

## Description of *Aetholaimus trochus* n.sp. and the male of *Ironus ignavus* Bastian, 1865 (Nematoda) from Caprivi, Namibia

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Two species of the genera *Aetholaimus* Williams, 1962 and *Ironus* Bastian, 1865 from the remote eastern Caprivi, show some remarkable morphological features, which are presented here in photomicrographs. *Aetholaimus trochus* n.sp. can be distinguished from all other species within the genus by its long body, long prerectum, long mural tooth, short odontophore and presence of males. Males of *Ironus ignavus* Bastian, 1865 are reported and described for the first time.

Twee spesies van die genera *Aetholaimus* Williams, 1962 en *Ironus* Bastian, 1865 is in die afgeleë Oos-Caprivi versamel en besit merkwaardige kenmerke wat in fotomikrograwe weergegee word. *Aetholaimus trochus* n.sp. kan van alle ander spesies in die genus onderskei word deur die lang liggaam, lang prerectum, lang murale tand, kort odontofoor en teenwoordigheid van mannetjies. Mannetjies van *Ironus ignavus* Bastian, 1865 word vir die eerste keer aangemeld en beskryf.

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### Materials and Methods

Specimens for the light microscope (LM) study were killed and fixed in hot FAA and mounted in anhydrous glycerine. Measurements were made along the median line. The oesophagus length was taken from the anterior end, and the positions of oesophageal glands as percentages of this length. All mounts are deposited in the nematode collection of the Rand Afrikaans University.

For scanning electron microscopy (SEM), specimens were killed with gentle heat, fixed in buffered 2,5% glutaraldehyde, post-fixed in buffered 1% osmiumtetroxide ( $\text{OsO}_4$ ) and dehydrated in a graded ethanol-amyacetate series. They were sputter-coated with gold and viewed at 10 kv.

### Descriptions

#### *Aetholaimus trochus* n.sp.

(Figures 1A–H; 2A–H; 3A–G)

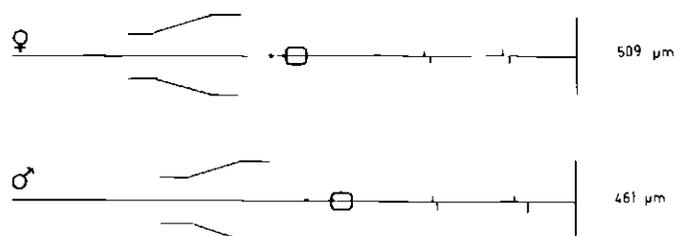
*Measurements:* See Tables 1 and 2

*Female:* Heat-relaxed body posture sinuous, irregularly curved ventrad. Cuticle 1–3  $\mu\text{m}$  thick, slightly thickened towards the posterior end. Transverse striae 1,5–2,0  $\mu\text{m}$  apart. Lateral chords 12–14  $\mu\text{m}$  wide. Lateral body pores prominent in anterior region, obscure on rest of body. Subventral and subdorsal body pores randomly placed in anterior region, not observed in rest of body.

Lip region transversely striated, off-set, with usual complement of 6 + 10 papillae (Figure 3A & B). Amphideal fovea rounded, internally divided by a transverse septum (Figure 1D — best seen in male). Cheilostome divided into two parts, the anterior part wide and bowl-shaped, well-sclerotized and containing six sclerotized radiating plates (Figure 3A). The posterior part of the cheilostome is narrower than the anterior part and not sclerotized. Rest of stoma well-sclerotized, containing a long mural tooth (Figure 1C). Odontophore short, about one-third of mural

tooth length.

Oesophagus consisting of a slender anterior part, narrowing as it passes through the nerve ring, then expanding at about 30% of its length, forming a long, cylindrical basal bulb which expands slightly at about the level of the dorsal gland nucleus. Dorsal gland nucleus prominent, measuring 13–15  $\mu\text{m}$   $\times$  5–7  $\mu\text{m}$ . Oesophageal gland openings are all well defined, but the ventro-sublateral gland nuclei are almost always obscure. In the specimens where the gland nuclei are visible, they are in line with their outlets. The positions of the outlets and the dorsal gland nucleus are given graphically for the holotype female and representative male:



The basal bulb is surrounded by a thin muscle sheath (Figure 1A). Nerve ring surrounding oesophagus at 103–139  $\mu\text{m}$  from anterior end, at less than 30% of oesophagus length. Oesophageal lumen with a thickened wall, narrowing where it joins the intestine. Three rounded cardiac glands observed at oesophago-intestinal junction. Intestinal wall with numerous small granules; separated from prerectum by columnar cells (Figure 2E). Prerectum 92,5–101,5  $\mu\text{m}$  long (2–3 times anal body diameter); rectum 22–33  $\mu\text{m}$  in length, 1,5–2,0 anal body diameters.

