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THE LEMON-COLORED PLEXAURIDS FROM THE WEST INDIES AND BRAZIL

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In Kükenthal's monograph of 1924 are listed two yellow plexaurids, referred to different genera and each definitely falling outside the normal limits of the genus in which it is placed. These two forms are *Plexaura flavida* (Lamarck) — which, incidentally, also appears in a dark purple phase — and a species which, hitherto, most commonly has been listed as *Eunicea humilis* Milne Edwards and Haime. The latter, thanks to the junior author's delving into old, forgotten literature, has now been given the older name *sulphurea* Donovan. Lamarck's species appears to be common in the West Indies, from the northern shores of South America to the eastern coasts of Florida, but apparently it does not reach Bermuda (see Verrill, 1907, p. 261), while Donovan's species is one of the most characteristic elements of the Brazilian reef fauna, ranging from 7°S to 20°S latitude with a few, rather dubious, records from Curaçao, Aruba, and San Bartholomew Island, in the West Indies.

As the Museum of Comparative Zoology possesses a large amount of material of both forms, and since a number of confusing statements concerning them have crept into the literature, there seems good reason for revising these two species and allocating them to their proper place, and at the same time reviewing their history.

Verrill established in 1907, page 309, a new genus *Plexauropsis*, to accommodate what he considered a new species, *P. bicolor*, taken from shallow water in Bermuda. The species was not found again until 1951, when it was realized that this small form merely represented the immature stage of the tall *Pseudoplexaura crassa* (Ellis and Solander), with a few flat rods still retained in the tentacle bases, and with a greater number of clubs and spindles with spines on the external side than are usually present in the older colonies. Hence *Plexauropsis* is a straight synonym of Wright and Studer's *Pseudoplexaura* 1889.

Verrill's genus and species was, however, included in Kükenthal's monograph of 1924 (p. 118), with a somewhat distorted description: The presence of the few tentacle rods was omitted, and too great emphasis was placed on the one-sided spinulation of the external spindles—a feature which occurs more or less pronounced in a number of plexaurids, but often has not been specially noticed. Neither Kükenthal nor his students had, of course, access to Verrill's material.

As a result of Kükenthal's misleading account, Stiasny included a number of species in *Plexauropsis*, in his papers from 1935 to 1951.

His *tricolor*, from Bermuda (1935 a, p. 241; 1935 b, p. 69, pl. 3, fig. 13 and text fig. R), is identical with *Plexaura homomalla* (Esper), redescribed by Verrill in 1907.

His *bicolor*, based on some old material labelled *humilis* (from Curaçao and "No locality," 1935b, p. 73), was later transferred back to *humilis* (1935c, pp. 107-115, text figs. 1-3), with a detailed analysis of all earlier records appended.

His *humilis* (1935b, pp. 74-78, pl. 3, fig. 14, pl. 7, fig. 32, text fig. T), was later changed to *Eunicea hicksoni* (1935c, p. 115), but it represents merely the widespread form *Plexaura flexuosa* Lamouroux. Most of this material had been identified by Gordon (1925, p. 17) as *mutica* Duchassaing and Michelotti.

In addition, Stiasny had included the following feather-shaped forms in the genus *Plexauropsis*:

P. flavida n. sp. (1935a, p. 242; 1935b, p. 71, pl. 1, fig. 5, text fig. S) from Curaçao.

P. sp. (1935b, p. 72) from "Antillen."

P. puertorealis n. sp. (1942, p. 101, pl. 1, figs. 5-8) from Venezuela, taken with numerous colonies of his new "*flavida*."

All these species are, however, identical with Lamarck's variable and widespread *Gorgonia flavida*. The latter is briefly mentioned by Stiasny (1935b, p. 57), but he merely states that the spicules agree with Kükenthal's description and, as the latter, he places it in the genus *Plexaura*.

The result of this survey is that of all the species referred by Stiasny to the now defunct genus *Plexauropsis*, only two remain, namely, Milne Edwards' *humilis*, now *sulphurea* of Donovan, and Lamarck's *flavida*, and for these two forms the proper generic name must be found.

