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LIST OF PLATES.

ERRATA.

Page 129, line 16 from top of page, *for P. globosa read A. gigas.*
Page 177, line 7 from bottom of page, *for Nerita angularia read Nerita angularis.*
Page 177, line 15 from bottom of page, *for* (v. d. Bucsh) *read* (v. d. Busch).
Page 181, line 12 from top of page, *for V. uni olor read V. unicolor.*
Page 201, line 22 from top of page, *for* Delafo d *read* Delafond.

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[*N.B.*—An asterisk (*) preceding a line denotes a new variety or subspecies; a dagger (†) indicates a new species; synonyms are printed in italics.]

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MEMOIRS

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INDIAN MUSEUM

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REPORT ON THE MADREPORARIAN CORALS IN THE COLLECTION OF THE INDIAN MUSEUM, CALCUTTA.

PART I.

By GEORGE MATTHAI, *M.A. (Cantab.), F.L.S., F.Z.S.,*
Indian Educational Service, Professor of Zoology in the Government College, Lahore, and the University of the Punjab.

Plates I—XI.

During a visit to Calcutta in the summer of 1922, I undertook, at the suggestion of Dr. Annandale, to study the large Coral collections in the Indian Museum.

In this Report reference is made to about 30 genera and 90 species of the Families Astraeidae and Fungidae (as employed by Milne-Edwards and Haime), to which nearly 600 hard coralla have been assigned. I hope to review the remaining families on a subsequent occasion.

Specimens have been collected from localities as shown in the following list :—

Localities.	Collectors.	Number of specimens.	Number of genera.	Number of species.
Andamans	J. Wood-Mason, G. H. Booley, F. Stoliczka.	103	12	29
Nicobar Islands, Nankauri Harbour	"Investigator" ...	1	1	1
Mergui Archipelago	"Investigator," J. Anderson, R. E. Lloyd.	56	17	29
Mergui Archipelago, Port Maria ...	.....	2	1	1
Mergui Archipelago, Pilai Island ...	J. Anderson ...	77	14	27
Mergui Archipelago, Padaw Bay, King Island.	J. Anderson ...	59	12	24
Mergui Archipelago, Lampee Island	J. Anderson ...	15	5	8
Moscos Island, off coast of Burma	"Investigator" ...	5	4	4
Arracan	W. Theobald ...	23	7	12
Malay Archipelago, Macassar Strait	Capt. T. S. Gardner ...	22	7	11
Singapore	Capt. J. T. Lewis ...	23	5	7
China	Dr. Cantor ...	1	1	1
Ceylon, Pearl Banks	J. Hornell	1	1	1
Ceylon, Galle	J. Anderson ...	1	1	1
Gulf of Mannar, Rameswaram Island.	S. W. Kemp ...	4	2	2
N. 64° W. of Colombo ...	"Marine Survey" ...	1	1	1
Western Indian Ocean, Mauritius and Rodriguez Islands.	J. Caldwell ...	17	3	4
Gulf of Suez	Capt. R. B. S. Sewell ...	1	1	1
Red Sea	T. Blandford, W. Theobald, Dr. Tschancko.	7	2	3
Unknown Locality	.....	183	25	57

Names of species obtained from each locality are given below :—

Andamans.

1. *Echinopora lamellosa* (Esp.)
2. *Galaxea fascicularis* (Linn.)
3. *Favia abdita* (Ell. & Sol.)
4. ,, *halicora* (Ehrb.)
5. *Cœloria dædalea* (Ell. & Sol.)
6. ,, *sinensis* (M. Ed. & H.)
7. ,, *stricta* (M. Ed. & H.)
8. *Merulina ampliata* (Ell. & Sol.)
9. ,, *laxa*, Dana
10. *Mussa corymbosa* (Forsk.)
11. *Symphyllia sinuosa* (Quoy & Gaim.)
12. *Fungia patella* (Ell. & Sol.)
13. ,, *distorta*, Mich.
14. ,, *cyclolites* (Lamk.)
15. ,, *somervillei*, Gard.
16. ,, *paumotensis*, Stutch.
17. ,, *echinata* (Pallas)
18. ,, *concinna*, Verr.
19. ,, *horrida*, Dana
20. ,, *subrepanda*, Döderl.
21. ,, *danai*, M. Ed. & H.
22. ,, *corona*, Döderl.
23. ,, *fungites* (Linn.)
24. *Herpetolitha limax* (Esp.)
25. *Leptoseris fragilis*, M. Ed. & H.
26. ,, *hawaiiensis*, Vaugh
27. *Pavona lata*, Dana
28. ,, *prætorta*, Dana
29. ? *Psammocora profundacella*, Gard.

Nicobar Islands, Nankauri Harbour.

1. *Hydnophora exesa* (Pallas)

Mergui Archipelago.

1. *Galaxea fascicularis* (Linn.)
2. ,, *musicalis* (Linn.)
3. *Favia favus* (Forsk.)
4. ,, *hululensis*, Gard.
5. ,, *speciosa* (Dana)
6. ,, *valenciennesi* (M. Ed. & H.)
7. ,, *versipora* (Lamk.)
8. ,, *halicora* (Ehrb.)
9. ,, *favosa* (Ell. & Sol.)
10. *Goniastrea retiformis* (Lamk.)

Mergui Archipelago—*contd.*

11. *Goniastrea incrustans*, Duncan
12. *Cœloria sinensis*, M. Ed. & H.
13. *Leptoria phrygia* (Ell. & Sol.)
14. *Hydnophora exesa* (Pallas)
15. *Merulina ampliata* (Ell. & Sol.)
16. ,, *laxa*, Dana
17. *Symphyllia valenciennesi*, M. Ed. & H.
18. *Euphyllia fimbriata* (Speng.)
19. *Tridacophyllia lactuca* (Pallas)
20. ? *Plesiastræa indurata*, Verr.
21. *Fungia somervillei*, Gard.
22. ,, *fungites* (Linn.)
23. *Polyphyllia talpina* (Lamk.)
24. *Podabacia crustacea* (Pallas)
25. *Pavona lata*, Dana
26. ,, *crassa*, Dana
27. *Coscinaræa monile* (Forsk.)
28. *Mycedium okeni*, M. Ed. & H.
29. ,, *aspera* (Ell. & Sol.)

Port Maria, Mergui Archipelago.

1. *Fungia fungites* (Linn.)

Pilai Island, Mergui Archipelago.

1. *Favia hululensis*, Gard.
2. ,, *speciosa* (Dana)
3. ,, *abdita* (Ell. & Sol.)
4. ,, *pentagona* (Esp.)
5. *Goniastrea retiformis* (Lamk.)
6. *Cœloria astræiformis*, M. Ed. & H.
7. *Merulina laxa*, Dana
8. *Mussa corymbosa* (Forsk.)
9. ,, *brüeggemanni*, Quelch
10. *Symphyllia agaricia*, M. Ed. & H.
11. *Tridacophyllia lactuca* (Pallas)
12. *Fungia patella* (Ell. & Sol.)
13. ,, *cyclolites*, Lamk.
14. ,, *somervillei*, Gard.
15. ,, *echinata* (Pallas)
16. ,, *danai*, M. Ed. & H.
17. ,, *corona*, Döderl.
18. ,, *fungites* (Linn.)
19. *Herpetolitha limax* (Esp.)

PILAI ISLAND, MERGUI ARCHIPELAGO—*contd.*

20. *Herpetolitha foliosa* (Ehrb.)
21. „ *stricta*, Dana
22. *Polyphyllia novæ-hiberniæ* (Lesson)
23. *Podabacia crustacea* (Pallas)
24. *Pachyseris speciosa* (Dana)
25. *Pavona lata*, Dana
26. „ *danai* (M. Ed. & H.)
27. *Coscinaræa monile* (Forsk.)

PADAW BAY, MERGUI ARCHIPELAGO.

1. *Galaxea fascicularis* (Linn.)
2. *Leptastrea roissyana*, M. Ed. & H.
3. *Favia favus* (Forsk.)
4. „ *doreyensis*, M. Ed. & H.
5. „ *speciosa* (Dana)
6. „ *abdita* (Ell. & Sol.)
7. „ *valenciennesi* (M. Ed. & H.)
8. „ *pentagona* (Esp.)
9. „ *favosa* (Ell. & Sol.)
10. *Goniastrea retiformis* (Lamk.)
11. „ *incrustans*, Duncan
12. *Cœloria dædalea* (Ell. & Sol.)
13. „ *sinensis*, M. Ed. & H.
14. „ *stricta*, M. Ed. & H.
15. ? „ *pachychila*, Klunz.
16. *Mussa corymbosa* (Forsk.)
17. *Symphyllia radians*, M. Ed. & H.
18. „ *agaricia*, M. Ed. & H.
19. *Euphyllia glabrescens* (Cham. & Eysen.)
20. „ *fimbriata* (Speng.)
21. *Tridacophyllia lactuca* (Pallas)
22. *Fungia somervillei*, Gard.
23. *Coscinaræa monile* (Forsk.)
24. *Mycedium okeni*, M. Ed. & H.

LAMPEE ISLAND, MERGUI ARCHIPELAGO.

1. *Favia doreyensis*, M. Ed. & H.
2. „ *hululensis*, Gard.
3. „ *abdita* (Ell. & Sol.)
4. „ *pentagona* (Esp.)
5. *Goniastrea retiformis* (Lamk.)
6. *Cœloria dædalea* (Ell. & Sol.)
7. *Hydnophora microconos* (Lamk.)
8. *Symphyllia sinuosa* (Quoy & Gaim.)

MOSCOS ISLAND, OFF COAST OF BURMA.

1. *Favia favus* (Forsk.)
2. *Cœloria forskælana*, M. Ed. & H.
3. *Antillia constricta*, Brügg.
4. *Fungia somervillei*, Gard.

ARRACAN.

1. *Galaxea fascicularis* (Linn.)
2. *Favia favus* (Forsk.)
3. „ *doreyensis*, M. Ed. & H.
4. „ *danæ*, Verr.
5. „ *speciosa* (Dana)
6. „ *pentagona* (Esp.)
7. „ *halicora* (Ehrb.)
8. *Cœloria dædalea* (Ell. & Sol.)
9. *Hydnophora exesa* (Pallas)
10. *Merulina ampliata* (Ell. & Sol.)
11. *Symphyllia radians*, M. Ed. & H.
12. *Cœloseris mayeri*, Vaugh

MALAY ARCHIPELAGO, MACASSAR STRAIT.

1. *Galaxea musicalis* (Linn.)
2. *Trachyphyllia amarantum* (Dana)
3. *Hydnophora exesa* (Pallas)
4. *Euphyllia turgida*, Dana
5. *Fungia paumotensis* (Stutch.)
6. „ *echinata* (Pallas)
7. „ *danai*, M. Ed. & H.
8. „ *fungites* (Linn.)
9. *Herpetolitha limax* (Esp.)
10. „ *stricta*, Dana
11. *Podabacia crustacea* (Pallas)

SINGAPORE.

1. *Trachyphyllia amarantum* (Dana)
2. *Merulina ampliata* (Ell. & Sol.)
3. *Symphyllia agaricia*, M. Ed. & H.
4. „ *valenciennesi*, M. Ed. & H.
5. *Fungia subrepanda*, Döderl.
6. *Polyphyllia talpina* (Lamk.)
7. „ *novæ-hiberniæ* (Lesson)

CHINA.

1. *Pavona venusta*, Dana

CEYLON, PEARL BANKS.

1. *Cyphastrea serailia* (Forsk.)

Ceylon, Galle.

1. *Favia pentagona* (Esp.)

Gulf of Mannar, Rameswaram Island.

1. *Cœloria dædalea* (Ell. & Sol.)
2. *Symphyllia radians*, M. Ed. & H.

N. 60° W. of Colombo.

1. *Fungia cyclolites*, Lamk.

Western Indian Ocean, Mauritius and Rodriguez Islands.

1. *Galaxea fascicularis* (Linn.)
2. *Fungia patella* (Ell. & Sol.)
3. ,, *cyclolites*, Lamk.
4. *Pavona lata*, Dana

Gulf of Suez.

1. *Fungia fungites* (Linn.)

Red Sea.

1. *Cœloria forskœlana*, M. Ed. & H.
2. ,, *bottai*, M. Ed. & H.
3. *Fungia fungites* (Linn.)

Unknown locality.

1. *Cyphastrea chalcidicum*, Klunz.
2. *Galaxea fascicularis* (Linn.)
3. *Diploastrea heliopora* (Lamk.)
4. *Favia favus* (Forsk.)
5. ,, *doreyensis*, M. Ed. & H.
6. ,, *hululensis*, Gard.
7. ,, *speciosa* (Dana)
8. ,, *abdita* (Ell. & Sol.)
9. ,, *valenciennesi* (M. Ed. & H.)
10. ,, *pentagona* (Esp.)
11. ,, *vasta* (Klunz.)
12. ,, *favosa* (Ell. & Sol.)
13. *Goniastrea retiformis* (Lamk.)
14. *Cœloria dædalea* (Ell. & Sol.)
15. ,, *sinensis*, M. Ed. & H.
16. ,, *bottai*, M. Ed. & H.
17. ,, *lamellina* (Ehrb.)

Unknown locality—*contd.*

18. *Cœloria astræiformis*, M. Ed. & H.
19. *Leptoria phrygia* (Ell. & Sol.)
20. *Trachyphyllia amarantum* (Dana)
21. *Antillia constricta*, Brügg.
22. *Manicina areolata* (Linn.)
23. *Pectinia quadrata* (Dana)
24. *Hydnophora exesa* (Pallas)
25. ,, *microconos* (Lamk.)
26. *Merulina ampliata* (Ell. & Sol.)
27. *Mussa brüeggemanni*, Quelch
28. *Symphyllia radians*, M. Ed. & H.
29. ,, *agaricia*, M. Ed. & H.
30. ,, *indica*, M. Ed. & H.
31. *Sclerophyllia margariticola*, Klunz.
32. *Euphyllia glabrescens* (Cham. & Eysen.)
33. ,, *fimbriata* (Speng.)
34. ,, *turgida*, Dana
35. *Tridacophyllia lactuca* (Pallas)
36. *Fungia patella* (Ell. & Sol.)
37. ,, *cyclolites*, Lamk.
38. ,, *simplex*, Gard.
39. ,, *paumotensis*, Stutch.
40. ,, *echinata* (Pallas)
41. ,, *subrepanda*, Döderl.
42. ,, *danai*, M. Ed. & H.
43. ,, *scriposa*, Klunz.
44. ,, *corona*, Döderl.
45. ,, *fungites* (Linn.)
46. *Herpetolitha limax* (Esp.)
47. ,, *stricta*, Dana
48. *Podabacia crustacea* (Pallas)
49. *Leptoseris digitata*, Vaugh.
50. *Pavona decussata*, Dana
51. ,, *crassa*, Dana
52. ,, *prætorta*, Dana
53. ,, *divaricata*, Lamk.
54. ,, *varians*, Verr.
55. ,, *venusta*, Dana
56. *Coscinarœa monile*, Forsk.
57. *Mycedium okeni*, M. Ed. & H.

It will be seen that the records are mostly from the Eastern Indian Ocean, a region hardly represented in the collections I had previously studied. The Geographical Distribution of several known species has thus been extended for the first time.

I have also re-examined those specimens collected in the Mergui Archipelago by Dr. John Anderson, late Superintendent of the Indian Museum, and reported on by Duncan

in 1889 (*Journ. Linn. Soc., London*, pp. 1-24), that are kept in the Museum. The following is a list of genera and species recorded by Duncan from Mergui.

MADREPORARIA APOROSA.

Family TURBINOLIDÆ.

1. *Paracyathus andersoni*, sp. nov.
2. ,, *profundus*, sp. nov.
3. ,, *indicus*, sp. nov.
4. ,, *cæruleus*, sp. nov.
5. *Paracyathus merguiensis*, sp. nov.
6. *Polycyathus verrilli*, sp. nov.
7. ,, *difficilis*, sp. nov.

Family POCILLOPORIDÆ.

8. *Pocillopora cæspitosa*, Dana
9. *Pocillopora favosa*, Ehr.

Family ASTRÆIDÆ.

10. *Mussa cristata*, Esper, sp.
11. ,, *flexuosa*, Ed. & H.
12. ,, *corymbosa*, Forskål, sp.
13. *Euphyllia striata*, Ed. & H.
14. ,, *rugosa*, Dana
15. ,, *plicata*, Ed. & H.
16. *Mœandrina* (*Cœloria*) *dædalea*, Solander, sp.
17. ,, (*C.*) *esperi*, Ed. & H., sp.
18. ,, (*C.*) *astræiformis*, Ed. & H., sp.
19. ,, (*C.*) *labyrinthiformis*, Linn., sp.
20. *Brachymœandrina pachychila*, Ehr., sp.
21. *Symphyllia grandis*, Ed. & H.
22. ,, *recta*, Dana, sp.
23. ,, (*Isophyllia*) *erythræa*, Klunz., sp.
24. *Hydnophora microcona*, Lmk., sp.
25. *Tridacophyllia lactuca*, Pallas, sp.
26. *Favia Ehrenbergi*, Klunz., var. *laticollis*, Klunz.
27. *Favia Okeni*, Ed. & H.
28. ,, *Rousseaui*, Ed. & H., sp.
29. ,, *tubulifera*, Klunz.
30. *Favia cavernosa*, Forskål, sp.
31. ,, *Geoffroyi* (Val.), Ed. & H.
32. *Goniastræa favus*, Forsk., sp., and variety.
33. ,, *retiformis*, Lmk., sp.
34. ,, *Bournoni*, Ed. & H.
35. ,, *halicora*, Hemp. & Ehr., sp., and variety.
36. *Goniastræa incrustans*, sp. nov.
37. *Heliastræa* (*Ulastræa*) *crispata*, Lmk., sp.
38. *Phymastræa irregularis*, Dunc.
39. ,, *aspera*, Quelch
40. *Solenastræa* (*Quelchia*) *spongiformis*, sp. nov.
41. *Plesiastræa indurata*, Verrill, variety
42. *Echinopora aspera*, Solander, sp.
43. *Leptastræa humilis*, sp. nov.
44. *Galaxea irregularis*, Ed. & H., sp.
45. *Prionastræa abdita*, Solander, sp.
46. ,, *vasta*, Klunz.
47. ,, *robusta*, Dana, sp.
48. *Merulina ampliata*, Solander, sp.
49. ,, *ramosa*, Ehr.

MADREPORARIA FUNGIDA.

Family PLESIOFUNGIDÆ, DUNC.

50. *Siderastræa radians*, Pallas, sp., variety *pulchella*=*S. pulchella*, Ed. & H.

Family FUNGIDÆ.

51. *Fungia crassa*, Dana
52. ,, *dentata*, Dana
53. ,, *patella*, Solander, sp.
54. ,, *glans*, Dana ?
55. *Fungia* (*Haliglossa*) *echinata*, Pallas sp.
56. *Halomitra* (*Podabacia*) *crustacea*, Ed. & H.
57. *Cryptabacia talpina*, Lmk., sp.
58. *Herpolitha limax*, Esper., sp.

Family LOPHOSERIDÆ.

59. *Lophoseris cristata*, Solander, sp.
60. ,, *cactus*, Hemp. & Ehr., sp.
61. *Pachyseris speciosa*, Dana, sp.
62. *Coscinaræa mæandrina*, Ehr., sp.
63. ,, *monile*, Forskål, sp.

Family PLESIOPORITIDÆ, Dunc.

64. *Mæandroseris Bottæ*, Rouss.

MADREPORARIA PERFORATA.

Family EUPSAMMIDÆ.

65. *Balanophyllia merguiensis*, sp. nov.
66. *Dendrophyllia coarctata*, sp. nov.
67. *Dendrophyllia (Cœnopsammia) affinis*, sp. nov.
68. *Astropsammia Pedersoni*, Verrill

Family MADREPORIDÆ.

69. *Madrepora gracilis*, Ed. & H.
70. ,, *valida*, Dana
71. ,, *surculosa*, Dana
72. ,, *hebes*, Dana
73. ,, *pyramidalis*, Klunz.
74. *Madrepora paxilligera*, Dana
75. ,, *cribripora*, Dana
76. ,, *spicifera*, Dana
77. *Turbinaria cinerascens*, Solander, sp.
78. ,, *crater*, Pallas, sp.

Family PORITIDÆ.

79. *Porites conglomerata*, Quoy & Gaim., variety
80. ,, *nodifera*, Klunz.
81. ,, *excavata*, Verrill
82. *Synaræa lutea*, Verrill
83. *Goniopora columna*, Dana
84. ,, *lobata*, Ed. & H.

To some extent the system of classification adopted in this paper is provisional, particularly in regard to the Fungidæ whose soft parts have yet to be systematically studied. I have frequently referred to Dr. Vaughan's Memoir on "Some Shoal-water corals from Murray Island (Australia), Cocos-Keeling Islands and Fanning Island" (1918). It would be premature, at this juncture, to undertake a critical discussion of this work although I have tentatively employed some of the specific names as interpreted by Dr. Vaughan. It is not unlikely that, with detailed study of the hard and soft parts of corals, names of some of the species and genera now generally accepted will undergo further change. Only the more important references to synonymy are, therefore, given under every species.

I am indebted to the Zoological Survey of India for financial aid in the preparation of this Memoir and for generously allowing me the use of the library of the Zoological Survey of India.

The photographs of corals in the plates accompanying this Report were taken by Mr. D. Bagchi, Artist of the Zoological Survey of India. Mr. Mukand Lal, M.Sc., Demonstrator of Zoology in the Government College, Lahore, gave me valuable assistance in the preparation of the plates.

Family ASTRÆIDÆ.

Genus **CYPHASTREA** Klunzinger

1879. *Cyphastrea*, Klunzinger, *Korall. Roth. Meer.* III, p. 50.
1914. *Cyphastrea*, Matthai, *Trans. Linn. Soc.*, XVII, Part I, p. 38.
1848. *Cyphastrea*, Milne Edwards and Haime, *Compt. rend. Acad. Sci.*, XXVII, p. 494.
1918. *Cyphastrea*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 87.

1. **Cyphastrea serailia** (Forskål)

1775. *Madrepora serailia* (Pars) Forskål, *Descr. Anim. in Itin. Orient.*, p. 135.
1914. *Cyphastrea serailia*, Matthai, *Trans. Linn. Soc., London*, XVII, Part I, p. 39, pl. 7, fig. 4 ; pl. 11, figs. 1-9 ; pl. 13, fig. 8 ; pl. 38, figs. 1 and 5.
1918. *Cyphastrea serailia*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 88, pl. 17, fig. 38 ; pl. 18, fig. 39 ; pl. 29, figs. 2, 2*a*, 2*b*.

I refer to this species one small specimen (M. 6110/1, height 4 cm., diameter 7·5 cm.) said to be a pest of the Pearl Oyster. Corallum is light, with vesicular peritheca. Calicinal surface is raised into rounded closely arranged hillocks. Part of the calicinal surface is dead. Primary septa are thicker than the secondaries.

Distribution.—Pearl Banks, Ceylon (1).

Previously known from Maldives ; Amirante (16 & 30 fms.) ; Saya de Malha (20 & 26 fms.) ; Red Sea ; New Hanover.

Vaughan records this species from Great Barrier Reef and Philippine Islands.

2. **Cyphastrea chalcidicum** Klunzinger

1879. *Cyphastrea chalcidicum*, Klunzinger, *Korall. Roth. Meer.* III, p. 53, pl. 5, fig. 8 ; pl. 10, figs. 11*a-c*.
1914. *Cyphastrea chalcidicum*, Matthai, *Trans. Linn. Soc., London*, XVII, Part I, p. 41, pl. 7, figs. 1, 5 ; pl. 12, figs. 1-3 ; pl. 14, fig. 1.

One large massive specimen (3654/3, height 20 cm., diameters 23 cm. × 20 cm.) is referred to this species. The corallum somewhat narrows towards the top of the calicinal surface which is raised into prominent ridges, about six of these ridges radiating from the top to almost the base. Between the ridges are comparatively broad valleys tending to rise into hillocks. Twelve septa (6 primaries and 6 secondaries) are present in each fully formed corallite, all of which meeting the columella. In some of the corallites primary septa are slightly thicker than the secondaries. Corallites are smaller and more crowded in depressions. Spines are not prominent on the peritheca.

Distribution.—Specimens in the Indian Museum from unknown locality.

Previously known from Maldives, Goidu ; Chagos, Solomon ; Ceylon ; Singapore ; Red Sea ; Rotuma ; Philippine Islands.

Further study is required to determine whether *Cyphastrea ocellina* (Dana), recorded from Laysan, Sandwich Islands and Hawaiian Islands, is to be merged with *C. chalcidicum* or not.

Genus **ECHINOPORA** Lamarck.

1816. *Echinopora*, Lamarck, *Hist. Nat. Anim. sans Vert.*, II, p. 252.
1914. *Echinopora*, Matthai, *Trans. Linn. Soc., London*, XVII, Part I, p. 48.
1918. *Echinopora*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 97.

1. **Echinopora lamellosa** (Esper).

1797. *Madrepora lamellosa*, Esper, *Forts. pflanz.*, p. 65, pl. 58, figs. 1 and 2.
1914. *Echinopora lamellosa*, Matthai, *Trans. Linn. Soc., London*, XVII, Part I, p. 50, pl. 8, fig. 6; pl. 14, figs. 2 to 6; pl. 15, fig. 1; pl. 16, fig. 6.
1918. *Echinopora lamellosa*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 97, pl. 32, figs. 1, 1*a*, 2, 2*a*, and 3.

In the single specimen (2673/3, diameters 18 cm. × 20 cm.) referred to this species, corallum is thin, showing the characteristic foliate growth, the foliæ being irregularly disposed. Since corallite-walls are almost absent and costæ are continuous from corallite to corallite, the calicinal surface presents a fungid facies.

Distribution.—Andamans, Port Blair (1).

Also known from Maldives, Hulule; Chagos, Solomon; Coin, Peros; Seychelles; Ceylon; Australia; New Holland; New Britain; Fiji Islands.

Vaughan records this species from Cocos-Keeling Islands and Philippine Islands.

Genus **GALAXEA** (Oken).

1815. *Galaxea (pars)* Oken, *Lehrb. Naturg.*, Th. 3, Abth. 1, p. 72.
1914. *Galaxea*, Matthai, *Trans. Linn. Soc., London*, XVII, Part I, p. 58.
1918. *Galaxea*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 98.

1. **Galaxea fascicularis** (Linnæus).

(Pl. II, fig. 5.)

1767. *Madrepora fascicularis*, Linnæus, *Syst. Nat.*, edit. 12, p. 1278.
1914. *Galaxea fascicularis*, Matthai, *Trans. Linn. Soc., London*, XVII, Part I, p. 59, pl. 8, fig. 4; pl. 16, fig. 4; pl. 34, fig. 3; pl. 38, fig. 6.
1918. *Galaxea fascicularis*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 98, pl. 33, figs. 2, 3, 3*a*; pl. 34, fig. 1.

Several of the specimens referred to this species are large and entire, the largest being 7 cm. in height and 23 cm. × 14 cm. in diameter. Heavy type of corallum, with large corallites, is represented by Zev. 7294/7, 3669/3, 3672/3, and 3668/3. In 3652/3 the calicinal surface rises into humps. 6476/4 from Mergui Archipelago, with corallum somewhat dead, is probably the specimen referred to *Galaxea irregularis* by Duncan (Fauna of Mergui, p. 14).

Distribution.—Mergui Archipelago (1); Padaw Bay (2); Arracan (1); Andamans (1); Moscos Island, off Burma coast (1); Western Indian Ocean; Rodriguez (1); unknown locality (10).

Also known from Aldabra; Saya de Malha; Seychelles; Red Sea; Fiji Islands; Philippine Islands; Amboina; Great Barrier Reef.

2. **Galaxea musicalis** (Linnæus).

(Pl. II, fig. 6.)

1767. *Madrepora musicalis*, Linnæus, *Syst. Nat.*, edit. 12, p. 1278.
1914. *Galaxea musicalis*, Matthai, *Trans. Linn. Soc., London*, XVII, Part I, p. 62, pl. 16, figs. 2 and 3.
1918. *Galaxea clavus*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 99, pl. 33, fig. 1.

Three specimens are referred to this species, the largest (No. 3709/3) being 12·5 cm. in height and 30 cm. × 22 cm. in diameter. The calicinal surface is destroyed in parts on which are attached a few shells of the cirripede *Pyrgoma grande* (Sowerby);[1] on two or three of these cirripede shells are corallites at different stages of growth, the soft parts of the coral having grown over the shells. Some of the corallites tend to assume the *G. fascicularis* facies but not more than 12 septa meet columella, primary septa being thicker than the secondaries.

Distribution.—Mergui Archipelago (2); Malay Archipelago (1).

Previously known from Maldives; Coin, Peros; Ceylon; Torres Straits; Philippine Islands and Fiji Islands. Not reported from the east coast of Africa, nor east of the Fiji Islands.

Genus **LEPTASTREA** Milne Edwards and Haime.

1848. *Leptastrea*, Milne Edwards and Haime, *Compt. rend. Acad. Sci.*, XXVII, p. 494.
1857. *Leptastrea* and *Baryastræa*, Milne Edwards and Haime, *Hist. Nat. Corall.*, II, pp. 493 and 512.
1914. *Leptastrea*, Matthai, *Trans. Linn. Soc., London*, XVII, Part I, p. 66.
1918. *Leptastrea*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 89.

1. **Leptastrea roissyana** Milne Edwards and Haime.

1850. *Leptastrea roissyana*, Milne Edwards and Haime, *Ann. Sci. Nat.*, 3e ser., X, pl. 9, figs. 6, 6*a*, and XII, p. 120.
1914. *Leptastrea roissyana*, Milne Edwards and Haime, *Trans. Linn. Soc., London*, XVII, Part I, p. 67, pl. 8, figs. 1-3; pl. 17, fig. 4; pl. 18, fig. 1; pl. 19, figs. 1 and 2; pl. 37, fig. 4.
1918. *Leptastrea transversa*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 94.

The two specimens (2977/3 and 2976/3) referred to this species are comparatively small, encrusting on pieces of stone, the larger with diameter 9·5 cm. The corallum, in each case, is burrowed in here and there from the calicinal surface.

Duncan described a new species, *viz.*, *Leptastrea humilis* (p. 13) from Mergui, but the specimen is not to be found in the Indian Museum. No. 2977/3 bears a label with the name *Leptastrea transversa*, Klunz.

Distribution.—Mergui Archipelago, Padaw Bay (2).

Also known from Chagos, Solomon; Maldives, Hulule, Goidu, Addu; Minikoi, Ceylon; Red Sea.

Vaughan records the species from Fanning Island.

[1] The two kinds of coral on which Darwin found shells of *P. grande* (p. 65, 1854) might probably have belonged to the genera *Galaxea* and *Euphyllia*.

Genus **DIPLOASTREA** Matthai.

1914. *Diploastrea*, Matthai, *Trans. Linn. Soc., London*, XVII, Part I, p. 72.
1918. *Diploastrea*, Vaughan, *Papers. Dep. Marine Biol., Washington*, IX, p. 142.

1. **Diploastrea heliopora** (Lamarck).

1914. *Diploastrea heliopora*, Matthai, *Trans. Linn. Soc., London*, XVII, Part 1, p. 72, pl. 20, figs. 7 and 8 ; pl. 34, fig. 9.
1918. *Diploastrea heliopora*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 143, pl. 59, figs. 5 and 5*a*.

This species is represented by an entire colony measuring 6 cm. in height and 13·5 cm. × 11·5 cm. in diameter. The calicinal surface is evenly convex, being typical in every respect. The corallum is attached by nearly the whole of its lower surface, whilst the upper calicinal surface is well preserved. Vaughan suggests that this genus may have closer relations with Fungid genera.

Distribution.—Specimen in Indian Museum from unknown locality.

Previously known from Minikoi ; French Somaliland ; New Britain ; Fiji Islands.

Genus **FAVIA** (Oken).

1815. *Favia*, Oken, *Lehrb. Naturg.*, Th. 3, Abth. I, p. 67.
1914. *Favia*, Matthai, *Trans. Linn. Soc., London*, XVII, Part I, p. 77.
1918. *Favia* and *Favites*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, pp. 100 and 109.

1. **Favia favus** (Forskål).

1775. *Madrepora favus* (pars), Forskål, *Descr. Anim. in Itin. Orient.*, p. 132.
1914. *Favia favus*, Matthai, *Trans. Linn. Soc., London*, XVII, Part I, p. 79, pl. 9, fig. 2 ; pl. 20, figs. 1-6 ; pl. 21, figs. 1-8 ; pl. 22, figs. 1-5 ; pl. 32, fig. 1 ; pl. 36, figs. 1 and 2.

I have referred twenty-one specimens to this species. The skeleton in this species is highly variable. 3642/3 and Zev. 7267/7 are more or less typical. In both specimens the corallum is somewhat light and the intercalicinal regions of peritheca are narrow. Zev. 7267/7 (8 cm. in height and 16·5 cm. ×15·5 cm. in diameter) has an evenly convex surface. 3651/3, 3607/3, 3694/3 have comparatively small corallites.

6201/3 varies towards the *F. speciosa* facies characterised by larger corallites with distinct rims and intercalicinal grooves. 3873/3 is marked *Prionastraea vasta*, but the specimens that Duncan referred to this species were from King Island Bay (p. 14). Corallites, in this specimen, have the polygonal facies characteristic of *Favia vasta*, but there is no alternating cycle of very narrow septa. Calices are also somewhat shallow. 6063/3 marked *Favia ehrenbergi* may perhaps be the specimen from Sullivan Island that Duncan referred to *F. ehrenbergi*, var. *laticollis* (p. 9).

Distribution.—Arracan, off Burma coast (3) ; Mergui Archipelago, Padaw Bay (9) ; Mergui Archipelago (2) ; Moscos Island, off Burma coast (1) ; unknown locality (6).

