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## Digenea of Fishes from Lake Nicaragua

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## Digenea of Fishes from Lake Nicaragua

DONALD E. WATSON

### INTRODUCTION

This paper covers a collection of helminths made during the summer of 1963. The Monogenea and Cestoda of elasmobranchs are reported in a separate paper (Watson and Thorson, 1976). Most of the teleosts were obtained (many still alive) from the fish market in Granada and were caught in Lake Nicaragua. The others were taken by seine or hook and line from the lake, from Tepeate and from San Carlos.

There have been relatively few studies on Digenea from Central America and most of the work has been done on helminths of vertebrates other than fishes. Brenes (1961) catalogued the parasites from Costa Rica, where most studies have been done, and listed only a single digenean from freshwater fishes: *Acanthostomum gnerii* Szidat, 1954 from *Rhamdia rogersi* (Regan). Since then Bravo-Hollis and Arroyo (1962) reported *Crassicutis cichlasomae* Manter, 1936 from *Cichlasoma* sp., also from Costa Rica.

### MATERIALS AND METHODS

The helminths were relaxed in 0.4% chloretone, fixed in formol-acetic acid-alcohol and stored in 70% ethanol. They were stained with acidified alum carmine, trichrome or Delafield's haematoxylin and mounted in either balsam or Permount. The sucker ratio is from the transverse diameter unless otherwise indicated. Measurements are in micra unless otherwise specified. The averages, in parentheses, follow the ranges. The rate of infection follows the host name, 12:5/10 meaning 12 worms from five of 10 fish.

Family Lepocreadiidae (Odhner, 1905) Nicoll, 1935

*Crassicutis cichlasomae* Manter, 1936

*Hosts:* *Cichlasoma rostratum* (Gill and Bransford) 24:5/10, *C. citrinellum* (Günther) 13:2/20, *C. spilurum* (Günther) 14:8/25, *C. labiatum* (Günther) 7:4/9, *C. managuense* (Günther) 2:2/12 and *C. nicaraguense* (Günther) 1:1/12.

*Location:* Intestine.

*Localities:* Fish market, Granada; Tepeate.

*Specimens deposited:* USNM Helm. Col. No. 61321 (*C. citrinellum*) and 61325 (*C. rostratum*).

*Remarks:* Manter (1936) described this species from specimens collected in 1932 by A. S. Pearse. The host was *C. mayorum* Hubbs from a cenote at Chichén Itzá, Yucatán. Bravo-Hollis and Arroyo (1962) reported it from *Cichlasoma* sp. in Costa Rica and Moravec and Baruš (1971) found it in *C. tetracantha* (Cuv. and Val.) in Cuba. This report adds six new host records and a new host locality.

Family Cryptogonimidae Ciurea, 1933

*Neochasmus ackerti* n. sp.

(Figures 1–2)

*Host:* *Pomadasys boucardi* (Steindachner) 2:1/3.

*Location:* Intestine.

*Locality:* Fish market, Granada.

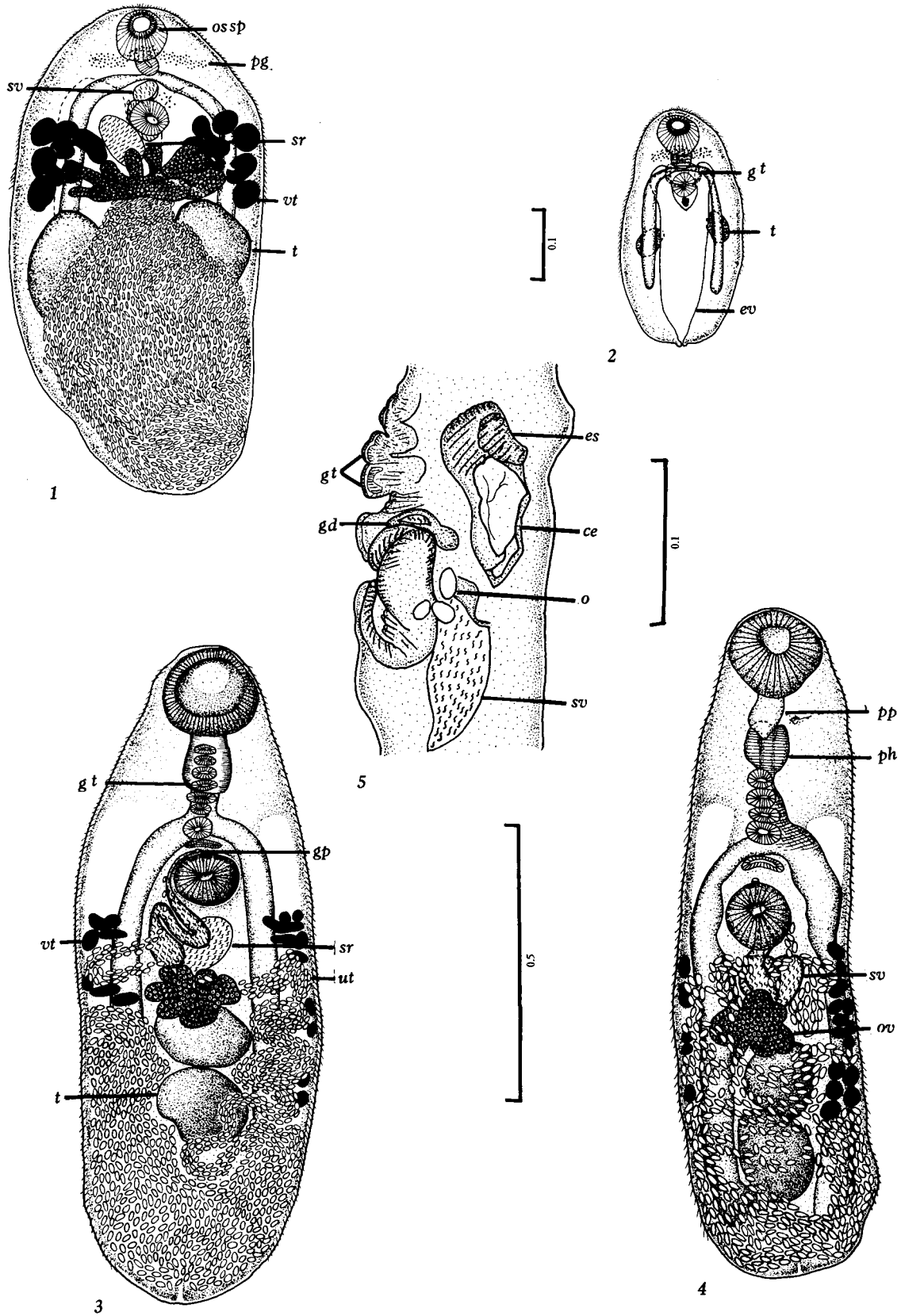
*Metacercaria:* Probable metacercaria found in intestine of *Gobiomorus dormitor* Lacépède 1:1/15.

