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ZOOLOGY.—*Some West American sea anemones*.¹ OSKAR CARLGREN, University of Lund, Sweden. (Communicated by WALDO L. SCHMITT.)

The present paper is based on material collected in California and Washington by Mr. E. F. Ricketts of the Pacific Biological Laboratory, who has long been interested in the Pacific Coast marine invertebrates. Two species taken by Professor T. Gislén, Lund, during a visit to California in 1931 are included. Three species are, I think, not previously described. Instead of the sub-tribe Protostichodactylinae, I have erected a tribe, Corallimorpheae.

Tribe CORALLIMORPHEAE, new name

As I have pointed out previously (1924, p. 180), I cannot agree with the opinion of some authors that the family Corallimorphidae, as well as all other Protostichodactylinae, belong to the Madreporaria. If we place them together, we must suppose that in the Protostichodactylinae the skeleton is lost or never has been developed. The first hypothesis, I think, we can leave out of consideration, because no traces of a skeleton have been found in the Protostichodactylinae, most of which live in shallow water, especially on coral reefs. On the other hand, supposing that the Protostichodactylinae never have been provided with a skeleton, we must consider them as descendants of forms from which the Actiniaria, as well as the Madreporaria, have arisen, for the supposition that the Madreporaria originate from the Protostichodactylinae is hardly probable. Moreover, we cannot indicate to which family of Madreporaria the latter group is allied. For my part, I am more inclined to consider the Protostichodactylinae as having developed parallel to the Madreporaria and the Protantheae (s. str.) among the Actiniaria having relations to both these groups. Perhaps an order, Corallimorpharia, equal to the Actiniaria and Madreporaria, should be erected for the Protostichodactylinae, but for the present I prefer to place them as a group, Corallimorpheae, among the Actiniaria. The name Protostichodactylinae is misleading, because on the one hand forms with the tentacles

¹ Received August 15, 1935.

not arranged in radial series must be referred to the Protostichodactylinae, and on the other that the so-called Stichodactylinae are not descendants of this group. I divide the Actiniaria then into five tribes: Protantheae (s. str.), Corallimorpheae, Ptychodactaeae, Endocoelanthaeae, and Nynantheae.

Family CORALLIMORPHIDAE

Corynactis californica n. sp.

Diagnosis.—Sphincter elongated weak. Tentacles large, especially those belonging to the exocoels. Endocoel-tentacles in each radius 2–5; 2 siphonoglyphs, little differentiated, and two pairs of directives (always?). Longitudinal muscles of the mesenteries rather weak. Macrocnidae of the column (38) $43\text{--}53 \times 11\text{--}12\mu$ rather common those of the heads of the tentacles $68\text{--}83 \times 12\text{--}14\mu$, those of the actinopharynx $34\text{--}42 \times 10\text{--}11\mu$, those of the filaments partly $76\text{--}86 \times 24\text{--}26\mu$, partly $38\text{--}60 \times 12\text{--}17\mu$; elongated cnidae with distinct basal part to the spiral thread in the column partly $43\text{--}48 \times 10\mu$ (few), partly $14\text{--}25 \times 2.5\text{--}5\mu$ (common), those of the heads of the tentacles $35\text{--}62 \times 4\text{--}6\mu$ and $29\text{--}34\text{--}(53) \times 4.5\text{--}5\mu$, those of the actinopharynx $26\text{--}29 \times 3.5\text{--}4\mu$ those of the filaments partly $33\text{--}43\text{--}(48) \times 8.5\text{--}10\mu$, partly $22\text{--}29 \times 6\text{--}7\mu$. Spirocysts (spirocnidae) of the column rather sparse, $19\text{--}24 \times 2.5\text{--}3.5\mu$, those of the heads of the tentacles 24×2 —about $60 \times 5\mu$, those of the actinopharynx $20\text{--}26 \times 2.5\text{--}3\mu$.

Color in formalin.—Column brown, other parts uncolored.

Dimensions of the largest specimen.—Largest breadth and length 1.3 cm.

Occurrence.—California, Monterey Bay 6–8 fms., June 3, 1934, 6 specimens; June 11, 1934, 1 specimen. Holotype, U. S. N. M. Cat. No. 43060.

