ART. VI.—*Descriptions of imperfectly known and new Actinians, with critical notes on other species*, II.; by A. E. VERRILL. *Brief Contributions to Zoology from the Museum of Yale College*, No. LIX.

Family HALOCLAVIDÆ Ver. nov.

COLUMN much elongated, either smooth or with suckers; base with a very small or rudimentary disk; tentacles 20, obtuse or capitate; ten pairs of mesenteries, all perfect.

Haloclava, gen. nov. Type *H. producta* (Stimp.) Ver. Figure 7.

Column much elongated, soft, without a sheath, the upper part with rows of distinct adhesive suckers. Upper end with a sphincter and capable of involution. Aboral end often inflated or bulbous, with a rudimentary disk, capable of adhesion to small pebbles. Tentacles twenty, short, usually clavate, nearly equal, marginal. Mesenteries very muscular, all perfect,

Fig. 7.

arranged in 10 pairs; six of these pairs are larger and form a regular primary cycle; four other pairs, narrower below, belong to the second cycle; the usual pair, next to the ventral or sulcar pair of directives, is lacking on each side.

Besides the type species this genus will include *H. albida* Ver., which I now consider only a variety. *H. Capensis* Ver., Commun. Essex Inst., v, p. 5, pl. 3, fig. 7, 1869;* *H. brevicornis* (Stimp.) Ver., op. cit., p. 4, pl. 3, figs. 2, 2^a, 2^b; and *H. Stimpsoni* Ver., op. cit., p. 5, pl. 3, fig. 1, 1869, resemble this genus but probably belong to *Eloactis* Andres. No specimens

* Andres, in his classical work on the Actinaria, has entirely overlooked my two illustrated articles on Actinaria of the North Pacific Expl. Expedition, in the Comm. Essex Inst., vols. v and vi, 1868, 1869, quoted above, and has, therefore, omitted one of the above named species from his work, as well as numerous other species and several genera first described and illustrated in those papers. In several cases he stated that no figures nor descriptions of certain species therein described had been published. Nevertheless he quotes those papers in his bibliography. In the papers referred to there are four plates of Actiniæ (40 figures). He also failed to quote several other papers by me. Among those omitted are Report on Invert. of Vineyard Sound, etc., 1874; Radiata from Coast of North Carolina, this Journal, iii, p. 432, 1872; Bulletin, U. S. Nat. Mus., No. 15, 1879; American Naturalist, ii, p. 251, and several others. He intended to include all the literature and all known species. Such omissions are liable to happen in the best works.

of either species were preserved by Dr. Stimpson. His original drawings show no suckers.

H. producta ranges from S. Carolina to Cape Cod. *Var. albida*, Cape Cod.*

Eloactis brevicornis and *E. Capensis* are from Cape of Good Hope.

E. Stimpsoni, Hong Kong, China.

Family BUNODACTIDÆ Verrill = *Bunodidæ* Gosse.

Bunodactis V., new name = *Bunodes* Gosse (restr.)

Bunodes (pars) Gosse, 1855, 1860, not of Eich. (genus of Eurypteroidea), 1854.

Unfortunately the name *Bunodes* was preoccupied,† as indicated above, for a genus of eurypteroids, and some other name has to be chosen for this well known genus of actinians. None of the numerous groups recently established seem to correspond with this genus, and I have, therefore, given it a new name.

This genus, as now limited, includes species that have from 12 to 48 pairs of perfect mesenteries,‡ the number increasing with age. All the larger mesenteries, except the directives may bear gonads. The submarginal sphincter is prominent, endodermal and circumscribed. The verrucæ of the column are intraseptal evaginations of the wall and serve as true adhesive suckers; some of the rows may reach the base. The wall is imperforate, at least in the typical forms. The marginal tubercles are simple and similar to those below, and are not true acrorhagi, though sometimes pigmented distinctively. The wall is thick and muscular.

