Cestodes in South American freshwater teleost fishes: keys to genera and brief description of species

Amilcar Arandas Rego [1]
James C. Chubb [2]
Gilberto C. Pavanelli [3]

ABSTRACT. Keys to genera of cestodes in South American freshwater teleost fishes are provided, with diagnoses of genera and short descriptions of species. Two new genera are proposed, *Chambriella* **gen.n.** for *Goezeella agostinhoi* Pavanelli & Santos, 1992 and *G. paranaensis* Pavanelli & Rego, 1989, and *Brooksiella* **gen.n.** for *Amphoteromorphus praeputialis* Rego, Santos & Silva, 1974. *Nomimoscolex magna* Rego, Santos & Silva, 1974, previously **species inquirenda**, is transferred to the genus *Proteocephalus* Weinland, 1858. *Goezeella nupeliensis* Pavanelli & Rego, 1989 is considered a **species inquirenda**. Species and host lists are included.
KEY WORDS. Cestoda, Proteocephalidea, freshwater fishes, parasitology

Eighty nine taxa of cestodes from six orders are known in South American freshwater teleost fishes. Most belong to the Order Proteocephalidea, found particularly in siluriform fishes.

Classification of Proteocephalidea is based on the studies of LA RUE (1911, 1914), WOODLAND (1933a,b,c, 1934a,b,c, 1935a,b,c), FREZE (1965), WARDLE & MCLEOD (1952), SCHMIDT (1986) and REGO (1994). BROOKS (1978) and BROOKS & RASMUSSEN (1984) acknowledged two major taxa of Proteocephalidea, Proteocephalidae and Monticelliidae, established by LA RUE (1911). Separation at family level was based on arrangement of the reproductive organs in relation to the longitudinal muscle bundles. REGO (1995) recommended modification to the taxonomy, suggesting that South American proteocephalids should be reduced to one family Proteocephalidae, with two subfamilies, Corallobothriinae and Proteocephalinae, distinguished by the presence or absence of a metascolex. Diagnosis of certain species of Corallobothriinae is, nevertheless, a problem. There is no difficulty if there is an obvious collar-like metascolex, as in Goezeella and Spatulifer, but in genera such as Paramonticellia and Mariauxiella the interpretation of presence of metascolex is not easy. We adopt in this paper separate the genera with metascolex from the others without metascolex.

1) Departamento de Helmintologia, Fundação Oswaldo Cruz. Avenida Brasil 4365, Caxa Postal 926, 20010-900 Rio de Janeiro, Brasil. Research Fellow of CNPq.
2) School of Biological Sciences, Derby Building, University of Liverpool. Liverpool L69 3BX, U.K.
3) Nupelia/DBI, Universidade Estadual de Maringá, Avenida Colombo 5790. 87030-900 Maringá, Paraná, Brasil.

REGO & PAVANELLI (1992b) included sixty-eight species of proteocephalids in forty-six fish species. CHAMBRIER & REGO (1994, 1995), REGO & CHAMBRIER (1995), PAVANELLI & TAKEMOTO (1995, 1996), PERTIERRA (1995) and CHAMBRIER *et al.* (1996) have described more species.

Three species, *Goezeella paranaensis*, *G. nupeliensis* sp. inquirenda and *G. agostinhoi* (described in PAVANELLI & REGO 1989, 1991 and PAVANELLI & SANTOS 1991) were re-evaluated by scanning electron microscopy (SEM): metascoleces were absent consequently they cannot be classified as Goezeella. One genus is proposed, *Chambriella* **gen.n.** for *Goezeella agostinhoi* and *G. paranaensis*. *Goezeella nupeliensis* Pavanelli & Rego, 1989 is considered **species inquirenda**. *Brooksiella* **gen.n.** is created for *Amphoteromorphus praeputialis* Rego, Santos & Silva, 1974 and *Nomimoscolex magna* Rego, Santos & Silva, 1974, previously **species inquirenda**, is transferred to the genus *Proteocephalus*.

The aim of this review is to provide host and parasite checklists, keys to genera, diagnoses and short descriptions of species of cestodes parasitic in South American freshwater teleost fishes up to December 1996. It is hoped, thereby, future studies on these interesting parasites will be facilitated.

MATERIAL AND METHODS

Fishes must be examined freshly killed. At autopsy in the field the entire intestine, depending on its size, is placed in a dish or tray, slit open longitudinally and examined using a binocular stereomicroscope. Cestodes are fixed in situ in the intestine using boiling (100°C) 4% formaldehyde solution. In the laboratory the entire intestine is examined in detail, cestodes removed and transferred to 70% ethanol for storage.

A binocular stereomicroscope show features of scolex, metascolex and suckers important for identification in all but the smallest specimens. Optimum resolution of detail is visible with a scanning electron microscope (SEM); this procedure is recommended. Scoleces are prepared by cutting the strobila 2-3 mm behind the neck region, thus including enough of the strobila to facilitate mounting and viewing from all sides in the specimen chamber. Cestodes in 70% ethanol are taken through absolute ethanol (minimum time 15 minutes in each), critical point dried, mounted on a viewing stub, sputter-coated in 60% gold/palladium and viewed.

For study of reproductive organs in whole mounts complete strobilae, or pieces that included mature and gravid proglottids, are stained with Delafield's haematoxylin or Langeron's alcoholic carmine. Details of relationships of musculature and reproductive organs in proglottids require transverse and/or longitudinal histological sections cut at 5 μm and stained with haematoxylin and eosin.

LIST OF SPECIES

Orders follow KHALIL *et al.* (1994), genera and species are in alphabetical order, with species transferred to new genera in **bold**.

Order Amphilinidea Poche, 1922

Nesolecithus janicki Poche, 1922

Schizochoerus liguloideus (Diesing, 1850)

Order Trypanorhyncha Diesing, 1863
Pterobothrium crassicolle Diesing, 1850

Order Tetraphyllidea Carus, 1863
Scolex pleuronectis Müller, 1788

Order Pseudophyllidea Carus, 1863
Bothriocephalus acheilognathi Yamaguti, 1934
Senga sp. Rego (1997)
Unidentified pseudophyllidean of WOODLAND (1935c)

Order Proteocephalidea Mola, 1928 – encapsulated plerocercoids
Genera without metascolex
Brayela karuatayi (Woodland, 1934)
Cangatiella arandasi Pavanelli & Santos, 1991
Crepidobothrium eirasi Rego & Chambrier, 1995
Gibsoniela mandube (Woodland, 1935)
Goezeella nupeliensis Pavanelli & Rego, 1989 **species inquirenda**
Harriscolex kaparari (Woodland, 1935)
Houssayela sudobim (Woodland, 1935)
Monticellia belavistensis Pavanelli, Santos & Takemoto,1994
M. coryphicephala (Monticelli, 1892)
M. diesingii (Monticelli, 1892) **species inquirenda**
M. loyolai Pavanelli & Machado dos Santos, 1992
M. macrocotylea (Monticelli, 1892) **species inquirenda**
M. megacephala Woodland, 1934
Nomimoscolex admonticellia (Woodland, 1934)
N. alovarius Brooks & Deardorff, 1980
N. arandasregoi Fortes, 1981 **species inquirenda**
* *N. emarginatum* (Diesing, 1856)
N. lenha (Woodland, 1933)
N. lopesi Rego, 1989
N. matogrossensis Rego & Pavanelli, 1990
N. microacetabula Pertierra, 1995
N. pimelodidi Pertierra, 1995
N. piracatinga Woodland, 1935
N. piraeeba Woodland, 1934
N. sudobim Woodland, 1935
N. woodlandi (Rego, 1984)
Nupelia portoriquensis Pavanelli & Rego, 1991
Proteocephalus bagri Spector & Garzon, 1988
P. chubbi Pavanelli & Takemoto, 1995
P. fossatus (Riggenbach, 1895)
P. gibsoni Rego & Pavanelli, 1992 (originally described as *P. ocellatus* Rego & Pavanelli, 1990, preoccupied)

P. jandia Woodland, 1934
P. kuyukuyu Woodland, 1935 **species inquirenda**
P. macdonaghi (Szidat & Nani, 1951)
P. macrophallus (Diesing, 1850)
P. magna Rego, Santos & Silva, 1974
P. microscopicus Woodland, 1935
P. piramutab (Woodland, 1933)
P. platystomi Lynsdale, 1959
P. regoi Chambrier, Scholz & Vaucher, 1996
P. renaudi Chambrier & Vaucher, 1994
P. rhamdiae Spector & Garzon, 1988
P. serrasalmus Rego & Pavanelli, 1990
P. soniae Chambrier & Vaucher, 1994
P. sophiae Chambrier & Rego, 1994
P. vazzolerae Pavanelli & Takemoto,1995
***Chambriella* gen.n.**
C. agostinhoi (Pavanelli & Santos, 1992)
C. paranaensis (Pavanelli & Rego, 1989)
Spasskyellina lenha (Woodland, 1933)
S. mandi Pavanelli & Takemoto, 1996
S. spinulifera (Woodland, 1935)
Travassiella avitellina Rego & Pavanelli, 1987
Undetermined proteocephalid larvae of Rego & Gibson (1989)
Zygobothrium megacephalum Diesing, 1850
* Change of name; anteriorly *Nomimoscolex pirarara* (Woodland, 1935); see the text

Genera with metascolex
Amphoteromorphus parkarmoo Woodland, 1935
A. peniculus Diesing, 1850
A. piraeeba Woodland, 1934
***Brooksiella* gen.n.**
Brooksiella praeputialis (Rego, Santos & Silva, 1974)
Choanoscolex abscisus (Riggenbach, 1895)
Corallotaenia sp. of Brooks & Deardorff, 1980
Ephedrocephalus microcephalus Diesing, 1850
Goezeella siluri Fuhrmann, 1916
Jauella glandicephalus Rego & Pavanelli, 1985
Manaosia bracodemoca Woodland, 1935 **species inquirenda**
Mariauxiella pimelodi Chambrier & Rego, 1995
Megathylacus brooksi Rego & Pavanelli, 1985
M. jandia Woodland, 1934
M. travassosi Pavanelli & Rego, 1992

Othinoscolex lenha Woodland, 1933
Paramonticellia itaipuensis Pavanelli & Rego, 1991
Peltidocotyle rugosa Diesing, 1850
Rudolphiella lobosa (Riggenbach, 1895)
R. myoides (Woodland, 1934)
R. piranabu (Woodland, 1934)
R. rugata (Rego, 1975)
Sciadocephalus megalodiscus Diesing, 1850 **species inquirenda**
Spatulifer piracatinga (Woodland, 1935)
S. piramutab (Woodland, 1933)
S. maringaensis Pavanelli & Rego, 1989
S. rugosa (Woodland, 1935)
S. surubim (Woodland, 1934)
Woodlandiella myzofera (Woodland, 1933)

Order Cyclophyllidea van Beneden in Braun, 1900
Valipora campylancristrota (Wedl, 1855)

WOODLAND (1934c) described *Anthobothrium pristis* Woodland, 1934 in swordfish *Pristis perotteti* (Valenciennes), a marine fish entering freshwaters of the Amazon, and THATCHER (1991) included 15 species of Tetraphyllidea and one species of *Trypanorhyncha* also from marine fishes in the Amazon. As these are in elasmobranchs they are excluded from this key.

KEYS AND DESCRIPTIONS

Measurements are mm in keys and descriptions. Generic and species descriptions compiled from literature follow appropriate key-couplets. Where there is more than one species in a genus descriptions are in alphabetical order of hosts. **species inquirenda** are included with appropriate genus except Sciadocephalus megalodiscus Diesing, 1850, *Manaosia bracodemoca* Woodland, 1935, and an unidentified bothriocephalid (ptychobothriid) WOODLAND (1935c).

Key to larval cestodes

1a. Larvae in capsules associated with peritoneum and viscera of fishes (Fig. 111) 2

1b. Larvae free in the lumen of stomach, intestine (Fig. 3), or less commonly, gall bladder (Fig. 114) 3

2a. Larvae removed from capsules have scolex with four acetabular suckers. ..... Proteocephalidea – encapsulated plerocercoids

2b. Larvae removed from capsules have scolex with armed tentacles (Figs 2, 113) ..... Order Trypanorhyncha – *Pterobothrium crassicolle*

3a. Larvae in the lumen of stomach or intestine. Scolex without rostellum or hooks (Figs 3, 115) 4

3b. Larvae in the lumen of gall bladder. Scolex with four suckers and a rostellum (Fig. 114) with two rows of hooks, one large, one small ..... Cyclophyllidea – *Valipora campylancristrota*

4a. Scolex with four acetabular suckers, some a fifth apical sucker (Fig. 3, upper arrow). A cercomer (Fig. 3), lower arrow may persist in recently acquired infections ..... Order Proteocephalidea -alimentary tract

4b. Scolex with four sessile or pedunculate bothridia of various shapes (Fig. 115), suckers may also be present .... Order Tetraphyllidea – *Scolex pleuronectis*

Descriptions to larval cestodes

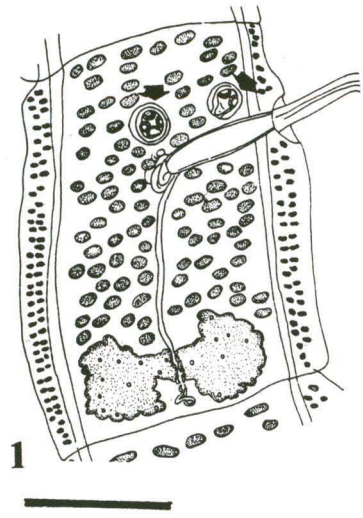
Order Proteocephalidea – encapsulated plerocercoids

Figs 111, 112

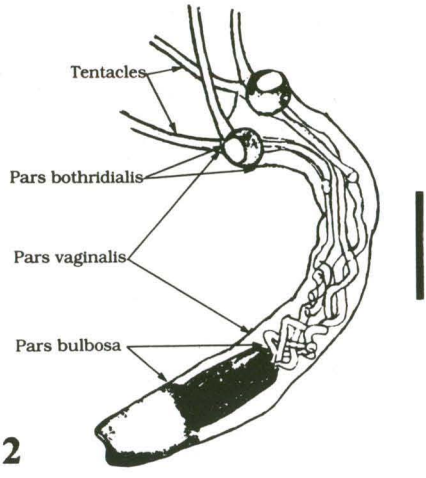
Some fish species have many larvae encapsulated on the intestine wall, whereas in others they are on the mesenteries or surface of viscera. Full-grown larvae removed from the host response capsule have proteocephalid scoleces. THATCHER (1981, 1991) attributed their origin to plerocercoid invasion of the intestine wall of a fish intermediate host leading to encapsulation. SCHÄFFER *et al.* (1992) noted large numbers of larvae from Loricariichthys platymetopon. BÉKÉSI *et al.* (1992) found plerocercoids in *Astronotus ocellatus*, *Cichla ocellaris*, *Colossoma brachipomum*, *C. macropodum*, *Cyprinus carpio*, *Hypophthalmichthys nobilis* (? bighead *Aristichthys nobilis*) and *Oreochromis* spp., with up to 250 in a single *C. macropodum*. Various stages were found, from plerocercoids making their way through the intestine wall to capsules on visceral serosa or pyloric caeca. In young fry there were extensive histopathological changes. BÉKÉSI *et al.* (1992) found adult proteocephalid tapeworms in the intestine of larvae-infected Cichla ocellaris, but were unable to identify species of adult. Procercoids were found in the haemocoel of a copepod *Diaptomus* sp. in samples of plankton. None of these reports showed whether these larvae were obligate transmission stages, or, if infected fishes were facultative paratenic hosts.

REGO & GIBSON (1989) found hyperparasitism of adult by larval proteocephalids. *Jauella glandicephalus*, *Megathylacus brooksi*, *Peltidocotyle rugosa* and *Travassiella avitellina* from the intestines of *Paulicea luetkeni*, *Choanoscolex abscissus* from *Pseudoplatystoma corruscans*, an unidentified proteocephalid from *Pseudoplatystoma fasciatus*, *Proteocephalus* sp. from *Rhamdia sapo* and *Nomimoscolex arandasregoi* from *Tachysurus* sp. were hyperparasitised by proteocephalid larvae. The only previous, similar South American record was RIGGENBACH (1896), who observed a plerocercoid larva in *Rudolphiella lobosa* from *Luciopimelodus pati*.

Figs 1-5. (1) *Proglottids* of *Megathyalacus* sp.: encapsulated larva of non identified proteocephalid (arrows), (original). Scale bar 0.4 mm; (2) *Pterobothrium crassicole*: larva removed from blastocyst, note typical trypanorhynch features: tentacles, pars bothridialis, pars vaginalis and pars bulbosa (from REGO 1987a). Scale bar 1 mm; (3) Proteocephalidea plerocercoid larva with apical sucker (upper arrow), four lateral suckers and cercomer (posterior arrow) from GINETSINSKAYA in DOGIEL 1958, after WAGNER 1915). Scale bar 0.1 mm; (4) *Senga* sp. scolex, note obvious apical cap, its edge indented, with two marginal semicircles of hooks (REGO 1997). Scale bar 0.1 mm; (5) *Senga* sp. gravid proglottid, (original). Scale bar 0.4 mm.

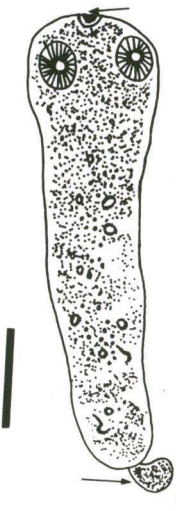


1



2

4



3

5

Pterobothrium crassicolle Diesing, 1850

Figs 2, 113

Blastocysts, about 5 long x 0.90 wide (Fig. 2). Tentacles of scolex armed with hooks of poeciloacanthous type, without chainette (Fig. 113). Hosts: *Brachyplatystoma flavicans*, *B. vaillanti* and *Bagrus marinus*. Erroneously recorded from *Erythrinus unitaeniatus* by Diesing (1850), corrected to *Pimelodus* **sp.n.** Nr. 84 (Diesing, 1856). Estuary of the Amazon, Belém, Pará, Brazil. DIESING (1850, 1856); REGO (1987a).

Valipora campylancristrota (Wedl, 1855) Baer & Bona, 1960

Fig. 114

Synonyms: see SCHMIDT (1986) and BONA (1994).

Larvae cysticercoids, 1-2 long, found in the lumen of gall bladder. Rostellum of scolex with two circles of hooks (Fig. 114, arrowed), ten in each. Host: *Prochilodus scrofa*. Paraná river, Paraná, Brazil. TAKEMOTO *et al.* (1994).

Order Proteocephalidea – alimentary tract (Fig. 3)

Larvae, plerocercoids, 0.5-3 long. Found frequently in stomach and intestines of freshwater fishes. Many occur in species of host in which they cannot develop to maturity. Cannot be identified further. REGO (unpublished data); THATCHER (1981).

Scolex pleuronectis Müller, 1788

Fig. 115

Major synonym: *Scolex polymorphus* Rudolphi, 1819; Monticelli (1888) provides other synonyms to his date.

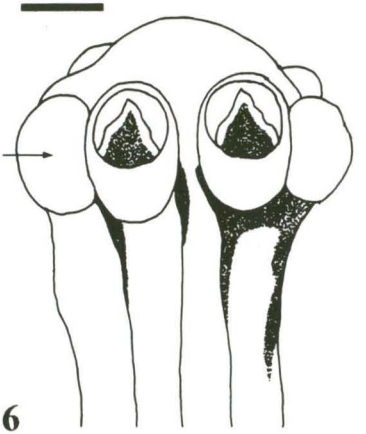
Plerocercoid larvae 0.5-2 long. Found commonly in marine and also estuarine fishes. A collective name (JONES *et al.* 1994) representing a large, unknown number of species of marine tetraphyllideans (YAMAGUTI 1934; WARDLE & MCLEOD 1952), Cannot be identified further. Host: *Brachyplatystoma* spp. Estuary of Amazon, Belem, Pará, Brazil. Rego (unpublished data).

Keys to adult cestodes

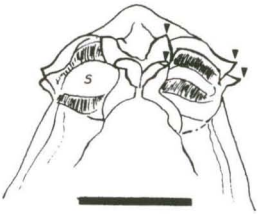
1a. External segmentation, with multiple sets of genitalia (proglottids) (Figs 10, 16) 3

1b. External segmentation absent, one genital system (monozoic) (Fig. 116) . . . . . .Order Amphilinidea 2

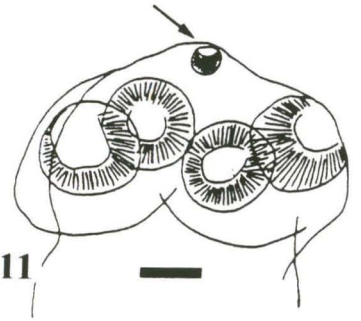
Figs 6-11. (6) *Brayela karuatayi* scolex, note closed division of sucker (arrow) (from WOODLAND 1934c). Scale bar 0.1 mm; (7) *Houssayela sudobim* scolex, note sixteen projections, four from each sucker (arrows). (S) Sucker, (from WOODLAND 1935a). Scale bar 0.1 mm; (8) *Travassiella avitellina* mature proglottid, note apparent absence of vitelline follicles (original). Scale bar 0.5 mm; (9) *Travassiella avitellina* gravid proglottid margin, showing vitelline follicles (original). Scale bar 0.1 mm; (10) *Crepidobothrium eirasi* strobila, note 7-12 proglottids, each with posterior appendix, mature square and gravid proglottids longer than wide (from REGO & CHAMBRIER 1995). Scale bar 0.5 mm; (11) *Proteocephalus gibsoni* scolex, apical sucker (arrow) (from REGO & PAVANELLI 1990). Scale bar 0.2 mm.



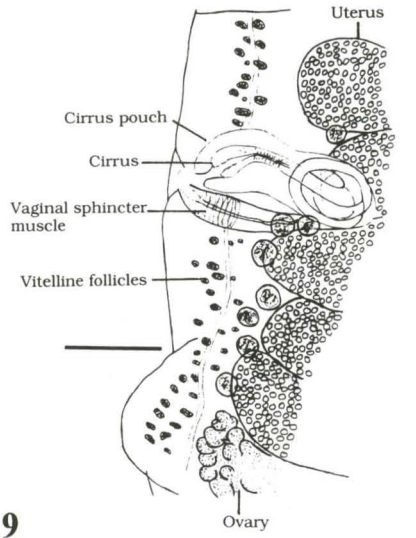
6



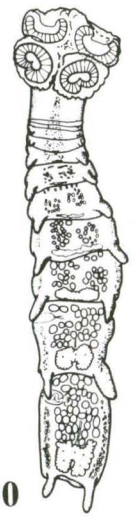
7



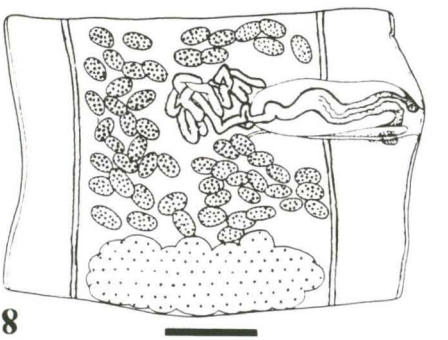
11


Uterus
Cirrus pouch
Cirrus
Vaginal sphincter muscle
Vitelline follicles
Ovary

9



10



8

2a. Body fusiform (Fig. 116) ..... *Nesolecithus*
2b. Body very elongate, filiform ..... *Schizochoerus*
3a. Genital pore lateral. Scolex with four lateral suckers, some with a fifth apical sucker (Fig. 11) or an apical glandular area (Fig. 20); four lateral suckers mostly with one (Fig. 124), but some with two openings (Fig. 118, or with an extra chamber clearly visible externally but without an opening (Fig. 6). Sucker cavities uniloculate (Fig. 124), biloculate (Fig. 119) or triloculate (Fig. 121). Metascolex present (Fig. 83, 135) or absent (Figs 127, 19) .... Order Proteocephalidea 5
3b. Genital pore dorsal, median (Fig. 5). Scolex with an apical disk, of variable prominence, sometimes without (Fig. 117) and sometimes with hooks (Fig. 4); two bothria (Fig. 117) ... Order Pseudophyllidea, Bothriocephalidae . .4
4a. Scolex with apical disk readily distinguished with SEM (Fig. 117), but sometimes not obvious in living materials, no hooks at its margin. Eggs operculate ..... *Bothriocephalus acheilognathi*
4b. Scolex with obvious apical cap, its edge indented dorsally and ventrally, with two marginal semicircles of hooks (Fig. 4). Eggs anoperculate .... *Senga* species
5a. Scolex without metascolex (Figs 65, 133) ..... see genera without metascolex
5b. Scolex with metascolex (Figs 83, 135) ..... see genera with metascolex

Descriptions to adult cestodes

Nesolecithus Poche, 1922

Body fusiform, 7 x 2.2. Seminal receptacle large, elongate, one sixth of body length. Uterus with descending limb adjacent to first ascending limb.

Type-species *N. janicki* Poche, 1922 (Fig. 116)

In body cavity of *Arapaima gigas*. Maicuru, Pará, Amazon river, Brazil. POCHE (1922); REGO *et al.* (1974).

Schizochoerus Poche, 1922

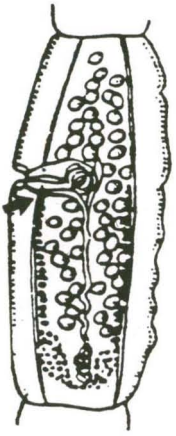
Body elongate and filiform, 75 x 2.9. Seminal receptacle large, reaching about one third of body length.

Schizochoerus liguloideus (Diesing, 1850) Poche, 1922

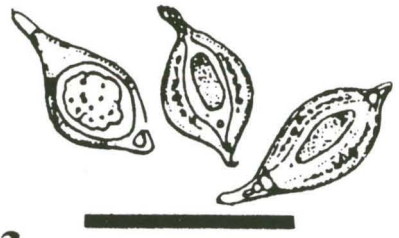
Synonym: *Amphilina liguloidea* (Diesing, 1850) Monticelli, 1892

In body cavity of *Arapaima gigas*. Maicuru, Pará, Amazon river, Brazil. POCHE (1922); REGO *et al.* (1974).

