

XI.—On the Metamorphoses of the Prawns. (First Memoir.)

By Dr. FRITZ MÜLLER of Desterro*.

[Plate IV.]

MILNE-EDWARDS indicated, as probably the larva of *Peneus*, a small Crustacean which had previously been referred to the Schizopoda as forming the genus *Cryptopus* of Latreille. I observed several species of small Crustacea approaching still more closely to the Schizopoda, and agreeing with *Cryptopus* and *Peneus* in the possession of three pairs of cheliform feet, and have been able to trace them back to *Mysis*-forms destitute of chelæ, thence to the form of a *Zoëa*, and one species still further to a *Nauplius*-form, and consequently to that fundamental young form which unites the Rhizocephala and Lernææ with the Cirripedes and the numerous group of the Cyclopidæ.

Of the *Zoëa*-form five different species were observed, and some of them pretty plentifully during the whole summer; the unaltered *Nauplius*-form, probably the same in which the animal escapes from the egg, came under notice only once (on the 13th December) †.

The body of this youngest larva (Pl. IV. fig. 1) is destitute of segments, pyriform, 0.4 mill. in length, rounded, and 0.2 mill. in breadth in front, and diminished behind to $\frac{1}{5}$ th of the length of the body, truncated, and slightly emarginated. Near the anterior margin stands a small, black, sharply defined eye. The posterior margin bears on each side a strong straight bristle, of half the length of the body, and near this a short spine. From the lower surface of the body spring six slender feet, furnished with long setæ, of which the anterior and intermediate attain four-fifths and the posterior about half the length of the body. The anterior are placed close to the frontal margin, the intermediate pair immediately behind these, and the posterior about the middle of the body. The anterior are simple, the intermediate and posterior biramose; the posterior branch appears to be the immediate continuation of the stem, and is stronger and, in the hinder feet, also much longer than the anterior branch. No distinct joints are to be detected in the feet, but indications of four or five joints may be seen in the posterior branch of the intermediate feet. A strong bristle, as long as the body, stands with some shorter ones at the apex of the anterior feet; the inter-

* Translated by W. S. Dallas, F.L.S., from Wiegmann's 'Archiv,' 1863, p. 8.

† This proves that, at least at the breeding-season, the parents do not reside in the vicinity of the shore, as otherwise the youngest larvæ must have been the most abundant. A species nearly allied to *Peneus Caramote*, which is frequently eaten here under the name of *Camarao* occurs sparingly in the market in summer, and scarcely ever above the middle size.

mediate feet have two bristles at the apex of the anterior branch, and six on the anterior margin and apex of the posterior branch; and each branch of the posterior feet has two bristles at its apex and one below this point.

The little animal is rather opaque, and of a brownish colour, which is more strongly marked at the apices of the feet. The structure of the mouth and of the internal organs was not observed.

The somewhat flexible feet, with their few long bristles, form no very effective motory apparatus. A man floating perpendicularly in the water, with widespread arms and slender willow-branches in each hand, striving to work himself upward, would furnish a notion of the peculiar movement by which this *Nauplius* and the *Zoëa* proceeding from it may be recognized at the first glance amongst hundreds of other small Crustacea*.

In a rather larger larva (0.5 mill. in length), taken on the 13th of January, which agreed in the general form of the body, in the structure of the feet, and in colour with the preceding one, the posterior extremity was drawn out into two thick conical processes, at the apices of which stood the two long caudal bristles, each accompanied on the inside by two and on the outside by three shorter and partly spiniform bristles. The number of bristles on the intermediate feet had also increased. As the first indication of the carapace, a transverse fold ran across the back, nearly in the middle of the body. The posterior feet were placed more anteriorly and nearer the median line, towards the mouth, which is situated between them; before the mouth, between the intermediate feet, was a large helmet-shaped upper lip. The short stem of these feet had become thickened almost into a globular form; some new part was evidently being formed in its interior, the outlines of which, however, were not yet distinct. Behind the mouth, and filling the median third of the body, four pairs of long and plump lobes had sprouted from the ventral surface, and, inclining backwards, had applied themselves to the body. In the form of the first two pairs the future lower jaws could already be recognized.

