

Two new *Batracobdella* species
from southern Africa and a
redescription of *Batracobdella*
disjuncta (Moore, 1939)
comb. nov. (Hirudinea:
Glossiphoniidae)

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Accepted: 20 October 1978

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ABSTRACT

Two new glossiphonids from southern Africa are described and figured. *Glossiphonia disjuncta* Moore, 1939, is redescribed and transferred to the genus *Batracobdella* Viguier.

1 INTRODUCTION

The two new *Batracobdella* species described here were discovered during an extensive survey of the freshwater leeches of the Republic of South Africa and South West Africa. Study of a large number of specimens of *Glossiphonia disjuncta* Moore revealed that this leech is closely related to the two new taxa. On the basis of, *inter alia*, having seven pairs of crop caeca and the proboscis pore in the centre of the sucker, all three species must be included in the genus *Batracobdella*. Moore's species is accordingly transferred to this genus.

The measurements given in the text are those of straight, moderately stretched, preserved specimens and are very similar to their dimensions when they were alive and at rest. 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 lists of material, the number of specimens constituting a sample is indicated in brackets behind the collection registration number.

2 DESCRIPTIONS

Batracobdella cheili sp. nov.

Figs. 1-3, Map 1.

Holotype: BM (NH) 1978.20.1 in the British Museum (Natural History), London. Underneath stone in Osheshe water-hole, Cuvelai Basin, Ovamboland, South West Africa (17°56'S 16°07'E), collected by J. H. Oosthuizen, 9 July 1968. Total length (including exposed part of posterior sucker protruding beyond body) 6,8 mm, maximum width 2,0 mm, diameter of posterior sucker 0,8 mm. Collected with five other specimens (paratypes), BM (NH) 1978.20.2 to 6.

Diagnosis

Three pairs of eyes; cephalic sucker cupuliform with high, delicate walls; gonopores separated by two annuli; proboscis stout; salivary gland cells diffusely arranged; first six pairs of crop caeca each with two well developed lobes terminally; post-caeca each with about fifteen slender, lateral secondary caeca.

Description

Form: Ovate, moderately flattened, dorsum arched, venter flat. Head moderately widened beyond nuchal constriction, cephalic sucker cupuliform with high, delicate walls, rim of sucker studded with small papillae; proboscis pore large, on summit of large, dome-shaped papilla in centre of sucker. Posterior sucker small, circular, diameter less than half of maximum body width, with thick margin and cupped venter, broadly attached, directed ventrally.

Colour and pattern: General appearance either brown or green, dorsum with about 30 dark brown or dark green, narrow, broken stripes in widest region of body, number of stripes decreasing towards extremities. Striped pattern occurs from just behind ocular area to about XXV. Anterior tip, post-anal annulus and lateral edges of annuli unpigmented, thus there is a continuous, translucent edge along entire circumference of body. Ocular area, segment XXVII and dorsum of posterior sucker with irregularly distributed chromatophores. Venter uniform, more lightly coloured than dorsum.

Annulation: I and II either completely united or I/II variably developed. III biannulate, dividing furrow variably developed. IV biannulate with (a1a2) or (a1 + a2) = 2a3. V triannulate dorsally, ventrally tri- or biannulate, in the latter case a1/a2 variably developed or absent, anterior annulus forming posterior wall of sucker; a2/a3 on both sides conspicuously deeper than neighbouring furrows. VI–XXIV complete, triannulate. XXV biannulate with (a1a2) or (a1 + a2) = 2a3. XXVI and XXVII uniannulate. Anus behind XXVII, followed by one very small post-anal annulus. Annuli in complete segments about equal in length dorsally but ventrally $a3 > a2 > a1$; from about VIII caudally, a1 and a3 with shallow transverse secondary furrows.

Eyes: Three pairs, first pair in anterior half of IV, second and third pairs in anterior half of V. Pigment cups of first pair usually separated, sometimes in contact. Pigment cups of members of second and third pairs on each side usually in contact, sometimes completely coalesced, the two pigment masses so formed being well separated; distance between them variable, sometimes as great as six times their diameter. Pigment cups of first two pairs of eyes directed antero-laterally, those of third pair postero-laterally.

Nephridiopores: Fourteen pairs, in middle of a2 of VIII – X and XIV – XXIV.

Papillation: No conspicuous papillae other than the low dome-shaped sensory papillae. Sensillae very small, three series: paramedian, intermediate and supra-marginal.

Gonopores: Separated by two annuli, male at XI/XII, female at XIIa2/a3.

Digestive system: Proboscis cylindrical, stout, truncate terminally; in relaxed specimens about equal in length to total length of six segments – with retraction, may

reach into XIII ventral to crop. Two bundles of protractor muscles extend forward from base of proboscis, diverge behind supra-pharyngeal ganglion and enter body wall in anterior half of VII. Retractor muscles of proboscis implanted in XII, forming together with salivary gland ductules on each side a common bundle which enters ventral lacuna in XII and is attached along side of oesophagus on its way to base of proboscis. Oesophagus distensible, shortened and deflected into a short loop ventral to crop by attached retractor muscles of proboscis. No oesophageal organ. Salivary gland cells diffusely arranged laterally to ventral lacuna, in X – XIV, more densely packed in XI and XII. Crop in XIII – XIX, seven pairs of caeca, first six pairs in XIII – XVIII bilobed, directed more or less laterally and confined to their respective segments; seventh pair in XIX elongated, deflected posteriorly and lateral to intestine, extends to about XXIV, each with about 15 slender, lateral secondary caeca. Intestinal caeca four pairs, unlobed, directed laterally, bent downwards against medial sides of post-caeca, expanded terminally, expansions particularly pronounced in first three pairs. Hind gut saccate, rectum narrow, tapering towards anus.

Reproductive systems: *Male:* Six pairs of testes, intersegmentally arranged at XIII/XIV – XVIII/XIX, much enlarged when in active state. Vas deferens enters ventral lacuna at XIIa3, expands gradually into sperm duct which forms a posteriorly directed, simple loop, both legs of loop expand to act as a seminal vesicle, loop may extend into XX at peak of male activity. Transition between recurrent limb and muscular ejaculatory duct in XIII is gradual, terminal end of duct with sharp vertical curve at XI/XII before turning sharply inwards, narrows abruptly towards junction with atrial cornu at XI/XII. Cornua muscular, strongly diverging, somewhat compressed dorso-ventrally, truncate in lateral view; atrium short, muscular, cylindrical.

Female: Ovisacs directed caudally, may extend into XXI when filled with eggs, oviducts joined dorsal to nerve and blood vessel, atrium very small, ligaments from front of system implanted in dorsal body wall in XII.

The holotype agrees with the above description in all essential details.

Remarks

Although the deep, cup-shaped cephalic sucker is a conspicuous feature in live specimens, it is often so distorted in dead animals that its typical shape is not apparent. The delicate walls of the sucker collapse very easily during fixation. The ocular pattern is fairly variable as regards both the size and arrangement of the eyes. Usually, however, a triangular pattern is clear.

Several attached spermatophores were encountered. Whereas the two halves of an empty spermatophore are cylindrical, each half of the undischarged spermatophore is fusiform in shape and terminates in a sharply-pointed projection. The halves of both undischarged and empty spermatophores are separated from each other along their entire lengths.

The largest and smallest (excluding attached young) specimens encountered measured 12,5 × 2,8 mm and 2,0 × 0,6 mm, respectively. The smallest specimen recorded with attached offspring measured 7,8 × 2,1 mm.

This leech is probably a parasite of, *inter alia*, freshwater snails. On two occasions a single, well-fed specimen was recovered from the mantle cavity of *Bulinus tropicus*. Once 21 specimens were collected from the surfaces of the plastrons of terrapins in the same body of water. It is unlikely, however, that this small leech would be able to penetrate the tough skin of these reptiles and they were probably only using them as places to hide.

Batracobdella cheili closely resembles *B. conjugata* and *B. disjuncta* with regard to colour, colour pattern and ocular pattern and it is often very difficult or even impossible to distinguish *B. cheili* from *B. disjuncta* when only external features are taken into account. However, *B. cheili* differs from the other two species in several ways. The most obvious differences are the separation in *B. cheili* of the gonopores by two annuli, compared with one in *B. conjugata*; and the lobed first six pairs of crop caeca of *B. cheili*, as opposed to unlobed caeca in *B. disjuncta*.

Other material examined

British Museum (Nat. Hist.): BM (NH) 1978.20.7 to 27 (21); 1978.20.28 to 29 (2).

Transvaal Museum, Pretoria: TM 11284 (1); 11285 (1); 11286 (10); 11287 (30).

Department of Zoology, University of Pretoria: HIR 189 (11); 341 (3).

State Museum, Windhoek: SMN 65742 (2).

Batracobdella conjugata sp. nov.

Figs. 4–6, Map 1.

Holotype: BM (NH) 1978.20.30 in the British Museum (Nat. Hist.), London. Underneath tree stump in dam at rest-camp, Daan Viljoen Game Park, Khomas Hochland, South West Africa (22°31'S 16°56'E), collected by J. H. Oosthuizen, 6 December 1970. Total length (including exposed part of posterior sucker protruding beyond body) 9,1 mm, maximum width 2,8 mm, diameter of posterior sucker 1,1 mm. Collected with 30 other specimens (paratypes), BM (NH) 1978.20.31 to 60.