*Holotype:* USNM Helm. Col. No. 61323.

*Metacercaria:* USNM Helm. Col. No. 61326.

*Description* (Two specimens collected, one in poor condition; measurements on one specimen): Body oval; spinose; 705 long by 353 wide. Dorsal band of pigment granules extending transversely just anterior to pharynx, scattered granules as far posterior as acetabulum. Oral sucker subterminal, 71 long by 75 wide, single row of 33 spines, about 11 long, around oral sucker. Acetabulum sunken into body, smaller than oral sucker, circular, diameter 43; sucker ratio 1:0.57. Forebody 136 long. Prepharynx not visible; pharynx 41 long by 32 wide; esophagus very short; posterior extent of ceca not observed. Testes 175 long by 114 to 121 wide, symmetrical, in middle third of body, anterior ends slightly tipping toward median line; seminal vesicle bipartite, 98 long by 36 wide, free in parenchyma; posterior portion dorsal to acetabulum, anterior portion curving around acetabulum, emptying into median genital pore just anterior to acetabulum; gonotyl not seen, rudimentary if present. Ovary multilobed, transversely elongate, pretesticular; 89 long by 236 wide; diagonal seminal receptacle anterior to ovary, 89 long by 54 wide; vitellaria lateral, consisting of large follicles between testes and posterior end of acetabulum; yolk ducts forming yolk reservoir just anterior to ovary; uterus filling entire body posterior to testes; eggs 18 to 21 (20) long by 11 to 14 (12) wide. Excretory arms reaching level of pharynx; excretory pore and branching of excretory vesicle not visible.

*Probable metacercaria* (Single specimen obtained): Body oval; spinose; 338 long by 173 wide. Dorsal band of pigment granules located transversely at level of pharynx. Oral sucker subterminal, circular, diameter 57; 36 oral spines, 6 long. Acetabulum 38 long by 39 wide, sunken into parenchyma; sucker ratio 1:0.68. Forebody 89. Short prepharynx 8 long, followed by pharynx 26 long by 28 wide; esophagus not seen; ceca extending posteriorly about four-fifths body length. Testes ovoid, almost equatorial, slightly diagonal, dorsal to ceca, anterior ends tipped toward median line, 55 to 57 long by 36 wide; circular gonotyl lying over anterior half of acetabulum and beyond, not well-developed. An-



FIGURES 1-2. *Neochasmus ackerti*. FIG. 1. Whole mount, ventral view. FIG. 2. Metacercaria, dorsal view. FIGURES 3-5. *Oligogonotylus manteri*. FIG. 3. Whole mount, ventral view. FIG. 4. Whole mount, ventral view, showing variation. FIG. 5. Sagittal section. Ce, Cecum; Es, Esophagus; Ev, Excretory vesicle; Gd, Genital duct; Gp, Genital pore; Gt, Gonotyl; O, Ovum; Ossp, Oral spines; Ov, Ovary; Pg, Pigment granules; Ph, Pharynx; Pp, Prepharynx; Sr, Seminal receptacle; Sv, Seminal vesicle; T, Testis; Ut, Uterus; Vt, Vitellaria.

lagen of ovary just postacetabular; vitellaria not differentiated. Excretory vesicle Y-shaped, branching just posterior to ovarian anlagen, arms extending to level of pharynx; excretory pore terminal.

This specimen is considered to be the probable metacercaria of *N. ackerti* because of apparent similarities in body shape, in presence and distribution of pigment granules and in both having the anterior end of the testes tipped medially. There is a difference in the number of spines, 33 in the adult and 36 in the metacercaria. However, this situation is not unusual in the genus in that differences in the number of oral spines among specimens of the same species occur in adult *N. magnus* with 34 to 36 and adult *N. sogandaresi* with 31 to 37. The gonotyl present in the metacercaria is not apparent in the adult. On the whole, the data indicate that they are the same species.

*Remarks:* *Neochasmus ackerti* resembles *N. labeosus* Bennett, 1935, *N. magnus* Winter, 1958 and *N. sogandaresi* Overstreet, 1971 in the number of oral spines and in having the acetabulum smaller than the oral sucker. *Neochasmus ackerti* differs from each of these in having a bipartite rather than a long and sinuous seminal vesicle and in having smaller oral spines. *Neochasmus labeosus* has numerous small vitelline glands which extend to the posterior end of the ceca in the third quarter of the body whereas *N. ackerti* has relatively few large follicles extending posteriorly only to the anterior end of the testes. In *N. sogandaresi* the vitellaria are comparatively numerous and extend posteriorly to the middle or posterior portion of the testes. Furthermore, *N. ackerti* lacks the muscular pad present in *N. sogandaresi*. *Neochasmus magnus* is much larger and has a seminal receptacle located posterior, rather than anterior, to the ovary.

The species is named in honor of the late helminthologist, Dr. James E. Ackert.

*Oligogonotylus manteri* n. gen., n. sp.

(Figures 3–5)

*Hosts:* *Cichlasoma nicaraguense* (Günther) 28:4/12, *C. managuense* (Günther) 25:6/12, *C. labiatum* (Günther) 16:7/9, *C. citrinellum* (Günther) 7:2/20, *C. maculicauda* Regan 1:1/5 and *C. rostratum* (Gill and Bransford) 1:1/10.

*Location:* Intestine.

*Locality:* Fish market, Granada.

*Holotype:* USNM Helm. Col. No. 61322 (*C. managuense*).

*Paratype:* USNM Helm. Col. No. 61324 (*C. nicaraguense*).