This larva is closely approached by four others, probably belonging to the same swarm, which were taken at the same time (24th of January). In the swelling at the base of the posterior

* From this peculiar movement, observed with the naked eye, I recognized the little animal just described as the larva of *Peneus*; microscopic examination made this opinion appear, if not erroneous, at least extremely improbable. A month later, intermediate forms occurred which showed the naked eye to have been right, in opposition to the microscope; the latter alone would probably never have led me to suspect the true nature of my *Nauplius*.

feet (fig. 2), the outlines of the future upper jaw may be distinctly recognized; the living contents are more or less completely withdrawn from the posterior ramus; the anterior ramus is still pretty well filled, but we may already see that it will be destitute of bristles after the change of skin. Of these feet, therefore, besides the stem which becomes converted into the upper jaw, only a short bristleless stump will remain. (An organ of this kind, rendered very striking by its dark brownish colour, was in fact observed once [on the 3rd of January] in a very young *Zoëa*; but even this soon disappears completely). Between the origins of the anterior feet two ganglia of considerable size, contiguous in the median line, may now be distinguished. In the anterior angle between these two ganglia the eye is situated, surrounded by numerous small orange-coloured globules (oil-drops?). Over the eye, and concealing it from above, a turbid finely granular tissue has been formed; from each side of this springs a small transparent button, projecting in a hemispherical form beyond the frontal margin. The intestine, liver, and heart are already present, of the same form as in the younger *Zoëa*.

It is probable, as shown by their bristles being already indicated, that at the next moulting the rudimentary feet become effective, and the *Nauplius* becomes converted into a *Zoëa*, to the appendages of which the names in use for those of the mature animal may be applied with less wresting of their meaning. I therefore henceforward indicate the first two pairs of feet of the *Nauplius* as antennæ, and the third as upper jaws; and of the four new pairs the two anterior as lower jaws, and the hinder as footjaws.

In the *Zoëa*-form (figs. 3-7) our larva was observed from 0·8 to 1·6 mill. in length. During this life-period the two eyes are developed, ten or eleven new segments are formed, with a pair of feet on the first, and rudiments of feet on the five following rings, and, lastly, the lateral caudal appendages are produced. These new parts are of course met with in very variable form; in other respects the animals undergo no important changes, even in size; for their increase in length proceeds almost exclusively from the gradual extension of the eleven new segments.

The carapace, 0·4 to 0·5 mill. long, is at first almost circular and flat, but it soon bends downwards and covers laterally the parts of the mouth and the basal joints of the feet. Posteriorly it exhibits a shallow sinuosity where it lies over the body. Whilst, at its first appearance, it separates from the body behind what are now the upper jaws, the separation is now effected behind the second pair of footjaws, and the carapace projects

freely over two or three of the newly formed segments. Anteriorly it is at first covered by the contiguous eyes (fig. 3); when these subsequently separate, it covers the interspace and the base of the ocular peduncles with a triangular process which runs out into a spine reaching a length of 0.12 mill. (fig. 6). The carapace has no other spiniform processes.

Beneath this anterior part of the carapace and the paired eyes is situated the *single eye*; the entire space between the origins of the anterior antennæ (0.1 mill.) is occupied by two large ganglia which meet in the median line; their anterior surfaces are strongly convex, and over both of them the integument is extended in a nearly semicircular form. From the depths of the free space thus left between the ganglia and the skin a clavate bacillus ("crystalline cone") rises until it nearly reaches the skin; at its lower part it is surrounded by black pigment-granules. The skin appears to me in this species to be destitute of lentiform thickenings.

The *antennæ* still form the chief instruments of locomotion; whilst in all other *Zoëæ* (of the Stomapoda, Crabs, *Porcellanæ*, *Paguri*, and the Prawns which quit the egg in the *Zoëa*-form) they have nothing to do with locomotion.