Previously known from Chagos, Solomon ; Seychelles ; Maldives, Suvadiva (25 fms.), Hulule ; Minikoi ; Singapore ; Ceylon ; Red Sea ; Funafuti ; Ellice Islands ; Tongatabou.

2. **Favia doreyensis** Milne Edwards and Haime.

1857. *Favia doreyensis*, Milne Edwards and Haime, *Hist. Nat. Corall.*, II, p. 432.

1914. *Favia doreyensis*, Matthai, *Trans. Linn. Soc., London*, XVII, Part I, p. 84, pl. 9, figs. 1 and 3 ; pl. 22, figs. 8 and 9 ; pl. 32, figs. 2 to 4.

1918. *Favia pallida* (pars), Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 105, pl. 16, figs. 26, 27, 29 and 30 ; pl. 38, figs. 1-7.

Seven entire colonies are referred to this species ; of these 3646/3 and 3665/3 (both from Arracan) are typical of the species. Zev. 7328/7 is the largest specimen, being an entire colony, 25 cm. in height and 48 cm. × 35 cm. in diameter ; it bears some resemblance to *F. speciosa*, Dana, in as much as the corallites are usually oval, with definite, thin, projecting rims and somewhat deep calices which tend to decrease in width towards their bottom. Corallites project least in 3645/3. The peritheca of 3660/3 is dense. 3223/3 is a small but entire colony in which corallites are comparatively small (as in examples of *F. hululensis*) but 12 or more septa meet columella ; this was wrongly marked *Goniastrea retiformis*.

In 3665/3 corallites towards the periphery of corallum project obliquely. This feature is marked to a less extent in 3660/3 and 3646/3. In Zev. 7285/7 (height 17 cm., diameters 24 cm. × 22 cm.) corallum towards the edge presents more or less the same facies as in *Favia speciosa*.

In all these specimens the corallum is massive, calicinal surface being convex.

Distribution.—Arracan (4) ; Mergui Archipelago, Lampee Island (1) ; Padaw Bay (1) ; unknown locality (1).

Also known from Maldives, Hulule, Goidu ; Minikoi ; Seychelles ; Coetivy ; Chagos, Solomon ; Coin, Peros ; Ceylon ; Rotuma ; Philippines ; Fiji Islands.

3. **Favia hululensis** Gardiner.

(Pl. XI, fig. 6.)

1904. *Favia hululensis*, Gardiner, *Fauna Georgr. Maldives and Laccadives*, p. 769, pl. 41, figs. 19-21.

1914. *Favia hululensis*, Matthai, *Trans. Linn. Soc., London*, XVII, Part I, p. 87, pl. 9, fig. 6 ; pl. 22, fig. 6 ; pl. 35, fig. 1.

1918. *Favia pallida*, Facies I, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 106, pl. 38, fig. 2.

I refer eight specimens (entire colonies) to this species, the largest specimen (Zev. 7395/7) being 23 cm. in height and 21 cm. × 20 cm. in diameter ; the lower half of this specimen is almost dead ; the calicinal surface is burrowed in places. A dried skeleton of *Heliopora cærulea* is attached to the non-calicinal surface of 6471/4, and brown shells of gregarious Vermetidæ on that of 3892/3. In the central region of the calicinal surface of Zev. 7297/7 (height 15 cm., diameters 21 cm. × 18 cm.) corallites are situated close together but intercorallite grooves are still present, and corallites tend to be elongated.

In this species the corallum has more or less the same growth-facies as that of *Favia doreyensis* except when the calicinal surface is affected by burrowing organisms. In 1914 I pointed out that *F. hululensis* has to be regarded as a small edition of *F. doreyensis*, the

former differing from the latter in having smaller corallites and fewer septa meeting columella.

6471/4 (Lampee Islands) is marked *Favia geofroyi* although Duncan records the latter species from King Island Bay (p. 10).

Distribution.—Mergui Archipelago, Lampee Island (3) ; Pilai Island (1) ; Mergui Archipelago (3) ; unknown locality (1). Previously known from Maldives, Hulule, Goidu ; Coetivy ; Ceylon ; Red Sea ; Funafuti ; Rotuma.

4. **Favia danae** Verrill.

(Pl. 1, fig. 2.)

1918. *Favia danæ*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 108, pl. 39, figs. 1 and 1*a*.

I refer one massive specimen (3666/3, 15 cm. in height and 17 cm. × 16 cm. in diameter) doubtfully to this species although it agrees, in many respects, with Vaughan's account. The corallum is heavy, with convex calicinal surface. In the central region of the calicinal surface corallites are arranged close together and intercorallite grooves are faintly marked or absent, whilst towards the edge of the colony corallites are farther apart and have distinctly projecting rims ; in this region small costæ are occasionally present which are not related to septa. Costæ and septa are comparatively thick. Columella is weakly developed and there are no distinct paliform lobes. The nearest relative of this species is *Favia doreyensis*.

Distribution.—Arracan (1), known also from Tongatabou (Vaughan, after Dana).

5. **Favia speciosa** (Dana).

(Pl. 1, figs, 3, 5 and 8 ; pl. xi, fig. 3.)

1846. *Astræa speciosa*, Dana, *U. S. Expl. Exp. Zooph.*, p. 220, pl. 11, figs. 1, 1*a-d*.

1914. *Favia clouei*, Matthai, *Trans. Linn. Soc., London*, XVII, Part I, p. 89, pl. 10, fig. 6 ; pl. 23, figs. 1, 2 and 5 ; pl. 25, fig. 2 ; pl. 34, fig. 1.

1918. *Favia speciosa*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 103, pl. 36, figs. 1, 2, 2*a*, 3, 4, 4*a* ; pl. 37, figs. 1, 2, 3, 4, 4*a*.

I refer sixteen specimens to this species. In this species peritheca is vesicular hence corallum is light ; corallites have distinct margins which usually project above the calicinal surface ; septa are comparatively thin ; columella is feebly developed, being composed of thin trabeculæ ; corallites are comparatively wide apart, hence perithecal regions are distinct ; costæ are prominent, and corallites are wider towards their distal ends.

There seem to be two facies in the species, one in which the corallites are large (with longer diameter of calyx, about 14 mm.) and deep, and the other in which the corallites are small (with longer diameter of calyx, about 9 mm.). If the specimen be large, as in 3890/3 and Zev. 7328/7, both facies may occur in different regions.

The growth-form of the colonies is striking in as much as they gradually decrease in width from the base to the top. Zev. 7328/7 is the largest colony, measuring 25 cm. in height and 48 cm. × 35 cm. in diameter. 3890/3 from Padaw Bay is a large massive

specimen (height 23 cm., diameters 34 cm. × 31 cm.), with an evenly convex calicinal surface and corallites varying in sizes. 3640/3 appears to be a sub-fossil.

A specimen of *Favia valenciennesi* is attached to 2987/3. 2975/3 contains a small encrusting colony of *Favia valenciennesi* at the edge-region of the corallum, the margins of the coralla of the two species being in juxtaposition.

In Zev. 7345/7 (height 7 cm., diameters 7·5 cm. × 7·5 cm.), which is a more or less hemispherical colony, the corallites are large. 6204/3 (Padaw Bay) is a small colony in which the corallites, though few, are particularly large, the largest calyx being 19 cm. × 17 cm. in diameter and 11 cm. in depth; the specimen is labelled *Favia cavernosa*, although Duncan records the latter species from King Island Bay.

6468/4 (Padaw Bay) and 6470/4 (Mergui Archipelago) are labelled *Favia cavernosa* Forsk., although Duncan mentions the locality of this species as King Island Bay (p. 10). 3876/3, a small broken piece from Padaw Bay, is labelled *Favia rotulifera*, perhaps meant for *F. tubulifera*, which Duncan records from King Island Bay.

Distribution.—Mergui Archipelago, Padaw Bay (5); Pilai Island (1); Mergui Archipelago (2); Arracan (2); unknown locality (6).

Previously known from Maldives, Hulule; Minikoi; Chagos, Solomon; Egmont; Seychelles; Ceylon; Cocos-Keeling Islands; Red Sea.

According to Vaughan, known also from Great Barrier Reef; Amboina; Philippines: Fiji Islands; Fanning Island.

6. **Favia abdita** (Ellis and Solander).

(Pl. 1, fig. 9; pl. IV, fig. 2.)

1786. *Madrepora abdita*, Ellis and Solander, *Nat. Hist. Zooph.*, p. 162, pl. 50. fig. 2.

1914. *Favia abdita*, Matthai, *Trans. Linn. Soc., London*, XVII, Part I, p. 91, pl. 9, fig. 5; pl. 29, figs. 1-4; pl. 35, fig. 2.

1918. *Favites abdita*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 109, pl. 40, figs. 1, 2, 3, 4, 5; pl. 16, fig. 31.

Eleven specimens are referred to this species, most of which are large entire colonies, all showing the characteristic mode of growth (which is different from that of all other species of *Favia*), *i.e.*, corallum rising into sharp-ridged irregular hillocks, with oblique corallites whose corallite-walls are fused and the frequent presence of small corallites near the calicular margins of the large ones.

Two skeletal types are represented in the series, *viz.*, one in which the intercalicinal walls and septa are thin and columella openly spongy, and the other with thicker walls and septa and columella formed of closely twisted trabeculæ. Zev. 7339/7 is a good example of the former and 3417/3 of the latter.

The flat regions of coralla present more or less the same facies as the ridged examples of *F. halicora* in as much as the corallites are polygonal, costae toothed and an alternating ring of narrow septa present (as seen in 3894/3).

Zev. 7339/7 (height 20 cm., diameters 27 cm. × 24 cm.) is the most interesting specimen since the corallum has grown in the form of a cluster of laterally compressed branching hillocks. 6225/3 (Lampee Island) is the largest specimen (height 19 cm., diameters 28 cm. × 27 cm.) containing brown shells of a species of Vermetid Mollusc.

2998/3, 3865/3, 6225/3, 3417/3, 3593/3, 6050/3 are labelled *Prionastræa abdita*, although Duncan records the species from King Island Bay and Sullivan Islands.

Distribution.—Andamans (2); Mergui Archipelago, Lampee Island (4); Padaw Bay (1); Pilai Island (1); unknown locality (3).

Previously known from Maldives, Hulule, Addu, Goidu; Minikoi; Chagos, Solomon; Egmont; Ceylon; Singapore; Red Sea; Tongatabou; Fiji Islands; Amboina; Banda Island; Salawatti.

7. **Favia valenciennesi** (Milne Edwards and Haime).

(Pl. IV, fig. 1; pl. XI, fig. 2.)

1850. *Phymastrea valenciennesi*, Milne Edwards and Haime, *Ann. Sci. Nat., Zool.*, 3 sér., X, pl. 9, fig. 3; XII, p. 124.

1914. *Favia bertholleti*, Matthai, *Trans. Linn. Soc., London*, XVII, Part I, p. 94, pl. 7, fig. 2; pl. 22, fig. 7; pl. 23, figs. 4 and 6; pl. 24, fig. 1.

Eleven specimens are referred to this species, in which there are two principal types of skeleton: (1) in which the adjacent corallite-walls are fused, the intercalicinal walls thus formed being not more than 1 mm. in thickness, often thinner, over these the thin septa are continuous in arches; (2) in which coralla are comparatively thicker, the corallite-walls are distinct, separated on the surface by the intercorallite grooves at the margins of which the exsert ends of septa stop; septa are thicker and rougher. In the Indian Museum collection only the latter variety is represented.

Coralla present a characteristic appearance, owing to the presence of deep intercorallite grooves and the absence of costal prolongations over the intercorallite area.

Corallites are approximated to one another, so that the intercorallite grooves, though deeper than in any other species of *Favia*, are quite narrow. Intercorallite grooves are almost invariably polygonal.

The largest specimen is an entire colony (Zev. 7306/7), 22 cm. in height and 35 cm. × 28 cm. in diameter, the corallum being massive and heavy, and calicinal surface convex.

9468/6 from Mergui Archipelago is labelled *Phymastrea irregularis*, Duncan, although the latter is recorded by Duncan from King Island Bay (p. 12). *Phymastrea irregularis*, Duncan, like *Phymastrea aspera*, Quelch, does not seem to be specifically different from *F. valenciennesi*.

Distribution.—Mergui Archipelago (4); Padaw Bay (2); unknown locality (5).

Also known from Seychelles; Aldabra; Ceylon; Red Sea; Banda Islands.

8. **Favia pentagona** (Esper).

1797. *Madrepora pentagona*, Esper, *Pflanzenth. Fortsetz.*, p. 23, pl. 39, figs. 1 and 2.

1914. *Favia pentagona*, Matthai, *Trans. Linn. Soc., London*, XVII, Part I, p. 95, pl. 10, fig. 5; pl. 24, figs. 2-4; pl. 36, fig. 4.

1918. *Favites melicerum*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 112, pl. 41, figs. 6, 6*a*.

According to Vaughan *Astrea deformis*, Lamk., is identical with *Madrepora pentagona*, Esp., hence the specific name *pentagona*, which is inapplicable to the present species, should

be replaced by Ehrenberg's name *melicerum*. But the specific character of Esper's species cannot be definitely settled till the type-specimen has been re-examined.

Eight undoubted and three doubtful specimens are referred to this species. Examples of *F. pentagona* have a certain general resemblance to *Goniastrea* in the following respects:— (1) Corallites are polygonal, comparatively small, corallite-walls being fused, the intercalicinal partitions thus formed are ridged and solid in section; (2) total number of septa ranging between 20 and 30, of which 10-12 septa meet columella; (3) presence of a conspicuous ring of paliform lobes.

2997/3, 3649/3, 3862/3, 3658/3 have been labelled *Goniastrea;* but species of *Goniastrea* differ from those of *Favia* in their polyp anatomy, *viz.*, (1) the presence of more than 6 principal couples of mesenteries, (2) subsidiary couples more than three times (usually four or five times) the number of principal couples, (3) nematocysts IIc[1] usually arranged in rows in the coils of mesenterial filaments, (4) nematocysts III narrower and longer than in *Favia*. Zev. 7304/3 and 3583/3 are small fragments, the remaining specimens are all entire colonies.

Coralla in *F. pentagona* often tend to rise in low humps. But in 6463/4 the corallum is encrusting, intercalicinal walls are thicker and calices shallow. 3862/3 (Lampee Island) has been labelled *Goniastrea favus;* in addition to recording *Goniastrea favus* from Mergui Archipelago, Duncan also records a variety from the same locality.

3649/3 is typical, measuring 9 cm. in height and 15 cm. × 10·5 cm. in diameter. The corallum is massive, the calicinal surface being more or less evenly convex; intercalicinal walls are comparatively thin and the ring of paliform lobes is quite distinct.

In 3658/3 (Arracan) which is a massive specimen measuring 9·5 cm. in height and 26 cm. × 18·5 cm. in diameter calices are wider (8 mm. × 6 mm.) and deeper (7 mm.), the intercalicinal walls being thin.

3791/3 and 2957/3 possess several distomodæal and a few tristomodæal corallites and, on this account, resembles *Cœloria astrœiformis* Ed. and H., but since the prevailing condition is monostomodæal and since the corallites are similar to those of *F. pentagona*, I have referred the specimens to the latter species. There is a larger number of septa in Zev. 7310/7 which resembles *Cœloria stricta* except that the prevailing condition is monostomodæal.

Duncan (*Proc. Zool. Soc.*, 1883, p. 409) bases his new species *Phymastrea irregularis* on a specimen (4 cm. in height and 10 cm. in breadth) fixed on a shell of *Ostrea*, from shallow water from the West Coast of India. His text fig. 1 with deep intercorallite grooves corresponds to 2961/3 and 9468/6. Shells of two lamellibranchs (probably of *Ostrea*) are attached to the non-calicinal surface of 2961/3 as well. One of the special features of Duncan's *P. irregularis* seems to be the presence of deep intercorallite grooves. According to Duncan, *Phymastrea profundior*, Ed. and H., differs from *P. valenciennesi* in having deep and small calices, a smaller columella, fewer septa and slender junctions. I believe that these three species are identical, the relative quantity of intercorallite peritheca (or exotheca) being variable.

[1] *Vide* Matthai, "A Revision of the Recent colonial Astræidæ possessing Distinct Corallites," *Trans. Linn. Soc., London*, XVII, Part I, 1914, pp. 10 to 17.

2987/3 is an excellent example of the close association of two species of coral, *viz.*, *F. speciosa* (Dana) and *F. valenciennesi*, Ed. and H. An encrusting colony of *F. valenciennesi* (diameters 17 cm. × 10 cm.) had been growing on the edge-region of a massive colony of *F. speciosa* (Dana), with the result that the outer edge of the latter and the inner edge of the former came in intimate contact. The combined mass measures 10·5 cm. in height and 20 cm. × 17·5 cm. in diameter. The specimen of *F. speciosa* itself had been growing on a piece of rock. Attached to the lower surface of the *F. speciosa* is a large bivalve mollusc.

Distribution.—Mergui Archipelago, Lampee Island (1); Pilai Island (1); Padaw Bay (1); Arracan (2); without locality (3).

Previously known from Maldives, Hulule, Addu, Suvadiva (25 fms.); Minikoi; Seychelles; Saya de Malha (29 fms.); Cargados (30 fms.); Chagos, Solomon (16 fms.); Providence (29 fms.); Red Sea.

9. **Favia versipora** (Lamarck).

(Pl. II, fig. 1; Pl. IV, fig. 4.)

1816. *Astrea versipora*, Lamarck, *Hist. Nat. Anim. sans Vert.*, II, p. 264; 2nd edit., p. 414.
1914. *Favia versipora*, Matthai, *Trans. Linn. Soc., London*, XVII, Part I, p. 103, pl. 23, fig. 3; pl. 25, figs. 5, 6 and 9; pl. 37, fig. 3.
1918. *Orbicella versipora*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 85, fig. 1.

One large entire colony from Padaw Bay has been referred to this species. This is placed on a stand on which is written *Plesiastræa peroni*, Ed. and H. Duncan records a variety of *Plesiastræa indurata* from King Island Bay, which is the only record of *Plesiastræa* made by Duncan.

This specimen is 4·5 cm. in height, 55 cm. long and 22 cm. broad. The corallum is somewhat bent in the middle in the form of an open horizontal V, the calicinal surface is somewhat convex, whilst the non-calicinal surface is somewhat hollowed in. On the calicinal surface are also many calcareous tubes of polyzhæte worms, several of these tubes have been covered over by a thin layer of corallum. This is clear indication that the colony had been a vigorously growing one, showing no sign of local death where the tubes had been formed by the worms. The soft parts had grown under to a distance of 3·5 cm. The colony is the largest of the species that I have examined till now. Corallum, though thin, is compact. A few giant corallite measuring 4 mm. × 3 mm. in width are present here and there, with up to 49 septa, 20 of which meeting the columella. Extra-tentacular budding seems to be the rule. On the non-calicinal surface of this specimen are several kinds of polyzoa, cirripedes and calcareous tubes of polychætes.

Corallite-rims are exsert, hence distinct, separated by the intercorallite grooves, and a ring of pali is present. The circular or oval corallites simulate the appearance of hexameral genera like *Leptastrea*, no hexameral symmetry has been noted in the polyps.

Distribution.—Mergui Archipelago (1).

Previously known from Maldives, Goidu; Minikoi; Seychelles; chagos, Solomon; Rotuma; Australia; Vanikoro Islands.

Vaughan records this species from Cocos-Keeling Islands.

10. **Favia halicora** (Ehrenberg).

(Pl. 1, figs. 4, 6.)

1834. *Astræa halicora*, Ehrenberg, *Corall. roth. Meer.* p. 96 (non *Prionastræa halicora*, Milne Edwards and Haime).

1914. *Favia halicora*, Matthai, *Trans. Linn. Soc., London*, XVII, Part I, p. 106, pl. 26, figs. 3 and 5-7.

1918. *Favites halicora*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 110, pl. 41, figs. 1-3.

Six specimens—all entire colonies—have been referred to this species. As I have previously noted there are two principal skeletal facies, (1) in which corallite-walls are fused intercalicinal partitions thin, polygonal, without intercorallite grooves, (2) in which corallites are oval or circular, thick-walled, with distinct inter-corallite furrows. All the six specimens in the Indian Museum belong to facies (1).

3425/3 (height 12·5 cm., diameters 19 cm. × 11 cm.) is almost typical of facies (1) in which corallites are polygonal, exsert ends of septa are continuous over corallite-walls; owing to the conspicuous dentation on the exsert ends of septa, calcinal surface has a spinous appearance, subsidiary septa often curve towards and fuse with sides of principal septa, an alternating ring of very narrow septa is present. Towards the edge of 3424/3 the intercalicinal partitions are thicker and the exsert ends of septa meet in notches so that an appearance of narrow shallow grooves is produced, calices being shallow. 3424/3 and 3429/3 are almost equal in size, being the largest colonies in the series. 3429/3 is an almost hemispherical corallum measuring 15 cm. in height and 18 cm. × 17 cm. in diameter, with an evenly convex calicinal surface. Towards one side of the calicinal surface is a deep burrow containing a bivalve mollusc. 6474/4 from Mergui Archipelago (height 7 cm., diameters 12·5 cm. × 10 cm.) is wrongly labelled *Goniastrea halicora* Ehrb.[1] Nearly one half of the calicinal surface of the specimen is dead. The intercalicinal walls are quite thin. It has all the essential features of *Favia halicora* except that the exsert ends of septa are not conspicuously toothed, hence lacking in spinous appearance. 3428/3 (Andamans) is a large rounded massive colony 16 cm. in height and 16 cm. × 15 cm. in diameter. This specimen is especially interesting since it has thin inter-calicinal wallsover the greater part of the calicinal surface. Towards the edge of the colony the walls vary in thickness, calices here become circular or oval, with shallow inter-calicinal grooves, and an alternating cycle of thin costæ are present over the walls. Thus in the same colony both facies are represented.

Distribution.—Andamans (4); Mergui Archipelago (1); Arracan (1).

Also from Maldives, Hulule, Goidu, Turadu; Minikoi; Chagos, Solomon; Aldabra; Peros, Diamant (15 fms.); Ceylon; Singapore; Red Sea.

Vaughan records this species from Murray Island and Fanning Island.

[1] Duncan has recorded *G. halicora* from King Island Bay (p. 11).

11. **Favia vasta** (Klunzinger).

(Pl. I, fig. 7 ; pl. XI, fig. 1.)

1879. *Prionastræa vasta*, Klunzinger, Korall. *Roth. Meer*, III, p. 38, pl. 4, figs. 8 and 12 ; pl. 10, figs. 4*a* and *b*.

1914. *Favia vasta*, Matthai, *Trans. Linn. Soc., London*, XVII, Part I, p. 108, pl. 27, figs. 3, 5 and 6.

1918. *Favites virens*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 111, pl. 16, fig. 28 ; pl. 41, figs. 4 and 5.

One large massive colony (30 cm. in height and 40 cm. × 40 cm. in diameter) with heavy corallum is referred to this species. Calicinal surface is evenly convex, being somewhat damaged.

It resembles Klunzinger's Pl. IV, fig. 2 of *Goniastræa halicora*, var. *obtusa*, the calices being smaller (about 15 mm. × 10 mm. in diameter and 8 or 9 mm. in depth) than in the normal type, the inter-calicinal partitions thinner and sharp ridged. Corallites are pentagonal or hexagonal. Inter-calicinal partitions are 1 or 1·5 mm. in thickness. The largest calyx is 20 mm. × 14 mm. in diameter. Lower one-third of septa is broader than upper two-thirds and simulate a pali-crown. Septal margins are finely dentate. An alternating cycle of narrow septa, though present, is not so conspicuous as is usually the case. Subsidiary septa curve towards and fuse with sides of principal septa, 1 to 4 of the former meeting one of the latter.

Distribution.—Single specimen in the Indian Museum from unknown locality.

Also from Chagos, Solomon ; Egmont ; Aldabra ; Red Sea.

Vaughan records this species from Murray Island ; Philippine Islands ; Fiji Island.

12. **Favia favosa** (Ellis and Solandar).

(Pl. 1, fig. 1 ; Pl. 2, figs. 2, 3, 7, 8 and 9.)

1786. *Favia favosa*, Ellis and Solander, *Nat. Hist. Zooph.*, p. 167, pl. 50, fig. 1.

1914. *Favia favosa*, Matthai, *Trans. Linn. Soc., London*, XVII, Part I, p. 112, pl. 28, fig. 2.

Thirteen specimens are referred to this species, of which all except 4 (Zev. 7327/7, Zev. 7265/7, 3698/3 and Zev. 7264/7) are entire colonies. Three principal facies are represented in the series :—

(1) Large calices, corallite-walls fused, inter-calicinal partitions without grooves though fairly thick, *e.g.*, Zev. 7336/7, 3418/3, 2964/3, 3421/3, 6286/3, Zev. 7269/7, Zev. 7327/7, Zev. 7265/7, 3698/3, Zev. 7264/7. Ellis and Solander's Pl. 50, fig. 1 of *Madrepora favosa* agrees with this facies.

(2) Calices nearly as large as in (1), inter-calicinal partitions thicker and grooved above, *e.g.*, Zev. 7329/7.

(3) Calices smaller than in (1) and (2), inter-calicinal partitions less thick, with or without grooves, *e.g.*, 6043/3, 3420/3.

The principal characters of the three facies are as follows :—

Facies 1.—Zev. 7336/7 is the largest example measuring 13 cm. in height and 36 cm. × 24 cm. in diameter. The corallum is comparatively light, corallites are polygonal, the

calices being about 18 mm. × 13 mm. in diameter and 11 mm. in depth, largest calyx measuring 25 mm. × 17 mm. in diameter. Inter-calicinal partitions are about 4 mm. thick. Number of septa varies up to about 50 (average about 40) of which about 18 meet columella. Some of the broader subsidiary septa meet principal septa near to where the latter join the columella. Inner margins of septa are finely dentate, lower one-third of septa is somewhat broader. In some calices the lower broader region of septa tend to simulate a pali-crown. Sides of septa are spinulose ; septa are exsert to 1 or 1·5 mm. Exsert ends of septa of adjacent corallites meet at obtuse angles over the inter-calicinal partitions. Columella are well developed in most of the corallites, about $\frac{1}{4}$ width of calices and composed of closely twisted septal trabeculæ. Towards the edge of the corallum columella is poorly developed, consisting of a few loosely inter-locking septal trabeculæ.

The soft parts are deflected beneath the edge of the corallum to a distance of 4·5 cm., the hard parts in this edge-region being vesicular and with thin low costal ridges about 2 mm. apart. Endothecal dissepiments are about 2 mm. apart.

In the specimen from the Red Sea that I referred to *F. favosa* in 1914 the inter-calicinal walls are flat and slightly grooved above and the exsert ends of septa are connected along the middle of wall by a thin ridge.

Zev. 7269/7 is the smallest colony (somewhat broken) attached to a piece of stone and measuring 8·5 cm. in length, 7 cm. in breadth and 2 cm. in thickness. The arched exothecal dissepiments are about 1·5 mm. apart. In several corallites of Zev. 7327/7, rough tubercular growths are present on the septal sides filling up the interseptal spaces. This is probably a pathological condition. In 6286/3 the greater part of the calicinal surface is dead, corallites are shallow, columella is rudimentary and inter-calicinal partitions are swollen to about 10 mm. in thickness. This colony is 9 cm. in height and 19·5 cm. × 17 cm. in diameter.

Facies 2.—Zev. 7329/7 is the only representative of this facies. It is an entire colony 14 cm. in height and 29 cm. × 27 cm. in diameter. The corallum is heavy, calicinal surface is evenly convex, under surface somewhat concave to which are attached five oyster shells. Inter-calicinal partitions are up to 8 or 9 cm. thick and grooved above, average thickness being about the same as in Zev. 7336/7. The grooves are conspicuous owing to the exsert ends of septa of adjacent corallites forming series of arches on each side of the groove, *i.e.*, the exsert ends of septa, instead of becoming continuous as in Zev. 7336/7, end off in the form of arches on each side of the inter-calicinal groove making the latter conspicuous. The lower broader region of septa are usually indentated, there being usually 2 or 3 long teeth, the last septal teeth in the corallite tending to form a pali-crown. Septa are thickened where they meet the corallite-wall (there is hardly any such thickening in Zev. 7336/7).

The chief points to note in this specimen are (1) heavy corallum, (2) conspicuous grooves on inter-calicinal partitions, (3) exsert ends not continuous over walls, (4) 2 or 3 long teeth on lower one-third of septa.

Facies 3.—6043/3 (Mergui) is the largest colony of *Favia favosa* in the Indian Museum, measuring 12 cm. in height and 41 cm. × 33 cm. in diameter. Inter-calicinal partitions 2 to 2·5 mm. thick, grooved above, but grooves are less conspicuous than in facies 2 (Zev. 7329/7). Calices are about 12 mm. × 8 mm. in diameter and 7 or 8 mm. in depth. Exsert ends

of septa end-off on each side of the inter-calicinal groove or sometimes meet in notches. Total number of septa is usually not more than 40 (average about 25) of which about 16 meeting columella. The broader lower one-third of septa are hardly incised to form long teeth as in Zev. 7336/7 and Zev. 7329/7.

The specimen resembles *Favia hemprichii* (Ehrb.) in the penta- or hexagonal shape of the corallites, size of calices, number of septa, appearance of furrows on inter-calicinal walls. But septal margins are devoid of conspicuous teeth, whilst, owing to the presence of prominent septal teeth in *F hemprichii*, coralla have a conspicuous spiny appearance. The septa are also much thicker in *F. hemprichii*.

It will be noticed that facies 3 is intermediate between facies (1) and (2) in the possession of narrow, shallow grooves on inter-calicinal walls.

2964/3 (Padaw Bay) and 3421/3 (Mergui) bear the names *Prionastræa vasta*; Duncan's record of the latter species being from King Island Bay. These are typical examples of facies 1. 3421/3 is a large colony 16 cm. in height and 21 cm. × 21 cm. in diameter; at the edge of this colony is a small incrusting corallum of *F. valenciennesii*, 5 cm. × 4 cm. in diameter.

Distribution.—Mergui Archipelago (4); Padaw Bay (3); unknown locality (6).

Also known from Chagos; Aldabra; Red Sea.

Genus **GONIASTREA** (Milne Edwards and Haime).

1849. *Goniastræa* (pars), Milne Edwards and Haime, *Compt. rend. Acad. Sci.*, XXVII, p. 495.
1914. *Goniastrea*, Matthai, *Trans. Linn. Soc., London*, XVII, Part I, p. 115.
1918. *Goniastrea*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 113.

1. **Goniastrea retiformis** (Lamarck).

(Pl. IV, fig. 3.)

1816. *Astrea retiformis*, Lamarck, *Hist. Nat. Anim. sans Vert.* II, p. 265, 2nd edit., p. 415.
1914. *Goniastrea retiformis*, Matthai, *Trans. Linn. Soc., London*, XVII, Part I, p. 118, pl. 10, fig. 3; pl. 31, figs. 1-5; pl. 33, fig. 3; pl. 38, figs. 2 and 4.
1918. *Goniastrea retiformis*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 114, pl. 15, fig. 24; pl. 16, fig. 25.

Eleven specimens are referred to this well-known species. They are all entire colonies with the exception of two fragments, *viz.*, 3227/3 (Lampee Id.) and 3221/3 (without locality). In the case of most of the colonies calicinal surface of corallum rises up in several blunt humps. Six of the colonies are large, the largest measuring 25 cm. in height and 42 cm. × 33 cm. in diameter.

Distribution.—Mergui Archipelago, Lampee Island (3); Pilai Island (1); Padaw Bay (1); Mergui Archipelago (3); unknown locality (3).

Previously known from Maldives, Hulule, Goidu; Minikoi; Seychelles; Aldabra; Ceylon; Singapore; Red Sea; Rotuma; Great Barrier Reef; Amboina; Philippine Islands; Fiji Islands, Wake Island.

2. **Goniastrea incrustans** Duncan.

(Pl. II, fig. 4 ; Pl. XI, fig. 4.)

1889. *Goniastrea incrustans*, Duncan, *Journ. Linn. Soc., London, Zool.*, XXI, p.11, pl. 1, figs. 19 and 20.

9469/6 named *Goniastrea incrustans*, from Mergui Archipelago, agrees entirely with the description of the species given by Duncan :—

" The colony is large, swollen and gibbous above, and has a thin edge, where an epitheca of a basal nature is seen. Encrusting old corals and parts of dead individuals of the same species. Calices very variable in shape and size, generally irregularly hexagonal, often elongate, and some are more simple than hexagonal, with a large crown of pali. Shallow as a rule, but many are deep ; united to the neighbouring corallites by sharp ridges at the surface or by decidedly broad ones ; in some parts there is a delicate line or furrow on the broad ridge over which the septa do not pass. Septa extremely variable in number, but the complete fifth cycle is not present. The distinction between the cycles is not possible, and the long and larger are separated by smaller and shorter septa ; hence the arrangement is alternate, and this is found in small calices as well as in large. The septa are rather crowded, alternately large and small, and project but slightly from the wall, are straight, and sharply and minutely granular at the free edge. The pali form a very large crown, and encircle a deep and small columellary space ; they are before nearly all the longer septa, and are often broader and higher than the septal ends, and are boldly arched and minutely granular. As the septal number of neighbouring calices is never the same, so the size of the crown of pali varies greatly. In some large calices where there are forty-eight septa the pali are before the large twenty-four septa, and then it may occur that those opposite the tertiaries are smaller than the others and bend towards them. But this arrangement does not always occur. Size of the calices has not everything to do with the dimensions of the crown of pali, for neighbouring calices exist of the same size, and in one there are not so many septa as the size would appear to warrant and the pali are diminished in number. In some recently formed corallites the septa are slender and there are no pali ; these occur near the margin of the colony. Fissiparous division occurs, and it is evident that it is the usual method of increase, but gemmation from the basal epitheca seems to happen. Columella deeply seated and very small.

