FOLIA PARASITOLOGICA 43: 287–291, 1996

Redescription of *Proteocephalus macrophallus*, a parasite of *Cichla ocellaris* (Pisces: Cichlidae) from South America

Tomáš Scholz[1], **Alain de Chambrier**[2], **Antonín Prouza**[3], and **Ramiro Royero**[4]

[1]Institute of Parasitology, Academy of Sciences of the Czech Republic, Branišovská 31, 370 05 České Budějovice, Czech Republic;

[2]Natural History Museum, Geneva, PO Box 6434, 1211 Geneva 6, Switzerland;

[3]State Veterinary Research Institute, Dolní ulice, 370 00 České Budějovice, Czech Republic;

[4]FUDECI, Palacio de las Academias, Edificio Anexo Piso 2, Av. Universidad, Bolsa a San Francisco, Caracas, Venezuela

Key words: *Proteocephalus macrophallus*, Proteocephalidae, *Cichla ocellaris*, Cichlidae, Venezuela

Abstract. *Proteocephalus macrophallus* (Diesing, 1850), considered by several authors as *species inquirenda*, was recently found in *Cichla ocellaris* in Venezuela. This material is compared with voucher specimens from the same host (*C. ocellaris*) from Brazil, identified and redescribed as *P. macrophallus* by Woodland (1933). The specific status of *P. macrophallus* is confirmed. This species is characterized by: 1) the shape of the body, which is wide and short, 2) the absence of a neck, 3) the distribution of the vitelline follicles, which converge posteriorly to the ovarian lobes, and 4) the structure of the uterus, which is evacuated in the last proglottides and transformed to thick-walled diverticles apparently separated each from other. A neotype is designated.

Proteocephalid tapeworms, apparently conspecific with *Proteocephalus macrophallus* (Diesing, 1850), were found in the intestine of a cichlid fish, *Cichla ocellaris*, from Venezuela. *Proteocephalus macrophallus* was first found by Natterer in *Cichla monoculus* (= *Cichla ocellaris*) from Mato Grosso, Brazil, 22.10.1826 and 30.06.1827, and described by Diesing (1850) as a new species. Since then, this taxon has only been found by Woodland (1933), who provided a brief description of immature specimens found in *C. ocellaris* from Brazil. La Rue (1914), Freze (1965), Rego (1987) and Rego and Pavanelli (1992) considered *P. macrophallus* as *species inquirenda*.

Since Woodland's description is incomplete and no details could be provided on the morphology of pregravid segments, *P. macrophallus* is redescribed on the basis of new material and a neotype is designated.

MATERIALS AND METHODS

Seven tapeworms were found in the intestine of *Cichla ocellaris* sampled at Sabanita, Rio Atabapo, Venezuela, on 13 March 1992 by one of us (A. P.). The worms were placed into saline water and fixed under a slight coverslip pressure with 70 % alcohol. Thereafter, they were stained with carmine, dehydrated and mounted in Canada balsam. The material has been deposited in the helminthological collection of the Institute of Parasitology, České Budějovice (IPCAS), the Natural History Museum, Geneva, Switzerland (MHNG), and the Natural History Museum, London, England (BMNH).

Woodland's material of *P. macrophallus*, deposited in the Natural History Museum, London (BMNH 1961.4.7.87-98), has also been studied. Type specimens of *P. macrophallus* have not been available. They have been found neither in the Natural History Museum in Vienna, Austria (H. Sattmann – personal communication) nor in the Natural History Museum in Geneva, where Diesing's specimens, including types of several proteocephalidean taxa, are stored.

All measurements are given in micrometres (μm) unless otherwise indicated. Abbreviations used in descriptions are as follows: m = mean; n = number of measurements; CV = coefficient of variation.

