

A new Egyptian species of *Chuniodrilus* (Eudrilidae, Oligochaeta) with observations on internal fertilization and parallelism with the genus *Stuhlmannia*

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Introduction

The genus *Chuniodrilus* Michaelsen, 1913, erected for *C. schomburgki*, from West Liberia, remained monotypic until 1958 when Omodeo described *C. zielae* from Mt. Nimba, Ivory Coast. Subsequently Wasawo & Omodeo (1963) added *C. vuattouxi* and *C. compositus* of which the latter had initially been placed in *Scolecillus* by Omodeo (1958). Both of these species were also from the Ivory Coast as was the sole remaining member of *Scolecillus*, *S. tantillus* Omodeo, 1958, the type species. Recently a further species, *C. fragilis* Sims, 1967, has been described from Gambia.

The present paper reports a sixth species of *Chuniodrilus*, *C. ghabbouri*, from Dahshur, near Cairo, Egypt. This species has been the subject of a valuable ecological paper by El-Duweini & Ghabbour (1965) who identified it as *Gordiodrilus* sp. (Ocneroдрilidae). The author is indebted to Mr. Ghabbour for the opportunity to examine the type series.

This extension of the known range of *Chuniodrilus*, beyond the vicinity of the West African seaboard, to the Nile Valley suggests that further species of the genus remain to be found southwards in the Sudan and East Africa and elsewhere in the wetter parts of tropical Africa. A review of the genus would therefore appear premature and the present paper will be restricted to delimitation of the new species, consequent modification of the generic definition and a brief discussion of the interesting mechanisms for internal fertilization which the genus displays.

Genus *CHUNIODRILUS* Michaelsen, 1913. Emended

Chuniodrilus Michaelsen, 1913 : 26-27 ; Stephenson, 1930 : 870 ; Omodeo, 1958 : 87 ; Wasawo & Omodeo, 1963 : 217-218.

Scolecillus (part.) Omodeo, 1958 : 89.

Terrestrial and limnic worms. Prostomium prolobous to pro-epilobous. Setae closely paired ; $dd : u = 0.5-0.6$. Female pores a pair in 14 or intersegment 14/15. Spermathecal pore paired or single, midventral and posterior in 12 or 13. Male pores paired or single, midventral, opening in segment 17 or intersegment 17/18. Clitellum in the region of segments 13-18. A single midventral or asymmetrically disposed puberty tubercle present in the region of segments 15-20. Oesophageal gizzard in segment 5 or absent ; intestinal gizzards and fat-body-like oesophageal appendages present or absent. Last hearts in segment 12. Testes in 10 and 11 ; testis-sacs absent ; seminal vesicles in 11 and 12, or 12 only. Euprostates with or without a small terminal

copulatory sac. Ventral setae of segment 17 replaced by penial setae. Ovaries persistent at maturity; free in 13 or each enclosed in a peritoneal capsule, into which an oviducal funnel opens and which may also enclose the spermathecal atrium. Oviducts each with a U-shaped loop projecting bend forward into segment 13 and/or a seminal chamber; also with a posteriorly projecting ovisac; the oviducal apparatus equally developed on each side or that of the right side reduced; tubular communication between the spermatheca and the oviducal apparatus absent. Alternatively each ovary is contained in a small sac which discharges into an ovisac and thence via the oviduct to the female pore, both ovarian complexes being enclosed in a perioesophageal coelomic sac system which sends a tube on each side to the spermathecal atrium. Spermatheca with single or double atrium and tubular or bulbous ampulla.

TYPE SPECIES: *C. schomburgki* Michaelsen, 1913. West Liberia.

OTHER SPECIES: *C. zielae* Omodeo, 1958.
C. compositus (Omodeo), 1958.
C. vuattouxi Wasawo & Omodeo, 1963. } Ivory Coast
C. fragilis Sims, 1967. Gambia.
C. ghabbouri sp. nov. Egypt.

