

New Species of *Nippotaenia* and *Amurotaenia*
(Cestoda : Nippotaeniidae)
from New Zealand Freshwater Fishes

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Abstract

The genera *Nippotaenia* Yamaguti, 1939 and *Amurotaenia* Achmerov, 1941 are redefined; *Amurotaenia* spp. differ from *Nippotaenia* as they are hyperapolytic, anterior segments are all considerably broader than long, and testes are retained in gravid and ripe proglottides. The genus *Amurotaenia* Achmerov, 1941 is reinstated with *A. percotti* Archmerov as its type species. *Amurotaenia mogurndae* (Yamaguti and Miyata, 1940) n.comb. is transferred from *Nippotaenia*.

Three new species, *N. contorta*, *N. fragilis*, and *A. decidua*, are described. *Nippotaenia contorta* n.sp. from *Retropinna retropinna* (Richardson, 1848) and *Galaxias maculatus* (Jenyns, 1842) is anapolytic and may be distinguished from *N. chaenogobii* Yamaguti, 1939 by its larger size, greater number of proglottides and dimensions of the scolex, genitalia and eggs. *N. fragilis* n.sp. from *R. retropinna* is hypoanapolytic and similar to *N. chaenogobii* but differs in dimensions of the genitalia and eggs. *A. decidua* n.sp. differs from *A. mogurndae* in the dimensions of the sucker, testes, cirrus pouch and eggs, and size of the shed proglottides; and from *A. percotti* by the size of the sucker, detached proglottides, and eggs.

INTRODUCTION

Yamaguti (1939) erected a new cestode order, Nippotaeniidea, containing one family, Nippotaeniidae, and one genus, *Nippotaenia* (type species: *Nippotaenia chaenogobii* Yamaguti, 1939 from *Chaenogobius annularis urotaenia* (Hilgendorf), *Gobius similis* Gill, and *Mogurnda obscura* (Temm. et Schleg.) in Lake Suwa, Japan). The new order was placed between the Pseudophyllidea and Cyclophyllidea because the excretory system resembled that of Pseudophyllidea, while the general internal anatomy, especially the vitellaria, resembled the cyclophyllidean pattern. Later, Yamaguti (1951) showed experimentally that the copepod *Diaptomus* could serve as an intermediate host for *N. chaenogobii*, and that, although the embryophore was of the cyclophyllidean type, the post-embryonic development involved a pseudophyllidean procercoid.

Yamaguti and Miyata (1940) described a second species, *N. mogurndae*, from *Mogurnda obscura* caught near Nisinomiya, Japan. Achmerov (1941) described a nippotaeniid, *Amurotaenia percotti*, from *Percottus glehni* in the Amur river but later (1960) considered the species fitted *Nippotaenia* and transferred *A. percotti* to that genus. More recently, Dubinina (1964) considered *N. percotti* synonymous with *N. mogurndae*.

The species described here are the first adult cestodes described from New Zealand freshwater fish. The original identification of *Nippotaenia* from New

Zealand was made by Prof. J. G. Baer from specimens taken from *Galaxias maculatus* (Jenyns, 1842) in the Waikanae River and Waimeha Stream at Waikanae. The species here described as *N. contorta*, was first noted by McDowall (1968) under the general heading 'Cestoda.'

MATERIALS AND METHODS

Retropinna retropinna (Richardson, 1848) and *G. maculatus* were collected live from the Waimeha Stream at Waikanae between October 1971 and April 1972, and *R. retropinna* and *Gobiomorphus cotidianus* McDowall, 1974, were taken from Lake Taupo between March 1973 and March 1974. The fish were killed with 1:8,000 MS 222, dissected, and helminths were either teased into Young's Freshwater Teleost Saline (5.5 g NaCl, 0.14 g KCl, 0.12 g CaCl₂/l) for observation on live animals, or relaxed in tap water for one hour and fixed in formol acetic alcohol (FAA) under slight cover-glass pressure. Fixed specimens were stained with methylene blue and counterstained in eosin using the technique of Schnur (1969). Several specimens were relaxed, fixed in FAA, embedded and sectioned at 7µm, and stained in Mallory-Heidenhain or Delafields Haematoxylin and counterstained with eosin. Measurements were taken on fixed and stained whole mounts.

For detailed observation of surface spination live specimens were fixed in phosphate buffered 5% glycerinaldehyde, dehydrated in ethyl alcohol, and transferred to trichlorotrifluoroethane (Arcton 12). This was slowly vaporised from the specimens; and they were then vacuum-coated with palladium and gold and observed under a Cambridge S600 Stereoscan electron microscope.

NIPPOTAENIIDAE

Genus *Nippotaenia* Yamaguti, 1939

With all the features of the family. Apical sucker provided at its opening with strong sphincter-like circular muscles. Neck may show genital primordia. Strobila round or oval in cross section; proglottides increasing in length posteriorly, first segment broader than long, second segment variable, third segment always longer than broad. Segments with parallel or convex sides, elliptical to oval when gravid; gravid segments retained on strobila but easily detached. Inner longitudinal muscles not bundled, but forming definite sheath, attached to sphincter-like anterior end of apical sucker. Longitudinal excretory vessels numerous in cortex but few in medulla. Nerve trunk ventral to cirrus pouch and vagina. Testes confined to previtellarian medulla, absent from gravid proglottides. Cirrus pouch thin-walled, situated for most part in medullary parenchyma, contains simple cirrus and convoluted ductus ejaculatorius, whose proximal part may serve as an internal seminal vesicle. Genital atrium opens on or near right or left margin within anterior third of proglottid. Ovary consists of two symmetrical lateral lobes and median isthmus, situated in middle third of proglottid. Vitellaria consists of two symmetrical lateral lobes, each of which lies immediately in front of corresponding part of ovary. Vagina opens into genital atrium immediately behind cirrus, may be more or less distended with spermatozoa before joining oviduct. Uterus extends in close transverse coils in central and dorsal medulla from posterior end of proglottid into testicular zone in mature proglottides but occupying entire or almost entire medulla when fully developed. Eggs three-shelled; outer shell delicate, large; middle shell rather rigid, small; inner shell thin, membranous. Parasitic in intestine of freshwater teleosts. (Amended from Yamaguti (1939).)

