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Four New Species of *Micromaldane* (Polychaeta: Maldanidae) from Eastern Australia

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ABSTRACT. Four new species of *Micromaldane* (Polychaeta: Maldanidae) found intertidally on the eastern rocky coast and coral reefs of Australia are described. A key to all species of *Micromaldane* is provided. The generic definition is discussed and emended.

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The Nicomachinae is one of five subfamilies within the Maldanidae. It is a small group with only three genera: *Nicomache* Malmgren, 1865, *Petaloproctus* Quatrefages, 1865, and *Micromaldane* Mesnil, 1897 (Fauchald, 1977). To date there has been only one previous record of the genus *Micromaldane* from Australian waters, an unidentified species from Heron Island, Great Barrier Reef (Reichelt, 1979).

The type species *Micromaldane ornithochaeta* Mesnil, 1897, originally found on the French Atlantic coast, has subsequently been recorded from Ireland (Southern, 1914), Norfolk (Hammond, 1966), British Colombia (Berkeley & Berkeley, 1962) and the Antarctic (Fauvel, 1951). To date there have been two additional species described: *Micromaldane bispinosa* Hartmann-Schröder, 1962 from the Red Sea and *M. jonesi* Kumaraswamy Achari, 1968, from the Indian Ocean.

While maldanids are regarded as common in continental shelf sediments (Fauchald, 1977) there have been few records of this family in Australian waters (see Day & Hutchings, 1979), possibly due to lack of sampling in these areas. Examination of the intertidal algal mats of the rocky shores around Sydney, New South Wales has revealed two new species of *Micromaldane*. An additional two new species have also been found from One Tree Reef, Great Barrier Reef.

Materials and Methods

Collections of algal mats were made from the lower intertidal zone at the sites indicated in the text. This material was then sorted under a binocular microscope. All species described here have distinctive sandy tubes and have to be coaxed out by probing the head of the worm so that it

retreats out of the posterior end of the tube. This also results in any larvae in the tubes being expelled. Specimens of all species were examined alive before fixation in 10% sea-water formalin and transfered to 70% ethanol (after washing). For scanning electron microscopy (S.E.M.), specimens were dehydrated in ethanol and critical point dried with CO^2 and coated with gold or platinum (200Å) before viewing with a Philips 505 S.E.M. Photomicrographs were taken with a Leitz Dialux photomicroscope using Interference Contrast and an Orthomat camera. Descriptions of new species are based on the alcohol preserved holotype and some S.E.M. observations of paratypes, the variation is based on alcohol preserved paratypes. Line drawings of setae were made from photographs from paratype material.

The following abbreviations have been used: AM – Australian Museum, Sydney; BMNH – British Museum of Natural History, London; HZM – Zoologisches Institut und Zoologisches Museum der Universität, Hamburg; USMN – National Museum of Natural History, Smithsonian Institution, Washington D.C.

Systematics

Nicomachinae

Nicomachinae Arwidsson, 1907: 82.—Day, 1967: 617.—Fauchald, 1977: 38.

Diagnosis. Nuchal grooves straight or curved. No cephalic plate. Pygidium on a foliaceous plate or sunken in a funnel that is crenulate or rimmed with cirri. Segments without collars. Neuropodial hooks usually in a single row.

Micromaldane Mesnil, emended

Micromaldane Mesnil, 1897: 146–148, figs 1–2, pl.6 figs 1–4.—Fauvel, 1927: 193.—Day, 1967: 619.—Kumaraswamy Achari, 1968: 269.—Fauchald, 1977: 40.

Type species. *Micromaldane ornithochaeta* Mesnil, 1897, by original designation.

Diagnosis. Nicomachinae with strongly curved avicular, rostrate, uncini on all setigers. Notosetae and neurosetae on all setigers. Notopodia short and rounded, neuropodia with elongated tori. Notosetae of 3 kinds: stout, spatulate or straight lancet-type setae with striations, delicate geniculate setae with fine teeth along one margin and/or fine bordered capillary setae. Anal plaque evenly crenated without cirri.

Comments. Since the original description of *Micromaldane ornithochaeta* Mesnil, 1897, several authors have expressed doubts as to the validity of this genus and have regarded *M. ornithochaeta* as a juvenile of *Nicomache* which can occur in the same habitat (Fauvel, 1927; Hammond, 1966; Day, 1967). *Nicomache*, however has no uncini on the first setiger and it is also notable that Mesnil (1897) noted greyish ova in his original description of *M. ornithochaeta*. Rouse & Jamieson (1987) described the ultrastructure of the spermatozoa of an unidentified species of *Micromaldane* (as *Micromaldane* sp.) further demonstrating the validity of the genus, although examination of the type species is necessary.

From the observations on the four new species in this study, and by Kumaraswamy Achari (1968) on *M. jonesi*, it is apparent that a maximum number of setigers is reached by each species. This has been used as a specific character (see key to species).

Key to the Species of *Micromaldane* *

1. Lancet-type notosetae spatulate (Fig.5l) 2
—— Lancet-type notosetae straight 3
2. Maximally 17 setigers ..... *M. ornithochaeta*
—— Maximally 19 setigers ..... *M. jonesi*
3. Preanal asetigerous segment present 4
—— Pre-anal asetigerous segment absent 5
4. Maximally 21 setigers ..... *M. bispinosa*
—— Maximally 25 setigers ..... *M. androgyne*
5. More than 20 setigers 6
—— Maximally 19 setigers ..... *M. nutricula*

6. Maximally 21 setigers ..... *M. rubrospermatheca*

—— Maximally 23 setigers ..... *M. pamelae*

*This key is not meant to imply phylogenetic relationships.

Micromaldane androgyne n.sp.

Figs 1a–i, 5a–b

Material examined. HOLOTYPE: Queensland, Great Barrier Reef, One Tree Reef, 23°30'S 152°05'E (AM W 20207). PARATYPES: Queensland, Great Barrier Reef, One Tree Reef, 23°30'S 152°05'E 4 (AM W 20208, in 70% alcohol), 2 (AM W 20209, on S.E.M. stub), 4 (BMNH ZB 1990. 4-7), 4 (HZM P-20208), 4 (USNM). All collected 2 Dec. 1988 by the author.