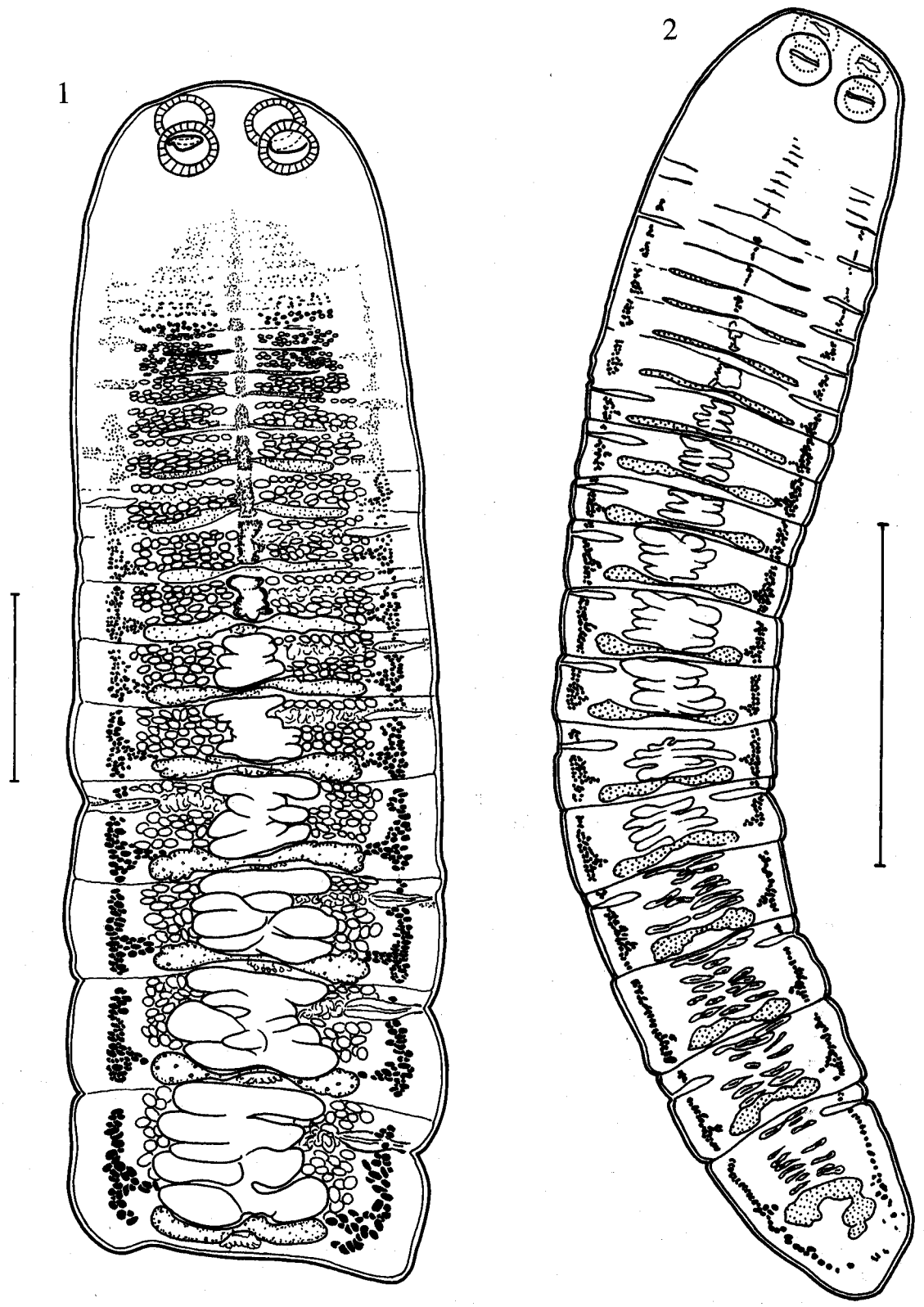
RESULTS

Redescription of *Proteocephalus macrophallus* (Diesing, 1850) Figs. 1–9

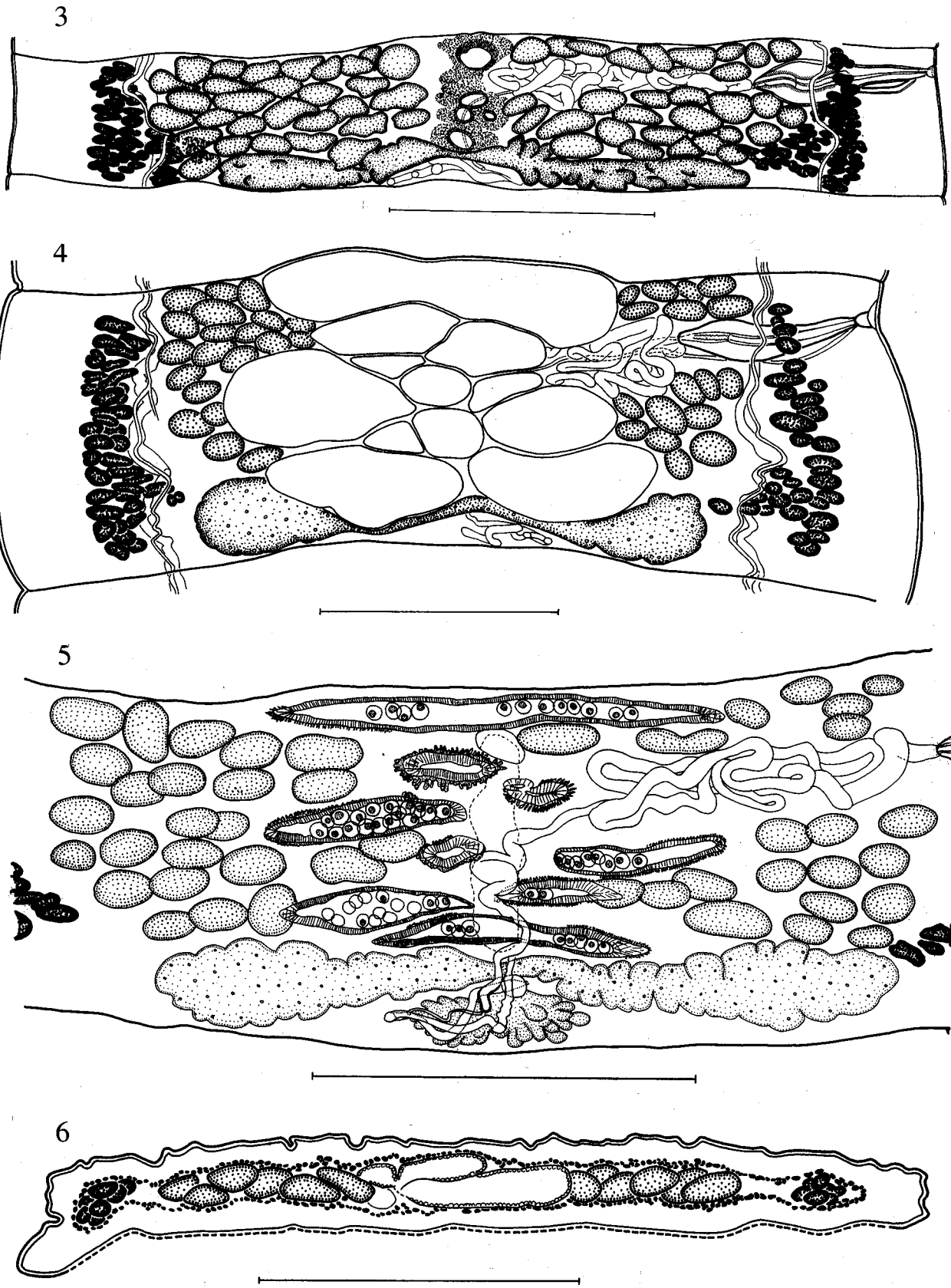
Synonyms: *Taenia macrophalla* Diesing, 1850; *Ichthyotaenia macrophalla* (Diesing, 1850) Riggenbach, 1896.

Material studied: 7 complete specimens from *Cichla ocellaris* from Venezuela (IPCAS – Cat. No. 245; MHNG INVE 19731, 19732; BMNH Cat. No. 1996.4.24.1); 10 immature specimens from *Cichla ocellaris* from Brazil (Amazonia) (BMNH – Cat. No. 1961.4.7.87-98).

Description (based on material from Venezuela): Proteocephalidae, Proteocephalinae. Testes, ovary, uterus and vitelline follicles medullar. Small worms, flattened dorsoventrally. Strobila acraspedote, bearing about

