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A REVISION OF THE BRITISH COPEPODA BELONGING TO THE GENERA BRADYA, Boeck, AND ECTINOSOMA, Boeck.

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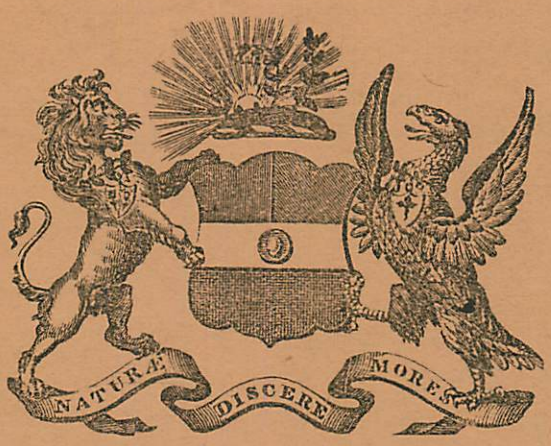

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M & Dr Jules Richard
with the Authors'

V. *A Revision of the British Copepoda belonging to the Genera* Bradya, *Boeck, and* Ectinosoma, *Boeck. By* Thomas Scott, *F.L.S., Mem. Soc. Zool. France, Naturalist to the Fishery Board for Scotland, and* Andrew Scott, *Fisheries Assistant, University College, Liverpool.*

(Plates 35–38.)

Read 19th November, 1894.

Introductory.

In the course of our study of the British Entomostraca during the past few years, we have observed from time to time specimens of Copepoda belonging apparently to one or other of the genera *Bradya* and *Ectinosoma*, which, so far as known to us, could not be identified with any of the described species of either of these two genera. Moreover, as considerable difficulty was sometimes experienced by us in satisfactorily diagnosing the characters by which these specimens differed from, and by which they agreed with, species already described, it was decided to delay beginning a critical study of the several forms which had been observed until, if possible, a more extended inquiry had been made. With this object in view, gatherings of tow-netted and dredged material from various places around our coasts have been examined as opportunities occurred, and numerous specimens collected. Careful dissections have been made of all doubtful forms, and, wherever necessary, accurate detailed drawings have been prepared. The results of these researches we now propose to lay before the Linnean Society in the form of a revision of the British Copepoda belonging to the genera *Bradya* and *Ectinosoma*, with figures of all the species described.

We have described and figured the few species already described and figured in works on British Copepoda as well as those which, so far as we know, are new to science, in order to bring into prominence certain obscure points not fully illustrated in previous works, as well as to allow of the various species, old and new, being compared with each other, with greater certainty and ease.

Though this revision has been the result of much careful research, it cannot be considered exhaustive; but if it tends to simplify the study of these two somewhat troublesome genera we shall feel amply rewarded for our labours.

We propose to take the genus *Bradya* first, as the structure of the anterior foot-jaws in this genus shows, in our opinion, a closer affinity with the *Calanidæ* than does that of their homologues in *Ectinosoma*.

The following is a list of the species described in this memoir, arranged in alphabetical order:—

Genus Bradya.

Bradya elegans, sp. n., p. 422.
„ *fusca*, sp. n., p. 424.
„ *hirsuta*, sp. n., p. 423.
„ *minor*, sp. n., p. 425.
„ *similis*, sp. n., p. 424.
„ *typica*, Boeck, p. 421.

Genus Ectinosoma.

Ectinosoma armiferum, sp. n., p. 434.
„ *atlanticum*, Brady & Robertson, p. 437.
Ectinosoma curticorne, Boeck, p. 430.
„ *erythrops*, Brady, p. 431.
„ *gracile*, sp. n., p. 429.
„ *Herdmani*, sp. n., p. 432.
„ *longicorne*, sp. n., p. 439.
„ *melaniceps*, Boeck, p. 434.
„ *Normani*, sp. n., p. 435.
„ *propinquum*, sp. n., p. 428.
„ *pygmæum*, sp. n., p. 433.
„ *Sarsi*, Boeck, p. 427.
„ *tenuipes*, sp. n., p. 436.
„ *tenuireme*, sp. n., p. 439.

Genus Bradya, Boeck (1872).

Description. Body elongate, fusiform; abdomen not distinctly separated from the thorax. The antennules are usually short and composed of five to eight joints.

The antennæ are 3-jointed, and the secondary branches of the antennæ are 2- to 3-jointed, usually slender, and of variable lengths.

The mandibles are each furnished with a well-developed palp, composed usually of a stout basal joint bearing two 1-jointed branches, one of which is apical and the other marginal.

The maxillæ are well developed.

The anterior foot-jaws are of considerable size and composed of five joints; the first two joints are large and the articulation between them is strongly hinged; the first joint also bears three setiferous marginal processes; the three terminal joints are usually very small.

The posterior foot-jaws are smaller than the anterior and are 3-jointed; the end-joint is shorter than the preceding one, and is usually provided with three apical setæ.

The first four pairs of swimming-feet are all somewhat similar in structure; both branches are composed of three subequal joints, and the outer are usually somewhat shorter than the inner branches.

Fifth pair small, composed of two joints, a basal and a secondary joint.

Remarks. The most important difference between *Bradya* and *Ectinosoma* is to be found in the structure of the anterior foot-jaws. In *Bradya* the anterior foot-jaws are composed of five distinct joints, the first two of which are usually large, while the other three are very small; the articulation between the first two joints is strongly hinged, and in all the "spirit" specimens examined by us the large second joint (together with the three small terminal joints) is bent at, or nearly at, a right angle to the first joint. Moreover, the secondary branches of the antennæ vary in the number of joints from two to three, whereas in all the specimens of *Ectinosoma* examined by us the secondary

branches were always 3-jointed. The labium in both *Bradya* and *Ectinosoma* is frequently in the form of a hook-like process.

BRADYA TYPICA, Boeck (1872). (Pl. 35. figs. 1, 11, 14, 22, 26, 32, 39, 44; Pl. 36. figs. 1 and 12.)

1872. *Bradya typica*, Boeck (2), p. 15.
1880. *Bradya typica*, Brady (3), vol. ii. p. 17, pl. xxxviii. figs. 1–10.
1893. *Bradya typica*, I. C. Thompson (16), p. 22, pl. xix. figs. 8 *b–c*.

Description. Length ·8 mm. ($\frac{1}{31}$ of an inch). Body moderately robust, fusiform; forehead produced into a short, narrow, but distinct rostrum, which reaches to about the second joint of the antennules. Antennules very short, stout, and 8-jointed; the first three joints are subequal and longer than the others, as in the annexed formula, which shows the approximate proportional lengths of all the joints:—

No. of the joints, counting from the head:	1	2	3	4	5	6	7	8
Proportional lengths of the joints:	7	7	6	2	3	3	4	3

The secondary branches of the antennæ are rather longer and more slender than the primary branches, and 3-jointed, the middle joint being very small (Pl. 35. fig. 14).

The mandibles are stout and armed at the truncate apex with a number of slender teeth; mandibular palp well developed, having the basal joint robust and furnished with several plumose setæ at the apex in addition to the two setiferous secondary branches (Pl. 35. fig. 22).

Anterior foot-jaws stout, the first two joints large and subequal, the last three very small (Pl. 35. fig. 26).

The end-joints of the posterior foot-jaws are very small; two elongate but unequal setæ spring from the inner distal angles of the first joints, while the second joints are each provided with a row of small teeth that extend from the lower proximal angle obliquely across the joint to the upper distal angle; a plumose seta also springs from the lower distal angle; the small terminal joint forms the base of a stout, elongate, and slightly curved setose spine, and a spiniform plumose seta springs from the inner margin of the same joint (Pl. 35. fig. 32).

First four pairs of swimming-feet moderately stout; outer branches of the first pair considerably shorter than the inner branches; in the fourth pair both branches are about equal in length (Pl. 35. figs. 39 and 44).

The fifth pair are small; the short produced interior portion of the basal joint, which is about as broad as long, bears two apical setæ—the inner one very long, spiniform, and slightly plumose, the other shorter and more slender; a moderately long and slender seta springs from the slightly produced outer portion of the same joint; secondary joint small, subquadrangular, and furnished with three slender setæ, the two inner ones being very long, while the other is much shorter (Pl. 36. fig. 1).

Caudal stylets short, and about equal in length to the last abdominal segment (Pl. 36. fig. 12).

Habitat. Off Port Cressa Bay, Scilly Islands; and off Hartlepool (*G. S. Brady*). West of May Island, Firth of Forth. Port Erin, Isle of Man (*I. C. T.*).

Remarks. The Firth of Forth specimens differ in one or two minor points from Dr. Brady's description and figures in his excellent Monograph of the British Copepoda, *i. e.* the antennules in the Forth specimens are 8-jointed and the secondary branches of the antennæ are 3-jointed (in this latter particular they agree with Boeck's description), but in all the more important characters they agree with the description and figures contained in Dr. Brady's valuable work.

BRADYA ELEGANS, sp. n. (Pl. 35. figs. 4, 10, 15, 25, 29, 36, 38, 46; Pl. 36. figs. 4 and 11.)

Description. Length 1·2 mm. ($\frac{1}{21}$ of an inch). Body elongate, slender; rostrum prominent, seen from above broadly rounded.

Antennules very short, stout, 5-jointed, strongly setiform, the second and last joints shorter than the others; the approximate proportional lengths of the joints are shown by the formula:—

No. of the joints:	1	2	3	4	5
Proportional lengths:	7	3	5	5	3

Antennæ stout; secondary branch shorter than the primary, 2-jointed, the first joint very short, the second elongate and becoming gradually dilated towards the distal end, provided with two elongate, somewhat unequal, and densely plumose apical setæ; the last joint of the primary branch bears a number of setæ that are coarsely and somewhat irregularly plumose (Pl. 35. fig. 15).

Mandibles somewhat stylet-shaped; both branches of the palp, which are subterminal on the basal joint, are strongly setiferous (Pl. 35. fig. 25).

Anterior foot-jaws small; basal joint stout, the three setiferous marginal processes nearly alike; second joint much narrower and somewhat dilated distally; the last three joints are very small (Pl. 35. fig. 29).

Posterior foot-jaws somewhat similar in structure to those of *Ectinosoma Sarsi*, Boeck, but smaller (Pl. 35. fig. 36).

The first four pairs of swimming-feet are proportionally more slender and elongate than those of *Bradya typica*, Boeck (Pl. 35. figs. 38 and 46).

The fifth pair are moderately large and broadly subquadrangular; the produced inner portion of the basal joint is cylindrical and twice as long as broad, and armed at the apex with a moderately long spiniform seta, and a stout spine about half the length of the seta; the outer angle of the basal joint, which is not produced, is provided with a single slender hair and a few small spines; the inner margin is fringed with small setæ, and there is an oblique row of similar setæ on the lateral aspect of the joint; the secondary joint is broad and nearly square in outline; the truncate apex, which does not extend beyond the end of the produced inner portion of the basal joint, is irregularly serrate and bears three elongate spiniform setæ arranged widely apart; the middle one is considerably longer than the one on either side; there is also a slender seta on the outer angle, and an oblique row of minute spines near the inner margin (Pl. 36. fig. 4).