Bunodactis seems to include a considerable number of species, widely distributed. Among these are the following: *B. verrucosa* (Penn.) = *gemmaea* (type); *B. Balli* (Cocks); *B. Listeri* (Johns.); *B. glandulosa* (Otto) = *B. rigida* (And.); *B. thallia* (Gosse); *B. sabelloides* (Andres), all from European seas; *B. pluvia* (Dana); *B. cruentata* (Dana); *B. ocellata* (Less.), and *B. papillosa* (Less.), West S. America; *B. inornata* (Ver.) Hong Kong; and *B. Japonica* (Ver.) Japan. In accordance with the usual custom, the change in the typical generic name will make it necessary to change the family name *Bunodidæ* to *Bunodactidæ*. *Tealiadæ* (Hert.) might be used, were not *Tealia* a synonym of *Urticina* (Ehr., 1834, restricted).

* Andres has based a new sp. (*H. Elizabethæ*) on an incorrect outline figure of this, in a popular work. It is the same as *H. albida*.

† Eichwald, Bull. Soc. Imp. Nat. de Moscou, vol. xxvii. part I, pp. 50, 107, pl. II, figs. 2-4, 1854, *Bunodes lunula*. The article is dated, at the end, Nov. 2, 1853.

‡ Y. and A. F. Dixon (Sci. Proc. Roy. Dublin Acad., ii, p. 310) have shown that in *B. thallia* the number of mesenteries and their arrangement are remarkably variable, and that abnormal specimens are found with one or with three pairs of directives and corresponding siphonoglyphs. I have found the same variations in *B. stella*, which usually has about 24 pairs of perfect mesenteries.

Bunodactis stella Verrill.

Bunodes stella Verrill, Revis. Polyps E. coast of U. S., p. 16, pl. I, figs. 1-8, 1864; Amer. Naturalist, II, p. 258, 1868.

Bunodes spectabilis Verrill, Check List Mar. Invert. N. New Eng., p. 15, 1879; Cont. to Nat. Hist. of Arctic America, in Bulletin U. S. Nat. Mus., No. 15, p. 152, 1879 (non Fabr.).

Bunodes (?) *stella* Andres, Attinie Golfes von Neapel, p. 230, 1884. McMurrich, Actinaria of Bahama Is., p. 30, 1889.

Having received large specimens of this species from Greenland and Cumberland Gulf, I at one time identified it with *A. spectabilis* Fabr., owing mainly to the green color of the latter, but as this was not described as verrucose, it is more probable that it was the green variety of *Urticina crassicornis*, which also occurs in Greenland. At Eastport, Me., between tides, a common variety of the latter is green mottled more or less with red or brown.

This species is a true *Bunodes*, closely related to the common European species (*B. verrucosa*), as stated in my detailed description in 1864. It is somewhat singular that Andres, with my full description and figures, should have put it as a doubtful species, even suggesting that it might belong to *Aulactinia*, a genus established by myself for a species described in the same paper with the present one, as if I did not know the characters of my own genera and species!

McMurrich simply followed Andres in expressing this doubt, but regretted that he could not obtain examples for study, after futile efforts. It is, however, a very abundant species at low-water mark at Eastport, Me., and numerous specimens have been preserved by me for the Mus. Comp. Zool. (including the original types); the U. S. Nat. Mus.; the Mus. of Yale University, etc. He certainly did not ask me for specimens.

He also described a very different species, from the Bahamas, for which he proposed the provisional name of *Aulactinia stelloides*, but he, at the same time, expressed the opinion that it might prove to be identical with *B. stella*.

Mr. Duerden (Journ. Inst. Jam., ii, p. 454, 1898), misled by this statement, went farther and definitely united the same species, from Jamaica (as *Aulactinia stella*), with my *B. stella*. The latter is a very arctic littoral species, ranging from Maine to Greenland. Its occurrence as a littoral species in the West Indies would, of itself, be a case without parallel. The West Indian species probably belongs to a different genus, but it does not agree with the characters of typical *Aulactinia*.

For such species I propose the name *Bunodella*.

Bunodella V., gen. nov. Type *B. stelloides* (McMur.)

Form of body and tentacles same as in *Bunodactis*. Column with longitudinal rows of true adhesive verrucæ on the upper

part. Margin with a row of simple, round or conical verrucæ similar in structure to the others. Mesenteries in several cycles with but six perfect pairs (in the type). Submarginal sphincter well developed, endodermal, circumscribed.

