



## Monogenoids (Diplectanidae, Polyonchoinea) from the gills of mojarras (Perciformes, Gerreidae) with the resurrection of *Neodiplectanum* Mizelle & Blatz, 1941 and the proposal of *Darwinoplectanum* n. gen.

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### Abstract

*Neodiplectanum* Mizelle & Blatz, 1941 is resurrected and emended for monogenoids from the gills of gerreid hosts from Western Atlantic: *Neodiplectanum weningeri* from *Eucinostomus gula* (Quoy & Gaimard) [type-host] and *Gerres cireneus* (Walbaum); *N. magnodiscatum* (Fuentes Zambrano, 1997) **n. comb.** (syn. *Diplectanum magnodiscatum* Fuentes Zambrano, 1997) from *Eugerres plumieri* (Cuvier); *Neodiplectanum gatunense* (Mendoza Franco, Roche & Torchin, 2008) **n. comb.** (syn. *D. gatunense* Mendoza Franco, Roche & Torchin, 2008) from *Eugerres brasiliensis* (Cuvier); *N. mexicanum* (Mendoza Franco, Roche & Torchin, 2008) **n. comb.** (syn. *D. mexicanum* Mendoza Franco, Roche & Torchin, 2008) from *Diapterus rhombeus* (Cuvier). *Neodiplectanum* is characterized for diplectanids with male copulatory organ and accessory piece non-articulated, heavily sclerotised vaginal atrium, ventral anchors with deep root twice as long as superficial root, dorsal anchors with conspicuous superficial and deep roots and squamodiscs with spinelike rodlets in the posterior rows. *Darwinoplectanum* **n. gen.** is proposed for species with male copulatory organ articulated to the accessory piece, vaginal opening sinistral, marginal or submarginal; non-sclerotised vagina atrium; and egg ovate with short filament. Here, we described three new species of *Darwinoplectanum* **n. gen.** from the gills of gerreid hosts from the Eastern and/or Western Atlantic: *Darwinoplectanum figueiredoi* **n. gen. n. sp.** [type species] from *Eucinostomus argenteus* Baird & Girard; *D. amphiatlanticus* **n. gen. n. sp.** from *Eucinostomus melanopterus* (Bleeker) [Type host] from Africa, and *E. argenteus* from Brazil; and *D. pilittae* **n. gen. n. sp.** from *G. cireneus*.

**Key words:** Monogenoidea, Diplectanidae, Diplectaninae, *Neodiplectanum*, *Darwinoplectanum* **n. gen.**, Gerreidae, taxonomy

### Introduction

Gerreids are primary marine fishes occurring most in warm seas (Nelson 2006) and are known to host five species of diplectanids (Domingues & Boeger 2008; Mendoza Franco *et al.* 2008). *Neodiplectanum* Mizelle & Blatz, 1941 was the first diplectanid genus reported from gerreid host. This genus was proposed by Mizelle & Blatz (1941) to accommodate their new species, *N. weningeri* Mizelle & Blatz, 1941 from the gills of *Eucinostomus gula* (Quoy & Gaimard) from Everglade Canal, north of Everglade City, Florida, USA. Skinner (1982) reported *N. weningeri* from *Gerres cinereus* (Walbaum) from south Biscayne Bay, Florida, USA. Oliver (1987) considered *Neodiplectanum* a junior synonym of *Diplectanum* Diesing, 1858, based on the morphology of squamodiscs. Bunkley-Williams & Williams (1994) reported *Diplectanum collinsi* (Mueller, 1936) from *Diapterus plumieri* (= *Eugerres plumieri* (Cuvier)) and *Gerres cireneus* (Walbaum) collected in Puerto Rico. Fuentes Zambrano (1997) described *Diplectanum magnodiscatum* Fuentes Zambrano, 1997 from the gills of *Eugerres plumieri* collected in the La Laguna de la Restinga, Venezuela. López-Jiménez *et al.* (2001 *apud* Kohn *et al.*, 2006, p. 43) as well as Aguirre-Macedo *et al.* (2007) accepted *Neodiplectanum* as a valid genus. López-Jiménez *et al.* (2001) indicated *Eugerres*

*mexicanum* (Steindachner) from Tabasco, Mexico as a new host for an unidentified species of *Neodiplectanum*. Aguirre-Macedo *et al.* (2007) reported *Neodiplectanum wenningeri* from *E. plumieri* from Chetumal Bay, Mexico. Mendoza Franco *et al.* (2008) described *Diplectanum gatunense* Mendoza Franco, Roche & Torchin, 2008 from *Eugerres brasiliensis* (Cuvier) from Gatun Lake, Panama Canal Watershed, Panama, and *D. mexicanum* from *Diapterus rhombeus* (Cuvier) collected at the coast of Campeche State, Mexico.

