

DISTRIBUTION TABLE
FOR
CRINOIDEA

DISTRIBUTION TABLE

	Is. of W. Indian Ocean	Mascarene Is.	E. Africa & Madagascar	Red Sea	S.E. Arabia	Persian Gulf
COMASTERIDAE						
<i>Capillaster macrobrachius</i> (Hartlaub)
<i>multiradiatus</i> (Linnaeus) ¹ 354	..	I03	I20 * 665	I41 * I48	..	..
† <i>sentosus</i> (P. H. Carpenter)
² <i>Comantheria</i> † <i>alternans</i> (P. H. Carpenter) 69
† <i>briareus</i> (Bell)
<i>grandicalyx</i> (P. H. Carpenter)
<i>polycnemis</i> (A. H. Clark)
<i>rotula</i> A. H. Clark
<i>Comanthina</i> † <i>belli</i> (P. H. Carpenter)
<i>schlegeli</i> (P. H. Carpenter)
<i>Comanthus bennetti</i> (J. Müller) 463
<i>parvicirrus</i> (J. Müller) ³ 463	(I01 * II3)	I01 * II3	I01 (I04)	..	..	..
<i>samoanus</i> A. H. Clark
<i>Comaster</i> † <i>brevicirrus</i> (Bell)
† <i>distinctus</i> (P. H. Carpenter)
<i>gracilis</i> (Hartlaub)
† <i>multibrachiatus</i> (P. H. Carpenter)
<i>multifidus</i> (J. Müller) ⁴ 463
<i>pulcher</i> A. H. Clark
<i>schoenovi</i> A. H. Clark
<i>tenellus</i> A. H. Clark
<i>Comatella</i> † <i>maculata</i> (P. H. Carpenter)
<i>nigra</i> (P. H. Carpenter)
† <i>stelligera</i> (P. H. Carpenter)
<i>Comatula pectinata</i> (Linnaeus) 354
<i>purpurea</i> (J. Müller)
<i>rotalaria</i> Lamarck ⁵ 344
<i>solaris</i> Lamarck 344
<i>Comissia hartmeyeri</i> A. H. Clark	112 283	..	..
<i>littoralis</i> A. H. Clark
<i>pectinifera</i> A. H. Clark
ZYGOMETRIDAE						
<i>Zygometa andromeda</i> A. H. Clark
<i>comata</i> A. H. Clark ⁶ 103
† <i>elegans</i> (Bell)
† <i>microdiscus</i> (Bell)
<i>punctata</i> A. H. Clark ⁷
EUDIOCRINIDAE						
<i>Eudiocrinus tenuissimus</i> Gislén
HIMEROMETRIDAE						
<i>Amphimetra ensifera</i> (A. H. Clark)
<i>laevipinna</i> (P. H. Carpenter)
<i>molleri</i> (A. H. Clark) ⁸ 593
<i>spectabilis</i> A. H. Clark
<i>tessellata</i> (J. Müller) 463

CRINOIDEA

FOR CRINOIDEA

W. India & Pakistan	Maldiv area	Ceylon area	Bay of Bengal	East Indies	North Australia	Philippine Is.	China & S. Japan	South Pacific Is.	Hawaiian Is.
..	(II6) I22	..	..	III 281	..	..
I21?	48 * II3	74 5I3	I08 I2I	I04 * I20	II2 * 257	I02 * 2I6	44 * 260	III * 282	..
..	(48 * II3)	(I08 I20)	(I08)	(72) * 320	II4	(94 I02)	II8 *	..	..
..	I20 5I3	(34 * I62)	(597)	..	..	..
..	II6 * 5I3	I80 * 588	I02 I20	(I02 260)	..	..
..	70 * III	..	..
..	(I20) 260	..	II6 (597)	..	I37	..
..	II0 II6	257 *	I20 2I6	..	..	..
..	72 * I99	..	..	..	..
..	(48 * II3)	I60	(I08)	69 * 5I3	I03 * I69	72 * (94)	260 (*) 663	I06 * 282	..
..	(I08 I20)	282 * 320	(I79 *) 282	72 * I20	(44 * II3)	46 * 58	..
I08	..	I60 * 5I3	I08 I20	I99 * 282	72 * I80	69 * (I02)	258 * 663	I04 * 468	..
..	..	I60	I08	II6 282	I20 * I62	I04 I20	..	97 * 262	..
..	(I08 I20)	II6 5I3	..	..	(44 * 259)	..	..
..	(II6 * I20)	..	72 * (I02)	..	..	..
..	48 * II3	..	I08	I24 281	..	..	I20 *	46 * I36	..
..	I08 I20	(72 * I22)	..	(94 597)	(44 II3)	..	..
..	282 * 468	34 * 72	69 (94)	..	46 * 262	..
..	II0 I20	..	..	..	..	..
..	I20	..	..	116 598	..	..
..	(I20)	..	..	(I20) 598	..	..
..	48 * 5I	5I3	(I2I)	II6 600	72 * I69	II6 I20	I20 (258)	I04 * 282	..
..	II6 5I3	I62 * (I79)	72 I69	530	..	..
..	..	74 5I3	7I I08	II6 * 283	I62 I69	72 I20	(44 * 258)	68 * 262	..
..	..	I08?	I2I	282 * 468	72 * I03	(94) * I20	282	..	..
..	II6 * 5I3	257 * 465	(I20) 2I6	..	..	..
..	*?	72 * II6	34 * I80	..	..	..	..
..	72 * II3	I20 * I99	..	70 282	..	..
..
..	II0 II6	..	I20	..	..	..
..	(I20) * 599	..	..	..	..	..
..	..	107? I26?	..	..	..	..	..	..	..
..	7I I03	I03 * II6	(II3) * I80	I02 I26	III 260	..	..
..	I24	I80 * 588	..	..	..	..
..	II6 5I3	I80 * 588	..	..	..	..
..	II0 (5I3)	I03? * II3?	..	..	..	..
..
..	262	..
..	II8 * 593	..	..	..	..	..
..	70 I26	..	..
..	(48? II6?)	(74) I08	7I 593	59 * 282	..	72 I26	260	..	..
..	(94) 116	..	..	..
..	467 5I3	I80 * 257	(94) * I26	II6 260	II3 *	..

DISTRIBUTION TABLE FOR CRINOIDEA

	Is. of W. Indian Ocean	Mascarene Is.	E. Africa & Madagascar	Red Sea	S.E. Arabia	Persian Gulf
<i>Cenometra bella</i> (Hartlaub)
† <i>cornuta</i> A. H. Clark
† <i>emendatrix</i> (Bell) ¹⁴	(51 * 113)	43 * 112	X	..	..	..
<i>herdmani</i> A. H. Clark
<i>Colobometra diadema</i> A. H. Clark
<i>perspinosa</i> (P. H. Carpenter)
<i>Cyllometra</i> † <i>manca</i> (P. H. Carpenter) ¹⁵	(108)
<i>Decametra</i> † <i>arabica</i> A. H. Clark	108 * 148	..
<i>brevicirra</i> (A. H. Clark) 108
<i>chadwicki</i> (A. H. Clark)	101 * 148	..	..
† <i>informis</i> (P. H. Carpenter)
<i>laevipinna</i> (A. H. Clark)
<i>modica</i> A. H. Clark ⁸	..	101	101 283	..	..	..
<i>mollis</i> (A. H. Clark) ¹⁶	560?	..	263
<i>mylitta</i> A. H. Clark
<i>parva</i> (A. H. Clark)
<i>taprobanes</i> (A. H. Clark) ¹⁷
<i>Iconometra</i> † <i>anisa</i> (H. L. Clark)
<i>bellona</i> (A. H. Clark)
<i>intermedia</i> (A. H. Clark)
<i>Oligometra</i> † <i>carpenteri</i> (Bell)
<i>serripinna</i> (P. H. Carpenter)	(101 * 112)	101 283	112	(113 * 148)	(125*)	..
<i>Oligometrides aedonae</i> (Lamarck)
<i>Petasometra clarae</i> (Hartlaub)
<i>helianthoides</i> A. H. Clark
<i>Pontiometra andersoni</i> (P. H. Carpenter)
TROPIOMETRIDAE						
<i>Tropiometra afra</i> (Hartlaub)
<i>carinata</i> (Lamarck)	(51) 104	344 370	415 * 625	112 * 118	72 * 125	..
ASTEROMETRIDAE						
<i>Pterometra venusta</i> A. H. Clark
ANTEDONIDAE						
<i>Antedon</i> † <i>arabica</i> (A. H. Clark)	125 * 139	..
<i>incommoda</i> Bell 589
<i>iris</i> (A. H. Clark)
<i>longicirra</i> (A. H. Clark)
<i>parviflora</i> (A. H. Clark)
<i>serrata</i> A. H. Clark
<i>Dorometra aegyptica</i> (A. H. Clark)	75 101	..	..
<i>andromacha</i> A. H. Clark
<i>mauritiana</i> A. H. Clark	..	101 283	101	..	..	..
<i>nana</i> (Hartlaub)
† <i>parvicirra</i> (P. H. Carpenter)

W. India & Pakistan	Maldiva area	Ceylon area	Bay of Bengal	East Indies	North Australia	Philippine Is.	China & S. Japan	South Pacific Is.	Hawaiian Is.
..	108 595	124 (281)	..	(94) 128	(258) 260	262	..
..	44 * 103	..	..	..	..
..	..	74 160	(108 595)	..	..	..	..	..	..
..
..	69 124	34 * 113	128	..	100 128 262	..
..
108?	(72 * 128)	..	72 * (94)	(258) * 663	..	..
128 * 148
..	(108)	..	..	..	..	..	..
..
..	112 128	..	(72) * 124	..	..	..
..	105 116	..	124 128	625?	..	..
..	113?	108?	..	..	..	..	..	..	..
99 128	118 *	..	..	..	..	..	..	..	..
..	128	..	105 (116)	128 259?	..	..
..	105 (128)	..	(116) 128	(128) 663	..	..
..	(48) * 148	(108 596)	..	..	..	..	..	..	..
..	(128)	179 * 162	..	..	..	..
..	117 128	..	..	..
..	107 128	..	..	..	..	..	..
..	116 128	34 * (179)	..	..	..	..
..	108 * 118	74 (108)	107 108	69 * 513	172	124 (128)	111 * 545	104 282	..
..	116 513	(257) * 344	..	..	..	..
..	(116) 281	..	..	..	..	..
..	111 180	..	..	..	..
..	71 108	321 * 513	..	(94) 111	260	104 282	..
..	(116)	169 * 281	128	258 * 623	..	..
121 128	..	112 * 513	113 121	70? 111?	..	..	..	..	..
..	(116 601)	..	..	260	..	..
..
..	139	..	..	..	..
..	(109) 124	(103 163)	..	..	..	..
..	(109) 116	..	..	..	..	..
..	(124)	..	..	109 116	..	(116 139)	(258)	..	..
..	258 * 592	..	..
..
..	124 139	..	..	..	..	..
..	113 * 139	..	..	..	..	..	..	..	..
..	108 598	124 281	162 169	594	258	262 281	..
..	113 * 139	139 180	(72) * 94	(113 258)	..	..

