Redescription of the African duck leech *Theromyzon cooperi* (Harding, 1932) (Hirudinea: Glossiphoniidae)

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The African duck leech *Theromyzon cooperi*, which is the only representative of the genus so far reported in Africa, is redescribed. Aspects of its internal morphology are described for the first time. The conspecificity of the two supposed species *T. cooperi* and *T. lineatum* is also indicated.

Die eendbloedsuier *Theromyzon cooperi*, wat tot dusver die enigste verteenwoordiger van die genus is wat vir Afrika aangemeld is, word herbeskryf. Die inwendige morfologie van hierdie bloedsuier word vir die eerste keer beskryf en die gelyksoortigheid van die gewaande twee verskillende spesies *T. cooperi* en *T. lineatum* word aangedui.

Introduction

At present 14 species, occurring in different parts of the world, are recognized under the genus *Theromyzon* and are separated by the number of annuli between the gonopores and/or their geographic origin. However, great uncertainty exists about the authenticity of some described species and there are indications that some distinct species have been overlooked. The urgent need for information on internal morphology to establish the real specific components in the genus is emphasized by the findings of Oosthuizen & Davies (1992) in their current study of North American duck leeches.

The original descriptions of *Theromyzon cooperi* by Harding (1932) and *T. lineatum* by Sciacchitano (1963) from Africa, are based on external features and the only taxonomically significant point on which their descriptions agree is the separation of the gonopores by two annuli. However, if one segment is added to Harding's (1932) enumeration of the segments in *T. cooperi*, as suggested by Moore (1939), then they also agree with regard to positions of the gonopores, eye-bearing segments, and annulation in general. On examination of both 'cotypes' of *Placobdella cooperi* I found that Moore was indeed correct in his supposition that Harding had left out one segment when he described the annulation of this species. This examination also revealed the conspecificity of *T. lineatum* and material I collected (listed here as voucher specimens) with that on which Harding based the description of *P. cooperi*.

Oosthuizen & Fourie (1985) point out that four size classes can be distinguished in the life cycle of *T. cooperi*. Examination of the holotype and paratypes of *T. lineatum* revealed that Sciacchitano's (1963) description of this species was based on sexually immature size class II specimens of *T. cooperi*. The following description includes a first account of the internal morphology of *T. cooperi* and identifies diagnostic features separating this leech from congenitors with the same arrangement of two annuli between the gonopores.

Systematic account

For the delimitation of segments, the neuromeric standard of segment limits has been adopted: the annulus bearing the segmental sensillae externally and the nerve ganglion internally is considered to be the middle ring of the segment. In the list of material, the number of specimens constituting a sample is indicated in brackets behind the collection registration number.

Theromyzon cooperi (Harding, 1932) (Figures 1–4)

Placobdella cooperi Harding, 1932, *Proc. zool. Soc.* London 1: 83 (type: Hora Harsadi, Ethiopia; Natural Hist. Mus., London).

Synonym: Theromyzon lineatum Sciacchitano, 1963, *Ann. Transv. Mus.* 24: 249 (type: Goedverwagting Pan, between Breyten and Lake Chrissie, Transvaal, Republic of South Africa; Transvaal Mus., Pretoria). New synonym.

Material examined: Syntypes of *Placobdella cooperi* (both mature with spent reproductive systems): 1931.12.26.6 and 1931.12.26.9 in The Natural History Museum, London.

Holotype and paratypes of *Theromyzon lineatum* (sexually immature): TM9281, 15011 and 15012 in the Transvaal Museum, Pretoria.

Voucher specimens: Transvaal Museum, Pretoria: TM17604(4); 17605(2); 17606(3); 17607(4); 17608(1); 17609(2); 17610(1); 17611(1); 17612(2); 17613(12); 17614(7).

