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Digenean trematodes of crocodiles collected by Johann Natterer in Brazil, deposited in the Natural History Museum, Vienna

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Abstract

The helminths from six vials in the Collection of the Natural History Museum, Vienna, were mounted as permanent preparations and the following species were found: *Stephanoprora nattereri* sp.n., *Stephanoprora* sp., *Caballerotrema* sp., *Echinostoma* sp., *Pseudotelorchis caimanis* CATTO & AMATO, 1993, *Proctocaecum dorsale* CATTO & AMATO, 1993*, Acanthostomum*(?) sp., and *Prohemistomum*(?) sp. Johann Natterer collected these helminths from the crocodiles *Melanosuchus niger* and *Caiman crocodilus* in the Mato Grosso, Brazil, between 1825 and 1830. Most of the specimens are in a relatively good condition. *Pseudotelorchis caimanis* and *P. dorsale* were recently described from *C. crocodilus* in Brazil, thus demonstrating their continuous presence over the last 200 years.

Key words: Natterer, Helminth Collection, Vienna, *Stephanoprora*, *Caballerotrema*, *Echinostoma*, *Pseudotelorchis*, *Proctocaecum*, *Acanthostomum*, *Prohemistomum*, *Melanosuchus*, *Caiman*

Zusammenfassung

Von den Helminthen aus 6 Gläsern der Sammlung des Naturhistorischen Museums in Wien wurden Dauerpräparate angefertigt und folgende Arten bestimmt und beschrieben: *Stephanoprora nattereri* sp.n., *Stephanoprora* sp., *Caballerotrema* sp., *Echinostoma* sp., *Pseudotelorchis caimanis* CATTO & AMATO, 1993, *Proctocaecum dorsale* CATTO & AMATO, 1993, *Acanthostomum*(?) sp*., Prohemistomum*(?) sp. Diese Helminthen wurde von J. Natterer aus den Krokodilen *Melanosuchus niger* und *Caiman crocodilus* des Mato Grosso, Brasilien, in den Jahren 1825-1830, gesammelt. Die Würmer befinden sich zum grossen Teil in einem guten Zustand. *Pseudotelorchis caimanis* und *P. dorsale* wurden kürzlich in Brasilien aus *Caiman crocodilus* beschrieben, und beweisen damit ein kontinuirliches Vorhandensein in den letzen rund 200 Jahren.

Introduction

Johann Natterer, an assistant curator at the Museum of Natural History in Vienna, Austria, travelled throughout Brazil during the years 1817-1834. He collected and prepared nearly 50,000 specimens of all classes of vertebrates, sending them back to the Museum in Vienna. He also preserved the parasites from the digestive tracts of several of the collected animals. Part of this material was studied by the early pioneers of trematodology (i.e. C.A. Rudolphi, F. Dujardin, G.P.H. Brandes, J.G. Bremser, K.M. Diesing, M. Braun, E. Dietz, and F. Fischoeder) during the years 1819-1903 (SATTMANN & al. 1999). DUBOIS (1936) mainly based his study of the diplostomes of reptiles on specimens collected by J. Natterer. In recent times, this helminth collection continues being used to study type material (MACKO 1968, OSTROWSKI DE NÚÑEZ 1986).

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In this study I examined six vials from the Evertebrata Varia Collection of the Natural History Museum in Vienna (NHMW ZOOEV), which contained digenean parasites from crocodiles collected by J. Natterer in the Mato Grosso, Brazil, during the years 1825-1829. These parasites belong to the families Echinostomatidae, Acanthostomidae and Telorchiidae.

Material and Methods

The specimens were preserved in ethanol in the vials Nos.: 766, 768, 772, 781,786, and 787. Since handling could damage the specimens due to their fragile condition, they were mounted as permanent preparations in order to avoid distorting this historic material as much as possible. Some specimens were stained with chlorhydric carmine. Most of the specimens and fragments were cleared in creosote without staining and mounted in Canada balsam. Four fragments of *Caballerotrema* were embedded in paraffin for histological sections and stained using the Mallory method, as modified by Frank Crandall (F. Crandall, personal communication). The holotype of *Stephanoprora campomica* Nasir & Diaz, 1971, US National Parasite Collection (USNPC) No. 072119, from *Caiman crocodilus* (L.), Venezuela, and two voucher specimens of *S. jacaretinga* Texeira de Freitas & Lent, 1938 (USNPC No. 082638) from *Crocodilus crocodilus yacare*, Brazil, collected and deposited by J.B. Catto (July 1988), *S. jacaretinga* from *Caiman sclerops* (No. 9808, type material) and from *Caiman crocodilus yacare* (No. 33036a, b, deposited by Catto, 1988) from the Helminth Collection of the Instituto Oswaldo Cruz (IOC), *Caballerotrema arapaimense* Thatcher, 1980 (No. 5745), and *C. aruanense* Thatcher, 1980 (No. 5744) from Museu de Zoologia da Universidade de São Paulo (MZUSP) were compared. Specimens and fragments were studied using an Olympus BH-2 NIC microscope and figures were made with the help of a camera lucida. Measurements are given in micrometers, unless otherwise stated, with the range followed by the mean in parentheses, when more than 3 measurements were taken. Forebody is measured from anterior extremity to anterior border of ventral sucker, total body length has been abbreviated as TBL. Crocodile nomenclature follows Travassos & al. (1969) and Freiberg (1977), but the original identification of the vials presumably made by Natterer is also given in parentheses.

Results

Most of the specimens, preserved for ca. 170 years, were in a relatively good condition, especially those with stout bodies. More slender specimens were seriously damaged and broken, and nearly all specimens had debris firmly attached to the tegument. Staining with chlorhydric carmine gave poor results, as shown in *Acanthostomum syphocephalum* (Braun, 1899) by Ostrowski de Núñez (1986). Vials No. 772, 786 and 787 only contained specimens of Echinostomatidae. Two different species were found in vial No. 781: nine specimens of an acanthostomid trematode and two whole, although damaged, specimens and several fragments of *Stephanoprora* sp. Vial No. 768 contained a species of Telorchiidae and vial No. 766 had poorly-preserved specimens and fragments of an acanthostomid and a cyathocotylid.

