FOUR SPECIES OF *CHORICOTYLE* VAN BENEDEN & HESSE (MONOGENEA: DICLIDOPHORIDAE:CHORICOTYLINAE) PARASITIC ON *ORTHOPRISTIS RUBER* (CUVIER) (OSTEICHTHYES: HAEMULIDAE) FROM THE BRAZILIAN COAST, WITH DESCRIPTION OF TWO NEW SPECIES.

J. L. LUQUE[1], J. F. R. AMATO[2] & R. M. TAKEMOTO[3]

(1) Bolsista da CAPES; (2) Pesquisador do CNPq.;(3) Bolsista do CNPq., Curso de Pós-Graduação em Parasitologia Veterinária, Departamento de Biologia Animal, Universidade Federal Rural do Rio de Janeiro, BR-465 km 7, Caixa Postal 74512, 23851-970, Seropédica, RJ, Brasil

SUMMARY: Four species of the genus *Choricotyle* (Monogenea: Diclidophoridae) parasites of the haemulid fish *Orthopristis ruber* are described and illustrated. Two of them, *Choricotyle brasiliensis* n. sp. and *C. orthopristis* n. sp. are considered new species. *Choricotyle brasiliensis* n. sp. can be differentiated from its congeners by a combination of characters which include, heterogeneity of the haptoral peduncles length and the clamps diameter, vitellaria penetrating the haptor, number of testes, and number of spines of the genital atrium. *Choricotyle orthopristis* n. sp. is characterized mainly by the uniformity of the clamps diameter and of the haptorial peduncles length, vitellaria not penetrating the haptor, and body length/haptor length ratio of 1: 1.5-2. *Choricotyle cynoscioni* (MacCallum, 1917) and *C. aspinachorda* Hargis, 1955 are recorded by the first time in Brazil.

KEY WORDS: Monogenea, Diclidophoridae, *Choricotyle, Choricotyle brasiliensis* n. sp., *Choricotyle orthopristis* n. sp., *Choricotyle aspinachorda, Choricotyle cynoscioni,* Haemulidae, *Orthopristis ruber,* Brazil, Atlantic Ocean.

INTRODUCTION

Choricotyle van Beneden & Hesse, 1863, is the largest diclidophorid genus. To date, it includes 17 species (MAMAEV, 1976; OLIVA, 1987). Studies about *Choricotyle* species from the American Atlantic Ocean include the papers of LLEWELLYN (1941a, b), PRICE (1943), FRAYNE (1943), SPROSTON (1946), HARGIS (1955), and BASHIRULLAH & RADO (1987). The only record of the genus *Choricotyle* in Brazil is that of KOHN *et alii* (1984) parasitizing *Haemulon sciurus* (Shaw) in the coast of Rio de Janeiro. There is a possible error in the identification of the fish host by these authors. According to MENEZES & FIGUEIREDO (1980), *H. sciurus* does not occur in the southeastern Brazilian coast. In the present paper, four species of *Choricotyle* are described and illustrated, all of them parasites of the haemulid fish *Orthopristis ruber* (Cuvier, 1829) from the Brazilian coast. Two of the taxa described are considered new species. Two new geographical and host records are included.

MATERIALS AND METHODS

The specimens studied are part of the material collected from 162 specimens of *Orthopristis ruber* (Cuvier, 1829), caught at Sepetiba Bay, State of Rio de Janeiro (22° 51'S, 43° 56'W), Brazil, during 1991 and 1992. Fishes measured 11.5 to 32 cm and weighted 25-410 g. Twelve specimens of *O. ruber* were collected before by one of the authors (J.F.R.A.) from Florianópolis, State of Santa Catarina (27° 29'S, 48-33' W), Brazil, during 1977 and 1978. Monogeneans were removed from the gills, washed in 0.65% NaCl solution, fixed in 5% formalin or A.F.A. and preserved in 70% ethyl alcohol. The parasites were stained either with Gomori's trichrome, Delafield's hematoxylin or Mayer's carmalumen, and were mounted in Canada balsam. A drawing tube was used in the preparation of the illustrations. Measurements were made in micrometers (μ) unless otherwise indicated, while the range is followed by the mean within parentheses. The terms prevalence, intensity of infestation, and mean intensity of infestation were used according to MARGOLIS *et alii* (1982). The holotypes, and some paratypes were deposited in the Helminthological Collection of the United States National Museum (USNM). Some paratypes were deposited in the Coleção Helmintológica da Fundação Instituto Oswaldo Cruz (CHIOC), Rio de Janeiro, Brazil.

