strong rectangular tooth beyond the middle, and a much more obtuse prominence before the tips, which are somewhat attenuated.

*Female* (?). Brownish black; antennæ 13-jointed, castaneous, darker at base, vertex slightly reddish; lateral borders of pronotum, tegmina, except a broad blackish band on the suture, and legs testaceous; wings not visible; pygidium longer and narrower than in the male, triangular above, and with the projecting lateral points much more conspicuous; forceps shaped as in the male, minutely denticulated on the inner edge, but without larger teeth.

*Hab.* Theresopolis.

Apparently allied to *Forficula parvicollis*, Stål.

Genus XXX. APTERYGIDA, *Westw.*

*Westw. Mod. Class. Ins.* ii. *Gen. Synopsis*, p. 44 (1840).

Type, *Forficula albipennis*, Charp., from Europe.

This genus will include the small subapterous European species with forceps diverging at the base in the male, which are included by some authors with *Forficula*, and by others with *Chelidura*. All the species which properly belong to *Sphingolabis* have fully developed organs of flight.

Genus XXXI. CHELIDURA, *Serv.*

*Serv. Ann. Sci. Nat.* xxii. p. 36 (1832).

Type, *Forficula aptera*, Charp., from Europe.

Genus XXXII. CARCINOPHORA, *Scudd.*

*Scudd. Proc. Bost. Soc. Nat. Hist.* xviii. p. 291 (1876).

Type, *Chelidura robusta*, Scudd., from Peru.
Not represented in the Museum Collection.

*Doubtful Genera.*

Genus XXXIII. (?) CONDYLOPALAMA, *Sund.*

*Sund. Forh. Skand. Naturf.* iv. p. 255 (1847); *Scudd. Proc. Bost. Soc. Nat. Hist.* xviii. p. 292 (1876).

Type, *Condylopalama agilis*, Sund., from Brazil.



Genus XXXIV. TYPHLOLABIA, *Scudd.*

*Scudd. Proc. Bost. Soc. Nat. Hist.* xviii. p. 300 (1876).

Type, *Forficula* (?) *lævis*, Phil., from Chili.
Believed to belong to the genus *Iapyx*, Hal. (*Thysanura*).

DESCRIPTION OF PLATE XII.

Fig. 1. *Labidura pugnax.*
2. *Demogorgon patagonicus.*
3, 3 *a*. *Demogorgon Batesi.*
4. *Chelisoches* (?) *picticornis.*
5. *Chelisoches tenebrator.*
6. *Spongophora Dysoni.*
7, 7 *a*. *Sphingolabis spiculifera.*
8. *Labia buprestoides.*
9. *Echinosoma Forbesi.*
10. *Anisolabis rufescens.*
11, 11 *a*. *Pygidicrana Horsfieldi.*
12, 12 *a*. *Opisthocosmia* (?) *cervipyga.*

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On a Variety of *Alectona Millari* (Carter). By A. VAUGHAN JENNINGS, F.L.S., F.G.S., Lecturer on Comparative Anatomy to the Birkbeck Institute.

[Read 20th November, 1890.]

(PLATE XIII.)

IN his 'Monograph of the British Spongiadæ,' Dr. Bowerbank * figured a siliceous spicule, remarkable for its resemblance in form to that of a *Gorgonia*, as belonging to a sponge that had "never yet been determined."

Mr. Carter in 1879 † described similar spicules associated with microscleres of his sceptrella type, occurring in a homogeneous dried sarcode. The sponge appeared to be of an excavating habit, but on account of its association with *Cliona* this could not be determined with certainty. He referred it to the genus *Gummina* ‡ under the name of *G. Wallichii*.

* Vol. i. pl. xi. no. 244.
† Annals and Magazine of Natural History, 1879, vol. iii. p. 353.
‡ Written *Corticium* but corrected subsequently.

Later in the same year Mr. Carter * was able to give a full account of a specimen boring in a coral (*Amphihelia oculata*, Duncan) dredged between Scotland and the Faroe Isles. Deciding that the sponge could not remain in the genus *Gummina*, he substituted for the name previously given that of *Alectona Millari*.