One species is considered as new, three are described at the generic level, two were recently described by CATTO & AMATO (1993a, b), whereas two others could only be poorly characterised due to their inadequate conditions.

Stephanoprora nattereri sp.n. (Figs 1-5)

Material: 4 specimens, mounted in Canada balsam, from vial 787, NHMW ZOOEV microslide No. 4329 (holotype), microslides No. 4330/a-c (paratypes); measurements based on 4 mounted, ovigerous specimens.

Description: Body elongate, 8.8-13 (11.3) mm × 384-576 (520) at ventral sucker level. Tegument spinous, with denser spines, 22-28 (25) long at forebody; diminishing in size, 13-25 (19) long, and density toward posterior testis level. Head collar 720-944 (852), armed with 22 straight spines arranged in single, dorsally interrupted row. Corner spines 88-107 (97) × 22-35 (29); remainder ones almost the same size 91-101 (97) × 25-35 (30), except for spine adjacent to dorsal interval 85-110 (100) × 25-38 (33). Oral sucker terminal, 126-176 (141) × 157-220 (192); prepharynx 94-144 (124); pharynx muscular, 188-251 (232) × 119-207 (170), situated anteriorly to corner spines level; oesophagus 1.1-1,4 (1.2) mm long; intestinal bifurcation at 107-207 (162), anterior to ventral sucker, forming 2 blind caeca, which almost reach posterior end. Pharynx/oral sucker length ratio: 1:1.4-1.9 (1:1.7), width ratio: 1:0.8-1 (1:0.9). Ventral sucker 480-768 (676) × 448-720 (644), situated at end of anterior fourth of body. Oral sucker/ventral sucker length ratio 1:3.8-5.7 (1:4.8), width ratio 1:2.8-3.8 (1:3.3). Genital organs approximately in mid-body region. Testes elongate, in one specimen slightly sinuous, with regular borders, arranged in tandem; anterior testis 800-1,040 (932) × 256-400 (304); posterior testis 800-960 (904) × 240-320 (292); testes separated 251-659 (510). Cirrus-sac dorsal to ventral sucker, 408-534 (487) × 220-283 (243), overlapping up to 2/3 of ventral sucker length. Seminal vesicle bipartite; prostatic glands and cirrus not discernible. Genital pore anterior to ventral sucker. Ovary round, 144-251 (193) × 188-251 (226), anterior to anterior testis; Mehlis' gland, small vitelline receptacle and uterine seminal receptacle present. Uterus containing up to ca. 300 eggs, 71-84 (79) × 44-59 (52), between ovary and gonopore. Distance between posterior border of ventral sucker and anterior border of ovary (vv-ov) representing 10.4-12.3 (11.4) % of TBL. Vitellarium follicular, follicles transversally elongate, extending in lateral bands from anterior level of anterior testis (in one specimen from ovary level) to posterior body end. Vitelline fields posterior to testes leaving narrow area free of follicles ventrally and dorsally. Distance between posterior border of posterior testes and body end representing 40.6-43.8 (41.9) % of TBL.

Host: *Melanosuchus niger* (Crocodili jacare guaçu).

Location: Unspecified, probably intestine.

Locality: Mato Grosso, Brazil.

Etymology: the species is named after J. Natterer, the collector of these helminths.

Remarks: The four specimens of this species were in relatively good condition. Three of them show a complete number of collar spines, but the fourth one has some missing spines. The corner spines of one specimen are clearly paired; whereas in the other three only one corner spine was seen. The next spine is situated more orally, but the total number of spines is the same (Figs 2, 3). The arrangement probably depends on the state of

contraction of the collar muscles at the moment of fixation. The anterior level of the vitelline follicles is also variable, either beginning anteriorly to the anterior testis or at the level of the ovary. The narrow area free of vitelline follicles on the mid-line posterior to the testes could not be seen in three specimens with a slightly twisted hindbody.

In the genus *Stephanoprora* ODHNER, 1902 there are about 20 species parasitising birds; four other species parasitise reptiles, namely, *S. ornata* ODHNER, 1902 and *S. odhneri* YAMAGUTI, 1971, both from *Crocodilus niloticus* (Africa), *S. jacaretinga* (TEXEIRA DE FREITAS & LENT, 1938), from *Caiman sclerops* (= *Caiman crocodilus crocodilus*) and *C. c. yacare* (Brazil), and *S. campomica* NASIR & DIAZ, 1971, from *Caiman crocodilus* (Venezuela). A similar species, *Allechinostomum crocodili* (POIRRIER, 1886) parasitises crocodiles in Africa, but differs from *Stephanoprora* in the long, slender cirrus-sac, which extends posteriorly to the ventral sucker almost reaching the ovary.