Habitat. Largo Bay, Firth of Forth.

Remarks. This is a slender and very graceful species; the broadly subquadrate form of the fifth pair of feet is very characteristic. The antennæ and mandibles differ somewhat from those of the typical *Bradya*, but otherwise it appears to be a true member of the genus.

BRADYA HIRSUTA, sp. n. (Pl. 35. figs. 2, 8, 17, 19, 23, 28, 34, 40, 47; Pl. 36. figs. 2–7.)

Description. Length 1 mm. ($\frac{1}{25}$ of an inch). Body seen from the side fusiform; abdominal segments more or less hirsute; rostrum prominent.

Antennules short, 5-jointed, the first two joints robust, the others smaller; the proportional lengths of the joints are nearly as shown by the formula :—

No. of the joints:	1	2	3	4	5
Proportional lengths:	7	8	3	4	4

Antennæ considerably more elongate than the antennules, the last joint armed with a number of spiniform setæ, the distal half of each of which is strongly ciliate along one side; secondary branches 2-jointed, slender, the first joint short, the second elongate and bearing two terminal setæ.

The labium consists of a small hook-like process (Pl. 35. fig. 19).

Mandibles comparatively small and narrow, and armed with a few slender teeth; mandibular palp larger, the basal joint furnished with a single short subapical plumose seta in addition to the secondary branches (Pl. 35. fig. 23).

Anterior foot-jaws small; the first joint is very dilated, the second much narrower, while the three terminal joints are very small (Pl. 35. fig. 28).

The first joint of the posterior foot-jaws bears a long setiferous spine on the upper distal angle, one of the margins of which is fringed with cilia; the last joint, which is very short, bears two moderately stout spiniform setæ and a long intermediate hair (Pl. 35. fig. 34).

The first four pairs of swimming-feet have the marginal spines and terminal spiniform seta strongly plumose on the exterior edges (Pl. 35. figs. 40 and 47).

The fifth pair are strongly setiferous; the produced inner portion of the basal joint bears one long and one short spiniform seta; the secondary joint extends beyond the end of the produced inner portion of the basal joint, and is armed with three terminal spines; the two outer ones are elongate and slender, while the inner one is strong and robust, and only about half the length of the one next to it; a plumose seta springs from the lateral aspect of the basal joint, near the exterior edge, and both joints bear transverse rows of cilia, as well as being otherwise hirsute, as shown by the figure (Pl. 36. fig. 2).

Caudal stylets stout, elongate, and considerably divergent, their margins ciliate on the distal half (Pl. 36. fig. 7).

Habitat. Largo Bay, Firth of Forth (1891).

Remarks. This species is at once distinguished by its comparatively large size and long divergent caudal stylets, as well as by its hirsute abdomen and fifth pair of thoracic feet.

BRADYA SIMILIS, sp. n. (Pl. 35. figs. 3, 7, 16, 27, 33, 41, 48; Pl. 36. figs. 3 and 10.)

Description. Length ·69 mm. ($\frac{1}{36}$ of an inch). Body seen from the side slender, fusiform; rostrum of moderate length and slightly curved.

Antennules short, robust, 5-jointed; the first four joints about equal in length, but the terminal joint rather shorter than the others. The proportional lengths of the joints are nearly as shown by the formula:—

No. of the joints:	1 . 2 . 3 . 4 . 5
Proportional lengths:	8 8 8 8 5

Antennæ longer than the antennules; the first joint is about one and a half times the length of the next and bears a small 2-jointed secondary branch at the distal end; the second and third joints are about equal in length (Pl. 35. fig. 16).

Mandibles nearly as in *Bradya hirsuta*.

Anterior foot-jaws much smaller than those of *Bradya hirsuta*, and with three small marginal processes on the first joint (Pl. 35. fig. 27).

Posterior foot-jaws also smaller and provided with simple setæ (Pl. 35. fig. 33).

The first four pairs of swimming-feet are all somewhat similar, except that the first pair are rather more slender than the others; the marginal spines of all the four pairs are elongate and slightly setose on both edges; the seta on the exterior angle of the second basal joint of the first pair is elongate and slender, while the seta similarly situated on the fourth pair is considerably shorter (Pl. 35. figs. 41 and 48).

In the fifth pair the exterior and interior produced portions of the basal joint are somewhat similar, except that the inner is rather longer than the outer process and is armed with a long stout spine, setose on both margins, and a stout seta, while the outer process bears a single moderately long seta; the basal joint is furnished with one short and one moderately long setose spine and a few small setæ on the lateral aspect, as shown in the figure (Pl. 36. fig. 3); the secondary joint reaches beyond the end of the basal joint and terminates in three more or less distinct lobes; the two inner ones, which are subequal, extend considerably beyond the outer; the inner and outer lobes are each armed with a very stout and moderately long spine, while the spine that springs from the middle lobe is slender and much more elongate than the lateral spines; all the three spines have setose margins.

Caudal stylets comparatively elongate, being about equal to the combined lengths of the last two segments of the abdomen; they are also somewhat divergent, as shown in the figure (Pl. 36. fig. 10).

Habitat. Largo Bay, Firth of Forth.

Remarks. This species resembles the one last described, but is much smaller. The small secondary branches of the antennæ and the structure of the fifth pair of thoracic feet seem to be the chief distinguishing characters.

BRADYA FUSCA, sp. n. (Pl. 35. figs. 6, 12, 18, 20, 30, 37, 43, 45; Pl. 36. figs. 6 and 8.)

Description. Length ·7 mm. ($\frac{1}{36}$ of an inch). Body not so slender as that of *Bradya*

similis, nor so stout as that of *Bradya typica*; rostrum rather more prominent than in these two species.

Antennules short, stout, 6-jointed, the first five gradually decrease in length, while the last is about equal in length to the third; the annexed formula shows approximately the proportional lengths of the joints :—

No. of the joints:	1	2	3	4	5	6
Proportional lengths:	7	6	5	4	3	5

Secondary branches of antennæ small, slender, 2-jointed, the first joint much shorter than the second; a number of setæ fringe the distal half of the upper margin of the first joint of the primary branches (Pl. 35. fig. 18).

Labium bluntly rounded (Pl. 35. fig. 20).

The anterior and posterior foot-jaws are somewhat similar in structure to those of *Bradya elegans*, but smaller (Pl. 35. figs. 30 and 37).

The first four pairs of swimming-feet are somewhat similar to those of *Bradya typica*, Boeck, but slender (Pl. 35. figs. 43 and 45).

The inner produced part of the basal joint of the fifth pair is elongate, narrow, cylindrical, ciliate on the inner margin, and provided with two apical setæ, one of which is rather longer than the basal joint, while the other is scarcely half as long; the outer angle of the basal joint is considerably produced and bears a small slender terminal seta; a moderately stout plumose seta springs from the lateral aspect of the basal joint and near the base of the secondary joint; the secondary joint, which is about one and a half times longer than broad, extends somewhat beyond the end of the produced inner part of the basal joint, and has a somewhat irregularly trilobed apex; the two inner lobes are subequal and extend beyond the outer one; the three lobes are each provided with a plumose seta; the inner seta is short and stout, the middle one long and slender, and nearly twice the length of the outer. Both basal and secondary joints are furnished with transverse rows of cilia on their lateral aspect, as shown by the figure (Pl. 36. fig. 6).

Caudal stylets about one and a half times the length of the last abdominal segment; colour brown (Pl. 36. fig. 8).

Habitat. Largo Bay, Firth of Forth (1891).

Remarks. The structure of the antennules and antennæ and of the fifth pair of thoracic feet are characters by which the species is readily distinguished; no similar structure has been observed in any of the other species examined by us.

BRADYA MINOR, sp. n. (Pl. 35. figs. 5, 9, 13, 21, 24, 31, 35, 42; Pl. 36. figs. 5 and 9.)

Description. Length ·54 mm. ($\frac{1}{46}$ of an inch). Body moderately stout; the abdomen is more distinctly separated from the thorax in this species than in any of the others described in this memoir; rostrum somewhat slender and prominent.

Antennules short, stout, and 6-jointed; a dusky-coloured pigment-spot occurs on the first joint, as shown in the figure (Pl. 35. fig. 9), but whether it functions as an eye

we cannot say. The formula shows approximately the proportional lengths of the joints:—

No. of the joints:	1	2	3	4	5	6
Proportional lengths:	14	9	12	5	7	9

The secondary branches of the antennæ are very slender and 3-jointed, and shorter than the primary branches; first two joints, but especially the second, very short (Pl. 35. fig. 13).

Mandibles well developed, the biting part broadly truncate and armed with several blunt-pointed teeth; the branches of the palp are furnished with plain setæ (Pl. 35. fig. 24).

Anterior foot-jaws stout, the first joint furnished with two marginal setiferous processes in addition to several setæ (Pl. 35. fig. 31).

Posterior foot-jaws small; the first joint bears on its distal end two long and stout setæ, which are plumose only on one side, and the second has its inner margin fringed with cilia (Pl. 35. fig. 31).

The first four pairs of swimming-feet are somewhat similar in structure to those of *Bradya fusca*.

The fifth pair somewhat resemble those of *Bradya fusca*, but the inner portion of the basal joint is not so much produced and does not reach the middle of the secondary joint; the two terminal spines of the produced inner part of the basal joint are very unequal in length, and there are a few small teeth round the inner margin and end of this part of the joint; the exterior angle of the same joint is also produced into a long conical lobe that extends well down the side of the secondary joint, and terminates in a slender hair; the secondary joint is broadly oblong, and ends in a trilobed extremity which reaches considerably beyond the basal joint; the middle lobe is larger and more produced than the lateral ones, which are subequal; each lobe forms the base of an elongate and spiniform plumose seta; the middle seta is rather longer and stouter than the other two; a slender seta springs from near the base of the same joint, and there are transverse rows of minute setæ on the lateral aspect of the basal joint, as shown in the figure (Pl. 36. fig. 5).

Caudal stylets short, about equal in length to the last abdominal segment (Pl. 36. fig. 9). Colour brownish.

Habitat. Firth of Forth, off St. Monans; rock-pools on the shore of Hilbre Island, Liverpool Bay.

Remarks. The eye-like dusky pigment-spot at the base of the antennules, together with the structure of the antennæ and mouth-organs, are characters which readily distinguish this from other British species of *Bradya*.

Genus Ectinosoma, Boeck (1864).

Description. Body elongate, fusiform, similar to that of *Bradya*.

Antennules 5- to 7-jointed, not longer than the first thoracic segment, and usually tapering more or less towards the distal end.

Antennæ similar to those of *Bradya*.

Mandibles usually cleft at the apex and armed with strong teeth; mandibular palp similar to that of *Bradya*.

