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IV.—NOTES ON SOME PARASITES OF FISHES.

By Thomas Scott, F.L.S., Mem. Zool. Soc. de France.

Plates XII. and XIII.

In continuation of my Notes on the Parasites of Fishes I propose to notice here several species not previously recorded, a few of which appear to be undescribed, while some others have not, so far as I am aware, been recorded from the coast of Scotland.

With the exception of two interesting Trematodes, all the species belong to the Copepoda, and include three species belonging to the family Ergasilidæ; four species belonging to the Caligidæ; five belonging to the Dichelestidæ; two to the Chondracanthidæ; one to the Lernæidæ; and two to the Lernæopodæ.

The Trematodes, which are described separately at the end of the paper, belong to the two genera *Callicotyle*, Diesing and *Acanthocotyle*, Monticelli; the first has not been recorded hitherto from Scottish waters, and the second is new to science.

I.

COPEPODA PARASITA.

Fam. Ergasilidæ.

Genus *Bomolochus*, Nordman (1832).

The only member of the genus *Bomolochus* which appears to have been recorded in the Crustacean fauna of the British Islands is the *Bomolochus soleæ* of Claus. This species was described (and figured) in the Eleventh Annual Report of the Fishery Board for Scotland, 1893,* it was taken on the back of *Solea vulgaris*, Guen., captured in the Firths of Forth and Clyde, as well as on the same species of fish captured in the Humber near Grimsby. In the Nineteenth Annual Report I have recorded what appears to be the same species of *Bomolochus* from the nostrils of several kinds of fishes, and the form which I am now to describe from the nostrils of the Ling, *Molua molva*, L., may also be merely a variety of the same *Bomolochus*, but I record it here in order to point out one or two differences and also to correct one or two errors in the former description of the species. Two other species are recorded here which are apparently undescribed.

Bomolochus soleæ, Claus (var. from Nostrils of Ling) Pl. XIII., figs. 13–18.

1864. *Bomolochus soleæ*, Claus, Zeitschrift fur Wissenschaft. Zool., vol. xiv., p. 374, pl. 35, figs. 6–20.

The length of the female represented by the drawing (fig. 13) is 1·6 mm. (about $\frac{1}{16}$ of an inch). The antennules (fig. 14) and antennæ are

* Additions to the fauna of the Firth of Forth; Eleventh Annual Report of the Fishery Board for Scotland, Part III., p. 212, pl. v., fig. 1-13.

similar to those of the specimens described in the Eleventh Annual Report. The mandibles have a somewhat simple structure, the basal joint is stout, but the second is rather slender, and is furnished with a stout and moderately long tooth-like terminal spine; from near the base of this spine there springs a similar but much smaller spine, as shown by the drawing (fig. 15). (In the description of the species in the Eleventh Annual Report the appendages doubtfully described and figured as mandibles are really the second maxillipeds, while figure 5 on the plate (pl. v.) represents one of the mandibles instead of one of the maxillæ.)

The maxillæ consist of small, one-jointed, and somewhat dilated appendages provided with apparently four moderately long plumose setæ (fig. 16).

The first maxillipeds (fig. 17) are small and two-jointed, the basal joint is moderately stout, and bears a small spine near the distal end of the inner margin, the end joint has a moderately long claw-like extremity, and is furnished with a stout ciliated spine which springs from a notch on the inner aspect, and rather below the middle of the joint.

Second maxillipeds large, two-jointed; both joints robust and furnished with a few moderately stout, elongated, and coarsely plumose setæ; the end joints are armed with a powerful and strongly curved terminal claw, the convex margin of which is produced slightly beyond the middle, into a spine-like process, and the curve of the claw is distinctly sigmoid, as shewn in the drawing (fig. 18). The thoracic feet are all as described and figured in Part III. of the Eleventh Annual Report already referred to.

Remarks.—The principal difference between the *Bomolochus* from the nostrils of the Ling and *Bomolochus soleæ* as described and figured in Part III. of the Eleventh Annual Report, is in the armature of the mandibles; in *Bomolochus soleæ* the terminal spines are both short, but in the form from the nostrils of the Ling the terminal spine is nearly as long as the joint from which it springs, while the secondary spine is small. All the other appendages appear to be much the same in both forms. The specimens from the Ling were somewhat larger than those observed on the Black Soles, and they did not appear to be very common. The fishes were obtained at the Fish Market at Aberdeen.

Bomolochus onosi, T. Scott, (sp. n.). Pl. XIII., figs. 19–22.

Description of the Female.—Length about 1·3 mm. ($\frac{1}{19}$ of an inch). The first body segment is proportionally larger than the same segment in the form just described, being equal to nearly half the entire length of the cephalothorax, but the second and third segments are smaller than the segments similar to them in that form (fig. 19).

The antennules are moderately stout, but taper gradually towards the distal extremity; the second joint, which appears to be the largest, is about one and a half times the length of the next one, the third and fourth are sub-equal and larger than those which follow, while the penultimate joint is considerably smaller than any of the others. The plumose setæ with which the antennules are furnished, though somewhat similar to those on the antennules of *Bomolochus soleæ*, do not appear to be quite so stout (fig. 20).

The antennæ, mandibles, maxillæ, and first maxillipeds appear to be similar to the same appendages in the *Bomolochus* from the nostrils of the Ling.

The second maxillipeds are stout and armed with a moderately stout and strongly curved claw, but not so powerful as the terminal claw of the

second maxillipeds of the form previously described, but it resembles it in the curve being distinctly sigmoid ; a slender seta springs from near the distal end of the inner margin of the first joint, and two small setæ from near the middle of the inner margin of the second joint, a very long and slender seta springs from near the base of the terminal claw, and a smaller one from a point a little further forward (fig. 21).

The thoracic feet are similar to those of the form already described.

The male differs little from the female except that the terminal claws of the second maxillipeds are more powerful and more evenly curved (fig. 22).

Habitat.—On the inside of the gill-covers of *Onos mustelus* (Lin.)—the Five-bearded Rockling—captured in the Firth of Forth in May, and off Kinnaird Head, in 60 to 80 fathoms, on July 24th, 1901. Also on the inside of the gill-covers of a specimen of *Onos cimbrius* (Lin.)—the Three-bearded Rockling—captured in the Forth estuary in 1892, and from the gills and gill-covers of the same species of fish taken on Bressay Shoal to the east of Shetland, on December 11th, 1901. Both males and females of this *Bomolochus* were obtained.

