NOTES ON LARVAL TREMATODES FROM SEISTAN.

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The following notes on larval trematodes obtained during our visit to Seistan are admittedly very incomplete. In the field it was not possible to follow out the detailed anatomy of the various forms from living specimens and for this, it is to be feared, no subsequent work on preserved material can compensate. My notes are in the main based on preserved cercariae and on sections of infected livers. As a fixative Schaudinn's solution, used hot, was employed; while for staining haematoxylin followed by eosin gave the best results.

In some instances cercariae were obtained in such small numbers that it has not been found possible to give any account of their anatomical characters. Of these one is a Xiphidiocercaria obtained in *Melanoides pyramis* var. *flavida* at Saindak in the extreme west of Baluchistan and the other a furcocercous form with extremely long tail-flukes obtained in *Gyraulus euphraticus* in the Hamun-i-Helmand. Of each of these only a single infection was discovered. The other three forms of cercariae are partially described below. One of them (Cercaria A) is a leptocercous form with rediae resembling those of *Fasciola hepatica*[1]. The other two (Cercaria B and C) are furcocercous forms; one of these (B) bears a close resemblance to the larva of *Schistosoma japonicum*, but is distinguished by a number of characters.

For the names of the molluscan hosts I am indebted to Dr. Annandale and Dr. Baini Prashad (see page 17 of this volume).

Cercaria A (text-figs. 1 *a–c*).

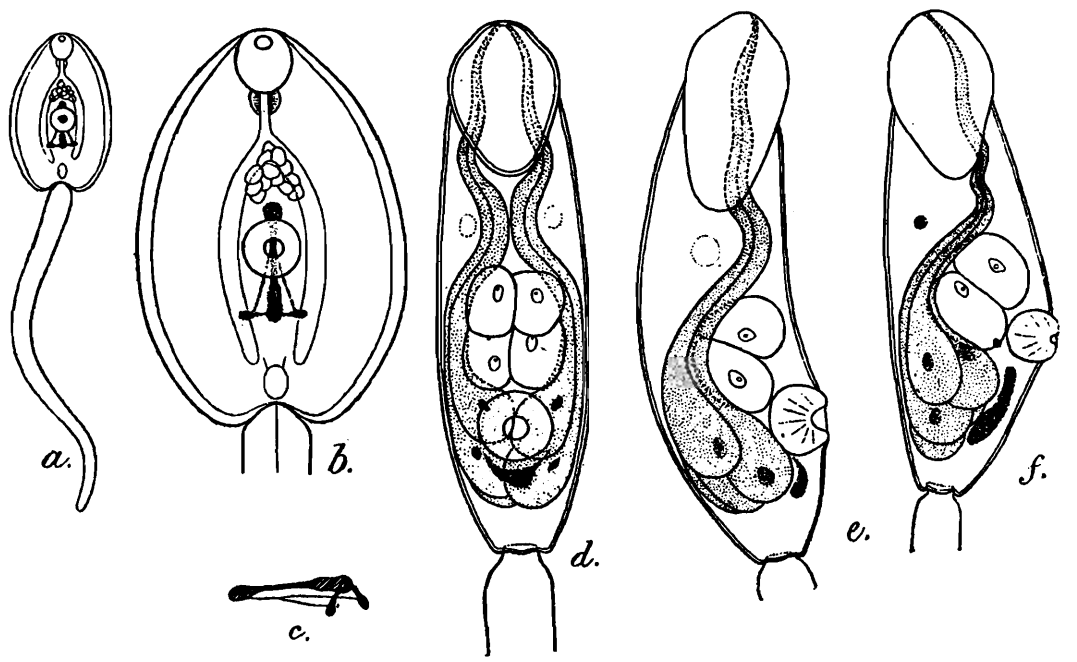
In well-preserved specimens the length of the body is from 290 to 360 μ (average 320 μ) and the breadth 170 to 220 μ (average 200 μ). The tail is twice or more than twice as long as the body, being from 670 to 780 μ in length (average 730 μ).