The *anterior* (inner) *antennæ* (0.4 mill. in length) now appear to be divided into four joints, the first of which occupies nearly half the length; the longest of the three strong apical bristles is nearly twice as long as the antenna. Close to the apical bristles and outside of them, stand one or two delicate bacilli, 0.09 mill. in length; there are one or two more of these a little below the apex on the outside of the terminal joint. The *posterior* (outer) *antennæ* are now close beside the inner ones, and attain only about two-thirds of their length; their thick stem shows two, their inner (anterior) branch three, and their outer (posterior) branch as many as ten joints. As before, the inner branch is but little shorter, although much weaker, than the outer one. The outer branch has as many as ten plumose bristles, of which four stand at the apex and the others at the ends of the six preceding joints.

The large *upper lip* (fig. 4 L) is very much in the form of the helmet of a Prussian soldier, which has only to be imagined rather broader and with its peak considerably enlarged and emarginated in the middle. The helmet, of which the point is directed forwards, is immoveable, and from it muscles pass to the moveable peak which covers the mouth and a part of the upper jaws.

In the examination of the uninjured animal from below, the only part of the powerful *upper jaws* (fig. 4 III) that is seen is a long tooth with two or three points, which projects far beyond the more deeply seated masticatory surface, which is beset with

small ridges and tubercles. At the base of the tooth, towards the masticatory surface, there are several stiff bristles, beset with short spinules (fig. 7). *The upper jaws are destitute of palpi.* This appears to be a peculiarity in which *all Zoëæ* agree with Insects, and which is in this case doubly remarkable, because not only does the perfect animal possess mandibular palpi, but even the younger larvæ have at this place biramose feet, from which the mandibles are produced.

In the *lower jaws* (*maxillæ*, fig. 4 iv, v) we distinguish—1. the peduncle with projections on its inner side, which have almost the appearance of joints, and are beset with strong bristles, partly spiniform and partly toothed or plumose; 2. a multiarticulate apical portion (inner branch?), which bears longer and more delicate bristles on its inside and at its apex; and 3. a small, elongated, lamelliform appendage (outer branch; *fouet*, Milne-Edwards, fig. 4 *a a*), on the margin of which are placed a few delicate setæ. In the first pair of maxillæ (iv) the peduncle has two long, and in the second pair (v) four shorter processes; the apical portion has in the former three, and in the latter five joints.

The *footjaws* (vi, vii) or *maxillipeds* appear to assist but little in locomotion. They consist of a thick peduncle (thickest in the first pair), a long 4-5-jointed inner branch, and a shorter inarticulate outer branch. Besides the apical setæ, there are bristles of various lengths upon the inner margin of the peduncle and of the inner branch, and also upon the outer margin of the outer branch. The first pair is longer and more powerful than the second.

The two branches of the *tail* project, separated by a semicircular notch, nearly at a right angle to each other; they appear to be rounded off at the apex, and twice acquire a new bristle on their inner margin, so that the number of these rises first to seven and then to eight on each branch. The oldest bristle continues to be recognizable by its greater length (0.4 mill.); the outermost bristle (the spine which is present even in the youngest *Nauplius*) continues to be distinguishable from the rest by its being smooth, whilst the others are rendered plumose by short spinules and longer hairs.

The alimentary canal presents no peculiarity; the *anus*, which is at first situated at the apex (Pl. IV. fig. 3), afterwards moves forward on the ventral surface nearly to the middle of the last segment (fig. 6). The *liver*, of a yellowish colour, consists of three pairs of wide tubes (one pair anterior and superior, one pair lateral, and one pair posterior and inferior), and does not differ in its structure from that of other *Zoëæ*.