Figs 12-17. (12) *Proteocephalus macdonaghi* mature proglottid, vitelline gland post-poral, reaching the level of the cirrus pouch (arrowed) (from SZIDAT & NANI 1951). Scale bar 0.1 mm; (13) *Proteocephalus macdonaghi* eggs with knob (from SZIDAT & NANI 1951). Scale bar 50 mm; (14) *Proteocephalus piramutab* scolex with a central pillar (R), four phyllidea-like suckers (PH) with the form of a cup-handle (from WOODLAND 1933b). Scale bar 0.1 mm; (15) *Proteocephalus piramutab* proglottid. (from WOODLAND 1933b). Scale bar 0.5 mm; (16) *Proteocephalus macrophallus* whole worm (from WOODLAND 1933a). Scale bar 0.5 mm; (17) *Proteocephalus microscopicus* whole worm (from WOODLAND 1935c). Scale bar 0.5 mm. (CIV) Common genital atrium, (CS) cirrus sac, (O) ovary, (T) testes, (UT) Uterus, (VIT) vitelline glands

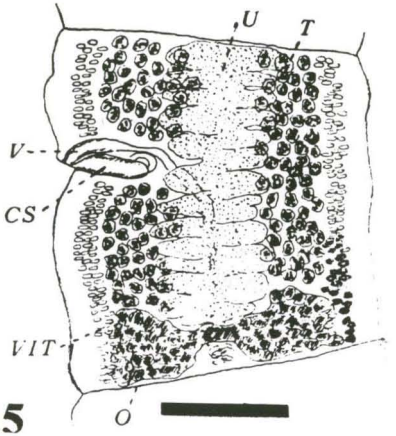


12

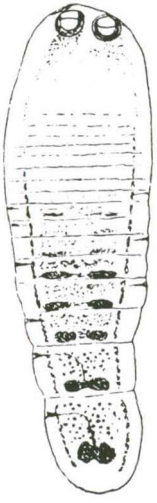


13

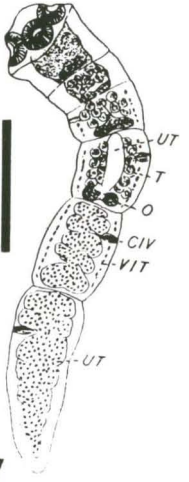
14



15



16



17

Bothriocephalus acheilognathi Yamaguti, 1934 (Fig. 117)

Synonyms: see POOL & CHUBB (1985).

Strobila 100-150 or more in length. Scolex inverted heart-shape. Two bothria variable in form, but distinct. Segments acraspedote, anapolytic. Genital atrium dorsomedial. Testes in lateral fields in medulla. Ovary transversely elongate, in ventral medulla. Vitellaria cortical. Uterus and uterine sac median or alternating submedian. Uterine pore median, anterior to genital atrium. Eggs operculate, unembryonated. Host: Cyprinus carpio. Cornelio Procópio, Paraná, Brazil. A pseudophyllidean probably translocated to Brazil with common carp. Pavanelli (personal observations).

Senga sp. (Rego, 1997)

Figs 4, 5

REGO (1997) described specimens of *Senga*, recently found in the intestine lumen of Astyanax scabripinnis from Campinas province, São Paulo, Brazil.

Unidentified ptychobothriid of Woodland, 1935c

This record by WOODLAND (1935c) from *Plagioscion squamosissima* is considered under **species inquirenda**.

In some genera, *Jauella* (Figs 138, 139), *Mariauxiella* (Fig. 105), *Paramonticellia* (Fig. 146), the metascolex is different from the typical collar-like form. Reference should be made to the figures indicated.

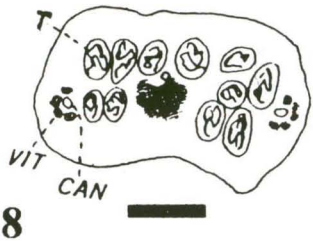
Key to genera without metascolex

1a. Scolex rounded, very wrinkled ..... *Zygobothrium*

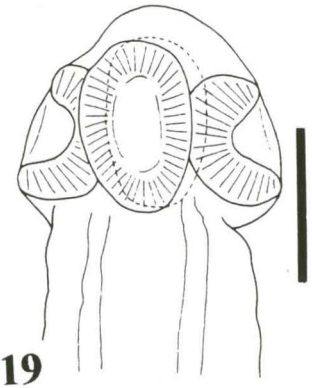
1b. Scolex not wrinkled. Four lateral suckers each with one (Fig. 124) or two openings (Fig. 118) to the outer surface of the scolex, Sucker cavities mostly undivided (uniloculate, Fig. 124), or some sub-divided by septa into two (biloculate, Fig. 119) or three (triloculate, Figs 121, 122), loculi visible through the sucker opening. Sometimes with a fifth simple apical sucker (Fig. 11), or an apical glandular region (Fig. 20) 2

2a. Sucker without an extra chamber. Each lateral sucker with only one opening (Fig. 11) to the outer surface of the scolex, sometimes with one (Figs 119, 120) or two internal septa (Figs 121, 122). An apical sucker sometimes present 3

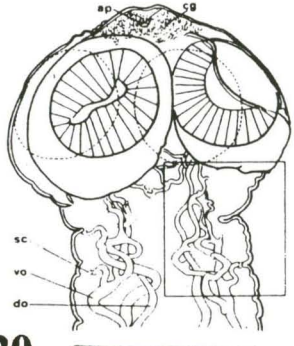
Figs 18-23. (18) *Proteocephalus microscopicus* transverse section of proglottid (from WOODLAND 1935c). Scale bar 0.1 mm; (19) *Proteocephalus chubbi* scolex (from PAVANELLI & TAKEMOTO 1995). Scale bar 0.1 mm; (20) *Proteocephalus regoi* scolex(from CHAMBRIER *et al.* 1996). Scale bar 0.5 mm; (21) *Proteocephalus regoi* mature proglottis (from CHAMBRIER *et al.* 1996). Scale bar 0.5 mm; (22) *Proteocephalus fossatus* scolex, apical gland arrowed (from Riggenbach, 1896). Scale bar 0.25 mm; (23) *Proteocephalus fossatus* facial section through a sexually mature proglottid to show vas efferentia (from RIGGENBACH 1896 slightly redrawn to enhance visibility). Scale bar 0.1 mm. (ap) Apical organ, (c) cirrus, (CAN) excretory canal, (cb) cirrus sac, (cg) cells with granular content, (do) dorsal osmoregulatory canal, (hb) testis vesicle, (pve) primary vasa efferentia, (sc) extremity of secondary canals in tegumental layer, (sve) large branch trunk of vas deferens, (T) testes, (v) vagina, (vo) ventral osmoregulatory canal, (vdk) coli of vas deferens, (VIT) vitelline glands.



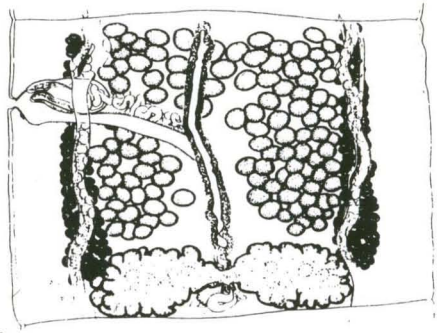
18



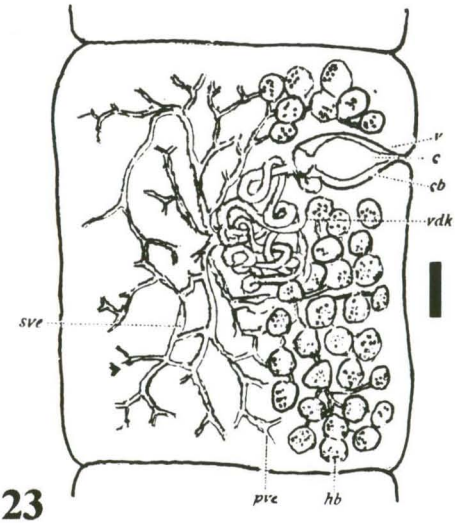
19



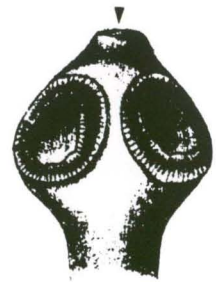
20



21



23



22

2b. Suckers with an extra chamber without an opening (Fig. 6) ..... *Brayela*

3a. Cavity of each lateral sucker with one (biloculate, Fig. 119, 120) or two septa (triloculate, Figs 121, 122). No apical sucker 4

3b. Cavity of lateral suckers without septum (uniloculate Figs 123, 124, 126). An apical sucker sometimes present (Fig. 11) 5

4a. Cavity of each lateral sucker with one septum (biloculate, Figs 119, 120) ..... *Chambriella*

4b. Cavity of each lateral sucker with two septa (triloculate, Figs 121, 122) ..... *Gibsoniela*

5a. Apical cap (Fig. 123) or lateral suckers (Fig. 7) with obvious horn-like projections 6

5b. Apical cap and lateral suckers without projections (Figs 124-126) 7

6a. Apical cap with eight triangular, horn-like projections, two above the upper (apical) edges of each lateral sucker (Fig. 123) ..... *Harriscolex*

6b. Rim of each lateral sucker with four horn-like projections, two on each side of each sucker, making sixteen in total (Fig. 7) ..... *Houssayela*

7a. In proglottids viewed in transverse sections ovary and testes are medullary (Fig. 28) (ovary partly cortical in Nupelia) within area enclosed by parenchymal longitudinal muscles, or some testes placed between the longitudinal muscle bundles (difficult to determine in *Travassiella*) 8

7b. In proglottids viewed in transverse sections ovary and testes are cortical (Fig. 66), placed outside area enclosed by parenchymal longitudinal muscles . .13

8a. Vitellaria inconspicuous, seen in gravid proglottids (Fig. 9) ..... *Travassiella*

8b. Vitellaria conspicuous (Fig. 15), visible in all sexually functional proglottids 9

9a. Vitellaria medullary (Fig. 39) 10

9b. Vitellaria cortical (Fig. 73), or mostly cortical, some paramuscular, with follicles in the medulla (Figs 41, 44) ..... .11

10a. Scolex with four lateral, notched, inverted-heart shaped suckers (Fig. 125). No fifth or apical sucker. Small worms, to 8.5, with seven to twelve segments (Fig. 10) ..... *Crepidobothrium*

10b. Scolex with four rounded lateral suckers (Figs 19, 27, 34). A fifth, apical sucker or gland may be present (Figs 11, 20). Most large worms, with many segments ..... *Proteocephalus*

11a. Vitelline glands internal to lateral osmoregulatory canals (Figs 41, 42) ..... *Cangatiella*

11b. Vitelline glands external to lateral osmoregulatory canals 12

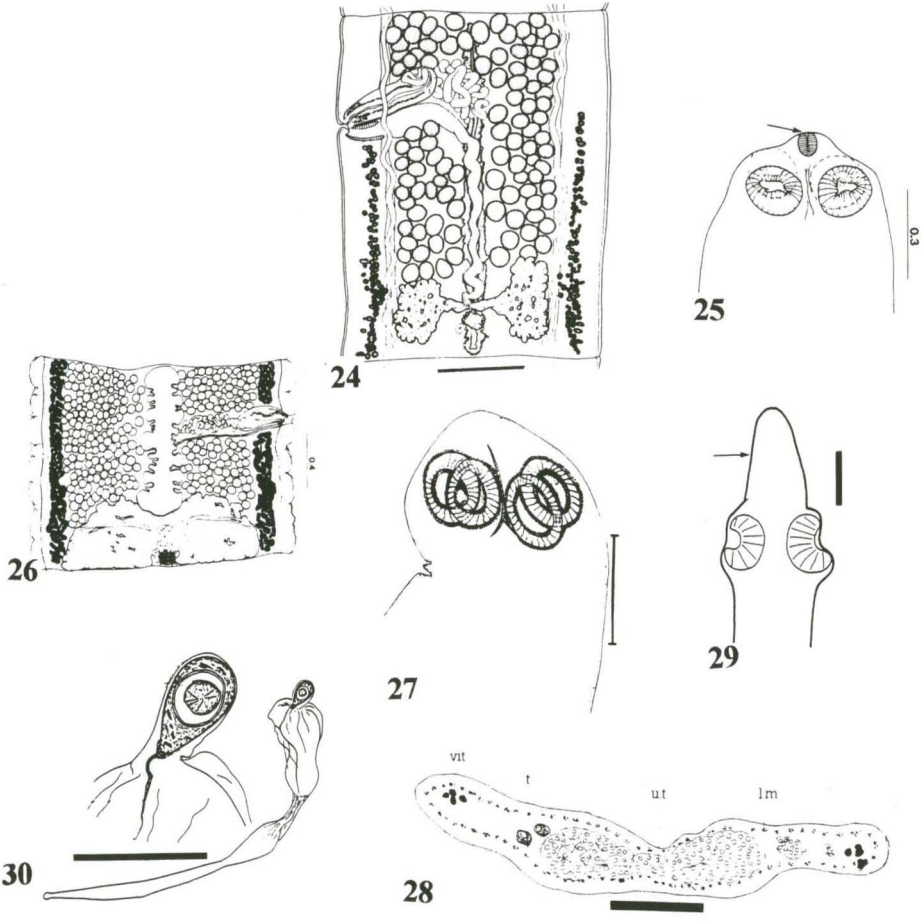
12a. Ovary, uterus and testes medullary. Vitellaria cortical (Fig. 44), generally not extending between the longitudinal muscle bundles ..... .*Nomimoscolex*

12b. Ovary and uterus partly cortical and partly medullary. Testes medullary but

with some placed between bundles of longitudinal muscle fibres (Fig. 64). Vitellaria paramuscular, extending between the longitudinal muscle bundles ..... *Nupelia*

13a. Testes in a single field (Fig. 66). Scolex and suckers round, no spines (Figs 132, 71) ..... *Monticellia*

13b. Testes in two lateral fields (Fig. 79). Suckers spinose (Fig. 134) .. *Spasskyellina*



Figs 24-30. (24) *Proteocephalus sophiae* mature proglottid, vitelline glands post-poral (from CHAMBRIER & REGO 1994). Scale bar 0.25 mm; (25) *Proteocephalus vazzolerae* scolex, apical sucker arrowed (from PAVANELLI & TAKEMOTO 1995); (26) *Proteocephalus vazzolerae* gravid proglottid (from PAVANELLI & TAKEMOTO 1995); (27) *Proteocephalus magna* scolex (original). Scale bar 0.4 mm; (28) *Proteocephalus magna* transverse section of gravid proglottid, (lm) longitudinal muscle, (t) testes, (ut) uterus, (vit) vitelline glands (original). Scale bar 0.2 mm; (29) *Proteocephalus renaudi* scolex, note elongate apical area arrowed (from CHAMBRIER & VAUCHER 1994). Scale bar 0.1 mm; (30) *Proteocephalus renaudi* eggs with appendix and membranes (from CHAMBRIER & VAUCHER 1994). Scale bar 50 mm.

Descriptions to genera without metascolex

Zygobothrium Diesing, 1855

Diagnosis: Worms about 20 long. Scolex very wrinkled, suckers large with two openings (Fig. 118). Segments craspedote, with medium notch on each surface, very numerous, broader than long. Vitellaria in dorsal and ventral cortex.

Type and only species: *Z. megacephalum* Diesing, 1850 (Fig. 118)

Strobila 20 x 1. Scolex, 1.6-3.5 wide, with globular suckers. Segments very numerous, craspedote. Longitudinal musculature well developed, compact. Testes 150-200. Vaginal sphincter present. In transverse section vitellaria appear as two semi-circular dorsal and ventral bands. Host: *Phractocephalus hemiliopterus*. Mato Grosso (DIESING 1850, 1854, 1855), Manaus, Amazonas and Santarém, Pará, Brasil. WOODLAND (1933a); FUHRMANN (1934); REGO (1984b).

Brayela Rego, 1984

Diagnosis: Strobila about 30 long. Scolex with dome-shaped apical area. Each lateral sucker divided into two parts externally, but only four have openings (Fig. 6).

Type and only species: *B. karuatayi* (Woodland, 1934) Rego, 1984 (Fig. 6).

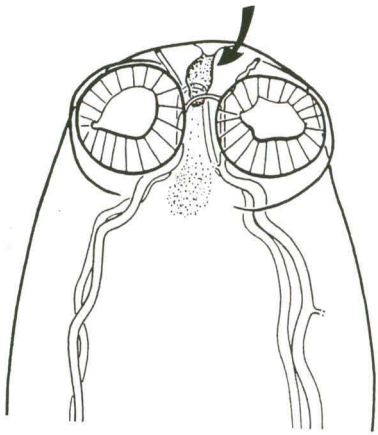
Synonym: *Anthobothrium karuatayi* Woodland, 1934.

Strobila, 30 x 1. Scolex, 0.24 x 0.40. Suckers phyllidea-like. Mature segments broader than long, gravid segments square. Longitudinal muscles not observed, only some diagonal fibres. Ovary massive. Uterus narrow, with few diverticula. Vitellaria in transverse section form two semi-circles. Host: *Glanidium* sp. Manaus, Amazonas, Brazil. WOODLAND (1934c); REGO (1984a).

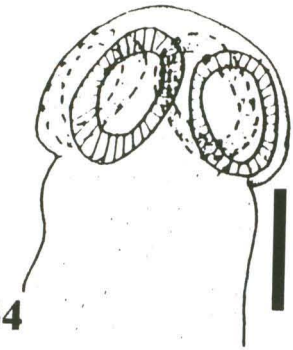
Chambriella **gen.n.**

Diagnosis: Worms to about 33. Scolex well-delimited, without wrinkles or furrows and with a conspicuous apical region. Suckers biloculate (Figs 119, 120). Most segments broader than long. Longitudinal musculature inconspicuous. Testes numerous. Vitellaria and gonads mostly cortical. Uterine diverticula well developed Parasites of Siluriform fishes. The generic name honours Alain de Chambrier, helminthologist, Museum of Natural History, Geneva, Switzerland.

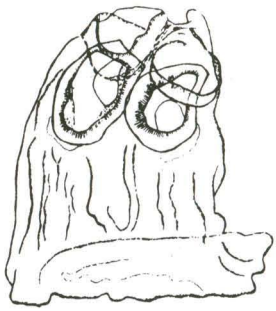
Figs 31-37. (31) *Proteocephalus soniae* scolex, apical glandular organ arrowed (from CHAMBRIER & VAUCHER 1994). Scale bar 0.25 mm; (32) *Proteocephalus platystomi* scolex, the small longitudinal grooves represent a rudimentary metascolex ? (from LYNSDALE 1959); (33) *Proteocephalus platystomi* eggs fused in pairs, (E) embryo, (IS) inner shell, (M) membrane, (OS) outer shell (from LYNSDALE 1959); (34) *Proteocephalus bagri* scolex (from SPECTOR & GARZON 1988). Scale bar 0.1 mm; (35) *Proteocephalus bagri* gravid proglottid (from SPECTOR & GARZON 1988); (36) *Proteocephalus rhamdiae* scolex (from SPECTOR & GARZON 1988); (37) *Proteocephalus rhamdiae* mature proglottid (from SPECTOR & GARZON 1988). Scale bar 0.5 mm.



31

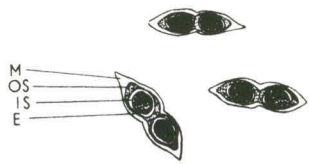


34



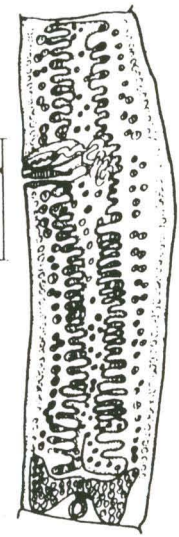
32

O·5 mm

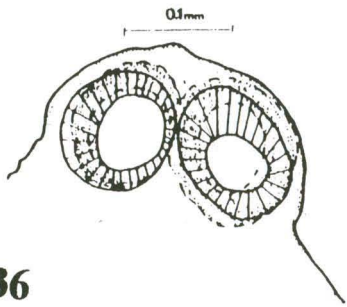


33

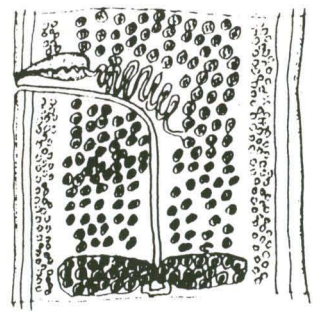
O·05mm



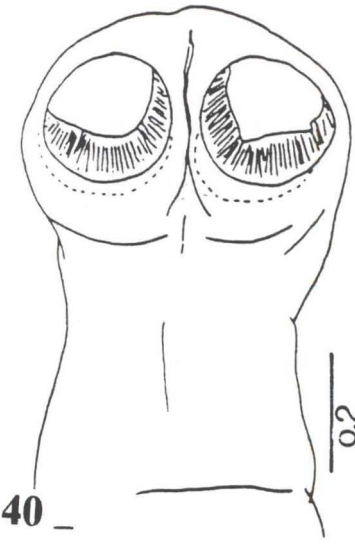
35

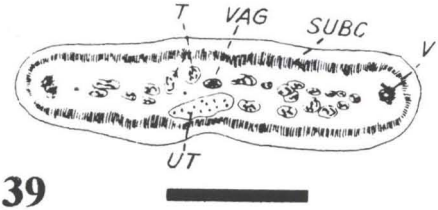


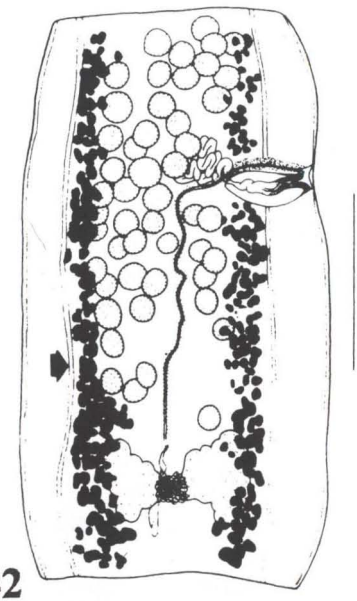
36

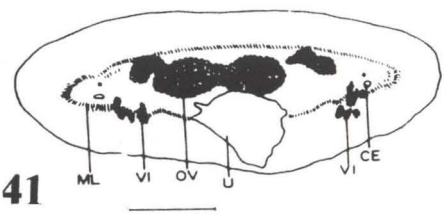


37









Figs 38-42. (38) *Proteocephalus jandia*: scolex (from WOODLAND 1934c). Scale bar 0.1 mm; (39) *Proteocephalus jandia* Transverse section of proglottid, longitudinal muscle absent (from WOODLAND 1934c). Scale bar 0.25 mm; (40) *Proteocephalus serrasalmus* scolex (from REGO & PAVANELLI 1990); (41) *Cangatiella arandasi* transverse section of proglottid (from PAVANELLI & SANTOS 1991). Scale bar 0.35 mm; (42) *Cangatiella arandasi* mature proglottid. Arrow shows vitelline glands inside longitudinal osmoregulatory canals (original). (CE) Osmoregulatory canal, (ML) longitudinal muscle, (OV) ovary, (SUBC) subcuticule, (T) testes, (U/UT) uterus, (V) vitelline glands, (VAG) vagina, (VI) vitelline glands.

Hemisorubin platyrhynchos

C. paranaensis (Pavanelli & Rego, 1989) **comb.n.**

Fig. 119

Synonym: *Goezeella paranaensis* Pavanelli & Rego, 1989.

Worms about 25 x 1.40. Scolex without wrinkles or furrows, with an apical region. Suckers biloculate, equal chambers. Strobila not sulcate or wrinkled, with about 80 broader than long segments. Internal musculature inconspicuous, but there are some dorso-ventral fibres. Cirrus pouch curved. 100-130 testes. Ovary bilobate. Uterine diverticula well developed. Host: *Hemisorubin platyrhynchos*. Itaipu and Paraná river, Paraná, Brazil. PAVANELLI & REGO (1989).

Paulicea luetkeni

Type species: *C. agostinhoi* (Pavanelli & Santos, 1992) **comb.n.** (Fig. 120).

Synonym: *Goezeella agostinhoi* Pavanelli & Santos, 1992.

Worms 8-33 x 1.15. Scolex quadrilobate, 0.6 x 1.10, without wrinkles or furrows. Suckers biloculate, with unequal chambers. Segments square. Longitudinal muscles inconspicuous. Genital pore at anterior third of proglottis. Cirrus pouch large. 180-200 testes. Ovary bilobed. Few uterine diverticula developed. Host: Paulicea luetkeni. Itaipu and Paraná river, Paraná, Brazil. PAVANELLI & SANTOS (1992).

Gibsoniela Rego, 1984

Diagnosis: Strobila to 170 long. Scolex with a prominent apical cone, suckers large, triloculate, bothridia-like (Figs 121, 122). Segments broader than long. Longitudinal musculature in large, regular bundles. Testes numerous. Vitellaria cortical and paramuscular (*i.e.* some vitelline follicles inside, between and outside the muscle bundles), in transverse section semi-crescent shaped. Ovary medullary, but some follicles cross longitudinal muscle bundles into cortex. Uterus with few but large diverticula.

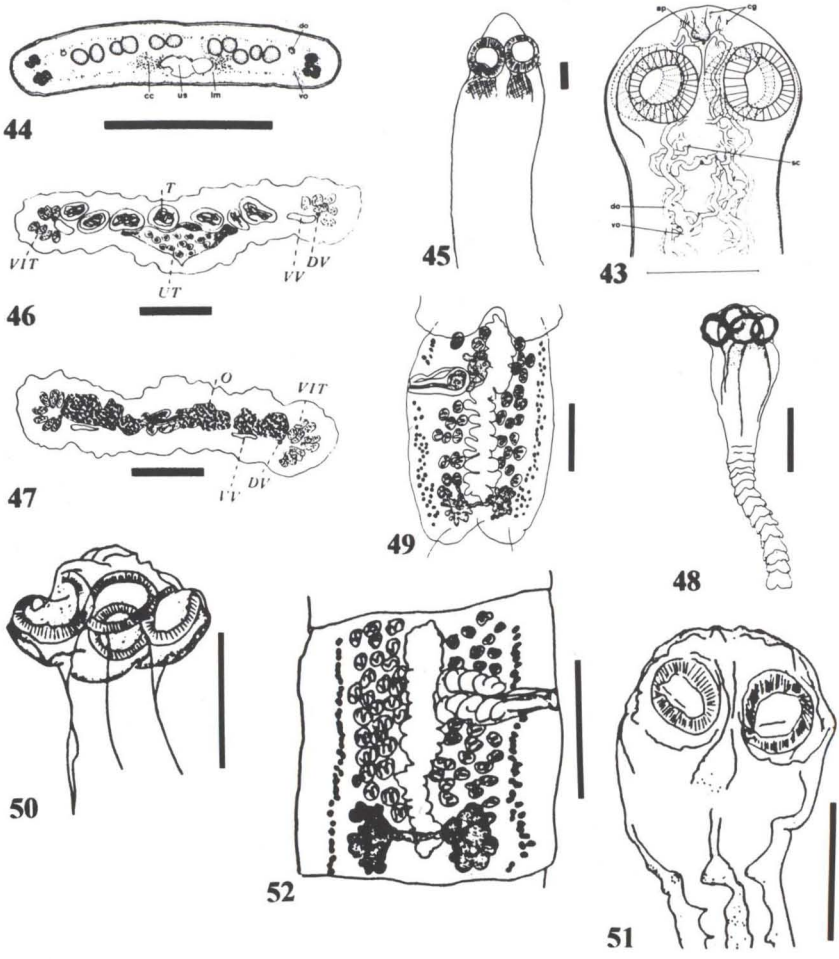
Type and only species: *G. mandube* (Woodland, 1935) Rego, 1984 (Figs 121, 122)

Synonyms: *Endorchis mandube* Woodland, 1935; *Anthobothrium mandube* Woodland, 1935; *Endorchis (Pseudoendorchis) mandube* (Woodland, 1935) Yamaguti, 1959.

