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XLI.—*On the British Diastylidæ.*
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[With three Plates.]

THE first recorded specimen of the anomalous group of Crustacea which forms the subject of the present memoir, was that figured by Col. Montagu in the 'Transactions of the Linnæan Society,' vol. ix., as *Cancer scorpioides*. He there describes it as a mutilated specimen, and the only one which he had observed. The head or forepart he believed to have been wanting, and thus accounted for his inability to detect the eyes or antennæ. But still, from the general appearance of the creature, he thought it entitled to a place amongst the *Canceri*,—which term appears to be with him synonymous with *Crustacea*, exclusive of the Isopoda and the Entomostraca,—and that it bore a near relation to *Cancer esca* of Gmelin.

Say, in the 1st volume of the 'Transactions of the Philadelphia Philosophical Society,' describes a Crustacean under the name of *Diastylis*, which he affirms to be of the same genus as the *Cancer scorpioides* of Montagu and the *Cancer esca* of Gmelin.

In the 13th volume of the 'Annales des Sciences Naturelles,' Dr. Milne-Edwards has described another specimen, under the name of *Cuma Audouinii*; but this he afterwards, in his 'Histoire des Crustacés,' qualified with a doubt as to whether it might not be the immature form of some known Decapod.

This last opinion has been recently supported by the assertion of Professor Agassiz to Mr. Dana, that the *Cumæ* were the larvæ of certain Macroura. Consequently the most recent and one of the most important works on the subject, Mr. Dana's great work on Crustacea, contains the following passage:—"But according to
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recent observations by Prof. Agassiz, communicated by him to the author, the *Cumæ* are in part, if not always, the young or immature forms of certain *Macroura*, as *Alpheus*, *Palæmon*, and *Hippolyte*. This distinguished observer has actually obtained *Cumæ* from the eggs of *Crangon septemspinus*, *Palæmon vulgaris*, and *Hippolyte aculeata*."

A communication made by so eminent a man is like the sound of a trumpet, the voice of which extends to the farthest limits of the earth, and long is the time ere its echo shall cease to be repeated.

Agassiz says that he has "*actually obtained Cumæ from the eggs of Macroura.*" This strong assertion by so great a man will require the clearest evidence that careful investigation can produce in order to demonstrate its error and to elucidate the truth, that the *Cumæ* are adult animals perfect in themselves, and that they belong to the suborder Stomapoda among Crustacea, in which they form a family of themselves, the *Diastylidæ*.

I have chosen this name from the earliest given to a genus of the family, which appears moreover to be the type of the group; also as considering the term *Diastylis* to be more significant in relation to the form of the animal than either of the other generic names in the family.

Kroyer, in his illustrations to the '*Voyages en Scandinavie*,' &c., has figured several species most carefully and most correctly, in accordance with the usual practice of that eminent carcinologist. More recently Mr. Goodsir, in the *Edinburgh New Philosophical Journal* for 1843 (in a paper which has been reprinted in full in Bell's '*British Crustacea*'), has described all the known British forms, and with the exception of Kroyer, whose work Mr. Goodsir appears not to have been aware of, has entered more fully into the subject than any previous author. He has recognized their true character as animals in their adult condition, and considers that they should be ranged with the lower forms of *Macroura*, and between them and the *Stomapoda*. With this, Prof. Bell in his '*British Crustacea*' entirely agrees, and has included these anomalous forms of Sessile-eyed Crustacea amongst the *Podophthalma*.

Sir James Dalyell, in his fine work on the '*Rare Animals of Scotland*,' has figured one or more species, without adding much, *we believe*, to the knowledge of either the structure or habits of the animals.

The first step will therefore be to describe the separate parts of the dismembered animal; and although this to a certain extent has been done by Kroyer, yet his great work is in the hands of so few, that it will scarcely be deemed a work of supererogation even to repeat some that he has well displayed, and by this

means we shall be enabled homologically to consider the relation which their several parts hold to the same respectively in the larvæ of the Decapoda, and demonstrate not only that the *Cumæ* are not the young of certain Macroura, but that they are animals complete in their development and capable of the production of others of their own form.

That the *Diastylidæ* are a depauperized family, there can, I think, be no doubt; yet it is one of those forms in creation which assist to destroy the popular theory of authors, of a gradual rise in the gradation of animal existence; for though in classification we place them among the higher types, yet there can be little doubt that in organized perfection they are less complete than those of animals below them in the natural scale of arrangement.

