The freeliving marine nematode genus *Sabatieria* (Nematoda: Comesomatidae). I. Two new species from Stonington Island, Antarctica

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Introduction

As a prelude to an eventual review of the genus *Sabatieria,* species from various geographical locations and differing habitats are being examined in detail. This first paper describes two new species from the constantly near-freezing Antarctic waters. The specimens were obtained by SCUBA divers on 30 March 1974 from a small inlet, Back Bay, in the vicinity of the former British Antarctic Survey base at Stonington Island; part of a series of collections detailed elsewhere (Platt, 1979). The substrate was fine sand and stones underlayed at about 2 cm with gravel which prevented coring beneath this depth. The methodology employed for studying the organisms and the abbreviations used in their description have been fully described elsewhere (Platt, 1982).

Systematic descriptions

Sabatieria kelletti sp. nov.

(Figs 1–3)

MATERIAL STUDIED. Holotype: ♂1 BM(NH) 1982.5.26. Allotype: ♀1 BM(NH) 1982.5.32. Paratypes: five males BM(NH) 1982.5.27–31; five juveniles BM(NH) 1982.5.33–37.

LOCALITY. 15 m depth, Back Bay, Stonington Island, Antarctica. Lat. 68°12·4′ S, long. 66°59·5′ W.

MEASUREMENTS (Table 1)

Holotype ♂: $\frac{-\ 350\ M\ 2845}{19\ \ 74\ \ 87\ \ 61}$ 3095 μm; a = 36; b = 8·8; c = 12·4; S = 63 μm

Allotype ♀: $\frac{-\ 330\ 1550\ 3035}{21\ \ 74\ \ 95\ \ 52}$ 3295 μm; a = 35; b = 10·0; c = 12·7; V = 47%

DESCRIPTION. The body narrows suddenly in the region just posterior to the amphid: h.d. 26–33% of the posterior oesophagus c.d. Cuticle punctated: in the lateral field the dots are larger and more irregularly arranged than medially, especially in the oseophagus and tail regions (Fig. 3c, e). The medial dots are more or less arranged in transverse rows (Fig. 3d). In the cylindrical portion of the tail the dots are present but are only very tiny. Somatic setae in four longitudinal files, one on each side of the lateral field: 5–7 μm long and spaced 50–130 μm apart but closer together at the ends than in the middle of the body. In adults there is a subventral row of three more closely spaced cervical setae (Figs 1c, d & 3a). In stage-4 juveniles (J1–4) there are ony two setae in this position (Fig. 1i) and no such setae were observed in what is probably a stage-2 juvenile (J5). There are additional 7–10 μm dorsal and ventral caudal setae in the males (Figs 1f, j & 2f). The tail tip has three terminal setae, one dorsal and two subventral. R1 sensilla papilliform. R2 sensilla short but clearly setiform. R3 sensilla in adults 42–47% h.d.: the same relative length in juveniles. Amphids

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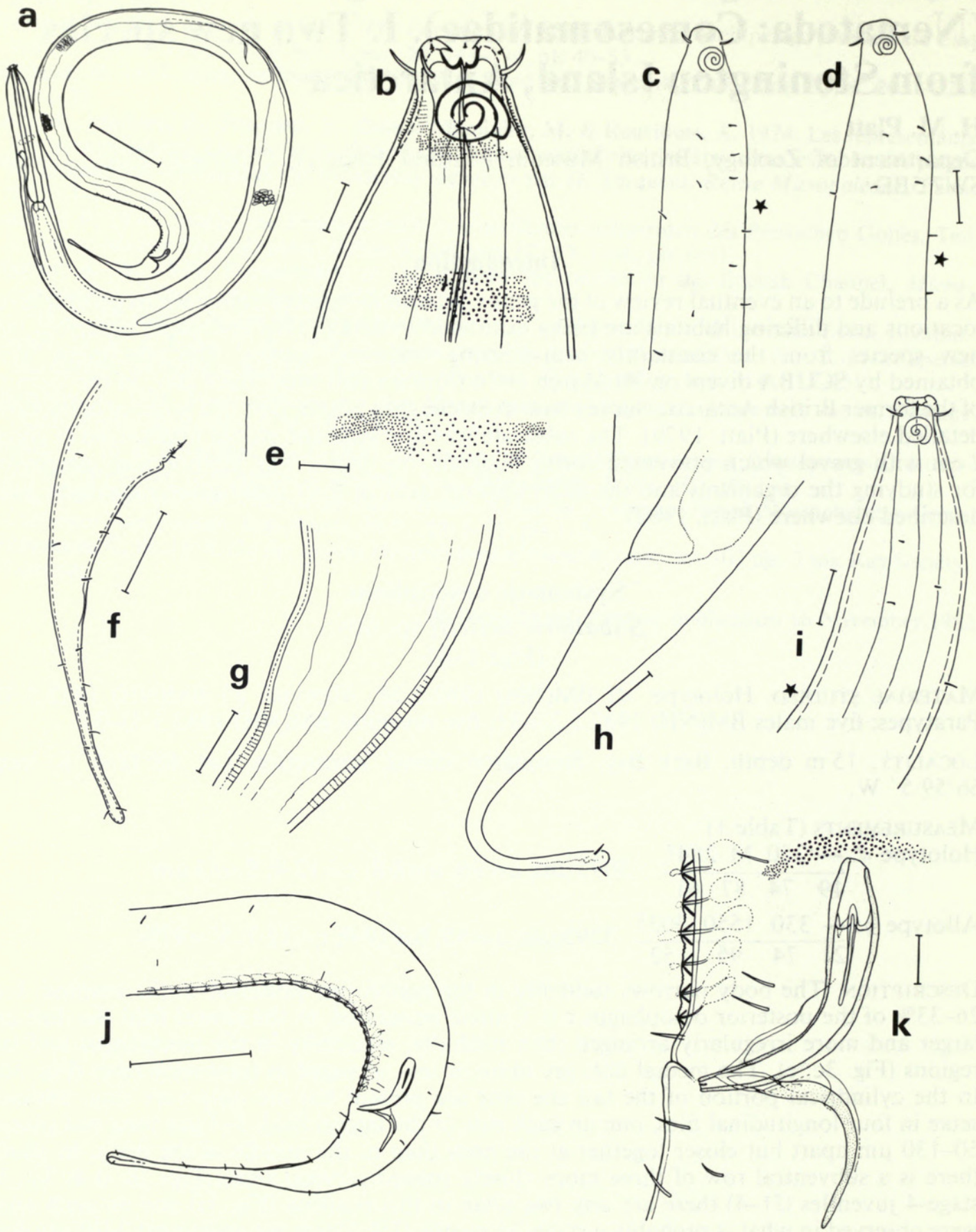