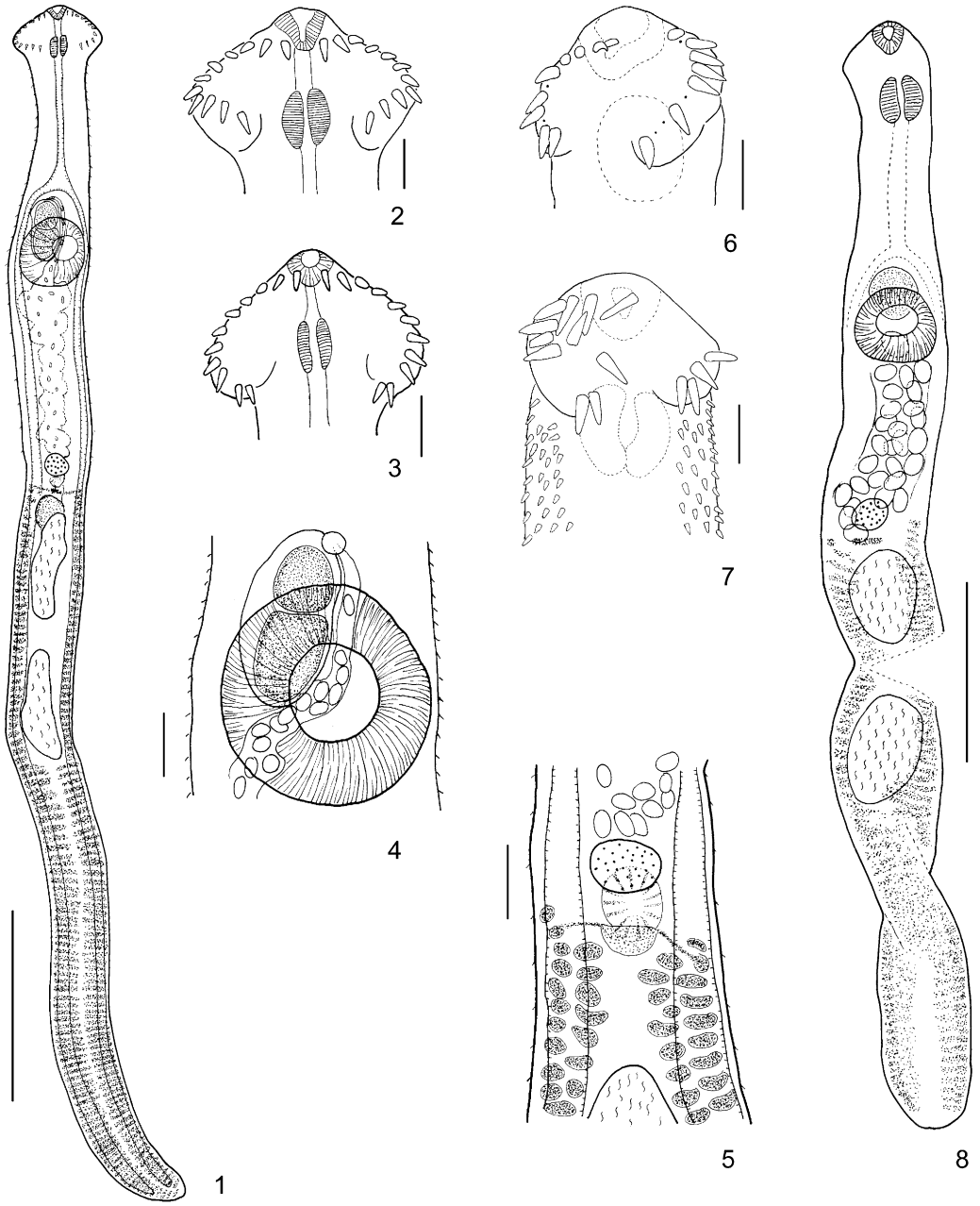
Stephanoprora nattereri sp.n. differs from all *Stephanoprora* described from birds by having elongate testes, and from *S. ornata* and *S. odhneri* by the number of collar spines (22 vs. 26 and 24, respectively) (ODHNER 1902, YAMAGUTI 1971). It is similar to *S. campomica* and *S. jacaretinga*, in having 22 spines and the same distribution of vitelline follicles, but differs from them in having more elongate testes vs. oval or round testes, body and collar spines more than twice as large, and smaller eggs. The collar spines are similar in size that those of *S. jacaretinga*, but twice as large than those of *S. campomica*. The pharynx is situated anteriorly to the corner spines in *S. nattereri* and *S. jacaretinga,* while in *S. campomica* it is situated more posteriorly. The distance between the ovary and the ventral sucker, corresponding to the area occupied by the uterus, represents 11.4 % of TBL in *S. nattereri*, 8.9 % in *S. campomica* (USNPC No. 072119) and 7.6 % in *S. jacaretinga* (estimated from published drawing) (NASIR & DIAZ 1971, TEXEIRA DE FREITAS & LENT 1938).

CATTO & AMATO (1994) mentioned *S. jacaretinga* while describing the community structure of *C. c. yacare* parasites, but the specimens deposited by the these authors in the USNPC show some differences with the original specimens of TEXEIRA DE FREITAS & LENT (1938), as in the position of the pharynx, situated posteriorly to the corner spines, and smaller collar spines. A revision of the systematic identification of this material would be necessary. The larger body and collar spines, and the elongated testes distinguished *S. nattereri* from all other described species of *Stephanoprora*, and therefore is considered a new species.

Stephanoprora **sp.** (Figs 6-8)

Material: 2 whole specimens and 10 fragments from vial No. 781, all mounted in Canada balsam, NHMW ZOOEV microslides No. 4331/a-i; measurements based on 2 whole specimens and 10 fragments. Percentages of TBL were calculated from the 2 whole specimens, and ratios only from fragments where both organs involved could be measured.

Description: Body elongate, 2992-3312 × 288-432 (344) at ventral sucker level. Tegument spinous, with denser spines, 16-22 long, anterior to ventral sucker, then diminishing in size and density toward ovary level. On ventral side, tegumental spines extending in 2 lateral bands, leaving middle region free. Spines covering whole dorsal surface of body, between head collar and ventral sucker, extending laterally only to ovary level. Head collar armed with ca. 22 straight spines arranged in single, dorsally



Figs 1-8: *Stephanoprora nattereri* sp.n., 1: adult, ventral view; 2 and 3: head collar, note different arrangement of corner spines; 4: terminal genitalia; 5: female genitalia. Figs 1, 2, 4: holotype NHMW ZOOEV microslide No. 4329, Figs 3, 5: paratype NHMW ZOOEV microslide No. 4330/c. *Stephanoprora* sp., 6: anterior end with incomplete row of collar spines, missing spines marked with a dot, NHMW ZOOEV microslide No. 4331/e; 7: anterior end with tegumental spines, microslide No. 4331/g; 8: adult, ventral view, microslide No. 4331/e. Scale is 2 mm in 1; 0.5 mm in 4 and 8; 0.2 mm in 2, 3, 5; 0.1 mm in 6 and 7.

