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2. Agaricoides, a new type of Siphonogorgid Alcyonarian.

By Jas. J. Simpson, M. A., Zoological Department, University of Aberdeen.

(With 19 figs.)

eingeg. 10. Juni 1905.

This beautiful and apparently unique Alcyonarian (Siphonogorginae) was included in a collection of Deep-sea forms obtained in the Indian Ocean by the Royal Indian Survey Ship "Investigator". As some time must elapse before the Report on the entire collection is published by the Indian Museum, it has been thought advisable to give a separate record of this peculiarly interesting type. I am indebted to Prof. J. Arthur Thomson, University of Aberdeen, and to Prof. A. Alcock, Calcutta, for the opportunity of describing it.

Fig. 1. Typical colony. (4/5 N. S.)

The new genus is represented by numerous specimens varying greatly in size which illustrate different stages of growth (figs. 1 and 4).

The following are the measurements of some of the more perfect specimens:

Total height	Maximum breadth	Length of Trunk	Thickness of Trunk
3 cm	3 cm	1,75 cm	1,5 cm
2,5 -	3 -	1,5 -	1 -
3,2 -	1,5 -	2,2 -	0,8 -
0,9 -	1,2 -	0,8 -	0,6 -

All were attached to pieces of Madrepore coral probably *Lophohelia* sp.

General Description.

The colony consists of 2 very distinct parts: (1) a bare trunk, and (2) a polyp-bearing "pileus". The trunk is composed of a large number of longitudinal canals with the adjacent walls fused and densely packed with spicules, which give consistency and rigidity to the colony. The upper umbrella-shaped portion or "pileus" so closely resembles a mushroom that the term "agariciform" might well be applied. The general colour of the pileus portion of the colony is a pale orange-yellow, while the trunk is whitish. The zooids, whose tentacles are not retractile, are introversible within cylindrical stalks which are expanded terminally into characteristic octagonal disc-like expansions. The close-set octagons covering the pileus, with a zooid appearing in the centre of each, present a most remarkable and unique appearance.

The Canal System.

Fig. 2 represents a section through the trunk, and shows the outlines of the longitudinal canals, with their fused partition walls. Owing

Fig. 3.

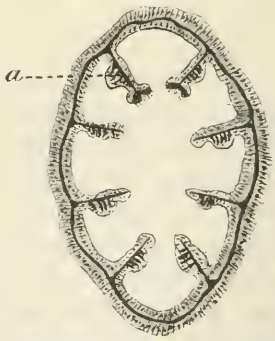

Fig. 2.

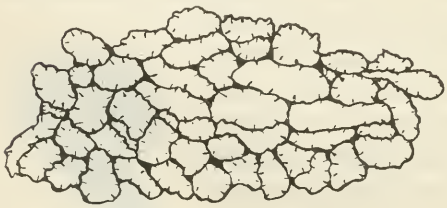

Fig. 2. Section through the trunk showing the mesenterial filaments passing into the stem canals ($\times 8$.

Fig. 3. Enlarged section of one of these canals ($\times 48$). *a*, ascular filament.

to the contraction of the spirit-specimens, the mode of growth is by no means obvious, but an examination of various stages, and of serial

sections through these, makes the mode of increase in the number of the canals fairly clear. The centre of the stem is occupied by a number of large canals whose cavities measure 3 mm in diameter. These do not communicate with one another, but at several points solenia can be seen connecting them with the canals in the cortical region whose cavities measure 2 mm to 1 mm in diameter. The cortical canals terminate basally in a "cul-de-sac" while upwards they increase in diameter so as to give rise to zooids on the pileus portion. The younger zooids are peripheral and the whole colony may thus be compared to a bundle of compound racemes, the branches of which are hollow, and where the secondaries and tertiaries fuse to the primaries and grow to an equal length with them, so as to result in a corymb-like expansion. The eight mesenteries of the zooids are continued downwards almost to the very base of the canals, and at the same time the asuclar pair can be clearly distinguished by the caracteristic ciliated groove (figs. 2 and 3). This is also the case in *Siphonogorgia* (Köll.) and *Lemnalia*, (Bourne) while in some of the Nephthyidae e. g. *Spongodes*, only the asulcar mesenteries are continued into the canals of the stem.

Origin of the Zooids.