Anterior foot-jaws usually composed of two robust joints, and armed at the extremity with two moderately stout and elongate spiniform claws and a few setæ; the first joint is also furnished with two or three setiferous marginal processes. Second joint usually larger than the other.

Posterior foot-jaws elongate, slender, three-jointed, and in structure resembling those of *Bradya*.

Five pairs of thoracic feet similar to those of *Bradya*.

Remarks. As already pointed out in the description of the genus *Bradya* (ante, p. 420), the difference in the structure of the anterior foot-jaws is the most important and the most constant difference between *Ectinosoma* and *Bradya*, and so great is the resemblance otherwise between species belonging to these two genera that frequently we have found it almost impossible to distinguish without careful dissection whether the specimen that happened to be under examination belonged to the genus *Ectinosoma* or to *Bradya*.

Ectinosoma Sarsi, Boeck (1872). (Pl. 36. figs. 14, 26, 42; Pl. 37. figs. 1, 21, 38, 52; Pl. 38. figs. 10, 22, 32, 51.)

1872. *Ectinosoma Sarsi*, Boeck (2), p. 45.
1880. *Ectinosoma spinipes*, Brady (3), vol. ii. p. 9, pl. xxxvi. figs. 1–10.
1885. *Ectinosoma Sarsi*, Poppe (9), p. 198.
1888. *Ectinosoma spinipes*, Scott (12), p. 239.
1892. *Ectinosoma Sarsi*, Canu (6), p. 152.
1893. *Ectinosoma spinipes*, I. C. Thompson (16), p. 18, pl. xviii. fig. 8.

Description. Length 1·2 mm. ($\frac{1}{21}$ of an inch). Body, seen from the side, slender fusiform; rostrum prominent, blunt-pointed, and reaching to near the extremity of the antennules.

Antennules short, robust, 5-jointed, gradually tapering towards the distal end, and strongly setiferous. The proportional lengths of the joints are nearly as shown in the formula:—

No. of the joints:	1	2	3	4	5
Proportional lengths:	16	12	9	6	10

Antennæ large, 3-jointed, joints subequal in length, the terminal joint furnished with a number of stout setæ, coarsely plumose on the upper margin, and with several short spines; secondary branch elongate, 3-jointed, arising from the end of the first joint of the primary branch; the last joint of the secondary branch is equal to nearly twice the combined lengths of the other two joints; the first two joints are each armed with a spiniform seta, that of the first joint is short, but that of the second is elongate and coarsely plumose on the upper edge; the last joint bears two long terminal setæ, also plumose on the upper edge (Pl. 37. fig. 1).

Mandibles armed with a few strong irregular-sized teeth and a small plumose seta; the basal joint of the palp, which is nearly equal in size to the mandibles, bears

a few terminal setæ in addition to the apical and marginal 1-jointed branches; the marginal branch is much smaller than the other (Pl. 37. fig. 21).

Anterior foot-jaws composed of two large, strongly dilated joints; the first joint bears three marginal processes on the distal half; the middle process is much smaller than the other two; the end joint bears two unequal and moderately short setose spines on the inner edge and two elongate subequal spiniform claws and a few setæ at the extremity (Pl. 37. fig. 38).

Posterior foot-jaws elongate, moderately stout, tapering towards the distal end; a long plumose seta springs from near the end of the first joint; the second joint is strongly ciliate on the upper margin, while the last joint bears two subterminal plumose spines and one long and one short terminal seta, as shown in the figure (Pl. 37. fig. 52).

The first four pairs of swimming-feet are robust; the interior marginal setæ on both branches are stout and strongly plumose, while the exterior margins are fringed with small spines; the outer marginal spines of the outer branches and the spiniform terminal setæ of both outer and inner branches are stout, and strongly setose on the exterior edges; a stout spine springs from the interior distal angle of the second basal joint of the first pair (Pl. 38. figs. 10 & 22).

The fifth pair are subquadrangular in outline; the produced inner portion of the basal joint is cylindrical and twice as long as broad; its extremity is somewhat bilobed, and reaches to near the end of the secondary joint; the inner margin bears several small setæ; each of the terminal lobes forms the base of a spine, the inner one of which is stouter and more elongate than the other; the secondary joints are subquadrate, but rather longer than broad, and terminate in three unequal lobes, each of which is the base of a moderately stout spine, and is furnished with three apical spine-like teeth; the middle one of the three spines is longer than the one on either side; there are a few spine-like teeth on the lateral aspect of the basal joint, as shown in the figure (Pl. 38. fig. 32).

Caudal stylets short and moderately stout (Pl. 38. fig. 51).

Habitat. All round the British coasts; moderately common.

Remarks. This species is readily distinguished from the other *Ectinosomata* by the form of the animal, and the structure and armature of the swimming-feet.

Ectinosoma propinquum, sp. n. (Pl. 36. figs. 19, 27, 46; Pl. 37. figs. 2, 15, 32, 55; Pl. 38. figs. 9, 23, 34, 54.)

Description. Length 1·1 mm. ($\frac{1}{23}$ of an inch). Body seen from the side fusiform; rostrum prominent and projecting nearly straight forward, somewhat spoon-shaped, or with the sides slightly decurved and the apex rounded.

Antennules short, stout, strongly setiferous, and composed of five joints. The proportional lengths of the joints are nearly as shown by the formula:—

No. of the joints:	1	2	3	4	5
Proportional lengths:	11	9	12	7	12

Antennæ nearly as in *Ectinosoma Sarsi* (Pl. 37. fig. 2). Mandibles also somewhat similar to those of that species (Pl. 37. fig. 15), but two of the terminal setæ of the apical branch of the palp are united for a short distance at the base.

The labium consists of a bifid and strongly-hooked process, a lateral view of which is shown in the figure (Pl. 36. fig. 27).

Both pairs of foot-jaws are somewhat similar to those of *Ectinosoma Sarsi* (Pl. 37. figs. 32 and 55).

The first four pairs of swimming-feet are also somewhat like those of that species; but in the first pair the inner branches are proportionately shorter, while both branches in the fourth pair are of nearly equal length, and the second basal joint of the same pair is furnished with an elongate slender spine on the exterior angle (Pl. 38. figs. 9 and 23).

The produced inner portion of the fifth pair is cylindrical in form, the length of which is equal to about one and one-third times the breadth; the secondary branches are nearly quadrangular in outline—the length only slightly exceeding the breadth; the armature of the fifth pair is somewhat similar to that of *Ectinosoma Sarsi* (Pl. 38. fig. 34).

Caudal stylets short, but rather longer than broad and about equal in length to the last abdominal segment. The posterior margins of the abdominal segments are all more or less fringed with cilia.

Habitat. Firth of Forth, off Musselburgh.

Remarks. This species comes near *Ectinosoma Sarsi*, Boeck, but differs in the following particulars: the proportionate lengths of the joints of the antennules are greater, the mandible is furnished with more small teeth on its biting-edge than that of *E. Sarsi*, the anterior foot-jaws are stouter, the armature of the swimming-feet is somewhat weaker, and the fifth feet are much shorter, being nearly as long as broad.

ECTINOSOMA GRACILE, sp. n. (Pl. 36. figs. 18 and 37; Pl. 37. figs. 13, 28, 45; Pl. 38. figs. 3, 27, 30.)

Description. Length ·7 mm. ($\frac{1}{36}$ of an inch). Body seen from the side very slender, nearly cylindrical. Rostrum prominent. Antennules (Pl. 36. fig. 37) elongate, slender, composed of seven joints; the penultimate joint is nearly equal to the combined lengths of the two preceding joints, as shown by the annexed formula :—

No. of the joints :	1	2	3	4	5	6	7
Proportional lengths :	8	8	5	8	4	11	4

Antennæ elongate, moderately stout; the secondary branches small and 3-jointed, not reaching to the end of the second joint of the primary branches; the first two joints are short, the other elongate, being nearly twice the entire length of the first two (Pl. 37. fig. 13).

Anterior foot-jaws elongate, moderately stout; the end-joint about twice as long as broad, and armed at the extremity with two long slender claws and two elongate slender setæ (Pl. 37. fig. 28).

Posterior foot-jaws slender, considerably shorter than the anterior foot-jaws; end-joint about half the length of the preceding one (Pl. 37. fig. 45).

Inner branches of the first four pairs of swimming-feet moderately slender and

elongate; outer branches very slender and considerably shorter than the inner branches; the first joint is nearly equal in length to that of the next two together (Pl. 38. figs. 3 and 27).

Fifth pair small; apical setæ slender, the middle seta of the secondary joint very long and slender, being considerably longer than the outer elongate and slender seta of the produced part of the basal joint; a moderately long slender seta springs from near the middle and on the lateral aspect of the secondary joint,—this joint extends very little beyond the end of the produced part of the basal joint (Pl. 38. fig. 30).

Habitat. Off St. Monans, Firth of Forth; vicinity of Port Erin, Isle of Man.

Remarks. The structure of the antennules, together with that of the antennæ, the mouth-organs, and fifth pair of thoracic feet, are characters by which *Ectinosoma gracile* may be distinguished from any other species described in this memoir.

Ectinosoma curticorne, Boeck (1864). (Pl. 36. figs. 22, 30, 34; Pl. 37. figs. 10, 24, 41, 48; Pl. 38. figs. 8, 20, 35, 44.)

1864. *Ectinosoma curticorne,* Boeck (1).
1885. *Ectinosoma curticorne,* Poppe (9), p. 194, Taf. 6. figs. 1–12.
1890 ? *Bradya Edwardsi,* Richard (10), p. 214, with 10 figures in the text.
1893 ? *Ectinosoma Edwardsi,* Schmeil (11), p. 92, Taf. viii. figs. 1–21.
1893. *Ectinosoma curticorne,* I. C. Thompson (16), p. 192, pl. xviii. fig. 8 *e*.

Description. Length ·7 mm. ($\frac{1}{36}$ of an inch). Somewhat like *Ectinosoma Sarsi* in general appearance; rostrum short and stout.

Antennules very short and robust, 6-jointed; a somewhat roundish and dark-coloured blotch occurs on the second joint of the antennules, as shown in the figure (Pl. 36. fig. 34). The proportional lengths of the joints are nearly as shown in the formula:—

No. of the joints:	1 . 2 . 3 . 4 . 5 . 6
Proportional lengths:	9 2 5 3 4 5

Antennæ nearly as in *Ectinosoma Sarsi*, but the secondary branches are shorter than the primary ones (Pl. 37. fig. 10). The biting part of the mandibles is broad and armed interiorly with several small teeth, but the outer teeth are large; the branches of the mandibular palp are not so wide apart as in *Ectinosoma Sarsi* (Pl. 37. fig. 24).

Anterior foot-jaws somewhat like those of *Ectinosoma Sarsi*, but very much smaller (Pl. 37. fig. 41).

Posterior foot-jaws short, moderately stout; two plumose setæ springing from the end of the basal joint, while the terminal joint, which is very small, bears two lateral plumose and spine-like setæ and a plain and slender terminal hair (Pl. 37. fig. 48).

