

Indosolenorchis hirudinaceus Crusz, 1951
(Platyhelminthes; Digenea) from the Dugong,
Dugong dugon (Müller) (Mammalia; Sirenia)

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SUMMARY. *Indosolenorchis hirudinaceus* Crusz, 1951 from the caecum and large intestine of the dugong (*Dugong dugon* Müller) is redescribed from specimens from the Red Sea, East Africa, Sri Lanka, Japan, Indonesia and Australasia. Specimens described by Dollfus (1950) as *Zygocotyle* species are referred to *Indosolenorchis hirudinaceus*. There is some doubt concerning the identity of the genus *Solenorchis* as described by Hilmy (1949), but for the time being, it seems best to retain *Solenorchis* and *Indosolenorchis* as separate genera.

Redescription d'*Indosolenorchis hirudinaceus* Crusz, 1951, parasite du caecum et du gros intestin du Dugong (d'après des spécimens de la Mer Rouge, d'Afrique Orientale, de Sri Lanka, du Japon, d'Indonésie et d'Australasie).

RESUME. *Zygocotyle* sp. Dollfus, 1950 est attribué à *I. hirudinaceus*. L'identité du genre *Solenorchis*, tel qu'il est décrit par Hilmy, 1949, soulève quelques doutes. Il semble cependant préférable actuellement de conserver l'individualité de *Solenorchis* et d'*Indosolenorchis*.

Indosolenorchis hirudinaceus Crusz, 1951 was described on the basis of four specimens from the caecum of a dugong from Sri Lanka (Ceylon). Since then the species has been recorded twice, once more from Sri Lanka (Crusz and Fernand, 1954) and once from Indonesia (Allen *et al.*, 1976). A collection of *Indosolenorchis*

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hirudinaceus from Australian dugongs has been made by the present author, and workers in other parts of the world have supplied specimens for comparison. As material is now available from widely separated parts of the geographical range of the dugong, it is appropriate to redescribe the species and add new geographical records.

Materials and Methods

Indosolenorchis hirudinaceus was amongst the species of parasitic worms collected from Australian dugongs by the author and members of the dugong research group at James Cook University of North Queensland. Preservation methods varied somewhat, according to the circumstances, but the favoured method was to kill and relax worms using hot (80 °C) water, then fix in formalin between sheets of filter paper to hold the specimens flat. Worms were thus subject to very little compression during fixation.

Whole mounts were stained in Gower's carmine, dehydrated in an alcohol series and cleared in methyl benzoate or cedar-wood oil. They were then examined in the clearing agent, or mounted in Canada balsam. Sagittal and transverse sections were cut at 8 microns and stained with haematoxylin and eosin.

For reconstruction of the excretory system, successive sections were drawn on cellulose acetate paper using a drawing tube. The drawings were then superimposed on one another to enable the structures to be visualised.

Host animals examined by the dugong research group at James Cook University are referred to in the text by their accession numbers, prefixed by the letters MM. Dugongs examined by the Dugong Project, Wildlife Division, Department of Lands and Environment, Papua New Guinea, came from Daru Island, Gulf of Papua, and are acknowledged by their Dugong Project code number.

Indosolenorchis hirudinaceus Crusz, 1951

(Fig. 1-4, Table I)

HOST: *Dugong dugon* (Müller).

LOCATION IN HOST: Caecum and proximal large intestine, doubtfully in stomach.

GEOGRAPHICAL DISTRIBUTION: Red Sea (Gulf of Elat = Gulf of Aqaba) (new record); East Africa (Djibouti, recorded as *Zygocotyle* by Dollfus, 1950; Mombasa (Kenya) (new record); Indonesia (South Sulawesi); Papua New Guinea (Gulf of Papua) (new record); Australia (east coast of Queensland and Gulf of Carpentaria) (new record *); Japan (Okinawa) (new record); Sri Lanka (Gulf of Mannar).

(*) Mackerras (1958) in her 'Catalogue of Australian Mammals and their recorded internal parasites', included extra-territorial records of parasites of the Dugong. *I. solenorchis* was listed here, but presumably had not been recovered from Australian dugongs at that time. The record of *I. hirudinaceus* and of *Solenorchis* spp. from Australia in Yamaguti (1971) was probably from this source.

MATERIAL EXAMINED.