The genus has not yet been recorded as boring in molluscan shells, but there is a variety of *A. Millari* commonly found in those of *Lima excavata*, Fabr., from Christiania and the Scandinavian coast. I have not yet observed it in any other shell, even in collections from the same locality.

Though not specifically distinct from the original type, this form seems worthy of attention on account of certain peculiarities in its mode of growth, and because it presents a striking instance of the inclusion of foreign spicules.

*The Habit of the Sponge.*—Scattered over the outer surface of the shell are circular openings, irregularly distributed and variable in size, leading into passages communicating with the chambers excavated by the sponge. The larger are about $\frac{1}{20}$ inch in diameter, and the passages into which they open are lined by a thin white crust. In many cases the opening is roofed over by a convex white disk with a central perforation, and similar structures are seen occasionally crossing the passages below the surface. (Pl. XIII. figs. 3, 4.)

On examination, these disks and the crust lining the passages are seen to consist entirely of the flesh-spicules.

In the region of the umbo the shell-substance has been eaten through in irregular patches, and the spaces are now filled by masses of spicules in which the flesh-spicules are far more numerous than the megascleres.

The question whether the sponge projected on the outside or grew over the surface in this region is of some interest, as in the original type there was distinct evidence of such an extension of growth outside the coral.

If there had been any such external growth, it is probable that remnants of it would be left, seeing that the more delicate papillæ over the small openings are still preserved. Moreover, the predominance of flesh-spicules in these patches suggests the

* Journal of the Royal Microscopical Society, vol. ii. 1879, p. 493, pls. xvii.–xvii. A.



presence of a dermal layer there. It seems probable therefore that the growth of the sponge is limited by the shell externally.

It is on examining the inner surface of the shell, however, that the special growth-characteristics of the sponge are seen. Instead of the smooth and even surface broken only by scattered perforations that is commonly seen in shells attacked by *Cliona* *, there appears in this case an irregular elevated area covered with blunt spines and papillæ.

Evidently the sponge has endeavoured to grow inwards, dissolving the nacreous layer and encroaching on the premises of the mollusc, instead of restricting its wanderings to the thickness of the shell. The mollusc has retaliated by depositing fresh shell-layers on the intruder, and the struggle has gone on till the chambers are several times the normal thickness of the shell, and are roofed over by a thin convex layer of secondary shell-substance, while the points at which branches have pushed further in are represented by thick conical papillæ.

The actively growing parts of the sponge are fine threads, sending off lateral branches or dividing dichotomously.

A careful examination of the extremities of the borings indicates that the excavation is carried on in the same manner as in the *Cliona* described by Nassonow †.

Immediately behind these growing tips the sponge thickens rapidly, but does not form distinct chambers, so that there is nothing of the moniliform appearance seen in some Clionas, while the older parts occupy wide confluent spaces only crossed here and there by pillars of shell.

The rapidity with which the shell is attacked is shown by the fact that only the extreme tips are in the normal thickness of the shell, while the convex secondary deposit is developed almost to the ends of the branches.

The best idea of the relations existing between the sponge and the shell is obtained from an examination of thin sections made through the chambers and papillæ.

* Ryder in the 'American Naturalist,' 1879, vol. xiii. p. 281, mentions the presence of papillæ on the inside of *Ostrea virginiana* peforated by a boring sponge, but does not specify the sponge. I have seen small papillæ due to the presence of *Cliona* in *Mytilus latus*; and Hancock mentions "clusters of pearl-like points" due to *Thoosa cactoides*, Ann. & Mag. Nat. Hist. (2) iii. 1849, p. 346.

† Zeitschrift für wiss. Zoologie, xxxix. pl. xviii. fig. 1.

Thus the section figured (Pl. XIII. fig. 6) shows that while the outer layer of the shell is left intact, the chamber occupied by the sponge is fully twice the normal shell-thickness. The nacreous layer is normally about ·75 millim. thick; over the chamber it is reduced to ·40 millim., except where the sponge has sent out two branches that have been covered by many concentric deposits to a thickness of 1–2 millim.