Differs from *Aulactinia* in not having lobate marginal verrucæ. The structure of the column-wall is also different: From *Bunodactis* it differs, so far as known, in having but six pairs of perfect mesenteries, as in very young examples of the latter. Should larger specimens of *Bunodella* be found to have a greater number of perfect mesenteries, this group would not differ essentially from *Bunodactis*.

Anthopleura Dowii Ver. Figure 8.

Trans. Conn. Acad. Sci., i, p. 474, 1869: Andres, op. cit., p. 223, 1884 (*Dowii*).

This species was pretty fully described by me in 1869, but the anatomy was not then given.

A medium sized example, 40^{mm} across, in alcohol, has about 96 pairs of mesenteries, of which 48 are perfect and furnished with large plicated muscles along most of their breadth; a pair of very small imperfect mesenteries, without gonads, usually intervenes between each perfect pair. The mouth has two large siphonoglyphs and about 22 crenulations on each side. Sphincter muscle well circumscribed, ovate in section, not very large. Larger submarginal tubercles or actinobranchs have 4 to 6 lobules on the lower side, each with a small point, appearing as if perforated, though the openings, said to exist in life, are not visible (fig. 8). Adhesive, cup-shaped suckers, of the longer rows, reach the base. Panama to San Salvador.

Anthopleura Stimpsoni Ver., Comm. Essex Inst., vi, p. 32, 1869. Figure 9:

This species has 12 pairs of perfect mesenteries, with large muscles along most of their breadth; 12 pairs of 3d cycle, well developed; about 24 pairs of 4th cycle, of small size and barren; all the others, except directives, bear large gonads. Sphincter muscle circumscribed, rather large, ovate in section. Actinobranchs (fig. 9) crowded, three to five in the larger rows, the upper one three to five lobed or digitate, the larger lobes often subacute and perforated. Adhesive suckers large, in unequal rows. Hong Kong, China. Type.

Bunodosoma, gen. nov. Type, *B. granulifera* (Les.).

General form and appearance as in *Bunodactis*, but the hollow verrucæ, arranged in vertical rows, are rounded or subconical and do not form adhesive suckers. Upper or submarginal ones are larger and in mature specimens more or less

lobulated, but have nearly the same structure as those below, though they are described as perforated when living. Tentacles numerous; many mesenteries, 12, 24, or more pairs being perfect. Sphincter muscle well developed, endodermal and circumscribed.

To this group I refer the following:

Bunodosoma granulifera (Les., 1817).

Aulactinia granulifera Andres, 1884, p. 221.

Bunodes granulifera Duerden, 1898, p. 454.

Bunodes læniatus Mc Mur., 1889, p. 23.

Cereus Lessoni Duch. and Mich., 1860, p. 42.

West Indies.

Bunodosoma cavernata (Bosc, 1801).

Bunodes cavernata Ver., 1864, p. 17.

Cladactis cavernata Ver., 1869, p. 473.

Phymactis cavernata Andres, 1884, p. 231; Mc Mur., 1887, p. 51.

South Carolina to Cape Hatteras.

Various other species described under *Bunodes*, *Aulactinia*, etc., may belong here, but the descriptions of the verrucæ and other parts are insufficient to determine their position. *Aulactinia crassa* Andres looks more like *Bunodosoma* than like *Aulactinia*.

Family PHYLLACTIDÆ.

Asteractis Verrill, 1869. Type, *A. Bradleyi*.

Asteractis Verrill, Trans. Conn. Acad. Sci., i, p. 465, 1869. Andres, op. cit., p. 292, 1884.

This genus is characterized by the presence of a special wide ruffled collar outside the tentacles, covered with complex rows of compound verrucæ or lobed outgrowths,* but not forming true free fronds. The column bears more or less numerous adhesive verrucæ in rows below the collar. There are 12 or 24, or more pairs of perfect mesenteries and one, or sometimes two, endodermal sphincter muscles.

Asteractis flosculifera (Les.) Ver.

Actinia flosculifera Les., Journ. Acad. Sci. Philad., i, p. 174, 1817 (not *Oulactis flosculifera* Duch. and Mich. nor of McMurrich).