Female genital tract didelphic, amphidelphic, the anterior branch on the right hand side of the intestine, the posterior

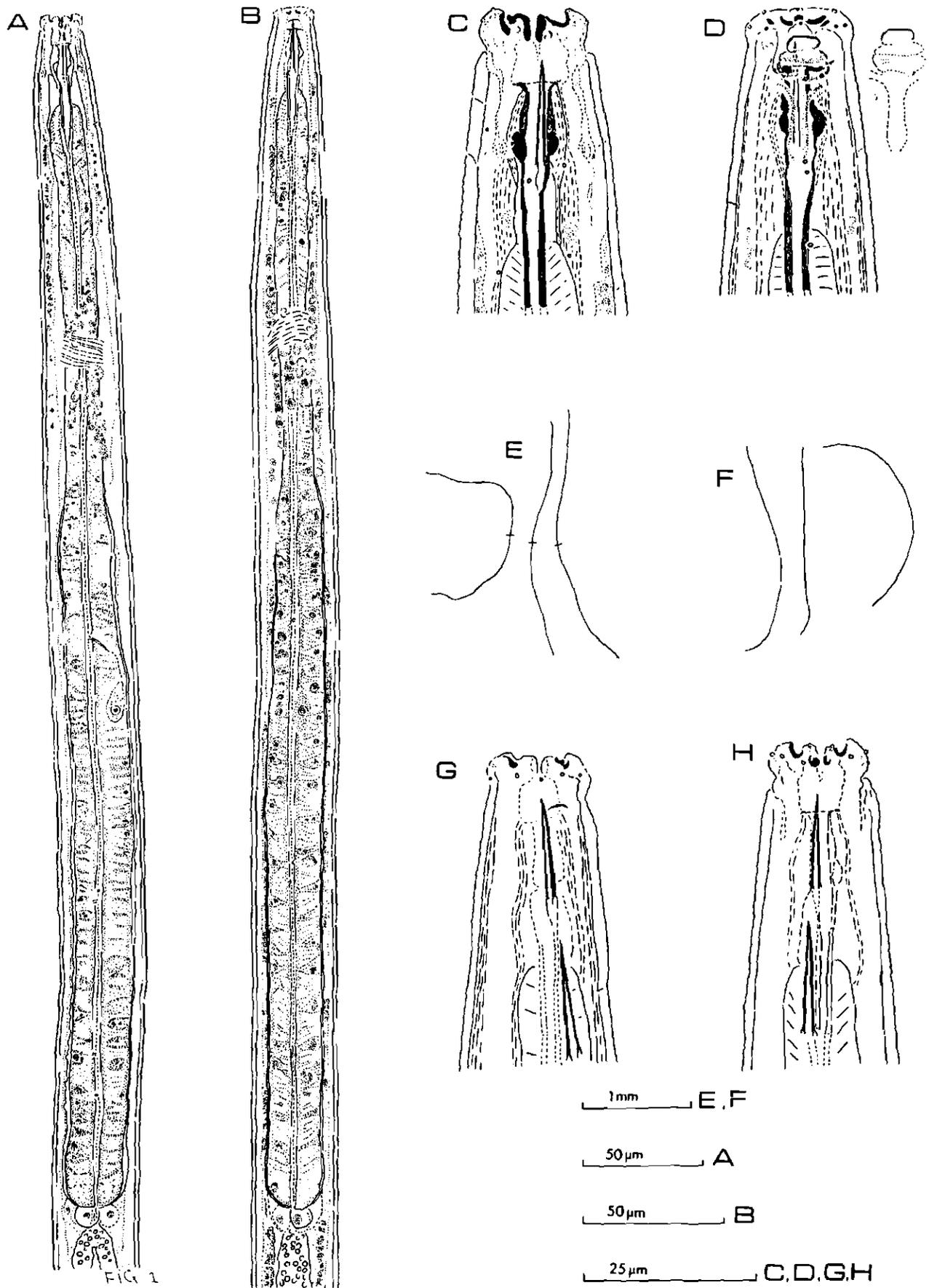
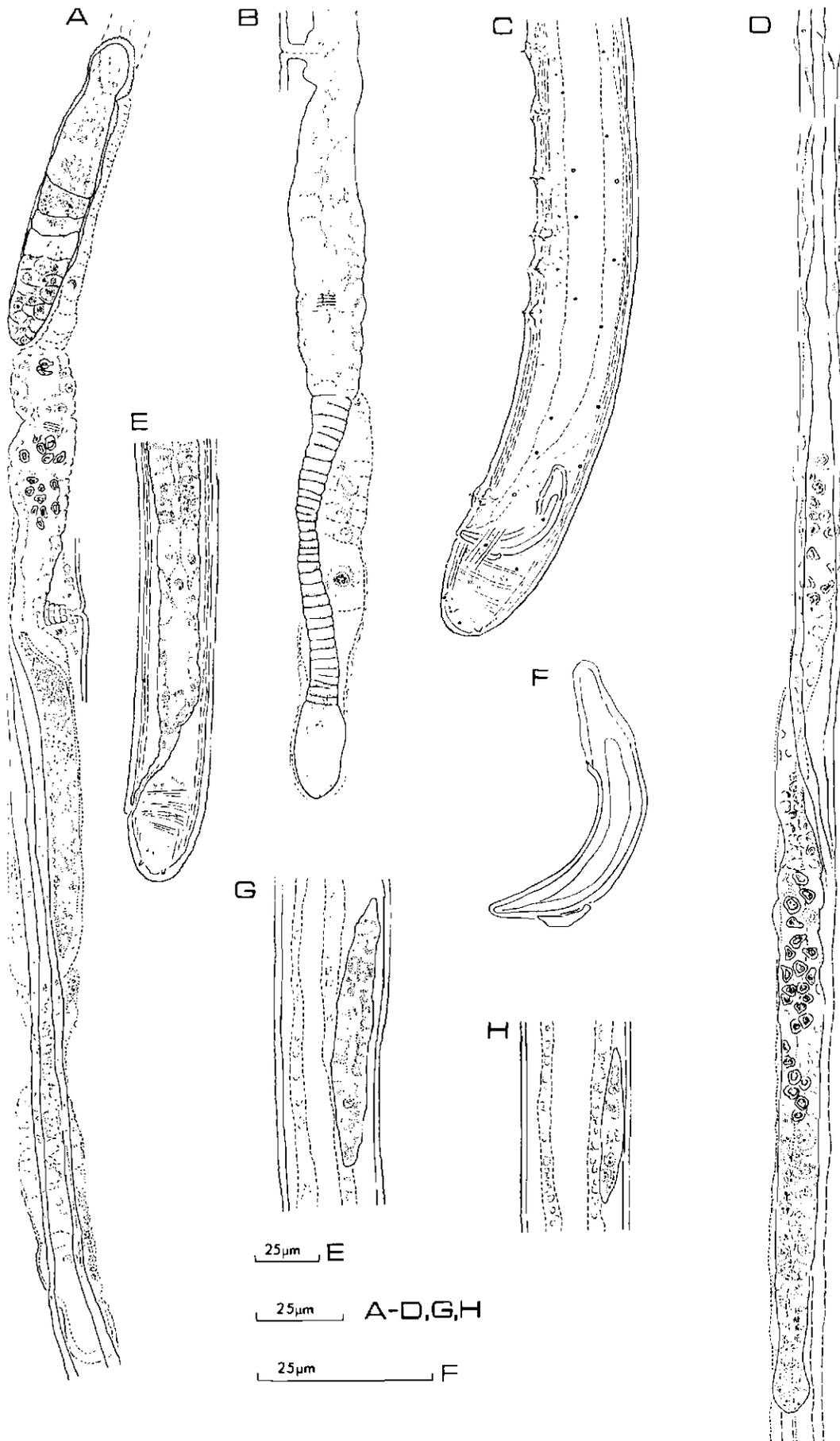
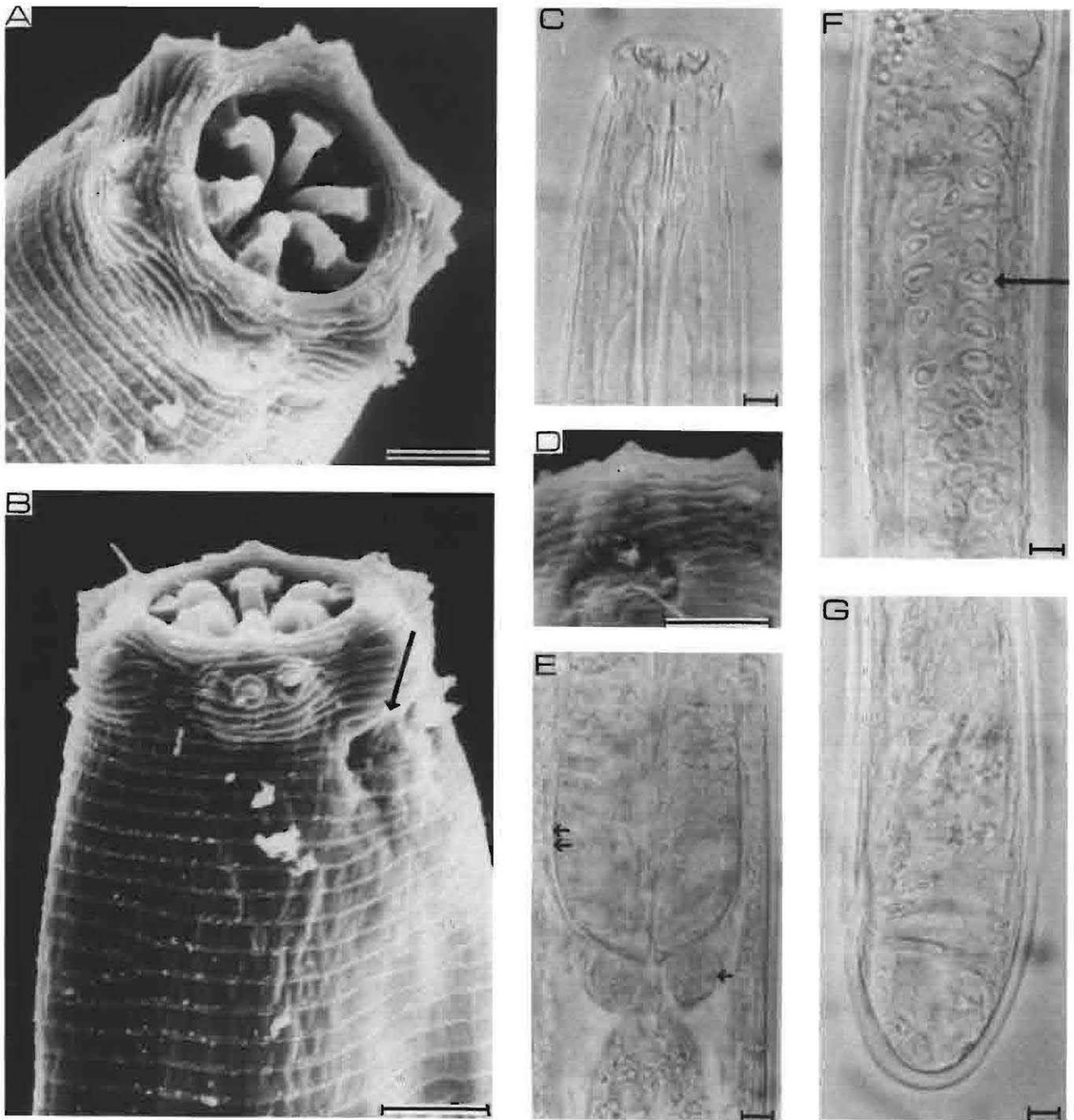


