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## Some Pacific Criconematina (Nemata)

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**ABSTRACT.** Several new or little known Criconematina are reported from Fiji, New Guinea, Tonga and Western Samoa. *Paratylenchus tui* n.sp. from Vava'u, a northern island in the Tonga group, most resembles *P. vandenbrandei* De Grisse, 1962, in measurements and lateral field but the anterior portion of the head is modified into a prominent disc, offset by constriction, distinguishing *P. tui* n.sp. from this and other species. *Gracilacus aonli* (Misra & Edward, 1971) is redescribed from a Western Samoan population. A new genus, *Syro*, is described in the subfamily Criconematinae for four species (three of them new) indigenous to New Guinea and three known species from tropical Africa. The genus is based on criteria which have not formerly been much considered in the group or have been overlooked, namely: form of head, uneven arrangement of appendages around body, appendages (whatever their shape) produced by basic dichotomy at least posteriorly, and a short, triangular postvulval region of few annules bearing long dichotomous trailing appendages. The genus consists of: *S. vexillatrix* n.sp., *S. chrisbarnardi* (Heyns, 1970) n. comb., *S. coronatus* (Schuermans, Stekhoven & Teunissen, 1938) n. comb., *S. dracomontanus* (Van den Berg, 1983) n. comb., *S. hughdavidi* n.sp., *S. orphreyifer* n.sp. and *S. melanesicus* (Andrássy, 1979) n. comb.; information additional to the original description is given on the last of these.

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**KEYWORDS:** plant nematodes, taxonomy, Criconematina, Pacific islands, New Guinea, Africa.

Several genera have been established to accommodate unusual species of Criconematina from Australia, New Zealand and the islands of the Central and South Pacific (*Blandicephalanema* Mehta & Raski, 1971; *Pateracephalanema* Mehta & Raski, 1971; *Colbranium* Andrassy, 1979 and *Amphisbaenema* Orton Williams, 1982). Considering the vastness of the region, the evolution within it of so many unique plants and animals and the scant attention it has received from nematologists, it would be surprising if there were not others. Among the taxa reported here is a group of closely related new species from New Guinea. These have clear affinities with three previously described species from Africa which have not hitherto fitted very satisfactorily into any of the existing genera. With the addition of one further species recently described from New Britain, all these are considered to constitute a new and distinct genus.

### Materials and Methods

Species from New Guinea were recovered in a survey for plant parasitic nematodes undertaken by Drs John Bridge and Sam Page, Oct. - Dec., 1982; material from Fiji, Western Samoa and Tonga came from a survey which I made in the region during 1976 - 1977. Specimens were heat killed, fixed in either 4% formalin or F.A. 4:10, cleared in lactophenol and processed to glycerin containing traces of picric acid by a modified Baker method.

Abbreviations used in the tables are fully explained in Orton Williams, 1982. They include: L ex (distance of excretory pore from anterior end of body), L t (tail length), W1 ca (width of first cephalic annule, W1 ba (width of first body annule) and W v (width at vulva).

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*Paratylenchus tui* n.sp.

Fig. 1, A-L

**Type material.** The holotype female, nineteen female and three male paratypes are deposited at the Commonwealth Institute of Parasitology, St. Albans, Hertfordshire, England. Paratypes have been sent to the following institutions: Australian Museum, Sydney, New South Wales, Australia (four females); Agricultural University, Wageningen, The Netherlands (three females); University of California Nematode Collection, Davis, California, U.S.A. (three females) and United States Department of Agriculture Nematode collection, Beltsville, Maryland, U.S.A. (two females).

**Type host and locality.** Soil around the roots of the small indigenous tree *Alphitonia zizyphoides* (Spreng.) A. Gray, (Rhamnales), besides coast road one mile south-west of Tefisi village, island of Vava'u, Tonga. Collected 8/12/1976.

**Description.** FEMALES. Body ranging from eyebrow shaped, through hook shaped to an open spiral, thin to only slightly swollen in prevulval region. Annules fine anteriorly, often obscure, becoming larger and more distinct by base of conus, measuring 1.0–1.5  $\mu\text{m}$  at midbody. Lateral field narrow with three incisures, the central line much less clearly marked than the outer pair. In transverse section (Fig. 1, I) the lateral field appears as a small pad of body cuticle with a shallow open V at centre.

Lip region truncate, modified into a flattened disc not resolvable into separate submedian lobes, between 3 and 4  $\mu\text{m}$  across, expanded equally around the head, rounded at the edge and set off from rest of head by a posterior constriction. Immediate oral area projecting very slightly from centre of head disc. Cephalic sclerotization moderately developed, vestibule rounded in outline. Stylet fine, flexible, conus 25–30  $\mu\text{m}$  long. Stylet knobs angular, about 2.5–3.0  $\mu\text{m}$  across, with small but definite outwardly directed points. Dorsal oesophageal gland orifice 4 or 5  $\mu\text{m}$  from stylet base. Excretory pore immediately anterior to hemizonid or impaling it, sited between nerve ring and top of basal bulb. Hemizonid about two body annules long causing a slight bulge in the cuticle.

Ovary outstretched; spermatheca ovoid, averaging 8 x 10  $\mu\text{m}$ , prominent in the majority of paratypes but in some a mass of sperm was present in the uterus and a separate spermatheca could not be distinguished. Cuticle anterior and posterior to vulva smooth for about two annule widths, especially in slender females. Vulval flaps well developed, rounded or flattened, with a well defined crenation at either end near the junction of flap and body cuticle. Postvulval region 40–60 (52)  $\mu\text{m}$  long with distinct annulation. Tail very variable 2–3.6 (2.6) anal body widths long, broadly or finely rounded to acute (Fig. 1, D–H).

MALES. More slender than females, an open C shape. Annulation not visible on head and neck, becoming more distinct further back, 0.7–1.2  $\mu\text{m}$  at midbody. Lateral field with two definite incisures and possibly a central third one. Stylet absent, oesophagus degenerate, its boundaries obscure. Excretory pore at base of nerve ring. Spicules weakly cephalate, almost straight. Anal sheath moderately developed, measuring about 1.0–1.5  $\mu\text{m}$ . Tail concave ventrally, convex dorsally, terminating in a short spike in all three specimens.

**Differential diagnosis.** The flattened head disc distinguishes *P. tui* n.sp. from the majority of *Paratylenchus* species but some degree of modification is also found in the labial region of *P. vandenbrandei* De Grisse, 1962; *P. coronatus* Colbran, 1965; *P. tateae* Wu & Townshend, 1973 and *P. labiosus* Anderson & Kimpinski, 1977. *Paratylenchus vandenbrandei* has roughly similar measurements and three lateral lines but a less pronounced lip region with a truncate anterior surface and a sharply conoid head contour joining the body at an angle. Annulation of the head is distinct. In *P. tui* n.sp. the head is not differentiated from the body posterior to the expanded labial disc, joins the body without an angle and is indistinctly annulated. Because of similarities in measurements and lateral field between the two species, these differences were checked on paratypes of *P. vandenbrandei* (slide R200 in the collection of Laboratorium voor Dierkunde, Rijksuniversiteit, Ghent, Belgium). *Paratylenchus coronatus* has a much less disc-like anterior than the new species, and one more line in its lateral field. Both *P. tateae* and *P. labiosus* have four lines in the lateral field and shorter stylet lengths (between 15 and 17  $\mu\text{m}$ ).

