On a New British Sea Anemone.

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With 1 Figure in the Text.

It is a curious fact that the majority of the British anemones had been discovered by 1860, and that half of them, as listed at that date, had been established during a burst of energy on the part of Gosse and his collecting friends. Gosse added 28 species to the British Fauna himself. It is still more surprising that since Gosse ceased work, no authentic new ones have been added, other than more or less offshore forms, with the exception of *Sagartia luciæ;* and this species appears to have been imported from abroad. There is, however, an anemone which occurs on the Breakwater and Pier at Plymouth, which has not yet been described. Dr. Allen tells me it has been on the Breakwater as long as he can remember, and to him I am indebted for the details of its habitat given further on. Whether it occurs elsewhere than in the Plymouth district and has been seen but mistaken for the young of *Metridium dianthus*, is as yet unknown.

The anemone in question, which is the subject of this paper, is a small creature, bright orange or fawn in colour, and presenting at first sight some resemblance to young specimens of certain colour-varieties of Metridium. When the two forms are observed carefully, however, and under healthy conditions, it becomes evident that they are perfectly distinct from each other; and a study of their anatomy bears out this fact.

The following is a description of a typical individual of the new anemone.

Body. Base adherent, wider than column. Column variable in shape, typically cylindrical, capable of great elongation, becoming narrow and vermiform in full extension (e.g. length of animal 3·2 cm., width of body at same time ·35 cm.). In partial extension it forms a fairly tall pillar with a long lower part (*scapus*) ending above in a slightly-marked bulge or collar, above which is a rather narrower part, this being the beginning of the more delicate upper region of the body (*capitulum*). Collar variable in distinctness according to state of expansion, smoothing completely away in full extension, but being nevertheless a definite structure, marking the point at which the thicker body-wall of the scapus passes into the

thinner wall of the capitulum, and forming a definite parapet and fosse when the column is not stretched out. Body translucent in expansion, allowing mesenterial insertions to show through the skin ; skin smooth in extension, delicate, wrinkling up in contraction ; no suckers. Capitulum extensive, its margin tentaculate, and without cinclides. Scapus with conspicuous cinclides, which are numerous and scattered, and which extend from collar right down to edge of base, but are more prominent above. They show up in certain states of expansion as minute mounds, a shade darker in colour than rest of skin, with a central perforation or thin spot. Column bright soft orange ; scapus, in partial contraction, a richer colour than capitulum. Animal shrinks very readily when alarmed. Acontia present, and able to be protruded via cinclides.

Tentacles. Long, slender, graceful, and tapering, but rather more gradually tapering than in many forms. Disc and tentacles entirely retractile. Tentacles not quite regularly arranged, in some sectors, running 6, 6, 14, etc., in five cycles. Their colour is that of the body, of a rather lighter tone than the scapus, in partial extension ; they are unmarked.

Disc. Small (though able to exceed column), circular, with not much free space within the tentacle-bases ; translucent, with little colour ; unmarked ; mesenteries show clearly through it. Mouth and throat red-orange, this colour showing through the capitulum by transparency, in extension. Throat ribbed. Probably only one siphonoglyph.

Variation. The species seems to be subject to little variation. One specimen is much like another but for size, and but for the fact that there are two colour-forms. The specimens from the Breakwater are of the orange kind described ; those from the Pier are fawn-coloured. In the specimens of the orange variety which I have seen the mouth is brighter orange than the rest of the flower, the lip is well ribbed, the tentacles are usually in five cycles, with six in the inner cycle. The inner tentacles are not necessarily evenly spaced out, and their arrangement is liable to irregularities. The directive tentacles and some or all of the other primary tentacles, may be stouter and more orange than the rest, or all the tentacles may be of one tone.* There are pores in their tips. The free space on the disc is rather small, the tentacles being long in proportion to it and tapering slowly, but the disc can exceed the

* Since the above was written, Mr. Evans tells me he has seen the Breakwater anemone stretch out a few tentacles to a great length, far beyond the others, and search about its environment with them ; these tentacles, after they were contracted again, were thick, short, blunt and opaque. This doubtless accounts for the thick orange tentacles seen in some of my specimens. A similar phenomenon is well known in certain other anemones. Mr. Evans adds that when the Breakwater anemone contracts in alarm, the body often jerks down in a very characteristic way, one side generally contracting more than the other, so that the animal collapses corkscrew-wise and ends up lop-sided. I have noticed the same sort of thing.