In the axis of each papilla thus formed lie spicules of the sponge, a pair of the large skeleton-spicules in one case lying close together parallel to the direction of growth and surrounded by the small flesh-spicules. The appearance of these sharp and spinose bodies lying in a crypt scarcely larger than themselves, like a *Pholas* in its burrow, might have been used as evidence in favour of the view that the excavating power of boring-sponges is due to the spicules.

One feature of considerable interest remains to be noted. It is only in quite the youngest regions that the sponge has been able to establish communication with the exterior on the inside of the shell. In all the older parts its attempt to grow inward, and the consequent deposit of shell over it, has prevented the formation of apertures. All the papillæ are closed at the apex, showing that the mollusc can deposit new shell faster than the sponge can dissolve it.

In the case of *Cliona*, there has been much difference of opinion as to the effect on one another of the two organisms. Thus while some writers have held that the sponge commonly dies first, Hancock's * opinion was that the death of the sponge came only on the breaking up of the shell, when, "Samson like, it perishes amidst the ruin produced by its own energy."

Whatever be the case with *Cliona*, it is evident that the sponge has not the best of the struggle in the present case, and it seems probable that the species is in a transition condition, and represents one of the stages in the evolution of shell-boring Porifera.

The original type inhabited a coral, in which it could grow freely in all directions. In the present instance a similar irregular growth has been most injurious if not fatal to the sponge, owing to waste of energy in dissolving shell that can be readily replaced, and to the deficient circulation resulting from the closure of apertures.

* Hancock, Ann. & Mag. Nat. Hist. iii. 1849, p. 323.



It is obvious that any individuals which tended to grow in two directions only would stand a very much better chance of survival, and that the continued selection of such individuals would result in highly specialized shell-boring sponges like *Cliona Fryeri* (Hancock), which burrows through *Placuna* shells of extreme thickness, establishing communications for each chamber on both sides, without setting up any irritation of the mollusc and consequent deformation of the shell.

*The Spicules.*—The *Skeleton-Spicules* or *Megasclera* are diactinal and pointed at the end (*oxeas*). They measure $\frac{1}{80}$ inch in length, and in breadth $\frac{1}{900}$ inch *, and the surface is covered with sharp conical spines; they are therefore somewhat smaller than those of *A. Millari*, Carter, and are rather more strongly spined.

The *Flesh-Spicules* or *Microsclera* are diactinal, consisting of a slightly bent shaft, blunt at the ends, bearing two whorls of papillæ, each situated at about one third of the length of the axis from the end †.

There are two forms of these microsclera:—(*a*) Larger ones in which the average length of the axis is $\frac{1}{500}$ inch and the papillæ are sessile. (*b*) Smaller forms only $\frac{1}{1000}$ of an inch in length, with the whorls of rounded knobs carried out from the axis on short stalks, and having consequently greater proportional width. These two types are well defined and do not graduate into one another. Both were present in *A. Millari*, but apparently only the smaller in the form first noticed as "*Gumnina Wallichii*." Fragments of a homogeneous membrane which resist the action of acid are full of the small microscleres, and probably are remains of a dermal layer.

There is a third kind of spicule present in the form of slender *raphides*. These were also present in *A. Millari*, and commonly occur in groups of two or three lying at definite angles to one another, connected by dried sarcode in which the smaller microscleres also occur in bands forming a sort of network. Possibly these bodies are gemmæ.

The most important difference then between this variety and

* The dimensions are given in inches to compare with the original type.

† The flesh-spicules of the original specimen were blunt-ended though represented as acute. Mr. Carter asks me to state that though his initials were appended to the plate accompanying the description (Journal Royal Micr. Soc. 1879, pl. xvii.), this was a mistake, and he is only responsible for pl. xvii. A.

the typical *A. Millari* lies in the absence of the smooth microxeas (subskeleton spicules, Carter) so abundant in that specimen.