DISTRIBUTION TABLE

	Is. of W. Indian Ocean	Mascarene Is.	E. Africa & Madagascar	Red Sea	S.E. Arabia	Persian Gulf
<i>Euatedon polytes</i> A. H. Clark
<i>tahitiensis</i> A. H. Clark
<i>Mastigometra flagellifera</i> A. H. Clark 593
<i>micropoda</i> A. H. Clark 596
<i>pacifica</i> A. H. Clark
<i>Toxometra bicolor</i> (H. L. Clark)
<i>lepta</i> (H. L. Clark)
<i>nomima</i> (H. L. Clark)
<i>paupera</i> A. H. Clark
<i>poecila</i> (H. L. Clark)

NOTES TO CRINOID TABLE

¹ *Capillaster multiradiatus*. The locality for the queried record is simply 'Arabian Sea'; it is presumed to be from west India or Pakistan. See key note 2 for explanation of record from Madagascar.

² *Comantheria weberi* A. H. Clark has been recorded from shallow water in the Philippines by Domantay (1936); since the holotype was taken at 69 metres in the Lesser Sunda Islands, I consider that this second record needs confirmation.

³ *Comanthus parvicirrus*. Following correspondence with A. H. Clark in 1949, his revised opinion that *C. timorensis* (J. Müller) is a synonym of *parvicirrus* is adopted here, the variability in the development of the cirri being even greater than supposed in his monograph (1931).

⁴ *Comaster multifidus*. Since Müller (1841) based this species on *Comatula multiradiata*: Lamarck [non Linnaeus], the type-locality is 'les mers de l'Inde' as given by Lamarck, though A. H. Clark has considered that the type is the specimen from the Moluccas subsequently described by Müller in 1849.

⁵ *Comatula rotalaria*. The record from the Bay of Bengal queried is based on a specimen from the Day collection supposedly from India, though at least one other specimen from this source I have had reason to believe was from Australian waters.

⁶ *Zygometa comata*. A type-locality cannot now be designated for this species since the type-material came from several stations and it is not clear whether A. H. Clark selected a holotype.

⁷ *Zygometa punctata*. H. L. Clark (1946) queries the Australian record.

⁸ *Amphimetra mollevi*, *Heterometra reynaudi* and *Decametra modica*. As noted in 1966 (Clark & Spencer Davies) the Maldivian records need confirmation.

⁹ *Heterometra amboinae*. A. H. Clark (1941) queries the identity of H. L. Clark's Sinhalese specimens (1915a) as *H. reynaudi* and believes they are referable to *H. amboinae*.

¹⁰ *Heterometra bengalensis*. The British Museum specimen so identified by A. H. Clark (1941) in my opinion may be referable rather to *H. singularis*.

¹¹ *Heterometra crenulata*. The specimen from the Maldivian Islands recorded by Bell (1902) as *Antedon variipinna* and tentatively assumed to be *H. crenulata* by A. H. Clark (1941) cannot be traced in the British Museum collections; possibly it has been otherwise re-identified.

¹² *Heterometra producta*. The record from the Maldivian Islands given by A. H. Clark (1912) may have been based on the same specimen he subsequently discussed as *Decametra taprobanes* (1947: 185).

¹³ *Heterometra savignii*. A. H. Clark (1941) refers the specimens from the Persian Gulf (Straits of Ormuz) named by him as *savignii* in 1912 to *H. africana*, thus casting doubt on Gislén's record from the same area (1940). The limits between *africana* and *savignii* need re-examination.

¹⁴ *Cenometra emendatrix*. The 'X' signifies a manuscript record from Madagascar, based on a specimen collected by Dr. Stock and returned to the Amsterdam Museum after identification by A.M.C.

¹⁵ *Cyllometra manca*. Although numerous records exist, the shallowest positive depth record outside of southern Japan is 22 metres (at least as quoted in the crinoid monograph [1947]); the "Challenger" collected it at Zebu Reefs but even this may have been beyond the ten-fathom mark. In southern Japan, however, it has been taken on shore (Utinomi & Kogo, 1965).

¹⁶ *Decametra mollis*. See A. M. Clark (1967a) regarding the queried Red Sea record.

¹⁷ *Decametra taprobanes*. Possibly all the records for this species are based on material from beyond the depth limit set. See also note 12.

FOR CRINOIDEA

W. India & Pakistan	Maldivian area	Ceylon area	Bay of 'Bengal	East Indies	North Australia	Philippine Is.	China & S. Japan	South Pacific Is.	Hawaiian Is.
..	124 139	..	..	..	..	..
..	116 139	..
..	598?	..	..	..	..	..
..	..	(108)	108? 139?	..	..	..	..	..	..
..	116 139	..
..	139 180	..	..	..	..
..	139 180	..	..	..	..
..	139 180	..	..	..	..
..	116	..	(102 * 118)	..	..	..
..	139 180	..	..	..	..

KEY TO THE CRINOIDEA

(Partly derived from A. H. Clark's Monograph)

- 1 Proximal pinnules very flexible and with some of the terminal segments modified to form a comb (fig. 2); mouth near the edge of the disc and anal tube approximately central (see pl. 1, fig. 1)
- 1' No comb on the proximal pinnules, their terminal segments simply tapering or only very finely thorny

COMASTERIDAE 2
32

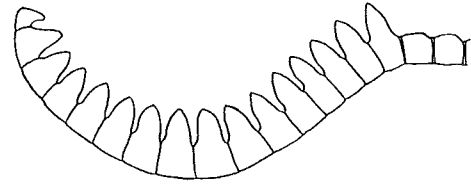


FIG. 2. Terminal comb of an oral pinnule of *Comaster multibrachiatus*.

- 2 Only 10 arms¹ 3
- 2' More than 10 arms¹ 8
- 3 No marked carinate processes on the first two segments of the proximal pinnules; first brachial syzygy at 3 + 4; division series and arm bases widely separated laterally. **COMISSIA** 4
- 3' A prominent keel at the bases of the proximal pinnules; first arm syzygy at 1 + 2; division series and arm bases approximating to one another **COMATULA** (part) 6
- 4 Up to 13 cirrus segments, cirri usually c.X in number but up to XIV have been recorded (arm length not known to exceed 40 mm) *Comissia hartmeyeri* A. H. Clark, 1912h 5
- 4' Up to 16 cirrus segments, cirri XX-XXXV in number *Comissia littoralis* A. H. Clark, 1912f 5
- 5 P₁ with comb of c.9 teeth only *Comissia pectinifera* A. H. Clark, 1911e 6
- 5' P₁ with comb of c.25 teeth *Comatula purpurea* (J. Müller, 1843a) 7
- 6 Cirri restricted to one or two at each interradian angle of the centrodorsal and therefore rarely exceeding X in number, often fewer. *Comatula pectinata* (Linnaeus, 1758) 7
- 6' Cirri more numerous, usually X-XX, distributed all round the edge of the centrodorsal, any gaps not being regularly confined to the radial areas *Comatula solaris* Lamarck, 1816 8
- 7 10-15 cirrus segments *Comatula pectinata* (Linnaeus, 1758) 7
- 7' 16-25, usually c.20 cirrus segments (pl. 1, figs. 7, 8) *Comatula solaris* Lamarck, 1816 8
- 8 Except on arms arising direct from a IBr axillary, P₁ arising from the first brachial and a syzygy between brachials 2 + 3 (fig. 3a; pl. 1, fig. 2) **CAPILLASTER** 9

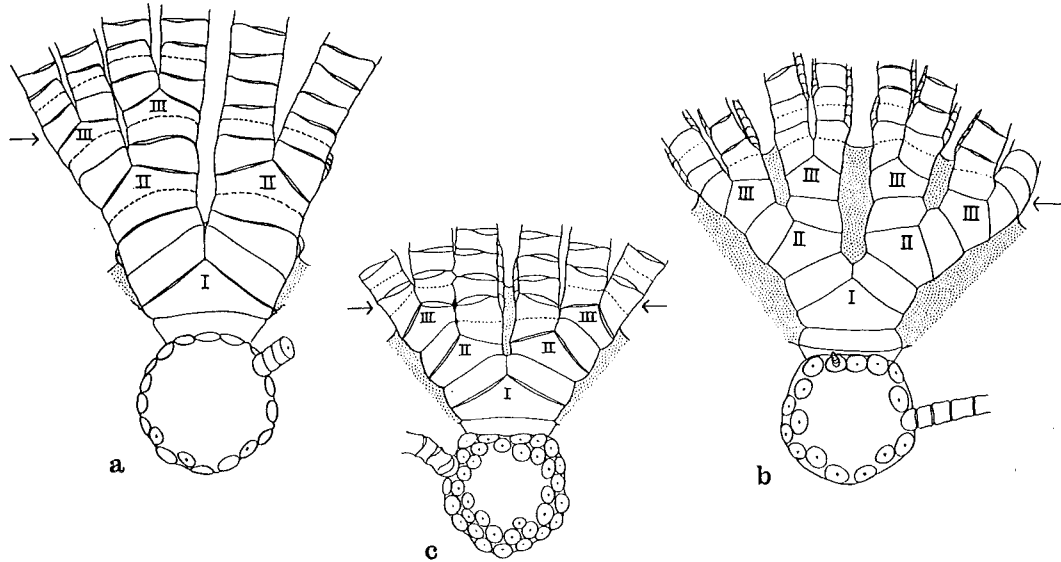


FIG. 3. Centrodorsal with division series and arm bases of a single radius of: a. *Capillaster multiradiatus*, b. *Comatella nigra* and c. *Comatella stelligera*. The roman numbers signify the axillaries of the respective division series; the arrows show the origin of P₁ where the pinnule itself is not visible; in c there is an abnormal fusion between the IIIBr series on the left side and the adjacent basal brachials of the arm rising direct from the IIBr axillary.