Type species: *N. chaenogobii* Yamaguti, 1939 in *Chaenogobius annularis urotaenia*, *Gobius similis* and *Mogurnda obscura*; Lake Suwa, Japan.

Remarks

The principal amendments to the original generic diagnosis are that gravid proglottides, although easily detached, are retained on the strobila, the relative

lengths and breadths of the first three proglottides are specified, and the testes are absent from gravid proglottides. Several anterior proglottides of *N. mogurndae* are broader than long, proglottides are shed while immature, testes persist anteriorly in gravid proglottides and it is therefore transferred to the genus *Amuotaenia* Achmerov, 1941 to form *A. mogurndae* (Yamaguti and Miyata, 1940) n.comb.

Order: NIPPOTAENIDEA

Family: Nippotaeniidae

***Nippotaenia contorta* n.sp. Figs. 1-6.**

Type host: *Retropinna retropinna* (Richardson, 1848).

Other host: *Galaxias maculatus* (Jenyns, 1842).

Site: Anterior and occasionally mid intestine.

Type locality: Waimeha Stream, Waikanae, North Island, New Zealand. Map Ref. N.Z.M.S. 1, N157 and PT N156,731570.

Holotype: National Museum, Wellington. Helminth Collection No. ZW1032, paratypes and supplementary material. ZW1033-1040. Description based on 52 specimens.

Description

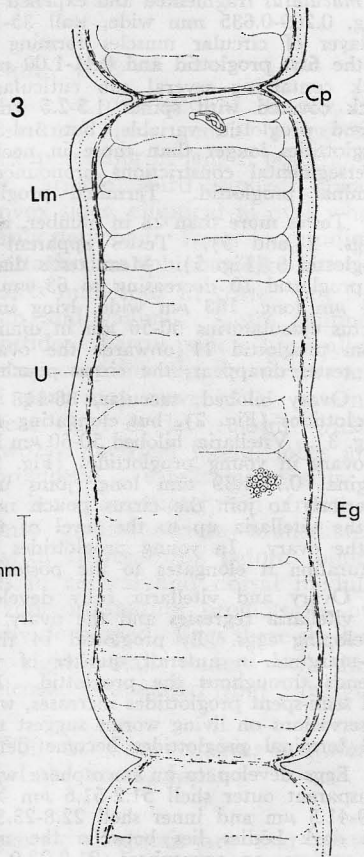
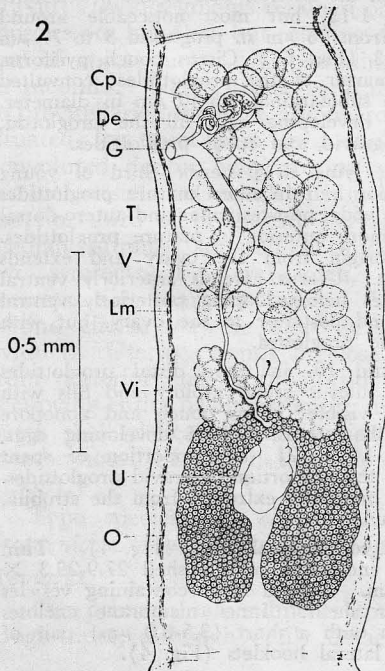
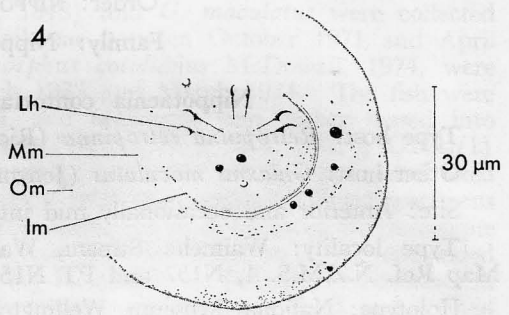
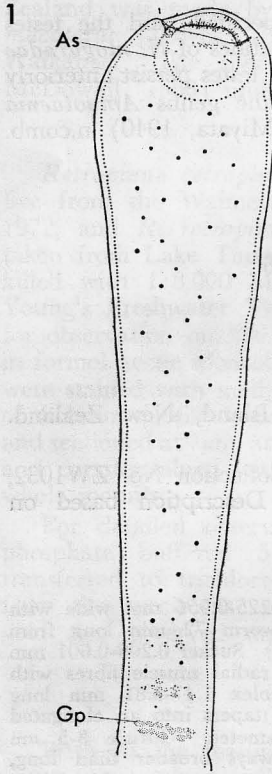
Worms cylindrical or oval, anapolytic, 2.96-34.6 mm long, 0.225-0.956 mm wide with 0-30 proglottides, scolex with a single apical sucker. (A live worm 72 mm long from *G. maculatus* fragmented and expelled eggs on attempts at fixation.) Sucker 0.209-0.601 mm long, 0.269-0.635 mm wide, wall 35-135 μm thick composed of radial muscle fibres with a layer of circular muscles forming a sphincter (Fig. 1). Scolex 1.47-3.81 mm long to the first proglottid and 0.41-1.00 mm wide just behind sucker, tapers into an elongated neck containing several sub cuticular nuclei 2.5-6.4 μm in diameter. Cuticle 3-5 μm thick covered with spines 1.5-2.5 μm long. First proglottid always broader than long, second proglottid variable, but 3rd-5th proglottides always longer than broad. Distal proglottides longer than those in neck region but proglottid width increases only slightly. Intersegmental constrictions pronounced distally where they facilitate detachment of the terminal proglottid. Terminal proglottid 3.20-5.02 mm long by 0.45-0.96 mm wide.

