

NEW STARFISHES FROM THE PHILIPPINE ISLANDS,
CELEBES, AND THE MOLUCCAS.

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The new genera and species of starfishes described in this paper were obtained from among the Philippine Islands and the neighboring islands to the southward by the steamer *Albatross* during her cruise of 1907-1910. These species will be fully illustrated and described in greater detail in the final report on the collection.

In two previous papers¹ 10 new genera, one new subgenus, and 64 new species were described.

In the present paper the following new genera are characterized:

Halityle (Oreasteridæ, near *Culcita*).

Dissogenes (Linckiidæ, aberrant).

Tarachaster (Ganeriidæ, aberrant).

A new subgenus of *Rhipidaster*, *Xenorias*, founded on a new species, *Rhipidaster polyctenius*, is described.

A list of the new species and subspecies is given for ready reference.

LUIDIIDÆ.

Luidia prionota.

Luidia orientalis.

Luidia avicularia.

Luidia gymnochora.

BENTHOPECTINIDÆ.

Pectinaster hylacanthus.

Cheiraster ludwigi.

Cheiraster triplacanthus.

Benthopecten moluccanus.

Benthopecten polyctenius.

Benthopecten styracius.

OREASTERIDÆ.

Pentaceroopsis tyloderma.

Asterodiscus helonotus.

Halityle regularis.

¹ New genera of starfishes from the Philippine Islands, Proc. U. S. Nat. Mus., vol. 40, May 17, 1911, pp. 415-427.

Four new genera and fifty-eight new species of starfishes from the Philippine Islands, Celebes, and the Moluccas, Proc. U. S. Nat. Mus., vol. 43, Feb. 5, 1913, pp. 599-648.

LINCKIIDÆ.

Dissogenes styracia.
Ferdina glyptodisca.
Fromia eusticha.

Fromia hemiopl.
Ophidiaster trychnus.
Leiaster analogus.

ASTEROPIDÆ.

Marginaster paucispinus.

GANERIIDÆ.

Tarachaster tenuis.

ASTERINIDÆ.

Nepanthia pedicellaris.
Nepanthia platydisca.

Anseropoda macropora.

SOLASTERIDÆ.

Lophaster suluensis.
Solaster tropicus.

Solaster scotophilus.
Rhipidaster (Xenorias) polyctenus.

MYXASTERIDÆ.

Asthenactis medusa.

Family LUIDIIDÆ.

LUIDIA PRIONOTA, new species.

Similar in general form to *Luidia forficifer* Sladen, but differing in lacking entirely adambulacral pedicellariæ; in having proximally at least 5 adambulacral spines in addition to the curved furrow spine, the 4 outer forming 2 longitudinally oriented pairs; central spinelets of paxillæ not granuliform; marginal spine usually longer than extreme width of inferomarginal plate; actinal intermediate pedicellariæ usually absent. Rays 5. $R=32$ mm., $r=5$ mm., $R=6r$; breadth of ray at base, 6 mm. Abactinal surface slightly arched, usually plane on radial region of ray; inferomarginals slightly arched, forming a broad border to actinal surface; marginal spines fairly long, single, forming a prominent fringe to ambitus.

Type.—Cat. No. 32622, U.S.N.M.

Type-locality.—Station 5181, off eastern Panay (6.6 miles northeast of Antonia Island), 26 fathoms, mud and fine sand.

L. prionota, on account of the absence of adambulacral pedicellariæ and the large number of adambulacral spines proximally can not be confused with *L. forficifer* or *L. quinaria* (including *L. limbata*). It differs from *L. penangensis* de Loriol, which has constantly 6 rays and a prominent madreporic body, in having larger paxillæ, in lacking adambulacral pedicellariæ, and in having more than 3 adambulacral spines.

The absence of adambulacral and abactinal pedicellariæ suggests *L. clathrata* of the West Indies and southern United States, and *L. foliolata* (southern Alaska to Mexico).

LUIDIA ORIENTALIS, new species.

Related to *L. sarsi* Dübén and Koren, *L. africana* Sladen, and *L. asthenosoma* Fisher. Closely resembling *L. asthenosoma*, from which it differs in having deeper and broader marginal fascioles, slightly longer inferomarginal and adambulacral spines, longer inferomarginal spinelets, and actinal intermediate pedicellariæ tapering slightly when seen from side (untapered or obovate in *asthenosoma*). Rays 5. R = about 120 mm., r = about 14 mm. The tip of ray is regenerating so that the original was considerably longer; breadth of ray at base, 15 mm.

Type.—Cat. No. 32623, U.S.N.M.

Type-locality.—Station 5301, China Sea, vicinity of Hongkong (lat. $20^{\circ} 37' N.$; long. $115^{\circ} 43' E.$), 208 fathoms, gray mud, sand, bottom temperature $50.5^{\circ} F.$

L. orientalis differs from *L. sarsi* in having longer paxillar, marginal, and actinal spines, broader and deeper marginal furrows. It differs from *L. africana*, which represents *elegans* on the east side of the Atlantic, in having broader inferomarginal fascioles, longer inferomarginal spinelets, more tapered actinal pedicellariæ, and agrees with it as well as with *asthenosoma* in having longer rays than *sarsi*.

LUIDIA AVICULARIA, new species.

Very closely related to *L. integra* Kœhler, which it resembles in general appearance but from which it differs in the following particulars: Scattered spinopaxillæ among the normal paxillæ of the 3 dorsolateral series; superomarginal and abactinal paxillæ with small two-jawed pedicellariæ; central spinelets of superomarginal and abactinal paxillæ, sharp, longer than thick, not granuliform; inferomarginals encroaching conspicuously upon abactinal area and with marginal spines varying from 2 to 6; inferomarginal pedicellariæ present on some of the plates; the characteristic furrow pedicellariæ, proximally with dorsal jaw curved over end of the slightly curved ventral jaw; proximal adambulacral plates with generally more than 3 spines, and more than 1 subambulacral pedicellaria, pedicellariæ sometimes replacing the spines; generally 2 large dental pedicellariæ, directed over the peristome. Rays 10. R = 195 mm., r = 18 mm., R = 10.5 r ; a shorter ray, R = 175 mm.; breadth of ray at base, 13 mm.; breadth 15 mm. from base, at widest part, 17 to 18 mm. Ray gradually tapering, blunt, abactinal surface slightly convex.

Type.—Cat. No. 32624, U.S.N.M.

Type-locality.—Station 5391, between Samar and Masbate (lat. $12^{\circ} 13' 15'' N.$; long. $124^{\circ} 05' 03'' E.$), 118 fathoms, bottom unrecorded; 1 specimen.

L. integra Kœhler was taken by the *Investigator*, off the Andaman Islands (lat. $13^{\circ} 06' N.$; long. $93^{\circ} 08' E.$), 60 to 75 fathoms.

LUIDIA GYMNOCHORA, new species.

Related to *L. denudata* Kœhler, but differing in having constantly 11 rays; prominent, central, two-jawed paxillar pedicellariæ, together with several small two-jawed pedicellariæ on the sides of the pedicels; superomarginal and dorsolateral spinopaxillæ distally; with the transverse processes of the regular paxillæ longer than the longitudinal (the reverse in *denudata*); frequently 3 or 4 inferomarginal spines; 1 to 5 inferomarginal pedicellariæ; inferomarginals broader actinally, the intervening naked spaces much wider than long, and elliptical to oblong in form; 1 or 2 pedicellariæ on the actinal intermediate plates; no slender furrow pedicellaria beyond a few plates at base of ray, except rarely and sporadically; second furrow spine compressed; several subambulacral pedicellariæ, the principal one situated adrad of the second and third spine. Rays 11. $R=230$ mm., $r=33$ mm.; breadth of ray at base, 22 mm., a short distance beyond base, 28 mm.; rays deciduous, and usually imperfect, the tips being in the process of regeneration or absent; many rays broken into 2 or 3 pieces; rays thin, plane, with very widely open, shallow ambulacral furrows; tube-feet long, sometimes reaching to the margin, and with a small conical button at tip; skeleton loose, dorsal integument thin.