Length of the colony 24 centim. breadth 14 ; height of the encrusting mass less than 10 millim. Diameter of calices from 3 millim. with forty septa, 5 millim. of the same septal number, 8 millim. with fifty-six septa. Locality, Mergui Archipelago" (pp. 11 and 12).

Again " *Goniastræa incrustans* is a new species, and it shows how necessary it is to study the variations of every part of a colony in order to diagnose a species properly. It is evident, after an examination of the whole of the specimen which is the type, that were it broken up and fossilized two or three species and a new genus might be made out of it. The interesting point is the absence of the large crown of pali in some few corallites and the thickness of the fused wall of others, some resembling species of *Favia*" (p. 22).

The distinguishing features of this specimen are as follows :—

(1) Comparatively large calices, average diameter 8 cm. × 6 cm., (2) a conspicuous ring of broad paliform lobes which are about 1 mm. broad, septa being deeply notched

behind the paliform lobes, (3) total number of septa about 25, most if not all, bearing paliform lobes; 13-16 septa meeting columella. The broader subsidiary septa curve towards and meet principal septa in groups of 1 to 4 as in *Favia halicora.*

Columella is composed of closely twisted trabeculæ closely surrounded by the palicrown. Towards the edge of the colony inter-calicinal partitions thicken up to 4 mm., occasionally inter-corallite grooves are present. Owing to the presence of an alternating cycle of narrow septa and costæ, the corallum present an appearance somewhat like that of *Favia halicora.*

Calices are nearly as wide as those of *G. pectinata* but are much shallower, being not more than 3 mm. deep and paliform lobes are more conspicuous than in the latter species. Further, there is no tendency for the corallites to meander. Duncan's pl. I, fig. 19 is the calicinal view of part of the corallum (nat. size); fig. 20 is a magnified view of a calyx.

A small colony (3874/3 from Padaw Bay) measuring 5·5 cm. in height and 10·5 cm. × 8·5 cm. in diameter is labelled *Goniastrea halicora.* This specimen agrees with 9469/6 in the thinness of inter-corallite partitions, number of septa meeting columella, presence of a ring of broad paliform lobes and of an alternating cycle of very narrow septa, but has somewhat larger and deeper calices.

3870/3, from Mergui, which has been labelled *Goniastrea bournoni* appears to have essentially the same skeletal features as 3874/3, the calices being larger than in *G. bournoni,* Ed. and H. 3871/3 (Padaw Bay), named *Goniastrea bournoni,* resembles 9469/6. In 2991/3 (an entire colony from Padaw Bay, 9 cm. in height, 13 cm. in length and 9 cm. in breadth) the calices are deeper than in 9469/6, being about 4 mm.

Bedot's figure of *Goniastrea Quoyi* (pl. 28, fig. 142) somewhat resembles *Goniastrea incrustans.*

Distribution.—Mergui Archipelago (2); Padaw Bay (3).

Genus **CŒLORIA** Milne Edwards & Haime.

1848. *Cœloria,* Milne Edwards and Haime, *Compt. rend. Acad. Sci.,* XXVII, p. 493.
1905. *Cœloria,* Gardiner, *Fauna Geogr. Maldive and Laccadive Archipel.,* p. 761.

1. **Cœloria dædalea** (Ellis and Solander).

(Pl. III, fig. 1., Pl. V, fig. 3).

1786. *Madrepora dædalea,* Ellis and Solander, *Nat. Hist. Zooph.,* p. 163, pl. 46, figs. 1 and 2.
1857. *Cœloria dædalea,* Milne Edwards and Haime, *Hist. Nat. Corall.,* II, p. 416.
1918. *Mœandra dædalea,* Vaughan, *Papers Dep. Marine Biol., Washington,* IX., p. 119, pl. 14, fig. 20; pl. 44, figs. 3, 3a; pl. 45, fig. 1.

Thirteen entire colonies are referred to this well-known species. Of these, 3650/3 is a worn specimen. Zev. 7291/7 (without locality), 3659/3 (Arracan), Zev. 7335/7 (Kilikarai, Gulf of Manaar) and Zev. 7351/7 (Kilikarai, Gulf of Manar) are large massive and heavy colonies.

According to Milne Edwards and Haime *C. dædalea, C. sinensis, C. stricta* and *C. astræiformis* have short valleys (" les séries calicinales courtes "), but in these specimens there is considerable variation in the length of valleys, *e.g.*, in 2990/3 and 3697/3 valleys are quite short, whilst in 3641/3 and 3655/3 valleys are comparatively long and sinuous. 3652/3 is

intermediate between the two lots in regard to the length of the valleys. In the four large massive colonies referred to above valleys are of varying length. Valleys are mostly sinuous. Small groups of straight valleys are seen on the calicinal surface of the four large massive colonies as well as in 3616/3.

Deep tubular burrows containing lamellibranch shells are present in several coralla. The calicinal surface of this species is usually evenly convex, but tend to become humpy when these tubular burrows are present. This humpy character is well seen in Zev. 7335/7 (height 30 cm., length 40 cm., and breadth 33 cm.), in which there are about 20 such tubular burrows. Valleys present a stellate arrangement around the mouths of these tubular burrows. Zev. 7291/7 has an evenly curved calicinal surface except in the central region, where it is depressed and possesses two deep burrows. In 2990/3 (Padaw Bay), with short valleys, collines are swollen to 2·5 mm. or 3 mm., whilst in 3691/3 collines are quite thin.

In *C. dædalea* valleys tend to become circumscribed into single corallites in narrow depressions of calicinal surface.

Distribution.—Arracan (5); Mergui Archipelago, Padaw Bay (1); Lampee Island (1); Andamans (1); Rameswaram Island, Gulf of Manaar (2); unknown locality (3).

Also from Maldives (Gardiner); Rotuma (Gardiner); Paumotus, Fakarava (Vaughan); Fiji Islands (Dana).

2. **Cœloria sinensis** Milne Edwards and Haime.

1857. *Cœloria sinensis*, Milne Edwards and Haime, *Hist. Nat. Corall.*, II, p. 416.

I refer seven entire colonies to this species, of which Zev. 7268/7, Zev. 7355/7, 6479/4 and 3618/3 are small. According to Milne Edwards and Haime, *C. sinensis* differs from *C. dædalea* in having extremely thin collines and very short valleys. Deep tubular burrows formed by bivalve molluscs are seen in coralla of this species as well, causing humpy growth of calicinal surface. Opening on the calicinal surface of 3896/3, which is the largest specimen in the Museum (height 14 cm., diameters 26 cm. × 23 cm.), over 20 such burrows are seen in the specimen, some of which pass through the entire thickness of the corallum, hence the corallum is quite light.

This species may ultimately have to be merged with *C. dædalea* as a facies with light corallum and short valleys. In both species collines are perforated.

Distribution.—Andamans (1); Mergui Archipelago (1); Padaw Bay (1); Unknown locality (4).

Also known from Minikoi and Maldives (Gardiner); China Sea (Milne Edwards and Haime); Funafuti (Gardiner).

3. **Cœloria forskælana** Milne Edwards and Haime.

1849. *Cœloria forskaliana*, Milne Edwards and Haime, *Ann. des Sci. Nat.*, 3e sér., IX, p. 296.
1857. *Cœloria forskœlana*, Milne Edwards and Haime, *Hist. Nat. Corall.*, II, p. 414.

I refer to this species two specimens one of which is a large massive colony (Red Sea, height 20 cm., diameters 25 cm. × 24 cm.) in which the columella is fairly well developed, but in other respects agreeing with Milne Edwards and Haime's description of *C. forskœlana*. Opening on the calicinal surface are three or four deep tubular burrows. On one side of the corallum is a shallow depression with star-shaped arrangement of valleys.

Distribution.—Red Sea (1) ; Moscos Island, off Burma Coast (1).

Previously known only from the Red Sea.

4. **Cœloria bottai** Milne Edwards and Haime.

1849. *Cœloria bottæ*, Milne Edwards and Haime, *Ann. des Sci. Nat.*, 3e, sér., XI, p. 295.

1857. *Cœloria bottai*, Milne Edwards and Haime, *Hist. Nat. Corall.*, II, p. 414.

I refer three colonies to this species, of which the largest (Zev. 7341/7, without locality) is 13·5 cm. in height and 12 cm.×11·5 cm. in diameter. The remaining two specimens are quite small colonies.

Distribution.—Red Sea (1) ; Unknown locality (2). Known only from the Red Sea.

5. **Cœloria lamellina** (Ehrenberg).

1834. *Platygyra lamellina*, Ehrenberg, *Korall. Roth. Meer.*, p. 99.

1851. *Cœloria lamellina*, Milne Edwards and Haime, *Pol. foss. des terr. palæoz.*, p. 93.

1918. *Mœandra lamellina*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX., p. 119, pl. 45, figs. 2, 2a.

I refer one large massive colony (Zev. 7290/7, without locality, height 20·5 cm., diameters 30 cm.×25 cm.) to this species. Towards one side of the corallum is a deep burrow opening on the calicinal surface ; on the non-calicinal surface also are some tubular burrows.

According to Klunzinger (1879) *C. forskœlana, C. bottai and C. lamellina* are skeletal varieties of the same species, *viz.*, *F. C. arabica* with which he has also merged *C. labyrinthiformis* and *C. subdentata.* These species are abundant in the Red Sea and form large growing heads. The valleys in these species are long, usually sinuous, tending to become straight on parts of the corallum, and collines are not usually perforated, whilst in *C. dœdalea* and *C. sinensis*, valleys are comparatively short and collines are perforated.

Distribution.—Unknown locality (1).

Vaughan mentions the following localities :—Red Sea ; Indian Ocean ; Murray Island ; Southern Philippine Islands ; Samoa ; Wake Island ; Fanning Island.

6. **Cœloria stricta** Milne Edwards and Haime.

1857. *Cœloria stricta*, Milne Edwards and Haime, *Hist. Nat. Corall.*, II, p. 417.

1918. *Mœandra stricta*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 120, pl. 45, figs. 3, 3a.

I refer three colonies to this species. They are more or less hemispherical, with evenly convex calicinal surface. 3423/3 is the largest of the three measuring 11 cm. in height and 15·5 cm.×13·5 cm. in diameter. Towards the edge of the colony is a deep tubular burrow containing a bivalve shell. There are several single corallites. The polystomodæal condition seems to be dominant although the valleys are quite short, the longest valley being 17 mm. in length. Valleys are narrower (4—5 mm. in width) than in all other examples of *Cœloria* in the Indian Museum collection. In single corallites of these three specimens there are 16 to 18 septa most of which meet the columella.

This species can be easily distinguished from *C. astrœiformis*, Ed. and H., by the larger number of septa (16—19 in 1 cm.) most of which meet the columella, whilst in the latter species there are only 10 septa in 1 cm.

Distribution.—Andamans (2) ; Mergui Archipelago, Padaw Bay (1).

Also known from Straits of Malacca (Milne Edwards and Haime) ; Southern Philippine Islands and Torres Strait (Vaughan).

7. **Cœloria astræiformis** Milne Edwards and Haime.

(Pl. V., fig. 4.)

1857. *Cœloria astræiformis*, Milne Edwards and Haime, *Hist. Nat. Corall.*, II, p. 417.

1899. *Cœloria astræiformis*, Gardiner, *Proc. Zool. Soc., London*, p. 743, pl. 46, fig. 4.

1918. *Mœandra astreiformis*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 120, pl. 14, fig. 19.

Eight entire specimens are referred to this species, most of which agree with Milne Edwards and Haime's description of the species. It is, however, doubtful whether this species is to be placed in the Genus *Cœloria* or in *Favia*, since half the number or more of the corallites are monostomodæal, the remaining ones are mostly distomodæal, and a few being tristomodæal. Transverse partitions in process of formation are seen in the distomodæal and tristomodæal corallites.

These specimens resemble *F. pentagona* in size and shape of single corallites, number of septa and nature of columella ; the calicinal surface is also usually irregular owing to the corallum rising up in the form of humps, but in typical examples of *F pentagona* most of the corallites are single, distomodæal ones being rare.

3413/3 (Padaw Bay) is the largest colony in the Indian Museum, being 22 cm. in height and 25 cm. × 25 cm. in diameter. Zev. 7357/7 is a small incrusting colony, with thick collines, thick septa, growing on a young shell of the large Lamellibranch *Tridacna*.

Distribution.—Mergui Archipelago, Pilai Islands (1) ; unknown locality (7).

Previously recorded by Milne Edwards and Haime from the Red Sea, and by Gardiner from Funafuti and Wakaya, Fiji Islands.

Genus **LEPTORIA** Milne Edwards and Haime.

1848. *Leptoria*, Milne Edwards and Haime, *Compt. rend. Acad. Sci.*, XXVII, p. 493.

1918. *Leptoria*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 117.

1. **Leptoria phrygia** (Ellis and Solander).

1786. *Madrepora phrygia*, Ellis and Solander, *Nat. Hist. Zooph.*, p. 162, pl. 48, fig. 2.

1849. *Leptoria phrygia*, Milne Edwards and Haime, *Ann. des Sci. Nat.*, 3e sér., XI, p. 292.

1918. *Leptoria phrygia, Vaughan, Papers Dep. Marine Biol., Washington*, IX, p. 117, pl. 45, figs. 4 and 5 ; pl. 46, fig. 1.

Three small specimens (without locality) are referred to this species, one of which is a broken fragment. 3013/3 (without locality) is a rounded colony 7·5 cm. in height and 7 cm. × 7 cm. in diameter.

Further study may show that *L. tenuis* and *L. gracilis* are only skeletal facies of *L. phrygia*.

Distribution.—Mergui Archipelago (1) ; Unknown locality (2).

According to Vaughan previous records have been from Cocos-Keeling Islands; Ceylon; Southern Philippine Islands.

Lamarck originally recorded the species from the Indian and Pacific Oceans.

Genus **MANICINA** Ehrenberg.

1834. *Manicina* (pars) Ehrenberg, *Korall. des roth. Meer.*, p. 101.

1. **Manicina areolata** (Linnæus).

1760. *Madrepora areolata*, Linnæus, *Syst. Nat.*, ed. 10, p. 795.

1841. *Manicina areolata*, Leuckart, *Zooph. Corall. et speciatim de genere Fungia*, pl. 3, figs. 3 and 4.

I refer to this well-known Atlantic species one entire colony (3690/3).

Distribution.—Single specimen in Indian Museum without locality.

Known only from the West Indies.

Genus **TRACHYPHYLLIA** Milne Edwards and Haime.

1848. *Trachyphyllia*, Milne Edwards and Haime, *Compt. rend. Acad. Sci.*, XXVII, p. 492.

The skeletal facies of this genus is comparable to the Atlantic genus, *Manicina*, having the same type of septal costæ and columellar texture. But while in *Trachyphyllia* there are distinct columellar centres, in *Manicina* columella extends throughout the valley as a trabecular plate. Verrill's genus *Callogyra* agrees with *Trachyphyllia* in every respect except that, in the former, the walls are fused.

1. **Trachyphyllia amarantum** (Dana).

(Pl. V, fig. 2.)

1846. *Manicina amarantum*, Dana, *U. S. Expl. Exp. Zooph.*, p. 189, pl. 9, fig. 1.

1849. *Trachyphyllia amarantum*, Milne Edwards and Haime, *Ann. des sci. Nat.*, 3e sér., XI, p. 275.

Thirteen entire colonies are referred to this well-known species. The valley is deep, continuous and sinuous. Columellar centres are well formed, consisting of interlocking septal trabeculæ, the lower one-third of septa is broader than the upper two-thirds, hence there is an appearance of broad paliform lobes around columellar centres; septal margins are finely dentate; exsert ends of septa are evenly curved and continued down the outer surface of the corallum as finely toothed ridges extending to base of corallum. The calicinal surface is evenly convex, the non-calicinal surface narrowing towards the central peduncle of attachment. Colonies grow to about the same size, as in the Genus *Manicina*.

4237/4 is the largest colony (Eastern Achipelago, Macassar Strait, height 7 cm, diameters 13 cm.×11 cm.). Zev 7324/7 (without locality, height, 5 cm, diameters 7·5 cm. × 6 cm.) has a single columellar centre; the calicinal wall is constricted in the middle, hence the specimen presents the same facies as in *Antillia constricta* Brugg. (*Ann. Mag. Nat. Hist.*, Ser. 4, XX, p. 309, 1877). Epitheca covers the outer surface from the base to a height of about 3 cm. Zev 7419/7 (Moscos Island, diameters 5 cm.×3·5 cm., height 3 cm.) is a single corallite slightly constricted in the middle and resembling *A. constricta*.

A. constricta may probably be a young stage of *T amarantum*, although Brüeggemann regarded the former as specifically different from the latter. According to that author the

young *Trachyphyllia* " begin to divide at a very early period, and exhibit the same irregular plications as the adult ; they have also no trace of an epitheca. On the contrary, all the numerous specimens of A. *geoffroyi*, before me, are quite simple, without any inclination to divide. The animals (preserved in spirit) show constantly a single mouth however elongate the calicle may be ; the epitheca is always present and neatly defined, although less extensive in the young " (*Ann. Mag. Nat. Hist.*, ser. 4, Vol. XX, p. 309, 1877). The usual growth-form of the valley is that of a long median portion becoming continuous at each end with a somewhat shorter transverse portion.

Distribution.—Moscos Island, off Burma coast (1) ; Macassar Strait, Malay Archipelago (4) ; Singapore (1) ; unknown locality (7).

Previously known from China Sea (Milne Edwards and Haime).

Genus **HYDNOPHORA** Fischer de Waldheim.

1807. *Hydnophora*, Fischer de Waldheim, *Mus. Damidoff.* III, p. 295.

1857. *Hydnophora*, Milne Edwards and Haime, *Hist. Nat. Corall.*, II, p. 418.

1. **Hydnophora exesa** (Pallas).

(Pl. V, fig. 6).

1766. *Madrepora exesa*, Pallas, *Elench. Zooph.*, p. 290.

1849. *Hydnophora exesa*, Milne Edwards and Haime, *Ann. des Sci. Nat.*, 3e sér., XI, p. 300.

1918. *Hydnophora exesa*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 121, pl. 47, figs. 2, 2a ; pl. 48, fig. 1.

Ten entire colonies and one broken hump are referred to this species ; of these Zev 7332/7 (without locality, diameters 28 cm.×24 cm., greatest height of hillock 16 cm.) is the largest.

Irregular branching hillocks arising from a thin somewhat concavo-convex basal portion, short discontinuous collines in addition to monticules, are features distinguishing *H. exesa* from *H. microconos*.

Corallum is light, in which tubular burrows usually occur. Attachment seems to be effected by the central region of the non-calicinal surface, towards which thin costal ridges radiate from the periphery.

Distribution.—Mergui (1) ; Malay Archipelago (1) ; Arracan (1) ; Nicobar Islands (1) ; Unknown locality (6).

Vaughan mentions the localities as follows :—Red Sea ; Indian Ocean ; Murray Island ; Amboina ; Southern Philippines ; Funafuti.

2. **Hydnophora microconos** (Lamarck).

1816. *Monticularia microconos*, *Lamarck*, *Hist. Nat. des Anim. sans Vert.*, II, p. 251, 2nd edit., p. 393.

1849. *Hydnophora microconos*, Milne Edwards and Haime, *Ann. des Sci. Nat.*, 3e sér., XI, p. 302.

1918. *Hydnophora microconos*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 122, pl. 18, fig. 42 ; pl. 47, figs. 3, 3a.

Four specimens are referred to this well-known species, one of which (6212/3, without locality) is a small entire colony. The largest specimen (Zev 7278) is 16 cm. in height

and 28 cm. × 15 cm. in diameter; opening on its calicinal surface are several tubular burrows.

In *H. microconos*, unlike the condition in *H. exesa*, the corallum is massive and heavy, monticules are mostly conical and the calicinal surface does not rise up in the form of irregular hillocks.

Distribution.—Mergui Archipelago (1); Lampee Island (1); Unknown locality (2).

According to Vaughan previous records have been from Red Sea; Indian Ocean; Murray Island; Amboina; Southern Philippine Islands; Rotuma; Fiji Islands; Wakaya; Fanning Island.

Genus **MERULINA** Ehrenberg.

1834. *Merulina*, Ehrenberg, *Corall. des Roth. Meer.*, p. 104.
1857. *Merulina*, Milne Edwards and Haime, *Hist. Nat. Corall.*, II, p. 628.

This genus was regarded by Milne Edwards and Haime as intermediate in position between the Astræidae and the Fungidæ. The genus has marked features distinguishing it from other genera. Collines tend to become discontinuous in places and are nearly as high and thick as in *Hydnophora*. Similarly there are two alternating series of principal and very narrow subsidiary septa.

1. **Merulina ampliata** (Ellis and Solander).

(Pl. V, fig. 5).

1786. *Madrepora ampliata*, Ellis and Solander, *Nat. Hist. Zooph.*, p. 157, pl. 41, figs. 1 and 2.
1851. *Merulina ampliata*, Milne Edwards and Haime, *Ann. des Sci. Nat.*, 3e ser., XV, p. 143.
1918. *Merulina ampliata*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 127, pl., 52, figs. 1, 1a, 1b.

I refer to this species twelve specimens which are entire colonies with the exception of 2629/3 from Singapore. The growth-form of this species agrees with that of *Hydnophora exesa*, *i.e.*, a thin basal plate from which upright branching hillocks arise. In Zev. 7338/7 (without locality, height 16 cm., diameters 35 cm. × 34 cm.) which is the largest colony a crowded cluster of branching hillocks arise from the calicinal surface.

In this species attachment is effected by the centre of the non-calicinal surface which is produced in the form of a short peduncle. The free part of the non-calicinal surface is fluted with closely arranged rough costæ between the radiating grooves. The under surface also shows perforations as in the case of some Fungid genera.

Repeated dichotomous branching of valleys is a special feature of this species. The periphery of the basal plate is incised at intervals. The basal plate frequently grows into horizontal foliæ. 2834/3, from Andamans, is the smallest entire colony of *M. ampliata*, being 11 cm. × 9 cm. in diameter, with a thin basal plate and a central peduncular stalk of attachment.

3796/3 (without locality, diameters 29 cm. × 25·5 cm.) is interesting owing to the presence, on the calicinal surface, of several specimens of a species of small cirripede, which is less numerous on other specimens.

2629/3 (Singapore) represents a thin skeletal facies of *M. ampliata* in which collines are thin and sharp-ridged and septa are comparatively thin. It has a few laterally compressed foliate hillocks agreeing with Dana's figure (Pl. 16, fig. 1) of *Merulina speciosa.*

In Zev 7279/7 (without locality), which is a large specimen, there is a bivalve shell wedged in between two hillocks one of which has grown on to the shell.

Distribution.—Singapore (4) ; Andamans (1) ; Arracan (1) ; Mergui Archipelago (1) ; unknown locality (5).

Also from Maldives (Gardiner) ; East Indies and Torres Strait (Vaughan).

2. **Merulina laxa** Dana.

(Pl. III, fig. 7., Pl. IV, figs. 5 and 6.)

1846. *Merulina laxa*, Dana, *U. S. Expl. Exp. Zooph.*, p. 276, pl. 16, fig. 3.

Four specimens are referred to this species which Dana described as follows : " Ramose, branches divaricate, often coalescent, with the branches angular, often alate and compressed $1\frac{1}{2}$ to 3 lines thick, sometimes half an inch broad and sub-palmate ; ridges small, acute, sometimes elongate-conical ; lamellæ lax, very oblique and ascending, much more lax at apex." Again " they are arboriform in shape and about six inches in height. The loose oblique lamellæ and sharp angular branches distinguish it from the preceding (*Merulina scabricula*)."

In *Merulina rigida*, Dana (*Hydnophora rigida*, Vaughan), conical monticules are present in large numbers.

In 3193/3 (Mergui, greatest height 19 cm., length 34 cm., breadth 24 cm.), which is the largest specimen, the corallum is arborescent, but is without a basal plate, the twigs of adjacent branches often coalescing. The branches are 10-15 mm. thick at the base, the terminal twigs being quite narrow. Valleys divide dichotomously and are present on all sides of the branches. Collines are somewhat oblique in direction and are usually discontinuous. Occasionally monticules are present on flat regions. Septal and columellar characters are not different from those of *Merulina ampliata.* Several specimens of a species of cirripede are present on the corallum.

The chief differences that separate this species from *Merulina ampliata* are (1) arborescent growth-form of corallum, (2) collines usually discontinuous, (3) absence of basal plate.

I refer 2649/3 (Andamans), with terminal twigs laterally flattened, doubtfully to this species. It differs from 3193/3 and 3194/3 in having wider intervals between the branches, shorter, discontinuous collines, and in the presence of a greater number of monticules on the flat regions. The terminal regions correspond with Bedot's pl. 25, figs. 123-126, which are of a fragment of a colony that was referred to *Hydnophora* instead of to *Merulina.*

Distribution.—Mergui Archipelago (2) ; Pilai Island (1) ; Andamans (1).

Dana originally recorded this species from Sulu Sea.

Genus **MUSSA** Oken.

1815. *Mussa*, Oken, *Lehrb. der Naturg.*, Th. 3, Abth. 1, p. 73.

1851. *Mussa*, Milne Edwards and Haime, *Pol. foss. des Terr. palæoz.*, p. 78.

1918. *Mussa*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 122.

1. **Mussa corymbosa** (Forskål).

1775. *Madrepora corymbosa* (Forskål), *Descr. Anim. in Itin. Orient.*, p. 137.
1857. *Mussa corymbosa*, Milne Edwards and Haime, *Hist. Nat. Corall.*, II, p. 333.

I am referring three small fragments to this well-known species. Corallites are mono-or distomodæal in these fragments. Columellar centres are never connected by horizontal calcareous partitions.

Distribution.—Mergui Archipelago, Pilai Island (1); Padaw Bay (1); Andamans (1).

Previously known from Red Sea (Milne Edwards and Haime, and Klunzinger) and Maldives (Gardiner).

2. **Mussa brueggemanni** Quelch.

1886. *Mussa brüeggemanni*, Quelch, *Challenger Reports*, Reef Corals, XVI, Pt. XLVI, p. 79, pl. 2, figs. 6, 6b.

Eight specimens are referred to this species, of which a detailed account has been given by Bedot (pp. 180-183, 1907).

Zev 7348/7 (without locality) is the only entire colony, 11 cm. in height, 20 cm. in length and 19 cm. in breadth. While this specimen and 3785/3 (without locality) are composed of long polystomodæal valleys, 6040/3 (Pilai Island), which is the largest specimen in the collection, is composed of short valleys, tri-, di-, and monostomodæal corallites.

On Zev 7287/7 is a broken shell of probably the large cirripede *Pyrgoma grande*, Darwin. Septal and costal teeth on this specimen are not so large as in others. Opening on the calicinal surface of 3785/3 is a large deep burrow containing a bivalve mollusc. In Zev 7348/7 are two such burrows; this specimen is also interesting owing to the deposition of a certain amount of exothecal matter between some o f the branches, whilst in the species the branches are usually distinct along their entire length.

It is to be noted that the columella consists of distinct centres connected by 1—3 or 4 horizontal calcareous partitions.

Bedot remarks " Il faut remarquer que si tous les replis arrivaient à se sonder complètement, on n' aurait plus de caractère permettant de distinguer *Mussa brüeggemanni* de *Symphyllia indica.*" (p. 183.)

Distribution.—Mergui Archipelago, Pilai Island (2); Unknown locality (6).

3. **Mussa echinata** Milne Edwards and Haime.

1857. *Mussa echinata*, Milne Edwards and Haime, *Hist. Nat. Corall.*, II, p. 337.

Bedot has given a detailed description (p. 184; pl. 18) of the species to which I refer one broken specimen (3214/3 from Red Sea, height 8·5 cm., diameters 14 cm. × 10·5 cm.). Part of the calicinal surface of this specimen is dead. The columellar centres are distinct, being connected by 1 to 3 horizontal calcareous partitions as in *M. brüeggemanni*.

Distribution.—Red Sea (1).

Also known from Amboina (Bedot). Milne Edwards and Haime's type came from unknown locality.

Genus **SYMPHYLLIA** Milne Edwards and Haime.

1848. *Symphyllia*, Milne Edwards and Haime, *Compt. rend. Acad. Sci.*, XXVII, p. 491.

1918. *Symphyllia*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 124.

The relationship between *Mussa* and *Symphyllia* has still to be settled. According to Milne Edwards and Haime *Symphyllia* is characterised by the presence of exothecal deposition uniting adjacent branches, whilst in *Mussa* the corallites are quite distinct. It is not unlikely that further investigation may show that those species hitherto assigned to *Mussa*, in which the columellar centres are connected by horizontal calcareous partitions, belong, in reality, to the Genus *Symphyllia*.

1. **Symphyllia sinuosa** (Quoy and Gaimard).

1833. *Meandrina sinuosa*, Quoy and Gaimard, *Voy. de l'Astrolabe, Zool.*, IV, p. 227, pl. 18, figs. 4 and 5.

1849. *Symphyllia sinuosa*, Milne Edwards and Haime, *Ann. des Sci. Nat.*, 3^{e} sér., X, pl. 8, fig. 7, and XI, p. 285.

1904. *Symphyllia sinuosa*, Gardiner, *Fauna and Geogr. Maldive and Laccadive Archipelago*, II, p. 700, pl. 59, figs. 1, 2, 3.

1918. *Symphyllia nobilis* Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 124, pl. 17, fig. 35.

Two specimens are referred to this species, of which 3208/3 (Port Blair, Andamans) is typical. The latter is a broken colony 5 cm. in height, 10 cm. in length and 8·5 cm. in breadth. The valley, part of which has been circumscribed into one corallite, is narrow and shallow, in comparison with that of other species of *Symphyllia*. Columellar centres are well developed, being composed of closely twisted trabeculæ, the centres appearing to be almost compact and connected by 1—4 horizontal calcareous partitions. Septa are alternatingly thick and thin, colline is grooved, the groove being narrow and shallow. The second specimen (3227/3, Lampee Island) is large and heavy, 19 cm. in height., 60 cm. in length and 45 cm. in breadth. Nearly half the calicinal surface of this colony is dead. Septa are somewhat thicker than in 3208/3.

Distribution.—Andamans, Port Blair (1) ; Mergui Archipelago, Lampee Island (1).

Previously recorded from Minikoi and Maldives (Gardiner) ; Singapore ; Rotuma (Gardiner) ; New Ireland (Milne Edwards and Haime) ; Amboina (Bedot); New Mecklenburg (Quoy and Gaimard) ; Murray Island and Phillippine Islands (Vaughan). Not known from the Red Sea.

2. **Symphyllia radians** Milne Edwards and Haime.

1849. *Symphyllia radians*, Milne Edwards and Haime, *Ann. des Sci. Nat.*, 3 sér., XI, p. 255.

I refer twelve specimens to this species, the largest from the Gulf of Manaar being 30 cm. in height and 48 cm.×47 cm. in diameter. These agree with the diagnostic features as given by Milne Edwards and Haime, *viz.*, colline not grooved above, septal teeth thicker than septa, 10 to 12 septa in 1 cm., valleys with a single row of columellar centres (" polypierites toujours simple "). All except Zev 7316/7, 3684/3 and 3610/3 are entire colonies. The calicinal surface in this species is usually evenly convex.

Valleys are sinuous and mostly continuous. Width and depth of valleys vary to some extent in the different specimens, in 3659/3 (height 13 cm., length 28 cm., breadth 26 cm.) width and depth of valley being up to 25 mm.

Opening on the calicinal surface of Zev 7315/7 (a small colony) are two tubular burrows, containing lamellibranch shells. In Zev 7331/7 there is a similar tubular burrow towards one side of the calicinal surface occupied by a lamellibranch shell. 3610/3 is a worn specimen.

These specimens differ from *S. indica,* M. Ed. and H. in possessing a larger number of septa, *i.e.*, 16 septa in 1 cm.

Distribution.—Mergui Archipelago, Padaw Bay (1); Arracan (1); Rameswaram Island, Gulf of Manaar (2); unknown locality (8).

Milne Edwards and Haime's type came from unknown locality.

3. **Symphyllia agaricia** Milne Edwards and Haime.

1849. *Symphyllia agaricia*, Milne Edwards and Haime, *Ann. des Sci. Nat.*, 3e ser., XI, p. 255.

Nine specimens are referred to this species, all of which, with the exception of Zev 7344/7, are entire colonies. The main points to note with regard to this species are (1) colonies are devoid of grooves, (2) in younger colonies valleys radiate from the centre towards the periphery, the growth-facies corresponding to that of *Mycetophyllia,* (2) two rows of columellar centres often occur in the same valley, (4) 9 to 10 septa in 1 cm. This species differs from *S. radians* in having wider valleys.

Zev 7319/7 (without locality) is the smallest specimen of *Symphyllia* in the Indian Museum, 8·5 cm.× 8 cm. in diameter, with a somewhat flat calicinal surface. The corallum is produced into 5 or 6 lobes surrounding the central columellar centre.

In 2965/3 which is the largest colony in the Indian Museum (Padaw Bay, height 10 cm. diameters 29 cm. × 27 cm.) the calicinal surface is moderately convex whilst the non-calicinal surface is concave, the valley is sinuous and continuous throughout the colony. In 3413/3 (without locality, diameters 21 cm. × 21 cm.) which is somewhat circular, valleys radiate from the centre towards the periphery, the calicinal surface is slightly convex, whilst the non-calicinal surface is slightly concave. Near the centre of the calicinal surface are two burrows in colline which, at this region, has risen to a height of 3·5 cm. There are also two columellar centres on one side of the raised region of the colline.

Zev 7330/7 (diameters 25 cm. ×24 cm.) is a highly concave-convex colony, being arched up to a height of about 17 cm. Attachment is effected, as is usually the case, by the centre of the non-calicinal surface.