Description. Holotype a complete mature simultaneous hermaphrodite with 25 setigers and 1 preanal asetigerous segment and total length of 5.5 mm. Figure 1a shows a mature adult with 25 setigers.

Head and anterior 5 setigers white, remainder of body transparent before turning white after fixation. Prostomium with slight thickening around dorsal edge (Fig.1c). 2 clusters of eyespots in front of buccal opening. Nuchal grooves straight (Fig.1c).

Notosetae of 2 types: straight, stout, lancet-shaped setae

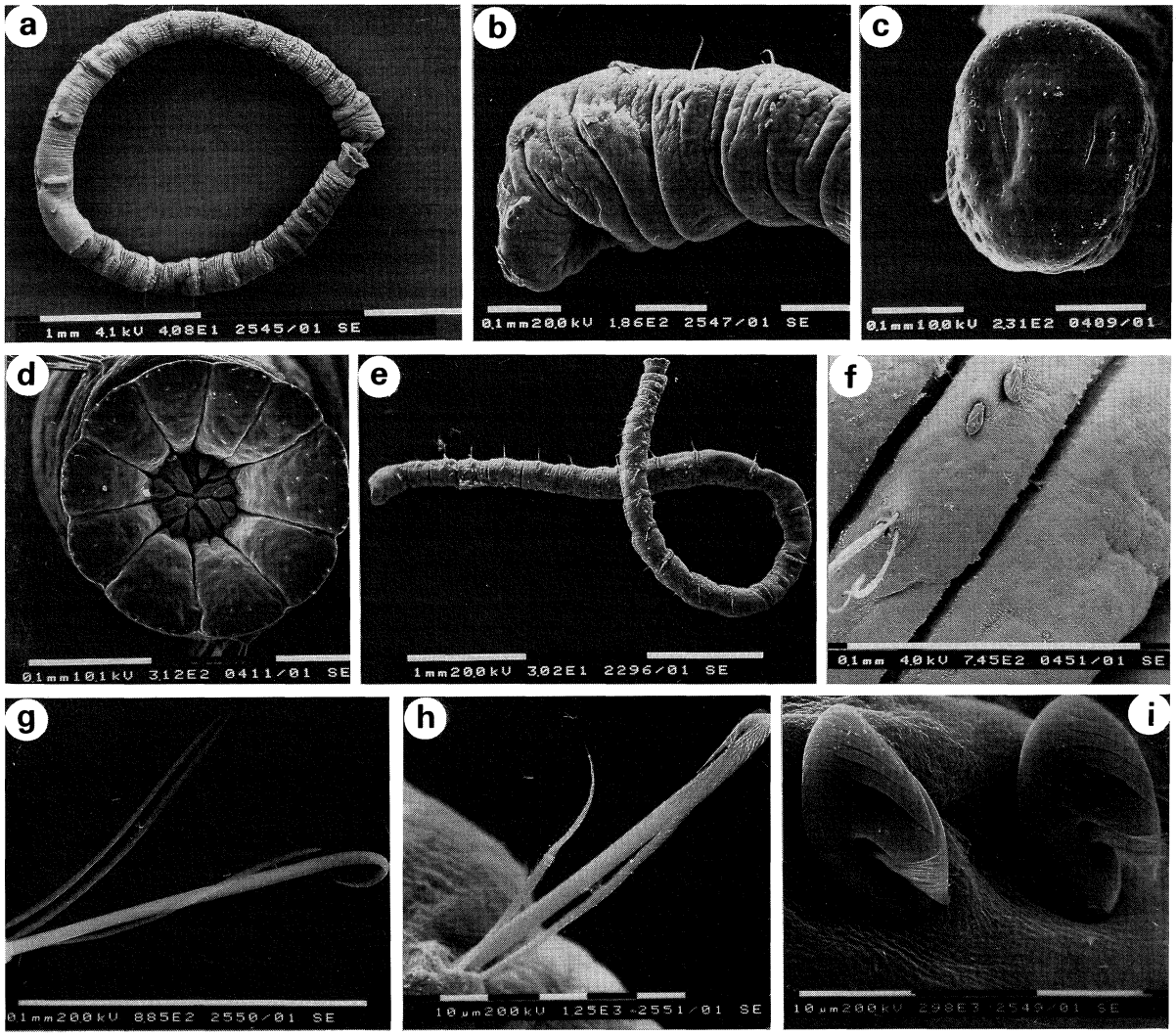

Fig.1. *Micromaldane androgyne* n.sp. (AM W 20209): a. S.E.M. side view of whole animal. b. S.E.M. side view of head and anterior setigers. c. S.E.M. frontal view of head showing small nuchal grooves. d. S.E.M. view of anal plaque showing crenations and anus. e. S.E.M. view of whole animal. Note bilateral symmetry of anal plaque with ventral region of the plaque projecting more than the dorsal region. f. S.E.M. of last setiger and preanal asetigerous segment. g. S.E.M. view of notosetae of 7th setiger. h. S.E.M. view of notosetae of 20th setiger. i. S.E.M. view of uncini showing main fang, subrostral barbules, four minor teeth over main fang and small lateral teeth. Scale indicated by white bar and bottom left measurement on each figure.

(Figs 1g,h, 5b) or delicate capillary setae with fine teeth along one margin (Figs 1g,h, 5a). All setigers have 1 or 2 lancet setae and 0–1 capillary setae. Uncini of neuropodia lie in single row on all setigers (Fig.1a). Setigers 1–6 have 2–4 uncini. Setigers 7–14 have 5–9 uncini and setigers 15–25 have 2–4 uncini. All uncini strongly curved with long shafts and prominent main fang surrounded by subrostral barbules. 4 smaller teeth and numerous lateral teeth lie over main fang (Fig.1i).

Setigers 8–11 longer than other setigers (Fig.1a,e). After setiger 11 setigers become progressively shorter until preanal asetigerous segment (Fig.1a,e,f). Anal plaque bears no cirri but is gently crenated (Fig.1d). Anal plaque bilaterally symmetrical and projects more on ventral side than on dorsal side (Fig.1e).