Type.—Cat. No. 32625, U.S.N.M.

Type-locality.—Station 5409, between Cebu and Leyte, 20.8 miles southeast of Capitanillo Light, Cebu, 189 fathoms, green mud.

L. gymnochora—the name referring to the bare spaces between the inferomarginals—is especially characterized by a looseness and flexibility of the skeleton which it shares with *L. denudata* Kœhler from the Coromandel Coast, India, 133 fathoms. The most important differences have been enumerated above.

Family BENTHOPECTINIDÆ.

PECTINASTER HYLACANTHUS, new species.

Related to *P. mimicus* Sladen, from which it differs in having the central spines of the paxillæ distributed all over the abactinal surface, and in having 13 (exceptionally 12 or 14) adambulacrals corresponding to the first 10 inferomarginals. $R=79$ mm., $r=10.5$ mm., $R=7.5r$ approximately; breadth of ray at base, 11 to 12 mm. General appearance similar to that of *P. mimicus*; disk small, rays long, slender, recurved at tip; superomarginal plates confined to side wall of ray, with an upright sharp spine close to, or on upper margin; normally no abactinal pedicellariæ; abactinal spines numerous and generally distributed; small spinelets in 1 or sometimes 2 circles surrounding base of spine; adambulacral furrow spines 7 or 8 at base of ray; pedicellariæ variable, present usually on actinal interradiæ

areas, and sometimes also intermarginally, and on actinal surface of intermarginals.

Type.—Cat. No. 32626, U.S.N.M.

Type-locality.—Station 5467, Lagonoy Gulf, southeastern Luzon, 480 fathoms, green mud.

As indicated above this species closely resembles *P. mimicus*, from which it differs in having only 13 adambulacrals to the first 10 inferomarginals, while *mimicus* has 15 to 18. In *mimicus* the abactinal spines are absent from the lateral portions of the area, while in *hylacanthus* they are distributed all over the area. *P. mimicus* inhabits depths of from 692 to 1,092 fathoms, subjected to a temperature of 36.3° to 39.5° F., while *hylacanthus* is found in less than 500 fathoms, the only temperature record being 44.3° F.

This species closely resembles a species of *Cheiraster* which I have identified as *niasicus* Ludwig, the two occurring together. Both have fasciculate pedicellariæ. In *hylacanthus* the superomarginals are more lateral in position, and the spine is nearer the upper edge of the plate. The pedicellariæ have blunter, broader jaws, and the actinal intermediate pedicellariæ of *niasicus* are generally pectinate—that is, stand on two plates, although subcircular in shape. The papularium of *hylacanthus* is more swollen and when examined from the inner side the plates are seen to be more modified, especially in the center of the area, and the area itself shows no sign of being two-lobed. In *niasicus* the papularium is flatter and slightly two-lobed. The superficial similarity of the two species is, however, very striking.

CHEIRASTER LUDWIGI, new species.

Near *Ch. gazellæ* Studer, but with pectinate, superomarginal, suture pedicellariæ interbrachially and intermarginal pedicellariæ on the distal third of ray, in addition to very prominent actinal intermediate pedicellariæ; abactinal pedicellariæ very rare; 1 superomarginal spine near middle of plate; 1 inferomarginal spine with 1 accessory spinule below it; adambulacral plates very prominent, meeting in middle of furrow; furrow spines 8 or 7; 1 subambulacral spine (2 distally); oral spines 7; suboral spines 2; 17 adambulacrals to first 10 inferomarginals. $R=53$ mm., $r=9.5$ mm., $R=5.5$ r; breadth of ray at second superomarginal, 9 mm.

Abactinal plates only slightly elevated, the groups of small, subequal, bluntly pointed or obtuse spinelets distinctly spaced, sometimes more than the diameter of the group. No enlarged central spine anywhere on the abactinal surface. The larger plates of disk with 10 to 12 upright or slightly divergent spinelets; the smaller have 5 to 7, or upward of 10. On the ray 5 to 7 slightly slenderer spinelets surround a single central one, or 3 to 5 form a simple group.

Papularia small, 2-parted, with about 10 pores, the distal-most being even with a line across the ray between the interradial marginal sutures of either interbrachium.

Pedicellariæ occur abactinally; between superomarginals interbrachially; intermarginally, on outer part of ray; on actinal intermediate plates; irregularly on the inferomarginals.

Type.—Cat. No. 32627, U.S.N.M.

Type-locality.—Station 5660, Flores Sea (lat. $5^{\circ} 36' 30''$ S.; long. $120^{\circ} 49'$ E.), 692 fathoms, gray mud, sand; bottom temperature, 39.2° F.

Cheiraster ludwigi would be placed in Ludwig's table (Notomyota, 1910, p. 546) next to *Ch. gazellæ*, from which it differs in having supero-, infero-, and intermarginal pedicellariæ, and equal actinal intermediate spinelets (probably not a specific character as it is variable in other species). From *Ch. trullipes*, *ludwigi* differs in having a well-developed actinal intermediate area, actinal intermediate and intermarginal pedicellariæ, larger abactinal paxillæ, longer furrow spines, 7 oral spines, and 17 (instead of 15) adambulacrals to the first 10 inferomarginals. *Ch. trullipes* was taken by the *Challenger* west of Luzon, in 1,050 fathoms, blue mud, bottom temperature 37° F.

This species is named in honor of Dr. Hubert Ludwig, whose paper on the Notomyota furnishes a most useful revision of *Cheiraster*.

CHEIRASTER TRIPLACANTHUS, new species.

Belonging to the *subtuberculatus* group; differing from *subtuberculatus* in having actinal pedicellariæ, 7 or 8 furrow spines, longer inferomarginal spines, and especially in having a transverse series of 3 prominent superomarginal spines on the distal half of ray and 1 spine only on the proximal half. Disk large, rays slenderer than in *subtuberculatus*, tapering very gradually from wide interbrachial arcs to a bluntly-pointed tip. $R=49$ mm., $r=12$ mm., $R=4r$; breadth of ray at first superomarginal 14 mm., at third, 8.5 mm. No enlarged abactinal spines; papularia large, flat, two-lobed; 1 inferomarginal spine, and proximally 1 or 2 small accessories; 8 or 9 oral, and 1 suboral spine.

Type.—Cat. No. 32628, U.S.N.M.

Type-locality.—Station 5651, Gulf of Boni, Celebes, 700 fathoms, green mud; bottom temperature, 38.7° F.

The transverse series of 3 prominent spines on the distal marginals is very characteristic and will serve to distinguish the species from *Ch. subtuberculatus* and *Ch. granulatus*.¹ The presence of only 1 prominent inferomarginal spine and of inferomarginal pedicellariæ are additional differences separating *triplacanthus* from *granulatus*.

¹ See Ludwig, Notomyota, p. 456.

Ch. subtuberculatus was taken by the *Challenger* at station 164, off the coast of Australia, east of Sydney, 950 fathoms, green mud; bottom temperature 36.5° F.

Genus BENTHOPECTEN.

Key to the species herein described.