Key to species of *Chuniodrillus*

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|------|--|------------------------------|
| 1 | Puberty tubercle located on the right of the midventral line in segments 14 and 15 or 15 and 16. (Gizzards present in 21 and 22) | <i>C. vuattouxi</i> |
| - | Puberty tubercle midventral. (Gizzards present or absent) | 2 |
| 2(1) | Median puberty tubercle limited to or beginning on segment 18 | 3 |
| - | Median puberty tubercle not on segment 18 | 4 |
| 3(2) | Oesophageal gizzard present. Intestinal gizzards absent | 5 |
| - | Oesophageal gizzard absent. Intestinal gizzards in segments 24-26 | <i>C. compositus</i> |
| 4(2) | Median puberty tubercle in 15. Oesophageal gizzard and five intestinal gizzards present | <i>C. schomburgki</i> |
| - | Median puberty tubercle on 16. Oesophageal gizzard present but intestinal gizzards absent | <i>C. ghabbouri</i> sp. nov. |
| 5(3) | Penial setae sigmoid. Peri-oesophageal coelomic sac present, enclosing the female organs | <i>C. fragilis</i> |
| - | Penial setae arciform. Peri-oesophageal sac absent | <i>C. zielae</i> |

Discussion

Chuniodrillus is distinguished from the closely allied *Stuhlmannia* by four characters: (1) the presence of a midventral puberty tubercle or genital pad, (2) the presence of a discrete 'cutting blade' (Wasawo & Omodeo, 1963) at the tip of each penial seta, (3) a tendency to reduction of the right oviducal apparatus as against reduction on the left side in *Stuhlmannia*, and (4) the presence of intestinal gizzards, which are unknown in *Stuhlmannia*. *Chuniodrillus* as thus defined is polythetic in that none of the four characters is present in all the constituent species. *C. fragilis* Sims lacks three of the characters, a fact which, taken with peculiarities of the female reproductive apparatus, especially the peri-oesophageal coelomic sac, suggests that it is cladistically, possibly generically, distinct from the remaining *Chuniodrillus*

species. The generic distinction of *Scolecillus* is, on the other hand, questionable. In the sole species, *S. tantillus* Omodeo, 1958, the form of the female genital apparatus, with its peritoneal ovarian capsule, seminal chamber and ovisac (fig. 1 E) conforms with that of *Chuniodrillus* and the fact that the right oviducal apparatus is entirely absent endorses the relationship, apparently constituting a completion of the tendency to asymmetry seen in *Chuniodrillus*. Absence of a puberty tubercle, of penial setae, of gizzards and of seminal vesicles may represent modifications associated with reduction in size, the maximum recorded length of *S. tantillus*, 13 mm, making it the smallest known terricolous oligochaete.

Internal fertilization in Chuniodrillus and variation in the female system

Sims (1964) and Jamieson (1967) have drawn attention to evidence of the occurrence of internal fertilization in the genera *Legonea* (Eudrilinae) and *Stuhlmannia* (Pareudrilinae) respectively. It is clear that the female genital system is adapted to internal fertilization in *Chuniodrillus* also. Thus in *C. schomburgki* the ovarian capsule of the left side contained large masses of mature sperm which must have wandered thence from the spermatheca (Michaelsen, 1913). Although no communication between the spermatheca and the ovarian capsule was observed, Michaelsen inferred that one existed on the left side, on which the ovisac, U-shaped loop and seminal chamber were well developed, but not on the right side where the oviducal apparatus was smaller in all respects and apparently lacked a seminal chamber. He considered that sperm in the seminal chamber of the left oviduct had reached it from the ovarian capsule through the oviducal funnel. It is perhaps unnecessary to postulate an open connection between the spermatheca and the female system as there is evidence that movement of sperm through the wall of the spermathecal atrium occurs in *Stuhlmannia* (v. Jamieson, 1967) but why sperm enter only the left system is problematical unless a special asymmetrical chemotaxis exists. A differential chemotaxis might, alternatively, be involved. Mere scarcity of sperm owing to absence of a seminal chamber on the right would be unlikely to cause them to be totally