Through the kindness of Prof. Martin Duncan, F.R.S., I have been able to examine preparations of the original specimen, and the perfect series of gradations from the smooth acerate microxea to the "sceptrella" type is very striking. The simple forms pass into those with scattered papillæ, and these again into the typical microsclere with its two whorls. It may be noticed also that these "subskeleton-spicules" are more markedly diactinal than the skeleton-spicules; they are bent at varying angles, and, as Prof. Duncan pointed out to me, in some cases a well-marked projection at the angle looks like a rudimentary third ray.

*Inclusion of Foreign Spicules.*—The incorporation of a heterogeneous aggregate of spicules, sand-grains, foraminifera, &c. in the fibrous network of the skeleton is a familiar feature in certain sponges. Equally well known is the chance occurrence of a foreign spicule embedded in the soft tissues. The phenomenon of the presence of a number of similar spicules of one kind in the tissues of a sponge which has no general habit of accumulating foreign bodies is of a different nature, and important on account of the errors it might in particular cases occasion.

In 1880 Mr. S. O. Ridley * brought before the notice of the Society two cases of monaxonid sponges which had included spicules belonging to other genera; but, so far as I know, similar instances have not been recorded in the boring-sponges, which are indeed the last group in which such an occurrence would be expected.

Among the spicules first examined from the cavities excavated in the shell, there occurred a considerable number of rounded triangular disks, evidently derived from the dermal layer of some species of *Discodermia*. The explanation at first seemed to be that they had been accidentally washed into the cavities after the death of the sponge; but the absence of other foreign bodies, and the fact that they occur in different parts embedded in the dried sarcode together with the proper spicules, rendered that explanation untenable. Moreover, I have since found them in another specimen from Christiania, and, more important still, a group of the same spicules occurs in a preparation of the original specimen of *Alectona Millari*, kindly lent me by Dr. Hinde.

* Journ. Linn. Soc., Zool. vol. xv. 1880, p. 149.



Bearing in mind the difference in habit between the latter and the shell-boring form, the difference in the localities, and the freedom of both from foreign bodies generally, this association of such widely different spicules seems especially difficult to understand. Thinking that the determination of the species of *Discodermia* from which the spicules are derived and a comparison of its habit and distribution might lead to some explanation, I have endeavoured to find a record of such a form.

The spicules are perfectly constant in form and size; in shape triangular, with rounded angles and measuring ·15 millim. in diameter. The three canals in the disk are well-marked, and the rudimentary ray short, conical, and pointed. Over the surface are scattered circular papillæ.

The margin is always entire, never lobed—a character of the *young* dermal spicules in many Lithistids, but not a constant one in any known species.

The nearest form seems to be the *Discodermia papillata*, recorded by Mr. Carter from the Gulf of Manaar *. In this case the papillæ are very much smaller and more numerous, while all except the youngest dermal spicules are lobed.

As the species was encrusting and perhaps partly excavating a *Melobesia*, the description suggested the possibility of the presence of an excavating *Discodermia* in the shell of *Lima*, subsequently replaced by *Alectona*. If such were the case, however, the skeleton-spicules of the Lithistid would be found as well. The fact that only dermal spicules occur, indicates that they have been derived from some distance, as they are not only easily detached, but also easily conveyed by currents.

*Systematic Position of the genus* Alectona.—In conclusion, it may be as well to point out that no satisfactory position in classification has been found for the genus *Alectona*, and that the nature of its spicules prevents its inclusion in any of the groups of the Monaxonida as defined in recent systems.

Mr. Carter placed it with other boring sponges in his division "*Eccœlonida*" †, but there is no doubt that a classification founded on a single character must give way to one with a morphological basis.

In Dr. Vosmaer's arrangement ‡ the genus is placed after *Cliona*, but it is only added in the appendix.

* Ann. & Mag. Nat. Hist. (5) vol. vi. 1880, p. 146. † *Ibid.* p 58.

‡ Bronn, Klassen u. Ordnungen des Thierreichs—Porifera, p. 406.

Messrs. Ridley and Dendy *, and Dr. R. von Lendenfeld †, have classified the Monaxonida according to their spicular characters, but neither arrangement includes the genus under consideration. In their division of the 'Clavulina' are included forms with microsclera of the "stellate" type ‡ and with monactinal megasclera.