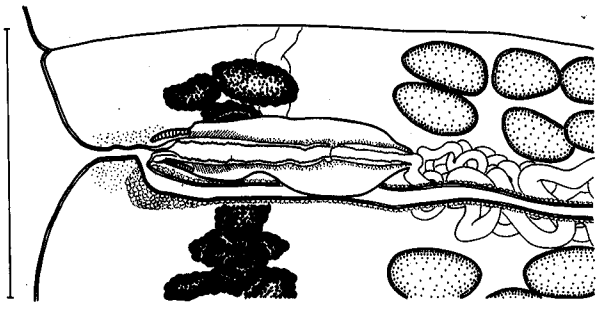


Figs. 1, 2. *Proteocephalus macrophallus* (Diesing, 1850). **Fig. 1.** Total view of the neotype. **Fig. 2.** Total view of a specimen with tapering posterior part of body. Scale bars = 1 mm (Fig. 1) and 2 mm (Fig. 2).

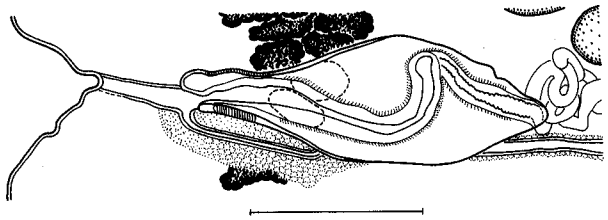


Figs. 3–6. *Proteocephalus macrophallus* (Diesing, 1850). **Fig. 3.** Mature proglottis, neotype, dorsal view. **Fig. 4.** Pregravid proglottis, neotype, dorsal view. **Fig. 5.** Pregravid proglottis showing collapsed thick uterine diverticles. **Fig. 6.** Transverse section of pregravid proglottis. Scale bars = 500 µm.