The *heart* (fig. 3 *h*) occupies the usual position at the end of

that section of the body which is amalgamated with the carapace; with the progressive extension of the carapace the heart likewise moves its position further back. Thus, in the older *Nauplius*, it is situated above the third pair of feet (upper jaws), but now over the sixth and seventh (footjaws). The structure of the heart, however, differs remarkably from that of the older animals, and indeed of the other larvæ of Decapods. It resembles the foremost dilated section of the younger Stomapod larvæ recently described by me. The intercrossing trabeculæ of the interior are wanting, and there are only two fissures for the entrance of the blood, situated on the lower side of the posterior part of the heart. These two fissures are unusually striking; and I think I may state with positive certainty that they are the only ones. I have frequently and for a long time traced the course of the blood-globules through the heart and in its vicinity, and never seen them enter anywhere but here: I have sometimes seen blood-corpuscles coming from the fore part of the body glide along close by the heart, in order to reach these posterior orifices. Moreover the other fissures, which are subsequently easily distinguishable notwithstanding the internal apparatus of trabeculæ, could hardly now be overlooked in the simple sac. One vessel originates at the anterior extremity of the heart, and a second below its rounded posterior extremity. Valves were seen at the origin of the former. Other vessels seem to be wanting. A great part of the blood returning from the anterior part of the body takes a circuitous course through the carapace, as in other *Zoëæ*.

The above are the parts which remain nearly unaltered during the whole of this period.

Of the new parts which make their appearance, the *paired eyes* are to be regarded as the first in order of time; for their earliest traces were already recognizable in the oldest *Nauplius*. They form a mass of considerable size, lying above the anterior part of the carapace, and projecting beyond the frontal margin (fig. 3). Near their external posterior angle a black pigment-spot makes its appearance, from which radiating lines may soon be traced to the surface of the future true eye. Before and within this the thickened visual nerves may be distinguished, behind which there remains a free space, subsequently traversed by a muscle. The eyes, which are at first quite contiguous, now rapidly become separated, so that the central eye and the whole breadth of the ganglia between which it is situated again become visible from above.

Peculiar structures, the signification of which I do not know, and which appear to be deficient in other species observed, are the two hemispherical transparent buttons which project from

the frontal margin even in the oldest *Nauplius*. They appear at first as delicate, nearly globular, limpid vesicles (fig. 3 o), but subsequently as minute, firmer, and more opaque mammiform appendages to the anterior margin of the ocular peduncles during the whole period of larval life (fig. 8 o).

The *new segments*, on which the thoracic and abdominal feet are afterwards developed, form at first an unjointed, soft, short zone, which, however, soon becomes elongated. Before this zone attains the length of the section of the body lying behind it, a division into eleven segments may be detected, although at first this is not very distinct. At first these segments are of nearly equal length, or the anterior ones may even be longer and more distinctly separated; but towards the end of this period the five posterior ones form about one-third of the entire length of the body, whilst the six anterior scarcely constitute one-ninth of it, the remainder of the length being half before and half behind these new segments*. The five posterior new segments (abdominal segments) acquire a short spine at the hinder margin in the middle of the back, and the last of them also one on each side. Of internal parts, only the intestine is at first clearly distinguishable in these new segments; the ganglionic chain is afterwards developed, and it is only towards the end of this period that the muscles become separated into sharply defined bundles.

The *new appendages* sprout from the ventral surface of the corresponding segments at first in the form of simple lobes, which, however, soon show a longer external and shorter internal branch. At first, and indeed when the separation of new segments just begins to be perceptible, the third pair of footjaws and the lateral laminæ of the caudal fan are produced; at a much later period the five pairs of thoracic feet make their appearance at once. Before the conclusion of this period, the branches of the footjaws acquire fully developed setæ, but still remain unjointed; the thoracic feet continue rudimentary and destitute of setæ. The lateral caudal laminæ which are attached directly (without a joint) to the basal joint, acquire a few short

* Whether the first of these eleven rings is already present (as I believe to be the case) at the commencement of this period—in other words, whether all the eleven, or only ten, segments are really to be indicated as new—I must leave undetermined. In the latter case, we should have,—in the first period (*Nauplius*) five original segments (antennæ, mandibles, tail) and the formation of five new ones (for the maxillæ and footjaws); in the second period (*Zoëa*) the formation of 2×5 new segments, of which some (thoracic segments) acquire rudimentary feet in this period, and the others (abdominal segments) only in the third period (*Mysis*-form). This simple relation, however, so far from applying generally, would not even suit all the species of the genus *Peneus*.

bristles, especially the apex of the longer external lamina; the long plumose setæ of a later period are still wanting. By the sprouting forth of the caudal appendages on the ventral surface, our animals are distinguished not only from the *Porcellanæ*, but also from those Prawns which quit the egg in the *Zoëa*-form, and in which, as in *Porcellana*, these lateral caudal laminæ are produced within the broad caudal fin.