If, as the authors of the 'Challenger' Report on the Monaxonida are of opinion, the microsclera are of more classificatory value than the megasclera, it may be possible to place *Alectona* among the *Spirastrellidæ* near to *Latrunculia*, in spite of its diactinal spicules. Two species with oxeate skeleton-spicules have indeed been included in the latter genus by Mr. Carter §, and Messrs. Ridley and Dendy have described as *Latrunculia* (?) *acerata* a third species with similar megasclera associated with microsclera of the "sceptrella" form.

If such a form as this can be retained among the *Clavulina*, the genus *Alectona* may be placed also in that division; but it will possibly be found advisable to establish a new group for the reception of those Monaxonids that have oxeate megasclera and stellate diactinal microsclera. Moreover, if, as the spiculation of the original specimen of *A. Millari* seems to indicate, the sceptrella can be derived from a simple oxea by development of lateral scattered projections and their gradual localization round two centres, the classificatory value of stellate microscleres may have to be reconsidered.

## EXPLANATION OF PLATE XIII.

Fig. 1. View of the inside of the shell of *Lima excavata*, Fabr., attacked by *Alectona Millari*. Nat. size.
Fig. 2. Outside of the same shell. Nat. size.
Figs. 3, 4. Ends of two passages opening on the surface of the shell. × 16.
Fig. 5. Part of the spicular crust round the opening of one of the same. ×50.

* 'Challenger' Reports, vol. xx. pp. liii–lxviii.

† Proc. Zool. Soc. 1887, pp. 558 662.

‡ For spicules of the shape of the microscleres of *Alectona*, Mr. Carter proposed the name of "*sceptrellæ*." Messrs. Ridley and Dendy propose the term "*discastra*" as a synonym ('Challenger' Reports, Zool. vol. xx. p. 263), but the forms to which they apply it are monactinal. It would perhaps be useful to keep Mr. Carter's term for diactinal forms, and use *discastra* for monactinal spicules like those of *Latrunculia*.

§ Ann. & Mag. Nat. Hist. vol. iii. 1879, p. 298; vol. vii. 1881, p. 380.



Fig. 6. Vertical section of the shell, passing through the chamber excavated by the sponge, and two of the nacreous papillæ. ×8.
Fig. 7. One of the same papillæ, ×30, showing spicules of the sponge in the centre.
Fig. 8. The skeleton-spicules. ×110.
Fig. 9. The larger flesh-spicules. ×350.
Fig. 10. The smaller flesh-spicules. ×400.
Fig. 11. One of the raphides.
Fig. 12. Part of dermal membrane?
Fig. 13. Gemmule? ×40.
Figs. 14, 15. Dermal spicules of a species of *Discodermia*, included in the tissues of the sponge. ×80.

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# On some Hermaphrodite Genitalia of the Codfish (*Gadus morrhua*), with Remarks upon the Morphology and Phylogeny of the Vertebrate Reproductive System.

By G. B. Howes, F.L.S., F.Z.S., Assist. Professor of Zoology, Royal College of Science, London.

[Read 5th February, 1891.]

(Plate XIV.)

I. Codfish possessed of hermaphrodite genital glands have been known since the days of Leewenhoek (1688), Baster (1761), Yarrell (1845), Smith (1870), Max Weber (1884), and others have since recorded examples. The fullest description of such yet published is that of Max Weber alluded to *, to be referred to later, and his excellent paper embodies a *résumé* of all that was known up to the time of writing, with full references to the works of authorities cited. I have lately received from one of my past pupils (Mr. Walter C. Chappel, of Sunderland) the genitalia figured on Plate XIV., and our President has afforded me opportunity of examining five specimens in the Museum of the Royal College of Surgeons, under his charge. My best thanks are due to these gentlemen for their kindness and liberality.