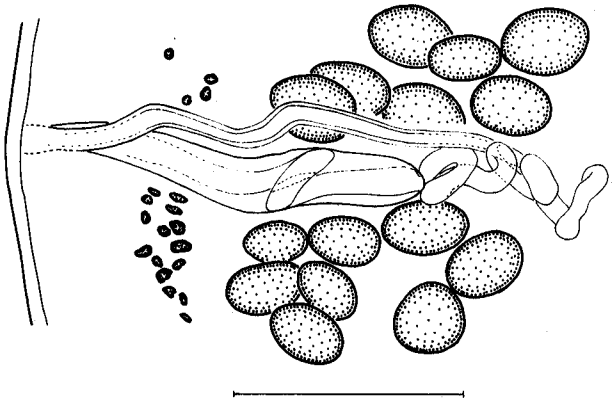
7



8



9



Figs. 7–9. *Proteocephalus macrophallus* (Diesing, 1850). **Fig. 7.** Terminal genitalia with straight cirrus. **Figs. 8, 9.** Terminal genitalia with curved cirrus. Figs. 1–8 – specimens from Venezuela; 9 – specimen from Brazil (Woodland 1933). Scale bars = 250 µm (Fig. 7) and 100 µm (Figs. 8 and 9).

25–30 proglottides, 6–9 mm long and 1.3–2.2 wide, width representing 20–30 % of total length (Figs. 1, 2). Immature, mature and pregravid proglottides wider than long; last pregravid proglottis triangular, longer than wide. Tegument thin.

Scolex indistinctly separated from strobila, devoid of apical organ or spines, 1090–1485 wide at level of suckers (Fig. 1). Four uniloculate suckers situated dorsoventrally two by two, with narrow, thin-walled apertures and strongly muscular internal walls, 265–330 (m = 300, n = 12) in diameter.

Internal longitudinal musculature easily visible, forming anastomosed muscular fibres. Osmoregulatory canals situated between testes and vitelline follicles. Ventral canals overlapping vitelline follicles in some segments, 30–60 in diameter. Dorsal canals 8–20 in diameter.

Testes medullary, in two fields separated by vas deferens, spherical to oval, 75–120 × 65–80, numbering 38–71 (m = 55, n = 22, CV = 17.94) (Fig. 3). Cirrus pouch elongate, thin-walled, 210–365 long, occupying 14–20 % (m = 17 %, n = 31, CV = 9.6) of proglottis width (Figs. 3, 4, 7, 8). Terminal portion of pouch thick-walled, with numerous muscle fibres. No sperm duct observable in cirrus pouch. Cirrus long, occupying total length of cirrus pouch, in most proglottides straight, with narrowed terminal part (Fig. 7), only exceptionally with one curve in basal part (Fig. 8).

Genital ducts passing between osmoregulatory canals. Vas deferens coiled, elongated, reaching to midline of body in mature proglottides. Genital atrium present; genital pore irregularly alternating, situated anteriorly in 15–28 % (m = 21 %, n = 34, CV = 16.11) of proglottis length (Figs. 3, 4).

Vagina posterior (68 %) or anterior (32 %, n = 34) to cirrus pouch, in terminal part lined with numerous chromophil cells, without muscular sphincter. Mehlis' glands 200–250 in diameter, occupying 10–13 % of proglottis width.

Ovary medullary, bilobed, massive, follicular, occupying 55–68 % (m = 60 %, n = 32, CV = 6.7) of proglottis width (Figs. 3, 4). Vitelline follicles medullary, arranged in two lateral rows, uninterrupted by vagina and cirrus pouch, not reaching anterior and posterior margins of segments in pregravid proglottides. In posterior part, vitelline follicles converging medially, almost reaching to ovarian lobes (Figs. 1–4).

Uterus medullar, preformed in immature proglottides, with 4–7 lateral thin-walled branches in pregravid segments (Fig. 4). Eggs released by several ventral apertures. In last proglottides, uterus partly or entirely evacuated, forming thick-walled diverticles, apparently separated one from another (Fig. 5). At this stage of development, internal uterine wall composed of a thick layer of numerous elongate chromophil cells. Eggs spherical, with thickened external collapsed envelope, 21–31 in diameter; oncospheres not fully formed, 10–15 in diameter, composed of numerous granulated cells.