Diagnosis

Three pairs of eyes; gonopores separated by one annulus or little less than length of annulus; walls of genital atria fused; proboscis stout; salivary gland cells diffusely arranged; first six pairs of crop caeca each with two small lobes terminally.

Description

Form: Ovate-lanceolate, moderately flattened, dorsum arched, venter flat. Head distinctly marked off by nuchal constriction in V, only slightly widened. Cephalic sucker scoop-shaped with deep cavity and well developed rim having numerous, minute papillae; proboscis pore large, in centre of cavity. Posterior sucker small, circular, diameter less than half of maximum body width, with deeply cupped venter and thin margin, broadly attached, directed ventrally.

Colour and pattern: General colouration either green or brown or shades thereof. Superficially situated chromatophores distributed all over body dorsally, except on narrow, marginal strips of body, greater part of head region and margins of posterior sucker. These chromatophores are either evenly distributed or are more concentrated in middle regions of annuli, the result then being a transverse, banded pattern. More deeply situated chromatophores compactly arranged into narrow, longitudinal stripes, decreasing in number towards extremities, 34 to 36 at widest region of body. Leech striped from just behind ocular area to just in front of anus. Venter much lighter in colour, without any pattern.

Annulation: I united with prostomium to form rounded, apical lip. II uniannulate or incomplete biannulate, distinctly separated from I. III complete or incomplete biannulate, annuli equal in length. IV biannulate with (a1a2) > a3. V triannulate dorsally, biannulate ventrally with a1 and a2 united to form buccal ring. Nuchal constriction in V. VI – XXIV complete, triannulate. XXV biannulate with (a1a2) or (a1 + a2) = 2a3. XXVI and XXVII uniannulate. Anus at posterior margin of XXVII, one small post-anal annulus. In middle body region, a1 < a2 < a3 on ventral side with shallow secondary furrows on a1 and a3, more prominent on a3.

Eyes: Three pairs, first pair at cephalic margin of IV or just anterior to III/IV, second and third pairs in cephalic half of V. Pigment cups of first, and smallest, pair usually well separated and directed antero-laterally; pigment cups of second and third pairs much larger, members of each pair far apart but the two eyes on each side united (giving the impression that there are only four eyes). The four pigment masses are so arranged that they correspond in position to the four corners of a trapezium. Pigment cups of second pair directed antero-laterally, those of third pair postero-laterally.

Nephridiopores: Fourteen pairs, on a2 of VIII – X and XIV – XXIV.

Papillation: Segmental sensory papillae very small, rounded domes, almost flush with body surface, three paired series on both sides: dorsally in inner-paramedian, intermediate and supra-marginal positions; ventrally in outer-paramedian, intermediate and sub-

marginal positions. Sensory papillae situated slightly within cephalic half of annuli. In addition, about 16 larger papillae present on each annulus (at their bases about equal in diameter to one quarter the length of annulus), plus numerous, much smaller ones of varying sizes, giving dorsal integument a roughened appearance. Venter also with small papillae but less numerous than dorsally.

Gonopores: Separated by one annulus or a little less than length of annulus, either both restricted to the furrows with male pore at XIIa1/a2 and female pore at XIIa2/a3; or one or both pores slightly within XIIa2.

Digestive system: Proboscis stout, sub-fusiform in lateral view, sides more or less parallel in dorsal or ventral view, truncate terminally; in relaxed specimens about the length of five segments. Two bundles of protractor muscles extend forward from base of proboscis, diverge behind supra-pharyngeal ganglion and enter body wall in VII. Retractor muscles of proboscis implanted in dorsal body wall in XII, link up with salivary gland ductules to form a stout bundle on each side which enters ventral lacuna in cephalic region of XII; bundles not attached to oesophagus, enter proboscis at its base. Oesophagus distensible, with retraction of proboscis slides together (like the bellows of a camera) attaining an annulated appearance. No oesophageal organ. Salivary gland cells diffusely arranged in IX – XIV, lateral to ventral lacuna, more densely packed in XI and XII. Crop in XII – XIX with seven pairs of caeca, one pair in each of XIII – XIX, first six pairs laterally directed, bilobed and confined to their respective segments. Seventh pair elongated, deflected posteriorly and lateral to intestine, extends to XXII, each with five or six short, lateral secondary caeca. Intestinal caeca four pairs, unlobed, directed laterally, bent downwards against medial sides of post-caeca, each terminating in a vesicular expansion, the expansion less pronounced in fourth pair. Hind gut saccate, rectal region narrow, cylindrical.

Reproductive systems: *Male:* Six pairs of testes, intersegmentally arranged at XIII/XIV – XVIII/XIX. Vas deferens enters ventral lacuna in XII, expands into sperm duct with posteriorly directed loop, at peak activity of male system loop may extend into XX. Descending limb of loop relatively narrow and of uniform width for most of its length, expands only gradually from a point near bend and towards it, recurrent limb considerably expanded, acts as seminal vesicle, joins muscular ejaculatory duct in XIII. Ejaculatory duct almost straight, proceeds obliquely outward and forward into XI, bends sharply inwards in XI to join atrial cornu at a marked constriction. Atrial cornu oblong-ovate, narrows sharply towards its junction with ejaculatory duct. Cornua strongly divergent, not vertical in orientation but directed obliquely dorsally and forward from fused atria; atrium short, truncate in anterior view.

Female: Ovisacs directed posteriorly, may extend into XIX or further when packed with eggs, oviducts directed obliquely dorsally and backward from fused atria, tubular connection between oviducts dorsal to nerve and blood vessel, atrium short. Walls of male and female atria fused over their whole lengths but there is no connection between the canals.

The holotype agrees with the above description in all essential details.

Remarks

Like its congeners discussed in this paper, this leech is quite variable as regards the arrangement and pigmentation of the eyes. Although the members of the second and third pairs of eyes are always well separated, those of the first pair are often united, resulting in a triangular ocular pattern. The second and third eyes of one or both sides may also be variably separated, in which case the symmetrical arrangement does not occur. Pigmentation was frequently absent in one or more of the eyes. As in the case of the other two species, the ocular pattern alone is, therefore, not a reliable criterion for identification.

Only two spermatophores were encountered. They consist of the usual two halves, each rather club-shaped and separated at their terminal ends. Each half terminates in a relatively stout, finger-like projection.

The largest and smallest (excluding attached young) specimens encountered measured 9,1 × 2,8 mm and 3,5 × 0,8 mm, respectively. The smallest specimen with attached offspring was 5,2 × 2,2 mm.

No information was obtained with regard to hosts. *Batracobdella conjugata* resembles *B. cheili* and *B. disjuncta*, especially as far as colouration and ocular pattern are concerned; but it is distinguishable from them externally in having the gonopores separated by not more than one annulus. Internally, the most striking differences are: the fusion of the genital atria, the oesophagus not folded into a loop with retraction of the proboscis and the retractor muscles of the proboscis not attached to the sides of the oesophagus.

Other material examined

British Museum (Nat. Hist.): BM (NH) 1978.20.61 (1); 1978.20.62 to 65 (4).

Transvaal Museum, Pretoria: TM 11288 (5); 11289 (12); 11290 (2); 11291 (4).

Department of Zoology, University of Pretoria: HIR 360 (25).

Collection of the National Institute for Water Research, Council for Scientific and Industrial Research, Pretoria: GEN. 579A (2); GEN. 658A (3); TRR. 26C (1); TRR. 39C (2).

State Museum, Windhoek: SMN 65743 (26).

Kruger National Park Museum, Skukuza: ANL-NKW 5 (23).

Batracobdella disjuncta (Moore) *comb. nov.*

Figs. 7–9, Map 1.

Glossiphonia disjuncta Moore, 1939, *Proc. Acad. nat. Sci. Philad.*, 90: 299 [type: Lake Bunyoni, Uganda; British Mus. (Nat. Hist.)]

In his preliminary examination of leeches from East Africa, Moore incorrectly identified this leech and listed it (1933) as *Glossiphonia weberi* Blanchard. Moore's later (1939) description of the leech as a new species was rather brief and there was very little information regarding characteristics that would enable one to recognise it. Apart from a photomicrograph illustrating nothing more than the body shape of the type specimen, no figures were supplied. In view of this and the fact that the original description contained erroneous information concerning a very important aspect which affects the generic status of the species, the description of this taxon must be reviewed.

Material: BM (NH) 1978.20.66 to 92 (27) in the British Museum (Nat. Hist.), London. Underneath stones in slow-flowing stream at The Fountains, Pretoria, Republic of South Africa (25°45'S 28°12'E), collected by J. H. Oosthuizen, 20 March 1963.

Diagnosis

Three pairs of eyes; dorsum of each annulus in middle body region with a transverse row of about 18 prominent papillae; gonopores separated by two annuli or a little less than length of two annuli; proboscis relatively long, slender; salivary gland cells diffusely arranged; first six pairs of crop caeca unlobed; post-caeca each with four, small lateral secondary caeca.

Description

Form: Oblong-ovate, slightly arched dorsum, flat venter. Head region perceptibly widened beyond nuchal constriction. Anterior sucker scoop-shaped; proboscis pore relatively large, at centre of sucker. Posterior sucker small, circular, diameter less than half maximum body width.