Tube housing holotype, composed of mucous and small particles of calcium carbonate sediment, also contained 2 directly developing larvae at same stage of development and whitish in colour. Body of holotype with a small number of white oocytes in coelomic cavity and several groups of spermatids connected by cytophore. Oogenesis solitary with oocytes floating free in the coelom during vitellogenesis.

Variation. The maximum number of setigers appears to be 25. All specimens found, including smaller juvenile specimens, have oocytes and several clumps of developing sperm. No specimens were found with sperm only and due to the paucity of sperm and the absence of spermathecae it is presumed that this species is self-fertilising. All large mature specimens were found to have larvae in their tubes. The number of setae per parapodia of the paratypes is similar to the holotype. Paratype size range from 4 to 5.5 mm in length.

The colour patterning of the anterior region of the body is variable. While most specimens have a white anterior end with the remainder of the body transparent (before preservation) some specimens had no pigmentation of the anterior end.

Comments. No other species of *Micromaldane* has been described with specimens having up to a maximum of 25 setigers (see Table 1). Also *M. ornithochaeta* Mesnil, 1897 and *M. jonesi* Kumaraswamy Achari, 1968 have spatulate lancet notosetae (Fig.5l), in contrast to the straight lancet notosetae of *M. androgyne* n.sp. *Micromaldane bispinosa* Hartmann-Schröder, 1960 has straight lancet notosetae and a preanal asetigerous segment however it differs from *M. androgyne* n.sp. in having fewer setigers and two types of uncini. *Micromaldane androgyne*n.sp. is clearly different from the three species described here in the number of setigers, shape of anal plaque and in that it is a simultaneous hermaphrodite.

Habitat. Found intertidally, gravid all year round, amongst mats of the red algae *Laurencia* sp. on the upper reef crest on the north-eastern side of One Tree Reef.

Distribution. Type locality only.

Etymology. Specific name from the latin *androgynus* meaning hermaphrodite.

Micromaldane nutricula n.sp.

Figs 2a–k, 5c–e

Material examined. HOLOTYPE: New South Wales, Port Jackson, Bottle and Glass Rocks, 33°58'S 151°00'E, intertidal, (AM W 20210). PARATYPES: New South Wales, Port Jackson, Bottle and Glass Rocks, 33°58'S 151°00'E, intertidal, 4 (AM W 20211, in 70% alcohol), 3 (AM W 20212, on the S.E.M. stub), 4 (BMNH ZB 1990. 8-11), 4 (HZM P-20209), 4 (USNM). All collected 10 Oct. 1988 by the author.

Description. Holotype is a complete mature female

Table 1. Characteristics of *Micromaldane*

Species of *Micromaldane*	Type locality	Setigers	Pre-anal aset. seg.	Notosetae (lancet type)	Length (mm)
M. androgyne n.sp. Rouse, 1990	Australia	25	present	straight	5.5
M. bispinosa Hartmann-Schröder, 1960	Red Sea	21	present	straight	8
M. nutricula n.sp. Rouse, 1990	Australia	19	absent	straight	3.5
M. jonesi Kumaraswamy Achari, 1968	Gulf of Mannar India	19	absent	spatulate	12
M. ornithochaeta Mesnil, 1897	France	17	present	spatulate	4
M. pamelae n.sp. Rouse, 1990	Australia	23	absent	straight	8
M. rubrospermatheca n.sp. Rouse, 1990	Australia	21	absent	straight	3