As whole mounts:

- 5 specimens from dugong MM 111 (female, Mornington Island, Gulf of Carpentaria, Australia, 13 July, 1976).
- 10 from MM 126 (male, Townsville, Australia, 10 October, 1976).
- 1 from MM 129 (female, Mornington Island, 11 November, 1976).
- 10 from dugong caught accidentally at Okinawa, Japan, 18 January, 1979 and died at Nago Aquarium, Okinawa, 22 February, 1979.
- 3 from dugong from Marsa el Mugeibila, Gulf of Elat, Red Sea, 19 June, 1971 (dugong No. 1 of Lipkin, 1975).
- 3 from dugong from Sharm esh Sheik, Red Sea, 4 March, 1976 (dugong No. 6 of Lipkin, 1975).
- 1 from Daru dugong 005 (Daru Island, Gulf of Papua, July, 1978).
- 2 from dugong from Djibouti, collected by Dr. Chabaneix, 1901, identified as *Zygocotyle* sp. by Dollfus (1950). In collection of Muséum National d'Histoire Naturelle, Paris.
- 3 from dugong from Pothondo, South Sulawesi, Indonesia, 1975, identified as *Solenorchis travassosi* Hilmy, 1949 by Dr. J.R. Palmeri and Purnomo. United States National Museum Collection number 74969.

As sagittal serial sections:

- 1 specimen from dugong MM 126 (details above).
- 4 from MM 129 (details above).
- 1 from MM 133 (male, Mornington Island, 21 April, 1977).
- 3 from dugong caught accidentally at Okinawa (details above).
- 2 from dugong No. 1 of Lipkin, 1975 (details above).
- 1 from dugong No. 6 of Lipkin, 1975 (details above).
- 1 from Daru dugong 011 (Daru Island, Gulf of Papua, July, 1978).
- 1 from dugong from South Sulawesi, Indonesia, 1975.
- 3 from dugong from Mombasa, Kenya, collected by Amberson and Schwarz, 1948, identified as *Solenorchis travassosi* by Sey. United States National Museum Helminth Collection number 54630.
- 2 from dugongs from Sri Lanka, 1950 and 1952. In collection of H. Cruz.

As transverse serial sections:

- 2 specimens from dugong MM 126 (details above).
- 1 from MM 129 (details above).

SPECIMENS DEPOSITED IN MUSEUMS:

South Australian Museum, Adelaide, South Australia:

- 10 specimens from MM 129 (details above) in formalin (registration number V 2107-V 2116); 3 from MM 126 (details above) as whole mounts (V 2118-V 2120); 1 from MM 126 as sagittal sections (V 2117).