GENUS DIASTYLIS.

Diastylis, Say, Trans. Phil. Soc. Philad. vol. i.

Alauna, Goodsir, Edin. New Phil. Journ. (1843).

Cumæ, Kroyer (Voyages en Scand. &c.).

Carapace with the lateral angles developed anteriorly, and meeting without uniting in front of the eye and antennal segments, and produced anteriorly in the form of a rostrum. Eyes confluent, and situated as a single organ on the top. Five segments of the thorax exposed behind the carapace. Upper antenna short, scarcely reaching to the anterior margin of the carapace. Lower antenna longer than the upper. First five abdominal segments without appendages, except the two anterior in the male only. The sixth furnished with a pair of members terminating with double stylets. The *telson** produced into a long styliform process.

Diastylis Rathkii. Pl. XIII.

Cumæ Rathkii, Kroyer.

Alauna rostrata, Goodsir.

The genus *Bodotria* is perhaps the highest form in the family; but since my opportunity of dissection has been more complete on the *Alauna* of Goodsir, which I believe to be of the same genus as *Diastylis* of Say, I shall take this latter as the type of the whole family, and under their respective heads trace the generic or specific differences in the group.

The first character in the general appearance of one of these animals that strikes the observer is that of its being a mutilated creature,—an idea present to the mind of Montagu when

* From *τέλοςον*, *extremity*. The centre tail-piece in Crustacea generally; the twenty-first segment in the homologies.

he described and figured in the 'Linnæan Transactions' the animal in the collection at the British Museum. From the reduced form of the members generally, many appear, on a careless examination, to be wanting; hence it is that both Say and Montagu mistook the character of their respective species.

Taking each of the segments in succession, we observe that that which supports the first pair of appendages in Crustacea is strongly marked as an independent segment, both in *Squilla* among the Stomapoda, and *Palinurus* among the Decapoda; and that in the Decapoda when the segment itself is absent, the eyes are still borne on projecting peduncles; but in the whole of this group not only is the segment absent, but the peduncles themselves are wanting; and the eyes not only lose their *podophthalmic* character, but the two are so closely associated as to appear, as they probably are, but a single organ, and to general observation fixed in the centre of the carapace, in which anomalous position they have been described by those who have discovered the organ, except Kroyer.

The second segment, or that which supports the first or internal pair of antennæ, is closely associated with the third, or that which bears the second or external pair of antennæ; the two segments united together are attached to the next succeeding by the posterior margin only, which is somewhat broader than the anterior, the centre of which is slightly advanced, as if to cover the organ of vision. The fourth segment, or that which supports the mandibles, is developed posteriorly to the preceding, to which it is united by the entire width of the anterior segment, but only at its posterior margin, for the lateral edges, unlike what is found in the perfect Macroura, are free. The lateral processes or wings of the mandibular segment extend considerably forward on each side of the segments which bear the antennæ, and meet without uniting in front of the same. This segment forms nearly the whole of the carapace, and surrounds the anterior segments, which appear as a central patch on the dorsal surface.

The carapace is developed from the same segments as in the perfect Macroura, but in this tribe covers only the first two or three instead of all the segments of the thorax;—obedient to a law which I think has been made out in a previous paper (see Ann. Nat. Hist. July 1855), that the anterior portion of the carapace lessens in importance in relation to the posterior, and that the whole decreases as the animal descends in the scale of nervous centralization. Consequently the great buckler, which in the Brachyura and Macroura protects the whole of the thoracic portion of the animal, extends its defence only over the two anterior segments; the last five are seen posterior to the carapace,

and, unlike the same segments in the higher forms, have the dorsal portion complete, and each is developed into a perfect ring to which the respective thoracic legs are attached.

The seven succeeding segments belong to the abdomen, and are unfurnished with appendages, except the penultimate, which is supplied with a pair of double-branched stylets, from which peculiarity of form Say derived his generic name for the American species. In the male however the first two segments are each supplied with a pair of short, stout, styliform appendages, which are probably intermittent organs, since they homologize with those which are known as such in the higher forms. The last segment is developed into a caudal style, the edges of which are furnished with short spinules: near the centre of this articulation debouches the alimentary canal.