DESCRIPTION

Choricotyle brasiliensis n. sp.
(Figs. 1-4)
DESCRIPTION (based on 24 specimens, measurements on seven stained whole mounts): Diclidophoridae. Choricotylinae. Total body length (Fig. 1) 2.12-3.10 mm (2.64 mm), maximum width at ovary level, 329-787 (544). Body length without haptor, 1.46-2.10 mm (1.87 mm), distinctly set off from haptor. Haptor with eigth clamps of unequal diameter, clamp peduncles decreasing in length posteriad; first pair 139-204 (154) long, 131-226 (193) wide; second pair 153-197 (180) long, 190-263 (216) wide; third pair 146-212 (186.5) long, 146-263 (191) wide; fourth pair 80-139 (111) long, 102-161 (128) wide; clamps (Fig. 2) typical of *Choricotyle*; anterior midsclerite subtriangular, thick, curved anteriorly, associated to small accessory sclerite and two accessory suckers of unequal diameter, articulated at base with the posterior midsclerite; anterolateral sclerites curved, anterior portion wide, subrectangular, posterior portion thinner, short, related to anterior midsclerite; midlateral sclerites short, slightly curved, wide at base, folded laterally, base articulated with anterolateral sclerites curvature, posterior extremity not in contact with posterolateral sclerites; posterolateral sclerites curved, anterior extremity thin, reaching posterior third of posterior midsclerite; posterior midsclerite with mid-longitudinal groove, surrounded by sligthly sclerotized thickening. Posterior quadrants of clamp with four to six concentric arcs of skeletal rods; terminal appendix between posterior clamps, with three pairs of hooks (Fig. 3); the two outer pairs simple, 11 long; inner pair sickle-shaped with long shank, curved shaft and point, 44-48 (46) long. Mouth subterminal; buccal organs 55-82 (69) long, 42-64 (52) wide; pharynx ovoid, 64-126 (86) long, 48-91 (69) wide; esophagus tubular, moderately long; intestinal bifurcation at level of genital atrium; intestinal ceca ramified, penetrating haptor. Testes postovarian, ovoid, 16-21 (19) in number, 43-95 (62) long, 35-64 (44) wide; vas deferens sinuous, extending to genital atrium; genital atrium (Fig. 4) subspherical, 38-51 (45) long, 42-64 (51) wide, with 7-10 (8) curved spines, typical of the genus. Ovary bilobed; seminal receptacle well developed, preovarian; genito-intestinal duct not observed; vitellaria filling most of body, coextensive and dorsal to intestinal ceca, penetrating haptor; eggs fusiform, 155 long, 84 wide, with two polar filaments.

Taxonomic summary
Synonym: *Choricotyle hysteroncha* of KOHN *et alii* (1984).
Type host: *Orthopristis ruber* (Cuvier).
Site of infestation: gills.
Type locality: Sepetiba Bay, State of Rio de Janeiro, Brazil.
Other locality: Florianópolis, State of Santa Catarina, Brazil.
Prevalence: 11.1%.
Intensity of infestation: 24, in 18 hosts.
Mean intensity of infestation: 1.33.
Specimens deposited: USNM Holotype N° 83196 , paratype N°s 83197 - 83201, CHIOC paratype N°s 33105 e 33106 .

Etymology: the specific name *brasiliensis* refers to the geographical area where the new species was collected.

Remarks
The genus *Choricotyle* van Beneden & Hesse, 1863 contains species reported from marine teleost fishes belonging to different families in temperate and subtropical waters of the world. These species are: *C. chrysophryi* van Beneden & Hesse, 1863 (type species); *C. elongata* (Goto, 1894); *C. labracis* (Cerfontaine, 1895); *C. cynoscioni* (MacCallum, 1917); *C. caulolatili* (Meserve, 1938); *C. hysteroncha* (Fujii, 1944); *C. multitesticulae* (Chauhan, 1945); *C. caudalis* (Koratha, 1955); *C. aspinachorda* Hargis, 1955; *C. sonorensis* Caballero & Bravo-Hollis, 1962; *C. oregonensis* McCauley & Smoker, 1969; *C. polynemi* Mamaev, 1972; *C. pellonae* Kristsky & Bilqees, 1973; *C. simplex* Mamaev, 1976; *C. australiensis* Roubal, Armitage & Rohde, 1983; *C. crassicaudata* Mamaev & Aleshkina, 1984 and *C. anisotremi* Oliva, 1987 (SPROSTON, 1946; MAMAEV, 1976; OLIVA, 1987).
The new species described above can be compared with *C. chrysophryi, C. caulolatili, C. sonorensis,* and *C. australiensis*; species with unequal haptorial peduncles and vitellaria penetrating the haptor. *Choricotyle chrysophryi* is a very common parasite of sparid fishes in the world (LLEWELLYN, 1941b; PRICE, 1943; YAMAGUTI, 1963; GAJEVSKAJA & ALJOSHKINA, 1986; RADUJKOVIC & EUZET, 1989) and is differentiated from the new species by: 1. the origin of the anteriormost pair of haptor peduncles, separated by the width of the body proper (contiguous to the body proper in the new species), 2. absence of terminal appendix hooks (conspicuous in the new species), and 3. the number of testis (30 in *C. chrysophryi*, 16-21 in the new species). Moreover, the measures of *C. chrysophryi* are larger than in the new species (*e.g.* the total body length is 6.0 mm in *C. chrysophryi* and 2.6 mm in the new species).
Choricotyle caulolatili, was described originally in *Diclidophora* by MESERVE (1938) based on two specimens collected from *Caulolatilis princeps* (Jenyns) in the Galapagos Islands. Later, SPROSTON (1946) transferred this species to the genus *Choricotyle*. PAYNE (1987) recorded this species from the California coast. *Choricotyle caulolatili* can be separated from the new species by: 1. the number of genital atrium spines (13 in *C. caulolatili*, 7-10 in the new species); 2. the anterior midsclerite shape; 3. the number of testis (55-65 in *C. caulolatili*, 16-21 in the new species), and 4. the body measures (*e.g.* total length, 4.5-6 mm in *C. caulolatili*, 2.64 in the new species).
Choricotyle sonorensis, a species initially considered as *species inquerenda* by MAMAEV (1976) and OLIVA (1987), because its description was based on one specimen, is a common parasite of the haemulid fish *Isacia conceptionis* (Cuvier) from the central Peruvian coast (TANTALEÁN *et alii*, 1988). The main differences between *C. sonorensis* and the new species are: 1. the position of the seminal receptacle (post-ovarian in *C. sonorensis*, preovarian in the new species) and 2. the number of the testes (40 in *C. sonorensis*, 16-21 in the new species).