Zev 7342/7 is a young form from Singapore (10 cm. × 9·5 cm. in diameter) with a distinct peduncular stalk of attachment, which I am doubtfully referring to *S. agaricia.*

3787/3 (Pilai Island, length 22·5 cm., breadth 15·5 cm.) is an elongated colony with convex calicinal surface. On one side of the corallum is a large cirripede whose shell has been partly overgrown by septa of the coral.

Distribution.—Mergui Archipelago, Padaw Bay (3); Pilai Island (2); Singapore (1) unknown locality (3).

Milne Edwards and Haime's type came from unknown locality.

4. **Symphyllia valenciennesi** Milne Edwards and Haime.

(Pl. VI, figs. 1 and 2.)

1849. *Symphyllia valenciennesi*, Milne Edwards and Haime, *Ann. des Sci. Nat.*, 3e sér. XI, p. 256.

I refer three specimens to this species, one of which is comparatively large (Zev 7283/7, Singapore, diameters 15 cm. × 13·5 cm.) with slightly convex calicinal surface and concave non-calicinal surface. As stated in Milne Edwards and Haime's original description of the species, walls of adjacent branches are united by vesicular exothecal deposition, leaving deep grooves above, 7 or 8 septa are present in 1 cm. In other respects the corallum resembles that of *S. agaricia.*

In 6053/3, from Mergui, which is a smaller specimen (diameters 10·5 cm. × 10 cm.) with a somewhat convex calicinal surface and a peduncular stalk of attachment, vesicular exothecal deposition has just commenced. The central columellar centre is distinct, the colony growing out in the form of lobes.

6052/3 (Mergui, diameters 11 cm. × 10 cm.) is a young form with 6 lobes, one of the lobes beginning to get bifurcated at the outer margin. The walls of adjacent branches of valley are quite distinct and no exothecal deposition has begun to take place. As in the genus *Mycetophyllia*, the central columellar centre is connected with the six surrounding columellar centres, at the commencement of the lobes, by means of horizontal calcareous partitions.

Both *S. agaricia* and *S. valenciennesi* have the same mode of growth as in *Isophyllia*, but in the two former columellar centres are connected by horizontal calcareous partitions which are absent in *Isophyllia.* In *S. agarica* and *S. valenciennesi* collines are well developed which are rudimentary or absent in *Mycetophyllia.*

Distribution.—Mergui Archipelago (2); Singapore (1).

Milne Edwards and Haime orginally recorded the species from Singapore.

5. **Symphyllia indica** Milne Edwards and Haime.

1849. *Symphyllia indica*, Milne Edwards and Haime, *Ann. des Sci. Nat.*, 3e sér., XI, p. 256.

I doubtfully refer to this species one colony (Zev 7314/7, without locality, diameters 13 cm. × 12 cm.) with evenly convex calicinal surface; it agrees with Milne Edwards and Haime's description of the species, except that there are only 8 or 9 septa in 1 cm. The colony has the same growth-form as *S. valenciennesi* or *S. agaricia, i.e.*, a continuous valley with its branches radiating from a common centre. There is an appearance of grooves on collines owing to the fact that septa meet in notches over the collines. Every third or fourth septum is greatly thickened.

Distribution.—Single specimen in Indian Museum, from unknown locality.

At first reported from Singapore (Milne Edwards and Haime).

Genus **SCLEROPHYLLIA** Klunzinger.

1879. *Sclerophyllia*, Kleunzinger, *Korall. Roth. Meer.* III, p. 4.

Sclerophyllia margariticola Klunzinger.

1879. *Sclerophyllia margariticola*, Klunzinger, *Korall. Roth. Meer.* III, p. 4, taf. i, fig. 12.

I refer to this species a single corallite (Zev 7289/7, without locality) agreeing with Klunzinger's pl. 1, fig. 12.

Distribution.—Single specimen in the Indian Museum from unknown locality. Originally recorded from the Red Sea.

Genus **EUPHYLLIA** (Dana).

1846. *Euphyllia* (pars), Dana, *U. S. Expl. Exp., Zooph., p. 157.*
1851. *Euphyllia*, Milne Edwards and Haime, *Pol. foss. des Terr. palæoz.*, p. 53.
1918. *Euphyllia*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 89.

This Indo-Pacific genus has more or less the same growth-form as the Atlantic Genus *Eusmilia*, but while a coulmella is present in the latter it is absent in the former. In both genera the corallum is fragile and septa are without marginal teeth.

1. **Euphyllia glabrescens** (Chamisso and Eysenhardt).

1821. *Caryophyllia glabrescens*, Chamisso and Eysenhardt, *Nov. act. curios. Nat.*, X, pt. 2, p. 369, pl. 33, figs. 1a and 1b.
1851. *Euphyllia glabrescens*, Milne Edwards and Haime, *Pol. foss. des Terr. palæoz.*, p. 53.
1904. *Euphyllia glabrescens*, Gardiner, *Fauna and Geogr. Maldive and Laccadive Archipel.*, II, p. 759.

Six specimens are referred to this species, of which two are entire colonies, *viz.*, Zev 7359/7 (without locality) and 2665/3 (Padaw Bay), the largest specimen being 2981/3 (without locality, height 12 cm., greatest length 16 cm., greatest breadth 11·5 cm.).

Corallites are usually monostomodæal, sometimes bi- and tristomodæal.

In 3687/3 and Zev 7282/7, both of which are fragments, costal ridges extend down the branches. In other colonies costal ridges are feebler or absent.

Distribution.—Mergui Archipelago, Padaw Bay (2); unknown locality (4).

According to Vaughan previous records have been from Fiji Islands; Philippines; Amboina (Bedot, Quelch); Murray Island; Minikoi and the Maldives (Gardiner). Also Rotuma (Gardiner); Radack Islands, Pacific (Milne Edwards and Haime).

2. **Euphyllia fimbriata** (Spengler).

(Pl. VI, fig. 6.)

1799. *Madrepora fimbriata*, Spengler, *Samling Videnskab. selskabs skrifter*, 2nd ser., V, p. 614.
1857. *Euphyllia fimbriata*, Milne Edwards and Haime, *Hist. Nat. Corall.*, II, p. 195.
1918. *Euphyllia fimbriata*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 83, pl. 27, figs, 1, 1a, 2.

I refer to this species seventeen specimens, none of which are entire colonies, although several of the specimens are quite large, the largest specimen being 22 cm. in height, 40 cm. in length and 35 cm. in breadth. Corallites have the meandering facies but are never continuous throughout the colony. In this species inner margins of principal septa curve towards one another in groups. Owing to the deposition of vesicular endotheca the thecæ appear swollen. Branches diverge towards the free extremity from a common peduncular stalk, and peritheca is absent. In several of the smaller specimens, *e.g.*, 4239/3 (Macassar Strait) the outer surface of the colony is covered almost up to the calicular margin with calcareous tubes of polychæte worms, calcareous polyzoa and lamellibranch shells. In the

larger specimens like Zev 7349/7, 2643/3, Zev 7302/7 and 3664/3—all without locality—the outer surface of the corallum is quite free of all extraneous growth.

3664/3 and Zev. 7301/7 are interesting since they are composed of comparatively short discontinuous valleys. In 3664/3 there are five corallites which are either mon- or distomodæal, not unlike those in *E. turgida.*

3866/3 (Padaw Bay) is a small colony attached to a piece of stone, resembling *Euphyllia striata,* Ed. and H. (young colony of *Euphyllia fimbriata*).

Distribution.—Mergui Archipelago (1) ; Padaw Bay (8) ; Macassar Strait (1) ; unknown locality (7).

According to Vaughan the species has been previously recorded from Maldives (28 and 36 fms., Gardiner) ; Amboina (Bedot) ; Cape York (Quelch) ; Malacca, East Indies ; China Sea (Milne Edwards and Haime). Not reported from the east coast of Africa, nor so far east as the Fiji Islands.

3. **Euphyllia turgida** Dana.

1846. *Euphyllia turgida,* Dana, *U. S. Expl. Exp. Zooph.*, p. 166, pl. 9, figs. 9a, 9b.

1857. *Euphyllia turgida,* Milne Edwards and Haime, *Hist. Nat. Corall.*, II, p. 193.

1904. *Euphyllia turgida,* Gardiner, *Fauna and Geogr. Maldive and Laccadive Archipel.*, II, p. 759.

Vaughan remarks that Dana's type of *Euphyllia turgida* is the peripheral portion of a colony of *E. meandrina,* Dana (*E. fimibriata*).

There are three specimens in the Indian Museum collection which may be referred to this species, of which two are small fragments, the third specimen (2087/5, Eastern Archipelago) being an entire colony—13 cm. in height, 24 cm. in length and 22 cm. in breadth. The largest corallite in this specimen is about 8 cm. long but is deeply constricted in two places where division will ultimately take place. There are several distomodæal corallites which are usually constricted in the middle. The permanent condition, therefore, is to be regarded as monostomodæal. Costæ are distinct only around the calicular rim.

In this species branches are taller and thicker, and corallites are larger than in *E. glabrescens.*

Distribution.—Malay Archipelago (1) ; without locality (2).

Gardiner recorded the species from the Maldives (North Male, 28 fms., S. Nilandu, 36 fms.). Also known from Singapore and Straits of Malacca (Milne Edwards and Haime.).

Genus **PECTINIA** (Oken).

1815. *Pectinia* (pars), Oken, *Lehrb. der Naturg.*, I, p. 68.

1. **Pectinia quadrata** (Dana).

1846. *Ctenophyllia quadrata,* Dana, *U. S. Expl. Exp. Zooph.*, p. 171, pl. 14, fig. 14.

1851. *Pectinia quadrata,* Milne Edwards and Haime, *Pol. foss. des Terr. palæoz.*, p. 57.

I refer to this species one worn specimen (3611/3) broken at one end. The species is restricted to the Atlantic region.

Distribution.—Single specimen in Indian Museum without locality.

Hitherto recorded only from the West Indies.

Genus **TRIDACOPHYLLIA** Blainville.

1830. *Tridacophyllia*, Blainville, *Dict. des Sci. Nat.*, LX., p. 327.

1857. *Tridacophyllia*, Milne Edwards and Haime, *Hist. Nat. Corall.*, II, p. 380.

1. **Tridacophyllia lactuca** (Pallas).

(Pl. III, figs. 8 and 9; Pl. VIII, fig. 6.)

1766. *Madrepora lactuca*, Pallas, *Elench. Zooph.*, p. 289.

1849. *Tridacophyllia lactuca*, Milne Edwards and Haime, *Ann. des sci. Nat.*, 3e sér., XI, p. 273.

I refer to this species thirteen specimens (all of which, excepting Zev 7321/7 and 3806/3, are entire colonies) which show considerable variation in regard to breadth and depth of valley. It is not improbable that the four species recognised by Milne Edwards and Haime represent four skeletal varieties of one species. 6062/3 (Mergui, height 15 cm., diameter 40 cm. × 40 cm.) is the largest colony in the Indian Museum attached to a massive corallum of *Porites*. The collines are irregular in size and arrangement, frequently discontinuous, in some regions being quite absent. There is considerable variation in depth of valleys—up to 3 cm. When the colline is deep, columellar centres occur on its side; columellar centres are distinct though poorly developed.

In Zev 7354/7 (Mergui, diameters 25 cm. × 23 cm.) the corallum is circular. Valleys are deeper (up to 6 cm.) than in 6062/3 and, though discontinuous, never totally disappears in some regions. Costæ are well seen on the non-calicinal surface, attachment being effected by a peduncular stalk in the centre. Valleys are wider (3·5 cm. or 4 cm.) than in 6062/3. Shells of two cirripedes occur at the bottom of the valley.

In 3886/3 (Mergui, diameter 16 cm. × 14 cm.) valleys are narrower (width, 1·5 cm. to 2 cm.) and less deep (greatest depth 2 cm.) than in 6062/3. The central peduncle has spread out on the surface of a dead piece of coral to which it is attached. Near the centre of the colony is a large calicinal area and a well-developed columellar centre composed of closely twisted thin trabeculæ. The calicinal surface is convex.

In 6302/3 (Padaw Bay, diameters 18·5 cm. × 17·5 cm.) collines are reduced to short ridges or monoticules are absent. One cirripede shell is present on the corallum.

3740/3 (Mergui, diameters 3·3 cm. × 3 cm.), fixed on a stone to which several specimens of *Balanus* have attached themselves, is the youngest stage in the Indian Museum collection. It has a central columellar centre and eight surrounding lobes. In the lobes columellar centres have not yet made their appearance. 3737/3 (Pilai Island), with a single central columellar centre and about 10 lobes, is only slightly larger than 3740/3.

3741/3 (diameters 6·5 cm. × 6·5 cm.) is a later stage with deeper calyx. It has a single central columellar centre surrounded by nine or ten lobes.

4703/9 (without locality, diameters 9 cm. × 9 cm.), though a small colony, has several columellar centres. The central columella, though not much larger than the others, is still recognisable.

The four species of *Tridacophyllia*, described by Milne Edwards and Haime, may turn out to be skeletal varieties of the same species.

It is to be noted that in *T lactuca* the corallum is light with characteristic growth-form, attachment being effected by the centre of the non-calicinal surface; the valley is continu-

ous; colline is thin, often becoming irregularly discontinuous; columellar centres are poorly developed, being wide apart and connected by 1 to 3 narrow horizontal calcareous partitions; septa are narrow.

Distribution.—Mergui Archipelago (6); Padaw Bay (2); Pilai Island (1); Unknown locality (4).

Gardiner has recorded this species from Maldives (20-30 fms.), and Milne Edwards and Haime from New Guinea.

Addenda.

There are two specimens in the Indian Museum which cannot be referred to any of the known species. They are as follows:—

1. Zev 7386/7 (Padaw Bay, Mergui Archipelago, length 22·5 cm., breadth 18 cm., height 21 cm.). The colony is entire, with highly convex calicinal surface and concave non-calicinal surface. The corallum is heavy. Calices, when monostomodæal, are oval, average diameters being 25 mm. × 20 mm., depth of calices is liable to considerable variation, from being quite shallow (columella then almost level with the general surface) on flat regions to 17 mm. on other parts, average depth 10 mm. Di- tri- and polystomodæal conditions are present, up to 7 columellar centres in a valley. Inter-calicinal walls are usually rounded above, becoming flat with increase in thickness or sometimes grooved, varying up to 20 mm. in thickness, average 10 or 12 mm. At the most convex region of calicinal surface, walls around calices are unevenly high and vary much in thickness, hence calices irregular in depth and width.

25 to 30 septa are present in a corallite of average size, of which 20 to 24 meet columella. Sides of septa are almost smooth, swollen in wall to 3 mm., thinning towards columella. Subsidiary septa curve towards and meet principal septa in groups of 3 to 5. Septa are exsert to 2·5 to 3 mm. and are continuous over intercalicinal walls. 6 or 7 conical teeth are present on margins of septa; these teeth which are 1·5 or 2 mm. apart increase in size towards exsert ends of septa. Columella is well developed, consisting of thin but closely interlocking septal trabeculæ, $\frac{1}{4}$ to $\frac{1}{3}$ width of calyx.

There is considerable variation in different parts of the corallum, owing to differences in depth and width of valleys and in thickness of intercalicinal walls. Towards the periphery, where the corallum is flat, calices are quite shallow, septa are almost like horizontal ridges extending from corallite to corallite, whilst in central region of corallum, where calices are deeper, septa slope obliquely towards the columella.

This specimen agrees with *Acanthastrea*, as described by Milne Edwards and Haime, in the following respects:—(1) septa swollen towards thecæ, (2) conspicuous septal teeth which give a spinous appearance to the corallum. On the other hand, corallites show a tendency towards formations of valley as in *Mussa*. Till other specimens are available for study it is not possible to determine whether the permanent condition is monostomodæal, as in *Acanthastrea*, or polystomodæal as in *Mussa*.

The great range in skeletal variation might be due to artificial conditions or growth.

(2) Zev 7415/7 (without locality, length 30·5 cm; breadth 18 cm., height 12 cm.). The specimen is part of a colony which has been sawed across. The calicinal surface is

evenly convex. Valleys are long, mostly sinuous, width of valley between columellar centres is 13-15 mm., wider opposite columellar centres, greatest width is 25 mm., depth about 10 mm. Colline is about 3 mm. thick and is ridged above.

Septa are uniformly thin, with almost smooth sides, 13 to 15 in 1 cm., of which 5 or 6 meet columella; the broader subsidiary septa curve towards and meet sides of principal septa. Inner margins of septa are irregularly dentate, upper two-thirds of septa falling almost perpendicularly, lower one-third broadening towards columella. Septa are slightly exsert and are usually continuous over collines, those on each side of a columellar centre curve towards it in order to meet it.

Columellar centres are distinct, consisting of loosely interlocking thin septal trabeculæ and are arranged in a single series along the middle of valley, except where branching of valley takes place. Columellar centres are 7-10 mm. apart, two or three horizontal calcareous partitions extending from centre to centre.

This specimen agrees with the Genus *Ulophyllia*, M. Ed. and H., in regard to the width and depth of valleys, but in the latter "les cloisons sont un peu débordantes, serrées, granulées lateralement; leur bord est profondément divisé et montre des dents longues, aiguës et serrées d' autant, plus grandes qu' elles sont plus rapprochées de la columelle" (*Hist. Nat. Corall., II, p. 378*). Nor are there, in *Ulophyllia*, any horizontal calcareous partitions between columellar centres.

The specimen agrees with *Colpophyllia* in having distinct columellar centres between which extend calcareous partitions, but in the latter genus a distinct groove is present on colline. Valleys are wider and septal characters are different.

In regard to both the above-mentioned specimens it would be premature to name them till further specimens are available for study.

3875/3 (Padaw Bay, length 16 cm., breadth 14 cm., thickness 8·5 cm.) somewhat resembles *Cœloria pachychila*, Klunz. (*Korall. Roth. Meer.*, p. 15, pl. 1, fig. 6, 1879). In parts of the calicinal surface collines are discontinuous. The general appearance of the corallum suggests that it has grown under abnormal conditions.

9481/6 (Mergui Archipelago) is a small colony incrusting on a piece of stone. This might have been the specimen which Duncan originally referred to *Plesiastræa indurata*. Verrill (*Proc. Essex. Inst.*, V, part 3, p. 35, pl. ii, fig. 7).

Family FUNGIDÆ.

Genus **FUNGIA** Lamarck.

1801. *Fungia*, Lamarck, *Syst. Anim. sans vert.*, p. 369.
1849. *Fungia*, Milne Edwards and Haime, *Compt. rend. Acad. Sci.*, XXIX, p. 71.
1902. *Fungia*, Döderlein, *Abhand. Senckenb. naturf. Gesellsch.*, XXVII, Part. I, p. 1.
1905. *Fungia*, Vaughan, *Proc. U. S. Nat. Mus.*, XXVIII, p. 380.
1909. *Fungia*, Gardiner, *Trans. Linn. Soc., London*, 2nd ser.; Zool., XII, p. 263.

Gardiner split Döderlein's *Patella*-Group into *Diaseris*-Group and *Cycloseris*-Group; in the former he placed *Fungia distorta*, Mich. and *Fungia fragilis* (Alcock).

PATELLA—GROUP.

1. **Fungia patella** (Ellis and Solander).

1786. *Madrepora patella*, Ellis and Solander, *Hist. Nat. Zooph.*, p. 148, pl. 28, figs. 1-4.
1851. *Fungia patella*, Milne Edwards and Haime, *Ann. des sci. Nat.*, 3e sér., XV, p. 77.
1902. *Fungia patella*, Döderlain, *Abhandl. Senckenb. Naturf. Gesellschaf.*, XXVII, p. 65, pl. 1 ; pl. 2 ; pl. 5, figs. 1, 2.
1909. *Fungia patella*, Gardiner, *Trans. Linn. Soc., London*, 2nd Ser., Zool., XII, p. 269.

Milne Edwards and Haime bring this species under the group " *Fungiæ lacerantes* " characterised by " le bord des cloisons muni de dents spiniformes."

I refer to this species fifteen specimens which are all " circulaire ou subcirculaire." These agree with Döderlein's figures of the *Cycloseris* form. This is a delicate fungid species, with no perforations on the under surface and costal spines are not prominent.

3864/3 (Pilai Island, diameters 13 cm. × 11·5 cm.) is the largest specimen, with two barnacles on its under surface, whilst 2868/3 (Andamans, diameters 4·8 cm. × 4·5 cm.) is the smallest. In young specimens costæ do not reach up to the central region. Zev 7417/7 (Mauritius, diameters 3·2 cm. × 2 cm.) is probably a small stalked stage of *Fungia patella*, the stalk being 1·5 cm. in height.

This species is characterised by more or less thin flat coralla, with fine teeth on the septal margins. On the younger specimens the scar is distinctly seen on the centre of the under surface. Columella, seen from above, is slightly elongated in the direction of the longer diameter of the corallite.

Distribution.—Mergui Archipelago, Pilai Island (8) ; Andamans (4) ; Mauritius (2) ; unknown locality (1).

Gardiner has reported the species from Amirante Bank (30 fms.) and Saya de Malha Bank (54 fms.) and has cited previous records from Andamans, China Sea (27-28 fms.), Philippines (10 fms.), New Britain (12-40 fms.) and Hawaii (43-253 fms.).

Vaughan has recorded the species from Hawaii (43-253 fms.) and from Djibouti, French Somaliland.

2. **Fungia distorta** Michelin.

(Pl. X, figs. 2, 3 and 4.)

1843. *Fungia distorta*, Michelin, *Mag. de Zool.*, V, Zooph., pl. 5.
1851. *Diaseris distorta* and *Diaseris Freycineti*, Milne Edwards and Haime, *Ann. des sci. Nat.*, 3e sér., XV, p. 118, and *Hist. Nat. Corall*, III, p. 55, pl. D12, fig. 4.
1902. *Fungia distorta, diaseris* form, Döderlein, *Abhandl. Senckenb. Naturf. Gesellschaf.*, XXVII, p. 74, pl. 3 ; pl. 5, figs. 3, 3a.
1909. *Fungia distorta*, Gardiner, *Trans. Linn. Soc., London*, 2nd Ser., Zool., XII, p. 268.

I refer to this species eleven small specimens (dredged from the Andaman sea), of which Alcock [1] referred five to *Diaseris distorta*, Ed. and H. and the rest to *Diaseris freycineti* (*Journ. Asiat. Soc., Bengal*, pp. 147 and 148, 1893). All these specimens agree with Döderlein's figures of the *Diaseris* form of *F. distorta*. Alcock noted that " in all the specimens of

[1] Alcock, in the same paper, describes two new species, viz., *Cycloseris mycoides* and *Diaseris fragilis*.

D. freycineti, except two very young ones, the corallum is tunnelled apparently by a worm, just as in *Heterocyathus* and *Heteropsammia*, except that the aperture for the exit of the worm instead of being on the base is at one side of the oral fossa." Such a tunnel is present also on 2898/3 of *Diaseris distorta* which is the largest specimen in the series (diameters 3·7 cm. × 2·8 cm., height of curvature 8 mm.). The smallest entire specimen is 2893/3 (*Diaseris freycineti*), 12 mm. × 10 mm. in diameter and consisting of four sections.

In this species costæ are delicate and the non-calicinal surface is without perforations.

It does not seem to me that there is any specific difference between Alcock's examples of *Diaseris fragilis*, of *Diaseris distorta* and of *Diaseris freycineti*. Indeed, the description of his new species might equally well apply to those specimens referred to the other two species. The largest specimen of *D. fragilis*, figured by Alcock, was broken along 5 different lines and subsequently joined together so that the condition of the columella could not properly be made out. In all three species the lower surface is flat or only slightly concave, imperforate, with delicate costæ.

There are six additional specimens in the Indian Museum named *D. fragilis*, all from Andamans. (2894/3, 2895/3, 2896/3, 2897/3, 2900/3 and 2902/3).

Döderlein has erroneously brought Alcock's *D. fragilis* under *Fungia patella* as a *Diaseris* form of the latter. 2901/3, 2860/3 and 2861/3 of *Fungia distorta* are comparable to 2902/3, 2896/3 and 2895/3 of *D. fragilis* inasmuch as, in every case, a major and a minor lobe are present.

Distribution.—Andamans (11).

According to Gardiner this species has been reported from Cargados Carajos (45 fms.); Red Sea (surface Bank); Zanzibar; Maldives (22-42 fms.,); Ceylon (deep water); China Sea (28 and 43 fms.); Philippines (6-10 fms.); Aldabra.

3. **Fungia cyclolites** Lamarck.

1816. *Fungia cyclolites*, Lamarck, *Hist. des Anim., sans vert.*, II, p. 236; 2e édit. p. 371.
1851. *Cycloseris cyclolites*, Milne Edwards and Haime, *Ann. des sci. Nat.*, 3e sér., XV, p. 112.
1909. *Fungia cyclolites*, Gardiner, *Trans. Linn. Soc., London*, 2nd Ser., Zool., XII, p. 270.

I refer to this species thirty-six specimens of the *Cycloseris* form. 3869/3 (Pilai Island, diameters 6 cm.×5·5cm., height of curvature 2·8 cm.) is the largest specimen, in which the under surface is highly concave. The smallest specimen is 2843/3 (without locality, diameters 8·5 mm. × 9 mm., height of curvature 4 mm.), with almost flat lower surface. The series represents various stages in the growth of this species.

In this species the calicinal surface is highly convex. Septa, forming a ring around the axial fossa, are broader, higher and thicker than others. Costæ are delicate. The non-calicinal surface is without perforations. The axial fossa is usually somewhat elongated in the direction of the longer diameter of the corallite, and the columella is visible from above.

Distribution.—Andamans, Port Blair, (19); Mauritius and Rodriguez (12); Mergui Archipelago, Pilai Island (2); N. 60° W of Colombo (1; 142 to 400 fms.); unknown locality (2). Gardiner has reported this species from Suez (4 fms.); Reefs off Port Sudan and Sawakin

and further cited the following localities :—Egypt (recent subfossil deposits) ; East Indies ; New Britain ; Great Barrier Reef ; China Sea (28 fms.) and Philippines (10 fms.).

4. **Fungia somervillei** Gardiner.

(Pl. IX, figs. 1 and 3 ; Pl. X, fig. 7.)

1909. *Fungia somervillei*, Gardiner, *Trans. Linn. Soc., London*, 2nd Ser., Zool., XII, p. 269, pl. 34, figs. 5 and 6.

I refer to this species seventeen specimens, of which one is somewhat worn. The largest undoubted specimen agreeing with Gardiner's description of this species is 3189/3 (Padaw Bay, diameters 14 cm. × 10 cm., axial fossa 4-5 cm. long). The calicinal surface is flat except around the elongated axial fossa where it is raised up to 22 mm. The corallum is oval in shape. Sides of septa are finely granular, the granules tending to run into lines. Septal margins are very finely dentate, sides of several of the septa are perforate. The perforations towards the edge often break through, hence septal edges appearing to be irregular. Columella is well seen from above, being composed of finely spongy tissue filling up the bottom of the axial fossa. Costæ are delicate corresponding to all the septa, about every fourth costa being thicker, sides of costæ are finely granular, the finely toothed margins extending into very fine lines over scar of attachment. The non-calicinal surface is almost flat, with perforations between costæ except in the region around the scar where it is solid. The corallum is comparatively thin.

Features especially characteristic of this species are that the oral surface is raised around the axial fossa, the corallum is thin and oval, septa are thin and very finely dentate, costæ are delicate, columella is well developed.

2875/3 (Andamans, diameters 5 cm. × 4·2 cm.) is the smallest specimen in the collection, in which the non-calicinal surface is slightly concave. The oral surface is raised up to 10 mm. around the axial fossa. In 3190/3 (Padaw Bay, diameters 8 cm. × 4·8 cm.) the calicinal surface is raised up to 2·6 cm. around the axial fossa. 2877/3, 2878/3 (both from Andamans) are almost circular.

3191/3 (Mergui, length of axial fossa 5 cm., diameters 19 cm. × 13·5 cm.) is the largest specimen in the Indian Museum collection ; one half of this specimen is broader than the other half. Oral surface is raised up to a height of 5 cm. around the axial fossa. At one end of the axial fossa (towards the broader half of the corallum) there are about six single calicinal depressions which might be pathological in origin, as also the broad coarsely spongy condition of several of the septal margins. The non-calicinal surface is concave with a conspicuous scar in the centre. Septa are not perforate. Edge of corallum is 6 mm. thick.

Gardiner founded his new species on a specimen 114 mm. long by 90 mm. broad from Seychelles (44 fms.) ; a second dead and rather broken specimen was dredged off the Amirante Group (20 fathoms).

Distribution.—Mergui Archipelago (1) ; Pilai Island (9) ; Padaw Bay (3) ; Andamans (3) ; Moscos Islands, off coast of Burma (1).

Gardiner reported one specimen from Seychelles (44 fms.) and another from Amirante (20 fms.).

Scutaria—Group.

5. **Fungia paumotensis** Stutchbury.

1833. *Fungia paumotensis*, Stutchbury, *Trans. Linn. Soc., London*, XVI, p. 485, pl. 32, fig. 6.

1851. *Fungia paumotensis*, Milne Edwards and Haime, *Ann. des sci. Nat.*, 3 sér., XV, p. 86.

1902. *Fungia paumotensis*, Döderlein, *Abhandl. Senckenb. Naturf. Gesellschaf.*, XXVII, p. 88, pl. 7, figs. 1-5.

1907. *Fungia paumotensis*, Vaughan, *U. S. Nat. Mus. Bull.* 55, Washington, p. 134, pl. 35.

Milne Edwards and Haime brought this species under " Fungiæ subintegræ " characterised by " les cloisons munies de dentelures très fines sur leur bord libre et plus ou moins épaissies dans leur partie interne " (p. 16).

This is an easily recognisable species. The corallites are longer than broad, as in *F echinata*; but, unlike the latter species, septa have no conspicuous teeth on their margins, axial fossa is relatively shorter, echinulations on the non-calicinal surface are not so large or rough.

I refer to this species four specimens which agree with Döderleins figures. 2819/3 (without locality, length 19 cm., breadth 11 cm., height of curvature 5·5 cm., length of axial fossa 7 cm.) is the largest specimen, in which the under surface is clothed with thick blunt slightly rough echinulations which begin from almost the centre and are arranged in more or less radiating rows. Perforations are present between the costal rows, except in the central region. No scar is visible on the non-calicinal surface.

4249/4 (Macassar St., diameters 15·5 cm. × 13 cm., height of curvature 6 cm., length of axial fossa 5·5 cm.) is the broadest specimen, whilst 2874/3 (Andamans, diameters 10 cm. × 6·5 cm., length of axial fossa 3·5 cm.) is the smallest specimen. The latter is quite flat. Echinulations on the under surface are much shorter than in 2819/3, though thick and blunt.

This species is characterised by thick heavy corallum, finely dentate septa, the broader septæ taking a somewhat wavy course towards the axial fossa. The columella is well seen from above, being composed of fine trabeculæ.

Distribution.—Andamans (2); Malay Archipelago, Macassar Strait (1); unknown locality (1).

Also reported from Hawaiian Islands (Quelch); Philippine Islands (Vaughan).

Echinata—Group.

6. **Fungia echinata** (Pallas).

(Pl. VIII, fig. 8; Pl. IX, fig. 4; Pl. X, fig. 8.)

1766. *Madrepora echinata*, Pallas, *Elench. Zooph.*, p. 284.

1851. *Fungia echinata*, Milne Edwards and Haime, *Ann. des sci. Nat.*, 3e sér., XV, p. 84.

1902. *Fungia echinata*, Döderlein, *Abhandl. Senckenb. Naturf. Gesellschaf.*, XXVII, p. 101, pl. 10, figs. 1-5.

1909. *Fungia echinata*, Gardiner, *Trans. Linn. Soc., London*, 2nd Ser., Zool., XII, p. 274.

This specimen has more or less the same form of elongated corallum as *Herpetolitha* and *Polyphyllia*. This is one of the most distinctive and easily recognisable species of *Fungia*.

I refer thirty-nine specimens to this species. In the smallest specimen (3177/3, Pilai Island, length 10 cm.; breadth 5 cm., height of curvature 2·7 cm.) the axial furrow extends nearly to the extremities. In 3168/3 (Pilai Island, length 31·5 cm.; breadth 16 cm., height of curvature 7 cm., length of axial furrow 17 cm.), which is the longest specimen, the region around the central part of the axial furrow is raised up somewhat as in *F somervillei*; on one side of this raised region subsidiary calicinal centres are present somewhat as in *Polyphyllia*. In 4246/4 (Macassar St., length 26 cm.; breadth 20·5 cm., height of curvature 6 cm.; length of axial furrow 10 cm.), which is the broadest specimen, the under surface is extremely rough owing to the presence of thick granular echinulations, several of which bifurcate; the corallum is perforated between radiating rows of echinulations. The axial furrow at one end meets a transverse row of about six columellar centres, this transverse row being represented on the non-calicinal surface by a transverse groove.

It is to be noted that, in this species, the corallum is invariably longer than broad; the axial furrow is elongated in the direction of the long diameter; broad, tall, granular teeth are present on septal margins; non-calicinal surface is very rough owing to the presence of conspicuous granular echinulations.

In several specimens some of the opposing broader septa have fused across the axial furrow forming an axial row of columellar centres, *e.g.*, in 2919/3 (Singapore, length 25 cm., breadth 12 cm., length of axial furrow 19·5 cm.) 10 such columellar centres can be counted, the central one being about 4 cm. long.

The specimens show variation in the degree of roughness (*i.e.*, of development of echinulations) of the lower surface. In the smaller specimens a scar is present in the centre of the non-calicinal surface which, in the larger and older specimens, gets covered with echinulations.