*Description* (Fifteen specimens measured): Body oval to elongate; spinose; without circumoral crown of spines or eyespots; 700 to 1385 (1184) long by 328 to 596 (440) wide. Oral sucker subterminal, 131 to 230 (159) long by 149 to 276 (189) wide. Acetabulum 84 to 147 (106) long by 94 to 164 (117) wide; somewhat sunken into body; no ventro-genital sac present; sucker ratio 1:0.49 to 1:0.70 (1:0.62). Median, ventral, longitudinal row of five to eight (seven) gonotyls between acetabulum and oral sucker, increasing in size from anterior to posterior. Forebody approximately one-third body length, 283 to 454 (338). Prepharynx extremely short, lacking pharyngeal glands; pharynx 64 to 118 (91) long by 57 to 168 (89) wide; esophagus about two-thirds as long as pharynx, very muscular; ceca extending to near posterior end of body. Testes tandem to oblique, intercecal, rounded to oval; anterior testis 77 to 146 (107) long by 93 to 225 (147) wide, posterior testis larger, 107 to

149 (116) long by 103 to 272 (162) wide; seminal vesicle sigmoid, undivided, mostly posterior and dextral to acetabulum. Medial genital pore immediately preacetabular; cirrus sac and cirrus lacking. Ovary median, pretesticular, six-or seven-lobed, partially overlapping (ventrally) anterior testis, 75 to 125 (106) long by 125 to 214 (168) wide; seminal receptacle median, pre-ovarian, ovoid, usually obliquely elongate, 71 to 143 (116) long by 61 to 75 (67) wide; vitellaria extracecal, between posterior portion of acetabulum and posterior portion of posterior testis, rarely intruding slightly into forebody; uterus filling posterior part of body, passing posteriorly on right side, then anteriorly on left side, passing medially between ovary and acetabulum and forward to genital pore; eggs 18 to 27 (23) long by 10 to 14 (12) wide, containing miracidia in terminal portion of uterus. Excretory pore terminal; excretory vesicle Y-shaped, branching at level of ovary, arms wide, extending to esophageal region.

*Remarks:* Two other cryptogonimid species have been described possessing several to numerous gonotyls. They are *Multigonotylus micropteri* Premvati, 1967 from the bass, *Micropterus salmoides* (Lacépède), in the Wakulla River, Florida, and *Polycryptocylis leonilae* Lamothe-Argumedo, 1970 from a snapper, *Lutjanus guttatus* (Steindachner), on the Pacific coast of Mexico. Lamothe-Argumedo (1970) placed *Polycryptocylis leonilae* in the Neochasminae and Premvati (1967) made *M. micropteri* the basis of a new subfamily, Multigonotylinae. The present species is best placed in the latter subfamily as the Neochasminae is characterized by the presence of circumoral spines; however, the present subfamily diagnosis is too narrow to contain it.

*Emended diagnosis of Multigonotylinae:* Cryptogonimidae; body oval to elongate; multiple gonotyls in pre-acetabular region. Acetabulum smaller than oral sucker, sunken into body, ventro-genital sac present or not. Oral sucker large, terminal to subterminal, circumoral crown of spines lacking; ceca simple, extending to near posterior end of body. Testes tandem to oblique, in posterior half of body; seminal vesicle long, divided or not. Ovary lobed, median to submedian; seminal receptacle and Laurer's canal present; uterus extending to near posterior end of body; vitellaria follicular or branched, distribution variable. Excretory vesicle Y-shaped, bifurcation near ovary, arms wide, extending to pharyngeal region or a little less. Type species: *Multigonotylus micropteri* Premvati, 1967.

My specimens differ from *Multigonotylus* in several respects. The oral sucker is rounded and subterminal instead of funnel-shaped and terminal. They lack the prepharyngeal glands and eyespots found in *Multigonotylus*. The acetabulum is merely sunken into the body parenchyma, not in a ventrogenital sac. The esophagus is quite muscular. I assume this is not so in *Multigonotylus* as Premvati neither mentioned it nor showed it in his figure, but stated only that it is short. The gonotyls extend more anteriorly and are fewer, five to eight compared with eight to eleven. The seminal vesicle is undivided rather than tripartite. There are more ovarian lobes, six or seven compared with three. The vitellaria are separate follicles rarely intruding into the forebody, whereas in *Multigonotylus* they are branched and pre-acetabular. Primarily on the basis of the lack of a ventro-genital sac, the differences in the shape of the seminal vesicle, the differences in the number of ovarian lobes and the differences in the vitellaria, I believe the present form to be sufficiently distinct to warrant the erection of a new genus to contain it.

*Generic diagnosis of Oligogonotylus:* Cryptogonimidae: Multigonotylinae. Body relatively small, spinose, without circumoral crown of spines, without evidence of eyespots. Acetabulum sunken into body parenchyma, in middle third of body, smaller than oral sucker. Single, median, ventral row of preacetabular gonotyls. Prepharynx present; esophagus muscular; ceca extending to near posterior end of body. Testes tandem to oblique, intercecal; seminal vesicle undivided; cirrus sac and cirrus lacking; genital pore median, immediately pre-acetabular. Ovary median, multilobed; seminal vesicle present; vitellaria follicular, in acetabulo-testicular zone, mostly lateral to ceca; uterus filling hindbody. Excretory vesicle Y-shaped. Parasites of fish.

The name *Oligogonotylus* indicates a reduced number of gonotyls as compared with *Multigonotylus*, the only other genus in the subfamily. The species is named in honor of the late helminthologist, Dr. Harold W. Manter.

Family Acanthostomatidae Poche, 1926  
*Acanthostomum gnerii* Szidat, 1954

*Hosts:* *Rhamdia nicaraguensis* (Günther) 7:1/7 and *R. managuensis* (Günther) 1:1/10.

*Location:* Intestine

*Locality:* Fish market, Granda

*Specimen deposited:* USNM Helm. Col. No. 61328.

*Remarks:* Szidat (1954) described this species originally from *Rhamdia quelon* (Quoy and Gaimard) in Argentina. Caballero and Brenes (1958) reported it from *R. rogersi* (Regan) in Costa Rica. This report adds two new hosts and a new host locality.

*Acanthostomum astorquii* n. sp.

(Figures 6-7)

*Host:* *Rhamdia nicaraguensis* (Günther) 4:1/7.

*Location:* Intestine.

*Locality:* Fish market, Granada.

*Holotype:* USNM Helm. Col. No. 61327.

