

X.—*Carcinological Gleanings*. No. IV.

By C. SPENCE BATE, F.R.S. &c.*

[Plates IX., X., XI.]

THE entrance to the English Channel appears to be the boundary or extreme limit of two distinct faunas. We find species that are decidedly arctic in their character represented by specimens that have a generally depauperized appearance, both as to size and typical expression, while Mediterranean species are represented without any large amount of variation in form or dimensions of specimens. But my observations induce me to believe that the southern forms, when taken on our shores, are generally dredged from water of considerable depth; whereas those of the arctic types are as invariably taken in shallow water.

The variations of depth and local habitats appear to us to depend more upon the condition of food and its general supply than upon other causes; we therefore think that the geographical distribution of animals in limited regions can only be worked out by a previous knowledge of the history of the animals, particularly in relation to their food, and even then cannot be very reliable.

Amongst the anomurous Crustacea I would wish to notice the genus that Leach has named *Munida* in order to distinguish it from the genus *Galathea*; but the points of distinction are not sufficient to warrant so great a separation, and they appear to me to be naturally but species of one genus.

Three fine specimens I have recently taken on the shelly ground off the Dudman, in about thirty fathoms of water. The first specimen that was obtained differed from those previously known and described by having, instead of a long central rostriform spine flanked by two shorter ones of analogous construction, three equally important anteriorly porrected spines—this in consequence of the two lateral spines being developed to a length corresponding with that of the central in normal specimens; whilst in another specimen the central spine appears to be rather longer in proportion to the lateral ones than that figured by either Leach or Prof. Bell, so that the specimen bears a very close relationship to *Galathea monodon* of Milne-Edwards from the Brazils—a circumstance that supports an opinion that I have elsewhere expressed, that there is a very considerable resemblance between the Crustacea of the South-American coast and that of the British seas.

This species, *Galathea bamffica* (*Munida Rondeletii*, Bell), is stated to be one of the rarest of our Crustacea, and is seldom to be met with in our museums. Its habitat is most probably

* Abstract, communicated by the author, from the Report of the Committee appointed to explore the Marine Fauna and Flora of the South Coast of Devon and Cornwall. (Brit. Association Report for 1867, p. 275.)

the temperate latitudes, in tolerably deep water, on the western shores of Europe; for although extending as far as the Shetlands, yet the specimens that have been dredged in the colder regions are, we believe, invariably very small, and the inhabitants of very deep water.

Among the *Galathea* that we have taken on our coast, and which embrace all that were previously known as British, is one that we think must be accepted as not having been previously described.

The largest specimen, measuring from the extremity of the tail to that of the extended hands, is little more than 2 inches, of which the animal itself, measuring from the extremity of the rostrum to that of the tail, is little more than 1 inch. This species differs from either of the others in having the large pair of chelate pereopoda flat and broad, the fingers much curved, very distant, and meeting only at their apex when closed, furnished on the inside with a considerable brush of hairs, and armed near the base of the moveable finger with a prominent tubercle or tooth, but which appears to be of little importance, since it is not able to impinge against the opposite finger. I have sometimes thought that this specimen may only be an extreme form of the male of *Galathea squamifera*; but the armature of the surface of the hands, which is generally a safe guide in specific character, has a distinct variation. In *G. squamifera* the arms are covered generally with a series of curved scale-like tuberculations, the anterior margin of which is divided into a series of bead-like elevations, of which in the most typical parts, such as on the surface of the meros and carpus, the central prominence is elevated to a point; and the whole of the tubercular ridge is crowned by a row of short hairs, so minute that they are not perceptible except by the assistance of a lens. These tuberculations are closely packed and regular.

In the supposed new species the tuberculations are less prominent and defined, their margins can only be perceived to be at all baccated by careful arrangement of the light, while the cilia, being far less numerous, are yet more conspicuous under the lens. If it be only a variation of *G. squamifera*, as we are inclined still to consider it, it is too important a variety to be passed over without notice; and we have named it provisionally *Galathea digitidistans*, until the observation of a larger series of specimens than we have as yet seen may enable us to arrive at a correct conclusion.