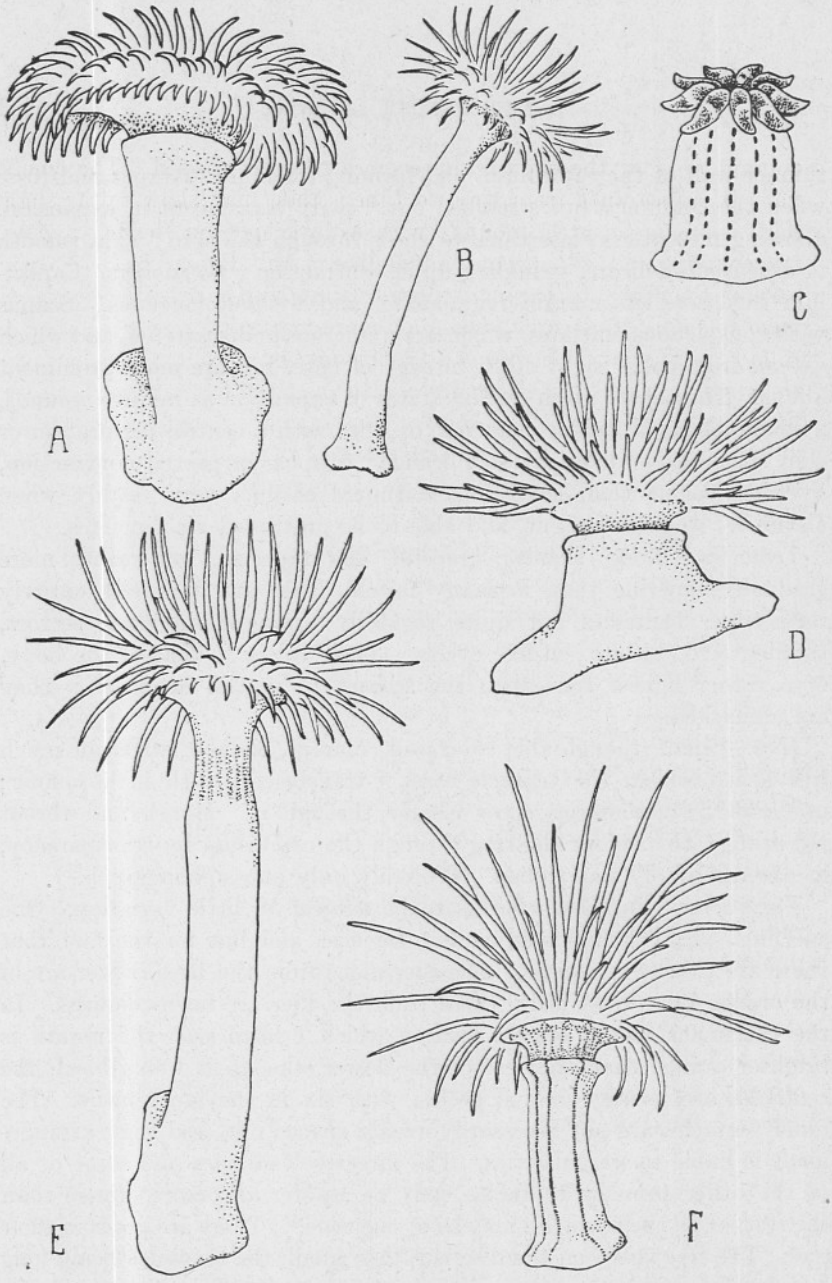

Fig. 1. Sketches, from living specimens, of the anemones dealt with in this paper.