Fig. 1 *Sabatieria kelletti*: (a) ♂1 whole body; (b) ♂1 head; (c) ♂2 anterior region; (d) ♂4 anterior region; (e) ♂1 lateral cuticle pattern mid-body; (f) ♂4 tail region; (g) ♂6 ventral caudal papilla; (h) ♀1 tail; (i) J1 anterior oesophagus region; (j) ♂1 posterior region; (k) ♂1 copulatory apparatus. Bar scales: a = 200 µm; j = 100 µm; f = 50 µm; c, d, h = 30 µm; i = 20 µm; b, e, g, k = 10 µm. Stars in c, d and i indicate ventral side.

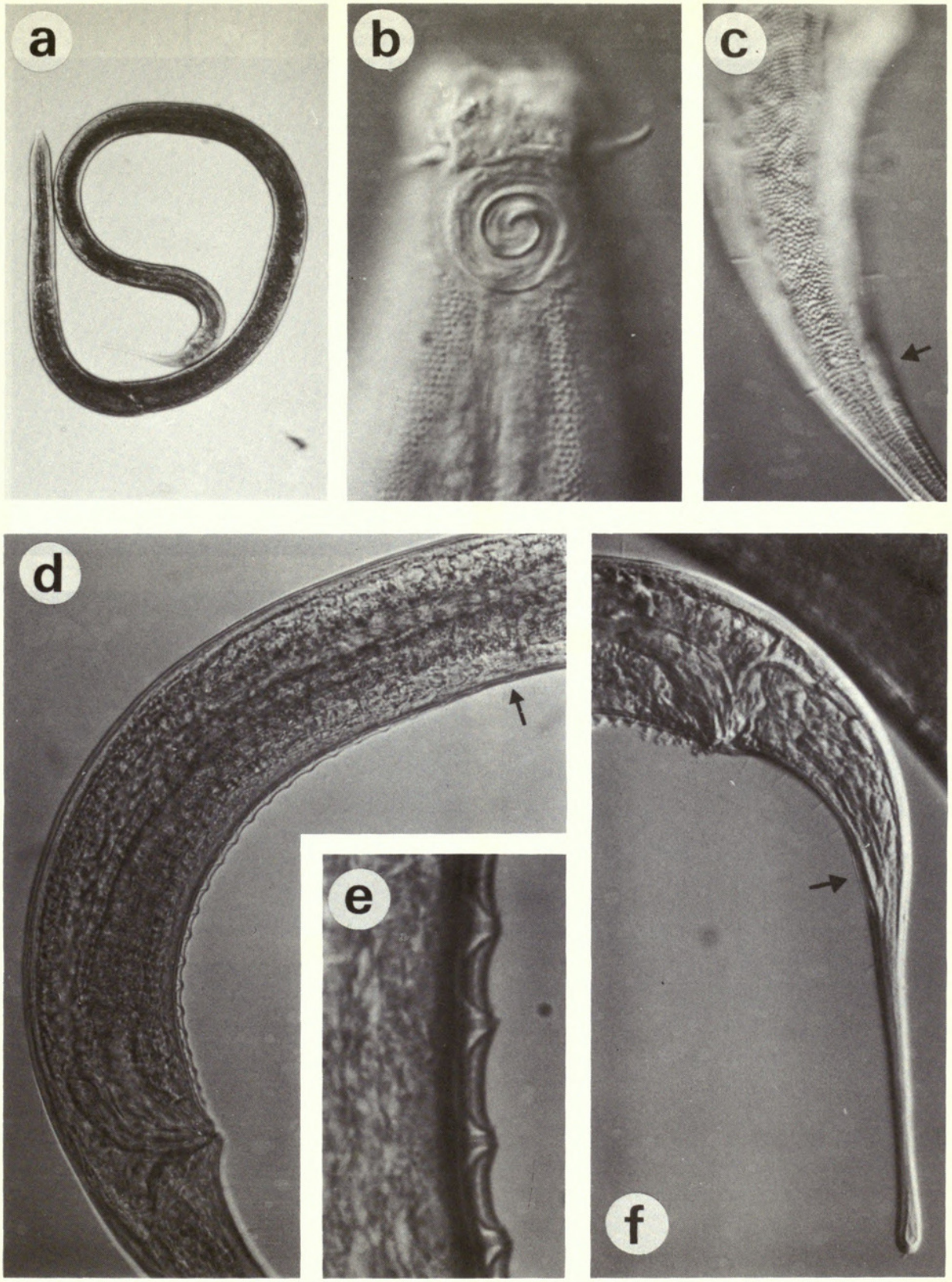


Fig. 2 *Sabatieria kelletti:* (a) ♂1 whole body; (b) amphid and R3 sensilla; (c) caudal cuticle punctations and position of ventral papilla arrowed; (d) posterior region showing precloacal supplements, the anteriormost (24th) is arrowed; (e) detail of supplements; (f) ♂ tail, postcloacal papilla arrowed.

describe 2½ to almost 3 turns; 60–70% c.d. in males; 40% c.d. in female; 45–60% in juveniles. Anterior part of buccal cavity cup-shaped, posterior part not expanded. Oesophagus widens in posterior 20% but is not set-off (Fig. 3b). Nerve ring at 52–54% of oesophagus length. Excretory pore at 61–67% of oesophagus length with a conspicuous ampulla (Fig. 3b). Tail conico-cylindrical; cylindrical part 50–60% of total with a distinct but not greatly swollen tip; 3·6–4·3 a.b.d. in males, 5·0 a.b.d. in females.