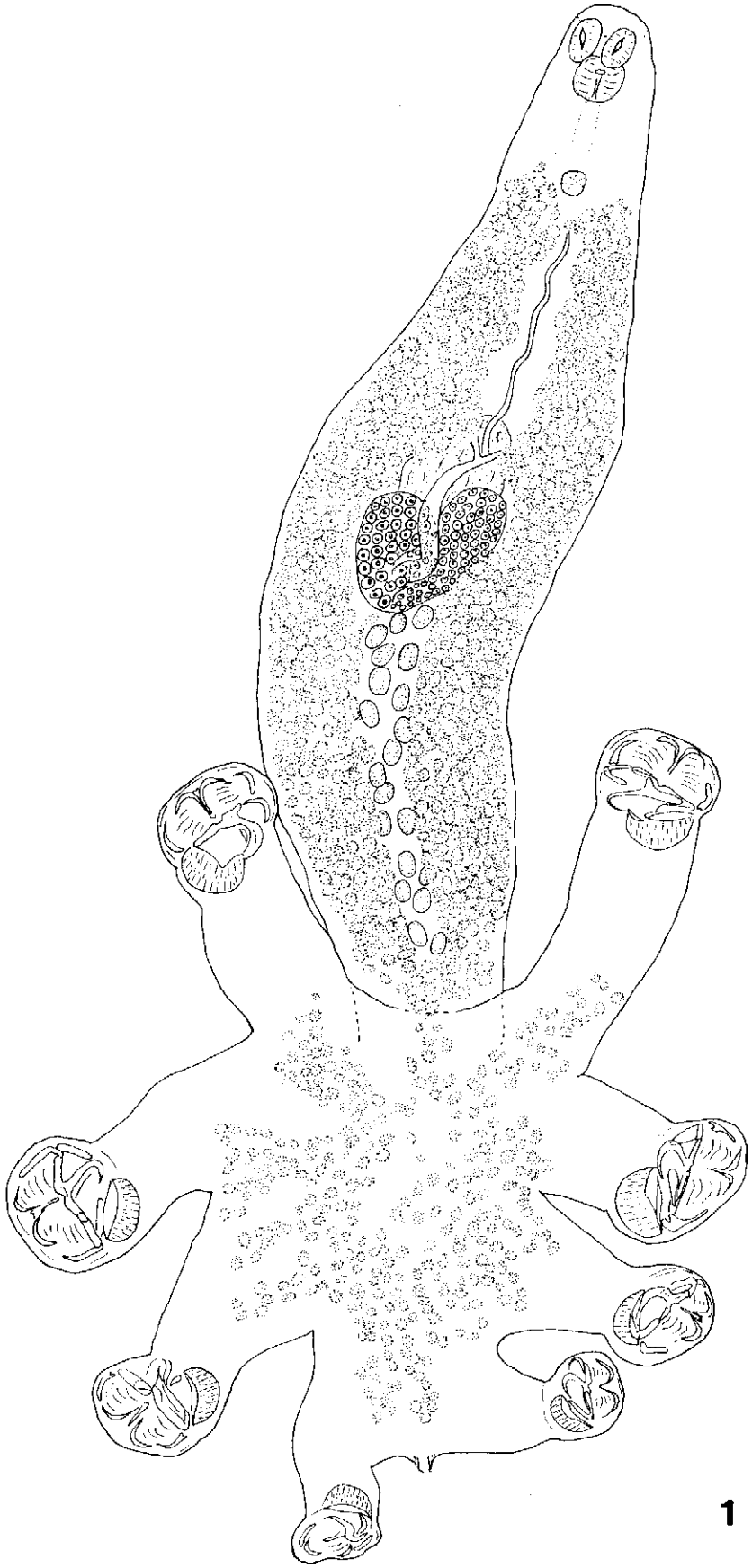
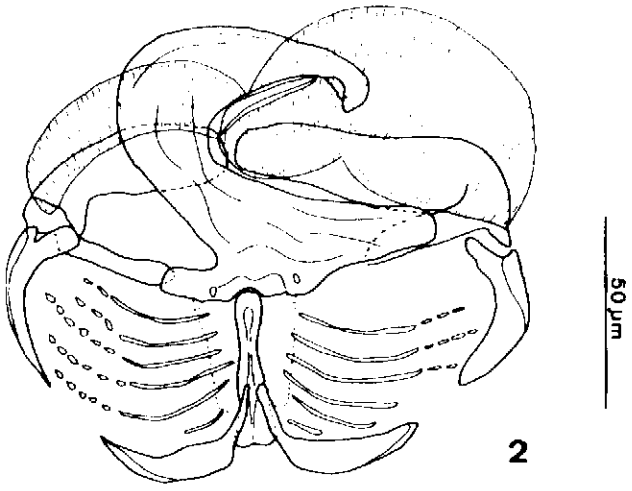


Fig.1. *Choricotyle brasiliensis* n. sp. - Holotype, entire worm, ventral view.



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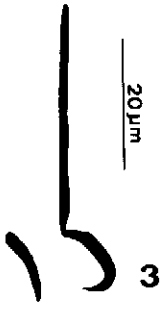

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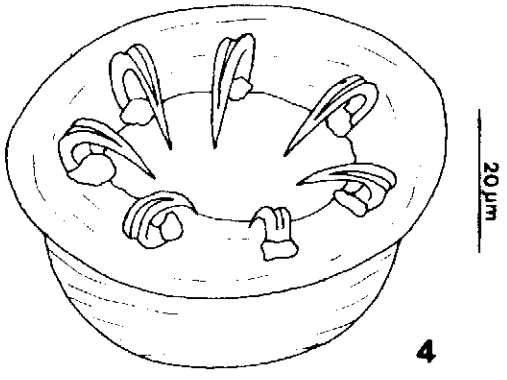

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Fig.2-4. *Choricotyle brasiliensis* n. sp.
Fig.2. Clamp. Fig.3. Hooks of the terminal appendix. Fig.4. Genital atrium.