Figure 1A–H *Aetholaimus trochus* n. sp. A: anterior region of female; B: anterior region of male; C: dorso-ventral view of female head; D: lateral view of male head with detail of amphid shown separately; E: heat-relaxed body posture of female; F: heat-relaxed body posture of male; G: head of short J2; H: head of longer J2.



**Figure 2A-H** *Aetholaimus trochus* n.sp. A: genital tract of holotype female; B: genital tract of young female; C: posterior region of male; D: testes of male; E: posterior region of female; F: spicule of male; G: genital primordium of long J2; H: genital primordium of shorter J2.



**Figure 3A–G** Photomicrographs of *Aetholaimus trochus* n.sp. A: frontal view of female head; B: sublateral view of female head. Arrow indicates amphid aperture; C: female head; D: amphid aperture — frontal view; E: oesophago-intestinal junction, showing cardiac glands (single arrow) and muscle sheath around the basal bulb (double arrows); F: part of testis, showing sperm cells (arrow); G: female tail. Bar equals 5  $\mu\text{m}$ .

on the left. Each branch consists of a reflexed ovary with an extensible ovarian sac, an oviduct narrowed towards its middle, a pars dilatata oviductus, a sphincter and a saccate, undifferentiated uterus. The pars dilatata is usually filled with sperm cells, which are rounded and have prominent nuclei (Figure 2A). The uterus may expand greatly (Figure 2A) when containing an egg. Dimensions of egg: 130  $\mu\text{m}$   $\times$  28  $\mu\text{m}$ . The vagina is narrow, extending about halfway into the body and surrounded by four well-defined muscle bands. Vulva a transverse, slit-like opening. Tail rounded, with two pairs of caudal pores.

**Male:** Description as for female, with the following differences: Males are, on average, shorter than females and heat-relaxed body posture tends to be ventrally curved in tail region.

Male genital tract diorchic, outstretched, the anterior testis on right and posterior testis on left hand side of intestine (Figure 2D). Sperm cells roundish with well-defined nuclei. Spermoduct not muscular, joining intestine at 33–35  $\mu\text{m}$  anterior to cloacal opening. Supplements prominent, papiloid, consisting of an adanal pair and five to six midventral non-contiguous ones. Spicules massive, curved ventrad,