**Etymology:** *Tui*, the Tongan word for chief or king, is treated as an indeclinable noun and alludes to the crowned appearance of the head.

	Females		Males
	Paratypes	Holotype	Paratypes
n	30		3
L ( $\mu\text{m}$ )	215–280 (250)	252	220–235 (228)
St ( $\mu\text{m}$ )	33–40 (35.6)	39	–
a	16–27 (22.5)	20.2	25–29 (26.9)
b	2.8–3.7 (3.3)	3.1	–
c	12.9–22.2 (17.1)	15.8	17–19 (18.5)
V	77–82 (79.3)	79.4	–
L ex ( $\mu\text{m}$ )	54–66 (58.6)	63	51–53 (52)
L oes ( $\mu\text{m}$ )	72–85 (76)	81	–
Lt ( $\mu\text{m}$ )	12–22 (15)	16	12–13 (12.3)
Spicules, chord ( $\mu\text{m}$ )	–	–	14–15 (14.2)
Gubernaculum ( $\mu\text{m}$ )	–	–	2–3

Table 1. Morphometrics of *Paratylenchus tui* n.sp.

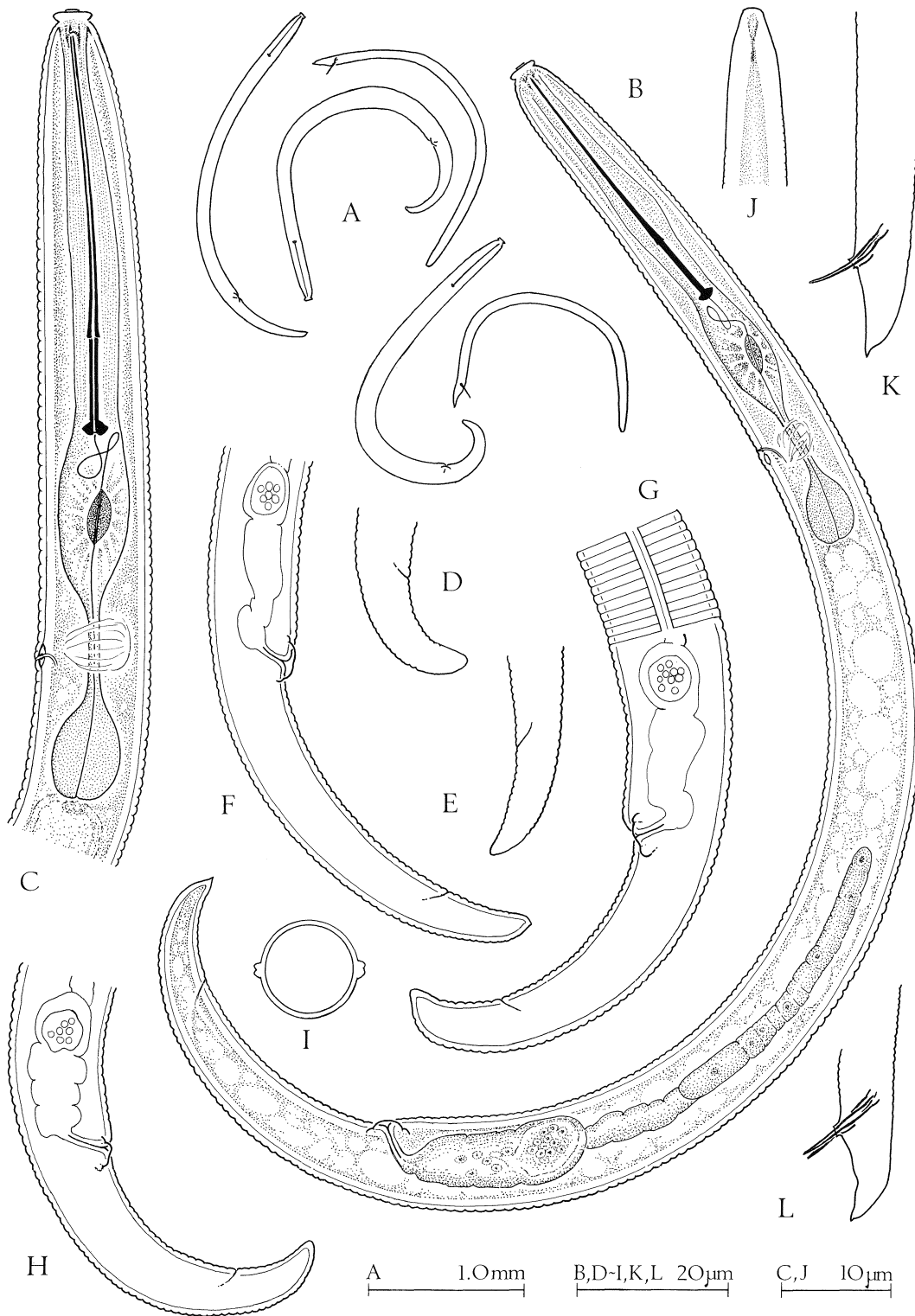
*Gracilacus aonli* (Misra & Edward, 1971) Raski, 1976

Fig. 2, A–K

*Paratylenchus aonli* Misra & Edward, 1971: 345, fig. 1.

*Gracilacus aonli* (Misra & Edward, 1971) Raski, 1976: 98

**Remarks.** When Raski (1976) revised *Gracilacus* he was unable to get access to the types of this species and based his account of it on the published description. This lacks some useful information whilst the accompanying illustrations are not as precise as they might be. Nevertheless, the specimens described here, from the roots of *Cerbera odollam* Geartn. on Upolu, the main island of Western Samoa, conform remarkably well to the measurements (Table 2), description and drawings given by Misra & Edward. A critical character in the identification was the presence of an elongate ovoid spermatheca. The spermatheca of *G. aonli* is



**Fig. 1.** *Paratylenchus tui* n. sp: **A**, habitus, both sexes. **B-I**, female: **B**, entire; **C**, anterior end; **D-H**, posterior ends; **I**, cross section midbody. **J-L**, male: **J**, anterior end; **K, L**, posterior ends.

described as 'oval, just above the uterus, about 9.5  $\mu\text{m}$  across'; unfortunately its length was not given. In one of the illustrations however (Fig. 1G), an attenuated oval shape, not separated into spermatheca and uterus, strongly indicates the presence of an elongate spermatheca rather than one of about the same length as width. Such a spermatheca is found in comparatively few species (which are discussed below) and the appearance of this character in both *G. aonli* and the Western Samoan population increases the likelihood that they are conspecific.

**Morphometrics.** See Table 2.

**Description.** FEMALES. Body hook-shaped to an open spiral, sometimes slightly swollen in the immediate prevulval region. Annulation visible on head and neck, coarsening down body; midbody annules 1.1–1.7  $\mu\text{m}$ . Lateral field of four incisures, the outer pair more distinct than the inner pair. Head weakly conoid, flattened anteriorly, the outer margins of the anterior surface slightly thickened suggesting the presence of minute submedian lobes; oral disc convex. Vestible rounded in outline, housing stylet tip, more strongly sclerotized than cephalic framework. Stylet fine, flexible, conus 50–56  $\mu\text{m}$  long. Stylet knobs rounded, 2.5–3.5  $\mu\text{m}$  across; dorsal oesophageal gland orifice about 5 or 6  $\mu\text{m}$  behind stylet knobs. Hemizonid just anterior to excretory pore or impaled by it, sited at base of median bulb to nerve ring.