The upper or interior antenna is short and pyriform, apparently consisting of a peduncle, which is formed of a single segment and a short filamentary appendage of four articulations, each being furnished with a long ciliated hair (Pl. XIII. fig. 4 *a*). The whole organ does not extend beyond the rostrum-like projection of the carapace.

The lower or exterior antenna is considerably longer than the upper, and consists of a peduncle formed of a single joint and a filamentary appendage, the first two articulations of which probably homologize with the second and third joints of the peduncle in the antenna of the true *Macroura*, since that which we call the peduncle in this, evidently homologizes with the first, or first and second, for the olfactory organ is distinctly discernible in the middle of the segment (Pl. XIII. fig. 5 *a*), which is considerably broader than the next succeeding; we therefore think it convenient to describe it as the peduncle, and the slighter continuation as the terminal filament, rather than according to what may or may not be homologically true. The first joint of the filament is nearly as long as the peduncle, and the second considerably longer, whereas the four terminal are extremely short, each successively shorter than the preceding; the last is tipped with a slight brush of cilia, and reaches considerably in advance of the most anterior extremity of the animal.

The mandibles are the next succeeding pairs of appendages, and are very powerful organs, not developed upon the type of the *Decapoda*, but furnished with a molar tubercle and a comb-like row of teeth or hairs as found among the *Amphipoda*, possessing however a long osseous tendon as in the *Macroura*, and therefore forming a type intermediate between the two extremes, and probably belonging to the *Stomapoda* (Pl. XIII. fig. 6).

The maxillæ are thin foliaceous plates intermediate in their

form between the higher and the lower types (Pl. XIII. figs. 7, 8). The maxilliped (fig. 10) partakes more essentially of the higher type than that of the lower forms; it is pediform, and consists of a stout basal joint supporting five terminal smaller ones, the last of which ends in an extremely fine point; three large plumose hairs are given off from the penultimate and antepenultimate articulations. To this pair of limbs are attached the branchial appendages, which consist on each side of eight or nine secondary saccular cæca, connected with a common membranous chamber in which the blood circulates for its perfect aëration.

The two gnathopoda (or second and third maxillipeds) are developed upon the true type of the Macrourea; the anterior (fig. 11) does not possess the secondary palpi, whereas the posterior (fig. 12) does, and moreover is developed so as to become the closing operculum to the mouth. The basal joint is long and broad, and its internal margin is fringed with a row of hairs, which answers to a corresponding row of teeth-like prominences in the true Macrourea, where they perform the part of an efficient biting apparatus; the upper extremity of the joint extends on the outer side, slantingly forwards, and is crowned with hairs. The five terminal articulations are short and unimportant, the whole not equalling the first joint in length. This pair of limbs, together with the preceding, is attached each to one of the first two rings of the thorax, the sternal portion and lateral walls of which are alone developed.

The next succeeding pair of feet are those which homologize with the great cheliform limbs of the Decapoda (fig. 13); they are the most powerfully formed organs which the animal possesses, are considerably longer than any of the others, and reach anteriorly beyond the extreme limits of the antennæ. Each is formed of an anteriorly curved basal joint, three succeeding posteriorly curved articulations, the three together equalling in length the preceding, and two others which appear to be more freely jointed than any of the preceding, and which together equal in length the basal articulation. The basal segment is ciliated upon the convex or posterior margin, the three succeeding are furnished with long plumose cilia upon the anterior margin, and the terminal one has long simple hairs upon the posterior margin only. Arising from the coxa, which in the whole family is closely associated and probably ankylosed with the segment of the body, is the *palpe* (of M.-Edwards's earlier writings, the *exognathe* of his later),—a secondary appendage to the legs peculiar to the Stomapoda; it consists of a single articulation, and a terminal ciliated stalk or filament (*tige*) equalling in length about half that of the true leg.

The next succeeding pair of limbs (fig. 14) homologize with the (so-called) second pair of thoracic legs in the Macroura. Each agrees closely in character with the preceding, but differs in details by the increased size of the coxæ, the shortness of the joints succeeding the basal, and the very great length of the penultimate articulation of the legs: like the two preceding sets of limbs, it is furnished with a *palpe* or secondary appendage. Moreover, in the female a scale-like appendage, the *fouet* of Milne-Edwards, is attached to this, the one preceding and the next succeeding pairs of legs, forming by their mutual overlapping the incubatory pouch, in which the egg is nourished, and the embryo cherished, and the larva carried until it assumes the form of the adult animal, when it leaves the parent to seek its existence as a self-providing animal.