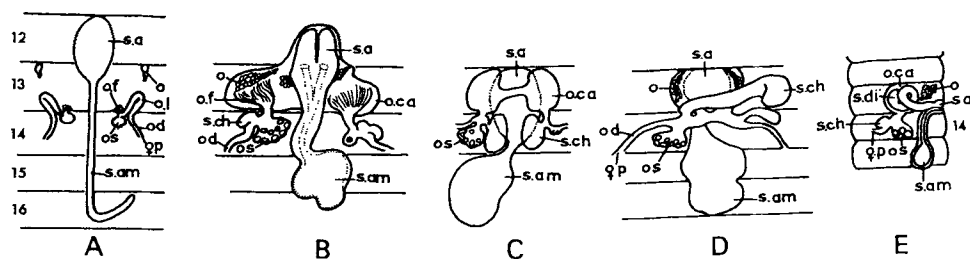


FIG. 1. Spermathecal and female genital systems in *Chuniodrillus* and *Scolecillus* arranged in order of increasing modification. (A) *C. ghabbouri* sp. nov.; (B) *C. zielae*; (C) *C. vuattouzi*; (D) *C. compositus*; (E) *Scolecillus tantillus*. (A, original. B, D and E modified after Omodeo, 1958. C, modified after Wasawo & Omodeo, 1963). Abbreviations: ♀p, female pore; o, ovary; o.ca, ovarian capsule; od, oviduct; of, oviducal funnel; o.l., oviducal loop; os, ovisac; s.a. spermathecal atrium; s.am, spermathecal ampulla; s.ch, seminal chamber; s.div, spermathecal diverticulum.

overlooked on this side. A slight possibility exists that sperm enter the oviducal apparatus through the female genital pores in segment 14 but if this were normal in eudrilids, the presence of sperm-filled spermathecae would be redundant.

In *C. zielae* (fig. 1 B) a capsule formed by duplication of the peritoneum envelops the ovaries and the spermathecal ampulla. Into this capsule open the oviducts. Each oviduct carries a seminal chamber and an ovisac but the ovisac of the right side is again vestigial (Omodeo, 1958). An oviducal loop has not been described but from the illustration (Omodeo, 1958, fig. 39) it appears possible that a loop is incorporated in the structure labelled as a seminal chamber.

In *C. vuattouxi* (fig. 1 C) and *C. compositus* (fig. 1 D) a peritoneal capsule again encloses the spermathecal atrium together with the ovaries and their funnels but U-shaped oviducal loops are absent. In *vuattouxi* there is a transverse connection between the ovarian capsules whereas in *compositus* it connects the oviducts. The right ovisac is rudimentary (*vuattouxi*) or absent (*compositus*). In *vuattouxi* two equal sized, globular seminal chambers depend posteriorly from the oviducts; the seminal chambers and the spermatheca contained sperm although the spermathecal pore was imperforate (Wasawo & Omodeo, 1963 : 221). These authors considered it likely that the spermatozoa reached the spermatheca through temporary perforation of the body wall underlying the spermathecal atrium, the sharp penial setae of the partner serving to effect this. Access to the ovarian capsules was surmised to be through the walls of the spermatheca. In *compositus* an elongated seminal chamber arises from the anterior aspect of each oviduct shortly ectal to their union. Both chambers contain sperm but that on the left is greatly enlarged (Omodeo, 1958 : 92, fig. 41). The conditions in the two species are thus essentially similar with *compositus* showing greater reduction on the right side.

C. ghabbouri sp. nov. (fig. 1 A) lacks ovarian capsules and sperm chambers, and possibly does not undergo internal fertilization. Symmetry of the ovisacs suggests that the simplicity of the funnel apparatus is primitive and not a retrogression. Confirmation of the structure described from fully mature specimens would be desirable.