Although, diplectanids from gerreid hosts were originally placed or transferred to *Diplectanum*, in the present paper, we were able to detect some features that allowed us to resurrect *Neodiplectanum* with the transfer of *Diplectanum magnodiscatum*, *D. gatunense* and *D. mexicanum* to *Neodiplectanum* and to propose a new genus, here described as *Darwinoplectanum* **n. gen.**, with the description of three new species.

## Material and methods

Hosts were collected with gill nets in southeastern Brazil and in Senegal (West Africa), in the following localities: Guaratuba Bay, Municipality of Guaratuba, Paraná, Brazil (25°52'19''S, 48°39'02''W) on November 2000; Municipality of Porto Belo, State of Santa Catarina, Brazil (27°09'25.12''S, 48°33'16.75''W) on January 2001; Municipality of Pontal do Paraná, State of Paraná, Brazil (25°35'28.27''S, 48°21'10.70''W) on July 2001; Bamboung, Sine Saloum, Senegal (13°49'30.5''N, 16°31'44''W) on May 2006. Gill arches were removed and placed in vials containing formalin 1:4000. After one hour, each vial was vigorously shaken and formalin was added to obtain a 5% final solution. In the laboratory, the contents of each vial were examined under a dissecting microscope. Some specimens were stained with Gomori's trichrome or mounted in Hoyer's mounting medium or Gray & Wess (Humason 1979). The measurements, all in micrometers, follow the procedures of Mizelle & Klucka (1953). Dimensions of organs and other structures represent the greatest measurement in dorsoventral view; lengths of curved or bent structures (anchors, bars, accessory piece) represent the straight line distances between extreme ends (fig. 1). The average measurement is followed by the ranges and the number (n) of specimens measured in parentheses. Numbering of hook pairs follows the recommendation for ancyrocephalines by Mizelle (1936), since diplectanids share the same distribution pattern. Illustrations were prepared using a camera lucida attached to a phase-contrast or differential interference contrast microscope Olympus BX-51. Type-specimens and vouchers are deposited in the parasite collections of Museu Paraense Emílio Goeldi (MPEG), Belém, State of Pará, Brazil; Instituto de Pesquisas da Amazônia (INPA), Manaus, State of Amazonas, Brazil; Coleção Helminológica do Instituto Oswaldo Cruz, Rio de Janeiro, State of Rio de Janeiro, Brazil (CHIOC); and U.S. National Parasitological Collection (USNPC), Beltsville, Maryland, USA, as indicated in the respective descriptions. The following museum specimens were examined: four cotypes, *Neodiplectanum wenningeri* Mizelle & Blatz, 1941 (USNPC 36823); one voucher, *N. wenningeri* (National Helminthological Collection of Mexico, Universidad Nacional Autónoma de México, México, CNHE 5713); 12 vouchers, *Diplectanum collinsi* (USNPC 83400, 84665-67); Five paratypes, *D. gatunense* Mendoza Franco, Roche & Torchin, 2008 (USNPC 100847); holotype, *D. magnodiscatum* Fuentes Zambrano, 1997 (Museo Oceanológico Hermano Benigno Román de la Estación de Investigaciones Marinas de Margarita, Fundación La Salle de Ciencias Naturales, Venezuela, MOBR-EDIMAR i-596); three paratypes, *D. mexicanum* (USNPC 100848). Historical review of species containing relevant taxonomic contributions, such as description (descr), redescription (redes), synonymization (synon), new record (recor), citation (citat), figure (fig) are included after valid species name.