interrupted row, with 2 corner spines; all spines nearly same size, 41-72 (55) × 13-22 (17). Oral sucker terminal 79-107 (88) × 95-117 (102); prepharynx 22-94; pharynx muscular, 120-158 × 110-151 (123), situated mainly posterior to collar spines; oesophagus 283-362 (320) long; intestinal bifurcation 63-110 (72) anterior to ventral sucker; blind caeca almost reaching posterior end. Pharynx/oral sucker length ratio: 1:0.58-0.76 (1:0.64), width ratio: 1:0.7-0.9 (1:0.8). Ventral sucker at end of anterior third to fourth part of the body, 167-227 (205) × 195-252 (223). Oral sucker/ventral sucker length ratio 1:1.9-2.8 (1:2.4), width ratio 1:2-2.4 (1:2.2). Distance from anterior end to ventral sucker representing 20-25 (22) % of TBL. Genital organs approximately in mid-body region. Testes oval, arranged in tandem, with regular borders, separated 47-79 (63); anterior testis 220-377 (290) × 110-220 (170); posterior testis 236-433 (317) × 142-204 (181). Cirrus-sac 170-337 (219) × 126-157 (143), dorsal to ventral sucker, sometimes overlapping ventral sucker length almost entirely. Shape of seminal vesicle, prostatic glands and cirrus not discernible. Genital pore anterior to ventral sucker. Ovary round, anterior to anterior testis, 79-110 (90) × 94-142 (106); Mehlis' gland present; Laurer's canal not discernible. Uterus contains ca. 30-100 eggs, 60-76 (68) × 44-50 (47), between ovary and genital pore. Distance between posterior border of ventral sucker and anterior border of ovary representing 8-13 (10) % of TBL. Vitellarium follicular, follicles transversally elongate, extending in lateral fields from anterior border of ovary or slightly anterior, to posterior extremity, partially overlapping lateral borders of testes. Post-testicular region representing 30-39 (35) % of TBL.

Host: *Caiman crocodilus* (Crocodili scleropis).

Location: Unspecified, probably intestine.

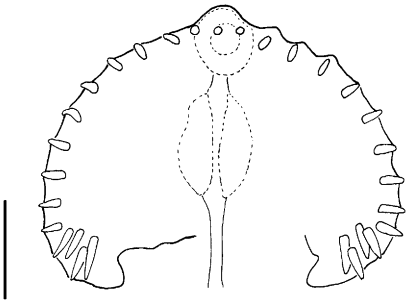
Locality: Mato Grosso, Brazil.

Remarks: None of the whole specimens or the fragments has a complete head collar, but probably bore 22 spines in a dorsally interrupted row (Fig. 6). Only one fragment preserved the tegumental spines. *Stephanoprora* sp. differs from all other species of the genus described from birds, except for *S. elongata* GUPTA & JAHAN, 1976, by its more anterior limit of the vitelline follicles. *Stephanoprora elongata* has a trilobed ovary and is more than three times larger than *Stephanoprora* sp., which has a round ovary (GUPTA & JAHAN 1976). Additionally, the two whole ovigerous specimens are considerably smaller than *S. nattereri*, *S. campomica* and *S. jacaretinga*, the testes are more oval and close together, and the vitelline glands began anteriorly to the anterior border of the ovary (TEXEIRA DE FREITAS & LENT 1938, NASIR & DIAZ 1971). Although the present specimens differ from the described species, their poor condition prevents the foundation of a new species.

Caballerotrema sp. (Figs 9-12)

Material: 10 whole specimens and several anterior and posterior fragments from vial No. 772, all mounted in Canada balsam; NHMW ZOOEV microslides No. 4332/a-o. Histological sections from 2 anterior and 2 posterior body fragments, deposited under No. 4338; body and organs measurements based on 10 whole specimens, anterior fragments were included for collar spines data.

Figs 9-12: *Caballerotrema* sp. 9: head collar, scale 0.2 mm; 10: adult, ventral view, scale 1.0 mm; 11: terminal genitalia, scale 0.1 mm; 12: female genitalia and testes, scale 0.1 mm. All figures from NHMW ZOOEV microslide No. 4332/g. Scale is 1 mm in 10; 0.2 mm in 9; 0.1 mm in 11 and 12.



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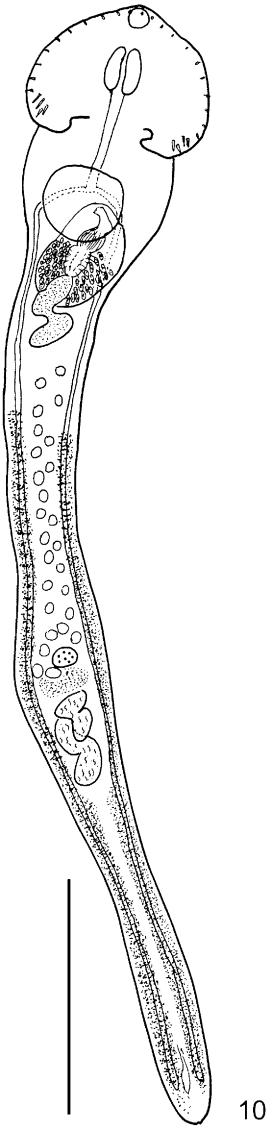

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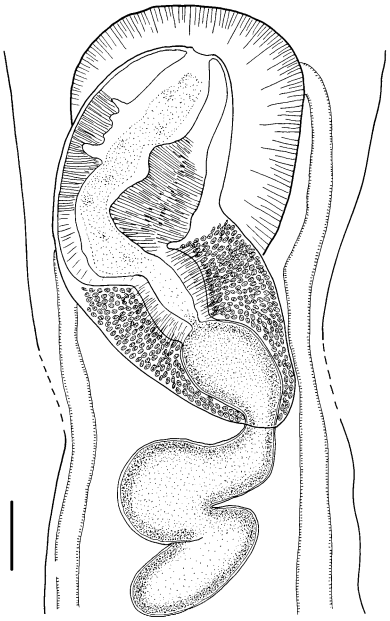