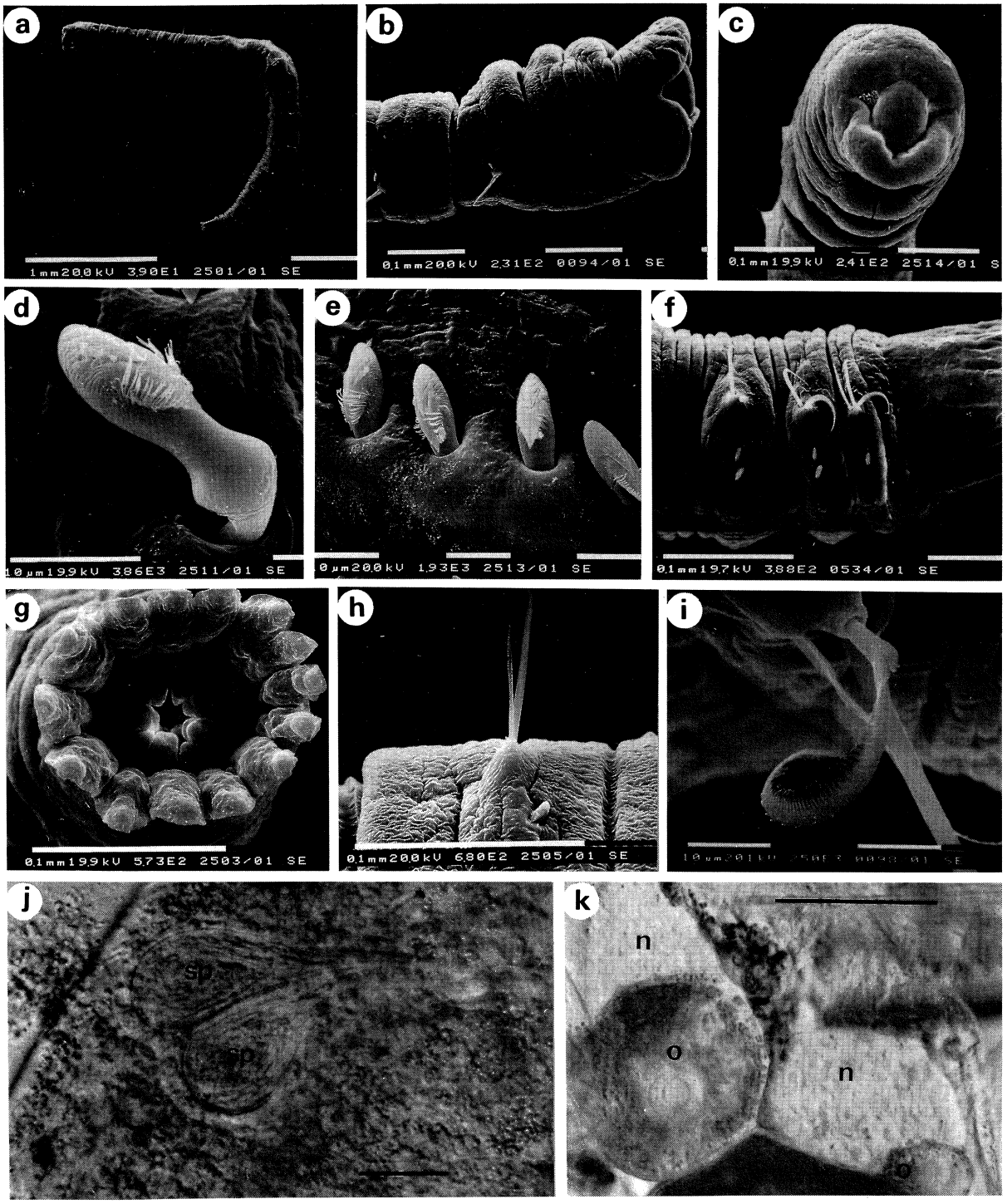

Fig.2. *Micromaldane nutricula* n.sp. (AM W 20212): a. S.E.M. side view of whole animal. b. S.E.M. side view of head and anterior setigers. c. S.E.M. frontal view of head showing small nuchal grooves. d. S.E.M. uncini of 7th setiger showing sharp avicular bend. e. S.E.M. uncini of 8th setiger showing four teeth above the main fang and subrostral barbules. f. S.E.M. of posterior end. Note lack of preanal asetigerous segment. g. S.E.M. view of anal plaque showing crenations. h. S.E.M. of 4th setiger. Note lancet type seta and fine capillary seta. i. S.E.M. of 9th setiger showing lancet seta, capillary seta and bifid type geniculate seta. Scale indicated by white bar and bottom left measurement on each figure. *Micromaldane nutricula* n.sp. Holotype (AM W 20210) j. Light micrograph of spermathecae between setigers 10 and 11. Note separate sacs (sp), containing sperm, and ducts leading to the exterior bound together by connective tissue. Scale indicated by black bar 50 µm. k. Light micrograph of vitellogenic oocytes in coelom. Note nurse cells (n) attached at one end of each oocyte (o). Scale indicated by black bar 50 µm.

with 19 setigers and total length of 3.5 mm. Figure 2a shows a mature female with 18 setigers.

Head and anterior 5 setigers red, remainder of body white. 2 clusters of eyespots in front of buccal opening. Nuchal grooves reduced to 2 small furrows (Fig.2c). Head simple, unmodified (Fig.2a,b,c).

Notosetae of 3 types: straight, stout, lancet-shaped setae (Figs 2b,h, 5c), fine bordered capillaries (Figs 2h,i, 5d), or delicate geniculate setae with fine teeth along one margin (Figs 2i, 5e). Only lancet setae and fine capillary setae in notopodia of setigers 1–7 (Fig.2h). After setiger 7 geniculate setae in addition to lancet setae and bordered capillaries. First serration of geniculate setae prominent, giving a bifid appearance (Fig.2i). Fine capillary notosetae absent from posterior setigers. All setigers have 1–3 lancet setae. Fine capillary notosetae present from setigers 1–10 and, after setiger 7, 1–3 geniculate setae. Uncini of neuropodia always lie in single row on all setigers. Setigers 1–7 have 1 or 2 uncini. Setigers 8–14 have 4–6 uncini.

Setigers 15–19 have 3–1 uncini. All uncini strongly curved with a long stem and a prominent main fang with subrostral barbules (Fig.2d). Above main fang are 4 smaller teeth and numerous fine lateral teeth (Fig.2e).

Setigers of midregion of body (8–11) much longer than anterior and posterior setigers (Fig.2a). Preanal asetigerous segment absent. Anal plaque bears no cirri but is sharply crenated 14 times (Fig.2g).

Holotype has 2 pairs of spermathecae attached to body wall with openings on ventral part of body. Spermathecae lie between junctions of setigers 10–11, 11–12. In life spermathecae could be seen through body wall with a compound light microscope (Fig.2j). Ducts leading from spermathecal openings lead into separate sacs bound by connective tissue. Both ducts and sacs contain sperm. No openings from spermathecae into coelomic cavity (Fig.2j). Further details on reproduction in this and other species of *Micromaldane* will be published separately (Rouse, in preparation).

Tube housing holotype, composed of mucous and small particles of siliceous sediment, also contained 5 directly developing larvae. Larvae white in colour. 2 larvae at early stage of development and without setigers; remaining 3 at late stage of development. Body of holotype with large number of white oocytes in coelomic cavity. During oogenesis oocytes float free in coelom. Oocytes have a group of nurse cells attached to one end until end of vitellogenesis (Fig.2k).

Variation. The maximum number of setigers appears to be 19. Males lack spermathecae and the body cavity is filled with spermatozoa especially in the posterior region. Most specimens have 16 to 18 setigers and, if female, have broods of larvae. This indicates that sexual maturity is reached before the full complement of setigers is acquired. Where broods were found there were almost always two sets of larvae at different stages of development. All specimens have reddish colouration on the head and the anterior setigers and the remaining part of the body white. Paratypes have similar setal counts to the holotype. Paratype size range from 2 mm to 3.5 mm in length.

Comments. *Micromaldane nutricula* n.sp. is similar to *M. jonesi* Kumaraswamy Achari, 1968 in having maximally 19 setigers, no preanal segment and having geniculate setae with a bifid appearance. However *M. nutricula* n.sp. differs from *M. jonesi* in that it has straight lancet-type notosetae instead of spatulate lancet notosetae and is only 3.5 mm long compared to 12 mm. Of the other species of *Micromaldane* only *M. rubrospermatheca* n.sp. has geniculate notosetae with a bifid appearance. *Micromaldane nutricula* n.sp. is clearly distinguishable from the other species described in this study in having oocytes with nurse cells attached, two pairs of spermathecae between setigers 10 and 11 and 11 and 12, and by the ability to have two broods of larvae in the tube at one time.

Habitat. Found, gravid all year round, amongst mats of the red algae *Corallina officianilis* in the littoral zone.

Distribution. Type locality only.