Colour and pattern: General appearance either flesh-coloured or green, all chromatophores irregularly distributed or superficially situated chromatophores arranged so as to form a finely-striped pattern dorsally, composed of about 36 longitudinal stripes at widest point of body.

Annulation: I and II united with prostomium to form rounded, apical lip, or lip with faint I/II. III uniannulate with faint furrows at margins. IV uniannulate, partially divided or biannulate. V triannulate dorsally with $a1/a2$ distinctly $< a2/a3$ or incomplete triannulate with $(a1 + a2) = 2a3$; biannulate ventrally with $a1$ and $a2$ united to form buccal ring. VI – XXIV complete, triannulate with $a1/a2 = a2/a3$ and

annuli within each segment about equal in length. XXV biannulate with $(a1a2) = 2a3$ and $a1/a2$ at margins only; or $(a1a2) = a3$, but then no sign of $a1/a2$. XXVI uniannulate with incomplete dividing furrow or biannulate. XXVII uniannulate, with or without faint furrows at margins. Anus directly behind XXVII, sometimes cutting deeply into posterior margin of XXVII. One small post-anal annulus.

Eyes: Three pairs, eyes of first pair close together or coalesced, in median field in IV; those of second and third pairs widely separated from each other but the two eyes of each side close together or coalesced, in V. The three pigment masses so formed thus correspond in position to the three corners of a triangle. Pigment cups of first and second pairs directed forward and outward, those of third pair backward and outward.

Nephridiopores: Fourteen pairs, on $a2$ of VIII – X and XIV – XXIV.

Papillation: A transverse row of fairly large, dome-shaped papillae along middle of each annulus dorsally, best developed in middle region of body, diameter at base of largest ones about equal to one third of length of annulus; 15 – 18 per annulus in this region plus several smaller papillae (some much smaller; some minute) irregularly distributed over surface of annulus and mostly difficult to detect. Sensory papillae three series, paramedian, intermediate and supra-marginal, not readily distinguishable from other papillae, characterized by small, opaque white sensillae on summits. Venter smooth, sensory papillae very small, almost flush with surface: present in paramedian, intermediate and sub-marginal positions.

Gonopores: Either separated by two full annuli with male at XI/XII and female at XIIa2/a3; or male pore in shifted position in anterior third of XIIa1.

Digestive system: Proboscis relatively long, slender, of uniform width over whole length, truncate terminally – with retraction proximal end may reach ventral to crop into XIII and in relaxed specimens extends from VIII – XIII. Two bundles of protractor muscles from base of proboscis, they proceed forward along sides of proboscis, diverge posterior to supra-pharyngeal ganglion and enter body wall in VI. Retractor muscles of proboscis implanted in dorsal body wall at XII – XIII, join up with salivary gland ducts of each side to form two stout bundles which enter ventral lacuna in XIII; each bundle attached along side of oesophagus on its way to base of proboscis. Oesophagus flattened, short, S-shaped with retraction of proboscis, extensible. No oesophageal organ. Salivary gland cells diffusely arranged laterally in XII – XIV, more densely packed in XII – XIII. Crop in XIII – XIX, seven pairs of caeca, first six pairs in XIII – XVIII unlobed, laterally directed, each pair restricted to its segment, seventh pair elongated, deflected posteriorly along sides of intestine into XXIII, only a small lateral lobe in each of XIX – XXII. Intestine with four pairs of

short, simple, tubular caeca. Hind gut sacciform, rectum narrow, tubular.

Reproductive systems: *Male:* Six pairs of testes, intersegmentally arranged at XIII/XIV to XVIII/XIX. Vas deferens on each side emerges from dorsal body wall in XIIIa1, expands into stout sperm duct forming a posteriorly directed loop which may reach into XX when system is functioning, both limbs markedly widened, act as seminal vesicle; wall of recurrent limb becomes muscular at about XIII/XIV, proceeds forward as more or less straight, thick-walled ejaculatory duct, tapers terminally before joining atrial cornu at XI/XII, no pre-atrial loop formed. Cornua muscular, short, oviform in front view, truncate in lateral view, cornua widely divergent; atrium muscular, cylindrical, dome-shaped terminally.

Female: Ovisacs posteriorly directed, in sexually mature animals may reach into XVIII when empty but into XXI when packed with ripe eggs. Oviducts with tubular connection dorsal to nerve cord and blood vessel, atrium very short, thin-walled.

Remarks

Although the annulation exhibits no special features helpful in the identification of this taxon, it is important to note that the intermetameric and intrametameric furrows at the anterior end are poorly developed in comparison with those of related forms. This often makes it impossible to see where the limits of the first three or four anterior segments are. The eyes vary greatly in size and deviations from the typical arrangement are common. Specimens without pigmentation of all the eyes were also encountered. Disarrangement of the eyes usually also affects the directional orientation of the pigment cups. The papillation, which proved to be the only diagnostic specific character mentioned in the original description, is indeed the most reliable distinguishing external feature. Its value as such lies in the pattern of distribution of the large papillae (namely in a single, transverse row) rather than in the details of their relative heights, so meticulously described by Moore (1939). He mentions that there are "... about 22 in a transverse row ..." on each annulus of the middle body region. However, the exact number is of secondary importance as it will vary according to the observer's interpretation of what papillae should be considered to be large ones.

Regarding the crop, it is important to note that in leeches that have not fed, the lateral lobes of the post-caeca may be completely collapsed; that the central part of the crop acts as the main storage place which, following dilation by food, results in shortening of the relative lengths of the first six pairs of caeca; and that in the gorged condition, the first pair of caeca may be barely visible. I initially believed that the presence of seven pairs of crop caeca in the material I studied indicated that it was representative of a new *Batracobdella* species, being quite unlike

known species of the genus. Subsequently, however, I found that the leeches agreed with Moore's (1939) description of *Glossiphonia disjuncta*, except that they differed in having seven instead of six pairs of crop caeca. With the discovery of *Batracobdella cheili* and *B. conjugata*, which also agree to a large extent with Moore's description of *G. disjuncta*, the similarities between his description and the particular leeches under discussion here, was again emphasised. This raised the question of possible conspecificity of my material with Moore's species. The type [BM (NH) 1933.1.21.17] and one other specimen marked "paratype" [BM (NH) 1933.1.19.16/18] of *G. disjuncta* were, therefore, examined. After clearing in lactophenol, seven pairs of partly filled crop caeca, shaped as described above, were observed in the paratype. Although only six pairs of similarly shaped caeca were seen on the empty crop of the type, which was obviously what led to the generic allocation of this species by Moore, there is no doubt about the conspecificity of the two specimens. Difficulty in locating the first pair of caeca of an empty crop without dissection was also experienced frequently with my material. The presence of seven pairs of crop caeca indicates that this species belongs to the genus *Batracobdella*.

Altogether, 19 spermatophores were found. The spermatophores very closely resemble that of *B. cheili* and as in that species, the two halves are separated from each other over their whole lengths. In the undischarged condition, each half is fusiform with a pointed terminal projection and slender pedicel. The spindle shape is lost with ejection of the contents and each half becomes a narrow tube of uniform width.

The largest and smallest (excluding attached young) specimens encountered measured 11,6 × 2,2 mm and 2,3 × 0,5 mm, respectively. The dimensions of the smallest specimen with attached offspring were 3,6 × 1,5 mm.

This leech is apparently fairly common in permanent bodies of water. It is probably primarily a parasite of freshwater snails, although it was recorded only once on a snail (from the mantle cavity of *Bulinus tropicus*). On one occasion, a specimen was observed feeding on an unidentified insect larva. This species was also collected once each on the following: terrapin *Pelomedusa subrufa*, clawed toad *Xenopus laevis* tadpoles and a freshwater crab *Potamon* species. There is, however, no proof that these animals are actually hosts.

Batracobdella disjuncta was recorded previously from Uganda (Moore, 1933; identified as *Glossiphonia weberi*), Ethiopia (Moore, 1939) and the Transvaal, Republic of South Africa (Sciacchitano, 1963; incorrectly identified by him as *Batracobdella nilotica*). The authenticity of Sciacchitano's identifications of *B. disjuncta* from Zaïre (1952), the Republic of

South Africa (Cape Province) and South West Africa (1959), Togo (1965) and Ethiopia (1967) is questionable, because his inability to recognise *B. disjuncta* was clearly indicated by his identification of 55 specimens (19 samples) of this species as *B. nilotica* (see Sciacchitano, 1963).

Other material examined

British Museum (Nat. Hist.): BM (NH) 1978.20.93 to 103 (11); 1978.20.104 to 111 (8); 1978.20.112 to 128 (17); 1978.20.129 to 136 (8); 1978.20.137 to 149 (13).

Transvaal Museum, Pretoria: TM 11292 (9); 11293 (14); 11294 (9); 11295 (44); 11296 (39); 11297 (24); 11298 (6); 11299 (20); 11300 (1); 11301 (6); 11302 (1); 11303 (12); 11304 (2); 11305 (1); 11306 (10); 11307 (4); 11308 (6); 11309 (7); 11310 (40); 11311 (4).

Department of Zoology, University of Pretoria: HIR 135 (1); 201 (1); 206 (2); 228 (1); 246 (1); 252 (2); 259 (9); 271 (1); 288 (2); 290 (23); 301 (1); 452 (2); 469 (5); 482 (1).