**Table 1** Morphometrical data of adults of *Aetholaimus trochus* n.sp.

	Holotype ♀	Paratypes ♀	Paratypes ♂	
n	1	1	1	3
L (mm)	2,16	2,02	2,34	1,68–1,99
a	60,0	50,4	57,2	55,2–68,3
b	4,1	3,9	4,6	3,8–4,3
c	96,0	82,5	106,4	71,5–80,8
c'	0,8	1,0	0,8	0,9–1,04
V(%)	54,6	56,1	50,7	–
Tail length (µm)	22,5	24,5	22,0	23,5–27
Oesophagus length (µm)	525	509	513	448–473
Basal bulb length (µm)	340	295	304	262–285
Lip region width (µm)	17	16	16,5	15,5
Tooth length (µm)	15,5	17	16	13,3–15,0
Odontophore length (µm)	7	5	6	4,5–5,5
DO(%)	46,7	53,4	51,8	51,5–53,0
DN(%)	48,6	56,4	56,1	54,7–59,0
DN–DO(%)	1,9	2,9	4,3	3,2–6,0
S <sub>1</sub> O <sub>1</sub> (%)	64,8	73,7	72,7	73–76
S <sub>1</sub> O <sub>2</sub> (%)	65,5	73,8	73,5	74–77
S <sub>2</sub> O <sub>1</sub> (%)	79,8	87,2	89,9	88,3–90,7
S <sub>2</sub> O <sub>2</sub> (%)	81,7	88,2	91,0	90,9–91,9
Spiculum length (µm)	–	–	–	42–45
Gubernaculum piece length (µm)	–	–	–	8–11

cephalated, distal part clearly less sclerotized than proximal part (Figure 2F). Gubernaculum small.

Tail rounded, dorsally convex with six pairs of caudal pores; three pairs situated subventrally, one pair laterally near the terminus and two pairs subdorsally. One row of lateral body pores on either side of lateral chord in posterior region of male, obscure anterior to midventral supplements.

**Juveniles:** The two juveniles studied may both belong to the J2-stage. The genital primordium of the shorter juvenile is small, undifferentiated, consisting of about twelve cells (Figure 2H) and that of the longer juvenile is extended and a distinct lumen is present (Figure 2G).

**Type specimens:** Holotype female on slide RAU 7160. Two paratype females on slides RAU 7156 and RAU 7158 and three paratype males on slides RAU 7157, RAU 7159 and RAU 7161.

**Type locality and habitat:** Samples taken from the sandy bottom of a small freshwater pond about 1 km from Nakatwa Camp, Mudumu Game Park in the eastern Caprivi, Namibia. Collected by A. Swart and A. Botha on 12 September 1991.

### Diagnosis

*Aetholaimus trochus* n.sp. clearly belongs to the genus *Aetholaimus* with its mural tooth, bowl-shaped stoma, cardiac glands and characteristic position of oesophageal gland nuclei and openings. The new species can be distinguished from all other species within the genus by its long body, long prerectum (2–3 times anal body diameter), long mural tooth, short odontophore (one-third of tooth length) and the presence of males. The pro-, meso- and metastome are also especially well-sclerotized and the

**Table 2** Morphometrical data of juveniles of *Aetholaimus trochus* n.sp.

	J2	J3?
L (mm)	1,77	1,83
a	58,1	60,9
b	3,9	4,1
c	93,2	87,1
c'	0,83	0,9
Tail length (µm)	19	21
Oesophagus length (µm)	450	449
Basal bulb length (µm)	264	259
Lip region width (µm)	15	14,5
Tooth 1 length (µm)	14,5	13
Tooth 2 length (µm)	15,5	16
DO (%)	53	52,5
DN (%)	57	55,7
DO–DN (%)	4	3
S <sub>1</sub> O <sub>1</sub> (%)	75,7	72,8
S <sub>1</sub> O <sub>2</sub> (%)	75,9	73,7
S <sub>2</sub> O <sub>1</sub> (%)	96,1	92,7
S <sub>2</sub> O <sub>2</sub> (%)	96,8	93,7
Gonad primordium length (µm)	44,1	79,4

cheilostome contains well-defined rib-like plates. The male is slightly shorter than the female. The male genital tract is diorchic, sperm cells are roundish with prominent nuclei and supplements are prominent, papilloid. Spicules are large, arcuate and cephalated.

### Differential diagnosis

The low c'-value of *Aetholaimus trochus* n.sp. is comparable only to that of *A. bucculentus* Williams, 1962; *A. gracilis* Thome, 1974 and *A. rotundicauda* (De Man, 1880) Coomans & Loof 1978. *A. trochus* n.sp. can immediately be distinguished from *A. gracilis* by its less massive and quite different stoma armature. *A. trochus* n.sp. differs from both *A. bucculentus* and *A. rotundicauda* in the longer body (L = 2,02–2,34 mm vs L = 1,32–1,57 mm and L = 1,14–1,54 mm), the longer mural tooth (15–17 µm vs 9–10 µm and 10–12 mm), the position of the vulva (V = 50,7–56,1% vs V = 42–46% and V = 41–48%) and the longer prerectum (2–3 times anal body diameter vs two times anal body diameter).