Etymology. Specific name from the latin *nutricula* meaning nurse because of the nurse cells attached to the oocytes.

Micromaldane pamelae n.sp.

Figs 3a–l, 5f–h

Material examined. HOLOTYPE: New South Wales, North Bondi rocks, 33°58'S 151°00'E, intertidal, (AM W 20213). PARATYPES: New South Wales, North Bondi rocks, 33°58'S 151°00'E, intertidal, 4 (AM W 20214, in 70% alcohol), 2 (AM W 20215, on S.E.M. stub), 4 (BMNH ZB 1990. 12-15), 4 (HZM P-20210), 4 (USNM). All collected 10 Oct. 1988 by the author.

Description. Holotype a complete mature female with 23 setigers and total length of 8 mm. Fig. 3a shows a mature female paratype of 22 setigers.

Head and anterior 5 setigers red, remainder of body white. Prostomium with slight thickening around dorsal edge (Fig.3b). Simple buccal opening ventrally (Fig.3b). 2 clusters of eyespots in front of buccal opening. Nuchal grooves straight (Fig.3c).

Notosetae of 3 types: straight, stout, lancet-shaped setae (Figs 3b,e,f, 5f), fine, bordered capillary setae (Figs 3e,f, 5h), or geniculate setae (Figs 3f, 5g). Setigers 1–10 have 2 or 3 lancet-shaped setae and 2 or 3 fine capillary setae. Setigers 11–23 have 1 or 2 lancet-shaped setae, 1 or 2 capillary setae and 2-6 geniculate setae. Uncini of neuropodia lie in single row on all setigers (Fig.3a,e). Setigers 1–7 have between 2 and 7 uncini. Setigers 8–13 have 10–15 uncini. Setigers 14–19 have 9–6 uncini and setigers 20–23 have from 4 uncini to 1 uncinus. Uncini strongly curved with long shafts and a prominent main fang surrounded by subrostral barbules. 4 smaller teeth and numerous lateral teeth lie over main fang (Fig.3g).

Preanal asetigerous segment absent. Anal plaque bears

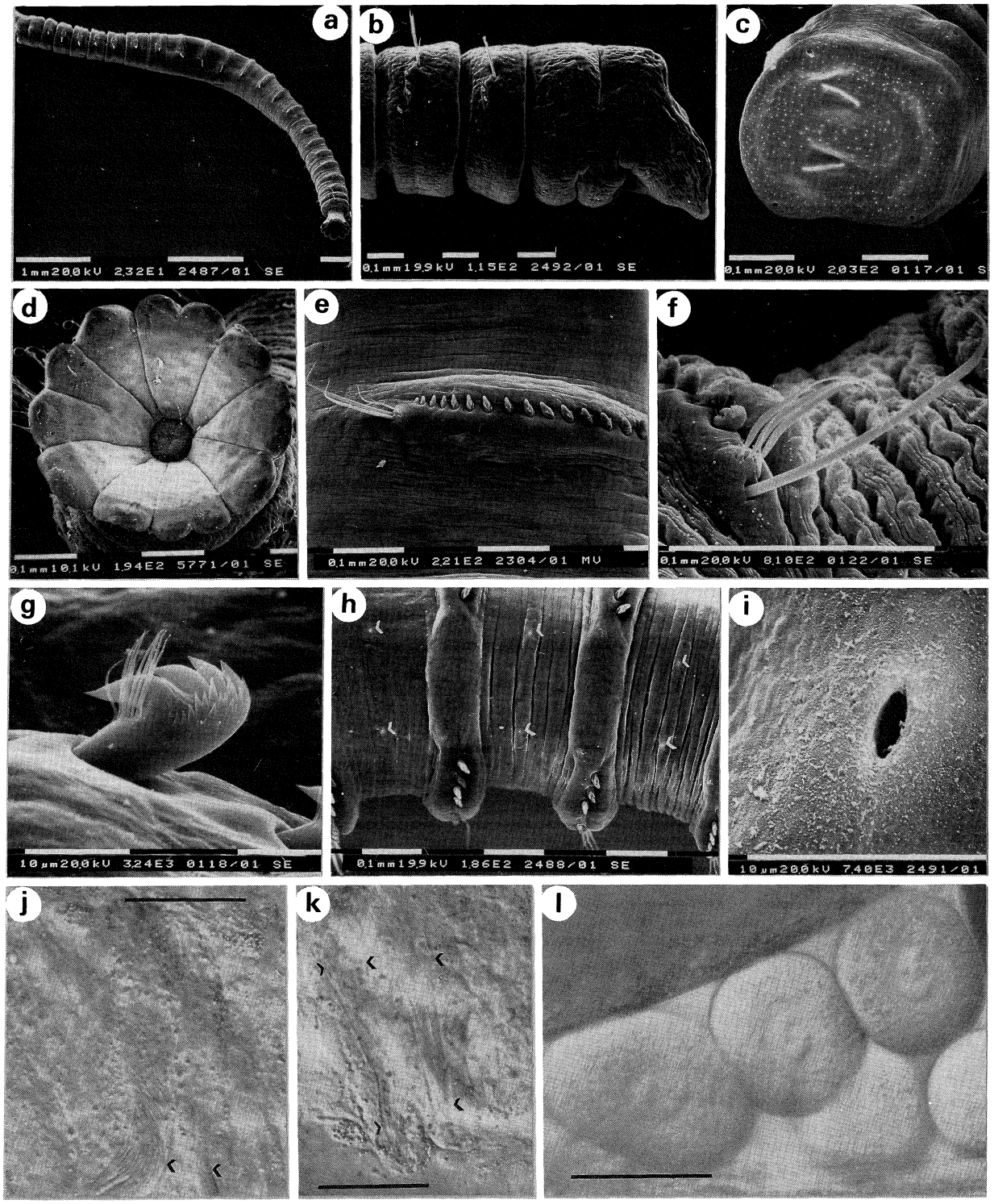

Fig.3. *Micromaldane pamelae* n.sp. (AM W 20215): a. S.E.M. oblique dorsal view of whole animal. b. S.E.M. side view of head and anterior setigers. c. S.E.M. frontal view of prostomium. d. S.E.M. view of anal plaque and anus. e. S.E.M. 10th parapodium showing lancet and fine capillary notosetae and single row of neuro-uncini. f. S.E.M. showing 13th setiger showing three types of notosetae. g. S.E.M. side view of uncinus showing main fang, subrostral barbules, four minor teeth over main fang and small lateral teeth. h. S.E.M. ventral of female showing spermathecal entrances (arrows). i. S.E.M. view of a spermathecal opening. Scale indicated by white bar and bottom left measurement on each figure. *Micromaldane pamelae* n.sp. Holotype (AM W 20213) j. Light micrograph of spermathecae showing contained sperm (arrows) between setigers 10–11. Scale indicated by black bar 50 µm. k. Light micrograph of ducts and spermathecal sacs (arrows) between setigers 10–11. Scale indicated by black bar 40 µm. l. Light micrograph of early vitellogenic oocytes. Note absence of nurse cells. Scale indicated by black bar 40 µm.