Spermatheca prominent, sausage shaped, rounded at the ends, 6–8  $\mu\text{m}$  across by 20–30  $\mu\text{m}$  long, 2.8–3.8 times longer than wide (exceptionally, in a single specimen 4.8 times), generally filled with sperm. Empty spermathecae appear thin walled but are still easily seen. Body scarcely constricted at vulva; postvulval region 58–72 (64)  $\mu\text{m}$  long. Vulval flaps present; small, rounded, not prominent. Tail coarsely annulated, 3.0–3.8 (3.5) anal body widths long; terminus variable, usually acute but sometimes finely to broadly rounded.

MALES. body C-shaped with distinct annulation throughout, including head, neck and tail. Lateral field with four incisures. Head shape resembling that of female. Stylet absent; oesophagus degenerate, its boundaries obscure. Spicules strongly cephalate, distal quarter bent at an angle. Anal sheath moderately developed (about 1.5  $\mu\text{m}$  long). Tail often drawn out to acute terminus (Fig. 2, I) but not infrequently rounded (Fig. 2, J & K).

**Differential diagnosis.** *Gracilacus aonli* is characterized by four lines in the lateral field, a weakly conoid - truncate head and an elongate spermatheca which is at least two and a half times longer than wide. This last feature is shared in the genus only by *G. pandata* Raski, 1976, perhaps *G. goodeyi* (Oostenbrink, 1953) Raski, 1962 and *G. janai* Baqri, 1979. In the original description of *G. goodeyi* the spermatheca was said to be round and was illustrated as such but in a number of populations identified as this species by Geraert (1965), the spermatheca was of an elongate type. This point was not resolved by Raski (1976) when he

revised *Gracilacus*, as the types available to him were in a useless condition. However, Oostenbrink, Geraert and Raski are in agreement that *G. goodeyi* has a strongly conoid head which tapers sharply to a narrow, rounded apex, a shape not likely to be confused with the weakly conoid truncate head of *G. aonli*.

*Gracilacus aonli* and *G. pandata* are morphologically very similar and can be distinguished only by the generally larger dimensions of the latter, particularly the total body length of both sexes. In *G. janai* the spermatheca is clearly illustrated as elongate but no mention of this (nor of its dimensions) is made in the text. The species can be differentiated from *G. aonli* mainly by its two lateral lines and absence of vulval flaps.

One further species with an elongate spermatheca is *G. raskii* Phukan & Sanwal, 1979, although here it is described as about twice as long as wide. Dimensions and head shape in this species closely resemble *G. aonli* and, from the description the main distinguishing features are this difference in length of spermatheca and lack of vulval flaps in *G. raskii*.

In addition to the Western Samoan population described here, I have also identified *G. aonli* from the roots of taro, *Colocasia esculenta* (L.) Schott, on Viti Levu, Fiji.

	Females		Males	
	Western Samoa	*Type Population	Western Samoa	*Type Population
n	13	25	7	15
L ( $\mu\text{m}$ )	255–305 (272)	250–310	240–285 (266)	280–340
St ( $\mu\text{m}$ )	59–66 (61)	55–65	–	–
a	21–25 (22.8)	9–26	22–28 (25.0)	24–34
b	2.4–2.8 (2.5)	2.5–3.0	–	3–4.5
c	11.2–14.2 (12.5)	14–20	11–14 (12.1)	10–14
V	75–78 (76.4)	76–84	–	–
L ex ( $\mu\text{m}$ )	77–88 (82)	75–90	62–73 (68)	65–70
L oes ( $\mu\text{m}$ )	103–112 (106)	–	–	–
Lt ( $\mu\text{m}$ )	18–25 (22)	–	20–25 (22)	–
Spicules ( $\mu\text{m}$ )	–	–	16–18 (17)	16–18
Gubernaculum ( $\mu\text{m}$ )	–	–	3–3.5 (3.1)	3.5–4.4

\*From Misra & Edward, 1971

**Table 2.** Morphometrics of *Gracilacus aonli* Misra & Edward, 1971

*Nothocriconema polynesianum* Orton Williams, 1982.

Fig. 2, L–N

*Nothocriconema polynesianum* Orton Williams, 1982: 245, Figs 4 & 5.

**Remarks.** One population of females from a mixed vegetable planting at Talipiko, Southern Highlands, New Guinea was studied. Specimens closely resembled the types from Western Samoa and Tonga but were longer, had longer stylets, a higher annule number and generally greater dimensions (see Table 3), annular margins were rough, often looking frayed, although they could not be called crenate. Additionally, most

