corroborate this opinion; and this similitude of parts could scarcely have been expected in such dissimilar animals on any other hypothesis. That they are males seems, moreover, to be established by the fact that, although between thirty and forty individuals have been examined, not one possessed ovigerous sacs or presented any appearance of such sacs having ever existed, whilst in every instance those organs which we take to be the male intromittent apparatus were present.

The startling fact of these individuals being furnished with an eye appears to bear upon this question. It is very extraordinary that we should meet with a visual organ in an internal parasite; and its presence in this case is an assurance that some peculiar necessity demands its existence.

The male lives free within the visceral cavity of the animal it inhabits, and undoubtedly enjoys a limited degree of locomotion. The thoracic feet, which are well placed for such a purpose, are therefore relatively larger than those of the female, in which they seem merely to assist in holding the parasite in its proper position. The male, being thus endowed with the power of transferring itself from place to place, might be liable to wander among the viscera into the interior of the body. It is required, however, to remain on the surface of the visceral organs, immediately beneath the skin, where the female resides permanently attached, and where the male is therefore required to exercise its sexual function. An eye is therefore given to it, which, though extremely low in structure, is sufficient for the perception of light, which is all that is necessary to enable the creature to retain its position on the surface of the viscera immediately below the skin. That the skin possesses the requisite degree of transparency for this purpose is proved by the fact that the comparatively highly organized eyes of the *Doris* itself are placed beneath the dermal envelope.

SPLANCHNOTROPHUS BREVIPES, n. sp. (Pl. XVI. figs. 1-6.)

Cephalothorax *feminæ* brevis, robustus. Appendices thoracicæ crassæ, corporis longitudine breviores. Pedes uniramei, inarticulati; ungues fortes. Annulus genitalis transversim oblongus, postice incisus. Appendices caudales setis tribus non plumosis instructæ.

Mas ignotus.

Longitudo $\frac{1}{4}$ unc.; lat. $\frac{1}{8}$ unc.

Doto coronata atque *Eolis rufibranchialis* huic speciei visceribus victum præbent.

The first segment of the cephalothorax in the female is thick, a little depressed, and not much longer than broad. That portion of it which belongs to the head projects slightly in advance, and is rounded in front, while, behind, the segment suddenly tapers to its junction with the second. On each side there are three stout, inarticulated, tapering processes, the bases of which meet each other at their junction with the thorax. These lateral processes are shorter than the length of the segment from which they originate. The radiating disposition of these curious arm-like appendages give to the animal a stellate appearance; and with them it clasps the viscera of the Nudibranch within which it has taken up its abode.

The antennæ and the whole of the apparatus of the mouth closely resemble the same organs as they have been described in *S. gracilis*. In neither species could the exact form of the extremely minute maxillæ be determined; nor could it be satisfactorily ascertained whether the extremity of the first pair of foot-jaws was denticulated, though in this as well as in the first species, as viewed in certain aspects, it appeared to be so.

The two pairs of thoracic feet (Pl. XVI. figs. 2 a & 5) are quite in a rudimentary condition, and reduced to mere hooks of no great size. The first pair are placed on the anterior portion of the thorax, rather far apart from each other, with their points inclining inwards. The second pair are situated at some distance behind the first, and in a line with them.

The second cephalothoracic segment (Pl. XVI. fig. 4 b) is minute, transversely oblong, and unprovided with appendages. It is of the same width as the tapering extremity of the first segment, and the sides are gently rounded.

The first abdominal (Pl. XVI. fig. 4 c) is slightly narrower than the preceding articulation. In form it is transversely oblong, with the posterior margin hollowed out centrally. The second abdominal segment (fig. 4 e) is very small, and subquadrilateral. It gives support to the tail, which is of the usual bifid form, each portion being apparently composed of two articulations, the last of which is much the smaller, and terminates in a short seta. There are also two minute setæ at the external margin of each of the caudal processes.

The ovigerous sacs (Pl. XVI. fig. 2 c) are oval, and nearly as long as the body of the animal. They issue from the posterior angles of the first abdominal segment. The eggs are rather large, and of a pale yellow colour.

The male has not been observed.