The zoëa of the genus *Porcellana* has, I believe, been figured from exotic species by Dana*; and having the opportunity of

* [Also by Fritz Müller, 'Für Darwin,' p. 35, fig. 24.—ED.]

observing that of *P. platycheles* (Pl. IX. fig. 4), I have taken advantage of the circumstance. It differs from the recognized typical zoëa of the common shore-crab (*Carcinus mœnas*) in the monstrous development of an anterior and two posterior cornuous processes to the carapace, and in the formation of the telson; but in its complete character it offers an intermediate condition between the brachyurous and macrurous Crustacea. It has the appendages of the cephalon and pereion developed to a similar extent with those of the Brachyura, whereas the telson and carapace bear a nearer resemblance to the same parts in the Macrura, from which they differ in degree only. In the carapace, instead of the rostrum and the posterior angles of the carapace being only just pronounced as in the macrurous zoëa, they are developed to a larger extent in the anomurous larvæ, and in the young of the *Porcellanæ* to nearly twice or three times the length of the animal; while the telson, instead of being shaped like the caudal fin of a fish, has in the Anomura the central portion sometimes produced to an angle posteriorly.

Beyond this stage of the development of this species, or, I believe, any species of the Anomura, we have no sure knowledge, except that which I stated relative to the genus *Glaucothoë* being a stage in the development of the genus *Pagurus*.

The zoëa of *Pagurus* (Pl. IX. fig. 1) is probably tolerably well known to carcinologists, but I am not aware of its having been figured* or described. It has the anomurous character of a pointed rostrum and a projecting point at each of the posterior angles of the carapace, and the telson terminating in a gradually widening fishtail-like appendage, fringed with a few terminal spines—the appendages being developed rather on the type of those of the Brachyura than of the Macrura. During our expeditions we have taken specimens that we believe to be the zoëa of the same genus still further developed; we say believe to be, because it is only from analysis that we have come to this conclusion, and have not the testimony of direct observation that the one is the older stage of the other.

That which we take to be the second stage of the genus *Pagurus* (Pl. IX. fig. 2) was captured toward the end of May, in a towing-net, in Plymouth Sound. From its general appearance my first impression was that it was the young of a *Palæmon*; but closer observation and a careful dissection of its parts induced me strongly to believe that it is the young of one of the anomurous group of Crustacea,—in the first place, the form of the carapace; in the next, the general divergence of its appendages from and their resemblance to those of the zoëa of a macrurous Decapod. The superior

* [Likewise figured by Fritz Müller, *op. cit.* p. 36, fig. 26.—ED.]

antenna is developed upon the brachyurous type; but the inferior has the squamiform appendage of the macrurous Crustacea. So have all the other appendages that pertain to the cephalon and pereion, except the last pair of pereiopoda; and these are not developed, at least they were not perceptible to our examination—a circumstance that would accord with the animal being an undeveloped anomurous crustacean. The pleon and its appendages bear a very close resemblance to those of the larva of a prawn, since it is equilaterally developed and furnished with a pair of appendages, posteriorly and ventrally, attached to each somite, the last of which is much larger than the others, and is evidently a progressive stage in the development of the great caudal plates of the macrurous Crustacea.

We attribute it to the genus *Pagurus* rather than to any of our other anomurous Crustacea, because it differs from the known zoëa of *Porcellana*, and of that of *Galathea* we have no knowledge; but from the nearer approach of these last genera to each other in their adult stage than to *Pagurus*, we are inclined to believe in a nearer resemblance of their larvæ. Hence our assumption that this present immature species is a young *Pagurus*.

The next stage to which we allude (Pl. IX. fig. 3) is one which we noticed in our preliminary Report to the British Association.

The animal is a small creature that was taken floating near the surface of the sea, in a warm day in June. Its general appearance is that of a young macrurous crustacean, and as such it has been classified near to *Callianassa* and *Calliadina*. It is symmetrical, except in the larger development of the great chela of the right side. The two succeeding pereiopoda are very long, but simple in their formation; the last two are considerably reduced in size, and the anterior terminates in a small imperfectly didactyle forceps, while the posterior has a copious terminal brush, consisting of cilia and short and broad spines, amongst which the short, obtuse, and spinous dactylos is discernible. The pleon is well developed, having each somite clearly defined, and all, except the first, carrying an equally developed pair of appendages, each of which consists of a peduncle and two unequal rami. The posterior pair, or uropoda, differ from the others in having the peduncle shorter and the outer ramus longer and more robust; it is likewise slightly curved, in the older specimens, more on the left side than on the right.

In this condition they probably continue until they find a suitable molluscous shell in which to reside. I imagine that

they may continue to cast their exuvium and grow, during the whole time that they are deficient of such shell, because I have taken specimens occupants of shells that are still smaller than the one described, and yet further advanced to maturity. It would be curious to see if, were they deprived entirely of the use of a shell for a habitat, they would continue to grow and retain the normal form of the pleon generally—a feature that characterizes some of the exotic closely allied genera.