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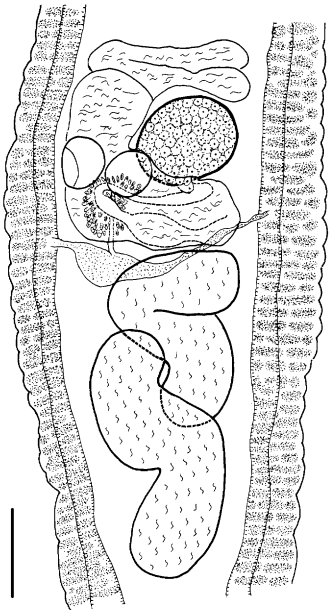

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Description: Body elongate, dorso-ventrally flattened, 4.1-6.8 (5.1) mm × 416-656 (498) at ventral sucker level, gradually diminishing in width to 224-496 (374) between testis and posterior extremity. Maximum width at head collar level, 720-992 (792). Head collar with pronounced ventral lobe; 29 conspicuous spines arranged in single row, with 4 corner spines slightly larger than latero-dorsal spines. First pairs of corner spines 60-104 (76) × 16-25 (20), first one being largest. Second pairs slightly smaller, 47-85 (64) × 13-22 (16). First lateral spine 47-69 (59) × 13-19 (16); subsequent 7 spines 44-69 (54) × 9-22 (16), next 2 spines 50-82 (64) × 16-22 (18); middle spine of row sometimes situated slightly aboral and larger than adjacent ones, 50-95 (68) × 13-22 (18). Forebody short, 672-864 (749), representing 11-18 (15) % of TBL. Tegumental spines not seen, probably lost. Oral sucker ventro-subterminal, 132-182 (149) × 132-182 (149); ventral sucker oval, 295-408 (357) × 245-364 (301). Sucker-width ratio 1:1.7-2.6 (1:2.0). Prepharynx short or indiscernible, 0-69 (40); pharynx muscular, 220-276 (249) × 119-151 (133). Pharyngeal / oral sucker width ratio 1:0.9-1.4 (1:1.1). Distance between oral and ventral sucker (almost corresponding to oesophagus length) 207-364 (301), intestinal bifurcation dorsal to ventral sucker. Intestinal caeca blind, almost reaching posterior end. Testes 2, in tandem, intercaecal, located in posterior end of middle third of body, elongate and slightly twisted; anterior testis 207-515 (359) × 94-170 (124); posterior testis 308-546 (420) × 82-151 (115); separated 1.2-2.8 (1.6) mm from body end, representing 23-43 (32) % of TBL. Cirrus-sac 628-1,036 (500) × 170-377 (255), situated dorsally to ventral sucker, containing seminal vesicle, well-developed pars prostatica and cirrus. Cirrus with strong muscular area immediately posterior to pars prostatica (Fig. 11). Posterior part of seminal vesicle 63-144 (100) wide. Genital pore situated in angle formed by anterior end of ventral sucker and body wall, only visible in lateral view. Ovary nearly spherical, 75-144 (106) × 82-170 (124), in mid-line of body, 1.1-2.3 (1.7) mm posterior to ventral sucker, representing 26-39 (33) % of TBL. Mehlis' gland posterior to ovary; Laurer's canal not discernible. Proximal part of uterus acting as uterine seminal receptacle. Uterus intercaecal, forming numerous transverse coils between ovary and ventral sucker, opening into genital atrium. Eggs numerous, 60-82 (71) × 41-57 (50). Vitellarium follicular; small follicles distributed in lateral fields overlapping caeca, extending 480-1,200 (780) from posterior border of ventral sucker to posterior extremity, corresponding to about half distance between ventral sucker and ovary or slightly anterior; in post-testicular zone not confluent, leaving narrow area without follicles. Excretory vesicle not discernible.

Host: *Melanosuchus niger* (Crocodili jacare guaçu 215).

Location: Unspecified, probably intestine.

Locality: Mato Grosso, Brazil.

Remarks: The slightly serrated margins of the body at the level of the gonads suggest the existence of annulations, also visible in the paratypes of *C. arapaimense* and *C. araunense*. KOSTADINOVA & GIBSON (2001) reported a fine membranous sac that envelops the seminal vesicle posteriorly to the prostatic region in the specimen of *C. aruanense* from *Zungaro zungaro* (HUMBOLDT). This feature which could not be seen in the whole specimens mounted, was sometimes visible in histological sections as a very delicate membrane adjacent to the membrane of the distal part of the seminal vesicle. This structure can be interpreted as an enveloping sac.

Caballerotrema PRUDHOE, 1960 was established for *C. brasiliense* from the osteoglossid fish *Arapaima gigas* (CUVIER) from Brazil (PRUDHOE 1960). THATCHER (1980) added two more species, *C. arapaimense* from *A. gigas,* and *C. aruanense* from *Osteoglossum bicirrhosum* VANDELLI, and redescribed *C. brasiliense* upon newly collected specimens. KOSTADINOVA & GIBSON (2001) redescribed *C. brasiliense* upon type material, considered *C. arapaimense* a *species inquirenda*, and transferred *Himasthla piscicola* STUNKARD, 1960 to *Caballerotrema*, as *C. piscicola* n. comb. *Distoma annulatum* DIESING, 1856 from *Gymnotus electricus* LINNEUS, 1766 (=*Electrophorus electricus*) was recently found to belong to *Caballerotrema* (OSTROWSKI DE NÚÑEZ & SATTMANN 2003).

The present species fits the description of *Caballerotrema* based on its head collar with 29 spines and its voluminous cirrus-sac, which extends far behind the ventral sucker. *C. aruanense* differs from the present species by the more posterior position of the cirrus-sac and the shape of the testes. *C. arapaimense* differs in its considerably larger collar spines and suckers, position of the ventral sucker, and the anterior limit of the vitelline follicles (THATCHER 1980). *C. annulatum* differs in the absence of the pronounced ventral lobes of the head collar (OSTROWSKI DE NÚÑEZ & SATTMANN 2003).