Testes more than 28 in number, almost spherical, in the anterior half of the proglottides (Figs. 2 and 3). Testes apparent in proglottides 1-13, but most noticeable around proglottid 6 (Fig. 5). Mean testis diameter increases from 36 μm in proglottid 3 to 77 μm in proglottid 10 decreasing to 63 μm in proglottid 13 (Fig. 6). Cirrus pouch pyriform, 244 μm long, 183 μm wide, lying in the anterior quarter of the proglottides; convoluted ductus ejaculatorius 50-56 μm in diameter. Gonopore submarginal, 35-40 μm in diameter. From proglottid 11 onwards the ovary disintegrates, developing eggs fill the proglottid, the testes disappear, the cirrus pouch is retained in gravid and spent proglottides.

Ovary bilobed, saccular, 86-118 \times 106-420 μm , lying in posterior third of young proglottides (Fig. 2), but elongating to occupy posterior half in more mature proglottides (Fig. 3). Vitellaria, bilobed 50-60 μm long, 171-174 μm wide, post-testicular and antero-dorsal to ovary in young proglottides (Fig. 2) but slightly more anterior in mature proglottides. Vagina, 0.71-1.39 mm long, joins uterus near its origin from the ovary and extends anteriorly to join the cirrus pouch near the gonopore. Uterus extends anteriorly ventral to the vitellaria up to the level of the posterior testes before looping posteriorly ventral to the ovary. In young proglottides it does not extend posterior to the ovary, but with maturation it elongates to the posterior margin of the proglottid.

Ovary and vitellaria fully developed by proglottid 10, in more distal proglottides the vitellaria regresses and the ovary fragments. The uterus grows rapidly and fills with developing eggs. By proglottid 14 the testes are not visible; cirrus pouch and gonopore sub-marginal in anterior quarter of proglottid, and the uterus, full of developing eggs, extends throughout the proglottid. From proglottid 14 to 21 the proportion of spent and semi-spent proglottides increases, with a decrease in the proportion of gravid proglottides. Observations on living worms suggest that eggs are not normally extruded from the strobila, and terminal proglottides become detached while gravid.

Eggs develop to an oncosphere within three ovoid to spherical shells (Fig. 4). Thin transparent outer shell 51.2-51.6 μm \times 67.5-69.5 μm encloses a middle shell 27.9-29.3 \times 32.9-41.3 μm and inner shell 22.8-23.3 \times 27.3-34.1 μm . A fluid layer containing vesicles and dark bodies lies between the middle and inner shells. Inner membrane encloses the embryo, an oncosphere, 21.9-22.9 \times 26.5-29.7 μm with a short (3.5-6.0 μm) pair of inner hooklets and two larger (6.4-11.0 μm) pairs of lateral hooklets (Fig. 4).



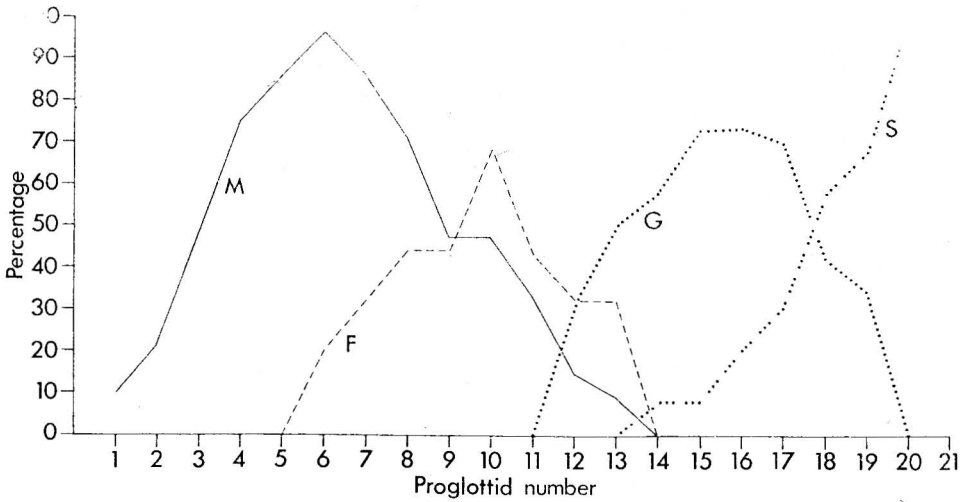


FIG. 5. — The relationship between proglottid number and the sequence of reproductive structures and stages in *N. contorta*. M = Male genitalia, F = Female genitalia, G = Gravid proglottides, S = Spent and semi-spent proglottides.