There is considerable variation in the height of curvature, as in *Herpetolitha*, from being flat as in 2870/3 (Andamans, length 16·5 cm., breadth 8 cm.) up to 11 cm. as in 3178/3 (Pilai Island, length 28 cm., breadth 13·5 cm.).

In 3824/3 (without locality, length 14·2 cm.; breadth 6·5 cm., height of curvature 2·7 cm.) the axial furrow extends from end to end as in Gardiner's type of *Fungia simplex* (1909, p. 274 and 1906, pl. 91, fig. 13). This is undoubtedly a young specimen of *Fungia echinata*. As Gardiner noted, the axial furrow extends to the extremities in young specimens of *Herpetolitha*. 3844/3 (length 21 cm., breadth 8 cm., height of curvature 5·2 cm.) is a noteworthy skeletal variety of *F echinata*, since the septa are more crowded, the axial furrow is broken up into six calicinal centres of which the central one is 4·5 cm. long, the calicinal centre on each side of the central one is separated from the latter by a transverse septal partition only, whilst the three remaining centres are situated towards one end separated from one another by intervals of 5 to 7 mm. On the non-calicinal surface, which is very rough, there are about ten concentric grooves, probably marking lines of growth.

Distribution.—Mergui Archipelago, Pilai Island (13); Andamans (8); Singapore (12); Malay Archipelago, Macassar Strait (2); unknown locality (4).

According to Gardiner this species extends from the Red Sea to Tahiti and Hawaii. Vaughan records it from the Philippine Islands.

7. **Fungia simplex** Gardiner.

1905. *Herpolitha simplex*, Gardiner, *Fauna and Geogr. Maldive and Laccadive Archipelago*, p. 943, pl. 91, fig. 13.

1909. *Fungia simplex*, Gardiner, *Trans. Linn. Soc., London*, 2nd ser., Zool., XII, p. 274.

I refer to this species one specimen 2879/3 (Andamans, length 10·3 cm., breadth 4 cm.) in which the axial furrow extends to the very extremities. The corallum is flat and thin resembling Gardiner's figure of the species, but the teeth are not so pronounced as in the Echinata-Group. This specimen may only be a young stage.

Distribution.—Andamans (1).

Gardiner reported a single specimen from the Maldives (S. Nilandu, 25 fms.).

Repanda—Group.

8. **Fungia concinna** Verrill.

1902. *Fungia concinna*, Döderlein, *Abhandl. Senckenb. Naturf. Gesellschaf.*, XXVII, p. 111.

1909. *Fungia concinna*, Gardiner, *Trans. Linn. Soc., London*, 2nd ser., Zool., XII, p. 276.

1918. *Fungia concinna*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 127.

I refer to this species one specimen (2880/3, Andamans, diameters 9·5 cm. × 9 cm., length of axial fossa 12 mm.) with slightly concave lower surface. Columella is visible from above. The lower surface is perforate between the costæ except a small central region where there are no perforations. A scar is clearly visible in the centre of the non-calicinal surface. Long pointed teeth set at wide intervals are present on those costæ corresponding to the broader septa; a few scattered teeth are present on the central imperforate region. No tentacular lobes are visible. Septal teeth are angularly pointed.

Distribution.—Andamans (1).

Gardiner reported the species from Solomon and Egmont of the Chagos group; Saya de Malha (26 fms.); Parslin and Mahé of the Seychelles Group; Red Sea; New Britain; Philippines.

Danai—Group.

9. **Fungia horrida** Dana.

(Pl. IX, fig. 2; Pl. X, fig. 6.)

1846. *Fungia horrida*, Dana, *U. S. Expl. Exp., Zooph.*, p. 298, pl. 19, fig. 7.

I refer to this species two specimens, one of which (3481/5, Andamans, diameters 10 cm. × 9 cm., height of curvature 3 cm., length of axial fossa about 15 mm.) agrees completely with Dana's description and figure (Pl. 19, fig. 7) of septal and costal dentation. Dana says "This species is remarkable for its coarse and ragged look, the lamellæ being very unequal and distant, and raggedly eroso-dentate." Milne Edwards and Haime remark "*Fungia horrida*, est remarkable par ses cloisons epineuses et les epines costate grosses et ramifiées." (p. 15).

In this specimen the larger septa are about 7 mm. apart at the margin, between which are 4 or 5 shorter and narrower septa. Teeth on these larger septa are angular and about

3 mm. high, sides granular ; synapticulæ are well seen from above. Axial fossa is elongated in the direction of the longer diameter of the corallite. Costæ corresponding to all the septa are present at the edge of the specimen, those of the larger septa being broader and longer ; marginal teeth of septa are well developed (about 4 mm. high), granular and often branching. A central region is marked off by a groove from a peripheral region. Costæ are not definitely visible beyond this groove. The corallum is dense except towards the periphery where a few perforations are present between the costæ.

Distribution.—Andamans (2).

Also known from Fiji Islands (Dana).

10. **Fungia subrepanda** Döderlein.

1902 *Fungia subrepanda*, Döderlein, *Abhandl. Senckenb. naturf. Gesellschaf.*, XXVII, p. 126, taf. xvii, figs. 1-7.

I refer to this species seven specimens of which the largest (3473/5, Andamans, diameters 10 cm. × 10 cm. ; height of curvature 3·7 cm., length of axial furrow 15 mm.) has imperforate wall, whilst the smallest specimen (3478/5, Andamans, diameters 6·5 cm. × 6 cm., length of axial fossa 9 mm.) has perforate wall and a scar distinctly seen on the under surface.

In the series in the Indian Museum there are perforate and imperforate specimens as Gardiner noted in the case of *F. concinna*, Verr.

Distribution.—Andamans (5) ; Singapore (1) ; unknown locality (1).

11. **Fungia danai** Milne Edwards and Haime.

(Pl. X, fig. 5.)

1851. *Fungia danæ*, Milne Edwards and Haime, *Ann. des sci. Nat.*, 3e sér., XV, p. 80.

1902. *Fungia danæ*, Döderlein, *Abhandl. Senckenb. naturf. Gesellschaf.*, XXVII, p. 129, pls. 14-18.

1909. *Fungia danæ*, Gardiner, *Trans. Linn. Soc., London*, 2nd Ser., Zool., XII, p. 278.

I refer to this species twenty-seven specimens, of which the largest is 2820/3 (without locality, diameters 26 cm. × 23 cm., height of curvature of corallum 6·5 cm., length of axial fossa 3·5 cm.). The axial fossa lies across the long diameter of the corallite, the calicinal surface is raised around the axial fossa. The scar has almost disappeared from the non-calicinal surface.

2943/3 (Pilai Island, diameters 9·5 cm. × 9 cm., height of curvature 2·3 cm., length of axial fossa 17 mm.) is the smallest specimen with the axial fossa lying across the long diameter of the corallite. The scar is visible in the centre of the non-calicinal surface.

3185/3 (Pilai Island, diameters 21·5 cm. × 21·5 cm., height of curvature 6·5 cm., length of axial fossa 5 cm.) is the largest specimen, in which the corallum is raised around the axial fossa.

2934/3 (Pilai Island, diameters 15·5 cm. × 15·5 cm.) has the greatest height of curvature (7 cm.) and has concave non-calicinal surface.

4247/4 (Macassar St., diameters 14·5 cm. × 14 cm.) is interesting owing to the presence of a stalked stage (diameter of top 5·5 cm. × 5 cm.) in the centre of the non-calicinal surface.

In most of the specimens of *F danai* a small central part of the non-calicinal surface is imperforate but covered with short thick blunt echinulations, whilst the rest of the surface is perforate.

Distribution.—Mergui Archipelago, Pilai Island (14); Andamans (3); Malay Archipelago, Macassar Strait (2); unknown locality (8).

Gardiner mentions previous records from Minikoi Atoll; Madagascar; Ceylon; Philippines.

12. **Fungia scruposa** Klunzinger.

1879. *Fungia scruposa*, Klunzinger, *Korall. Roth. Meer.*, III, p. 63, taf. vii, fig. 2, taf. viii, fig. 1.

1902. *Fungia scruposa*, Döderlein, *Abhandl. Senckenb. naturf. Gesellschaf.*, XXVII, p. 133, pl. xix, fig. 1.

I refer to this species one specimen (3815/3, without locality, diameters 11 cm. × 10·5 cm., height of curvature 5 cm., length of axial fossa 15 mm.) which agrees with pl. xix, fig. 1 of Döderlein. The margins of the broader septa are irregularly dentate, presenting a somewhat pathological appearance; on each side of the axial fossa also there is some extraneous calcareous growth. The non-calicinal surface is very rough, owing to the presence of thick, blunt, coarsely granular echinulations, those corresponding to costæ of broad septa being especially conspicuous.

Distribution.—Single specimen in the Indian Museum, without locality.

Previously known from the Red Sea.

13. **Fungia corona** Döderlein.

1902. *Fungia corona*, Döderlein, *Abdhandl. Senckenb. naturf. Gesellschaf.*, XXVII, p. 132, taf. xv, fig. 2.

I refer to this species five specimens. 3470/5 (Andamans, diameters 16 cm. × 14·5 cm., height of curvature 6 cm., length of axial fossa 18 mm.) is the largest, in which the corallum is bent down at a radius of 4 cm. from the axial fossa; the central region of corallum is almost flat. In Zev 7379/7 (without locality) the corallum is more evenly bent at a radius of 6 cm. or 6·5 cm. down to a depth of 2 cm. to 3 cm. 3464/5 (Andamans, height of curvature 8 cm., diameters 11·5 cm. × 11 cm.) is cone-shaped.

In these specimens, septa are strongly dentate, teeth being angular or bluntly pointed. Echinulations on the lower surface are only slightly rough, as in *F. paumotensis*, but are longer and bluntly pointed, being largest in 3464/5.

Distribution.—Mergui Archipelago, Pilai Island (2); Andamans (2); unknown locality (1).

Gardiner records this species from Egmont Atoll, Chagos. Known also from Singapore.

Fungites—Group.

14. **Fungia fungites** (Linnæus).

1767. *Madrepora fungites* (pars), Linnæus, *Syst. Nat.*, ed. 12, p. 1273.

1857. *Fungia linnæi*, Milne Edwards and Haime, *Hist. Nat. Corall.*, III, p. 13.

1902. *Fungia fungites*, Döderlein, *Abhandl. Senckenb. naturf. Gesellschaf.*, XXVII, p. 136, pls. 20-25.

1909. *Fungia fungites*, Gardiner, *Trans. Linn. Soc., London*, 2nd Ser., Zool., XII, p. 279.

1918. *Fungia fungites*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 127.

As both Döderlein and Gardiner have pointed out this is perhaps the most variable of the recorded species of *Fungia*. Thirty-six specimens are referred to this species. 2862/3

(Port Blair, diameters 17 cm. × 16 cm., height of curvature 7·5 cm.), which is cone-shaped is interesting since, as in the *Diaseris* forms, it is composed of six or more sections, but the oval contour of the specimen is not disturbed except for notches where the sections meet. 2867/3 (Red Sea) is a small distored specimen at whose margin a bud appears to have been formed. The largest specimen in the series is Zev 7377/7 (without locality, diameters 18·5 cm. × 15·5 cm.), in which the corallum is raised up at the edge.

3319/3 (Pilai Island), which is slightly broken, is probably a small stalked stage of *Fungia fungites.*

Distribution.—Andamans (17); Mergui Archipelago (3); Port Maria (2); Pilai Island (1); Malay Archipelago, Macassar Strait (1); Red Sea (4); Gulf of Suez (1); unknown locality (8).

Gardiner has recorded the species from Suvadiva Atoll (40 fms.); Chagos; Coetivy; Seychelles; Singapore; Zanzibar; Coast of Red Sea; and Vaughan from Tahiti and Samoa.

Genus **HERPETOLITHA** Eschscholtz.

1825. *Herpetolitha*, Eschscholtz, *Isis*, p. 746.
1860. *Herpetolitha*, Milne Edwards and Haime, *Hist. Nat. Corall.*, III, p. 23.
1909. *Herpetolitha*, Gardiner, *Trans. Linn. Soc., London*, 2nd ser., Zool., XII, p. 282.
1918. *Herpetolitha*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 129.

The systematic position and characters of this genus are fully discussed by Gardiner. Dana described six species, whilst Gardiner referred his specimens to three species, *viz.*, *H. foliosa* (Ehrb.), *H. limax* (Esp.) and *H. crassa*, Dana.

1. **Herpetolitha limax** (Esp.).

(Pl. VIII, figs. 7 and 9.)

1797. *Madrepora limax*, Esper, *Pflanz. Forts.*, I, p. 77, pl. lxiii.
1851. *Herpetolitha limax*, Milne Edwards and Haime, *Ann. des. sci. Nat.*, 3_e sér., XV, p. 94.
1909. *Herpetolitha limax*, Gardiner, *Trans. Linn. Soc., London*, 2nd ser., Zool., XII, p. 284, pl. 38, figs. 20-23; pl. 39, figs. 24, 25.
1918. *Herpetolitha*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 130.

Sixteen specimens are referred to this species of which 2823/3 and Zev 7382/7 (both without locality) are broken in the middle. As pointed out by Gardiner there is a central imperforate region on the non-calicinal surface of all the specimens. This central part is covered with coarse irregular spines passing into costal rows of blunt granular columnar spines. This is the only species described by Milne Edwards and Haime. 3182/3 (Pilai Island, length 42 cm., breadth 18 cm., height of curvature 10 cm.) is the largest specimen in the Indian Museum. At one end of 4256/4 (Macassar Strait, length 18·5 cm., breadth 8 cm., height of curvature of corallum 4·5 cm.) the axial furrow meets at right angles a transverse row of calicinal centres running from side to side, probably owing to this end having been regenerated. The smallest specimen is 4257/4 (Macassar Strait, length 14 cm., breadth 8 cm., height of curvature 4·5 cm.); at one end of this specimen also there is a transverse row of calicinal centres which is represented on the non-calicinal surface by a transverse groove; on this side the axial furrow extends to the extremity of the specimen

4251/4 (Macassar Strait, greatest height 27 cm., breadth 7·5 cm.), which I hesitatingly refer to *H. limax*, is interesting because of the presence of three arms at one end, two of which are lateral and more or less in the same plane, whilst the third arm is shorter, irregular and project from the non-calicinal surface where the other two arms fork. These arms are unequal in length and have been probably regenerated. Its non-calicinal surface is identical with that of *H. limax*, with central imperforate region, coarse spines and columnar costal spines, whilst the calicinal surface resembles that of *H. foliosa*, septa being thin and subsidiary calicinal centres less distinct than in *H. limax*.

In *H. limax* the subsidiary calicular centres are less distinct than in *H. crassa*.

Distribution.—Mergui Archipelago, Pilai Island (1); Malay Archipelago, Macassar Strait (5); Andamans (3); Mauritius (1); unknown locality (6).

Gardiner cites the following localities :—

Singapore; Ceylon; East Indies; Red Sea; Zanzibar.

Also Philippines (Vaughan) and Amboina (Bedot).

Both Gardiner and Vaughan are of opinion that the records for Fiji Islands and Tahiti need verification.

2. **Herpetolitha foliosa** (Ehrenberg).

1879. *Herpetolitha foliosa*, Klunzinger, *Korall. Roth. Meer.*, III, p. 68, pl.8, figs. 4 and 5.

1909. *Herpetolitha foliosa*, Gardiner, *Trans. Linn. Soc., London*, 2nd Ser., Zool., XII, p. 282, pl. 36, figs. 14 and 15; pl. 37.

I am referring to this species five entire specimens which agree with Gardiner's description. Gardiner remarks that the species differs from *H. limax* "in being much more finely built, thinner and less heavy, and in its wall being much more perforate, the perforations being small slits between the costæ. It has rather lower, thinner and more finely toothed septa, while its costæ are much more definitely radiating with smaller spines. Its subsidiary calicular centres on the sides of the disc are even more indistinct than in *H. limax*, in which character both species markedly differ from *H. interrupta* and *H. crassa*" (pp. 282 and 283).

3179/3 (Pilai Island, length 33·5 cm., breadth 9·5 cm., height of curvature 7·5 cm.) is the largest specimen; opening on its calicinal surface are burrows, each containing a lamellibranch shell. In 3180/3 and 3183/3 (both from Pilai Island) axial furrow extends to the extremities, whilst in 3179/3 the axial furrow stops short of the extremities. Zev 7420/7 (Mergui Archipelago, length 7 cm., breadth 4 cm.) is the youngest example of *H. foliosa* in the Indian Museum collection.

In *H. foliosa* the columella is better seen from the calicinal surface than in *H. limax*.

Distribution.—Mergui Archipelago (1); Pilai Island (4).

According to Gardiner, known also from Red Sea and East Africa.

3. **Herpetolitha stricta** Dana.

1846. *Herpetolitha strictus*, Dana, *U. S. Expl. Exp., Zooph.*, p. 309, pl. 21, fig. 1.

1918. *Herpetolitha stricta*, Vaughan, *Papers Dep. Marine Biol., Washington*, p. 129, pl. 51, figs. 3, 3*a*, 3*b*.

I refer five entire specimens to this species since they agree with the description of Dana's type of the species as given by Vaughan (p. 129, 1918). 2825/3 (without locality,

length 25 cm., breadth 8·5 cm.) is the largest specimen in the Indian Museum, with almost flat or very slightly concavo-convex corallum. In the centre of the non-calicinal surface of 4252/4 (Macassar Strait) as well as of 2940/3 (Pilai Island) a scar is present, being probably evidence of a broken-off stalk of attachment.

In all these specimens the axial furrow extends to the extremities, calices become less distinct towards the extremeties ; upper margins of the large septa are flat above, not arched as in *H. limax*, septa are finely dentate and synapticulæ are well seen from above.

Vaughan remarks that *H. stricta* differs from *H. limax* " by having more crowded large septa, the upper margins of which are flat, not conspicuously arched, next the axial furrow ; secondary calices develop nearer the furrow and are more distinctly radiate " (p. 130, 1918).

The non-calicinal surface in this species has some resemblance to the condition in *H. foliosa*. The columella is better seen from above than in *H. limax* or *H. foliosa*. In 4252/4 (length 19·5 cm. and breadth 5·5 cm.) there are about 20 columellar centres including the central one.

Distribution.—Mergui Archipelago, Pilai Island (2) ; Malay Archipelago, Macassar Strait (2) ; Unknown locality (1).

Previously known from Tahiti (Dana) and Marshall Islands (Vaughan).

Genus **POLYPHYLLIA** (Quoy and Gaimard).

1833. *Polyphyllia* (pars), Quoy and Gaimard, *Voy. de l'Astrol., Zooph.*, p. 184.
1849. *Polyphyllia*, Milne Edwards and Haime, *Compt. rend. Acad. sci.*, XXIX, p. 71.
1909. *Polyphyllia*, Gardiner, *Trans. Linn. Soc., London*, 2nd ser., Zool., XII, p. 287.

Gardiner combined the genera *Lithactinia* and *Cryptabacia* with the genus *Polyphyllia*.

1. **Polyphyllia talpina** (Lamarck).

1801. *Fungia talpina*, Lamarck, *Syst. des Anim. sans Vert.*, p. 370.
1851. *Cryptabacia talpina*, Milne Edwards and Haime, *Ann. des sci. Nat.*, 3e sér., XV, p. 95.
1909. *Polyphyllia talpina*, Gardiner, *Trans. Linn. Soc., London*, 2nd ser., Zool., XII, p. 287, pl. 36, fig. 13 ; pl. 38, figs. 18, 19 ; pl. 39, fig. 26.
1918. *Polyphyllia talpina*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 130, pl. 54, fig. 2.

Three colonies (two entire and one broken) are referred to this species. Zev 7385/7 (Singapore, length 27·5 cm., breadth 8 cm., height of curvature 4 cm.) is the largest specimen, in which about 33 calicinal centres are present along the median line in addition to the central one. In *Polyphyllia* these axial calicinal centres are more definite than in *Herpetolitha* since septa are arranged around every columellar centre. Subsidiary columellar centres are more definitely formed than in *Herpetolitha* and are more closely arranged and the larger septa are thicker.

Distribution.—Singapore (2) ; Mergui Archipelago (1).

Previously recorded from Singapore (Gardiner) ; Philippines (Vaughan); Amboina (Quelch, Bedot) ; New Holland and Vanikoro (Quoy and Gaimard).

2. **Polyphyllia novæ-hiberniae** (Lesson).

1833. *Lithactinia Novæ-Hiberniæ*, Lesson, *Illustr. Zool.*, figs. 1 and 2.

Since Gardiner recognises only two species of *Polyphyllia* (p. 287, 1909) I am referring to this species two specimens, *viz.*, 3167/3 (Pilai Island, length 4 cm., breadth 26 cm., height of curvature 15·5 cm.) and 2908/3 (Singapore, length 26 cm., breadth 10·5 cm., height of curvature 5·5 cm.) which differ from the three examples referred to *P. talpina.*

These two specimens differ from the examples of *P. talpina* in having the calicinal centre wider apart (5 or 6 mm. in 3167/3, 4 or 5 mm. in 2908/3). In 3167/3 the larger septa are thicker and rougher than in examples of *P. talpina* and the columellar plates are denser, whilst in 2908/3 septa are about the same thickness as in *P. talpina* and columellar plates thin as in examples of that species.

In Pl. 6, fig. 2 of Lesson (*Illustrations de Zoologie*) septa (as far as can be made out) are thick and calicinal centres wide apart as in 3167/3.

Distribution.—Mergui Archipelago, Pilai Island (1); Singapore (1).

Previously known from New Ireland (Milne Edwards and Haime).

Genus **PODABACIA** Milne Edwards and Haime.

1849. *Podabacia*, Milne Edwards and Haime, *Compt. rend. Acad. sci.*, XXIX, p. 71.

1. **Podabacia crustacea** (Pallas).

(Pl. VII, fig. 3; Pl. VIII, figs. 3, 4 and 5.)

1776. *Madrepora crustacea*, Pallas, *Elench. Zooph.*, p. 271.

1851. *Podabacia crustacea*, Milne Edwards and Haime, *Ann. des sci. Nat.*, 3e sér., XV, p. 98.

1905. *Podabacia crustacea*, Gardiner, *Fauna Geogr. Maldive and Laccadive Archipel.*, p. 942, pl. 90, fig. 8.

I refer six entire colonies to this species, a detailed description of which has been given by Bedot. In Zev 7390/7, which is the smallest colony (without locality, diameters 7 cm. × 5·5 cm.), calicinal and non-calicinal surfaces are somewhat irregular, corallum is thin and the large primary calyx is somewhat to one side. In 3320/3 (Pilai Island, diameters 11 cm. × 9 cm.) the corallum is thin, calicinal surface is more or less concave, non-calicinal surface is convex, the edge of the corallum is lobular, the primary calyx is more or less central in position, distinct but not so conspicuous as in Zev 7390/7. Attachment is effected by the centre of the non-calicinal surface.

2091/5 (without locality, 33 cm. × 26 cm. in diameter) is the largest specimen, in which several secondary fronds have grown from the original one; the general contour of the colony is that of a cup, the margins of the fronds being invariably twisted; the primary calyx is hardly distinguishable, the other calices showing a somewhat concentric arrangement, although the arrangement is not by any means regular. The non-calicinal surface is very rough owing to the presence of granular echinulations on costæ between which the corallum is perforated. There are several comparatively short tubular burrows on the non-calicinal surface with oval openings, probably formed by small lamellibranchs. The non-calicinal surface of the two smaller specimens is less rough.

In all these specimens the septa are strongly alternating, with very rough sides.

Distribution.—Mergui Archipelago (1); Pilai Island (1); Padaw Bay (1); Malay Archipelago (1); unknown locality (2).

Previously known from Amboina (Bedot); Ceylon and Straits of Malacca (Milne Edwards and Haime); Maldives and Minikoi (Gardiner).

Genus **LEPTOSERIS** Milne Edwards and Haime.

1849. *Leptoseris*, Milne Edwards and Haime, *Compt. rend. Acad. sci.*, XXIX, p. 72.
1905. *Leptoseris*, Gardiner, *Fauna Geogr. Maldive and Laccadive Archipel.*, p. 947.
1907. *Leptoseris*, Vaughan, *U. S. Nat. Mus. Bull.*, 59, p. 137.

Gardiner remarks " The genus appears to me to be distinguishable from *Pavonia* by the thin character of its growth, in its being unifacial in respect to its calices, by the absence of crests and lines of calices and also of any definite mural structures, either synapticular or other. Further, the sub-equal septa, much echinulated on their sides, and branching or twisted between the calicular centres, serve to separate the species at once from their nearest allies among the encrusting forms of *Pavonia* " (p. 947, 1906).

1. **Leptoseris fragilis** Milne Edwards and Haime.

(Pl. X, fig. 1.)

1849. *Leptoseris fragilis*, Milne Edwards and Haime, *Compt. rend. Acad. sci.*, XXIX, p. 72.
1905. *Leptoseris fragilis*, Gardiner, *Fauna Geogr. Maldive and Laccadive Archipel.*, p. 947, pl. 92, fig. 24.

I refer one excellent colony to this species (2885/3, Andamans, diameters 19 cm. × 17 cm.). This agrees entirely with Milne Edwards and Haime's description of the species. The corallum is more or less circular, thin, with a lobular margin, irregularly concave calicinal surface and irregularly convex non-calicinal surface which, in this specimen, is attached to the edge of a lamellibranch shell. Non-calicinal surface is costate, the costæ being thin and rough. Central calicinal centre is large and conspicuous, in which the columella is composed of closely twisted trabeculæ; the remaining calicinal centres are much smaller and placed at irregular, comparatively wide intervals, although showing a somewhat concentric arrangement. The arrangement of septa is markedly alternate. Septa bend towards the columellar centres, but are continued as straight septo-costæ towards the edge of the corallum. Synapticulæ are well seen from the calicinal surface. The specimen agrees with L. Rousseau's Pl. 29, fig. 1 (1854) of this species.

Distribution.—Andamans (1).

Milne Edwards and Haime record the species from l'Ile Bourbon (*i.e.*, Reunion, Indian Ocean) and Gardiner from the Maldives (20-38 fms.).

2. **Leptoseris hawaiiensis** Vaughan.

1907. *Leptoseris hawaiiensis*, Vaughan, *U. S. Nat. Mus. Bull.*, 59, p. 137, pls. 39 and 40.

I doubtfully refer one small irregular colony (2922/3, diameters 9 cm. × 6·5 cm.) to this species. The corallum consists of flat irregular lobes lying over a basal lobe. The central calicinal centre is obscured by the irregular growth of the corallum. Columellar

centres are small and are set at comparatively wide and irregular intervals. Septo-costæ are low, thick, alternating in size. The columella is more or less plate-like, its longer diameter being at right angles to the septo-costæ. The non-calicinal surface is faintly costate; attachment is effected by means of a central peduncular stalk. 5 or 6 cirripedes are seen on the calicinal surface.

In *L. scabra*, Vaugh., there are two rows of calices bounded below by a ridge which has not been observed in *L. hawaiiensis*, but according to Vaughan the most striking difference is the extreme roughness of the whole calicular surface.

Distribution.—Andamans (1).

The first record of this species was from the Hawaiian Islands by Vaughan who remarked "This species was collected at 11 stations around the Hawaiian Islands, the sounding showing a range from 29 to at least 257 fathoms, but all the specimens collected in deep water and at a temperature as low as 61° F. are small, being either young or stunted in their growth. The most favourable conditions for growth are a depth between 26 and 73 fathoms, a temperature of about 70° F., a clear bottom of sand, pebbles or shells" (p. 139).

3. **Leptoseris digitata** Vaughan.

(Pl. XI, figs. 5 and 7).

1907. *Leptoseris digitata*, Vaughan, *U. S. Nat. Mus. Bull.*, 59, p. 140, pl. 42, figs. 1 and 2.

I refer one small but highly branching specimen from the Andamans (15 fms.) to this species. It is difficult to determine the original calyx, which may probably be the large calicinal centre situated at the basal fork of the specimen. The corallum is highly branching, the terminal lobes being narrow, about 3 mm., but widening terminally to 5·7 mm. The calicinal surface is concave, whilst the non-calicinal costate surface is convex. Septo-costæ are comparatively thick and alternating in size. The columellar centres consist of a few twisted septal trabeculæ. Columellar centres are comparatively wide apart. Two small cirripedes, partly overgrown by the coral, occur on one of the branches. One or two cirripedes are also present on the non-calicinal surface.

Distribution.—A single specimen from Andamans (15 fms.). Vaughan originally recorded this species from Hawaiian Islands (13-43 fms.).

Genus **PACHYSERIS,** Milne Edwards and Haime.

1849. *Pachyseris*, Milne Edwards and Haime, *Compt. rend. Acad. sci.*, XXIX, p. 72.

1918. *Pachyseris*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 131.

1. **Pachyseris speciosa** (Dana).

(Pl. VII, fig. 5; Pl. VIII, fig. 2.)

1846. *Agaricia speciosa*, Dana, *U. S. Expl. Exp. Zooph.*, p. 337, pl. 21, fig. 7.

1851. *Pachyseris speciosa*, Milne Edwards and Haime, *Ann. des sci. Nat.*, 3e sér., XV, p. 136.

1918. *Pachyseris speciosa*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 131, pl. 54, figs. 3, 3*a*, 4, 4*a*.

Three large specimens are referred to this species. Two of these, *viz.*, Zev 7393/7 and Zev 7394/7 (probably from Mergui) are entire colonies, with flattish mode of growth.

The main frond is thin and appears to be lobular owing to the presence of deep incisions at the periphery; there are also smaller secondary lobes growing out from the upper surface of the main frond. In all these three cases, the greater part of the non-calicinal surface is covered with ciripedes, calcareous tubes of polychæte worms and Polyzoa. Attachment seems to be effected by the centre of the non-calicinal surface.

In 6057/3 (Pilai Island) there are several cirripedes on the calicinal surface, most of which are covered over by the coral, as well as smaller ones on the non-calicinal surface. On the lower surface of each specimen are numerous skeletons of cirripedes, polychæte tubes and polyzoa.

In this species valleys are arranged concentric to the lobes of the main frond; collines are ridged; numerous septa with very rough sides are present, which meet the columella and are continuous over the collines; the columella is well developed in the form of a somewhat solid ridge running along the middle of the valley, without any calicinal centres; collines are discontinuous in parts of the corallum. Opening on the calicinal surface of Zev 7393/7 are a few burrows containing lamellibranch shells.

Dana remarks with regard to his specimen " this is a neat specimen with even prominent narrow ridges, and the frond very thin for two inches from the margin " (p. 337).

Distribution.—Mergui Archipelago, Pilai Island (3).

Also known from East Indies (Dana); Murray Island (Vaughan); Tahiti (Quelch).

Genus **PAVONIA** Lamarck.

1801. *Pavonia*,Lamarck, *Syst. Anim. sans vert.*, p. 372.

1849. *Lophoseris*, Milne Edwards and Haime, *Compt. rend. Acad. Sci.*, XXIX, p. 72.

1918. *Pavonia*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 132.

Vaughan has given a synopsis of species of *Pavonia* which is useful in identifying specimens (pp. 134 and 135).

1. **Pavonia decussata** Dana.

1846. *Pavonia decussata*, Dana, *U. S. Expl. Exp., Zooph.*, p. 329, pl. 22, fig. 4.

I refer to this species one large colony (Zev 7392/7, without locality, height 15 cm., diameters 25 cm. × 23 cm.) consisting of flat-sided fronds rising up vertically and freely anastomosing. These fronds are comparatively thick and crowded, and carinæ running transverse to series are conspicuous. Shells of cirripedes are present overgrown by the corallum.

With regard to *P. decussata*, Dana remarks " The folio are nearly flat, few lobed, and are so aggregated and united transversely by others, so as to form an open cellular clump with subquadrangular spaces among the plates, from half an inch to two inches broad. Small nearly circular plates or folia often grow out as processes from the surface of a large plate " (p. 329).

Distribution.—Single specimen in the Indian Museum, without locality. Dana records this species from Fiji Islands.

2. **Pavonia lata** Dana.

(Pl. VII, fig. 6 ; Pl. VIII, fig. 1.)

1846. *Pavonia lata*, Dana, *U. S. Expl. Exp. Zooph.*, p. 330, pl. 23, fig. 1.

Three large specimens and four detached fronds are referred to this species. 6059/3, from Mergui, is the largest colony (height 30 cm., diameters 34 cm. × 26 cm.) with the corallum partly dead.

In this species fronds are much broader than in *P. decussata* and farther apart, but anastomosis of neighbouring fronds is quite common. Carinæ are almost absent. Shells of cirripedes occur on fronds.

Principal septa are specially prominent in 2630/3, which is a large colony from the Andamans (height 19 cm., diameters 26 cm × 23 cm.).

Distribution.—Mergui Archipelago (2); ilai Island (1) ; Rodriguez, Western Indian Ocean (2) ; Andamans (1).

Dana records this species from Fiji Islands.

3. **Pavonia crassa** Dana.

1846. *Pavonia crassa*, Dana, *U. S. Expl. Exp., Zooph.*, p. 331, pl. 23, figs. 2 ; pl. 24, fig. 1.

I refer two large colonies to this species, 6054/3 (Mergui, height 24 cm. ; length 40 cm. ; breadth 30 cm.) being the larger of the two.

The growth-form is more or less the same as in *P. lata*, but the columella is better developed and is solid in texture ; carinæ running transverse to series of calicinal centres are feebler than in examples of *P. decussata* (*e.g.*, Zev 7392/7).

Dana describes 3 varieties, *viz.*, *ascia*, *obtusa* and *loculata*. Both the specimens in the Indian Museum seem to belong to var. *loculata*, with wide intersecting plates.

In specimens of both *P. lata* and *P. crassa* are small cirripedes overgrown by a thin layer of corallum.

Distribution.—Mergui Archipelago (1) ; unknown locality (1). Dana records this species from Singapore and Fiji Islands.