The exterior agrees with that of other *Corynactis* species. The endocoel-tentacles varied in each radius between 2 and 5. In a specimen pierced by a Gephyrean, probably swallowed alive by the sea anemone, the number of the endocoel-tentacles in each radius was as follows: 5, 3, 2, 5, 2, 4, 2, 4, 2, 4, 2, 3, 2, 2, 2, 2, 4, 2, 4, 2, 5, 2, 4, 5, 2, 4, 2, 4, 3, 4, 2, 3, 2, 4, 3. Between each of these radii and inside the outermost endocoel-tentacles one large exocoel-tentacle was situated. The sphincter was very elongated and rather weak (fig. 1), the actinopharynx provided with numerous high longitudinal ridges. There were 2 slightly differentiated siphonoglyphs. The mesenteries were, in the sectioned specimen, 72 in the middle of the actinopharynx, 34 on one side, 38 on the other; 10 pairs and 3 single mesenteries were perfect; 2 pairs were directives. Moreover, the anatomy of the species agrees with that of other species of *Corynactis*. The measurements of the cnidae and the heads of the tentacles have been made on the largest specimen, taken June 3. I have called the large broad capsules macrocnidae, as they seem to agree with those of the Zoantharia (compare Seifert 1928). The more elongated capsules (c, c₁, capsules Carlgren, 1928, p. 131) seem to be of the same appearance as those figured by Möbius (1866, Pl. 1, figs. 5, 6) of *Caryophyllia*. The basal part of the spiral thread reminds one of that of a penicillus, but the terminal thread, at least 10 times as long as the capsules, seems to be provided with very small bristles, not figured in fig. 2. There were no zooxanthellae in the endoderm.

It is very difficult to give good diagnoses of the species of *Corynactis*, as they agree very much in their structure. The species cannot be identical with the West Indian *C. bahamensis* and *C. myrcia*. if Duerden's (1900, p. 182) statement of the arrangement of the tentacles of the latter is correct, and probably not with *C. carnae*, which is unknown on the west coast of Central America and has not been taken north of Guaytecas Islands on the west coast of South America.