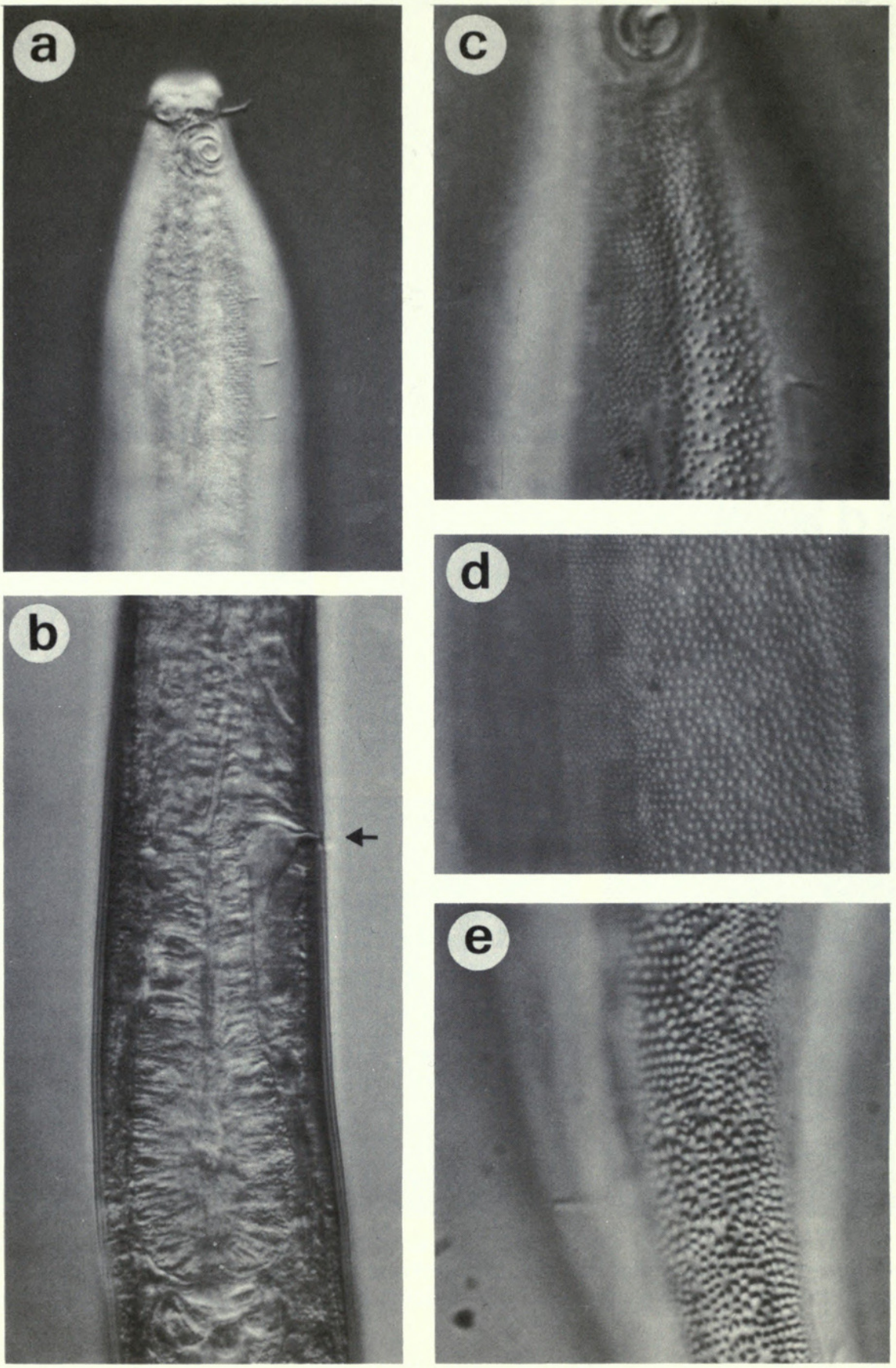


Fig. 3 *Sabatieria kelletti*: (a) anterior region showing row of three subventral cervical setae; (b) posterior oesophagus region showing excretory pore (arrowed) and posterior expansion of the oesophagus; (c) lateral cuticle pattern in post-amphid region; (d) lateral cuticle pattern mid-body; (e) lateral cuticle pattern on tail.

Table 1 Measurements of *Sabatieria kelletti* (μm)

Character	♂1	♂2	♂3	♂4	♂5	♂6	Mean	CV%	♀	J1	J2	J3	J4	J5
Total body length	3095	2700	2620	3020	2525	2775	2789	8·1	3295	2345	2270	2265	2210	1600
Demanian ratio a	36	40	31	39	37	36	37	8·6	35	38	34	36	33	36
Demanian ratio b	8·8	9·2	9·0	10·2	9·0	9·9	9·4	6·0	10·0	7·9	8·4	9·1	9·0	6·8
Demanian ratio c	12·4	11·5	12·8	13·1	11·5	13·4	12·5	6·5	12·7	10·7	10·8	11·2	11·1	9·7
R3 sensilla length	8	9	9	9	8·5	8	8·5	5·7	9·5	7·5	7·5	7·5	7·5	6·5
Head diameter	19	20	19	20	19	19	19	2·7	21	16	18	16	16	15
Amphid diameter	15	15	15	14	15	14	14·5	3·5	10	10	9	9·5	9·5	7·5
Amphid c.d.	24	22	22	22	22	23	22·5	3·7	26	17	20	19	19	17
Oesophagus length	350	295	290	295	280	280	298	8·8	330	295	270	250	245	235
Oesophagus c.d.	74	61	75	67	62	66	68	8·7	74	57	57	53	57	45
Maximum body diameter	87	68	85	78	69	78	78	10·2	95	62	67	63	67	45
Spicule length (chord)	63	60	63	62	64	60	62	2·7	—	—	—	—	—	—
a.b.d.	61	55	57	56	52	55	56	5·3	52	45	45	46	47	37
Cloaca to anterior supplement (α)	247	243	147	195	150	160	190	24·0	—	—	—	—	—	—
Cloaca to anterior supplement (β)	320	295	245	287	225	265	275	12·7	—	—	—	—	—	—
Number of supplements	27	24	22	23	22	21	—	—	—	—	—	—	—	—
Tail length	250	235	205	230	220	210	225	7·4	260	220	210	165	200	200