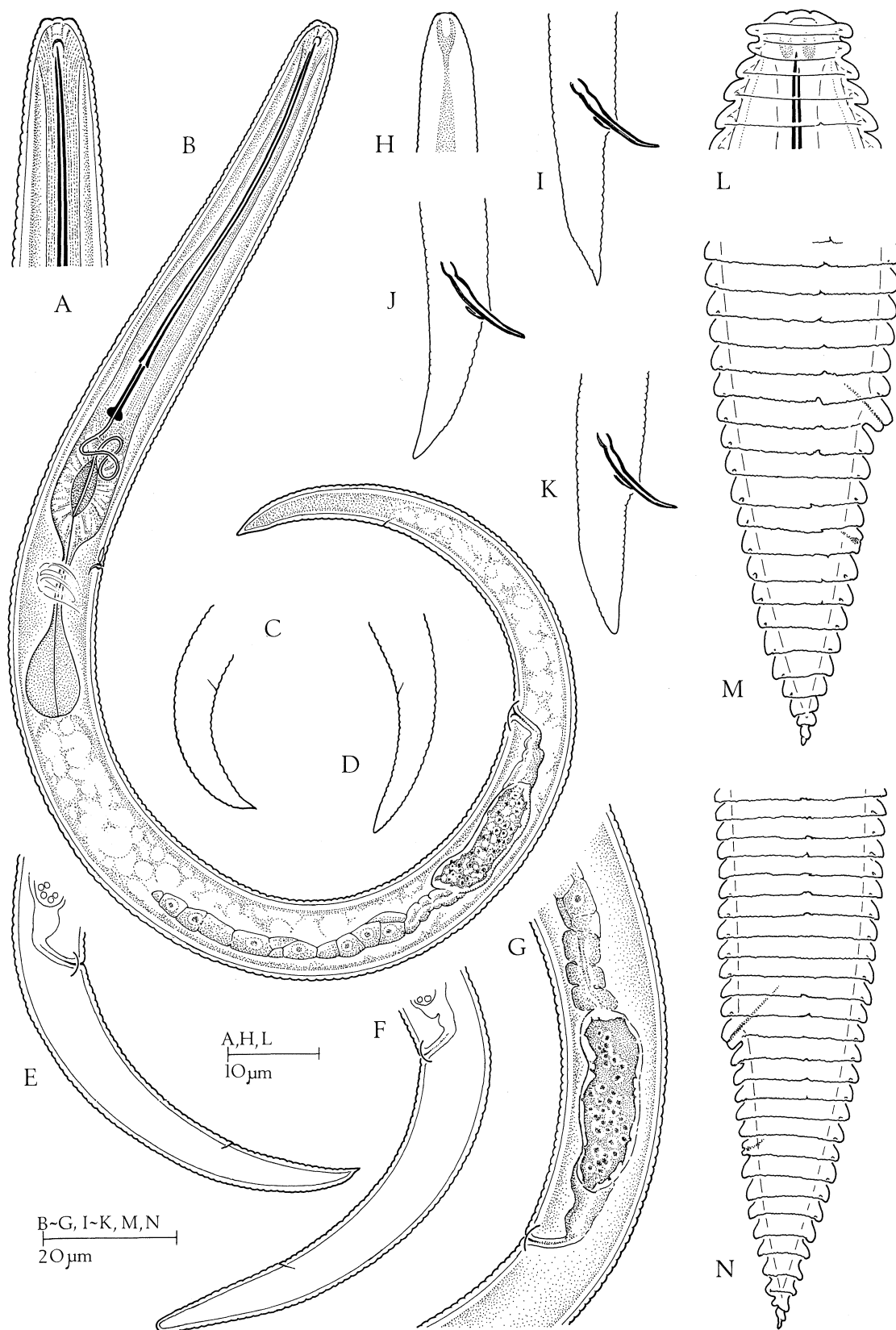


Fig. 2. A-K, *Gracilacus aonli* (Misra & Edward, 1971) Raski, 1976. A-G, female: A, anterior end; B, entire; C-F, posterior ends; G, region of spermatheca. H-K, male: H, anterior end; I-K, posterior ends. L-N, *Nothocriconema polynesianum* Orton Williams, 1982: L, female, anterior end; M, N, female, posterior ends.

specimens had a small notch, indentation or other irregularity in a midlateral position on some body annules particularly between midbody and anus. Re-examination of holotype and paratypes of *N. polynesianum* showed that this feature is present in the type series also although not as pronounced as shown in Fig. 2, M & N. This gives another diagnostic character to the species and puts it closer to *N. acriculum* Raski & Pinochet, 1976, from which it can be differentiated by its wider first head annule than second (in *N. acriculum* the first head annule is narrower than the second) and less drawn out tail.

	Females		
	Western Samoa* (Type population)	Tonga*	New Guinea
n	32	8	10
L ( $\mu\text{m}$ )	256-323 (290)	232-306 (281)	270-345 (320)
St ( $\mu\text{m}$ )	46-54 (50)	45-50 (47.6)	51-58 (55)
R	76-86 (82)	75-82 (78)	91-101 (95)
R sr	15-18 (17)	14-17 (15)	16-21 (19)
E oes	21-25 (23)	20-25 (22)	24-29 (26)
R ex	24-28 (26)	23-26 (25)	28-31 (29)
R v	11-15 (13)	12-14 (13)	15-19 (17)
R an	6-10 (8)	7-9 (8)	10-12 (11)
R van	3-6 (4)	3-4 (3.4)	4-7 (5)
L oes ( $\mu\text{m}$ )	65-80 (74)	65-77 (71)	75-87 (84)
L ex ( $\mu\text{m}$ )	74-96 (84)	71-92 (83)	80-102 (94)
L v ( $\mu\text{m}$ )	35-52 (42)	37-44 (49)	42-58 (48)
Lt ( $\mu\text{m}$ )	17-30 (22)	14-26 (20)	26-31 (28)
W1 ca ( $\mu\text{m}$ )	109-12 (11.2)	10.5-12 (11.2)	11-12.6 (12)
W2 ca ( $\mu\text{m}$ )	9-11.5 (10.7)	9.5-11.8 (10.5)	10.5-12.5 (11.5)
W1 ba ( $\mu\text{m}$ )	12.5-15 (14)	12.8-15.5 (14)	12.5-16.5 (14)
W v ( $\mu\text{m}$ )	20-25 (23)	22-26 (24)	21-27 (25)
a	8.4-11.7 (10.3)	9.6-11.4 (10.6)	10.3-11.6 (10.9)
b	3.4-4.6 (3.9)	3.3-4.4 (3.9)	3.4-4.0 (3.8)
c	10.7-17.4 (13.3)	11.9-18.4 (14.5)	10.5-12.5 (11.4)
V	83.9-89.3 (85.7)	85.4-88.0 (86.5)	83.1-85.9 (85.0)

\*From Orton Williams, 1982

**Table 3.** Morphometrics of *Nothocriconema polynesianum* Orton Williams, 1982.

### *Syro* n. gen.

This genus is erected in the subfamily Criconematinae Taylor, 1936, for seven species, four indigenous to the Central and Western Pacific and three from Africa. The several criteria used in defining it have not previously been given much consideration in the group (e.g. head form) or have not been reported (i.e. dorsal and ventral halves of the animal morphologically different). By these and the other criteria used for the genus, the species have strong affinities although they do not resemble each other closely.

- Type-species.** *S. vexillatrix* n. sp.  
**Other species.** *S. chrisbarnardi* (Heyns, 1970) n. comb.  
*Syn. Criconema chrisbarnardi* Heyns, 1970  
*Crossonema chrisbarnardi* (Heyns, 1970) Loof & De Grisse, 1973  
*Ogma chrisbarnardi* (Heyns, 1970) Andrassy, 1979  
*S. coronatus* (Schuurmans Stekhoven

& Teunissen, 1938) n. comb.

- Syn. Ogma coronatum* Schuurmans Stekhoven & Teunissen, 1938  
*Criconema coronatum* (Schuurmans Stekhoven & Teunissen, 1938) De Coninck, 1943  
*Crossonema coronatum* (Schuurmans Stekhoven & Teunissen, 1938) Mehta & Raski, 1971  
*Seriespinula coronata* (Schuurmans Stekhoven & Teunissen, 1938) Andrassy, 1979

*S. dracomontanus* (Van den Berg, 1983) n. comb.

*Syn. Crossonema dracomontanus* Van den Berg, 1983

*S. hughdavidi* n. sp.

*S. melanesicus* (Andrassy, 1979) n. comb.

*Syn. Seriespinula melanesica* Andrassy, 1979

*Crossonema melanesicum* (Andrassy, 1979) Ebsary, 1981

*S. orphreyifer* n. sp.

**Diagnosis.** FEMALES. Body fusiform, thick, rounded at both ends, of small to medium length (285-643  $\mu\text{m}$ ) with a low number of coarse annules (39-63). Head of one annule expanded anteriorly, posteriorly collar-like; pseudolips present, sublateral lobes absent. Body bearing numerous appendages; those on main portion arranged either in longitudinal rows or horizontally across annules but in either case, unequally distributed between dorsal and ventral halves and more concentrated dorsally. Main body appendages simple, bifurcate, or with several points, often dichotomizing. Posterior appendages greatly modified, elongate, sometimes 'antler-like', showing evidence of one or more dichotomies. Terminal appendages extending beyond posterior end of body, often profusely branched, dichotomizing. Stylet 57-103  $\mu\text{m}$ . Vulva with strongly developed lips, conoid, projecting beyond level of adjacent annules. Postvulval region of 4-8 annules (generally 5 or 6), triangular in shape, wider than long (VL/VB = about 0.6).

JUVENILES. With 12-14 longitudinal rows of scales, each scale divided into two equal parts by a deep bifurcation, and bearing two or more terminal spines on each part (type-species).

MALES. Unknown.