### Remarks

It is noteworthy that in *A. trochus* n.sp. the amphid aperture is crescent-shaped and the fovea rounded and divided by a transverse septum, while Coomans & Loof (1978) illustrated cup-shaped foveas with transverse, slit-like apertures in *A. rotundicauda* and *A. indicus* Jairajpuri, 1965.

### *Ironus ignavus* Bastian, 1865

(Figures 4A–G; 5A–E)

**Syn:** *I. longicollis* Daday, 1899

*I. minor* N.A. Cobb, 1915 in Cobb, M.V. 1915

*I. ignavus* v. *brevicauda* f. *typica* sf *minor* N.A. Cobb in Cobb, M.V. 1915 (Micoletzky, 1922)

*I. intermedius* Stefanski, 1936

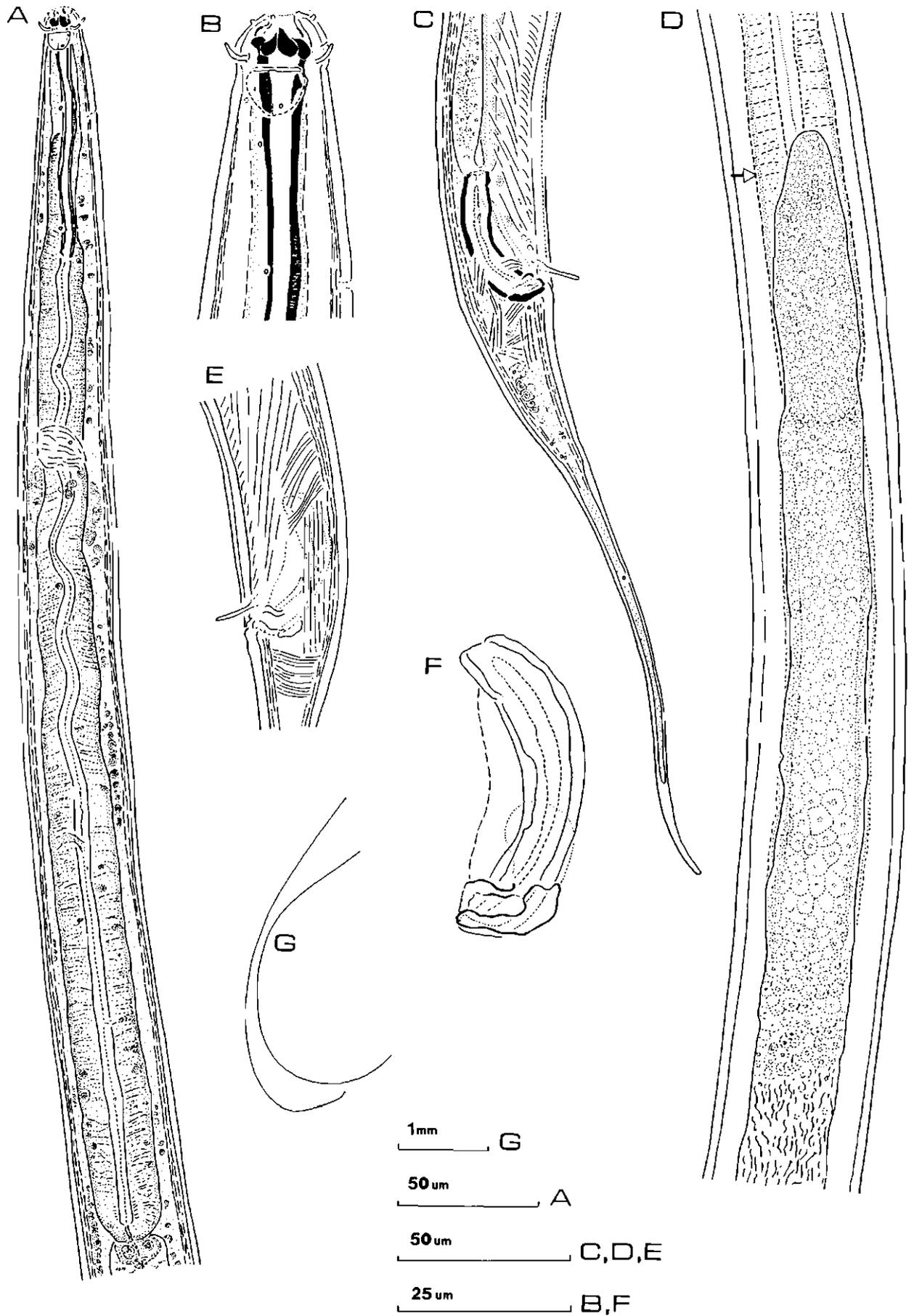
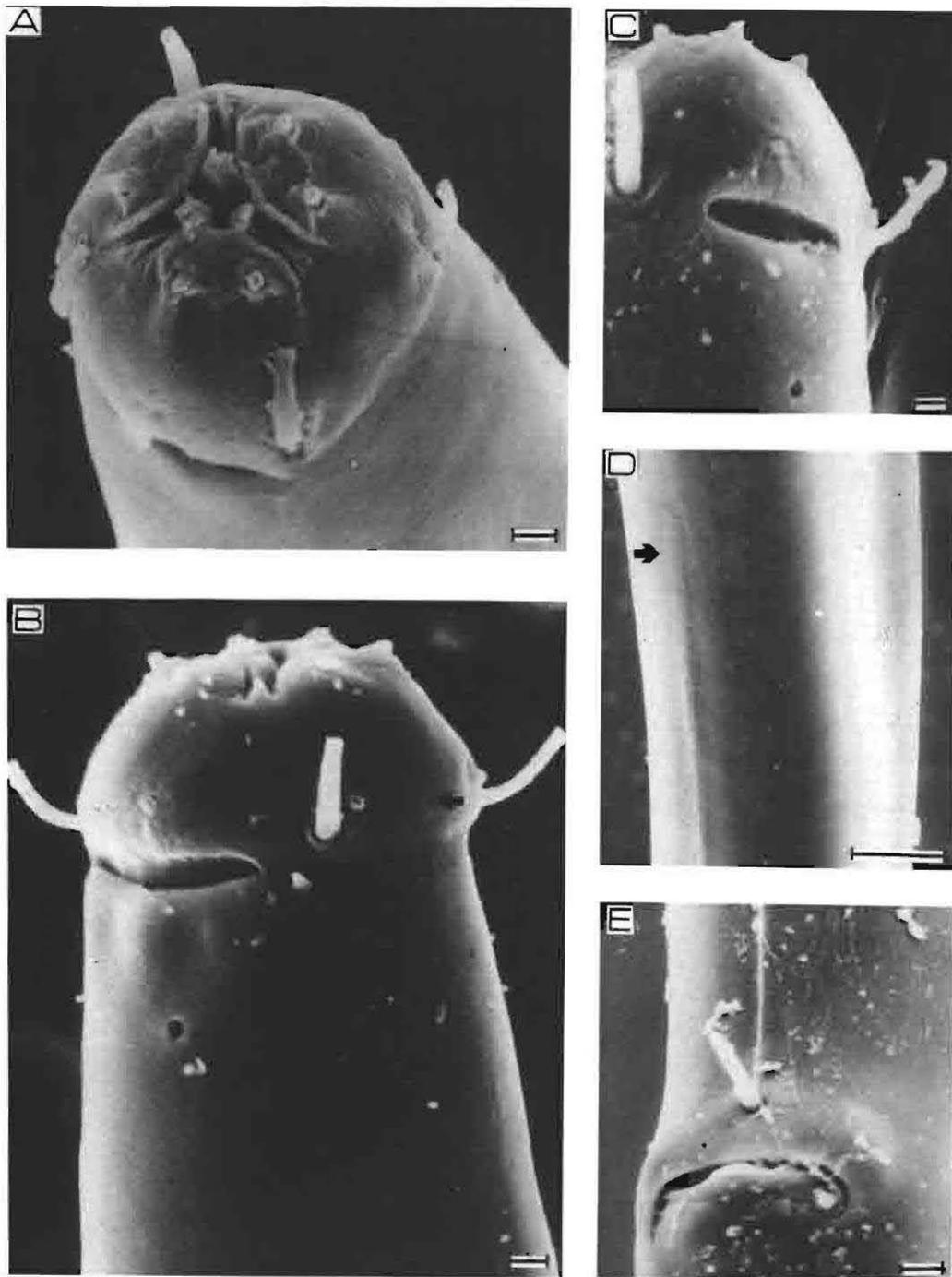