Scolecillus tantillus (fig. 1 E) appears, like *C. schomburgki*, *zielae*, *compositus*, and *vuattouxi* to be adapted to internal fertilization, although spermatozoa have not been observed in the female system. Congruence of the female system with that of *Stuhlmannia asymmetrica* is striking, both species representing the final stage in reduction of the oviducal apparatus of one side. In *S. tantillus* there are two ovaries, of which the right is reduced, enclosed in an ovarian capsule which also encloses the spermathecal atrium and the helical diverticulum of this. There are no oviducal funnels. The single (left) oviduct bears a large ovisac and a small sperm chamber. The location and appearance of the latter in Omodeo's illustration (fig. 40) suggests the possibility that it is a U-shaped oviducal loop rather than a sperm chamber. The spermathecal diverticulum has the appearance of being the equivalent of the single coelomic diverticulum of *Stuhlmannia asymmetrica* or a sperm chamber of *Chuniodrillus*, but its enclosure in the ovarian capsule militates against this.

The female genital apparatus of *C. fragilis* Sims, 1967, differs markedly from the condition seen in other species of the genus. The paired ovaries lie posteriorly in the body cavity of segment 13 and because septum 13/14 is conical are actually housed within the parietes of segment 14. Each ovary is contained within a small sac which discharges into an ovisac; this in turn opens into an oviduct terminating at the corresponding female pore in inter-segmental furrow 14/15; a digitiform diverticulum arises from the ectal end of the oviduct. Each set of female organs is enclosed in a tube which forms part of a coelomic sac system. The tubes pass forward from the ovarian region, widening greatly, and unite above and below the oesophagus where this overlies the spermathecal atrium. From the ventral junction a small tube passes downward, one on each side, to the laterodorsal aspect of the spermathecal atrium (Sims, 1967). It seems probable, from its form and position, that the ovary is the equivalent of the ovisac of other *Chuniodrilus* species and that the ovisac represents the ovarian capsule. If the former suggestion be correct, it would seem that the original ovaries may have been transferred to the ovisacs as Beddard (1895) has described for *Polytoreutus kilindinensis*. The diverticula of the oviducts may be homologues of the seminal chambers of other *Chuniodrilus* species but they more nearly resemble, in form and location, the oviducal diverticula of the eudriline genus *Legonea*. Sims has drawn attention to this and other indications of possible affinity between *C. fragilis* and the Eudrilinae.

Parallelism in Chuniodrilus and Stuhlmannia

The female reproductive apparatus of *Chuniodrilus* raises an interesting question of homology. The seminal chambers ('chambres spermatiques') of *C. compositus* are reminiscent of the 'coelomic diverticula' of some species of *Stuhlmannia*. If the oviducts, instead of uniting below the oesophagus, were united above it, as in *Stuhlmannia*, a condition similar to that in *S. gracilis*, which has paired diverticula, would obtain with the exception that asymmetry is reversed and oviducal loops are absent. The ovarian capsules, the region of the oviducts ental to union, and the oviducal funnels, would appear to be the equivalents of the peri-oesophageal 'coelomic tubes' of *Stuhlmannia*.

The term 'equivalents' has been used above to avoid postulating strict homology with *Stuhlmannia*. The evidence favours regarding the simpler members of either genus, lacking sperm chambers or coelomic diverticula, ovarian capsules, coelomic tubes and union of the oviducal apparatus of the two sides, as primitive and not as secondarily simplified (Jamieson, 1967). Yet the fact that *ghabbouri* is recognizably a *Chuniodrilus* rather than a *Stuhlmannia* suggests, as does the inversion of asymmetry between the two, that complication of the female organs in each genus has occurred separately and independently of the other genus. If this be the case, similarity of structure in the two genera might more correctly be regarded as an instance of parallelism than one of strict homology. Thus equivalence of the coelomic diverticulum and the seminal chamber may be regarded not as a case of homology i.e. resemblance due to inheritance from common ancestry (Simpson, 1961) but of parallelism, i.e. the development of similar characters separately in two or more lineages of common ancestry and on the basis of, or channeled by,

characteristics of that ancestry (Simpson, l.c.). Strict homology would appear to be well exemplified by the female systems in the *variabilis* group of *Stuhlmannia* (see Jamieson, 1967) and probably in *C. compositus* and *C. vuattouxi*. In the latter case it is possible to envisage for the two species common ancestry already displaying an essentially similar female system. Overall phenetic resemblance of the two species is correspondingly unusually high.