The three next succeeding homologize with the three posterior pairs of legs in the Decapoda, and are developed in one form (fig. 15). The first joint or *coxa* appears not to be so closely associated with the segment of the body as those belonging to the anterior legs. The second joint is long, the third short, the fourth long, and the two next intermediate; the last joint appears to be represented by a stout jointed hair.

Appendages are attached to the two next succeeding segments of the body, in the male only, these being the first two segments of the abdomen; they must therefore homologize with the styliform processes in the males of the Decapoda which are known to be intromittent organs, and probably answer the same purpose in these creatures.

The three succeeding segments are unfurnished with appendages in both sexes; but the next, the penultimate, supports a pair of a form peculiar to the family. They consist each of a long basal joint, armed with a single row of spinules upon the inner margin, and a pair of unequal terminal styliform processes slightly fringed with cilia. This pair of appendages, with the pointed terminal segment or *telson*, form the caudal appendage or tail of the animal.

The general structure of the integumentary tissues is slight: the cell-character of the original formation is readily apparent beneath the microscope, with a few granules of lime deposited in each. The colour of the animal is stated by Mr. Harry Goodsir, who took them in the Frith of Forth, as of a beautiful bright straw colour inclining to yellow. I have never seen any alive, but have received specimens from the Moray Frith from a highly esteemed correspondent, the Rev. Geo. Gordon; also from St. Ives, where it has been dredged by my friend Geo. Barlee, Esq., who also dredged a single specimen with mature larvæ off the Isle of Arran. From Falmouth I have received it from my

friend W. Webster, Esq., and have taken it myself from the refuse of the trawlers in the neighbourhood of Plymouth.

Genus CUMA.

Cancer, Montagu.

Cuma, Edwards, Ann. Sc. Nat. ; Goodsir, Edin. New Phil. Journ. 1843 ; Kroyer, Voyages en Scand.

Carapace with the lateral angles meeting in front of the confluent eye and the antennal segments, but not produced anteriorly into a rostrum-like projection. The lower anterior margin not generally receding. *Four segments* of the thorax complete, and exposed behind the carapace. The *upper antennæ* "single-jointed and scalelike" (*Goodsir*); the *lower* short and unimportant, reaching not far in advance of the carapace. *Abdomen* without appendages to the *five anterior* segments, sixth with double branched stylets, seventh or *telson* absent.

Cuma scorpioides. Pl. XIV. fig. II.

Cancer scorpioides, Montagu, Linn. Trans. vol. ix.

Cuma Audouinii, Edwards, Ann. Sc. Nat. ; Goodsir, Edin. New Phil. Journ. 1843.

— *Edwardsii*, Goodsir, Edin. New Phil. Journ. 1843.

This animal has been described by Edwards and Goodsir. I have received but a single specimen, and that taken in the Moray Frith by the Rev. Geo. Gordon, from which the present drawing was made*. Mr. Goodsir was more fortunate, having captured many, some carrying spawn. He has imagined that there were two species among them, but I am inclined to think that neither his figures nor his descriptions support this conclusion, and I believe them to have been mere varieties of the species described in the 'Annales des Sciences Naturelles,' vol. xiii., by Dr. Milne-Edwards, and that the whole, as also the one from which my own figure has been taken, are identical with the species found by Montagu and figured by him in the Linnæan Society's 'Transactions,' and still preserved in his collection in the British Museum.

Upper antennæ "rhomboidal" (*Goodsir*); lower very short, terminating but a little in advance of the carapace. The lateral angles of the carapace meeting in front of the antennal segments, but not culminating to a rostrum-like projection. A lateral ridge extends on either side from the posterior margin nearly to a level with the eye. Eyes confluent, and apparently a single organ. Thoracic feet furnished with a palpe. Telson rudimentary.

* Not wishing to destroy the only specimen that I have seen, I am not enabled to examine the animal by dissection; therefore my description is taken from the perfect creature.

The whole animal (says Goodsir) is of a fine straw colour with a delicate tinge of pink, which is brighter in certain lights.

Cuma Edwardsii. Pl. XIV. fig. iv.