Thus a careful examination of numerous specimens has enabled us to demonstrate the progressive development of the genus *Pagurus*, and to affirm with much confidence, judging by the descriptions and figures of the authors, that the genera *Glaucothoë* of M.-Edwards and *Prophylax* of Latreille are no other than an immature stage of the genus *Pagurus*; but since their specimens were exotic, they are probably the young of some foreign species.

Amongst the macrurous Crustacea we have had the opportunity of examining and figuring the larva of *Palinurus* (Pl. X. fig. 2). The young of this genus was first made known to the British Association by the late Mr. R. Q. Couch, of Penzance, at the Meeting at Dublin, in 1857, when he drew attention to the near resemblance existing between it and the genus *Phyllosoma*. In 1864–65, M. Gerbe, in the 'Comptes Rendus,' repeated the discovery of Mr. Couch, and asserts that the larva of *Palinurus* is identical with the genus *Phyllosoma*, and that consequently the genus *Phyllosoma* is the young of the genus *Palinurus*.

The larvæ of most of the Decapod Crustacea have the largest amount of development commencing with the cephalon and the pleon; whilst in the larva of *Palinurus* the greatest advancement exists in the anterior part of the cephalon and in the pereion, whereas the pleon is almost rudimentary.

On comparing it with the genus *Phyllosoma* (Pl. X. fig. 1), as M. Gerbe has done, there is little that can warrant a separation of the two in the general structure of the animals, or that might not be accounted for by increased development of the younger specimens. Yet there are certain points that weigh heavily in the balance of evidence against the larva of *Palinurus* and *Phyllosoma* being but different stages of the same animal.

(1) It is contrary to our experience that so small an amount of progressive development has taken place in an animal that has increased in growth to about thirty times its size. We generally perceive, in the development of Crustacea, that the most important changes are those that immediately succeed

the birth of the larva. (2) The most certain mark by which a young animal may be known is the immature condition of the antennæ, more especially the flagella; now, whilst in the larva of the *Palinurus* they are very rudimentary, in *Phyllosoma* they assume an adult character, and in the second pair one that is of a peculiar feature, at least in the species to which we refer. (3) The oral appendages appear to be present, though only as the germs of the future parts; whilst in *Phyllosoma* they appear to exist in a rudimentary condition that assimilates little to a progressive stage. (4) Double branchial vesicles are attached to the coxæ of each pair of pereopoda, whilst none exist in the larva of *Palinurus*. We must admit, however, that this argument is not very strong, seeing that in the adult *Palinurus* such organs are present, and that there must be a period when they first appear; and it is most probable that their earliest stage is of the most simple character. And perhaps we should not have thought it sufficiently important to have remarked upon, had not M. Gerbe stated that *Phyllosoma*, like the larva of *Palinurus*, was without branchial appendages, and M. M.-Edwards remarked that these vesicular appendages are vestiges of the external branch of the limbs. (5) *Phyllosoma* is a tropical genus, and with such we can only compare the larva of *Palinurus*; two specimens only of the former have been obtained in the British seas, whereas *Palinurus* is very common on our coasts—an argument that might be very forcible were we not cognizant of the fact that we are quite as much, if not more, in the dark in relation to the development of the common lobster.

Our ignorance upon these interesting and important points in the history of the Crustacea, together with the discovery of Fritz Müller that the larva of *Peneus*, and probably that of some other prawns, very closely resembles that of the cirripeds and other entomostracous larvæ, shows that there is much yet to be done of far more interest to zoological science than the mere discovery of new species to be added to our fauna. The great diversity of structure, and the wonderful variation in the development of animals that possess a great similarity in their adult condition, indicates that careful study of these animals will probably assist in throwing a considerable light on some of the more profound problems of biological knowledge.

Several specimens of *Scyllarus arctus* have been taken recently on our coasts. It is some years since Mr. Couch announced the first appearance of this as a British species; and none has since been recorded until these last two years, when six have been taken near Penzance by Mr. Cornish, and one off the Mewstone, near the eastern entrance of Plymouth Sound; two

of these were furnished with spawn, and two of the others were found in the stomach of a codfish. That which was obtained off the Mewstone was $4\frac{1}{2}$ inches long, and one of the most interesting additions to our local fauna: this length is half as long again as that recorded by M. Milne-Edwards of the Mediterranean specimens.