Three individuals of this grotesque form were obtained from as many specimens of

Doto coronata found in rock-pools at Cullercoats, on the Northumberland coast, by Mr. A. Hancock and Mr. H. T. Mennell, in the early part of last year. A few specimens had occurred some years ago on the same coast, and are mentioned in the 'Monograph of the British Nudibranchiate Mollusca,' at p. 26. One of these latter examples was imbedded in *Eolis rufibranchialis*, and had the ovigerous sacs, which were large and more irregular in form than usual, of a rose-colour and protruding in the region of the dorsal tentacles. This may probably prove to be a distinct species.

The three specimens obtained at Cullercoats had all taken up their residence immediately below the dorsal skin in the neighbourhood of the heart. They lay across the visceral chamber, resting with their under surface upon the alimentary tube and ovary, which they clasped with their lateral processes; the thorax, moreover, is undoubtedly held close to these parts by the two pairs of hook-formed thoracic feet, while the large uncinæ antennæ lock the head also to the part attacked.

As in the former species, the abdomen penetrates the skin, in this instance amidst the dorsal or branchial papillæ. Here the ovigerous sacs, which are about as large as those organs, float, bathed, no doubt, by the branchial currents of the unfortunate *Doto*; so that the eggs are thus vivified by the organic labour of the sustaining animal, as is the case also in the species first described.

The two parasites forming the subject of this communication are remarkable for their great size in comparison with the animals which they infest. *Splanchnotrophus gracilis* is not very much shorter than the length of the liver upon which it lies, and which it almost encircles with its arm-like processes; while *Splanchnotrophus brevipes* nearly occupies one-third of the visceral cavity of *Doto coronata*, and lives in a position where it might be thought to interfere with the central organs of circulation; and in the case of *Eolis rufibranchialis*, before alluded to, the parasite must have been in contact with the cerebral ganglions. Yet these animals seemed perfectly unconscious of the presence of the insidious foe that was feeding upon their life's blood. They moved about apparently quite at their ease, and were in no way distinguishable from unafflicted individuals, except by the presence of the protruding ovigerous sacs of the parasite. They had mostly attained their full growth, and there seemed every probability of their living the usual time allotted to the life of the species. When they perish, the contained parasite must perish also; for it is an inert, helpless creature, quite incapable of any active exertion in search of food or for self-preservation. No doubt, however, in the larval state it is endowed with the locomotive powers necessary to enable it to approach, select, and take up its abode in the creature most suited to its economy, where, soon losing the higher powers of its youthful state, never again to assume them, it becomes fixed for the remainder of its life.

The parasite, lodged within the body of its selected victim, is entirely cut off from the aërating influence of the surrounding water, with the exception of the tip of its microscopic abdomen and the ovigerous sacs. In the male, however, no part of the animal is exposed. Gills to a creature so situated could be of no use, and here it is quite impossible for any part of the surface of the parasite to act as their substitute. All internal parasites are similarly circumstanced as regards their respiration, and they, as well as the species

under consideration, must derive their oxygen from that absorbed by the animals they infest. They extract it, most probably, either directly from the blood or from the exuded serum, which will at once nourish and aërate the tissues of the parasites, in the same manner as it acts upon the tissues of the animals from which they extract it. It is apparently in consequence of this low condition of the respiratory function that the ovigerous sacs of the parasite are placed, as we have seen, in the vicinity of the gills of the Nudi-branch, where the ova obtain the advantage of the branchial currents of the infested animal. And it is interesting to remark that most of the allied forms of *Lerneoidea*, in which there are no respiratory organs, take up their abode on the gills of the sustaining animal, or at least in such a position that the branchial currents must pass over them. The *Caligoidea*, moreover, in which the respiratory organs are of low functional significance, avail themselves of the aid thus afforded by the animals they inhabit, some taking up their abode on the gills, others near to the fins of various fishes, whilst even those which attach themselves to the surface of the body are exposed to the almost perpetual currents occasioned by the general movements of the fish through the water.

In consequence of the opacity and soft condition of the specimen examined, the internal anatomy could not be made out; but, from the perfectly animalized nature of the food, we may fairly assume that the alimentary canal is very simple in its structure. We have seen that the organs of the mouth are minute and feeble, formed apparently for piercing and wounding the tissues, so that the fluids may escape. The fluids are imbibed perhaps chiefly by the aid of the largely developed labrum; for, although it is not in the form of a suctorial proboscis or tube, yet the posterior angles, which we have described as considerably produced, may, in life, be still more so, and perhaps entirely encircle the mandibles, so that an incomplete suctorial disk or tube may thus be extemporized.