The body (figs. 1 *a*, *b*) is oval in outline, distinctly excavate posteriorly at the insertion of the tail, and is relatively thick-walled. The oral sucker is about 0·05 mm. in diameter. The acetabulum is approximately the same size and is situated slightly behind the middle of the body. There is a small pharyngeal bulb situated on the undivided anterior portion of the gut close to

1 Erroneously recorded as a monostome on p. 22 of this volume.

the oral sucker. The coeca are long reaching to the distal quarter of the body-length. Near the junction of the coeca there is a cluster of cells which have the appearance of glands, but no ducts leading to the oral sucker were detected in the preserved material. Close to the tail a small bladder can sometimes be observed with traces of a pair of ducts directed anteriorly and one running posteriorly down the middle of the tail.

The most characteristic feature of the anatomy is, however, the partially developed gonad which lies immediately above the acetabulum. The gonad is very conspicuous in stained preparations and in dorsal or ventral view appears T-shaped with a fine strand joining each cross-piece to the stem. In reality the structure is more complex than this view indicates. The principal portion consists of a rod, about twice as long as the diameter



TEXT-FIG. 1.—Cercariae from Seistan.
a-c. Cercaria A. *d-e.* Cercaria B.
f. Cercaria C.

of the acetabulum, which is dilated anteriorly and in its posterior third. At its hinder end a transverse portion, consisting of a slender shaft and swollen head, joins it on either side and each of these portions curves downwards, so that the head itself is on a much lower level than the central rod from which it arises (fig. 1 *c*). From the head of each transverse portion a fine strand runs forward ; the two unite and the single strand so formed meets the dilated anterior part of the main axis on its ventral side. The disposition of the parts, as seen obliquely from the side, is indicated in text-fig. 1 *c*. The structure is remarkably constant in form, showing little variations in fully grown and well preserved individuals.

The space between the gut and the body-wall is filled with large cells which lie with their long axes placed transversely.

The cercariae develop in rediae which, as in those of *Fasciola hepatica*, bear a pair of processes near the hinder end; they reach a maximum length of about 2·5 mm.

Cercaria A was found in specimens of *Limnaea bactriana*, Hutton, living in small irrigation channels close to the British Consulate at Nasratabad in Seistan. Of one hundred molluscs which were examined for parasites nine contained this Cercaria.

Cercaria B (text-figs. 1 *d*, *e*).

This is a furcocercous form which appears to resemble rather closely the larva of *Schistosoma japonicum* as described by Cort.[1]

The body in well-preserved specimens is from 167 to 193 μ in length and the mean of a number of observations is 186. Its breadth varies from 41 to 52 μ, the mean being 48. The undivided part of the tail is from 192 to 222 μ, with mean of 208 μ; the furca are from 62 to 67 μ, with mean of 64 μ.

The oral sucker is from 31 to 33 μ in diameter and the acetabulum from 22 to 23 μ.

The alimentary canal appears to be altogether absent and the body is for the most part filled with large gland cells (figs. 1 *d*, *e*). The four anterior gland cells differ very decidedly in character from the remainder, for in preparations treated with eosin the posterior cells are always very heavily stained, while the four anterior remain colourless. No ducts leading forwards from the four anterior cells could be traced in preserved material, though on analogy with similar forms it is probable that they really exist. The ducts from the posterior cells stain readily with eosin and are very conspicuous. The number of posterior cells appears to be six, making five pairs of cells in all; but two are usually concealed by others which overlie them.

On either side of the ducts from the gland cells, in the anterior half of the body length there is a small semitransparent area which perhaps represents an unpigmented eye-spot. Posterior to the acetabulum the beginnings of the gonad are visible, consisting of a mass of cells which is usually crescentic in form when seen in dorso-ventral view.

This cercaria, so far as can be seen from preserved material, seems akin to that of *Schistosoma japonicum* or, more nearly, to the very closely allied form from Bengal recently described by Major Sewell (*loc. cit.*). There are, however, marked differences. In the Seistan cercaria the tail-flukes appear proportionately shorter, the acetabulum larger and unpigmented eye-spots are perhaps present. No trace of the gut could be found, nor of teeth on the anterior sucker.

Cercaria B was found in specimens of *Gyraulus convexiusculus* (Hutton) obtained in the Hamun-i-Helmand, Seistan. Forty-three

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[1] Cort, *Univ. Calif. Publ. Zool.*, XVIII, p. 485 (1919); see also Sewell, *Rec. Ind. Mus.*, XVI, p. 425 (1919).