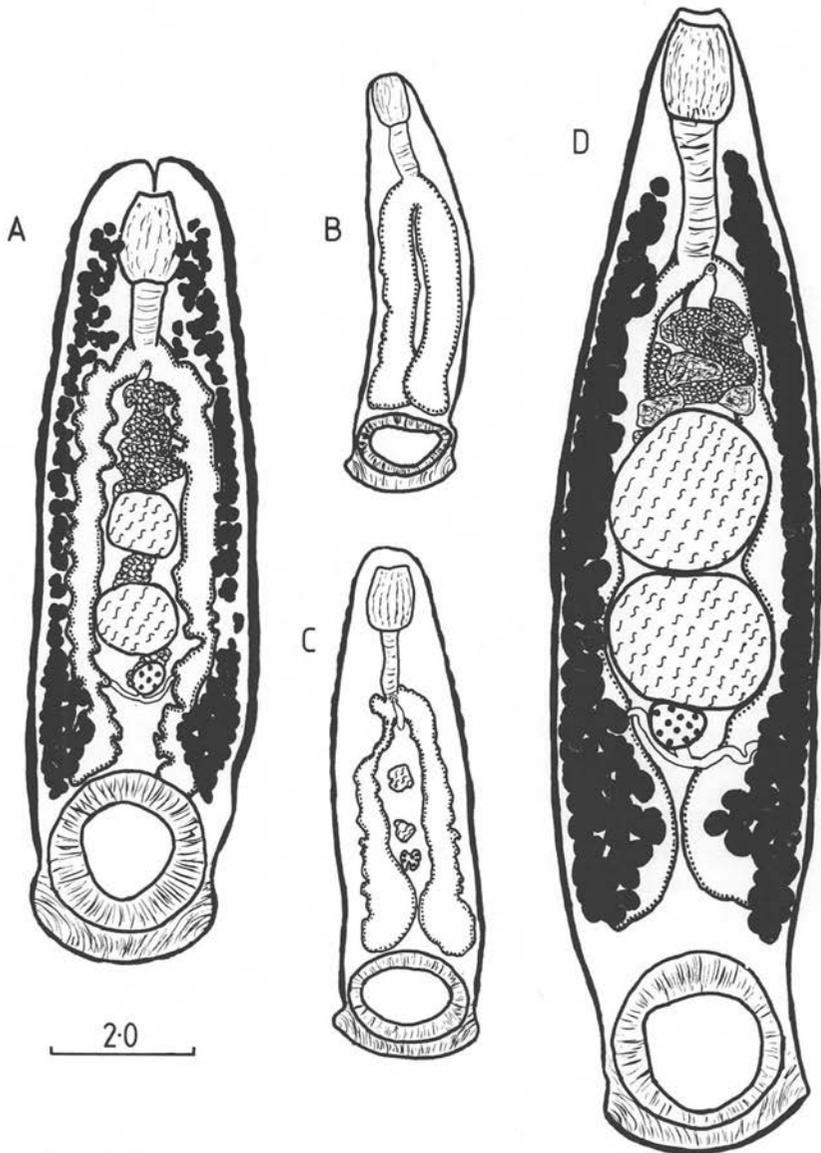


Fig. 1. *Indosolenorchis hirudinaceus*; whole mounts, all to same scale. A, specimen from dugong MM 129 (Mornington Island, Gulf of Carpentaria, Australia, 11 Nov. 1976); B, C, immature specimens from dugong MM 111 (Mornington Island, 13 July 1976); D, specimen from dugong captured accidentally at Okinawa, Japan, 18 Jan. 1979, died at Nago Aquarium, Okinawa, 22 Feb. 1979.

Meguro Parasitological Museum, Tokyo:

5 specimens from dugong caught accidentally at Okinawa (details above), stained in Gower's carmine, cleared in methyl benzoate and stored in cedarwood oil; 3 from MM 129 (details above) in formalin; 1 from MM 129 as sagittal sections.

United States National Museum Helminth Collection:

3 specimens from MM 129 (details above) in formalin (U.S.N.M. Helm. Coll. n° 75835).
2 from MM 126 (details above) as whole mounts (U.S.N.M. Helm. Coll. n° 75834).
1 from MM 129 as sagittal section (U.S.N.M. Helm. Coll. n° 75835).

Muséum National d'Histoire Naturelle, Paris :

3 specimens from MM 129 (details above) in formalin.
2 from MM 126 (details above) as whole mounts.
1 from MM 129 as sagittal sections.

British Museum (Natural History):

3 specimens from MM 129 (details above) in formalin.
2 from MM 126 (details above) as whole mounts.
1 from MM 129 as sagittal sections (Registration numbers of all specimens, 1980, 3.31, 1-10).

DESCRIPTION.

Body shape.

The body is elongate, displaying a variable but slight degree of dorso-ventral flattening, generally slightly concave ventrally and convex dorsally (*fig. 1 A, B, C and D*). Specimens fixed in a contracted state tend to be broadest at the equator. Specimens fixed in an extended condition or immature specimens are often broadest at the acetabulum.

Acetabulum.

The acetabulum is round, relatively large and directed ventrally. Posterior to it, and forming the posterior extremity of the body, is a post-acetabular lip. This contains strong oblique muscle fibres running in the antero-dorsal to postero-ventral plane. Other oblique fibres run at right angles to these, and a scattering of small transverse fibres lie along the posterior margin of the lip.

The main elements of the acetabulum musculature, as seen in sagittal sections (*fig. 2 B*) are the radial muscles and the antero-dorsal muscular cushion. The radial muscle fibres are dense and uniform along the length of the sucker. The muscular cushion occurs only along the anterior proximal edge of the sucker and consists of very dense fibres running in a dorso-ventral plane and inserting at each end on to the exterior boundary layer of the sucker. Circular muscle layers are present anteriorly and posteriorly both along exterior and interior margins. These are generally not well developed, but the exterior layer is more conspicuous than the