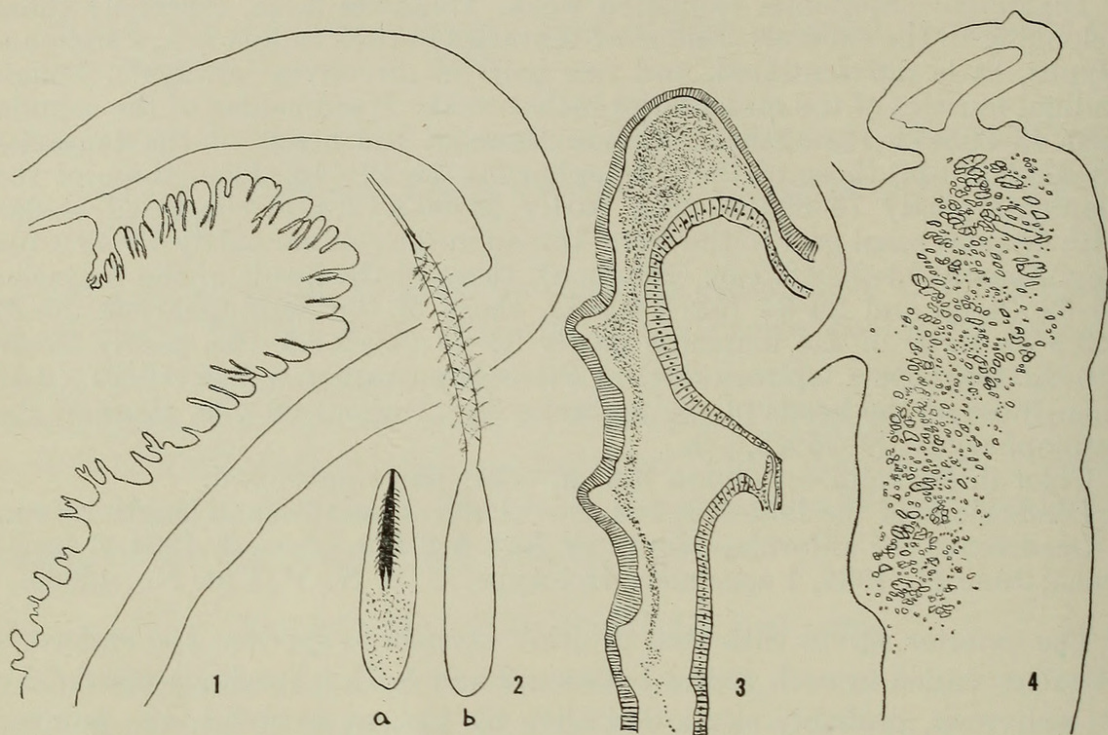


Fig. 1.—*Corynactis californica*. Sphincter. Fig. 2.—*Corynactis californica*. Cnidae: *a*, unexploded; *b*, exploded. The basal part and a little piece of the long terminal thread are figured. Fig. 3.—*Amphianthus californicus*. Sphincter. Fig. 4.—*Stephanauge annularis*. Sphincter.

Tribe NYNANTHEAE

Family EDWARDSIIDAE

Edwardsia californica (McMurrich)

Edwardsiella californica McMurrich, Proc. U. S. Nat. Mus. 44: 551, fig. 1. 1913.

Diagnosis.—Physa well developed. Scapus with 8 rows of rather large nemathybomes polygonal. Tentacles 16. Pennons of the macrocnemes on cross-sections elongated with about 30–40 folds, not especially high, branched in the inner and especially in the outer part, with a palisade-like arrangement in the middle. Outer lamellar part of the macrocnemes in the reproductive region attached to the pennon rather close to its center. Parietal muscles very well developed, fan-like or more rounded, with about 8–10 branched folds on either side of the main lamella. Extension of the parietal muscles on the column normal. Nematocysts of the actinopharynx partly $29\text{--}34 \times 2.5\text{--}3\mu$ (numerous spirulae), and partly $24\text{--}31 \times$ about 5μ (probably penicilli, considerably fewer); those of the nemathybomes partly $115\text{--}153 \times 6.5\text{--}7\mu$, and partly $72\text{--}77 \times 2.5\mu$.

Dimensions.—Length 2.2 cm., breadth 0.3 cm.

Occurrence.—Balboa, California. Littoral. T. Gislen, 1931.

The figure given by McMurrich of a pennon and a parietal muscle agrees very well with what I have seen from the sections through the upper part of the reproductive region; the folds of the pennons in our specimen were somewhat fewer, those of the parietal muscles somewhat more numerous, but the appearance of the muscle-folds showed good agreement in both specimens. McMurrich mentions that the nemathybomes stand in two or three rows in the proximal end of the scapus. Certainly this arrangement was caused by contraction; in our specimen the scapus was provided with only 8 rows of nemathybomes. The specimen was a female.

Family HALCAMPOIDIDAE

Harenactis attenuata Torrey

Harenactis attenuata Torrey, Proc. Wash. Acad. Sci. 4: 384, pl. 24, figs. 4, 5, text-figs. 16, 17. 1902.

Occurrence.—Newport Bay, California, low water, sand. T. Gislen, 1931, several specimens.

I have measured the cnidae of a large specimen. The nematocysts of the column were very numerous, $8-14 \times 1.5-2\mu$; those of the tentacles numerous, rodlike, $17-22 \times 1.5-2\mu$; those of the actinopharynx $24-27 \times 2.5\mu$ (spirulae), and $19-22 \times 3-4.5\mu$ (penicilli); those of the filaments $16-24 \times 4-5\mu$ penicilli—2 rodlike nematocysts $19-22 \times 2.5\mu$, spirulae?). Spirocyst of the tentacles $10 \times 1-19 \times 2\mu$.

Family HALCAMPIDAE

Halcampa duodecimcirrata (M. Sars)?