**Differential diagnosis.** *Syro* has a number of similarities to *Crossonema* Mehta & Raski, 1971, as typified by *C. civellae*. The different head form of this species (of two annules as defined below, and lacking a pronounced collar), equal distribution of appendages around body and presence of alternating palmate appendages, not formed from successive dichotomy at the posterior end, render it distinct.

**Etymology.** *Syro*, from *συρω* = I trail (something behind) treated as a masculine Latin noun.

**Remarks.** *Syro* is characterized by four main features:

1. The form of the head. In all species this is composed of a single annule with an expanded, outwardly directed anterior portion and a pronounced, collar-like posterior portion, often tapering towards the base. This is seen in each of the new species described here (Figs 3,A & B; 4,C; 5,B), and is illustrated by De Coninck (1945) for *S. coronatus* and Andrassy (1979) for *S. melanesicus*. I take the head to extend posteriorly to the base of the cephalic sclerotization only, and consider the second head annule mentioned by Andrassy and the second and third of De Coninck to be, in reality, body annules. In *S. hughdavidi* n. sp., the external form of the second annule is such that it might be considered either as a second head annule or as a first body annule. Using the extent of the labial sclerotization as a definition, it is part of the body, leaving the head with a single annule.

2. The unequal arrangement of appendages around the body. This was found by chance after sectioning a female of *S. vexillatrix* n. sp. (Fig. 3, D) and subsequently checked, as far as possible, on all the material. It is difficult to see on laterally mounted specimens and is unlikely to have been noticed on the single female from which *S. chrisbarnardi* was described (Heyns, 1970). Andrassy (1979) did not mention this feature in his description of *S. melanesicus* either, but there is a slight dorsal shift to the scale rows on a specimen of this species from Western Samoa which I examined. There are indications in De Coninck's illustrations of *S. coronatus* that some sort of difference between the dorsal and ventral halves of the body occurs in *S. coronatus*; the same is true in illustrations of *S. dracomontanus*, see Van den Berg (1983). The three species newly described here clearly demonstrate this difference which is most obvious in *S. orphreyifer*. One species outside *Syro*, *Seriespinula octozonale* (syn. *S. sokliense*), is also known to have scale rows unequally arranged around the body (see Momota & Ohshima, 1974; Choi & Geraert, 1975).

3. The presence of elongate, dichotomously branched appendages trailing posterior to the terminus. The terminal appendages of all species show this dichotomous form, and those of *S. orphreyifer* and *S. hughdavidi* particularly can be seen to have attained their form by successive dichotomies. In these two species the appendages also dichotomize over most of the body.

4. Short triangular postvulval region (of greater width than length) with a strongly modified projecting vulva.

***Syro vexillatrix* n. sp.**

Fig. 3, A-K

**Type material.** The holotype female, nine female and two juvenile paratypes are deposited at the Commonwealth Institute of Parasitology, St. Albans, Hertfordshire, England. A single female has been sent to each of the following

institutions: Australian Museum, Sydney, New South Wales, Australia; Agricultural University, Wageningen, The Netherlands; University of California Nematode Collection, Davis, California, U.S.A. and United States Department of Agriculture Nematode Collection, Beltsville, Maryland, U.S.A.

**Type host and locality.** Soil from the rhizosphere of *Crotalaria lunata* Beddome ex Polhill (Sabaceae), a small shrub native to Southern India, at Tobua, Nembi Plateau, Southern Highlands, New Guinea. Collected 4/11/1982. Populations 2-4 were associated with sweet potato, *Ipomoea batatas* (L.) Lam. or vegetable garden soil at other localities in the Southern Highlands.

**Morphometrics:** See Table 4.

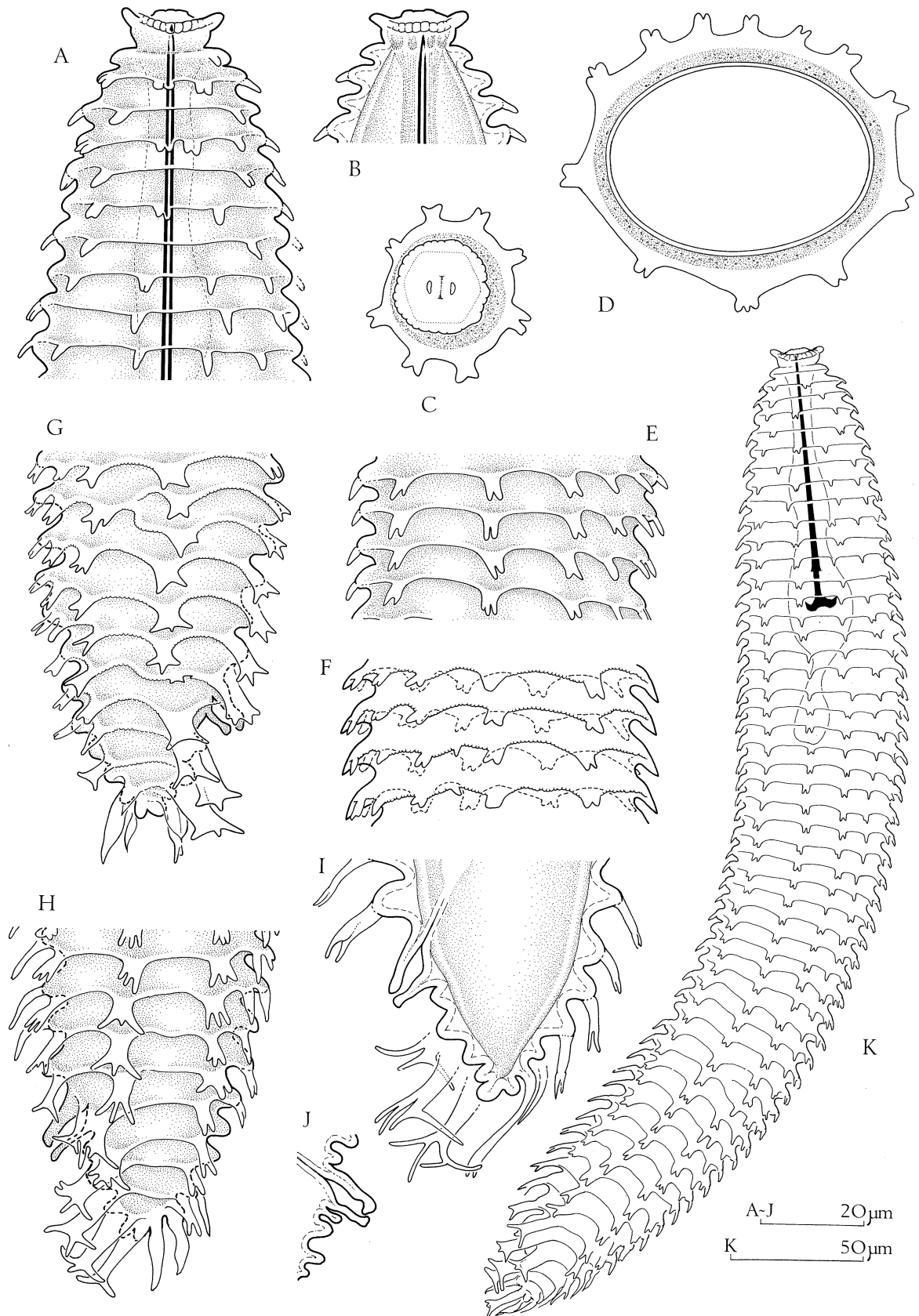
**Description.** FEMALES (all populations). Body stout, fusiform, slightly curved, heavily covered by detritus in all but a few specimens. Head of one annule, its anterior margin expanded, outwardly or partly forwardly directed and coarsely crenate. Lip region simple with pseudolips but lacking sublateral lobes. Remainder of head collar-like, tapering posteriorly, 13-15  $\mu\text{m}$  across at base. Total height of head 7-8  $\mu\text{m}$ .