4. **Pavonia praetorta** Dana.

(Pl. VII, fig. 4.)

1846. *Pavonia prætorta*, Dana, *U. S. Expl. Exp. Zooph.*, p. 325, pl. 22, figs. 5, 5*a*.

I refer three colonies to this species, the largest (3450/5, Andamans, height 12 cm., diameters 24 cm. × 21 cm.) is attached to a dead coral mass, part of the calicinal surface of the colony being dead.

Zev 7389/7 (without locality, height 11 cm., length 15 cm., breadth 10·5 cm.) is the smallest colony in the Indian Museum. Attached to one side of 3451/5 (Andamans) is a small colony of *Porites*.

Dana's diagnosis of this species applies to all the three specimens, *viz.*, " Cespitoso-hemispherical; folia bificial, delicate and lobato-subdivided, everywhere strongly crispate and contorted. Corallum with the folia quite thin at the margin, nearly like paper in thickness." And again " the hemispherical clumps of this species consist of gracefully turned leaves, closely aggregated, and contorted in every direction, and very thin at the margin."

Dana's pl. 22, fig. 5 illustrates these features. The diagnostic features of *P. prætorta* as given in Dana's synopsis are also applicable to these specimens. *P. venusta*, Dana, is closely allied to *P. prætorta* and may, perhaps, be only a variety of *P. prætorta*.

Distribution.—Andamans (2); Unknown locality (1). Also from Society Islands (Dana).

5. **Pavonia danai** (Milne Edwards and Haime).

1857. *Lophoseris danai*, Milne Edwards and Haime, *Nist. Nat. Corall.*, III, p. 71.

1918. *Pavonia danai*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 136, pl. 55, fig. 2; pl. 56, figs. 2, 2*a*.

I refer one colony (3629/3, without locality, height 32 cm., length 82 cm., breadth 37 cm.) to this species; it is the largest fungid in the Indian Museum collection, agreeing with Vaughan's pl. 56, figs. 2 and 2*a* of the type specimen of *P. boletiformis*, Dana (=*P. danai*, Ed. & H.) and with the description given by Vaughan (p. 137, 1918). The basal part of this immense colony is dead, the fronds are comparatively narrow, somewhat crowded (but not to the same extent as in the example of *P. decussata*) and undergo transverse anastomosis; in the crevices thus formed are several lamellibranch shells partly overgrown by the coral. There are also calcareous tubes of polychæte worms, several of which being overgrown by the coral. On the dead surface are encrusting polyzoa.

Carinæ, running almost transverse to series of calices, are present. Ambulacra are crossed by strongly alternating septo-costæ between which synapticulæ can be seen.

With regard to *Pavonia boletiformis* (*non* Lamarck), Dana remarks "This is one of the small-leaved species. Their crimpled form, and the lax appearance of the lamellæ (arising in part from the fact that the intermediate are so small as to be scarcely seen between the larger), and the non-carinate surface, are the distinguishing characteristics" (p. 328). Vaughan has, however, noted carinæ in his examples of *P. boletiformis*.

Distribution.—Mergui Archipelago, Pilai Island (1).

Vaughan mentions the following localities:—

Red Sea; Eastern Indian Ocean; Amboina; Sulu Sea; Philippines; Caroline Islands.

6. **Pavonia divaricata** Lamarck.

1816. *Pavonia divaricata*, Lamarck, *Hist. des Anim. sans Vert.*, II, p. 240; 2e édit., p. 378.

1851. *Lophoseris divaricata*, Milne Edwards and Haime, *Ann. des sci. Nat.*, 3e sér., XV, p. 123.

One piece (3803/3, height 13·5 cm., length 8 cm., breadth 4·5 cm.) agreeing with Vaughan's diagnosis of this species. Branches are comparatively thick, but narrow, twisted and undergoing anastomosis. Columellæ are poorly developed; carinæ are present.

Distribution.—Single specimen in the Indian Museum is from unknown locality.

Previously known from Tongatabou (Milne Edwards and Haime); Fiji Islands (Dana).

7. **Pavonia varians** (Verrill).

1864. *Pavonia varians*, Verrill, *Bull. Mus. Comp. Zool.*, I, p. 55.

1918. *Pavonia varians*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 138, pl. 18, fig. 44; pl. 57, figs. 1-4.

I refer to this species one large colony partly dead (Zev 7272/7, without locality, height 13·5 cm., diameters 20 cm. × 19 cm.) resembling Vaughan's Pl. 57, fig. 4. This colony

is distinguished by the Hydnophoroid form of growth, the lobes of corallum being quite narrow, irregular, crowded and anastomosing, the colony assuming a more or less hemispherical growth-form. The corallum does not become massive owing to the fact that the lobes undergo only partial fusion, leaving a network of open spaces between the anastomoses in which several organisms find refuge. Columella is feebly developed. Although the calices are usually in continuous series, a few circumscribed ones are occasionally present.

Vaughan regards *P. repens*, Brügg., *P. intermedia*, Gard. and *P. calcifera*, Gard. as synonyms of *P. varians*.

Distribution.—Single specimen in the Indian Museum, from unknown locality.

Vaughan gives the distribution as follows :—

Red Sea (Brüeggemann, Klunzinger) ; Maldives (down to 40 fms.) ; Minikoi (Gardiner) ; Cocos-Keeling (Wood-Jones) ; Funafuti and Rotuma (Gardiner) ; Fanning Island and Hawaiian Islands (down to 29 fms., Vaughan).

8. **Pavonia venusta** Dana.

1846. *Pavonia venusta*, Dana, *U. S. Expl. Exp., Zooph.*, p. 326.

1918. *Pavonia venusta*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 136.

I doubtfully refer one large colony (Zev 7389/7, without locality, height 17 cm., length 36 cm., breadth 26 cm.) to this species. Transverse anastomosis of fronds is very common. Numerous calcareous tubes, probably of Polychæte worms are present, overgrown by the coral.

Septa alternating in size, the series of narrow septa being very thin. Carinæ are absent. Columella is present. As Vaughan has remarked this species agrees with *P. danai* to a certain extent in the arrangement of the septa. The fronds are thicker than in colonies of *P. prætorta*.

In Zev 7398/3 the fronds extend up to almost the same level, hence the upper surface of the colony is more or less flat. The fronds have the twisted mode of growth characteristic of *P. prætorta* but are thicker and more closely arranged.

Dana remarks with regard to *P. venusta* " this species in the general form of its folia is intermediate between the *formosa* and *prætorta*. the alternate lamellæ are so unequal that the smaller are scarcely seen without a glass " (p. 326).

Distribution.—One large specimen from unknown locality and a piece from China Sea.

According to Vaughan, Dana's type came from the Indo-Pacific region.

Genus **CŒLOSERIS** Vaughan.

1918. *Cœloseris*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 139.

1. **Cœloseris mayeri** Vaughan.

1918. *Cœloseris mayeri*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 139, pl. 14, fig. 18 ; pl. 58, figs. 1-3.

I refer to this species one large massive colony (3653/3, Arracan, height 18·5 cm., diameters 24 cm. × 17·5 cm.). Opening on the calicinal surface are seven or eight tubular burrows, hence corallum is raised into humps between which are narrow valleys. This specimen agrees completely with Vaughan's description and figure of the new genus and species ; no further comments are therefore necessary.

Distribution.—Single specimen in the Indian Museum, from Arracan.

Vaughan recorded the species from Murray Islands; Southern Philippines.

Genus **COSCINARÆA** Milne Edwards and Haime.

1848. *Coscinaræa*, Milne Edwards and Haime, *Compt. rend. Acad. sci.*, XXVII, p. 496.

Milne Edwards and Haime originally placed the genus in the family Portidæ.

1. **Coscinaræa monile** (Forskål).

(Pl. VII, fig. 1.)

1775. *Madrepora monile*, Forskål, *Descr. Anim. in Itin. Orient.*, p. 133.

1851. *Coscinaræa meandrina*, Milne Edwards and Haime, *Pol. foss. des terr. palæoz.*, p. 144.

1879. *Coscinaræa meandrina*, Klunzinger, *Korall. Roth. Meer.*, III, p. 79, pl. ix, fig. 4.

1905. *Coscinaræa monile*, Gardiner, *Fauna and Geogr. Maldive and Laccadive Archipelago*, p. 950.

I refer to this species nine colonies, of which the largest is 3302/3 (Mergui) attached to a stone. On one side of this stone is a worn incrusting colony of *Favia valenciennesi* partly overgrown by the *Coscinaræa*. In this species septa over the intercalicinal walls are comparatively thick, closely aggregated with very rough sides and sloping margins and are continuous over the intercalicinal walls; subsidiary septa usually meet principal septa in groups of 1 to 6 or more. Several circumscribed corallites are present. Columellar centres are quite distinct. Synapticulæ are present. Corallum is incrusting. Calicinal surface is convex whilst non-calicinal surface is concave. Peripheral region of the non-calicinal surface has thin costæ as in *Pachyseris*. The following five colonies are found incrusting on pieces of stone, *viz.*, 3302/3 (Mergui Archipelago), 2640/3 (Mergui), Zev 7396/7 (without locality), Zev 7395/7 (Pilai Island), 3742/3 (Padaw Bay).

In 6478/4 (Mergui) the calicinal surface is raised up around the opening of a tubular burrow containing a bivalve mollusc.

Gardiner remarks that the relationship of *Coscinaræa* with *Psammocora* is undeniable, but the proper relationship of the two genera to the rest of the Fungida is doubtful (p. 949, 1905).

Distribution.—Mergui Archipelago (3); Pilai Island (1); Padaw Bay (2); Unknown locality (3). Also from Suvadiva, Maldives (Gardiner).

According to Milne Edwards and Haime, *Coscinaræa meandrina* occurs in the Red Sea and as sub-fossil in Egypt in recent deposits.

Genus **PSAMMOCORA** Dana.

1846. *Psammocora*, Dana, *U. S. Expl. Exp., Zooph.*, p. 344.

1. **Psammocora profundacella** Gardiner.

1898. *Psammocora profundacella*, Gardiner, *Proc. Zool. Soc., London*, p. 537, pl. 45, fig. 3.

1918. *Psammocora profundacella*, Vaughan, *Papers Dep. Marine Biol., Washington*, IX, p. 142, pl. 54, figs. 4, 4*a*.

I doubtfully refer to this species one small entire colony (3430/3), with irregular calinal surface.

Distribution.—Single specimen in Indian Museum, from Andamans.

The species was originally reported by Gardiner from Funafuti and subsequently by Vaughan from Fanning Island.

Genus **MYCEDIUM** (Oken).

1815. *Mycedium* (pars), Oken, *Lehrb. der Naturg., Zool.*, p. 69.

1851. *Mycedium*, Milne Edwards and Haime, *Ann. des sci. nat.*, 3e sér. XV, p. 130.

Milne Edwards and Haime remark " Les calices sont circonscrits, penchés, submamillaries et disposés en séries, parallèles autour du parent qui reste ordinairement plus développé que les autres individus. Les rayons septo-costaux sont fort longs. Le plateau commun est nu et costulé " (p. 73).

1. **Mycedium okeni** Milne Edwards and Haime.

(Pl. III, fig. 6.)

1851. *Mycedium okeni*, Milne Edwards and Haime, *Ann. des sci. nat.*, 3e sér., XV, p., 132.

1857. *Mycedium okeni*, Milne Edwards and Haime, *Hist. Nat. Corall.*, III, p. 75, pl. 12, fig. 1.

I refer to this species three specimens which agree with Milne Edwards and Haime's description. In the largest of these (3195/3, Mergui, length 26 cm., breadth 25 cm.) the corallum is thin, incrusting on a piece of stone, rising (up to 7 cm.) as tubes in two or three places. A large calyx, 3 cm. long—probably the original one—is visible towards one side of the corallum. In some parts the corallum is not raised around the columellar centres, hence calices appearing flush with the surface. Most of the corallites are single, but here and there 2 to 6 corallites are connected by a common ridge. Alternating with the thick principal septa are thin subsidiary ones. Columellar centres are quite distinct, being composed of thin twisted trabeculæ. Several specimens of the cirripede *Pyrgoma crenatum* Sowerby, are seen on the calicinal surface around which the corallum has risen obliquely. The remaining two specimens are small broken pieces.

It is to be noted that, in this species, the corallum is thin and encrusting; corallites are distinct, wide apart, oblique, being raised on the side away from the free margin of the corallum; columella is well developed; there are two alternating series of septa, most of the thick ones meeting the columella; septo-costæ are long; costæ are present on the lower surface; the non-calicinal surface, which is not perforated, bears costæ; the average width of the calyx is about 10 mm., with 12 to 15 septa meeting the columella.

Distribution.—Mergui Archipelago (1); Padaw Bay (1); Unknown locality (1).

Milne Edwards and Haime's specimens came from unknown locality.

2. **Mycedium aspera** (Ellis and Solander).

(Pl. III, fig. 5; Pl. VII, fig. 2.)

1786. *Madrepora aspera*, Ellis and Solander, *nat. Hist. Zooph.*, p. 156, pl. 39.

1850. *Echinopora aspera*, Milne Edwards and Haime, *Ann. des sci. nat.*, 3e sér., XII, p. 188.

I doubtfully refer to this species one large colony (6223/3 Mergui, diameters 40 cm. × 30 cm.) in which the corallum is thin and incrusting. The general skeletal facies is similar to that of *Mycedium okeni*, but in *M. aspera* the oblique corallites are larger and tend to be arranged in rows more or less concentric to the periphery. Several of the corallites in the same row tend to be connected by a common ridge. An average-sized corallite measures diameters 15 mm. × 13 mm. Calices may increase up to 20 mm. or 25 mm. in width, although the average is 15 mm. × 13 mm. Towards the summit of the specimen corallites

tend to get raised evenly up to a height of 25 mm. In such corallites the costæ, which have toothed margins, are in two alternating rows, broad thick ones corresponding to the broad septa and thick narrow ones corresponding to the subsidiary septa; the principal septa are exsert to 2 mm. Septa have irregularly toothed inner margins, 15 to 20 meeting columella. Septa become thickened as they meet the corallite wall. The columella is well developed as in *M. okeni*. Distanee between rows of corallites is about 10 mm.

Distribution.—Mergui Archipelago (1).

Milne Edwards and Haime had previously recorded the species from East Indies.

APPENDIX.

List of Shells found on Corals.

Name of Shell	Name of Coral	Reg. No. of Coral	Locality of Coral	Collector.
Lithodomus nasuta, Phil.	In *Cœloria stricta*, Mil. Ed.& H.	$\frac{3423}{3}$	Andamans.	J. Wood Mason.
,, ,, ,,	,, *Cœloria dædalea* (Ell. & Sol.)	$\frac{3652}{3}$	Arracan.	W. Theobald.
,, ,, ,,	,, *Symphyllia radians*, Mil. Ed. & H.	Zev. $\frac{7315}{7}$	?	?
,, ,, ,,	,, ,, ,, ,,	Zev. $\frac{7331}{7}$	?	?
,, ,, ,,	,, *Coscinaræa monile* (Forsk.)	$\frac{6478}{4}$	Padaw Bay.	J. Anderson.
,, ,, ,,	,, *Cœloria dædalea* (Ell.& Sol.)	Zev. $\frac{7351}{7}$	?	?
,, ,, ,,	,, *Mussa brüeggemanni*, Quelch	$\frac{3785}{3}$	Mergui.	J. Anderson.
Lithodomus lithophagus, L.	,, ,, ,, ,,	Zev. $\frac{7348}{7}$	?	?
,, ,,	,, *Cœloria dædalea* (Ell. & Sol.)	Zev. $\frac{7335}{7}$	Gulf of Mannar.	S. W. Kemp.
Modiola sp.	,, ,, ,, ,,	$\frac{3650}{3}$	Arracan.	W. Theobald.
Modiolaria sp.	,, ,, ,, ,,	$\frac{3650}{3}$	,,	,,
Lithodomus nasuta, Phil.	,, *Herpetolitha foliosa* (Ehrb.)	$\frac{3179}{3}$	Pilai Island	J. Anderson.
Aviculidae (?*Perna* sp.)	,, *Cœloria dædalea* (Ell. &.Sol.)	Zev. $\frac{7335}{7}$	Gulf of Mannar.	S. W. Kemp.
Lithodomus gracilis, Phil.	,, ,, ,, ,,	Zev. $\frac{7335}{7}$	,,	,,
Gastrochaena sp.	,, ,, ,, ,,	$\frac{3650}{3}$	Arracan	W. Theobald.
Pholas sp.	,, ,, ,, ,,	$\frac{3650}{3}$	,,	,,
Gastrochaena sp.	,, *Cœloria stricta*, Mil. Ed. & H.	$\frac{3422}{3}$	Andamans.	J. Wood-Mason.
Ostrea sp.	On *Cœloria dædalea* (Ell. & Sol.)	Zev. $\frac{7335}{7}$	Gulf of Mannar.	S. W. Kemp.

The twelve plates accompanying this part are published by order of the Director, Royal Indian Marine, and may be regarded as in continuity with the series of "Illustrations of the Zoology of the R.I.M.S. Investigator."

EXPLANATION OF PLATE I.

CALICINAL VIEWS OF CORALLA.

Fig. 1. *Favia favosa* (Ell. & Sol.). Reg. No. 6043/3. Nat. size.

Fig. 2. *Favia danæ*, Verr. Central region. Reg. No. 3666/3. Nat. size.

Fig. 3. *Favia speciosa* (Dana). Part of calicinal surface, showing small corallites. Reg. No. 3890/3. Nat. size.

Fig. 4. *Favia halicora* (Ehrb.). Central region of calicinal surface, with thin intercalicinal partitions. Reg. No. 3428/3. Nat. size.

Fig. 5. *Favia speciosa* (Dana). Part of calicinal surface, showing large corallites and wide perithecal intervals. Same specimen as fig. 3. Nat. size.

Fig. 6. *Favia halicora* (Ehrb.). Edge-region, showing thick intercalicinal partitions. Same specimen as fig. 4. Nat. size.

Fig. 7. *Favia vasta* (Klunz.). Reg. No. Zev 7360/7. Nat. size.

Fig. 8. *Favia speciosa* (Dana). Edge of corallum, with a small incrusting colony of *Favia valenciennesi*, M. Ed. & H. Reg. No. 2975/2. Nat. size.

Fig. 9. *Favia abdita* (Ell. & Sol.). With several attached cirripedes (*Pyrgoma indica*, Annandale). Reg. No. Zev 7334/7. Nat. size.

ERRATA.

EXPLANATION OF PLATE I.

For "Fig. 1"	. . . . .	*read* "Fig. 9."
,, "Fig. 2"	. . . . .	,, "Fig. 8."
,, "Fig. 3"	. . . . .	,, "Fig. 7."
,, "Fig. 4"	. . . . .	,, "Fig. 6."
,, "Fig. 6"	. . . . .	,, "Fig. 4."
,, "Fig. 7"	. . . . .	,, "Fig. 3."
,, "Fig. 8"	. . . . .	,, "Fig. 2."
,, "Fig. 9"	. . . . .	,, "Fig. 1."

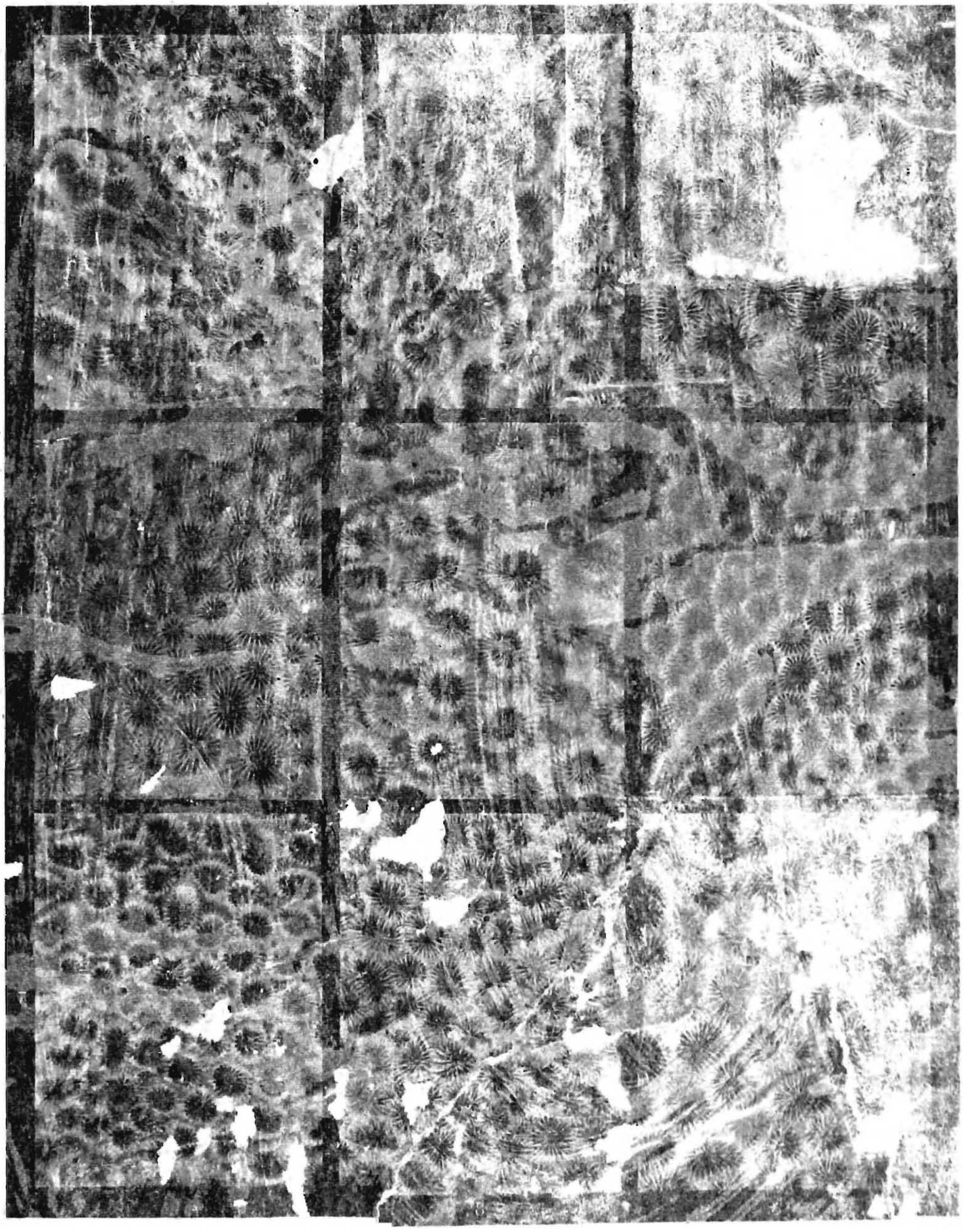

Photo. by D. Barua

MADRASPATAMIAN CO[illegible]

EXPLANATION OF PLATE II.

CALICINAL VIEWS OF CORALLA.

Fig. 1. *Favia versipora* (Lam.). Part of calicinal surface, showing giant corallites. Reg. No. 6473/4 ×3.

Fig. 2. *Favia favosa* (Ell. & Sol.). Part of calicinal surface, without intercorallite grooves. Reg. No. Zev 7336/7. Nat. size.

Fig. 3 *Favia favosa* (Ell. & Sol.). Part of calicinal surface, showing intercorallite grooves. Reg. No. Zev 7329/7. Nat. size.

Fig. 4. *Goniastrea incrustans*, Duncan. Part of calicinal surface, showing thick-walled corallites towards edge, in addition to normal thin-walled corallites. Reg. No. 9469/6. Nat. size.

Fig. 5. *Galaxea fascicularis* (Linn.). Part of calicinal surface, with two attached cirripedes (*Pyrgoma grande*, Darwin). Reg. No. Zev 7271/7. Nat. size.

Fig. 6. *Galaxea musicalis* (Linn.). Part of calicinal surface, with two attached cirripedes (*Pyrgoma grande*, Darwin). Reg. No. 3709/3. Nat. size.

Fig. 7. *Favia favosa* (Ell. & Sol.). Part of calicinal surface, showing tubercular growths on sides of septa. Reg. No. Zev 7327/7. Nat. size.

Fig. 8. *Favia favosa* (Ell. & Sol.). Part of calicinal surface, showing shallow calices and thick inter-calicinal walls. Reg. No. 6286/3. Nat. size.

Fig. 9. *Favia favosa* (Ell. & Sol.). Edge-region, with an incrusting colony of *Favia valenciennesi*, M. Ed. & H., with cirripede (*Balanus arcuatus*, Hoek). Reg. No. 3421/3. Nat. size.

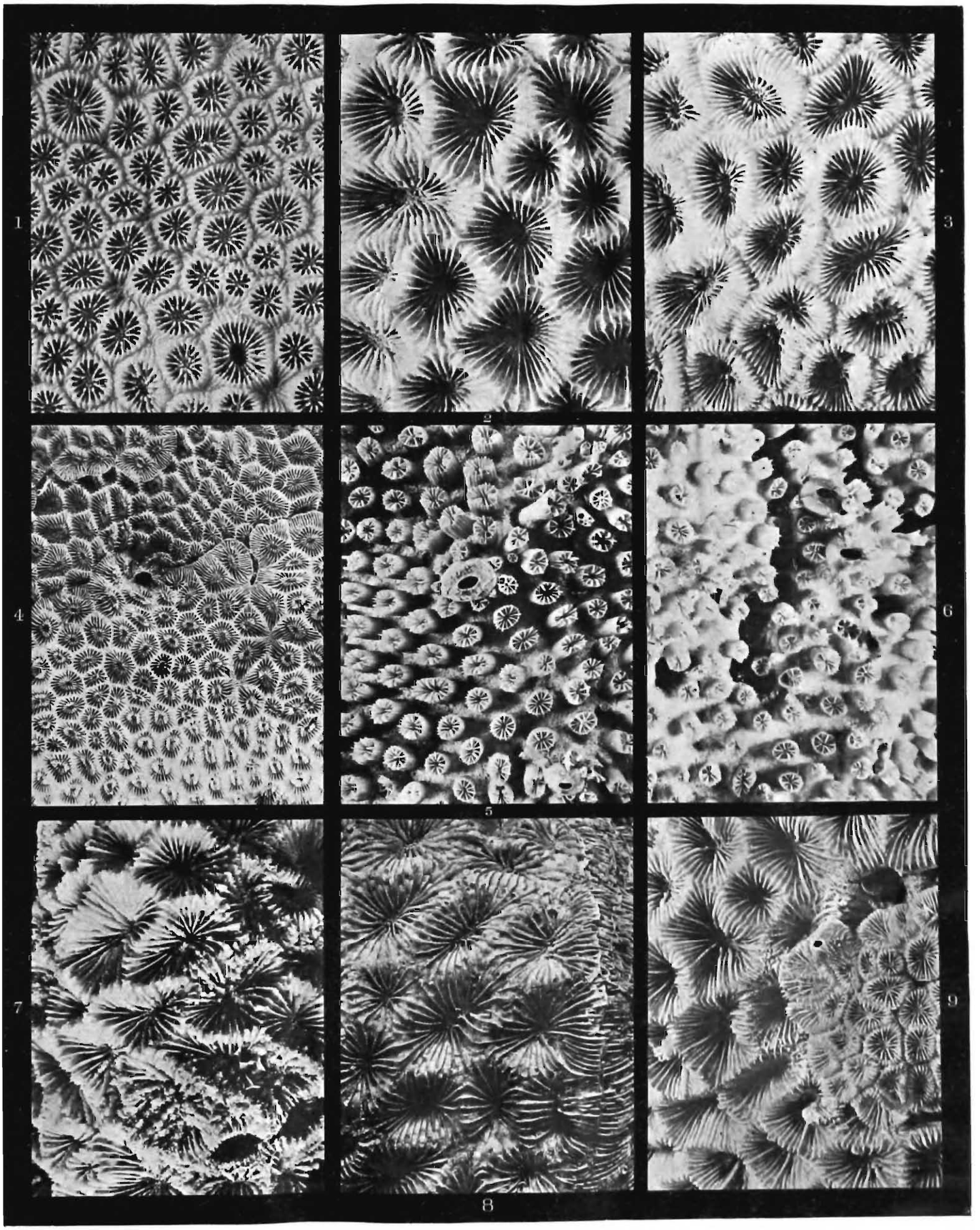

Photo. by D. Bacchi.

MADREPORARIAN CORALS.

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EXPLANATION OF PLATE III.

CALICINAL VIEWS.

Fig. 1. *Cœloria dœdalea* (Ell. & Sol.). Part of corallum, showing tubular burrow of the mollusc ***Lithodomus*** around which is a stellate disposition of valleys. Reg. No. 3659/3. Nat. size.

Fig. 2. *Acanthastrea* or *Mussa* sp. ?. Summit of corallum, showing corallite-walls. Reg. No. Zev 7386/7. Same specimen as Pl. V., fig. 1. Nat. size.

Fig. 3. *Acanthastrea* or *Mussa* sp. ?. Region towards edge of corallum, without corallite-walls. Same specimen as fig. 2. Nat. size.

Fig. 4. *Colpophyllia* sp. ?. Reg. No. Zev. 7415/7. Nat. size.

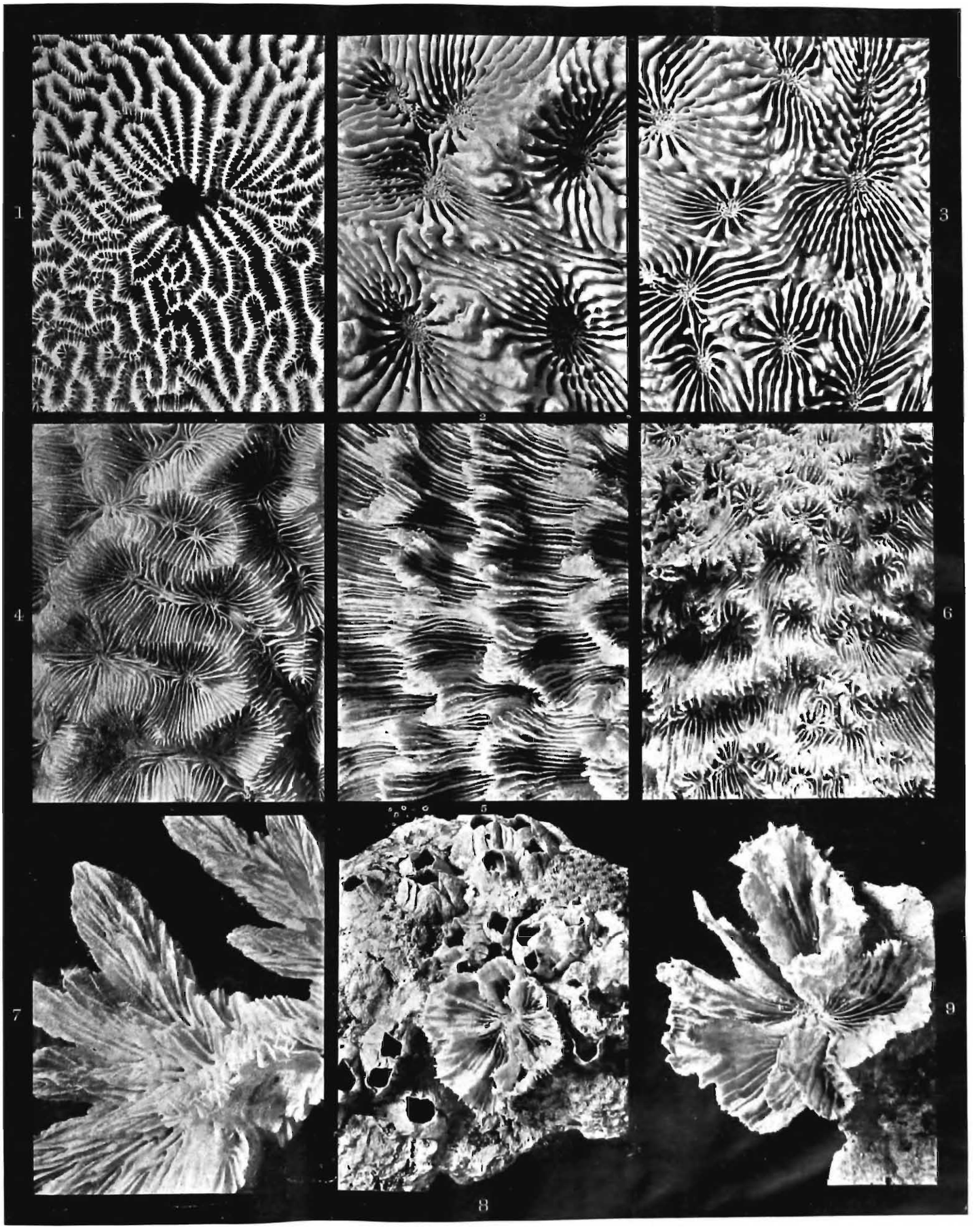
Fig. 5. *Mycedium aspera* (Ell. & Sol.). Part of corallum, showing normal corallites. Reg. No. 6223/3. Nat. size.

Fig. 6. *Mycedium okeni*, M. Ed. & H. Reg. No. 3195/3. Nat. size.

Fg. 7. *Merulina laxa*, Dana. Enlarged view of two branches. Reg. No. 2649/3 ×3.

Fig. 8. *Tridacophyllia lactuca* (Pallas). Small colony (entire). Reg. No. 3740/3. Nat. size.

Fig. 9. *Tridacophyllia lactuca* (Pallas). Entire colony. Reg. No. 3741/3. Nat. size.



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EXPLANATION OF PLATE IV.

CALICINAL VIEWS.

Fig. 1. *Favia valenciennesi* (M. Ed. & H.). Attached to edge of corallum of *Favia speciosa* (Dana), with Cirripedes (*Pyrgoma indicum*, Annandale and *P. crenatum*, Sowerby). Reg. No. 2987/3. Nat. size.