*Description* (Three specimens measured): Body oval, with broadly rounded anterior and posterior ends; 750 to 875 (825) long by 255 to 390 (300) wide; spinose, anterior spines about 18 long, posterior about 13 long, spines sometimes lost on posterior half of body. Oral sucker cup-shaped, terminal, 147 to 180 (169) long by 119 to 135 (130) wide, with single row of 20 stout spines, 32 to 36 (33) long by 9 to 13 (11) wide, surrounding mouth. Acetabulum smaller than oral sucker, 86 to 107 (99) long by 90 to 114 (103) wide; slightly dextral to midline, posterior edge at junction of anterior and middle thirds of body. Opening of oral sucker with a single row of closely aligned papillae; opening of acetabulum with few small papillae. Sucker ratio 1:0.76 to 1:0.85 (1:0.80). Prepharynx (from a single specimen) 46 long; pharynx large, 100 to 107 (104) long by 57 to 118 (88) wide; esophagus very short; left cecum five to six times as broad as right cecum, each cecum with anus at posterior end of body. Testes ovoid, diagonal, wider than long, in posterior one-fourth of body, anterior testis 96 to 121 (105) long by 116 to 132 (122) wide, posterior testis slightly larger, 107 to 121 (114) long by 107 to 144 (125) wide; seminal vesicle tubular, free in parenchyma, mostly posterior to acetabulum, 81 to 125 (103) long by 18 to 29 (24) wide; neither cirrus nor cirrus sac present; genital pore immediately pre-acetabular. Ovary nearly spherical, 82 to

93 (86) long by 52 to 100 (79) wide, dextral, slightly anterior to posterior testis; seminal receptacle 50 long by 54 to 71 (63) wide, posteriodorsal to ovary; vitellaria lateral, mostly extracecal, from level of seminal vesicle or slightly posterior to level of anterior testis; uterus not extending posterior to ovary, sometimes extending ventral to ceca laterally; eggs 29 to 32 (30) long by 18 to 20 (19) wide. Excretory vesicle saccular, extending to middle of anterior testis or slightly beyond; excretory pore terminal.

*Remarks:* The difference in widths of the ceca places this species in the subgenus *Atrophocaeum* (as defined by Khalil, 1963). Two other species have been described in this subgenus: *A. burminis* (Bhalerao, 1926) and *A. hindusthanensis* Baugh, 1957 (= *A. simhai* Khalil, 1963). Both species occur in water snakes in India; the former also occurs in water snakes in Burma. *Acanthostomum astorquii* differs from both in the type of host and in having oblique rather than tandem testes. *Acanthostomum burminis* further differs from *A. astorquii* in being very elongate, in having testes somewhat removed from the posterior end, in having the acetabulum in the anterior one-fifth of the body and in having more numerous vitellaria. *Acanthostomum hindusthanensis* differs from the present species in being elongate and in having testes almost as broad as the body.

The species is named in honor of Father Ignacio Astorqui, ichthyologist at the Colegio Centro America, who identified the fish.

Family Plagiorchiidae Lühe, 1901

*Allomacrodroides lepisostei* n. g., n. sp.

(Figures 8-9)

*Host:* *Lepisosteus tropicus* (Gill) 6:2/2.

*Location:* Intestine.

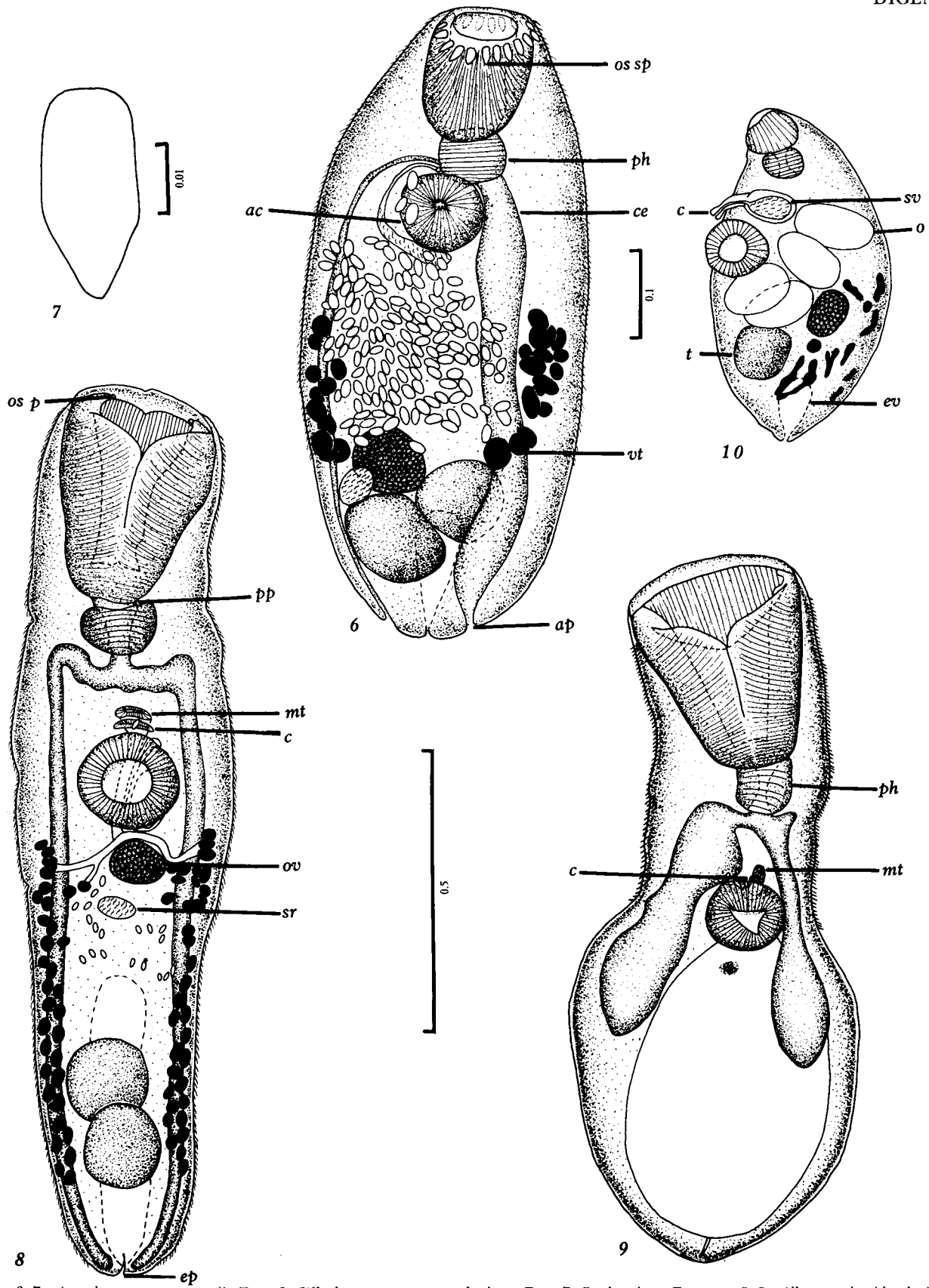
*Locality:* Rio San Juan, San Carlos.