Species diagnosis

With characters of the genus; proboscis pore about halfway between centre and anterior rim of sucker; V uniannulate ventrally forming buccal ring; gonopores separated by two annuli; male atrium cylindrical; terminal ends of paired male ducts differentiated into atrial cornua, each joins atrium separately; vagina short; in mature condition oviducts with large, posteriorly directed, saccate expansions; crop with 12 pairs of caeca.

Description

Form (Figures 1A, B, E)

Body heavy, sub-fusiform, sides nearly parallel, only slightly more tapered at anterior end; lip widely rounded; head not distinctly demarcated; venter flat, dorsum arched.

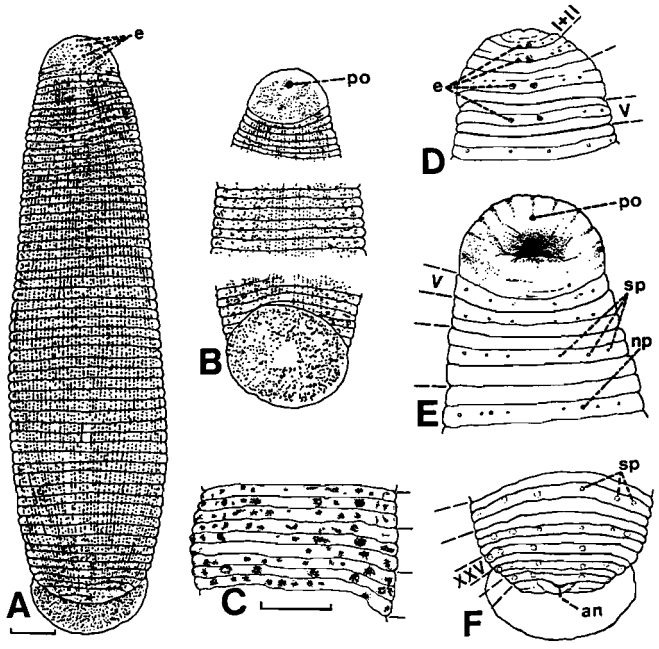

Figure 1 *Theromyzon cooperi*. A, Linear arrangement of green chromatophores on dorsal side. B, Pigmentation on ventral side. C, Maculations on dorsal side. D, Dorsal and E, ventral views of anterior region. F, Dorsal annulation at posterior end. A and B, and C–F, respectively, are drawn to the same scale. Scale bars = 1 mm. an, anus; e, eyes; np, nephridiopore; po, proboscis pore; sp, sensory papillae.

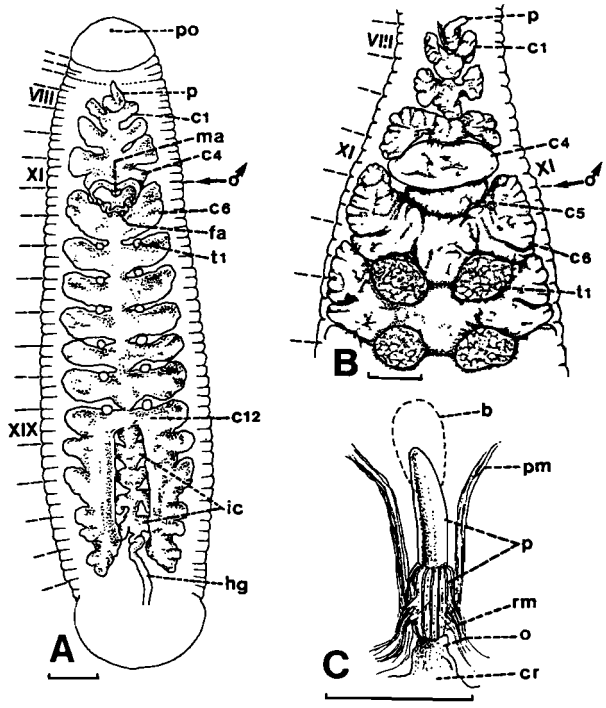

Figure 2 *Theromyzon cooperi*. A, Ventral view of empty digestive tract and unripe reproductive systems of a size class III specimen, *in situ*. B, Caeca of full crop in anterior region, ventral view. C, Details of anterior end of digestive tract, dorsal view. Scale bars = 1 mm. b, brain; c, crop caecum; cr, crop; fa, female atrium; hg, hindgut; ic, intestinal caecum; ma, male atrium; o, oesophagus; p, proboscis; po, proboscis pore; pm, protractor muscles; rm, retractor muscles; t, testisac.