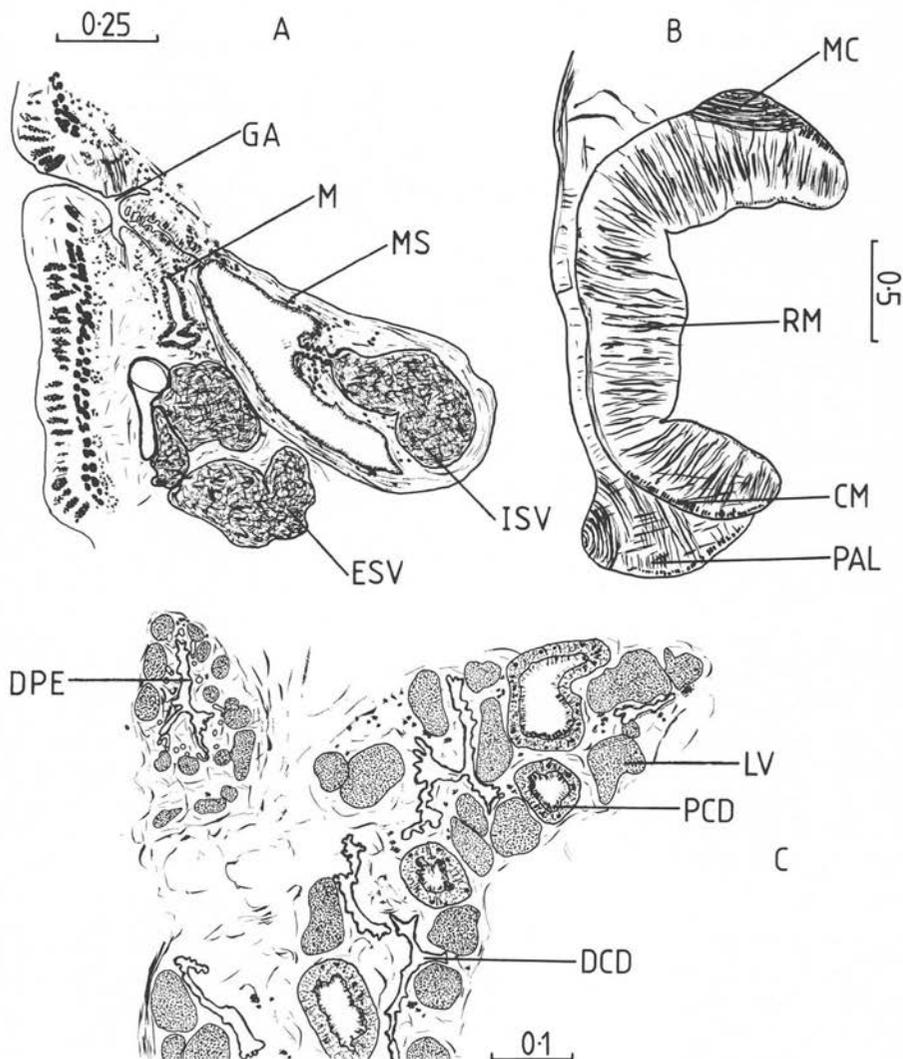


Fig. 2. *Indosolenorchis hirudinaceus*; A, sagittal section through terminal genitalia; B, sagittal section through acetabulum; C, sagittal section through region of coiled excretory duct.

Key to legend: CM, circular muscle layer; DCD, distal coiled excretory duct; DPE, excretory duct just prior to entry to bladder; ESV, external seminal vesicle; GA, genital atrium; ISV, internal seminal vesicle; LV, lymphatic vessel; M, metraterm; MC, antero-dorsal muscular cushion; MS, muscular sac; PAL, post-acetabular lip; PCD, proximal coiled excretory duct; RM, radial muscle layer.

interior. Consistent counts could not always be made, but where these were possible, the anterior exterior layer peripheral to the muscular cushion contained 30-39 bundles of fibres, and the posterior exterior layer 47-59.

A conspicuous ribbon of longitudinal muscle fibres, lying in the dorso-ventral plane, runs along the body on each side lateral to the gonads and medial to the caeca. Posteriorly, each inserts on the acetabulum in the region of the muscular cushion. Anteriorly, they terminate at the intestinal bifurcation, but a number of fibres run radially and anteriorly to provide attachment to the tegument.

Digestive tract.

The oral opening is terminal at the anterior end and passes almost immediately into the pharynx. The pre-pharynx is quite muscular but appears to be derived simply from the tegument. The pharynx lumen is transversely broad and gives off a pair of lateral diverticula close to its posterior end. The entrances to the diverticula are generally very narrow and may be difficult to find in sections. The degree of dilation of the diverticula is variable. Although they often form an almost spherical cavity, they may also be very narrow and inconspicuous (*fig. 3 A, B*). The diverticula cannot be seen easily in whole mounts and do not project beyond the pharynx.

A sphincter is present at each of the pharynx (*fig. 3 C*), that at the posterior end being more developed. The interior circular layer of muscles is very poorly developed. A middle circular layer is present but is not very conspicuous. An exterior circular layer is only present at or posterior to the equator. A basal circular layer is well developed at the level of the posterior sphincter. A rather poorly developed interior longitudinal layer divide close to the posterior sphincter and fibres pass on either side of the sphincter.

A muscular oesophagus leaves the posterior end of the pharynx and passes a short distance posteriorly then dorsally into a rounded oesophageal bulb (*fig. 3 C*). At the point where the oesophagus turns dorsally, its lumen is narrowed by a particularly well developed region of circular muscle fibres, presumably acting as a sphincter. The oesophagus and its bulb are surrounded externally by a layer of gland cells. The lumen of the oesophagus and bulb is bounded by a convoluted layer of 'frothy' cells. The gut caeca arise laterally from the oesophageal bulb. The form of both the bulb and the caeca arising laterally from it vary according to the extent of dilation of the caeca, and this in turn depends on the fixation and condition of the specimen.

