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CERCARIA TURRITELLAE N.SP., A 'HUGE-TAILED' MONOSTOME LARVA FROM *TURRITELLA COMMUNIS* RISSO

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(Text-figs. 1 and 2)

Rothschild (1935) reported that Dr M. V. Lebour drew her attention to a 'huge-tailed' monostome which had occurred during 1931 in specimens of *Turritella communis* collected from the Rame Mud, Plymouth. From 1932 to 1934 Rothschild (1935) examined 541 specimens of this gastropod from that locality without finding this larva. During the summer of 1952, the present author examined a number of specimens from the same locality and was also unsuccessful in finding such a larval trematode. However, in November 1952, the monostome described below was found in two of 110 *Turritella* collected from Cawsand Bay, Plymouth Sound.

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Methods

Fully developed cercariae were obtained by isolating infected specimens of *T. communis* in jars of sea water and allowing the cercariae to emerge. Rediae and immature cercariae were obtained by crushing the shells of the hosts. Living specimens as well as permanent preparations were studied. Whole mounts were fixed in sublimate, stained with borax-carmine, and mounted in Canada balsam, or fixed in sublimate or formalin, unstained, and mounted in Faure's medium or in Cristalite (E. Gurr). Serial sections (5μ) of several cercariae were stained with Ehrlich's haematoxylin and eosin. The orientation of the objects in the desired position at imbedding was achieved by the method of Péterfi (after Romeis, 1948, p. 99). The incidence of infection was determined by crushing the gastropods and examining the digestive glands and gonads under the dissecting microscope.

Cercaria turritellae n.sp.

Specific diagnosis. The body of this non-swimming, non-oculate, monostome larva is elongate. Cuticular spines were not observed on the body. The digestive system (Fig. 2*f*) consists of the following structures: a mouth, located in the centre of a subterminal sucker; a short prepharynx; a small pharynx (?); and a narrow oesophagus leading into two long intestinal caeca that terminate near the posterior end of the body. The excretory vesicle is of moderate size with two lateral branches, containing large refringent inclusions, extending forward and joining in the mid-line of the body well in back of the oral sucker. Underneath the cuticle of the body wall in fully formed cercariae, numerous cystogenous glands, containing small refringent rods, obscure much of the internal structure. The tail is extremely large, wider and somewhat longer than the body; characteristically, it curves ventrally. On the dorsal side of this structure, two finely spined fin-like ridges (Figs. 1*d* and 2*c*, *d*) extend over more than half of its length. Annulations which appear to be circular muscle fibres uniformly cover the tail. Internally, the tail is composed mainly of large hyaline cells, each of which contains a nucleus (Fig. 1*d*). Measurements of fifteen living specimens in various stages of extension and contraction and slightly compressed between a cover-glass and glass slide are (in microns): body length 108–226 (av. 167); body width 46–124 (85); oral sucker width 24–32 (28); tail length 164–260 (212); tail width 62–128 (95). The redia (Fig. 2*e*) is elongate, without collar or ambulacral processes, and provided with a short intestine and a birth pore which is near the pharynx. Lateral to the pharynx is an undetermined number of cephalic glands. The largest rediae contain fully formed cercariae as well as cercarial embryos; no daughter parthenitae were observed. Measurements of three living specimens in various stages of extension and contraction and slightly compressed between a cover-glass and glass slide are (in microns): body length 596–1190 (av. 893); body width 154–306 (230); pharynx width 26–32 (29). The excretory formula of the redia is 2 (1+2).

Host. *Turritella communis* Risso.

Habitat. Digestive gland and gonad.

Locality. Cawsand Bay, Plymouth Sound.

Incidence of infection. 0·57% (two out of 350 specimens examined).

Remarks. The large tail of these cercariae appears to be an organ used for flotation because there is never any indication that the animals are able to swim, and, as they are usually suspended in the water with the body hanging below the tail, it seems likely that the hyaline cells of which the tail is mainly composed aid the buoyancy of the cercariae. In addition to the large cells, the tail contains near its base, and also bordering the two dorsally placed fin-like ridges, a number of smaller cells (Fig. 1*d*). These two finely spined ridges begin near the base of the tail and extend posteriorly over slightly more than