Halcampa duodecimcirrata M. Sars. Carlgren, K. Vet. Akad. Handl., (25) 10: 38, pl. 5, figs. 1-5 pl. 6, figs. 1, 2. Stockholm, 1893. Danish Ingolf Exped. (5) 9: 119, pl. 4, fig. 8. 1921. Verril, Rept. Canadian Arctic Exped. 1913-18, P. G: 120, pl. 21, figs. 1, 2, 2a, var. *nitida*, p. 121.

Dimensions of the largest specimen.—Length 1.7 cm., breadth of its lower part 0.2, of its upper 0.3 cm. Length of the tentacles 0.2 cm. Dimensions of the smallest specimen: Length 1.2 cm., breadth 0.25 cm.

Occurrence.—Pysht, Washington, June 26, 1930, 2 specimens.

The column was broader in the distal than in the proximal end, the physa contracted, the scapus in its lower part somewhat incrustated with sand. I cannot decide whether there were real tenaculi here, as I have sectioned only the upper part of a specimen. Here no tenaculi were present. The tentacles, in number only 10, were robust and, in the contrasted state, somewhat acuminate. The sphincter had the same size and appearance as that of other *Halcampa* species. There were 20 mesenteries, 10 of which had well developed pennons and were probably perfect—the inner organs were not well preserved. The mesenteries of the sixth pair, as well as the dorso-lateral and lateral pairs of the second order were imperfect; the ventro-lateral pairs of the second order were absent. The cnidae agree rather well

with those of *farinacea*. The nematocysts of the scapus were $11-12 \times$ about 1.5μ (not numerous); those of the scapulus $11-13 \times 2-2.5\mu$; those of the tentacles $12 \times 2\mu$ (very sparse); those of the actinopharynx $19-24 \times (4.5)-5\mu$ (probably penicilli). Spirocysts of the scapulus very numerous, about $14 \times 1.5-25\mu$; those of the tentacles $14 \times 1-1.5-31 \times 2-2.5\mu$.

It is very difficult to give good diagnoses of the species of *Halcampa* and it is possible that *duodecimcirrata* and *farinacea* are identical species but probably not *chrysanthellum*, as the tentacles of this species, according to Stephenson's figure 3, pl. 2 (1928), are conical, while those of *duodecimcirrata* are cylindrical. I have never seen the tentacles of the latter species so acuminate as in *chrysanthellum*, though I have examined many specimens of the former which lived for a long time in my aquaria.

The species of the genus *Halcampa* live, it seems, only in the arctic, subantarctic, and boreal regions; at least there are no species from tropical seas. The largest species occur in the Arctic and this raises the question of whether *H. arctica* is not an ancestor of *duodecimcirrata* which often has 8-10 tentacles in the boreal region. If so, there is nothing astonishing in the fact that *duodecimcirrata*, which Verrill records from the east coast of North America—his variety *nitida* had also 10 tentacles—occurs in the North Atlantic as well as in the North Pacific. We have, then, a parallelism with *Tealia* (*Urticina*) *felina*, the variety *coriacea* (or *tuberculata*) of which occurs in both these seas and the ancestor of which certainly is *T. felina crassicornis* (compare Carlgren 1934, p. 349).

***Cactosoma arenaria* Carlgren**

Cactosoma arenaria Carlgren, Arkiv f. Zool. (23A.) 3: p. 39, fig. 36. Stockholm, 1931.

Occurrence.—Monterey Bay, California, 6-8 fms., June 3, 1934, 1 specimen.

The specimen was provided with a physa, the scapus with tenaculi and incrustations. The tentacles were 24, agreeing with the number of mesenteries. The nematocysts of the scapulus (capitulum) were $8-10 \times 1\mu$, those of the tentacles $12-13 \times$ about 1.5μ ; those of the actinopharynx partly $24-29 \times 3.5-4.5\mu$ (probably penicilli), and partly $14-15 \times$ about 1.5μ (rare, often curved, probably spirulae). The spirocysts of the tentacles were $14-29 \times 1.5-3\mu$, thus showing a good agreement with the cnidae of the type specimen.