Remarks.—The species just recorded has such a close general resemblance to *Bomolochus soleæ*, Claus, that it might easily be mistaken for that species ; the most obvious difference is in the form of the posterior foot-jaws, by the difference in the structure of these appendages the species may be distinguished even without dissection when viewed from the ventral aspect and with the aid of a good light.

Bomolochus zeugopteri, T. Scott, (sp. n.). Pl. XIII., figs. 23–25.

Description of the Female.—Length about ·84 mm. (about $\frac{1}{30}$ of an inch). The first body segment is equal to rather more than the entire length of the next three, the last thoracic segment is small (fig. 23).

The antennuls (fig. 24) are moderately stout ; the second joint is equal to about one and a half times the length of the next one ; the third and fourth are sub-equal, while the fifth and last joints, which are also of about equal length, are rather smaller than the third or fourth ; the penultimate joint is only about two-thirds the length of the end one. The armature of the antennules resembles those of the last species.

The second maxillipeds are short and moderately robust, the terminal claw is feeble, and the curve of the claw is only slightly sigmoid ; a small seta springs from the distal end of the inner margin, while two slender and moderately elongate setæ arise from near the base of the claw as shown in the drawing (fig. 25).

All the other appendages are somewhat similar to the same appendages in the *Bomolochus* from the Ling.

Habitat.—About a dozen specimens, most of them females with ovisacs, were found adhering to the back of a small Müller's Topknot, *Zeugopterus punctatus* (Bl.). The fish was captured near the mouth of the Clyde estuary in September 1897, but the *Bomolochus* were not observed till March of the present year (1901) ; and as it had been in alcohol from the time it was captured, and had more than once been transferred from one vessel to another, it is evident that the copepods must have had a firm hold of their host.

The marked difference in the structure and armature of the second maxillipeds are the principal characters by which this species may be distinguished ; it is also a smaller species than the other two, being little more than half the size of the *Bomolochus* from the Ling.

Fam. CALIGIDÆ.

Genus *Caligus*, Müller (1785).

Caligus labracis, T. S., sp. nov. Pl. XIII., fig. 26–29

Description of the Female.—Length about 3·3 mm. (about $\frac{1}{8}$ of an inch). The cephalic shield (fig. 26) is about as broad as long; it is widest near the posterior end, and has the margins evenly rounded, somewhat like *Caligus diaphanus*, Nordmann. The last thoracic segment is subquadrate in outline, but its length is only equal to about three-fourths of the breadth; it is considerably smaller than the cephalic segment, being little more than a third of the length of that segment and half its breadth. The abdomen (exclusive of the caudal furca) is equal to about half the length of the last thoracic segment, and is apparently unsegmented, as shown in the figure.

The fourth pair of thoracic feet are small, and the single branch in each is composed of two joints, which are armed with sabre-like spines (fig. 29).

The sternal fork (fig. 28) is stout; both branches are moderately broad, and obliquely truncate at the ends, and are not greatly divergent.

The male (fig. 27) is smaller than the female, being only about 2·6 mm. in length, it differs little from the female except that, as usual, the last thoracic segment and the abdomen are smaller.

Habitat.—On the gills of *Labrus mixtus*, Lin.—the Striped Wrasse—captured in the Firth of Clyde in the vicinity of Ayr, on January 30th, 1900, and forwarded to the Laboratory by Mr. Robert Duthie, Fishery Officer, Girvan. My son (Mr. A. Scott) has taken the same species on the gills of *Labrus mixtus* and *Labrus maculatus* captured in the Irish Sea.

This *Caligus* differs from any species with which I am familiar in the proportional sizes of the cephalic shield and the last thoracic segment, and in the peculiar form of the sternal fork.

Genus *Pseudocaligus*, A. Scott (1900).

Pseudocaligus brevipedis (Bassett-Smith).

1896. *Caligus brevipedis*, Bassett-Smith, Ann. and Mag. Nat. Hist., (6), vol. xviii., p. 11, pl. III., fig. 1.

1901. *Pseudocaligus brevipedis*, A. Scott, Some Additions to the Fauna of Liverpool Bay, *Trans. Liverpool Biol. Soc.*, vol. xv., p. 350, pl. II., figs. 1–6.

One or two specimens of this curious form were found in the throat of a specimen of the Three-bearded Rockling—*Onos tricirratus*—captured at Dunbar, Haddingtonshire, in 1892. The copepods were only noticed on the fish in August of the present year, 1901, by my son, Mr. A. Scott.

This is comparatively a small species, and differs from *Caligus*, especially in the rudimentary character of the fourth thoracic feet.

Genus *Lepeophtheirus*, Nordmann (1832).

Lepeophtheirus pollachii, Bassett-Smith.

Specimens of this copepod were obtained in the throat of young Pollack—*Gadus pollachius*—sent from Girvan, Ayrshire, in May, 1901. A few of them were also adhering to the tongue of the fish, and the part to which they were adhering appeared to be lacerated.

Genus *Echthrogaleus*, Steenstrup and Lütken (1861).

Echthrogaleus coleoptratus (Guérin).

Two specimens of this species were obtained adhering to the pectoral fins of a small *Lamna cornubica* sent from the Fish Market at Aberdeen on December 12th, 1901.

Fam. Dichelestidæ.

Genus *Clavella*, Oken (1815).

Clavella cluthæ, T. Scott, sp. nov. Pl. XII., figs. 26–31.

Description of the Female.—Length about 1·5 mm. (nearly $\frac{1}{17}$ of an inch). This copepod is like *Clavella labracis*, Van Beneden, in general appearance, but is about one and a half times its size, the lateral margins of the cephalic segment are also evenly rounded instead of being angular, as in that species (fig. 26).

The antennules are short, and apparently four-(? or five-) jointed, and also moderately stout; the basal joint is about as long as all the other three together, while the end joint is very minute; the armature of the antennules consists of a few minute spines (fig. 27).

The antennule represented by the drawing had the basal joint slightly damaged.

The antennæ are fully as long as the antennules; they are composed of two joints and armed with a short but strong terminal claw (fig. 28).

The maxillæ are very small and simple in structure; they consist of a minute papilliform basal joint bearing three small spines as shown by the drawing (fig. 29).