Body annules retrorse, well separated from each other; first body annule wider than head. Annules bearing appendages arranged in longitudinal rows over much of the body, except anteriorly to about the level of the stylet base. In this region, appendages randomly spaced, neither absolutely in longitudinal rows nor alternating (Fig. 3, A & K). Appendages mostly simple, triangular, with finely rounded points but sometimes bifid. At stylet base, appendages forming up into 12-16 longitudinal rows unequally spaced around body (Fig. 3,D) and concentrated on the dorsal side. Appendages short (4-6  $\mu\text{m}$ ) midbody, generally bifurcate, although 1, 3 and 4 pronged forms were seen. Between appendages, annular margins appearing smooth, rough or, in one specimen, finely crenate (somewhat exaggerated in Fig. 3, F & G). Appendages of vulval region and posterior becoming increasingly elongate, branching dichotomously to form large flaps which often have two narrow, outwardly directed prongs, sometimes with a third, shorter, central prong, or, rarely, branch twice. Appendages reaching 28  $\mu\text{m}$  in length at terminus, trailing behind the animal for up to 20  $\mu\text{m}$ .

Stylet moderately developed, conus 78-88  $\mu\text{m}$  long, knobs strongly pointed, of greater width than height, 11-14  $\mu\text{m}$  across. Dorsal oesophageal gland orifice about 4 or 5  $\mu\text{m}$  behind knobs. Gonad typical; spermatheca not seen. Vulval lips pronounced, extending beyond line of annules but not to level of appendage ends. Vulva closed, lips forming a chamber internally (Fig. 3,I & J). Postvulval length 10-26  $\mu\text{m}$ , 0.3-0.7 of vulval body width; postvulval region sharply conoid, almost an equilateral triangle in optical section, with a broadly rounded terminus composed of several lobes, the bases of the terminal appendages. Anus not seen.

**JUVENILES.** Two were found. Appendages arranged in longitudinal rows, 12-14 in number but difficult to





**Fig. 3.** *Syro vexillatrix* n. sp., female: **A, B**, anterior ends; **C**, face view; **D**, cross section midbody; **E, F**, annules midbody (dorsal side to the right in **E**, the left in **F**); **G-I**, posterior ends; **J**, vulval region; **K**, entire. **Note:** the rings of stippling in **C** and **D** indicate detritus.

count accurately. Appendages prominent, deeply divided into two equal parts by an inverted V-shaped bifurcation, the distal end of each part bearing two (sometimes more) fine spikes.

MALES. Not found.

**Differential diagnosis.** *Syro vexillatrix* n.sp. is most closely related to *S. coronatus* and *S. chrisbarnardi*, a subgroup of the genus, all with the appendages on the anterior quarter of the body differing from the main body appendages in arrangement or kind (or both) but with the terminal appendages very similar in type. *Syro vexillatrix* can be distinguished from *S. coronatus* by the triangular, widely separated scales of its anterior region (compared with the almost continuous line of squarish scales in this species) and the lack of ornament on the terminal appendages (which are clubbed, with minute papillae in *S. coronatus*). It more resembles *S. chrisbarnardi* in general morphology but has bifurcate appendages over most of the body instead of simple ones, and 12–16 scale rows instead of 8. Information about *S. coronatus* has been taken mainly from De Coninck (1945) who redescribed the type specimens, in preference to the original description of Schuurmans Stekhoven & Teunissen (1938) which contains a number of inaccuracies.

**Etymology.** *Vexillatrix*, a neo-Latin noun for a female standard bearer, in reference to the type-species and the banner-like appearance of some of the terminal appendages.

	Females					holotype
	Type pop	Pop 2	Pop 3	Pop 4	Total range	
n	3	5	3	1	12	
L (μm)	383–495	334–465	395–526	450	334–526 (431)	383
St (μm)	94–103	95–102	101–103	94	94–103 (99)	94
R	57–59	56–63	58–61	46	46–63 (58)	57
R st	14–15	14–18	15–17	11	11–18 (15)	14
R oes	19–20	17–23	19–22	15	15–23 (20)	19
R ex	–	19–20*	22*	–	20–22* (20)	–
R v	5–6	5–6	5–6	6	5–6 (6)	6
L oes (μm)	130–157	133–148*	126–148	139	126–157* (141)	133
Wl ca (μm)	18	19–21	19–21	20	18–21 (20)	18
Wl ba (μm)	22–24	21–25	23–25	25	22–25 (23)	22
a	6.0–8.1	6.1–8.2	6.8–8.9	7.1	6.0–8.9 (7.0)	6.4
b	2.9–3.2	2.5–3.3	2.9–3.8	3.2	2.5–3.8 (3.1)	2.9
V	94.5–96.0	94.7–97.0	96.2*	94.9	94.9–96.2 (95.5)	95.0

\*not measurable in all specimens

Table 4. Morphometrics of *Syro vexillatrix* n.sp.

### *Syro orphreyifer* n. sp.

Fig. 4, A–F

**Type material.** The holotype female is deposited at the Commonwealth Institute of Parasitology, St. Albans, Hertfordshire, England.

**Type host and locality.** Soil from the rhizosphere of sweet potato, *Ipomoea batatas* (L.) Lam. at Kuari Kogu, Tari, Southern Highlands, New Guinea. Collected 1/11/1982.

**Description.** HOLOTYPE FEMALE: L = 285 μm (excluding trailing appendages), 300 μm (including

appendages); a = 5.3; b = 2.7; c = ?; V = 96.1; stylet = 74 μm (conus = 62 μm). Body almost straight, stout, fusiform, with 39 coarse annules dorsally and ventrally (including head and terminus), packed with detritus. Annules bearing elongate appendages, mostly bifurcate but sometimes trifurcate or more with rounded distal ends. Appendages borne in two distinct arrangements which succeed each other on alternate annules down the length of the body. First arrangement: appendages completely encircling the body, continuous along the posterior margin of the annule, numbering about 60 on midbody annules; those borne dorsally 5–7 μm long, gradually increasing in size around the body to those occupying a midventral position which are 9–11 μm long. Second arrangement: commencing on the fourth annule behind head, appendages forming a semicircle around the dorsal half of the body only, all about 5–7 μm long, except those at the very ends of the semicircle which are midlateral in position and slightly smaller. The ventral half of such annules is devoid of appendages. From about the 12th annule from terminus, both sets of appendages becoming more elongate and branched. Terminal appendages up to 27 μm long, extending about 15 μm beyond terminal cuticle, profusely branched. All appendages with two or more prongs have divided in a basically dichotomous manner.

Head of one annule, anteriorly much expanded and saucer shaped, 20 μm across with a strongly crenate margin; posteriorly, a broad tapering collar, 11 μm across at base. Oral disc prominent; sublateral lobes absent. Total height of head 7.5 μm. Stylet occupying 11 annules, knobs 9.5 μm across. Dorsal oesophageal gland orifice not visible. Oesophagus 105 μm long; isthmus very short, 25 μm behind stylet base. Excretory pore not seen.