G. convexiusculus were examined of which three contained examples of the parasite.

Cercaria C (text-fig. 1 *f*).

The cercaria is a furcocercous form, similar in most respects in its internal anatomy to Cercaria B. It is, however, a much larger form and possesses pigmented eye-spots.

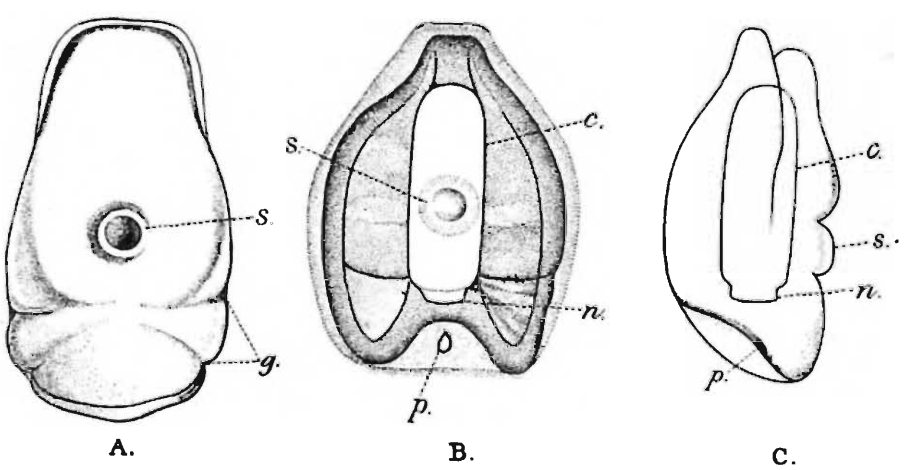
In well-preserved specimens the body is from 188 to 230 μ in length and from 56 to 80 μ in breadth, the mean of a number of observations being 206 by 70. The undivided part of the tail is from 247 to 360 μ, with mean of 305, and the furca are from 106 to 136 μ, with mean of 120.

The internal anatomy, so far as it can be made out, is very similar to that of Cercaria B; the same gland cells are to be seen and in stained specimens the four anterior cells differ in the same way from those placed further back. The gonad, however, is not crescentic in dorso-lateral view, the acetabulum is smaller and the eye-spots are deeply pigmented and black in colour.

This cercaria was found with the preceding in specimens of *Gyraulus convexiusculus* (Hutton) obtained in the Hamun-i-Helmand, Seistan. Two molluscs, out of forty-three which were examined, contained examples of the parasite.

ADDENDUM.

With Dr. Kemp's permission I add here three figures of the parasite of *Schizothorax zarudnyi* referred to by Mr. S. L. Hora



TEXT-FIG. 2.—Parasite from *Schizothorax zarudnyi*.

and myself on p. 173 of this volume. The figures have been placed at my disposal by Major R. B. Seymour Sewell, I.M.S. and represent three views of the animal as seen as a solid object (A) and mounted in glycerine (B & C) after extraction from the cysts in the muscles of the fish. Their magnification is not stated, but it is at least 12 as reproduced. The structure of the organism is so enigmatic that none of us are able even to suggest its taxonomic position. The preservative had apparently failed to penetrate the

peculiar cylinder in the interior of the animal and sections were a complete failure. Major Sewell notes in explanation of his figures that there is a more or less well-defined groove round what appears to be the anterior extremity and sucker-like disc (*s*) in the middle of the (?) ventral surface. The (?) posterior part of the organism is divided by faint grooves (*g*), as shown in fig. A. These are visible only on the (presumed) ventral surface. On the dorsal surface, near the posterior extremity, there is a small aperture (*p*). The outer parts seem to form a kind of test, lined by a thin membrane, and inside this there is a cylindrical body (*c*) with an apparently chitinous investment. At the end nearest the (?) dorsal grooves the extremity of this body is contracted to form a collar (*n*). Though the specimens had been fixed in Schaudinn's fluid and were apparently well preserved, no further structure could be made out.—*N. Annandale.*