The first four pairs of swimming-feet are somewhat like those of *Ectinosoma Sarsi*, but smaller; the outer and inner branches of the fourth pair are also of nearly equal length, and the lower marginal seta of the third pair is considerably longer than the others (Pl. 38. figs. 8 and 20). The inner produced portion of the fifth pair extends to about the middle of the secondary joint; the terminal spines of both basal and secondary joints are long and moderately stout, and both joints (but especially the basal joint)

are furnished with many small setæ arranged in straight or curved rows, as shown in the figure (Pl. 38. fig. 35). Caudal stylets short, apparently 2-jointed, and equal in length to the last abdominal segment (Pl. 38. fig. 44). Colour chocolate-brown.

Habitat. Firth of Forth, off Burntisland; Cromarty Firth, near the mouth of the River Alness; in the stomachs of young dabs from Blackpool, Lancashire; head of West Loch Tarbert, Argyleshire.

Remarks. This species resembles *Bradya minor* in having an eye-like pigment-spot at the base of each antennule, and may therefore be mistaken for it unless some care is taken and dissections made. It is, however, quite distinct from that species, as a comparison of the parts will show. *Ectinosoma curticorne* appears to form a source of food for the young dabs (*Pleuronectes limanda*) on the Blackpool closed fishing-grounds; as many as sixteen specimens were counted in one stomach.

The difference between *Bradya Edwardsi*, Richard, and *Ectinosoma curticorne*, Boeck, is, so far as we can make out, scarcely sufficient to warrant us in separating them.

Ectinosoma erythrops, Brady (1880). (Pl. 36. figs. 24, 31, 36; Pl. 37. figs. 14, 18, 37, 42; Pl. 38. figs. 13, 15, 39, 48.)

1880. *Ectinosoma erythrops*, Brady (3), vol. ii. p. 12, pl. xxxvi. figs. 11–17.
1890. *Ectinosoma erythrops*, Scott (13), p. 318.
1893. *Ectinosoma erythrops*, I. C. Thompson (16), p. 192, pl. xviii. fig. 8 *c*, *d*).

Description. Length ·73 mm. ($\frac{1}{34}$ of an inch). Body slender fusiform; rostrum moderately prominent, incurved (Pl. 36. fig. 24). Antennules short, setiferous, gradually tapering to the slender extremity, 5- (? or 6-) jointed; the last joint is long and narrow and appears to be composed of two coalesced joints; the proportional lengths of the joints are nearly as shown in the formula:—

No. of the joints:	1	2	3	4	5
Proportional lengths:	11	6	11	5	(7 7)

Antennæ elongate, the last joint sparingly setiferous; the secondary branch, which does not extend much beyond the end of the second joint of the primary branch, has the first two joints very small, while the last is long and slender (Pl. 37. fig. 14).

Mandibles rather smaller, and with the palp more elongate than the same appendages in *Ectinosoma Sarsi* (Pl. 37. fig. 18).

Anterior foot-jaws are also somewhat similar to those of that species, but the last joint is more elongate, and the terminal claws are also proportionally longer (Pl. 37. fig. 37). Posterior foot-jaws small and slender (Pl. 37. fig. 42).

The first four pairs of swimming-feet are considerably longer than those of *Ectinosoma Sarsi*; the inner marginal setæ on both branches are plain and more slender than those of that species, and the terminal spines are also more elongate; the second joint of the inner branches has the outer distal angle produced into a long spine-like process, that extends downward in front of the upper half of the third joint (Pl. 38. figs. 13 and 15). The inner portion of the basal joint of the fifth pair is not much produced; the

secondary joint is broadly subcylindrical, with the extremity irregularly trilobed and armed with three long spines, the middle one of which is considerably longer than the other two; two small setæ also spring from near the base of the joint; the inner produced part of the basal joint is furnished with two spines, the inner one being very long and powerful, the other smaller; all the large spines are plumose (Pl. 38. fig. 39). Caudal stylets short, but rather longer than the last abdominal segment (Pl. 38. fig. 48).

Habitat. Firth of Forth, off St. Monans.

Remarks. As all the specimens of this Copepod had been in spirit for some time before being identified, we were unable to see the red pigment-spot to which the species owes its name. The form of the animal, together with the divergent setæ of the fifth feet, serves to distinguish it when mixed up with any of the other members of the genus.

Ectinosoma Herdmani *, sp. n. (Pl. 36. figs. 16, 44; Pl. 37. figs. 3, 16, 29, 54; Pl. 38. figs. 7, 25, 33, 47).

Description. Length ·8 mm. ($\frac{1}{31}$ of an inch). Body, seen from the side, fusiform and somewhat similar to *Ectinosoma Sarsi*, but proportionally narrower; rostrum prominent. Antennules (Pl. 36. fig. 44) 6-jointed, moderately slender, the first joint considerably longer than any of the others, as shown by the annexed formula:—

No. of the joints:	1	2	3	4	5	6
Proportional lengths:	13	7	9	6	4	4

Antennæ somewhat similar to those of *Ectinosoma Sarsi*, but smaller, and the first two joints of the secondary branch are together nearly equal in length to the third joint (Pl. 37. fig. 3).

Mandibles very small, but with a proportionally larger palp than in those of *Ectinosoma Sarsi* (Pl. 37. fig. 16). Anterior foot-jaws robust, somewhat similar in form to those of *Ectinosoma Sarsi*; the first joint bears only two small marginal processes at the distal end, and the terminal claw-like spines are very long and slender (Pl. 37. fig. 29). Posterior foot-jaws elongate and slender; the middle joint is about four times the length of the end one, and is fringed with twelve or fourteen moderately stout hairs (Pl. 37. fig. 54).

The first four pairs of swimming-feet somewhat like those of *Ectinosoma Sarsi*, but much smaller and with the marginal setæ plain (Pl. 38. figs. 7 and 25).

Fifth pair also similar to those of that species, but the inner portion of the basal joint is less produced; the secondary joint is shorter, and the apical spines are longer and are all of nearly equal length (Pl. 38. fig. 33).

Caudal stylets very short and about equal in length to the last abdominal segment (Pl. 38. fig. 47).

Habitat. Firth of Forth, off St. Monans; Port Erin, Isle of Man.

Remarks. The elongate form of this species, together with the somewhat slender

* In compliment to Prof. W. A. Herdman, F.R.S.

antennules and broadly subquadrangular form of the fifth pair of thoracic feet, the apical spines of which are all of nearly equal length, are characters by which it can be readily distinguished.

Ectinosoma pygmæum, sp. n. (Pl. 36. figs. 15 and 41; Pl. 37. figs. 5, 20, 39, 43; Pl. 38. figs. 4, 26, 31, 55.)

Description. Length ·33 mm. ($\frac{1}{76}$ of an inch). Seen from the side the thoracic portion of the body is moderately stout, with the dorsum considerably arched, but the abdomen, which is comparatively narrow, is only slightly tapering; rostrum prominent (Pl. 36. fig. 15).

Antennules 6-jointed, short, moderately stout, gradually tapering to the apex and furnished with numerous hairs; the proportional lengths of the joints are nearly as shown in the formula:—

No. of the joints:	1	2	3	4	5	6
Proportional lengths:	6	3	4	2	2	2

Antennæ larger than the antennules; the secondary branch is composed of three nearly equal joints, but the middle one is slightly shorter than the one on either side (Pl. 37. fig. 5). Mandibular palp well developed; basal joint large, with two plumose apical setæ; the subapical branch is much larger than the marginal one; two elongate teeth spring from a notch near the middle of the inner margin of the mandibles, and reach to the truncate and slightly-toothed apex (Pl. 37. fig. 20).

Anterior and posterior foot-jaws somewhat similar in structure to those of *Ectinosoma Sarsi*, but very small (Pl. 37. figs. 39 and 43). The first four pairs of swimming-feet are also somewhat similar to that species, but are more slender; the marginal setæ are plain, the first pair want the transverse rows of small spines possessed by those of *Ectinosoma Sarsi*, and the outer branches of the fourth pair are proportionally longer (Pl. 38. figs. 4 and 26). The fifth pair are small and furnished with elongate fusiform spines, which become extremely slender towards the extremity; the secondary joint, which extends considerably beyond the inner produced portion of the basal joint, is irregularly trilobed, and each lobe forms the base of a spine; the two outer spines are of nearly equal length, but the inner one is scarcely half the length of the one next to it; the outer portion of the basal joint is produced into an elongate and very narrow appendage bearing a slender apical seta (Pl. 38. fig. 31).

Caudal stylets very short, being scarcely equal in length to the last abdominal segment (Pl. 38. fig. 55).

Habitat. Firth of Forth, and in the vicinity of Port Erin, Isle of Man.

Remarks. This is the smallest species of *Ectinosoma* known to us. The structure of the secondary branches of the antennæ and of the mandibles, together with the peculiar fusiform spines of the fifth pair of thoracic feet, appear to be sufficiently characteristic to distinguish it from any of the others described in this memoir.

ECTINOSOMA MELANICEPS, Boeck (1864). (Pl. 36. figs. 13, 28, 45; Pl. 37. figs. 11, 22, 40, 49; Pl. 38. figs. 2, 21, 41, 46.)

1864. *Ectinosoma melaniceps*, Boeck (1), p. 30.
1880. *Ectinosoma melaniceps*, Brady (3), vol. ii. p. 11, pl. xl. figs. 17–20.
1890. *Ectinosoma melaniceps*, T. Scott (13), p. 318.
1893. *Ectinosoma melaniceps*, I. C. Thompson (16), p. 18, pl. xxi. fig. 2 *a*.

Description. Length ·63 mm. ($\frac{1}{40}$ of an inch). Rostrum elongate, slender, curved downward.

Antennules short, 7-jointed, gradually tapering from the moderately stout base to the slender apex; the third joint is considerably longer than any of the other joints, as exhibited by the formula, which shows the proportional lengths nearly of all the joints:—

No. of the joints:	1	2	3	4	5	6	7
Proportional lengths:	9	6	11	4	5	5	2

Antennæ elongate; basal joint stout and equal to about two-thirds the length of the next one; the second and third joints are more slender than the basal joint, and the last is somewhat shorter than the preceding one; the secondary branch has the middle joint very small, while the first and third are comparatively elongate (Pl. 37. fig. 11).

Mouth-organs nearly as in *Ectinosoma Sarsi*, but much smaller (Pl. 37. figs. 22, 40, 49).

The outer branches of the first pair of swimming-feet are equal to about three fourths the length of the inner branches; the first and second joints only of the outer branches are furnished with elongate spines, and the interior marginal setæ of both branches are slender and not plumose; in the fourth pair the outer and inner branches are about equal in length (Pl. 38. figs. 2 and 21).

The produced inner portion of the basal joint of the fifth pair, which is cylindrical in outline and reaches only a little beyond the middle of the secondary joints, is provided with a moderately long apical seta and stout conical spine serrate on the edges, while the secondary joint bears one slender and three spiniform apical setæ, the second one from inside being very long with a tenuated extremity (Pl. 38. fig. 41).