Family NORMATHIIDAE

***Amphianthus californicus* n. sp.**

Diagnosis.—Pedal disc very wide. Column smooth, without tubercles, thin. Only one cinclis, not situated on a tubercle issuing from the directive chamber (sometimes absent?) Sphincter strong, alveolar, consisting of very small meshes, in its upper part occupying the greater part of the meosgloea, in its lower gradually diminishing. Tentacles to about 100, rather short, the inner more than twice as large as the outer ones. Actinopharynx with about

14 longitudinal ridges. One siphonoglyph (always?). Mesenteries at the limbus about twice as many as those at the margin. A single directive pair (always?). More than 6 pairs of perfect mesenteries. Arrangement of the mesenteries irregular. Reproduction probably also by tearing of the limbus. Nematocysts of the column $17-20 \times 3.5-4$ (4.5μ) (penicilli), and $19-24 \times 2.5$ —almost 3μ (probably spirulae); those of the tentacles $17-22$ (28) $\times 3.5$ (5μ) (penicilli), $12-14 \times 2.5\mu$ (probably penicilli), and $19-26 \times 2.5\mu$ (spirulae); those of the actinopharynx $17-20.5 \times 3.5$ (penicilli), $20-22 \times 2-2.5\mu$ (probably spirulae); those of the acontia $26-31 \times 4-4.5$ (5μ) (spirulae). Spirocysts of the tentacles to about $48 \times 6\mu$.

Color in alcohol.—Yellowish, around the mouth a brownish annulus.

Dimensions.—The largest specimen was 1.3 cm. high, the breadth of the oral disc 1.2 cm., the folded pedal disc considerably broader; another sectioned specimen 0.8 cm. high and 0.6 cm. broad, the pedal disc considerably broader.

Occurrence.—Monterey Bay, California; C.Y. Rock, June 11, 1934, 12 specimens. Some of these attached to a Hydrocoral. Holotype, U. S. N. M. Cat. No. 43061.

The pedal disc was very broad and mostly rather strongly folded, the column thin and smooth, with weak transverse furrows due to contraction. No cinclis was observed in cross-sections of a smaller specimen, but on sections of a piece of the column of the largest specimen (fig. 3) corresponding to the directive chamber I have found a cinclis almost wholly excavated from the endoderm. This cinclis was not situated on a distinct tubercle. The tentacles, in the largest specimen about 98, in the smaller specimens fewer, were rather short, especially the outer ones, which were less than half as large as the inner tentacles. The oral disc was wide with visible insertions of the mesenteries. Seven specimens had a single, rather broad siphonoglyph. I have not examined the smallest specimens. The actinopharynx of the largest specimens was provided with about 14 distinct and some more weakly developed longitudinal ridges.

The ectoderm of the column was low, with numerous gland cells, the mesogloea rather thin, the sphincter (fig. 4) long, broad in its upper part, gradually diminishing toward the pedal disc, and at the same time approaching the ectoderm, with very fine muscle meshes and wholly separated from the endodermal muscles of the column. The longitudinal muscles of the tentacles and the radial muscles of the oral disc were ectodermal, normally developed and with a palisade-like arrangement. The ectoderm of the actinopharynx was somewhat thicker than that of the column, the ridges mostly thickenings of the ectoderm. The cilia of the siphonoglyph was longer than in the other part of the actinopharynx.

The mesenteries were about twice as numerous as the tentacles. In a specimen with 52 tentacles I counted about 110 mesenteries at the limbus. A sectioned specimen had 9 pairs of perfect mesenteries, including a pair of directives. Judging from the insertions of mesenteries on the oral disc, there were more than 20 perfect mesenteries in the largest specimen. The pennons and the parietobasilar muscles were very weak in the sectioned specimen,

which seems to be sterile. As I have not wished to destroy the largest specimen, I cannot give any information as to the distribution of the generative organs which may be developed in it. The ciliated streaks of the filaments were well developed, as were also the thick acontia. The nematocysts of the tentacles and acontia were measured in 2 specimens.

The species agrees rather closely with *A. dohrni*, as well as with a new species from Drontheim fjord, but is certainly distinct.