Choricotyle australiensis is a parasite of the sparid fish *Chrysophrys auratus* (Bloch & Schneider) from the Australian and New Zealand coasts (ROUBAL *et alii*, 1983), and although it presents a similar disposition of the clamp peduncles the clamp diameter is only sligthly unequal. It differs from the new species by: 1. the presence of the terminal appendix (absent in the adult specimens in *C. australiensis*, conspicuous in the new species) and 2. the number of testes, also notoriously different (70 in *C. australiensis*, 16-21 in the new species).

Other species of *Choricotyle* parasitizing haemulid fishes are: *C. hysteroncha* (Fujii, 1944) and *C. anisotremi* Oliva, 1987. *Choricotyle hysteroncha* was described originally based on specimens collected from *Bathystoma striatum* (Linnaeus), *Brachygenys chrysargyreus* (Günther), and *Haemulon flavolineatum* (Desmarest) off the North American Atlantic coast, has vitellaria penetrating the haptor. The new species is clearly differentiated from *C. hysteroncha* by: 1. the heterogeneous clamp diameter, 2. the length of the clamp peduncles, 3. the number of testes (16-21 in the new species, 6-7 in *C. hysteroncha*), and 4. the number of hooks in the terminal appendix (3 pairs in the new species, 1 in *C. hysteroncha*). KOHN *et alii* (1984) described a *Choricotyle* species identified as *C. hysteroncha* parasitic of a haemulid fish from the coast of the State of Rio de Janeiro. The description and the illustrations of the specimens described by KOHN *et alii* (1984) do not correspond to the taxon annotated, but are in agreement with the description of *Choricotyle brasiliensis* n. sp.

Choricotyle anisotremi is a common parasite of the haemulid fish *Anisotremus scapularis* (Tschudi), from the northern Chilean coast (OLIVA, 1987). It also has vitellaria penetrating the haptor and the last pair of peduncles is smaller than the others. The origin of the anteriormost peduncles is separated by the width of the body and the clamps are of equal diameter. Other differences are: 1. the number of testes (90 in *C. anisotremi*, 16-21 in the new species) and 2. the number of genital atrium spines (12 in *C. anisotremi*, 7-10 in the new species).

Choricotyle orthopristis n. sp.
(Figs. 5-9)

DESCRIPTION (based on 25 specimens, measurements on ten stained whole mounts): Total body length 2.98-4.04 mm (3.64 mm), maximum width 458-732 (586) (Fig 5). Body length without haptor 2.03-2.75 mm (2.10 mm). Haptor with eight symmetrical clamps and peduncles; clamps (Fig. 6) 174-189 (181) in diameter, typical of the genus *Choricotyle*, anterior midsclerite curved, reaching the curvature of the anterolateral sclerite, posterior portion of anterolateral sclerite is aproximately equal to anterior portion; with small accessory sclerites, one large and one small accessory sucker in the anterior quadrants and six to seven concentric arcs of small skeletal rods in the posterior quadrant; terminal appendix similar to other *Choricotyle* species, inner pair of hooks sickle-shaped, 36.6 long, outer pair simple, 9.15 long (Fig. 7). Buccal organs 58.6-73 (63.13) long, 40-73 (54) wide; pharynx ovoid, 95-110