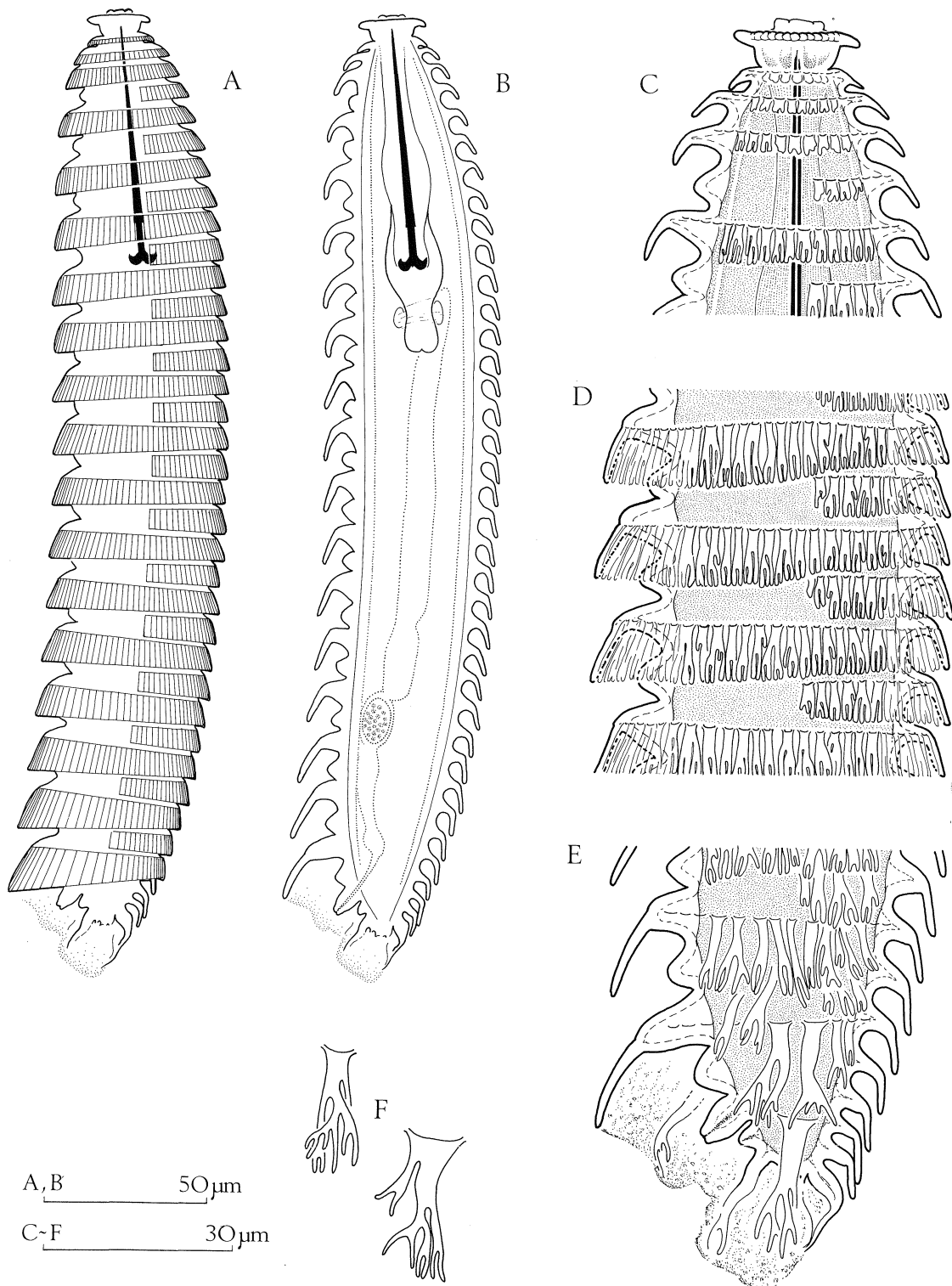
Gonad typical; spermatheca present, oval 11x17 μm, filled with sperm. Vulva sited on the fourth annule from terminus between two ventrally scaleless annules, projecting beyond them, conical, closed. Postvulval region conoid, triangular, about 11 μm long (to base of terminal appendages), 0.5 times vulval body width. Terminus a confused mass of appendage bases.

JUVENILES. Not found.

MALES. Not found, although the sperm in the spermatheca of the holotype female indicates that they exist.

**Differential diagnosis.** The alternating arrangement of appendages that completely encircle the body, or are confined to its dorsal half on successive body annules, is unique to *S. orphreyifer* and immediately differentiates it from all known criconematids.

**Etymology.** From *orphrey*, a late Middle English word for a richly decorated band on a garment, + *ifer* = a Latin suffix denoting carrying.



**Fig. 4.** *Syro orphreyifer* n. sp., female: **A**, entire, surface view; **B**, entire, optical section; **C**, anterior end; **D**, annules midbody; **E**, posterior end; **F**, terminal appendages. **Note:** detritus indicated at terminus only; dorsal side to the right in all except **F**.