Strobila 60-170. Scolex 0.70 x 0.58. Suckers 0.526-0.670 x 0.327-0.374. Segments broader than long, about 500. Testes 160-200. Ovary a thin, posterior strip of tissue. Uterus diverticula 10-12. Vitellarian follicles mostly in the cortex, partly in medulla. Host: *Ageneiosus brevifilis*. Manaus, Amazonas and São João, Mato Grosso, Brazil. WOODLAND (1935a); REGO (1984a).

Harriscolex Rego, 1987

Diagnosis: Strobila about 30 long. Scolex with dome-shaped apical cap, with two horn-like projections above each sucker (Fig. 123). Segments broader than long. Longitudinal musculature well developed. Vitellaria cortical, in dorsal and ventral bands. Testes in single field.



Figs 43-52. (43) *Nomimoscolex matogrossensis* scolex (from CHAMBRIER *et al.* 1996). Scale bar 0.25 mm; (44) *Nomimoscolex matogrossensis* transverse section of proglottis at level of testes and uterus (from CHAMBRIER *et al.* 1996). Scale bar 0.5 mm; (45) *Nomimoscolex piracatinga* scolex (from WOODLAND 1935b). Scale bar 0.1 mm; (46) *Nomimoscolex piracatinga* transverse section of proglottis anterior to cirrus pouch (from WOODLAND 1935b). Scale bar 0.1 mm; (47) *Nomimoscolex piracatinga* transverse section of proglottis at level of ovary (from WOODLAND 1935b). Scale bar 0.1 mm; (48) *Nomimoscolex emarginatum* scolex (from REGO 1984b). Scale bar 0.5 mm; (49) *Nomimoscolex emarginatum* proglottid (from REGO 1984b). Scale bar 0.4 mm; (50) *Nomimoscolex woodlandi* contracted scolex (from REGO 1984b). Scale bar 0.4 mm; (51) *Nomimoscolex woodlandi* expanded scolex (from REGO 1984b). Scale bar 0.4 mm; (52) *Nomimoscolex woodlandi* proglottid (from REGO 1984b). Scale bar 0.4 mm. (ap) Apical organ, (cc) mass of chromophil cells, (cg) cells with granular content, (do) dorsal osmoregulatory canal, (DV) dorsal longitudinal osmoregulatory canal, (lm) longitudinal muscle, (O) ovary, (sc) secondary canals ending in tegument, (T) testes, (us) uterine stem, (UT) uterus, (VIT) vitelline glands, (vo) ventral osmoregulatory canal, (VV) ventral longitudinal osmoregulatory canal.

Type and only-species: *H. kaparari* (Woodland, 1935) Rego, 1987 (Fig. 123).

Synonym: Nomimoscolex kaparari Woodland, 1935.

Strobila 30 x l. Scolex 0.585 x 0.819, suckers 0.585 x 0.386. About 100 segments, mostly broader than long. Longitudinal musculature regular, with small bundles of fibres. Testes about 100. Uterus diverticula small. Hosts: *Brachyplatystoma vaillanti* Isla Tres Canos, delta of Orinoco river, Venezuela (BROOKS & RASMUSSEN 1984), *Pseudoplatystoma tigrinum*. Manaus, Amazonas, Brazil (WOODLAND 1935b) and *P. corruscans*, Salobra and Cuiabá rivers, Mato Grosso, Pirapora, Minas Gerais and Barra do Rio Grande, Bahia, Brazil (REGO 1987b, 1990).

Houssayela Rego, 1987

Diagnosis: Large worms 85 x 2.9. Scolex small, rim of each lateral sucker with four horn-like projections, two on each side, making sixteen in total (Fig. 7). Strobila with numerous segments, most broader than long. Longitudinal musculature well developed. Gonads medullary, some vitelline follicles in medulla, but most cortical. Uterus with numerous diverticula. Vitellaria in transverse section crescent-shaped.

Type and only species: *H. sudobim* (Woodland, 1935) Rego, 1987 (Fig. 7).

Synonyms: *Myzophorus sudobim* Woodland, 1935; *Nomimoscolex woodlandi* Freze, 1965.

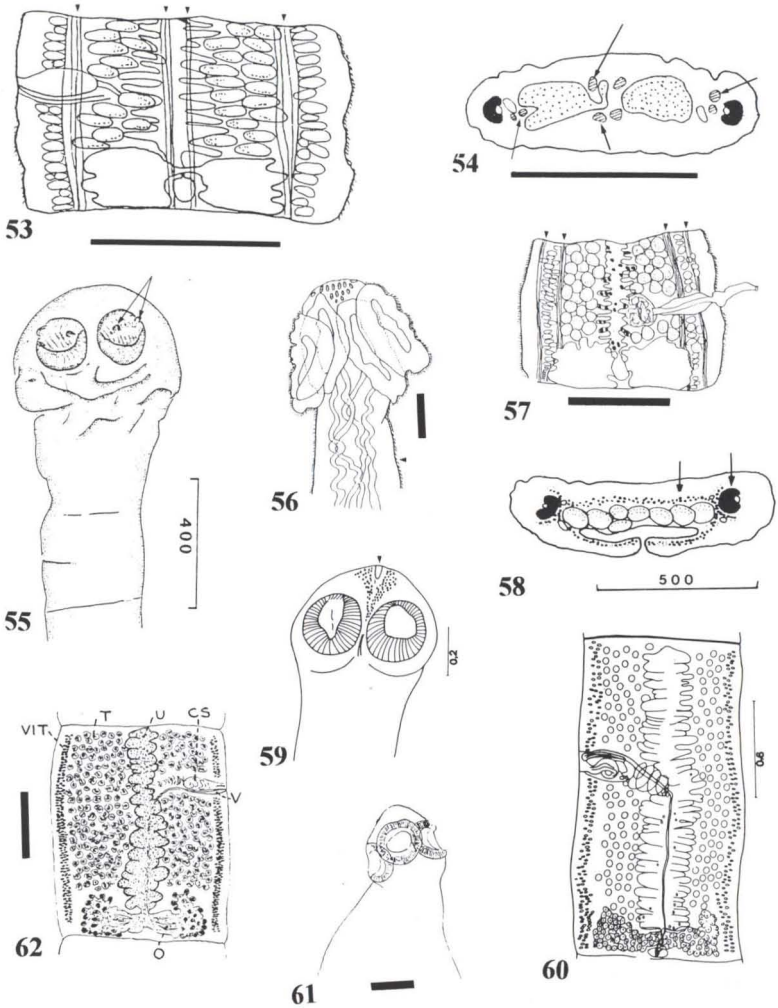
Strobila 85 x 2.9 flattened. Scolex, 0.40 x 0.26; each sucker has on each side two horn-like projections. Numerous segments, mostly broader than long, except the terminal ones. Longitudinal musculature well developed, large bundles of fibres. Testes about 150. Ovarian follicules diffuse. Uterus with numerous diverticula. Vitellaria crescent-shaped in transverse section, paramuscular. Host: *Pseudoplatystoma fasciatus* Santarém, Pará, Brazil. WOODLAND (1935a); FREZE (1965); REGO (1987b).

Travassiella Rego & Pavanelli, 1987

Diagnosis: Filiform worms 26-90 long. Scolex with prominent suckers directed laterally (Fig. 124). Longitudinal musculature inconspicuous, thus division between medulla and cortex difficult to discern so uncertain whether gonads and uterus medullary. No vitellaria observed by the original authors (Fig. 8), but more recent examination shows presence of inconspicuous vitelline follicles, which do not stain clearly, in gravid proglottids (Fig. 9).

Type and only species: *T. avitellina* Rego & Pavanelli, 1987 (Figs 9, 124).

Strobila 25-90. Scolex 0.41 x 0.49, suckers 0.114, prominent (Fig. 124). About 150 segments, more or less square. Genital pores open in anterior third of proglottis. About 100 testes. Uterus with few diverticula. Vitellaria not observed by REGO & PAVANELLI (1987) (Fig. 8), but recent examinations show the presence of inconspicuous vitelline follicles, which do not stain clearly, in gravid proglottids (Fig. 9). Host: *Paulicea luetkeni*, Itaipu and Porto Rico, Paraná, Salobra, Mato Grosso and Pirassununga, São Paulo, Brazil. REGO & PAVANELLI (1987).



Figs 53-62. (53) *Nomimoscolex microacetabula* proglottid; 4 pairs of longitudinal muscle bundles arrowed (from PERTIERRA 1995). Scale bar 0.5 mm; (54) *Nomimoscolex microacetabula* transverse section of proglottid; 4 pairs of longitudinal muscle bundles arrowed (from PERTIERRA 1995). Scale bar 0.5 mm; (55) *Nomimoscolex alovarius* scolex, two small papillae arrowed (from BROOKS & DEARDORFF 1980); (56) *Nomimoscolex pimelodi* scolex, spinose surface arrowed (from PERTIERRA 1995). Scale bar 50 mm; (57) *Nomimoscolex pimelodi* proglottid, note spinose surface, muscle bundles arrowed (from PERTIERRA 1995). Scale bar 0.5 mm; (58) *Nomimoscolex pimelodi* transverse section, vitellaria lateral (arrowed), muscle in bundles (arrowed) (from PERTIERRA 1995); (59) *Nomimoscolex admonticellia* scolex, apical organ arrowed (from REGO 1992); (60) *Nomimoscolex admonticellia* gravid proglottid (from REGO 1992); (61) *Nomimoscolex lenha* scolex (from WOODLAND 1933c). Scale bar 0.1 mm; (62) *Nomimoscolex lenha* proglottid. (from WOODLAND 1933c). Scale bar 1.0 mm. (CS) Cirrus sac, (O) ovary, (T) testes, (U) uterus, (V) vagina, (VIT) vitelline glands.

Crepidobothrium Monticelli, 1900

Diagnosis: Scolex well-defined. Suckers inverted heart-shaped (Fig. 125). Testes in two lateral fields (in immature proglottids) (Fig. 10). Ovary bilobed, near posterior margin of proglottid. Uterus median, with lateral branches.

Only species in fish: *C. eirasi* Rego & Chambrier, 1995 (Figs 125, 10).

Worms 2-8.5 long. Scolex massive 0.495-0.99. Four inverted-heart shaped suckers 0.19-0.41 (Fig. 24). Seven-12 segments with a posterior appendix on each side (Fig. 10). Mature proglottids square, gravid proglottids longer than wide (Fig. 10). Internal musculature weakly developed, forming small bundles, most visible laterally. Testes, 21-51. Ovary bilobed. Uterus preformed (i.e. formed in immature proglottis); few diverticula developed. Eggs with polar structures. Host: *Phractocephalus hemiliopterus* Amazon river, Brazil. REGO & CHAMBRIER (1995).

Proteocephalus Weinland, 1858

Synonym: *Ichthyotaenia* Lönnberg, 1894.

Diagnosis: Scolex with four lateral suckers (Fig. 19), a fifth, apical sucker or glandular area may be present (Figs 11, 126). Reproductive organs and vitellaria medullary, vitellaria lateral (Fig. 28). Testes in continuous field through proglottids (Figs 21, 24). Uterus median, with lateral diverticula (Figs 15, 26).

Astronotus ocellatus*, *Astronotus* sp. and *Geophagus brasiliensis

P. gibsoni Rego & Pavanelli, 1992 (Fig. 11).

Synonym: *P. ocellatus* Rego & Pavanelli, 1990. RUDOLPHI (1802) used the name *Taenia ocellata* (now *P. percae*) for a European species, so REGO & PAVANELLI (1991) suggested *P. gibsoni*.

Worms 23-58 x 1.35. Scolex large, sulcate, 0.618 x 0.918, with apical sucker (Fig. 11). Segments broader than long. Longitudinal musculature strong, bundles regular. Genital atrium in anterior third of proglottis. Cirrus pouch small. Testes, less than 100. Ovary bilobed. Uterus with 7-12 diverticula. Santa Tereza, Espírito Santo (*G. brasiliensis*), Maicuru, Pará (*Astronotus* sp.) and Manaus, Amazon river (*A. ocellatus*), Brazil. REGO & PAVANELLI (1990).

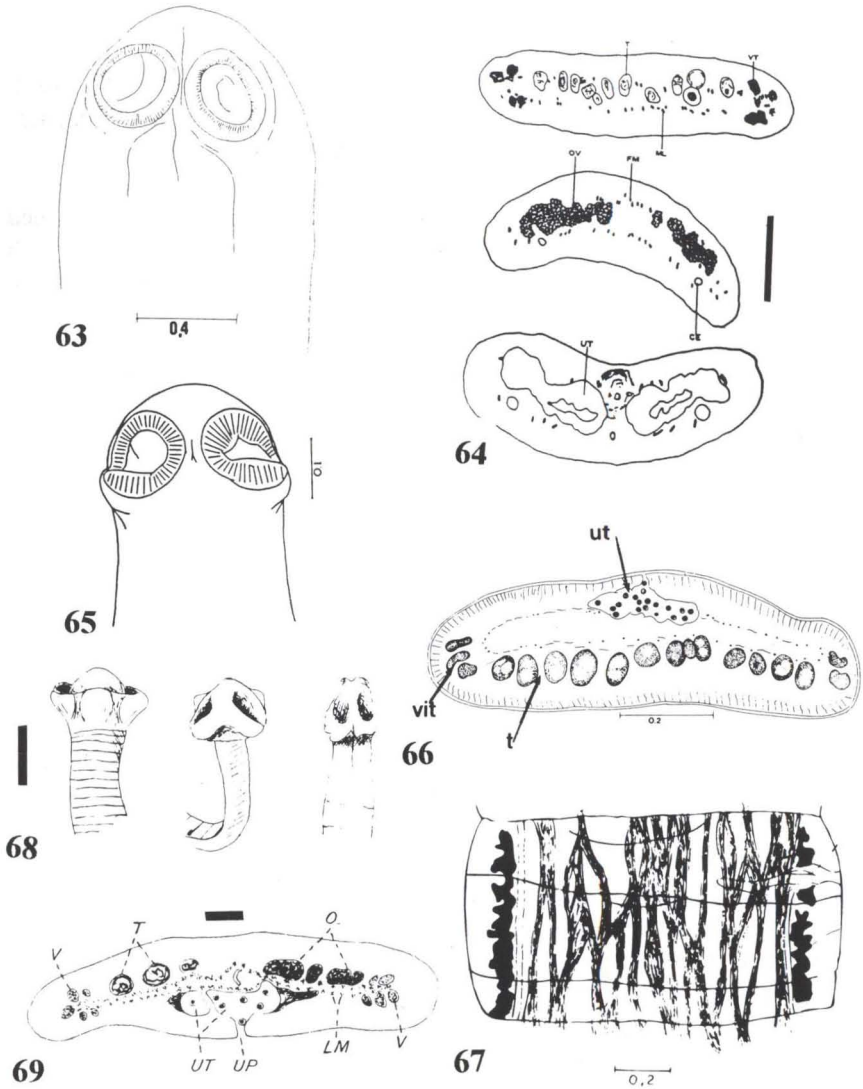
Basilichthys microlepidotus

P. macdonaghi (Szidat & Nani, 1951) Yamaguti, 1959

Figs 12, 13

Synonym: *Ichthyotaenia macdonaghi* Szidat & Nani, 1951.

Worms 15 x 0.25, strobila with 18-20 segments. Scolex 0.40 wide, four lateral suckers 0.16 diameter, no apical sucker. Genital pores unilateral, opening in anterior half of proglottis. Testes 40-60. Lateral vitelline follicles post-poral, reaching only to the level of cirrus pouch (Fig. 12). Uterine diverticula 8-9. Eggs with knobs (Fig. 13). Argentina (locality not given). SZIDAT & NANI (1951); YAMAGUTI (1959); FREZE (1965).



Figs 63-69. (63) *Nomimoscolex lopesi* scolex (from REGO 1989); (64) *Nupelia portoriquensis* transverse sections of proglottid, showing testes (upper), ovary (middle) and uterus (lower) (from PAVANELLI & REGO 1991). Scale bar 0.25 mm; (65) *Nupelia portoriquensis* scolex (from PAVANELLI & REGO 1991). Scale bar 0.1 mm; (66) *Monticellia species* transverse section to show cortical genitalia: (t) testes, (ut) uterus, (vit) vitelline glands (original); (67) *Monticellia loyolai* proglottid showing strongly developed longitudinal muscle bundles (from PAVANELLI & SANTOS 1992); (68) *Monticellia megacephala* scolex, different aspects (from WOODLAND 1934c). Scale bar 0.5 mm; (69) *Monticellia megacephala* transverse section of proglottid (from WOODLAND 1934c). Scale bar 0.1 mm. (CE) Longitudinal osmoregulatory canal, (FM & ML) longitudinal muscle bundles, (LM) longitudinal muscle, (O/OV) ovary, (T) testes, (UP) uterine pore, (UT) uterus, (V/VT) vitelline glands.

Brachyplatystoma vaillanti

P. piramutab (Woodland, 1933) Rego, 1984

Figs 14, 15

Synonym: *Anthobothrium piramutab* Woodland, 1933.

Strobila 60 x 1.23. Scolex with a central pillar bearing the four phyllidea-like suckers, with the form of a cup-handle (Fig. 14). Apical gland present. Segments very numerous. Gravid proglottids longer than broad (Fig. 15). Longitudinal muscle fibres scattered. Testes 80. Ovary bilobed. In transverse section vitellaria as two semi-circles. Uterine diverticula numerous. Amazon river, Brazil. WOODLAND (1933b); REGO (1984a).

Cichla ocellaris* and *C. monoculus

P. macrophallus (Diesing, 1850) La Rue, 1914

Fig. 16

Synonyms: *Taenia macrophalla* Diesing, 1850; *Ichthyotaenia macrophalla* (Diesing, 1850) Riggenbach, 1896.

Description based on SCHOLZ *et al.* (1996b). Strobila 6 x 0.94. About 25-30 proglottids. Scolex indistinctly separated from strobila. Lateral sucker diameter 0.265-0.33, no apical sucker. Segments broader than long. Internal longitudinal musculature easily visible, comprising anastomosed fibres. Gravid proglottids not described by WOODLAND (1933a). Cirrus pouch elongate. Ovary bilobed, occupying 55-68% proglottis width. Vitelline follicles lateral, uninterrupted by vagina and cirrus pouch, not reaching anterior and posterior margins of segments in pregravid proglottids, converging posteriorly to almost reach ovarian lobes. Testes in two fields, 38-71. Uterus preformed in immature proglottids, sac-like, with 4-7 thin-walled diverticula; terminal proglottids with eggs shed, leaving thick-walled chambers. Eggs spherical 0.021-0.031, oncospheres not fully formed. Amazon river, Brazil. DIESING (1850); LA RUE (1914); WOODLAND (1933a). Sabanita, Rio Atabapo, Venezuela. SCHOLZ *et al.* (1996b), TAKEMOTO & PAVANELLI (1996).

P. microscopicus Woodland, 1935

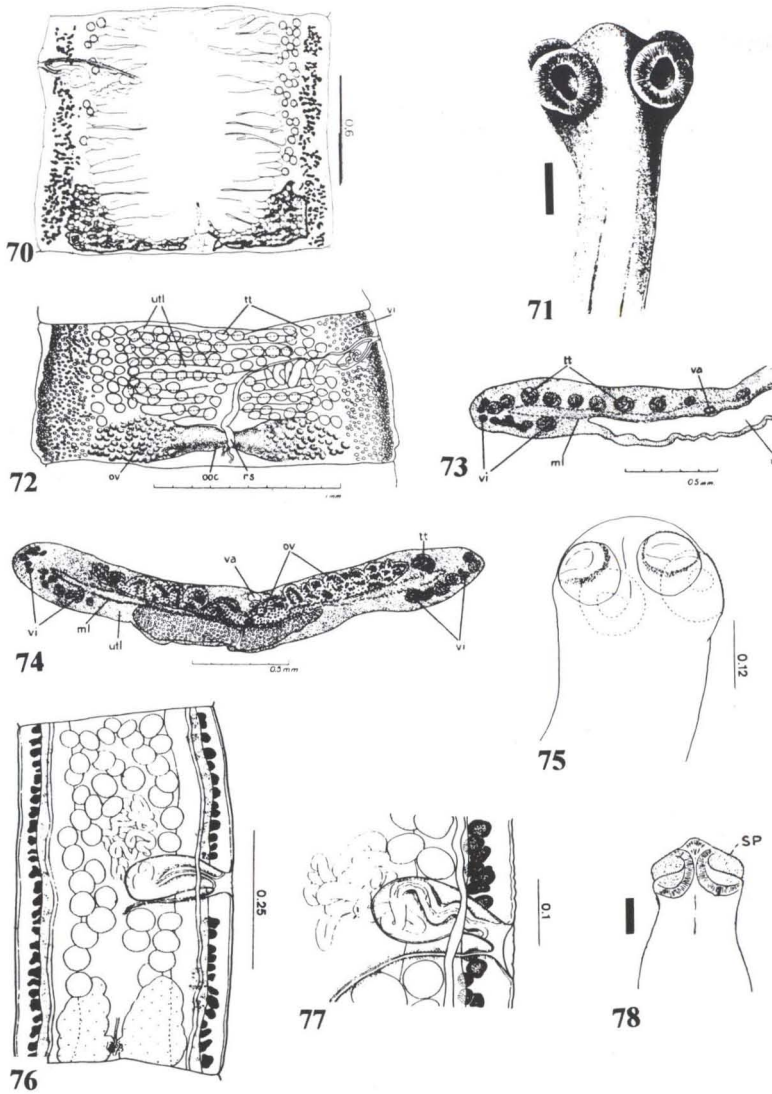
(Figs 17, 18)

Very small worms 1.54-2.02 x 0.26-0.41. With six segments (Fig. 17). Scolex: lateral suckers 0.139-0.175 x 0.109-0.117, no apical sucker. Longitudinal musculature not observed (Fig. 18). Testes 19-26. Ovary bilobed. Few vitelline follicles. Amazon river, Brazil. WOODLAND (1935c), TAKEMOTO & PAVANELLI (1996).

Geophagus brasiliensis

P. gibsoni Rego & Pavanelli, 1990

See under *Astronotus ocellatus* (Agassiz).



Figs 70-78. (70) *Monticellia belavistensis* gravid proglottid (from PAVANELLI *et al.* 1994); (71) *Monticellia coryphicephala* scolex (from MONTICELLI 1892). Scale bar 0.1 mm; (72) *Monticellia coryphicephala* gravid proglottid (from LA RUE 1914); (73) *Monticellia coryphicephala*: transverse section (from LA RUE 1914); (74) *Monticellia coryphicephala* transverse section, note regular longitudinal musculature (from LA RUE 1914); (75) *Spasskyellina mandi* scolex (from PAVANELLI & TAKEMOTO 1996); (76) *Spasskyellina mandi* mature proglottis (from PAVANELLI & TAKEMOTO 1996); (77) *Spasskyellina mandi* cirrus pouch and vagina, note posterior position of vagina (from PAVANELLI & TAKEMOTO 1996); (78) *Spasskyellina lenha* scolex (from WOODLAND 1933c). Scale bar 0.1 mm. (ml) Longitudinal muscles, (ooc) oocapt, (ov) ovary, (rs) seminal receptacle, (tt) testes, (ut) uterus, (utl) lateral uterine pouches, (va) vagina, (vi) vitelline glands.

Gymnotus carapo

P. chubbi Pavanelli & Takemoto, 1995

Fig. 19

Worms 77-144. Scolex small 0.27-0.32, well delimited from neck. Lateral suckers 0.10-0.11, no apical sucker (Fig. 19). Gravid proglottids longer than broad. Longitudinal musculature weakly developed, fibres irregularly scattered. Testes 73-112. Paraná river, Paraná, Brazil. PAVANELLI & TAKEMOTO (1995). CHAMBRIER & VAUCHER (1997) examined material of this species and concluded that vitellaria is cortical and consequently should be transferred to genus *Nomimoscolex*.

Hoplias malabaricus

P. regoi Chambrier, Scholz & Vaucher, 1996

Figs 20, 21

Worms 75-265. Scolex wider than neck, 0.525-0.875 (Fig. 20), apical organ small, sucker-like, with narrow and deep central pit 0.025-0.030 x 0.025-0.040. Suckers strongly muscular, 0.275-0.34. Neck growth zone very long. Segments acraspedote, immature and mature proglottids broader than long. Segments to about 240. Longitudinal muscles strong, anastomosed, genitalia medullary. Cirrus pouch elongate, pyriform. Testes, 88-144, in a single layer in two lateral fields joined anteriorly (Fig. 21). Ovary bilobed, follicular, occupying 60-66% of segment width. Uterus preformed, 9-25 branches on each side. Ripe eggs about 0.07 in diameter. Neembucu and Paraguari Provinces, Paraguay. CHAMBRIER *et al.* (1996).