Anterior sucker shallow, furrows of dorsal annulation continued faintly on surface of sucker; posterior sucker large, in diameter larger than half maximum body width, circular.

Colour and pattern (Figures 1A–C)

General appearance green or brown. Green phase — sexually immature and post-reproduction conditions: Large, green chromatophores in deeper tissues with linear arrangement, form 36 or 38 longitudinal, narrow stripes dorsally, some close together to form broader stripes in all or some of following positions: median, innerparamedian and paramedian. Striped pattern stops behind eyes, chromatophores in ocular region and posterior sucker irregularly distributed. Yellow chromatophores arranged in groups forming irregular distributed maculations on dorsum (Figure 1C), some at positions of sensory papillae. Brown phase — sexually mature condition: Superficial brown pigment obscures dorsal striped pattern completely, thence uniformly greenish brown with bright yellow maculations. Venter in both phases always lighter in colour, only median field with slight striping (Figure 1B).

Annulation (Figures 1D–F)

I and II uniannulate, I/II variably developed, always distinct. III biannulate with (a1a2) or (a1+a2) > a3. IV biannulate with (a1+a2) = 2a3 and incipient a1/a2 always better developed than that of III. V triannulate dorsally with a1/a2 much < a2/a3, ventrally uniannulate forming buccal ring. VI triannulate dorsally with a1/a2 < a2/a3, biannulate ventrally. VII–XXIV complete triannulate. XXV and XXVI biannulate. XXVII uniannulate. Anus behind XXVII followed by one partly divided annulus.

Eyes (Figure 1D)

Four pairs in innerparamedian positions. First in II, second in caudal half of large anterior annulus of III, third in posterior half of IV(a1+a2), fourth in Va2. Pigment cups of first two pairs directed antero-lateral, those of third and fourth pairs postero-lateral and slightly upward.

Nephrediopores

Fourteen pairs, in a2 of VIII–X and XIV–XXIV, in outer-paramedian position, slightly into cephalic half of annulus, transversely in line with sensory papillae (Figure 1E).

Papillation

Body surface smooth. Dorsal sensory papillae dome-shaped, almost flush with surface, three series: paramedian, intermediate, supramarginal (Figures 1D,F), inconspicuous except where situated on yellow maculations where sensillae show off as small, opaque white spots. Ventral sensory papillae very small, in transverse row slightly into cephalic half of annulus (Figure 1E).

Gonopores

Separated by two annuli; male at XI/XII, female at XIIa2/a3; both strictly within furrows.

Digestive system (Figures 2A–C, 3B)

Proboscis pore small, about halfway between centre and anterior rim of sucker; proboscis extremely short, pointed terminally, retracted reaching from about VIa3 to VIIIa1 in relaxed specimens; salivary glands diffuse, ductules enter proboscis at its base; oesophagus short with retraction of proboscis, joins crop in VIII; crop in VIII–XIX with 12 pairs of caeca: three lobed pairs in preclitellar region in VIII–X, two pairs of small, unlobed caeca in XI and XII, seven pairs lobed caeca in postelitellar region in XIII–XIX; caeca more or less restricted to their respective segments except for sixth pair in XIII which extends anteriorly into XI and twelfth pair (post-caeca) which are elongated, deflected posteriorly into XXIV with lateral, secondary lobes in each of XIX–XXIV. Intestine with four pairs of unlobed, tubular caeca partly overlaying post-caeca on dorsal side. Hindgut and rectal region narrow, tubular.