Caudal stylets very short (Pl. 38. fig. 46).

Habitat. Generally distributed, and usually among weeds, in the laminarian zone.

Remarks. This species is readily distinguished by its having a considerable portion of the front part of the head of a dusky colour, as well as by the structure of the antennules and fifth pair of feet.

ECTINOSOMA ARMIFERUM, sp. n. (Pl. 36. figs. 20 and 43; Pl. 37. figs. 4, 17, 31, 53; Pl. 38. figs. 14, 19, 37, 43.)

Description. Length ·97 mm. ($\frac{1}{26}$ of an inch). Body stout; rostrum prominent (Pl. 36. fig. 20).

Antennules 5- (? or 6-) jointed, very short and robust, strongly setiferous, especially towards the distal end, where there are several strong and very elongate plumose setæ

(Pl. 36. fig. 43). The approximate proportional lengths of the joints are shown by the formula :—

No. of the joints :	1	2	3	4	5	(?6)
Proportional lengths :	15	9	11	8	3	(?3)

Antennules stout, well developed, armed with strong plumose setæ; secondary branches 3-jointed, shorter than the primary branches; the middle joint is equal to about half the length of the first and a third of the length of the last joint (Pl. 37. fig. 4). Mandibles stout, furnished at the apex with two strong teeth,—one bifid, the other conical,—and a few small spines; mandibular palp somewhat like that of *Ectinosoma elongatum*, but more strongly setiferous (Pl. 37. fig. 17).

Anterior foot-jaws dilated, apparently 5-jointed; the first joint is considerably larger than all the others together, the terminal joints very small; two of the marginal processes are each armed with a stout spine and a few setæ; the subapical claws are strong and slightly curved, the terminal setæ few and comparatively short (Pl. 37. fig. 31). In the structure of the anterior foot-jaws this species connects *Ectinosoma* with *Bradya*.

Posterior foot-jaws cylindrical and slightly distorted, much smaller than those of *Ectinosoma Sarsi*; the end-joint, which is equal to about one-third the length of the middle joint, bears one stout and strongly plumose, and one long, slender, and plain terminal seta; a short seta also springs from near the proximal end of the upper margin (Pl. 37. fig. 53). The outer branches of the first pair of swimming-feet are short, being only about three-fifths of the length of the inner branches; a long plumose seta springs from the outer angle of the second basal joint, and a moderately stout spine from the interior angle; the fourth pair are somewhat like the first, but the outer branches are proportionally rather longer, and the seta on the outer angle of the second basal joint is plain, and there is no spine on the inner angle (Pl. 38. figs. 14 and 19).

The fifth pair is small; the secondary joint is subquadrate and scarcely reaches beyond the produced inner portion of the basal joint; the middle apical seta of the secondary joint, and the inner one on the truncate apex of the produced inner portion of the basal joint, are stout, slightly curved, and of great length (Pl. 38. fig. 37).

Caudal stylets very short and somewhat wide apart; abdomen clothed with transverse rows of minute hairs (Pl. 38. fig. 43).

Habitat. Firth of Forth, west of May Island.

Remarks. The species now described is readily distinguished from any of the others recorded in this Report, by its robust form, by the structure and armature of the antennules and antennæ, and especially by the form and by the peculiarly elongate setæ of the fifth pair of thoracic feet.

ECTINOSOMA NORMANI*, sp. n. (Pl. 36. figs. 21, 29, 39; Pl. 37. figs. 12, 26, 34, 51; Pl. 38. figs. 5, 18, 42, 45.)

Description. Length ·55 mm. ($\frac{1}{45}$ of an inch). The thorax seen from the side is broadest at the posterior end of the first body-segment, and from thence the

* In compliment to the Rev. A. M. Norman, F.R.S., &c.

dorsum tapers gradually to the extremity of the abdomen; the anterior part of the cephalothoracic segment curves gently and regularly to the apex of the comparatively small rostrum. On the lower rounded angle of the cephalothoracic segment, and immediately posterior to the base of the antennules, there is a small but distinct and bright-red pigment-spot, as shown in the full-size drawing of the animal (Pl. 36. fig. 21). Antennules small, moderately stout, 7-jointed; the proportional lengths of the joints are nearly as shown in the formula:—

No. of the joints:	1	2	3	4	5	6	7
Proportional lengths:	7	7	7	4	3	3	3

Secondary branches of the antennæ 3-jointed, and reaching to near the middle of the last joint of the primary branches; the middle joint is very small, while the end-joint is equal to about one and a half times the length of the first joint (Pl. 37. fig. 12).

Mandibles armed at the apex with a stout irregularly trifid process and a strong conical blunt-pointed tooth; a small and moderately stout plumose marginal seta springs from a little below the base of the conical tooth; the basal joint of the mandibular palp bears a single short subapical seta in addition to the two 1-jointed branches (Pl. 37. fig. 26). Anterior foot-jaws very small, but moderately stout; marginal processes small and crowded near the end of the first joint; terminal claws slender, curved, their inner margin ciliate on the distal half (Pl. 37. fig. 34).

Posterior foot-jaws very small, but similar in structure to those of *Ectinosoma Sarsi* (Pl. 37. fig. 51).

The first four pairs of swimming-feet are slender, the outer branches considerably shorter than the inner ones; marginal setæ elongate, slender, and not plumose (Pl. 38. figs. 5 and 18). Fifth pair somewhat like those of *Ectinosoma tenuipes* (to be described), but the lobes of the secondary joints are separated from each other by a deep sinus; there is also a transverse row of cilia at the proximal end (Pl. 38. fig. 42).

Caudal stylets nearly twice as long as broad (Pl. 38. fig. 45). Ovisac large.

Habitat. Firth of Forth, off Burntisland; Barrow Channel, near Barrow-in-Furness.

Remarks. This is not the *Ectinosoma erythrops* of Dr. Brady's 'Monograph of the British Copepoda,' though it agrees with the description of that species in so far as it possesses a red pigment-spot near the lower anterior angle of the cephalothoracic segment. *Ectinosoma Normani* distinctly differs from that species, as well as from the others described in these pages, by the structure of the mouth-organs and of the fifth pair of thoracic feet. The red pigment-spot, though very conspicuous when freshly preserved, disappears after being in spirit for a few days.

Ectinosoma tenuipes, sp. n. (Pl. 36. figs. 25, 32, 35; Pl. 37. figs. 9, 19, 30, 47; Pl. 38. figs. 12, 17, 36, 52.)

Description. Length ·6 mm. ($\frac{1}{41}$ of an inch). Seen from the side the thoracic dorsum is very gently curved and tapers gradually to the moderately stout abdomen; rostrum prominent (Pl. 36. fig. 25).

Antennules 7-jointed, rather longer and much less robust than those of *Ectinosoma*

Sarsi, sparingly setiferous; a long slender sensory filament springs from the third joint, the upper distal angle of which is produced to form the base of the filament (Pl. 36. fig. 35). The annexed formula exhibits the proportional lengths of the joints very nearly:—

No. of the joints:	1	2	3	4	5	6	7
Proportional lengths:	8	6	9	5	8	4	4

Antennæ slender; secondary branches 3-jointed, very slender, scarcely longer than the second joint of the primary branches; the first joint is rather shorter than the last, while the middle one is small (Pl. 37. fig. 9).

Labium with a very slender "hook" (Pl. 36. fig. 32).

Mandibles armed on one side of the apex with a broad tridentate process and on the other side with a moderately stout spine, while between these is a large conical tooth; the branches of the palp are slender (Pl. 37. fig. 19). Anterior foot-jaws somewhat like those of *Ectinosoma Sarsi*, but scarcely so stout (Pl. 37. fig. 30).

Posterior foot-jaws very slender, and the end-joint is nearly equal to half the length of the one immediately preceding (Pl. 37. fig. 47).

The first four pairs of swimming-feet have the inner branches moderately stout and elongate, but the outer branches are considerably shorter than the inner one and very slender (Pl. 38. figs. 12 and 17).

Fifth pair small; the produced inner portion of the basal joint is furnished with a short stout spine and a long spiniform seta; the secondary joint is nearly as broad as long and does not reach much beyond the produced part of the basal joint; its outer margin is broadly rounded, but the inner margin is nearly straight; the apex is broadly truncate and indistinctly four-lobed—each lobe forming the base of a seta; the outer seta is stout and elongate, the next is short and very slender, the third seta is stout and considerably longer than the outer one, while the inner seta is short and spiniform (Pl. 38. fig. 36).

Caudal stylets equal to about two-thirds the length of the last abdominal segment (Pl. 38. fig. 52).

Habitat. Firth of Forth, off St. Monans.

Remarks. The slender posterior foot-jaws and outer branches of the first four pairs of swimming-feet serve to distinguish *Ectinosoma tenuipes* from the other species described in this memoir.

ECTINOSOMA ATLANTICUM (Brady and Robertson). (Pl. 36. figs. 17 and 40; Pl. 37. figs. 6, 23, 35, 50; Pl. 38. figs. 11, 16, 38, 53.)

1873. *Microsetella atlantica*, B. & R. (5), p. 130, pl. ix. figs. 11–16.
1880. *Ectinosoma atlanticum*, Brady (3), vol. ii. p. 13, pl. xxxviii. figs. 11–19.
1883. *Ectinosoma atlanticum*, Brady (4), p. 100, pl. iv. figs. 10–14.
1887. *Ectinosoma atlanticum*, Jules de Guerne (8), p. 344.
1891. *Microsetella atlantica*, Scott (14), p. 302.
1892. *Microsetella atlantica*, Giesbrecht (7), p. 550, Taf. 44.
1893. *Ectinosoma atlanticum*, I. C. Thompson (16), p. 192, pl. xix. fig. 1.
1894. *Microsetella atlantica*, T. Scott (15), p. 91.

Description. Length ·55 mm. ($\frac{1}{45}$ of an inch). Body very slender; the forehead, seen from the side, is small and sharply rounded to form the small beak-like rostrum (Pl. 36. fig. 17).

Antennules 6-jointed, elongate, slender, and sparingly setiferous; the third joint is considerably longer than any of the others, but the last joint is very small, as shown by the formula :—

No. of the joints :	1	2	3	4	5	6
Proportional lengths :	10	8	18	11	11	3

Antennæ slender; secondary branches 3-jointed, longer than the second joint of the primary branches; the first two joints are small, the other is elongate (Pl. 37. fig. 6). Basal joint of the mandibular palp comparatively small and furnished with a stout submarginal plumose seta; the superior apical branch is nearly as large as the joint to which it is articulated, and is armed with a stout spiniform and semiplumose seta and also with several plain setæ; the inferior marginal branch is extremely small (Pl. 37. fig. 23). The anterior foot-jaws closely resemble those of *Ectinosoma Sarsi*, but are much smaller (Pl. 37. fig. 35). Posterior foot-jaws short, moderately stout, somewhat cylindrical in form, and with the terminal joint very short (Pl. 37. fig. 50).