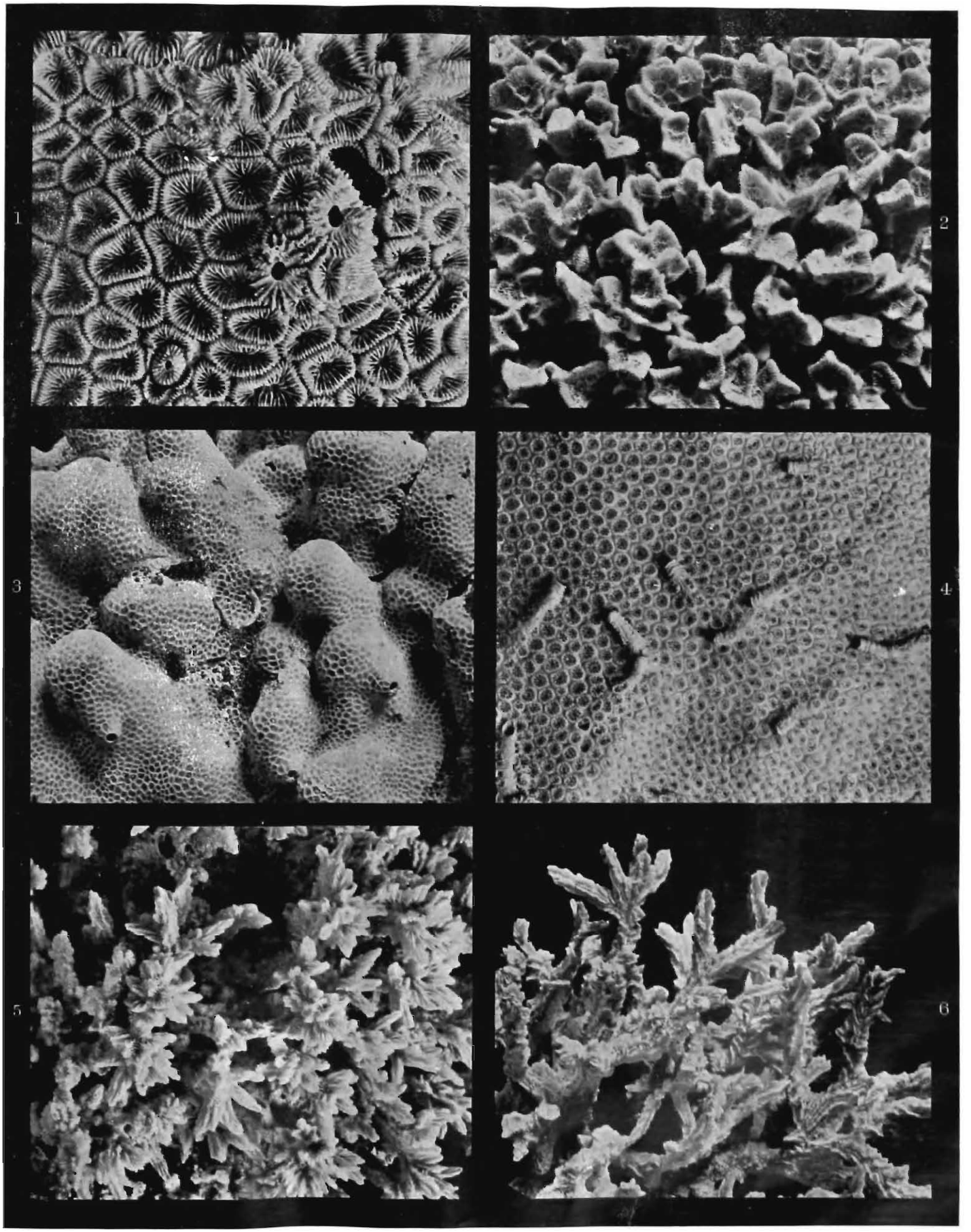
Fig. 2. *Favia abdita* (Ell. & Sol.). Corallum with cluster of hillocks. Reg. No. Zev. 7339/7. $\frac{1}{2}$ nat. size.

Fig. 3. *Goniastrea retiformis* (Lamk.). Reg. No. 3897/3. $\frac{1}{2}$ nat. size.

Fig. 4. *Favia versipora* (Lamk.). Corallum with partly hidden calcareous tubes of tubicolous worms. Same specimen as Pl. II, fig. 1. Nat. size.

Fig. 5. *Merulina laxa* (Dana). Corallum with branching hillocks. Same specimen as Pl. III, fig. 7. $\frac{2}{3}$ nat. size.

Fig. 6. *Merulina laxa* (Dana). Reg. No. 3193/3. $\frac{3}{7}$ nat. size.



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EXPLANATION OF PLATE V.

CALICINAL VIEWS.

Fig. 1. *Acanthastrea* or *Mussa* sp. Flat region of corallum. Same specimen as Pl. III, figs. 2 and 3. Nat. size.

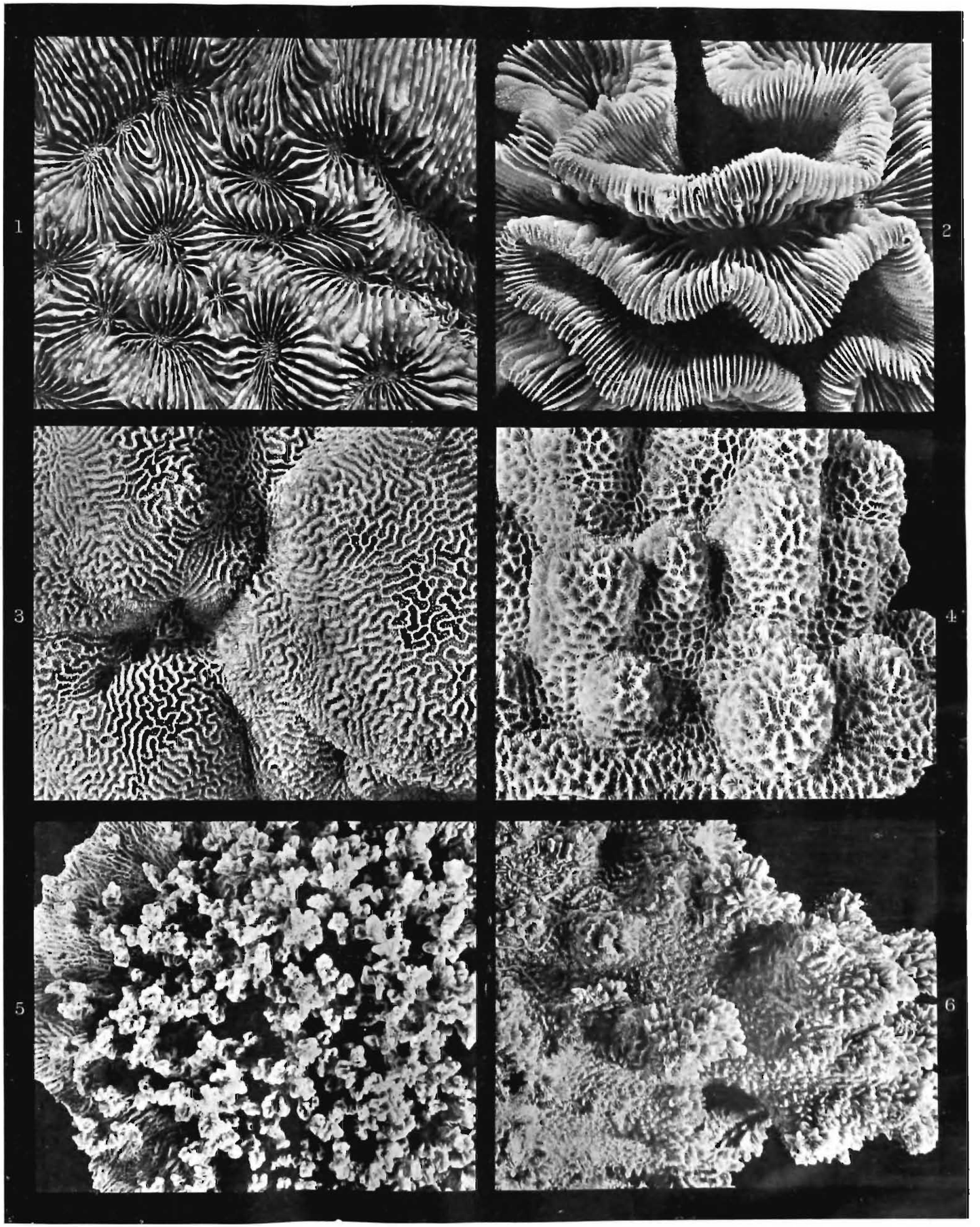
Fig. 2. *Trachyphyllia amarantum* (Ell. & Sol.). Colony with H-shaped valley. Reg. No. 4237/4. Nat. size.

Fig. 3. *Cœloria dædalea* (Ell. & Sol.). Showing humpy mode of growth of corallum. Reg. No. Zev. 7335/7. ⅓ nat. size.

Fig. 4. *Cœloria astræiformis*, M. Ed. & H. Reg. No. Zev 7296/7. ½ nat. size.

Fig. 5. *Merulina ampliata* (Ell. & Sol.). Corallum rising up to form cluster of hillocks. Reg. No. Zev 7338/7. ⅓ nat. size.

Fig. 6. *Hydnophora exesa* (Pallas). With cavity made by the cirripede ***Pyrgoma monticulariæ***, Gray. Reg. No. 3415/3. ½ nat. size.



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EXPLANATION OF PLATE VI.

CALICINAL VIEWS.

Fig. 1. *Symphyllia valenciennesi* (M. Ed. & H.). Reg. No. 6052/3. Nat. size.

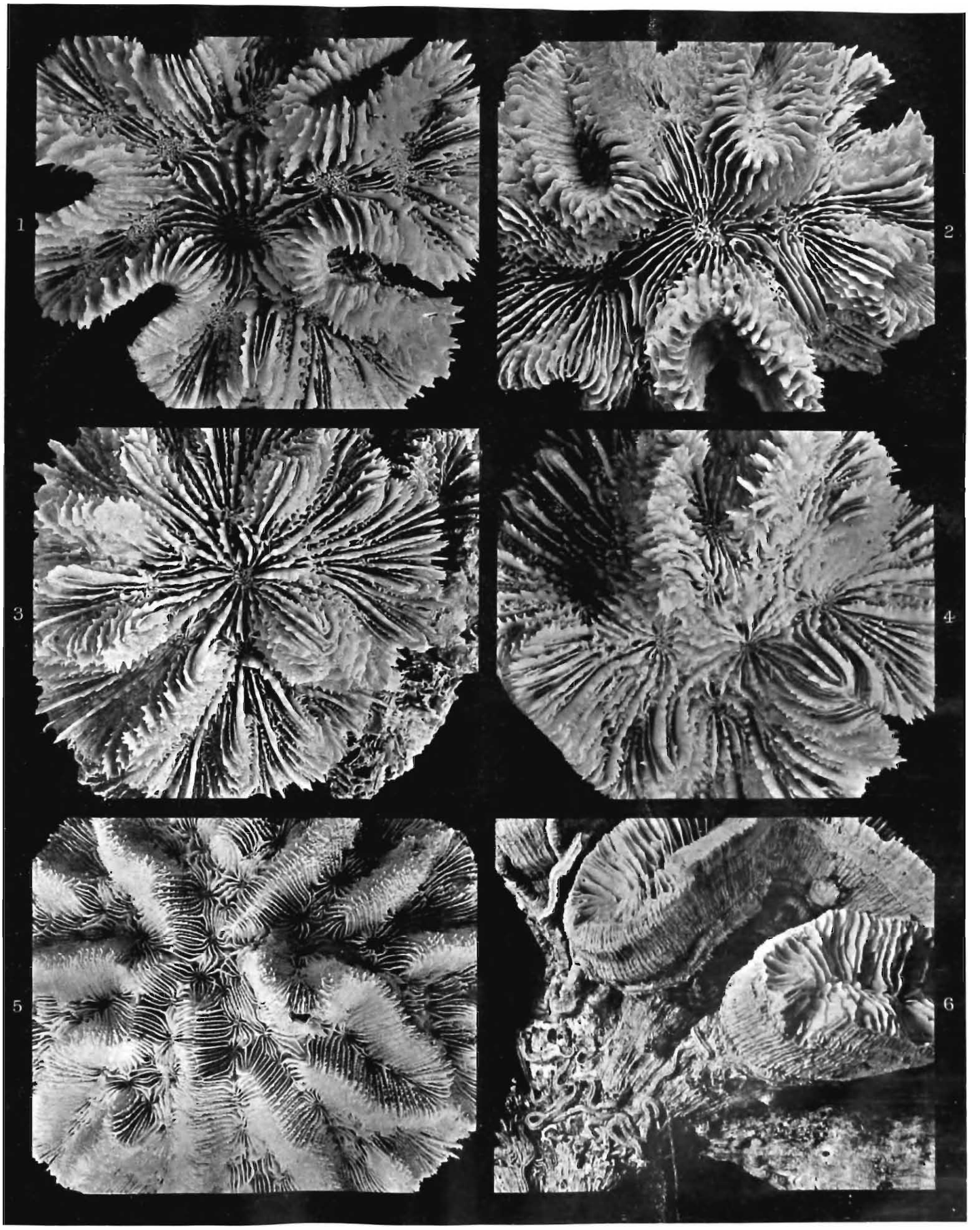
Fig. 2. *Symphyllia valenciennesi* (M. Ed. & H.). Reg. No. 6053/3. Nat. size.

Fig. 3. *Symphyllia agaricia*, M. Ed. & H. Youngest colony in the Indian Museum collection. Reg. No. Zev 7319/7. Nat. size.

Fig. 4. *Symphyllia agaricia*, M. Ed. & H. Reg. No. Zev. 7342/7. Nat. size.

Fig. 5. *Symphyllia agaricia*, M. Ed. & H. Reg. No. 3413/3. ½ nat. size.

Fig. 6. *Euphyllia fimbriata* (Speng.). Outer surface of corallum, with calcareous tubes of tubicolous worms and cirripedes (*Balanus arcuatus*, Hoek). Reg. No. 4239/4. Nat. size.



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EXPLANATION OF PLATE VII.

Fig. 1. *Coscinaræa monile* (Forsk.). Reg. No. 6478/4. Nat. size.

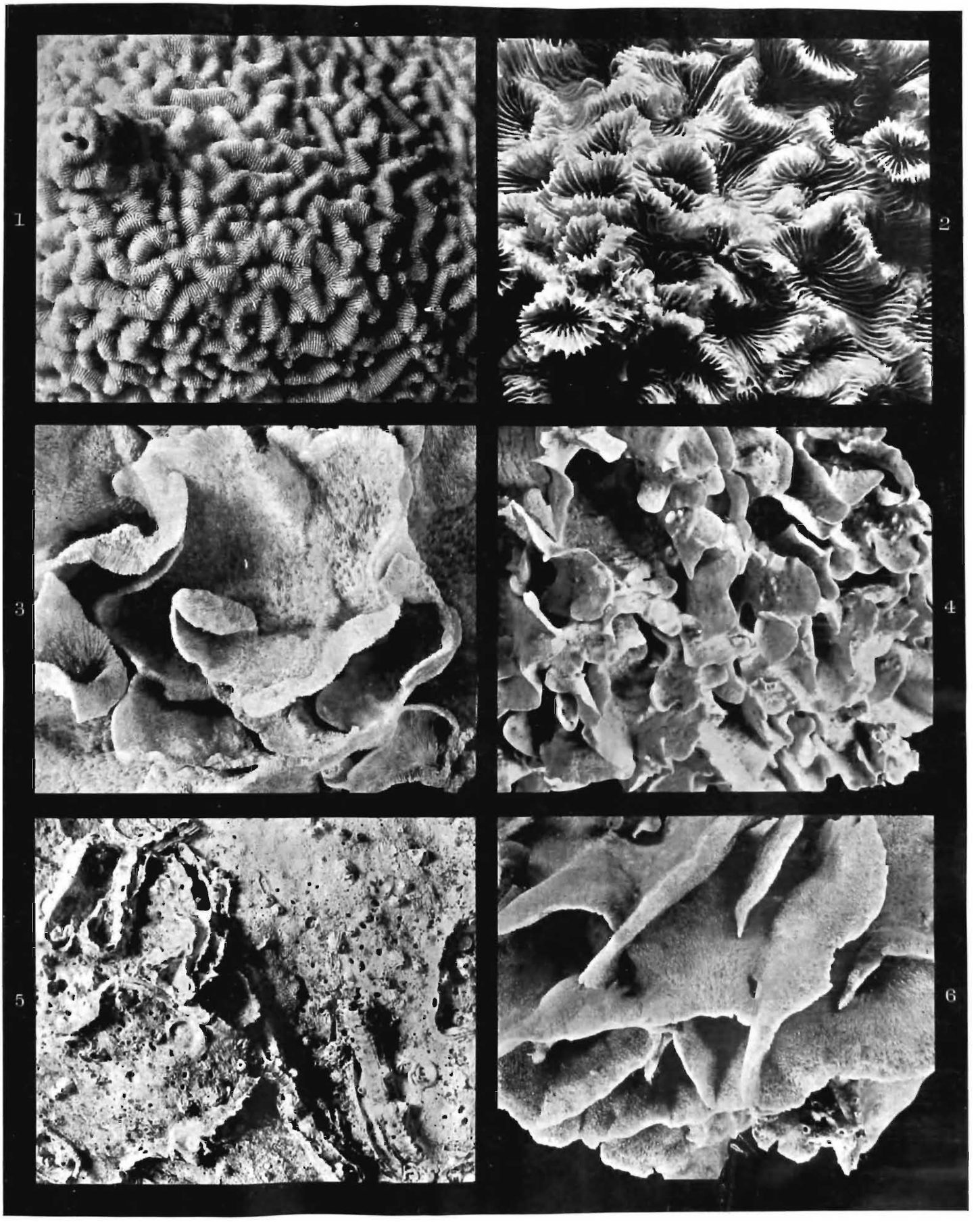
Fig. 2. *Mycedium aspera* (Ell. & Sol.). Part of corallum, showing protruding corallites. Same specimen as Pl. III, fig. 5. Nat. size.

Fig. 3. *Podabacia crustacea* (Pallas). Reg. No. 2091/5. $\frac{3}{7}$ nat. size.

Fig. 4. *Pavona prætorta*, Dana. Reg. No. 3451/5. $\frac{4}{5}$ nat. size.

Fig. 5. *Pachyseris speciosa* (Dana). Part of non-calicinal surface, with calcareous tubes of tubicolous worms, cirripedes (*Balanus fujiama*, Annandale and *B. arcuatus*, Hoek), Polyzoa, etc. Reg. No. Zev 7393/7. Nat. size.

Fig. 6. *Pavona lata*, Dana. Reg. No. 2630/3. $\frac{1}{2}$ nat. size.



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EXPLANATION OF PLATE VIII.

Fig. 1. *Pavona lata*, Dana. Part of calicinal surface. Same specimen as Pl. VII, fig. 6. ×3.

Fig. 2. *Pachyseris speciosa* (Dana). Part of calicinal surface, showing two cirripedes (*Creusia spinulosa*, Leach). Reg. No. 6057/3. Nat. size.

Fig. 3. *Podabacia crustacea* (Pallas). Showing burrows made by small lamellibranchs. Same specimen as Pl. VII, fig. 3. Nat. size.

Fig. 4. *Podabacia crustacea* (Pallas). Reg. No. 3524/3. ×3.

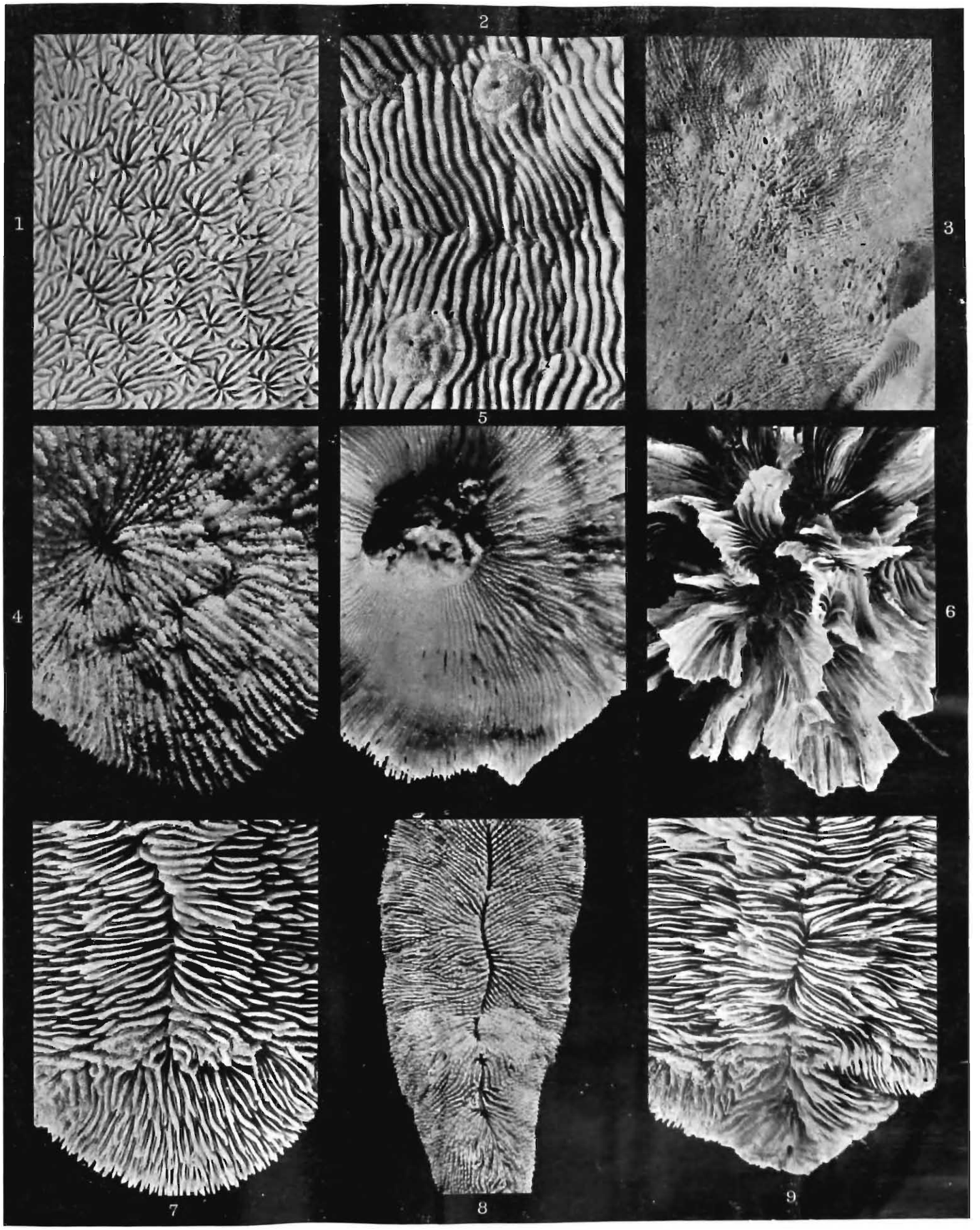
Fig. 5. *Podabacia crustacea* (Pallas). Same specimen as fig. 4. Basal view. ×3.

Fig. 6. *Tridacophyllia lactuca* (Pallas). Reg. No. 4703/9. Nat. size.

Fig. 7. *Herpetolitha limax* (Esp.). Reg. No. 4256/4. Nat. size.

Fig. 8. *Fungia echinata*, Mich. Reg. No. 3844/3. ½ nat. size.

Fig. 9. *Herpetolitha limax* (Esp.). Reg. No. 4257/4. Nat. size.



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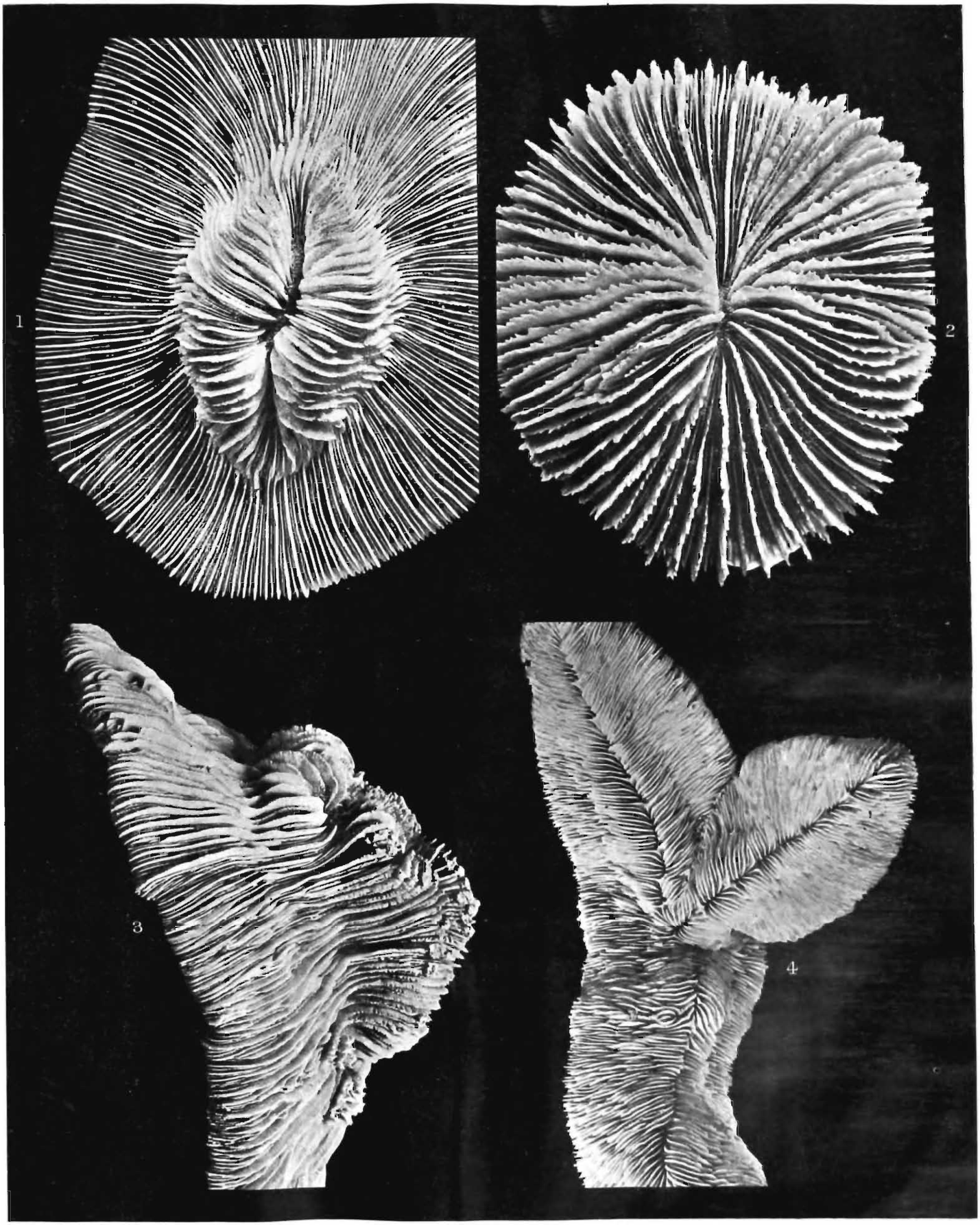
EXPLANATION OF PLATE IX.

Fig. 1. *Fungia somervillei*, Gard. Reg. No. 3189/3. Nat. size.

Fig. 2. *Fungia horrida*, Dana. Reg. No. 3481/5. Nat. size.

Fig. 3. *Fungia somervillei*, Gard. Reg. No. 3191/3. $\frac{3}{4}$ nat. size.

Fig. 4. *Fungia echinata*, Mich. Specimen forked at one end. Reg. No. 4251/4. $\frac{4}{7}$ nat. size.



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EXPLANATION OF PLATE X.

Fig. 1. *Leptoseris fragilis*, M. Ed. & H. Reg. No. 2885/3. $\frac{4}{7}$ nat. size.

Fig. 2. *Fungia distorta*, Mich. Reg. No. 2897/3. $\times 2$.

Fig. 3. *Fungia distorta*, Mich. Reg. No. 2895/3. $\times 3$.

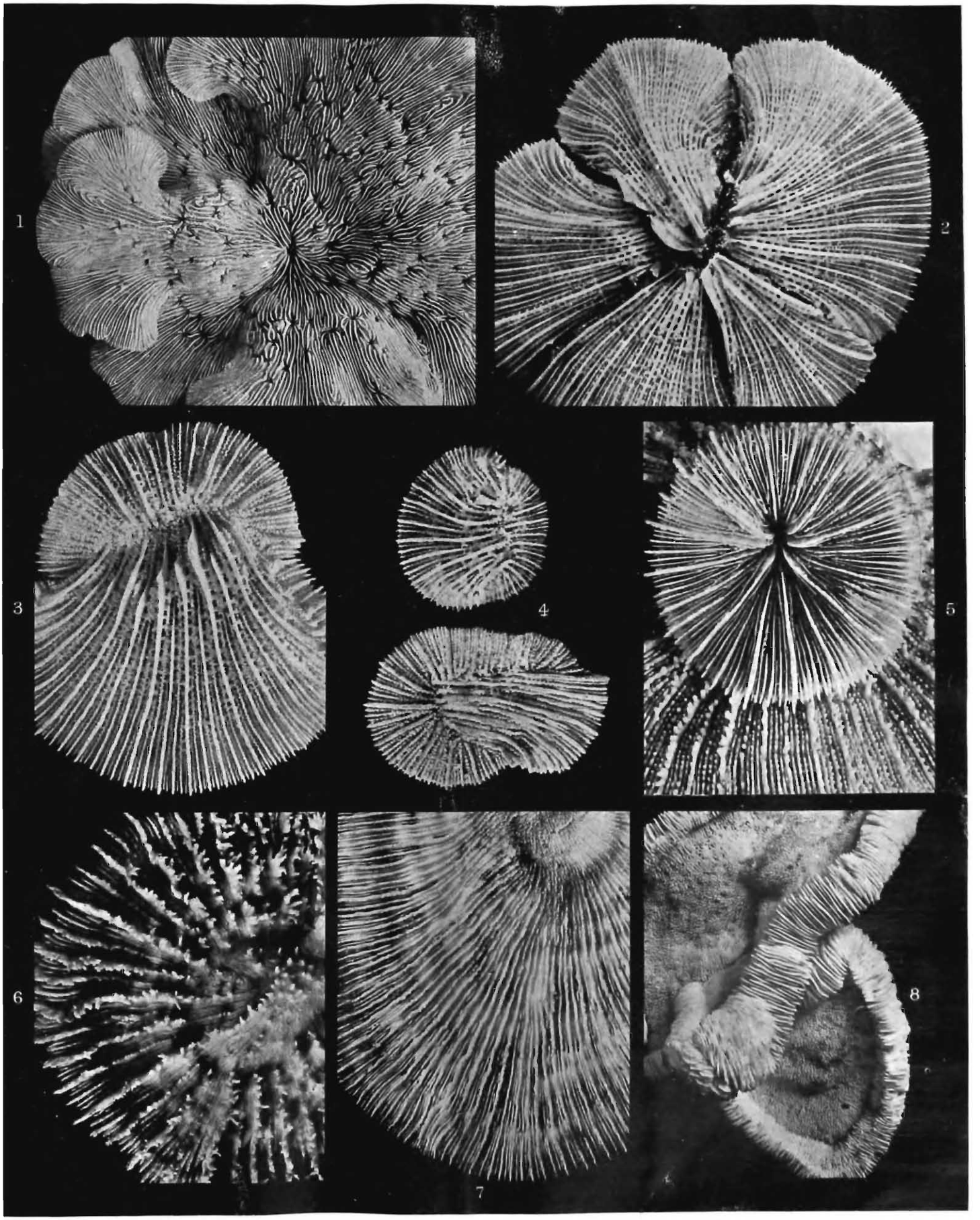
Fig. 4. *Fungia distorta*, Mich. (*a*) Reg. No. 2896/3 (upper figure). $\times 3$. (*b*) Reg. No. 2902/3 (lower figure). $\times 3$.

Fig. 5. *Fungia danai*, M. Ed. & H. Reg. No. 4247/4. Nat. size.

Fig. 6. *Fungia horrida*, Dana. Basal view of Pl. IX, fig. 2. Nat. size.

Fig. 7. *Fungia somervillei*, Gard. Basal view of Pl. IX, fig. 1. Nat. size.

Fig. 8. *Fungia echinata*, Mich. Basal view of Pl. IX, fig. 4. $\frac{4}{7}$ nat. size.



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EXPLANATION OF PLATE XI.

Fig. 1. *Favia vasta* (Klunz.). Same specimen as Pl. I, fig. 7. $\frac{2}{7}$ nat. size.

Fig. 2. *Favia valenciennesi* (M. Ed. & H.). Reg. No. 3207/3. Nat. size.

