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JOHNSON-SMITHSONIAN DEEP-SEA EXPEDITION
TO THE PUERTO RICAN DEEP

A NEW GENUS OF STARFISHES FROM PUERTO RICO

(WITH ONE PLATE)

BY

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A NEW GENUS OF STARFISHES FROM PUERTO RICO

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Among the starfishes obtained by the First Johnson-Smithsonian Deep-Sea Expedition to the Puerto Rican Deep was a single very small specimen representing a species falling in the family Ganeriidae, though wholly unlike any form now included in that family.

A very similar specimen was described by M. Edmond Perrier in 1881 under the name of *Korethraster radians*. Perrier's description is very sketchy and lacks many essential details. No locality is given for the specimen or specimens upon which it was based, and there are no figures.

In 1883 Perrier listed this species as *Lophaster radians* and gave two localities for it—off Barbados in 56 fathoms, and off Havana in 80 fathoms. In the same memoir he listed and figured it under the name of *Solaster radians*, and reprinted the original description under the new name *Korethraster hispidus*.

The figures of *Solaster radians*, though lacking in essential details, might well have been drawn from the species represented by the specimen dredged by the *Caroline*.

Thanks to the kindness of my friend Dr. Hubert Lyman Clark, I have been permitted to examine the type specimen of Perrier's *Korethraster radians* (M.C.Z. no. 912). This and the *Caroline* specimen agree in all essential particulars, and appear to represent the same species—*radians* Perrier. The generic type represented by *radians*, however, is far removed from *Korethraster*, *Lophaster*, and *Solaster*, which belong to the family Solasteridae.

This generic type may be known as

LEILASTER, n. gen.

Korethraster (part) E. PERRIER, Bull. Mus. Comp. Zoöl., vol. 9, no. 1, p. 12, June 25, 1881.

Lophaster (part) E. PERRIER, Nouv. arch. mus. d'hist. nat., ser. 2, vol. 6, pp. 167, 169, 170, 1883.

Solaster (part) E. PERRIER, Nouv. arch. mus. d'hist. nat., ser. 2, vol. 6, p. 184, 1883.

Diagnosis.—A genus of Ganeriidae in which the abactinal plates are arranged in regular contiguous longitudinal rows, with a row of enlarged plates separating the abactinal from the lateral surface of each arm; the superomarginals are blocklike, but the inferomarginals are greatly produced outward, forming conspicuous stalks projecting diagonally outward from the arm; there is a single row of contiguous elongated actinal plates; and the adambulacral plates bear two combs of 3-4 spines, a furrow comb and a similar comb on the outer part of the plates, both diagonally placed. Size small, R up to 12 mm. Form stellate, the arms with rather broadly rounded tips. $R=2.24$ to 2.4 r.

Genotype.—*Korethraster radians* Perrier, 1881.

Affinities.—The genus *Leilaster* appears to show the closest affinities with *Ganeria*, from which, however, it is rather widely separated.

LEILASTER RADIANS (Perrier)

Plate I, figs. 1, 2

Korethraster radians E. PERRIER, Bull. Mus. Comp. Zoöl., vol. 9, no. 1, p. 12 (description), June 25, 1881.

Lophaster radians E. PERRIER, Nouv. arch. mus. d'hist. nat., ser. 2, vol. 6, p. 167 (listed); p. 169 (*Blake* sta. 292, off Barbados, 56 fathoms); p. 170 (*Blake* sta. 292 [*sic*], Havana, 80 fms.); 1883.

Solaster radians E. PERRIER, Nouv. arch. mus. d'hist. nat., ser. 2, vol. 6, p. 184 (56 fms.); pl. 6, figs. 9-11; 1883.

Korethraster hispidus E. PERRIER, Nouv. arch. mus. d'hist. nat., ser. 2, vol. 6, p. 212 (description of *K. radians* reprinted; *Blake* sta. 292, Barbados, 56 fms.; *Blake* sta. 000 [*sic*], Havana, 80 fms.); 1883.

Description of the specimen from the Caroline collection.—A very small specimen with five short, regularly tapering, bluntly pointed arms. The abactinal surface is elevated, and on each arm is bounded on either side by a regular row of elongate and enlarged plates beyond which the sides drop rather sharply down to the flat abactinal surface. The entire animal is covered with a rather thick skin that partially conceals the underlying plates. $R=4.7$ mm, $r=2.1$ mm; R =about 2.24 r.