The maxillipeds are also small; they are two-(or three-) jointed, and furnished with a small terminal claw (fig. 30).

There are only two pairs of thoracic feet, and they are both somewhat similar in structure. The drawing (fig. 31) represents the first pair. Each foot, which has two moderately stout basal joints, is two-branched, and each branch is two-jointed and furnished with two small terminal spines; in the outer branches the first joint is larger than the second and bears a small spine at its outer distal angle; in the inner branches, on the other hand, the first joint is smaller than the end one. A small spine springs from the inner distal angle of the second basal joint, as shown in the figure.

The caudal furca are very short, as represented in the full-size drawing (fig. 26).

Habitat.—On the gills of a *Ctenolabrus rupestris*, Lin. (Jago's Goldsinny), captured in East Loch Tarbert in 1885; but the copepods were only observed during the past summer.

Clavella labracis, Van Beneden. Pl. XIII., figs. 10–12.

This species was recorded, but not figured, in Part III. of the Nineteenth Annual Report, and I now give a few figures in order to indicate one or two points of difference between this species and the one just described.

The largest of the female specimens of *Clavella labracis* measured scarcely more than a millimetre in length. In the specimen represented by the figure (fig. 10) the cephalic segment is equal to about one-fifth of the entire length of the animal. The lateral margins are produced

outwardly on each side so as to form distinct angular projections and give to the segment, when seen from above, a kind of diamond-shaped outline. The "genital" segment is fully three times the length of the cephalic segment, its breadth is not much more than a third of the length, and its margins curve gently towards both ends. The abdomen is very small, and so also are the furcal joints. The ovisacs appear to be moderately elongated, but in none of the specimens examined were the ovisacs entire.

The antennules are short and moderately stout, and composed of five joints. The first joint is large, and nearly equal to half the entire length of the antennule. The lower distal angle of this joint is produced downwards in the form of a strong hook. The three last joints are sub-equal and shorter than the second. Several short and dagger-like spines spring from the upper margins of the antennules as shown in the drawing (fig. 11).

The antennæ (fig. 12) are somewhat similar to those of *Clavella cluthæ*, and, like them, are armed with strongly-curved terminal hooks.

Habitat.—On the gills of the Striped Wrasse, *Labrus mixtus*, Lin., captured in the Clyde, near Ayr, in January, 1900, and forwarded to the Laboratory by Robert Duthie, Fishery Officer, Girvan. Taken also on the gills of *Labrus mixtus* captured in the Irish Sea (A. Scott).

Remarks.—The angular form of the cephalic segment, and the strong hook on the first joint of the antennules, seem to be characteristic of *Clavella labracis.* This copepod has lately been recorded from the Irish Sea, from the gills of the Striped Wrasse,* and as Professor van Beneden speaks of it as abundant on the gills both of *Labrus bergylta* and *Labrus mixtus*†, it seems probable that its distribution is co-extensive with that of its hosts.

Genus *Eudactylina*, Van Beneden (1853).

Eudactylina acuta, Van Beneden. Pl. XII., figs. 20–25.

1853. *Eudactylina acuta*, Van Beneden, Bull. Acad. Roy. Belg., vol. xx., pt. 1, p. 235; Mem. Acad. Roy. Belg. (1861), p. 150, pl. xxv.

Description of the Female.—Length about 2·6 mm. (fully $\frac{1}{10}$ of an inch). The body is slender and elongated, the thoracic portion consists of five distinct segments, and the abdomen of three (including the genital segment). The first body segment is about equal to the combined lengths of the next two, but the second is smaller than the third; the fourth is about equal in length to the first and only slightly longer than the fifth segment; the abdomen is very small, being equal to little more than a fourth of the entire length of the thorax. The furcal plates are short and dilated (fig 20).

The antennules are short, very stout, and apparently four-or five-jointed, and they are armed with several strong spines. A large strongly-curved spine springs from the upper distal angle of what appears to be the second basal joint, and reaches to near the end of the next joint, there is also a stout and much shorter spine on the lateral aspect of the same joint, and also one or two spiniform setæ; a moderately stout, elongate, and nearly straight spine springs from the upper distal angle of the following joint, while behind and below this spine there is another, which is also moderately stout, but only about half

* Fifteenth Annual Report L.M.B.C., and their Biol. Station at Port Erin (Isle of Man) Dec., 1901, p. 13.

†Les Poissons des Cotes de Belgique, *Mem. Acad. Roy. Belg.*, vol. xxxviii., pp. 45, 46 (1870).

the length of the first ; the penultimate joint is furnished with a short stout spine and a few spiniform setæ near its distal end ; the last joint is very minute, as shown by the drawing (fig. 21).

The antennæ, which are similar in structure to those of the next species, are provided with one or two stout tooth-like spines on the lower aspect, and armed with an arrangement of strong terminal hook-like claws.

The mandibles resemble very closely those of *Charopinus dalmanni* (Retz.). The maxillæ are also somewhat similar in structure to those of that species, except that the secondary lobe is more produced.

The first maxillipeds are small and three-jointed and furnished with a minute terminal claw.

The second maxillipeds are of moderate size and strongly chelate,, and have a curious resemblance to the chelæ of *Pseudotanais*—a genus belonging to the Isopoda-Chelifera.

The first four pairs of thoracic feet are all two-branched ; in the first pair and in the third and fourth pairs both branches are distinctly three-jointed ; in the second pair the inner branches, as in the other pairs, are composed of three distinct joints, but in the other branches, which differ considerably from the others, the second and third joints are nearly obsolete, while the first joint is fully as large as the whole outer branch. The basal portion of each foot consists of two joints, the first being large and considerably dilated, while the second is scarcely half the size of the other.

In the first pair of feet the outer branches are rather shorter than the inner ones, the first joint is stout and longer than the combined length of the next two, it is furnished with a row of small spines along its outer margin, while a dagger-like spine springs from its outer distal angle ; a similar spine springs from the outer distal angle of the next joint, and two from the end joint, the end joint also carries a moderately long and spiniform terminal seta, together with a small hook-like spine on the inner distal angle ; the three joints of the inner branches are sub-equal in length, but the first joint is more dilated than the others, and is provided with a fringe of minute spines on the outer edge ; the second and third joints carry a few minute spines on the inner margin, while two moderately large spiniform setæ spring from the apex of the last joint (fig. 22). The inner rounded margin of the second basal joint is fringed with several small but stout spines.