The caeca follow a more-or-less direct course to terminate just anterior to the acetabulum. They lie lateral to the testes, ovary and uterus, and largely medial to the vitellaria. The topography of the gut caeca varies considerably according to the age of the specimens and the way in which they were treated. In Australian specimens, which were generally fixed without compression, the caeca are relatively narrow, slightly sinuous, converge slightly posterior to the ovary, then diverge and are sometimes dilated at their ends. In immature specimens, the caeca are generally more conspicuous than in adults.

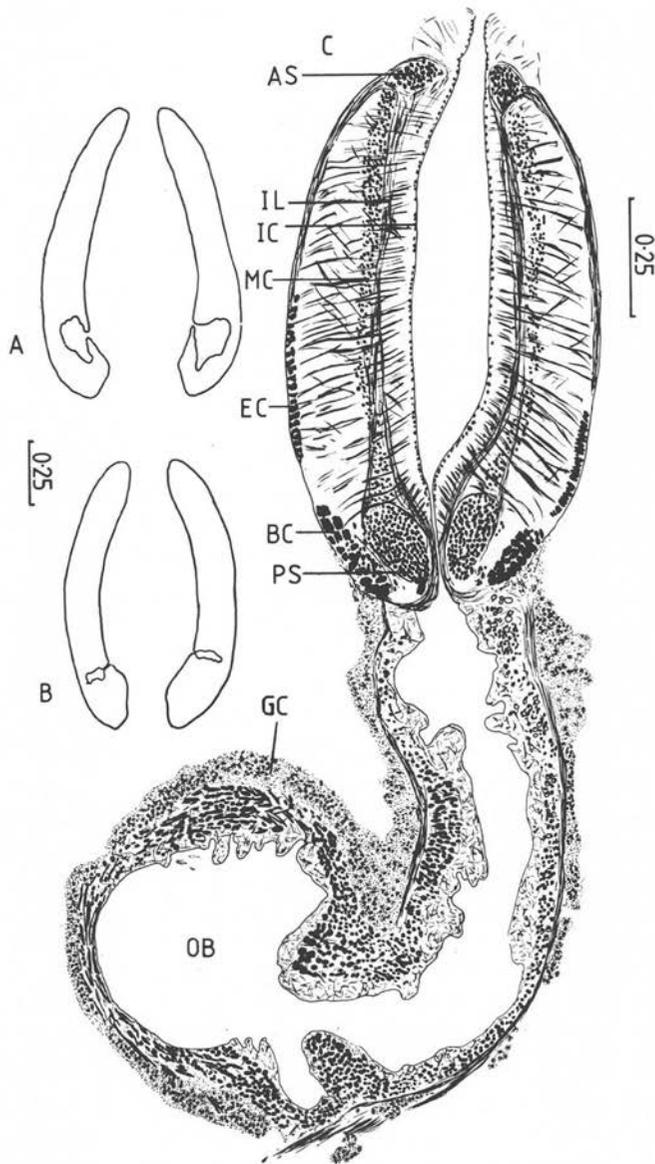


Fig. 3. *Indosolenorchis hirudinaceus*; A, B, diagrams reconstructed from horizontal longitudinal sections through pharynx to show variations in size of pharyngeal diverticula; C, sagittal section through pharynx, oesophagus and oesophageal bulb.

Key to legend: AS, anterior sphincter; BC, basal circular muscle layer; EC, exterior circular muscle layer; GC, glandular cells; IC, interior circular muscle layer; IL, interior longitudinal muscle layer; MC, middle circular muscle layer; OB, oesophageal bulb; PS, posterior sphincter.

Excretory system.

The principal components of the excretory system (*fig. 4*) are a pair of longitudinal collecting ducts which unite with a coiled duct posteriorly, and which, in turn, enters the excretory bladder located between the testes. The excretory opening is mid-dorsal between the testes.