A. Young specimen of *Metridium dianthus*, for contrast with *Diadumene cincta*. Nearly twice natural size.

B. *Diadumene cincta*. Well expanded. About natural size.

C. Tracing from Gosse's copy of a drawing, sent to him by Cocks, of *Sagartia chrysosplenium*. Natural size. The dotted lines on the body are rows of yellow spots in the actual anemone.

D. *Diadumene cincta*, with the column shortened, showing the collar as a parapet. Nearly twice natural size.

E. *Diadumene cincta*, partly extended, with the collar still visible and not smoothed out as at B. Nearly twice natural size.

F. *Diadumene* (?) *luciæ*, well expanded, showing scapus and capitulum ; the orange stripes on the scapus are shown as dotted lines, in reality they are continuous. About three and a half times natural size.

column, so that the capitulum becomes trumpet-shaped. The cinclides vary in appearance from time to time; they may show up as slightly dark spots or as little mounds with a dark spot on them, or may be transparent and somewhat bubble-like. Mr. Evans has seen them assume a curious appearance, those of the lower part of the body being inconspicuous, those up above much more marked, forming a sort of belt round the animal. I have not seen this myself, all my specimens having the cinclides (which are actually spread over the whole scapus, and are, wherever one can see them clearly, mostly endocœlic) more conspicuous above, but not presenting the appearance of a belt. The substance of the body is soft, but the base quite strongly adherent when well fixed. The size is not large, the best specimen I have seen not exceeding about 3 cm. in diameter of disc and tentacles, and 2 cm. in diameter of base; the length of its body could, however, much exceed these measurements. It had six cycles of tentacles, with a few odd additional ones, but the cycles not all fully represented.

The fawn variety, which Mr. Smith tells me turns up not infrequently on the Pier, has all the essential features of the orange form, but is otherwise coloured. The following is the colour of typical examples: Scapus buff, capitulum more translucent with the pink-buff throat showing through it by transparency; disc transparent, almost colourless, tentacles translucent, light buff, paler than body, a little opaque cream bar running across the bases of the outer ones. At the back of the base of each directive tentacle is a little cream patch, and there is cream on the directive radii. On the column a little cream stripe runs part-way down each directive endocœl. The throat has the most positive colour in the animal, and the lip is ribbed as usual, but not orange. The cinclides are easily seen as grey dots, often on little mounds. The largest specimen I have seen had three of its inner tentacles more solid and brighter buff than the others, and when it was preserved these three were longer than all the others. Two of them were adjacent, and they were both directive tentacles.

The species occurs near low-water mark on stones on the inner (north) side of the Breakwater. The stones are limestone, and the anemones appear to live both on the upper side of them and on the lower, when the latter hangs free. On some of the stones they occur in large numbers. They probably do not occur in profusion elsewhere in the neighbourhood, except on the Pier; but a few specimens may exist which have not been noted. They were found in numbers on the Breakwater by Garstang in the early nineties, since when they have been brought in very often by the Plymouth collectors. Other Zoantharia abundant on the Breakwater are *Caryophyllia Smithii* and *Corynactis viridis*.

The only form with which this species can be confused is the young of *Metridium dianthus*, as mentioned above. The young of Metridium has given a good deal of trouble at one time and another, by reason of its complete difference in appearance from the adult. It is a small rather pellucid anemone like a Sagartia in general build, and white, orange, or brown in colour ; its tentacular crown is quite circular, and gives no sign of the lobed and frilled condition which it will gradually assume as it grows up. This has led to its being identified, incorrectly, as *Sagartia pallida* Holdsworth, and even as a new species. If it is carefully compared with the Breakwater anemone, it is found to be perfectly distinct from it. The more obvious external differences may be tabulated as follows :—