Cuma Edwardsii, Kroyer, Voyages en Scand.

Carapace covering only two segments of the thorax, leaving the five posterior ones exposed as complete rings in themselves. The carapace is marked on the lateral margins as if it were divided into segments; its anterior portion extends in front of the antennal segments, the anterior inferior angle receding. The lower antenna exposed considerably in advance of the carapace. The two anterior thoracic legs succeeding the gnathopoda are extremely long, the three posterior extremely short, and all except the posterior furnished with a palpe or secondary appendage. The segments of the thorax lie very compact, and resemble a continuation of the carapace; those of the abdomen are naked, except the penultimate, which is furnished with a pair of limbs common in form to the tribe. *Telson* rudimentary.

Having seen but a single specimen, for which I am indebted to Professor Williamson, who obtained it from Weymouth and kindly sent it to me, I am not enabled to speak so positively as one could wish, but I am much inclined to believe that it should represent a separate genus. All the *Cumæ* exhibit but four segments posterior to the carapace, whereas this species exposes five; it is less compressed at the sides, the anterior form of the carapace is more pointed, and the antenna appears longer, but the importance of these relative parts can only be distinctly appreciated by dissection and a proper examination of the details.

It is evidently the same species as the one figured in Kroyer's great work, and until further opportunity occurs of examining its structure, it must still be retained in the genus assigned to it by its discoverer.

EUDORA, n. g.

Differs from *Cuma* in having the upper antenna obsolete*.

Eudora truncatula, mihi. Pl. XIV. fig. III.

The lateral angles of the carapace meet in front of the antennal segments and are somewhat raised above them. The inferior

* My own inclination is to unite this genus with *Cuma*, and *Venilia* with *Bodotria*, to which in general form they respectively agree. But Mr. Goodsir, who has dissected many of the genus *Cuma*, distinctly affirms the upper antenna to be present, whereas in *Bodotria* he is as positive that the lower is "quite obsolete;"—facts so distinctly at variance with my own experience of the closely allied forms of *Eudora* and *Venilia*, that I am compelled, in deference to so careful an investigator, to place the new species in separate genera.

anterior edge is considerably produced, and gives a truncated character to the appearance of the animal. The margin is serrated, anteriorly more prominently so.

The upper antenna is wanting; the lower (fig. 5) is very short, and consists of a peduncle of three joints and a filamentary terminal appendage, the first segment of which is long and the rest extremely small and fine.

Mandible furnished with a prominent molar tubercle, but not supplied with hair-like spinules between it and the incisive margin. The first gnathopod (fig. 11) is pediform; the second (fig. 12) also, but the basal articulation is broadly developed anteriorly, so as to fulfil the office of an operculum; the internal margin is convex and furnished with strong hairs; the external margin is concave posteriorly, and extends at the anterior corner into a long, firm, ciliated spine; a second spine of the same character is situated on the anterior margin between the former and the terminal joints of the appendage, which consists of four small segments supplied with a few plumose cilia. This pair of limbs is furnished with a *palpe*, or secondary appendage, consisting of a single-jointed peduncle and a terminal filamentary appendage supplied with a brush of cilia. The next succeeding pair of legs (fig. 13), the homologues of the large claw-feet of the Decapoda, are extremely long, reaching considerably in advance of the anterior margin of the animal; each of them consists of a long basal joint, denticulated with four or five strong spines upon the convex or inferior margin, followed by a short joint and three terminal long ones: this as well as the three succeeding legs are furnished with a *palpe* similar in formation to that of the preceding pair.

The four next succeeding pairs of legs (figs. 14, 15, 16, 17) are similarly formed, except that they gradually diminish in size posteriorly, the last being considerably the smallest, and moreover unfurnished with a *palpe*. In the female the two anterior pairs of these last four are furnished with *fouets*, or scale-like appendages which overlap each other and carry the ova and the larvæ.

I have received four or five specimens of this species, which were dredged by W. Webster, Esq., in Plymouth Sound, somewhat within the Breakwater; some of them having eggs in the incubatory pouch.

Genus HALIA, n. g.

Cuma, Goodsir.

Carapace elongate, compressed, covering the thorax, except the three posterior segments. The four posterior legs of the

thorax without a *palpe*. Telson rudimentary. Upper antenna prominent, lower membranaceous.