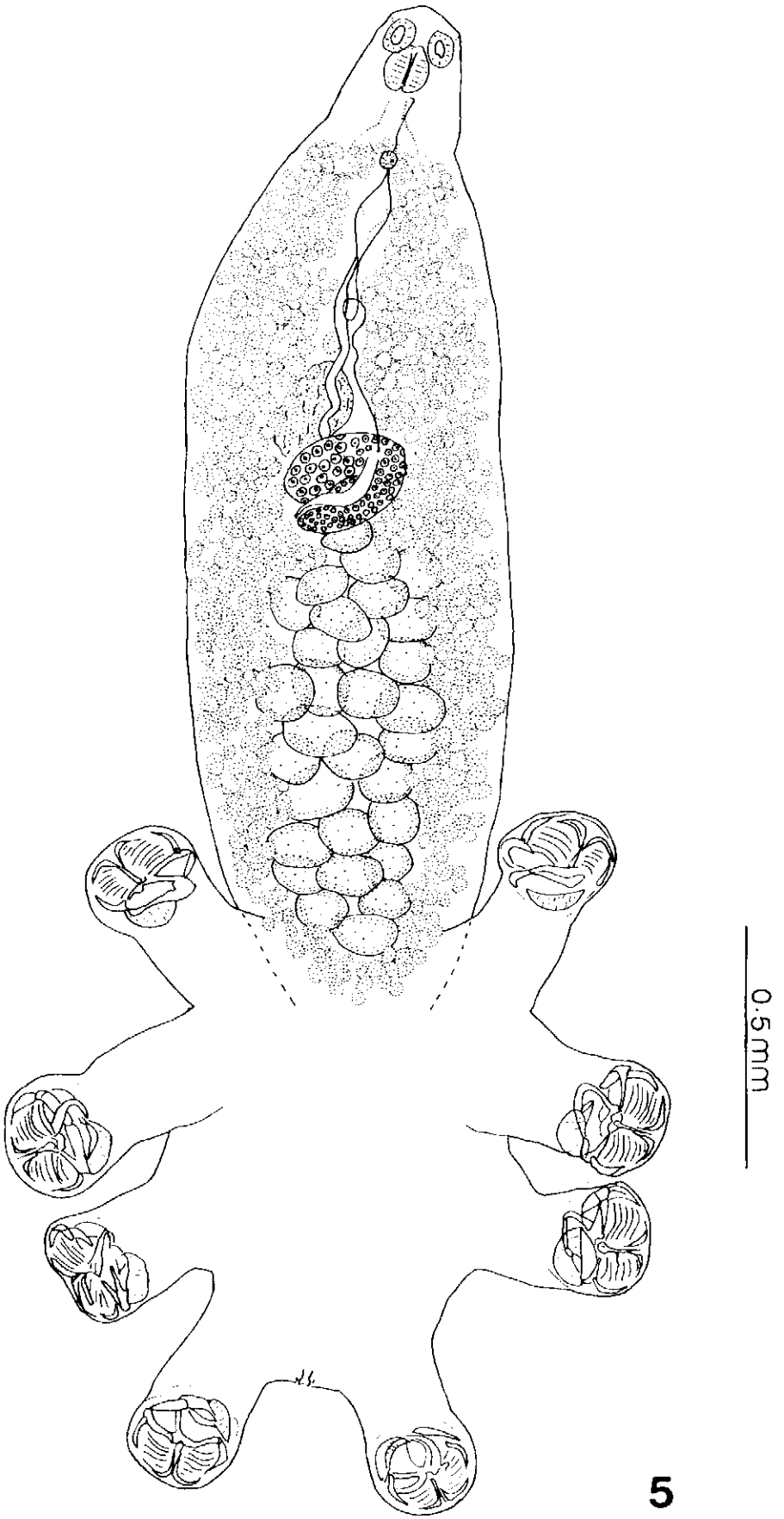


Fig.5. *Choricotyle orthopristis* n. sp. - Holotype, entire worm, ventral view.

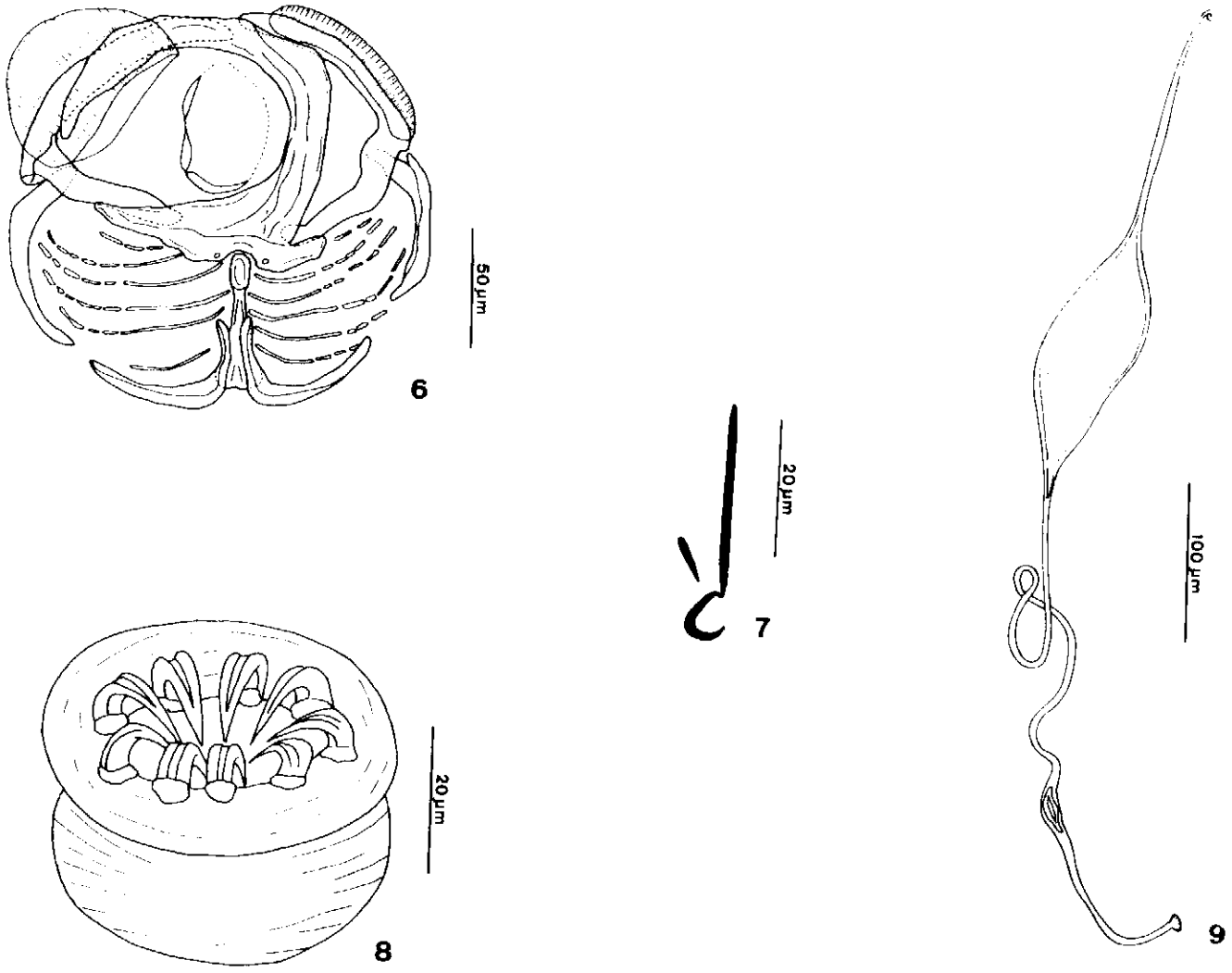


Fig.6-9. *Choricotyle orthopristis* n. sp.
Fig.6. Clamp. Fig.7. Hooks of the terminal appendix. Fig.8. Genital atrium. Fig.9. Egg.