Collection of the National Institute for Water Research, CSIR, Pretoria: BEN. 2E (25); CRO. 9G (9); CRO. 6T (39); CRO. 13E (5); GEN. 490A (12). The following in the same collection (which were identified by Sciacchitano (1963) as *Batracobdella nilotica*): VAL. series, numbers 616A (1); 988C (1); 1030C (3); 1052B (2); 1105A (2); 1004D (1); 1048C (14); 1051C (10); 1140B (1); 1150B (1); 909A (2); 1003A (2); 998E (3); 895F (4); 1104A (3); 346 B-C (2); 378A (1); 23B (1); 169A (1).

State Museum, Windhoek: SMN65744 (2); 65745 (9); 65746 (18).

3 DISCUSSION

The colours and colour patterns described above are those observed in live and freshly killed leeches. The colouring may become largely or even totally destroyed by preservatives, leaving only the ocular pigment.

The eyes of *Batracobdella disjuncta* are usually relatively larger than those of *B. cheili* and *B. conjugata* and normally the members of the first pair are in contact with each other. Thus, *B. disjuncta* frequently shows a more perfect triangular ocular pattern than the other two species, in which the members of the first pair are usually separated, resulting in eyes roughly arranged in the shape of a trapezium. The occurrence of variations in arrangement and sizes of eyes is common in all three species, which overlap in these respects to such a great extent that the ocular pattern alone cannot reliably be used as a distinguishing feature. A similar situation prevails with regard to general colouration and striping as criteria for distinguishing between these species, particularly in preserved material where the body pigmentation has become greatly changed.

Although the exceptionally deep, cup-shaped oral sucker is a peculiarity of *B. cheili*, it is often drastically altered in appearance during fixation because of contraction of its relatively thin walls. Consequently it is not always distinct enough to enable one to recognise the species by means of this character alone.

If the positions of the gonopores cannot be determined, for separation of *B. conjugata*, the only reliable way to distinguish between the three species is by dissection, when material can be identified according to the following key:

- | | |
|--|---------------------|
| 1. First six pairs of crop caeca unlobed | <i>B. disjuncta</i> |
| Caeca lobed | 2 |
| 2. Genital atria joined | <i>B. conjugata</i> |
| Atria not joined | <i>B. cheili</i> |

Moore's (1939) supposition of conspecificity of his material with that identified by Harding (1932) from Ethiopia as *Glossiphonia heteroclita* is not acceptable in view of the fact that at least four African glossiphonids, one *Glossiphonia* species (Oosthuizen, 1978) and three *Batracobdella* species, are now known to have a "heteroclita - weberfi" ocular pattern.

Although the material reported on herein was carefully compared with Augener's (1936) descriptions of *Clepsine namaquaensis* and *Clepsinides windhukensis*, I could not find any grounds for including the two new *Batracobdella* species described above in either of his two species. Moore (1939) mentioned the possibility of his *Glossiphonia disjuncta* being conspecific with *C. namaquaensis* but the available information does not justify such a supposition. The names *namaquaensis* and *windhukensis* are to be regarded as *nomina dubia* until the material on which Augener based his descriptions can be re-examined to obtain certain essential information omitted by him. Augener (1936) did not mention the repository for his material and so far I have been unable to trace its whereabouts. It seems likely that at least one of his species will prove to be conspecific with one of the three species discussed above, but since the situation is such that any one or two of the present three species may be involved, it is best, for the sake of stability, not to attempt to draw conclusions based on speculation.

4 ACKNOWLEDGEMENTS

I wish to extend my sincere thanks to the following persons and authorities: Prof. F. C. Eloff, Head of the Department of Zoology, University of Pretoria, for research facilities and for reviewing my doctoral dissertation, from part of which this paper was drafted. Mr. R. K. Brooke of the Percy FitzPatrick Institute of African Ornithology, University of Cape Town, for his assistance in choosing names for the two new species. Mr J. J. van Rensburg for inking over the

drawings. Dr. E. Joubert, Nature Conservation and Tourism Division, South West Africa Administration, who acted as my host and guide during collecting trips to South West Africa. Dr. U. de V. Pienaar and his colleagues at Skukuza, who did their utmost to take me to as many habitats as possible during my visits to the Kruger National Park. Dr. M. B. Markus, Department of Zoology, University of the Witwatersrand, who during his stay in London, arranged for the loan of the type-material of *Glossiphonia disjuncta* and for critically reviewing the manuscript. The Chief Director of National Parks and the National Parks Board for the opportunity of carrying out an extensive survey of leeches in the Kruger National Park. The Director of Nature Conservation and Tourism, South West Africa Administration, for permission to collect material in the different game parks and for making transport available. The Keeper of Zoology, British Museum (Nat. Hist.) and Mr R. W. Sims, for the loan of the type-material of *G. disjuncta*.

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6 ABBREVIATIONS

a	atrium
an	anus
br	pharyngeal ganglionic mass
c1, c2, etc.	crop caeca
cr	crop
e	eyes
ej	ejaculatory duct
f	canal for passage of nerve and vessel
fa	female atrium
g IX, X, etc.	ganglia of respective segments
go	gonopore
h	atrial cornu
hg	hind gut
i	intestine
ic	intestinal caeca
lg	ligament
ma	male atrium
n	ventral nerve
o	oesophagus
od	oviduct
os	ovisac
p	proboscis
po	proboscis pore
ps	posterior sucker
re	rectum
rm	retractor muscles
sg	salivary glands
sp	sensory papillae
t1, t2, etc.	testes
tu	tubular connection between oviducts
vs	seminal vesicle
♂ and ♀	indicate furrows in which the respective gonopores are situated.

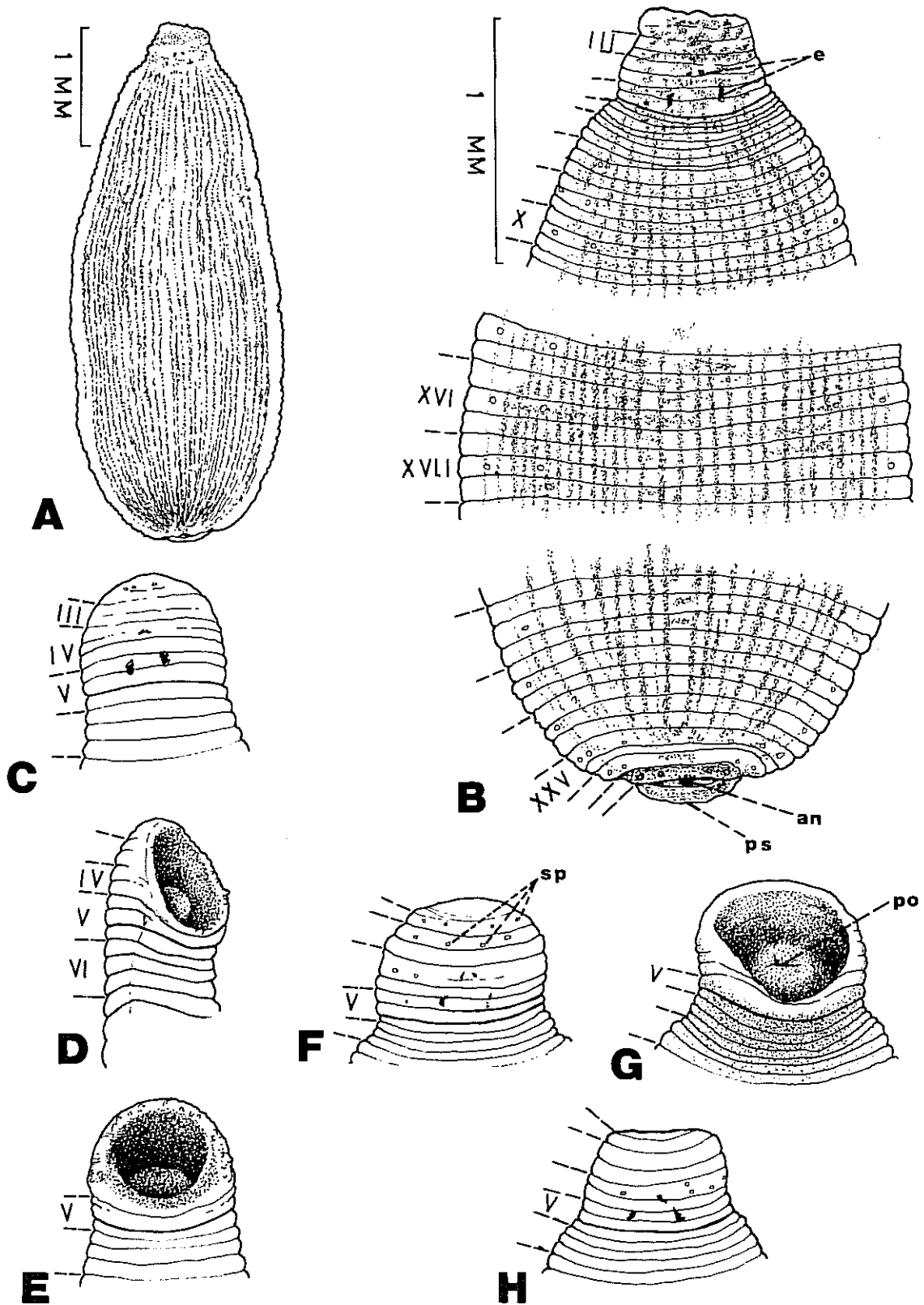


FIGURE 1: *Batracobdella cheili* sp. nov. A, General appearance of freshly preserved material, dorsal view. B, Details of dorsal striped pattern and annulation in anterior, middle and posterior regions. C, Dorsal, D, oblique-ventral and E, ventral views of ideally-preserved head region illustrating typical ocular pattern and nature of cephalic sucker. F and H, examples of variations in size and arrangement of eyes. G, Example of cephalic sucker only mildly affected by fixation, showing inward folding of its posterior wall. B - H drawn to the same scale.