*Metacercaria:* *Cichlasoma rostratum* (Gill and Bransford); intestine; fish market, Granada.

*Holotype:* USNM Helm. Col. No. 61329.

*Metacercaria:* USNM Helm. Col. No. 61330.

*Description* (Most measurements on ventral view of two specimens, remainder on lateral view of one specimen): Body elongate, with rounded posterior end; blunt, somewhat truncate anterior end; 1.485 and 1.493 mm long by 300 and 360 wide at acetabulum; coarse spination over entire body, anterior spines 13 to 14 long, posterior 8 to 11 long. Oral sucker robust, terminal, elongate cup-shape with two lateral lobes, each provided with a single anterior papilla about 7 long (easily seen in lateral view) on inner aspect of sucker; 330 and 390 long by 300 and 345 wide; no oral spines present. Acetabulum pre-equatorial, smaller than oral sucker, slightly wider than long, 157 and 173 long by 180 wide; sucker ratio 1:0.52 and 1:0.60. Forebody 585 and 593. Prepharynx short, 18 in lateral view, generally hidden by pharynx; pharynx slightly wider than long from ventral view, lying diagonally from posterior part of oral sucker to near dorsal surface in lateral view; 111 and 118 long by 114 and 125 wide; esophagus short, extending in dorsoventral direction; ceca fairly broad, extending to near posterior end. Testes smooth, tandem, in posterior quarter of body; anterior testis 87 and 107 long by 136 and 144 wide; posterior testis 125 and 135 long by 100 and 136 wide; seminal vesicle bi- or tripartite, 136 and 182 long by 57 and 59 wide, enclosed with well-developed prostatic



FIGURES 6-7. *Acanthostomum astorquii*. FIG. 6. Whole mount, ventral view. FIG. 7 Oral spine. FIGURES 8-9. *Allomacrodieroides lepisostei*. FIG. 8. Whole mount, ventral view. FIG. 9. Metacercaria. FIG. 10. *Saccocoeleoides* sp., whole mount, lateral view. Ap, Anal pore; C, Cirrus; Mt, Metaterm. Other abbreviations as before.

complex in cirrus sac dorsal to, and extending slightly posterior to, acetabulum; muscular cirrus and muscular metraterm open into common genital sinus; genital pore median, just pre-acetabular. Ovary immediately postacetabular, slightly sinistral, wider than long, roughly ovoid, 57 and 64 long by 96 and 123 wide; seminal receptacle posterodextral to ovary; vitellaria follicular, mostly lateral with a few extending across body dorsally near ovary, from posterior edge of acetabulum to posterior edge of hind testis; uterus extending to near posterior end of body; eggs 29 to 34 (31) long by 16 to 18 (16) wide. Excretory vesicle saccular, extending anteriorly to level of seminal receptacle, or a little short of this; excretory pore ventro-terminal.

*Metacercaria* (Single specimen): Flask-shaped, 1.208 mm long by 510 in maximum width. Oral sucker 345 long by 300 wide, having same appearance as in adult. Acetabulum 120 long by 203 wide, equatorial; sucker ratio 1:0.68. Prepharynx not visible; pharynx 96 long by 91 wide; esophagus not visible; ceca very broad, extending posteriorly about two-thirds body length. Genital anlagen for ovary present; both muscular cirrus and muscular metraterm present. Excretory vesicle swollen, filling posterior half of body.

*Generic diagnosis of Allomacrodroides*: Body elongate, spinose. Oral sucker large, terminal, provided with two lobes on inner lateral surface, each lobe bearing a single papilla. Prepharynx present; pharynx well-developed; esophagus short; ceca reaching posterior end of body. Acetabulum smaller than oral sucker, in middle third of body. Testes tandem, in posterior third of body, intercecal; seminal vesicle bi- or tripartite; cirrus sac present, enclosing seminal vesicle, prostatic complex and muscular cirrus; genital pore median, just pre-acetabular. Ovary postacetabular, median or submedian, entire; seminal receptacle post-ovarian; vitellaria follicular, lateral, postacetabular; uterus reaching posterior end of body; eggs small, fairly numerous. Excretory vesicle saccular. Intestinal parasites of fish.

*Remarks*: *Allomacrodroides* most closely resembles the genera *Macroderoides* Pearse, 1924 and *Paramacrodroides* Vernard, 1941. It differs from both these genera in the nature of the oral sucker, which is circular in the other two. In addition, the oral sucker is provided with oral spines in *Paramacrodroides*. Neither of the related genera possesses a broad muscular cirrus and metraterm. The testes in *Allomacrodroides* are more posterior than in the other two genera. *Macroderoides* differs in that it has a weakly developed prostatic complex and lacks a seminal receptacle. *Paramacrodroides* has a shorter excretory vesicle and its vitelline follicles extend to the middle of the posttesticular field.

The name *Allomacrodroides* is from the Greek (allo—different) plus *Macroderoides*, the name of a similar genus. The species name, *lepisostei*, refers to the host.

Family Haploporidae Nicoll, 1914

*Saccocoelioides* sp.

(Figure 10)

*Host*: *Roeboides guatemalensis* (Günther) 1:1/24.

*Location*: Intestine.

*Locality*: Lake Nicaragua, Granada.

*Specimen deposited*: USNM Helm. Col. No. 61331.

*Description* (Measurements from a lateral view of one

specimen in rather poor condition): Body containing numerous pigment granules spreading dorsally and ventrally at level of pharynx; 465 long by 255 deep. Subterminal oral sucker 57 long by 58 deep. Acetabulum immediately pre-equatorial, 100 by 100; sucker ratio (lengths) 1:1.75. Forebody 151. Prepharynx 11 long; pharynx 43 long by 57 deep; intestinal bifurcation not visible; ceca extending posteriorly about two-thirds of body length. Single, ventral testis 68 long by 71 deep, its anterior margin at junction of middle and posterior thirds of body; external seminal vesicle not visible, internal seminal vesicle present in what may be hermaphroditic sac which measures 63 long by 22 deep, completely pre-acetabular; hermaphroditic duct (?) somewhat extruded. Ovary dorsal, between acetabulum and testis; vitellaria consisting of elongate follicles, from posterior edge of acetabulum to near posterior end of body; receptaculum seminis uterinum and terminal portion of uterus not visible; four large eggs, 96 to 100 (98) long by 61 to 63 (61) wide. Excretory vesicle appears saccular, extending anteriorly to level of posterior edge of testis; excretory pore terminal.