Young Metridium.	*Breakwater Anemone.*
Body. Capable of stretching out a good deal, but not to the same extent as in the Breakwater form.	*Body.* Decidedly worm-like when well extended, forming a tall thin pillar, very much longer than wide.
Collar. Sharply marked and definite, cannot smooth away in expansion.	*Collar.* Forms a distinct parapet or rim containing a fosse, in a rather short state of the column, but in better expansion it is a somewhat vague structure, not sharply marked, and smoothing away completely in full expansion.
Capitulum. Short in proportion to whole body.	*Capitulum.* Decidedly longer in proportion to whole body.
Tentacles. Begin to be rather numerous at a fairly early age, and give a characteristically fluffy appearance, as a whole, to the tentacular crown.	*Tentacles.* Probably never exceeding 200, and often rather few and of fairly large size, giving a different total effect.
Disc. Soon begins to expand more extensively beyond the column than ever does the disc of the Breakwater anemone.	*Cinclides.* Tend to be more conspicuous than in Metridium, being rather easily visible, with a lens.
Colour. The orange of the orange variety less vivid than in the Breakwater anemone.	
Animal. Less irritable and less rapidly contractile than the Breakwater anemone.	

These differences may not be absolute, but as far as my experience goes of the two forms, they are constant. I have examined a considerable number of both. The differences look very slight when reduced to black and white, but actually they constitute a marked difference of facies. My friend, Mr. W. Edgar Evans, has now kept the Breakwater anemone for over a year in his aquarium at Edinburgh, in a state of good health. He is quite convinced of its distinctness, and informs me that it does not change or show any tendency to "grow up," that it is shy and difficult to feed. It reproduces, moreover, by fragmentation, and not by longitudinal fission.

The anatomy of the Breakwater anemone has been studied in comparison with that of young Metridium, by Miss E. M. Stephenson (see p. 897 of the present issue of this journal), so that I need not go into it here. I will only remark that its lack of sphincter distinguishes it from young Metridium, which has a mesoglœal one; so does the arrangement of its cinclides, which are predominantly endocœlic in the former, exocœlic in the latter; and the rest of the anatomy bears out the distinction. I can add to Miss Stephenson's account that in the largest of the fawn specimens which I have seen from the Pier gonads were present and very strongly developed. In the middle of the body there are three cycles of mesenteries present; two pairs of these are directives, and are adjacent, not at the opposite poles of the throat; each has its own siphonoglyph. Six pairs of mesenteries are perfect. Gonads occur on all mesenteries of cycles 1 and 2, and on some at least of those of cycle 3. Basilar muscles are present in the species.

It remains to discuss the systematic position of the form in question, and this is not very straightforward. There are only two existing genera in which it can find lodgment, and they are Diadumene and Aiptasiomorpha. Neither of these genera is well known, unfortunately, so that in dealing with them one is on rather uncertain ground.

Diadumene has as its type the Indian brackish-water anemone *D. schilleriana*. The account of this, given by Annandale (*Records of the Indian Museum*, Vol. 1, Part 1, p. 47, Calcutta, 1907; and *Cœlenterata* in *Fauna of the Chilka Lake*, *Mem. Indian Museum*, Vol. 5, 1915, p. 65), is extensive and good, but it permits of more than one interpretation in some of the essential points. In my paper on classification (*Quart. Journ. Micros. Sci.*, 1920–22, Part 1, 1920, p. 425; see pp. 457, 499, 508, 521), I interpreted *D. schilleriana* from Annandale's account as a form with a division of the mesenteries into macro- and microcnemes, in which this division is not fully carried out; and this was, I still think, a permissible view. But at best, it is an intermediate form; and since my paper was written, Carlgren (*Actiniaria*, *The Danish Ingolf-Expedition*, Vol. 5, No. 9, Copenhagen, 1921, p. 1, see p. 21, and *Vidensk. Medd. fra Dansk.*