¹ This artificial distinction necessitates the inclusion of the genus *Comatula* twice.

- 8' First brachial pinnule always on the second arm segment; the first brachial syzygy either between brachials 1 + 2 or 3 + 4 (sometimes both joints are syzygies but more often only the latter) (figs. 3b, c, 4, 5) 11
- 9 Cirri absent or rudimentary, the flat pentagonal centrodorsal hardly, if at all, projecting from the dorsal surface *Capillaster macrobrachius* (Hartlaub, 1890) 11
- 9' Cirri present, centrodorsal projecting from the surface, its shape more rounded than angular 10
- 10 Arms very numerous, rarely less than 40 and sometimes over 100; the longest cirri with c.30 segments, sometimes more *Capillaster sentosus* (P. H. Carpenter, 1888b) 10
- 10' Arms fewer, rarely over 40, usually 15-25; longest cirri with up to 28 segments, usually 20-24 *Capillaster multiradiatus* (Linnaeus, 1758)² 12
- 11 The IIBr and any subsequent division series each made up of only two ossicles like the IBr series (figs. 3b, c) 12
- 11' Some of the division series of four ossicles (figs. 4, 5) 15
- 12 Cirri rudimentary or absent; about 20 arms, in immature specimens alternate arms more or less reduced in size *Comatula rotalaria* Lamarck, 1816 13
- 12' Cirri well developed, the distal segments with dorsal spines or tubercles; usually more than 30 arms, sometimes only about 20 but then the two arms of a pair are similar in size **COMATELLA** 13

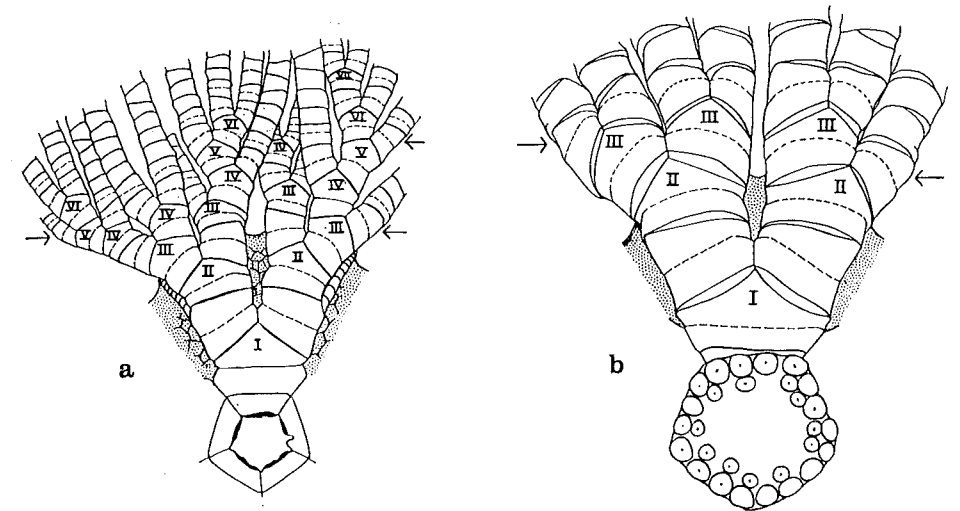


FIG. 4. Centrodorsal with division series and arm bases of a single radius of: a. *Comaster multifidus* and b. *C. distinctus*. In a particularly the syzygies really show as continuous thin lines but are drawn here with the conventional interrupted lines.

- 13 No IIIBr series present, there being no more than 20 arms *Comatella maculata* (P. H. Carpenter, 1888b) 14
- 13' Some IIIBr series, often also subsequent ones, present 14
- 14 Most, if not all, the IIBr series with two IIIBr series arising from them (fig. 3b), often IVBr series present also, the arms numbering up to 80 though usually 40-45 in adult specimens; up to 30 cirrus segments *Comatella nigra* (P. H. Carpenter, 1888b) 16
- 14' IIIBr series usually present only on the external side of each IIBr series (fig. 3c), the arms numbering up to 50 though usually 30-40; up to 26 cirrus segments *Comatella stelligera* (P. H. Carpenter, 1880) 16
- 15 The two ossicles of the IBr series and the first two after most, if not all, the axillaries united by syzygy³; division series often alternating with arms (fig. 4a, b) **COMASTER** 17
- 15' The joint within each IBr series and following each axillary not a syzygy³; most axillaries bearing either two arms or two division series, not one of each 23
- 16 Cirri absent or very reduced so as to form isolated groups around the edge of the centrodorsal 17
- 16' Cirri well developed, with few, if any, gaps in their arrangement 18

² Receipt of six large specimens of *Capillaster multiradiatus* with 36-48 arms from Madagascar, the type-locality of *C. coccodistoma* (P. H. Carpenter, 1883), convinces me that the latter is a synonym, having been based on immature specimens of *C. multiradiatus*.

³ In *Comaster multifidus*, the type-species of the genus (fig. 4a) the joint in the IBr series may be more like a synarthry, lacking the radiating sculpturing so that superficially the line of the joint does not appear to be interrupted. However, the presence of syzygies immediately following the axillaries, together with the more or less alternating arrangement of the division series and arms, ally it with the other species of *Comaster*.

- 17 Growing to a large size, the arms often exceeding 80 in number; subradial clefts present around the edge of the centrodorsal (fig. 4a) *Comaster multifidus* (J. Müller, 1841)⁴
- 17' Arms numbering up to 80 but often less than 60; no subradial clefts *Comaster gracilis* (Hartlaub, 1890)⁴
- 18 Arms well over 100 in number (when fully grown) *Comaster multibrachiatus* (P. H. Carpenter, 1888b)
- 18' Not more than 65 arms 19
- 19 50-60 arms (in the two specimens described or figured) *Comaster schoenovi* A. H. Clark, 1918⁵
- 19' Not more than 45 arms⁵ 20
- 20 Up to 22 arms; cirri rather weak and grouped at the interradial angles of the centrodorsal *Comaster tenellus* A. H. Clark, 1931b
- 20' 30-45 arms; cirri arranged all round the centrodorsal 21
- 21 Cirri with 15-17 segments (in the only specimen described) *Comaster pulcher* A. H. Clark, 1912f
- 21' Cirri short with up to 13 segments 22
- 22 IIBr series often developed externally (towards the interradia) on the IIBr as well as internally, so that the arms commonly number about 40 in larger specimens (arm length > 60 mm.) *Comaster brevicirrus* (Bell, 1894)⁵
- 22' IIBr series usually developed only internally, though as many as 36 arms have been recorded (fig. 4b) *Comaster distinctus* (P. H. Carpenter, 1888b)⁵
- 23 Some IIBr series present and consisting of two ossicles (very rarely four after IIBr series of two), the IIBr series all or mostly of four (fig. 5a) **COMANTHERIA** 24
- 23' IIBr series sometimes lacking, when present some or all of them of four ossicles 28
- 24 Centrodorsal well developed, projecting, with numerous more or less well-developed cirri about one-third as long as the arms *Comantheria grandicalyx* (P. H. Carpenter, 1882a)
- 24' Centrodorsal very reduced; cirri absent or rudimentary 25
- 25 About 40 arms *Comantheria rotula* A. H. Clark, 1912f
- 25' More than 45 arms 26
- 26 IVBr series all two, also any following series except the most external which are of four ossicles *Comantheria polycnemis* (A. H. Clark, 1909i)
- 26' IVBr series four, the VBr series (if present) either two or four 27
- 27 Arms numbering up to 160, a few VI Br series sometimes present; VBr series regularly two *Comantheria alternans* (P. H. Carpenter, 1881)
- 27' 50-150 arms, commonly 80-100; VI Br series very rare; VBr series (if present) often four (fig. 5a) *Comantheria briareus* (Bell, 1882c)
- 28 The most external IIBr series of each ray usually two, the internal ones four (except sometimes when following IIBr series of two rather than the usual four); up to 200 arms (fig. 5b) **COMANTHINA** 29
- 28' IIBr series, when present, either all four or else four and two irregularly; up to 120 arms but in most species less than 60 (fig. 5c) **COMANTHUS** 30
- 29 Proximal and middle pinnules with high dorsal processes on their basal segments; cirri nearly always present, their distal segments each with a dorsal tubercle *Comanthina belli* (P. H. Carpenter, 1888b)
- 29' No dorsal processes on the basal segments of the proximal pinnules; if cirri are present at all then their distal segments are smooth dorsally. (pl. 1, fig. 6) *Comanthina schlegeli* (P. H. Carpenter, 1881)
- 30 Cirri very reduced in size and number, often discontinuously arranged around the edge of the centrodorsal (fig. 5c), their distal segments only slightly shorter than the proximal ones; the texture of the arms smooth; some IIBr and IIBr series usually two. (pl. 1, figs. 3, 4) *Comanthus parvicirrus* (J. Müller, 1841)
- 30' Cirri numerous and evenly distributed around the centrodorsal, their distal segments laterally compressed and distinctly shorter than the proximal segments; IIBr and following division series almost invariably four 31
- 31 More than 60 arms; no dorsal processes on the distal cirrus segments *Comanthus bennetti* (J. Müller, 1841)
- 31' Less than 40 arms, usually about 20; cirri with small dorsal processes on the distal segments *Comanthus samoanus* A. H. Clark, 1909c
- 32 Only five arms *Eudiocrinus tenuissimus* Gislén, 1940a

⁴ Gislén (1934) without explanation refers to *Comaster multifidus* as if it were a synonym of *gracilis*, whereas if the two cannot be maintained as distinct then *multifidus* has priority. However, in 1940 (b) Gislén compared the two and noted that the occurrence of subradial clefts seems to be the only means of distinction.

⁵ Although the number of arms in 19' has been raised from 40 to 45 in modification of A. H. Clark's key to the species of *Comaster* I still doubt that it will prove to provide a valid distinction between *C. schoenovi*, *brevicirrus* and *distinctus*. Until recently Bell's holotype of *C. brevicirrus* could not be found in the British Museum collections but a search among the specimens of *Comaster* from Macclesfield Bank revealed that it is none other than specimen no. 4 from 20 to 35 fathoms referred to under the heading of *C. distinctus* by A. H. Clark in 1913, although it originally had well over the 36 arms which is the maximum number mentioned for specimens of *distinctus* in Mr. Clark's monograph. In fact there are 44 arms remaining and a IIBr and a IIBr series are broken so that there must be at least six arms missing, making a total of 50 to perhaps 55, external IIBr series being present more often than not so that it would run down to *C. schoenovi*.