First four pairs of swimming-feet slender. In the first pair the outer branches are scarcely equal in length to the inner branches, but in the fourth pair both branches are of about equal length (Pl. 38. figs. 11 and 16).

Fifth pair small; the produced inner portion of the basal joint extends to about the apex of the secondary joint; two slender and very long plain setæ spring from the apex of the secondary joint, and one from the produced inner portion of the basal joint; both joints are also furnished with a small seta at the inner distal angle, in addition to a transverse row of small spines, as shown in the figure; a slender seta also springs from the lateral aspect of the secondary joint (Pl. 38. fig. 38).

Caudal stylets short (Pl. 38. fig. 53).

Abdomen clothed with indistinct transverse rows of minute hairs; the posterior margins of the segments of the thorax and abdomen are also fringed as in most of the other species described here.

Habitat. From various parts of the British coasts, both inshore and in the open sea, and in dredged material, as well as in tow-net gatherings—as, for example, in the Atlantic, off the west coast of Ireland and in Kinsale Harbour; in various parts of Loch Fyne; in various parts of the Firth of Forth (we have taken *Ectinosoma atlanticum* both with the dredge and with the tow-net in the Firth of Forth, and it was very common in material collected in a large flannel sieve used for filtering the sea-water that is pumped into the fishpond at the Dunbar hatchery).

Remarks. After a careful study of numerous specimens of *Ectinosoma atlanticum*, we, like Dr. G. S. Brady *, can find no valid reason for separating this species from *Ectinosoma*. It no doubt differs from the typical *Ectinosoma* in the greatly disproportionate sizes of the branches of the mandibular palp and in the structure of the posterior

* 'Monograph of the British Copepoda,' vol. ii. p. 14 (1880).

foot-jaws; it also wants the prominent rostrum of the typical *Ectinosoma*; but these differences are so small as, in our opinion, to be of no more than specific value. The elongate antennules of this species cannot be considered to be of any more than specific importance, as those of some of the other species now described are also of considerable length.

Ectinosoma longicorne, sp. n. (Pl. 36. figs. 23 and 38; Pl. 37. figs. 7, 25, 33, 44; Pl. 38. figs. 6, 28, 29, 50.)

Description. Length ·6 mm. ($\frac{1}{42}$ of an inch). Body moderately robust; seen from the side, the dorsum tapers gradually from the first cephalothoracic segment to the extremity of the abdomen, while the anterior end is boldly rounded to where it merges in the somewhat prominent rostrum (Pl. 36. fig. 23).

Antennules (Pl. 36. fig. 38) elongate, slender, and 6-jointed; the first joint is considerably longer than any of the others, as shown by the annexed formula:—

No. of the joints:	1	2	3	4	5	6
Proportional lengths:	18	8	11	5	5	9

econdary branches of the antennæ very slender, 3-jointed, rather longer than the second joint of the primary branches; the first and third joints are subequal in length, but the second is very small (Pl. 37. fig. 7).

Mandibles armed with a few large apical teeth and a short marginal spine; the basal joint of the palp is provided with a few terminal setæ, and both of the one-jointed branches are comparatively well developed, but the apical is about twice the length of the marginal branch (Pl. 37. fig. 25). Anterior foot-jaws stout, somewhat similar to those of *Ectinosoma Sarsi*, but the setæ of the marginal processes on the first joint are not plumose (Pl. 37. fig. 33).

The posterior foot-jaws also resemble those of *Ectinosoma Sarsi*, but are more slender (Pl. 37. fig. 44).

First four pairs of swimming-feet slender and furnished with plain marginal setæ (Pl. 38. figs. 6 and 28).

The fifth pair are small, and somewhat resemble those of *Ectinosoma pygmæum*; but the apical setæ are not fusiform, and the middle seta of the secondary joint is considerably longer than the one on either side (Pl. 38. fig. 29). Caudal stylets short, being about equal in length to the last abdominal segment (Pl. 38. fig. 50).

Habitat. Firth of Forth, off St. Monans.

Remarks. The elongate antennules, the slender 3-jointed secondary branches of the antennæ, and the slender foot-jaws readily distinguish this from other species of *Ectinosoma*. We do not know of its occurrence beyond the Forth area.

Ectinosoma tenuireme, sp. n. (Pl. 36. fig. 33; Pl. 37. figs. 8, 27, 36, 46; Pl. 38. figs. 1, 24, 40, 49.)

Description. Resembling *Ectinosoma gracile* in general appearance.

Antennules 7-jointed, and somewhat like those of *Ectinosoma gracile*, but more elongate, and the penultimate joint is nearly equal in length to the first, and about

twice the length of the preceding joint (Pl. 36. fig. 33). The formula shows approximately the proportional lengths of all the joints:—

No. of the joints:	1	2	3	4	5	6	7
Proportional lengths:	17	10	13	10	8	15	5

Secondary branches of the antennæ 3-jointed and very slender, rather longer than the second joint of the primary branches; the middle joint very small, but the terminal joint is equal to about twice the length of the first (Pl. 37. fig. 8). Anterior foot-jaws large and moderately stout; terminal joint elongate-ovate, fully twice as long as broad; terminal claws very long, the distal half fringed with cilia on the inner aspect; terminal setæ two, shorter than the claws and very slender (Pl. 37. fig. 36). Posterior foot-jaws elongated and very tenuated, the terminal joint nearly equal to half the length of preceding one, while the middle apical seta is about two and a half times the length of the joint from which it springs (Pl. 37. fig. 46). The inner branches of the first pair of swimming-feet elongate, slender; the outer branches, which are composed of three nearly equal joints, are also slender, but scarcely reach to the end of the second joint of the inner branches; the fourth pair are stouter than the first, and the outer branches extend somewhat beyond the end of the second joint of the inner branches (Pl. 38. figs. 1 and 24).

In the fifth pair the middle seta of the secondary joint is extremely long and slender, being nearly three times the length of those on either side; the inner seta of the produced inner portion of the basal joint is nearly equal in length to the shorter setæ of the secondary joint; the outer seta is slender and shorter than the inner; the two outer setæ of the secondary joint and the longest seta of the produced inner part of the basal joint are somewhat dilated or fusiform at the proximal end,—the longer of the two setæ on the produced part of the basal joint especially being very distinctly swollen near the base; a slender seta springs from near the middle of the hollow at the base of the secondary joint, as shown in the figure (Pl. 38. fig. 40).

Habitat. Firth of Forth, off St. Monans.

Remarks. This species, which somewhat resembles *Ectinosoma gracile* in general appearance, differs quite distinctly from it by most of the characters described above, but especially by the structure of the antennæ, the very elongate and slender posterior foot-jaws, and by the structure of the first and fifth pairs of thoracic feet.

A List of some of the Works referred to in this Memoir.

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EXPLANATION OF THE PLATES.

Plate 35.

Fig. 1.	*Bradya typica*, Boeck.	Female seen from left side.		× 53.
2.	„ *hirsuta*, n. sp.	„	„	× 53.
3.	„ *similis*, n. sp.	„	„	× 53.
4.	„ *elegans*, n. sp.	„	„	× 53.
5.	„ *minor*, n. sp.	„	„	× 80.
6.	„ *fusca*, n. sp.	„	„	× 80.
7.	„ *similis*, n. sp.	One of the antennules (female).		×380.
8.	„ *hirsuta*, n. sp.	„	„ „	×380.
9.	„ *minor*, n. sp.	„	„ „	×380.
10.	„ *elegans*, n. sp.	„	„ „	×253.
11.	„ *typica*, n. sp.	„	„ „	×253.
12.	„ *fusca*, n. sp.	„	„ „	×380.
13.	„ *minor*, n. sp.	One of the antennæ.		×333.
14.	„ *typica*, n. sp.	„	„	×253.
15.	„ *elegans*, n. sp.	„	„	×253.
16.	„ *similis*, n. sp.	„	„	×253.
17.	„ *hirsuta*, n. sp.	„	„	×253.
18.	„ *fusca*, n. sp.	„	„	×253.
19.	„ *hirsuta*, n. sp.	Labium.		×304.
20.	„ *fusca*, n. sp.	„		×304.
21.	„ *minor*, n. sp.	„		×500.
22.	„ *typica*, n. sp.	Mandible and palp.		×253.
23.	„ *hirsuta*, n. sp.	„	„	×253.
24.	„ *minor*, n. sp.	„	„	×304.
25.	„ *elegans*, n. sp.	„	„	×253.

Fig. 26.	*Bradya typica*, n. sp.	One of the anterior foot-jaws.	×304.
27.	„ *similis*, n. sp.	„ „	×500.
28.	„ *hirsuta*, n. sp.	„ „	×380.
29.	„ *elegans*, n. sp.	„ „	×380.
30.	„ *fusca*, n. sp.	„ „	×380.
31.	„ *minor*, n. sp.	„ „	×500.
32.	„ *typica*, n. sp.	One of the posterior foot-jaws.	×500.
33.	„ *similis*, n. sp.	„ „	×500.
34.	„ *hirsuta*, n. sp.	„ „	×380.
35.	„ *minor*, n. sp.	„ „	×500.
36.	„ *elegans*, n. sp.	„ „	×380.
37.	„ *fusca*, n. sp.	„ „	×380.
38.	„ *elegans*, n. sp.	Foot of first pair of swimming-feet.	×126.
39.	„ *typica*, n. sp.	„ „	×126.
40.	„ *hirsuta*, n. sp.	„ „	×126.
41.	„ *similis*, n. sp.	„ „	×190.
42.	„ *minor*, n. sp.	„ „	×126.
43.	„ *fusca*, n. sp.	„ „	×126.
44.	„ *typica*, n. sp.	Foot of fourth pair of swimming-feet.	×126.
45.	„ *fusca*, n. sp.	„ „	×126.
46.	„ *elegans*, n. sp.	„ „	×126.
47.	„ *hirsuta*, n. sp.	„ „	×126.
48.	„ *similis*, n. sp.	„ „	×190.

Plate 36.

Fig. 1.	*Bradya typica*, Boeck.	Foot of fifth pair (female).	×253.
2.	„ *hirsuta*, n. sp.	„ „	×253.
3.	„ *similis*, n. sp.	„ „	×253.
4.	„ *elegans*, n. sp.	„ „	×253.
5.	„ *minor*, n. sp.	„ „	×253.
6.	„ *fusca*, n. sp.	„ „	×253.
7.	„ *hirsuta*, n. sp.	Abdomen and caudal stylets.	× 53.
8.	„ *fusca*, n. sp.	„ „	× 53.
9.	„ *minor*, n. sp.	„ „	× 80.
10.	„ *similis*, n. sp.	„ „	× 53.
11.	„ *elegans*, n. sp.	„ „	× 53.
12.	„ *typica*, n. sp.	„ „	× 53.
13.	*Ectinosoma melaniceps*, Boeck.	Female seen from left side.	× 64.
14.	„ *Sarsi*, Boeck.	„ „	× 40.
15.	„ *pygmæum*, n. sp.	„ „	× 80.
16.	„ *Herdmani*, n. sp.	„ „	× 53.
17.	„ *atlanticum* (Brady & Robertson).	„ „	× 64.
18.	„ *gracile*, n. sp.	„ „	× 48.
19.	„ *propinquum*, n. sp.	„ „	× 40.