Reproductive systems

Male (Figures 2A,3A,B,E,F): Six pairs of testisacs, intersegmentally arranged at XIII/XIV–XVIII/XIX. Vas deferens on each side emerges from dorsal body wall in XII between fifth and sixth pairs of caeca, widens into extensively lengthened, relatively narrow sperm duct forming posteriorly directed loop and acts as sperm vesicle; terminal end of recurrent limb functions as ejaculatory duct which joins atrial cornu at about X/XI, no preatrial loop formed by ejaculatory duct. Atrial cornua relatively short, oblong-ovate, muscular; atrium large, muscular, protrusible.

Female (Figures 2A,3A–D): Ovisacs tubular, directed posteriorly with tubular connection between two ovisacs at their anterior ends dorsal to the nerve cord; each of relatively narrow, short oviducts from terminal ends of ovisacs expands extensively into a large, posteriorly directed sac; terminal portions of oviducts leading from sacs wide, join to form short, cylindrical vagina which ends in very short atrium. Ligaments at anterior ends of ovisacs anchor system to dorsal body wall.

Size

The measurements given (in millimetres) are the length and maximum body width of unfed, straight, moderately stretched, preserved specimens and are similar to their dimensions when alive and at rest. The measurements of the smallest and largest specimen, respectively, encountered for

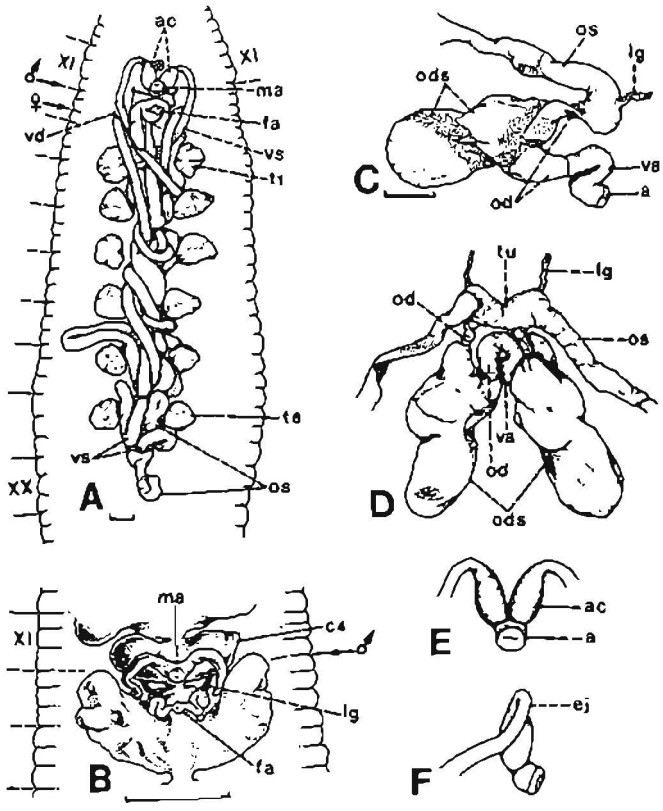

Figure 3 *Theromyzon cooperi*. A, Ventral view of mature reproductive systems, *in situ*. B, Ventral view of terminal ends of unripe reproductive systems, *in situ*. C, Lateral and D, dorsal views of terminal end of female system. E, Anterior and F, lateral views of terminal end of male system. C–F are drawn to the same scale. Scale bars = 1 mm. a, atrium; ac, atrial cornu; c, crop caecum; ej, ejaculatory duct; fa, female atrium; lg, ligament; ma, male atrium; od, oviduct; ods, oviducal sac; os, ovisac; t, testisac; tu, tubular connection between ovisacs; va, vagina; vd, vas deferens; vs, seminal vesicle.