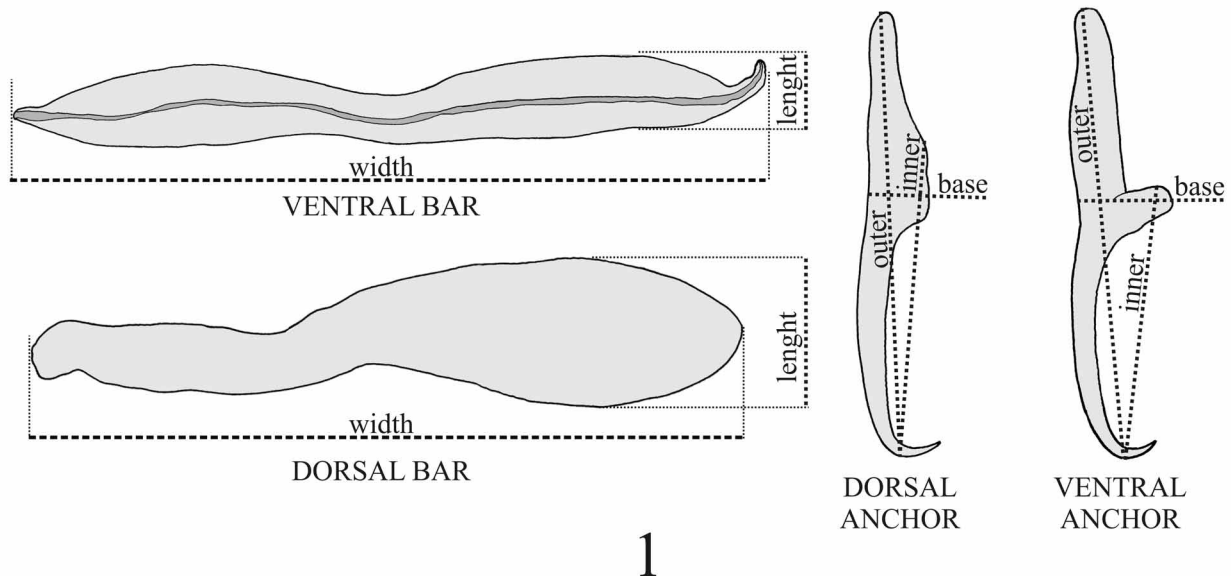
## Results

### Subclass Polyonchoinea Bychowsky, 1937

### Order Dactylogyridea Bychowsky, 1937

### Diplectanidae Monticelli, 1903

### Diplectaninae Monticelli, 1903



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FIGURE 1. Measurement protocol for some haptoral structures.

### *Neodiplectanum* Mizelle & Blatz, 1941

**Type species.** *Neodiplectanum wenningeri* Mizelle & Blatz, 1941 from *Eucinostomus gula* (Quoy & Gaimard) [Type host] and *Gerres cironeus* (Walbaum).

**Other species.** *Neodiplectanum magnodiscatum* (Fuentes Zambrano, 1997) **n. comb.** from *Eugerres plumieri* (Cuvier); *Neodiplectanum gatunense* (Mendoza Franco, Roche & Torchin, 2008) **n. comb.** from *E. brasiliensis* (Cuvier); *N. mexicanum* (Mendoza Franco, Roche & Torchin, 2008) **n. comb.** from *Diapterus rhombeus* (Cuvier); *Neodiplectanum* sp. from *E. mexicanum* (Steindachner).

**Amended diagnosis.** Body fusiform, comprising cephalic region, trunk, peduncle, haptor. Tegument smooth or scaled. Cephalic lobes poorly developed; head organs present; cephalic glands unicellular, lateral or posterolateral to pharynx. Eyes present (2 pairs). Mouth subterminal, midventral. Pharynx muscular, glandular. Intestinal caeca 2, non-confluent posteriorly, lacking diverticula. Genital pore opening midventral, posterior to copulatory complex. Genital atrium muscular. One testis, postgermian. Copulatory complex comprising male copulatory organ, accessory piece; male copulatory organ sclerotised, tubular, nested tubes present; accessory piece sclerotised, non-articulated with male copulatory organ. Vas deferens, seminal vesicle not observed. Prostatic reservoir simple or separated into three zones. Germarium saccate, looping right intestinal caecum, dorsoventrally. Vagina sinistral, vaginal atrium heavily sclerotised. Seminal receptacle saccate. Egg not observed. Accessory adhesive organ, squamodiscs, present (two), ventral, dorsal; anterior and medial rows with rodlet dumbbell-shaped, posterior rows with spinelike rodlets; anterior rows of rodlets with open rings. Haptor with 3 (1 midventral, 2 laterodorsal) haptoral bars; 14 hooks, similar (8 marginal, 2 central, 4 dorsal); 2 pairs of anchors (1 ventral, 1 dorsal). Ventral bar with longitudinal groove. Superficial root of ventral anchor well define; deep root, twice as long than superficial root. Dorsal anchor with conspicuous superficial and deep roots. Parasites of Gerreidae (Perciformes).