Luciopimelodus pati

P. fossatus (Riggenbach, 1895) La Rue, 1911

Figs 22, 23

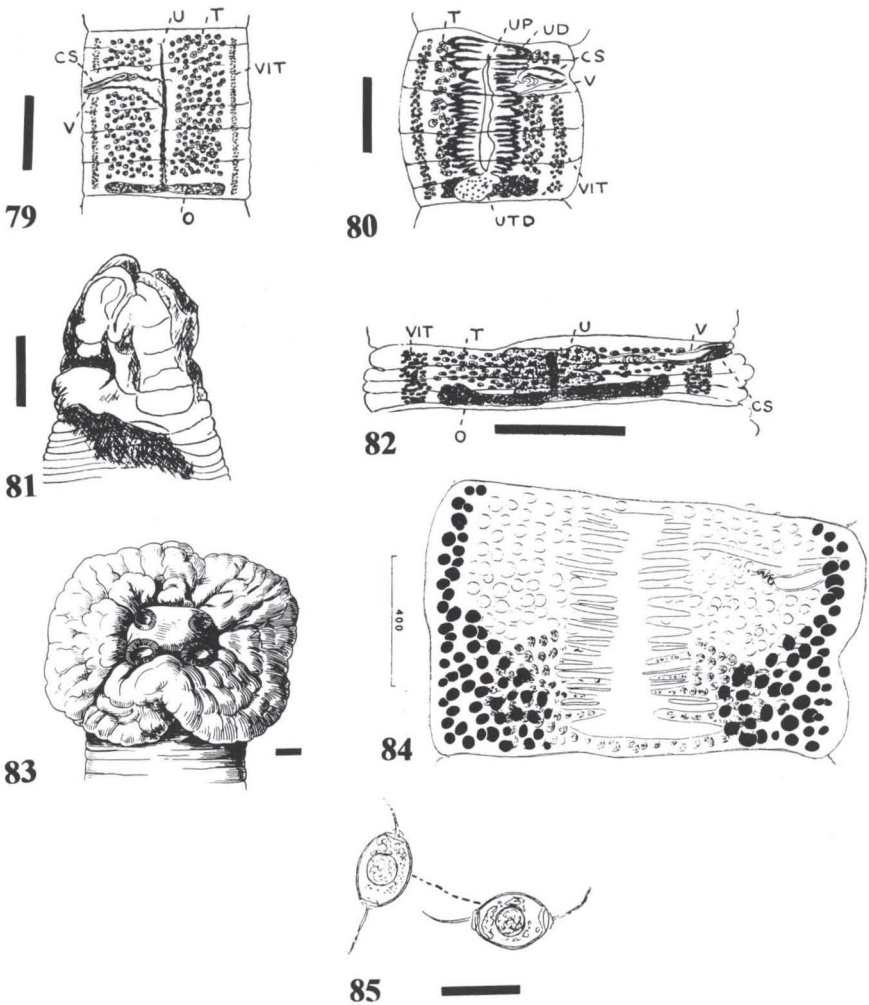
Synonym: *Ichthyotaenia fossata* Riggenbach, 1895. RIGGENBACH (1896, p. 166) used "nov. spec." although he described the species in 1895..

Strobila, 35-40. Scolex relatively large, well-delimited from neck. Lateral suckers strong, 0.34 mm. Apical gland present (Fig. 22). Longitudinal musculature weakly developed. Testes, 120-150. Vagina with sphincter muscle. Genital pores tend to open unilaterally. Paraguay river, Paraguay. RIGGENBACH (1895, 1896), LA RUE (1911, 1914).

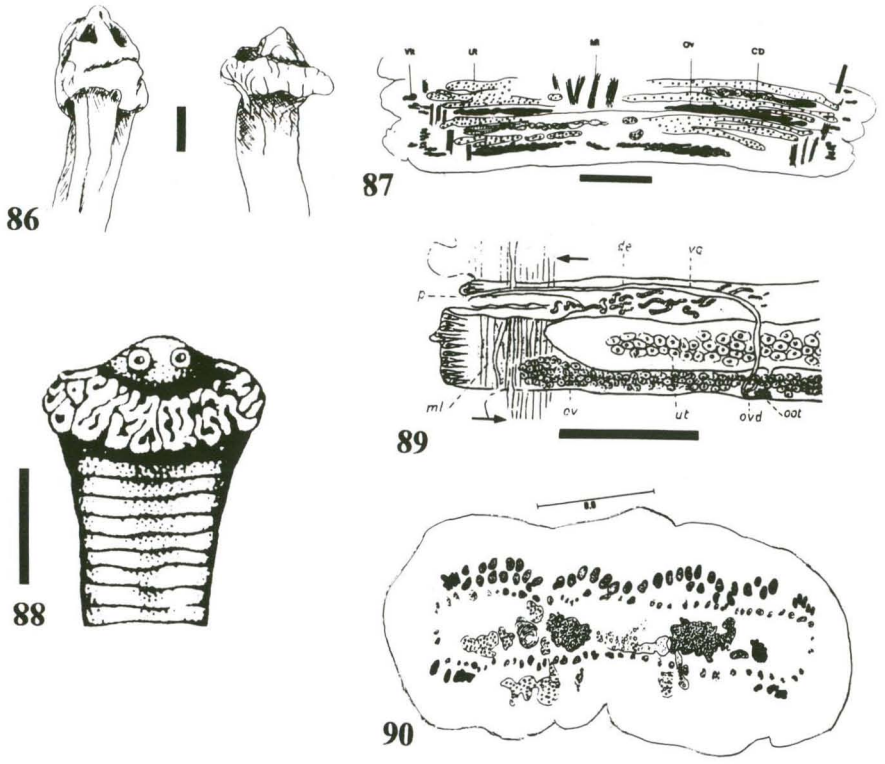
Megalodoras irwini* and *Pseudodoras niger

P. kuyukuyu Woodland, 1935 **species inquirenda**

Worms described by Woodland immature and resembled a nematode. Scolex 0.13-0.25, with an apical cap, suckers 0.073-0.095. Numerous irregular segments, broader than long. Longitudinal musculature large fibres, not well-defined. Pseudodoras niger Valenciennes and *P. ? brunnescens* [see page 620 WOODLAND (1935c), fish species unknown to us]. Codajas and Manaus, Amazon river, Amazonas, Brazil (*Pseudodoras niger* Valenciennes) and Delta del Orinoco, Venezuela (*Megalodoras irwini* Eigenmann). WOODLAND (1935c), BROOKS & RASMUSSEN (1984).



Figs 79-85. (79) *Spasskyellina lenha* mature proglottid (from WOODLAND 1933c). Scale bar 0.5 mm; (80) *Spasskyellina lenha* gravid proglottid, note uterine slit (from WOODLAND 1933c). Scale bar 0.5 mm; (81) *Othinoscolex lenha* scolex (from WOODLAND 1933c). Scale bar 0.5 mm; (82) *Othinoscolex lenha* gravid proglottid (from WOODLAND 1933c). Scale bar 0.5 mm; (83) *Goezeella siluri* scolex (from FUHRMANN 1930). Scale bar 0.1 mm; (84) *Goezeella siluri* gravid proglottid (from BROOKS & DEARDORFF 1980); (85) *Goezeella siluri* eggs with filaments (from WOODLAND 1933b). Scale bar 25 mm. (CS) Cirrus sac, (O) ovary, (T) testes, (U) uterus, (UD) uterine diverticula, (UP) uterine slit, (UTD) uterine duct, (V) vagina, (VIT) vitelline glands.



Figs 86-90. (86) *Amphoteromorphus parkamoo* scolex, two views (from WOODLAND 1935b). Scale bar 0.25 mm; (87) *Peltidocotyle rugosa* proglottids (from REGO & PAVANELLI 1987). Scale bar 0.4 mm; (88) *Ephedrocephalus microcephalus* scolex (from MOLA 1906). Scale bar 0.5 mm; (89) *Ephedrocephalus microcephalus* proglottid, note strong longitudinal muscle (arrowed) (from MOLA 1906). Scale bar 1.0 mm; (90) *Jauella glandicephalus* transverse section (from REGO & PAVANELLI 1985). (CD) Vas deferens, (de) vas deferens, (Ml) longitudinal muscle, (ml) longitudinal muscle, (oot) ootype, (Ov) ovary, (ovd) oviduct, (p) cirrus, (Ut) uterus, (vg) vagina, (Vit) vitelline glands.

Paulicea luetkeni

P. sophiae Chambrier & Rego, 1994

Figs 126, 24

Worms 60-100. Scolex with conical apical glandular region 0.525 -0.67 (Fig. 126). Sucker diameter 0.30, with two very small protuberances in each. About 200 segments, longer than broad. Internal longitudinal musculature well developed, forming bundles. Cirrus pouch long, angled (Fig. 26). Vitellaria paramuscular, postporal (no follicles anterior to cirrus pouch). Testes. 83-141. Uterine diverticula 35-45. Itacoatiara, Amazon river, Brazil. CHAMBRIER & REGO (1994).

Piaractus mesopotamicus

P. vazzolerae Pavanelli & Takemoto, 1995

Figs 25, 26

Worms 134-367 long. Scolex with apical sucker (Fig. 25) 0.60-0.69. Lateral suckers 0.21-0.24. Segments broader than long. Musculature well developed, longitudinal, transverse and dorsoventral fibres obvious. Testes 230-300. Uterus preformed, with about 16 diverticula. Paraná river, Paraná, Brazil. PAVANELLI & TAKEMOTO (1995).

Pimelodus clarias

P. magna (Rego, Santos & Silva, 1974) **comb.n.**

Figs 27, 28

Synonym: *Nomimoscolex magna* Rego, Santos & Silva, 1974.

Previously **species inquirenda**. Worms 50. Scolex 0.672 x 0.756, suckers 0.364, no apical organ (Fig. 27). Segments square or longer than wide. Vitelline follicles mostly medullary, but some follicles paramuscular Testes, 150-200. Ovary biwinged. Twenty five uterine diverticula. Sections of proglottids were not described by the original authors, but recently sections prepared by Chambrier confirmed the species as Proteocephalus. Porto Esperanca, Mato Grosso, Brazil. REGO *et al.* (1974). CHAMBRIER & VAYCHER (1997) reexamined the type material of this species and concluded that is a composite species, specimens of Proteocephalus mixed with Monticellia; they proposed the name *Monticellia magna* (Rego, Santos & Silva, 1974) **comb.n.**, but they failed to name the *Proteocephalus* specimens.

Platydoras costatus

P. renaudi Chambrier & Vaucher, 1994

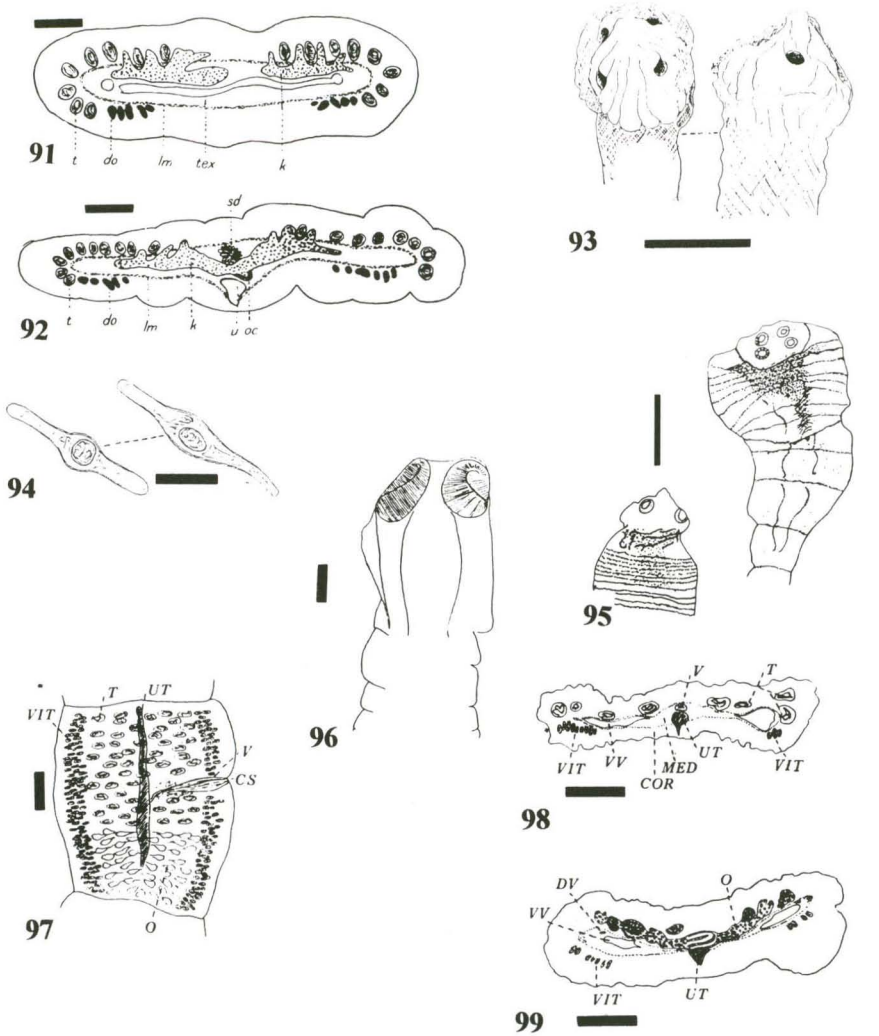
Figs 29, 30

Worms 120-480. Scolex 0.205-0.340, not well-delimited from neck, without apical organ (Fig. 29). Lateral suckers 0.07-0.11. About 160 segments. Mature and gravid proglottids longer than wide. Longitudinal musculature regular. Testes 124 to 276. Vitellaria paramuscular. Uterus preformed, with 52-88 diverticula, with subsidiary outpockets to the diverticula. Eggs with appendix and elongate external membrane (Fig. 30). General Diaz, Paraguay. CHAMBRIER & VAUCHER (1994).

P. soniae Chambrier & Vaucher, 1994

Fig. 31

Strobila 84-145. Scolex not well-delimited from neck, 0.19-0.245. Lateral suckers 0.08-0.10, apical organ present (Fig. 31). About 145 segments. Mature proglottids broader than long, gravid ones longer than broad. Longitudinal musculature regular. Testes 139-371, in two fields. Uterus preformed, 29-40 diverticula. General Diaz, Paraguay. CHAMBRIER & VAUCHER (1994).



Figs 91-99. (91) *Rudolphiella lobosa* transverse section, note testes (t) in dorsal cortex and vitelline glands (do) in ventral cortex (from FUHRMANN 1916). Scale bar 0.1 mm; (92) *Rudolphiella lobosa* transverse section, note ovary (k) mostly medullary, partly cortical (from FUHRMANN 1916). Scale bar 0.1 mm; (93) *Rudolphiella myoides* scoleces (from WOODLAND 1934a). Scale bar 0.5 mm; (94) *Rudolphiella myoides* spindle-shaped eggs (from WOODLAND 1934a). Scale bar 0.02 mm; (95) *Spatulifer piramutab* scolex and anterior of body (modified from WOODLAND 1933b). Scale bar 1.0 mm; (96) *Spatulifer piracatinga* scolex (from WOODLAND 1935b). Scale bar 0.1 mm; (97) *Spatulifer piracatinga* proglottid (from WOODLAND 1935b). Scale bar 0.1 mm; (98) *Spatulifer piracatinga* transverse section of proglottis anterior to ovary (from WOODLAND 1935b). Scale bar 0.1 mm; (99) *Spatulifer piracatinga* transverse section in region of ovary (from WOODLAND 1935b). Scale bar 0.1 mm. (COR) Cortes, (CS) cirrus sac, (do) vitelline glands, (DV) dorsal osmoregulatory canal, (MED) medulla, (oc) oocapt, (k/O) ovary, (lm) longitudinal muscle, (sd) Mehlis gland, (t/T) testes, (tex) transverse duct of osmoregulatory system, (u/UT) uterus, (V) vagina, (VIT) vitelline glands, (VV) ventral osmoregulatory canal.

Pseudodoras niger

P. kuyukuyu Woodland, 1935 **species inquirenda**

See under *Megalodoras irwini* Eigenmann and *Pseudodoras niger* Valenciennes above.

***Pseudoplatystoma* sp.**

P. platystomi Lynsdale, 1959

Figs 32, 33

Strobila, 45 x 1.21. Scolex and neck with small longitudinal grooves (rudimentary metascolex ?), large 1.25 x 0.87 mm (Fig. 32). Lateral suckers 0.42-0.48 x 0.32. Longitudinal muscle bundles very slender. Genital pore at anterior half of proglottis. Testes 30-50. Cirrus pouch 0.31 x 0.10. Eggs fused in pairs (Fig. 33). Amazon river, Brazil. LYNSDALE (1959).

Rhamdia sapo

P. bagri Spector & Garzon, 1988

Figs 34, 35

Strobila 80 x 0.52. Scolex 0.2 x 0.15, well-delimited from neck. Suckers relatively large in relation to size of scolex, 0.105 x 0.05-0.072. Mature and gravid proglottids longer than broad. Testes 71 to 89. Uterus with 34 to 48 diverticula. Laguna del Sauce, Maldonado, Uruguay. SPECTOR & GARZON (1988).

P. rhamdiae Spector & Garzon, 1988

Figs 36, 37

Strobila 112 x 0.66-1.05. Scolex small 0.235 x 0.154. Suckers round 0.131, neck very long. Segments broader than long or rectangular. Testes 109 – 137. Uterus with 17-26 diverticula. Laguna del Sauce and laguna del Diario, Maldonado, Uruguay. SPECTOR & GARZON (1988).

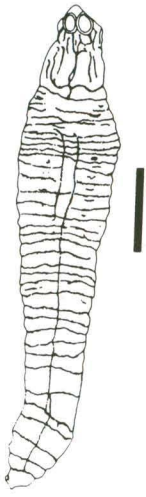
***Rhamdia* sp.**

P. jandia Woodland, 1934

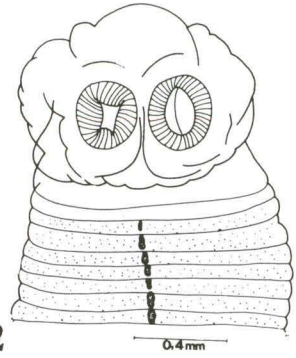
Figs 38, 39

Strobila slender 49 x 0.94. Scolex small 0.16 x 0.16; suckers large, no apical sucker. Segments broader than long. Longitudinal musculature absent (Fig. 39). Genital atrium opens at anterior third of proglottis. Testes about 100. Cirrus pouch 0.20 x 0.049. Uterine diverticula numerous. Amazon river, Brazil. WOODLAND (1934c).

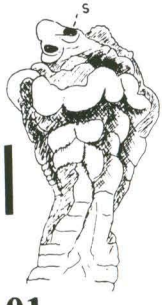
Figs 100-106. (100) *Spatulifer surubim* whole worm (partially redrawn from WOODLAND 1933a). Scale bar 1.0 mm; (101) *Woodlandiella myzofera* scolex (from WOODLAND 1933c). Scale bar 1.0 mm; (102) *Brooksiella praeputialis* scolex (original). Scale bar 0.4 mm; (103) *Brooksiella praeputialis* gravid proglottid (original); (104) *Brooksiella praeputialis* egg (original). Scale bar 0.02 mm; (105) *Mariauxiella pimelodi* scolex, showing banana-shaped sphincter muscles, arrowed (from CHAMBRIER & REGO 1995). Scale bar 0.5 mm; (106) *Corallotaenia intermedia* scolex (from FRITTS 1959). Scale bar 0.5 mm. (S) Sucker.



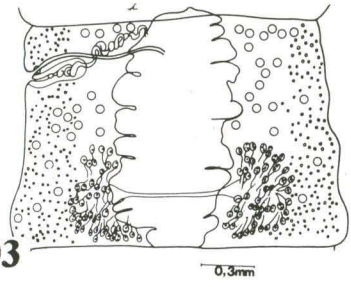
100



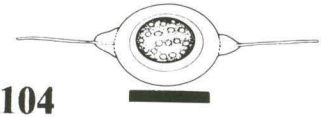
102



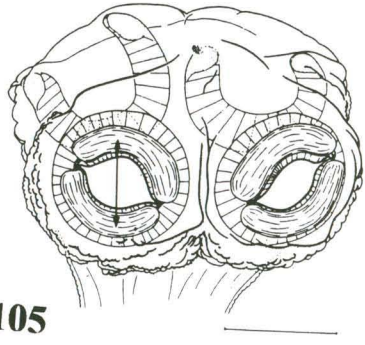
101



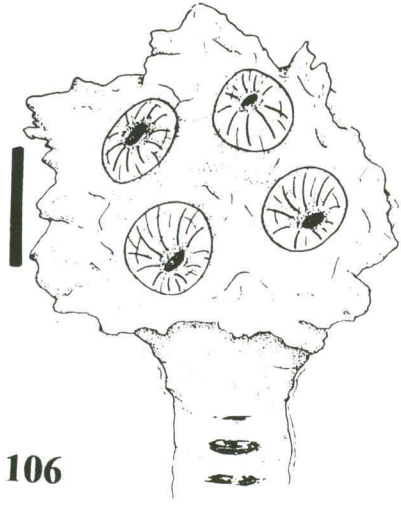
103



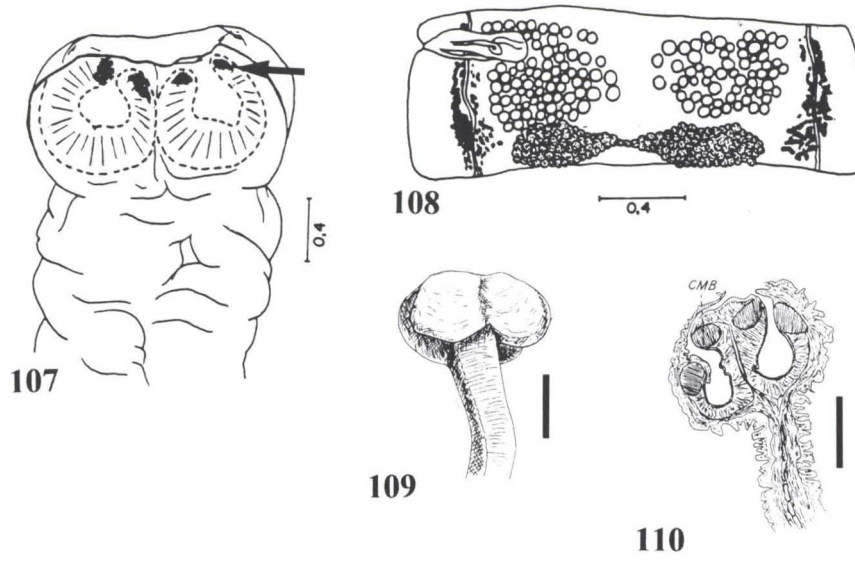
104



105



106



Figs 107-110. (107) *Megathylacus travassosi* scolex, sphincter arrowed (from PAVANELLI & REGO 1992). Scale bar 0.4 mm; (108) *Megathylacus travassosi* proglottid (from PAVANELLI & REGO 1992); (109) *Megathylacus jandia* scolex (from WOODLAND 1934c). Scale bar 1.0 mm; (110) *Megathylacus jandia* section of scolex: (CMB) sphincter muscles (from WOODLAND 1934c). Scale bar 1.0 mm.

Serrasalmus nattereri and *S. spilopleura*

P. serrasalmus Rego & Pavanelli, 1990

Fig. 40

Worms 25-45 x 0.98. Scolex globous, small, 0.292-0.409 mm. Lateral suckers prominent 0.216, no apical sucker (Fig. 40). Segments square. Longitudinal musculature inconspicuous, but there are transverse fibres. Testes 80, in two separate fields. Ovary bilobed. Uterus partly cortical. Paraná river (*S. spilopleura*) Salobra, Mato Grosso (*S. nattereri*), Brazil. REGO & PAVANELLI (1990).

Cangatiella Pavanelli & Santos, 1991

Diagnosis: Scolex with rounded apical dome, well-delimited from strobila, four lateral suckers round. Vitellaria cortical, not extending laterally beyond the longitudinal osmoregulatory canals; some follicles intrude into the longitudinal muscle layer (paramuscular) (Fig. 41). Central axis of uterus medullary, but diverticula extend into cortex. Eggs with polar filaments.

Type and only species: *C. arandasi* Pavanelli & Santos, 1991 (Figs 41, 42).

Strobila 64-102 x 1.35. Scolex 0.26-0.43, lateral suckers diameter 0.28-0.32 (Fig. 127). Strobila with 60-79 segments, longer than broad, with a longitudinal groove with transverse ones crossing. Vitelline follicles in several ranks (Fig. 42), not extending laterally beyond longitudinal osmoregulatory canals (Figs 41, 42).

Testes 111-183. Uterus with 8-9 diverticula. Host: *Parauchenipterus galeatus*. Itaipu and Porto Rico, Paraná river, Brazil. PAVANELLI & SANTOS (1991).

Nomimoscolex Woodland, 1934

Diagnosis: Scolex variable, apical gland present in some species (Fig. 128); lateral suckers round, with obvious orifice, minute spines (microtriches?) present around the suckers in a few species (Fig. 129). Segments usually longer than broad. Longitudinal musculature may be obvious or inconspicuous. Ovary, testes and uterus medullary (Fig. 44). Vitellaria lateral and cortical, rarely paramuscular (Fig. 44). Uterus mostly medullary, with diverticula. CHAMBRIER & VAUCHER (1997) revalidated the genus *Endorchis* Woodland, 1934 and redefined the genus Nomimoscolex; numerous synonymies were presented.

Brachyplatystoma filamentosum* and *B. flavicans

Type species: *N. piraeeba* Woodland, 1934 (Figs 128, 129).

Synonyms: *Endorchis piraeeba* Woodland, 1934; *Myzophorus dorad* Woodland, 1935; *Nomimoscolex dorad* (Woodland, 1935) Freze, 1965.

Worms 45 x 1.32-1.7. Scolex 0.54 x 0.60, apical organ present (Fig. 128); lateral suckers with minute spines (Fig. 129). Segments numerous, most broader than long. Longitudinal musculature with well-developed bundles of fibres. Testes 100-150, cirrus pouch small. Ovary medullary, with projections into the dorsal cortex. Vitellaria lateral, sometimes semi-crescentric, in dorsal and ventral cortex. Parintins, Óbidos, Santarém, Amazon river, Brazil. WOODLAND (1934c, 1935a); FREZE (1965), REGO (1991), REGO & PAVANELLI (1992b). CHAMBRIER & VAUCHER (1997) revalidated the genus *Endorchis* and the species *Endorchis piraeeba* Woodland, 1934.

See also *N. sudobim* Woodland, 1934 in *Brachyplatystoma flavicans* described under *Pseudoplatystoma corruscans* and *P. fasciatus* below.

Genidens genidens* (identification uncertain), *Tachysurus agassizi*, *T. barbus* and *T. upsulonophorus

N. arandasregoi Fortes, 1981 **species inquirenda**

Worms 110 x 2. Scolex 0.386-0.464 x 0.435-0.519, suckers 0.193. Segments of mature proglottids square, gravid longer than wide. Testes 215-240. Uterus with diverticula. No sections of proglottids studied. Guaíba estuary, Rio Grande do Sul, Brazil. FORTES (1981), REGO (1987b).