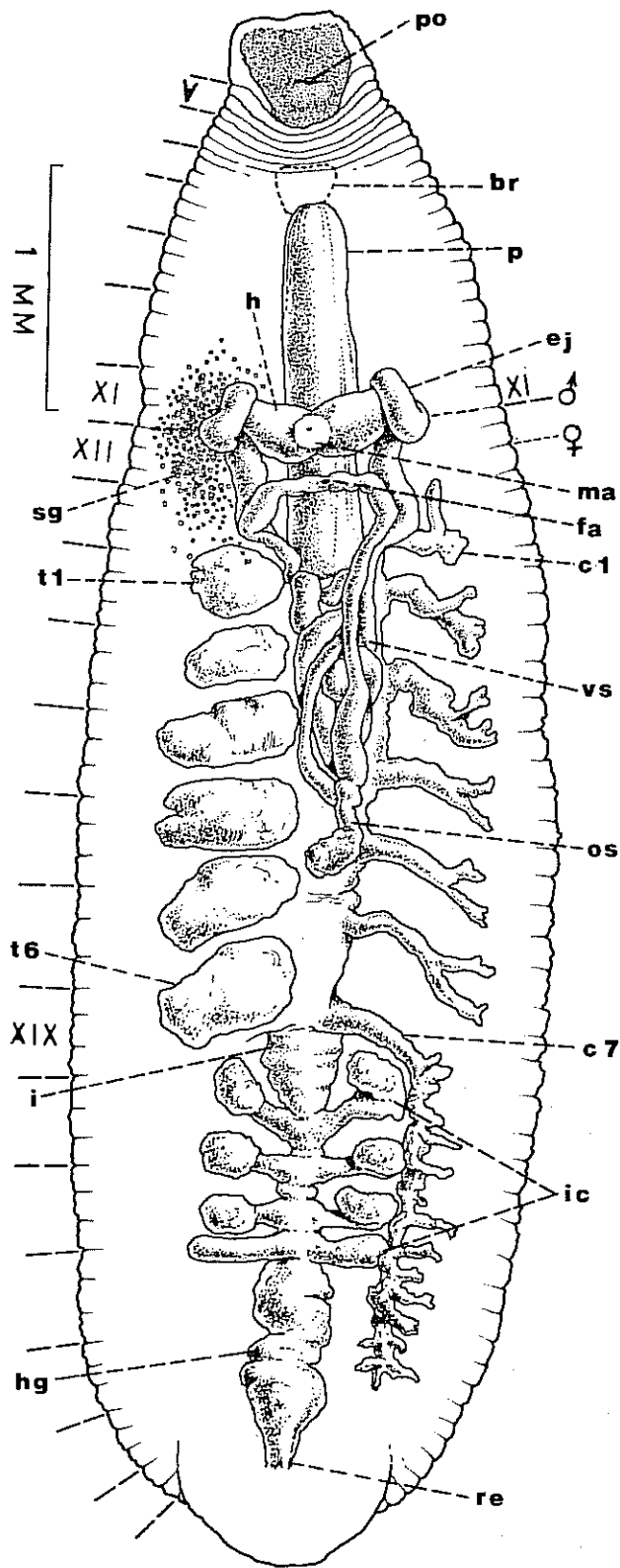


FIGURE 2: *Batracobdella cheili* sp. nov. General dissection showing major internal organs *in situ*, ventral view. Crop caeca of right side and testes of left side omitted.

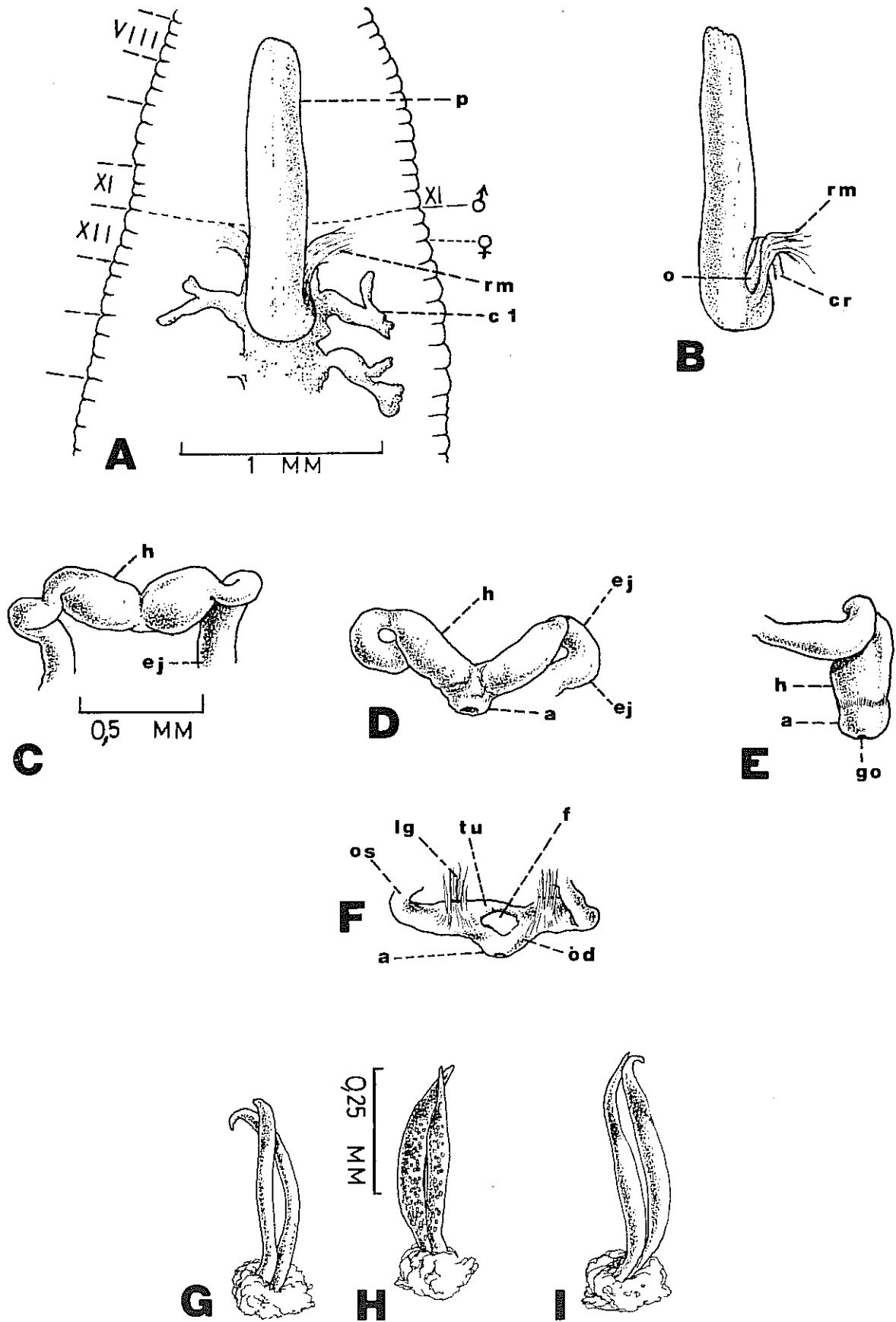


FIGURE 3: *Batracobdella cheili* sp. nov. A, Proboscis *in situ*, protractor muscles omitted, ventral view. B, Lateral view of proboscis. C, Dorsal, D, anterior and E, lateral views of terminal end of male system. F, Posterior view of terminal end of female system. G, Empty and H, I, undischarged spermatophores. A and B, C - F and G - I, respectively, drawn to the same scale.