The rather conspicuous anus is surrounded by three small plates with the center strongly elevated into a rounded boss. About these is a ring of five large interradial plates. These are thick, with the inner ends broadened and swollen, sometimes bilobed. One of these imbricates laterally over those on either side; another is partly concealed by the overlapping of the plates on either side; the other three overlap the plates on one side and are overlapped by the plate on

the other. From each of these five large interradial plates two regular rows each composed of nine elongate swollen plates run to the arm tips. The proximal plates in these rows, slightly overlapping the large interradial plates, are in contact or nearly so; from this point the rows diverge, each row bounding the abactinal surface of an arm. The plates at first are about three times as long as broad, but they gradually become shorter and at the arm tip are little, or not at all, longer than broad. They are much swollen with high broadly rounded crests, and imbricate adcentrally. Between each two of the large interradials, and therefore between the innermost plates of the two rows running down each arm, is a plate similar to the latter, but somewhat smaller. At the distal end of this on either side and partially overlapping it are two similar but slightly smaller plates lying between the line of union between the first two plates in the two outer rows. Beyond these are three plates forming the bases of three regular rows running to the arm tips. The plates of the central row alternate with the plates of the two outer rows. Each row includes usually nine plates. The plates in these three rows, which fill the area between the two outer rows on each arm, are somewhat more than half as large as the plates in the outer rows; like them, they are highest at the inner ends, and imbricate adcentrally. The elongate swollen central or inner portion of each plate is well separated from that of the plates adjacent. In the interradial areas a rather broad deep groove runs downward to the abactinal surface. Outside each of the rows of plates bordering the abactinal surface of each arm from the second to the fifth plate in each row, runs a row of four plates resembling those in the central portion of the abactinal surface of the arms but narrower. Outside of this row, opposite the junction between the first and second and second and third plates, are two similar but smaller plates.

The superomarginals are seven in number and form a regular row. They are intermediate in size between the plates of the rows bordering the abactinal surface of the arms and the lateral plates of the arms, but are somewhat broader and more regularly swollen, appearing more or less oval. They are about half again as long as their greatest width. They are oblique in position, the actinal ends being more distal than the abactinal, their long axes making an angle of about 60° with the line of the row as a whole. Below each superomarginal is an inferomarginal. The inferomarginals are produced outward in the form of a stout pillar with parallel sides and a broadly rounded tip that is about twice as long as broad at the base. The first three or four of these pillars are separated by about their own width, but

those succeeding are closer together. They are somewhat oblique, their tips being farther from the arm base than their bases.

Between the inferomarginals and the adambulacral plates and adjoining each is a single continuous row of actinal plates. There are two of these under the first inferomarginal, and one long narrow one under each of those following.

There are 13 or 14 adambulacral plates. These at first are slightly broader than long, becoming about as long as broad distally.

The tube feet, which have large sucking disks, are in two rows.

All the plates of the abactinal surface bear numerous—up to a dozen or more—short stout spinelets. These have a broad base, a narrowed column, and the outer half swollen and club-shaped, echinulate, with a broadly rounded tip. These spinelets are set upon the swollen portions of the plates more or less in contact by their broad bases. On the longer plates there are commonly five or six along each side, with one or two additional between the rows. On the more rounded plates there may be six peripheral and one central. They form a very even investment of the abactinal and lateral surfaces.

Each superomarginal bears 10 or 11 of these spinelets, exactly resembling those on the abactinal surface. There are 8 to 10 around the swollen central portion, and 1 or 2 in the middle.

The upper surface of the produced inferomarginals bears eight or nine of these spinelets, commonly arranged in two rows of four or five each, though sometimes irregular. The outermost of these are swollen for their whole length, and therefore appear larger than the others. At the tip of the pillarlike production are three longer, much stouter, strongly echinulate rounded conical somewhat flattened spines. On the actinal side the inferomarginal bears from four to six small slender echinulate spinules without swollen ends which are well separated from each other.

The two basal actinal plates bear three spinules resembling these, but more than twice as large; the actinal plates following bear first two, then one, and distally none.

The first three adambulacral plates bear a comb of four rather long echinulate furrow spines that are webbed for about half their length; the combs on the following adambulacrals consist of three spines. These combs are set obliquely, making an angle of about 45° with the furrow. On the outer portion of the adambulacral plates, away from the furrow margin, is another oblique comb of three similar spines, less completely webbed.

The mouth plates are large and broad, the pairs of mouth plates being somewhat broader than long with the outline of the inner half semicircular. Each mouth plate bears six well spaced spines about its border, of which the innermost is somewhat larger than the others, and the outermost is the smallest. One of the mouth plates of each pair bears an additional spine near its center.

Description of the type specimen (from Perrier).—A small species with 5 short blunt arms flattened below, rather strongly convex above; $R=10$ mm, $r=4$ mm; $R=2.5$ r.

Each adambulacral plate bears on the border of the ambulacral groove three rather short divergent spines; outside of these on the ventral surface there is a transverse row of three spines, equally divergent, so arranged that a narrow naked band separates them from the border of the arms, which is definitely marked and fringed with the groups of blunt spinules borne by the abactinal plates; the dorsal ossicles each bear a group of a dozen rather short spinelets, obtuse at the end or even slightly capitate, divergent, longer along the margin of the arms, disposed irregularly on the surface of the plates, though in such a way as to cover their whole surface.