The first basal joint of the second pair is considerably dilated, the second is smaller and fringed on the inner edge with minute spines ; the inner branches are small and shorter than the outer, the second and third joints are fringed on both edges with minute spines, while a moderately long and slender seta and a small spine spring from the apex ; the first joint of the outer branches is dilated and exceeds the inner branches in length, but the end joints are so modified as to be almost obsolete (fig. 23).

In the third and fourth pairs, which are somewhat similar to each other in structure, the inner branches resemble the same branches in the first pair, except that they carry a single moderately stout and elongated terminal spine ; the outer branches are rather longer than the inner ones, and the first joint, which is equal to more than the entire length of the second and third, is fringed on the outer edge with small tooth-like spines, a moderately stout spine springs from its outer distal angle, while a similar spine springs from the outer distal angle of the second joint ; the third joint bears three moderately stout spines of varying lengths at its truncate end as shown by the drawing (fig. 4), which represents one of the fourth pair.

The fifth pair consist of broad lamelliform and uniarticulate plates situated on the lateral aspect and near the distal end of the fifth body segment ; each foot is about one and a half times longer than broad, it is evenly rounded at the apex, and furnished with two or three small setæ (fig. 24).

The caudal furca, which are fully one and a half times the length of the last abdominal segment, are somewhat dilated, and provided with a small seta on the outer edge and two small tooth-like spines on the rounded apex (fig. 25).

Habitat.—On the gills of an Angel-fish, *Rhina squatina* (Lin.), captured about 8 to 9 miles S.E. from Buchan Ness in January last (1902). My son finds this parasite to be moderately frequent on the gills of Angel-fishes captured in the Irish Sea.

This being the first *Eudactyline* described, may be considered the type of the genus, and its description given above will show more clearly the distinctive points by which the next species may be satisfactorily identified.

Eudactylina similis, T. Scott, sp. nov. Pl. XII., figs. 1-19.

Description of the Female.—Length of the female specimen represented by the figure, 2·97 mm. (about $\frac{2}{17}$ of an inch) ; it resembles in general appearance the *Eudactylina acuta* (Van Beneden), but differs in the proportional lengths of the body segments and in the structure of some of the thoracic and tail appendages. The first body segment (fig. 1) is about one and a half times the length of the second ; the second, third, and fourth are nearly equal in length, but the second is rather the longest ; the last is equal to about two-thirds of the length of the preceding segment. The abdomen is small, being scarcely equal to a third of the entire length of the thorax.

The antennules are stout, and taper towards the distal extremity ; they somewhat resemble, in structure and armature, the antennules of *Eudactylina acuta* (fig. 3).

The antennæ (fig. 4) are moderately stout and four-jointed, the first and second joints are each furnished with a short and stout tooth-like spine on its inner aspect; the last joint is short and is armed with two or three stout but short terminal claws.

The mandibles are very feeble, and are similar to those of *Eudactylina acuta* (fig. 5).

The maxillæ are small and of a simple bilobed structure, the principal lobe is rather longer than broad, and bears two moderately long spiniform terminal setæ, the one being about twice the length of the other ; the secondary lobe is small and provided with a slender one-jointed branch which extends somewhat beyond the apex of the primary lobe, and terminates in a moderately long spiniform seta, as shown by the drawing (fig. 6).

The first maxillipeds are also small, they are three-jointed and armed with a minute terminal claw (fig. 7).

The second maxillipeds are moderately large and strongly chelate, the terminal joint is broad and its lateral angles are more or less produced ; the one angle is extended into a spoon-like process, while to the other is articulated a stout, strongly-curved claw, the apex of which impinges against the spoon-like process of the opposite angle as shown in the drawing (fig. 8).

The first pair of thoracic feet are somewhat similar to those of *Eudactylina acuta* except in the following particulars:—The inner margin

of the second basal joint is furnished with two small but moderately stout spines; the first joint of the outer branches is, proportionally, considerably larger than either the second or third joints, and the inner branches are more slender (fig. 9).

The second pair are similar to the same pair in *Eudactylina acuta*, but the inner branches are proportionally smaller (fig. 10).

The third and fourth pairs are also similar to those of the species referred to (fig. 11).

The fifth pair are larger than those of *Eudactylina acuta*, and they are also proportionally broader, the width being about equal to four-fifths of the length, as shown in the drawing (fig. 12).

The caudal furca, which are equal to about twice the length of the last abdominal segment, are narrow and slightly curved; they are widest at the base, but the width is scarcely equal to half the length; they taper gradually to the blunt-pointed apex, and carry two or three minute spines (fig. 13).

Description of the Male.—Length 1·9 mm. (about $\frac{1}{13}$ of an inch), being only about three-fourths the length of the female. The body is more slender than that of the female, while the abdomen is about equal in length to the cephalo-thorax (fig. 2).

The antennules are moderately stout, and appear to be seven-jointed; they do not taper as much as the antennules of the female, but are provided with somewhat similar spines; they also differ from the female antennules in being furnished with a short but strong hooked claw at the distal extremity (fig. 14).

The antennæ and mouth appendages are somewhat like those of the female, with the exception of the second maxillipeds, which resemble the same appendages in *Charopinas ramosus* (fig. 15).

The first four pairs of thoracic feet have both branches apparently three-jointed, but in the outer branches of the first pair the articulation between the second and third joints is somewhat indistinct (fig. 16). The inner branches of the second pair are armed on the inner aspect with a moderately stout and elongated curved spine, which springs from the distal angle of the first joint (fig. 17).

The third and fourth pairs have somewhat slender branches; the inner are furnished with two terminal spiniform setæ, the outer bear two terminal setæ and a spine; a moderately stout spine also springs from the outer distal angles of the first and second joints (fig. 18).

The fifth pair are somewhat similar to those of the female.

The caudal furca are very narrow, and armed with small and slightly-hooked terminal spines (fig. 19—see also fig. 2).

Habitat.—On the gills of *Raia radiata*, Don. (the Starry Ray), captured to the east of the Shetland Islands on May 22nd, and off Aberdeen on November 29th, 1901; both females and males of this *Eudactyline* were obtained, and specimens were moderately frequent on the gills of some of the tarry Rays examined.

Eudactylina similis, though it resembles *Eudactylina acuta* in general appearance, may be readily distinguished from it by the difference in the form of the caudal furca.