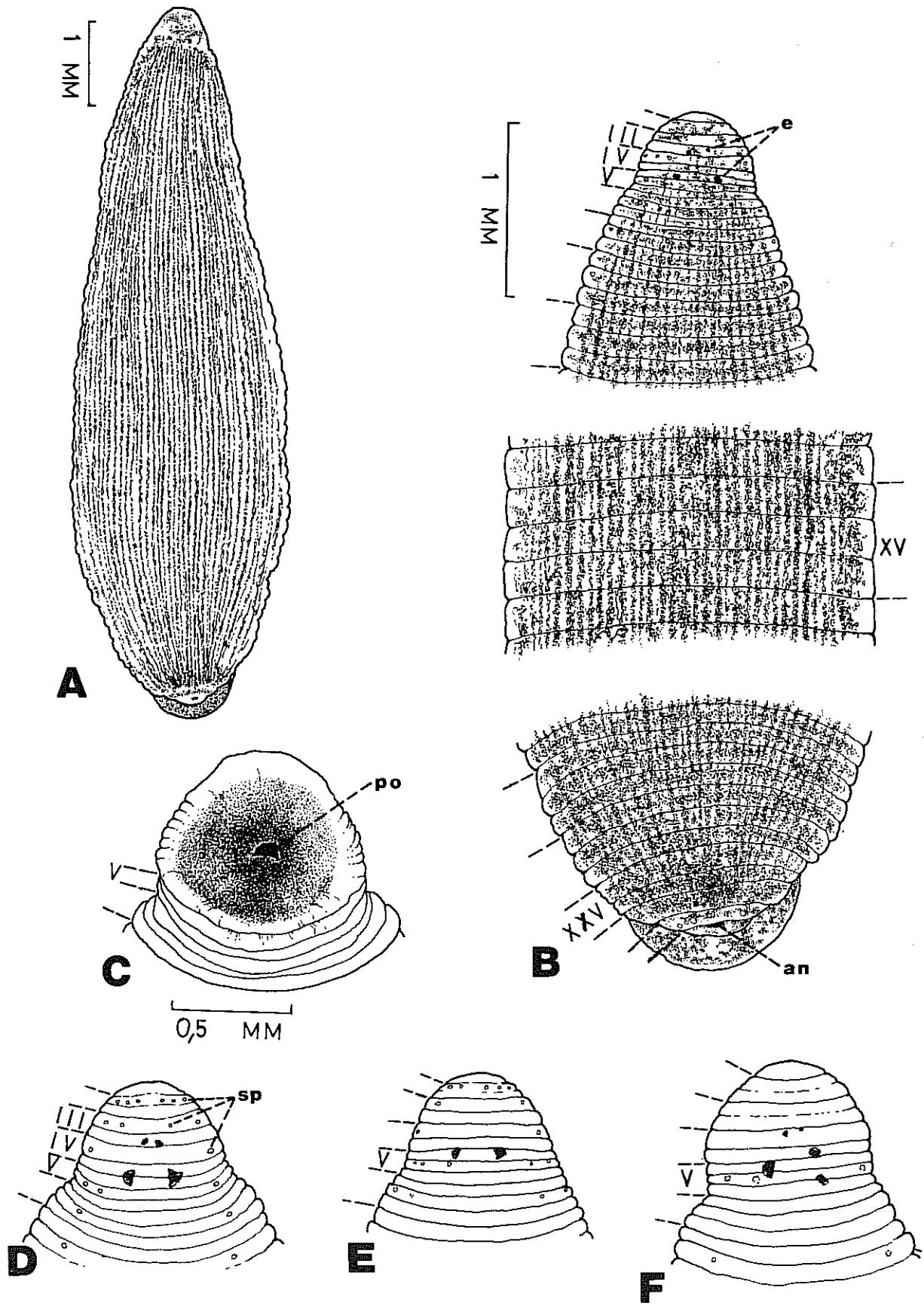


FIGURE 4: *Batracobdella conjugata* sp. nov. A, General appearance of freshly preserved material, dorsal view. B, Details of dorsal striped pattern and annulation in anterior, middle and posterior regions. C, Cephalic sucker. D, Typical and E, F, examples of variations in the ocular pattern. C - F drawn to the same scale.

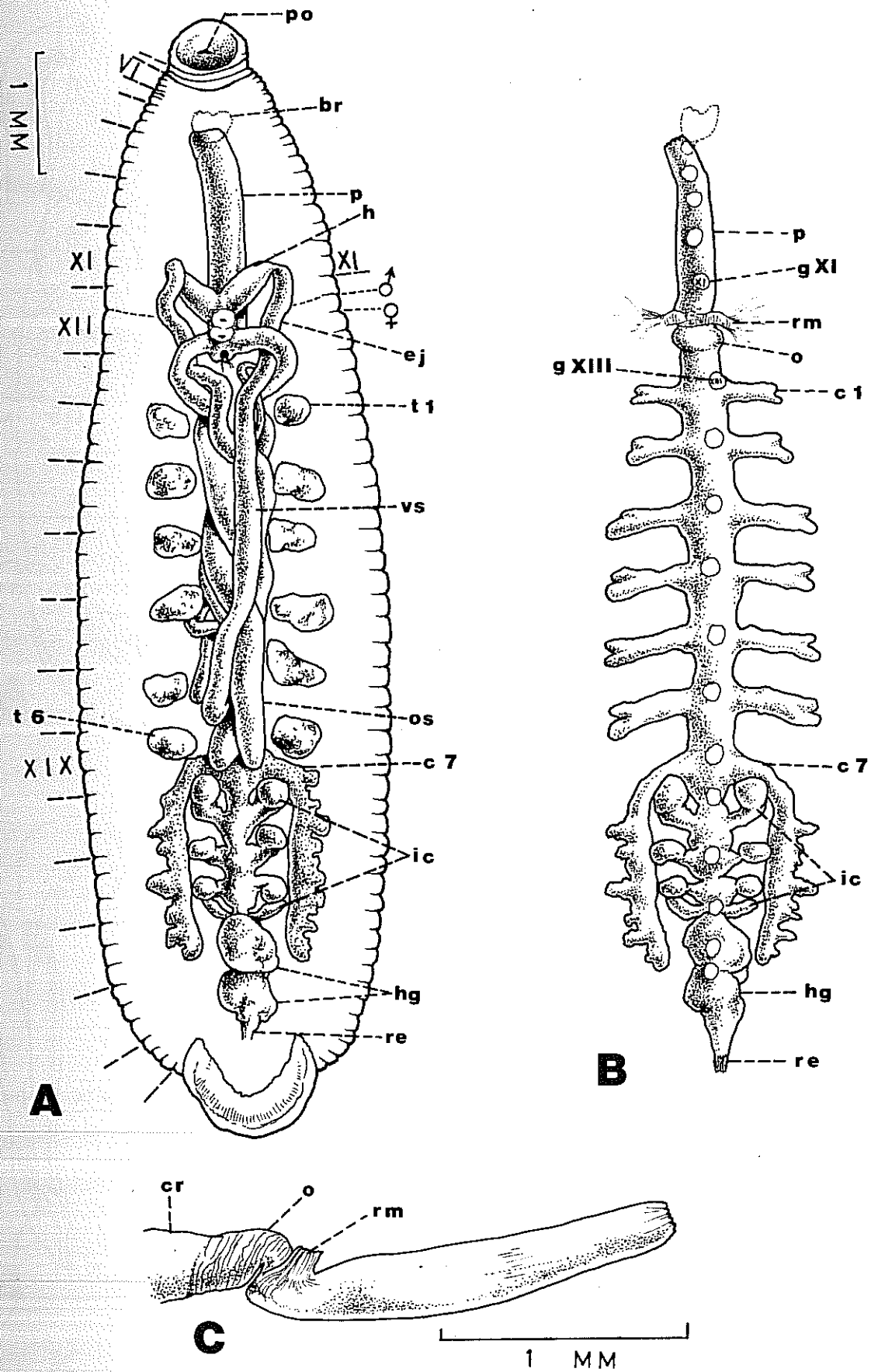


FIGURE 5: *Batracobdella conjugata* sp. nov. A, General dissection showing major internal organs *in situ*, crop largely omitted. B, complete alimentary canal, ventral view. C, Lateral view of proboscis, protractor muscles omitted. A and B drawn to the same scale.