(105) long, 82-110 (98) wide; intestinal ceca ramified, penetrating haptor. Testes 30-34 (32) in number, 80-109 (95) long, 66-95 (73) wide; genital atrium (Fig. 8) 38-42 (40) long, 38-49 (43) wide, with 9-10 curved spines. Ovary bilobed, seminal receptacle preovarian, well developed; vitellaria distributed from level of genital atrium to end of body, not penetrating haptor; eggs (Fig. 9) fusiform, 474 long, 226 wide; with two longitudinal grooves and two polar filaments; anterior filament shorter than posterior, with extremity conspicuosly curved, posterior filament with button-shaped terminal structure.

Taxonomic summary

Type host: *Orthopristis ruber* (Cuvier).
Site of infestation: gills.
Type locality: Sepetiba Bay, State of Rio de Janeiro, Brazil.
Prevalence: 9.87%.
Intensity of infestation: 25, in 16 hosts.
Mean intensity of infestation: 1.56.
Specimens deposited: USNM Holotype N° 83192 , paratype N°s 83193, 83194 and 83195; CHIOC paratype N°s 33108a and 38108b.
Etymology: the specific name *orthopristis* refers to the generic name of the fish host.

Remarks

The new species is related to *Choricotyle aspinachorda* Hargis, 1955, but can be clearly differentiated by: 1. the body/haptor length ratio (1:3-4.5 in *C. aspinachorda*, 1:1.5-2 in the new species). *Choricotyle orthopristis* n. sp. can also be compared with the other *Choricotyle* species with clamp peduncles of similar length, clamps of equal diameter, and vitellaria not penetrating the haptor. These species are: *C. cynoscioni* (MacCallum, 1917), *C. oregonensis* McCauley & Smoker, 1969, and *C. pellonae* Kritsky & Bilqees, 1973. The new species can be easily differentiated from *C. cynoscioni* and *C. pellonae* by: 1. the general body shape (body without slender haptor and with a narrow peduncle in *C. cynoscioni* and *C. pellonae*; body stout, without narrow peduncle in the new species). *Choricotyle oregonensis* is separated from the new species by the presence of subsessile clamps.

Choricotyle cynoscioni (MacCallum, 1917)
(Figs. 10-12)

DESCRIPTION (based on 11 stained whole mounts, measurements on three specimens): Body (Fig. 10) elongate, peduncle long, narrow; total length (including haptor) 3.9-8.6 mm (5.7 mm), maximum width at ovary level, 421-549 (475);

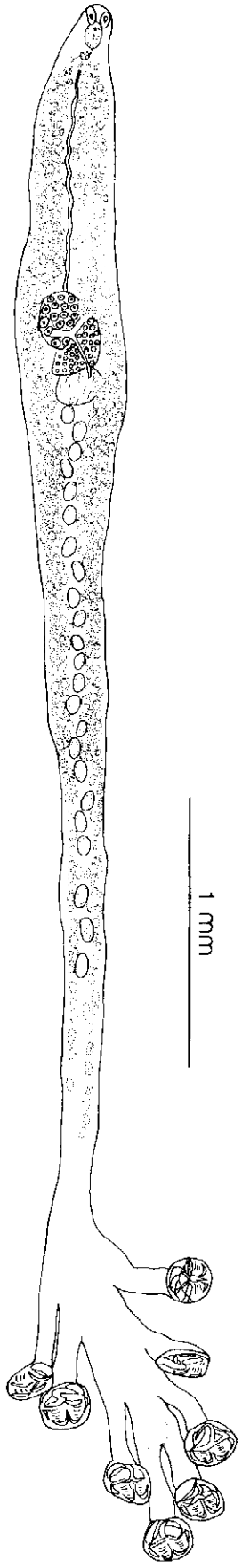


Fig.10. *Choricotyle cynoscioni* (MacCallum, 1917) - Voucher specimen, entire worm, ventral view.

body length without haptor, 2.8-6.8 mm (4.5 mm). Haptor with eight peduncles of similar length, with respective clamps (Fig. 11) typical of *Choricotyle*, of similar size, 168-191 (179) in diameter; anterior midsclerite slender, strongly curved, reaching anterolateral sclerite curvature, associated with oval accessory sclerite and two accessory suckers; posterior quadrants with six concentric arcs of small skeletal rods; terminal appendix with two pairs of hooks (Fig. 12), outer pair simple, 7.3-9.0 (7.9) long, inner pair sickle-shaped, 36.6 long. Buccal organs 60-75 (68) long, 46-59 (53) wide; pharynx ovoid, 97-112 (106) long, 70-102 (88) wide; cecal bifurcation at level of genital atrium, intestinal ceca penetrating haptor. Testes postovarian, 18-26 (21) in number, 117-153 (131) long, 51-66 (58.4) wide; genital atrium (Fig 13) 42-44 (43) long, 33-46 (38) wide, with 10, curved spines. Ovary bilobed; seminal receptacle postovarian; vitellaria lateral, not penetrating haptor; eggs not observed.

Taxonomic summary

Synonyms: *Diclidophora cynoscioni* MacCallum, 1917, *Neoheterobothrium cynoscioni* (MacCallum, 1917) Price, 1943, and *Choricotyle reynoldsi* Frayne, 1943.

Host: *Orthopristis ruber* (Cuvier).

Site of infestation: gills.

Locality: Sepetiba Bay, State of Rio de Janeiro, Brazil.

Prevalence: 4.32%.

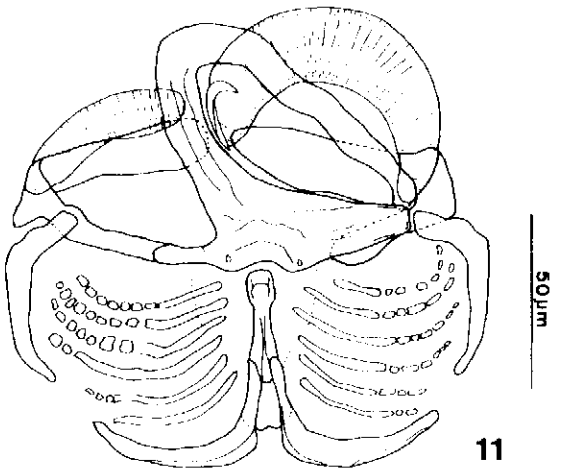
Intensity of infestation: 11, in 7 hosts.