The gradual changes which the appearance of the animal undergoes in consequence of the development of the paired eyes and the new body-segments and their appendages, are followed, when it has attained a length of about 1.6 mill., by a new fundamental and sudden metamorphosis—the change into the *Mysis*-form (fig. 8). The antennæ cease to serve for locomotion; they are replaced by the setigerous thoracic feet and by the long abdomen, which, having been hitherto painfully dragged along like a useless burden, now, by means of its powerful muscles, impels the animal rapidly with a jerking movement.

The *carapace*, with its frontal process still undenticulated, has acquired two short teeth on each side of its anterior margin—one over the eye, the other on the inferior angle. It soon entirely covers the thoracic segments, of which some at first remain uncovered, at least above.

The *anterior antennæ* have lost their long setæ. The first three joints now appear as a peduncle, a second branch, at first unjointed and running out into a simple seta, being developed inwards from the fourth bacilligerous joint.

The *exterior branch of the posterior antennæ* has become converted into the scale of the antenna of the Prawn, namely, into an unjointed leaf, the outer margin of which is furnished with a short tooth, whilst the more prominent apex and the inner margin are fringed with long plumose setæ. Close to this lamina, within and below it, there is a short, bristleless, unjointed lobe, from which the flagellum of the antenna is subsequently produced (figs. 8 II, 9). Whether this lobe is developed from the inner branch of the antenna of the *Zoëa*, or whether it is a new formation, whilst that inner branch entirely disappears, I must leave undecided: the latter appears to me most probable; and I think that the flagellum of the Prawn's antenna is to be regarded as the median branch (*palpe*, M.-Edw.).

The feet already existing in the *Zoëa* have undergone no particular change. The third pair of footjaws now resembles the two preceding ones. The five *new pairs of feet* are at first all of the same structure; the unjointed peduncle bears a short and likewise unjointed inner branch with two terminal setæ, and an outer branch, of twice the length of the other, annulated in its

apical half, and beset with long bristles; this is almost constantly in a whirling motion.

In the *tail*, the lateral plates are now moveably articulated upon a short basal joint and beset with long plumose setæ; the middle piece (the seventh abdominal segment) appears to be longer and narrower, as though the two divergent branches had been pressed together to almost complete amalgamation; the setæ of the *Zoëa* are retained in their full number, but contracted into short spines. The anus is situated at the base of this last segment.

About the same time a considerable alteration of the heart takes place; it acquires four new fissures for the entrance of the blood, and internal muscular trabeculæ.

In this *Mysis*-like form our larva was observed from scarcely 2 mill. to 4·5 mill. in length. During this period the auditory organs, the pincers, and ambulatory feet are developed, and the rudiments of the mandibular palpi, abdominal feet, and branchiæ make their appearance.

The flagella of the antennæ become elongated and divided into joints; in animals of 4 to 4·5 mill. in length the two flagella of the inner antennæ are three-jointed; the outer one, which is somewhat shorter, bears about seven bacilli; the flagellum of the outer antenna attains nearly the length of the scale.

In the basal joint of the inner antenna the *auditory* apparatus is formed. The lower third of this joint becomes inflated externally, the swelled portion having a crescentiform anterior margin. In the interior of this inflation an elongated cavity is soon observed (in animals of 3 mill. in length). A little later there appears in the cavity a globular, strongly refractive otolith, and in the crescent-shaped anterior emargination three or four short, plumose setæ, bulbous at the base (fig. 9). The otolith does not appear to lie freely in the cavity, but (as is the case in the tail of *Mysis*) to be supported by delicate filaments, which issue from a ganglion situated inwards from the cavity.

The extended spine of the *upper lip* begins to disappear, but is still recognizable as a minute point in animals of 4·5 mill. in length. The *palpi* make their appearance on the *mandibles*, about the time of the formation of the otoliths, in the form of small mamillæ, which are soon elongated, but remain unjointed and destitute of setæ.