DISCUSSION

The original description of *Taenia macrophalla* (= *Proteocephalus macrophallus*) is very brief and incomplete (Diesing 1850). Woodland (1933) provided a more complete description of this species; however, his study was based only on immature specimens, which are apparently deformed or contracted; in addition the

quality of the mounts is very poor and many characters are difficult to observe.

The shape of *Proteocephalus macrophallus* cestodes was described as oblong, with maximum body width in the anterior part (Woodland 1933). However, this shape does not seem to be typical for *P. macrophallus* because six of seven specimens from Venezuela were slightly widened posteriorly (Fig. 1), similarly to those figured by Diesing (1850 – figs. 16 and 20) in the original description of *Taenia macrophalla.*

In his description, Woodland (1933) did not report the distribution of vitelline follicles, which are distinctly convergent posteriorly, reaching to ovarian lobes (Figs. 1–4). Although difficult to observe, vitelline follicles in some segments of Woodland's specimens are evidently convergent. Woodland (1933) also mentioned the presence of "a long coiled unarmed cirrus" (p. 195). Only in Woodland's cross section material, we observe in the cirrus pouch region, a tubular structure forming some loops, but the poor condition of this cross section material did not demonstrate if these loops are internal or external to the cirrus pouch. On the contrary, Woodland's entire specimens demonstrated that the cirrus is straight in most segments. It is exceptionally curved, when it does not form loops but only one curve (Fig. 9). An identical structure of the cirrus was found in the present study. In addition, in the three last proglottides of a specimen from Brazil the cirrus appears to be straight.

The presence of a chromophil cell layer on the internal wall of the uterine diverticles in the final proglottis is uncommon in the Proteocephalidea. The function of these cells, which seem to be of the apocrine type, remains unclear as the eggs seem to be evacuated before their complete development. This particular character needs to be studied in more samples.

It can be concluded that the re-examination of Woodland's material from Brazil confirmed the conspecificity of these cestodes with those recently collected from Venezuela.

Morphological features typical for *P. macrophallus* are: 1) the shape of the body, which is wide and short; 2) the absence of a neck; 3) the distribution of vitelline follicles, which converge posteriorly towards ovarian lobes; and 4) the structure of the uterus, which is evacuated in the last proglottides and transformed to thick-walled diverticles separated each from other. These features, and particularly the structure of the gravid uterus, differentiate it from most other Proteocephalideans (Freze 1965, Schmidt 1986, Rego 1994). We refrain from attributing it to a new monospecific genus until its systematic and phylogenetic position is clearly demonstrated. Since type specimens of *P. macrophallus* do not exist, the specimen found in *Cichla ocellaris* in Venezuela at Sabanita, is designated as the neotype and deposited in the MHNG collection.

Acknowledgements. The authors thank to Dr. David I. Gibson (Natural History Museum, London) for the loan of Woodland's material of *Proteocephalus macrophallus*, and to Dr. Helmut Sattmann (Natural History Museum, Vienna) for providing the information about Diesing's material of cestodes deposited in Vienna. One of the authors (T.S.) is deeply indebted to the authorities of the Natural History Museum in Geneva for supporting his visits to the Museum in 1994 and 1995. This study was also partly supported by a research project of the Grant Agency of the Czech Republic (project No. 506/3294).

REFERENCES

DIESING C. M. 1850: Systema Helminthum. Vol. I. Vindobonae. XII + 679 pp.

FREZE V. I. 1965: Essentials of Cestodology. Proteocephalata in Fish, Amphibians and Reptiles. Publ. House Nauka, Moscow, 597 pp.

LA RUE G. R. 1914: A revision of the family Proteocephalidae. Ill. Biol. Monogr. 1:1–350.

REGO A. A. 1987: Cestoides proteocefalídeos do Brasil. Reorganizacao taxonomica. Rev. Brasil. Biol. 47: 203–212.

REGO A. A. 1994: Order Proteocephalidea Mola, 1928, In: L. F. Khalil, A. Jones and R. A. Bray (Eds.), Keys to the Cestode Parasites of Vertebrates. CAB International, Wallingford, UK, pp. 257–293.

REGO A. A., PAVANELLI G. C. 1992: Checklist of the cestode order Proteocephalidea parasites from South America freshwater fishes. Revta Unimar 14: 109–137.

SCHMIDT G. D. 1986: Handbook of Tapeworm Identification. Boca Raton, Florida, CRC Press Inc., 675 pp.

WOODLAND W. N. F. 1933: On the anatomy of some fish cestodes described by Diesing from the Amazon. Quart. J. Micr. Sci. 76: 175–208.

Received 18 March 1996

Accepted 21 June 1996