no cirri but has 12 rounded crenations. Anus lies in middle of anal plaque (Fig.3c). Body divided into 3 distinct regions based on relative size of setigers and development of parapodia. Anterior 6 setigers small and distinct with parapodia relatively undeveloped (Fig.3a,b). Parapodia in middle of segment in anterior setigers (Fig.3a). Setigers 7–12 large and junction between setigers indistinct. Parapodia of these segments show increasing differentiation from rest of segment (Fig.3a,e,i). After setiger 12 segments progressively smaller and all parapodia well developed (Fig.3a).

Holotype has 3 pairs of spermathecae attached to body wall with openings on ventral part of body. Spermathecae lie between junctions of setigers 10–11, 11–12 and 12–13 (Fig.3h). Openings to spermathecae small (less than 5 μm across) and are best seen via the S.E.M. (Fig.3i). In life spermathecae could be seen through body wall with a compound light microscope. Ducts from elliptical spermathecal openings lead into separate sacs bound by connective tissue. Both ducts and sacs contain sperm. No openings from spermathecae into coelomic cavity.

Tube housing holotype, composed of mucous and small particles of siliceous sediment, contained 31 directly developing larvae all at same stage of development and whitish in colour. Body of holotype also contains large number of white oocytes. Oogenesis solitary with oocytes floating free in coelom during vitellogenesis (Fig.3l).

Variation. The maximum number of setigers appears to be 23. Males lack spermathecae and the body cavity is filled with spermatozoa. Most specimens had 20 to 22 setigers and, if female, had broods of larvae. This indicates that sexual maturity is reached before the full complement of setigers is acquired. The size of the broods varied from 10 to 31. Setal counts of the paratypes are similar to the holotype. Paratype size range from 6 mm to 8 mm in length. The colour pattern of the anterior region of the body is quite variable. While most specimens have a red anterior, as with the holotype, others may have longitudinal crimson stripes or transverse brown stripes on a cream background or have no colouration at all. This variation does not appear to be sex-linked.

Comments. This species can be clearly separated from other species of *Micromaldane* previously described in having a maximum of 23 setigers (see Table 1). Also *M. ornithochaeta* Mesnil, 1897 and *M. jonesi* Kumaraswamy Achari, 1968 have spatulate lancet notosetae (Fig.5l), in contrast to the straight lancet notosetae of *M. pamelae* n.sp. *Micromaldane bispinosa* Hartmann-Schröder, 1960 has straight lancet notosetae, however it differs from *M. pamelae* n.sp. in having fewer setigers and a preanal asetigerous segment. *Micromaldane bispinosa* is also unique in having two types of uncini. *Micromaldane pamelae* n.sp. is clearly different from the three other species described here in overall size, the number of setigers and the shape of the anal plaque although *M. rubrospermatheca* n.sp. is similar in bearing spermathecae between setigers 10 and 11, 11 and 12 and 12 and 13, and in having solitary oogenesis.

Habitat. Found, gravid all year round, amongst mats of the red algae *Corallina officianilis* in the littoral zone.

Distribution. Type locality only.

Etymology. Specific name after Ms Pamela Scott, co-discoverer of this species.

Micromaldane rubrospermatheca n.sp.

Figs4a–l,5i–k

Material examined. HOLOTYPE: Queensland, Great Barrier Reef, One Tree Island Reef, 23°30'S 152°05'E (AM W 20216). PARATYPES: Queensland, Great Barrier Reef, One Tree Island Reef, 23°30'S 152°05'E. 8 (AM W 20217, in 70% alcohol), 2 complete and 1 posterior fragment (AM W 20218, on the S.E.M. stub). All collected 2 Dec. 1988 by the author.

Description. Holotype a complete mature female with 21 setigers and total length of 3 mm. Fig. 4a shows mature female with 20 setigers.

In life holotype transparent with internal organs clearly visible. After preservation body became uniform white colour. 2 clusters of eyespots in front of buccal opening. Nuchal grooves reduced and head unmodified (Fig.4a,b,c).

Notosetae of 3 types: straight, stout, lancet-shaped setae (Figs 4e,f, 5i), fine bordered capillary setae (Figs 4e, 5k), or delicate geniculate setae with fine teeth along one margin (Figs 4f, 5j). All setigers have 1 lancet-shaped setae. 1 or 2 fine capillary setae on setigers 1–10. Setigers 11–13 have 1 or 2 capillary setae and 1 or 2 geniculate setae. 1 or 2 geniculate setae found along with lancet setae on remaining setigers. First serration of geniculate setae prominent, giving bifid appearance (Fig.4f). Fine capillary notosetae absent from posterior setigers. Uncini of neuropodia lie in single row on all setigers (Fig.4g,h,j). Setigers 1 to 9 have between 1 and 3 uncini. Setigers 10–12 have 4 or 5 uncini. Setigers 13–21 have 3–1 uncini. All uncini avicular with a long stem and prominent main fang bordered with subrostral barbules (Fig.4g,h,i). 4 smaller teeth and numerous fine lateral teeth above main fang (Fig.4g,h,i).

Preanal asetigerous segment absent (Fig.4d). Anal plaque bears no cirri but is slightly crenated (Fig.4d). Anterior setigers bear parapodia in middle of segment (Fig.4c), however segment boundaries difficult to determine in middle and posterior setigers. Setigers of middle region of body (10–13) much longer than the rest (Fig.4a).