Mean intensity of infestation: 1.57.

Specimens deposited: USNM voucher specimen N°s 83205 and 83206; CHIOC voucher specimen N° 33107.

Remarks

This species was described originally by MACCALLUM (1917) as *Diclidophora cynoscioni*. LLEWELLYN (1941a) transferred *D. cynoscioni* to the genus *Choricotyle* considering the arrangement of the clamp sclerites as the main character. FRAYNE (1943) stated that some characters of this species (postovarian seminal receptacle and the apparent absence of the genito-intestinal duct) are unusual in the genus *Choricotyle*, but recommended that *C. cynoscioni* be retained in this genus. PRICE (1943) proposed the genus *Neoheterobothrium*, for the *Choricotyle* species with an elongate body and a slender peduncle without testes and vitellaria. This author proposed the new combination *Neoheterobothrium cynoscioni*. SPROSTON (1946), NAGIBINA (1953), and MAMAEV (1976) are not in accordance with this criterion and did not recognized *Neoheterobothrium*. However, YAMAGUTI (1963) considered the presence of the peduncle as a generic character and retained *Neoheterobothrium* as a valid diclidophorid genus. MAMAEV (1987) redefined *Neoheterobothrium* considering as generic character the ring-shaped anterior midsclerite in addition to the presence of the "peduncle". This character is absent in *C. cynoscioni*.



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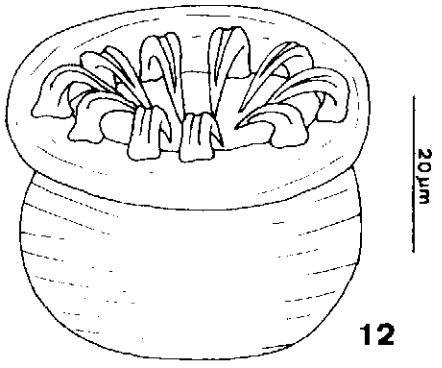

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Fig.11-12. *Choricotyle cynoscioni* (MacCallum, 1917)
Fig.11. Clamp. Fig.12. Genital atrium.

Choricotyle cynoscioni was previously recorded by BASHIRULLAH & RADO (1987) parasitic on *Orthopristis ruber* from the Venezuelan coast. This is the first record for this species in the Brazilian coast.

According to BASHIRULLAH & RADO (1987) *C. cynoscioni*, *C. aspinachorda*, and *C. reynoldsi*, are species which occur concomitantly on *Orthopristis ruber* in the Venezuelan coast. This is doubtful because according to HARGIS (1955), *Choricotyle reynoldsi* is a junior synonym of *C. cynoscioni* and is not considered in the genus by MAMAEV (1976) and OLIVA (1987). Unfortunately, voucher specimens were not deposited by BASHIRULLAH & RADO (1987), thus, it became impossible to study the especies.

Choricotyle aspinachorda (Hargis, 1955)
(Figs. 13-15)

DESCRIPTION (based on 16 specimens, measurements on seven stained whole mounts): Total body length (Fig. 15) 3.97-7.94 mm (5.68 mm). Maximum width at testicular level 549-1281 (828). Body length without haptor, 3.1-6.4 mm (4.43 mm). Haptor with clamps of similar size, 153-212 (160.7) in diameter; armature of clamps (Fig. 14) typical of the *Choricotyle* species, anterior midsclerite with notorious curvature; posterior quadrants with 6-7 concentric arcs of small skeletal rods, anterior quadrants with two accessory suckers of unequal size and oval accessory sclerite; terminal appendix (Fig. 15) with two pairs of hooks, outer pair 9.15 long, inner pair 38 long. Buccal organs 49-73 (58) long, 37-55 (45) wide; pharynx ovoid 73-130 (101) long, 60-110 (83) wide; intestinal ceca ramified laterally, penetrating the haptor. Testes 23-36 (29) in number, 110-238 (167) long, 91-201 (133) wide; genital atrium (Fig. 16) 38-46 (44) in diameter, with nine to 10 spines. Ovary bilobed; preovarian seminal receptacle well developed; vitellaria not penetrating haptor; eggs not observed.

Taxonomic summary

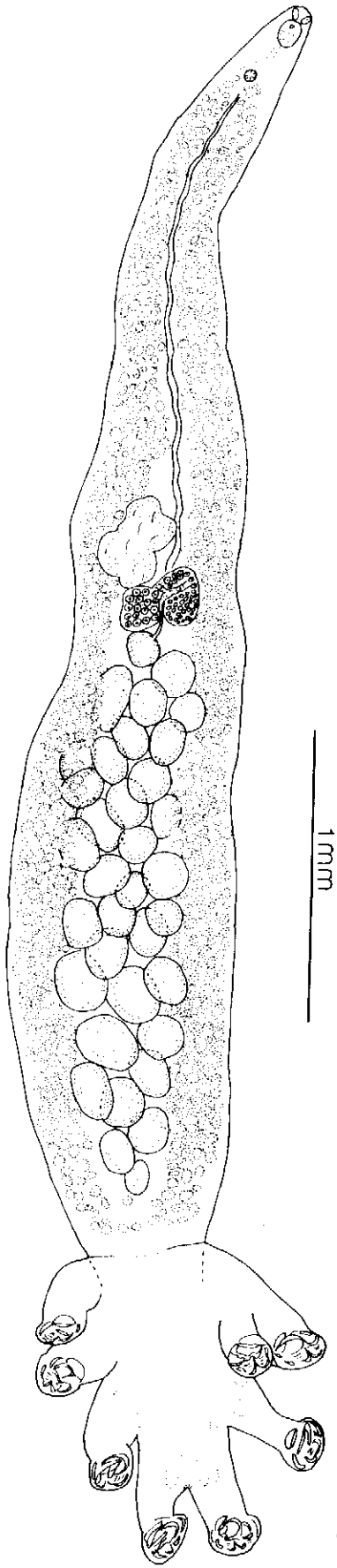
Host: *Orthopristis ruber* (Cuvier).
Site of infestation: gills.
Locality: Sepetiba Bay, State of Rio de Janeiro, Brazil.
Prevalence: 3.08%.
Intensity of infestation: 16, in 5 hosts.
Mean intensity of infestation: 3.20.
Specimens deposited: USNM voucher specimen N°s 83202, 83203 and 83204;. CHIOC voucher specimen N°s 33103 and 33104.