Evactis (?) *flosculifera* Andres, op. cit., p. 235.

Oulactis fasciculata McMurrich, Proc. Philad. Acad. Sci., 1889, p. 108; also in Heilprin's "The Bermuda Islands," p. 112, pl. x, fig. 5 (section), 1889.

This species is common at Bermuda, living buried to its margin in shell-sand at low-water mark. Figures from life will be published soon in Trans. Conn. Acad. Science.

* They are probably branchial in function and may be called actinobranchs (*Actinobranchiæ*). The groups that they form may be called pseudofronds.

It has been pretty fully described, as to its anatomy, by McMurrich. The collar is covered by radial pseudofronds composed of about three rows each, of lobed tubercles, the lobules being short or rounded; a single larger lobed tubercle or actinobranch occupies the distal end of each group, and a nearly simple one often forms the proximal end, next to the fosse at the bases of the tentacles. The color is variable, but the collar is usually umber-brown, varied with yellowish, flake white, and reddish brown spots.

Fig. 10.

Asteractis Bradleyi Ver. Figures 10, 11, 12.

Trans. Conn. Acad., i, p. 465, 1869. Andres, op. cit., p. 292, 1884.

This is closely allied to the preceding species. The pseudofronds of the collar are made up of more finely lobulated verrucæ, so that they appear more complex. These verrucæ, in

the alcoholic specimen, are closely crowded in each radial series, of which there are 48; their upper and lateral surfaces are divided into many small rounded or conical lobules, most prominent along the outer sides and at the distal end of the last or distal one, where about five lobules project, in each group, beyond the edge of the collar, giving it a finely serrate or fringed appearance (figs. 11, 12). The verruciform adhesive suckers are in 48 rows, of 3 to 5 each, corresponding to the

pseudofronds, and extending only a short distance below the collar.

The general figure, now given, is based on a sketch from life, by F. H. Bradley, of the original type, corrected by comparison with the preserved specimen, which was from Panama.

Asteractis conquilega (Duch. and Mich.) Ver,

Oulactis flosculifera Duch. and Mich., Corall. Antill., p. 46, 1860 (*non* Les.); Supl., p. 129, 1866. McMurrich, Actin. Bahamas, p. 56, pl. II, fig. 2, pl. IV, figs. 12–14 (anatomy), 1889.

Oulactis conquilega Duch. and Mich., op. cit., pp. 49, 89, pl. VII, figs. 7, 11, 1860.
Oulactis foliosa Andres, op. cit., p. 290, 1884.

The collar of this West Indian species is very broad and is covered with about 24 pseudofronds, or groups of small folds and lobulated and crowded actinobranchs, much more complex than in either of the preceding species.

Asteractis formosa (Duch. and Mich.) Ver.

Oulactis formosa D. and M., op. cit., p. 47, pl. VII, figs. 4, 5, 1860; Supl., p. 36 (130), 1866. Andres, op. cit., p. 291.

This is closely allied to the preceding species, but has smaller and less complex groups of lobulated actinobranchs on the collar and fewer tentacles. Guadeloupe.

Family DENDROMELIDÆ McMurrich.

Lebrunia Duch. and Mich., Corall. Ant., p. 48, 1860.

Actinodactylus (pars) Duch. and Mich., op. cit., p. 44, 1860.

Stauractis (pars) Andres, op. cit., p. 255, 1884 (new name for last).

Taractea Andres, op. cit., p. 284, 1884 (for *L. Danæ*).

Lebrunea McMurrich, Actinaria Bahama Is., p. 33, 1889; Duerden, Actin. Jamaica, p. 456, 1898.

This remarkable genus is characterized by having a series of about six (sometimes 5 or 8) large, dichotomously branched fronds, or branchiæ (*actinobranchiæ*) exterior to the tentacles. The species examined by me has, on these fronds, at the forks, many more or less spherical bodies having the structure of acrorhagi. There are numerous mesenteries, most of them perfect and bearing gonads. Sphincter muscle feebly developed or wanting.