Both the central or primary canals, and the cortical or secondary canals give rise to zooids in a remarkable and interesting manner. After

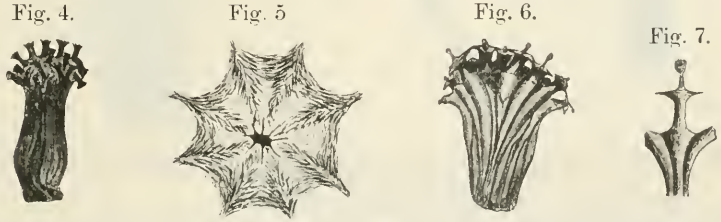

Fig. 4. Young colony (4/5 N.S.), showing first stage in the development of the verrucae.
Fig. 5. Surface view of a verruca-disc, the zooid being introverted (× 5).
Fig. 6. Vertical section through a colony showing the relations of the parts (4/5 N. S.)
Fig. 7. Slightly enlarged polyp and stem canal showing the method of growth.

attaining a certain height, which is practically uniform for the colony, the walls turn inwards, so that the cavity is thus reduced in diameter, and when this is approximately one-half of the original measurement (fig. 7), a vertical upgrowth again commences, thus forming a cylindrical cup-shaped projection, homologous to the verruca in the Axifera. When the height of this part is about 4 mm, the circumference grows out into eight digitiform structures, while the wall again growing inwards fuses with the lower part at the eight indentations forming a similar number of blind short tubes. This constitutes what might be termed the verruca

proper. Growth still takes place, and a zooid is the result, consisting of a comparatively long stalk bearing the anthocodia. That this is the mode of growth is clearly demonstrable in the younger colonies, and also in the less advanced polyps round the periphery of the older colonies. Fig. 4 represents a colony where this is the maximum development attained, the zooids however being introverted. As the colonies grow in size, the verrucae also become more complicated, the terminate stellate part expanding horizontally to form an octagonal disc, with the indentations less pronounced, containing eight cavities which correspond to those formed by the retractor muscles. To complicate matters still further, towards the centre of the older colonies, verrucae which correspond to the primary canals fuse with the adjoining verrucae so that the canals are now continuous.

Fig. 5 represents a surface view of one of those isolated octagonal

Fig. 8.

Fig. 9.

Fig. 10.

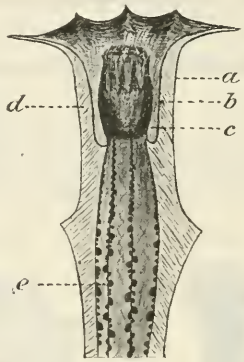

Fig. 8. Enlarged section through a wall showing the spicule cavities and the residue of the organic axis (*a*) (× 12).
Fig. 9. Zooid enlarged (× 8).
Fig. 10. Vertical section through a verruca and stem canal with the zooid introverted (× 8). *a*, outer wall of the verruca; *b*, wall of the zooid stalk; *c*, zooid; *d*, retractor muscle of the zooid; *e*, mesenteries with ova.

discs closed over the introverted zooid — the indentations corresponding to the fused walls, and the raised portions indicating the position of the canals, the spicules being arranged biserially along the eight radii. A vertical section through a complete colony is given in fig. 6, while fig. 7 shows the method of arrangement and growth as detailed for an individual isolated polyp and stem canal, the zooid being in this case everted. The partitions of the canals are densely spiculose, in addition to the outer feltwork, and a cross section shows that the spicules are arranged for the most part vertically, the cavities conforming to the tubercules on the spicules (fig. 8).

Structure of the Zooids.

The zooids (fig. 9) are about 5 mm in height and consist of a somewhat slender stalk bearing a cup-like anthocodia, the whole being densely covered with a felt-work of minute warty spindles. The tentacles are short and broad, with a single row of pinnules on each side; their bases are confluent so as to enclose a capacious hollow — the oral disc, over which they can be infolded. They are not retractile, but when at rest, being infolded, the biserial arrangement of the spicules forms a very primitive operculum.

The wall of the anthocodia is prolonged into eight triangular lobes, on which the spicules are also arranged biserially, so that each pair forms two sides of a triangle, the enclosed angle becoming more and more obtuse towards the base. This arrangement is continued down to the origin of the stalk, forming a series of ridges on the anthocodia. The triangular projections thus function as a protection to the infolded tentacles. The stalk, though narrow, is very elastic, because the zooid when at rest forms an introvert within it, which in turn sinks within the verruca (fig. 10). The zooid is withdrawn by eight strong bands of retractor muscles which thus form eight cavities running upwards, and corresponding to the canals in the octagonal disc. These retractor muscles pass downwards and are continuous with the eight mesenteries of the zooid.

The oral disc is spacious and circular, containing a rather large elliptical mouth — opening, which leads into a keyhole-shaped, richly-ciliated stomodaeum, in which a very distinct sulcus can be distinguished. The ectodermic cells in this region are more numerous and the cilia are longer (fig. 12).

The mesenteries are all complete, and the muscle banners on the sulcar aspect are easily discernible. The filaments are continued down the stem canals almost to the very base of the colony, while the asulcar filaments show very markedly the ciliated groove so characteristic of the group (fig. 13 *a*).