Figure 4A–G *Ironus ignavus* Bastian, 1865. A: anterior region of male; B: head region of male; C: tail region of male; D: distal part of anterior testis in male. Arrow indicates posterior part of oesophagus; E: cloacal region of male, showing muscles associated with spicular apparatus; F: spicular apparatus; G: heat-relaxed body posture of males.



**Figure 5A–E** SEM photomicrographs of *Ironus ignavus* Bastian, 1865. A: frontal view of male head; B: sublateral view of male head. Arrow indicates excretory pore; C: sublateral view of female head; D: midventral ridge in male (arrow); E: male cloacal opening showing the adanal setum and beginning of midventral ridge. Bar equals 1,6  $\mu\text{m}$ .

**Measurements:** Table 3.

A full description of the males is given as this is the first report of males in the species. The identity of the males reported as *I. ignavus* by Lorenzen (1981) is doubtful, probably not *I. ignavus* but rather *I. tenuicaudatus* de Man, 1876, based on the measurements of the females.

**Male:** Heat-relaxed body strongly curved ventrad in posterior region. Cuticle very finely striated, 1–1,5  $\mu\text{m}$  thick in neck region, 1,5–2  $\mu\text{m}$  at mid-body and 2,5–3,5  $\mu\text{m}$  on tail. Head slightly offset with three crescent-shaped lips (one ventral and two subdorsal), each with two inner

labial papillae (Figure 5A). Six outer labial papillae, four cephalic setae (3–4  $\mu\text{m}$  long) and an excretory pore present on head (Figure 5B). Amphid stirrup-shaped with a slit-like aperture. Prongs of dorsal and two subventral teeth divided, that of the dorsal tooth trifurcated, those of subventral teeth, bifurcated (Figure 5A). No stomatal gland opening observed in stoma. Dorsal plate of stoma 0,7  $\mu\text{m}$  thick, two subventral plates each 1,1–1,5  $\mu\text{m}$  thick. Stoma 4,2  $\mu\text{m}$  at widest part.

Oesophageal musculature begins on dorsal side at about mid-stoma level and on ventral side, almost at base of stoma. Oesophagus cylindrical; 2–4 oesophageal gland

**Table 3** Morphometrical data of adults of *Ironus ignavus* Bastian, 1865

	Females		Males	
	Range	Standard deviation	Anterior part broken	
n	7		1	1
L (mm)	2,11(1,88–2,26)	0,1	1,6	–
a	44,7(39,5–48,1)	2,9	40	–
b	4,8(4,2–5,3)	0,4	3,6	–
c	11,3(10,7–11,8)	0,5	11	–
c'	7,9(6,8–9,3)	0,8	5,4	–
V (%)	53(51–56)	1,5	–	–
Tail length (µm)	188(164–214)	15,1	159	145
Oesophagus length (µm)	441(405–480)	23,5	440	–
Lip region width (µm)	14,5(14–15)	0,5	14,5	–
Stoma length (µm)	117(92–129)	11,8	87,5	–
Cardia length (µm)	13,9(7,5–15)	1,6	12,5	7,5
Spicule length (µm)	–	–	47	50
Gubernaculum length (µm)	–	–	15	14
L'	1,9(1,7–2,06)	0,1	1,5	–
a'	40,8(36,2–43,5)	2,5	36,3	–
b'	4,4(3,8–4,8)	0,4	3,4	–
V'	58(55–60,8)	1,9	–	–

openings observed (Figure 4A). Cardia flattened, almost disc-shaped with two prominent nuclei. Nerve ring situated at 150 µm from anterior end, at about 30% of oesophagus length.

Male genital tract diorchic, outstretched. Testes well-developed, the anterior testis reaching the oesophageal region in one male (Figure 4D). Anterior testis situated on right side of intestine, posterior testis situated dorsally, proceeding ventrad to join spermiduct on left hand side of intestine. Secondary sexual characters consisting of one adanal setum (about 5 µm long) and a midventral ridge, stretching from the adanal setum anteriorly for 400 µm (about 25% of body length). Spicules massive, arcuate, apparently not cephalated, with many associated muscles.

Velum present. Gubernaculum present, its morphology obscure (Figure 4F). Intestine and spermiduct uniting at 41 µm anterior of cloacal opening. Sperm cells have an elongated, sinuous appearance.

Tail elongated with five pairs of caudal pores arranged as follows. Two pairs on ventral side, and three pairs on dorsal side of tail. One pore in a mid-tail position observed in one male. Hyaline tip 28,6 µm long, occupying 18% of tail length.

*Specimens:* Seven females on slides RAU 712–7145 and 7147. Two males (one broken) on slide RAU 7142.

*Locality and habitat:* Same as that described for *Aetholaimus trochus* n.sp.

## Discussion

The measurements of the females of the present population are very similar to those of *I. ignavus* Bastian, 1865 as described by Tsalolikhin (1987) from Kaliningrad viz: L = 1,88–2,26 mm vs 1,80–2,55 mm; a = 39,5–48,1 vs 38–63; b = 4,2–5,3 vs 4–5,5; c = 10,7–11,8 vs 8–13 and V = 51–55,6% vs 51–54%. Even L', b' and V'-values (where tail length is not taken into account), are quite similar.

## Acknowledgements

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## References

- COOMANS, A. & LOOF, P.A.A. 1978. Observations on the subfamily Aetholaiminae Jairajpuri, 1965 (Nygolaimidae: Nematoda). *Proc. helminthol. Soc. Wash.* 45: 82–92.
- LORENZEN, S. 1981. Bau, Anordnung und postembryonale Entwicklung von Metanemen bei Nematoden der Ordnung Enoplida. *Veröff. Inst. Meeresforsch. Bremerhaven* 19: 89–199.
- TSALOLIKHIN, S.J. 1987. Revision of the genus *Ironus* (Nematoda: Dorylaimida). *Zool. Zh.* 66: 662–673.