The genus *Actinodactylus* Duch., 1850, was based on *A. Boscii* D., which may, perhaps, have been only a young *Lebrunia*. It was only 4 to 5 lines in diameter, with 15 small, simple tentacles, in a single circle, and with 5 elongated, pedicelled, trilobed fronds, the lobes with small subdivisions. It may, however, prove to be a distinct genus when larger examples can be studied.

The second species referred to it (1860), as *A. neglectus*, appears to be the young of *Lebrunia neglecta*, described in the same work. Although it was only 5 lines in diameter it had 30 tentacles and 5 dichotomously branched fronds.

Lebrunia Danæ (D. and M.) Verrill. Figure 15.

Oulactis Danæ Duch. and Mich., op. cit., p. 47, pl. VII, fig. 10 (frond), 1860:

Rhodactis Danæ Duch. and Mich., Supl., p. 37, 1866.

Taractea Danæ Andres, op. cit., p. 284, 1884.

Lebrunea neglecta Duerden, Actin. Jamaica, p. 456, 1898.

? *Hoplophoria coralligens* Duerden, loc. cit. (*non* Wilson).*

Specimens of large size, up to 8 inches or more in diameter, were obtained by me at Bermuda, in 1898. These agree very well with the specimens described by Duerden from Jamaica, as *L. neglecta*, but not with those described by McMurrich under the same name. In having numerous rounded acrorhagi on the actinobranchs or fronds (fig. 15) my species agrees with the *Oulactis Danæ* D. and M., from St. Thomas, which is evidently a *Lebrunia*, and there is no reason to doubt its identity with the Bermuda species.

My larger examples were usually dark green in life, with the tentacles somewhat paler green and flecked more or less with white; disk olive-green with whitish radial spots; fronds bluish green with the tips and rounded bodies light blue. It lives with the body concealed in holes or crevices of the reef-rock, at and below low-water mark. The tentacles are long.

Lebrunia neglecta Duch. and Mich.

Lebrunia neglecta Duch. and Mich., op. cit., p. 48, pl. VII, fig. 8, 1860 (young). Andres, op. cit., p. 362 (*non* Duerden).

? *Actinodactylus neglectus* Duch. and Mich., op. cit., p. 44, 1860 (very young).

? *Stauractis incerta* Andres, op. cit., p. 255, 1884 (new name for last).

Lebrunea neglecta McMurrich, Actin. Bahama Is., p. 33, pl. I, fig. 7 (general), pl. III, figs. 11–14 (anatomy).

This species was originally based on a small specimen (about one-half an inch high), but it had relatively large, much dichotomously divided fronds, according to the figure. McMurrich has given a detailed description of a species that appears to be the same, though much larger in size. His figures represent the 6 fronds as dichotomous, but with few divisions, though in

*The *Hoplophoria coralligens* Wilson, was described from a single, very small specimen (diameter about 2^{mm}), having 48 unequal tentacles and 4 simple, elongated, marginal fronds. Duerden identified with it a small form of *Lebrunia*, having dichotomous fronds and agreeing nearly in color, etc., with *L. Danæ*. The identity of his specimens with the true *Hoplophoria* seems to me very doubtful. This generic name is unfortunate for its variants, *Hoplophorus* and *Hopliphorus*, had been used previously for five distinct genera. It evidently cannot be the young of either nominal species of *Actinodactylus*, for although much smaller, it has more tentacles. It is most likely to be the young of *Diplactis Bermudensis* McMur., or some similar species.

his description it is stated that they "dichotomize many times until a dendritic structure is produced." The rounded bodies are not figured nor described by him, nor by D. and M. as occurring on the fronds. In this respect the fronds are very different from those of the Bermuda species studied by me. I am, therefore, disposed to believe that there are two large West Indian species.

Subfamily ALICINÆ = Family ALICIADÆ Duerden.

Duerden, Ann. and Mag. Nat. Hist., 6, xv, p. 213, 1895; Haddon and Duerden, Sci. Trans. Roy. Dublin Soc., vi, p. 153, 1896.

This family was established to include certain tuberculated genera, such as *Alicia* (= *Cladactis* Panc.), *Cystiactis*, etc.