Hoplias malabaricus

N. matogrossensis Rego & Pavanelli, 1990

Figs 43, 44

Worms 29.4 x 1.37. Scolex small, globous, 0.28 diameter, lateral suckers 0.128 diameter (Fig. 43). Apical organ very conspicuous. Segments square. Longitudinal musculature inconspicuous. Testes 200; cirrus pouch small. Ovary bilobate. Vitellaria paramuscular (Fig. 44). Uterus with 20 diverticula. Salobra, Mato Grosso, Brazil; Concepcion and San Pedro Provinces, Paraguay. REGO & PAVANELLI (1990), CHAMBRIER *et al.* (1996).

Luciopimelodus pati

N. emarginatum (Diesing, 1856)

Figs 45-47

Worms 20 x 0.70. Scolex small, 0.199 x 0.22; lateral suckers 0.106 diameter (Fig. 45). Strobila about 50 segments, mostly longer than broad. No longitudinal muscle present (Figs 46, 47). Testes 150. Vitellaria crescent-shaped in transverse sections (Figs 65, 66). Uterus narrow. Amazon river, Brazil. WOODLAND (1935b). CHAMBRIER & VAUCHER (1997) transferred this species to Monticellia, renamed *Monticellia amazonica* **nom.n.** due the name piracatinga is occupied. However, these authors did not redescribed or give figures of the species.

Phractocephalus hemiliopterus

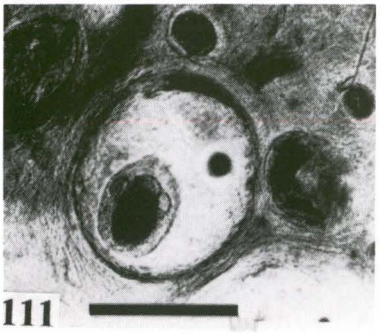
N. pirarara (Woodland, 1935) Rego & Pavanelli, 1992

Figs 48, 49

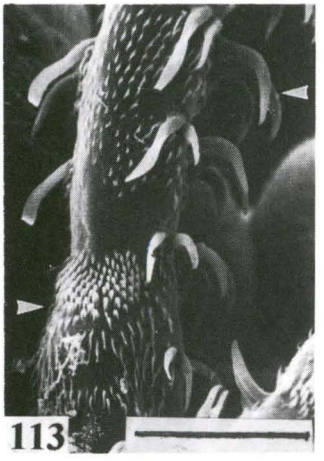
Synonyms: *Tetrabothrium emarginatum* Diesing, 1856; *Myzophorus pirarara* Woodland, 1935: *Nomimoscolex pirarara* (Woodland, 1935) Rego & Pavanelli, 1992.

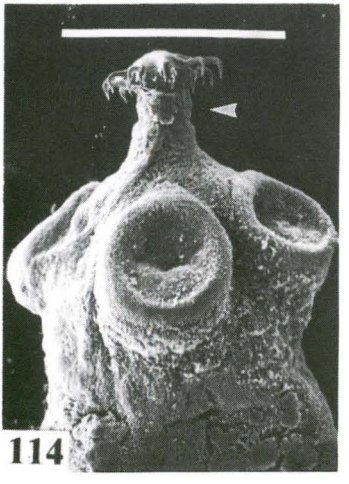
Worms 33 x 0.94. Scolex very variable, sometimes "inflated", as if a pseudo-metascolex, 0.42 x 0.53 (Fig. 48). Lateral suckers 0.22-0.34. Strobila very variable in form, expanded or contracted, segments usually longer than broad, with a laciniated posterior margin overlapping the anterior of the following segment (Fig. 49). Longitudinal muscle sparse, scattered irregularly. Testes 50-60. Cirrus pouch large. Cirrus with spines. Ovary bilobate, with projections into the dorsal cortex. Uterus narrow, with few diverticula. Vitellaria in ventral cortex. Amazon river, Brazil. DIESING (1856); WOODLAND (1935a); REGO (1984b), REGO & PAVANELLI (1992b). DIESING (1856) under the name *Tetrabothrium emarginatum* described this species, WOODLAND (1935) ignoring this paper, described this species, named *Myzophorus pirarara*. Recently we examined the paper of Diesing; the inspection of figure show clearly the velum of proglottids, characteristic of this species. CHAMBRIER & VAUCHER (1997) transferred this species to *Proteocephalus*, but did not redescribed or give figures; due to the homonimy with *Proteocephalus woodlandi* Moghe, 1926, they proposed the name *Proteocephalus hemiliopteri* **nom.n.**.

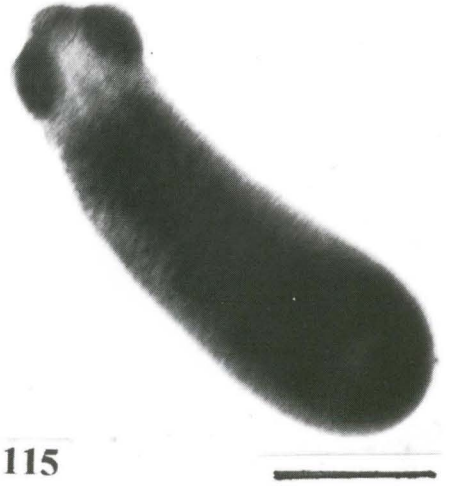
Figs 111-115. (111) Order Proteocephalidea encapsulated larva from peritoneum of Loricariichthys platymetopon, (original). Scale bar 0.2 mm; (112) Encapsulated larva of non-identified proteocephalid from parenchyma of Megathylacus sp., (original). Scale bar 0.1 mm; (113) *Pterobothrium crassicole* SEM metabasal (upper arrow) and basal armature (lower arrow) of tentacle of larva (from REGO 1987a). Scale bar 0.1 mm; (114) *Valipor campylancristrota* SEM scolex of larva, with armed rostellum (arrow) and four suckers (from CHUBB *et al.* 1987). Scale bar 0.1 mm; (115) *Scolex pleuronectis* larvae from a non identified host. Amazon estuary (original). Scale bar 0.2 mm.

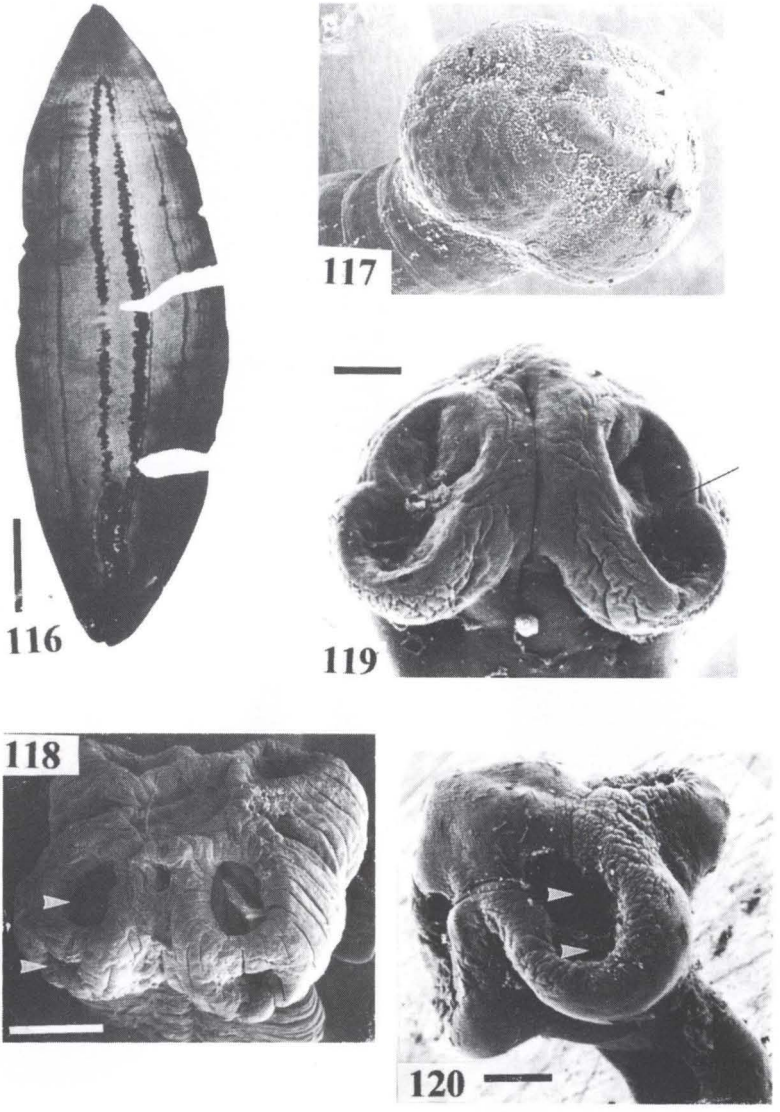

111


112


113


114


115



Figs 116-120. (116) *Nesolecithus janicki* adult, no segmentation, fusiform body (from REGO *et al.* 1974). Scale bar 10 mm; (117) *Bothriocephalus acheilognathi* Scolex of adult, note inverted-heart shape when viewed laterally, with apical disc (four arrowheads) and bothria (arrow with shaft) (original). Scale bar 0.2 mm; (118) *Zygobothrium megacephalum* SEM scolex, two openings (arrows to the single sucker cavity (original). Scale bar 1 mm; (119) *Chambriella paranaensis* SEM scolex, septum (arrow) (original). Scale bar 0.1 mm; (120) *Chambriella agostinhoi* SEM apical view of scolex, two loculi (arrows) (from PAVANELLI & SANTOS 1992). Scale bar 0.1 mm.

N. woodlandi (Rego, 1984) Rego & Pavanelli, 1992

Figs 50-52

Synonym: *Myzophorus woodlandi* Rego, 1984.

Worms 30 long. Scolex variable, contracted (Fig. 50) or expanded, 0.37 x 0.60 (Fig. 51) in life. Suckers prominent 0.252 x 0.144. Mature proglottids square, gravid ones longer than broad (Fig. 52). Longitudinal muscles fibres very small. Testes 70. Genital pores open in anterior third of segment. Ovary bilobate. Uterus with diverticula. Amazon river, Brazil. REGO (1984b), REGO & PAVANELLI (1992b). CHAMBRIER & VAUCHER (1997) transferred this species to *Proteocephalus*, but did not redescribe or figure the species.

Pimelodus albicans* and *P. clarias

N. microacetabula Pertierra, 1995

Figs 53, 54

Small worms 11 long. Scolex small, 0.143-0.220 x 0.198-0.242; apical glandular organ present. Spines on scolex and strobila. Longitudinal musculature in 4 pairs of bundles (Figs 53, 54). Testes 40-65. Cirrus pouch 0.220-0.253 x 0.066-0.132. Uterine diverticula 8-12. In transverse section vitellaria lateral (Fig. 54). La Plata river, Argentina. PERTIERRA (1995).

Pimelodus clarias

N. alovarius Brooks & Deardorff, 1980

Fig. 55

Worms 30 long. Scolex round 0.34-0.445; no apical organ. Suckers 0.135-0.179 x 0.142-0.155, each with two small papillae on anterior surface (Fig. 55). Mature segments 0.48-0.88 long x 0.33-0.37 wide. Testes, 40-61. Cirrus pouch piriform. Ovary biwinged. Uterus preformed, lateral diverticula numerous, to 30 on each side. Caldas, Colombia. BROOKS & DEARDORFF (1980).

N. pimelodi Pertierra, 1995

Figs 56-58

Small worms 14 long. Scolex small 0.165-0.220 x 0.143-0.220; apical glandular region present, lateral suckers spinose 0.110-0.165 x 0.055-0.110 (Fig. 56). Strobila spinose (Fig. 57). Longitudinal musculature regular, forming bundles (Fig. 58). Testes 41-81. Cirrus pouch 0.198-0.286 x 0.054-0.099. In transverse section vitellaria lateral (Fig. 58). La Plata river, Argentina. PERTIERRA (1995). CHAMBRIER & VAUCHER (1997) reexamined the type material and transferred this species to *Proteocephalus*.

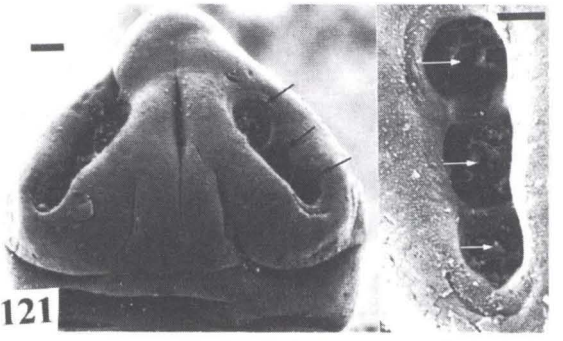
Pinirampus pirinampu

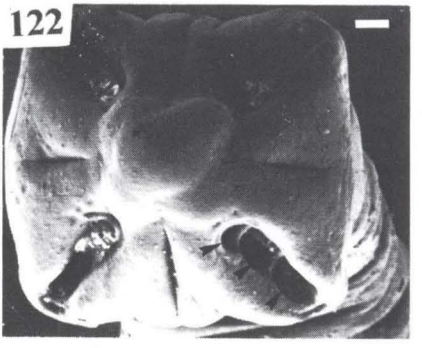
N. admonticellia (Woodland, 1934) Rego & Pavanelli, 1992

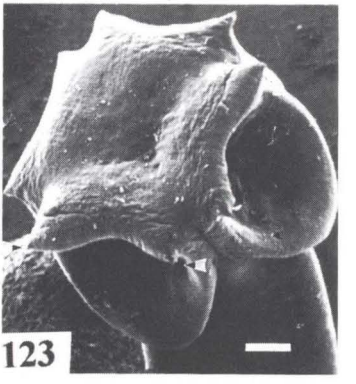
Figs 59, 60, 130

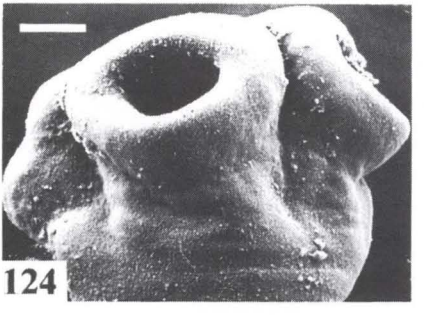
Synonym: *Myzophorus admonticellia* Woodland, 1934.

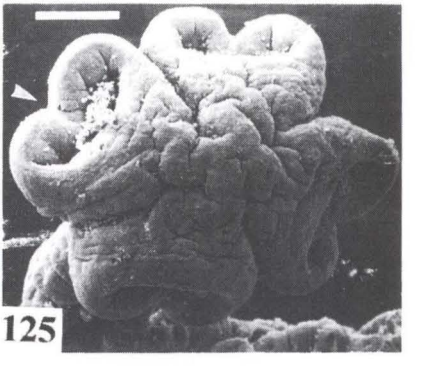
Worms, 52-100 x l. Scolex (Figs 59, 130) pleomorphic, with contracted and











Figs 121-125. (121) *Gibsoniela mandube* SEM lateral view of scolex, three loculi (arrows) (original). Insert shows aperture of single sucker, three loculi (also arrows) (original). Scale bars 0.1 mm; (122) *Gibsoniela mandube* SEM apical view of scolex (three loculi arrows) (original). Scale bar 0.1 mm; (123) *Harriscolex kaparari* SEM scolex, two projections of the apical cap above each sucker (arrows) (original). Scale bar 0.1 mm; (124) *Travassiella avitellina* SEM scolex (original). Scale bar 0.1 mm; (125) *Crepidobothrium eirasi* SEM scolex, notch of one inverted-heart- shaped sucker arrowed (from REGO & CHAMBRIER 1995). Scale bar 0.25mm.

expanded forms in living worms, 0.248-0.480; apical glandular organ present (Figs 130, 59). Segments of mature proglottids square, gravid ones longer than broad (Fig. 60). Longitudinal musculature inconspicuous, with few scattered fibres. Testes 300-400 (Woodland observed 200). Ovary with projection to dorsal cortex. Uterine diverticula numerous, 60 (Fig. 60). In transverse sections vitellaria crescent-shaped. Itacoatiara, Amazon river; Cuiabá river, Mato Grosso; Paraná river, Paraná and Paraguay river, Paraguay. WOODLAND (1934a), REGO & PAVANELLI (1992a).

Platystomatichthys sturio

N. lenha (Woodland, 1933) Woodland, 1935

Figs 61, 62

Synonym: *Proteocephalus lenha* Woodland, 1933; *Nomimoscolex lenha* (Woodland, 1933) Woodland, 1935.

Worms 130 x 2.59. Scolex small 0.16-0.28 x 0.190-0.280; lateral suckers 0.090-0.160 (Fig. 61). Segments longer than broad. Thin layer of circular muscles fibres. Testes 200. Uterine diverticula, 17-18, not strongly developed (Fig. 62). The "peixe-lenha" examined by Woodland could be *Sorubimichthys planiceps* (Agassiz). Amazon river, Brazil. WOODLAND (1933c).

Pseudoplatystoma corruscans*, *P. fasciatus* and *Brachyplatystoma flavicans

N. sudobim Woodland, 1935

Fig. 131

Synonym: *Myzophorus sudobim* Woodland, 1935.

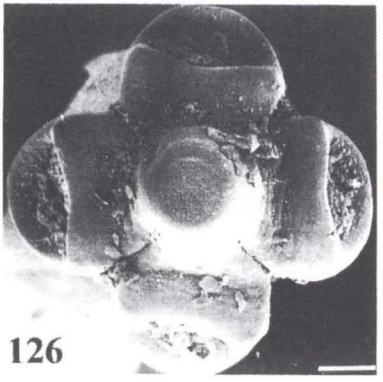
Worms 53 x 1.2. Scolex very small 0.116-0.149 x 0.199 (Fig. 131). Lateral suckers elongate 0.172 x 0.08, with minute spines on their edges (referred to by PAVANELLI & REGO (1992), but not described by WOODLAND (1935a). Secondary transverse grooves on segments. Gravid proglottids elongate. Thin layer of longitudinal muscular fibres with some bundles present. Testes 200-250. Cirrus pouch large 0.43 long. Ovary massive, bilobed. Uterine diverticula numerous. Vitellaria crescent-shaped in transverse section. *Pseudoplatystoma fasciatus* and *B. flavicans* Amazon river and *P. corruscans* Paraná river, Paraná. WOODLAND (1935a), REGO & PAVANELLI (1992).

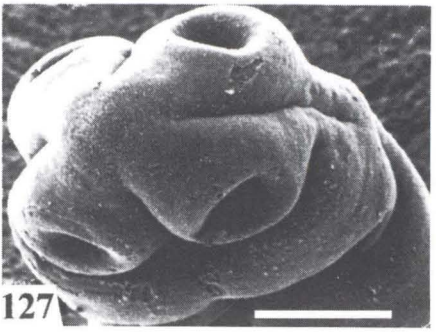
Pseudoplatystoma fasciatus

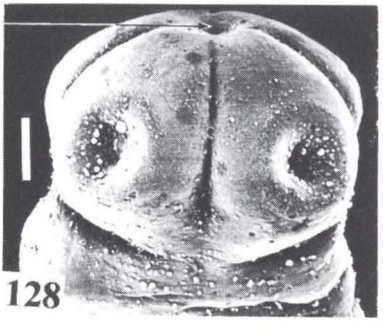
N. lopesi Rego, 1989

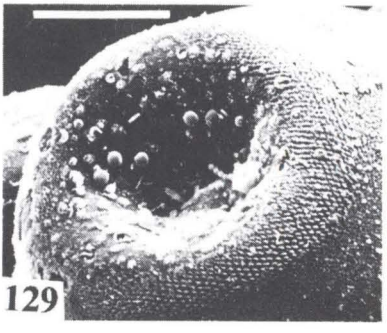
Fig. 63

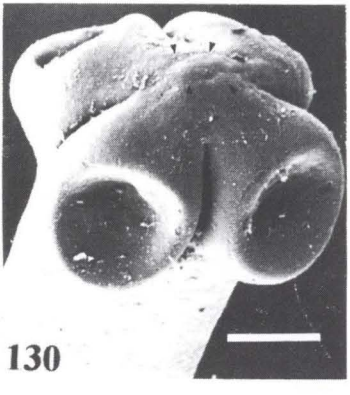
Worms 54.8 x 2.35. Scolex large 1.56 x.1.6; lateral suckers 0.509 x 0.546 (Fig. 63). Strobila about 80 segments, broader than long. Longitudinal musculature strong and regular. Testes numerous about 300. Cirrus pouch elongated. Uterus with about 25 well developed diverticula, similar in form to the uterus of mammalian Taenia species. Miranda and Cuiabá rivers, Mato Grosso, Brazil. REGO (1989).

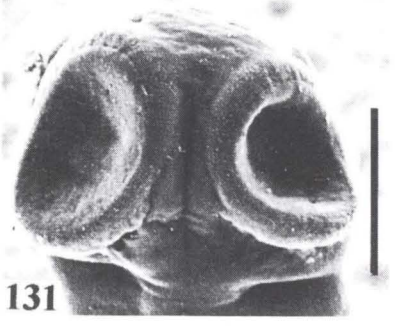












Figs 126-131. (126) *Proteocephalus sophiae* SEM scolex, note conical apical glandular region (from CHAMBRIER & REGO 1994). Scale bar 0.1 mm; (127) *Cangatiella arandasi* SEM of scolex (original). Scale bar 0.1 mm; (128) *Nomimoscolex piraeeba* SEM scolex, apical gland arrowed (original). Scale bar 0.1 mm; (129) *Nomimoscolex piraeeba* SEM spinose lateral sucker (original). Scale bar 0.1 mm; (130) *Nomimoscolex admonticellia* SEM scolex, apical organ seen only as surface irregularities, arrowed (original). Scale bar 0.1 mm; (131) *Nomimoscolex sudobim* SEM scolex (original). Scale bar 0.1 mm.

***Tachysurus agassizi*, *T. barbus* and *T. upsulonophorus* (identifications uncertain)**

Nomimoscolex arandasregoi Fortes, 1981 **species inquirenda**

See under *Genidens genidens* above.

Nupelia Pavanelli & Rego, 1991

Diagnosis: Scolex and suckers simple, rounded in form. Longitudinal musculature scattered, irregular (Fig. 64). Testes mostly medullary, some placed between longitudinal muscle fibres. Ovary and uterus partly cortical, partly medullary (Fig. 64 middle and lower). Vitellaria mostly cortical, some follicles in medulla (Fig. 64 upper).

Type and only species: *N. portoriquensis* Pavanelli & Rego, 1991 (Figs 64, 65).

Worms 14-52. Scolex small 0.19-0.25, lateral suckers 0.120 (Fig. 65). About 100 segments, mature proglottids square. Longitudinal muscles weakly developed, irregular. Testes 130-150. Uterine diverticula numerous. Some vitelline follicles between longitudinal muscular fibres (Fig. 64 upper). Host: *Sorubim lima*. Itaipu and Porto Rico, Paraná, Brazil. PAVANELLI & REGO (1991).

Monticellia La Rue, 1911

Diagnosis: Scolex and suckers round, no folds of tissue at base of suckers (Figs 132, 71). Gonads cortical (Fig. 66). Vitellaria lateral, semi-crescentric in transverse section (Figs 73, 74), other gonads cortical (Figs 66, 74). Longitudinal muscle variable, strongly seen in some (Fig. 67), but weakly developed in other species (Fig. 73).

Pimelodus maculatus

M. loyolai Pavanelli & Santos, 1992

Figs 132, 67

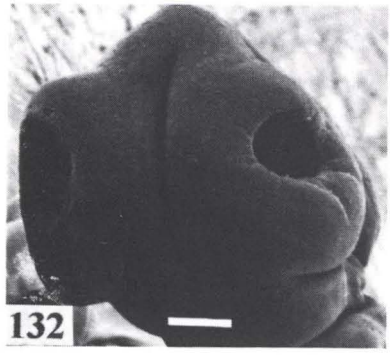
Worms size 21-59 x 0.88-1.71. Scolex round 0.550 x 0.640; lateral suckers 0.250 (Fig. 132). Neck sulcate, mature proglottids broader than long. Longitudinal musculature strongly developed (Fig. 67). Testes 100. Cirrus pouch long 0.320 x 0.076. In transverse sections vitellaria lateral. Uterine diverticula, 20. Paraná river, Paraná, Brazil. PAVANELLI & SANTOS (1992).

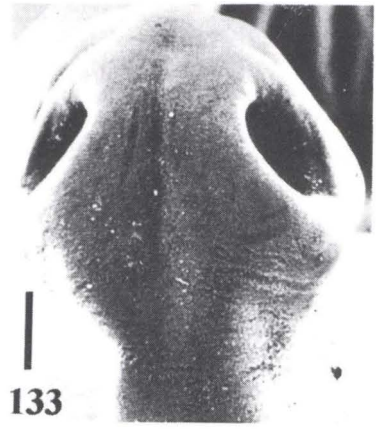
Platystomatichthys sturio

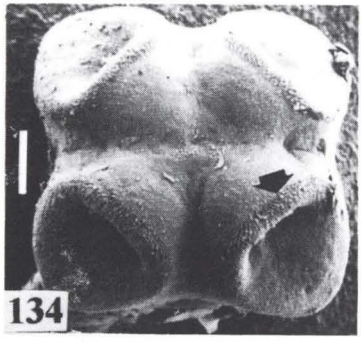
M. megacephala Woodland, 1934

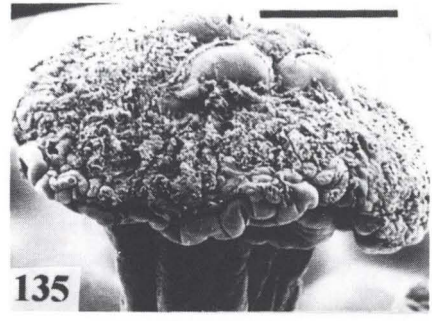
Figs 68, 69

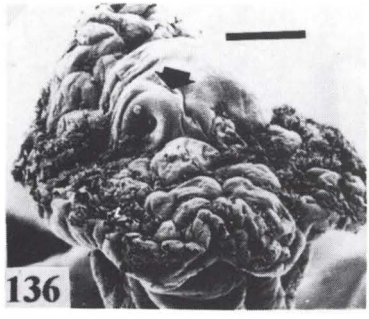
Worms 24 x 1.06. Scolex lobate, large, 0.41-0.76 x 0.53-0.79. Suckers large 0.33-0.340 x 0.149-0.182 (Fig. 68). Mature proglottids square, gravid ones quadrate or longer than broad. Genital pores open in anterior quarter of segment. Longitudinal musculature regular, small bundles of fibres. Testes 200. Cirrus pouch long. Vitelline glands crescent shaped in transverse sections (Fig. 69). Uterine diverticula











Figs 132-137. (132) *Monticellia loyolai* SEM scolex. (original). Scale bar 0.1 mm; (133) *Monticellia belavistensis* SEM scolex (from PAVANELLI *et al.* 1994). Scale bar 0.1 mm; (134) *Spasskyellina spinulifera* SEM scolex, note rows of spines around lateral sucker margins, arrowed (original). Scale bar 0.1 mm; (135) *Amphoteromorphus piraeeba* SEM scolex, upper surface of metascolex obscured by mucus (original). Scale bar 0.5 mm; (136) *Amphoteromorphus peniculus* SEM scolex, metascolex with some mucus, sucker arrowed (original). Scale bar 0.5 mm; (137) *Peltidocotyle rugosa* SEM scolex, note biloculate suckers (original). Scale bar 0.5 mm.