Spicules equal, curved; 1·0–1·2 a.b.d. as chord; 1·2–1·4 a.b.d. (68–72 μm) as arc. Gubernaculum with strongly curved apophyses which proximally are caudally directed. Ventral precloacal spine and 21–27 conspicuous precloacal supplements which extend 150–250 μm anterior to the cloaca measured along the ventral side of the body (measurement *a*) or 225–320 μm (9–11% of total body length) as measured along the mid-line of the body (measurement *β*). There is a very slight but distinct swelling resembling a flattened papilla between the conical and cylindrical parts of the male tail (Figs 1f, g, j & 2c, f) Two opposed testes: anterior to the left, posterior to the right of the gut.

Ovaries opposed and outstretched. Anterior ovary to the right, posterior to the left of the gut.

DIFFERENTIAL DIAGNOSIS. *Sabatieria kelletti* sp. nov. belongs to the *celtica*-group in terms of general body shape, cuticle punctation pattern, R3 sensilla length, amphid form and size, number of precloacal supplements and general tail shape. Indeed, the new species seems to be most similar to *S. celtica* Southern, 1914 itself, as redescribed by Lorenzen (1972), from which it differs in the range of supplement number (21–27 vs 15–22), more conspicuously narrowed and relatively smaller head (h.d. as percentage of posterior oesophagus c.d. 26–33% vs 33–42%), relatively shorter cephalic setae (0·4–0·5 h.d. vs 0·6–1·2 h.d.) and the presence in the male of a ventral caudal swelling or papilla.

ETYMOLOGY. The species is named after Mr Brian Kellett, my co-diver during the Antarctic peninsula collecting trip.

REMARKS. Because of the differing amounts of curvature in the posterior region of the males, measurement of the distance from cloaca to anteriormost supplement is subject to great variation (Table 1) even when an attempt is made to take into account the differing number of supplements among the specimens. For example, the ratio of the *a*-measurement to the number of supplements has a mean of 8·2 and a CV of 16·7%. However, this variation is less when the *β*-measurement is used, which should approximate the *a* of a straight worm: the ratio of *β* to supplement number has a mean of 11·8 and a CV of 7·8%. It would seem therefore that *β* would be the better measurement to report, although in view of the fact that *β* can be considerably larger than *a*, 1·2 to 1·7 times larger in *S. kelletti*, the exact method of measurement should also be reported.

Sabatieria lawsi sp. nov.
(Figs 4–6)

MATERIAL STUDIED. Holotype: ♂1 BM(NH) 1982.6.38. Allotype: ♀1 BM(NH) 1982.6.44. Paratypes: five males BM(NH) 1982.6.39–43; five females BM(NH) 1982.6.44–48; nineteen juveniles BM(NH) 1982.6.49–68.

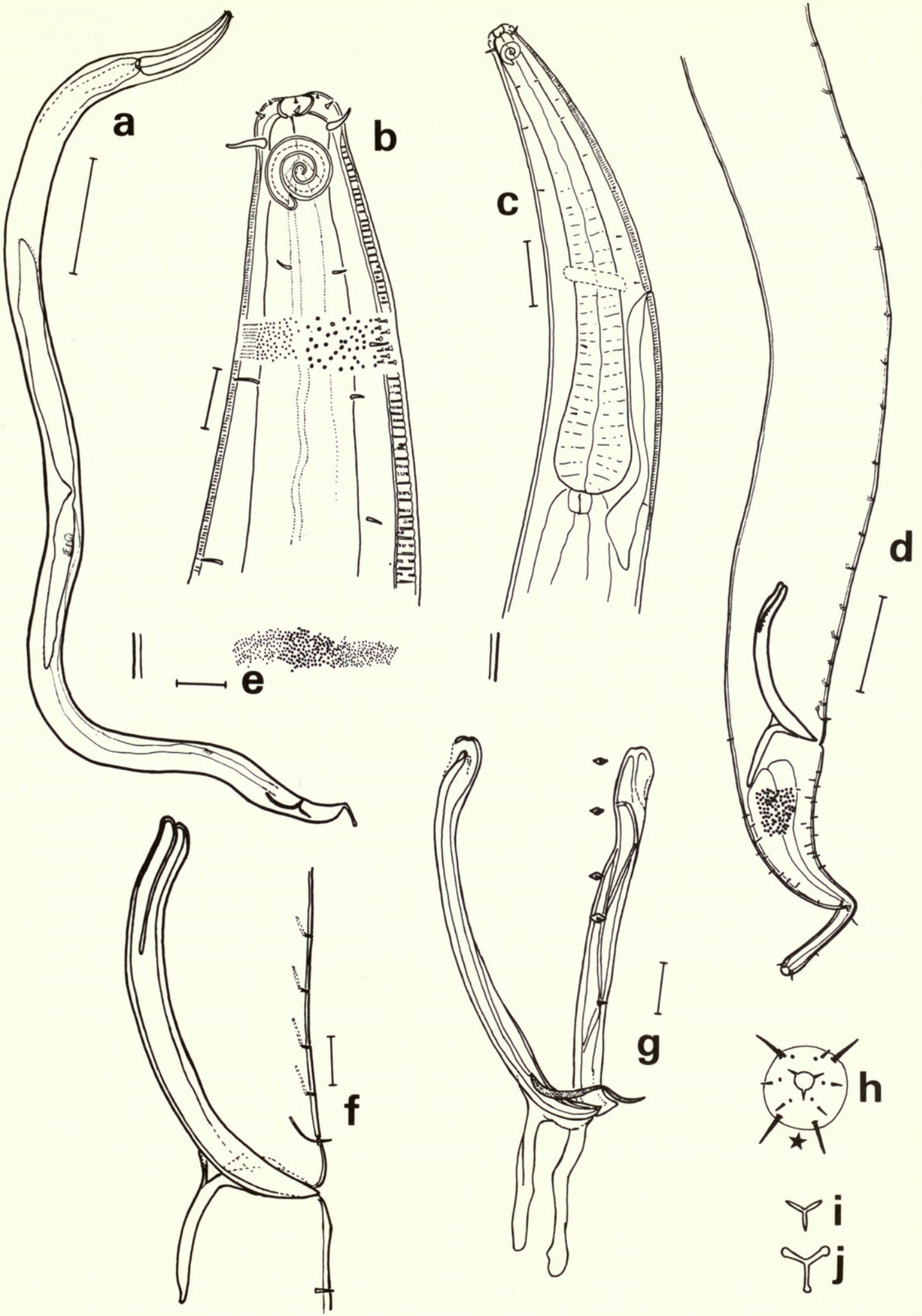
LOCALITY. See *S. kelletti*.