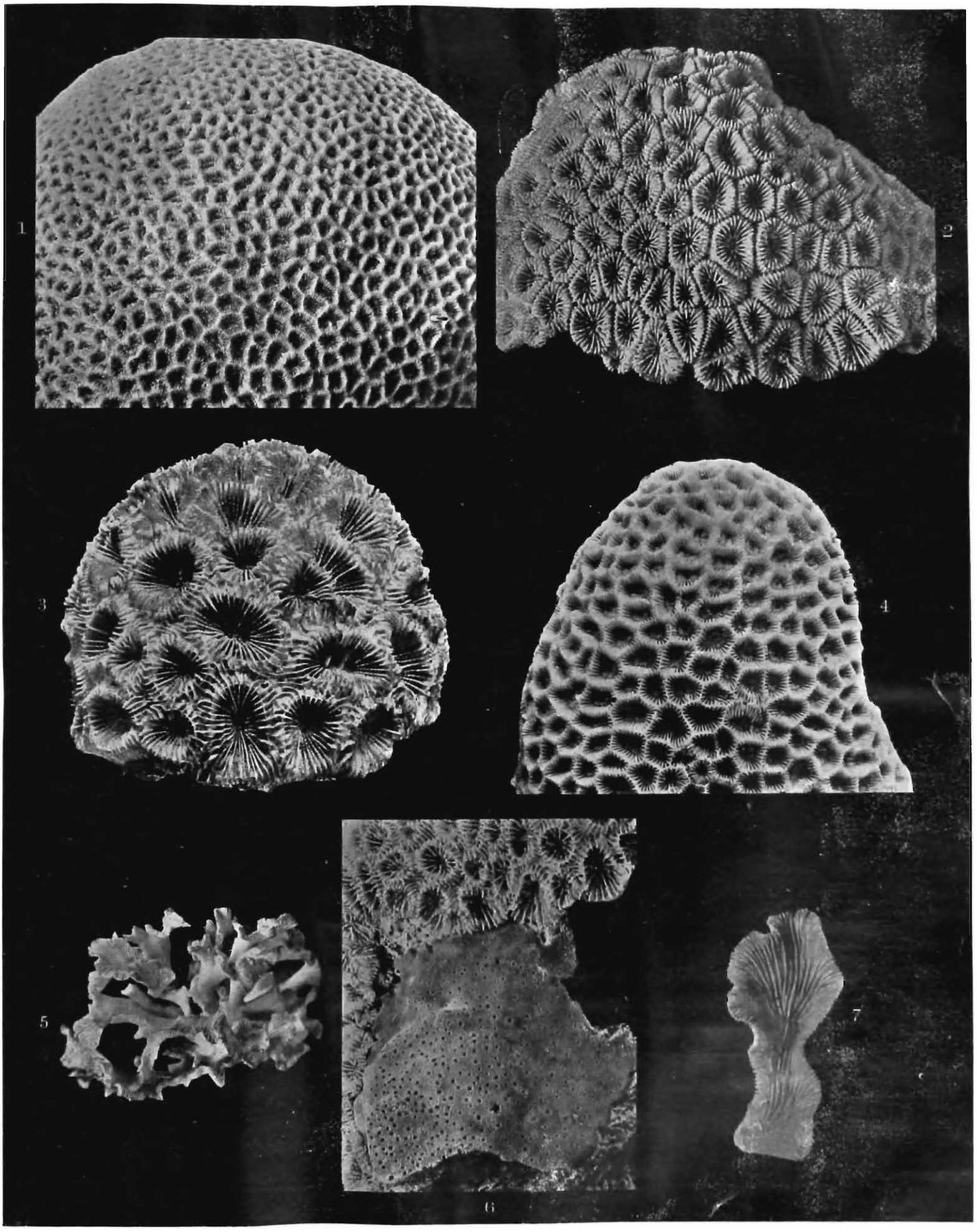
Fig. 3. *Favia speciosa* (Dana). Reg. No. Zev 7345/7. Nat. size.

Fig. 4. *Goniastrea incrustans*, Duncan. Reg. No. 2991/3. Nat. size.

Fig. 5. *Leptoseris digitata*, Vaugh. Reg. No. Zev 7391/7. Nat. size.

Fig. 6. *Favia hululensis*, Gard. Partly overgrown by a small colony of *Porites*. Reg. No. 6471/4. Nat. size.

Fig. 7. *Leptoseris digitata*, Vaugh. Enlarged view of part of corallum. Same specimen as fig. 5. ×3.



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CIRRIPEDES ASSOCIATED WITH INDIAN CORALS OF THE FAMILIES ASTRAEIDAE AND FUNGIDAE.

By N. ANNANDALE, *D.Sc., F.A.S.B., Director,*
Zoological Survey of India.

Plate XII.

At Professor Matthai's request I have worked out the Cirripedes associated with the corals discussed by him in the preceding report. These do not include the whole of the collection of Madreporaria preserved in the Indian Museum, for several important genera have been reserved for future consideration. The chief are *Turbinaria*, *Acropora* (*Madrepora*) and *Porites*, on all of which other barnacles may yet be found. I have included a reference to those cirripedes already known to be associated with *Turbinaria* in my key on p. 61.

No attempt has been made since Darwin's time, so far as I am aware, to discover definitely what cirripedes are associated with what corals, or whether the association is in any case specific or even generic. To investigate this point was my chief motive in examining the collection. The results have been disappointing. They are summarized in the table on pp. 67-68. Discussion may be postponed until further material is rendered available by authoritative determination of the corals and the acquisition of well preserved specimens.

Key to the Species of Cirripedes known to be associated with Corals in the Bay of Bengal.

1. Shell with six compartments visible externally, conical or globose.
   - A. Shell conical, with the orifice apical or near (*Balanus*).
     - (*i*) Basis cup-shaped, forming a simple suture with the shell. (Orifice moderately large, distinctly rhomboidal) ... *B. arcuatus.*
     - (*ii*) Basis flat; basal margin of shell produced into processes.
       - (*a*) Basis solid; basal processes of shell simple; orifice pore-like ... ... *B. fujiyama.*
       - (*b*) Basis pierced by numerous perforations, very thin; basal processes of shell (in var. *radicifer*) branched; orifice moderately small ... ... *B. terebratus.*
   - B. Shell globose, with the aperture eccentric in the rostro-carinal line (*Acasta*).
     (Basis flat, solid; shell with basal processes) ... ... *A. funiculorum.*
2. Shell with four compartments visible externally, flat (*Creusia*).
   (Basis cup-shaped; orifice moderately small, rhomboidal; shell decorated with numerous radiating ribs) ... ... *C. spinulosa.*
3. Shell forming a uniform disk without external sutures (*Pyrgoma*).
   - A. Shell with four compartments distinct internally; tergum and scutum fused together ... ... *P. indicum.*

B. Internal sheath of shell uniform, without sutures; tergum and scutum fused or distinct.

(*i*) Shell star-shaped or lobate, with a minute orifice ... ***P. monticulariæ.***

(*ii*) Shell oval or ovate, with a moderately large orifice.

(*a*) Shell smooth, conical, projecting; main axis of orifice forming an angle with that of base of shell; tergum and scutum fused, forming a broad subtriangular plate ... ... ***P. grande.***

(*b*) Shell with radiating ribs, flat or nearly so; main axis of orifice parallel to base; tergum and scutum distinct, the former separated into an upper and a lower region by a transverse ridge, the latter very broad and low ... ... ***P. crenatum.***

Balanus arcuatus Hoek.

1913. *Balanus arcuatus*, Hoek, *Siboga-Exp.* XXXI b, p. 210, pl. xxi, figs. 4-14.

Hoek distinguished his *B. arcuatus* from Darwin's *B. allium* by the structure of the operculum and particularly on the fact that the apex of tergum was distinctly beaked. In the large series of specimens I have examined I find much variation in the opercular valves and especially in the form of the apex of the tergum, which seems to be liable to be worn away into a fine process or beak. I am, therefore, doubtful whether the two forms are specifically distinct, but leave them so provisionally as my specimens agree on the whole rather with Hoek's than with Darwin's figures.

B. arcuatus is by far the most indiscriminate of the cirripedes examined so far as the choice of host is concerned. It is the only species found associated with *Fungia* or its allies. I have rarely observed it, however, on parts of a coral-colony in which growth was very active. On *Fungia* it occurs either on the lower surface or, more rarely, wedged in between the transverse plates on the upper surface. In the latter position the barnacle must have been almost completely enveloped in the soft tenues. On compound coralla its cup-shaped basis is usually overgrown with coral, but in some way it usually succeeds in keeping its shell free or almost free from overgrowth. Occasionally, however, the whole shell is covered by a thin layer of coral.

B. arcuatus was described from the Malay Archipelago.

Balanus fujiyama, sp. nov.

1903. (?) *Balanus terebratus*, Borradaile "Marine Crustaceans VII" in Gardiner's *Faun. Geogr. Maldive and Laccadive Arch.* I, p. 442.

1906. *Balanus terebratus*, Annandale (*nec* Darwin), in Herdman's *Ceylon Pearl Fish.* V, p. 148.

This species has hitherto been confused with Darwin's ***B. terebratus,*** from which the absence of perforations in its basis will at once distinguish it. The structure of the operculum is also different.[1] The nearest ally of the species is probably ***B. quadrivittatus*** Darwin, but the aperture is much smaller and the valves are narrower.

[1] See Hoek, *op. cit.*, p. 207, pl. xx, figs. 17-21; pl. xxi, figs. 1-3.

The shell is very sharply conical, with a very small, indeed almost pore-like orifice, white, sometimes tinged with rose-pink, thin and rather fragile. The compartments are difficult to distinguish in old specimens and the alae and radii are always narrow. The external surface is sculptured with numerous stout irregular vertical ribs, which are prolonged beyond the edge of the basis in the form of simple horizontal root-like processes. These tend to disappear in old shells. No part of the shell or basis is porous. The internal sheath is not very stout and the transverse striation of the parietes is not strong on this surface, but the lower part of the shell is deeply grooved vertically.

The basis is flat, thin, devoid of perforations, somewhat translucent but permeated by numerous radiating threads of more opaque substance.

The type-specimen is 10 mm. high, with a transverse diameter at the base of 13 mm. The orifice is about 1 mm. in diameter.

The operculum closely resembles that of *B. quadrivittatus* Darwin as figured by Hoek, but the outer articular border of the scutum is much narrower on the internal surface and the inner border both of this valve and of the tergum straighter. The tergal spur is also less differentiated.

Type-specimen (C. $\frac{664}{1}$ Z. S. I.) from lower surface of *Pachyseris speciosa* (Dana) from Pilai I, Mergui Archipelago.

The species occurs on the lower surface of *Turbinaria crater* in the Gulf of Manaar as well as on the corals indicated on p. 67.

Balanus terebratus Darwin, var. **radicifer,** nov.

The shell and basis of this barnacle so closely resemble those of *B. terebratus* Darwin that I do not feel justified, in the absence of opercular valves and internal organs, in describing it as a distinct species.

There are, however, constant differences in the seven shells I have examined, not only from Darwin's specimen but also from those recently described and figured by Hoek (*Siboga-Exp.* XXXI b, p. 207, pl. xx, figs. 17-21 ; 1913).

The shell forms a low and fairly regular cone with a small terminal rhomboidal or star-shaped orifice. It is white and fragile. The parietes are rather more distinct than in *B. terebratus typicus.* Their apices are pointed and minutely serrate, their alae poorly developed. Internally the upper part is strongly striated transversely, but externally only obscure traces of transverse striation can be detected. Strong, irregularly serrated ribs arise on the parietes a short distance from the tip and running down the shell are produced horizontally over its support in the form of slightly flattened processes, which in large specimens bifurcate or branch freely at their extremity. There are about 5 or 6 such ribs on each compartment. Their processes extend outwards from the shell for a varying distance but never for much more than half its height. The basis is flat and very thin. It is strengthened below by numerous ribs like those of the parietes, with which they often alternate. Their external terminal processes are similar and extend outwards for the same distance. These ribs converge towards the centre of the basis but leave a circular space bare round it. Between and within them the base is pierced by numerous perforations of varying shape and size but mostly somewhat elongate in a transverse direction. They have no

definite arrangement. On the bare central space the perforations are often partially or completely obliterated by the growth of a very thin calcareous membrane. The upper surface of the basis is smooth.

The shell is small, my largest specimen, without the processes, being about 8 mm. in maximum transverse diameter and 5 mm. high. The maximum diameter of the orifice is about 2·5 mm., but it is smaller in other specimens.

The variety is easily distinguished from *B. terebratus typicus* by its branching processes and by the structure of its basis, which is smooth on its upper surface and strengthened on the lower surface by ribs, which are not in continuity with those of the parietes.

The method by which *B. radicifer* anchors itself to the coral is different from that adopted by *B. fujiyama*, but like that species it is found not on the polyp-bearing surface but on the comparatively inactive lower part of the colony and avoids regions of active growth. It possesses no power of elongating its shell or basis but is attached so lightly to the surface by means of its branching processes that the whole shell can be removed intact without difficulty. In some respects the method of attachment is analogous to that of my *Acasta funiculorum*[1], but the structure is much more complex and differs in that the retaining cables spread out over the surface of the coral instead of penetrating into it.

Type-specimen (C. $\frac{6}{1}\frac{5}{}\frac{9}{}$ Z. S. I.), from the lower surface of a large specimen of the coral *Pachyseris speciosa* (Dana) from Pilai I., Mergui Archipelago. The form occurs also on the basal part of colonies of *Pavona crassa* (Dana) of unknown provenance.

Creusia spinulosa Leach.

1854. *Creusia spinulosa*, Darwin, *op. cit.*, p. 376, pl. xiii, fig. 6; pl. xiv, fig. 6.

Large typical specimens occur on both the upper and the lower surface of a fine specimen of *Pachyseris speciosa* (Dana) from Pilai I. in the Mergui Archipelago. They are completely buried in the coral, except for the orifice, in most instances and the wart-like projection formed over them is often stained of a brownish colour. Some have been entirely overwhelmed and buried. The operculum of one of these specimens has the tergum and scutum of each side fused and agrees with Darwin's fig. 6 *d* on his plate xiii except that the scutal region is a little broader.

I also attribute to the species a number of small specimens in *Pavona praetorta* Dana from the Andamans, but these have lost their opercula.

Pyrgoma indicum, sp. nov.

The species seems to be by far the commonest of its genus in the Bay of Bengal, at any rate on the genera of corals considered. The corals in which it has been found are indicated in my list (p. 68).

P. indicum resembles *P. conjugatum* Darwin in certain characters and cannot always be distinguished with certainty from *P. crenatum* Sowerby by an external examination only. It differs from both in the internal structure of the shell and in the form of the fused tergum and scutum, in both respects showing an interesting approach to the genus *Creusia.*

[1] Annandale, *op. cit.*, p. 145, figs. 5-9 (1906).

The disc is oval or ovate, usually small but sometimes as much as 15 mm. long and 11 mm. broad. It is moderately thin and nearly flat and as a rule white but sometimes irregularly stained with rose-pink. In some specimens it is slightly raised round the orifice, which is ovate and of moderate size, though variable in the latter respect. The external surface exhibits no trace of sutures and bears a comparatively small but variable number of radiating ribs, which take the form of sharp, more or less strongly serrated keels and usually project outwards beyond the margin of the disc. Sometimes the surface is completely overgrown by the coral host. The internal structure of the shell is characteristic in that the compartments and even the radii remain distinct in spite of the complete fusion of the outer sheath, thus resembling those of *Creusia*, in which, however, the sutures remain on the external surface. The internal surface of the parietes is coarsely striated transversely and as a rule stained with purple. There are no pores in any part of the shell. The basis forms a long and narrow cylinder more or less contracted below and often somewhat sinuous. The shell and the basis articulate in a characteristic fashion. From the margin of the former numerous long, pointed processes are given off vertically downwards. These interdigitate with similar processes directed upwards from the edge of the basis. The external surface of the basis bears numerous strong vertical ridges, which are represented by deep grooves on the internal surface.

The fused tergum and scutum resemble those of *P. conjugatum* as figured by Darwin, but differ in that (*a*) the tergal spur is shorter and blunter and is followed externally by a distinct excavation, that (*b*) the external margin of the tergum slopes directly downwards from the apex to the lower margin, that (*c*) the basal part of the valve is nearly square and that (*d*) the scutum is broader and much blunter and not at all retroverted at the tip. The structure of the plate is remarkably constant throughout the species, the only variation observed being in the relative breadth of the scutum, and this is not great.

The *forma typica* is found on corals with star-shaped corallites and of massive form or with stout quadrate branches. It is particularly common on certain species of *Favia*, such as *F. abdita* (Ell. & Sol.).

Type-specimen (C. $\frac{668}{1}$ Z. S. I.) form *Favia valenciennesii* (M. Edw. & H.), Padaw B., King I., Mergui Archipelago.

Phase **merulinae,** nov.

The disc differs from that of the typical form in being much thinner and in that the ribs are more finely and regularly serrate and produced into long horizontal spines, which are finely serrate on their lower margin. The external surface is dull white. The internal structure of the shell and that of the basis and operculum are identical.

I have seen this form only in *Merulina laxa* Dana, a delicately branching coral, from the Mergui Archipelago. It is abundant on colonies of this species from King I. and Pilai I.

Type-specimen (C. $\frac{667}{1}$ Z. S. I.) from Pillai I., Mergui Archipelago.

Phase **symphylliae,** nov.

The structure of the shell is so distinct that I would have regarded the form as a good species but for the identity of the opercular valves. The disc is smooth or nearly so externally, with the ribs obsolete or obsolescent, and of a subconical form. Internally the struc-

ture is similar to that of the *forma typica*, except that the downwardly-directed processes of the disc are fewer and more regular and arise not at the margin but immediately below the internal compartments, which do not extend so far downwards. The external ridges and internal grooves of the basis are also less strongly developed.

This form is scarce. I have seen only two specimens, each in a colony of *Symphyllia agaricia* M. Edw. & H. One of these is from the Mergui Archipelago, the other from the coast of Arracan. The former was growing on a stone side by side with colony of *Favia* in which there were barnacles of the *forma typica* of the species.

Type-specimen (C. $\frac{669}{1}$ Z. S. I.) from Pilai I., Mergui Archipelago.

Pyrgoma crenatum Sowerby.

1854. *Pyrgoma crenatum*, Darwin, *op. cit.*, p. 370, pl. xiii, fig. 4.

After *P. indicum* this is the commonest species of the genus in the corals examined. Most of my specimens agree well with Darwin's description and figures. The shells can usually be distinguished externally from those of *P. indicum* by the shorter, coarser and smoother ridges on the disc and by the narrower and more oval, less ovate form of both disc and orifice, but specimens occur that are difficult to diagnose without an examination of the internal structure of the shell and of the opercular valves. In the former the inner sheath is thin and completely fused into a homogeneous ring, marked internally with fine uninterrupted concentric striae. The tergum shows some variation, the spur being frequently much narrower than the upper part of the valve.

A few specimens from the coral *Tridacophyllia lactuca* (Pallas) seem sufficiently distinct and sufficiently constant to be given a name :—

Phase **tridacophylliae,** nov.

The shell and basis differ only in being much more fragile than those of the *forma typica* and in having the horizontal pores below the outer lamella of the disc exceptionally well developed. The lamella, indeed, is only attached lightly to the partitions between these pores and can be stripped off, leaving the partitions standing up as prominent ribs. The disc is also somewhat concave on the outer surface towards one end.

The spur of the tergum is narrow and spoon-shaped in the specimens examined.

Type-specimen (C. $\frac{677}{4}$ Z. S. I.), probably from the Mergui Archipelago.

Pyrgoma grande Darwin.

1854. *Pyrgoma grande*, Darwin, *op. cit.*, p. 365, pl. xiii, fig. 1.

Darwin's figures of this species are excellent. It is by no means common in Indian seas, in which it is mainly confined to the two genera *Galaxea* and *Euphyllia*, corals which only resemble one another in that the corallites project strongly from the base of the colony. I have, however, seen some dwarfed specimens attached to the edge of a solitary coral. In these the basis was conical and much shorter than usual, but the operculum was normal. Specimens from *Euphyllia* are usually larger than those from *Galaxea*.

I have also found in a colony of *Symphyllia* from the Mergui Archipelago a single barnacle which may represent a much dwarfed and somewhat distorted phase of this species, but the operculum is lost and the shell incomplete, and accurate determination is impossible.

Pyrgoma (Daracia) monticulariae Gray.

1854. *Pyrgoma monticulariae*, Darwin, *op. cit.*, p. 372, pl. xiii, fig. 5.

I have found only one complete specimen of this peculiar barnacle in the collection. It was embedded in a specimen of *Hydnophora exesa* (Pallas) from the coast of Arracan. Other specimens of this coral of unknown provenance, however, contain the characteristic star-shaped cavities formed by the barnacle. The shell of the individual from Arracan is deep pink.

P. monticulariae has been found only on *Hydnophora*, of which *Monticularia* is a synonym.

List of Cirripedes and of Corals with which they are associated.

NAME OF CIRRIPEDE.	NAME OF CORAL	LOCALITY.
Balanus arcuatus Hoek ...	*Fungia danai* Mil. Edw. & H. ...	Pilai Island, Mergui Archipelago
,, ,, ,, ...	,, ,, ,, ...	Macassar Strait, Malaysia.
,, ,, ,, ...	,, ,, ,, ...	?
,, ,, ,, ...	,, *corona* Döderl.	Pilai Island, Mergui Archipelago.
,, ,, ,, ...	,, *patella* (Ell. & Sol.) ..	,, ,, ,,
,, ,, ,, ...	*Pavona lata* Dana	,, ,, ,,
,, ,, ,, ...	,, *crassa* Dana ...	?
,, ,, ,, ...	,, ,, ,, ...	Mergui Archipelago.
,, ,, ,, ...	,, *danai* (Mil. Edw. & H.) ...	Pilai Island, Mergui Archipelago.
,, ,, ,, ...	,, *decussata* Dana ...	?
,, ,, ,, ...	*Pachyseris speciosa* (Dana) ...	Pilai Island, Mergui Archipelago.
,, ,, ,, ...	*Favia valenciennesii* (Mil. Edw. & H.)	Mergui.
,, ,, ,, ...	,, ,, ,,	Padaw Bay, King Island, Mergui Archipelago.
,, ,, ,, ...	,, *abdita* (Ell. & Sol.) ...	?
,, ,, ,, ...	,, ,, ,, ...	Padaw Bay, King Island, Mergui Archipelago.
,, ,, ,, ...	,, *favus* (Forskal) ...	,, ,, ,,
,, ,, ,, ...	,, *doreyensis* Mil. Edw. & H.	,, ,, ,,
,, ,, ,, ...	,, *speciosa* (Dana) ...	?
,, ,, ,, ...	*Leptoseris hawaiiensis* Vaugh. ...	Andamans.
,, ,, ,, ...	,, *fragilis* Mil. Edw. & H.	,,
,, ,, ,, ...	*Cœloria stricta* Mil. Edw. & H. ...	Padaw Bay, King Island, Mergui Archipelago.
,, ,, ,, ...	*Mycedium okeni* Mil. Edw. & H.	,, ,, ,,
,, ,, ,, ...	*Goniastrea incrustans* Duncan ...	,, ,, ,,
,, ,, ,, ...	,, ,, ,, ...	Mergui.
,, *fujiyama* Annand. ...	*Pachyseris speciosa* (Dana) ...	Pilai Island, Mergui Archipelago.
,, ,, ,, ...	*Pavona crassa* Dana	?
,, ,, ,, ...	*Mussa brueggemanni* (Quelch) ..	?
,, ,, ,, ...	*Pachyseris speciosa* (Dana) ...	Pilai Island, Mergui Archipelago.
,, ,, ,, ...	,, ,, ,,	,, ,, ,,
,, *terebratus* var *radicifer* Annand.	,, ,, ,,	,, ,, ,,
,, ,, ,,	*Pavona crassa* Dana	?
Creusia spinulosa Leach. ...	*Pachyseris speciosa* (Dana) ...	Pilai Island, Mergui Archipelago.
,, ,, ,, ...	*Pavona prætorta* Dana ...	?
,, ,, ,, ...	,, ,, ,, ...	Andamans.

List of Cirripedes and of Corals with which they were associated—contd.

NAME OF CIRRIPEDE.	NAME OF CORAL.	LOCALITY.
Pyrgoma grande (Sowerby) ...	*Galaxea musicalis* (Linn.) ...	Mergui.
,, ,, ,, ...	,, *fascicularis* (Linn.) ...	?
,, ,, ,, ...	*Euphyllia fimbriata* (Spengler) ...	Mergui.
,, *crenatum* Sowerby ...	*Favia valenciennesii* (Mil. Edw. & H.)	Padaw Bay, King Island, Mergui Archipelago.
,, ,, ,, ...	,, ,, ,,	?
,, ,, ,, ...	,, *doreyensis* Mil. Edw. & H.	Padaw Bay, King Island, Mergui Archipelago.
,, ,, ,, ...	*Cœloria dædalea* (Ell. & Sol.) ...	,, ,, ,,
,, ,, ,, ...	,, ,, ,, ...	Kilakarai, Gulf of Manaar.
,, ,, ,, ...	,, *stricta* Mil. Edw. & H. ...	Padaw Bay, King Island, Mergui Archipelago.
,, ,, ,, ...	,, ,, ,, ...	Andamans.
,, ,, ,, ...	,, *astræiformis*, Mil. Edw. & H.	?
,, ,, ,, ...	,, *sinensis* Mil. Edw. & H.	?
,, ,, ,, ...	*Mycedium okeni* Mil. Edw. & H	Mergui.
,, ,, ,, ...	*Merulina ampliata* (Ell. & Sol.) ...	Arracan.
,, ,, ,, ...	,, ,, ,, ...	Singapore.
,, ,, ,, ...	,, ,, ,, ...	?
,, ,, ,, ...	*Goniastrea incrustans* Duncan ...	Padaw Bay, King Island, Mergui Archipelago.
,, ,, ,, ...	,, ,, ,, ...	Mergui.
,, *crenatum* phase *tridacophyllae* Annand.	*Tridacophyllia lactuca* (Pallas) ...	Padaw Bay, King Island, Mergui Archipelago.
,, ,,	,, ,, ,, ...	?
,, *indicum* Annand. ...	*Favia valenciennesii* (Mil. Edw. & H.)	Padaw Bay, King Island, Mergui Archipelago.
,, ,, ,, ...	,, ,, ,,	?
,, ,, ,, ...	,, *abdita* (Ell. & Sol.) ...	Lampee Island, Mergui Archipelago.
,, ,, ,, ...	,, ,, ,, ...	Pilai Island, Mergui Archipelago.
,, ,, ,, ...	,, ,, ,, ...	?
,, ,, ,, ...	,, *speciosa* (Dana) ...	?
,, ,, ,, ...	,, ,, ,, ...	Pilai Island, Mergui Archipelago.
,, ,, ,, ...	,, ,, ,, ...	?
,, ,, ,, ...	*Favia pentagona* (Esper) ...	Lampee Island, Mergui Archipelago.
,, ,, ,, ...	*Coeloria daedalea* (Ell. & Sol.) ...	Padaw Bay, King Island, Mergui Archipelago.
,, ,, ,, ...	,, *astreiformis* Mil. Edw. & H.	?
,, ,, ,, ...	*Galaxea fascicularis* (Linn.) ...	?
,, ,, ,, ...	,, ,, ,, ...	Padaw Bay, King Island, Mergui Archipelago.
,, *indicum* phase *merulinae* Annand.	*Merulina laxa* Dana ...	,, ,, ,,
,, *indicum* phase *symphyllae* Annand.	*Symphyllia agaricia* Mil. Edw. & H.	Padaw Bay, King Island, Mergui Archipelago.
,, ,,	,, ,, ,,	Pilai Island, Mergui Archipelago.
,, *monticulariae* (Gray) ...	*Hydnophora exesa* (Pallas) ...	Arracan.
,, ,, ,, ...	,, ,, ,, ...	?

EXPLANATION OF PLATE XII

CIRRIPEDES ASSOCIATED WITH INDIAN CORALS.

Balanus fujiyama, sp. nov.

Fig. 1. Type-specimen as seen from above, ×2.

Fig. 2. Scuta of another specimen, ×2.

Fig. 3. Terga of the specimen figured in fig. 2, ×7.

Balanus terebratus var. **radicifer,** nov.

Fig. 4. Part of the base of an old specimen as seen from below, ×3.

Fig. 5. Type-specimen as seen from above, ×2.

Fig. 6. Younger specimen in the same view, ×2.

Balanus arcuatus Hoek.

Fig. 7. Shell (*a*) partly embedded in coral (*Favia valenciennesii*). Nat. size.

Creusia spinulosa Leach.

Fig. 8. Specimen on lower surface of coral-colony (*Pachyseris speciosa*) completely embedded except for the orifice. Nat. size.

Pyrgoma indicum, sp. nov.

Fig. 9. Shell of an old specimen of typical form seen from within, showing separate internal compartments, ×7.

Fig. 10. Part of shell of younger specimen of the same form in the same view, showing the vertical processes of the disc interdigitating with the ridges on the inner surface of the basis, ×3.

Figs. 11, 11*a*. Fused scuta and terga of type-specimen of the same form, ×3.

Fig. 12. Fused tergum and scutum of type-specimen of the phase *merulinæ*, nov.

Fig. 13. *a*, type-specimen of the *forma typica*; *b*, another specimen of the same form. Both on *Favia*. Nat. size.

Fig. 14. Part of shell of a specimen of the phase *merulinæ*, showing an internal compartment and a horizontal rib in profile, ×7.

Fig. 15. *a*, a young specimen of the *forma typica* in *Favia*. Nat. size.

Pyrgoma crenatum Sowerby.

Fig. 13. *c*, a small specimen of the *forma typica* in *Favia*. Nat. size.

Fig. 15. *b*, a larger specimen of the same form in the same coral. Nat. size.

Figs. 16, 17. Upper and lower views of a normal shell of the same form, ×4.

Figs. 18, 18*a*. Tergum and scutum of a young specimen of the same form, ×7.

Figs. 19, 19*a*. Tergum and scutum of an older specimen, ×7.

Figs. 20, 21. Tergum and scutum of the type-specimen of the phase *tridactophylliæ*, ×7.

Fig. 22. Type-specimen of the phase *tridactophylliæ* as seen from above, ×4.

Fig. 23. Larger specimen in the same view with the outer lamella stripped off, ×4.

Fig. 24. Outer lamella of the same specimen seen from below, ×4.

Pyrgoma grand Darwin.

Fig. 25. Two specimens (*a*, *b*) in *Galaxea musicalis*, showing young polypites growing on their surface. Nat. size.

Pyrgoma (Daracia) monticulariæ Gray.

Fig. 26. Cavity left in colony of *Hydnophora exesa* after removal of the shell of this barnacle. ½ nat. size.

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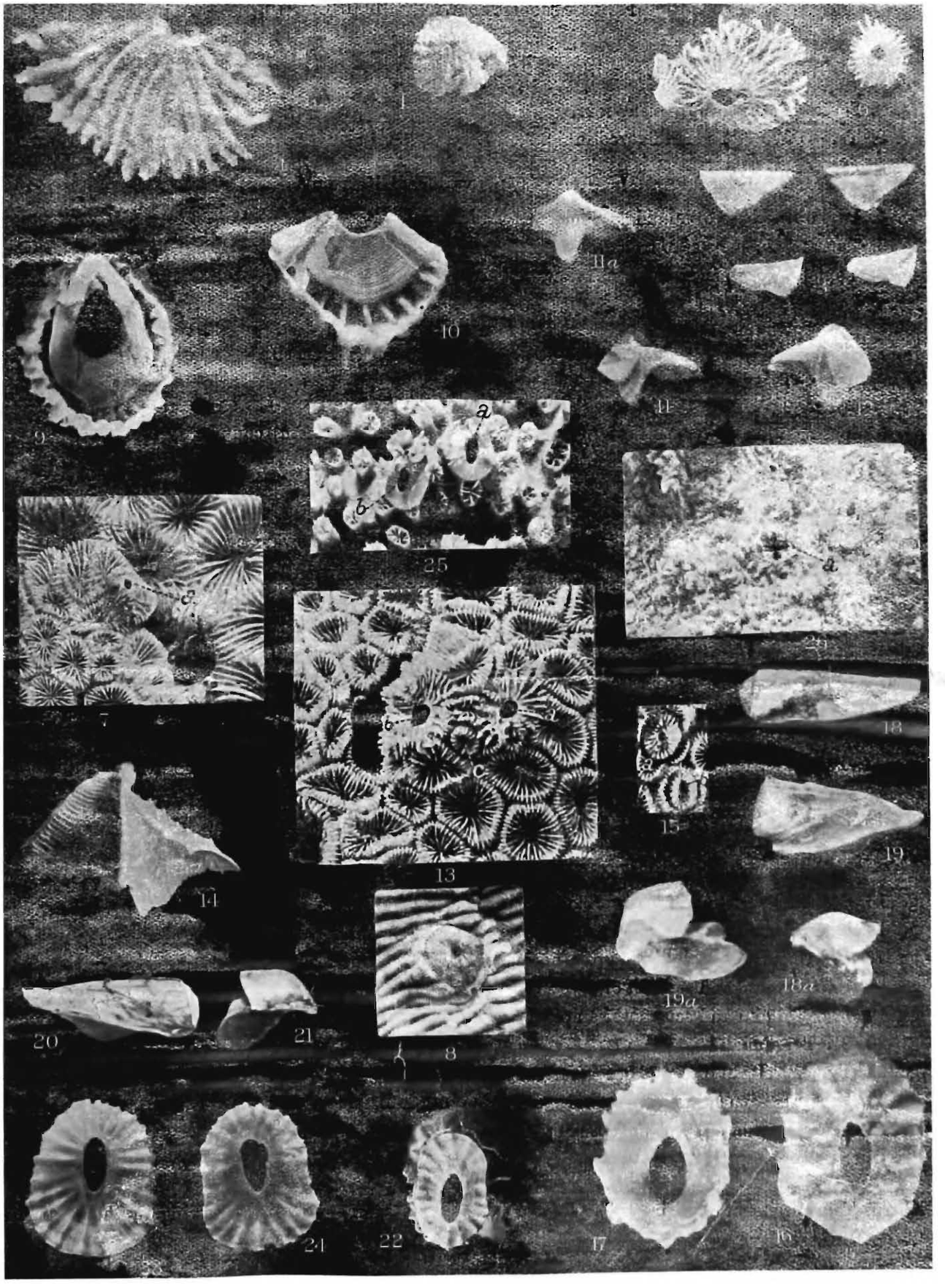

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