*Remarks*: The condition of this specimen is too poor for a complete comparison with previously described species or for a specific designation. There are seven named species in this genus, plus an additional three designated as *Saccocoelioides* sp. only. The named species are *S. nanii* Szidat, 1954; *S. elongatus* Szidat, 1954; *S. magniovatus* Szidat, 1954; *S. magnus*, Szidat, 1954; *S. octavus* Szidat, 1970 and *S. sogandaresi* Lumsden, 1963. Overstreet (1971) tentatively transferred *Saccocoelium beauforti* Hunter and Thomas, 1961 to *Saccocoelioides*. The first four are from fresh waters in Brazil; *S. octavus* is from a brackish lake, also in Brazil. *Saccocoelioides sogandaresi* occurs in brackish water ponds in Galveston Bay, Texas, and Overstreet's specimens were from the Gulf of Mexico.

The three species not designated were also by Szidat (1954). Two are immature and no comparison is possible. The third, from *Schizodon fasciatus* Agassiz, has suckers equal in size, vitellaria extending posteriorly to a pretesticular level and eggs measuring 110 to 118 by 48 to 53.

As far as I can determine, the described species closest to my specimen is *S. sogandaresi*; however, the eggs of the latter are smaller (78 to 87 by 37 to 55). The eggs in my specimen are closest to those of *S. beauforti* (70 to 107 by 47 to 57) and *S. magniovatus* (95 to 114 by 41 to 60). *Saccocoelioides beauforti*, however, has pigment granules spread throughout the body, concretions in the excretory vesicle and a larger, more posterior hermaphroditic sac. In *S. magniovatus* there are no pigmented granules in the forebody and the vitellaria are distributed from the anterior edge of the acetabulum to the anterior edge of the testis.

The present specimen apparently differs from all described species and may well represent a new species.

Family Hemiuridae Lühe, 1901

*Paravitellotrema astyanactis* n. g., n. sp.

(Figures 11–12)

*Host*: *Astyanax fasciatus* (Cuv.) 4:3/20.

*Location*: Stomach.

*Locality*: Tepetate.

*Holotype*: USNM Helm. Col. No. 61332.

*Description* (Measurements on three specimens): Body

elongate-oval, without ecsoma, 0.87 to 1.455 mm (1.175) long by 225 to 315 (280) wide at acetabulum. Pre-oral lobe present; subterminal oral sucker, 120 to 173 (148) long by 165 wide. Acetabulum nearly equatorial, 210 to 270 (248) long by 203 to 233 (215) wide, aperture longitudinal; sucker ratio 1:1.23 to 1:1.27 (1:1.25). Forebody 285 to 495 (407). Prepharynx absent; pharynx 64 to 82 (72) long by 66 to 71 (68) wide; esophagus very short; ceca extending to near posterior end of body. Testes intercecal, slightly diagonal, located about one-third distance between acetabulum and posterior end of body, subspherical, 46 to 79 (65) long by 46 to 89 (73) wide; seminal vesicle pre-acetabular, 114 to 179 (147) long by 32 to 50 (41) wide, forming a shallow "C" in holotype, tight "C" in others; prostatic complex free in parenchyma, cells few; prostatic vesicle tubular; sinus sac weakly developed; hermaphroditic duct short. Ovary posttesticular, in posterior one-fifth of body, ovoid to spherical, 96 to 104 (100) long by 89 to 96 (93) wide; vitellaria compact, paired, oblique, near posterior end, slight indications of lobing sometimes present, 104 to 116 (112) long by 79 to 93 (86) wide; proximal end of Laurer's canal expanded but no sperm visible; uterus pre-ovarian, anteriorly with loops intruding into extracecal areas; eggs with long unipolar filament, 41 to 45 (43) long by 21 to 25 (24) wide, excluding filament. Excretory pore terminal, excretory vesicle Y-shaped, arms uniting dorsal to pharynx, point of bifurcation not noted.

*Remarks:* There are presently eight genera in the subfamily Halipeginae: *Halipegus* Looss, 1899; *Deropegus* McCauley and Pratt, 1961; *Dollfuscella* Vercammen-Grandjean, 1960; *Genarchopsis* Ozaki, 1925; *Gonocercella* Manter, 1940; *Indoderogenes* Srivastava, 1937; *Tangiopsis* Skrjabin and Gushanskaja, 1955 and *Vitellotrema* Guberlet, 1928.

*Dollfuscella* is characterized by very large suckers, the acetabulum reaching the sides of the body, possession of a definite cirrus pouch and having nine distinctly separate vitelline follicles. *Genarchopsis* and *Tangiopsis* have the ceca united in the hindbody and the prostatic complex enclosed in a thin-walled sac. The latter genus has non-filamented eggs. *Indoderogenes* and *Gonocercella* apparently lack a seminal receptacle and have non-filamented eggs. *Gonocercella* has the genital pore posterior to the intestinal bifurcation and *Indoderogenes* has ceca which terminate anterior to the ovary and a flask-shaped seminal vesicle. *Deropegus* has non-filamented eggs and the uterus, which extends posterior to the vitellaria, lacks loops in the forebody. *Vitellotrema* has the prostatic cells enclosed in the sinus sac and the uterus is swollen to form a voluminous organ in the midbody. *Halipegus* lacks a sinus sac.

My specimens, thus, differ from all reported genera of Halipeginae, but appear closest to *Halipegus* and *Vitellotrema*. They have the prostatic complex free in the parenchyma as does *Halipegus* and a sinus sac as does *Vitellotrema*. Yamaguti (1958), Skrjabin and Gushanskaja (in Skrjabin *et al.*, 1964) and Saoud and Roshdy (1970) all stress the lack of a sinus sac in the genus *Halipegus*. The latter authors also state that the lack of a sinus sac in *Halipegus* and the presence in *Vitellotrema* is the only basic difference between these two genera. It appears, then, that this character is of generic importance and its presence excludes my specimens from *Halipegus*. The prostatic complex is not enclosed in the sinus sac and this separates my specimens from *Vitellotrema*.

I propose the name *Paravitellotrema* (*para* from Greek—near) to include the present specimens. I do, however,

consider *Halipegus*, *Vitellotrema* and *Paravitellotrema* to be closely related and future studies may indicate the latter two to be subgenera of *Halipegus*. The generic diagnosis of *Paravitellotrema* is deferred until after the next description. The species name, *astyanactis*, is from the host.

*Paravitellotrema thorsoni* n. sp.

(Figures 13–14)

*Host:* *Rhamdia managuensis* (Günther) 3:2/10.

*Location:* Stomach.