In 1931, Aurivillius established a new genus, *Muriceopsis*, to which *humilis* (*sulphurea*) belongs — in fact it ends up by being the type species — and this genus has now had its diagnosis emended so it also accommodates Lamarck's *flavida*.

Whether any member of the genus occurs outside the tropical Western Atlantic remains to be seen. Possibly some little known West African species may have to be included in the genus. Furthermore, the Museum of Comparative Zoology possesses a branch which hardly can be distinguished from the typical *flavida* from the West Indies, but which bears the label Mauritius (N. Pike). While the possibility of mislabelling is not excluded, it must, nevertheless, be remembered that in the case of the crustaceans several West Indian forms have been taken in Mauritius and Madagascar, so this disjointed distribution is not unique. The branch from Mauritius bears some similarity to Lamouroux' figure of *olivacea* from the Indian Ocean and may possibly be referred to that species.

MURICEOPSIS Aurivillius 1931 (emended)

Muriceopsis Aurivillius, 1931, p. 115.

Diagnosis. Colonies either low, bushy, with crooked branchlets or tall, feather-shaped with crowded, straight pinnulae. Polyps small, either completely retractile so the pores are flush with the surface, or they form low mounds or crescent-shaped lower lips. Spicules arranged in an inner layer of slender, pointed spindles with distant warts, yellow or purple in color, a middle layer of slender or stout spindles and an external layer of clubs or spindles with large, mostly flattened, spines on the

external side. Polyps with a delicate operculum of flattened, warted rods, bent or straight. Color lemon yellow, buff or purple.

Type species. *Gorgonia sulphurea* Donovan 1825.

Remarks. Milne Edwards and Haime's name, *Eunicea humilis* 1857, has been most commonly used and that name takes in *Muriceopsis tuberculata* Aurivillius 1931, *nec Gorgonia tuberculata* Esper 1791.

Aurivillius selected, quite properly, what he considered to be Esper's *tuberculata* as the type, on the basis of some material from the West Indies which had been identified by Kölliker. However, Esper's species came from the Mediterranean and his figure (1791, pl. 37) agrees completely with a number of fans received from the Mediterranean in 1957 (in U.S.N.M.). These have been referred to *Eunicella lata* Kükenthal, but the clubs, 0.07 mm. long, are rather similar to those found in *Eunicella verrucosa* (Pallas) — from the same lot — hence *lata* possibly should be withdrawn as a synonym of Pallas' species. On the other hand, some of Esper's material — possibly that which was examined by Kölliker — may well have been a West African species, which is known to range from Congo to Cape Blanco, and possibly farther north. This species appears in several of Stiasny's papers, first as *Plexauropsis mauritaniensis*, but finally withdrawn by himself as a synonym of *Muriceides chuni* Kükenthal (see Stiasny 1951, p. 17). From the excellent figures which Stiasny has given, one has the impression that he is dealing with a form which externally is quite similar to Esper's *tuberculata*. As for the spicules, Stiasny indicates that some are deep yellow, often with purple center, and that purple spicules, including some red ones, occur scattered but do not form a continuous inner layer. We do not know whether Kölliker had any material of such a species, but he referred two colonies from St. Bartholomew Island, West Indies, to Esper's *tuberculata* and *gracilis* n. sp. Both colonies, in the Zoological Museum in Stockholm, were re-examined by Aurivillius, who considered *gracilis* a variety of *tuberculata*.

In this connection the question is of little importance since Aurivillius' "*tuberculata*" is based on specimens of what commonly has been called *Eunicea humilis* Milne Edwards and Haime, now *sulphurea* Donovan.

The three other species which Aurivillius lists as valid (in his key) are all synonyms of the type species (*Muricea bicolor* Wright and Studer 1889, *Muricea acropora* Verrill 1912, and *Eunicea humilis* Milne Edwards and Haime 1857).

As dubious species, he lists three. Of these *Muricea granulosa* Verrill (1870, p. 373, text fig. 4) came from Sherbro Island, West Africa; it has clumsy spindles and clubs, which are stated to be all yellow or white, with tendency to form flat spines with bilobed or tri-lobed ends; the largest spindles measure 0.69 mm., while the clubs measure 0.49 mm. From Verrill's description it looks as if the colony is fan-shaped and it may possibly represent a colony of *Muriceides chuni* Kükenthal in which no purple or red spicules were observed.