MEASUREMENTS (Tables 2 and 3)

Holotype ♂: $\frac{— \quad 233 \quad M \quad 2250}{16 \quad 57 \quad 71 \quad 46}$ 2400 μm; a = 34; b = 10·3; c = 16·2; S = 73 μm

Allotype ♀: $\frac{— \quad 233 \quad 1180 \quad 2395}{15 \quad 52 \quad 83 \quad 50}$ 2595 μm; a = 31; b = 11·1; c = 12·9; V = 45%

Fig. 4 *Sabatieria lawsi*: (a) ♂1 whole body; (b) ♂1 head; (c) ♂1 anterior region; (d) ♂1 posterior region; (e) lateral cuticle pattern mid-body; (f) ♂1 copulatory apparatus; (g) ♂ copulatory apparatus, ventral view; (h) en face view; (i) buccal cavity lumen shape level with R3 sensilla; (j) oesophagus lumen shape just posterior to amphids. Bar scales: a = 200 μm; d = 50 μm; c = 30 μm; others = 10 μm. Star in h indicates the ventral side.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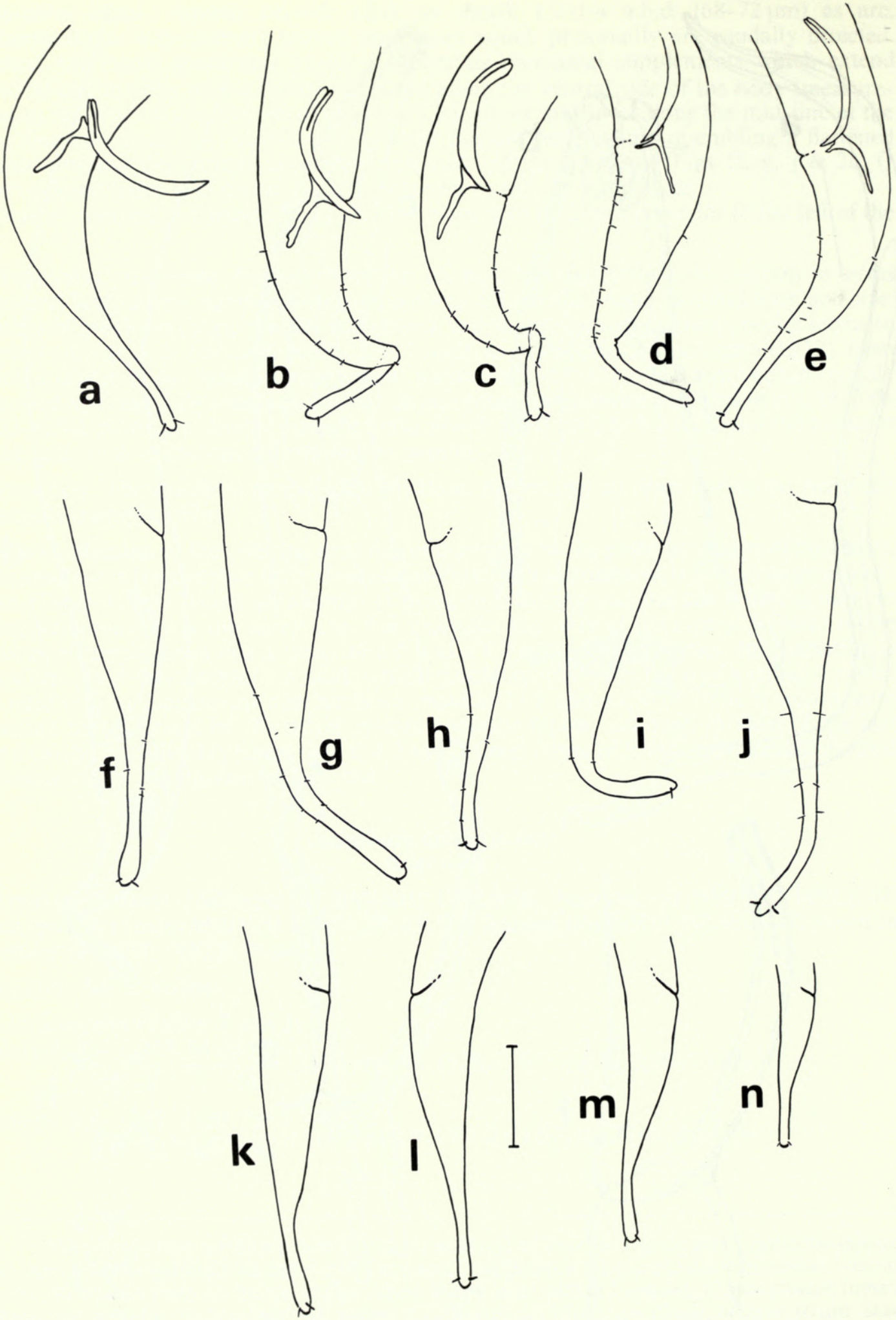
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DESCRIPTION. The anterior region gradually narrows from the end of the oesophagus to the head: h.d. 26–35% of the posterior oesophagus c.d. The anterior end is typically bent dorsally in formalin-fixed specimens (Fig. 4c).. Cuticle punctated. Lateral differentiation of larger, more irregularly arranged dots begins immediately posterior to the amphids and is especially conspicuous in the oesophageal and caudal regions. In the middle region of the body the lateral dots are not so markedly larger than the medial ones but they are still more irregularly arranged (Fig. 6c). The decrease in the size of the lateral dots posterior to the oesophagus region occurs gradually. In the anterior oesophagus, the dots appear somewhat stellate when the microscope is focused at the surface (Fig. 6b). The dots are also conspicuously large ventrally in the oesophagus region (Fig. 4b, c). Short but stout somatic setae are located at the edges of the lateral field, relatively more numerous in the oesophagus and tail regions where there are also some subdorsal and subventral somatic setae: no regular repeated or distinctive patterns could be made out in the distribution of somatic sensilla. R1 sensilla papilliform but conspicuous. R2 sensilla very short but setiform, about 1·5 μm (Fig. 6a). R3 sensilla 32–44% h.d.: similar relative length in juveniles. Amphids in adults describe almost 3 turns (Fig. 6a); similar in size in both sexes, 48–66% c.d. Buccal cavity cup-shaped anteriorly, posterior part tubular and tri-radiate (Fig. 4i) but not expanded. Oesophagus widens posteriorly: marginal tubes at the ends of the radii can be seen in optical cross-section (Fig. 4j). Nerve ring at 50–54% of oesophagus length. Excretory pore at 53–66% of oesophagus length. Tail conico-cylindrical with the cylindrical part about 33% of the total which shows little variation (Fig. 5): 3·1–3·8 a.b.d. in males, 3·8–4·6 a.b.d. in females. There appear to be separate subterminal openings to the caudal glands at the tail tip (Fig. 6f, g).