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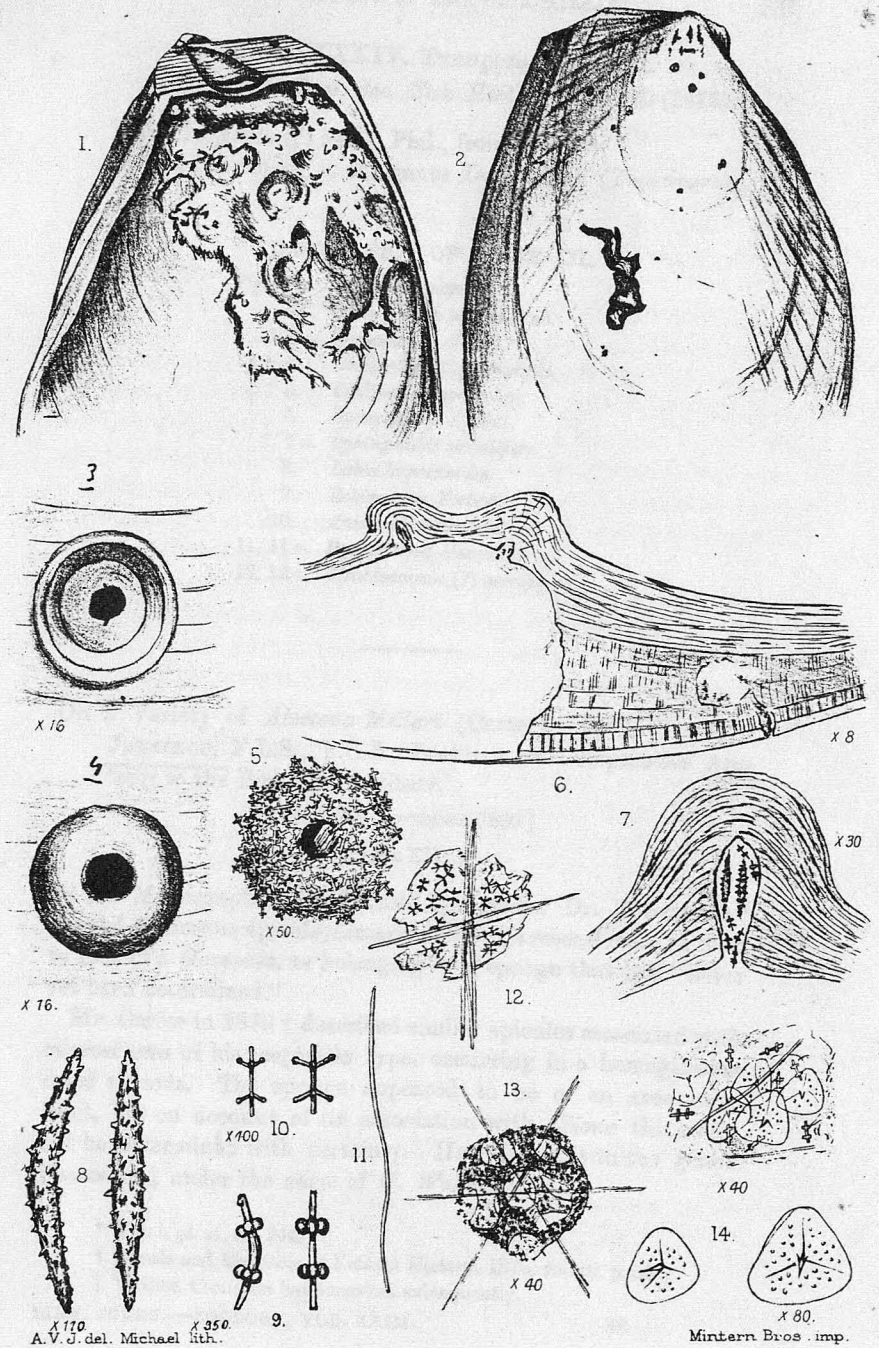
II. I give below the total lengths of the ovaries of the

* Nederl. Tijdschr. v. d. Dierkunde, Jhg. v. Af. 2, p. 21 (1884).




A. V. J. del. Michael lith. Mintern Bros. imp.

ALECTONA IN LIMA EXCAVATA