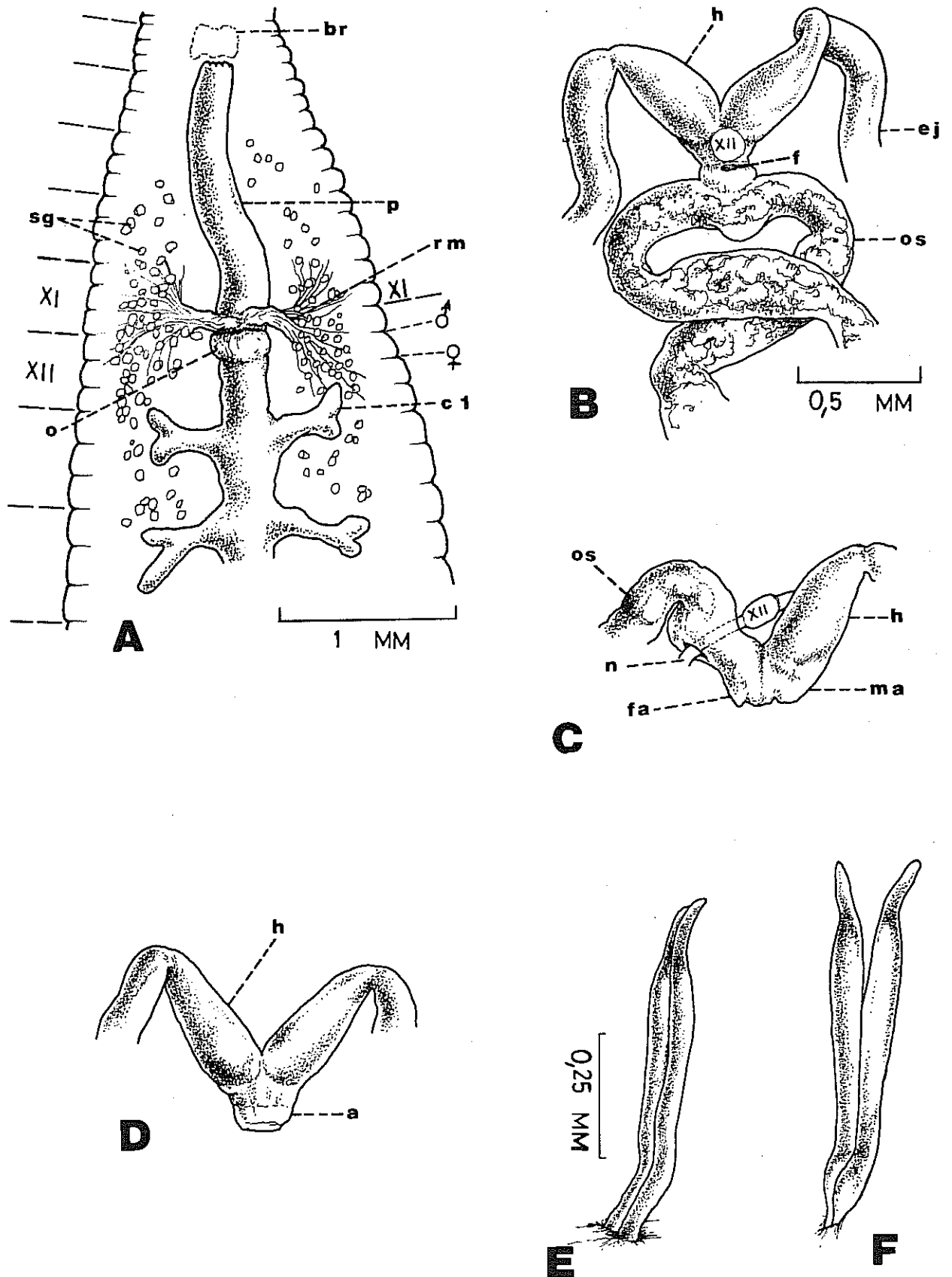


FIGURE 6: *Batracobdella conjugata* sp. nov. A, Proboscis *in situ*, protractor muscles omitted, dorsal view. B, Dorsal and C, lateral views of terminal ends of reproductive systems. D, Anterior view of terminal end of male tubes. E and F, undischarged spermatozoa. B - D and E and F, respectively, drawn to the same scale.

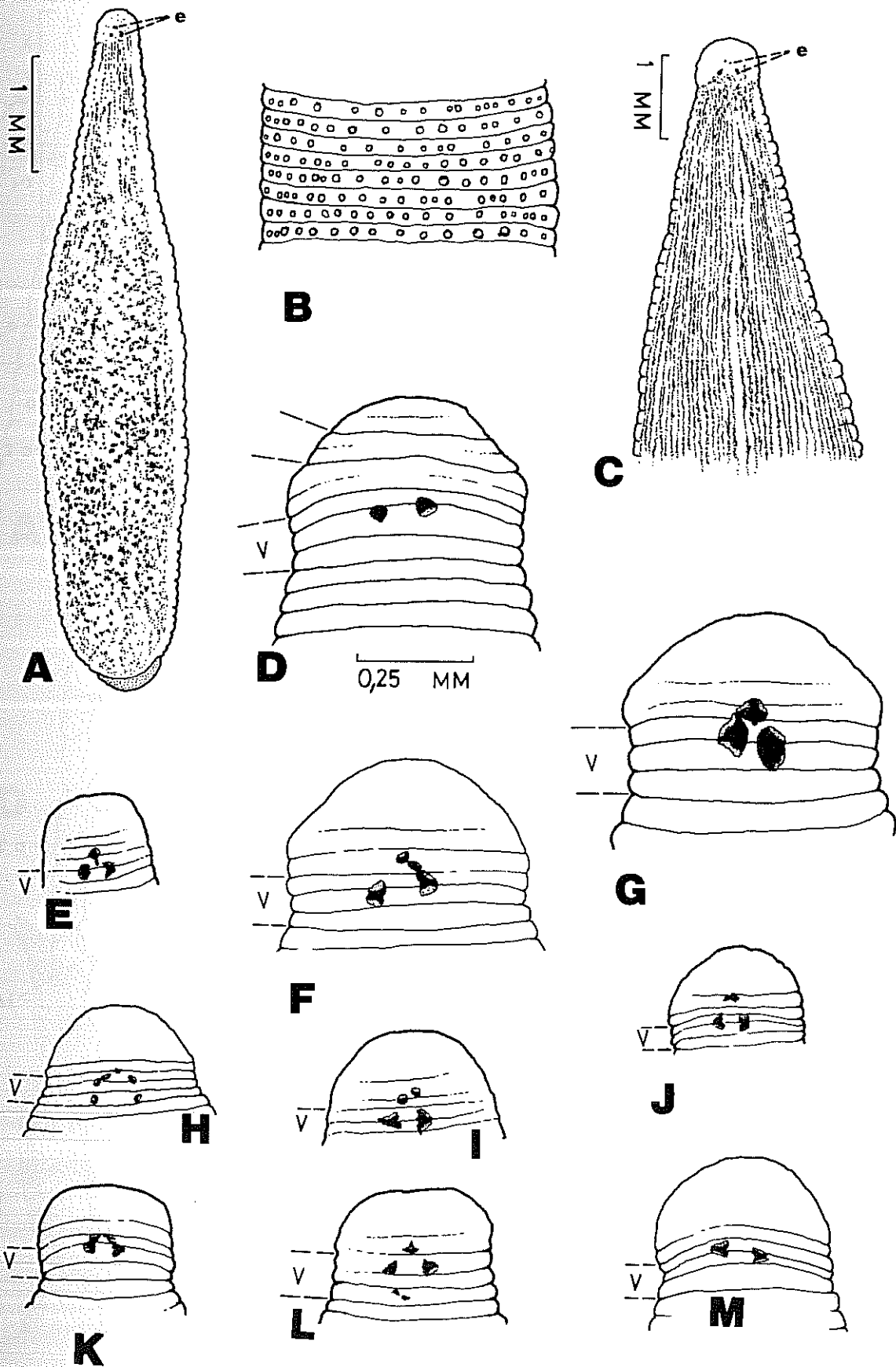


FIGURE 7: *Batracobdella disjuncta*. A and C, colour patterns, dorsal views. B, Dorsal papillation in middle body region. D - M, Annulation in head region and examples of variations in ocular pattern. A and B and D - M, respectively, drawn to the same scale.

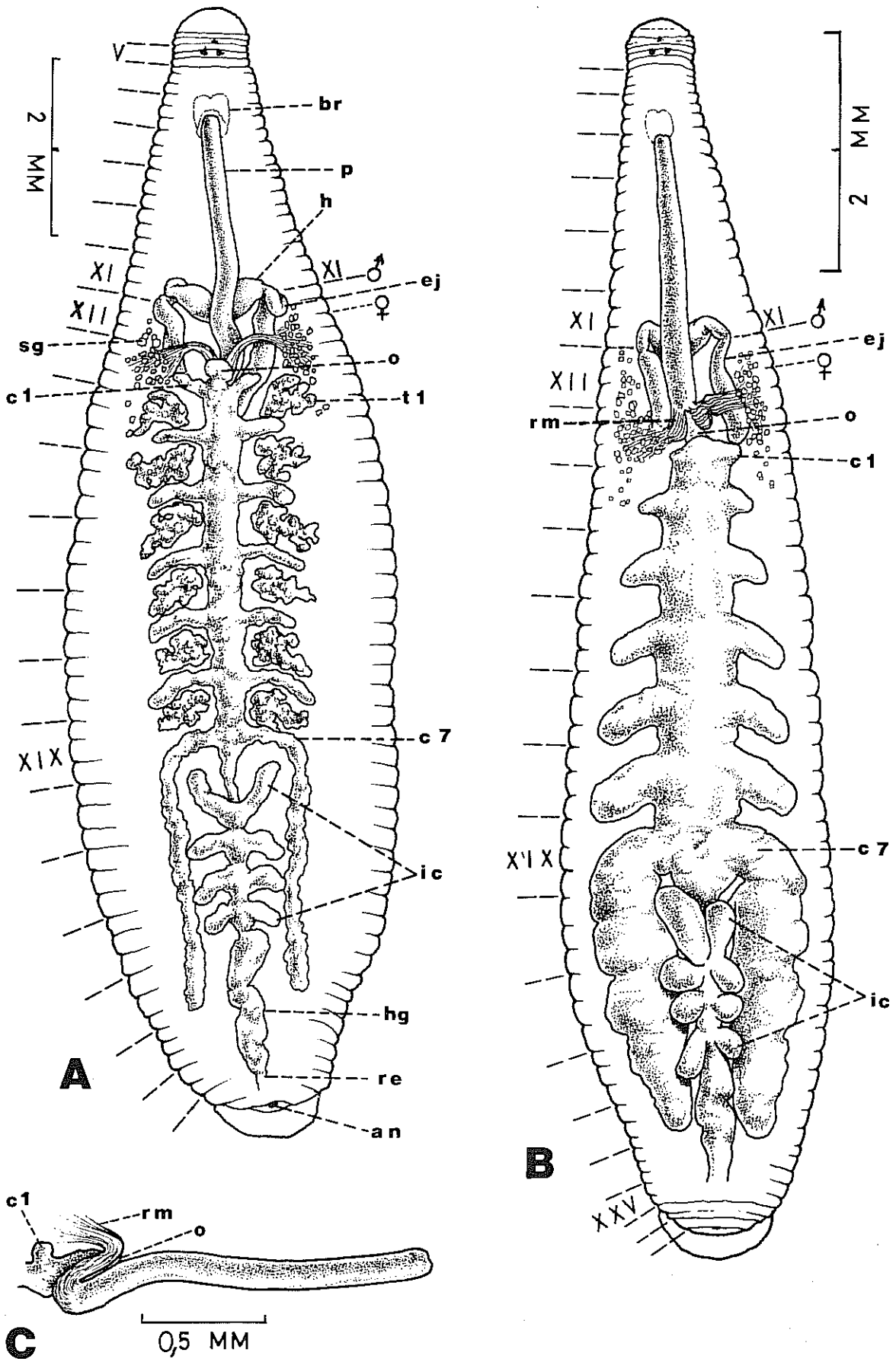


FIGURE 8: *Batracobdella disjuncta*. Alimentary canal in A, starved and B, gorged conditions, dorsal views. C, Proboscis, lateral view, protractor muscles omitted.