The *pincers* (*chelæ*) are indicated, even in animals of 2·8 mill. long, by the still unjointed inner branch of the corresponding three pairs of feet acquiring a small process on the inner margin a little below the apex. In animals of 3·5 mill. in length, these feet are already divided into joints as in the mature animal, and this process (the immoveable finger) attains two-thirds of the

length of the apical joint (the moveable finger) which still bears its terminal bristles. In the fourth and fifth pairs of thoracic feet also, the inner branch is now divided into four joints, and already somewhat exceeds the outer one in length. In animals 4·5 mill. long, the fingers of the chelæ are of equal length; on the fourth and fifth pairs of feet an acute process (the claw) is visible beside the terminal setæ, and, especially in the fourth pair, the length of the true leg considerably exceeds that of the outer branch.

The *abdominal feet* are recognizable as small mammillæ even in animals of 2·8 mill. in length; they are at first simple, and, as in the case of the thoracic feet, it is the outer branch that is first developed. In animals of 4·5 mill. in length, they are already of considerable size, but still without joints or setæ, and the inner branch appears only as an insignificant appendage to the outer one.

The first rudiments of the *branchiæ* are recognizable, in animals below 4 mill. in length, in the form of small roundish excrescences at the base of the footjaws and chelæ, and subsequently also on the fourth pair of thoracic feet.

From the *Mysis*-like larva of 4·5 mill. in length there is but a small step to the Prawn-form. The youngest animals observed in this form were 5 mill. long. Their frontal process had three teeth above. The antennæ had undergone no change. The eyes no longer had any appendage: the median eye had become very indistinct. The upper lip had entirely lost its spine, and the mandibular palpi had acquired two joints and short setæ. The two anterior pairs of footjaws had approached close to the mouth, and become much shorter than the third pair. The outer branches of the thoracic feet, which are retained through life (as the so-called *palpus flagelliformis*) in many species of *Peneus*, had entirely disappeared. The abdominal feet had acquired joints and bristles (on the outer branch). The central plate of the caudal fan was diminished posteriorly, and bore on its straight posterior margin ten spines, of which those at the angles were the longest; on each lateral margin there were three shorter spines. The *branchiæ* (one over each fourth thoracic foot, and two over each of the preceding ones) were still elongated laminæ with entire margins (they are plumosely cut in animals 9 mill. in length). The liver had begun to acquire a more composite form by the formation of new sacs and the ramification of the old ones.

The animal was not observed more than 9–10 mill. in length.

A second larva is readily distinguishable from the preceding, in the later *Zoëa*-form, by the fact that the anterior margin of

the carapace has, besides the median spine-like process, a shorter one on each side, which is directed obliquely forwards and outwards. Moreover, when at the same grade of development, it is larger, and was seen as a *Zoëa* as much as 2·3 mill. in length. Younger *Zoëæ*, which still want the processes of the carapace, are so like those of the former species, that it was not without trouble that I learnt to distinguish them by the structure of the antennæ &c. Upon the median eye of this second species the skin usually forms two lentiform thickenings at the sides of the bacillus; once I saw a single larger one opposite to the bacillus. Between the two nervous cords of the ventral chain, a minute median filament may be distinguished running from ganglion to ganglion (this can hardly be wanting in the other species, but has not yet been distinctly seen in them). Notwithstanding its remarkable similarity to the former species, the course of development is somewhat different, the third pair of footjaws and the caudal appendages appearing not before, but simultaneously with the thoracic feet.

A third species was traced from young *Zoëæ* 1·2 mill. in length, in which the new segments were still of equal length, and the first rudiments of the third pair of footjaws and of the caudal appendages had just been formed, up to *Mysis*-like forms, 3 mill. long, furnished with three imperfect pairs of chelæ and abdominal feet. It is characterized by its being abundantly armed on the carapace and the segments of the abdomen with spinous processes; the median lamina of the caudal fan is also produced, in the *Mysis*-form, into two long points. The course of development appears to be precisely like that of the first species; the form of the basal joint of the inner antenna in the oldest observed larvæ (fig. 10) indicates that here also an ear is formed similar to that of the first species.