Spicules equal, curved, relatively long and slender with a proximal median partition extending up to a third of the total spicule length (Fig. 4f): 1·6–1·7 a.b.d. (chord). Gubernaculum apophyses long, straight and dorso-caudally directed. Ventral view of cloacal opening shows it to be a double-bowed transverse slit (Fig. 4g). Ventral precloacal spine about 1·5 μm (Fig. 6h). 17 inconspicuous tubular precloacal supplements extending 355–385 μm from cloaca (β) or 15–17% of total body length. The posterior 4 or 5 supplements are situated closer together than the remainder. Two opposed testes; anterior to left, posterior to right of gut.

Ovaries opposed, outstretched. Vulva conspicuous; V = 45–49%. Eggs round. Receptaculum seminis of mature females contain large hollow sperm (Fig. 6d, e).

DIFFERENTIAL DIAGNOSIS. *Sabatieria lawsi* sp. nov. belongs to the *celtica*-group of species in terms of general body shape, cuticle punctation pattern, R3 sensilla length, amphid form and size, number of precloacal supplements and general tail shape. In several respects, the new species appears to be similar to *S. heterura* (Cobb, 1898), a species originally found in Australia and subsequently redescribed by Wieser (1954) on specimens from Chile. However, the species may be distinguished most easily by the detailed structure of the spicules and gubernaculum.

ETYMOLOGY. The species is named after Dr R. M. Laws, Director of the British Antarctic Survey.

REMARKS. *Sabatieria lawsi* would appear to be the more common of the sympatric *Sabatieria* species: they could be readily distinguished even in the juvenile stages by the markedly different shape of the oesophagus region.

The hollow sperm in the females were similar to those previously reported from *Sabatieria* by Riemann (1983).

Fig. 5 *Sabatieria lawsi:* (a–e) tails of ♂5, ♂6, ♂4, ♂2 and ♂3, respectively; (f–j) tails of ♀5, ♀1, ♀4, ♀3 and ♀2 respectively; (k–l) tails of fourth-stage J1 and J4; (m) tail of third-stage J7; (n) tail of second-stage J15. Bar scale = 50 μm for all figures.