Halia trispinosa. Pl. XIV. fig. v.

Cuma trispinosa, Goodsir.

The carapace is long and much compressed, the lateral angles meeting in front of the antennal segments, and projecting forwards into a rostrum-like point. Half-way between the eye and the posterior margin of the carapace are two (three, *Goodsir*) small teeth or spines, from which the specific name is derived. The superior antenna consists of a single-jointed peduncle and a terminal filament, the first two segments of which are half the length of the whole organ; the remainder are minute and furnished with cilia. The lower antenna consists of a peduncle formed of two minute articulations, calcareous in structure and furnished with plumose cilia, and a terminal filament of a membranous structure, soft and flexible in its character, the anterior portion of which exhibits an appearance of rudimentary articulations, and the organ generally bears a strong resemblance to that of the embryo Crustacean.

The mandible (fig. 6) is furnished with a very prominent molar tubercle and a secondary incisive denticle, as well as a row of intermediate spinous hairs more or less furnished with cilia. The maxillæ (figs. 7, 8) are foliaceous, and resemble those described in *Diastylis*.

The maxilliped (fig. 10) consists of a long and stout basal joint, followed by a second, rather shorter and less robust, furnished on the inner margin with minute denticles, and terminated by two minute articulations well supplied with cilia. This pair of members carries the branchiæ.

The first gnathopod (fig. 11) is pediform, consisting of a long basal joint and four or five terminal smaller ones.

The second gnathopod (fig. 12) is also pediform, but developed so as to fulfil the office of an operculum. The basal joint is long, and the external anterior margin is prominent and furnished with a number of hairs; the second joint is similarly formed, but short; the three terminal ones are unimportant. The member is furnished with a *palpe* consisting of a basal joint and a terminal filament.

The next succeeding leg (Pl. XV. v. fig. 13), which is homologous with the large cheliform organ in the Decapoda, consists of a long basal joint (the rest except the *palpe* in our specimens were broken off).

The four succeeding pairs closely resemble each other, and are each respectively formed of a long basal joint and four or five

terminal shorter ones. None of these are furnished with a *palpe*, or secondary appendage. They are moderately covered with cilia, most of which are of a peculiar form, very long and slight (15 *a*), with a smaller, short stout hair at the base. The longer one is very straight, and through two-thirds of its length possesses what appears to be an internal spiral.

The penultimate segment of the abdomen is furnished on each side with a member consisting of a long basal joint and a pair of terminal styliform appendages, each of which is double-jointed; the outer one being fringed on the inner side only with plumose cilia, the inner one with corresponding serrated spinules. The termination of the alimentary canal is seen to debouche in the rudimentary *telson* (or terminal joint of the animal).

We have received this species through the kindness of the Rev. Geo. Gordon, who took it in the Moray Frith. Mr. Goodsir took a single species in the Frith of Forth.

Genus *BODOTRIA*, Goodsir, Edin. New Phil. Journ. 1843.

Bodotria arenosa, Goodsir*. Pl. XV. fig. vi.

First, second, third, fourth and fifth segments of the abdomen each armed with a pair of bifurcate finlets. The two terminal scales of the caudal styles are single-jointed. The superior antennæ are quite obsolete; the inferior pair are of considerable length, and are terminated by means of two long spines.

Genus *VENILIA*, n. g.

Carapace with the lateral angles meeting in front of the antennal segments. Both pairs of antennæ well developed. Five of the posterior segments of the thorax exposed. Each of the five anterior abdominal segments carries a pair of swimming feet; the penultimate is furnished with a pair of appendages of the form common to the family. *Telson* rudimentary.

Venilia gracilis, mihi. Pl. XV. fig. vii.

Carapace long and narrow, the lateral angles meeting in front of the antennal segments, and projecting anteriorly into a rostrum-like point. The superior antenna well developed, and reaching much beyond the anterior margin of the carapace. The inferior antenna consisting of a peduncle formed of three (or more) articulations, the last of which is longest, and an extremely long and delicate terminal filamentary appendage,

* For this description, together with the figure, I am indebted to Mr. Goodsir's paper, to which I must refer the reader for a more complete account.

equalling about half the length of the entire animal. The third thoracic leg, the homologue of the claw in the Decapods, is very long, reaching to the anterior margin of the carapace; the four succeeding are much shorter, being scarcely longer than the basal joint of the preceding. None of them appear to be furnished with a *palpe*.