Of two other species whose *Zoëæ* closely approach the three preceding in the structure of the antennæ, of the spinose upper lip, of the multiarticulate second maxilla, of the tail, heart, &c., one was only traced to the non-cheligerous *Mysis*-form; the other, however, which acquires three pairs of chelæ, departs so widely from the rest in its mode of development, that I postpone the history of its metamorphosis for the present, in order to describe it separately.

EXPLANATION OF PLATE IV.

The figures of the animals are magnified 45 diameters; fig. 2, 180 diameters; and the rest, 90 diameters. The Roman numbers I.-XIX. indicate the appendages corresponding with the nineteen pairs of the mature animal: *g*, flagellum of the second pair; *a*, outer, *i*, inner branch of the appendages; *L*, upper lip; *h*, heart; *l*, liver; *l'*, anterior, *l''*, median,

l''', posterior sacs of the liver; *o*, appendage to the eye, of unknown import; *s*, median frontal process; *t*, orange-coloured oil-drops.

Fig. 1. Young *Nauplius* of a *Peneus*, from the sea of Santa Catharina; from above.

Fig. 2. Foot of third pair of an older *Nauplius*, with the rudiment of the mandible: A, from below; B, from the side.

Fig. 3. Young *Zoëa* of the same, from above.

Fig. 4. Parts of the mouth of the same *Zoëa*, from below.

Fig. 5. Eyes of a somewhat older *Zoëa*.

Fig. 6. Older *Zoëa* of the same, from below.

Fig. 7. Mandible of an older *Zoëa*.

Fig. 8. Young *Mysis*-form of the same species, from the side.

Fig. 9. Part of the basal joint of the inner antenna, with developed auditory apparatus, from a larva 4 mill. in length.

Fig. 10. Frontal process and inner antenna of the third *Mysis*-like larva, from above.

XII.—*Catalogue of Chrysomelidæ of South Africa.*

By the Rev. HAMLET CLARK, M.A., F.L.S.

EACH of the three great regions in the southern hemisphere possesses a fauna (as we might expect) peculiarly its own: in the beautiful Coleopterous group the *Chrysomelidæ*, this fauna is represented in South America by the special genus *Doryphora* (which is the subject of the excellent monograph by Dr. Stål), in Australia by several special genera, *Phyllocharris*, *Australaca*, *Chalcomela*, &c. (which have been well and fully studied by Mr. Baly in his papers in the Entomological Society's Transactions), and especially by *Paropsis*; and in South Africa by certain genera which have a nearer affinity to European forms than any of the preceding, but the species of which have never yet been critically examined. This I propose to attempt. By the kindness of my friend Mr. Baly, I have the advantage of access to his rich collection; and so I am encouraged to hope that the comparatively few South-African species may be without much difficulty determined.

The species of this paper includes the representatives of the two MS. genera *Atechna*, Chev., and *Centroscelis*, Chev. (Dejean's Catalogue, ed. 3, p. 427): I can discover no real difference between them; they both are united by Hope (Coleopterist's Manual, pt. 3. p. 164) under the name of *Polysticta*: his diagnosis is too brief, and not quite accurate; but it is clear that these are the forms which he had before him ("the majority of the species are remarkable for the number of the guttæ or spots with which they are adorned"); and hence it is right that his name should be preserved. The following analysis of the genus will explain the arrangement of the species.



Müller, Fritz. 1864. "XI.—On the metamorphoses of the prawns. (First Memoir)." *The Annals and magazine of natural history; zoology, botany, and geology* 14, 104–115.

View This Item Online: <https://www.biodiversitylibrary.org/item/53343>

Permalink: <https://www.biodiversitylibrary.org/partpdf/51404>

Holding Institution

Smithsonian Libraries and Archives

Sponsored by

Smithsonian

Copyright & Reuse

Copyright Status: Public domain. The BHL considers that this work is no longer under copyright protection.

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at <https://www.biodiversitylibrary.org>.