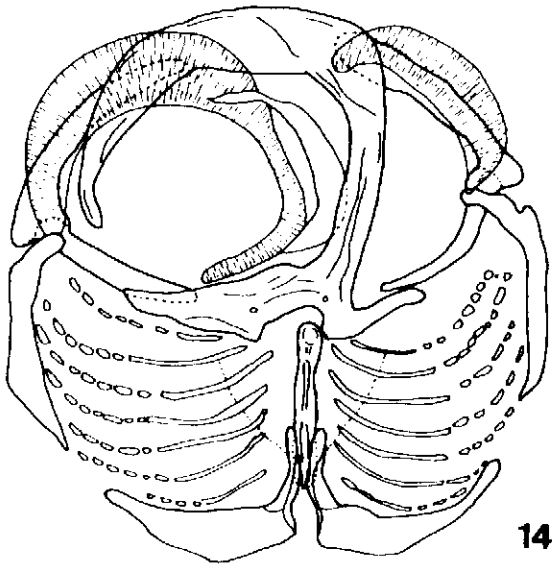
Remarks

The specimens described above are in agreement with the information given by HARGIS (1955) from specimens obtained from *Orthopristis chrysopterus* (Linnaeus) of Florida, North American Atlantic coast. Minor differences are in relation to the number of testes and to the total body length. KINGSTON *et alii* (1969) recorded this species in the same host and locality of the Hargis' specimens. HARGIS (1955) and OVERSTREET (1978) mentioned the presence of *C. aspinachorda* parasitic on isopod parasites, but this condition of hiperparasitism was not observed in the material obtained in the present work. BASHIRULLAH & RADO (1987) recorded this species on *O. ruber*, from Venezuela.

SUMÁRIO

Quatro espécies do gênero *Choricotyle* (Monogenea: Diclidophoridae) parasitas do peixe haemulídeo *Orthopristis ruber* são descritas e ilustradas. Duas delas, *C. brasiliensis* sp. n. e *C. orthopristis* sp. n., são consideradas espécies novas. *Choricotyle brasiliensis* sp. n. pode ser diferenciada das suas congêneres por uma combinação de caracteres que incluem, a heterogeneidade do comprimento dos pedúnculos do haptor e o diâmetro dos grampos, glândulas vitelogênicas penetrando o haptor, o número de testículos, e o número de espinhos do átrio genital. *Choricotyle orthopristis* n. sp. é caracterizada, principalmente, pela uniformidade do diâmetro dos grampos, pelo comprimento dos pedúnculos do haptor, pelas glândulas vitelogênicas que não penetram no haptor, e pela relação entre os comprimento do corpo e o comprimento do haptor que é de 1:1.52. *Choricotyle cynoscioni* (MacCallum, 1917) and *C.*





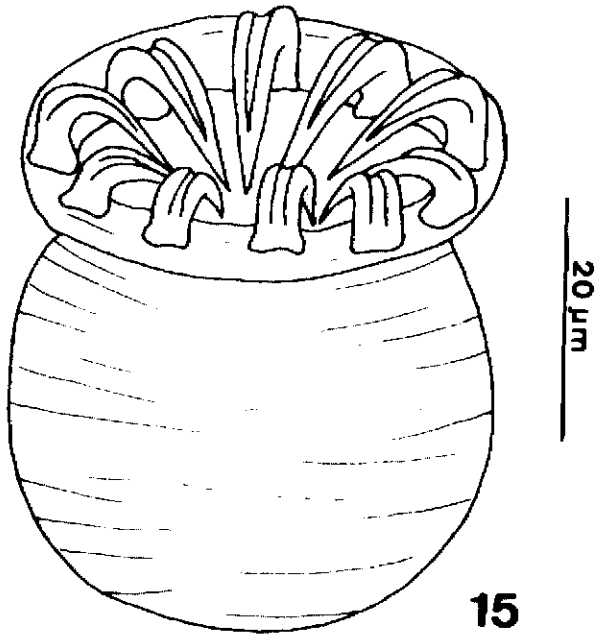


Fig.13-15. *Choricotyle aspinachorda* (Hargis, 1955)
Fig.13. Voucher specimen, entire worm, ventral view. Fig.14. Clamp. Fig.15. Genital atrium.

aspinachorda Hargis, 1955 são registradas pela primeira vez no Brasil.

PALAVRAS-CHAVE: Monogenea, Diclidophoridae, *Choricotyle*, *Choricotyle brasiliensis* n. sp., *Choricotyle orthopristis* n. sp., *Choricotyle aspinachorda*, *Choricotyle cynoscioni*, Haemulidae, *Orthopristis ruber*, Brasil, Oceano Atlântico.

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