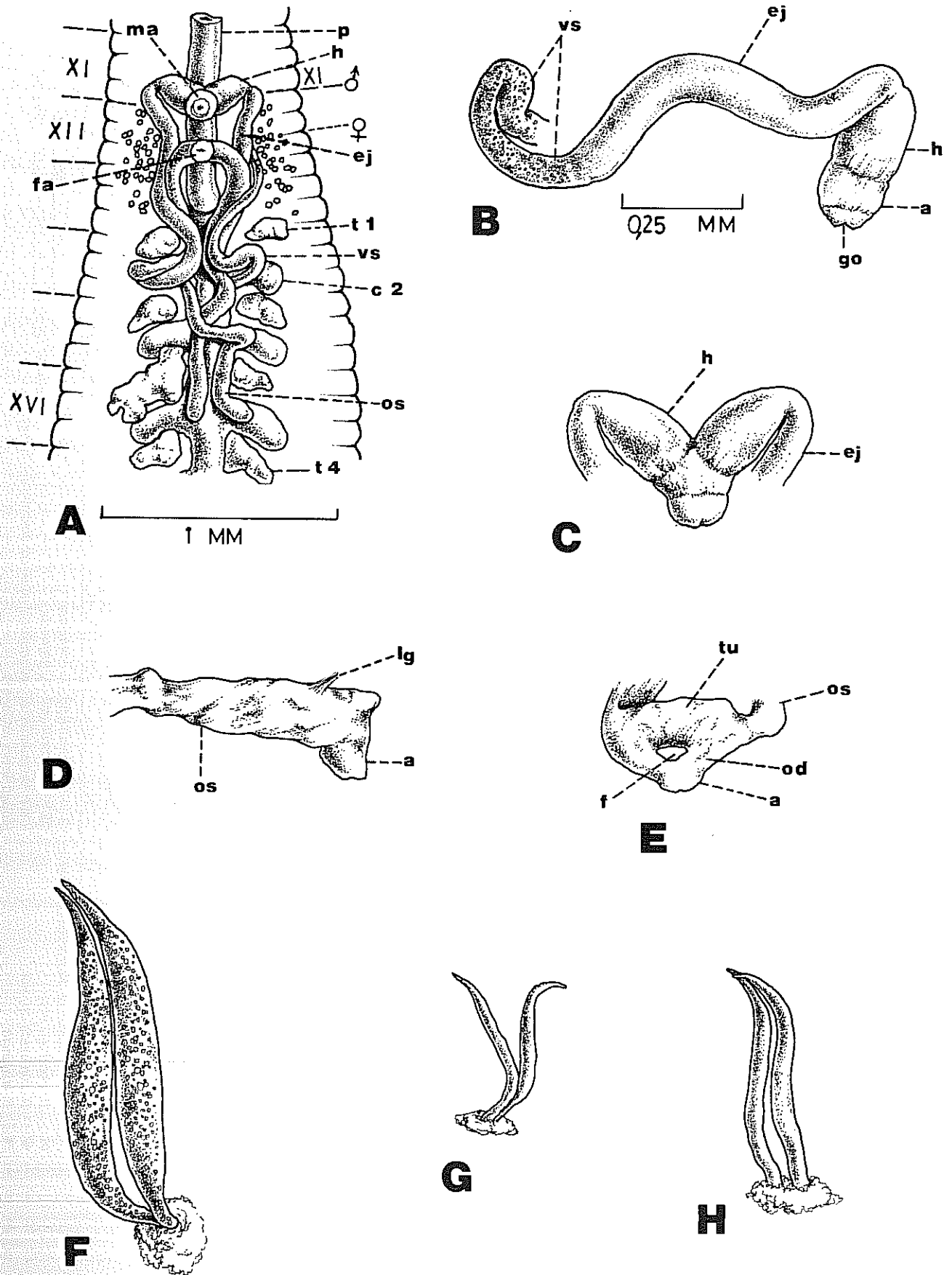
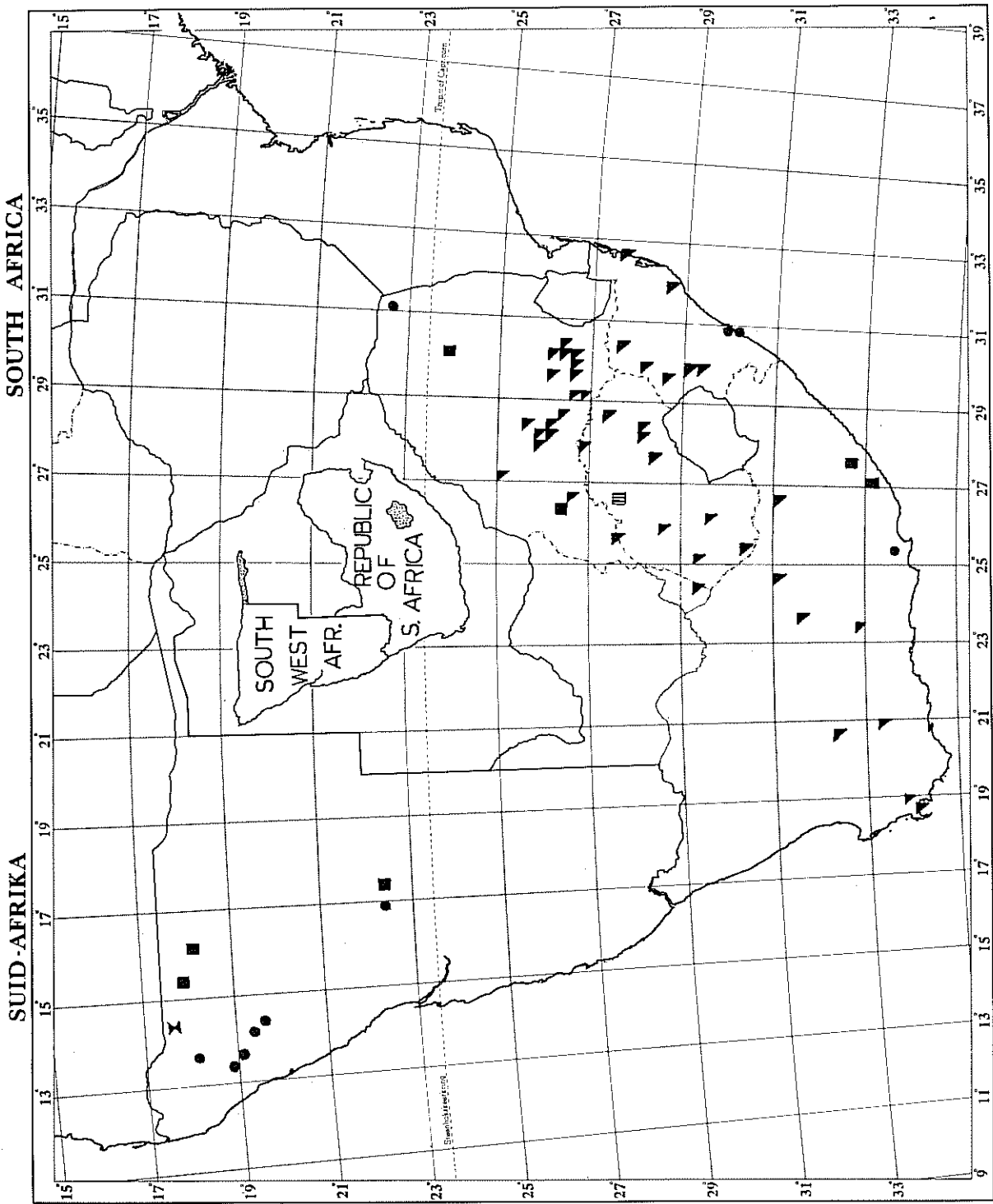


FIGURE 9: *Batracobdella disjuncta*. A, Reproductive systems *in situ*, ventral view, testes 5 - 7 not included. B, Male tubes, lateral view. C, Terminal end of male tubes, anterior view. D, lateral and E, anterior views of terminal end of female system. F, Undischarged and G, H, empty spermatophores. B - H drawn to the same scale.



MAP 1: Distribution of *Battarabdeella* species. \blacksquare : *B. cheitii* and *B. conjugata*
 \bullet : *B. cheitii* sp. nov. \blacksquare : *B. conjugata* sp. nov. \blacktriangle : *B. disjuncta*
 Inset: Boundaries of geographical area covered during survey (dotted areas excluded).