- a¹. Abactinal plates with a single spinelet, the long spines of disk graduated in length into the spinelets of ray..... *moluccanus*.
- a². Abactinal plates with more than 1 spinelet, at least on disk, the comparatively few prominent spines of ray not graduated in length into those of disk.
 - b¹. Abactinal plates of ray with 5, or even more, spinelets; odd interradial superomarginal spine not unusually long (equal in length to first 1½ to 2 superomarginals); short accessory superomarginal spines; inferomarginal pedicellariæ on outer part of ray..... *polyctenus*.
 - b². Only 1 or 2 spinelets to each abactinal plate of ray; odd interradial superomarginal spine very long (equal in length to first 4 or 5 superomarginals); no accessory superomarginal spines; no inferomarginal pedicellariæ on outer part of ray..... *styracius*.

BENTHOPECTEN MOLUCCANUS, new species.

Differing from *B. huddlestonii* in having only 2 inferomarginal and 2 subambulacral spines, and from *B. acanthonotus* in having a larger adambulacral furrow comb (with 7 to 9 spines), pedicellariæ between the distal inferomarginal plates, very few or no accessory abactinal spinelets, a more restricted papular area, and inferomarginal spines which are subequal proximally. R=80 mm., r=8 mm., R=10r; breadth of ray at base, about 10 mm. Disk small, rays slender and very flexible. Abactinal plates with a single spine, those of disk graduated in length into spines of rays; superomarginals with 1 and inferomarginals with 2 spines; subambulacrals 2; furrow spines 7 to 9; oral spines variable, 5 to 8; suborals, 3 to 5; abundant abactinal pedicellariæ on disk, and variable on rays; inferomarginal pedicellariæ in interbrachium and on outer part of ray; actinal intermediate pedicellariæ often present; 19 or 20 adambulacral plates to first 10 inferomarginals.

Type.—Cat. No. 32629, U.S.N.M.

Type-locality.—Station 5618, Molucca Passage (lat. 0° 37' N.; long. 127° 15' E.), 417 fathoms, gray mud; 2 specimens.

In Ludwig's key to the species of *Benthopecten*,¹ *B. moluccanus* would occupy a position just after *B. huddlestonii*, with a coordinate subhead reading: Inferomarginal plates with 2 spines; adambulacral plates with 7 to 9 furrow and 2 subambulacral spines; mouth spines with 5 to 8 oral spines. *B. moluccanus* differs from *B. semisquamatus* (Sladen) and *B. antarcticus* (Sladen) in having pedicellariæ and more numerous furrow spines. It differs from *B. spinosus* Verrill in having pedicellariæ, in having only 2 (and larger) inferomarginal spines,

¹ Notomyota, 1910, p. 465.

smaller disk, smaller actinal intermediate areas, and more numerous, long, abactinal disk spines which are graduated in length into those of the ray, not abruptly larger as in *spinus*. *B. spinus* is of a much stouter habit, as is also *B. mutabilis*, which does not at all resemble *moluccanus*, having the abactinal spines abruptly larger in the middle of the disk. *B. acanthonotus* differs in having a shorter furrow comb with 4 or 5 spines, several prominent accessory inferomarginal spinules, and 1 to 6 accessory spinelets in connection with the abactinal spines of disk, and the inferomarginal pedicellariæ confined to base of ray.

BENTHOPECTEN POLYCTENIUS, new species.

Closely related to *B. violaceus* (Alcock), but differing in having abactinal pedicellariæ, inferomarginal pedicellariæ far along the ray (in adult specimens), more numerous furrow spines, and 20 instead of 24 adambulacral plates to the first 10 inferomarginals. $R=224$ mm., $r=18$ mm., $R=12+r$; breadth of ray at base, 23 mm. Abactinal area of large specimen with numerous large pedicellariæ extending far along ray; abactinal plates with 4 to 8 short spinelets, and scattered spines on disk only; superomarginals with 1 spine, together with 2 unequal accessory spinules and 3 or 4 slender spinelets proximally, and only 1 accessory spinule over most of ray; 2 inferomarginal spines; 2 subambulacral spines, with often a third, smaller accessory; furrow spines 13 or 14 (9 or 10 on first 2 plates); 7 or 8 oral spines and 3 to 5 suboral spines; 20 adambulacral plates correspond to the first 10 inferomarginals, omitting the odd plate.

Type.—Cat. No. 32630, U.S.N.M.

Type-locality.—Station 5654, Gulf of Boni, Celebes, 805 fathoms, bottom not recorded; bottom temperature 38.3° F.

The following are the differences between *B. violaceus* and *B. polyctenius* of equal size, the type of the latter being much larger than that of *violaceus*.

<i>B. violaceus.</i>	<i>B. polyctenius.</i>
24 adambulacral plates correspond to first 10 inferomarginals.	20 adambulacrals correspond to first 10 inferomarginals.
No abactinal pedicellariæ.	Abactinal pedicellariæ few, on disk only. (In the type, numerous on disk and rays.)
Inferomarginal pedicellariæ in inter-brachial arcs only.	Inferomarginal pedicellariæ in inter-brachial arcs and far along ray also.
Furrow spines 7 or 8.	Furrow spines 9 to 11 (as high as 13 or 14 in type).

BENTHOPECTEN STYRACIUS, new species.

Similar in general appearance to *B. violaceus* but with numerous abactinal pedicellariæ, and very large odd interrachial superomarginal spines; differing from *B. polyctenius* in having only 1 or 2 spinelets

to each abactinal plate of the ray, much larger interradiial superomarginal spines, no accessory superomarginal spines, fewer inferomarginal pedicellariæ (none on outer part of ray), fewer furrow spines. $R=105$ mm., $r=10.5$ mm., $R=10$ r; breadth of ray at base, about 10 mm.; odd interradiial superomarginal spine, 17 mm. long. The inferomarginals bear 2 spines, the lower one-half to three-fourths the length of the upper, similar to those of *B. polyctenius*. The plates of outer third of ray are very slender and bear as a rule only 1 spine. Between the plates of proximal half of ray is a pectinate pedicellaria, but these may be absent from a number of plates, their occurrence being subject to variation. Actinal interradiial areas small, bearing each 2 large pectinate pedicellariæ. Furrow spines 7 or 8, slender, bluntly pointed, the successive combs spaced a little less than their base line. (In *B. polyctenius* a comparable specimen has 9 to 11 spines, the combs spaced only one-half the length of their base line.) Subambulacral spines 2, the outer slightly the shorter, with a third quite small spinule usually present adrad of the outer spine. Nineteen to 22 plates correspond to first 10 inferomarginals, omitting the odd interradiial. Oral spines 6; suboral, 3, in a series along middle of plate.

Type.—Cat. No. 32631, U.S.N.M.

Type-locality.—Station 5668, Macassar Strait (lat. $2^{\circ} 28' 15''$ S.; long. $118^{\circ} 49'$ E.), 901 fathoms, gray mud; bottom temperature, 38.2° F.

Family OREASTERIDÆ.

PENTACEROPSIS TYLODERMA, new species.

Differing from *P. obtusata* in having shorter rays, 1 series of subambulacral spines, in lacking inferomarginal tubercles except on the first few plates, in having less prominent distal superomarginals without smooth tubercles, and very much smaller granules among the papulæ than on the convex plates. $R=94$ mm., $r=49$ mm., $R=1.9$ r.; breadth of ray at base, 44 to 54 mm. Disk inflated, rays convex, much lower than disk; actinal surface subplane; interbrachial arcs well rounded; rays broad, tapering little until near the end, which is rounded. No true spines anywhere except on adambulacral and mouth plates.