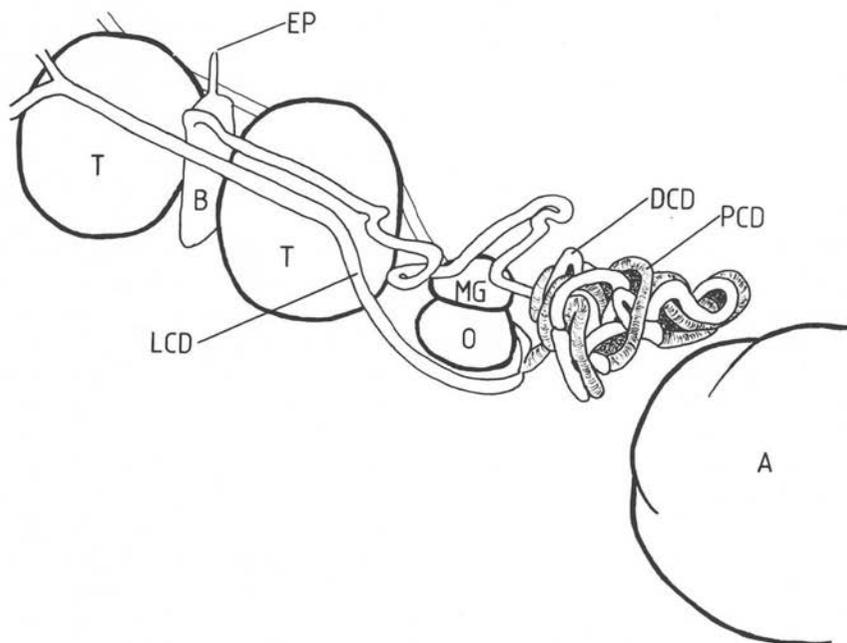


Fig. 4. *Indosolenorchis hirudinaceus*; diagram of main components of excretory system. Key to legend: A, acetabulum; B, bladder; DCD, distal coiled excretory duct; EP, excretory pore; LCD, longitudinal collecting excretory duct; MG, Mehlis' gland; O, ovary; PCD, proximal coiled excretory duct; T, testis.

In sections, the walls of the longitudinal ducts are quite thin, but contain nuclei. In intimate association with these ducts are numerous lymphatic vessels, recognised by their finely granular eosinophilic contents (Crusz, 1951; Cheng, 1966). Each longitudinal collecting duct arises ventro-laterally close to the pharynx where it receives two or three small tributaries draining this region. Each duct then passes dorso-medially to receive another tributary, then posterad dorso-lateral to the testes before turning ventrad to a point immediately posterior to the ovary. Here the longitudinal ducts unite and give off a long, tightly coiled duct occupying much of the space between the caeca, posterior to the ovary and antero-dorsal to the acetabulum. In sections (*fig. 2 C*), the proximal half of the coiled duct, originating at the union of the

longitudinal ducts, is seen to be bounded by a thick cellular wall and may have a ciliated lining. By contrast, the distal half of the duct is thin walled and often appears collapsed. The change in histology between proximal and distal portions of the duct occurs dorsal to the anterior edge of the acetabulum. Numerous lymphatic vessels occur in the region of the coiled duct. The distal part of the coiled duct emerges from the coiled region and is transversely looped once or twice, dorsal or postero-dorsal to the ovary, before passing round one side of the second testis to enter the bladder dorsally. The wall of the bladder resembles that of the distal coiled duct and has numerous lymphatic vessels associated with it. An additional network of structures resembling narrow tubes lies around the wall of the bladder and distal duct after it emerges from the coiled region.

The details of the lymphatic system were not studied.

Male reproductive system.

The testes are quite large, tandem in the middle third of the body, generally spherical and unlobed, but may be slightly irregular in shape. A sperm duct leaves the anterior face of the second testis and passes anteriorly round one side of the first testis. The sperm duct from the first testis leaves the posterior face of this testis and passes round the side of the testis opposite the other sperm duct. The two ducts unite at the start of the convoluted external seminal vesicle which lies in the middle region of the body between the first testis and the genital pore. In one case the external seminal vesicle was seen to give off a blind diverticulum dorsally. The male terminal genitalia are enclosed in a pyriform muscular sac (*fig 2 A*). The muscular internal seminal vesicle is attached for over half of its area to the inner wall of this sac. A narrow, muscular duct passes from the seminal vesicle into the main lumen of the sac. Dark staining, possibly glandular, cells line the lumen close to the opening from the internal seminal vesicle, but otherwise there is no evidence of a prostatic region. The lumen wall appears to bear small hairs or cilia. There is nothing in the structure of the muscular sac to suggest that an eversible cirrus is contained here. A narrow, muscular duct passes from the lumen of the sac and opens through a genital papilla into the genital atrium located in the midline at, or immediately posterior to, the intestinal bifurcation. There are no sphincters around the atrium, and no genital sucker.

Female reproductive system.

The ovary is rounded, median, ventral, immediately posterior to the second testis. The oviduct arises on the dorsal side of the testis and passes directly into the Mehlis' gland where it receives the Laurer's canal and the common vitelline duct before entering the ootype. The Laurer's canal opens on the dorsal surface, dorsal to the ovarian mass. There is no seminal receptacle. The vitelline follicles are rounded in mature specimens, arranged in a lateral field on each side from the level of the pharynx to the anterior end of the acetabulum, extending further towards the midline at each end of the field. The common yolk duct is formed by the union of a

yolk duct from each side immediately posterior to the ovary. The common duct passes dorsally into the Mehlis' gland where it is dilated as a vitelline reservoir for part of its length. The uterus arises from the postero-ventral side of Mehlis' gland and passes dorsally, then anteriorly, dorsal to the testes. Throughout its length, it remains medial to the caeca. Anterior to the first testis it is looped extensively before emerging via a short metraterm on the genital papilla immediately posterior to the male opening. Eggs oval, operculate, non-embryonated.