**Remarks.** Features distinguishing *Neodiplectanum* from the other species of Diplectaninae includes presence of male copulatory organ and accessory piece non-articulated, heavily sclerotised vaginal atrium, squamodiscs with spinelike rodlets, and dorsal anchors with conspicuous superficial and deep roots. One other diplectanine genus, *Paradiplectanum* Domingues & Boeger, 2008, is characterized by sharing the first three characters with member of *Neodiplectanum*. However, in species of *Paradiplectanum*, the superficial and deep roots of dorsal anchors are inconspicuous (Domingues & Boeger 2008).

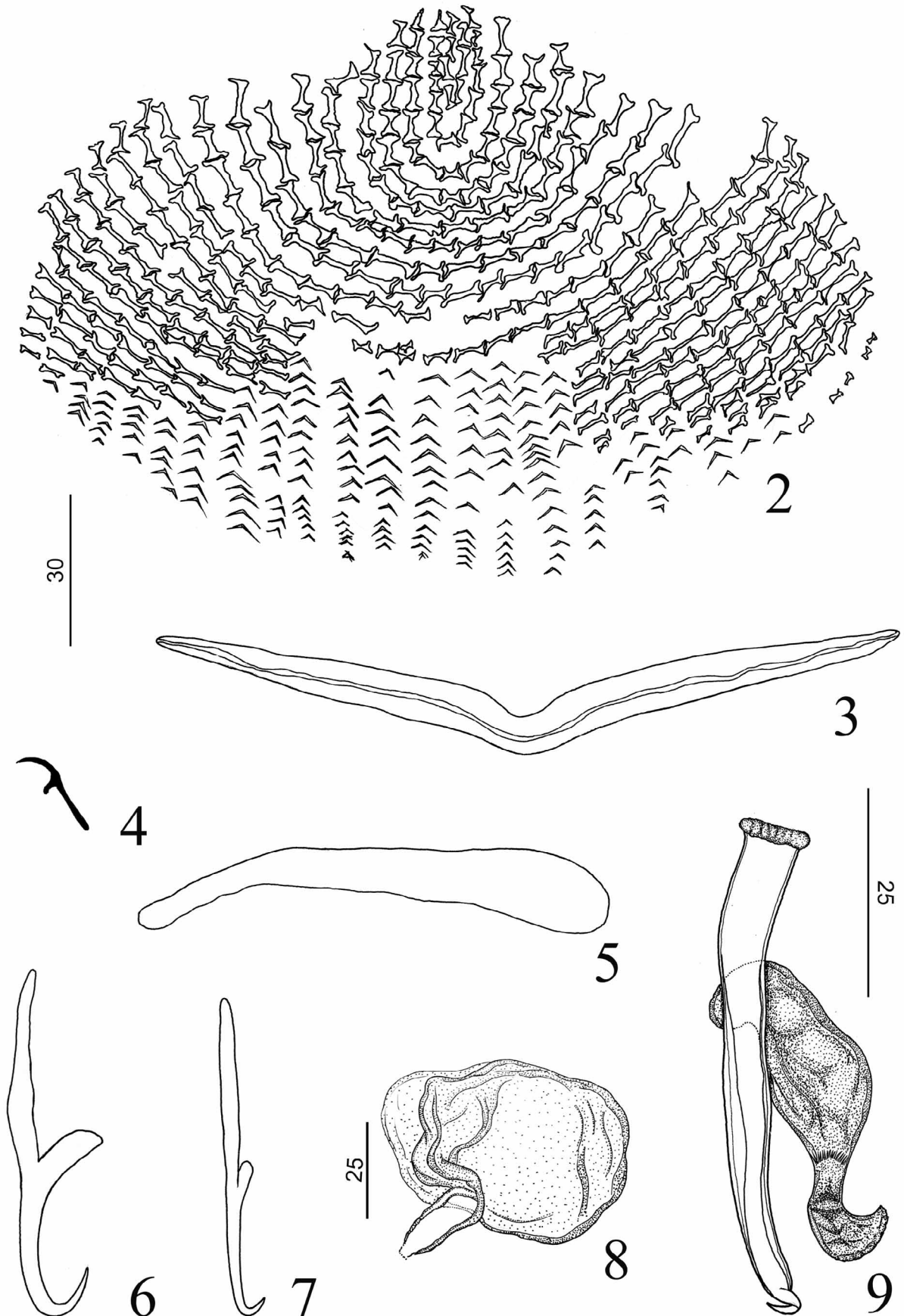
***Neodiplectanum wenningeri* Mizelle & Blatz, 1941**