The present species is most similar to *C. brasiliense* in its measurements and in the anterior limit of the vitelline follicles, as described by THATCHER (1980) and KOSTADINOVA & GIBSON (2001), except in the smaller size of all collar spines and its larger cirrus-sac (PRUDHOE 1960, THATCHER 1980, KOSTADINOVA & GIBSON, 2001). These differences may indicate that *Caballerotrema* sp. from *M. niger* represents a new species, but newly collected and well-preserved specimens are needed to confirm this finding. The species from fishes have tegumental spines, which are missing (likely lost) in the species from crocodiles, like in most of the specimens of this collection.

Echinostoma sp. (Figs 13-16)

Material: 12 specimens from vial 786 mounted in Canada balsam; NHMW ZOOEV microslides No. 4333/a-k. Other 6 specimens, preserved in 70 % ethanol, that remained in vial No. 786, were deposited under collection No. 17146; measurements based on 10 ovigerous specimens.

Description: Body elongate, muscular, dorso-ventrally flattened, 6.5-14.3 (10.3) × 0.448-1.328 (0.915) mm at ventral sucker level and 0.88-1.6 (1.27) mm at testicular level. Hindbody with almost parallel lateral margins. Forebody short, 496-1,280 (932), representing 7-13 (10) % of TBL. Tegument armed with spines 16-22 (19) long, denser in forebody and extending ventrally to ventral sucker, present laterally posterior to ventral sucker; dorsal spines present in one specimen but missing in the others. Head collar well developed, 320-736 (548), representing 28-51 (40) % of body width at testicular level. Collar spines 47, conspicuous, arranged as follows: 2 oral 57-107 (83) and 2 aboral 69-123 (95) corner spines, 16 ventro-lateral and lateral spines in double row [8 oral 44-94 (72) and 8 aboral 47-98 (71)] and 7 dorsal spines [4 oral 63-94 (66), 3 aboral 41-57 (50)]. Aboral corner spines always more robust and larger than oral corner spines and lateral spines. Oral sucker ventro-subterminal, 176-283 (227) × 157-220 (195); ventral sucker ovoid, muscular, 432-1280 (763) × 320-880 (636). Sucker-width ratio 1:3.3-4 (1:3.8). Prepharynx short or indiscernible, 0-138 (103); pharynx oval, 176-251 (208) × 119-188 (170). Pharynx/oral sucker width ratio 1:1-1.2 (1:1.1). Oesophagus 345-471

(408) long; intestinal bifurcation 75-251 (176) anterior to ventral sucker. Intestinal caeca blind, almost reaching posterior end. Testes 2, located in third quarter of body, in tandem, intercaecal, elongate, slightly sinuous, with 1-2 indentations; anterior testis 534-1568 (978) × 282-480 (368); posterior testis slightly larger, 722-1,552 (1,085) × 295-480 (398), post-testicular region representing 24.9-35.7 (30) % of TBL. Cirrus-sac oval, 314-628 (447) × 157-377 (236), between intestinal bifurcation and ventral sucker, dorsally overlapping ventral sucker 50-70 % of its length; representing 40-73 (58) % of ventral sucker length. Cirrus-sac containing seminal vesicle, pars prostatica and cirrus. Genital pore in mid-line of body, just posterior to intestinal bifurcation. Ovary transversely oval, 188-327 (243) × 239-389 (309), in mid-line of body, 1.8-3.0 (2.4) mm, posterior to ventral sucker, representing 10-31 (25) % of TBL. Mehlis' gland posterior to ovary; Laurer's canal opens dorsally at level of posterior margin of ovary. Proximal part of uterus forms uterine seminal receptacle. Uterus intercaecal, with numerous transverse coils between ovary and ventral sucker; terminal portion in form of metratrem, opens into genital atrium. Eggs numerous, 88-113 (101) × 54-63 (58). Vitellarium follicular, follicles 31-113 (51) × 31-94 (54), in lateral fields overlapping caeca, between posterior level of ventral sucker and posterior extremity; never confluent in post-testicular zone, leaving a broad area devoid of follicles. Excretory vesicle not discernible.

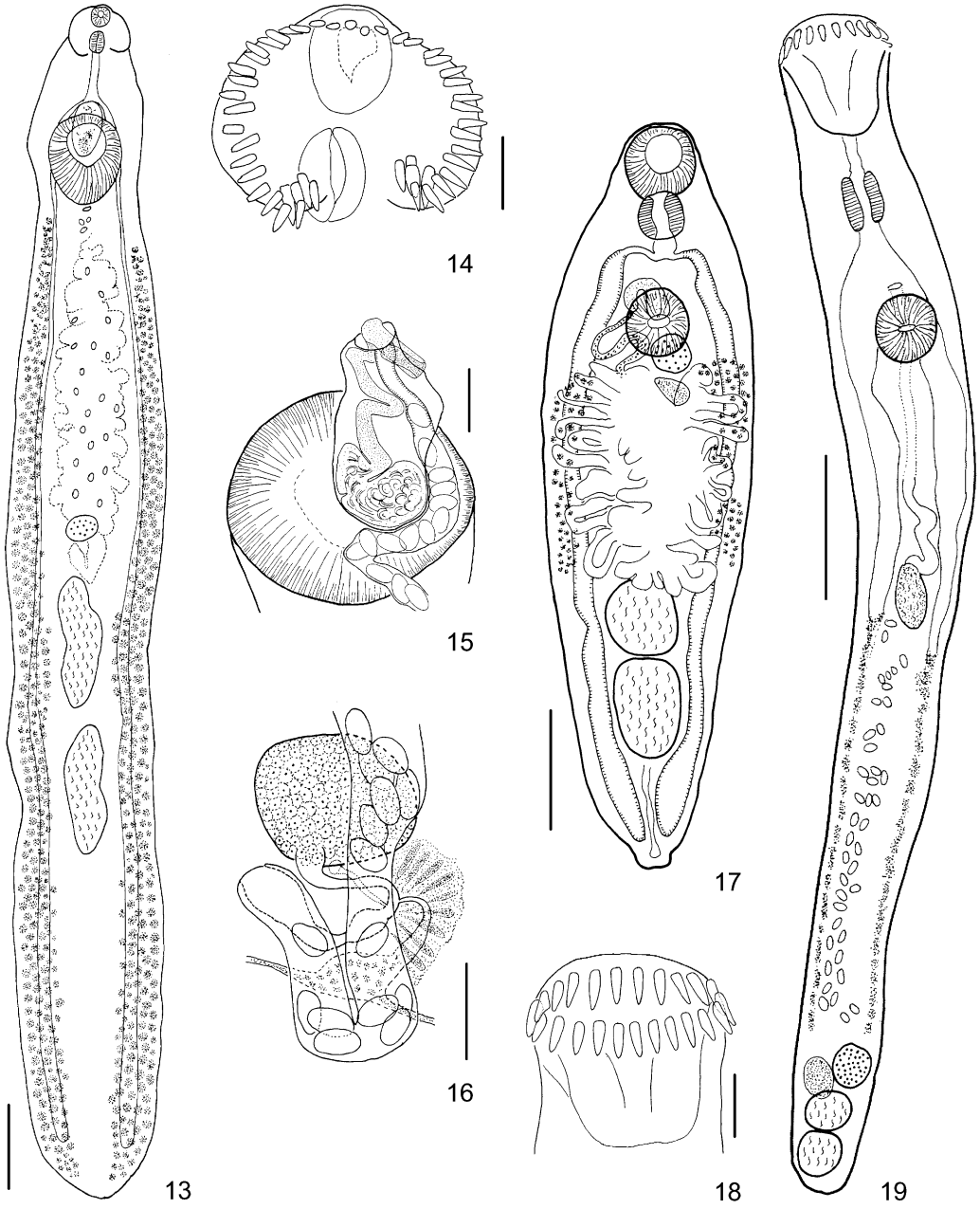
Host: *Melanosuchus niger* (Crocodili jacare guaçu).