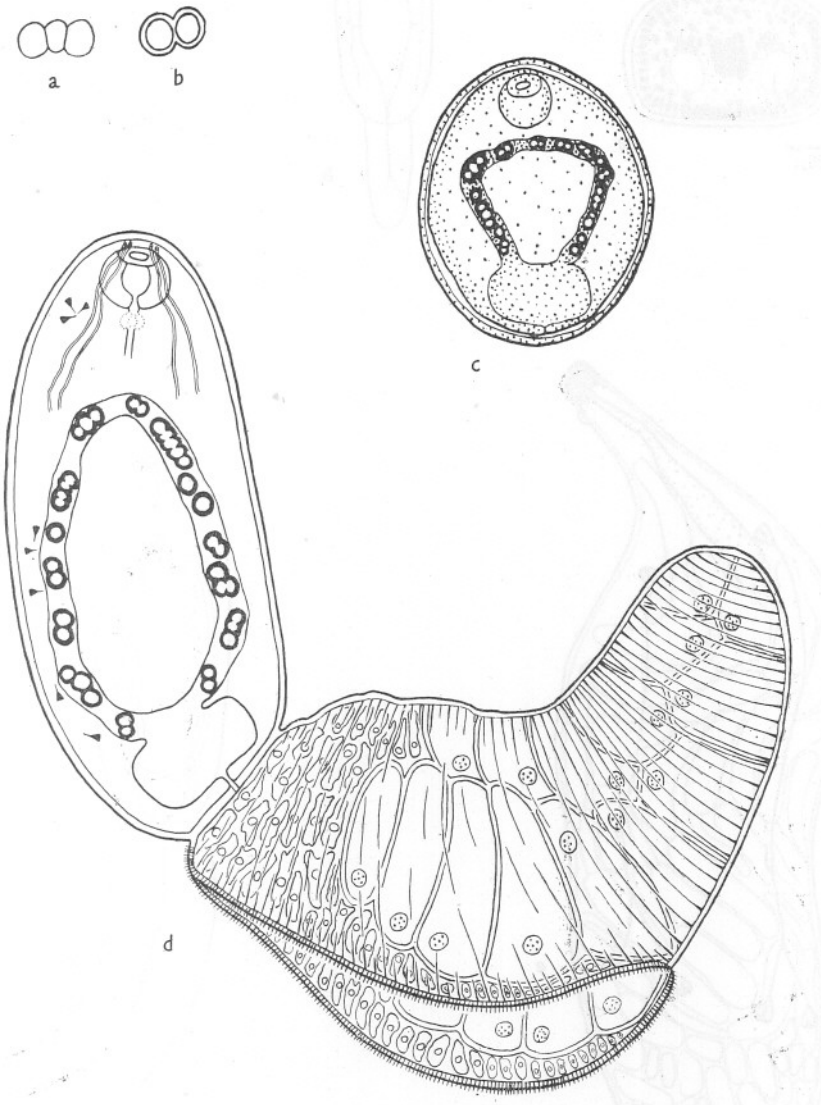

Fig. 1. *Cercaria turritellae*. *a*, thin-walled inclusions in the branches of the excretory vesicle; *b*, thick-walled inclusions in the branches of the excretory vesicle; *c*, encysted cercaria as it appears after sudden pressure from a cover-glass; *d*, fully developed cercaria as it appears under slight pressure from a cover-glass.