In the dredging-list published by the British Association, the common lobster of Europe is called *Astacus gammarus* (L.), *marinus* (Fabr.), and *Homarus vulgaris* (M.-Edwards). But, since the descriptions of Crustacea by Linnæus are so very general, and the specific name used by him has been long closely associated with that of a very distinct genus, we think that of Fabricius, the next in succession, should be adopted. Again, the generic name, given by Fabricius, of *Astacus*, although prior to all others, yet included the freshwater genus, with which it is so closely associated as to make an exchange inconvenient. I therefore propose, in accordance with the rules laid down by the Association, to retain the generic name of M. M.-Edwards and the specific name of Fabricius, and call it *Homarus marinus*, Fabr.

We cannot turn away from this species without noticing the manner in which the process of repair is carried on in the development of a new flagellum to the inferior pair of antennæ. Mr. Lloyd, Conservator of the Marine Zoological Collection at Hamburg, to whom we are indebted for the preparation from which fig. 4 in Pl. XI. is taken, writes to me:—"The animal lost the antenna by accident, just where the juncture with the peduncle takes place, and then the antenna began to grow in a spiral case, the spiral growing larger and increasing the number of its turns as it grew older, but never getting hard or coloured. When the entire exuviation of the lobster took place (in about four months after the antenna was broken off), the antenna was drawn out of its special case and came forth straight, the spiral skin retaining its shape. Hardening of the antenna does not take place (or at least it does not appear hard) till after exuviation, and in like manner the limbs of all the lobsters here which renew their limbs."

A specimen of the genus *Axius* was taken by Mr. Couch off Polperro, and described by him as new, in the 'Zoologist,' 1856, pp. 52-82; but I am not aware that it has been since met with.

I have taken what I believe to be specimens of *Crangon fasciatus* and *Cr. sculptus*; and a careful comparison of them with the descriptions and figures of the authors has failed to convince me that they are not more or less spinous varieties of the same species; and in character they agree so well

with the description of *Crangon boreas* that it is difficult to believe that they are not depauperized specimens of that large arctic species.

Several specimens of *Alpheus ruber* have been taken on shelly ground off the Dudman,—and from the same locality two other specimens of *A. Edwardsii*, which I believe is the first time that this latter species has been recorded as British. I had them alive for several days. Their colour is a brilliant red crimson, *A. ruber* being rather paler and more banded than *A. Edwardsii*. One peculiar and interesting feature in the structure of this animal is the alteration of the character of that portion of the carapace that covers and protects the organs of vision (not so much from the anterior development of the carapace as from the eyes having receded beneath it), which, while it offers protection to the organs of vision, yet has become so transparent that it is only by close and careful examination that, in the living state, the relation of the two parts to each other can be distinguished.

The next genus to which we have to allude is one that we believe must be described as new to our fauna. It was first described by Costa from a Mediterranean species (*Typton spongicola*), as far back as 1844, in the 'Annali dell' Accad. degli Aspir. Nat. di Nap.' ii., also by Grube (Ein Ausflug nach Triest und Quarnero, pp. 65 & 125), and again by Heller under the name of *Pontonella* (Verhandlungen des zool.-bot. Vereins in Wien, p. 627, Tafel ix. f. 1-15), as well as in his 'Crustaceen des südlichen Europa,' p. pl. f. . Believing it to be distinct, I have given it the name of *Typton spongiosus*, of which the following is a short description:—

Gen. char.—Carapace short and deep, covering the entire pereion. Pleon twice as long as the carapace, with the lateral walls deep. Eyes prominent, not concealed under the carapace; superior antennæ having a secondary branch. First pair of pereiopoda equal, slender, long, and chelate; second pair large, in general the right much larger than the left.

Spec. char.—Carapace having a short simple rostrum. Eye longer than the rostrum. Anterior antennæ with the secondary appendage longer than the primary; posterior antennæ having the squamiform plate of the third joint small, pointed, and not ciliated. Second pair of pereiopoda having the propodos as long and nearly as broad as the carapace. Dactylos of the right hand with the cutting margin convex and simple, of the left hand less convex and cuneated. Posterior pair of pleopoda with the posterior external angle of the outer ramus dentated, the inner tooth being the longest; telson armed with

four lateral dorsal spines, and tipped with a few spines and hairs.