Eudactylina acanthii, A. Scott. Pl. XIII., figs. 1–9.

1901. *Eudactylina acanthii*, A. Scott, 15th Ann. Rept. of the L.M.B.C., and their Biol. Stat. at Port Erin, Isle of Man, Dec., 1901, p. 14.

Description of the Female.—Length about 2 mm. ($\frac{2}{25}$ of an inch). Body moderately stout, the cephalothoracic segment about one and a half

times the length of the next one; the second, third, and fourth segments sub-equal in length, but the fifth is rather shorter than the one immediately preceding. The abdomen is very short, being only about a fifth of the entire length of the cephalothorax; the genital segment exceeds the combined lenghts of the next two as shown in the full-size drawing (fig. 1).

The antennules are short but moderately stout, and they taper towards the distal end; the first and second joints are considerably dilated, and together are equal to more than half the entire length of the antennules; the curved spine at the distal end of the second joint is much smaller than the spine similar to it on the second joints of the antennules of *Eudactylina acuta* (fig. 2).

The antennæ are somewhat similar to the same appendages in *Eudactylina acuta*, but they want the stout tooth-like spines on the inner aspect of the first and second joints, and there appears to be only one claw-like spine at the end of the last joint (fig. 4).

The mandibles, maxillæ, and other mouth appendages are somewhat similar to those of *Eudactylina acuta* (or *Eudactylina similis*).

In the first four pairs of thoracic feet, the inner branches are all two-jointed; but while the outer branches of the first pair consist apparently of one joint, those of the next three pairs appear to be composed of three joints; all the four pairs are short and robust. The inner branches of the first pair are armed with a number of very short but stout spines, chiefly on the exterior margins; the outer branches, which are shorter than the inner ones, are fringed on the exterior edge with minute setæ; a small spine springs from a notch slightly posterior to the middle of the same margin, while two or three small spiniform setæ terminate the joint, as shown in the drawing (fig. 5).

In the second pair the inner branches are somewhat similar to, but rather stouter than, the inner branches of the first pair; the outer branches are somewhat indistinctly three-jointed, and only slightly longer than the inner branches, and both branches are fringed on the exterior edge with small spines; the outer margin of the first basal joint is also similarly fringed, while small spines are scattered sparingly over portions of the surface of all the joints as shown in the drawing (fig. 6).

The remaining two pairs are somewhat similar in structure to the second pair, but are, comparatively, rather stouter, they are also less spiniferous than that pair (fig. 7).

The fifth pair resemble those of *Eudactylina acuta*, but differ slightly in their form and armature (fig. 8).

The caudal furca, which are not much longer than the last abdominal segment, are somewhat narrower than those of *Eudactylina acuta*—the width being only equal to about half the length; two short spines spring from the outer margins of each furcal joint and the spiniform setæ from the apex, the middle apical seta being the longest (fig. 9).

Habitat.—On the gills of the Piked Dog-fish, *Squalus acanthius*, L., captured in Beaumaris Bay, on September 26th, 1901. I am indebted to my son for the privilege of describing this species, and for the illustrative drawings. This *Eudactylina* appears to be of frequent occurrence on the gills of *S. acanthius*, captured in the Irish Sea, and may probably also be obtained on the gills of Scottish specimens of the fish. It may be noted in passing that *Eudactylina acuta* has been recorded both from the Angel-fish and the Piked Dog-fish (see Professor van Beneden's memoirs already referred to); perhaps the two forms may have been mixed up under the one name; but whether that be so or not, the parasites from the two fishes named, which have been examined by myself and my son, appear to be distinct.

Fam. LERNÆIDÆ.

Genus *Hæmobaphes*, Steenstrup and Lutken (1861).

Hæmobaphes ambiguus, T. Scott.

1900. *Hæmobaphes ambiguus*, T. Scott, 19th Ann. Rept. of the Fishery Board for Scotland, pt. iii., p. 162; pl. vii., fig. 15.

Specimens of this curious Lernæan were obtained on Spotted Dragonets, *Callionymus maculatus*, Bonap., captured in the Firth of Clyde on October 4th, 1901. This is an addition to the Clyde crustacean fauna, and an extension of the distribution of the species (see also a further reference to this species under the record of *Chondracanthus ornatus*).

Hæmobaphes cyclopterina (Fabr.).

A specimen of this parasite was obtained on the gills of a Butterfish, *Pholis gunnellus*, L., captured in the Forth estuary during the preceding summer. This appears to be an addition to the number of the hosts of *Hæmobaphes cyclopterina*.

The following are the names of the fishes mentioned by Steenstrup and Lutken in their work on Parasite Copepoda (p. 65) as hosts for this *Hæmobaphes* :—

Cottus grönlandicus, *Cottus bubalis*, *Cottus scorpius*, *Cyclopterus spinosus*, *Gadus merlangus*, *Centronotus fasciatus*, and *Sebastes norvegicus*. To this list have been added the *Pholis gunellus* mentioned above, and *Agonu cataphractus*, also captured in the Forth, and on which *Hæmobaphes cyclopterina* was obtained some years ago.

Fam. CHONDRACANTHIDÆ.

Genus *Chondracanthus*, De la Roche (1811).

Chondracanthus ornatus, T. Scott. Pl. XIII., fig. 34.

Further specimens of this species have been obtained on the gills of some Spotted Dragonets captured in the Clyde on October 4th, 1901, both males and females were obtained on these Dragonets, and I am now able to give a full-size figure of a male specimen, prepared by my son. The specimen scarcely reaches half a millimetre in length, and is moderately robust, as shown by the drawing (fig. 34).

A number of specimens of *Hæmobaphes ambiguus*, T. Scott, were obtained on the gills of the same sample of Spotted Dragonets, and as both species were sometimes found on the gills of the same fish, the following notes on the relative frequency of the two forms may be of interest.