Abactinal surface paved with plates of about 3 sizes, but only 2 of these are evident externally because the small ossicles which fill in the spaces between the large plates are covered with granules. There is a not very regular carinal series of about 12 convex, transversely elliptical plates, starting with the primary radial, spaced about one-fourth to one-half their longer diameter, which varies from 4 to 7 mm. Between this and the superomarginal series are 3 others, not at all regular, spaced, convex, decreasing in size toward the margin, the adradial plates being transversely elliptical,

the others irregularly roundish. Two dorsolateral series reach the end of ray, the third extends about two-thirds or three-fourths the length of ray, while in the interbrachial arcs are 2 additional series, the plates being rather small and of secondary size. These primary plates are covered with close-set, flat, or very faintly convex polygonal granules, which increase very rapidly in size from the margin toward the center, where 1 to several are conspicuously larger than the rest and slightly more convex. The plates of second size are widely spaced, unequal, and except near the ambitus are conspicuously smaller than the primary plates. They are most numerous on the disk and proximal portion of ray, rather few on the outer part of ray. They are convex and usually bear a relatively large hemispherical tubercle, very much larger than the granules surrounding it. Between the primary and secondary plates the integument is thickly beset with very small, unequal, convex, subconical, or even spinuliform granules, largest on the center of the small intercalary ossicles, and smallest on the margin of the papular pores. Small pedicellariæ with spatulate jaws, slightly higher than wide, or sometimes wider than high, are scattered among the granules, which they exceed little or not at all in size. Papular pores rather evenly distributed occupy all this granular area, and likewise between angular dorsal extensions of the superomarginal plates. There is no subdivision into areas. The arrangement of the abactinal plates is similar to that in the genus *Asterodiscus*, and unlike that of *Oreaster*. Ambitus bounded by superomarginals, the inferomarginals being actinal. Small intermarginal plates are found at the base of ray and irregularly near the tip. Furrow spines 8, the 2 central about as long as the slightly curved furrow margin. Subambulacral spines 2, less often 3, becoming 1 near the end of ray. Mouth plates with 14 to 18 furrow spines.

Type.—Cat. No. 32632, U.S.N.M.

Type-locality.—Tictauan Island, Mindanao.

ASTERODISCUS HELONOTUS, new species.

Similar in shape and general appearance to *A. truncatus* Coleman, but differing in having smaller and more numerous abactinal tubercles (of a similar form), much larger terminal superomarginal plate, less conspicuous marginal plates (the superomarginals not distinguishable); more numerous inferomarginal plates, 9 underlying the terminal superomarginal, and others bearing a large, compressed, fan-shaped tubercle; flattened or spatulate actinal intermediate spines near furrow, where they are larger than near margin; only 3 furrow spines; outer subambulacral spine flattened, and heavier than the inner (the reverse in *truncatus*); inner mouth spines shorter than the others. $R = 98$ mm., $r = 48$ mm., $R = 2r$; breadth of ray at base, about 53 mm.; general form stellate, depressed.

Abactinal tubercles similar in form to those of *A. truncatus*, but much smaller and much more numerous. Larger tubercles not arranged in evident series, in form resembling inverted truncated cones, the base of the cone being convex, and the truncated end immersed, as it were, in the plate and surrounding by a circle of small bead-like granules. Packed closely among the largest tubercles are more numerous smaller ones of several sizes, more numerous than in *A. truncatus*. These are clavate, or obovate, more or less irregular in form, and toward the margin of the disk a certain number become slender. The height of an average primary is 2 to 2.5 mm. and its breadth at the top 2.5 to 3 mm. (in *truncatus* similar measurements of a comparable specimen are 3.5 to 4.5 and 6 to 7.5). Between the tubercles are widely spaced small granules similar to those around the base of the tubercles. Numerous long, very slender, 2-jawed pedicellariæ, straight or curved at the end, stand beside many of the tubercles. There are 18 inferomarginals, of which 9 underlie the large terminal superomarginal. The other superomarginals are indistinguishable from the abactinal plates.

Type.—Cat. No. 32633, U.S.N.M.

Type-locality.—Station 5149, off Sirun Island, vicinity of Siasi, Sulu Archipelago, 10 fathoms, coral, shells.

In both *A. elegans* and *A. tuberculosus* the abactinal tubercles are conical, more or less acute, to hemispherical or truncate hemispherical, and R is equal to less than 1.8 r. In *A. truncatus* and *A. helonotus* the tubercles are obconical to obovate, broader at summit than base, and R is equal to 2 r.

HALITYLE, new genus.

Differing from *Culcita* in having the marginal plates visible in the adult, and in having the papulæ in very numerous, regularly arranged, triangular areas resembling those of *Oreaster*; no spines on any plates except the adambulacral and mouth plates.

Type of genus.—*Halityle regularis*, new species.

HALITYLE REGULARIS, new species.

Differing from the species of *Culcita* in having well-defined marginal plates in the fully adult, no tubercles or spines on abactinal or actinal plates, and in having more numerous abactinal plates, forming a very regular triangular reticulum, between which are triangular papular areas arranged in regular series parallel to the radial series of plates, and much more numerous than in *C. schmideliana* or *C. novæ-guinææ*, or their varieties; R=133 mm., r=95 mm., R=1.4 r; form massive, pentagonal with slightly arcuate sides which are perpendicular and formed by the marginal plates and about 1 series of adjacent large papular areas with intervening perpendicular

trabeculæ (each of which joins the upper end of a superomarginal plate); abactinal surface more or less swollen, and marked off into regular triangular papular areas by narrow trabeculæ; whole surface finely granular with minute 2-jawed granuliform pedicellariæ; no spines; actinal intermediate plates sharply marked off by sutural grooves and covered with a close mosaic of unequal, smooth, very compact granules; the 3 chevrons nearest furrow with an odd interradial plate, the others without; furrow comb compact, perpendicular, with 8 to 11 slender spines, the aboral end of 1 comb slightly overlapping the adoral end of the next younger comb.

Type.—Cat. No. 32634, U.S.N.M.

Type-locality.—Station 5165, Tawi Tawi group, Sulu Archipelago, 9 fathoms, coral.

This curious, large starfish has retained the phanerozoniata character of young *Culcita*. This feature and the more numerous abactinal plates, regularly arranged triangular papular areas, and lack of spines or tubercles gives it a very characteristic facies, recalling somewhat a gigantic, tumid "*Goniodiscus sebæ*," but one without tubercles.

Family LINCKIIDÆ.

DISSOGENES, new genus.

Disk large, slightly inflated; rays moderately long and slender; whole body covered with small granules, obscuring the outlines of all plates except the marginal, which are confined to side wall of body, and are unarmed except for 1 to 3 small central spines on the first 2 or 3 superomarginals; abactinal plates of 2 kinds, irregular, mostly convex primary plates with 2 to 4 semicircular excavations on margin, overlying and bound together by secondary elliptical or oblong connecting ossicles, all very irregular in arrangement; primary plates of disk with small rigid central upright truncate spine; actinal intermediate areas with about 4 chevrons of similar longer spines; actinal intermediate plates extending in a single series nearly to end of ray, and a second series two-thirds the length of ray; adambulacral armature with 4 or 5, sometimes 3, prominent, slender furrow spines on a nearly straight furrow margin; subambulacral spines 2 on disk, 1 on rays, a little longer and much stouter than furrow spines. No pedicellariæ.

Type of genus.—*Dissogenes styracia*, new species.

DISSOGENES STYRACIA, new species.

Rays 5. $R = 110$ mm., $r = 28$ mm., $R = 4r$; breadth of ray at base, about 34 mm.; rays tapering at first rapidly, then gradually to pointed extremity; interbranchial arcs wide, rounded. Other characters as in genus.

Type.—Cat. No. 32635, U.S.N.M.

Type-locality.—Station 5617, off Ternate Island, west of Gilolo Island, Molucca Islands, 131 fathoms, bottom not recorded.

This genus, like *Narcissia* and *Ferdina* might reasonably be included in the Goniasteridæ. It is placed in the Linckiidæ, however, on account of the irregular abactinal skeleton, small marginals, and the close granulation which covers the body and obscures the outlines of the actinal and abactinal plates. The general appearance suggests the Linckiidæ. But the rather long slender furrow spines and prominent subambulacral spines are unlike those of any other genus of this family, while the abactinal and actinal intermediate spines are exceptional, and without parallel in any of the Linckiidæ having a large disk. The genus does not seem to be nearly related to any known.