naturh. Foren., Bd. 77, p. 179, 1924, see pp. 224 and 234), has taken the view that Diadumene has really no division of the mesenteries into macro- and microcnemes, and has consequently defined the family Diadumenidæ afresh on his basis, removing from it the genera Peloccetes, Phytoccetes, and Mena, which I took to be relatives of Diadumene. This matter cannot yet be settled finally, as there are not enough data for a decision. Meanwhile, I have sections of about one-third of a good-sized specimen of *D. schilleriana*, and in this there are apparently (the specimen is not in first-class condition) three cycles of mesenteries represented; there are more or less diffuse to more or less circumscript well-developed retractors on mesenteries of all the cycles, also gonads; though only some of the mesenteries of the third cycle are well developed. This rather supports Carlgren's contention about the mesenteries of Diadumene, and I have no wish to press my former view if another is better. But I do not think the question of the possible relatives of Diadumene can be settled summarily by the placing of Peloccetes and Phytoccetes in the Halcampactidæ, as Carlgren has done. I can quite believe that it may prove best in the end to keep Diadumenidæ for Diadumene, and to put Peloccetes, etc., apart from that family, but it has yet to be proved that Peloccetes has no relationship to Diadumene. On the contrary, there is quite a possibility that the two may be connected, and in this event, even if they go into different families, those families should stand in juxtaposition. Further than that, I do not think we can go at present.*

Aiptasiomorpha contains two genuine species, *A. minima* and *A. neozealanica*, both New Zealand forms. These have many of the characters of the Breakwater anemone, and it is a question also whether they differ essentially from Diadumene; in fact, Carlgren has recently united the two genera.

The Breakwater anemone is a fully retractile form, and *Diadumene schilleriana* appears to be the same; this is not a family character, but may be an indication of relationship. In considering Aiptasiomorpha one must remember that it may be related to Aiptasia; whereas the Breakwater anemone is certainly not directly related to Aiptasia as represented by *A. Couchii*, as a comparative study of the two forms, alive, clearly shows; if anything it is nearer to Metridium. *Aiptasia Couchii* is very distinct from any other anemone I know alive; it has the greater part of its skin covered by minute adhesive papillæ, like those of Peachia (these are absent from the submarginal region of the column), and its large curious tentacles have a very distinct arrangement of pigment on them as a microscopic network-pattern. For this reason I should not

* Mena has been shown by Carlgren to lack acontia, and is thus a Halcampid. Arkiv for Zoologi, Bd. 17A, No. 21, Stockholm, 1925, p. 1; see p. 8.

be averse to Carlgren's family Aiptasiidæ, provided it fits in with other things later on.

We are faced then with two genera, neither of them well known, and which may be identical; and into either of which the Breakwater anemone may fit. For the time being I follow Carlgren in uniting the two genera and I place the Breakwater anemone in it, giving it the specific name *cincta*, because of its collar. If Diadumene=Aiptasiomorpha, the name *Diadumene* has priority, so that the Breakwater anemone will be *Diadumene cincta* unless further knowledge makes a change necessary. If it has to go by itself later on I propose the generic name *Farsonia* for it.