Fifty-five fishes were contained in the sample collected on the 4th of October, and on the gills of these, fifteen specimens of *Hæmobaphes ambiguus* and eight of *Chondracanthus ornatus* were obtained; usually the specimens of the two species occurred singly and on different fishes, but in several instances two specimens of the same species, or a specimen belonging to each species, occurred on the gills of a single fish; for example, a Spotted Dragonet seventy-three millimetres in length had a *Chondracanthus* on one side and a *Hæmobaphes* on the other; another Spotted Dragonet had a *Chondracanthus* and a *Hæmobaphes* on the same side. Another fish one hundred and four millimetres in length had two *Chondracanthus ornatus* on the same side, while the other side was free of parasites; a fourth specimen of Spotted Dragonet eighty-six

millimetres in length had a *Hæmobaphes* on each side, but no *Chondracanthus.* The total number of parasites observed on this sample of fifty-five Spotted Dragonets was twenty three, and they comprised fifteen *Hæmobaphes ambiguus* and eight *Chondracanthus ornatus.* It was also observed that when only one parasite occurred it was frequently on the right side—the fish resting on its ventral surface and with its head toward the observer.

It may be further noted that seventeen specimens of the Common Dragonet, *Callionymus lyra,* captured at the same time and place, were also examined, but no parasites were observed on them.

Fam. LERNÆOPODIDÆ.

Genus *Thysanote,* Kröyer (1863).

Thysanote impudica (Nordmann).

This species was recorded in Part III. of the Eighteenth Annual Report (p. 169), but there was some doubt as to the exact locality where the fish on which it was obtained came from, but I am able to record the occurrence of another specimen which was obtained on the gills of a *Trigla hirundo* captured in Burghead Bay, Moray Firth,on July 1st, 1901.

II.

TREMATODA.

In the present paper I am able to record only two Trematodes in addition to those described in my paper on Fish Parasites published in Part III. of the Nineteenth Annual Report, but they both appear to be of special interest. They are each provided with a single large posterior sucker which is discoidal and sessile or nearly so, and would thus appear to belong to the Tristomatidæ, but they differ in several important points not only from each other, but also from the Tristomes described in my previous paper.

Fam. TRISTOMATIDÆ.*

Genus *Callicotyle,* Diesing (1850).

Callicotyle Kröyeri, Diesing. Pl. XIII., fig. 30.

1850. *Calicotyle Kröyeri,* Diesing, Syst. helminth., vol. i., p. 434.
1856. *Calicotyle Kröyeri,* Hök, Ofvers of K. Vet. Akad. Förhandl Stokholm, September 20th (1856).
1858. *Calicotyle Kröyeri,* Diesing, Denkschrift. d. K. Akad. d. Wissensch, vol. xiv., p. 70. k., i, figs. 16–20.
1863. *Callicotyle Kroyeri,* P.-J. van Beneden and Hesse, Rech. sur les Trématodes, p. 79.

The Trematode which I ascribe to this species was obtained in the cloaca of specimens of *Raia radiata,* Don., captured about 60 miles south-east of the Shetland Islands on May 22nd, 1901. Specimens of the same Trematode were subsequently observed on *Raia radiata* captured off Aberdeen ; as well as on a small *Raia clavata* captured in the Clyde

* In the Cambridge Natural History, vol. ii., p. 73, Van Beneden's division of the Trematodes into Monogenea and Digenea is adopted, and *Callicotyle* is, along with other two genera, placed in the sub-family Monocotylinæ Tschbg—one of the three sub-families into which the Tristomatidæ are divided.

on October 10th, 1901, and forwarded to the Laboratory at Bay of Nigg. My son has also obtained the same species on *Raia clavata* captured in Beaumaris Bay.* Professor P.-J. van Beneden in his work on the Fishes of the Coast of Belgium (p. 16) records this Trematode also from the cloaca of the Grey Skate, *Raia batis*.

Kröyer, after whom this Trematode is named, discovered the species on *Raia radiata*, taken in the Kattegat,† and it is described very shortly by Diesing in Vol. I. of his *Systema Helminthum*, published in 1850 (p. 431). In 1856 M. C.-T. Hök published a special work on this parasite, while Van Beneden and Hesse in their *Recherches sur les Trématodes* (p. 79) refer to a few of the more important characters which serve to distinguish this species from others of the family Tristomatidæ to which it seems to belong. Two of the more obvious of these characters are, (1) the posterior sucker has seven rays and two spines, and (2) the small sucker which in most of the Tristomatidæ is present on each side of the mouth at the anterior end is in this species apparently wanting. The authors referred to appear to consider the latter peculiarity as of special interest, for they remark "Ce qu'il offre de plus remarquable jusqu'à present, c'est que, tout en appartenant à la famille des tristomides les ventouses anterieures semblent faire complétement défaut."

This parasite, besides occupying a peculiar position on the fish, is usually of an opaque white colour, corresponding very closely with that of the skin on which it is adhering, so that unless the observer knows beforehand what to look for, it is easily missed. If specimens with nearly ripe eggs be closely examined, the sides (indicated in the figure by the darker shading) will be seen to be of a faint yellow colour. The general form, as might be expected, varies considerably, but that which is indicated by the figure seems to be the more normal one.

Genus *Acanthocotyle*, Monticelli, 1888.
(Saggio di una morfologia dei Trematodi, p. 97.)

Acanthocotyle monticellii, T. Scott, sp. n, pl. XIII., figs. 31–33.

A single specimen of a small Trematode was obtained on the gills of a Thornback Skate, *Raia clavata*, sent from the Fish Market at Aberdeen in April, 1901—the fish was captured in the North Sea. This Trematode belongs to the genus *Acanthocotyle* instituted by Fr. Sav Monticelli in 1888, but does not appear to agree with any of the species already described. There have been three species of *Acanthocotyle* described by Monticelli, and they have all been found adhering to the skin of specimens of the Thornback Skate (*Raia clavata*) captured at different times in the Gulf of Naples. The following are their names, arranged in the order in which they were described.

(1.) *Acanthocotyle lobiancoi*, Monticelli, described in 1888 in a work entitled *Saggio di una morfologia dei Trematodi* (p. 13). This species was obtained on the dorsal surface of the Thornback Skate, *Raia clavata*, captured in the Gulf of Naples in December, 1887. It does not appear to be a very rare species, but is easily missed; it measures from three to six millimetres in length, and its colour closely resembles that of the skin to which it is attached.

* Fifteenth Annual Report of the L.M.B.C., and their Biol. Station at Port Erin (Isle of Man), December, 1901, p. 13.

† I.V. Beneden and Hesse, in their *Recherches* (p. 79), state that Kroyer found the worm which served for the establishment of the genus in the rectum of *Raia batis*, but Diesing's record is "Habitaculum—*Raia radiata*; in corporis superficie, Kattigat—(*Kroyer*)."