(Figs. 2–9)

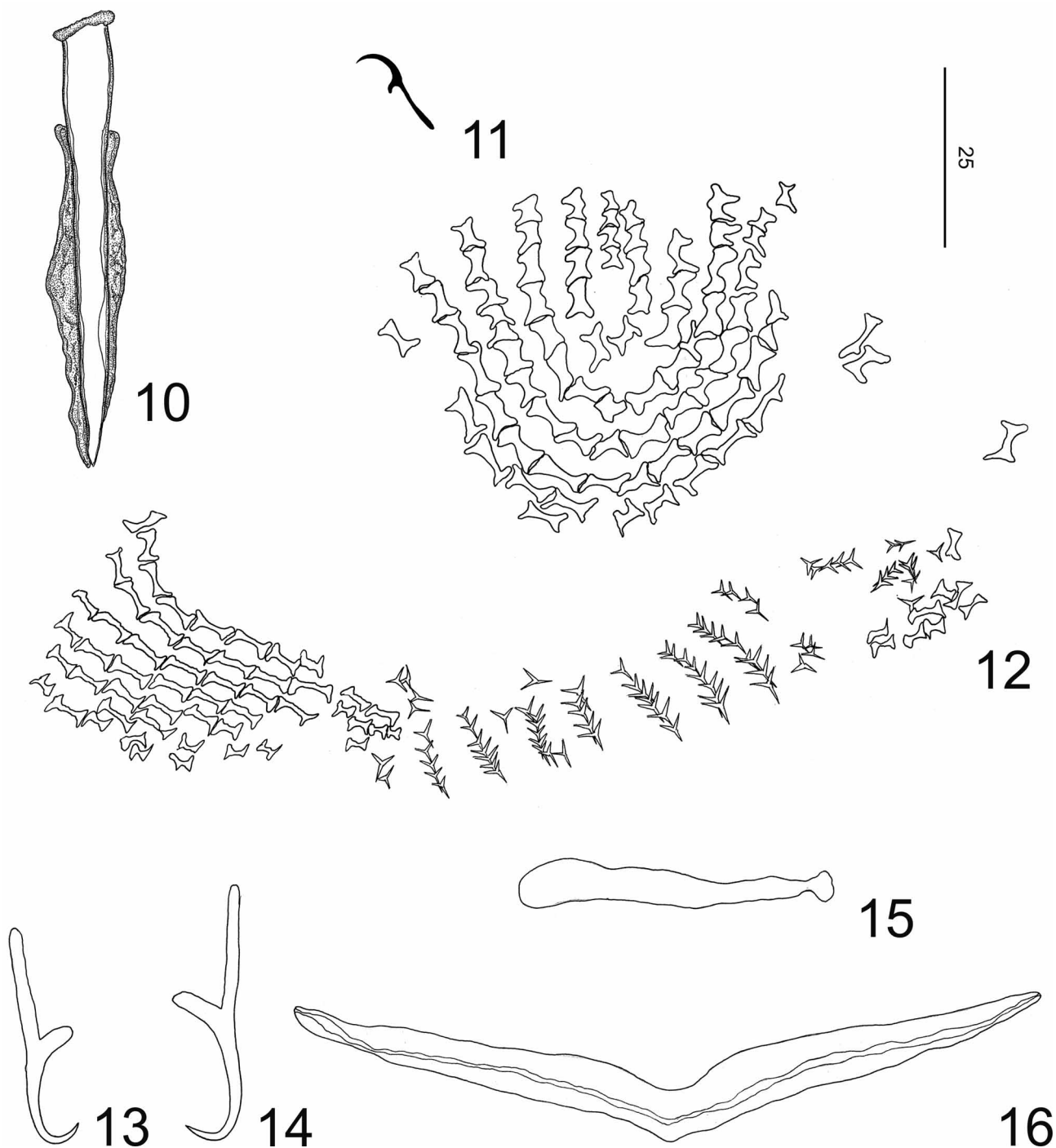
Syn. *Diplectanum wenningeri* Oliver (1987)*Neodiplectanum wenningeri*: Mizelle and Blatz (1941): 107–108, figs. 11–21 (descr); Yamaguti (1963): 102, pl. 25, fig. 199 (citat); Skinner (1982): 275 (recor); Aguirre-Macedo *et al.* (2007): 21–22, 24, 29 (recor).*Diplectanum wenningeri*: Oliver (1987): 82, figs. 21 (synon); Mendoza Franco *et al.* (2008): 171–174, 176, fig. 5 (recor, redes).**Type host.** *Eucinostomus gula* (Quoy & Gaimard).**Site.** Gills.**Type locality.** Everglades canal, north of Everglades City, Florida, USA (Mizelle & Blatz 1941).**Other record.** *Gerres cireneus* (Walbaum) from South Biscayne Bay, Florida, USA (Skinner 1982).**Material examined.** Four cotypes, USNPC 36823; voucher, CNHE 5713.**Remarks.** Originally indicated by monotypy, *N. wenningeri* is the type species of the genus. *Neodiplectanum wenningeri* can be distinguished from the other three congeneric species by having a laterally expanded distal end of the accessory piece without ornamentation (accessory piece tapered distal end in *N. magnodiscatum* (Fuentes Zambrano, 1997) **n. comb.**; accessory piece pyriform tip possessing delicate indentations on margins in *N. gatunense* (Mendoza Franco, Roche & Torchin, 2008) **n. comb.**; accessory piece distally bifurcate and hook-shaped accessory piece in *N. mexicanum* (Mendoza Franco, Roche & Torchin, 2008) **n. comb.**); and the greater total length of the anchors and bars (see table 1).***Neodiplectanum magnodiscatum* (Fuentes Zambrano, 1997) n. comb.**