FERDINA GLYPTODISCA, new species.

Resembling *F. offreti* Kœhler; differing in having all the prominent abactinal plates, and all the marginal plates with an extensive, central naked area; the smaller abactinal plates less distinct and not at all convex; granules smallest on center of obscured plates, largest over the sutures (reverse in *offreti*); abactinal area narrower, about equal to extreme width of superomarginal plate; inner series of small actinal intermediate plates lacking; adambulacral spines 3 (2 in *offreti*). Rays 5. $R = 35$ mm., $r = 11$ mm., $R = 3.2 r$; breadth of ray at base, 13 mm. Rays and disk very rigid; abactinal surface sub-plane, actinal surface convex.

Type.—Cat. No. 32636, U.S.N.M.

Type-locality.—Station 5640, Buton Strait, Celebes (a mile west of Labuan Blanda Island), 24 fathoms, sand, broken shells.

Genus FROMIA Gray.

Key to some East Indian species of Fromia.

- a^1 . Superomarginal plates of distal half of ray large and small alternating; granules surrounding papular pores, larger than the others.....*major*.
- a^2 . Superomarginal plates not large and small, alternating.
 - b^1 . Abactinal plates of proximal half or two-thirds of ray in regular longitudinal series; marginal plates very regular, most of them longer than wide; rays slender; furrow spines 2 or 3, subambulacral spines 2; actinal pedicellariæ.....*eusticha*.
 - b^2 . Abactinal plates not in regular series.
 - c^1 . Most of the marginal plates with 1 or more central, enlarged tubercular granules; rays slender, about 3 times as long as width at base.....*hemiopla*.
 - c^2 . Marginal plates without central tubercles; rays usually about 2 to $2\frac{1}{2}$ times as long as width at base.....*milleporella*.

FROMIA EUSTICHA, new species.

Differing from typical *F. milleporella* in having longer, slenderer rays, more regularly arranged abactinal plates, only 2 adambulacral furrow spines on distal half of ray, and abundant actinal pedicellariæ.

R=41 mm., r=8.5 mm., R=4.8 r; breadth of ray at base, 9.5 mm. Rays slender, evenly tapering, abactinally plane; disk slightly convex; marginal plates very regular, mostly longer than wide, regularly decreasing in size, not alternate large and small; abactinal plates roundish or hexagonal, sometimes with faint indication of lobing, arranged in quincunx in regular longitudinal series; actinal plates in 3 regular series at base of ray; adambulacrals with proximally 3 rather narrow furrow spines, 2 distally; 2 subambulacral spines and 1 to 3 subambulacral pedicellariæ. Granules of abactinal surface polygonal, close-set, fairly uniform, not larger in center of plate, about 8 to 10 in the transverse diameter of a carinal plate. Granules surrounding papular pores unequal, some of them a little larger than the granules of plates. Papulæ single, at the corners of the plates. Superomarginal plates 18, encroaching conspicuously upon abactinal surface. Inferomarginals 20. Actinal granules increasing in size toward furrow. On proximal half of ray there are rather abundant, granuliform 2- or 3-jawed pedicellariæ, from 2 to 5 times the diameter of adjacent granules.

Type.—Cat. No. 32637, U.S.N.M.

Type-locality.—Station 5146, vicinity of Siasi, Tapul Group, Sulu Archipelago, 24 fathoms, coral sand, shells.

FROMIA HEMIOPLA, new species.

Differing from *F. armata* Kœhler in the absence of abactinal conical tubercles, and the slighter development of the marginal tubercles; differing from *F. milleporella* in having 1 or more tubercular granules in the center of the marginal plates of the distal three-fourths or half of ray, in having slenderer rays, and broad, but thin, spatulate furrow spines. R=36 mm., r=9 mm., R=4 r; breadth of ray at base, 10 mm.

Marginal plates convex, the granules increasing in size toward the center, where the plates of at least the distal half of ray bear 1, 2, or even more enlarged tubercular granules, there being as high as 5 to 10 on the distal marginals of the type. The first half dozen plates usually lack a tubercle, and the tubercles become a trifle more prominent as the end of the ray is approached. Superomarginals 19 or 20; inferomarginals about 23 or 24. Adambulacral plates with proximally 3 or 4, or near end of ray 2, broad, flat subtruncate (spatulate) furrow spines, the end of the series with a curved contour and part or all of the aboral spine usually underlying the adoral spine of the succeeding plate. Subambulacral spines 2, sometimes 3, considerably shorter, round-tipped, heavier, but not broader than the furrow spines, and forming a straight series. External to these are 2 or 3 granules larger than the succeeding. Part or all of a second series of smaller granules belongs to the adambulacral plates.

Type.—Cat. No. 32638, U.S.N.M.

Type-locality.—Tonquil Island, Gumila Reef, south of Zamboanga, Mindanao.

This species differs from *F. balansæ* Perrier in having narrower rays, tuberculate marginals, and spatulate furrow spines.

OPHIDIASTER TRYCHNUS, new species.

Differing from *O. pusillus* Müller and Troschel in having the papulæ in 8 longitudinal series and the central granules of the abactinal, marginal, and actinal plates enlarged, and subtuberculate on outer part of ray, and in having the pedicellaria sheaths toothed, not entire; differing from *O. tuberifer* in having 8 longitudinal series of papular pores, much larger and broader pedicellariæ with the sheaths toothed, not entire, and in having a number of enlarged granules on the plates, not a single conical tubercle of predominant size. $R=19$ mm., $r=4$ mm., R = about 5 r ; breadth of ray at base, 5 mm. Rays cylindrical, only very slightly tapering, with a blunt extremity capped by a dorsal, convex, roundish terminal plate. Adambulacral plates wider than long, obliquely oriented; furrow spines 2, flattened, the adoral broadly spatulate, roundly truncate, about twice as long as breadth at tip; the aboral slightly shorter, much narrower, slightly tapering, and blunt. Forming a transverse, oblique, adorally trending series with the larger furrow spine, and without intervening granules, there is first a shorter compressed, broad, round-tipped granule, then a longer, much thicker ovoid or acorn-shaped slightly flattened tubercle, about as long as the larger furrow spine, but much more conspicuous. Between these consecutive transverse series there is a transverse series of elongate, bluntly pointed granules; and external to the series of tubercles there is a less regular series of shorter actinal intermediate tubercles, interspersed with a few longitudinally oriented pedicellariæ. Relatively large two-jawed, excavate pedicellariæ occur in variable numbers on the abactinal, marginal, and actinal intermediate plates. Each jaw is broadly spatulate, semicircular distally, broader than in *O. germani*, and has 4 or 5 relatively large teeth with corresponding indentations on the edge of the form.

Type.—Cat. No. 32639, U.S.N.M.

Type-locality.—Port Palapag, north coast of Samar; no record of depth or bottom, but probably collected on reef.

LEIASTER ANALOGUS, new species.

Resembling *L. coriaceus* Peters in having grooved furrow spines, but differing in having longer, slenderer rays, numerous pedicellariæ, and the abactinal papulæ in very definitely circumscribed areas. Differing from other species of *Leiaster* in having channeled furrow spines. $R=125$ mm., $r=13.5$ mm., $R=9$ r ; breadth of ray at base,

15 mm. Rays unequal, the longest 8.5 to 9 times as long as the width at base.

Type.—Cat. No. 32640, U.S.N.M.

Type-locality.—Station 5165, off Observation Island, Tawi Tawi Group, Sulu Archipelago, 9 fathoms, coral.