Fig. 10 shows the relation of these parts in longitudinal section:

a. the outer wall of the verruca.
b. wall of the zooid stalk.
c. zooid.
d. retractor muscle of the zooid.
e. mesenteries with ova.

In a cross section through the introverted anthocodia the following parts can be distinguished (fig. 11):

a. the outer wall of the verruca.
b. the prolongation of this outer wall, when introverted, forming on its downward course the elastic wall of the zooid stalk.

c. the same turned upwards forming the wall of the anthocodia.
d. the wall of the stomadaeum.
e. the retractor muscles of the zooid.
f. the mesenteries.
g. the sulcus (see fig. 12 *a*).
h. muscle banners on the sulcar aspect.

Ova of enormous size were present in great abundance attached to the mesenterials filaments (fig. 10 *e*), varying in size from 0,1 mm to 0,6 mm in diameter, but although a considerable number of the larger and more mature ova were stained with borax-carmine, no sign of segmentation could be found, so that the question of viviparity for this genus must remain undecided.

A fact which may prove to be of great interest is that in every zooid examined there was a large number of Foraminifera of various

Fig. 11.

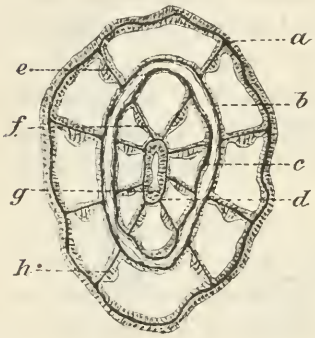

Fig. 12.

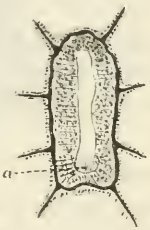

Fig. 13.

Fig. 11. Cross section through the introverted anthocodia (× 24). *a*, outer wall of the verruca; *b*, the prolongation of this outer wall, when introverted, forming on its downward course the elastic wall of the zooid stalk; *c*, the same turned upwards forming the wall of the anthocodia; *d*, the wall of the stomodaeum; *e*, the retractor muscles of the zooid; *f*, the mesenteries; *g*, the sulcus; *h*, muscle banners on the sulcar aspect.
Fig. 12. Enlarged section through the stomodaeum showing the sulcus (*a*) (× 56.
Fig. 13. Ascular filament enlarged (× 64). *a*, ciliated groove.

kinds, and in the decalcified sections examined the protoplasmic contents could be seen surrounded by the ectodermic cells of the stomodaeum, while many were also enclosed within the pinnules of the tentacles. When the zooids are at rest, the tentacles are infolded, and as many Foraminifera are enclosed by the pinnules they must have entered while the polyp was expanded. The absence of food in the coelentera of most Alcyonarians and the frequent presence of zooxanthellae point to the fact that many Alconaria are symbiotic organisms, but the fact we have noticed suggests that some have the power of assimilating food from other sources.

Spicules.

The great majority of the spicules are arranged irregularly so as to form a dense feltwork on the surface of the canals giving consistency and rigidity to the whole colony, but many are also embedded in the mesogloea. On several parts of the colony, however, the arrangement is particularly regular, e. g. on the expanded disc of the verruca (fig. 5), on the protective prolongations of the wall of the anthocodia (fig. 9), and also on the tentacles, where, in all cases the arrangement is biserial.

All are irregularly echinate, while many may be called warty. The spines vary greatly in form and size, some sharp and triangular standing at right angles to the spicules, others hooked and thornlike, while others are truncated. They are, for the most part, simple, but compounds forms are not infrequent. No type, however, can be said to be characteristic of any particular part of the colony.

The spicules consist chiefly of straight and curved spiny spindles, some approaching the "scaphoid" form so characteristic of the genus *Gorgonia*, thus showing convergence in another direction. Other forms

Fig. 14.

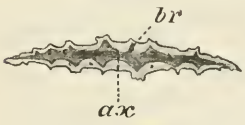

Fig. 15.

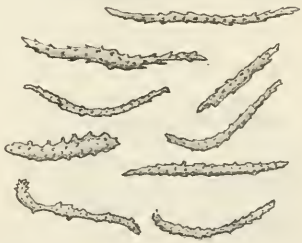

Fig. 14. Spicule enlarged (× 390) to show the organic axis. *ax*, organic axis; *br*, branches of the axis.

Fig. 15. Transparent spicules of the outer wall of the trunk.

are single clubs and clubs with a curved termination resembling "hockey-clubs".

In the decalcified sections an organic residue was to be seen in the spicule cavities in the mesogloea, and an examination of the smaller and more transparent spicules showed that there was an organic axis with branches which passed out into the spiny projections (fig. 14 *ax*, organic axis; *br*, branches of the axis).