Discussion

1 — Variability within *Indosolenorchis hirudinaceus*.

A glance at Table 1 shows that dimensions of *I. hirudinaceus* appear to vary quite substantially across its geographical range. For example, there is no overlap in length between Australian specimens and those from the Red Sea. However, accurate assessment of size variation within the species is difficult due to the differing and generally unspecified fixation treatments given to the specimens by various workers. In addition, specimens were probably of differing degrees of freshness when collected. The histological appearance of worms from the Red Sea suggest that they had been dead for some time before fixation. This was confirmed by Lipkin (*in litt.*) who stated that the host animals had been dead for up to 7 days before parasites were collected. In these worms, the caeca were greatly swollen and the gonads had been squeezed out of shape and appeared partly decomposed. Nevertheless, structures characteristic of the species could be seen.

The size and musculature of the acetabulum and pharynx, the form of the terminal genitalia and the dimensions of the egg are all quite constant throughout the range of the species. There is no need to recognise more than one species within the genus *Indosolenorchis*.

2 — Comparison with the description by Cruz.

Cruz (1951) gave a careful, detailed description of *I. hirudinaceus*. However, there are a number of points in which his interpretation of structures differed from that of the present author.

In his Figure 7, Cruz shows a cirrus sac virtually identical with that seen by the present author in several specimens. There is a muscular internal seminal vesicle opening through a narrow passage into a second cavity. This second cavity was termed a cirrus by Cruz. However, a cirrus is an eversible structure and there must be a second lining within the cirrus sac to make eversion possible. It is difficult to see how the 'cirrus' of *I. hirudinaceus* could be made to evert. It therefore seems inappropriate to term the muscular sac enclosing the male terminal genitalia a cirrus sac.

Table I. — *Indosolenorchis hirudinaceus* principal measurements (mature specimens)

	Australia (MM 126)	Japan	Red Sea
Body length	8.0 — 12.0 (9.9 ; n = 9)	10.13 — 15.75 (13.76 ; n = 10)	12.87 — 18.23 (15.21 ; n = 6)
Body width	1.9 — 3.46 (2.76 ; n = 9)	2.60 — 4.45 (3.67 ; n = 10)	3.09 — 4.80 (3.84 ; n = 6)
Acetabulum length ..	1.66 — 2.62 (2.15 ; n = 9)	1.90 — 2.76 (2.34 ; n = 10)	2.04 — 3.04 (2.55 ; n = 6)
Acetabulum width ..	1.59 — 2.64 (2.15 ; n = 9)	1.82 — 2.62 (2.43 ; n = 10)	2.20 — 2.93 (2.67 ; n = 6)
Pharynx length	0.86 — 1.25 (1.02 ; n = 9)	0.79 — 1.34 (1.17 ; n = 9)	1.01 — 1.29 (1.17 ; n = 5)
Pharynx width	0.60 — 1.02 (0.83 ; n = 9)	0.78 — 1.1 (0.98 ; n = 9)	0.94 — 1.21 (1.01 ; n = 5)
Oesophagus length ..	0.90 — 1.48 (1.26 ; n = 6)	1.48 — 2.12 (1.91 ; n = 9)	1.52 — 1.70 (1.54 ; n = 5)
1st testis length	0.57 — 1.24 (0.90 ; n = 9)	1.03 — 2.25 (1.97 ; n = 10)	—
1st testis width	0.64 — 1.13 (0.95 ; n = 9)	1.01 — 2.22 (1.92 ; n = 10)	—
2nd testis length	0.57 — 1.17 (0.86 ; n = 9)	1.01 — 2.22 (1.83 ; n = 10)	—
2nd testis width	0.58 — 1.25 (0.89 ; n = 9)	0.82 — 2.54 (1.90 ; n = 10)	—
Ovary length	0.30 — 0.48 (0.40 ; n = 8)	0.42 — 0.71 (0.62 ; n = 10)	—
Ovary width	0.26 — 0.55 (0.40 ; n = 8)	0.42 — 0.73 (0.65 ; n = 10)	—
Vitellarium length	0.11 — 0.19 (0.16 ; n = 9)	0.19 — 0.40 (0.30 ; n = 10)	0.21 — 0.53 (0.28 ; n = 4)
Vitellarium width	0.12 — 0.22 (0.16 ; n = 9)	0.18 — 0.40 (0.33 ; n = 10)	0.21 — 0.52 (0.28 ; n = 4)
Egg length	0.12 — 0.13 (— n = 10)	0.14 (— n = 10)	0.13 — 0.14 (— n = 10)
Egg width	0.08 — 0.09 (— n = 10)	0.09 (— n = 10)	0.09 (— n = 10)