It is characterized by a thin wall; feeble, diffused sphincter muscle; hollow tubercles, usually compound, on the column; 12, 24, or more pairs of perfect mesenteries; no acontia.

The wall-tubercles are thin and doubtless serve as branchiæ; they are not adhesive suckers.

The group is practically equivalent to tuberculated *Actinidæ*, and might well form a subfamily of that family.

Eucladactis Ver., new name. Type, *E. grandis* V.

Cladactis Ver., Trans. Conn. Acad. Sci., i, p. 472, 1869 (*non* Panceri, 1868).

By a mere coincidence the name *Cladactis* was given by M. Panceri and myself to two distinct genera, at nearly the same time. The former appears to be the same as *Alicia* Johns. which preceded it. No other name seems to have been given, as yet, to my *Cladactis*. The latter is characterized by very numerous tentacles, which are scarcely retractile; column thickly covered with hollow clavate and lobulated tubercles, the upper ones larger and more lobed than the rest; margin with a deep fosse; sphincter muscle very feeble and diffuse, or almost lacking; 36, 48, or more pairs of perfect and many imperfect mesenteries, having feeble muscles extending along most of their breadth; gonads numerous, borne on most of the mesenteries, both perfect and imperfect; a distal septal foramen; mouth large, with two large equal siphonoglyphs; lips with very numerous lateral furrows.

Eucladactis grandis Ver. Figures 13, 14.

Cladactis grandis Ver., Trans. Conn. Acad. Sci., i, p. 473, 1867. Andres, op. cit., p. 226, 1884.

The larger specimens of this species are over 2 inches in diameter and height, as preserved in alcohol. The tentacles

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are partially contracted in length and sulcated, but are rarely concealed, even in the young, by the infolding of the margin of the disk; generally they are fully exposed and the margin is but little contracted or not at all, owing to the feeble development of the circular muscles. There are about 480 tentacles in the larger specimens; they form five or six crowded rows, the inner ones standing about half way between the center and the margin of the disk; the inner ones are larger and somewhat swollen at the bases but are not much longer than the outer ones; all are sulcated by contraction. The lips have about 48 to 60 furrows on each side. The mesenteries are hexamerous and, like the tentacles, vary in number according to the age. A medium-sized specimen had about 120 pairs, of which about 48 were perfect, but the arrangement is more or less irregular, for one, two, or even three imperfect pairs may intervene between the various perfect pairs. The larger specimens have about 60 pairs perfect and about 180 imperfect. Nearly all bear gonads. The larger upper actinobranchs (fig. 14 *a, c*), next the smooth fosse, are elongated, more or less clavate, the distal portion divided into four to six irregular rounded or obtuse lobules; those lower down become shorter and less lobulated, but nearly all are clavate or capitate, to the base, and most of them, in large specimens, are divided into two, three, or more lobules. They are thickly crowded over the whole surface, and in alcoholic specimens appear to be united together in horizontal series by thin folds of the wall (fig. 14 *b*).

Panama; Païta, Peru; San Salvador.

Explanation of figures.

Fig. 7. *Haloclava producta* (St.). Type, natural size.

Fig. 8. *Anthopleura Dowii* V. Side view of a tentacle, actinobranch, and two upper verrucæ. Enlarged.

Fig. 9. A similar view of the same organs of *Anthopleura Stimpsoni* V., from the type, enlarged.

Fig. 10. *Asteractis Bradleyi* V. Type, about natural size.

Fig. 11. The same, side view of tentacles and actinobranchs.

Fig. 12. The same, view of a portion of the disk, tentacles, pseudofronds, enlarged.

Fig. 13. *Eucladactis grandis* Ver. Type, $\frac{1}{2}$ natural size.

Fig. 14. The same; *a*, one tentacle and a single vertical row of actinobranchs; *b*, a group of actinobranchs or papillæ from the middle of the column; *c*, various forms of marginal actinobranchs.

Fig. 15. *Lebrunia Dana*, one of the actinobranchs with acrorhagi, $\frac{1}{2}$ natural size.

Figs. 8 to 15 are by A. H. Verrill. Fig. 7 is by Wm. Stimpson.

Erratum—In part I, p. 494, line 17, for W. E. Coe, read W. R. Coe.