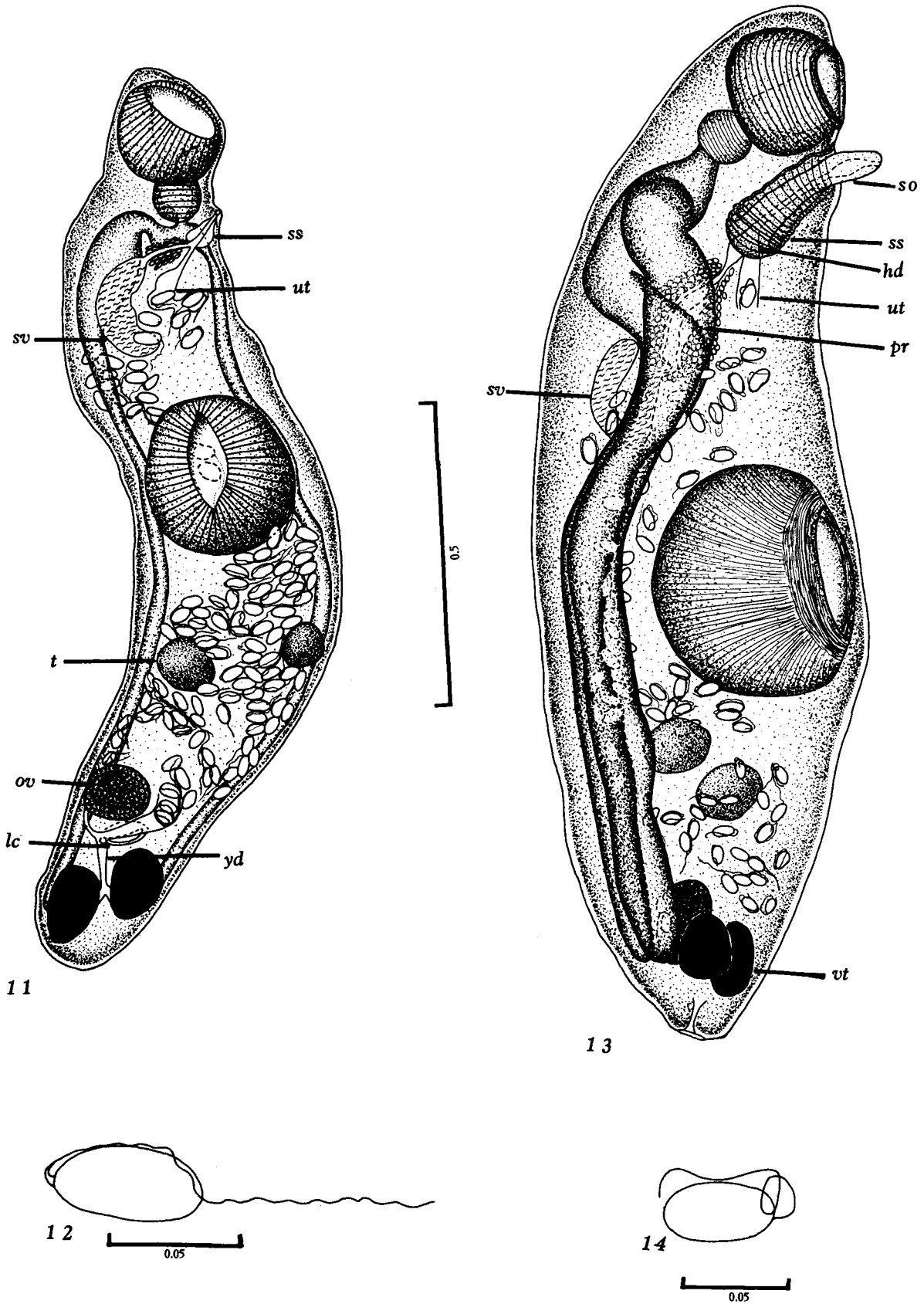
*Locality:* Fish market, Granada.

*Holotype:* USNM Helm. Col. No. 61333.

*Description* (Measurements on three specimens): Body elongate, subcylindrical, without ecsoma, widest at acetabulum or slightly posterior to it; 1.310 to 1.613 mm (1.424) long by 495 to 510 (505) wide, 510 thick. Pre-oral lobe present; oral sucker subterminal, 150 to 210 (175) long by 188 to 195 (192) wide, 180 deep. Acetabulum post-equatorial, 270 to 375 (310) long by 255 to 277 (263) wide, 315 deep; sucker ratio 1:1.36 to 1:1.39 (1:1.38). Forebody 638 to 750 (693). Prepharynx lacking; pharynx 68 to 71 (69) long by 61 wide, 75 deep; ceca extending to near posterior end of body. Testes postacetabular, slightly diagonal, about one-third the distance between acetabulum and posterior end of body, intercecal or overlapping inner edges of ceca, 86 to 118 (99) long by 82 to 107 (92) wide; seminal vesicle pre-acetabular, 136 to 295 (216) long by 41–43 (42) wide, "C"-shaped or "U"-shaped with dorsal portion of "U" extending more anteriorly than ventral portion, continuing into a slightly expanded, tubular prostatic vesicle surrounded by numerous prostate cells which are arranged in elongate diamond shape, free in parenchyma; ejaculatory duct emptying into muscular, protrusible sinus organ 170 long by 54 wide at its widest portion when not extended, 232 to 257 long by 43 to 62 at widest point when extended; sinus organ surrounded by thick-walled, muscular sinus sac 151 to 161 (158) long by 68 to 103 (80) in maximum width; genital pore at base of oral sucker, ventral to pharynx. Ovary posttesticular, ovoid, 89 to 107 (101) long by 89 to 125 (105) wide; seminal receptacle not noted; vitellaria compact, slight indications of lobing may be present, diagonal, close together, anterior vitellarium 132 to 154 (141) long by 71 to 89 (82) wide, posterior one 89 to 144 (97) long by 79 to 100 (91) wide, postovarian, ventral to ceca, near posterior end of body; uterus extending to posterior end of ovary with loops in forebody, entering sinus sac to form hermaphroditic duct in sinus organ; eggs with long unipolar filament, 41 to 50 (45) long by 21 to 25 (22) wide excluding filament. Excretory pore terminal, excretory vesicle Y-shaped, arms united dorsal to pharynx, point of bifurcation not observed.