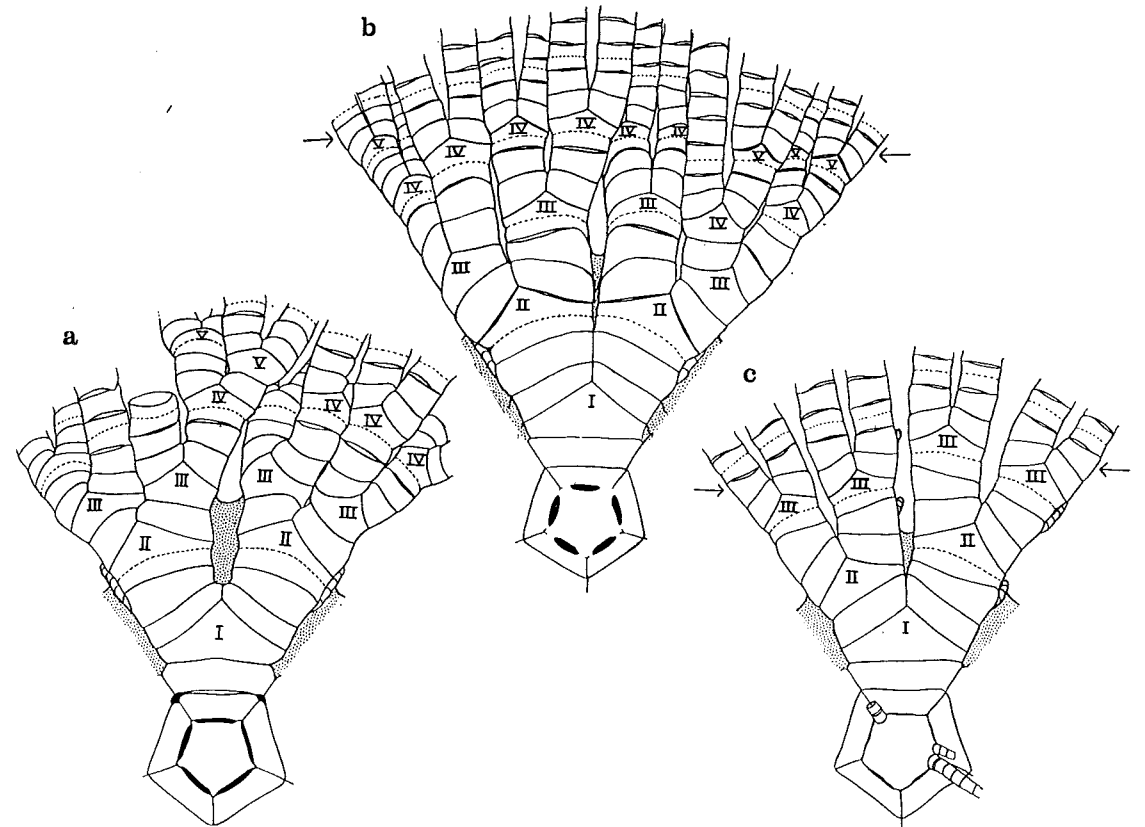


FIG. 5. Centrodorsal with division series and arm bases of a single radius of: a. *Comantheria briareus*, b. *Comanthina schlegeli* and c. *Comanthus parvicirrus*.

- 32' Ten or more arms 33
- 33 The two ossicles of the IBr series joined by syzygy, appearing externally as a straight continuous or sometimes interrupted line **ZYGOMETRIDAE** 34
- 33' No syzygy in the IBr series 38
- 34 35-100 arms, rarely less; the peripheral cirri with rarely less than 40 segments⁶ 35
- 34' Up to 41 arms recorded but usually less than 35; cirri with up to 45 segments but usually about 30. 36
- 35 IIBr and any subsequent division series all or mostly four; usually 50-90 arms *Zygometa microdiscus* (Bell, 1882c)
- 35' The internal IIBr and often also the subsequent series (when present) consisting of two ossicles, though external IIBr series tend to be of four; usually 35-40 arms *Zygometa elegans* (Bell, 1882c)
- 36 Cirri short and stout, the peripheral ones with up to 21 segments; arm number not known to exceed 21 *Zygometa punctata* A. H. Clark, 1912f
- 36' Cirri fairly long, with 25-30 segments; usually 25-30 or more arms 37
- 37 The radials, division series and first two brachials with the edges everted and scalloped or tubercular *Zygometa andromeda* A. H. Clark, 1912c
- 37' The radials, division series and proximal brachials with their distal edges unmodified (pl. 2, fig. 1) *Zygometa comata* A. H. Clark, 1911c
- 38 Middle and distal cirrus segments with a pair of dorsal spines or tubercles, one each side of the mid-line, rarely a transverse ridge (fig. 6a) **COLOBOMETRIDAE** 39
- 38' Distal cirrus segments with a median prominence (dorsal spine, tubercle or longitudinal crest) if any (fig. 6c, d) 64
- 39 Arms very numerous, 50-120 in the specimens recorded; cirrus segments also numerous, the largest cirri usually with more than 45 40
- 39' Arms fewer, <40; rarely >45 cirrus segments 41
- 40 53-120 arms; division series all two; cirri with 41-80 segments; all the pinnules present and P₁ (on external arms) several times longer than P₂ and the following pinnules *Pontiometa andersoni* (P. H. Carpenter, 1888a)

⁶ There is much more overlap in the arm and pinnule counts of the seven nominal species of *Zygometa* than might be supposed from A. H. Clark's key; I suspect that some of them will prove to be untenable.

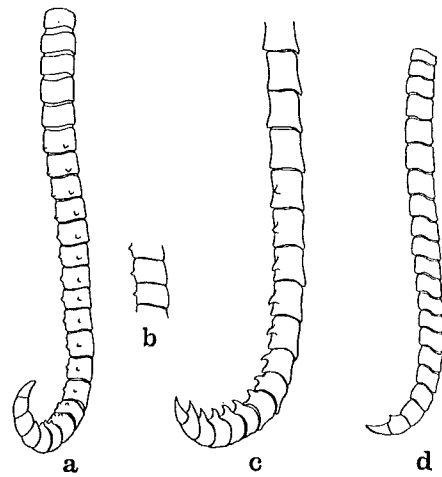


FIG. 6. Cirri of: a and b. *Decametra arabica*, c. *Heterometra savignii* and d. *Tropiometra carinata*. a and c in oblique dorsal view, b and d in side view.

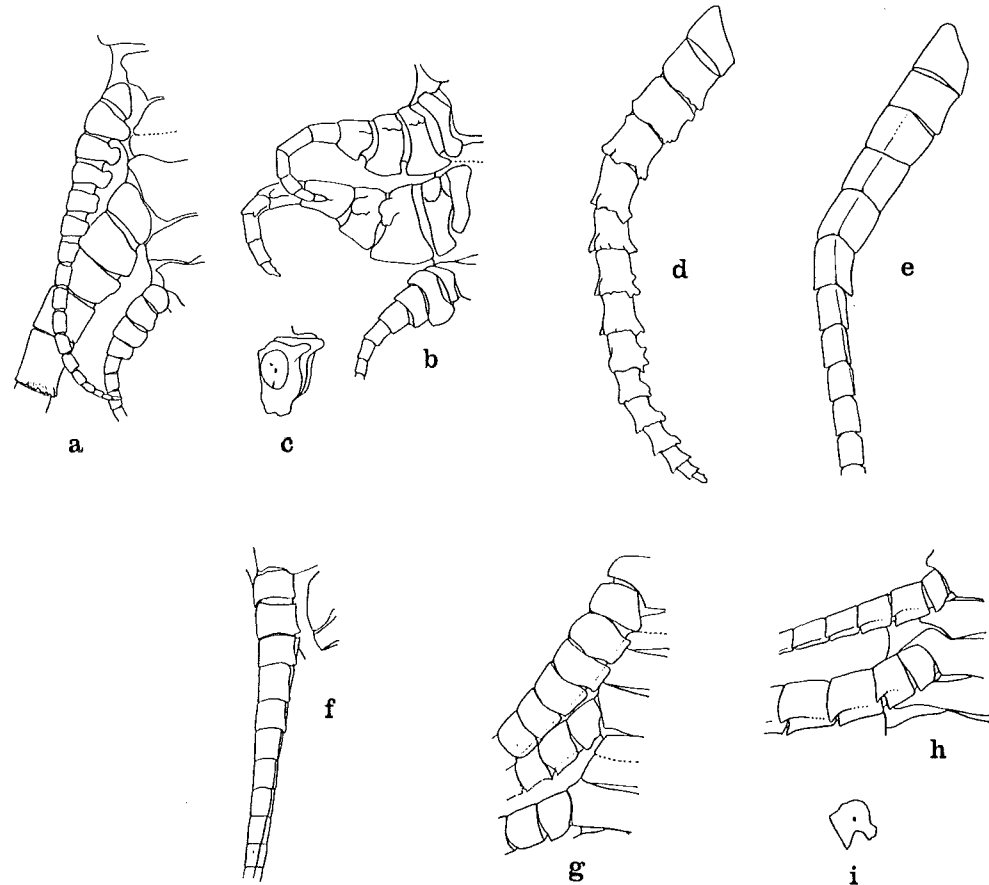


FIG. 7. Proximal pinnules: a. P₁ and bases of P₂ and P₃ of *Cenometra emendatrix* (syntype), b. P₁ to P₃ of *Oligometra carpenteri*, c. the same, basal three segments of P₂ viewed end-on, d and e. P₂s of two specimens of *Oligometra serripinna* from the Red Sea and from Cargados Carajos, W Indian Ocean, f. P₂ of *Tropiometra carinata*, g. bases of P₁ and P₂ of *Heterometra savignii*, h. bases of P₂ and P₃ of *H. crenulata* and i. the same P₃ in basal cross-section, the dorsal process to the right. [All taken from the right side of post-radial series, a drawn at half the size of the rest.]