L. analogus differs from *L. leachii* in having perfectly smooth plates, not finely granulated ones, in having more numerous and grooved adambulacral furrow spines, and in having abundant pedicellariæ. *L. speciosus* is described as differing from *L. leachii* only in possessing pedicellariæ. Apparently *L. analogus* bears much the same relation to *coriaceus* that *speciosus* does to *leachii*. *L. glaber* and *L. callipeplus* lack pedicellariæ and have furrow spines without grooves.

Family ASTEROPIDÆ.

MARGINASTER PAUCISPINUS, new species.

Differing from *M. capreensis* (Gasco) [*M. fimbriatus* Sladen] in having no actinal intermediate and very few abactinal spinelets, broader marginal plates with slightly longer spines, more distinct lobes to the carinal plates, and 2 narrowly spatulate, webbed, subambulacral spinelets in a longitudinal series near the furrow margin; furrow spines 2 on the first 2 plates, then 1. R=11 mm., r=8 mm., general form arcuate pentagonal; whole body overlaid by skin; a few carinal, apical, and superomarginal spinelets, all inconspicuous, a conspicuous marginal fringe of webbed, flattened, narrowly spatulate spines; plates not superficially visible.

Type.—Cat. No. 32641, U.S.N.M.

Type-locality.—Station 5310, China Sea, vicinity of Hongkong (lat. 21° 33' N.; long. 116° 13' E.), 100 fathoms, sand, shells.

Family GANERIIDÆ.

TARACHASTER, new genus.

Rays slender, disk small; dorsolateral plates four-lobed, imbricated in regular transverse and longitudinal series; plates of median radial region mostly three-lobed, irregularly imbricated; marginal plates actinal in position, separated from adambulacrals over most of ray by a single series of actinal intermediate plates, and on disk by small plates in transverse series; actinal interradial areas small; papulæ single in the small interspaces between abactinal plates; plates convex and armed with a group of short, blunt, spinelets resembling parapaxillæ or pseudopaxillæ, 15 to 20 to a plate; marginal and actinal spinulation compact; adambulacral plates small with slightly curved furrow margin; spines small, crowded, grading into actinal spinulation; proximally 5 or 6, distally 3 or 4 furrow spines, with 2 to 4 crowded series each of 2 or 3 subambulacral spines. Well-developed

superambulacral ossicles; ampullæ double; tube feet rather small, with well-developed sucking disks.

Type of genus.—*Tarachaster tenuis*, new species.

TARACHASTER TENUIS, new species.

Rays 5. $R=67$ mm., $r=12$ mm., $R=5.5+r$; breadth of ray at base, 14 mm.; rays depressed, rather slender, long, bluntly pointed; disk small; sides of ray rounded and occupied by the abactinal plates; abactinal plates small, those on disk and along radial area of ray irregularly three-lobed, imbricating; dorsolateral, lateral, and narrow portion of ventral surface occupied by four-lobed plates in about 10 longitudinal series at base of ray, also forming transverse series; 3 series of larger plates adjacent to adambulacrals, the outer two being the marginals; plates covered by small, stout, upright, round-tipped, often clavate, close-set spinelets in groups resembling low parapaxillæ, 15 to 20 to a group; single papulæ between the abactinal plates; adambulacral plates small, armature dense, upright, the spinelets grading from the furrow series into those of the actinal intermediate and marginal plates; furrow spines proximally 5 or 6, distally 4 or 5, prismatic or four-sided, blunt or truncate, the proximal and distal shorter than the central 3 or 4; subambulacral spines in 2 or 3, sometimes 4, series, with 2 or 3, or proximally 4, shorter, less stout spines in each series. General appearance suggestive of a *Henricia* with closely placed plates.

Type.—Cat. No. 32642, U.S.N.M.

Type-locality.—Off Point Tagolo, northern Mindanao, 162 fathoms, sand; bottom temperature, 54.5° F.

It is difficult to place this genus. While it resembles *Henricia* superficially, the double ampullæ, closely placed and regularly imbricated plates, and presence of superambulacral ossicles debar *Tarachaster* from the Echinasteridæ. The two other families to which it shows most resemblance are the Ganeriidæ and Asterinidæ. *Tarachaster* resembles *Nepanthia* superficially, on account of the radial zone of irregularly arranged plates, but the actinal surface is more like that of the Ganeriidæ, to which the imbricated pseudo-paxillæ with definite lobes, the definite but not particularly conspicuous marginals, the actinal interradial plates in transverse columns, and the adambulacral armature would ally it. Superambulacral plates have not been reported in any of the three families.

Family ASTERINIDÆ.

NEPANTHIA PEDICELLARIS, new species.

Related to *N. brachiata* Kœhler, but differing in lacking a flange to the margin of rays, in having a narrower actinal intermediate area, with fewer (about 10) chevrons of plates, but more numerous

spinelets; subambulacral spines more numerous (8 to 12). Rays 6. $R=22$ mm., $r=8$ mm., $R=2.75 r$; breadth of ray at base, 7 or 8 mm.; abactinal surface arched, actinal surface plane; rays tapering, bluntly pointed, broader than usual in this genus; radial area of plates not very sharply marked off from lateral areas; plates crescent-shaped, the larger bearing 35 to 45 minute, sharp spinelets, and sometimes a simple pedicellaria composed of 2 spinelets stouter than the others; furrow spines 6 or 7, webbed, the adoral much the smaller; subambulacral spines webbed, 8 to 12; proximal actinal intermediate plates with 7 to 9 slender webbed spines.

Type.—Cat. No. 32643, U.S.N.M.

Type-locality.—Station 5482, off Cabugan Grande Island, Surigao Strait, east of Leyte, 67 fathoms, broken shells, stones, green mud.

In *N. belcheri* Perrier there are 7 rays, 6 furrow spines, and 3 subambulacral spines. In *N. joubini* the arms are slenderer and the furrow series symmetrical, not as in *pedicellaris* with the adoral spine much shorter than the aboral. The adambulacral spines are also much shorter, and the actinal intermediate plates bear numerous short spinelets. They are similar to the dorsolateral plates, and do not, as in *pedicellaris*, resemble the actinal intermediate plates of *Asterina*.

NEPANTHIA PLATYDISCA, new species.

Rays 5. $R=54$ mm., $r=23$ mm., $R=2.3 r$; breadth of ray at base, 36 mm.; interbrachia rounded; rays tapering evenly from base to bluntly pointed extremity; general form much flattened, and resembling an *Asterina* with thin disk; edges of disk and ray thin; abactinal plates divided into 2 areas, a median radial where the plates are irregularly distributed and lateral areas where the plates form transverse (and also to some extent longitudinal) series, the transverse with about 26 or 27 plates at base of ray; plates resembling small flat-topped pseudopaxillæ; actinal intermediate plates small, in transverse series, the larger plates with 15 to 20 slender, very sharp, webbed spines; furrow spines 7 or 8, webbed into a very convex fan; subambulacral spines 18 to 20, also webbed, usually erect. In favorable places they may be seen to form a very convex series with 6 or 8 spines in the concavity of the series, and involved in the same membrane. Mouth plates with 11 or 12 marginal spines; suboral spines 20 to 25, in 2 series, parallel to free margin, with 5 or 6 extra spines between the second series and the median suture.

Type.—Cat. No. 32644, U.S.N.M.

Type-locality.—Station 5645, Buton Strait, Celebes, 206 fathoms, bottom not recorded

This species has the general appearance of a very thin *Asterina*, with radial areas of irregularly arranged plates and lateral areas of serially arranged plates. The actinal intermediate plates are very

numerous and bear numerous webbed sharp spinelets, which are usually bent toward the margin and have the appearance of serrate combs. The spinelets are really in groups (as may be seen when they stand erect), and all are involved in the web.