The second, *Muricea vatricosa* (Valenciennes) — not Esper, as Aurivillius writes — from Bissago Archipelago, West Africa, has coarser spicules; the spindles are up to 0.84 mm. long, the clubs 0.66 mm., and the slender spindles 0.72 mm. long. (Verrill's measurements [1870, p. 374] are based on material received from Kölliker, who lists the species [1865, p. 136]). Nothing is said about its outer form and its position is quite uncertain; it is not even mentioned by Kükenthal in 1924.

The third, *Muricea humosa* (Esper) (1794, p. 36, pl. 6, figure erroneously labelled "*placomus*"!) is stated to have come "most likely" from Curaçao. Its crumbling, earth-like tissue and its general shape suggest *Plexaura homomalla* (Pallas), a form not uncommon along the northern shores of South America. The spicules of *humosa* are — according to Kölliker — small, 0.44-0.67 mm. long, which fact agrees reasonably well with what one finds in *homomalla*, where the clubs and spindles have a tendency to form long, flat, narrow spines on the external side.

Key to the species accepted in the genus *Muriceopsis* Aurivillius 1931

Low, 10-20 cm. high, scrubby bushes, with crooked branchlets, strongly warted; polyps completely retractile, with minute pores, scattered over the surface. Inner layer slender, pointed rods with distant warts, about 0.35 mm. long; middle layer with heavy warted spindles, mostly 0.60 mm. long; outer layer clubs and spindles 0.25-0.35 mm. long with lacinated leaves on the external side. All spicules yellow or those in the inner layer purple.

Shallow water, coasts of Brazil, possibly in some localities farther north. (St. Bartholomew, Venezuela.)

Muriceopsis sulphurea (Donovan)

Tall, up to 40 cm. high, feather-shaped colonies, often secondary feathers arising in the same plane; pinnulae 3-6 cm. long, crowded, not all in one plane; polyps with minute pores, rarely forming low warts or halfmoons. Inner layer slender, pointed rods averaging 0.27 mm. in length; middle layer mostly slender rods with distant warts, often slightly bent, mostly 0.3 mm. long, rarely up to 0.5 mm. long; outer layer clubs and spindles with tall spines on the external side, up to 0.40 mm. long. Spicules in inner layer purple; in middle and outer layer yellow, or partly or all purple. Shallow water, West Indies, possibly also Mauritius.

Muriceopsis flavida (Lamarek)

MURICEOPSIS SULPHUREA (Donovan)

Plates 1, 3

Gorgonia sulphurea Donovan, 1825, p. 126, and a colored plate.

Eunicea humilis Milne Edwards and Haime, 1857, pp. 149-150, pl. B 2, fig. 1; Verrill, 1866-1871, p. 360, pl. 4, figs. 4, 4a-b; Kunze, 1916, p. 550 (not examined).

Muricea humilis and var. *humilis*, var. *mutans* and var. *macra* Verrill, 1912, pp. 377-379, pl. 29, figs. 1-1a, pl. 32, figs. 4-5, pl. 35, fig. 2, text fig. 1.

Muriceopsis humilis Aurivillius, 1931, p. 115 (not examined).

Muricea acropora Verrill, 1912, p. 379, pl. 32, fig. 3, pl. 35, figs. 1, 1a.

Muriceopsis acropora Aurivillius, 1931, p. 115 (not examined).

Nec Eunicea mutica Duchassaing and Michelotti, 1860, p. 28, pl. 3, fig. 10; Gordon (*partim*) 1925, p. 17 (= *Plexaura flexuosa* Lamouroux 1816).

Nec E. humilis Stiasny, 1935b, p. 74, pl. 3, fig. 14, pl. 7, fig. 32, text fig. T (= *Plexaura flexuosa* Lamouroux 1816).

Eunicea citrina Valenciennes, 1855, p. 13.

Nec Gorgonia citrina Esper, 1794, p. 129, pl. 38 [= *Pterogorgia citrina* (Esper)].

Muricea bicolor Wright and Studer, 1889, p. 134, pl. 23, fig. 11, pl. 25, fig. 8; Verrill, 1912, p. 380 (not examined).