Neither has much respecting the reproductive system been satisfactorily determined. The ovaries are lobulated organs, and occupy the greater portion of the cavity of the thorax, extending into the arm-like lateral processes even to their extremities. The ovigerous sacs are appended to the lateral angles of the first abdominal segment, through which each communicates with its ovary by a slit-like orifice placed diagonally (Pl. XV. fig. 4 *b*, & Pl. XVI. fig. 3). In one instance the sacs disappeared the second day after capture, and in the course of a few hours were replaced by others, in which the ova were evidently in a much less advanced condition of development.

The testes appear to be irregular-formed masses, lying in the thoracic cavity, in contact with and on either side of the alimentary canal. There are two elongated pyriform seminal vesicles (Pl. XV. fig. 11 *d*), placed in the posterior thoracic segments, with their attenuated extremities directed downwards, and terminating at the sides in two tubercular swellings (Pl. XV. fig. 11 *e*, & Pl. XVI. fig. 10) situated at the junction of the genital and succeeding abdominal segments. These swellings are the roots of the intromittent organs, through which their extremities may be seen occasionally protruding in the form of curved processes of no great length. They each communicate with their respective seminal vesicle by a short constricted duct-like tube, but the connexion of these vesicles with the testes could not be determined.

There can be no doubt that our two new parasites are rightly associated with the

Chondracanthidæ. In comparing the genus *Chondracanthus* with *Splanchnotrophus*, we see this relationship in the structure of the antennæ, the first pair in both being formed of few joints, the second pair in both assuming the form of strong prehensile hooks. It is, however, in the oral apparatus that this connexion is most evident. Both genera are provided with a largely developed labrum, which overhangs the oral orifice and mandibles, and is apparently capable, both in the one and the other, of encircling these latter organs within a sort of short imperfect suctorial tube or disk. In both, too, we observe the same peculiar rudimentary condition of the maxillæ; while the two pairs of foot-jaws have much in common: they are closely approximate to the mouth in each; but the second in the female of *Chondracanthus* are large, and have a transverse direction, instead of being directed forwards side by side as in *Splanchnotrophus*; it is satisfactory, however, to find that in the male of the former genus the second pair of foot-jaws are no larger than the first, and assume a longitudinal position between them and the maxillæ, exactly as is the case in the new forms described.

The connexion of *Splanchnotrophus* with *Chondracanthus* is likewise seen in the peculiar lateral appendages of the former. The remarkable conformation of these structures, together with the fact that they are used as clasping-members with which the animal enwraps the viscera on which it feeds, might lead the observer to entertain the impression that they were the homologues of thoracic feet. This, however, is not the case: they arise from the sides, not from the front, of the thorax, and are clearly digitiform processes of that division of the body, similar to those we find to exist in *Chondracanthus*; for the thorax of this latter genus is furnished in front with two pairs of organs, which are transformed thoracic feet, and these are homologues of the two pairs of feet we have described as existing in *Splanchnotrophus*, but, in addition to these two pairs of feet, the sides are produced into more or less numerous lobular or digitiform appendages homologous with the three pairs of simple arm-like processes in our new genus. This is evident from the general resemblance of the parts, and by the fact that in both cases portions of the ovaries are pushed into them. They are thus of a similar nature also to the lateral wing-like expansions of *Nicothoë*, within which portions of the ovaries are also placed; and in *Nicothoë* these expansions cannot be homologous with the thoracic feet, because the full number of these limbs is present in the usual form. Moreover, in *Splanchnotrophus* it is quite impossible for these processes to form part of a series with the thoracic feet, whether or not the latter are the first and second pairs. Indeed, the anterior and posterior lateral processes are respectively in the same transverse line with the two pairs of thoracic feet, and consequently they must be members of the same segments to which the feet belong. If therefore those organs which we have called thoracic feet be really so (and of this there can scarcely be a doubt), then the lateral arm-like appendages cannot represent them, and the conclusion is forced upon us that they are merely thoracic processes.

In further proof of the close relationship existing between *Splanchnotrophus* and *Chondracanthus* it is only necessary to look at the males of the two forms. In both genera they are minute, and in general appearance resemble each other, having the anterior cephalothoracic segment large, and the rest of the body attenuated and produced.