- 40' 50-80 arms; IIIBr series two, but IIBr, IVBr and any following division series usually four; cirri with 41-51 segments; P₁ similar to P₂ and P₃; P_a and some other internal proximal pinnules usually lacking
Basilometra boschmai A. H. Clark, 1936
- 41 P₂ very stout, stiff and erect or even recurved over the disc, much larger than P₁ and P₃, its segments with conspicuously flared and spinose distal ends (fig. 7a; pl. 3, figs. 1, 2); more than 10 arms **CENOMETRA** 42
- 41' P₂ not stiffened or recurved or conspicuously different from the neighbouring pinnules; often only 10 arms. 44
- 42 Basal segments of the proximal pinnules with knob-like rounded processes forming a crest along the edge facing the tip of the arm (fig. 7a)⁷. *Cenometra emendatrix* (Bell, 1892)
- 42' A simple keel on the bases of the proximal pinnules or else this edge rounded? 43
- 43 Basal segments of none of the proximal pinnules carinate (except in very large specimens with arm length c. 140 mm.). *Cenometra bella* (Hartlaub, 1890)
- 43' P₂ at least with no trace of a basal carination *Cenometra herdmani* A. H. Clark, 1909g
- 43'' P₂ with a slight basal carination *Cenometra cornuta* A. H. Clark, 1911c
- 44 Middle and distal cirrus segments each with two transverse ridges across the dorsal side, appearing in profile as two consecutive tubercles; P₁, P₂ and P₃ progressively decreasing in length
Oligometrides adeonae (Lamarck, 1816)
- 44' Cirrus segments each with only one transverse dorsal ridge or series (usually a pair) of tubercles, so that a single projection appears in side view (fig. 6b); P₂ at least equal to or longer than P₁. 45
- 45 Cirrus segments numbering 35-65, the distal edges of the proximal ones fringed with spines; a pair of prominent dorsal spines developing on each segment, approximating together on the distal ones to fuse into a single spine on about the antepenultimate segment (i.e. two removed from the terminal claw); arm length up to 170 mm., at least in *C. perspinosa*⁸. **COLOBOMETRA** 46
- 45' Up to 35 cirrus segments but rarely more than 30, their distal edges smooth, the middle segments usually developing a transverse dorsal ridge or crescent which resolves itself into a pair of tubercles or small spines, or else a single median spine on the distal segments; arm length up to 130 mm. but rarely exceeding 100 mm.⁹ 47
- 46 Size up to 170 mm. arm length; cirri with 35-65 segments, usually at least 45
Colobometra perspinosa (P. H. Carpenter, 1881)
- 46' Arm length 70 mm. in the type and only known specimen; cirri with up to 40 segments
Colobometra diadema A. H. Clark, 1910
- 47 P_a present 48
- 47' P_a rarely present 52
- 48 P₂ quite smooth **ICONOMETRA** 49
- 48' P₂ markedly prismatic, often with the angles conspicuously produced at the distal ends of the segments (fig. 7b). **OLIGOMETRA** 51
- 49 Up to 23 cirrus segments (the arms up to 100 mm. long); P₃ similar to P₂ and hardly, if at all, shorter
Iconometra bellona (A. H. Clark, 1920)
- 49' Up to 19 cirrus segments (but the arms only known to reach 65 mm.); P₃ distinctly smaller than P₂ 50
- 50 P₂ longer than P₁¹⁰. *Iconometra anisa* (H. L. Clark, 1915c)
- 50' P₂ similar to P₁¹⁰. *Iconometra intermedia* (A. H. Clark, 1912c)
- 51 Segments of P₂, except the distalmost, much broader than long, the edge of the proximal segments towards the arm tip produced into a high continuous keel; a separate tubercle or blunt spine at the distal end of each segment on the dorsal side
Oligometra carpenteri (Bell, 1884c)
- 51' P₂ very variable in form with most segments as long as, or longer than, broad, either simply prismatic with only the dorsal keel well developed or the segments more or less flared at the distal ends on the angles of the longitudinal ridges, with spinose processes, so that the profile of the pinnule is more or less serrated (fig. 7d, e; pl. 2, fig. 7). *Oligometra serripinna* (P. H. Carpenter, 1881)

⁷ Gislén (1940a) believes that the occurrence of crests on the proximal pinnules is liable to vary according to size and so doubts the validity of the four nominal species of *Cenometra*, though these were still maintained on the same grounds by A. H. Clark (1947). I have re-examined the holotype of *C. cornuta* in the British Museum collections and find that P₂ has only a trace of a keel on the basal segments, contrary to Mr. Clark's description, though the other proximal pinnules do have distinct crests. The knob-like processes found in *C. emendatrix* may provide a valid distinction but I think that Gislén is probably right where *C. bella*, *herdmani* and *cornuta* are concerned and that the two last names should be considered as synonyms of *bella*. Accordingly, these three are included here in a triple division, with reservations about its validity.

⁸ *Amphimetra tessellata* (Himerometridae, pl. 2, fig. 3) may run down here since certain specimens have paired tubercles on the cirrus segments; it is easily distinguished from *Colobometra* by the smooth distal edges of the cirrus segments and brachials.

⁹ The length of 130 mm. is derived from a paratype of *Decametra arabica* in the British Museum collections, not measured by A. H. Clark.

¹⁰ The holotype and only known specimen of *Iconometra intermedia* has arms only about 18 mm. long and many of its differential characters, including the absence of P_a, may well be due to immaturity. Gislén (1919) thinks that it may be only a young specimen of *Oligometrides adeonae* or a related species.

- 52 P₁ and P₂ similar; when more than 10 arms are present the IIBr series are four . . . **PETASOMETRA** 53
 52' P₂ distinctly larger than P₁; IIBr series, if any, of two ossicles . . . 54
 53 10 to 14 arms in the seven recorded specimens¹¹. . . *Petasometra helianthoides* A. H. Clark, 1912g
 53' 15 to 31 arms in the four recorded specimens¹¹. . . *Petasometra clarae* (Hartlaub, 1890)
 54 More than 10 arms (at least in c. 80% of the 593 specimens mentioned by A. H. Clark, (1947))
 Cyllometra manca (P. H. Carpenter, 1888b)
 DECAMETRA¹² 55
 54' 10 arms only . . . **DECAMETRA**¹² 55
 55 Cirri with a transverse dorsal ridge on the middle segments, sometimes also on the distal ones but there it usually narrows to take on the form of a single tubercle, at least on about the last five segments . . . 56
 55' A pair of tubercles on most of the distal segments though they may be preceded by transverse ridges and followed by single spines or tubercles on the last few segments before the penultimate (fig. 6a) . . . 59
 56 Cirri with a broad transverse ridge on all the middle and distal segments preceding the penultimate
 Decametra laevipinna (A. H. Clark, 1912a) 57
 56' Four to ten of the cirrus segments preceding the penultimate with a median tubercle derived by narrowing of a transverse ridge . . . 57
 57 23-29 cirrus segments when the arm length is 75-80 mm.; P₃ slightly longer than P₁ (at least in the type)¹³
 Decametra taprobanes (A. H. Clark, 1909h) 58
 57' Up to 20 cirrus segments when the arm length is 30-50 mm.; P₃ shorter than P₁ (except in the immature holotype of *D. informis*, where it is longer, contrary to A. H. Clark's assumption¹³) . . . 58
 58 Cirri few, about X when the arms are 33 mm.¹⁴; P₃ longer than P₁
 Decametra informis (P. H. Carpenter, 1888b)
 Decametra modica A. H. Clark, 1911a 60
 59 Cirri numbering XIII-XIX, usually c.XVI¹⁵ . . . 60
 59' Cirri numbering XVII-XXII, usually c.XX¹⁵ . . . 63
 60 Cirrus segments relatively few, up to only c.15, at least when the arm length is 40 mm.
 Decametra parva (A. H. Clark, 1912a) 61
 60' More than 20 segments in the longest cirri, even when the arm length is only c.35 mm. (as in the type of *brevicirra*) . . . 61
 61 P₁ and P₂ with a similar number of segments¹⁶ . . . *Decametra brevicirra* (A. H. Clark, 1912d) 62
 61' P₂ usually with more numerous segments than P₁¹⁶ . . . 62
 62 Cirri very stout, all the segments distinctly broader than long . . . *Decametra mylitta* A. H. Clark, 1912a
 62' Nearly all the cirrus segments about as long as broad . . . *Decametra chadwicki* (A. H. Clark, 1911a)
 63 P₂ very long in comparison with P₁, more than three times as long in the type (measuring 13 mm. at arm length 65 mm.) . . . *Decametra mollis* (A. H. Clark, 1909e)
 63' P₂ rarely as much as twice as long as P₁ (in length up to 10.5 mm. and that only at arm length c.100 mm.)¹⁷
 Decametra arabica A. H. Clark, 1912d

¹¹ With so few specimens known it is more than likely that the types of *Petasometra clarae* and *helianthoides* will prove to be conspecific, as A. H. Clark himself comments.

¹² The variety *macrobrachia* of *Oligometra serripinna* runs down here since it usually lacks P_a. It should be distinguishable from the species of *Decametra* by the more serrated and prismatic appearance of P₂ with flaring processes at the angles rather than finely spinose continuous frills at the distal ends of the segments.

¹³ A. H. Clark has used the number of cirrus segments as the primary character for splitting up the species of *Decametra*. However, when this number is plotted against arm length for the holotype and 12 paratypes of *D. arabica* together with six specimens from Karachi (labelled as '*arabica*??' but referred to under the heading of *D. mollis* by Mr. Clark) the resultant scatter and the slope of the graph leaves little probability that the number of cirrus segments in any one of the other nominal species of *Decametra* is significantly different, at least on the evidence of the specimens detailed by Mr. Clark. He himself notes the following possible synonymies among the species included in this work: *informis* and *modica*; *mylitta* and *mollis*; *taprobanes* and *arabica*. I disagree about the last since the type of *D. taprobanes* has a transverse ridge giving way to median tubercles on nearly a dozen distal cirrus segments whereas *D. arabica* has paired tubercles on the middle segments and a median one on only two or three subterminal ones. However, apart from this I think that several of the other nominal species must prove to be synonymous when the extent of variation can be examined.

¹⁴ This number and length apply to the holotype of *Decametra informis*, contrary to A. H. Clark's enumeration, which appears to have been based on the rather inaccurate figure given in the 'Challenger' report.