Muriceopsis bicolor Aurivillius, 1931, p. 115 (in key).

Plexauropsis bicolor, Stiasny, 1935b, p. 73.

Nec Plexauropsis bicolor Verrill, 1907, p. 265, pl. 33B, figs. 2b-c, pl. 35A, figs. 1-2; text fig. 149 [= *Pseudoplexaura crassa* (Ellis and Solander) 1786].

Muricea tuberculata K  lliker, 1865, p. 136.

Nec Gorgonia tuberculata Esper, 1794, p. 137, pl. 37. [= *Eunicella* sp. (*partim*) and ? *Muriceides chuni* K  kenthal, 1919].

Muriceopsis tuberculata Aurivillius, 1931, p. 115.

Diagnosis. Low, scrubby colonies, 10-20 cm. high, with crooked branchlets, 3-5 mm. in diameter; surface knobby and the small pores mostly upwardly directed, toward the tip of the branchlets; sometimes a short, hook-like lower lip is formed. Branching dichotomously or loosely pinnately, with branchlets alternate or opposite, occasionally all developed from one side. Color bright yellow, whitish or pale buff.

Spicules in inner layer slender, pointed rods with distant warts, usually about 0.35 mm. long; in middle layer a varying number of moderately thick spindles, about 0.6 mm. long with composite warts of fairly uniform distribution and size; a few may be 0.7 mm. long. In some colonies this middle layer is weakly developed. Outer layer with large asymmetrical clubs and spindles with large irregular spines or lacinated leaves on the external side while the inner side has low, composite warts. The polyps have a weakly developed operculum of flat rods of which the largest are curved, with warts along the edge; length varying from 0.10-0.12 mm.

The spicules are either all yellow or those in the inner layer — and occasionally a few in the middle and outer layer — are purple.

Type. Possibly in some collection in England.

Type locality. "Brazilian Sea." Collected in numbers by Señor Ribello.

Distribution. Taken under various names in Bahia: *humilis*, *bicolor*, *acropora*. According to Verrill, common in Porto Seguro and ranging at least from Parahiba, N. of Pernambuco, to Guarapary in the South, that is, from about 7°S to 21°S latitude.

In addition, the species has been listed from San Bartholomew, W.I., by Kölliker and Aurivillius (same material), and from Curaçao (old material in Holland) by Stiasny. Both these non-Brazilian localities may possibly be wrong. At least the species has not been reported from north of Pernambuco in any recent collection.

Specimens examined. One fragment with purple inner spicules and no locality, probably from Kölliker (labelled no. 51 — not a M.C.Z. number). Twelve lots from Brazil: Murraio, Armaçao, Victoria, Guarapary, Porto Seguro, Bahia and "Brazil."

Remarks. Donovan's material is brilliantly sulphur-colored and, as the plate indicates, falls into two varieties: an elongate and a more scrubby one. It is not known whether the type of *humilis* lacked the purple inner spicules, but this was apparently assumed by Wright and Studer, who realized that their *bicolor* otherwise was almost identical with *humilis* (*sulphurea*). Verrill described, in 1912, the three varieties of *Muricea humilis* as having purple spicules in the inner layer, while his own species, *M. acropora*, has only yellow or white spicules.

The material in the Museum of Comparative Zoology lacks in all cases the purple spicules, except the old fragment, without locality, "no. 51" — in all likelihood received from either Kölliker or the Paris Museum. The material shows great variation in the size of the colonies as well as in the number of branchlets and their thickness. Here and there are found colonies with very slender branchlets, and in these the middle layer of thick spindles is poorly developed, as in *Muricea gracilis* of Kölliker (forma *gracilis* of Aurivillius) — perhaps the result of unfavorable ecological conditions.

MURICEOPSIS FLAVIDA (Lamarck)

Plate 4

Keratophyton Seba, 1734-1765, III, p. 198, pl. 107, fig. 8.

Gorgonia flava Lamarck, 1815, p. 158; 1816, p. 318; 1836, p. 496; Lamouroux, 1816, p. 402; Dana, 1848, p. 664.