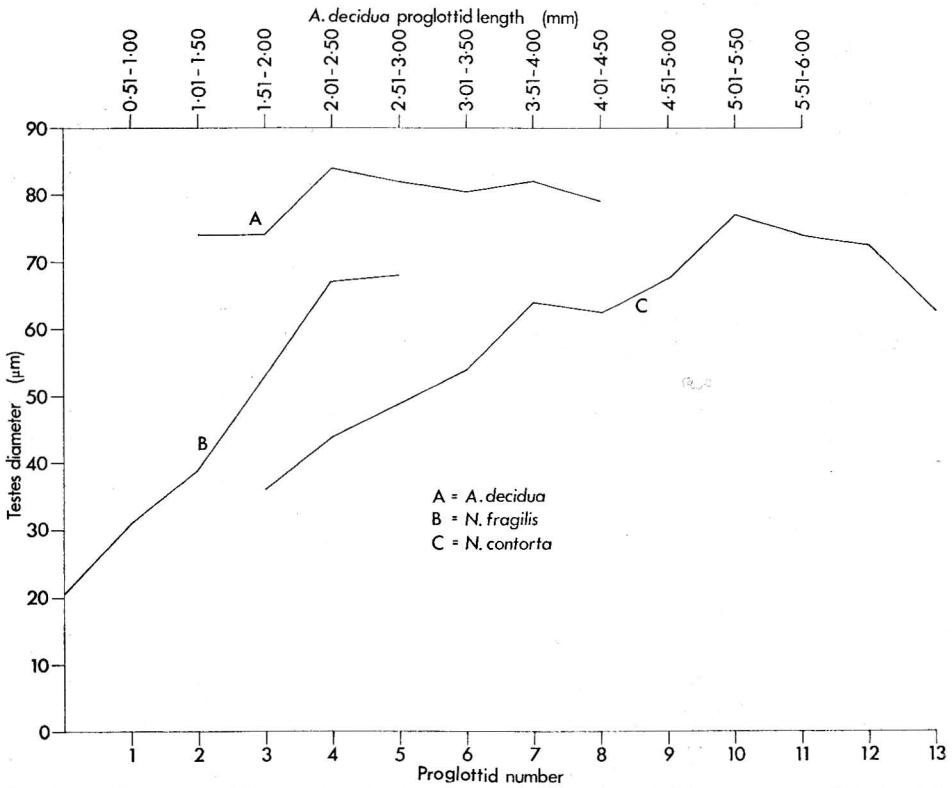


FIG. 6. — Mean testes diameter in relation to proglottid number in *N. contorta* and *N. fragilis*, and in relation to proglottid length in *A. decidua*.

FIGS. 1-4. — *Nippotaenia contorta* n.sp. Fig. 1 Scolex and neck. Fig. 2 Young proglottid. Fig. 3 Mature proglottid. Fig. 4 Egg. (As = Apical sucker, Cp = Cirrus pouch, De = Ductus ejaculatorius, Eg = Egg, G = Gonopore, Gp = Genital primordia, Im = Inner membrane, Lh = Larval hooklets, Lm = Longitudinal muscle, Mm = Middle membrane, O = Ovary, Om = Outer membrane, T = Testes, U = Uterus, V = Vagina, Vi = Vitellaria).

TABLE 1 — Comparative dimensions of nipotaeniid species

(a)	<i>N. chaenogobii</i> Yamaguti, 1939	<i>N. contorta</i> n.sp.	<i>N. fragilis</i> n.sp.
Sucker dimensions (μm)	190-330 \times 240-350	209-601 \times 269-635	135-300 \times 155-346
Thickness sucker wall (μm)	27-80	35-135	37-152
Cuticle thickness (μm)	3	3-5	6.4-7.6
Subcuticular nuclei (μm)	5-7	2.5-6.4	16-20
Terminal proglottid (mm)	2.0-3.0 \times 0.7-1.0	3.20-5.02 \times 0.45-0.96	0.5-3.7 \times 0.3-0.9
Testes (μm)	90-130 \times 70-105	36-77 mean diameter	67-76 \times 68-70
Ovary (μm)	170-330 \times 400-570	86-118 \times 106-420	141-334 \times 67-283
Vitellaria (μm)	80-150 \times 320-480	50-171 \times 60-174	53-125 \times 50-198
Outer egg membrane (μm)	80-200 \times 80-190	51.2-51.6 \times 67.5-69.5	51.62 \times 42-50
Embryo (μm)	33-36 \times 27-33	21.9-22.9 \times 26.5-29.7	29-31 \times 21-23
No. proglottides	7-10	0-30	10
Overall worm length (mm)	13.0	72.0	12.5