The type of the genus *Nepanthia*, *N. maculata*, is an entirely differently formed animal, with cylindrical rays. It becomes difficult to separate *Nepanthia* sharply from *Asterina*, because *N. platydisca* really agrees with *Asterina* in form. The differentiation of the abactinal plates and the numerous actinal intermediate spinelets will separate this species from any known *Asterina*, while the flattened form and numerous adambulacral and actinal intermediate spines will separate it from *N. brachiata*, which has 6 rays and a more depressed, *Asterina*-like form than any other species heretofore described.

ANSEROPODA MACROPORA, new species.

Rays 5. $R=16$ mm., $r=8.5$ mm., R =slightly less than $2r$. Proportions and form variable; a four-rayed specimen has the following dimensions: $R=17.5$ mm., $r=13$ mm.; in the latter the margin of ray curves outward and has a broad leaf-like contour. Species characterized by presence along radial line of a zigzag series of 7 to 11 wartlike conspicuous protuberances composed of 4 upright spinulate plates, guarding a large papular pore; other abactinal plates with divaricate tuft of 8 to 12 very delicate spinelets; actinal intermediate area with spaced combs of 3 to 5 delicate, sharp, spinelets; furrow spinelets 5, webbed, the adoral set back slightly from margin; subambulacral spinelets 1 or 2, near adoral margin of plate.

Type.—Cat. No. 32645, U.S.N.M.

Type-locality.—Station 5146, Sulu Archipelago, off Sulade Island, southwest of Jolo, 24 fathoms, coral sand, shells.

This species belongs to the section of the genus in which there are few papular pores, in a single series, on either side of the median radial line. Its distinguishing peculiarity is the specialization of these pores, which are guarded by elevated plates, forming tubercular, spinulate, protuberances. The papulæ themselves are large.

Family SOLASTERIDÆ.

LOPHASTER SULUENSIS, new species.

Resembling *L. furcilliger* Fisher in general form but with much lower paxillæ, especially the marginal, the pedicels being much shorter than the spines; inner or lower inferomarginal spines conspicuously longer than upper; furrow spines 5 or 6, rather long; subambulacral spines 3 or 4, heavier and longer than furrow spines, and equal to about 2 plates in length. Rays 5. $R=82$ mm., $r=16$ mm., $R=5r$; breadth of ray at base, 19 or 20 mm.; rays slender, gradually tapering, bluntly pointed; abactinal surface arched, actinal surface plane.

Abactinal plates strongly four-lobed, with a low pedicel, bearing 7 to 10 tapering, thorny, pointed spines, the median slightly longer than the peripheral. The spines vary from 1 to 2 mm. in length, while the pedicel is ordinarily about one-half the length of spines. Papular areas of apical region with 5 to 7 papulæ; those of proximal part of ray with 3 or 4; those of distal portion of ray with 1 or 2. Counting across base of ray about 18 longitudinal series of plates, rather regular in median radial region.

Marginal paxillæ comparatively small, the superomarginal decidedly smaller than the inferomarginal and usually alternating with them. The inferomarginal paxillæ have low pedicels, about as high as broad, surmounted by about 15 to 18 spines, of which 3 or 4 on the side toward furrow are about 2.5 mm. long while the others decrease in size to about 0.75 mm. on the dorsal side of the paxilla. The proximal superomarginals have 12 to 15 spines and the pedicel is about two-thirds the height of the inferomarginal pedicels, while the tuft of spines is of about half the bulk of the inferomarginal spines.

Actinal interradial areas small, the plates bearing 3 or 4 spinelets and extending about two-thirds the length of ray in a single series.

Type.—Cat. No. 32646, U.S.N.M.

Type-locality.—Station 5423, Sulu Sea, off Cagayan Island, 508 fathoms, gray mud, coral sand, bottom temperature, 49.8° F.

L. suluensis differs from *L. furcifer* in having longer, slenderer rays, longer paxillar spines, and relatively shorter pedicels, longer and unequal marginal paxillar spines, more numerous furrow spines, and very much longer subambulacral spines, the latter being longer than the marginal paxillæ with their spines. The mouth plates of *L. suluensis* are larger with more numerous and longer marginal spines (12 or 13). *L. suluensis* differs from *L. stellans* Sladen, and *L. abbreviatus* Kœhler (Antarctic species) in having a much less robust form, longer rays, more numerous furrow spines (4 short ones in *stellans* and 3 rather long ones in *abbreviatus*) and much more prominent subambulacral spines (longer, not shorter, than marginal paxillæ with their spines). *L. suluensis* resembles in general form 2 Antarctic species, *L. antarcticus* Kœhler and *L. gaini* Kœhler, but differs in having 5 or 6 instead of 4 furrow spines, 12 or 13 instead of 7 or 8 marginal mouth spines. *L. antarcticus* has 20 to 40 paxillar spines and much less prominent subambulacral spines when compared either with the fairly long furrow spines or the more prominent inferomarginal paxillæ. *L. gaini* has more prominent paxillar pedicels, less thorny paxillar spines, more prominent inferomarginal paxillæ, and the actinal intermediate paxillæ are reduced to about 4 in each interradial area. In *L. suluensis* they extend at least two-thirds the length of the ray.

SOLASTER TROPICUS, new species.

Rays 9 or 10. $R=145$ mm., $r=53$ mm., $R=2.7+r$; breadth of ray at base, about 35 mm. Disk large, rays fairly broad at base, tapering to a pointed extremity. Pseudopaxillæ very small, well spaced, with 4 to 6 small spinelets; inferomarginal plates prominent with numerous spinelets increasing very rapidly in size toward the inner or lower end of the compressed, transversely oriented tabulum or pedicel; distal marginals with mostly large spinelets only; furrow spines 5 or 6, rather long; subambulacral spines 5 to 7, subequal in length to furrow spines, but heavier; the inner end of the transverse comb is turned aborad, and the innermost spine is shorter than the second; superomarginal paxillæ small, alternating with the inferomarginals. Resembling somewhat *S. paxillatus*, but with more numerous furrow spines, less conspicuous subambulacrals, heavier inferomarginal spinelets, less conspicuous superomarginals, and fewer paxillar spinelets.

Type.—Cat. No. 32647, U.S.N.M.

Type-locality.—Station 5654, Gulf of Boni, Celebes, 805 fathoms; bottom not recorded.

This species is allied to *S. paxillatus* Sladen, but probably not very closely, while it also shows some resemblance to *S. borealis* Fisher, although it is not at all closely related to this form. The following differences separate *tropicus* from *paxillatus*. In *tropicus* the paxillæ have fewer, relatively coarser spinelets; marginal plates lower, with conspicuously heavier spinelets at the inner or lower end than at the upper or outer, and distal marginals occupied almost entirely by a relatively few large spinelets (somewhat as in *S. borealis*); in *S. paxillatus* the inner marginal spinelets are only a little larger than the outer and the armature of the distal marginals does not differ materially from that of the proximal; in *tropicus* the superomarginals are lower and less conspicuous, the furrow spines more numerous (5 or 6 instead of 3 or 4) and in large specimens the subambulacral spines are decidedly less prominent (subequal to furrow spines). *S. tropicus* differs from *S. borealis* in having less prominent marginal plates and much more numerous and smaller marginal spines, distinguishable superomarginal plates, more numerous and longer furrow spines, and more numerous and longer subambulacral spines. *S. regularis* Sladen has larger and more widely spaced paxillæ, more prominent marginal plates, and the subambulacral spines form a straight series. *S. subarcuatus* Sladen has fewer inferomarginal spines (10–12), fewer furrow spines (3 or 4), and fewer oral and suboral spines. *S. torulatus* Sladen has less prominent, actinally situated marginals, with subequal spinelets, shorter furrow spines, fewer subambulacral spines in a straight series, smaller actinal inter-radial areas, and slightly more numerous abactinal paxillar spinelets.