Description

Chuniodrillus ghabbouri sp. nov.

(Figs. 1 A, 2-4)

Gordiodrillus sp., El-Duweini & Ghabbour, 1965 : 271-287.

TYPE LOCALITY : Dahshur, Egypt, in marshy ground, collector Samir I. Ghabbour, 19 September 1961 and 19 September 1966. The Dahshur marsh, lying at the edge of the Western Desert, has a coarse-textured soil which is submerged in water seeping from the Nile flood from September to January. It is exposed for the rest of the year but the soil remains saturated. The vegetation is mainly *Cynodon dactylon*, *Cyperus rotundus*, *C. laevigatus* and *Phragmites communis*. For a map and edaphic and other data see Khalaf & Ghabbour (1965).

MATERIAL : Many specimens most of which are sexual but none of which has a recognizable clitellum. Absence of the hind end from most specimens suggests that autotomy occurs readily. The following material has been lodged in the British Museum (Natural History) : the holotype (vertical and horizontal longitudinal sections), B.M.(N.H.) Reg. No. 1967.9.1/23 ; 10 paratypes B.M.(N.H.) Reg. No. 1967.9.24/33 and two slides of penial setae B.M.(N.H.) Reg. No. 1967.9.34/35.

DESCRIPTION : Length 130-149 mm, width 3 mm, 308-321 segments (paratypes 1 and 3). Prostomium proepilobous, small and rounded. Form slender, circular in cross section, widest in the region of segments 4 and 5. Pigmentless in alcohol. Clitellum undeveloped apparent modification in $\frac{1}{2}$ 12 to 18 in 1 specimen. Setae small unornamented, very closely paired, all pairs ventrolateral and ventral. Intersetal ratios are as follows :

Segment	Specimen	aa	ab	bc	cd	dd	aa : ab	dd : u
12	Holotype	8.5	1.5	7.0	1.0	32.5	5.7	0.54
12	Paratype	7.5	1.3	5.5	1.0	30.0	6.0	0.57
12	Paratype	6.4	1.2	7.0	1.0	22.0	5.3	0.47
300	Paratype (skin preparation)	11.8	1.3	6.8	1.0	45.0	9.4	0.59

An approximately diamond-shaped orifice, which may be termed the male genital vestibule, lies in intersegmental furrow 17/18 (fig. 2). Its lateral limits are in line with the ventral setal couples ; anteriorly, it reaches half way to the setal arc of 17 and posteriorly impinges a little on 18. Viewed from the ventral side, the floor of the vestibule is inclined internally from the rear edge and is overhung by the anterior border ; the male pore is a small, transverse, median

slit between two dark points which are the orifices of the follicles of the penial setae. The distance between the follicles approximately equals *ab*. The ventral setal couples are absent from 17. The ventral surface of segment 17, in front of the vestibule, is thrown into folds or ridges which laterally reach to *b* lines; the posterior ridges follow the outline of the vestibule while the anterior are transverse. The prostates are visible through the body wall, converging towards the male pore.

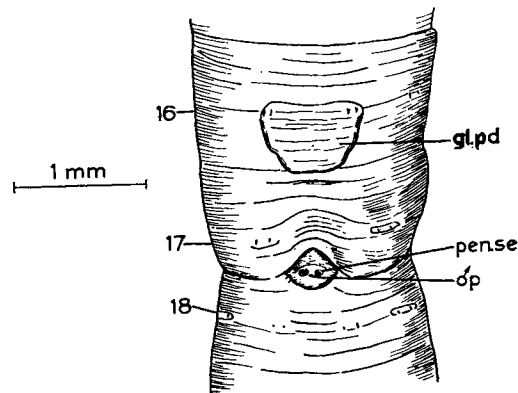


FIG. 2. *Chuniodrillus ghabbouri* sp. nov. Male genital field of a paratype. Abbreviations: gl.pd, glandular pad (puberty tubercle); ♂p, male pore; pen.se, penial seta (freshhand).