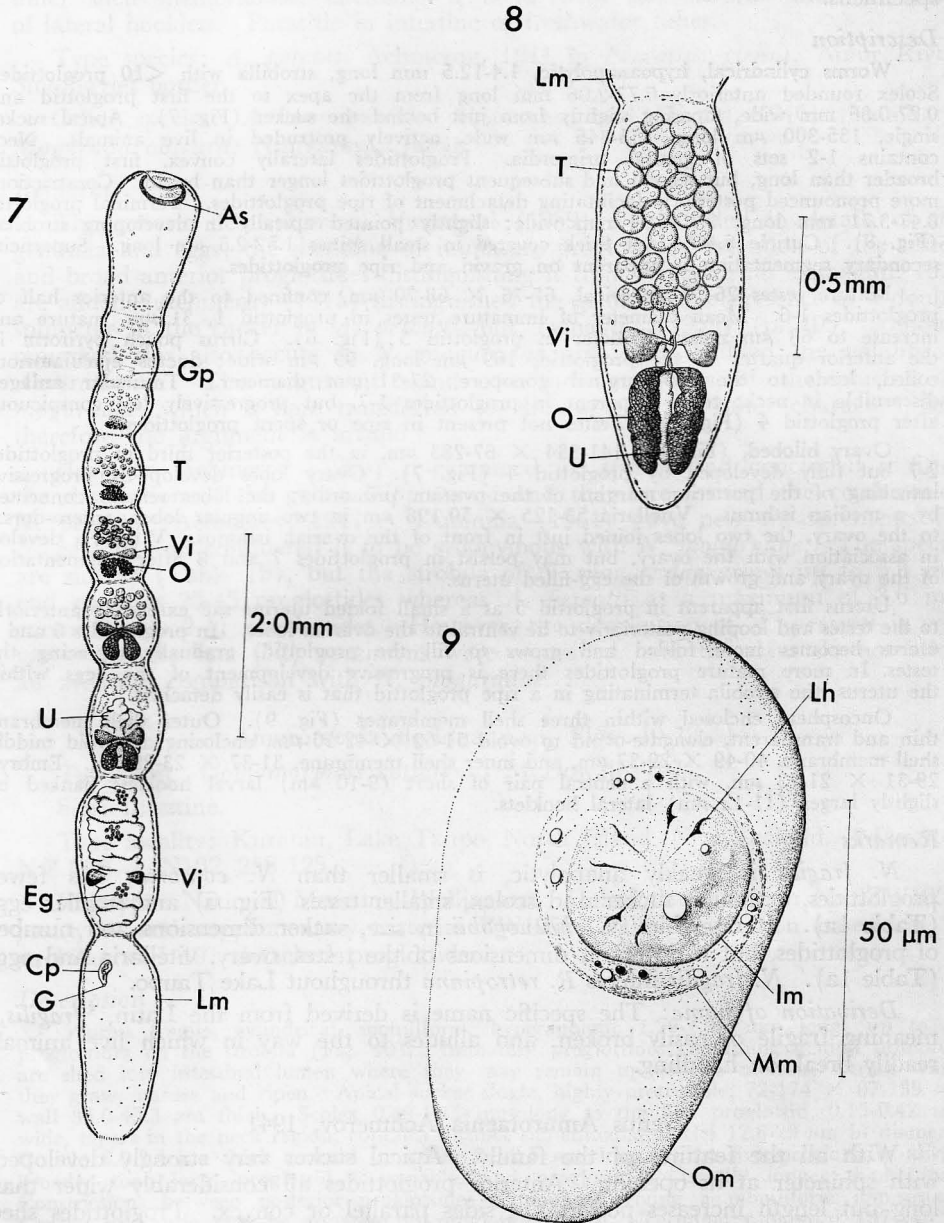
(b)	<i>A. percotti</i> Achmerov, 1941	<i>A. percotti</i> Achmerov, 1941 (after Dubinina, 1964)	<i>A. mogurndae</i> (Yamaguti and Miyata, 1940)	<i>A. decidualis</i> n.sp.
Sucker dimensions (μm)	150-320 \times 115-285	—	180-260 \times 210-300	72-174 \times 87-139
Thickness sucker wall (μm)	—	—	35-80	35.0-43.5
Cuticle thickness (μm)	—	—	3-5	6.0-7.4
Subcuticular nuclei (μm)	—	—	—	12.6-23.0
Terminal proglottid (μm)	300 \times 600	—	280-400 \times 200-350	197-246 \times 283-629
Detached proglottides (mm)	1.23-3.45 \times 0.37-0.75	0.8-2.0 \times 0.3-0.5*	1.6-4.4 \times 0.50-0.85	0.54-8.81 long
Testes (μm)	—	—	75-145	74-84
Ovary (μm)	150-300 long	—	130-200 \times 340-460	189-299 \times 56-94
Vitellaria (μm)	120 \times 120	—	70-120 \times 75-125	44-138 \times 52-137
Outer egg membrane (μm)	—	80-200 \times 70-180	70-160 \times 65-150	66-90 \times 65-66
Embryo (μm)	—	24-32	24-35	32-39 \times 35-37
No. proglottides	2-11	7-19	25-45	<13
Overall worm length (mm)	<3.6	<4.1	<5.3	<4.4

* Freshly detached

Remarks

N. contorta and *N. chaenogobii* are both anapolytic forms, but *N. contorta* is distinguished from *N. chaenogobii* by its larger size, the greater number of proglottides, dimensions of the scolex and genitalia, and the smaller size of the eggs (Table 1a).

Derivation of name: The specific name is derived from the Latin, 'contorqueo,' 'twist', from the spiral twisting of fresh unrelaxed specimens.



FIGS. 7-9. — *Nippotaenia fragilis* n.sp. Fig. 7 A fully mature specimen showing the sequence of reproductive structures and stages down the strobila. Fig. 8 Terminal mature proglottid on a developing strobila. Fig. 9 Egg. Lettering as in Figs. 1-4.

***Nippotaenia fragilis* n.sp. Figs. 6, 7-9**

Type host: *Retropinna retropinna* (Richardson, 1848).

Site: Anterior and mid intestine.

Type locality: Kuratau, Lake Taupo, North Island, New Zealand. Map Ref. N.Z.M.S. 1, N102, 256125.

Holotype: National Museum, Wellington. Helminth Collection No. ZW1043, paratypes and supplementary material ZW1044-1050. Description based on 50 specimens.

Description

Worms cylindrical, hypoanapolytic, 1.4-12.5 mm long, strobilla with <10 proglottides. Scolex rounded anteriorly 0.77-2.06 mm long from the apex to the first proglottid and 0.27-0.86 mm wide, tapering slightly from just behind the sucker (Fig. 7). Apical sucker single, 135-300 μm long, 155-346 μm wide, actively protruded in live animals. Neck contains 1-2 sets of genital primordia. Proglottides laterally convex, first proglottid broader than long, but second and subsequent proglottides longer than broad. Constrictions more pronounced posteriorly facilitating detachment of ripe proglottides. Terminal proglottid 0.47-3.71 mm long, 0.30-0.94 mm wide; slightly pointed apically in developing strobilae (Fig. 8). Cuticle 6.4-7.6 μm thick covered in small spines 1.52-2.5 μm long. Superficial secondary segmentation is apparent on gravid and ripe proglottides.