17-18. The "peixe-lenha" of Woodland tentatively identified as Platystomatichthys, but could be *Sorubimichthys*. Santarém, Amazon river, Brazil. WOODLAND (1934c).

Pterodoras granulosus

M. belavistensis Pavanelli, Machado, Takemoto & Santos, 1994

Figs 70, 133

Worms 70-206 x l-2.29. Scolex quadrilobulate (Fig. 133) 0.49 x 0.38 to 1.22 x 0.8 (average size 0.82 x 0.58), with apical glandular region. Suckers 0.15 (Fig. 133). Longitudinal musculature weakly developed. Testes 136-200. Genital pore opens in anterior quarter of proglottids. Uterus with 13-22 diverticula (Fig. 70). Paraná river, Paraná, Brazil. PAVANELLI *et al.* (1994).

***Salminus brevidens*, *S. maxillosus* and ? *Silurus* sp. (this genus unknown in South America)**

Type species: *M. coryphicephala* (Monticelli, 1892) La Rue, 1911 (Figs 71-74).

Synonyms: *Taenia coryphicephala* Monticelli, 1892; *Ichthyotaenia coryphicephala* (Monticelli, 1892) Lönnberg, 1894; *Ichthyotaenia coryphicephala* (Monticelli, 1892) Riggenbach, 1896; *Tetracotylus coryphycephala* (Monticelli,1891) La Rue, 1911.

Worms 78-235 long. Scolex relatively small 0.409 x 0.643; lateral suckers 0.175-0.254 (Fig. 71). Segments broader than long. Longitudinal musculature regular (Figs 73, 74). Testes 200. Genital pores in anterior quarter of segment. Numerous vitelline follicles lateral. Uterus with about 30 diverticula (less in the original description) (Fig. 72). Vagina with sphincter. Locality not stated (Monticelli, 1892); Paraguay river (? *Silurus* sp.), Paraná river (*S. maxillosus*) and Pirapora, Minas Gerais (*S. maxillosus*). LA RUE (1911, 1914); REGO & PAVANELLI (1990).

? *Silurus dargado* (species unknown; could be "dourado", *Salminus maxillosus* Valenciennes)

M. diesingii (Monticelli, 1892) La Rue, 1911 **species inquirenda**

Synonyms: *Taenia diesingii* Monticelli, 1892; *Ichthyotaenia diesingii* (Monticelli, 1892) Riggenbach, 1896; *Tetracotylus diesingii* (Monticelli, 1891) La Rue, 1911.

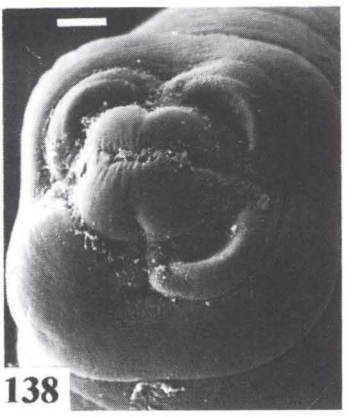
Scolex 0.300, suckers 0.170. Mature proglottids broader than long. Testes 100. Genital pores open in anterior quarter of segment. Ovary bilobate. Uterus not observed. Sections of proglottids not described. Provenance unknown. MONTICELLI (1892), RIGGENBACH (1896), LA RUE (1911, 1914).

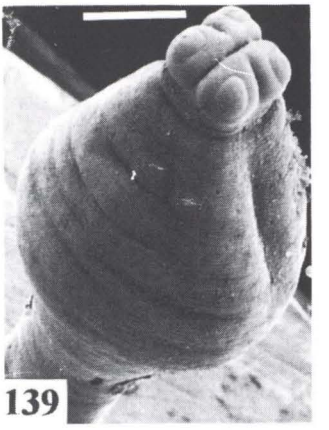
***Silurus megacephalus* (host unknown in South America)**

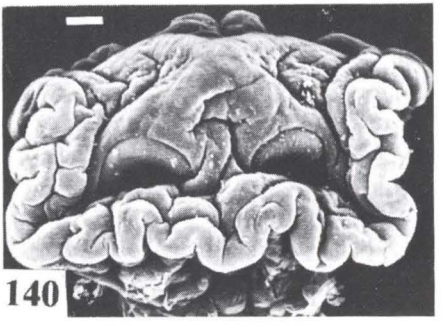
M. macrocotylea (Monticelli, 1892) La Rue, 1911 **species inquirenda**

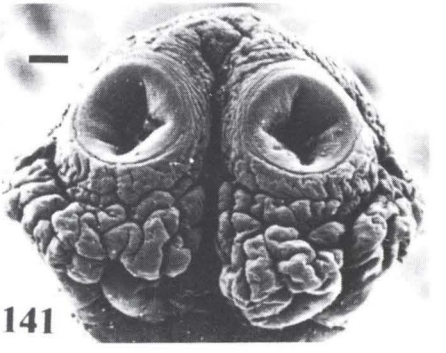
Synonyms: *Taenia macrocotylea* Monticelli, 1892; *Ichthyotaenia macrocotylea* (Monticelli, 1892) Riggenbach, 1896; *Tetracotylus macrocotylea* (Monticelli, 1891) La Rue, 1911.

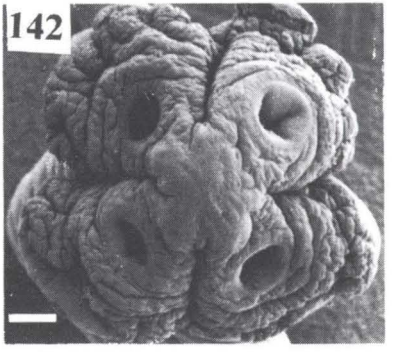
Scolex 1.10 x 0.90. Suckers 0.45-0.5. Segments square. Genital pores open

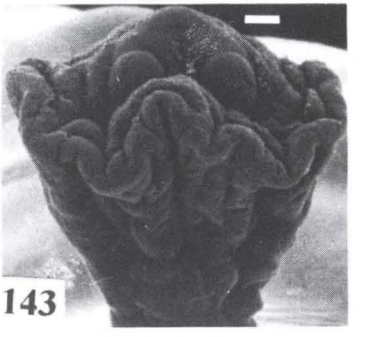












Figs 138-143. (138) *Jauella glandicephalus* SEM apex of scolex, suckers normal (compare Fig. 113) (original). Scale bar 0.1 mm; (139) *Jauella glandicephalus* SEM scolex, suckers everted, metascolex clearly seen (original). Scale bar 0.5 mm; (140) *Rudolphiella rugata* SEM contracted scolex, suckers partly hidden (original). Scale bar 0.1 mm; (141) *Rudolphiella rugata* SEM relaxed scolex, suckers clearly seen on central protuberance (original. Scale bar 0,1 mm; (142) *Rudolphiella piranabu* SEM scolex (original). Scale bar 0.1 mm; (143) *Spatulifer maringaensis* SEM scolex (original). Scale bar 0.1 mm.

in anterior quarter of segment. Testes 100. Ovary bilobate. Uterus not observed. Sections of proglottids not studied. Provenance unknown. MONTICELLI (1892), RIGGENBACH (1896), LA RUE (1911, 1914).

Spasskyellina Freze, 1965

Diagnosis: Small or medium size worms. Suckers and part of scolex armed with several rows of small spines (Fig. 78, 134). Longitudinal musculature weakly developed. Ovary, testes and uterus entirely cortical. Vagina always situated posterior to cirrus pouch (Fig. 80). Uterus preformed early in proglottis development. Uterine diverticula poorly to well developed (Fig. 80).

Pimelodus ornatus

S. mandi Pavanelli & Takemoto, 1996

Figs 75-77

Worms maximum length 60. Scolex small, 0.16 x 0.21; four antero-lateral suckers, diameter 0.05-0.10 (0.08) (Fig. 75). About 65 segments, mature proglottids (Fig. 76) slightly longer than broad, gravid longer than wide. Longitudinal musculature inconspicuous. Ventral osmoregulatory canal broad. Cirrus pouch claviform, thin walled. Genital pores about middle of mature proglottids, alternating irregularly. Twenty five to 51 testes in one cortical and dorsal field. Ovary bilobed, lobes overlap the longitudinal osmoregulatory ducts. Vagina (Fig. 77) posterior to cirrus pouch, with weak sphincter, seminal receptacle present. Uterus preformed, occupying only posterior of proglottis, 18-28 (22) diverticula each side. Vitellaria compact, extending the whole proglottis length. Eggs with delicate external membrane 0.027, embryophore 0.020 and oncosphere 0.015 diameter. Terminal proglottids without eggs. Porto Rico, Paraná river, Paraná, Brazil. PAVANELLI & TAKEMOTO (1996).

Platystomatichthys sturio

Type species: *S. lenha* (Woodland, 1933) Freze, 1965 (Figs 78-80)

Synonym: *Monticellia lenha* Woodland, 1933.

Worms 30 x 1. Scolex small 0.23-0.36 x 0.24-0.29; suckers 0.18 (Fig. 78). Numerous segments, most broader than long, with secondary striations across the tegument. Longitudinal musculature consists of a small number of fibres not in bundles. About 200 testes in two fields. Genital pores open in anterior quarter of segments (Fig. 79). Uterine diverticula small but numerous (Fig. 80). Vitellaria crescent-shaped in transverse sections. Amazon river, Brazil. WOODLAND (1933c), FREZE (1965).

Pseudoplatystoma corruscans* and *P. fasciatus

S. spinulifera (Woodland, 1935) Freze, 1965

Fig. 134

Synonym: *Monticellia spinulifera* Woodland, 1935.

Worms 25 x 0.59. Scolex round 0.26-0.49 x 0.21-0.28. Suckers 0.18-0.24, with 12-16 rows of spines around the margins (Fig. 134). Strobila slender, with numerous segments, broader than long. Longitudinal musculature sparsely evident.

Testes 60-80. Cirrus pouch relatively large. Vitellaria in ventral cortex, with few follicles, some internal to longitudinal muscles. Amazon river, Amazon, Brazil. WOODLAND (1935a); FREZE (1965); REGO (1990).

Species inquirenda

Goezeella nupeliensis Pavanelli & Rego, 1991 **species inquirenda**

Worms 3-13 x 0.8-1.8. About 60 segments. Scolex large 1.11 x 1.31. Suckers diameter 0.48. No metascolex. Segments mostly broader than long. Longitudinal musculature not observed. Cirrus pouch very small. Testes 50-70. Uterine diverticula few developed, uterus saccular (?) Host: *Sorubim lima*. Itaipu and Paraná river, Paraná, Brazil. PAVANELLI & REGO (1991).

Key to genera with metascolex

1a. Metascolex proportionally larger and more massive than the part of the scolex with four suckers (Figs 83, 136, 137), sometimes suckers apparently absent or covered by folds of metascolex (Figs 81, 140, 143) 2

1b. Metascolex proportionally smaller and less massive than the part of the scolex with four suckers which are always clearly visible (Figs 102, 145, 146) . . 10

2a. Suckers uniloculate (Fig. 141) or biloculate (Fig. 137) 3

2b. Suckers apparently absent, scolex covered by irregular mass of folds (Fig. 81) . . . . . *Othinoscolex*

3a. Suckers biloculate (Fig. 137), metascolex collar-like, prominent (Figs 83, 136) 4

3b. Suckers uniloculate (Figs 141, 149), metascolex of various other forms (Figs 138, 145), less dominant (Fig. 146) 6

4a. In transverse section ovary completely medullary, vitelline follicles in dorsal and ventral or lateral groups 5

4b. In transverse section central part of ovary medullary, main lateral parts cortical, vitelline follicles ventral (FUHRMANN 1916) but lateral and ventral (BROOKS & DEARDORFF 1980). In whole mounts vitellaria forming a triangular band, with follicles more numerous towards ovary at posterior margin of the proglottis (Fig. 84) . . . . . *Goezeella*

5a. Ovary, testes and uterus medullary . . . . . *Amphoteromorphus*

5b. Ovary medullary, testes in dorsal cortex, uterus mostly cortical but with central part in medulla . . . . . *Peltidocotyle*

6a. Suckers not stalked (Figs 138, 141), metascolex collar-like with surface structure other than folds (Figs 139) 7

6b. Suckers stalked, metascolex collar-like with surface with numerous folds (Fig. 88) . . . . . *Ephedrocephalus*

7a. Uterus entirely cortical 9

7b. Uterus entirely medullary, or uterus medullary with uterine diverticula cortical 8

8a. Uterus medullary, uterine diverticula cortical (Fig. 90). Metascolex cone-shaped; suckers in anterior part of scolex (Fig. 139) ..... *Jauella*

8b. Uterus entirely medullary (Fig. 92). Suckers on central protuberance of scolex (Fig. 141) ..... *Rudolphiella*

9a. In transverse section vitelline follicles mostly ventral or half-crescent shaped (Figs 98, 99). Large well-formed collar-like metascolex with surface striated or folded (Figs 95, 143) ..... *Spatulifer*

9b. In transverse section vitelline follicles in two groups representing dorsal and ventral bands. Large well-formed collar-like metascolex with surface highly folded (Fig. 101) ..... *Woodlandiella*

10a. Vitellaria cortical 11

10b. Vitellaria medullary 14

11a. Testes cortical 12

11b. Testes medullary. Metascolex represented by folds of tissue between and posterior to the suckers (Fig. 102) ..... *Brooksiella*

12a. Ovary partly medullary and partly cortical, or with medullary outgrowths to cortex 13

12b. Ovary completely cortical. Metascolex represented by folds of tissue at base of suckers, partly covering them (Fig. 145) ..... *Choanoscolex*

13a. Ovary medullary with outgrowths to cortex. Uterus in ventral cortex, with outgrowths through medulla reaching dorsal cortex. Sphincter muscle at opening of suckers appears banana-shaped (Fig. 105) ..... *Mariauxiella*

13b. Ovary partly medullary and partly cortical. Uterus in dorsal cortex. Metascolex consists of wrinkled tissue between the suckers (Fig. 146) .. *Paramonticellia*

14a. Suckers orientated to anterior of scolex, with folds of tissue representing metascolex (Fig. 106) ..... *Corallotaenia*

14b. Suckers large, powerful, but internal, opening towards anterior of scolex, with strong sphincters not banana-shaped (Figs 107, 110), metascolex with furrows in surface tissue (Figs 147, 109) ..... *Megathylacus*

Descriptions to genera with metascolex

Othinoscolex Woodland, 1933

Diagnosis: Surface of scolex covered by series of thick, irregular, folds of tegument (Fig. 81). No suckers observed by WOODLAND (1933c) but Chambrier (personal communication) has recently found suckers which are very difficult to find. Surface of segments with highly developed, secondary, transverse pseudosegmentation (Fig. 82). Segments many times broader than long. Longitudinal musculature a thin layer of small bundles of fibres. Uterus with few, small, rounded diverticula. Vitellaria cortical in dorsal and ventral bands.

Type and only species: *O. lenha* Woodland, 1933 (Figs 81, 82).

Synonym: *Peltidocotyle lenha* (Woodland, 1933) Woodland, 1934.

Strobila 40 x 2.2. Scolex and metascolex 1.0-1.5 x 0.9-1.4. Numerous segments, broader than long; posterior segments smaller than preceding ones. Cirrus pouch 0.332 x 0.182. Testes about 100. Uterus few, small, rounded diverticula (Fig. 82). Host: *Platystomatichthys sturio*. Santarém, Pará, Brazil. WOODLAND (1933c, 1934b).

Goezeella Fuhrmann, 1916

Diagnosis: Metascolex well-developed, collar-like (Fig. 83). Biloculate suckers, hidden by folds of tissue of metascolex. Secondary pseudosegmentation of strobila. Ovary mostly cortical, but central isthmus in medulla. Uterus cortical, well-developed, numerous diverticula. Vitelline follicles arranged in several bands in ventral cortex, more numerous towards ovary forming a triangular area as viewed in whole mount (Fig. 84).

Type and only species: *G. siluri* Fuhrmann, 1916 (Figs 83-85).

Synonyms: *Monticellia siluri* (Fuhrmann, 1916) Woodland, 1925. FREZE (1965 translation page 508) gives "*Corallobothrium siluri* (Fuhrmann, 1916), Harwood, 1933" as a synonym. This is not justified from HARWOOD's (1932) comment (p.31) "It is sufficient to state here that all the following species definitely belong to WOODLAND's (1925) *Crepidobothrium* group, or, as it has been more generally known in the past, LA RUE's (1914) genus *Ophiotaenia*". There is no specific mention of *G. siluri*..

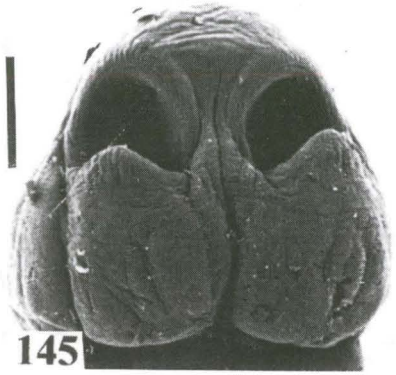
Worms 40-80. Scolex conical 0.7; suckers biloculate 0358-0.414 x 0.222-0.266. Massive, highly-folded metascolex l.l wide (Fig. 83). Segments broader than long. Longitudinal musculature regular, well-developed. Cirrus pouch small. Testes 183-310. Ovary highly follicular. Uterus with numerous diverticula, 22 or more on each side (Fig. 84). Vitelline follicles in lateral and ventral bands in transverse section. Eggs with two filaments (Fig. 85). Hosts: *Cetopsis caecutiens*, Maicuru, Pará, Brazil, *Pseudocetopsis othonops*, Orinoco Delta, Venezuela, *Ageneiosus caucanus*, Magdalena river, Bolivar, Colombia. FUHRMANN (1916), WOODLAND (1925a), REGO *et al.* (1974), BROOKS & DEARDORFF (1980).

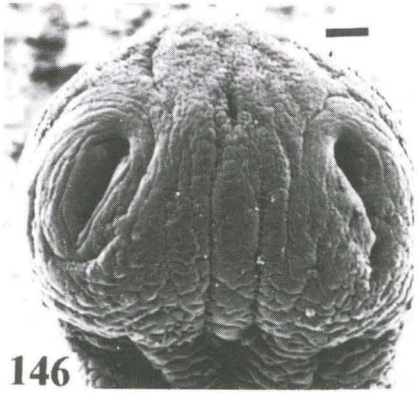
Amphoteromorphus Diesing, 1850

Diagnosis: Strobila has numerous broader than long segments. Scolex with four biloculate suckers, surrounded by a massive, highly-wrinkled, collar-like metascolex (Figs 135, 136). Testes, ovary and uterus medullary. Vitelline follicles in dorsal and ventral cortex; in transverse sections arranged in a more or less triangular pattern.

Figs 144-149. (144) *Spatulifer rugosa* SEM scolex (original). Scale bar 0.1 mm; (145) *Choanoscolex abscisus* SEM scolex (original). Scale bar 0.1 mm; (146) *Paramonticellia itaipuensis* SEM scolex (original). Scale bar 0.1 mm; (147) *Megathylacus brooksi* SEM scolex in situ with "plug" of intestinal mucosa, arrows (original). Scale bar 0.5 mm; (148) *Megathylacus brooksi* SEM scolex, suckers hidden by enveloping metascolex (original). Scale bar 0.5 mm; (149) *Megathylacus brooksi* SEM apical view of extended scolex. Metascolex not seen in this view owing to inflated scolex (original). Scale bar 1.0 mm.


144


145


146


147


149


148

Brachyplatystoma filamentosum

A. piraeeba Woodland, 1934

Fig. 135

Strobila 50-60 x 1.32. Scolex 1.6 x 0.66. Segments numerous, broader than long. Longitudinal musculature very prominent, formed by large bundles of fibres. Genital pores unilateral. Vitellaria lateral in transverse section. Testes 200. Parintins, Óbidos and Santarém, Amazon river, Amazon, Brazil. WOODLAND (1934b). CHAMBRIER & VAUCHER (1997) discussed the species of *Amphoteromorphus* and concluded thet *A. peniculus* sensu Woodland, 1933 is the same species of *A. piraeeba* Woodland, 1934.

Brachyplatystoma flavicans

Type species: *A. peniculus* Diesing, 1850 (Fig. 136).

Strobila 50 x l.19-2.65. Biloculate suckers difficult to discern as hidden by folds of metascolex (Fig. 136). Longitudinal muscle fibres in thin layer. Vitelline follicles in transverse section in bands, ventral more prominent than short dorsal band. Genital pores irregularly alternating. Cirrus pouch large. Testes 120-160. Ovary bilobate. Mato Grosso, Manaus and Parintins, Amazon river, Amazon, Brazil. DIESING (1850, 1855); WOODLAND (1933a); FUHRMANN (1934), CHAMBRIER & VAUCHER (1997).

? *Pseudopimelodus zungaro* (host uncertain)

A. parkarmoo Woodland, 1935

Fig. 86

Strobila 33 x l. Segments broader than long. Scolex with four suckers on pyramidal apical projection 0.47-0.88 x 0.53-1.12, metascolex collar-like, relatively less prominent than other species (Fig. 86). Longitudinal musculature regular. Genital pores unilateral. Testes less than 40. Vitellaria ventral in transverse section. Manaus, Amazon river, Amazon, Brazil. WOODLAND (1935b).

Peltidocotyle Diesing, 1850

Diagnosis: Scolex large, with well-developed collar-like metascolex with longitudinal furrows. Suckers divided into two loculi by transverse septum (Fig. 137). Strobila wide even immediately behind scolex, tapering towards posterior end. Secondary surface pseudosegmentation present. Longitudinal musculature strongly developed. Ovary medullary. Vitellaria cortical, in transverse section in dorsal and ventral bands. Uterus mostly cortical. Testes in dorsal cortex.

Type and only species: *P. rugosa* Diesing, 1850 (Figs 137, 87).

[**nec** Peltidocotyle rugosa (Diesing, 1850) Woodland, 1934].

Strobila 27-43 x 2.94. Scolex 2.15 x 2.74, suckers 0.470 x 0.274. Metascolex sulcate, transversely and longitudinally (Fig. 137). Segments broader than long (Fig. 87). Testes about 300. Uterus with few diverticula. Hosts: *Pseudoplatystoma tigrinum* (Valenciennes) Amazon river; *Pseudoplatystoma corruscans*, Cuiabá river, Mato Grosso (locality not given); *Pseudoplatystoma fasciatus*, Miranda and

Cuiabá rivers, Mato Grosso; *Paulicea luetkeni*, Paraná river, Paraná and Salobra, Mato Grosso; *Zungaro mangurus*, Argentina (locality not given). DIESING (1850, 1855); WOODLAND (1933a), FUHRMANN (1934), REGO (1989, 1990); REGO & PAVANELLI (1987).

Ephedrocephalus Diesing, 1850

Diagnosis: Metascolex collar-like, highly folded (Fig. 88). Four stalked, uniloculate suckers. Strobila with longitudinal furrows. Longitudinal musculature very strongly developed (Fig. 89). Testes in dorsal cortex. Ovary and uterus entirely medullary. Vitellaria in ventral cortex.

Type and only species: *E. microcephalus* Diesing, 1850 (Figs 88, 89)

Stout worms 31.6 x 8.4. Scolex 2.1, metascolex 3.8 wide. Suckers 1.3 diameter. Numerous secondary segmentation of strobila. Longitudinal musculature very obvious (Fig. 89). Eggs operculate. Host: *Phractocephalus hemiliopterus*. Mato Grosso, Amazonas (locality not given), Brazil. DIESING (1850, 1855), WOODLAND (1933a), FUHRMANN (1934), REGO (1984b).

Jauella Rego & Pavanelli, 1985

Diagnosis: Scolex and metascolex retractile. Suckers apical, small (Fig 138). Metascolex cone-shaped, with transverse, circular folds (Fig. 139). Testes in dorsal cortex. Uterus medullary, but with diverticula in cortex. Vitellaria as seen in transverse section in dorsal and ventral bands (Fig. 90).

Type and only species: *J. glandicephalus* Rego & Pavanelli, 1985 (Figs 138, 90).

Strobila 22-32 x 3.30. Scolex and metascolex 0.48 x 0.90, variable in shape depending on the state of contraction. Suckers 0.315 x 0.270. About 100 segments, mature proglottids broader than long, gravid ones longer than broad. Longitudinal musculature well developed. Genital pores mostly unilateral. Testes about 500. Ovary a thin strip of tissue. Uterus with 6-8 diverticula. Host: *Paulicea luetkeni*. Itaipu, Paraná and Salobra, Mato Grosso, Brazil. REGO & PAVANELLI (1985).

Rudolphiella Fuhrmann, 1916

Diagnosis: Scolex with massive, wrinkled, collarlike metascolex (Figs 140, 141). Suckers on central protuberance of scolex (Figs 141, 142). Testes in dorsal cortex. Most ovarian lobes cortical, but central parts medullary (Fig. 92). Uterus medullary. Vitellaria in ventral cortex (Fig. 91).

Callophysus macropterus

R. rugata (Rego, 1975) **comb.n.**

Figs 140, 141

Synonyms: *Monticellia rugata* Rego, 1975; *Spatulifer rugata* (Rego, 1975) Brooks & Deardorff, 1980.