Holotype has 3 pairs of spermathecae attached to body wall with openings on ventral part of body. Spermathecae lie between junctions of setigers 10–11, 11–12 and 12–13

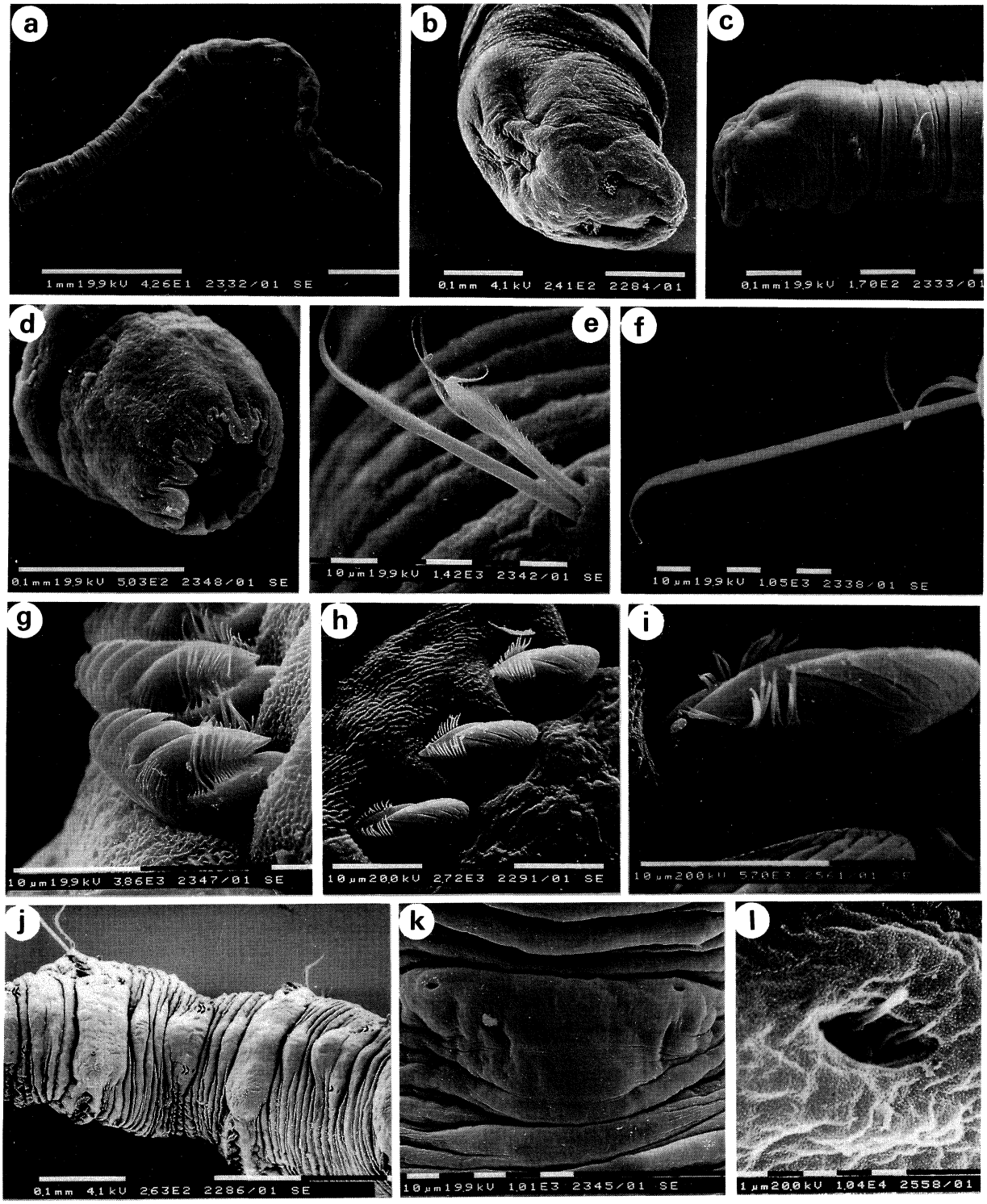

Fig.4. *Micromaldane rubrospermatheca* n.sp. (AM W 20218): a. S.E.M. side view of whole animal. b. S.E.M. frontal view of head showing small nuchal grooves. c. S.E.M. side view of head and anterior setigers. d. S.E.M. view of anal plaque showing slight crenations. e. S.E.M. view of notopodium of 6th setiger showing lancet setae and bordered capillary setae. f. S.E.M. view of notopodium of 14th setiger showing lancet setae and bifid type geniculate setae. g. S.E.M. showing side view of uncini with main fang, subrostral barbules, four minor teeth over main fang and small lateral teeth. h. S.E.M. showing single row of uncini of 7th setiger. i. S.E.M. of single uncinus showing main fang, subrostral barbules, four minor teeth over main fang and small lateral teeth. j. S.E.M. ventral of female showing spermathecal entrances of setigers 10–11, 11–12, 12–13 (arrows). k. S.E.M. view of a spermathecal openings of setiger 11–12. l. S.E.M. view of spermathecal opening of setigers 10–11. Note possible spermatozoa in the opening. Scale indicated by white bar and bottom left measurement on each figure.