We have taken several specimens of *Nika*; and from their general resemblance to *N. Couchii*, while possessing the channelled telson of *N. edulis*, so particularly pointed out by Bell as specifically distinctive, I am much inclined to believe that there is but a single British species yet known, and that *N. Couchii* is but a variety of *N. edulis*, Risso. An examination of its parts in detail has shown us that the mandibula (Pl. XI. fig. 3) are formed on a plan that nearer associates the genus with *Crangon* than with *Alpheus*, in the family of which (Alpheidæ), the latter being the type, *Nika* is placed by Milne-Edwards and Bell, while Dana, more correctly we think, has placed it in a subfamily of the Crangonidæ, the *Lysmatinæ*.

Two or three specimens of *Athanas nitescens* have been taken off Polperro.

Hippolyte Barleei, which was described by me from a Shetland specimen several years ago, must, I think, be expunged from the list of species, since, as pointed out by the Rev. A. M. Norman some time since, it is only an accidental variety of *H. Cranchii*. Observations of the Stomapoda on the south-western coast have been limited to a few of the commoner species: whether this arises from the species not being abundant on our southern shores as compared with those on the northern, or from accidental causes attributable to collecting arrangements, is yet to be determined.

Amongst the smaller Crustacea, there is little to which I should wish to draw special attention, except the recent discovery of what may prove to be an undescribed *Anthura*, and some observations on the structure of *Tanaïs*.

In 1861 Van Beneden asserted that the proper place of the genus *Tanaïs* was near to that of the family of the Diastylidæ, because the cephalon was developed upon the type of the carapace of the Decapoda. In 1864 this opinion was followed by Dr. Fritz Müller, who stated that though he had been unable to identify branchial appendages, yet he felt assured that it possessed rudimentary organs, because he had observed a current of water playing from beneath the carapace. Recently, having obtained some living specimens, I have been able to support Dr. Fritz Müller's conclusion relative to the current of water; for, by the assistance of transmitted light, I have been able, through the walls of the carapace, to see the branchial appendage waving to and fro; since which I have dissected out the organ, a drawing of which accompanies this memoir. (Pl. XI. fig. 5.)

EXPLANATION OF THE PLATES.

PLATE IX.

- Fig. 1.* First stage of development of *Pagurus**.
Fig. 2. Second stage. The author gives this with the reservation stated, having taken it swimming in the open sea. *c*, dorsal view of cephalon; *a*, eye; *b*, superior antennæ; *c*, inf. ant.; *d*, mandible; *g*, posterior maxilliped; *h*, first pair of gnathopoda; *l*, second pair; *k*, first pair of pereopoda; *l, m, n, o*, three posterior pairs of pleopoda; *p, q, t*, pleopoda; *u*, sixth pair of pleopoda; *z*, telson.
Fig. 3. Third stage, representing the genus *Glaucothoë* of Milne-Edwards and *Prophylax* of Latreille: *n*, penultimate pair of pereopoda; *o*, ultimate pair of pereopoda; *p*, a pleopod; *u*, sixth or posterior pair of pleopoda; *z*, telson; *P*, pleon of an older specimen.
Fig. 4. Zoëa of *Porcellana platycheles*: *z*, telson.

PLATE X.

- Fig. 1.* *Phyllosoma*.
Fig. 2. Zoëa of *Palimurus marinus*.

PLATE XI.

- Fig. 1.* *Typton spongiosus*, n. sp. References as above.
Fig. 2. *Alpheus Edwardsii*.
Fig. 3. Mandible of *Nika edulis*.
Fig. 4. *Homarus marinus*. Development of flagellum to lower antenna.
Fig. 5. *Tanais*: *h*, first pair of gnathopoda, with branchial appendage attached.