A trapezoidal tumescent pad fills the region from the setal zone of 16 to intersegmental furrow 16/17; its anterior border extends laterad of setae *b*, its posterior border to *b* lines. Female pores not visible; from internal examination paired and equatorial in 14.

Spermathecal pore imperforate. Spermatheca visible through the body wall as a narrow, longitudinal, whitish, median strip extending from intersegmental furrow 16/17 to the anterior border of segment 12; an expansion in this segment represents the spermathecal atrium. Dorsal pores absent.

INTERNAL ANATOMY. (From paratype 2, with other specimens where stated.)

Septa funnel-shaped as far as 14/15, 6/7-9/10 extremely thickened; 5/6 and 10/11 slightly thinner but still very thick; 11/12 moderately, 12/13 and 13/14 slightly thickened; the remainder delicate (holotype and three paratypes). The most posterior salivary glands are masses on the anterior wall of segment 5 (holotype and several paratypes). Nephridia avesciculate holonephridia, the postseptal bodies commencing in 13; not reaching maximum size until 16 where they form flattened lobes extending far dorsally; ducts entering the body wall in *ab* lines (several specimens).

Dorsal blood vessel single, continuing onto the pharynx, receiving in segment 15 a pair, and in the succeeding segments two pairs of dorso-intestinal blood vessels from the roof of the intestine. Dorso-ventral hearts in 7-12, those of 11 and 12 (paratype 2) and also 9 and 10 (further paratype) latero-oesophageal hearts (connecting the dorsal and supra-oesophageal vessels to the ventral vessel). Supra-oesophageal vessel present from the heart of 12 as far forward as the pharynx, being larger on the pharynx than is the dorsal

vessel. In segment 10 a pair of wide vessels arises from below the oesophagus and, encircling the latter, unites with the supra-oesophageal vessel posteriorly in the segment. Each of the encircling vessels is ensheathed in fat-body-like tissue and with it constitutes one of the "fettkörperartige Oesophagelanhänge" (e.g. Michaelsen, 1900) characteristic of the Pareudrilinae. These fat-body-like appendages (fig. 3) are present in segments 6–14 (holotype and paratype); it appears that they communicate with the supra-oesophageal vessel in 6–10, but in 11 and 12 this connection was not verified, and in 13 and 14 the upper end of each appendage remains below the oesophagus, the supra-oesophageal being absent behind 12. Subneural vessel absent throughout. Large latero-parietal trunks run forward on the parietes on each side of the gut at least as far as segment 8, and backwards past the euprostates, from their origins in 14 from the ventral blood vessel (paratype 2). It appears that fat-body-like appendages arise from a longitudinal suboesophageal blood vessel (distinct from the ventral vessel) and that those which communicate with the supra-oesophageal also send a vessel to the gut (presumably to the peri-oesophageal sinus) (paratype 2 and other specimens).

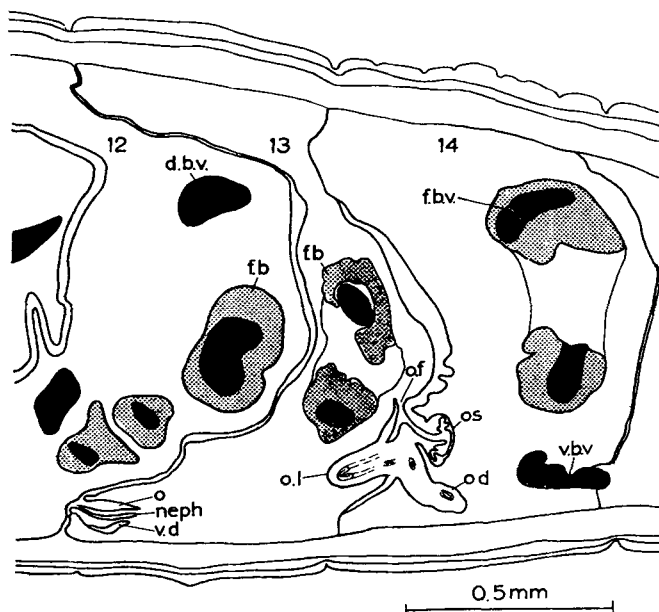


FIG. 3. *Chuniodrillus ghabbouri* sp. nov. Vertical section through the female segments of the holotype. Abbreviations: d.b.v., dorsal blood vessel; f.b., fat-body-like oesophageal appendage; f.b.v., blood vessel of the latter; neph, nephridium; v.b.v., ventral blood vessel; v.d., vas deferens; other abbreviations as fig. 1 (camera lucida).