This settles the genus, but does not give us a clue to the family relationships of the new form. Since I subdivided the old family Sagartiidæ (1920), Carlgren has objected to my method of doing it, because he does not think we know enough yet about the anemones with acontia and basilar muscles to make a final arrangement. With this latter remark I agree, but one must begin somewhere, and the families which I proposed will do for a starting-point and can be modified as new facts come to light. They are not meant to be rigid or final, and I shall not be the last to make modifications where needed. We have at any rate, as Carlgren admits, groups within the "Sagartiidæ"; and of these groups there are undoubtedly four recognisable—the Chondractiniid series, the Phellias, the Metridiids (as represented by Metridium, Calliactis, and Adamsia), and the genus Sagartia. These groups stand out quite well, and even if there are intermediates, something will have to be done about them. But after these four sets there are the Aiptasias to be placed, and here we get on to more difficult ground. If these are to stand apart from the Metridiidæ, there is the difficulty that there are forms like the Breakwater anemone and its probable relatives, which appear to link up the two sets. The family Diadumenidæ may be the present representatives of the ancestral link, as I thought previously (1920). Carlgren himself admits subdivision of the old Sagartiidæ into Phelliidæ, Diadumenidæ, Aiptasiidæ, and Sagartiidæ (restr.), and as the subdivision is likely to have to go further in the end, my own method of doing it may well serve as a basis for further work—indeed, it has done so already, since Phelliidæ is one item in my scheme, and Diadumenidæ another (though how this family is to be ultimately limited is as yet uncertain); and I am not averse to Aiptasiidæ. Then again Carlgren does not think that presence or absence of cinclides is a family character, and doubts whether distribution of gonads will always be one. I cannot enter into this question here in detail, but hope to do so later. Summation of those available characters which are the least variable seems to me to be the only final criterion, since few characters are perfectly satisfactory. The above is the only

indication which can be given at present as to the position of the Breakwater form.

Before closing it seems advisable to consider another British anemone which may belong to the same genus as the Breakwater anemone. This is *Sagartia luciæ*. It has been the subject of a recent paper by McMurrich (*Proc. Zool. Soc.*, 1921, pp. 729–739), who describes its anatomy and discusses its systematic position and past history. This study is very valuable, and has been long needed, because although *S. luciæ* has excited considerable interest from points of view of distribution, experiment, etc. ; its anatomy has been neglected. McMurrich shows that it possesses no sphincter, that it has a division of the body into scapus and capitulum, that its mesenterial formula, although actually irregular, because of its fissiparous habit, is clearly derived from a plan with six pairs of perfect mesenteries only, these being sterile ; and, therefore, shows that it is not a member of the genus Sagartia, but belongs to the Metridium group, and to no actually recognised genus.

It would seem, however, that *S. luciæ* is likely to be eligible for the genus Diadumene, or at least for the same genus as the Breakwater anemone. It has the same essential combination of characters, but for the sterility of the older mesenteries, on the basis of the facts as stated by McMurrich. I have not as yet a full enough series of preparations of *luciæ* to be able to confirm McMurrich's account, but I am inclined to think it will be found that the older mesenteries can be fertile. At any rate in two specimens from Plymouth I have seen what I take to be young gonads on some of the largest mesenteries in the animal. The acontia of both *luciæ* and *cincta* have large nematocysts, some which I measured in the former were nearly as large as those of the latter. Curiously enough both have a tendency to produce endocœlic stripes of colour, cream in *cincta* and orange in *luciæ*. Both have scapal cinclides and not capitular ones, and what I have seen of those of *luciæ* suggests that when studied fully they will prove to be arranged as in *cincta*.

Unfortunately, McMurrich has contended that *S. luciæ* is probably identical with *Sagartia chrysosplenium* Cocks, and that since *luciæ* (=*chrysosplenium*) needs a genus of its own, this genus should be called *Chrysoela*, a name put forward by Gosse (1860, p. 123) for *chrysosplenium* in the event of its needing separation. This would be perfectly legitimate if *luciæ* and *chrysosplenium* were, indeed, identical, but I cannot see that there is any actual evidence in favour of their identity. *S. chrysosplenium* has never been seen, either alive or preserved, by any competent observer, and Cocks, who described it (*19th Annual Report of the Royal Cornwall Polytechnic Society, for* 1851, p. 5, Pl. I, Fig. 17) has left such a poor description and figure that it is difficult to build upon it. But the following points may be noted.