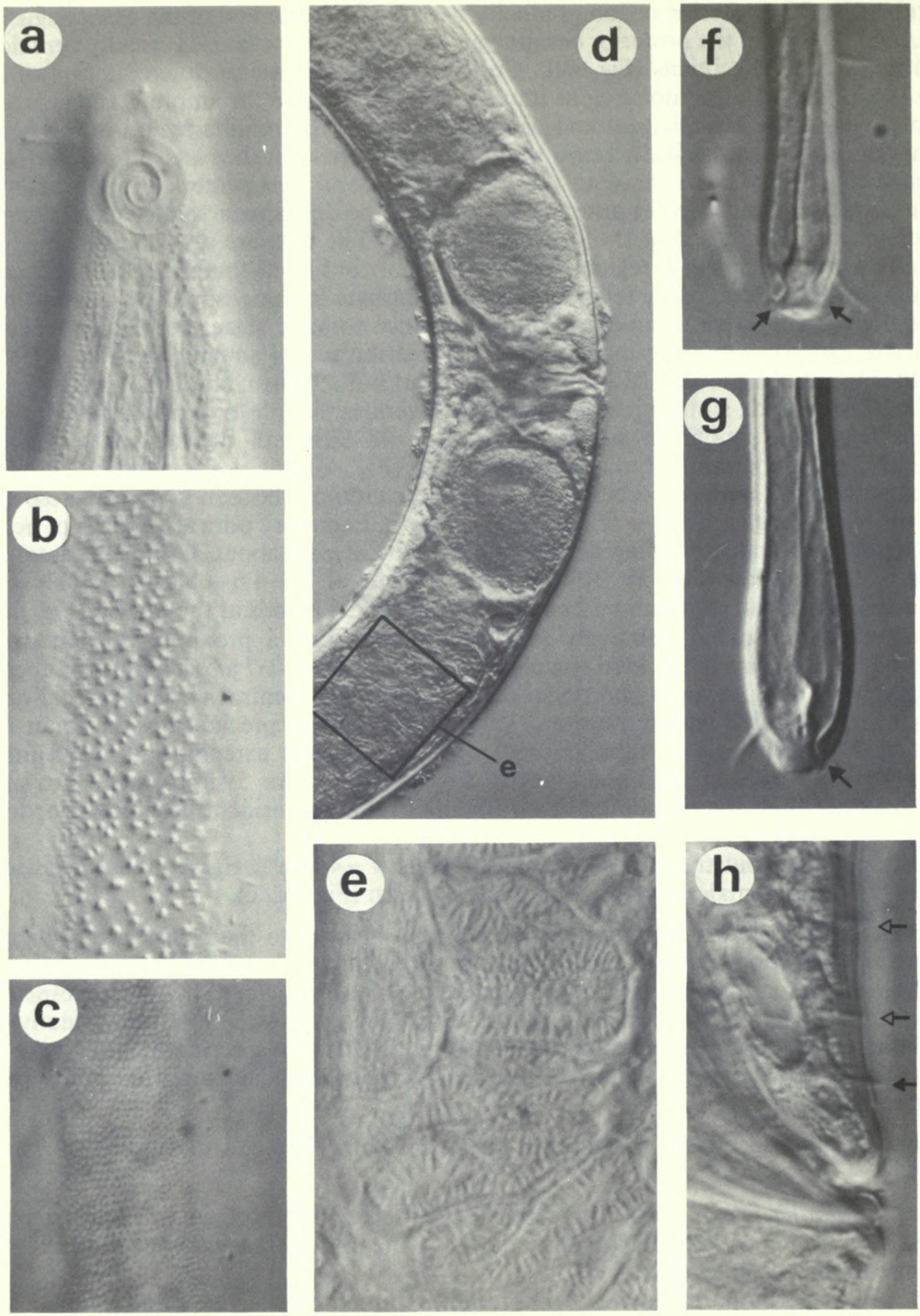

Fig. 6 *Sabatieria lawsi:* (a) anterior region showing amphid, R3 sensilla and lateral R2 sensilla; (b) lateral cuticle punctations in post-amphid region; (c) lateral cuticle pattern mid-body; (d) mid-body region of ♀ showing vulva and two eggs, box labelled e shows position of following figure; (e) large hollow sperm in receptaculum seminis, see Fig. 6d; (f–g) tail tips showing exit pores of caudal glands, arrowed; (h) precloacal region showing spine (solid arrow) and first two supplements (hollow arrows).

Table 2 Measurements of adult *Sabatieria lawsi* (µm)

Character	Holotype	All males				Allotype	All females			
		No.	Mean	Range	CV%		No.	Mean	Range	CV%
Total body length	2400	6	2250	2060–2400	6	2595	6	2295	1940–2595	12
Demanian ratio a	34	6	34	32–35	4	31	6	31	26–34	8
Demanian ratio b	10·3	6	10·0	8·8–10·6	7	11·1	6	9·8	8·4–11·1	12
Demanian ratio c	16·2	6	14·5	12·0–16·2	11	12·9	6	12·3	11·7–13·3	6
R3 sensilla length	6	6	6	6–7	10	7	6	6	5–7	10
Head diameter	16	6	15	14–16	4	15	5	16	15–18	6
Amphid diameter	11	6	10	9–11	7	10	6	10	8–10	12
Amphid c.d.	16	6	18	16–19	5	19	6	17	16–19	6
Oesophagus length	233	6	225	201–235	6	233	6	236	226–243	3
Oesophagus c.d.	57	4	56	54–57	3	52	6	55	47–62	9
Maximum body diameter	71	6	67	61–74	7	83	6	76	57–95	17
Spicule length (chord)	73	6	73	70–75	—	—	—	—	—	—
a.b.d.	46	6	44	43–46	2	50	6	45	39–50	10
Vulva to anterior	—	—	—	—	—	1180	6	1065	950–1180	9
Cloaca to anaterior supplement (β)	355	4	363	340–385	5	—	—	—	—	—
Tail length	150	6	155	135–170	9	200	6	185	165–215	10

Table 3 Measurements of juvenile *Sabatieria lawsi* (µm)

Character	Fourth-stage juveniles				Third-stage juveniles				Second-stage juveniles			
	No.	Mean	Range	CV%	No.	Mean	Range	CV%	No.	Mean	Range	CV%
Total body length	4	1705	1585–1860	7	6	1130	1025–1295	8	9	725	630–850	9
Demanian ratio a	4	31	29–35	8	6	29	26–32	10	9	27	24–30	7
Demanian ratio b	4	8·2	7·9–8·4	3	6	6·8	6·5–7·1	3	9	5·1	4·7–5·8	7
Demanian ratio c	4	11·2	10·5–12·7	9	6	9·7	8·3–10·7	12	9	8·5	7·8–9·3	6
R3 sensilla length	4	5·2	4·4–5·9	12	6	4·8	4·4–5·2	7	8	4·2	3·7–4·8	10
Head diameter	4	13	11–15	12	5	11	9–13	13	7	9	7–11	11
Amphid diameter	4	8	7–8	5	5	7	6–8	10	8	5	4–6	19
Amphid c.d.	4	14	13–16	10	5	13	11–14	11	8	11	9–13	11
Oesophagus length	4	208	192–225	7	6	166	144–187	9	9	142	124–182	12
Maximum body diameter	4	55	53–56	2	6	39	36–41	6	9	27	24–32	9
Tail length	4	155	130–170	11	6	115	100–130	9	9	85	75–105	12