¹⁵ In the cases of *Decametra parva* and *brevicirra* the relatively small number of cirri may be correlated with the small size of the specimens described, arm length about 40 mm. and 35 mm. respectively. However, specimens of *D. chadwicki* with arm length up to 120 mm. still have less than XX cirri and may have only XV, so I believe that this character may have some significance.

¹⁶ I doubt if this will still hold good when more material from the type-locality of *Decametra brevicirra* is available. There is considerable variation in the pinnules of the British Museum specimens of *chadwicki*, as well as of *arabica*.

¹⁷ Ten-armed specimens of the very variable *Cyllometra manca* may run down here; they should be distinguishable from *Decametra arabica* by the more slender cirri with the middle segments usually distinctly longer than broad.

- 64 The proximal pinnules at least usually with a slight, sometimes well-marked, keel or series of processes on the dorsal side basally, or else all the pinnules prismatic throughout their lengths (fig. 7f, h); often more than 10 arms; the second brachial syzygy usually farther out than brachials 9 and 10; the brachials distinctly wider than long for at least the proximal half of the arm, sometimes discoidal in shape . . . 65
 64' No keels on the dorsal surfaces of any of the pinnules; only 10 arms; the second brachial syzygy almost invariably at 9 + 10; brachials from about the fourteenth usually as long as wide or longer and distinctly wedge-shaped . . . **ANTEDONIDAE** 118
 65 Only the proximal pinnules at all prismatic; the distal pinnules, if not all of them, flexible and not conspicuously stiffened . . . 66
 65' All the pinnules prismatic and conspicuously straight and stiff (fig. 7f) . . . 116
 66 10 or more arms; if more than 10 then the external IIBr series at least are usually of four ossicles¹⁸
 HIMEROMETRIDAE 67
 66' Always more than 10 arms, the IIBr series and any other division series of 2 ossicles **MARIAMETRIDAE** 100
 67 The first three external brachial pinnules, P₁, P₂, and P₃, progressively diminishing in size; if any pinnules are present on the division series they are largest of all . . . **HIMEROMETRA** 68
 67' P₁ (and P_D when present) smaller than P₂ . . . 72
 68 The enlarged proximal pinnules very stout with most, if not all, of their segments no longer than broad . . . 69
 68' Enlarged proximal pinnules slender and elongate, their segments mostly longer than broad . . . 71
 69 Enlarged proximal pinnules with 28-42 segments, the tips of the pinnules flagellate
 Himerometra magnipinna A. H. Clark, 1908a 70
 69' Proximal pinnules with up to 25, usually 20, segments, tapering fairly abruptly near the tip, not flagellate . . . 70
 70 Enlarged proximal pinnules with smooth segments though their distal ends may be flared; proximal brachials with smooth but hardly at all flared distal edges
 Himerometra robustipinna (P. H. Carpenter, 1881) 70
 70' Proximal pinnules with finely spinose distal edges to their segments; proximal brachials with markedly everted distal ends . . . *Himerometra martensi* (Hartlaub, 1890)
 71 35 to over 60 arms when their length exceeds 100 mm.; a few basal segments in the proximal pinnules broader than long . . . *Himerometra bartschi* A. H. Clark, 1908a
 71' Not more than 25 arms, even when their length exceeds 100 mm.; all the segments of the proximal pinnules longer than broad . . . *Himerometra persica* A. H. Clark, 1908b
 72 Cirri hardly, if at all, curving inwards distally, the distal segments not significantly shorter than the longest proximal ones and tapering to a slender tip, there being no dorsal processes or opposing spine while the terminal claw is nearly straight . . . *Craspedometra acuticirra* (P. H. Carpenter, 1882a)
 72' Cirri more or less incurved distally, the distal segments short, usually shorter than the proximal ones and nearly always bearing dorsal tubercles or at least a median crest, the terminal claw distinctly curved and with an opposing spine on the penultimate segment . . . 73
 73 Usually more than 10 arms with the IIBr series mostly four but if only 10 arms are present then the proximal pinnules are distinctly modified with a strong crest or the segments have flared or spinose distal ends
 HETEROMETRA 74
 73' Rarely more than 10 arms but should this number be exceeded then the IIBr series are two; the proximal pinnules little different from the following ones . . . **AMPHIMETRA** 95
 74 Distal cirrus segments smooth dorsally or with only a slight median crest
 Heterometra quinduplicava (P. H. Carpenter, 1888b)
 74' Distal cirrus segments with distinct dorsal spines or tubercles (fig. 6c) . . . 75
 75 Proximal pinnules appearing serrated in profile, due to projections from the distal ends of the segments (fig. 7h)¹⁹ . . . 76
 75' Proximal pinnules smooth and slender (except for their basal crests) the distal ends of the segments not conspicuously flared or spinose¹⁹. . . 78
 76 Segments of enlarged proximal pinnules (notably P₃ and/or P₂) with their distal ends bearing rounded rather than spinose processes on the dorsal side (fig. 7h, i, pl. 2, fig. 2)²⁰.
 Heterometra crenulata (P. H. Carpenter, 1882a)

¹⁸ Occasional individuals of *Amphimetra* with more than the normal ten arms are also exceptional in having the IIBr series of only two ossicles.

¹⁹ I think it is significant of the ill-defined state of some of the many nominal species of *Heterometra* recognised by A. H. Clark that he made two further attempts in his monograph to improve upon the key to the species given in his 'Siboga' report. Even so, some of the characters used seem to be at variance with the descriptions given in the text. The character used at this stage of his key, namely the presence or absence of carinate processes on the basal segments of the proximal pinnules along the edge facing the arm tip, does not hold good for some of the species. For instance, all the specimens I have studied of both *H. savignii* and *H. crenulata* have a sharp keel on this edge of the proximal pinnule segments basally (fig. 7g, h); in *crenulata* the pinnules are distinctly prismatic owing to the dorsal processes in addition to the keel.

- 76' Distal ends of the enlarged proximal pinnule segments spinose²⁰ 77
- 77 Up to 28 arms; up to 38 cirrus segments; proximal pinnules cylindrical or only slightly prismatic, the distal edges of the segments flared and spinose; disc with small plates in the skin
Heterometra variipinna (P. H. Carpenter, 1882a)
- 77' 13 arms in the type (and only known) specimen; up to 26 cirrus segments; the proximal pinnules strongly prismatic, the distal ends of the segments particularly spinose at the angles; disc not plated
Heterometra producta (A. H. Clark, 1908c)
- 78 Arms often exceeding 20 and then the IIIBr series with four ossicles
Heterometra philiberti (J. Müller, 1849)
- 78' If the arms exceed 20 in number then the IIIBr series are usually two (exceptionally four when following IIBr series of two) 79
- 79 Dorsal spines on the distal cirrus segments sharp and usually long, beginning abruptly in the middle of the cirrus 80
- 79' Spines or tubercles developed gradually over several segments of the middle part of the cirrus and usually all short and blunt 85
- 80 Keels on the proximal pinnules not very conspicuous or strongly projecting (fig. 7g) 81
- 80' Keels on the proximal pinnules prominent and flange-like 82
- 81 Up to 21 (usually 20) arms; cirri with up to 37 segments, the distal ones with long dorsal spines (fig. 6c)
Heterometra savignii (J. Müller, 1841)
- 81' Arms more numerous, 38-48 in the four specimens described; cirri usually with 40-50 segments, the dorsal spines of the distal segments not very long.
Heterometra nematodon (Hartlaub, 1890)
- 82 Cirri slender or only moderately stout so that their longest segments are as long as broad or longer 83
- 82' Cirri very stout, all the segments broader than long²¹ 84
- 83 Up to 45 (usually 35-40) cirrus segments²². *Heterometra singularis* A. H. Clark, 1909h
- 83' Up to 34 (usually 27-30) cirrus segments *Heterometra africana* (A. H. Clark, 1911a)
- 84 Only 10-13 arms, even at a length of over 150 mm. *Heterometra flora* (A. H. Clark, 1913)
- 84' 19-39 arms, not known to exceed 100 mm. in length *Heterometra delagoae* Gislén, 1938
- 85 Peripheral cirri with not more than 31 segments. 86
- 85' Peripheral cirri with 30-44 segments. 87
- 86 Brachials beyond the eighth or ninth wedge-shaped or triangular *Heterometra affinis* (Hartlaub, 1890)
- 86' All the brachials short and more or less discoidal *Heterometra bengalensis* (Hartlaub, 1890)
- 87 All the cirrus segments broader than long 88
- 87' The longest cirrus segments at least as long as broad 92
- 88 The fourth pinnule (P₃ on arms following a IIBr series) larger than the preceding pinnule²³; brachials exceedingly short and discoidal. *Heterometra sarae* A. H. Clark, 1941a
- 88' The third pinnule (P₂ on arms following a IIBr series or P₃ on arms following a IBr series) the largest; brachials wedge-shaped 89
- 89 30-47 cirrus segments, the distal ones usually with sharp conical spines
Heterometra reynaudi (J. Müller, 1846)
- 89' Up to 43 cirrus segments, the distal ones each with a blunt spine or median carination 90
- 90 Cirrus segments mostly twice as broad as long *Heterometra amboinae* (A. H. Clark, 1912d)
- 90' Cirrus segments about half as broad again as long 91
- 91 Only 14 arms, though their length is as much as 160 mm. in the holotype and only known specimen; only 32-36 cirrus segments *Heterometra atra* (A. H. Clark, 1911a)

²⁰ However, A. H. Clark includes in *Heterometra crenulata* the specimens from north-west Australia described by Gislén (1919) under the name of *Amphimetra variipinna* though these were described as having spinose pinnule processes. Others from the same area in the British Museum collections have the pinnule processes distinctly more rugose than specimens from Torres Strait.

²¹ *Heterometra reynaudi* may run down here since the spines on its cirri may be rather sharp, though not very long.

²² This maximum number is derived from two unrecorded specimens of *Heterometra singularis* from off Penang in the British Museum collections which have arm lengths of probably 150 and 170 mm. (as large as or larger than the largest specimens already described); their cirri are XXV and XXVII with up to 44 and 45 segments respectively. The proportions of the proximal pinnules are somewhat variable but P₃ is as large as or larger than P₂ (on arms following a IIBr series, which is the usual condition) not smaller as in the specimen from 80 miles NW of Penang described by A. H. Clark (1941a, p. 292) and in the much smaller type specimen.