(Fig. 10–16)

Syn. *Diplectanum magnodiscatum* Fuentes Zambrano, 1997*Diplectanum magnodiscatum*: Fuentes Zambrano (1997): 227–231, fig. 2 (descr) (the legends for the figures of *Diplectanum magnodiscatum* in Zambrano's description are inverted with the legends of the figures of *Rhamnocercus margaritae* Fuentes Zambrano, 1997, described in the same publication).**Type host.** *Eugerres plumieri* (Cuvier).**Site.** Gills.**Type locality.** La Redonda, Laguna de La Restinga (10°57'00" – 11°03'00" N, 64°01'00" – 64°12'00" W), Venezuela (Fuentes Zambrano 1997).**Other record.** *E. plumieri* from Loíza River, San Juan, Puerto Rico; Bucaná River, Ponce, Puerto Rico (Bunkley-Williams & Williams 1994); and Chetumal Bay (18°21'00" – 18°52'00" N, 87°54'00" – 88°23'00" W), Mexico (Aguirre-Macedo *et al.* 2007).**Material examined.** Holotype, MOBR-I-596; vouchers USNPC No 84665 – 84666, CNHE 5713 (G5.16C).**Remarks.** Fuentes Zambrano (1997) proposed *D. magnodiscatum* Fuentes Zambrano, 1997 based on the morphology of the squamodiscs, haptor bars, copulatory complex and sclerotised vagina. The holotype specimen studied, originally stained with Semichon's acetocarmine, is overstained (probably the material oxidised over the time). As a result, it was not possible to measure and determinate many of the diagnostic features of internal anatomy or some sclerotised parts of the haptor. Nonetheless, we detected misinterpretations in the morphological description of the copulatory complex. The drawings of Fuentes Zambrano (1997) shows an inverted "Y" copulatory complex interpreted as an articulated male copulatory organ and accessory piece (fig. 2A, B, F). However, the type specimen and voucher specimens examined clearly showed a non-articulated copulatory complex.This species is supported as a member of *Neodiplectanum* by the presence of a male copulatory organ non-articulating with the accessory piece, a heavily sclerotised vaginal atrium, spine-like rodlets in the posterior rows of the squamodiscs and dorsal anchors with conspicuous superficial and deep roots. Therefore, we propose *Neodiplectanum magnodiscatum* **n. comb.** It differs from its congeners by the possession of an accessory piece with tapered distal end, dorsal bar with a constriction at the end, and spine-like rodlets in the posterior rows with three axes (Fig. 12).