The abdomen is well developed, and partakes of the character of the higher types in the way in which the lateral edges overlap the sides and seem to protect the delicate appendages beneath, which consist, to each segment, of a pair of organs formed each of a basal joint and a pair of flexible scale-like appendages.

The appendages of the sixth or penultimate segment resemble those of the preceding species. The telson is rudimentary.

This very elegant species was taken in the Moray Frith by the Rev. Geo. Gordon, among several specimens of *Halia trispinosa*.

Having examined all the forms of the family that I have met with, or believe to have been discovered as British, and the structure of those of which I could obtain more than a single specimen, it will be necessary that I should compare them with the larvæ of the Decapoda Macroura, since Agassiz's assertion that he has taken *Cumæ* from *Hippolyte*, &c., is so very positive. All the species mentioned by Agassiz are American—it will therefore be difficult for persons on this side of the Atlantic to procure their evidence from the same; but I think an examination of one of the same genus will be quite sufficient, particularly as all the *Diastylidæ* that have been examined in this paper are British; consequently, if they are the young of any of the Decapoda Macroura, as asserted by Agassiz, they must be those of British forms. The larva which I have chosen as being the nearest to those mentioned in Dana's work, is that of *Hippolyte varians*, of which I have given a careful figure in Pl. XV. fig. VIII. It was obtained direct from the parent,—therefore in the same manner that Agassiz obtained his *Cumæ*.

The carapace, furnished with a distinct rostrum, is broad, and not laterally compressed; it reaches back to the commencement of the abdomen, which consists of but three segments, the terminal one being dilated at the extremity into a fish-tail form, having seven unequal spines on each division.

The eyes are large, situated laterally at the anterior portion of the carapace, and extend on each side beyond the margin; they can scarcely be ranked among the sessile forms of the organ, as typified among the Edriophthalma.

The anterior antenna (Pl. XV. fig. 2) has at least two segments to the peduncle, and two terminal short filaments (the number belonging to the genus in the adult form). The posterior antenna (Pl. XV. fig. 3) consists of a peduncle with two seg-

ments, to the first of which is attached a scale-like appendage, the extremity of which is fringed with cilia, and to the second a terminal filament scarcely so long as those belonging to the anterior organ.

The mandibles and maxillæ are distinctly visible; and Mr. Darwin, who dissected the specimen from which the figure accompanying this paper is taken, found the mandibles and two pairs of maxillæ*, after which follow six pairs of appendages, all of which are united at the base in pairs, so that they represent three sets of limbs. The basal articulation of the anterior organ is furnished with three strong spines, which are directed anteriorly. That of each of the two posterior members has but a single spine. Each separate appendage consists of from two to three articulations, furnished with four or five strong hairs.

The abdomen is unfurnished with appendages, but at the posterior limit of the first segment are two cells with a coloured nucleus.

In this immature state of a known decapod Crustacean, we perceive the organs that are present possess the character of the adult animal in an embryonic form. The eyes are placed at the lateral margins of the carapace, ready to be elevated on foot-stalks. The superior antenna has a peduncle, with two out of three of the normal articulations, and differs in no other feature but size from the perfected organ of the adult Crustacea. The inferior antenna bears also a near resemblance to the adult form, except in the incomplete number of the articulations in the peduncle. The moveable scale peculiar to the *Macroura* is distinctly seen, and the terminal filament differs from that of the adult only in being very short, and the three double pairs of leg-like appendages are the immature forms of the maxillipeds in the adult Crustacea. The rest of the appendages are yet in embryo. The length of the entire animal is the sixteenth of an inch; and as it increases in size, other limbs are developed upon the type of those which they ultimately assume in the adult form, becoming more and more complete as the creature progresses in age and growth.

But in the *Diastylidæ* we find that there is a material difference. The carapace, instead of being broad and flat as in the larva of the *Macroura*, is laterally compressed; and although, as in *Diastylis*, there is the appearance of a rostrum, yet it is the result, as shown in the description of the animal, of a monstrous development of the lateral angles of the mandibular section of the carapace,—a circumstance which gives a peculiar and eccentric feature to the whole family, that of the

* Cirripedia, vol. ii. p. 107, note †.

posterior portion of the carapace surrounding the anterior, which consequently appears to be situated in the middle instead of at the anterior extremity of the carapace, and its importance is so lessened in degree as to impoverish the character of the appendages which it supports. Thus the eyes, instead of being efficient organs, supported upon peduncles, are so reduced in size and converged together as not to be distinguishable from a single organ; a circumstance which, together with the known habits of the animal, induces me to believe that they are subterranean Crustacea, living chiefly in muddy and sandy soils.