²³ In his key Mr. Clark (1941a) does not appear to have distinguished here between arms borne on IBr series and those on IIBrs since he simply specified P₂ and P₃; in the second case because P_D is present, the first brachial pinnule, P₁, is comparable to P₂ when no IIBr series occurs. Thus in the specimen of *Heterometra amboinae* from Ceylon described by Reichensperger, when the first pinnule is P_D then P₂ is the longest pinnule and P₃ is smaller, whereas in the specimen described by A. H. Clark (p. 298), 'P₂ is . . . almost as long as P₃' (on an arm evidently based on a IBr series). In *H. reynaudi* also P₂ is the largest pinnule on arms from IIBr series in contradiction to its position in Mr. Clark's key.

- 91' 20 arms at a length of only 80 mm.; cirri with 39-43 segments
Heterometra joubini A. H. Clark, 1911a
- 92 P₁, P₂ and P₃ (on arms following a IIBr division series) progressively increasing in size 93
- 92' P₃ smaller than P₂ 94
- 93 24-32 arms; 32-45 cirrus segments *Heterometra pulchra* A. H. Clark, 1912d
- 93' 13-18 arms; 32-36 cirrus segments *Heterometra madagascarensis* (A. H. Clark, 1911a)
- 94 Over XXV cirri, their segments numbering 36-39, when the arm length is 80 mm.; P₁ (after a IIBr series) much smaller than P₂ *Heterometra graviere* A. H. Clark, 1911a
- 94' Less than XXV cirri, their segments numbering 31-35, when the arm length is as much as 110 mm.; P₁ similar to P₂ *Heterometra compta* A. H. Clark, 1909h
- 95 Cirri very stout but evenly flexible throughout their length, the proximal segments several times broader than long but the distal ones very slightly longer 96
- 95' Cirri moderately stout, flexible distally but stiffer proximally, the distal segments shorter than the proximal ones, the latter not more than twice as broad as long 98
- 96 Dorsal spines not developed before about the fourteenth cirrus segments; P₃ larger than P₂ (arm length c.200 mm. in the two very large specimens known)²⁴ *Amphimetra spectabilis* A. H. Clark, 1918
- 96' Spines developed on the cirrus segments from between the sixth to twelfth; P₂ usually the largest pinnule (arm length up to 150 mm. in the recorded material)²⁴ 97
- 97 Cirri with c.25 segments and P₂ with c.12 when the arm length is 60 mm.
Amphimetra pinniformis (P. H. Carpenter, 1881)
- 97' Cirri with 30-35 segments and P₂ with 18-21 when the arms are c.100 mm. long
Amphimetra molleri (A. H. Clark, 1908c)
- 98 A very prominent snout-like synarthrial tubercle on each division series and the first two brachials of each arm (fig. 8a) *Amphimetra ensifera* (A. H. Clark, 1908c)
- 98' Synarthrial tubercles moderately developed, if at all. 99
- 99 Proximal pinnules cylindrical in the basal as well as distal part; arm length not known to exceed 100 mm.
Amphimetra laevipinna (P. H. Carpenter, 1882a)
- 99' Proximal pinnules prismatic basally, usually with a slight dorsal keel; arm length up to 300 mm. (pl. 2, fig. 3)
Amphimetra tessellata (J. Müller, 1841)
- 100 Cirri with more than 40 segments (at least when the arms are >90 mm. long), their length between a third and half the arm length OXYMETRA 101
- 100' Cirri medium-sized or small, with less than 40 segments and rarely more than a quarter of the arm length, usually about a fifth 102

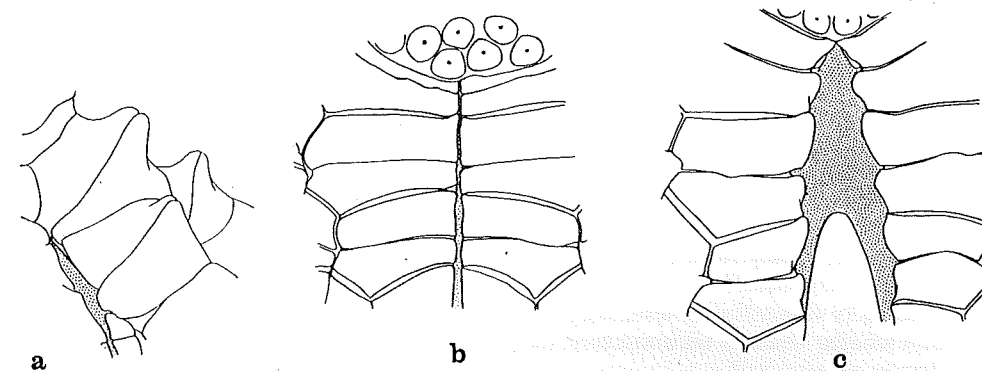


FIG. 8. a. Dorso-lateral view of division series and arm base of *Amphimetra ensifera*, b. interradius of *Lamprometra palmata* and c. of *Stephanometra indica*.

- 101 First four pairs of pinnules on each arm stiff and spike-like with a sharp point, often erected vertically, even in preserved specimens *Oxymetra erinacea* (Hartlaub, 1890)
- 101' Proximal pinnules flexible distally though stiffer basally, their tips more or less flagellate (whip-like)
Oxymetra finschi (Hartlaub, 1890)

²⁴ However, the specimen from 80 miles NW of Penang determined by A. H. Clark as *Amphimetra molleri* in 1929 has dorsal spines not developed until the fourteenth to seventeenth cirrus segments as in *spectabilis*, while the segments themselves are relatively longer than specified for *molleri* in his key, being more like those of *tessellata*. I doubt whether all the nominal species of *Amphimetra* recognised by Mr. Clark are tenable; many of their differential characters are dependant on size or are too variable for much reliance to be placed on them. For instance, both *A. molleri* and *A. spectabilis* could be based on moderate or large-sized specimens of *A. pinniformis*; also *A. ensifera* may be only the extreme form of *A. tessellata* with outsize synarthrial tubercles.

- 102 One or more of the enlarged proximal pinnules very stiff and spike-like (pl. 2, fig. 4); the division series well separated with rounded ventrolateral extensions (fig. 8c)²⁵. **STEPHANOMETRA** 103
- 102' The enlarged proximal pinnules tapering to a usually flexible point, rarely erected in preserved specimens; the division series without ventrolateral extensions, variable in form but the adjacent ones often straight-sided and closely approximating laterally (fig. 8b)²⁵. 108
- 103 The distal cirrus segments with well-developed dorsal spines 104
- 103' No dorsal spines on the cirri, the distal segments only slightly carinate. 105
- 104 28-40 arms, at least when their length is 85-170 mm.; 24-37 cirrus segments at this same size²⁶. *Stephanometra echinus* (A. H. Clark, 1908a)
- 104' Not more than 24 arms (though in the four specimens recorded the arms are up to only 70 mm. long); about 20 cirrus segments²⁶. *Stephanometra tenuipinna* (Hartlaub, 1890)
- 105 P₁ spike-like and resembling P₂ though smaller *Stephanometra spinipinna* (Hartlaub, 1890)
- 105' P₁ flexible and much more slender than P₂. 106
- 106 P₃ and the following pinnules smaller and more flexible than P₂ which is the only spike-like pinnule²⁷. *Stephanometra indica* (Smith, 1876)
- 106' P₃ at least spike-like, resembling P₂ but usually smaller²⁷. 107
- 107 P₄ not spike-like but flexible *Stephanometra spicata* (P. H. Carpenter, 1881)²⁷
- 107' P₄, sometimes also P₅, spike-like and resembling P₂ and P₃ *Stephanometra oxyacantha* (Hartlaub, 1890)
- 108 P₂ the largest proximal pinnule, often quite stout and stiffened basally. **LAMPROMETRA**²⁷ 109
- 108' P₂ similar in size to P₃ or smaller 110
- 109 P₂ either very stout (*L. palmata palmata*) or distinctly carinate basally (*L. palmata gyges*) (pl. 2, fig. 5) *Lamprometra palmata* (J. Müller, 1841)
- 109' P₂ fairly slender and usually with little sign of a keel basally²⁸. *Lamprometra klunzingeri* (Hartlaub, 1890)
- 110 P₂ and P₃ slender and similar in shape and length **LIPAROMETRA** 111
- 110' P₃ longer and stouter than P₂ **DICHROMETRA** 112
- 111 Cirri long and slender, about a third or a quarter as long as the arms, their longest segments distinctly longer than broad; P₁ about two-thirds as long as P₂ and P₃ *Liparometra articulata* (J. Müller, 1849)
- 111' Cirri stout, about a fifth or a sixth of the arm length, the longest segments not longer than broad; P₁ only about half as long as P₂ and P₃ *Liparometra regalis* (P. H. Carpenter, 1888b)
- 112 P₁ only about half as long as P₂, which is itself markedly shorter than P₃; distal cirrus segments carinate dorsally or with small spines. *Dichrometra bimaculata* (P. H. Carpenter, 1881)
- 112' P₁, P₂ and P₃ progressively longer but usually not conspicuously different in size (except that in some individuals of *D. flagellata* P₁ may be little more than half as long as P₂); distal cirrus segments with dorsal spines or tubercles 113
- 113 Cirri slender, the longest segments twice as long as broad or even longer *Dichrometra tenuicirra* A. H. Clark, 1912a
- 113' Cirri stouter, the longest segments not more than about a third again as long as broad 114
- 114 P₂ and P₃ slender, most of their segments much longer than broad; division series and arm bases smooth *Dichrometra doederleini* (de Loriol, 1900)
- 114' P₂ and P₃ rather stout with fairly short segments, even the distalmost only about twice as long as broad; division series and arm bases sometimes distinctly knobby owing to synarthrial and articular tubercles 115
- 115 P₂ markedly longer than P₁; synarthrial tubercles often well-developed *Dichrometra flagellata* (J. Müller, 1841)
- 115' P₁, P₂ and P₃ not markedly dissimilar in size, only c.2 or 3 mm. difference in length from the first to the third (P₃ sometimes smaller than P₂ on immature specimens or regenerating arms); synarthrial tubercles poorly developed. *Dichrometra afra* A. H. Clark, 1912g

²⁵ *Lamprometra palmata palmata* approaches *Stephanometra* in having P₂ somewhat stiffened and more or less erect but its tip is fairly flexible.

²⁶ As A. H. Clark himself suggests, *Stephanometra echinus* is probably based on large specimens of *S. tenuipinna*.