Plexaura flava Valenciennes, 1855, p. 12; Milne Edwards and Haime, 1857, p. 153; Kölliker, 1865, p. 138, pl. 13, fig. 6 (cross-section of axis); Verrill, 1907, p. 138, pl. 36A, fig. 4 (table explanation to 35A), text fig. 148; Kükenthal, 1917, p. 335; 1924, p. 117; Moser, 1921, p. 114; Stiasny, 1935b, p. 57; 1951, p. 54.

Gorgonia spicifera Dana, 1848, p. 117.

Nec *Gorgonia spicifera* Lamouroux, 1821, p. 36, pl. 70, figs. 1-2. (= *Muricea spicifera*).

Plexauropsis flava Stiasny, 1935a, p. 242; 1935b, p. 71, pl. 1, fig. 5, text fig. S; 1942, p. 106, pl. 1, figs. 6-7; 1951, pp. 51, 56.

Plexauropsis puertorealis Stiasny, 1942, p. 107, pl. 1, figs. 7-8, text fig. B.

Plexauropsis sp. Stiasny, 1935b, p. 72.

? *Plexaura olivacea* Lamouroux, 1816, p. 431, pl. 16.

Diagnosis. Colonies tall, up to 40 cm., feather-shaped, often with secondary branches developing into new feathers, placed in

the same plane as the original one. Pinnulae crowded, round, straight, 3-6 mm. long and about 3 mm. in diameter. Polyps numerous on all sides of the pinnulae usually completely retracted so only a fine pore is visible, as a pin-prick, rarely forming low warts; openings usually at right angles to the branchlet. Color of colonies varying from bright lemon-colored to buff or light to dark purple.

Spicules in inner layer slender, purple, spindles with distant warts, length about 0.27 mm. Middle layer with numerous, slender, spindles with similar armature of warts and often slightly curved or bent, length about 0.35 mm., rarely up to 0.50 mm. in length, and extremely rarely becoming stout. External layer clubs and spindles, with long spines on the external side and low, composite warts on the inner side; length up to 0.40 mm. Tentacles with delicate operculum of flattened rods, often curved and with marginal warts, length up to 0.20 mm., mostly around 0.13 mm. Spicules in middle and external layer yellow or purple or mixed; those in the operculum always colorless.

Type. Possibly in the Natural History Museum in Paris.

Type locality. "Antilles"; Seba's *Keratophyton* came from Nova Hispania (=Mexico).

Distribution. Seems to be not uncommon in the West Indian region, ranging from the coast of Venezuela, Mexico, Dominica, Tobago, Puerto Rico, Florida to the Bahamas. Some old records from Bermuda mentioned by Verrill are rejected, as the species has not been taken in that well-explored region during the last 50 years. Verrill's figures are based on spicules from a specimen from Dominica.

From Mauritius, the Museum of Comparative Zoology possesses a fragment, buff in color, with slightly more delicate spicules (Plate 5, figs. 25-34). It may possibly represent Lamouroux' *olivacea* from "Indes orientalis" (Plate 2). Wright and Studer have with some doubt placed the latter as a synonym of their *Euplexaura pinnata*, 1889 (p. 144, pl. 33, fig. 5), from Japan, 8 and 50 fathoms depth. From the figures given of the spicules, I doubt that their species is identical with the one from Mauritius. There is of course the possibility that the M.C.Z. specimen has had a locality label misplaced and merely represents the West Indies form. The spicules are figured here and

it is hoped that future workers may be able to procure more material — from Mauritius or localities in the vicinity — and thereby settle the question.

Specimens examined. A total of 20 colonies or fragments from 11 different lots: Gulf of Mexico, Guadeloupe, Cuba, "Antilles" Tobago, Puerto Rico, Bahamas, Key West, Florida, Indian River, Florida, "Florida" and "W.I.", besides the branch from Mauritius.

Remarks. The species varies in color as well as in spicules, but it does not seem possible to separate the material into different groups. As far as color is concerned, those from the Caribbean region have all been dull brown or buff in color, as are the colonies of *Plexaura flexuosa* Lamouroux and *Antillogorgia acerosa* (Pallas), while in other parts of the West Indies both purple and yellow or buff colonies are found.

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