Gizzard very large and highly muscular in segment 5, which it does not longitudinally distend, bent in paratype 2 into a Z-shape, the transverse portions being less muscular. Intestine beginning in 15 where the alimentary canal expands abruptly and may be wider than further posteriorly; a low rounded dorsal typhlosole commencing in segment 22; oesophageal gizzards absent. No calciferous glands. Vascular striae in the walls of the gut in 14–16 do not warrant recognition of Morren's glands as corresponding internal ridges were not consistently present in different specimens.

The buccal cavity opens in segment 3 into a tubular pharynx which is continuous posteriorly with the oesophagus and dorsally forms a large diverticulum. The diverticulum is lined by a very regular columnar epithelium, with brush-border, and is surrounded by radial musculature with fibres orientated in the direction of the long axis of the epithelial cells. Also associated with the pharynx is a longitudinal series of fine chromophil (salivary?) glands each of which, except that adjacent to the gizzards in segment 5, is supported posteriorly by a tendon joined to the dorsal wall (holotype).

Holandric; very elongated tongue-like free testes in 10 and 11, sperm funnels relatively simple, beaker-shaped, located about half way up septa 10/11 and 11/12, the mouth directed antero-dorsally, a vas deferens emerging from each between the lower lip and the base of the testis segment.

Fusiform seminal vesicles, with long axes orientated in the antero-posterior direction, a pair in each of segments 11 and 12, the posterior pair the larger, being as long as the segment. The two vasa deferentia of each side leave the small, free seminal funnels in 10 and 11 and join in 12. The common vas of each side then runs along the corresponding latero-parietal vessel and appears

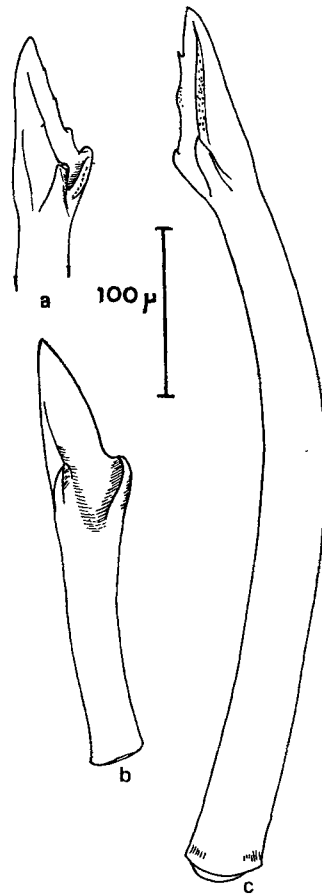


FIG. 4. *Chuniodrillus ghabbouri* sp. nov. Penial setae of three paratypes. (A) tip of left seta observed *in situ*; (B) immature left seta; (C) a mature right seta (camera lucida).

to join the euprostate gland of its side near the ectal end of the gland (paratype). Sections of paratype 1 reveal, however, that the lumina of vas and prostate unite at the ental extremity of the latter. Euprostate glands wide, straight, divergent, muscular tubes, with rounded ental ends. They unite anteriorly in 18 without narrowing; the longitudinal extent of the zone of junction of the two prostates is therefore greater than the width of a gland. The common duct, which is approximately as long as this zone, is a little narrower than a gland and discharges into a small copulatory pouch. A single penial seta with a very muscular follicle is located anterolateral to each prostate, (paratype 2).