S. chrysosplenium, calculating from Cocks' figure, which is $\frac{2}{3}$ nat. size, was just over $\frac{3}{4}''$ wide (diameter of column without tentacles) and nearly an inch high (again not counting the tentacles), the measurements given by Gosse being very near this also ; in fact, quite a solid creature ; cf. Gosse's coloured figure (Pl. VI, Fig. 8, 1860), copied from a drawing by Cocks, which shows an animal about the size of a medium specimen of *Actinia equina ;* as both figures seem to be of a somewhat contracted anemone it could probably be larger than this when healthy. This is too large for *S. luciæ* altogether, as it occurs in England. *S. chrysosplenium* has rather short tentacles, *S. luciæ* very long ones. *S. chrysosplenium* has yellow labial tubercles and a yellow line round edge of base (remarkable points, if true), *S. luciæ* has neither of these things. In Cocks' figure his animal has small oval areas scattered over it, which, if they are suckers are absent in *S. luciæ*, if they are cinclides are probably not arranged in the same way as in *S. luciæ*, in which, as far as I have seen, they are mostly in rows on the orange stripes. McMurrich's remark that the tentacles in Cocks' figure are "quite as they are in *S. luciæ*" is difficult to understand, unless it depends on his only having seen sick specimens of *luciæ ;* in a really healthy and expanded specimen the tentacles are very long and fine, longer in proportion perhaps than in any other British species, and not at all like Cocks' picture. Moreover, Cocks says the tentacles of *chrysosplenium* are stouter than in Actinia ; those of *luciæ* are much longer than in Actinia, and slender although fairly wide at the base. Other remarks of McMurrich suggest too, that he does not know *luciæ* in health—he remarks that the capitulum remains introverted when the animal is expanded (quite the opposite is true), and refers to the "somewhat pustulous" appearance frequently presented by *S. luciæ*—an appearance absent in healthy expansion. In *chrysosplenium* the yellow stripes seem to have been discontinuous, in *luciæ* they are typically continuous. Cocks considered *chrysosplenium* "allied to *crassicornis*," i.e. *Tealia*—he could never have thought this of *luciæ*.*

It is true that some of the discrepancies may be due to (*a*) sick specimens having been seen by Cocks, and (*b*) the imperfection of observation at the time when Cocks wrote ; one cannot say it is impossible that *chrysosplenium=luciæ*, but it does seem to stretch things too much to assume identity where, even if there is not absolute proof *against* there is no evidence *for*. I have given this point more attention than its intrinsic interest warrants, because I feel that on the basis of Cocks' and Gosse's descriptions (and we have no other basis on which to go), it cannot be maintained that *S. luciæ* is the same as *S. chrysosplenium*, and it seems

* Fig. 1 C is a tracing of Gosse's copy of a coloured drawing sent to him by Cocks, natural size.

a pity to dig up old and imperfectly described species such as the latter. They are better off decently buried, unless something really answering to their description turns up in the original locality. Unless this happens we shall never know what *S. chrysosplenium* was. In this particular case, too, an assumption of identity would lead to a new interpretation of the geographical distribution of an interesting form, without any actual basis for it.

The following is a diagnosis of *Diadumene cincta* n. sp. :—

Base well developed, basilar muscles present. Column long and narrow in extension, divided into scapus (ending above in a collar varying in appearance according to state of expansion) and capitulum. Skin smooth, without suckers. Scapus with numerous cinclides, extending from collar to base, which are mostly endocœlic, and are typically partial ectodermal invaginations. Capitulum without cinclides, rather extensive, its margin tentaculate. No sphincter. Disc and tentacles fully retractile. Free space on disc rather small. Tentacles long, up to nearly 200 in number, often fewer than this, in 5–6 cycles. Lip ribbed. Siphonoglyphs and directives variable. Perfect mesenteries, six pairs. Retractors well developed, diffuse, on more than the first cycle of mesenteries. Labial and parietal stomata present. Mesenteries more numerous above than below. Acontia well developed, with large nematocysts. Gonads, filaments, and acontia on all stronger cycles of mesenteries. Ciliated tracts present. Longitudinal musculature of tentacles ectodermal. Animal irritable. General colour orange or fawn.