Fig. 20.	*Ectinosoma armiferum*, n. sp.	Female seen from left side.		× 40.
21.	,, *Normani*, n. sp.	,,	,,	× 80.
22.	,, *curticorne*, Boeck.	,,	,,	× 53.
23.	,, *longicorne*, n. sp.	,,	,,	× 64.
24.	,, *erythrops*, Brady.	,,	,,	× 53.
25.	,, *tenuipes*, n. sp.	,,	,,	× 64.
26.	,, *Sarsi*, Boeck.	Labium.		× 190.
27.	,, *propinquum*, n. sp.	,,		× 253.
28.	,, *melaniceps*, Boeck.	,,		× 253.
29.	,, *Normani*, n. sp.	,,		× 380.
30.	,, *curticorne*, Boeck.	,,		× 253.
31.	,, *erythrops*, Brady.	,,		× 253.
32.	,, *tenuipes*, n. sp.	,,		× 304.
33.	,, *tenuireme*, n. sp.	One of the antennules (female).		× 253.
34.	,, *curticorne*, Boeck.	,,	,, ,,	× 253.
35.	,, *tenuipes*, n. sp.	,,	,, ,,	× 218.
36.	,, *erythrops*, Brady.	,,	,, ,,	× 218.
37.	,, *gracile*, n. sp.	,,	,, ,,	× 170.
38.	,, *longicorne*, n. sp.	,,	,, ,,	× 253.
39.	,, *Normani*, n. sp.	,,	,, ,,	× 218.
40.	,, *atlanticum* (B. & R.).	,,	,, ,,	× 253.
41.	,, *pygmæum*, n. sp.	,,	,, ,,	× 500.
42.	,, *Sarsi*, Boeck.	,,	,, ,,	× 253.
43.	,, *armiferum*, n. sp.	,,	,, ,,	× 218.
44.	,, *Herdmani*, n. sp.	,,	,, ,,	× 253.
45.	,, *melaniceps*, Boeck.	,,	,, ,,	× 253.
46.	,, *propinquum*, n. sp.	,,	,, ,,	× 190.

PLATE 37.

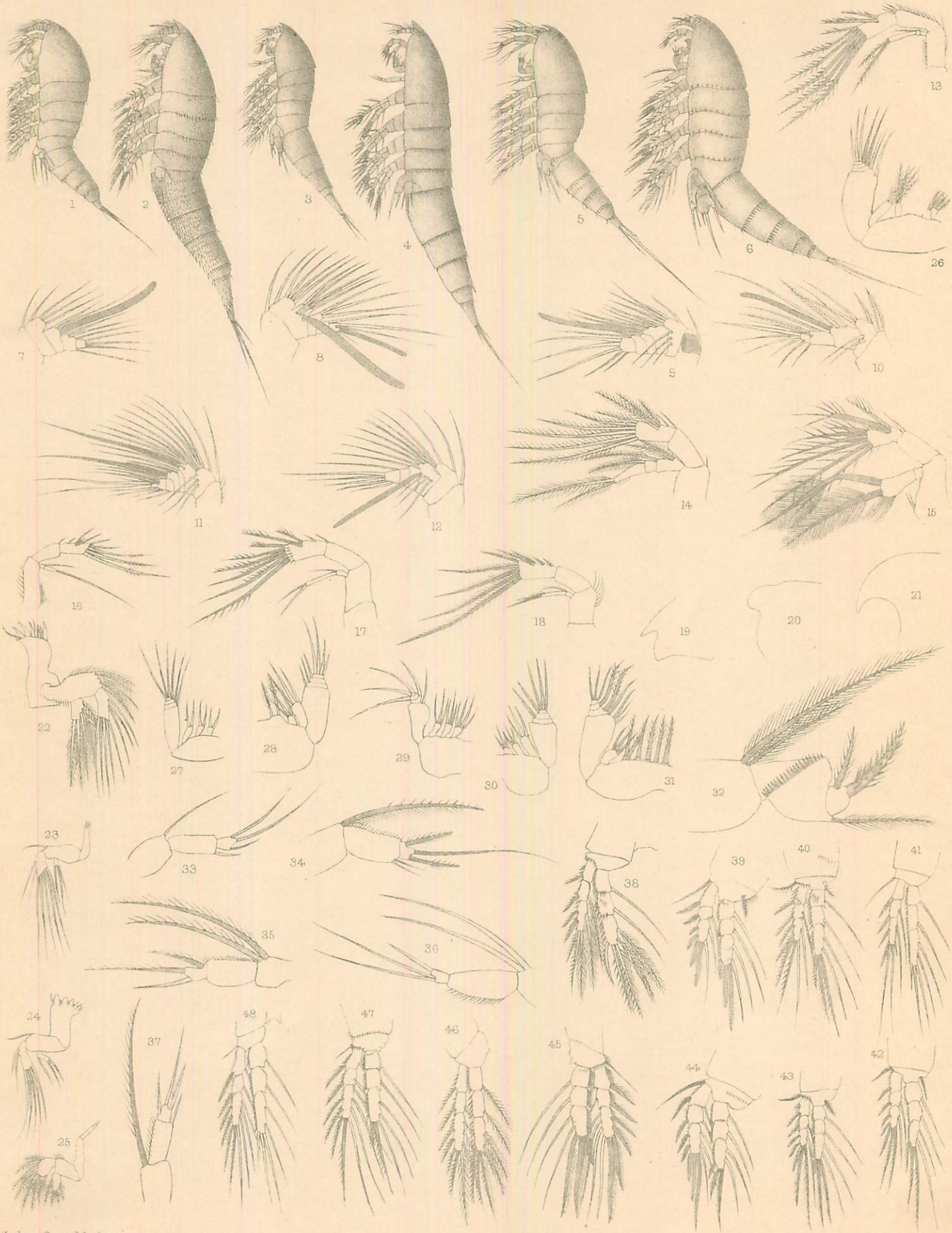
Fig. 1.	*Ectinosoma Sarsi*, Boeck.	One of the antennæ.		× 200.
2.	,, *propinquum*, n. sp.	,,	,,	× 200.
3.	,, *Herdmani*, n. sp.	,,	,,	× 300.
4.	,, *armiferum*, n. sp.	,,	,,	× 170.
5.	,, *pygmæum*, n. sp.	,,	,,	× 380.
6.	,, *atlanticum* (B. & R.).	,,	,,	× 300.
7.	,, *longicorne*, n. sp.	,,	,,	× 300.
8.	,, *tenuireme*, n. sp.	,,	,,	× 300.
9.	,, *tenuipes*, n. sp.	,,	,,	× 300.
10.	,, *curticorne*, Boeck.	,,	,,	× 300.
11.	,, *melaniceps*, Boeck.	,,	,,	× 300.
12.	,, *Normani*, n. sp.	,,	,,	× 300.
13.	,, *gracile*, n. sp.	,,	,,	× 333.
14.	,, *erythrops*, Brady.	,,	,,	× 300.

Fig. 15.	*Ectinosoma propinquum*, n. sp.	Mandible and palp.		×170.
16.	„ *Herdmani*, n. sp.	„	„	×540.
17.	„ *armiferum*, n. sp.	„	„	×253.
18.	„ *erythrops*, Brady.	„	„	×253.
19.	„ *tenuipes*, n. sp.	„	„	×253.
20.	„ *pygmæum*, n. sp.	„	„	×380.
21.	„ *Sarsi*, Boeck.	„	„	×170.
22.	„ *melaniceps*, Boeck.	„	„	×253.
23.	„ *atlanticum* (B. & R.)	„	„	×253.
24.	„ *curticorne*, Boeck.	„	„	×253.
25.	„ *longicorne*, n. sp.	„	„	×333.
26.	„ *Normani*, n. sp.	„	„	×253.
27.	„ *tenuireme*, n. sp.	„	„	×253.
28.	„ *gracile*, n. sp.	One of the anterior foot-jaws.		×200.
29.	„ *Herdmani*, n. sp.	„	„ „	×380.
30.	„ *tenuipes*, n. sp.	„	„ „	×300.
31.	„ *armiferum*, n. sp.	„	„ „	×200.
32.	„ *propinquum*, n. sp.	„	„ „	×190.
33.	„ *longicorne*, n. sp.	„	„ „	×380.
34.	„ *Normani*, n. sp.	„	„ „	×380.
35.	„ *atlanticum* (B. & R.)	„	„ „	×380.
36.	„ *tenuireme*, n. sp.	„	„ „	×250.
37.	„ *erythrops*, Brady.	„	„ „	×190.
38.	„ *Sarsi*, Boeck.	„	„ „	×190.
39.	„ *pgmæum*, n. sp.	„	„ „	×500.
40.	„ *melaniceps*, Boeck.	„	„ „	×380.
41.	„ *curticorne*, Boeck.	„	„ „	×380.
42.	„ *erythrops*, Brady.	One of the posterior foot-jaws.		×380.
43.	„ *pygmæum*, n. sp.	„	„ „	×380.
44.	„ *longicorne*, n. sp.	„	„ „	×333.
45.	„ *gracile*, n. sp.	„	„ „	×333.
46.	„ *tenuireme*, n. sp.	„	„ „	×253.
47.	„ *tenuipes*, n. sp.	„	„ „	×380.
48.	„ *curticorne*, Boeck.	„	„ „	×380.
49.	„ *melaniceps*, Boeck.	„	„ „	×380.
50.	„ *atlanticum* (B. & R.).	„	„ „	×380.
51.	„ *Normani*, n. sp.	„	„ „	×380.
52.	„ *Sarsi*, Boeck.	„	„ „	×253.
53.	„ *armiferum*, n. sp.	„	„ „	×333.
54.	„ *Herdmani*, n. sp.	„	„ „	×570.
55.	„ *propinquum*, n. sp.	„	„ „	×190.

Plate 38.