Mature testes 26-30, spherical, 67-76 \times 68-70 μm , confined to the anterior half of proglottides 1-6. Mean diameter of immature testes in proglottid 1, 31 μm , mature and increase to 68 μm mean diameter in proglottid 5 (Fig. 6). Cirrus pouch pyriform in the anterior quarter of the proglottid, 169 μm long, 99 μm wide; ductus ejaculatorius coiled, leads to the sub-marginal gonopore, 27-31 μm diameter. Testicular anlagen discernible in neck; testes apparent in proglottides 1-7, but progressively less conspicuous after proglottid 4 (Fig. 7). Testes not present in ripe or spent proglottides.

Ovary bilobed, (Fig. 8), 141-334 \times 67-283 μm ; in the posterior third of proglottides 2-7 but fully developed by proglottid 4 (Fig. 7). Ovary lobes develop by progressive intucking of the posterior margins of the ovarian primordia; the lobes remain connected by a median isthmus. Vitellaria 53-125 \times 50-198 μm in two angular lobes, antero-dorsal to the ovary, the two lobes joined just in front of the ovarian isthmus. Vitellaria develop in association with the ovary, but may persist in proglottides 7 and 8 after fragmentation of the ovary and growth of the egg-filled uterus.

Uterus first apparent in proglottid 5 as a small folded uterine sac extending anteriorly to the testes and looping posteriorly to lie ventral to the ovarian lobes. In proglottides 6 and 7 uterus becomes more folded and grows to fill the proglottid, gradually replacing the testes. In more mature proglottides there is progressive development of the eggs within the uterus, the strobila terminating in a ripe proglottid that is easily detached.

Oncosphere enclosed within three shell membranes (Fig. 9). Outer shell membrane thin and transparent, elongate-ovoid to ovoid 51-62 \times 42-50 μm , enclosing an ovoid middle shell membrane, 40-49 \times 29-37 μm , and inner shell membrane, 31-37 \times 23-29 μm . Embryo 29-31 \times 21-23 μm , with a central pair of short (9-10 μm) larval hooklets flanked by slightly larger (11-12 μm) lateral hooklets.

Remarks

N. fragilis is weakly anapolytic, is smaller than *N. contorta*; has fewer proglottides, a smaller sucker and scolex, smaller testes (Fig. 6) and smaller eggs (Table 1a). It resembles *N. chaenogobii* in size, sucker dimensions and number of proglottides, but it differs in dimensions of the testes, ovary, vitellaria and eggs (Table 1a). *N. fragilis* infects *R. retropinna* throughout Lake Taupo.

Derivation of name: The specific name is derived from the Latin, '*fragilis*,' meaning fragile or easily broken, and alludes to the way in which live animals readily break on handling.

Genus *Amurotaenia* Achmerov, 1941

With all the features of the family. Apical sucker very strongly developed, with sphincter at its opening. Anterior proglottides all considerably wider than long but length increases posteriorly; sides parallel or convex. Proglottides shed when immature; growth and maturity occur after detachment. Testes previtellarian, partially or completely retained in mature and gravid proglottides. Cirrus pouch thin-walled with coiled ductus ejaculatorius at the level of the posterior of the

anterior third or anterior of the middle third of the proglottid. Gonopore opens on left or right margin of the proglottid in the anterior half of the middle third. Ovary of two symmetrical lateral lobes joined by a median transverse isthmus and elongated longitudinally, situated in the mid-region of the proglottid. Vitellaria preovarian, consists of two lateral symmetrical spherical to reniform lobes joined transversely. Uterus laterally coiled, or with lateral branches, develops anteriorly in mature proglottides, but extends only partially into testicular region. Eggs three-shelled; outer shell delicate, large; middle shell rather rigid, small; inner shell membranous, enclosing a larva with one central and two pairs of lateral hooklets. Parasitic in intestine of freshwater fishes.

Type species: *A. percotti* Achmerov, 1941 in *Percottus glehni*; Amur River, Sino-Soviet border.

Other species: *A. monogurndae* (Yamaguti and Miyata, 1940) n.comb. in *Mogurnda obscura*; Nisinomiya, Japan.

Remarks

The generic description of Yamaguti (1959) is expanded in details of the genitalia and eggs; the shedding of immature proglottides, retention of the testes, and broad anterior proglottides distinguishing it from *Nippotaenia* Yamaguti, 1939 are added. Achmerov (1941) distinguished the genus on the presence of a double sphincter in the sucker of *A. percotti*, but Yamaguti (1959) (p. 105, footnote) remarked this also occurs in *N. mogurndae* and thus doubted the validity of *Amurotaenia*. This argument stands on the correctness of the placing *N. mogurndae*, which is here transferred to *Amurotaenia* on other characters, and therefore the argument is invalid.

However, Achmerov (1960) re-examined his species and concluded it fitted the description of the genus *Nippotaenia* and therefore formed the combination *N. percotti* (Achmerov, 1941). Dubinina (1964) gave new measurements for *N. percotti* and considered it to be synonymous with *N. mogurndae*. The species are similar (Table 1b), but the strobila of *N. mogurndae* grows up to 5.3 mm and contains 25-45 proglottides whereas *A. percotti* at a maximum of 3.6 mm contains only 2-11 proglottides. However, the description of *A. percotti* is very vague because few (12) specimens were examined, and the data do not allow an accurate comparison with *N. mogurndae*.

Amurotaenia decidua n.sp. Figs. 10-13, 14

Type host: *Gobiomorphus cotidianus* McDowall, 1974.

Site: Intestine.