Location: Unspecified, probably intestine.

Locality: Mato Grosso, Brazil.

Remarks: The present species is included in the genus *Echinostoma* RUDOLPHI, 1809, because of the double, dorsally uninterrupted row of collar spines, and the extent of the uterus and vitellarium. More than 120 species have been described in this genus (KOSTADINOVA & GIBSON 2000), all of them parasitic of birds and mammals. Eight of these species exhibit 47 collar spines [*E. chloropodis* (ZEDER, 1800) DIETZ, 1909*, E. corvi* YAMAGUTI, 1935*, E. hystricosum* LIE & UMATHEVY, 1966*, E. hilliferum* NICOLL, 1914, *E. necopinum* DIETZ, 1909*, E. rousseloti* DOLLFUS, 1956*, E. sarcinum* DIETZ, 1909*,* and *E. travassosi* SKRJABIN, 1924], all of them are parasites of birds. *Echinostoma* sp. differs from *E. hystricosum* and *E. rousseloti* by the shape of the testes (LIE & UMATHEVY 1966, DOLLFUS 1956). It is similar to the remaining species in the elongate testes, but differs in the size of the collar spines; the greatest spine in *E. chloropodis* measures up to 90, and in *E. sarcinum* up to 164 (both are European species). This character is considered an important diagnostic feature by MACKO (1968), based on the study of 102 specimens from Museums and 337 specimens of his own collection. *Echinostoma corvi, E. travassosi* and *E. hilliferum* have not been studied upon such abundant material (SKRJABIN & BASCHKIROVA 1956). In the Asian species *E. corvi* and *E. travassosi* the spines are all smaller (the largest spine measures up to 84 and 94, respectively). In *E. hilliferum,* from Australia, the spines are more uniform in length, 154 for the two larger corner spines, 100 for the smaller corner spines, and 115 for the remaining spines (SKRJABIN & BASCHKIROVA 1956).

Echinostoma necopinum is the most similar to the presently observed species from crocodiles, and was also collected by J. Natterer in Brazil. MACKO (1968), who studied the specimens stored under this name in the NHMW, found a variable number of collar spines (46-49), being their size in mature specimens: corner spines 109-164 × 34-54, lateral



Figs 13-19: *Echinostoma* sp., 13: adult, ventral view; 14: head collar; 15: terminal genitalia; 16: female genitalia. Figs 13, 14: NHMW ZOOEV microslide No. 4333/g; Figs 15, 16: NHMW ZOOEV microslide No. 4333/k. *Pseudotelorchis caimanis* CATTO & AMATO, 1993, 17: adult, ventral view, NHMW ZOOEV microslide No. 4334/g. *Proctocaecum dorsale* CATTO & AMATO, 1993, 18: anterior end with 23 circumoral spines; 19: adult, ventral view. Figs 18, 19: NHMW ZOOEV microslide No. 4335/d. Scale is 1 mm in 13 and 17; 0.2 mm in 14-16 and 19; 0.05 mm in 18.

spines 90-147 × 27-41, and dorsal spines 90-144 × 27-41. These measurements are similar to those originally given by DIETZ (1910), and both are larger than those observed in *Echinostoma* sp. Of the remaining features, *Echinostoma* sp. differs from *E. necopinum* by its more slender body, smaller collar, smaller average oral and ventral sucker size, shorter forebody and slightly smaller eggs. Although these differences are not impressive, it must be taken into account that *Echinostoma* species are often very similar and difficult to distinguish. In addition to the few morphological differences found, the fact that *Echinostoma* sp. was found in a crocodile while *E. necopinum* parasitises birds, may indicate that *Echinostoma* sp. is a new species. However, the species of *Echinostoma* have never been found in crocodiles. Therefore, new findings, both of *E. necopinum* and other species of *Echinostoma* from crocodiles, are needed to justify the creation of the new species.

Pseudotelorchis caimanis CATTO & AMATO, 1993 (Fig. 17)

Material: 12 specimens in vial No. 768 mounted in Canada balsam, NHMW ZOOEV microslides No. 4334/a-i.12 other specimens and a fragment, preserved in 75 % ethanol, that remained in vial No. 768, were deposited under collection No. 17147.