A well developed penial seta in one sexual paratype (fig. 4 C) measures 0.53 mm in length and its cylindrical, slightly bowed shaft is maximally (at the ental end) $46\ \mu$ wide. The shaft tapers slightly to the ectal fifth which ends in a sharp bullet-shaped point but on each 'ventrolateral' flank (regarding the concavity of the setal curvature as ventral) expands to form a ridge or flange increasing in height entally until it meets the tip of the very large, curved ectally directed tooth. Each connecting ridge has a minutely denticulated or roughened surface and, in a further paratype, a few coarse serrations. The structure of the penial setae of several specimens was the same (fig. 1 A, B). It is reminiscent of the penial seta of *Stuhlmannia suctorica* but differs in the pointed tip.

The walls of the prostate glands near the common duct consist, from the exterior inwards, of a low peritoneum with few irregular longitudinal muscle fibres and blood vessels, an extremely thick layer of circular fibres, a narrow layer of longitudinal muscle, a zone of apparently radial (muscle?) fibres with obvious nuclei and finally deeply-staining ciliated columnar epithelium. Near the ental end, layering internal to the wide circular muscle layer is indefinite, the tissue between the muscle layer and the internal epithelium consisting solely of a diffuse connective tissue, with blood vessels, in which can be seen the vas deferens. A distinct glandular layer is not present but oval lacunae in the circular muscle layer appear to have secretory contents, each lacuna resembling, though somewhat larger than, an epidermal goblet cell.

The histology of the euprostates in *C. ghabbouri* is thus unlike that of *C. zielae*, *C. vuattouxi* and *Scolecillus tantillus* in which the muscular layer is thin and a glandular layer is very well developed (Omodeo, 1958; Wasawo & Omodeo, 1963).

Ovaries paired on the anterior wall of segment 13, each located immediately above the point at which the nephridial narrow tube penetrates its septum and above and slightly median to the vas deferens (several specimens). Oviducal apparatus (figs. 1 A, 3) symmetrically developed on each side. A slit-like oviducal opening on a very short stalk, which does not comprise a typical funnel, projects from the posterior wall of 13 on each side. This funnel leads directly into an ovisac (empty owing to immaturity) on the posterior face of septum 13/14 and is also continuous with the oviduct which forms a U-shaped loop projecting, bend forward, far into segment 13 before continuing latero-posteriorly to the female pore of its side (lateral to setae *b*, in paratype 4, at the equator of segment 14, paratype 2). Septum 13/14 is funnel shaped and its narrow posterior end in the midline above the oesophagus, forms an inconspicuous pouch the walls of which appear somewhat

flocculent (paratypes 2 and 4). It is possibly homologous with a similar sac in *Stuhlmannia*. No tubular connection exists between this pouch and the female organs, and there is no communication between the spermathecal and the female genital organs. In a further paratype no definite dorsal pouch could be discerned although septum 13/14 was again funnel-shaped. The ovaries also have no communication with the oviducal funnels other than via the general coelom of segment 13. Spermatheca (fig. 1 A) with a long tubular ampulla extending below the ventral nerve cord, which it approximately equals in width, from segment 16 (18 in paratype 4) to segment 13; enlarging slightly in 13 to form the spermathecal atrium. The atrium is a simple unpaired sac the lumen of which, probably because of immaturity and absence of spermatozoa, is very narrow dorso-ventrally. Ventrally septum 13/14 is confluent with septum 12/13 owing to displacement forwards of the former by the atrium. In terms of external segmentation the atrium lies in segment 12 with a small portion in 13.

Summary

A new Egyptian species of the pareudriline genus *Chuniodrillus* is described and the generic definition emended to include it. A key to the six species of the genus diagnoses the new species. Evidence is presented which indicates that evolution of the female genital system for internal fertilization has closely paralleled that in the genus *Stuhlmannia*, including encapsulation of the ovaries in the oviducal system, provision for sperm storage within this system, union of the systems of the two sides, and reduction of the ovisac of one side (the right in *Chuniodrillus*, the left in *Stuhlmannia*). The ultimate condition, loss of the right oviduct, is seen in *Scolecillus tantillus* which is probably congeneric with *Chuniodrillus*, and corresponds with the condition in *Stuhlmannia asymmetrica* in which the left oviducal system has been eliminated.

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