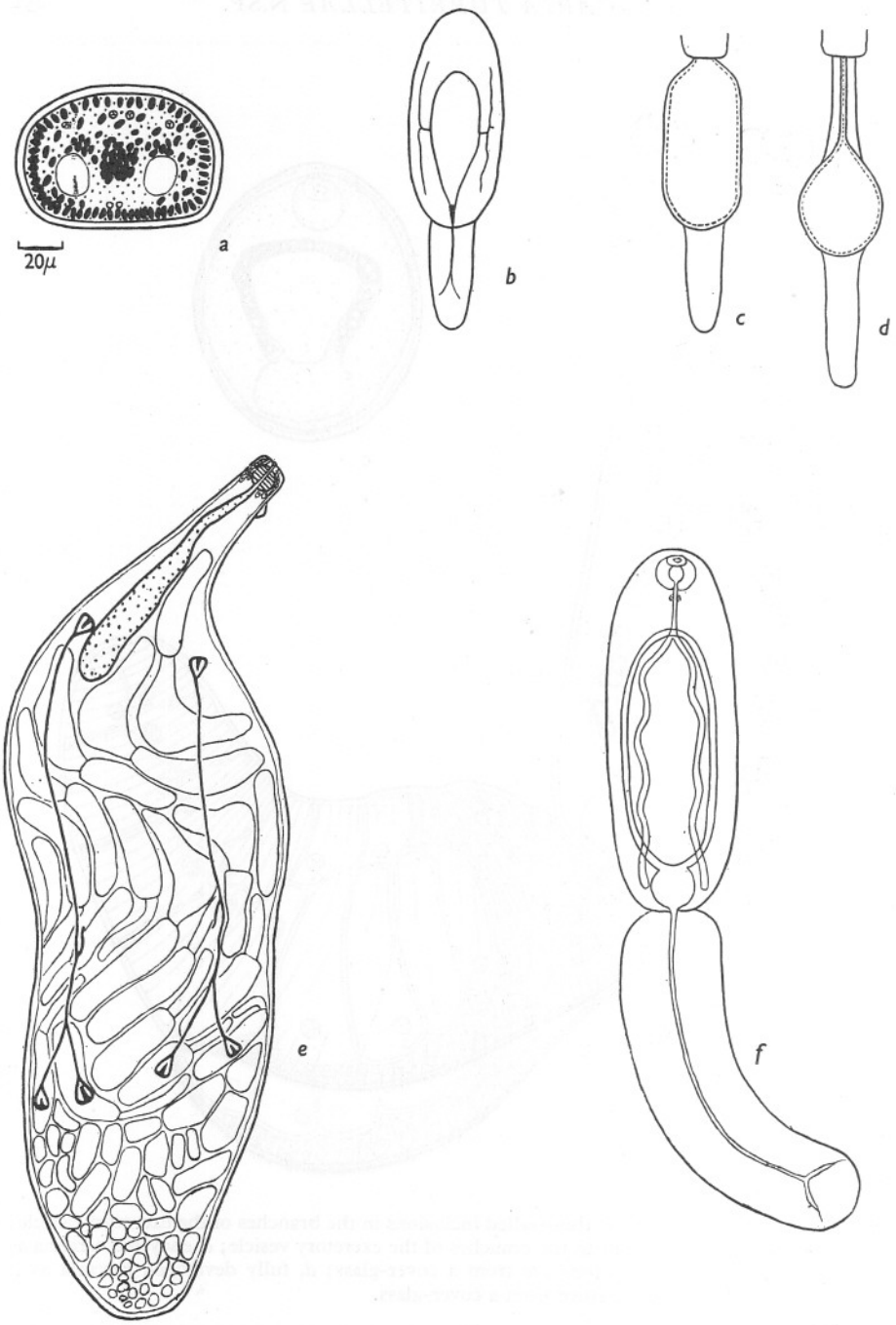

Fig. 2. *Cercaria turritellae*. *a*, transverse section (5 μ) through the body of a fully developed cercaria at a level slightly anterior to the excretory vesicle; *b*, view from ventral side of an immature cercaria showing the type branching of the excretory system in the body and in the tail; *c*, dorsal view of tail showing fin-like ridges as they appear when the tail is contracted; *d*, dorsal view of tail showing fin-like ridges as they appear when the tail is extended; *e*, mature redia showing germ balls, developing cercariae and the excretory system: *f*, immature cercaria showing the digestive tract and part of the excretory system.

half of its length. At that point they curve medially and join together at the mid-dorsal line of the body (Fig. 1*d*). While the cercariae are suspended in the water, the tails are slowly extended and contracted intermittently. This causes a change in the appearance of the fin-like ridges. Fig. 2*c* shows the shape of the ridges in a specimen with a contracted tail, while Fig. 2*d* is a specimen with an extended tail; both figures are views from the dorsal side.

In laboratory containers, immediately after being released from the molluscan host, members of this species rise in the water and float just below the surface film. Later, if the water remains quiet, the cercariae gradually settle to the bottom of the containers. Slight agitation of the water causes the larvae to rise and float for some time after the agitation stops.

A short time after being released, the cercariae begin to secrete a substance which forms large cocoon-like cysts enclosing the larvae completely. These cysts are composed of a thin substance that is translucent except for numerous scattered wart-like knobs which are composed of small rods similar to, but smaller than, those present within the cystogenous glands of the fully-formed cercaria. While within these cysts, the bodies and attached tails continue to extend and contract intermittently.

Sudden pressure of a cover-glass on unencysted cercariae just released from their molluscan host causes decaudation and encystment. These cysts (Fig. 1*c*) are approximately five to six times smaller than the cocoon-like structures previously mentioned. Cysts of ten living specimens produced in this manner measure 118–136 μ in length and 94–108 μ in width.

As was stated previously, there are underneath the cuticle of the body numerous cystogenous glands containing a number of refringent rods. The largest of these rods measure 12 μ in length and almost 2 μ in width. They are evidently cystogenous granules similar to those reported by Sinitsin (1911) and Sewell (1922), as well as by other writers. The cuticle of the body is pierced by numerous small openings, each of which appears to lead into a cystogenous gland.

In living fully formed cercariae well extended under pressure from a cover-glass, a structure evidently representing a small pharynx (Fig. 1*d*) is visible. Only in immature larvae (Fig. 2*f*), in which the cystogenous glands are not so well developed, are the digestive caeca distinguishable. They extend to the posterior end of the body and terminate lateral to the excretory vesicle.