It is interesting to note that the same has been recorded by Bourne for *Lemnalia*, the genus most closely related to our form.

The following measurements of spicules were taken:

a. Transparent spicules of the outer wall of the trunk (fig. 15).

Straight spindles 0,85 × 0,03 mm; 0,75 × 0,04 mm.

Curved spindles 0,7 × 0,025 mm; 0,75 × 0,03 mm.

b. Transparent spicules of the partition walls (fig. 16).

These show a greater perponderance of straight forms and bear more compound spines.

Spindles 0,85 × 0,05 mm.

Single clubs 0,7 × 0,03.

c. Transparent and pale yellow spicules of the disc-like expanded portion of the verruca (fig. 17).

On the whole these are smaller than the two preceding groups and hardly so spinose.

Spindles 0,65 × 0,02 mm; 0,6 × 0,01 mm.

d. Spicules of the anthocodia mostly pale yellow with few and small spines (fig. 18).

Straight spindles 0,6 × 0,015 mm; 0,4 × 0,02 mm.

Fig. 16.

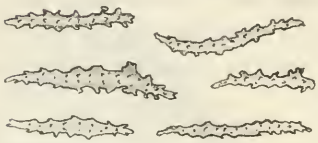

Fig. 17.

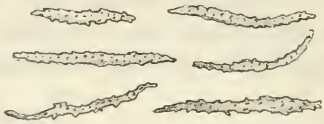

Fig. 18.

Fig. 19.

Fig. 16. Transparent spicules of the partition walls.
Fig. 17. Transparent and pale yellow spicules of the verruca-disc.
Fig. 18. Pale yellow spicules of the anthocodiae.
Fig. 19. Pale yellow spicules of the tentacles.

Curved spindles 0,55 × 0,015 mm; 0,55 × 0,01 mm.

Hockey-clubs 0,6 × 0,2 mm; 0,4 × 0,015 mm.

e. Pale yellow spicules of the tentacles mostly curved spindles and hockey-clubs (fig. 19).

Curved spindles 0,45 × 0,02 mm; 0,35 × 0,03 mm.

Hockey-clubs 0,35 × 0,04 mm.

Systematic Position.

The presence of the close feltwork of spicules already referred to places this form in the sub-family Siphonogorginae as defined by Wright and Studer. The genera *Siphonogorgia* (Kölliker), *Chironephthya* (Wright and Studer), *Paranephthya* (Wright and Studer) and

Scleronephthya (Wright and Studer) need not be considered, but there is undoubtedly retationship with *Lemnalia* (Gray emend. Bourne). From this genus, however, our specimen differs essentially, in that it is not branched, and in having the anthocodiae pedicelled. Other features, such as the form of the verrucae, the nature of the anthocodiae, the introversion of the zooids and the general details of the colony, mark it off as a new and very distinct genus.

Diagnosis.

Agaricoides alcocki n. gen. et sp.

Colony upright, attached, mushroom-shaped (agariciform), consisting of (1) a stout, densely spiculose trunk composed of a longitudinally arranged system of coenenchymal canals with fused walls, the more superficial of which appear as ribs on the surface; and (2) a "pileus" portion bearing the zooids which are introversible within projecting verrucae — cylindrical extensions of the trunk canals, the upper portions of which are expanded peripherally into octagonal discs containing eight canals, corresponding to the eight compartments formed by the retractor muscles. The anthocodiae are borne on somewhat slender stalks, the elastic walls of which are continuations of the upper walls of the discs. The tentacles are not retractile but are simply folded over the wide oral disc, the biserial arrangement of the spicules forming a very primitive operculum. The oral disc is spacious, protected by eight triangular projections of spicules. The mouth, considerably elongated, leads into a richly ciliated stomodaeum in which a distinct sulcus can be distinguished. The mesenteries are complete, and are continued down to the very base of the stem canals. The spicules are irregularly echinate and consist chiefly of straight and curved spindles, while some approach the "scaphoid" type, others are single and "hockey-clubs", i. e. club-shaped with a curved termination.

Locality: Indian Ocean, 6° 31′ N. — 79° 33′ 45″ E. 401 fathoms.

3. Sull' Anatomia degli Scafopodi.

Del Dr. Arcangelo Distaso.

(Zool. verg.-anatom. Laboratorium beider Hochschulen Zürich.)

(Con 6 figure.)

eingeg. 12. Juni 1905.

Questa mia nota preliminare non ha la pretensione di trattare a fondo il difficile argomento che da due anni circa ho intrapreso a studiare. Dovendo farne una monografia e dovendo necessariamente trattare dello sviluppo, che in questo caso può essere di grande aiuto in alcune questioni controverse, credo utile, frattanto, dare questi brevi