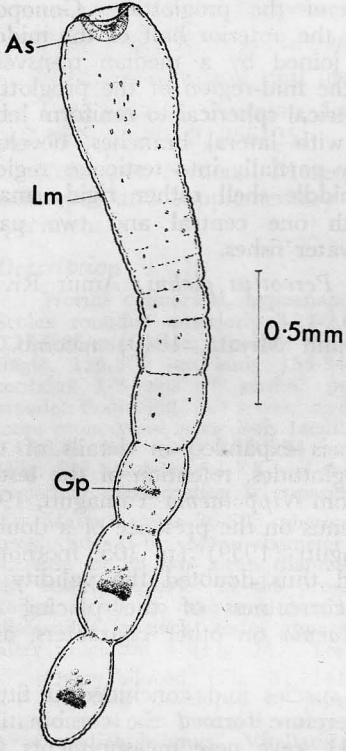
Type locality: Kuratau, Lake Taupo, North Island, New Zealand. Map Ref. N.Z.M.S. 1, N102, 256 125.

Holotype: National Museum, Wellington. Helminth Collection No. ZW1051, paratypes and supplementary material ZW1052-1060. Description based on 20 strobilae and 191 detached proglottides.

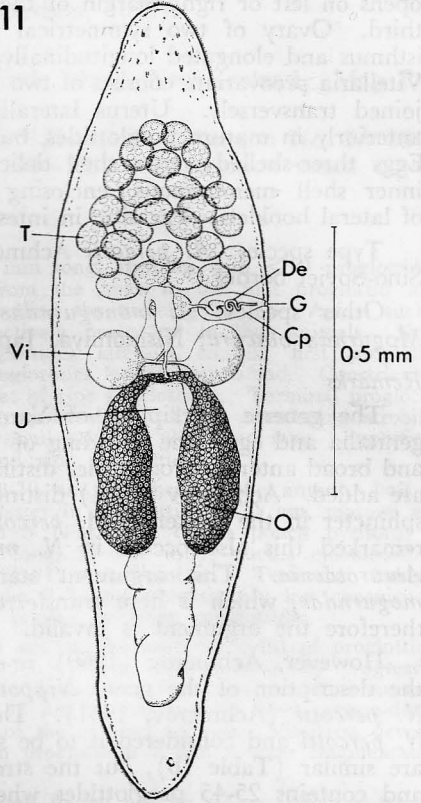
Description

Worms fragile, cylindrical, moniliform, hyperapolytic 1.29-4.36 mm long; up to 13 proglottides on the strobila (Fig. 10). Immature proglottides containing genital primordia are shed into intestinal lumen where they may remain up to two months, during which they grow, mature and ripen. Apical sucker single, highly protrusible, $72-174 \times 87-139 \mu\text{m}$, wall $35.0-43.5 \mu\text{m}$ thick. Scolex 0.49-1.15 mm long to the first proglottid, 0.15-0.42 mm wide, tapers in the neck region, contains distinct sub-cuticular nuclei $12.6-23 \mu\text{m}$ in diameter. Cuticle $6.0-7.4 \mu\text{m}$ thick covered in spines $2.0-2.5 \mu\text{m}$ long. First five proglottides always broader than long, proglottid 6 variable, and proglottid 7 usually longer than broad. Constrictions between posterior proglottides pronounced giving a moniliform appearance. Genital primordia may be apparent in proglottides 7-10. Terminal proglottid $197-246 \times 283-629 \mu\text{m}$, slightly pointed posteriorly.

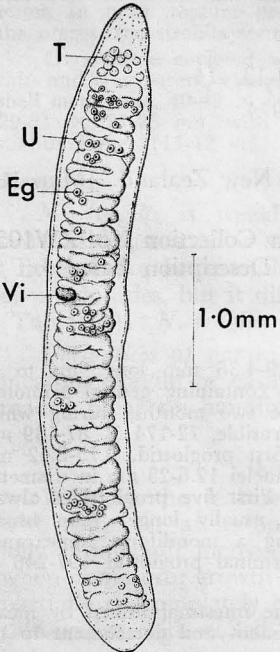
Shed proglottides 0.54-8.81 mm long, move actively in the intestinal lumen by means of posteriorly directed waves of muscular contraction. Attachment and detachment to the



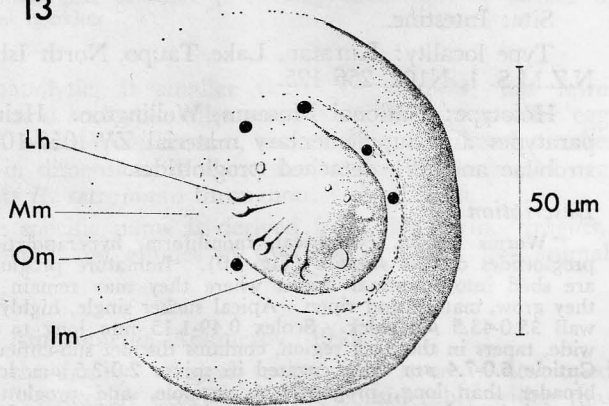
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12



13



intestine is achieved by expansion of the anterior of the proglottid between the intestinal villi, and the use of the cuticular spines for enhanced traction against the mucosal cells.