On each side of the oesophagus, a pair of small ducts run forward and open to the exterior in front of the subterminal sucker. Although in serial sections the penetration glands could not be discerned, it seems likely that because of their position these ducts are penetration gland canals. Serial sections (5 μ) of several specimens stained with Ehrlich's haematoxylin and eosin reveal six ducts in addition to those of the lateral branches of the excretory vesicle; however, I was unable to follow their ultimate courses.

Large rounded inclusions within the branches of the excretory vesicle are

very conspicuous structures of mature cercariae. They do not occur in the vesicle itself and in the immature larvae are altogether absent. Usually they exhibit characteristic thick walls (Fig. 1*b*), but thin walls sometimes occur (Fig. 1*a*). Figs. 1*c*, *d* show the thick-walled inclusions as they appear under the dissecting microscope using incident light.

A special effort was made to study the details of the excretory system, but the refringent rods underneath the cuticle of the body obscured the pattern of the excretory system of the mature cercaria; however, there is a possibility that the flame cells occur in groups of three since such a group was observed near the oral sucker (Fig. 1*d*). Immature cercariae revealed the type-branching of the excretory system as shown in Fig. 2*b*. From each lateral branch of the vesicle, a single collecting tubule extends for a short distance before bifurcating into anterior and posterior branches. From the posterior end of the vesicle, a single median tubule passes through the tail and bifurcates as shown in Fig. 2*b*, *f*.

Of the two gastropods infected with *Cercaria turritellae* one was a male 29 mm. long while the other was a female 35·5 mm. long.

Discussion

Sinitsin (1911) described a binoculate monostome, *C. equitator*, with a huge tail. This species was described from *Cerithiolum exille* collected from the Black Sea. Miller (1925*a*) described a similar binoculate monostome, *Cercaria purpuracauda*. It was found in the digestive gland of *Bittium eschrichtii* collected from Puget Sound; later (1925*b* and 1929) he described very briefly four additional species (*Cercaria* F, *Cercaria* T, *Cercaria* U, *Cercaria* W) with eye-spots collected from the Dry Tortugas area. Cable (1952)[1] also reported a magnacercous monostome cercaria with eye-spots from *Turritella exoleata* collected from the marine waters of Puerto Rico. This cercaria, like those reported by Sinitsin and Miller, is an active swimmer. Cable believes this larva, from morphological and ecological observations, is a heterophid trematode belonging to the subfamily Galactosominae.

Cercaria turritellae n.sp. differs conspicuously from the above species by lacking eye-spots, by not being an active swimmer, by having a smaller proportion of tail length to body length (with the possible exception of *Cercaria* W since Miller did not give any measurements for this species) and by having fin-like ridges on the proximal part of the tail. Also, this cercaria differs from *C. equitator*, *C. purpuracauda* and the species reported by Cable by not having spines at the anterior end of the body. Large rounded inclusions which occur in the branches of the excretory vesicle of *C. turritellae* are very conspicuous in the fully formed larva; they have not been reported for other marine 'huge-tailed' monostome larvae.

[1] And personal communication.

REFERENCES

CABLE, R. M., 1952. Studies on marine digenetic trematodes of Puerto Rico. Four species of magnacercous heterophid cercariae with zygocercous aggregation in one. *J. Parasit.*, Vol. 38, p. 28. (Program and abstracts of the 27th annual meeting, Amer. Soc. of Parasitologists.)

MILLER, H. M., 1925*a*. Larval trematodes of certain marine gastropods from Puget Sound. *Publ. Puget Sd Mar. (biol.) Sta.*, No. 5, pp. 75–89.

—— 1925*b*. Preliminary report on the larval trematodes infesting certain mollusks from Dry Tortugas. *Pap. Tortugas Lab.*, Publ. No. 24, pp. 232–8.

—— 1929. Continuation of study on behavior and reactions of marine cercariae from Tortugas. *Pap. Tortugas Lab.*, Publ. No. 28, pp. 292–4.

ROMEIS, B., 1948. *Mikroskopische Technik.* Munchen: Leibniz.

ROTHSCHILD, M., 1935. The trematode parasites of *Turritella communis* Lmk. from Plymouth and Naples. *Parasitology*, Vol. 27, pp. 152–70.

SEWELL, R. B. S., 1922. *Cercaria indicae. Indian J. med. Res.*, Vol. 10 (Suppl. No.) 370 pp.

SINITSIN, D. F., 1911. Parthenogenetic generation of trematodes and its progeny in molluscs of the Black Sea. [English translation of Russian text edited by G. R. La Rue, 1925.] *Mém. Acad. Sci. St.-Pétersb.*, Ser. 8, Vol. 30, pp. 1–127.