CATTO & AMATO (1993b) described two new species of *Pseudotelorchis* YAMAGUTI, 1971 from the oviduct of *Caiman crocodilus yacare, P. caimanis* and *P. yacarei,* captured at Corumba, Mato Grosso, Brazil. The present, relatively well-preserved specimens, were easily identified by their morphology as *P. caimanis*, because of the tongue-shaped body, the position of the ovary and testes, the rather lateral genital pore, the distribution of the vitelline follicles, and the same host. Measurements were thorough somewhat smaller than those of the original description:

Body 5.5-6.3 (5.9) × 1.3-1.7 (1.6) mm at ventral sucker level; tegumental spines 13-19 (16); oral sucker 480-640 (576) × 448-608 (528); prepharynx 0-64; pharynx 320-400 (350) × 336-480 (391); oesophagus 0-128 (35); ventral sucker 480-608 (552) × 416-592 (520); ovary 320-432 (385) × 352-448 (393); anterior testis 448-672 (582) × 416-688 (558); posterior testis 544-848 (656) × 464-736 (564); cirrus-sac 440-848 (628) × 151-251 (210); vitelline follicles 50-101 (64) × 47-72 (58); eggs 19-32 (25) × 9-16 (13).

Host: *Caiman crocodilus* (Crocodili scleropis).

Location: Unspecified.

Locality: Mato Grosso, Brazil.

Proctocaecum dorsale CATTO & AMATO, 1993 (Figs 18-19)

Material: 9 whole specimens and one fragment from vial No. 781, mounted in Canada balsam, NHMW ZOOEV microslides No. 4335/a-j.

CATTO & AMATO (1993a) described *Proctocaecum dorsale* from *Caiman crocodilus yacare* captured at Corumba, Mato Grosso, Brazil. The present specimens were easily identified by their morphology as *P. dorsale*, because of the number of collar spines, its relatively short forebody, the position of the seminal vesicle, and the same host, although pre- and postacetabular pits and anal openings were not discernible. Measurements were thorough somewhat smaller than those of the original description:

Body 1,099-2,355 (1,687) × 126-227 (181), oral sucker 135-176 (153) × 98-148 (132); surrounded anteriorly by a continuous row of 23 circumoral spines, ventral spines 25-32 (27) long, dorsal spines 32-36 (34) long; prepharynx 32-94 (63); pharynx 57-95 (74) × 57-95 (73); ventral sucker 72-101 (88) × 72-98 (85); ovary 60-95 (72) × 50-72 (58); anterior testis 60-104 (82) × 72-110 (92); posterior testis 63-126 (90) × 66-101 (87); eggs 17-21 (18) × 8-9 (9).

Host: *Caiman crocodilus* (Crocodili scleropis).

Location: Unspecified, probably intestine

Locality: Mato Grosso, Brazil.

Other material

Vial No. 766 contained several poorly preserved specimens of two species from *Melanosuchus niger* (Crocodili 164 = *Jacare guaçu*). One species is a Cyathocotylidae, probably *Prohemistomum* sp. The other one is a small Acanthostomidae, probably *Acanthostomum* sp. with 20 oral spines, body up to 1500 long with maximum width at the level of the uterus, full of eggs of 19-23 (22) × 11-13 (11), which could not be described in detail. These species were deposited in the Evertebrata Varia Collection of the Museum of Natural History, Vienna, NHMW ZOOEV microslides No. 4336/a-e and 4337/a-g, respectively.

Discussion

DUBOIS (1936), who studied the material collected by Natterer commented: "recueilli ...il y a environ un siécle, s'est révélé d'une richese insoupçonnée en formes nouvelles dont l'état de conservation était souvent si parfait quìl était aisé de suivre le tracé des conduits sexuels sur les exemplaires montés 'in toto' ". This statement is entirely supported by the present study.

The fact that two species (*Caballerotrema* sp. and *Echinostoma* sp.) belong to genera normally present in fish and birds, respectively, lead to question whether they are true or accidental parasites of crocodiles, either due to their primarily piscivorous diet, or to the eventual ingestion of birds. The specimens of both species are fully mature, numerous, and their condition is too good to assume that they were merely surviving within a wrong host. On the other hand, crocodiles have been more seldom examined for parasites than birds. Crocodiles are poikilotherms and share some other genera of acanthostomids with fish (*Acanthostomum* LOOSS, 1899, *Timoniella* REBECQ, 1960, *Proctocaecum* BAUGH, 1956), as well as Echinostomatidae and Cyathocotylidae with birds (*Stephanoprora* ODHNER, 1902, *Cyathocotyle* MÜHLING, 1896, *Prohemistomum* ODHNER, 1913). Therefore, it is not surprising to find other representatives of Echinostomatidae parasitising crocodiles.

The finding of two recently described species, *Pseudotelorchis caimanis* and *Proctocaecum dorsale* among the parasites collected by J. Natterer more than 170 years ago, demonstrates their continuous presence despite of the influence of man on the natural ecosystem of the Mato Grosso.

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Kulturerbe Natur –
Naturkundliche Museen in Sachsen-Anhalt

Nach Schätzungen des Natural History Museum in London befinden sich weltweit über 2 Milliarden Präparate und Proben von Pflanzen und Tieren in Sammlungen und Museen. Dieser unvergleichliche Fundus der Biodiversität wird of gering geschätzt – ein Dirttel der Sammlungsobjekte befindet sich in einem schlechten Zustand und jedes Jahr gehen Millionen Präparate unwiederbringlich verloren. Wir wissen gar nicht, was verloren geht, weil die Proben nicht katalogisiert und erfaßt sind. Doch wo anfangen mit der Katalogisierung?

Diese Buch macht für Sachsen-Anhalt einen ersten Anfang, indem es die naturkundlichen Sammlungen und Museen auflistet und deren Schätze und Besonderheiten zumindest grob erfaßt. Die Liste der besonderen Sammlungen liest sich wie der "Who is who" der taxonomischen Wissenschaftsgeschichte. Die nett zusammengestellten Bilder von Übersichten, einzelnen Objekten und einigen Sammler-Portraits machen Lust darauf, in den Sammlungen der erwähnten Museen zu stöbern und auf wissenschaftliche Entdeckungsreisen zu gehen.

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