Immature proglottides 0.54-1.18 mm, widest at middle and tapering at the ends. Genital primordia become progressively differentiated with growth and maturation of the proglottid. Mature proglottides, 1.04-2.61 mm, widest at the mid-body, tapering slightly to rounded ends, the anterior end with a distinctly muscular region (Fig. 11). Testes 26-28, ovoid to spherical, 74-84 μm diameter occupy the anterior half of the proglottid. Gonopore 40-49 μm , 40-50% of the distance down the proglottid leads to a pyriform cirrus pouch

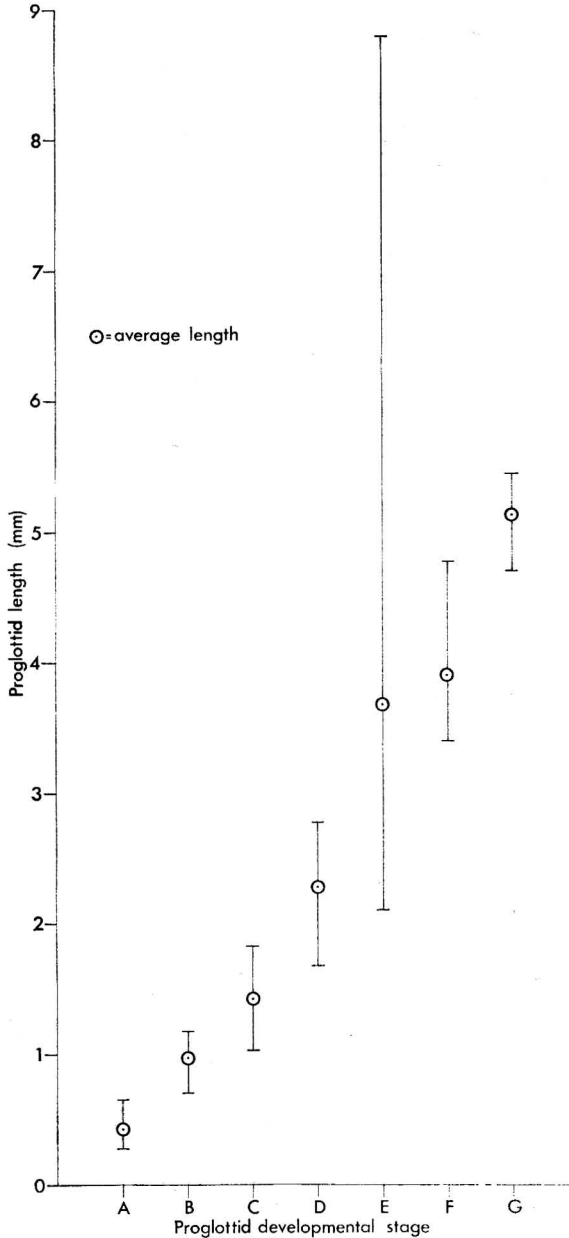


FIG. 14. — The stage of development of shed proglottides of *A. decida* in relation to their length. A = terminal proglottid on strobila, B = immature, C = mature, D = mature/gravid, E = gravid, F = gravid/spent, G = spent.

283-329 μm long and 95-146 μm wide; ductus ejaculatorius convoluted. Ovary bilobed, 189-299 \times 56-94 μm , extends from the mid-posterior to the middle of the proglottid, the lobes joined anteriorly by a narrow isthmus. Vitellaria bilobed, spherical to reniform, 44-138 \times 52-137 μm , joined antero-dorsally to the ovarian isthmus. Uterus saccular with many folds, extends anteriorly to the level of the cirrus pouch and then loops ventrally to the posterior apex of the proglottid.

Further development was observed in proglottides 1.46-2.74 mm in length. Before the ovary fragments the eggs pass into the uterus, the ovary and vitellaria move slightly anteriorly as the uterus grows to fill the posterior of the proglottid. Rapid growth continues until the uterus fills the whole proglottid, except the anterior parenchyma in which a reduced number of testes are retained. Vitellaria may be visible between the uterine folds of the mid-body. During this period the proglottid grows rapidly to become an elongated cylinder, up to 8.81 mm long, with rounded ends and a distinct muscular anterior end (Fig. 12). It is likely that gravid proglottides attain greater lengths than this, but the ready expulsion of eggs prohibits accurate measurement. Shrinkage of spent proglottides (2.84-5.68 mm) and development in relation to proglottid length are shown in Figure 14.

Outer shell of egg thin and transparent, ovoid to spherical, 66-90 \times 65-66 μm , enclosing a middle shell, 43-58 \times 43-51 μm , and inner shell 37-42 \times 37-40 μm . A fluid layer containing vesicles and dark bodies lies between the middle and inner shells. Oncosphere ovoid, 32-39 \times 35-37 μm , with three pairs of larval hooklets 13.2-16.0 μm in length (Fig. 13).

Remarks

A. decidua has a smaller sucker, larger detached proglottides, smaller outer egg membrane and larger embryo than *A. percotti* (Table 1b), but because of lack of information on *A. percotti*, the relationship is ill-defined. *A. decidua* also has a smaller sucker, fewer proglottides, smaller testes, longer cirrus pouch, smaller eggs containing a larger embryo and larger detached proglottides than *A. mogurndae* (Table 1b).

Gob. cotidianus is infected with *A. decidua* throughout Lake Taupo.

Derivation of name: The specific name is derived from the Latin, 'decido,' meaning "fall off", an allusion to the shedding of proglottides by this species.

General Remarks

The principal differences between species described here and previously described species are size, proglottid number, and organ shape and dimensions. Size and proglottid number may depend on host species or habitat, although no differences were observed in *N. contorta* taken from *R. retropinna* and *G. maculatus*. Organ dimensions and shape are partly determined by specimen preparation and the state of material measured, but previous authors do not give details of this; also the limited measurements on *A. percotti* are based on very few specimens. Until further data are forthcoming on other species their relationship with those described here is unclear.

The three New Zealand species appear to be very limited in distribution as examination of native fishes from 65 localities throughout the country in 1972-75 has not yielded further specimens.

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