SOLASTER SCOTOPHILUS, new species.

Related to *Solaster papposus*, but differing in being of a much more delicate habit, with more numerous furrow and suboral spines, smaller paxillæ, smaller and more numerous marginal paxillæ, and a much more delicate skeleton. Rays 9. $R=48$ mm., $r=14$ mm., $R=3.4$ r; breadth of ray at base, 10 mm.; disk large, rays slender, flexible, tapering to a sharp point; skeleton delicate, open, irregular; paxillæ small, the pedicel about 0.5 mm. high and the longest spinelets 1.25 mm. long; marginal paxillæ, 24 or 25, delicate; furrow spines very delicate, 8 or 9; subambulacral spines, 7 to 9; marginal mouth spines, 15.

Type.—Cat. No. 32648, U.S.N.M.

Type-locality.—Station 5651, Gulf of Boni, Celebes, 700 fathoms, green mud; bottom temperature 38.7° F.

The only species, besides *S. papposus*, to which *S. scotophilus* shows close resemblance are *S. penicillatus* (Sladen) and *S. japonicus* Fisher. *S. japonicus* is of the habit of *S. papposus*, having large penicillate paxillæ, and heavier spines generally than occur in *scotophilus*. From *S. penicillatus*, *scotophilus* differs in having much more numerous furrow spines (4 or 5 in *penicillatus*), more numerous marginal paxillæ, and smaller and more delicate abactinal paxillæ.

Genus RHIPIDASTER Sladen.

XENORIAS, new subgenus.

Differing from *Rhipidaster* sensu strictu in the position of the marginal plates which are oblique, but instead of being parallel with one another are inclined at an angle of 45° and touch by the intermarginal ends, forming a series of chevrons along the side of ray. Abactinal plates and adambulacral plates essentially as in *Rhipidaster*.

Type of subgenus.—*Rhipidaster (Xenorias) polycytenius*, new species.

RHIPIDASTER (XENORIAS) POLYCTENIUS, new species.

Rays 7. $R=50$ mm., $r=14$ mm., $R=3.5+$ r; breadth of ray at base, 12 mm.; rays slightly convex, tapering evenly to bluntly pointed extremity. Differing from *R. vannipes* in having very much shorter abactinal spinelets invested in a common sheath; curiously compressed, obliquely oriented, lateral, superomarginal and inferomarginal plates (with intermarginal ends adrad) bearing a transverse comb of webbed spines, those at the abrad end of each plate much longer than the others; furrow spines 9 or 10; subambulacral comb of 4 spines; abactinal integument pulpy, hiding the skeleton which consists of 3- or 4-lobed, closely imbricated plates; papulæ 1 to 3 to each mesh.

Abactinal surface is covered with rather uniformly distributed fascicular tufts of small spinelets invested in a common pulpy sheath from which the tips of the spinelets protrude a short distance. These fascicles with their investment are about 1 mm. long and 0.75 mm. in diameter, and resemble tubercular projections of the integument. In those which appear to be nearly normal the investment forms a collar surrounding the spinelets, which are themselves imbedded in the central pulpy part of the sheath. Fascicles spaced about once their own diameter, or less, on disk and base of rays, and are arranged in quincunx on the sides of rays. Each pseudopaxilla consists of a low pedicel or convex plate, surmounted by 9 to 12, or sometimes fewer, very delicate, tapering, glassy spinelets ending in several points.

The marginal plates are conspicuous, low, transverse ridges, oriented obliquely, as well as bent aborad, each pair of marginals forming a chevron the angle of which is toward base of ray. A series of about 40 of these chevrons occupies the side of each ray. The spine-bearing crest of the marginals has the appearance of being bent aborad, and the upper end of the superomarginal and the lower end of the inferomarginal is in the form of a slight knob, each bearing about 3 prominent, tapering, sharp, closely appressed spines, the median usually the longer. The inferomarginal spines are longer than the corresponding superomarginal spines, being slightly longer than the extreme width of the plate. Six to nine slenderer, shorter spinelets continue the superomarginal series to the intermarginal end of the plate, while 3 to 5 similar spinelets complete the inferomarginal series. Both series are webbed. The large inferomarginal spines are on the angle between the lateral and actinal faces of ray, and proximally a fourth shorter spine is added to the actinal end of the series. The points of the spines frequently converge (the median being longest), and the group has the appearance of Sladen's figure of the "actinal intermediate" spines of *R. vannipes*.

Furrow spines 9 or 10, distally 8, united by membrane for two-thirds their length into a prominent scoop-shaped fan very much as in *R. vannipes*. On the surface of the plate is an oblique comb of 4 stouter, tapering, sharp spines, the 2 median the longest and slightly longer than the furrow spines.

Mouth plates prominent and strongly convex at the outer end. Marginal spines 15 to 17, the 3 inner long, slender, pointed, and directed over actinostome, the remainder usually standing upright, and much shorter and slenderer. A prominent suboral spine near inner end of plate, and 3 shorter spines near outer end of plate midway between suture and furrow margins.

Type.—Cat. No. 32649, U.S.N.M.

Type-locality.—Station 5622, off Makyan Island, Molucca Islands, 275 fathoms, gray mud.

Family MYXASTERIDÆ.

ASTHENACTIS MEDUSA, new species.

Differing from *A. papyraceus* Fisher¹ in lacking entirely the actinolateral membrane, in having 13 marginal mouth spines forming a sharply angular webbed series, the distal of conspicuous length, and in having 9 rays. $R = 225$ mm., $r = 52$ mm., $R = 4.3$ r; breadth of ray at base, 25 mm. Rays slightly swollen above base, tapering to slender, flexible, pointed extremity; dorsal surface of ray arched; that of disk flattened.

The adambulacral armature, with the exception of the actinolateral membrane, is very similar to that of *A. papyraceus*, consisting of 9 or 10 very delicate, webbed spines increasing in length from the inner to the outermost, the outer two being longest and standing on an extension of the next adorally situated plate (see figures of *A. papyraceus*). In *papyraceus* the consecutive outer spines are joined by a sort of actinolateral membrane, but in *A. medusa* they are independent, the membrane being joined to the side of the ray just above the base of the outer spine.

The mouth spines form an angular series, the first to seventh being on the actinostomial margin, the eighth on the angle of the plate directed toward mouth of furrow, while the remaining five form a group adjacent to the first adambulacral comb, on the very short furrow margin of the plate. All are joined by membrane, and the distal spines are of conspicuous length, though shorter than the innermost.

The abactinal spines are extremely delicate and resemble fine glassy hairs. Eight or nine are borne on an eminence of the extremely thin plates and are united by membrane. The fascicles are 6 to 8 mm. long and spaced 2 or 3 mm. apart.

Madreporic body slightly convex, 6 mm. in diameter, and situated slightly adcentral to the middle of r . The actinostome is wide (38 mm.) and the tube-feet large, with large sucking disks.

Type.—Cat. No. 32650, U.S.N.M.

Type-locality.—Station 5605, Gulf of Tomini, Celebes, 647 fathoms, bottom not recorded.

The absence of an actinolateral membrane suggests the possibility that in *Myxaster* the adambulacral armature may also be common to two plates. In such an event this species would be placed in *Myxaster*, and the actinolateral membrane might be retained as the diagnostic character of *Asthenactis*. For the present it seems best to classify this species in *Asthenactis* on the basis of the identity of structure of the adambulacral plates.

The name *medusa* is suggested by the twisted snake-like rays.

¹ For description and figures, see Starfishes of the Hawaiian Islands, U. S. Fish Commission Bulletin for 1903. Part 3, p. 1096, pl. 40, figs. 3, 3a.