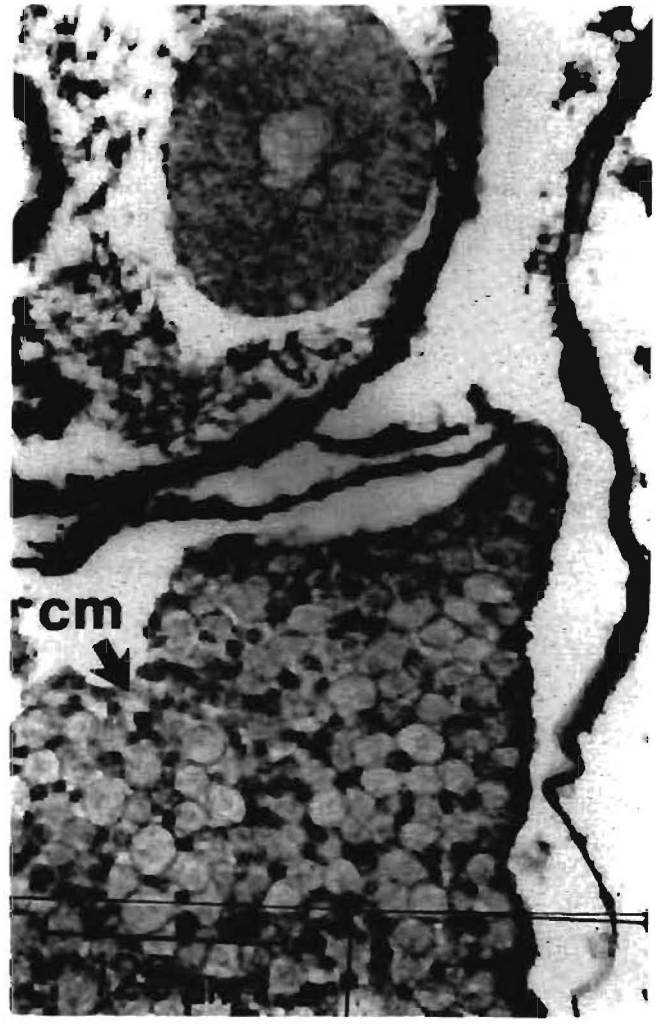

Figure 4 *Theromyzon cooperi*. Transverse section through oviducal sac. cm, cell mass.

each size class are listed:

Size class I	:	1,8 × 0,9	:	4,8 × 1,2
Size class II	:	6,5 × 1,4	:	8,2 × 1,6
Size class III	:	11,1 × 2,0	:	13,8 × 2,3
Size class IV	:	20,0 × 6,0	:	26,0 × 6,2

Geographic range

Previously recorded from Ethiopia (Harding 1932, Moore 1939) and as *Theromyzon lineatum* from the Republic of South Africa (Sciacchitano 1963).

Discussion

Young animals and specimens which have already reproduced invariably display dorsally the distinct linear arrangement of pigment (Figure 1A). The increase in superficial pigmentation is a phenomenon correlated with growth towards sexual maturity which decreases again after reproduction in this semelparous leech. The general colouration is rapidly lost in preservatives and even the black pigment of the eyes may fade considerably.

In gorged condition the crop caeca are, except for the fourth and fifth pairs, distinctly bilobed terminally (Figure 2B) but lobation becomes gradually less prominent and eventually disappears as the contents are digested (Figure 2A).

There are marked differences in the appearance and size of the terminal ends of the reproductive systems of sexually immature (size classes I to early IV: Figure 3B) and of sexually ripe (late size class IV: Figures 3A, C–F) individuals. It is only after intake of the third (and last) blood meal that the systems begin to deploy towards their full development and eventually attain their typical delineation for the species (Figures 3A, C–F). The large saccate expansions of the oviducts are filled with cellular masses (Figure 4) in the ripe system and are utilized during reproduction because in spent systems nothing or very little of the cell masses remain. The origin of, and way in which the contents of the oviducal sacs are utilized, remains unknown.

Acknowledgements

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