**FIGURES 2-9.** *Neodiplectanum weningeri* Mizelle & Blatz, 1941. 2. Squamodisc. 3. Ventral bar. 4. Hook. 5. Dorsal bar. 6. Ventral anchor. 7. Dorsal anchor. 8. Vagina. 9. Copulatory complex. Figs. 2-3 scale of 30  $\mu$ m; Figs. 4-9 scale of 25  $\mu$ m.



**FIGURES 10–16.** *Neodiplectanum magnodiscatum* (Fuentes Zambrano, 1997) **n. comb.** **10.** Copulatory complex. **11.** Hook. **12.** Squamodisc. **13.** Dorsal anchor. **14.** Ventral anchor. **15.** Dorsal bar. **16.** Ventral bar. Figs. 10–16 scale of 25  $\mu\text{m}$ .

Specimens identified as *Diplectanum collinsi* by Bunkley-Williams & Williams (1994) from *E. plumieri* from Puerto Rico, and *Neodiplectanum wenningeri* collected by Aguirre-Macedo *et al.* (2007) from *E. plumieri* from Caribbean Sea (Chetumal Bay, Mexico) were examined. These specimens are considered conspecific with *N. magnodiscatum* **n. comb.** by the presence of the accessory piece with tapered distal end, spine-like rodlets in the posterior rows of the squamodiscs with three axes, and because all share the same host species.

TABLE 1. Comparative measurements (in  $\mu\text{m}$ ) of species of *Neodiplectanum* Mizelle & Blatz, 1941. MCO = male copulatory organ.

	<sup>1</sup> <i>N. wenningeri</i> <i>E. gutta</i>	<sup>2</sup> <i>N. magnodiscatum</i> <i>E. plumieri</i>	<sup>3</sup> <i>N. magnodiscatum</i> <i>E. plumieri</i>	<sup>4</sup> <i>N. gatunense</i> <i>E. brasiliensis</i>	<sup>5</sup> <i>N. mexicanum</i> <i>D. rhombus</i>	N
<b>Body</b>						
Length	575	1 550	1 -	500 (450-580)	10 398 (350-450)	5
Width	115 (95-125)	4 110	1 -	102 (85-125)	10 85 (70-100)	4
<b>Haptor</b>						
Length	130 (115-150)	4 120	1 -	126 (75-176)	7 86 (55-103)	3
Width	174 (150-200)	4 200	1 -	173 (150-190)	7 107 (100-120)	3
Pharynx	33	1 33	1 -	40 (35-50)	10 30 (28-33)	2
MCO	70 (63-75)	3 62 (58-64)	3 65	1 72 (69-75)	10 41 (35-47)	2
Accessory piece	36 (33-40)	3 47	1 50	1 49 (40-60)	10 34 (31-36)	3
<b>Squamodisc</b>						
Length	142 (113-183)	4 75	1 -	111 (100-136)	7 85	2
Width	161 (150-172)	4 150	1 -	144 (112-168)	7 78 (75-83)	2
Rows	22 (20-26)	4 20	1 -	24 (22-25)	3 20 (18-21)	3
<b>Ventral Anchor</b>						
Outer	43	2 38 (37-40)	3 39	1 36 (35-36)	2 30 (27-33)	7
Inner	20	2 21 (20-22)	3 22	1 21 (20-22)	3 18 (15-20)	7
Base	10	2 8	3 10	1 -	6	1
<b>Dorsal Anchor</b>						
Outer	39 (37-40)	2 32 (31-33)	3 34	1 32 (30-36)	5 32 (30-38)	7
Inner	20	2 18 (16-20)	3 20	19 (16-22)	3 19 (13-28)	6
Base	-	- 7 (7-8)	3 8	6	1 6	1
<b>Ventral Bar</b>						
Length	8 (7-10)	4 8 (8-9)	3 7	6 (5-8)	6 6 (5-6)	4
Width	144 (135-151)	4 117 (112-120)	2 110	124 (120-135)	7 81 (75-90)	4
<b>Dorsal Bar</b>						
Length	10	2 9 (7-10)	2 8	9 (9-10)	3 -	-
Width	66 (63-69)	2 51 (47-55)	2 54	56 (51-60)	3 36	1
Hook	11 (10-12)	9 15 (14-15)	15 14 (13-15)	7 -	12 (11-13)	6
Germarium	-	-	-	74 (60-80)	4 -	-
Testis	-	-	-	37 (35-40)	3 -	-