²⁷ However, Gislén (1940a) concludes from his Fijian and Marshall Islands specimens that the stiffening of the proximal pinnules is progressive with age, only P₂ being stiff in immature specimens. This observation implies that a re-assessment of specific limits within the genus *Stephanometra* is needed, as well as the generic limit between it and *Lamprometra*. Gislén refers *S. spicata* to the synonymy of *S. protectus*, which is treated by A. H. Clark (1941) and in the present work as conspecific with *S. indica*.

²⁸ However, six specimens of *Lamprometra klunzingeri* in the British Museum collections from the Sudanese Red Sea have basal keels on the proximal pinnules as strong as those in many specimens of *Lamprometra palmata gyges* from Australia; conversely, some Australian specimens have hardly a trace of keels on the pinnules. In fact, the variation in the proximal pinnules is so great in *Lamprometra* that it might be better to consider *klunzingeri* as well as *gyges* as subspecies of *L. palmata*. Some specimens of *Dichrometra afra* may run down to *L. klunzingeri* since regenerating arms or entire immature specimens can have P₃ smaller than P₂ instead of larger. A. H. Clark has recognised both species among specimens from Zanzibar in the British Museum collections, the example of *D. afra* having the dorsal spines on the distal cirrus segments much sharper than those of *L. klunzingeri*.

- 116 More than 20 arms; ventral perisome of the pinnules protected by series of overlapping side and covering plates easily seen with a hand lens; small dorsal processes on the cirrus segments and the distal end of each proximal one produced ventrally into a sharp spine. *Pterometra venusta* A. H. Clark, 1912i
- 116' 10 arms only, side and covering plates along the pinnules microscopic, if present; no dorsal or ventral processes on the cirrus segments **TROPIOMETRIDAE** 117
- 117 Arms evenly convex dorsally *Tropiometra afra* (Hartlaub, 1890)
- 117' Arms carinate dorsally, at least in the proximal half (pl. 2, fig. 6). *Tropiometra carinata* (Lamarck, 1816)
- 118 P₃ the largest pinnule 119
- 118' P₁ or P₂ (or both) larger than P₃ 128
- 119 Cirrus segments somewhat flared at their distal ends, overlapping the succeeding segments (fig. 9a), longer on the dorsal edge than broad at their proximal ends **DOROMETRA** 120
- 119' Cirrus segments not overlapping, the distal ones about as long dorsally as broad at their proximal ends **TOXOMETRA** 124
- 120 P₂ intermediate in size and number of segments between P₁ and P₃ 121
- 120' P₂ similar to P₁ or smaller and with fewer segments 122
- 121 Cirri relatively small, their length usually between a fifth and a sixth of the arm length (pl. 2, fig. 8) *Dorometra parvicirra* (P. H. Carpenter, 1888b)
- 121' Cirri larger, about a third of the arm length (at least in the unique type specimen) *Dorometra aegyptica* (A. H. Clark, 1911a)
- 122 P₁ more than twice as long as P₂ *Dorometra andromacha* A. H. Clark, 1936
- 122' P₁ less than half as long again, if at all, longer than P₂ 123
- 123 P₃ with 18-25 segments (arm length 45-60 mm.) *Dorometra mauritiana* (A. H. Clark, 1911a)
- 123' P₃ with up to 16 segments (arm length up to 60 mm.) *Dorometra nana* (Hartlaub, 1890)

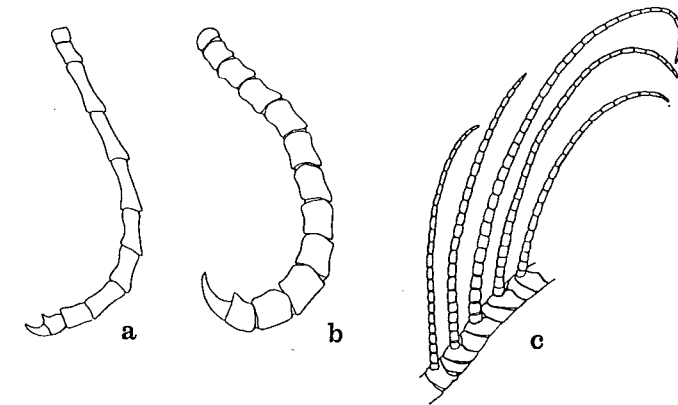


FIG. 9. a. Cirrus of *Dorometra nana*, b. of *Antedon arabica*, and c. P₂ to P₅ of *Toxometra nomima*. [c. from H. L. Clark, 1938.]

- 124 Proximal pinnules relatively small, P₁ only about 5 mm. long and with 12-15 segments when the arm length is 80-90 mm. *Toxometra paupera* A. H. Clark, 1911b
- 124' Proximal pinnules larger, P₁ 6-12 mm. long with about 20 segments when the arm length is only 35-50 mm. 125
- 125 Proximal pinnules very long, P₁ about 12 mm. when the arms are only 35 mm. and P₃ 25 mm. with more than 30 segments (fig. 9c) *Toxometra nomima* (H. L. Clark, 1938)
- 125' P₁ 6-8 mm. long and P₃ 15-25 mm. when the arms are 35-50 mm. 126
- 126 Fourth to sixth cirrus segments particularly elongated, more than twice as long as their median breadths; cirri white in colour, arms usually purple but sometimes also white except for the basal pinnules *Toxometra bicolor* (H. L. Clark, 1938)
- 126' The longest cirrus segments shorter, less than twice as long as broad; colour white, brown, yellow or purple, often variegated 127
- 127 P₄ much smaller than P₃ *Toxometra leptota* (H. L. Clark, 1938)
- 127' P₄ very little smaller than P₃ *Toxometra poecila* (H. L. Clark, 1938)
- 128 P₃ similar in size to P₂ **ANTEDON** 129
- 128' P₃ distinctly smaller than P₂ 134
- 129 Cirri slender, the longest segments well over twice as long as their median breadths, sometimes six times as long 130
- 129' Cirri stouter, the segments not more than twice as long as broad, usually shorter (fig. 9b) 132
- 130 Cirri few, X-XX, and relatively long with 12-27 segments up to six times as long as their median breadths (arms about 40 mm. long in the specimens described) *Antedon longicirra* (A. H. Clark, 1912e)

130'	Cirri rarely less than XXV and with not more than 12 segments, the longest three or four times as long as broad (arm length up to 45 mm.)	131
131	P ₁ with about 17 segments	<i>Antedon iris</i> (A. H. Clark, 1912e)
131'	P ₁ with only 8-11 segments	<i>Antedon parviflora</i> (A. H. Clark, 1912e)
132	Centrodorsal discoidal, the dorsal pole quite flat	<i>Antedon incommoda</i> Bell, 1888
132'	Centrodorsal low hemispherical to rounded conical, the dorsal pole more or less convex	133
133	Up to 15, rarely 16, cirrus segments	<i>Antedon serrata</i> A. H. Clark, 1908b
133'	Up to 12 cirrus segments (in the only specimen known)	<i>Antedon arabica</i> (A. H. Clark, 1937)
134	P ₁ rarely with more than 20 segments	EUANTEDON 135
134'	P ₁ with numerous segments, 30 or more	MASTIGOMETRA 136
135	Cirri short, only about an eighth of the arm length with about 14 segments when the arms are 80 mm. long; P ₁ long, as long as or longer than, the cirri	<i>Euatedon polytes</i> A. H. Clark, 1936
135'	Cirri longer, about a fifth of the arm length and with up to 25 segments when the arms are 100 mm. long; P ₁ much shorter than the cirri	<i>Euatedon tahitiensis</i> A. H. Clark, 1918
136	Cirri about XXXV; centrodorsal very flat (the arms 105 mm. long in the unique type)	<i>Mastigometra pacifica</i> A. H. Clark, 1918
136'	Cirri very numerous, L-XC in number when the arms are 80-120 mm. long; centrodorsal low hemispherical in shape	137
137	P ₁ about 25 mm. long when the arms are 120 mm.	<i>Mastigometra flagellifera</i> A. H. Clark, 1908c
137'	P ₁ about 15 mm. long when the arms are about 80 mm. long	<i>Mastigometra micropoda</i> A. H. Clark, 1909h

SUMMARY OF CHANGES OF TAXONOMIC STATUS—CRINOIDEA

Comanthus timorensis (J. Müller, 1841) a synonym of *C. parvicirrus* (J. Müller, 1841)—see table note 3.
Capillaster coccodistoma (P. H. Carpenter, 1883) a synonym of *C. multiradiatus* (Linnaeus, 1758)—see key note 2.

SUMMARY OF RELATIONSHIPS NEEDING FURTHER INVESTIGATION

Comaster schoenovi A. H. Clark, 1918, *brevicirrus* (Bell, 1894) and *distinctus* (P. H. Carpenter, 1888b)—see key note 5.
Zygometa andromeda A. H. Clark, 1912c, *punctata* A. H. Clark, 1912f, *microdiscus* (Bell, 1882c) and *elegans* (Bell, 1882c)—see note 6.
Cenometra cornuta A. H. Clark, 1911c, *herdmani* A. H. Clark, 1909g, and *bella* (Hartlaub, 1890)—see note 7.
Iconometra intermedia (A. H. Clark, 1912c) and *Oligometrides aedonae* (Lamarck, 1816)—see note 10.
Petasonmetra helianthoides A. H. Clark, 1912g and *clarae* (Hartlaub, 1890)—see note 11.
Decametra spp., notably *mylitta* A. H. Clark, 1912a, *brevicirra* (A. H. Clark, 1912d), *modica* A. H. Clark, 1911a, *mollis* (A. H. Clark, 1909e) and *informis* (P. H. Carpenter, 1888b)—see note 13.
Heterometra spp. included—see table note 13 and key note 19.
Amphimetra mollerii (A. H. Clark, 1908c), *spectabilis* A. H. Clark, 1918 and *pinniformis* (P. H. Carpenter, 1881)—see key note 24.
Amphimetra ensifera (A. H. Clark, 1908c) and *tessellata* (J. Müller, 1841)—see note 24.
Stephanometra echinus (A. H. Clark, 1908a) and *tenuipinna* (Hartlaub, 1890)—see note 26.
Stephanometra spinipinna (Hartlaub, 1890), *oxyacantha* (Hartlaub, 1890), *spicata* (P. H. Carpenter, 1881) and *indica* (Smith, 1876)—see note 27.
Lamprometra klunzingeri (Hartlaub, 1890) and *palmata* (J. Müller, 1841)—see note 28.