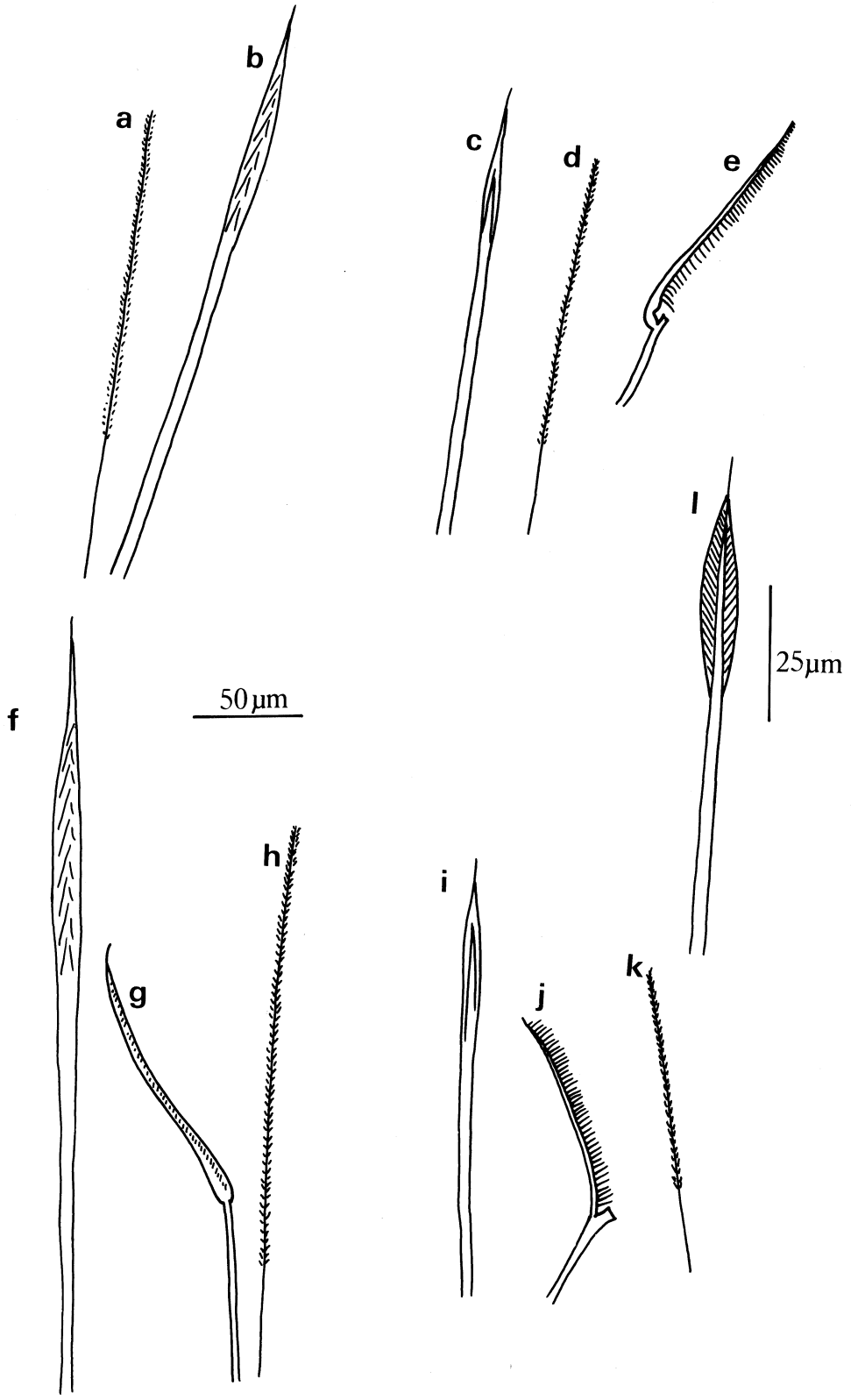

Fig.5. *Micromaldane androgyne* n.sp. paratype (AM W 20208): a. Fine capillary notoseta. b. Lancet type notoseta. *Micromaldane nutricula* n.sp. paratype (AM W 20211): c. Lancet type notoseta. d. Fine capillary notoseta. e. Geniculate notoseta. *Micromaldane pamelae* n.sp. paratype (AM W 20214): f. Lancet type notoseta. g. Geniculate notoseta. h. Fine capillary notoseta. *Micromaldane rubrospermatheca* n.sp. paratype (AM W 20217) i. Lancet type notoseta. j. Geniculate notoseta. k. Fine capillary notoseta. Scale bar for 5 a-k 50 µm. *Micromaldane ornithochaeta* Mesnil: l. Spatulate notoseta redrawn from Mesnil (1897). Scale bar 25 µm.

(Fig.4j). Elliptical openings to spermathecae small (5 μm across) and best seen via the S.E.M (Fig.4j,k,l). In life spermathecae could be seen through body wall with compound lightmicroscope. Ducts leading from spermathecal openings lead into separate sacs bound by connective tissue. Both ducts and sacs contain sperm. No openings from spermathecae into coelomic cavity. Connective tissue surrounding spermathecae was bright red in life and still visible in preserved specimen.

Tube housing holotype, composed of mucous and small particles of calcium carbonate sediment, also contained 8 directly developing larvae all at same stage of development and whitish in colour. Body of holotype also has similar number of white oocytes in coelomic cavity. Oogenesis solitary with oocytes floating free in coelom during vitellogenesis.

Variation. The maximum number of setigers appears to be 21. Males lack spermathecae and the body cavity is filled with spermatozoa. Most specimens have 19 to 20 setigers and, if female, have broods of larvae. This indicates that sexual maturity is reached before the full complement of setigers is acquired. The colour pattern of the anterior region of the body is variable with some specimens having small red spots in the middle of the prostomium whereas most, like the holotype, were transparent. Setal counts for paratypes are similar to that of the holotype. Paratypes range from 2.5 to 3mm in length.

Comments. Of the previously described species of *Micromaldane* only *M. bispinosa* Hartmann-Schröder, 1960 has 21 setigers. *Micromaldane rubrospermatheca* can be clearly distinguished from *M. bispinosa* in being much smaller (see Table 1) and lacking a preanal asetigerous segment. *Micromaldane bispinosa* also has two types of uncini, a feature not found in any other species of *Micromaldane* described to date. Of the other species described in this study *M. rubrospermatheca* n.sp. most closely resembles *M. pamelae* n.sp. in having spermathecae between setigers 10 and 11, 11 and 12 and 12 and 13, and in having solitary oogenesis. However *M. rubrospermatheca* n.sp. is much smaller than *M. pamelae* n.sp. and has fewer setigers, fewer larvae per brood, and distinctive red colouration of the connective tissue around the spermathecae.

Habitat. Found intertidally, gravid all year round, among mats of the red algae *Laurencia* sp. on the upper reef crest on the north-eastern side of One Tree Reef.

Distribution. Type locality only.

Etymology. Derived from the latin *rubor* meaning red, and *spermathecae* meaning sperm case.

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