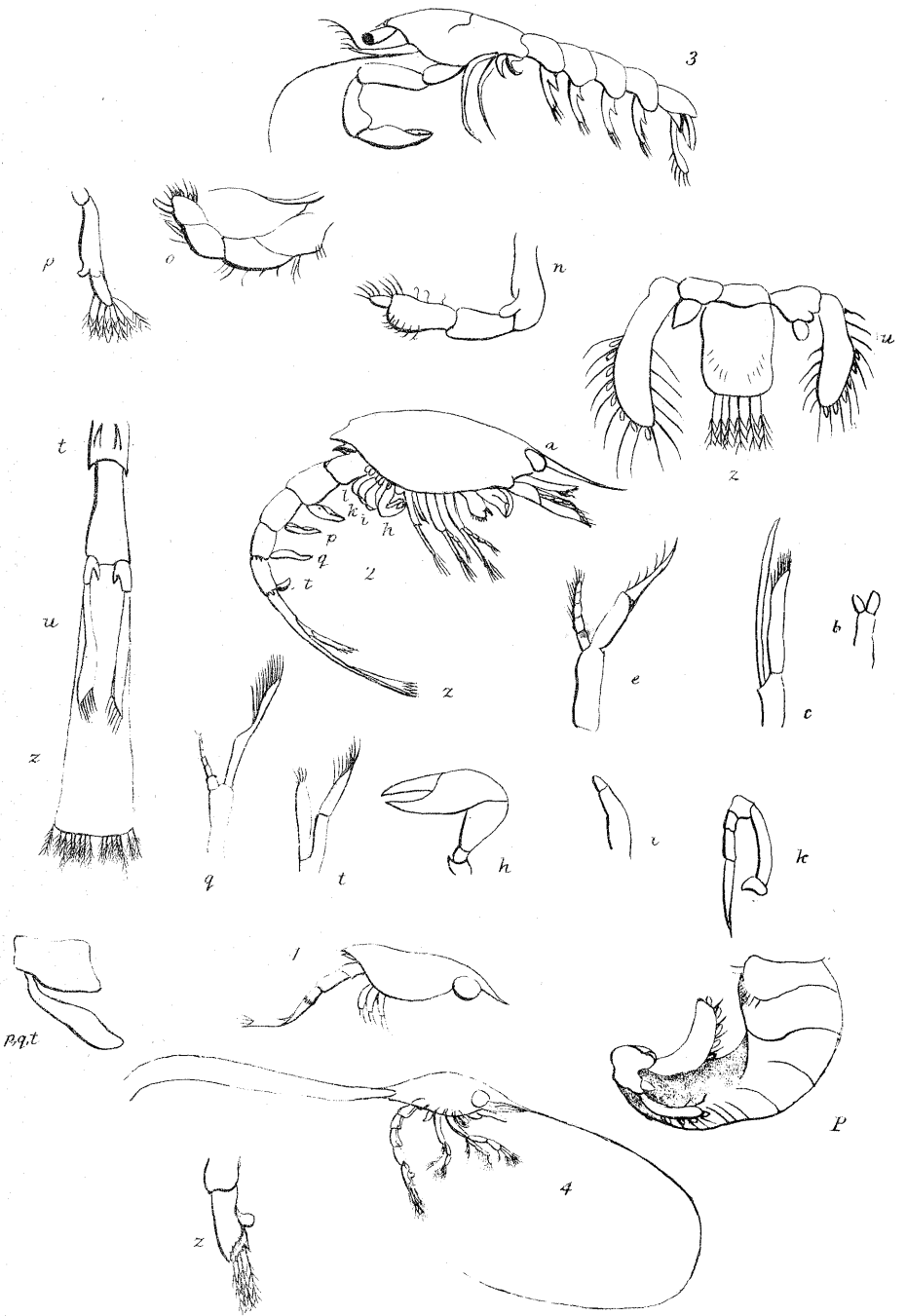
XI.—*Observations on some of the Heliotropiceæ.*

By JOHN MIERS, F.R.S., F.L.S., &c.

IN the 'Prodromus' of De Candolle we find the order *Borraginæ* divided into four distinct tribes, the *Cordiceæ*, *Ehreticeæ*, *Heliotropiceæ*, and *Borragææ*. Long before the appearance of that work, the late Mr. R. Brown had pointed out, in his 'Prodromus,' p. 492, that the *Cordiceæ* ought to be held as a distinct family, on account of their 4-fid style, and their seeds without albumen, with plicated cotyledons—an opinion supported by Endlicher and Lindley for reasons which appear sufficiently valid. Von Martius rightly held that the perfectly gynobasic style, placed in the middle of four distinct ovaries, entitled the *Borragææ* to rank as a separate natural order, and accordingly he combined the two remaining tribes of DeCandolle, the *Ehreticeæ* and *Heliotropiceæ*, in another family, which he designated with the name of *Ehretiaceæ*. The uncertainty and confusion in the distribution of the species in these several groups have in great measure arisen from a neglect to examine the structure of the fruits; it may, however, be taken as a rule that among the whole of them it is essential that the seeds

* This was taken so young from the ovum that I am not certain whether the long projecting rostrum is a feature or not, as at this period it is generally folded under.

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