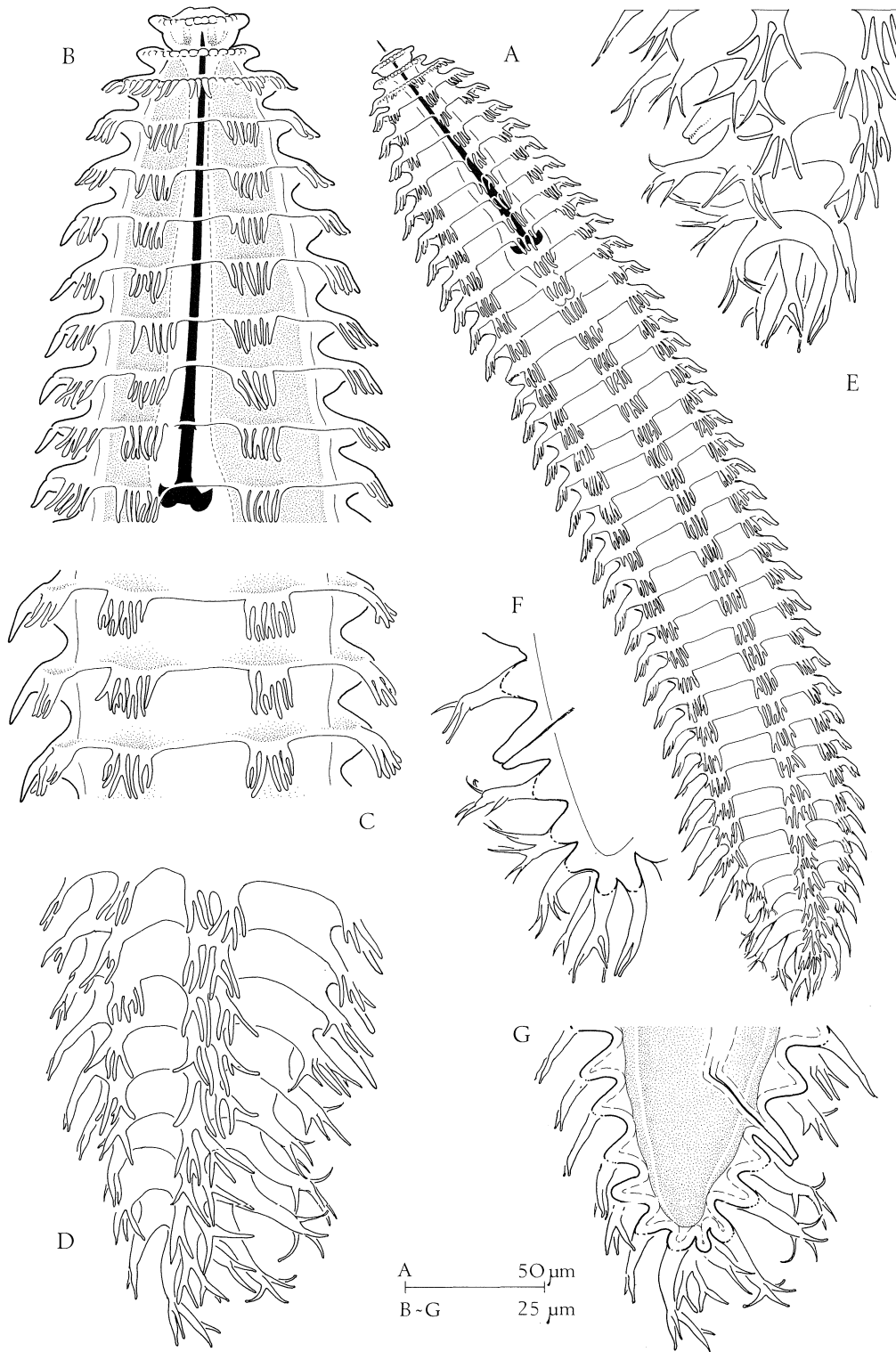


Fig. 5. *Syro hughdavi* n. sp., female: A, entire; B, anterior end; C, annules midbody; D-G, posterior ends. Note: in B-D the dorsal side is to the left.

*Syro melanesicus* (Andrássy, 1979) n. comb.

*Seriespinula melanesica* Andrásy, 1979: 41, fig. 9  
*Crossonema melanesicum* (Andrássy, 1970) Ebsary, 1981: 106

**Remarks.** This unusual and readily identified species was based on two females from rain forest in New Britain. A single female which came from the roots of taro, *Colocasia esculenta* (L.) Schott, Savai'i island, Western Samoa, was seen in this study. Although rather flattened on mounting, the following can be given: L = 295  $\mu\text{m}$ , stylet = 68  $\mu\text{m}$  (conus = 54  $\mu\text{m}$ ), R = 51, Rv = 6.

Compared with the types, the samoan specimen has a slightly shorter stylet and lower number of both of body annules and postvulval annules. However, the most obvious difference is that only eight rows of palmate appendages are present, not the ten rows of Andrásy's population. These could be counted clearly on the flattened specimen. Compared with the other species of *Syro*, the scale rows are not much shifted to the dorsal side of the body but the difference remains detectable.

*Syro melanesicus* has strong affinities with one other species, that is *S. hughdavidi* n. sp. which is described below. Body appendages of *S. melanesicus* do not dichotomize and are very much as illustrated by Andrásy. One or two of the terminal appendages appear to be formed from tubular outgrowths of the cuticle at the margin of the annule, and branch distally in a dichotomous manner similar to *S. hughdavidi*, but ventrally, in the vulval region, appendages remain palmate and unbranched, and it would be difficult to confuse the two species.

*Syro hughdavidi* n. sp.

Fig. 5, A-G

**Type material.** The holotype female and single female paratype are both deposited at the Commonwealth Institute of Parasitology, St. Albans, Hertfordshire, England.

**Type host and locality.** Soil from the rhizosphere of sweet potato, *Ipomoea batatas* (L.) Lam. at Usa village, Kagua, Southern Highlands, New Guinea. Collected 29/10/1983.

**Description.** FEMALES. Holotype female: L = 545  $\mu\text{m}$  (including posterior appendages), a = 7.5, b = 4.1, c = ?, V = 92.3%, stylet = 98  $\mu\text{m}$  (conus = 82  $\mu\text{m}$ ), R = 44. Paratype female: L = 382  $\mu\text{m}$  (including posterior appendages), a = 5.2, b = 3.3, c = ?, V = 90.0, stylet = 91  $\mu\text{m}$  (conus = 77  $\mu\text{m}$ ), R = 41.

Body fusiform, stout, rounded at both ends. Head of one annule, expanded anteriorly, 18–19  $\mu\text{m}$  across, its margin outwardly directed and distinctly crenate; posteriorly tapering as a slightly convex collar, 12  $\mu\text{m}$  across at base. Total height of head 6.5  $\mu\text{m}$ .

Appendages arranged in 10 longitudinal rows over most of the body, slightly shifted dorsally so that there appear to be 4 rows on the ventral half and 6 on the dorsal. Appendages compound, composed of single digitate spines and bifurcate spines, together forming

groups of 5–9 projections with distally rounded ends. Appendages becoming considerably elongate posteriorly and dividing more than once to form 'antler-like' processes (Fig. 5,D). From vulval region to terminus some appendages are formed from tubular extensions of the body cuticle extending from the body almost at right angles and branching dichotomously, becoming needle-like distally. These fine spikes sometimes have a small terminal swelling. Posterior appendages up to 17  $\mu\text{m}$  in length.

Stylet strongly developed, extending over 11 annules; basal knobs 10–11  $\mu\text{m}$  across. Excretory pore opening on 15th or 16th annule, appendages lacking in its immediate vicinity. Gonad typical, with small ovoid spermatheca filled with sperm. Vulva on 5th annule from terminus with well developed lips extending beyond line of adjacent annules but not to level of surrounding appendages. Body width at vulva 47–52  $\mu\text{m}$ , twice the vulva – terminus length of 24–25  $\mu\text{m}$  (measured to base of terminal appendages). Anus not seen. In optical section (Fig. 5,G), terminus broadly rounded with several lobes which form the bases of the terminal appendages.

JUVENILES. Not found.

MALES. Not found, although the sperm in the spermatheca of the holotype female indicates that they exist.

**Differential diagnosis.** *Syro hughdavidi* n. sp. most resembles *S. melanesicus* (both have ten longitudinal rows of several-pronged appendages) but the ornamentation of the body is more exaggerated. The palmate groups of processes are commonly bifid, become elongate posteriorly and branch dichotomously several times. Tubular extensions of the body cuticle terminating in needle-like spikes are also present in profusion. Additionally, *S. hughdavidi* has a differently shaped head, greater stylet length (91–98  $\mu\text{m}$  compared to 68–71  $\mu\text{m}$ ) and fewer body annules (41–44 compared to 51–60).

**Etymology.** The species is named in memory of my brother Hugh David.

ACKNOWLEDGEMENTS. I thank Dr A. De Grisse, Rijksuniversiteit, Ghent, Belgium for the loan of types of *Paratylenchus vandenbrandei*; staff of the Royal Botanic Gardens, Sydney, Australia for verifying the name of *Crotalaria lunata*, and the Director and staff of the Commonwealth Institute of Parasitology, St. Albans, England for laboratory space, facilities and many kindnesses during my visit in 1983. I am most grateful to Dr John Bridge (C.I.P.) for permitting me to study and describe the criconematid material collected in New Guinea.

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