Fig. 1.	*Ectinosoma tenuireme*, n. sp.	Foot of first pair of swimming-feet.		×140.
2.	„ *melaniceps*, Boeck.	„	„ „	×140.
3.	„ *gracile*, n. sp.	„	„ „	×140.
4.	„ *pygmæum*, n. sp.	„	„ „	×250.
5.	„ *Normani*, n. sp.	„	„ „	×140.
6.	„ *longicorne*, n. sp.	„	„ „	×140.
7.	„ *Herdmani*, n. sp.	„	„ „	×140.
8.	„ *curticorne*, Boeck.	„	„ „	×140.
9.	„ *propinquum*, n. sp.	„	„ „	×115.
10.	„ *Sarsi*, Boeck.	„	„ „	×115.
11.	„ *atlanticum* (B. & R.).	„	„ „	×230.
12.	„ *tenuipes*, n. sp.	„	„ „	×230.
13.	„ *erythrops*, Brady.	„	„ „	×230.
14.	„ *armiferum*, n. sp.	„	„ „	×115.
15.	„ *erythrops*, Brady.	Foot of fourth pair of swimming-feet.		×230.
16.	„ *atlanticum* (B. & R.).	„	„ „	×230.
17.	„ *tenuipes*, n. sp.	„	„ „	×230.
18.	„ *Normani*, n. sp.	„	„ „	×150.
19.	„ *armiferum*, n. sp.	„	„ „	×115.
20.	„ *curticorne*, Boeck.	„	„ „	×150.
21.	„ *melaniceps*, Boeck.	„	„ „	×150.
22.	„ *Sarsi*, Boeck.	„	„ „	×115.
23.	„ *propinquum*, n. sp.	„	„ „	×115.
24.	„ *tenuireme*, n. sp.	„	„ „	×150.
25.	„ *Herdmani*, n. sp.	„	„ „	×150.
26.	„ *pygmæum*, n. sp.	„	„ „	×253.
27.	„ *gracile*, n. sp.	„	„ „	×170.
28.	„ *longicorne*, n. sp.	„	„ „	×170.
29.	„ *longicorne*, n. sp.	Foot of fifth pair (female).		×253.
30.	„ *gracile*, n. sp.	„	„	×253.
31.	„ *pygmæum*, n. sp.	„	„	×380.
32.	„ *Sarsi*, Boeck.	„	„	×145.
33.	„ *Herdmani*, n. sp.	„	„	×220.
34.	„ *propinquum*, n. sp.	„	„	×145.
35.	„ *curticorne*, Boeck.	„	„	×253.
36.	„ *tenuipes*, n. sp.	„	„	×253.
37.	„ *armiferum*, n. sp.	„	„	×190.
38.	„ *atlanticum* (B. & R.).	„	„	×253.
39.	„ *erythrops*, Brady.	„	„	×253.
40.	„ *tenuireme*, n. sp.	„	„	×190.
41.	„ *melaniceps*, Boeck.	„	„	×190.
42.	„ *Normani*, n. sp.	„	,	×190.
43.	„ *armiferum*, n. sp.	Abdomen and caudal stylets.		× 53.
44.	„ *curticorne*, Boeck.	„	„	× 80.
45.	„ *Normani*, n. sp.	„	„	× 80.

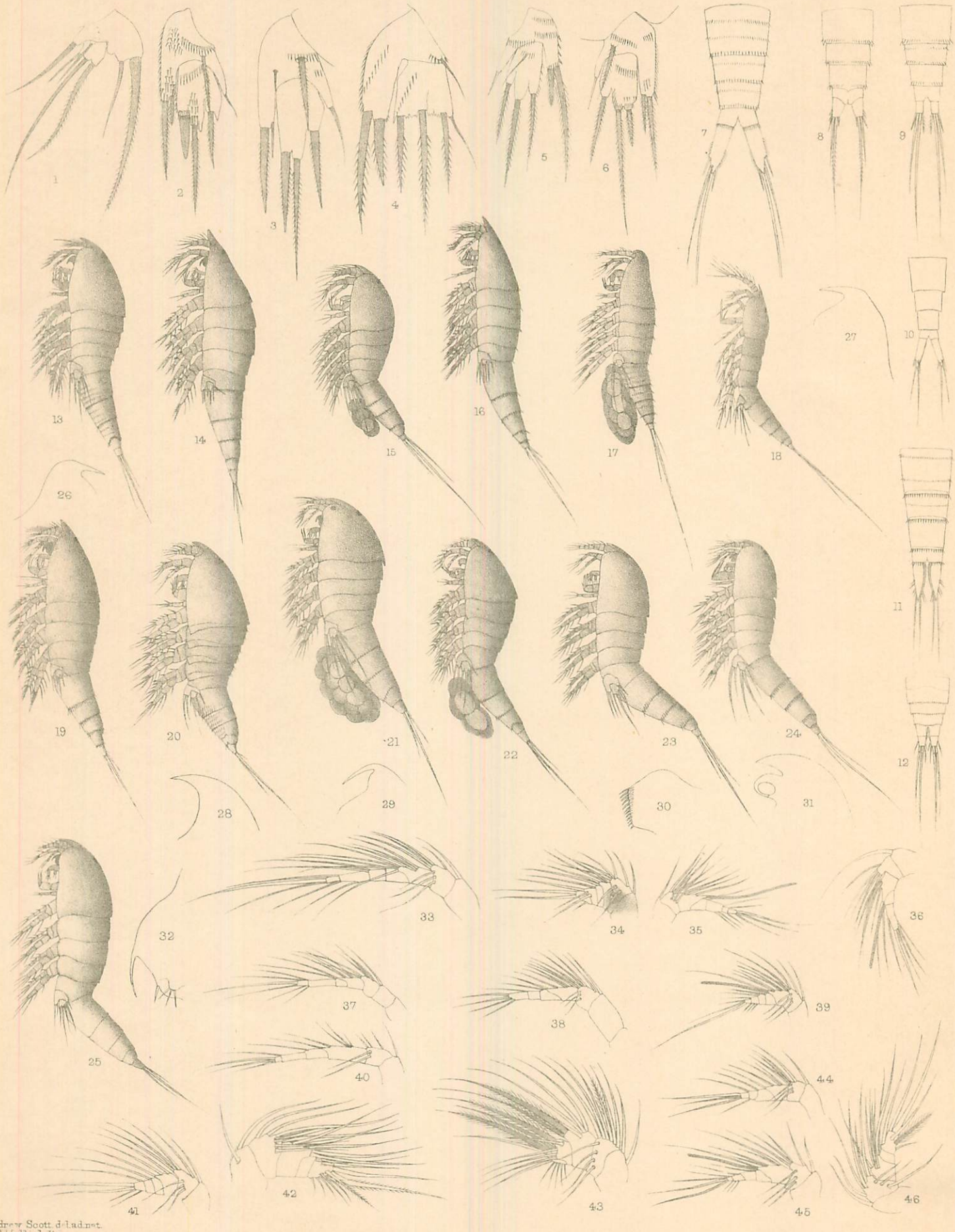
Fig. 46. *Ectinosoma melaniceps*, Boeck. Abdomen and caudal stylets. × 80.
47. „ *Herdmani*, n. sp. „ „ × 80.
48. „ *erythrops*, Brady. „ „ × 80.
49. „ *tenuireme*, n. sp. „ „ × 53.
50. „ *longicorne*, n. sp. „ „ × 127.
51. „ *Sarsi*, Boeck. „ „ × 53.
52. „ *tenuipes*, n. sp. „ „ × 127.
53. „ *atlanticum* (B. & R.). „ „ × 64.
54. „ *propinquum*, n. sp. „ „ × 53.
55. „ *pygmæum*, n. sp. „ „ × 127.



Andrew Scott del. ad nat.
A. T. Hollick lith.

West, Newman imp.

BRITISH COPEPODA. BRADYA.



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BRITISH COPEPODA. BRADYA AND ECTINOSOMA.

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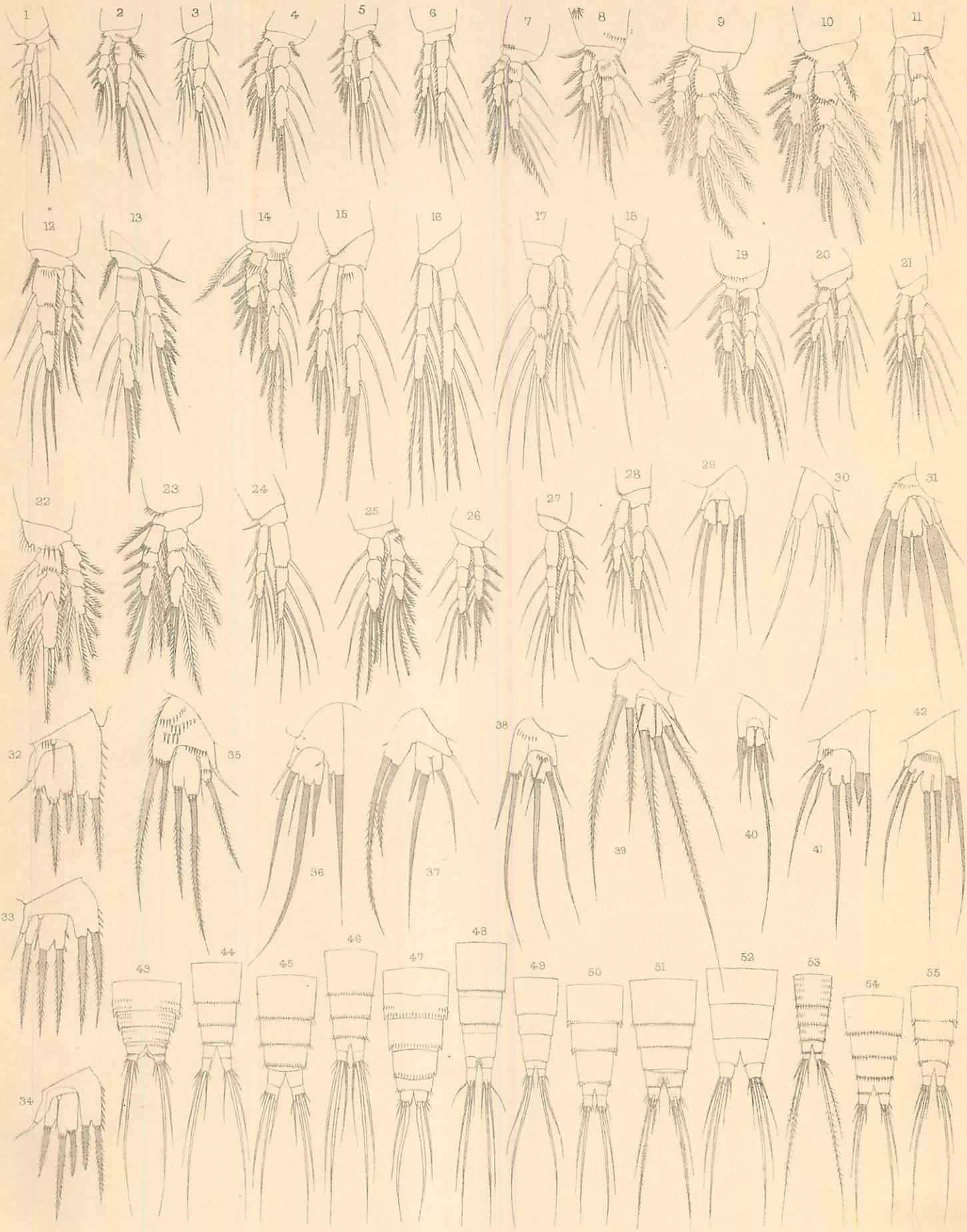
BRITISH COPEPODA. ECTINOSOMA.



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BRITISH COPEPODA. ECTINOSOMA.