In broad outline, the present author agrees with the structure of the excretory system given by Crusz. However, there are interpretive differences concerning the posterior coiled duct. Crusz recognised only a single blind-ending diverticulum whereas the present author found that the coiled duct was not blind-ending but turned back on itself. The distal coiled duct is relatively inconspicuous and could easily be overlooked. In sagittal sections of specimens from Sri Lanka borrowed from Crusz, both the proximal and distal duct are visible. However, the specimens are not in excellent condition and the thin-walled distal duct is difficult to see.

The median muscular mass reported by Crusz to run from the muscular cushion on the acetabulum to the region of the ovary was interpreted by the present author as a pair of muscle bands running lateral to the gonads from the acetabulum to the intestinal bifurcation. Crusz mentioned and figured (*fig. 3 and 4*) an internal radial muscle layer in the oesophagus and oesophageal bulb. This region appears to correspond with the layer of non-muscular 'frothy' cells observed by the present author. In material borrowed from Crusz, a thin layer of non-muscular cells occurs between the lumen and the muscle fibres.

3 — Comparison of *Indosolenorchis hirudinaceus* with related species.

Indosolenorchis belongs to the subfamily Solenorchiinae Hilmy, 1949. Hilmy erected this subfamily to contain four species of his new genus *Solenorchis* from a dugong from the Red Sea. *Solenorchis* differs from *Indosolenorchis* in lacking diverticula within the pharynx, an oesophageal bulb, 'cirrus sac' and Laurer's canal.

Dollfus (1950) gave a very brief description of a paramphistome from a dugong from Djibouti. He placed this worm in the genus *Zygocotyle*, but did not give it a specific name as his specimens were poorly preserved and he had not been able to obtain histological sections. Of the original six specimens examined by Dollfus, only two, both whole mounts, appear to be extant and these are now in the Museum National d'Histoire Naturelle in Paris. The two specimens are in poor condition, but pharyngeal diverticula are visible within the walls of the pharynx and an oesophageal bulb can be seen. These characters are thought sufficient to merit inclusion of the specimens in *Indosolenorchis hirudinaceus*. There is no sign of the large pharyngeal diverticula figured by Dollfus as extending beyond the pharynx. He may have misinterpreted muscle bands running postero-laterally from the pharynx as extensions of the diverticula outside the pharynx.

In a note added in proof to the same paper, Dollfus (1950) reported seeing the paper by Hilmy (1949). He stated that all four of Hilmy's species were identical with that described by himself and should be placed in the genus *Zygocotyle*. His reasoning is difficult to follow, as the excretory bladder lies between the testes in *Solenorchis* and posterior to them in *Zygocotyle*. In 1955, Dollfus further suggested that *Indosolenorchis hirudinaceus* was also a synonym of *Zygocotyle* sp. As he gave no justification for this, his opinion cannot be given much credence. Presumably following Dollfus, Baer and Joyeux (1961) listed *Indosolenorchis* as a possible syno-

nym of *Solenorchis*, and placed the latter in the subfamily Zygoctyinae. Mettrick (1958) suggested that the *Solenorchis* species should be referred to *Zygoctyle lunata*.

Whereas it is certain that *Solenorchis* and *Indosolenorchis* are distinct from *Zygoctyle* and merit a subfamily to themselves, it is less certain that *Solenorchis* and *Indosolenorchis* are distinct from one another. It is significant that all specimens examined by the present author, including specimens from close to the type locality for *Solenorchis*, belong unmistakably to *Indosolenorchis*. The described differences between the two genera are quite considerable. However, in the experience of the author, none of the distinguishing features (i.e. pharyngeal diverticula, 'cirrus sac', oesophageal bulb and Laurer's canal) can be seen easily or consistently in whole mounts. Hilmy apparently had only a few specimens (although Gohar, 1957, reported *Solenorchis* to be quite common in the Red Sea dugong) and could not have sectioned many of these. It is possible that he failed to observe the structures which Crusz later used to characterised the genus *Indosolenorchis*. Efforts to trace type material of *Solenorchis* have failed. As it does not seem advisable to synonymise the two genera without sight of the types, both must be retained for the time being. The present author agrees with Dollfus (1950, 1955) that all of Hilmy's *Solenorchis* species should be placed under the name of its type species, *S. travassosi*.

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