In the male *Chondracanthus*, too, the thorax and abdomen are nearly as well developed as in the new forms, only the segments are not so distinctly marked; and on the under side of the thorax, immediately behind the oral organs, there are two pairs of minute appendages, each bearing a seta and a stout process, which are the homologues of the two pairs of thoracic feet, and go far to prove the intimate relation of the genera. The oral organs also in the two males are even more alike than they are in the females—the second pair of foot-jaws closely resembling each other, while in the latter they exhibit some disparity.

Nicothoë likewise seems to be in some degree connected with our new form, though not by any means so intimately as is *Chondracanthus*. The lateral thoracic ovigerous appendages in the female, and the aggregation of the external ova in sacs, are evidences of this connexion. But the complete segmentation of the body and limbs in both sexes seems to place this genus in close proximity to the Cyclopoidea, though the peculiar character of the oral organs shows its affinity to the Pœcilopoda.

EXPLANATION OF THE PLATES.

PLATE XV.

- Fig. 1. *Splanchnotrophus gracilis*, female; ventral view, much enlarged: (a) thoracic feet; (b) lateral arm-like processes; (c) first abdominal segment, with portions of the ovigerous sacs attached.
- Fig. 2. Ventral view of the posterior portion of the body of the same, more highly magnified: (a) terminal extremity of the thorax, exhibiting the appearance of forming a distinct segment; (b) first abdominal segment, with remains of ovigerous sacs appended; (c) second or terminal segment, forming the bifid tail; (d) posterior pair of thoracic feet; (e) roots of posterior pair of lateral processes.
- Fig. 3. Much-enlarged view of the oral organs of the same, as observed under slight compression: (a) first antennæ; (b) second antennæ; (c) labrum; (d) mandibles; (e) maxillæ; (f) first foot-jaws; (g) second foot-jaws.
- Fig. 4. View of the abdomen of the same, as seen in the compressor: (a) first segment; (b) orifice for the passage of the eggs into the ovigerous sacs (c); (d) second segment; (e) tail.
- Fig. 5. Anterior thoracic foot, much enlarged: (a) second member of the same.
- Fig. 6. Posterior thoracic foot: (a) second member.
- Fig. 7. *Splanchnotrophus gracilis*, male; enlarged lateral view: (a) first antennæ; (b) second antennæ; (c) thoracic feet; (d) first abdominal segment.
- Fig. 8. Ventral view of the same, exhibiting the antennæ, oral organs, and thoracic feet.
- Fig. 9. Much-enlarged view of the oral organs of the same, seen by reflected light: (a) labrum; (b) mandibles; (c) maxillæ; (d) first foot-jaws; (e) second foot-jaws.
- Fig. 10. One of the thoracic feet of the male, highly magnified.
- Fig. 11. Highly magnified view of the terminal tail-like segments of the body, seen by transmitted light: (a, a, a) the three posterior thoracic segments; (b, b) abdominal segments; (c) tail; (d) seminal vesicles; (e, e) male intromittent organs.

PLATE XVI.

- Fig. 1. Enlarged view of *Doto coronata*, laid open along the back, to exhibit an enclosed *Splanchnotrophus brevipes* in its natural position : (a) dorsal surface of the parasite ; (b) ovigerous sacs.
- Fig. 2. *Splanchnotrophus brevipes*, female, ventral view : (a) thoracic feet ; (b) lateral processes ; (c) ovigerous sacs.
- Fig. 3. Ventral view of the abdominal segments of the same, as seen in the compressor, much enlarged : (a) first segment, exhibiting the orifices for the escape of the eggs into the external sacs ; (b) portions of the sacs ; (c) posterior segment ; (d) tail.
- Fig. 4. Dorsal view of terminal extremity of the body of the same : (a) portion of the first thoracic segment ; (b) second thoracic segment ; (c) first abdominal segment ; (d) fragments of the ovigerous sacs attached to the same ; (e) second abdominal segment, supporting the tail.
- Fig. 5. A thoracic foot of the same.
- Fig. 6. Enlarged view of one of the first antennæ, as imperfectly observed.
- Fig. 7. First antenna of male of *Splanchnotrophus gracilis*.
- Fig. 8. Mandible of the same, much enlarged.
- Fig. 9. First foot-jaw of the same, as it occasionally appears, denticulated.
- Fig. 10. One of the male intromittent organs, highly magnified.