(2.) *Acanthocotyle elegans*, Monticelli. This was described in 1890 (Boll. Soc. Napoli, iv., p. 191, fig. III.), it measures from two to four millimetres in length, and, like the other, was found on the back of a Thornback Skate captured in the Gulf of Naples.

(3.) *Acanthocotyle oligoterus*, Monticelli. This species was obtained on the under (ventral) side of a Thornback Skate captured in the Gulf of Naples in 1893, but was not described till 1899, in *Archives de Parasitologie*, II. No. i., p. 115. This appears to be the smallest of the three species, as it measures only from one and a half to two and a half millimetres.

The learned author, after whom the present species is named, informs me that another *Acanthtcotyle—A. verrilli*, Goto—is described in *Journ. Coll. Sc. Imp. Univ. Tokyo*, 1899, p. 4; but that our species differs from it as well as from the others mentioned above.

The following are one or two of the more easily observed characters which distinguish *Acanthocotyle* from other Trematodes, and by which also the different specics of *Acanthocotyle* may be distinguished. First, the structure of the posterior sucker (ventouse) differs from that of other Trematodes; this sucker is provided with numerous rows of small teeth—twenty rows appear to be the prevailing number, as this is the number in the species I record (see fig. 32), and it is also the number in the three species described by Monticelli. Second, the large posterior sucker is provided with a minute supplementary disk—the "*adhesive* disk,"—situated at its posterior end (as shown in fig. 32). In *Acanthocotyle lobiancoi* this *disk* is tongue-shaped (lingualate), but in the other three species it is circular in form. In *Acanthocotyle elegans* the posterior edge of the *adhesive disk* is almost in line with the posterior margin of the large sucker.* In *A. oligoterus* about half of the *adhesive disk* extends beyond the margin of the sucker; while in *A. concinna* the whole of the *disk* is outside.

The *adhesive disk* is armed with a number of small hooks that appear to be placed at the ends of the stalk-like processes, and which in their form and arrangement differ to some extent in the different species. In *A. lobiancoi* these hooks, which appear to be eight in number, are arranged along and just within the posterior margin, their stalks being directed inward like the radii of a circle. In *A. elegans* and *A. oligoterus*, the number of hooks is fifteen, and they are arranged in regular order all round and a little within the circumference of the *disk*, with their stalks directed towards its centre. In *A. monticellii*, on the other hand, the *adhesive disk* appears to be furnished with sixteen hooks, fourteen of which are arranged somewhat irregularly around the circumference, while two are sub-central; the stalks of these hooks are not directed toward the centre so regularly as in the other species.

It may also be noted that in the species recorded here the teeth form a continuous row, each being joined to the other as shown in figure 32A. *Acanthocotyle monticellii* appears also to be a larger species than any of those described by the author referred to; the largest of the species recorded by him is *A. lobiancoi*, which measures from three to six millimetres in length, whereas the length of our specimen extends to about six and a half millimetres.

It may be of interest to state that M. Monticcelli, who very kindly examined for me not only this but also several other Scottish Trematodes,

* In this species, the margin of the large sucker is fringed with short, narrow, and somewhat irregular scallops; and in this respect it differs from the next two species in which the margin of the sucker is plain.

remarks concerning the *Acanthocotyle* now recorded, that it is a very distinct new species, and differs from others :

1. In its general features.
2. In its more slender and elongated body.
3. In the anterior suckers not being well developed, and somewhat resembling those of *A. verrilli*, Goto.
4. In the great development of the anterior glands.
5. In the form and structure of the hooks of the posterior sucker.
6. In the *testes* being smaller in number, and apparently more developed.

A second species—probably *A. lobiancoi*, Monticelli, has recently been obtained in some material from the Firth of Clyde ; this specimen, which measures 2·4 mm., will, however, require further study, as it is somewhat imperfect.

EXPLANATION OF THE PLATES.

PLATES XII.—XIII.

PLATE XII.

Eudactylina similis, sp. n. Diam.

Fig. 1. Female, side view . . . . . × 29.
Fig. 2. Male, side view . . . . . × 58.
Fig. 3. Antennule, female . . . . . × 233.
Fig. 4. Antenna, ,, ... × 233.
Fig. 5. Mandible, ,, ... × 525.
Fig. 6. Maxilla, ,, ... × 525.
Fig. 7. Anterior foot-jaw, female . . . . . × 154.
Fig. 8. Posterior foot-jaw, ,, ... × 154.
Fig. 9. Foot of first pair, ,, ... × 177.
Fig. 10. Foot of second pair, ,, ... × 154.
Fig. 11. Foot of fourth pair, ,, ... × 105.
Fig. 12. Foot of fifth pair, ,, ... × 77.
Fig. 13. Part of abdomen and caudal furca, female . . . × 103.
Fig. 14. Antennule, male . . . . . × 233.
Fig. 15. Posterior foot-jaw, male . . . . . × 175.
Fig. 16. Foot of first pair, ,, ... × 350.
Fig. 17. Foot of second pair, ,, ... × 233.
Fig. 18. Foot of fourth pair, ,, ... × 175.
Fig. 19. Part of abdomen and caudal furca, male . . . × 154.

Eudactylina acuta, Van Beneden.