*Remarks:* *Paravitellotrema thorsoni* differs from *P. astyanactis* in the presence of an eversible sinus organ and a muscular, thick-walled sinus sac. Manter (1969, 1970) indicated that the presence or absence of a sinus organ is not of generic value in that it occurs in several species of *Dimurus* Looss, 1907, in a varying degree in *Elytrophalloides* Szidat, 1955 and *Ectenurus* Looss, 1907; it also occurs as a prominent coiled feature in the genus *Elytrophallus* Manter, 1940. The above mentioned genera are members of the subfamily Dinurinae. This constitutes the first report of a sinus organ in the Halipeginae.





FIGURES 11-12. *Paravitellotrema astyanactis*. FIG. 11. Whole mount, ventral view. FIG. 12. Ovum. FIGURES 13-14. *Paravitellotrema thorsoni*. FIG. 13. Whole mount, lateral view. FIG. 14. Ovum. Hd, Hermaphroditic duct; Lc, Laurer's canal; Pr, Prostate; So, Sinus organ; Ss, Sinus sac; Yd, Yolk duct. Other abbreviations as before.

The species is named in honor of Dr. Thomas B. Thorson with whom I worked in Central America on several occasions.

*Generic diagnosis of Paravitellotrema:* Halipeginae. Body elongate, lacking ecsoma. Pre-oral lobe present, oral sucker subterminal; acetabulum in middle third of body. Pre-pharynx lacking; esophagus short; ceca extending to near posterior end of body, not uniting. Testes diagonal, post-acetabular; seminal vesicle pre-acetabular; prostatic complex free in parenchyma; sinus sac present, with or without muscular sinus organ; genital pore ventral to pharynx. Ovary posttesticular, near posterior end of body; vitellaria postovarian, compact, may have indications of lobing; uterus not extending posterior to ovary, with loops in forebody, joining ejaculatory duct to form hermaphroditic duct in sinus sac; eggs numerous, with long unipolar filaments. Excretory pore terminal; excretory vesicle Y-shaped, arms united dorsal to pharynx. Stomach parasites of freshwater fishes.

#### DISCUSSION

With the exception of two species of characids (*Astyanax fasciatus* and *Roeboides guatemalensis*), all fish examined were secondary division fishes such as catfishes, cichlids, eleotrids, pomadasyids and gars. The Digenea collected reflect this situation as they are primarily (six of nine species) from predominantly marine families (Cryptogonimidae, Haploporidae, Hemiuridae and Lepocreadiidae). Szidat (1954, 1956, 1960) explains the marine affinities of such Digenea in Argentina and Brazil as reflecting the influence of the Tethys Sea in Miocene-Pliocene times when it covered much of South America. The Tethys Sea also covered Central America during much of the Tertiary leaving a series of islands (George, 1962; Urdy, 1969). Thus, the same situation might explain the nature of the Lake Nicaragua fish Digenea.

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#### SUMMARY

This report lists nine species of Digenea belonging to six families from fishes of Lake Nicaragua. One of these, *Saccocoelelioides* sp. (Haploporidae) from *Roeboides guatemalensis* (Günther, 1864) is identified only to genus and two, *Acanthostomum gnerii* Szidat, 1954 (Acanthostomatidae) from *Rhamdia managuensis* (Günther, 1869) and *R. nicaraguensis* (Günther, 1864) and *Crassicutis cichlasomae* Manter, 1936 (Lepocreadiidae) from *Cichlasoma citrinellum* (Günther, 1864), *C. labiatum* (Günther, 1864), *C. managuense* (Günther, 1868), *C. nicaraguense* (Günther, 1864), *C. rostratum* (Gill and Bransford, 1877) and *C. spilurum* (Günther, 1862) are previously known. The remaining six are designated as new and include three new genera. These six are: *Acanthostomum astorquii* n. sp. from *R. managuensis* and *R. nicaraguensis*; *Neochasmus ackerti* n. sp. (Cryptogonimidae) from *Pomadasyd boucardi* (Steindachner, 1869); *Oligogonotylus manteri* n. g., n. sp. (Cryptogonimidae) from *C. citrinellum*, *C. labiatum*, *C. maculicauda* Regan, 1905, *C. managuense*, *C. nicaraguense* and *C. rostratum*; *Allomacrodroides lepisostei* n. g., n. sp. (Plagiiorchiidae) from *Lepisosteus tropicus* (Gill, 1863); *Paravitellotrema thorsoni* n. g., n. sp. (Hemiuridae) from *R. managuensis*; and *P. astyanactis* n. sp. from *Astyanax fasciatus* (Cuvier, 1819). Possible metacercariae for *N. ackerti* from *Gobiomorus dormitor* Lacépède, 1800 and *A. lepisostei* from *C. rostratum* are also given.

#### RESUMEN

Se encontraron nueve especies de Digenea, pertenecientes a seis familias en peces del Lago de Nicaragua. Uno de los digéneos sólo se identificó hasta el género *Saccocoelelioides* (Haploporidae) de *Roeboides guatemalensis* (Günther, 1864), y dos de ellos eran ya conocidos: *Acanthostomum gnerii* Szidat, 1954 (Acanthostomatidae) de *Rhamdia managuensis* (Günther, 1869) y *R. nicaraguensis* (Günther, 1864) y *Crassicutis cichlasomae* Manter, 1936 (Lepocreadiidae) de *Cichlasoma citrinellum* (Günther, 1864), *C. labiatum* (Günther, 1864), *C. managuense* (Günther, 1868), *C. nicaraguense* (Günther, 1864), *C. rostratum* (Gill y Bransford, 1877), y *C. spilurum* (Günther, 1862). Tres géneros (*Oligogonotylus*, *Allomacrodroides*, y *Paravitellotrema*) y las siguientes especies son nuevas y se describen por primera vez: *Acanthostomum astorquii* de *R. managuensis* y *R. nicaraguensis*; *Neochasmus ackerti* (Cryptogonimidae) de *Pomadasyd boucardi* (Steindachner, 1869); *Oligogonotylus manteri* (Cryptogonimidae) de *C. citrinellum*, *C. labiatum*, *C. maculicauda* Regan, 1905, *C. managuense*, *C. nicaraguense*, y *C. rostratum*; *Allomacrodroides lepisostei* (Plagiiorchiidae) de *Lepisosteus tropicus* (Gill, 1863); *Paravitellotrema thorsoni* (Hemiuridae) de *R. managuensis*; y *P. astyanactis* de *Astyanax fasciatus* (Cuvier, 1819). Se encontraron también posibles metacercarias de *N. ackerti* en *Gobiomorus dormitor* Lacépède, 1800 y *A. lepisostei* en *C. rostratum*.

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