***Stephanauge annularis* n. sp.**

Diagnosis.—Pedal disc clasping stems of *Balticina* and forming an annulus around the stem. Column smooth, 1+1 cinclides on distinct tubercles. Sphincter strong, but short, reticular-alveolar, its proximal end truncate. Tentacles of ordinary length to about 96, the inner considerably longer than the outer ones. Two deep siphonoglyphs. Mesenteries probably fewer in the proximal part than at the margin, at any rate not more numerous; 48 pairs of mesenteries, 6 pairs perfect, 2 pairs of directives. All mesenteries, with the probable exception of the directives, fertile. Acontia? Nematocysts of the actinopharynx $15-18 \times 3.5-4\mu$ (penicilli); those of the filaments $14-17 \times 3.5-4\mu$ (penicilli). Spirocysts of the tentacles $19 \times 2.5-36 \times 5.5(6)\mu$.

Dimensions.—Largest specimen about 1 cm. broad, greatest height about 1.5 cm.

Occurrence.—Monterey Bay, California, on *Balticina*, 70 fms., June 26, 1930, several specimens, badly preserved. Holotype, U. S. N. M. Cat. No. 43062.

The pedal disc encircled stems of *Balticina*, therefore the Actinia, when separated from its host, has the appearance of an annulus, from which a

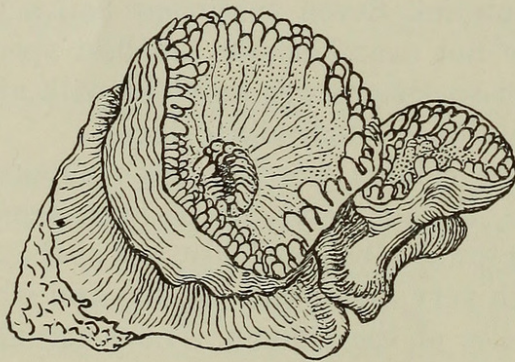


Fig. 5.—*Amphianthus californicus*, natural size.

low cylinder arises. The specimens occurred in groups, in which they stand very close to each other. The mesogloea of the smooth column was thick, the ectoderm lost. There were 1+1 cinclides in the best preserved specimen. The conical tentacles were about 96, in some specimens the outer part of the oral disc was radially furrowed. Two more closely examined specimens had 2 deep siphonoglyphs situated perpendicularly to the stem of *Balticina*.

Owing to the bad preservation of the specimens, a perfect description of their anatomy cannot be given. The sphincter was strong, reticular-alveolar, not elongated, with rather large meshes (fig. 5). The actinopharynx was

provided with longitudinal ridges caused by the swellings of the mesogloea, in the smaller, sectioned specimen 12, in the largest about twice as many. The mesogloea of the actinopharynx was thick.

The pairs of mesenteries were in one specimen 48 in the upper part, in another about 48. I cannot decide with certainty how many were present at the pedal disc, but probably they were fewer here or present perhaps in the same number as at the margin; at any rate, they were not more numerous at the limbus. Two sectioned specimens had 2 pairs of directives; 6 pairs were perfect. The longitudinal muscles of the mesenteries were weak, somewhat stronger on the directives. All mesenteries were fertile, with the probable exception of the directives. The filaments of the mesenteries were very poorly preserved, mostly dissolved; the whole coelenteric cavity was filled up by the testes. I have not found any acontia; probably they were few in number. As to the nematocysts of the tentacles and column I am not able to give any information, as the ectoderm of these organs was almost entirely lost.

Family METRIDIIDAE

Metridium senile (L.) var. *fimbriatum* (A. E. Verrill)

Occurrence.—Sitka, August 2, 1932, 1 specimen; Whale Island near Sitka, August 17, 1932, 1 specimen.

I have examined the nematocysts of the acontia in both specimens. The Penicilli were $41-50 \times 5\mu$ and $54-60 \times 5\mu$ respectively; the spirulae, 43–58, mostly $50-53 \times 4-4.5\mu$ and $58-62 \times 4-4.5\mu$ respectively. The specimens were respectively 0.8 and 0.4 cm. high, the breadth of the pedal disc 0.9 and 0.55 cm.

I take the opportunity to rectify a lapsus in my paper *Some Actiniaria from Bering Sea and arctic waters* (1934, p. 353). Where I have written “var. *marginatum*” read “var. *fimbriatum*.”

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