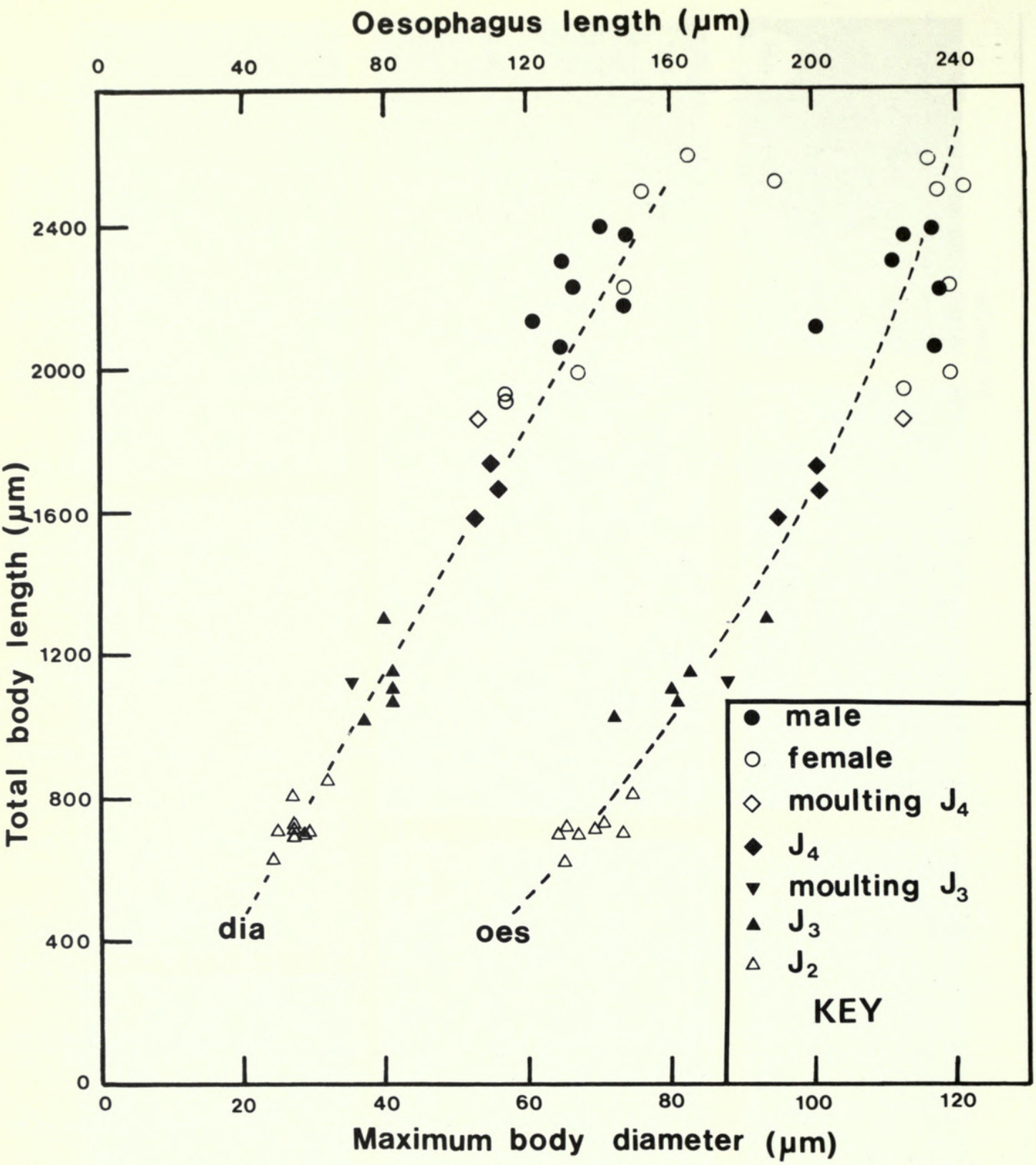

Fig. 7 Relationships between body length and oesophagus length, and body length and maximum body diameter for *S. lawsi*: curves fitted by eye.

Discussion

Although several species of *Sabatieria* have previously been reported from Antarctic waters (as defined in Platt, 1979) only one can be considered valid: *Sabatieria mawsoni* Wieser, 1954 which was originally described from Commonwealth Bay, Adelie Land, as *Parasabatieria antarctica* by Cobb (1930). Cobb provided a small and rather inadequate figure but described it as having six supplements, which clearly separates it from the two species described here. *Sabatieria antarctica* Cobb, 1914, not *Parasabatieria antarctica,* was described from a juvenile and was considered doubtful by Wieser (1954). Allgen's (1929)

S. australis was also described from juveniles and is here considered dubious as are several other species either described, *S. curvispiculum, S. dorylaimopsis* and *S. heterospiculum*: all from South Georgia and unfortunately too poorly described ever to be recognised again with any degree of certainty, or reported from Antarctic waters by Allgen (1953, 1959).

Measurements of *S. lawsi* juveniles and adults suggest that during post-embryonic growth, or more strictly during post-juvenile-stage-4 growth, most of the anatomical features other than those of the reproductive system remain in similar proportion. There is some indication from the 'a' ratio that the worms become slightly thinner relatively (Tables 2 & 3) although a straight line can be fitted to the points of the relationship between body length and width (Fig. 7); that this line does not pass through the origin suggests a curved line might be more appropriate. Geraert (1978*a*, 1979*a*) also concluded that various freeliving soil forms became relatively thinner during post-embryological growth but became thicker again during maturation.

A less equivocal change can be seen in the relative length of the oesophagus, with the 'b' ratio increasing (i.e. the oesophagus becoming relatively shorter) with no overlap in the ranges for the various developmental stages, assuming these have been correctly identified (Tables 2 and 3). Geraert (1978*a*, 1978*b*, 1979*a*) found that for freeliving soil forms there were many different kinds of oesophageal growth patterns: the shape of the curve in Fig. 7 suggests that for *S. lawsi* the oesophagus continues to grow in all stages but progressively slows down, as Geraert found occurred in rhabditids.

In his study of relative tail length, Geraert (1979*b*) concluded that the 'c' ratio was of minor importance and that tail length varied independantly and was taxonomically unimportant. However, the relatively low CV for these measurements in marine nematodes together with low infraspecific variability in shape (Fig. 5) indicates that at least for these comesomatids, characters of the tail are of greater importance than in the soil forms studied by Geraert, possibly because in marine nematodes the tail plays a greater functional role than in soil forms.

A final point of interest to emerge from this study is the general range of infraspecific variation found in these organisms in view of what would appear to be very stable and cold environmental temperatures. The CV for most characters was under 10% (Tables 1–3), similar to but not any less than the range previously reported for *Sabatieria* species from warmer waters (Jensen & Gerlach, 1977; Jensen, 1979*a*, 1979*b*). The maximum body diameter CV can exceed 10%, especially in females (Table 2) but this, as pointed out by Jensen (1979*a*) is influenced by the state of gonad development.

Acknowledgements

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