Chambrier (personal communication) reviewed the material, concluding that the species should be transferred to *Rudolphiella*. Worms 14 x 0.86. Scolex 0.96 x 0.86. Suckers 0.276, well-defined from metascolex (Fig. 141). No striations on

apical part of scolex. Metascolex striated longitudinally, less so transversally. Segments square. Longitudinal musculature regular, clearly developed. Testes 160-180. Ovary highly folliculate. In transverse sections vitellaria crescent-shaped; follicles more numerous in ventral cortex. Uterus with diverticula. Eggs small, with a knob and filaments. Maicuru, Pará, Amazon river, Brazil. REGO (1975).

Luciopimelodus pati

Type species: *R. lobosa* (Riggenbach, 1895) Fuhrmann, 1916 (Figs 91, 92).

Synonyms: *Corallobothrium lobosum* Riggenbach, 1896. Riggenbach (1896, p. 211) used "n. sp." although he described the species in 1895. *Ephedrocephalus (Corallobothrium) lobosus* (Riggenbach, 1895) Mola, 1906; *Ephedrocephalus lobosus* (Riggenbach, 1895) Woodland, 1934, 1935.

Strobila 20-30 x 1.3. Apex of scolex in form of a flat cup, suckers at the base of the cup. Metascolex folds form base of scolex. About 50 segments, mature ones square, gravid proglottids longer than broad. Internal longitudinal musculature a thick layer of individual fibres. Testes 150-200. Ovary bilobed. Uterus a narrow central axis with diverticula. Eggs with knobs. Paraguay river, Paraguay. RIGGENBACH (1895, 1896), WOODLAND (1925a,b, 1935b), LA RUE (1914).

Pinirampus pirinampu

R. myoides (Woodland, 1934) Woodland, 1935

Figs 93, 94

Synonym: *Amphilaphorchis myoides* Woodland, 1934.

Strobila 11 x 0.6. Scolex massive 0.59 x 0.40, with a wrinkled surface and an apical projection above the suckers (Fig. 93). Segmentation ill-defined, wrinkled; most segments broader than long. Longitudinal musculature numerous fibres clustered into large bundles. Testes about 100, reaching the edges of proglottids as in *R. piranabu*. Uterus medullary. Eggs spindle-shaped with elongated poles (Fig. 94). Manaus, Amazon river, Brazil. WOODLAND (1934a, 1935a).

R. piranabu (Woodland, 1934) Woodland, 1935

Fig. 142

Synonym: *Amphilaphorchis piranabu* Woodland, 1934.

Strobila 10 x 0.88; with about 50 wrinkled segments, square or longer than broad. Scolex with many wrinkles, suckers conspicuous 0.24. Metascolex 0.68 x 0.49 with longitudinal furrows and a preeminence in the centre (Fig. 142). Longitudinal muscle fibres delicate, few in number not forming bundles. Testes about 100, extending to the lateral borders of proglottids close to vitellaria. Ovary mostly cortical. Uterus medullary with short diverticula. Eggs with a plug and sometimes a short filament. Manaus, Amazon river, Amazon, Brazil. WOODLAND (1934a, 1935a), PAVANELLI & SANTOS (1992).

Spatulifer Woodland, 1934

Diagnosis: Uniloculate suckers on apical part of scolex. Well-developed collar-like metascolex (Figs 143, 144). In transverse sections vitelline follicles

ventral or in semi-crescentric pattern (Fig. 99). Ovary, testes and vitellaria cortical (Figs 98, 99).

Brachyplatystoma vaillanti

S. piramutab (Woodland, 1933) Brooks & Deardorff, 1980

Fig. 95

Synonym: *Goezeella piramutab* Woodland, 1933; **nec** *Goezeella siluri* Fuhrmann, 1916. WOODLAND (1933b) confuses by comparing both species in his description of *G. piramutab* (=*S. piramutab*).

Worms 55 x 1.5. Scolex 1.35 x 0.88, with suckers, 0.36, on apical part. Metascolex folded collar-like (Fig. 95). Eggs without knob or filaments. Amazon river, Brazil. WOODLAND (1933b), REGO (1975), BROOKS & DEARDORFF (1980).

Hemisorubin platyrhynchos

S. maringaensis Pavanelli & Rego, 1989

Fig. 143

Worms 41.5-92 x 0.94. Scolex 1.26 x 1.43, suckers 0.25, hidden by folds of collar-like metascolex. About 250 segments, longer than broad. Longitudinal musculature regular, well developed. Genital pores open in anterior third of segment. Cirrus pouch small. About 60 testes. Uterine diverticula 8-10. Vitelline follicles mostly ventral in transverse section. Paraná river, Paraná, Brazil. PAVANELLI & REGO (1989).

Luciopimelodus pati

S. piracatinga (Woodland, 1935) Brooks & Deardorff, 1980

Figs 96-99

Synonym: *Monticellia piracatinga* Woodland, 1935.

Strobila 6 x 0.53, with about 50 segments. Scolex 0.59-0.74 x 0.34-0.36, suckers 0.16-0.22. Metascolex with longitudinal folds, not collar-like (Fig. 96). Segments broader than long. No longitudinal muscle fibres, but there are some transverse muscles. Cirrus pouch long and narrow 0.135 x 0.033, extending one third of segment width (Fig. 97). Testes 40-50. Vitellaria ventral in transverse sections (Figs 98, 99). Manaus, Amazon river, Brazil. WOODLAND (1935b), REGO (1975), BROOKS & DEARDORFF (1980).

Pseudoplatystoma fasciatus

S. rugosa (Woodland, 1935) Brooks & Deardorff, 1980

Fig. 144

Synonym: *Monticellia rugosa* Woodland, 1935.

Strobila 40 x 1. Scolex 0.88-1.30 x 0.6-1.0, comprising a conical part with conspicuous suckers 0.29 x 0.19 and a collar (Fig. 144). Segments longer than broad, genital pores at anterior quarter or fifth. Cirrus pouch long and broad 0.28 x 0.180, extending one third across width of proglottid. Testes 150-200 [400 according to

REGO (1989)]. Ovary massive. Vitellaria mainly ventral, crescent-shaped in transverse section. Uterus has large number of short diverticula. Manaus, Amazon river, Salobra and Cuiabá, Mato Grosso, Brazil. WOODLAND (1935b), BROOKS & DEARDORFF (1980), REGO (1975, 1989).

Pseudoplatystoma tigrinum

Type species: *S. surubim* Woodland, 1934 (Fig. 100)

Synonyms: **nec** *Peltidocotyle rugosa* Diesing, 1850 in WOODLAND (1933a), an error corrected by WOODLAND (1934a, 1935a) following a letter from Fuhrmann who examined the type specimens of *Peltidocotyle rugosa* Diesing, 1850; *Monticellia surubim* (Woodland, 1934) Woodland, 1935.

Worms up to 38 x 1.4. Scolex 1.4, apical part with with spoon-like areas (suckers). Very wrinkled metascolex (Fig. 100). Strobila about 25 segments, sulcate, with numerous secondary transverse folds (Fig. 100). Segments broader than long. Longitudinal musculature inconspicuous. Cirrus pouch very long 0.266 x 0.066. Testes numerous 200-300. Ovary highly folliculate. Vitellaria crescent-shaped in transverse-section. No gravid proglottids described. Solimões river and Codajaz, Amazon river, Amazon, Brazil. WOODLAND (1933a, 1934a), FREZE (1965), REGO (1975, 1990), BROOKS & DEARDORFF (1980).

Woodlandiella Freze, 1965

Diagnosis: Apical part of scolex with four suckers, very wrinkled metascolex (Fig. 101). Segments much broader than long, secondary folds of strobila highly developed. Substantial longitudinal musculature. Uterus entirely cortical. In transverse sections vitelline glands in dorsal and ventral bands.

FREZE (1965) proposed the genus *Woodlandiella* based mostly in the presence of suckers in *Othinoscolex myzofer* (suckers lacking in *O. lenha*) but recent observations of the Chambrier (personal communication) showed the presence of suckers also em Othinoscolex lenha, comsequently. The genus *Woodlandiella* seems unnecessary.

Type and only species: *W. myzofera* (Woodland, 1933) Freze, 1965 (Fig. 101).

Synonym: *Othinoscolex myzofer* Woodland, 1933.

Strobila 30 x 1.8. Scolex 2.3 x 1.1, with anterior cone and four large suckers, but no apical organ. Segments numerous, terminal ones small. Tegument very thick. Internal musculature well developed, but not forming defined bundles of muscles. Testes 150. Uterus small with small diverticula. Platystomatichthys sturio. Itacoatiara, Amazonas and Óbidos, Pará, Brazil. WOODLAND (1933c), WOODLAND (1934b), FREZE (1965).

Brooksiella gen.n.

Diagnosis: Small to medium size worms. Scolex well delimited. Metascolex represented only by folds of tissue between and posterior to uniloculate suckers (Fig. 102). Strobila with secondary segmentation and longitudinal furrows. Testes medullary, numerous, reaching the lateral margin of proglottis. Ovary and uterus

medullary, ovary highly follicular, uterus broad, with few, shallow diverticula. Eggs with knob and filament. The genera is named in honour to Daniel Brooks, Department of Zoology, University of Toronto, Canada.

Type and only species *B. praeputialis* (Rego, Santos & Silva, 1974) **comb.n.** (Figs 102-104).

Synonym: *Amphoteromorphus praeputialis* Rego, Santos & Silva, 1974.

Strobila 27-50, enlarged after scolex. Scolex 0.67-0.79 x 0.79-1.17, suckers round 0.219-0.31. Tegument with longitudinal and transverse external furrows. About 60 segments, broader than long. Longitudinal musculature of isolated fibres, not forming bundles. Testes 300-400. Ovary delicate, folliculate (Fig. 103). Uterus preformed, with thick wall, uterine diverticula weakly developed. Eggs with knob and long filaments (Fig. 104). *Cetopsis caecutiens*, Maicuru, Pará, Itacoatiara, Amazon, Brazil and *Pseudocetopsis othonops*, Isla de Tres Canos, La Portuguesa, Venezuela. REGO *et al.* (1974), BROOKS & RASMUSSEN (1984).

Choanoscolex La Rue, 1911

Diagnosis: Scolex conical, suckers elongate, directed laterally, their basal parts covered by folds of tissue which represents the metascolex (Fig. 145). Longitudinal musculature weakly developed. Gonads and vitellaria cortical. Uterus with many lateral diverticula.

Type and only species *C. abscisus* (Riggenbach, 1895) La Rue, 1911 (Fig. 145).

Synonyms: *Ichthyotaenia abscisa* Riggenbach, 1896. RIGGENBACH (1896, p. 193) used "nov. spec." although he described the species in 1895. *Ichthyotaenia abscisa* (Riggenbach, 1895) Southwell, 1913; *Corallobothrium abscissus* (Riggenbach, 1895) Meggitt, 1927; FREZE (1965) gives *Proteocephalus abscissus* (Riggenbach, 1895) Fuhrmann, 1933 (Handbuch der Zoologie) as a synonym, however, FUHRMANN (1930, p. 243) notes *Choanoscolex* as a synonym of *Proteocephalus* but does not mention *C. abscisus*.

There are two forms. Strobila of forma major 41 x 0.538 and forma minor 15 x 0.280. About 90 segments, longer than broad. Scolex variable in size from 0.28 x 0.357 to 0.514 x 0.526, suckers 0.21 x 0.14 to 0.303 x 0.164. Testes 100-200. Vitellaria lateral in transverse sections. Thirty uterine diverticula. Hosts: *Silurus* sp. in unknown Paraguay river, Paraguay. *Pseudoplatystoma corruscans*, Cuiabá river, Mato Grosso, Barra do Rio Grande, Bahia, and Pirapora Minas Gerais, Brazil. *Paulicea luetkeni*, Paraná river, Paraná. *Raphiodon vulpinus*, Salobra, Mato Grosso, Brazil. *Pseudoplatystoma fasciatus*, Cuiabá river, Mato Grosso, Brazil; Orinoco river, Venezuela. RIGGENBACH (1895, 1896), LA RUE (1911, 1914), BROOKS & RASMUSSEN (1984), REGO (1990), REGO & PAVANELLI (1990).

Mariauxiella Chambrier & Rego, 1995

Diagnosis: Scolex with four uniloculate suckers with powerful circular musculature in their distal parts, metascolex represented by folds of tegument at base of suckers (Fig. 105). Strobila acraspedote. Testes cortical, in continuous dorsal field with one or two layers, Ovary medullary, with outgrowths in cortex. Uterus in

ventral cortex, with numerous outgrowths penetrating the medulla reaching the dorsal cortex. Vitelline glands cortical, crescentic in transverse section.

Type and only species *M. pimelodi* Chambrier & Rego, 1995 (Fig. 105).

Strobila 30 -50. Scolex massive 1.1-1.5. Suckers 0.455-0.71. About 100 segments. Mature proglottids square. Longitudinal musculature well developed. Testes 105-172. Uterus preformed, uterine diverticula 18-26. Pimelodus ornatus. Paraná river, Paraná State, Brazil. CHAMBRIER & REGO (1995).

Paramonticellia Pavanelli & Rego, 1991

Diagnosis: Scolex with suckers internal sac-like, metascolex represented by delicate folds of tissue between suckers (Fig. 146). Longitudinal musculature well developed. Genital pore anterior. Ovary cortical and partly medullary. Uterus cortical. Vitellarium crescent-shaped in transverse section.

Type and only species *P. itaipuensis* Pavanelli & Rego, 1991 (Fig. 146).

Worms 7.9-20.6 x 1.0-1.9. Scolex 0.6-0.8 x 1.1-1.4. Suckers 0.35-0.51. About 60 square segments. Testes 60. Uterine diverticula 7-10. *Sorubim lima.* Paraná river, Paraná, Brazil. PAVANELLI & REGO (1991).

Corallotaenia Freze, 1965

Diagnosis: Small worms. Suckers orientated to anterior of scolex, surrounded by folds of tissue, with metascolex relatively weakly developed (Fig. 106). Few segments. Mature proglottids longer than broad. Testes in one layer. Ovary, testes uterus and vitellaria medullary. Vitelline follicles lateral. FREZE (1965) erected this genus to accommodate *C. parva* (Larsh, 1941) and *C. intermedia* (Fritts, 1959) (see Fig. 106), both from North American siluroid fishes.

Ageneiosus caucanus

Corallotaenia sp. Brooks & Deardorff, 1980

Madalena river, Bolivar, Colombia. BROOKS & DEARDORFF (1980).

Megathylacus Woodland, 1934

Diagnosis: Worms of medium size. Suckers large, internal, sac-like, openings as holes (Fig. 149), with strong sphincter muscles (Fig. 110). Metascolex consists of surface, circumscolex furrows elow suckers (Figs 148, 109). Longitudinal musculature well developed. Genital pore near centre of proglottis margin. Ovary, testes, uterus and vitellaria medullary.

Paulicea luetkeni

M. brooksi Pavanelli & Rego, 1985

Figs 147-149

Worms 24-56 x 1.5-2.0. Scolex (Fig. 148) round, large, 1,5 – 4,5 x 1,89-4,5. Suckers internal, hidden often by enveloping metascolex (Fig. 148), 0,660 x 0,400; with powerful sphincter. About 80 segments, broader than long. Longitudinal musculature regular, well developed. Cirrus pouch piriform. Testes, 300-400. Few uterine diverticula. Vitellaria paramuscular. Paraná river, Brazil. REGO & PAVANELLI (1985), PAVANELLI & SANTOS (1991).

Pseudoplatystoma corruscans

M. travassosi Pavanelli & Rego, 1992

Figs 107, 108

Synonym: *Megathylacus* sp. Rego, 1990.

Worms 45 x 2.6. Scolex globose (Fig. 146) 1.2 x 1.9, suckers 0.51 x 0.45. Forty eight to 57 broader than long segments. Longitudinal musculature well developed. Testes about 140. Ovary bilobate (Fig. 108). Uterus with few diverticula. Itaipu and Paraná river, Paraná, Brazil. REGO (1990), PAVANELLI & SANTOS (1991), PAVANELLI & REGO (1992).

***Rhamdia* sp. (host uncertain)**

Type species: *M. jandia* Woodland, 1934 (Figs 109, 110).

Worms 25 x 1.65. Scolex quadrilobulate, 2.53 diameter. Suckers four large sacs, each with a strong sphincter muscle (Fig. 110). Strobila wrinkled. Segments broader than long. Longitudinal musculature well developed, forming bundles of fibres. Testes numerous. Ovary massive. Few uterine diverticula. Ovary, testes, uterus and vitellaria medullary. Manaus, Amazon river, Brazil. WOODLAND (1934c), REGO & PAVANELLI (1987).

Species inquirenda

***Cichla monoculus* Spix, 1831**

Sciadocephalus megalodiscus Diesing, 1850.

Strobila 3 x l. Scolex umbrella-shaped, suckers large, with an apical sucker. Segments broader than long. Internal musculature absent. Cirrus pouch very small 0.04 x 0.026. Testes not numerous [number not estimated by WOODLAND (1933a)]. Ovary highly folliculate. Vitellaria in two semicircles in transverse section. Ovary, testes, uterus and vitellaria cortical (medullary ?). Mato Grosso (Diesing, 1850, 1855) Manaus, Amazon river, Amazon, Brazil (WOODLAND 1933a).

Recently, REGO *et al.* (unpublished data) found this species, from *Cichla monoculus* Spix, 1831, colected from Rio Paraná; the species is being redescribed; the gonads and vitellaria are confirmed as entirely medullary.

? *Pseudoplatystoma* sp. identification uncertain, could be *Sorubim lima*, known as "braço de moça" in the Amazon

Manaosia bracodemoca Woodland, 1935.

Only fragments were described. Scolex 0.94, globular, with a wrinkled surface, with internal, sac-like suckers, openings 0.33. Strobila creased. Longitudinal muscle system well-defined, with large bundles of fibres. Ovary medullary, but with processes in dorsal cortex. Manaus, Amazon river, Amazon, Brazil. WOODLAND (1935b).

Unidentified bothriocephalid (ptychobothriid) WOODLAND (1935c) recorded four specimens of an unidentified pseudophyllidean (ptychobothriid) from the "pescada" *Plagioscion squamosissima*, from Manaus, Amazon. These had no scoleces, but were Bothriocephalidae (see Woodland page 622, and his plate I,

figures 10 to 13, which clearly show a bothriocephalid arrangement of genitalia). WOODLAND (1935c) believed it was the first ptychobothriid species [now included in Bothriocephalidae (BRAY *et al.* 1994)] to have been found in South America.

List of hosts

Hosts listed by families; some local names indicated. "*" indicates identifications of hosts uncertain. Cestodes adult unless otherwise stated. **species inquirenda**e indicated, but not synonyms.

Hosts	Parasites
Characidae	Cestodes
Astyanax scabripinnis Eigenmann, 1927, "lambari"	*Senga* sp.
Salminus brevidens (Cuvier, 1819), "dourado"	*Monticellia coryphicephala*
Salminus maxillosus Valenciennes, 1840, "dourado"	*Monticellia coryphicephala*
	Monticellia diesingi
Serrasalmidae	
Piaractus mesopotamicus (Holmberg, 1887), "pacu"	*Proteocephalus vazzolerae*
Serrasalmus nattereri (Kner, 1860), "piranha"	*Proteocephalus serrasalmus*
Serrasalmus spilopleura (Kner, 1860), "piranha"	*Proteocephalus serrasalmus*
Colossoma brachypomum (Cuvier, 1818), "pacu"	Unidentified proteocephalid larvae (BÉKÉSI *et al.* 1992)
Colossoma macropomum (Cuvier, 1818), "tambaqui"	Unidentified proteocephalid larvae (BÉKÉSI *et al.* 1992)
Prochilodontidae	
Prochilodus scrofa Steindachner, 1882, "curimbatá"	*Valipora campylancristrota* (larva)
Erythrinidae	
Hoplias malabaricus (Bloch, 1794), "traíra"	*Nomimoscolex matogrossensis*
	Proteocephalus regoi
Gymnotidae	
Gymnotus carapo Linnaeus, 1758, "morenita"	*Proteocephalus chubbi*
Doradidae	
Platydoras costatus Linnaeus, 1766), "graviola"	*Proteocephalus renaudi*
	Proteocephalus soniae
Pterodoras granulosus (Valenciennes, 1833), "abotoado, bacu, armado"	*Monticellia belavistensis*
Megalodoras irwini Eigenmann, 1925, "rebeca"	*Proteocephalus kuyukuyu*
Pseudodoras niger Valenciennes,1817 (=*Oxydoras niger*), "cuiu-cuiu"	*Proteocephalus kuyukuyu*
Auchenipteridae	
Parauchenipterus galeatus (Linnaeus, 1766), "cangatí"	*Cangatiella arandasi*
Glanidium sp., "anduiá"	*Brayela karuatayi*
Ageneiosidae	
Ageneiosus brevifilis Valenciennes, 1840, "manduvé"	*Gibsoniella mandube*
Ageneiosus caucanus Steindachner, 1880, "manduvé"	*Corallotaenia* sp.
	Goezeella siluri
Cetopsidae	
Cetopsis coecutiens (Lichtenstein, 1829), "candiru"	*Brooksiella praeputialis*
	Goezeella siluri
Pseudocetopsis othonops (Eigenmann, 1912), "Candiru"	*Goezeella siluri*
	Brooksiella praeputialis
Pseudocetopsis brunnescens (species unknown)	*Proteocephalus kuyukuyu*
Pimelodidae	
Brachyplatystoma filamentosum (Lichtenstein, 1819), "piraíba"	*Amphoteromorphus piraeeba*
	Nomimoscolex piraeeba
Brachyplatystoma flavicans (Castelnau, 1855), "dourada"	*Amphoteromorphus peniculus*
	Nomimoscolex piraeeba
	Nomimoscolex sudobim
	Pterobothrium crassicole (larva)
	Proteocephalus piramutab
Brachyplatystoma vaillanti Valenciennes, 1840, "piramutaba"	*Harriscolex kaparari*
	Pterobothrium crassicole (larva)
	Spatulifer piramutab
Brachyplatystoma spp.	*Scolex pleuronectis* (larva)
Hemisorubin platyrhynchos Valenciennes, 1840, "bico-de-pato, jurupoca"	*Robertiella paranaensis*
	Spatulifer maringaensis

Hosts	Parasites
Luciopimelodus pati Valenciennes, 1840, "pati, piracatinga"	*Nomimoscolex piracatinga*
	Proteocephalus fossatus
	Rudolphiella lobosa
	Spatulifer piracatinga
Paulicea luetkeni (Steindachner, 1875), "jau"	*Robertiella agostonhoi*
	Choanoscolex abscissus
	Jauella glandicephalus
	Megathylacus brooksi
	Peltidocotyle rugosa
	Proteocephalus sophiae
	Travassiella avitellina
Phractocephalus hemiliopterus (Schneider, 1801)	*Crepidobothrium eirasi*
	Ephedrocephalus microcephalus
	Nomimoscolex pirarara
	Nomimoscolex woodland
	Zygobothrium megacephalum
	Tetrabothrium (Eutetrabothrium) emarginatum
Pimelodus albicans Valenciennes, 1840, "bagre-branco"	*Nomimoscolex microacetabula*
Pimelodus clarias Lacépède, 1803 (=*P. maculatus*), "mandi–amarelo"	*Nomimoscolex microacetabula*
	Nomimoscolex alovarius
	Nomimoscolex pimelodi
	Proteocephalus magna
Pimelodus maculatus Lacépède, 1803, "bagre pintado", "mandi-amarelo"	*Monticellia loyolai*
Pimelodus ornatus Kner, 1857, "mandi"	*Mariauxiella pimelodi*
	Spasskyelina mandi
Pimelodus pati (=*Luciopimelodus pati*) (Valenciennes, 1840), "pati, piracatinga"	*Spatulifer piracatinga*
	Proteocephalus fossatus
	Nomimoscolex piracatinga
	Rudolphiella lobosa
Pinirampus pirinampu (Spix, 1829), "barbado, piranabu"	*Nomimoscolex admonticellia*
	Rudolphiella myoides
	Rudolphiella piranabu
Platystomatichthys sturio (Kner, 1857), "peixe-lenha"	**Monticellia megacephala*
	Woodlandiella myzofera
	Nomimoscolex lenha
	Othinoscolex lenha
	Spasskyelina lenha
* *Pseudopimelodus zungaro* (Humboldt, 1833), "bagre-sapo"	*Amphoteromorphus parkamoo*
Pseudoplatystoma corruscans (Agassiz, 1829), "surubim, pintado"	*Choanoscolex abiscisus*
	Harriscolex kaparari
	Spasskyelina spinulifera
	Megathylacus travassosi
	Nomimoscolex sudobim
	Peltidocotyle rugosa
Pseudoplatystoma fasciatum (Linnaeus, 1766)	*Choanoscolex abiscisus*
	Spasskyelina spinulifera
	Houssayela sudobim
	Nomimoscolex sudobim
	Nomimoscolex lopesi
	Peltidocotyle rugosa
	Spatulifer rugosa
	Unidentified proteocephalid (Rego & Gibson, 1989)
Pseudoplatystoma tigrinum (Valenciennes, 1840), "caparari"	*Harriscolex kaparari*
	Spatulifer surubim
	Peltidocotyle rugosa
Pseudoplatystoma sp.	*Proteocephalus platystomi*
**Pseudoplatystoma* sp. (=*Sorubim lima*)	*Manaosia braçodemoça*
Rhamdia sapo (Valenciennes, 1840), "bagre-sapo"	*Proteocephalus bagri*
	Proteocephalus rhamdia
	Proteocephalus sp. (Rego & Gibson(1989)
Rhamdia sp., "bagre"	*Megathylacus jandia*
	Proteocephalus jandia
Sorubim lima (Schneider, 1801), "bico-de-pato, jurupensen"	*Nupelia portoriquensis*
	Paramonticellia itaipuensis
	Goezeella nupeliensis **species inquirenda**
Zungaro mangurus (Valenciennes, 1840), "manguruyu"	*Peltidocotyle rugosa*

Hosts	Parasites
Cichlidae	
Astronotus ocellatus (Agassiz, 1831), "acará-açu, oscar"	*Proteocephalus gibsoni*
	Unidentified proteocephalid larvae (Békési *et al.* 1992)
Astronotus sp.	*Proteocephalus gibsoni*
Cichla ocellaris Schneider, 1801, "tucunaré"	*Proteocephalus macrophalus*
	Proteocephalus microscopicus
	Unidentified proteocephalid adults (Békési *et al.* 1992)
Cichla monoculus Spix, 1831, "tucunaré"	*Proteocephalus macrophallus*
	Sciadocephalus megalodiscus
Geophagus brasiliensis (Quoy & Gaimard, 1824), "papa-terra"	*Proteocephalus gibsoni*
Oreochromis spp.	Unidentified proteocephalid larvae (Békési *et al.* 1992)
Cyprinidae	
Cyprinus carpio Linnaeus, 1758, "carpa"	*Bothriocephalus acheilognathi* (translocated)
	Unidentidied proteocephalid larvae (Békési *et al.* 1992)
**Aristichthys nobilis* (Richardson, 1844) (=*Hypophthalmichthys nobilis*), "carpa-cabeça-grande"	Unidentified proteocephalid larvae (Békési *et al.* 1992)
Osteoglossidae	
Arapaima gigas (Cuvier, 1829), "pirarucu"	*Nesolecithus janicki*
	Schizochoerus liguloideus
Atherinidae	
Basilichthys microlepidotus Jenyns, 1842, "peixe-rei"	*Proteocephalus macdonaghi*
Ariidae	
**Genidens genidens* (Valenciennes, 1839), "bagre urutu"	*Nomimoscolex arandasregoi* **species inquirenda**
**Tachysurus agassizii* (Eigenmann & Eigenmann, 1888), "bagre"	*Nomimoscolex arandasregoi* **species inquirenda**
**T. barbus* Lacépède, 1803, "bagre"	*Nomimoscolex arandasregoi* **species inquirenda**
**T. upsulonophorus* Eigenmann & Eigenmann, 1889, "bagre"	*Nomimoscolex arandasregoi* **species inquirenda**
Cynodontidae	
Rhaphiodon vulpinus Agassiz, 1829, "dourado-cachorro"	*Choanoscolex abscisus*
Calophysidae	
Calophysus macropterus (Lichtenstein, 1819), "piranampu", "fidalgo"	*Rudolphiella rugata*
Loricaridae	
Loricariichthys platymetopon Isbrücker & Nijssen, 1979, "cascudo-chinelo"	Unidentified proteocephalid larvae (Békési *et al.* 1992)
Sciaenidae	
Plagioscion squamosissimus (Heckel, 1840), "corvina"	Unidentified pseudophyllidean (ptychobothriid)
Siluridae (family unknown in South America)	
**Silurus dorgado*	*Monticellia diesing*
**Silurus megacephalus*	*Monticellia macrocotylea* **species inquirenda**
**Silurus* sp.	*Choanoscolex abscisus*
	Monticellia coryphicephala
Crustaceans	
Diaptomus sp.	Haemocel, proteocephalid larvae (Békési *et al.* 1992)

* *Silurus* is an european genera, unknown in South America; these fishes, specialy *Silurus dorgado* could be "dourado", *Salminus maxillosus*.