Isolated tentacular pores occur between the plates; there are 11 more or less irregular rows from one side of the arm to the other.

The madreporic plate is rounded, convex, rather small, half concealed among the spinelets of the dorsal surface, situated half way between the actinal surface and the summit of the interbrachial angle.

Notes on the type specimen.—Perrier's type specimen is much larger than the specimen collected by the *Caroline*; $R=12$ mm, $r=5$ mm; $R=2.4$ r. Most of the spinelets on the abactinal surface are in place, so that the plates are more or less concealed.

The plates on the abactinal surface are more numerous than is the case in the *Caroline* specimen, and the rows are not quite so regular. The rows bordering the abactinal surface consist of 14 or 15 plates instead of 9, and these plates are not sensibly different from those of the outer rows, which are proportionately more numerous.

The abactinal plates bear 7-15 (usually 8-10) short, stout, club-shaped and echinulate spinules.

Beyond the area delimited by the five interradiial plates are rows of papulae that run to the outer third of the arm. The papulae are situated in the depressions between the plates. They are usually solitary, but in a few cases two were noticed in a single depression. There are eight rows of papulae of which the lowest consist of four or five, and those on the abactinal surface of about a dozen.

The madreporite is very small and is situated about one-third of the distance between the anus and the interradial angle. It is naked, shows a few coarse irregular striations, and is almost concealed by the spinelets on the adjacent plates.

There are 14 superomarginals which are somewhat smaller than the plates above them, and are transversely elongate and oblique. Each bears 6-9 spinelets.

The inferomarginals number 14. They bear a diagonal terminal comb of 3-5 (commonly 4) stout, subconical, more or less flattened, echinulate spines on their outer ends, in addition to the spinelets described for the *Caroline* specimen on the abactinal and actinal surfaces.

The actinal plates each have one or two slender and sharp spinelets.

Localities.—Blake station 62 Ag.; off Havana, Cuba; 80 fathoms; 1877-78 (Perrier, 1883).

Blake station 292; off Barbados (lat. $13^{\circ}13'55''$ N., long. $59^{\circ}38'50''$ W.); 56 fathoms; bottom temperature 74.5° F.; bottom, coral, sand, and broken shell; March 9, 1879 (Perrier, 1883).

Caroline station 102; northeast of Puerto Rico (lat. $18^{\circ}51'$ N., long. $64^{\circ}33'$ W.); 140 fathoms; March 4, 1933 (1, U.S.N.M. no. E.5599; original no. 678).

Remarks.—Profs. Walter K. Fisher and Hubert Lyman Clark have both been so kind as to examine the *Caroline* specimen, and we are all three in agreement regarding its disposition.

LOPHASTER VERRILLI, n. sp.

Lophaster radians VERRILL, Univ. Iowa, Bull. Lab. Nat. Hist., vol. 7, no. 1, p. 51, pl. 5, fig. 2; pl. 7, fig. 3; pl. 9, figs. 1-1c; March 20, 1915.

Notes.—Prof. Addison E. Verrill in 1915 described in detail and figured a species that he regarded as representing Perrier's *Korethraster radians*. According to his description and figures, what he had was not Perrier's species, but a true *Lophaster*. A specimen at hand from *Albatross* station 2415 agrees with his description and figures, and was labeled by him *Lophaster radians*. This specimen measures $R=35$ mm, $r=10$ mm. The largest specimen mentioned by him measured $R=40$ mm, $r=17$ mm. This species may be called *Lophaster verrilli*.

Localities.—*Albatross* station 2415; off Fernandina, Fla. (lat. $30^{\circ}44'00''$ N., long. $79^{\circ}26'00''$ W.); 440 fathoms; coral, coarse sand, shells, and foraminifera; April 1, 1885 (U.S.N.M. no. 10512).

Several *Albatross* stations in the West Indies (Verrill).

It was taken by the Bahama Expedition [of the University of Iowa] at several stations. The largest . . . was from station 64, in 110 fathoms, off Florida. Smaller ones occurred at sta. 28, off Sand Key, in 116 fathoms; and at sta. 56, Pourtales Plateau, in 220 fathoms. Another (radii 10 mm. and 33 mm.) was from station 62, off Florida, in 80 fathoms. [Verrill].

EXPLANATION OF PLATE

PLATE I

Leilaster radians, a specimen from *Caroline* station 102 (U.S.N.M. no. E.5599), abactinal (upper) and actinal (lower) surfaces; one ray, right in the upper figure, lower left in the lower, has been cleaned to show the plates; the abactinal surface has been almost completely denuded of spinelets. $\times 4\frac{1}{2}$.



LEILASTER RADIANUS

(For explanation, see page 7.)