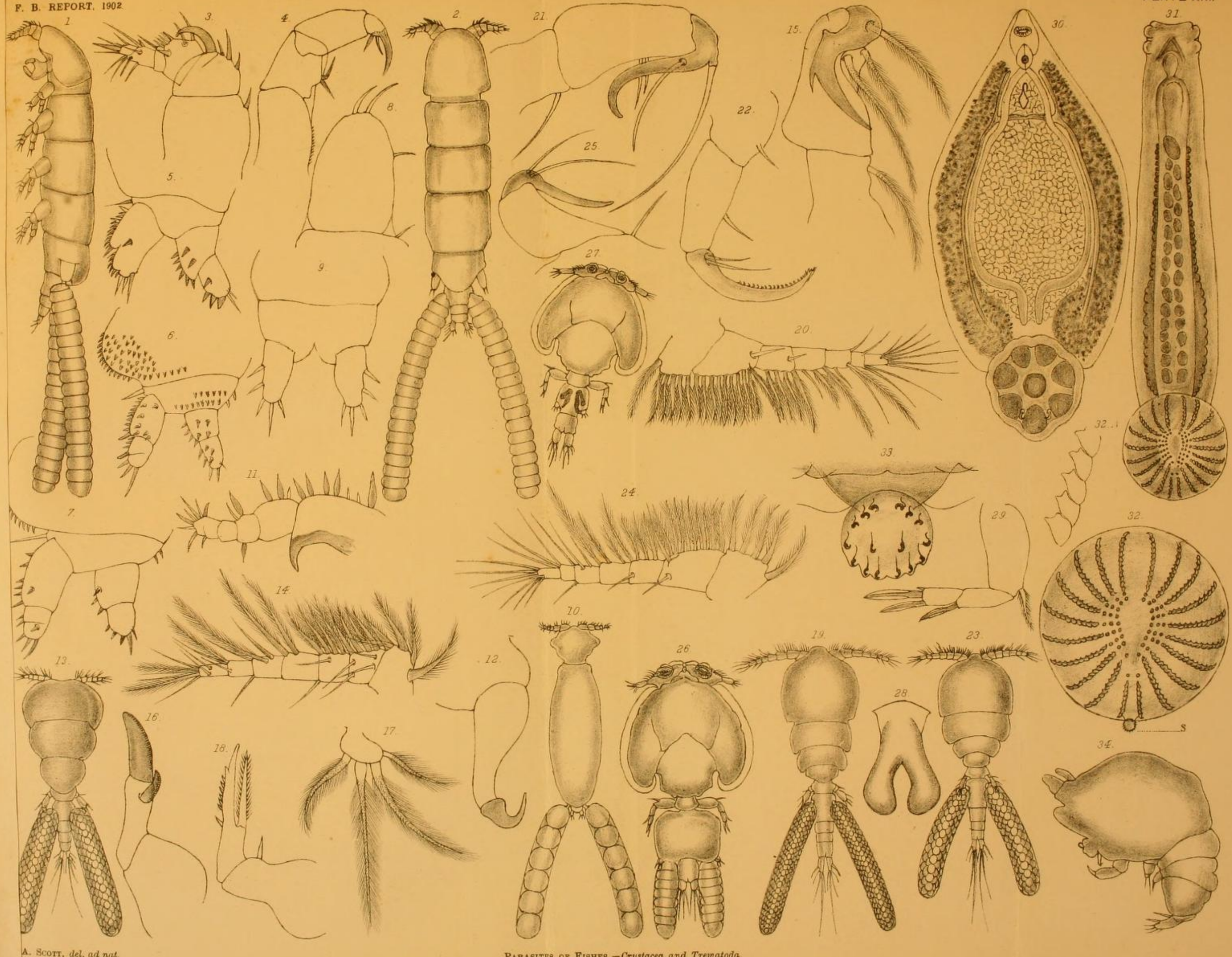
Fig. 20. Female, side view . . . . . × 41.
Fig. 21. Antennule . . . . . × 350.
Fig. 22. Foot of first pair . . . . . × 233.
Fig. 23. Foot of second pair . . . . . × 105.
Fig. 24. Foot of fifth pair . . . . . × 175.
Fig. 25. Part of abdomen and caudal furca . . . . × 131.

Clavella cluthæ sp. n.

Fig. 26. Female, dorsal view . . . . . × 58.
Fig. 27. Antennule . . . . . × 262.
Fig. 28. Antenna . . . . . × 154.
Fig. 29. Maxilla . . . . . × 1050.
Fig. 30. Posterior foot-jaw . . . . . × 262.
Fig. 31. Foot of first pair . . . . . × 525.

A. Scott, *del. ad nat.*

Parasites of Fishes.—*Crustacea.*



A. Scott, *del. ad nat.*

Parasites of Fishes.—*Crustacea and Trematoda.*

PLATE XIII.

Eudactylina acanthii, A. Scott.

Fig. 1. Female, side view . . . . . × 41.
Fig. 2. Female, dorsal view . . . . . × 41.
Fig. 3. Antennule . . . . . × 262.
Fig. 4. Antenna . . . . . × 262.
Fig. 5. Foot of first pair . . . . . × 262.
Fig. 6. Foot of second pair . . . . . × 175.
Fig. 7. Foot of fourth pair . . . . . × 262.
Fig. 8. Foot of fifth pair . . . . . × 262.
Fig. 9. Part of abdomen and caudal furca . . . . × 262.

Clavella labracis, Van Beneden.

Fig. 10. Female, dorsal view . . . . . × 38.
Fig. 11. Antennule . . . . . × 262.
Fig. 12. Antenna . . . . . × 262.

Bomolochus soleæ, Claus, var.

Fig. 13. Female, dorsal view . . . . . × 19.
Fig. 14. Antennule . . . . . × 131.
Fig. 15. Posterior foot-jaw . . . . . × 262.
Fig. 16. Mandible . . . . . × 350.
Fig. 17. Maxilla . . . . . × 262.
Fig. 18. Anterior foot-jaw . . . . . × 350.

Bomolochus onosi, sp. n.

Fig. 19. Female, dorsal view . . . . . × 38.
Fig. 20. Antennule . . . . . × 131.
Fig. 21. Posterior foot-jaw, female . . . . . × 262.
Fig. 22. Posterior foot-jaw, male . . . . . × 262.

Bomolochus zeugopteri, sp. n.

Fig. 23. Female, dorsal view . . . . . × 51.
Fig. 24. Antennule . . . . . × 262.
Fig. 25. Posterior foot-jaw . . . . . × 525.

Caligus labracis, sp. n.

Fig. 26. Female, dorsal view . . . . . × 15.
Fig. 27. Male, dorsal view . . . . . × 15.
Fig. 28. Sternal fork, female . . . . . × 117.
Fig. 29. Foot of fourth pair, female . . . . . × 77.

Callicotyle kröyerii, Diesing.

Fig. 30. Seen from the ventral side . . . . . × 15.

Acanthocotyle monticellii, sp. n.

Fig. 31. Seen from the ventral side . . . . . × 15.
Fig. 32. Posterior sucker (*s. adhesive disk*) . . . . × 28.
Fig. 32A. Teeth of one of the rays of posterior sucker . (greatly enlarged).
Fig. 33. Adhesive disk . . . . . (greatly enlarged).

Chondracanthus ornatus, T. Scott.

Fig. 34. Male, side view . . . . . × 115.