Hiperparasitism of adult cestodes by proteocephalid larvae	
Choanoscolex abscisus	from *Pseudoplatystoma corruscans*
Jauella glandicephalus	from *Paulicea luetkeni*
Megathylacus brooksi	from *Paulicea luetkeni*
Nomimoscolex arandasregoi	from *Tachysurus* sp.

DISCUSSION

The current taxa of cestodes from South American freshwater fishes almost certainly represent but a fraction of the total, especially considering that of some 1,500 teleost fish species only about 60 currently are known to have tapeworms.

Some taxa will almost certainly need redefinition, as there must be many species of South American proteocephalids awaiting description, although already there are 26 genera known, often displaying highly divergent morphological featu-

res. By contrast, North America and Europe proteocephalids are represented by few genera with numerous species. Knowledge of each South American species varies from short latin narratives of DIESING (1850) to recent detailed, well-illustrated accounts [SCHOLZ *et al.* (1996) redescription of *Proteocephalus macrophallus*, descriptions of *P. regoi* Chambrier, Scholz & Vaucher, 1996 and *Spasskyellina mandi* Pavanelli & Takemoto, 1996]. In most species, however, the number of worms studied was small, thus knowledge of intraspecific variation is limited. Future studies should include more worms, with comprehensive, detailed illustration and quantification of morphological features, and parameters beyond those currently included. Standard descriptions, such as those summarised here, rarely permit unequivocal identification in genera with many species. With South American fish cestodes it is unlikely that molecular techniques will contribute short-term, thus focus should be on additional anatomical, behavioural, distributional, life cycle, maturation and ultrastructural (SEM) features.

Identification of cestodes is a demanding and time-consuming task. Some genera and species can be named from scolex morphology, but relaxed scoleces are essential to avoid errors. Figures 140 show *Rudolphiella rugata*, where suckers are almost hidden in contracted scoleces, similarly for a contracted scolex of *Megathylacus brooksi* (Fig. 148). Figures 138 and 139 illustrate *Jauella glandicephalus*; in one scolex the suckers are normal, in the other they are everted owing to abnormal osmotic conditions at fixation. Good transverse histological sections of proglottids are critical for correct determination of many genera and species of Proteocephalidea.

South American freshwater teleosts harbour larval stages belonging to the Orders Proteocephalidea, Tetraphyllidea, Cyclophyllidea and Trypanorhyncha. The tetraphyllidean *Scolex pleuronectis* Müller, 1788 is found in fishes of brackish waters in the Amazon estuary (A.A. Rego personal observation). There is only one record of a larval cyclophyllidean, *Valipora campylancristrota* (Dilepididae), in the gall bladder of a teleost (TAKEMOTO *et al.* 1994). *Pterobothrium crassicolle* (Trypanorhyncha) is found in fishes of the Amazon estuary (REGO 1987a). Larval proteocephalids currently cannot be identified.

No complete life cycle of a South American fish cestode has been experimentally demonstrated (THATCHER 1991). The presence of a variety of eggs including some with filaments or polar knobs, may be indirect evidence that there is not such a uniformity in the spectrum of intermediate host as in the Holarctic, although it is unlikely that major new variations will be found. Virtually nothing is known about intermediate hosts, apart from BÉKÉSI *et al.* (1992) reporting procercoids in the haemocoel of a copepod *Diaptomus* sp. Geographic range, altitudinal variation, occurrence within host ranges and seasonal biology are also unknown.

There are, then, many opportunities for further exciting discoveries about the biology of cestodes of freshwater fishes of South America.

ACKNOWLEDGEMENTS. We wish to thank C.J. Veltkamp (School of Biological Sciences, University of Liverpool) for SEM of most scolices illustrating this work. Also the Department of Multi Meios (Fiocruz) for printing these photographs. Dr. D.I. Gibson, The Natural History Museum, London for kindly provided copies of figures from Riggenbach (1896). Dr. A. de Chambrier, Museum National d'Histoire Naturelle, Geneva, for providing unpublished data.

REFERENCES

BÉKÉSI, L.; V.A. FEITOSA & F.A.B. CABRAL. 1992. Metacestodosis caused by plerocercoids of Proteocephalidea (Cestoda) in fish fry cultured in large scale in the Brazilian Northeast. **Parasitol. Hung. 25:** 9-13.

BONA, F.V. 1994. Family Dilepididae Railliet & Henry, 1909, p.443-554. *In*: L.F. KHALIL, A. JONES & R.A. BRAY (Eds). **Keys to the cestode parasites of vertebrates.** St Albans, CAB International, 751p.

BRAY, R.A.; A. JONES & K.I. ANDERSEN. 1994. Order Pseudophyllidea Carus, 1863, p. 205-247. *In*: L.F. KHALIL, A. JONES & R.A. BRAY (Eds.). **Keys to the cestode parasites of vertebrates.** St Albans, CAB International, 751 p.

BROOKS, D.R. 1978. Evolutionary history of the cestode order Proteocephalidea. **Syst. Zool. 27**: 312-323.

BROOKS, D.R. & T.L. DEARDORFF. 1980. Three proteocephalid cestodes from Columbian siluriform fishes, including Nomimoscolex alovarius sp.n. (Monticellidae: Zygobothriinae). **Proc. Helminthol. Soc. Wash. 47**: 15-21.

BROOKS, D.R. & G. RASMUSSEN. 1984. Proteocephalidean cestodes from Venezuelan siluriform fishes with a revised classification of the Monticellidae. **Proc. Biol. Soc. Wash. 97**: 748-760.

CHAMBRIER, A. DE & A.A. REGO. 1994. *Proteocephalus sophiae* n.sp. (Cestoda: Proteocephalidae), a parasite of the siluroid fish Paulicea luetkeni (Pisces: Pimelodidae) from the Brazilian Amazon. **Rev. Suisse Zool. 101**: 361-368.

———. 1995. *Mariauxiella pimelodi* n.g., n.sp. (Cestoda: Monticelliidae): a parasite of pimelodid siluroid fish from South America. **Syst. Parasitol. 30**: 57-65.

CHAMBRIER, A. DE & C. VAUCHER. 1994. Etude morpho-anatomique et génétique de deux nouveau Proteocephalus Weinland, 1858 (Cestoda: Proteocephalidae) parasites de Platydoras costatus (L.), poisson siluriforme du Paraguay. **Syst. Parasitol. 27**: 173-185.

CHAMBRIER, A. DE; T. SCHOLZ & C. VAUCHER. 1996. Tapeworms (Cestoda: Proteocephalidea) of *Hoplias malabaricus* (Pisces: Characiformes, Erythrinidae) in Paraguay: description of *Proteocephalus regoi* sp.n., and redescription of *Nomimoscolex matogrossensis*. **Folia Parasitol. 43**: 133-140.

CHAMBRIER, A. DE & C. VAUCHER. 1997. Révision des Cestodes (Monticelliidae) décrits pour Woodland (1934) chez *Brachyplatystoma filamentosum* avec redefinition des generes *Endorchis* et *Nomimoscolex*. **Syst. Parasitol. 37**: 219-233.

CHUBB, J.C.; D.W. POOL & C.J. VELTKAMP. 1987. A key to the species of cestodes (tapeworms) parasitic in British and Irish fishes. **Jour. Fish Biol. 31**: 517-543.

DIESING, C.M. 1850. Systema Helminthum. Vindobonae, Wilhelmum Braumüller, Vol. 1.

DIESING, K.M. 1854. Über eine naturgemässe Vertheilung der Cephalocotyleen. Sitzungsberichte der Kaiserlichen Akad. der Wissenschaften. Mathematisch-Naturwiss. **Classe**, Wien, **13**: 556-616.

———. 1855. Sechzehn Gattungen von Binnewürmern und ihre Arten. Denkschr. der Kaiserlichen Akad. der Wissenschaften. Mathematisch-Naturwiss. **Classe**, Wien, **9**: 171-185.

———. 1856. Zwanzig arten von Cephalocotyleen. Denkschr. der Kaiserlichen

Akad. der Wissenschaften. Mathematisch-Naturwiss. **Classe**, Wien, **12**: 23-38.

FORTES, E. 1981. Descrição de quatro espécies novas de helmintos de bagres (Pisces, Bagridae) do estuário do Guaíba, Porto Alegre, RS, Brasil. **Arq. Fac. Vet. Univ. Fed. Rio Grande do Sul 9**: 69-78.

FREZE, V.I. 1965. **Essentials of cestodology. Proteocephalata, in fish, amphibians and reptiles.** Jerusalem, Israel Program of Scientific Translations, Vol. 5.

FRITTS, D.H. 1959. Helminth parasites of the fishes of Northern Idaho. **Trans. Amer. Microsc. Soc. 78**: 194-202.

FUHRMANN, O. 1916. Eigentümlich Fischcestoden. **Zool. Anz. 46**: 385-398.

———. 1930. 1. Ordnung der Unterklasse Cestoda: Tetraphyllidea, p.204-247. *In*: W. KÜKENTHAL & T. KRUMBACH (Eds.). **Handbuch der Zoologie: eine Naturgeschichte der Stamme des Tiereiches 2 (7 Lief).** Berlin & Leipzig, De Gruyter, teil 2.

———. 1934. Vier Diesing'sche Typen. **Rev. Suisse Zool. 41**: 545-564.

GINETSINSKAYA, T.A. 1961. The life cycles of fish helminths and the Biology of their larval stages, p.140-179. *In*: V.A. DOGIEL, G.K. PETRUSHEVSKI & Y. POLYANSKI (Eds). **Parasitology of fishes.** Edinburgh & London, Oliver and Boyd, 384p.

HARWOOD, P.D. 1932. The helminths parasitic in the Amphibia and Reptilia of Houston, Texas, and vicinity. **Proc. U.S. Nat. Mus. 81**: 1-71.

JONES, A.; R.A. BRAY & L.F. KHALIL. 1994. Lists of genera, p.673-677. *In*: L.F. KHALIL; A. JONES & R.A. BRAY (Eds). **Keys to the cestode parasites of vertebrates.** St Albans, CAB International, 751p.

KHALIL, L.F.; A. JONES & R.A. BRAY. 1994. **Keys to the cestode parasites of vertebrates.** St Albans, CAB International, 751p.

LA RUE, G.R. 1911. A revision of the cestode family Proteocephalidae. **Zool. Anz. 38**: 473-482.

———. 1914. A revision of the cestode family Proteocephalidae. **Ill. Biol. Monogr. 1**: 1-350.

LYNSDALE, J.A. 1959. On a new species of Proteocephalus from Brazil. **Jour. Helminthol. 33**: 145-150.

MOLA, P. 1906. Di alcune specie poco studiate o mal note di Cestodi. **Ann. Mus. Zool. R. Univ. Napoli**, N.S., **2** (6): 1-12.

MONTICELLI, S. 1892. Notizie su di alcune specie di Taenia. **Boll. Soc. Nat. Napoli 5**: 151-174.

PAVANELLI, G.C. & A.A. REGO. 1989. Novas espécies de proteocefalídeos (Cestoda) de *Hemisorubin platyrhynchos* (Pisces-Pimelodidae) do Estado do Paraná. **Rev. Brasil. Biol. 49**: 381-386.

———. 1991. Cestóides proteocefalídeos de Surubim lima (Schneider, 1801) (Pisces-Pimelodidae) do rio Paraná e reservatório de Itaipu. **Rev. Brasil. Biol. 51**: 7-12.

———. 1992. *Megathylacus travassosi* sp.n. and *Nomimoscolex sudobim* Woodland, 1935 (Cestoda -Proteocephalidea) parasites of Pseudoplatystoma corruscans (Agassiz, 1829) (Siluriformes – Pimelodidae) from the Itaipu reservoir and Paraná river, Paraná state, Brazil. **Mem. Inst. Oswaldo Cruz 87** (Supl. 1): 191-195.

PAVANELLI, G.C. & M.H.M. SANTOS. 1991. *Cangatiella arandasi*, **gen.n., sp.n.** (Cestoda – Proteocephalidae) parasito de *Parauchenipterus galeatus* (Siluriformes – Auchenipteridae) do rio Paraná, Paraná. **Revta bras. Zool. 7**: 535-539.

———. 1992. *Goezeella agostinhoi* sp.n. e *Monticellia loyolai* sp.n., cestoides proteocephalídeos parasitas de peixes pimelodideos do rio Paraná, Paraná, Brazil. **Rev. Bras. Parasitol. Vet. 1**: 45-50.

PAVANELLI, G.C. & R.M. TAKEMOTO. 1995. New species of *Proteocephalus* (Cestoda – Proteocephalidae) parasitic in fishes from the Paraná River, Paraná, Brazil. **Mem. Inst. Oswaldo Cruz 90**: 593-596.

———. 1996. *Spasskyellina mandi* n.sp. (Proteocephalidae: Monticelliidae), parasite of *Pimelodus ornatus* Kner, 1857 (Pisces: Pimelodidae) of the Paraná River, Paraná, Brazil. **Mem. Inst. Oswaldo Cruz. 91**: 723-726.

PAVANELLI, G.C.; M.H. MACHADO; R. M. TAKEMOTO & M.H.M. SANTOS. 1994. Uma nova espécie de cestóide proteocefalídeo, *Monticellia belavistensis* sp.n. parasita de Pterodoras granulosus (Val.) (Pisces, Doradidae) do reservatorio de Itaipu, rio Paraná, Brazil. **Rev. Brasil. Biol. 11**: 587-595.

PERTIERRA, A.A.G. DE. 1995. *Nomimoscolex microacetabula* sp.n. y *N. pimelodi* sp.n. (Cestoda: Proteocephalidea), parásitos de Siluriformes del Río de La Plata. **Neotrópica 41**: 19-25.

POCHE, F. 1922. ZurKenntnis der Amphilinidea. **Zool. Anz. 54**: 276-287.

POOL, D.W & J.C. CHUBB. 1985. A critical scanning electron microscope study of the scolex of *Bothriocephalus acheilognathi* Yamaguti, 1934, with a review of the taxonomic history of the genus *Bothriocephalus* parasitizing cyprinid fishes. **Syst. Parasitol. 7**: 199-211.

REGO, A.A. 1975. Estudos de cestóides de peixes do Brazil. 2a. Parte: Revisão do gênero *Monticellia* La Rue, 1911 (Cestoda, Proteocephalidae). **Rev. Brasil. Biol. 35**: 567-586.

———. 1984a. Proteocephalidea from Amazonian freshwater fishes: new systematic arrangement for the species described by Woodland as *Anthobothrium* (Tetraphyllidea). **Acta Amazonica 14**: 86-94.

———. 1984b. Proteocefalídeos (Cestoda) de *Phractocephalus hemiliopterus*, peixe da Amazonia. **Mem. Inst. Oswaldo Cruz 79**: 257-261.

———. 1987a. Redescrição de *Pterobothrium crassicolle* Diesing, 1850 (Cestoda: Trypanorhyncha) e revalidaçao da espécie. **Mem. Inst. Oswaldo Cruz 82**: 51-53.

———. 1987b. Cestóides proteocefalídeos do Brasil. Reorganização taxonômica. **Rev. Brasil. Biol. 47**: 203-212.

———. 1989. Cestóides proteocefalídeos de "cachara", *Pseudoplatystoma fasciatus* (L.) (Pisces, Pimelodidae) de Mato Grosso. **Mem. Inst. Oswaldo Cruz 84** (Supl. 4): 455-461.

———. 1990. Cestóides proteocefalídeos parasitas de pintado, *Pseudoplatystoma corruscans* (Agassiz) (Pisces, Pimelodidae). **Ciênc. Cult.**, São Paulo, **42**: 997-1002.

———. 1991. Redescription of *Nomimoscolex piraeeba* Woodland, 1934 (Cestoda, Proteocephalidea), from the Amazon catfishes, *Brachyplatystoma* spp. with proposal of synonyms and invalidation of *Endorchiinae* and

Endorchis. **Mem. Inst. Oswaldo Cruz 86**: 229-232.

———. 1992. Redescription of *Gibsoniela mandube* (Woodland, 1935) (Cestoda: Proteocephalidea), a parasite of *Ageneiosus brevifilis* (Pisces: Siluriformes), and a reappraisal of the classification of the proteocephalideans. **Mem. Inst. Oswaldo Cruz 87**: 417-422.

———. 1994. Order Proteocephalidea Mola, 1928, p.257-293. *In*: L.F. KHALIL, A. JONES & R.A. BRAY (Eds). **Keys to the cestode parasites of vertebrates.** St Albans, CAB International, 751p.

———. 1995. A new classification of the cestode Order Proteocephalidea Mola. **Revta bras. Zool. 12**: 791-814.

———. 1997. *Senga* sp., Occurrence of a pseudophyllid cestode in a Brazilian freshwater fish. **Mem. Inst. Oswaldo Cruz 92**: 607.

REGO, A.A. & A. DE CHAMBRIER. 1995. *Crepidobothrium eirasi* n.sp. (Cestoda: Proteocephalidae), a parasite of the siluroid fish *Phractocephalus hemiliopterus* (Schneider, 1801) (Pisces: Pimelodidae) from the Brazilian Amazon. **Rev. Suisse Zool. 102**: 3-11.

REGO, A.A. & D.I. GIBSON. 1989. Hyperparasitism by helminths: new records of cestodes and nematodes in proteocephalid cestodes from South American siluriform fishes. **Mem. Inst. Oswaldo Cruz 84**: 371-376.

REGO, A.A. & G.C. PAVANELLI. 1985. *Jauella glandicephalus* gen.n. sp.n. e *Megathylacus brooksi* sp.n., cestóides proteocefalídeos patogênicos para o jaú, *Paulicea luetkeni*, peixe pimelodídeo. **Rev. Brasil. Biol. 45**: 643-652.

———. 1987. Cestóides proteocefalídeos do jaú, *Paulicea luetkeni*, peixe pimelodídeo do Brasil. **Rev. Brasil. Biol. 47**: 357-361.

———. 1990. Novas espécies de cestóides proteocefalídeos parasitas de peixes não siluriformes. **Rev. Brasil. Biol. 50**: 91-101.

———. 1991. *Proteocephalus gibsoni* nom. nov. for *Proteocephalus ocellatus* Rego and Pavanelli, 1990 preoccupied by *Proteocephalus ocellatus* (Rudolphi, 1802). **Rev. Brasil. Biol. 51**: 701.

———. 1992a. Redescrição de *Nomimoscolex admonticellia* (Woodland), **comb.n.** (Cestoda, Proteocephalidea), parasito de *Pinirampus pirinampu* (Spix), um siluriforme de água doce. **Revta bras. Zool. 9**: 283-289.

———. 1992b. Checklist of the cestode order Proteocephalidea parasites from South America freshwater fishes. **Rev. Unimar**, Maringá, **14**: 109-137.

REGO, A.A.; J.C. SANTOS & P.P. SILVA. 1974. Estudo de cestóides de peixes do Brazil. **Mem. Inst. Oswaldo Cruz 72**: 187-204.

RIGGENBACH, E. 1895. Beiträge zur Kenntnis der Taenien der Süsswasserfische. Centralbl. Bakteriologie und Parasitenkunde. Erste Abteilung. **Medizinisch-hygienische Bakteriologie und tierische Parasitenkunde 18**: 609-613.

———. 1896. Das Genus *Ichthyotaenia*. **Rev. Suisse Zool. 4**: 165-275.

RUDOLPHI, C.A. 1802. Beobachtungen über die Eingeweidewürmer. **Arch. Zool. Zoot. 3**: 61-125.

SCHÄFFER, G.V.; A.A. REGO & G.C. PAVANELLI. 1992. Peritoneal and visceral cestode larvae in Brazilian freshwater fishes. **Mem. Inst. Oswaldo Cruz 87** (Supl. 1): 257-258.

SCHMIDT, G.D. 1986. **CRC Handbook of tapeworm identification.** Boca Raton,

Florida, CRC Press 675p.

SCHOLZ, T.; A. DE CHAMBRIER; A. PROUZA & R. ROYERO. 1996b. Redescription of *Proteocephalus macrophallus*, a parasite of *Cichla ocellaris* (Pisces: Cichlidae) from South America. **Folia Parasitol. 43**: 287-291.

SPECTOR, B.H. & F.M. GARZON. 1988. Two new species of the genus *Proteocephalus* Weinland, 1858 (Proteocephalidea, Eucestoda) of freshwater fishes *Rhamdia sapo* (Valenciennes, 1840) from Uruguay. **Parasitologia al Dia 12**: 148-154.

SZIDAT, L. & A. NANI. 1951. Diplostomiasis cerebralis del pejerrey una grave epizootia que afecta a la economia nacional producida por larvas de trematodes que destruyen el cerebro de los pejerreyes. **Revista del Instituto Nacional de Investigacion de las Ciencias Naturales**, Museo Argentino de Ciencias Naturales "Bernardino Rivadavia", Ciencias Zoológicas, **1**: 323-384.

TAKEMOTO, R.M. & G.C. PAVANELLI. 1996. Proteocephalidean Cestodes in the Freshwater Fish, *Cichla monoculus* from the Parana river, Brazil. **Stud. Neotropical Fauna & Environment 31**: 123-127.

TAKEMOTO, R.M.; G.C. PAVANELLI & F. BONA. 1994. Ocorrência de larvas de *Valipora* sp. (Cestoda: Cyclophyllidea) em *Prochilodus scrofa*, "curimba", peixe de escama do rio Paraná, região de Porto Rico, Pr, Brasil, p.170. *In*: **VIII Simpósio Brasileiro de Aqüicultura**, Piracicaba, p.170.

THATCHER, V.E. 1981. Patologia de peixes da Amazonia brasileira. I. Aspectos gerais. **Acta Amazonica 11**: 125-140.

———. 1991. Amazon fish parasites. **Amazoniana 11**: 263-571.

WAGNER, O. 1915. Über den Entwicklungsgang einer Fischtänie. **Zool. Anz. 46**: 70-75.

WARDLE, R.A. & J.A. MCLEOD. 1952. **The zoology of tapeworms.** Minneapolis, The University of Minnesota Press, 780p.

WOODLAND, W.N.F. 1925a. On three new proteocephalids (Cestoda) and a revision of the genera of the family. **Parasitology 17**: 370-394.

———. 1925b. On some remarkable new *Monticellia*-like and other cestodes from Sudanese siluroids. **Q. Jour. Microsc. Sci. 69**: 703-729.

———. 1933a. On the anatomy of some fish cestodes described by Diesing from the Amazon. **Q. Jour. Microsc. Sci. 76**: 175-208.

———. 1933b. On two new cestodes from the Amazon siluroid fish *Brachyplatystoma vaillanti* Cuv. and Val. **Parasitology 25**: 485-490.

———. 1933c. On a new subfamily of proteocephalid cestodes – the Othinoscolecinae – from the Amazon siluroid fish *Platystomatichthys sturio* (Kner). **Parasitology 25**: 491-500.

———. 1934a. On the Amphilaphorchidinae, a new subfamily of proteocephalid cestodes, and *Myzophorus admonticellia*, gen. et sp.n., parasitic in *Pirinampus* spp. from the Amazon. **Parasitology 26**: 141-149.

———. 1934b. On some remarkable new cestodes from the Amazon siluroid fish, *Brachyplatystoma filamentosum* (Lichtenstein). **Parasitology 26**: 268-277.

———. 1934c. On six new cestodes from Amazon fishes. **Proc. Zool. Soc. Lond. 104**: 33-44.

———. 1935a. Additional cestodes from the Amazon siluroids pirarará, dorad and

sudobím. **Proc. Zool. Soc. Lond. 104**: 851-862.
———. 1935b. Some more remarkable cestodes from Amazon siluroid fish. **Parasitology 27**: 207-225.
———. 1935c. Some new proteocephalids and a ptychobothriid (Cestoda) from the Amazon. **Proc. Zool. Soc. Lond. 105**: 619-623.
YAMAGUTI, S. 1934. Studies on the helminth fauna of Japan Part 4. Cestodes of fishes. **Jpn. Jour. Zool. 6**: 1-112.
———. 1959. **Systema Helminthum.** New York & London, Interscience, Vol. 2, 860p.

Recebido em 12.IX.1997; aceito em 18.III.1999.