The antennæ are peculiar, sometimes one or other being rudimentary or obsolete, but never, as far as I know, developed upon the type of those of the Macrourea.

Again, the mandibles are developed upon a type so decided in their character, that their form alone would be sufficient to demonstrate that they do not belong to the true Macrourea; each organ being furnished with a molar tubercle similar to that of the Amphipoda, and not supplied with a flagellum. The maxillæ are developed upon the type of the Stomapoda rather than the Amphipoda. This is equally correct with regard to the maxillipeds and the five succeeding pairs of appendages.

The abdomen consists of seven segments, which, with the exception of the penultimate, are generally destitute of appendages, although in the genera *Bodotria* and *Venilia* they are attached to every segment, and the whole animal assumes, in each of these two genera, a character more normal in its condition.

Thus it will be seen, that the segments are developed as in the adult animal; and the appendages also, I think, possess a similar signification. But should these not be admitted as sufficient evidences of the maturity of the animals, they can further be supported by the fact recorded by Mr. Goodsir, that he had taken the female *Cuma* with "spawn,"—a circumstance that I have corroborated by obtaining a *C. truncatula* with ova in the pouch, and also a specimen of *Diastylis Rathkii* with larvæ fully developed in the same position. This latter specimen was taken by G. Barlec, Esq., in the Isle of Arran.

The female has attached to two pairs of legs four plates, analogous to those found in the Amphipoda, which overlap each other, and form a pouch in which the ova and the undeveloped larvæ are protected during incubation.

The larva quits the pouch in a form resembling the parent—at least so near, that, with the assistance of a most efficient microscope, I have failed to distinguish any difference. Those in the pouch at the same time were of two sizes, as if it contained the young of separate ages, or distinct broods.

The male in *Diastylis*, if not in the other genera, is capable

of being recognized by the two pairs of short styliform processes attached to the two anterior segments of the abdomen, analogous to those of the higher types of Crustacea.

Having traced the forms of the *Diastylidæ* and compared the same with that of the larva of a *Macroura*-form Decapod, and having, moreover, shown that the former are in a condition to continue their species, I think I am in a position to assume that they are Crustacea of adult forms, and that, consequently, they are not the young of any of the Decapoda, and that they form several genera in a family essentially characteristic. It now becomes necessary to see where, among Crustacea, this family should be placed, and the comparison of the dissected animal with that of others may lead to an approximation of the truth.

The carapace is developed upon the type of the *Podophthalma*, whereas the eyes are sessile; but in some of the *Macroura*, as in *Athanas* and *Alpheus*, the peduncles are rudimentary: therefore it is but legitimate to assume that the organs are formed upon the same type, but rudimentary in character, in the *Diastylidæ*,—reduced to this form by the subterranean (?) habits of the animal and the eccentric development of the carapace from the normal form.

The antennæ are generally more or less abortive, and all are typically below the *Macroura*; although in some species, as in *Diastylis*, there may be observed in the lower antenna an organ which can only homologize with the olfactory organ of the Decapoda (fig. 5 a).

The mandibles are developed upon the type of those of the Amphipoda rather than upon those of the *Macroura* or the Stomapoda, although they assimilate to the latter somewhat in the development of the internal lever-like process for the attachment of muscles. The maxillæ and posterior members all approximate the Stomapod type, as exemplified in the *Mysidæ*, whereas the abdominal segments, except in *Bodotria* and the closely allied genus *Venilia*, are mostly wanting.

Taking these several distinctions into consideration, there can, I think, be little doubt,—

1st. That the animals are adult Crustacea.

2nd. That they belong to the suborder Stomapoda.

3rd. In that suborder they rank after the *Mysidæ*, that is, they hold the lowest position known among the Stomapoda; but that they indubitably belong to that suborder,—not to the suborder Decapoda *Macroura*, as suggested by Goodsir, and repeated with doubt in the 'British Crustacea.'