<sup>1</sup>USNPC 36823 (cotypes); <sup>2</sup>USNPC 84665-66 (vouchers); <sup>3</sup>CNHE 5713 (vouchers); <sup>4</sup>USNPC 100847 (paratypes); <sup>5</sup>USNPC 100848 (paratypes)

***Neodiplectanum gatunense* (Mendoza Franco, Roche & Torchin, 2008) n. comb.**

Syn. *Diplectanum gatunense* Mendoza Franco, Roche & Torchin, 2008

*Diplectanum gatunense*: Mendoza Franco *et al.* (2008): 172–174, figs. 1–4, 6–9 (descr).

**Type host.** *Eugerres brasiliensis* (Cuvier).

**Site.** Gills.

**Type locality.** Gatun Lake, Panama Canal Watershed (9°10'2.68"N, 79°50'13.90"W), Panama (Mendoza Franco *et al.* 2008).

**Material examined.** 11 Paratypes USNPC No 100847

**Remarks.** This species, originally placed in *Diplectanum* by Mendoza Franco *et al.* (2008), is transferred to *Neodiplectanum* as *N. gatunense* **n. comb.**. This species resembles *N. magnodiscatum* by sharing spine-like rodlets in the posterior rows of the squamodiscs with three axes, and a dorsal bar with constriction at the end. However, *N. gatunense* can be distinguished from this species by having indentations on the distal margins of the accessory piece, which is tapered in *N. magnodiscatum*; and morphometric features (table 1).

***Neodiplectanum mexicanum* (Mendoza Franco, Roche & Torchin, 2008) n. comb.**

Syn. *Diplectanum mexicanum* Mendoza Franco, Roche & Torchin, 2008

*Diplectanum mexicanum*: Mendoza Franco *et al.* (2008): 174, figs. 10–17 (descr).

**Type host.** *Diapterus rhombeus* (Cuvier).

**Site.** Gills.

**Type locality.** Coast of Campeche State, Mexico (18°48'45"N, 92°03'45"W) in the Gulf of Mexico, Mexico (Mendoza Franco *et al.* 2008).

**Other record.** *D. rhombeus* from Guaratuba Bay, Municipality of Guaratuba, Paraná, Brazil (25°52'19"S, 48°39'02"W) on 25 November 2000.

**Material examined.** 7 Paratypes USNPC No 100848; 9 vouchers, CHIOC 37544a–c, INPA 594a–c, MPEG 000020–000022.

**Remarks.** *Diplectanum mexicanum* Mendoza Franco, Roche & Torchin, 2008 is transferred to *Neodiplectanum* as *N. mexicanum* (Mendoza Franco, Roche & Torchin, 2008) **n. comb.** because it shows all diagnostic features so far proposed for *Neodiplectanum*. This species can be distinguished from the other species by possessing a copulatory complex with an elongate accessory piece with bifurcate tip, distally hook-shaped; and dorsal anchors with perpendicular superficial and deep roots.

***Darwinoplectanum* n. gen.**

**Type species.** *Darwinoplectanum figueiredoi* **n. gen. n. sp.** from *Eucinostomus argenteus* Baird & Girard.

**Site.** Gills.

**Type locality.** Municipality of Pontal do Paraná, State of Paraná, Brazil (25°35'28.27"S, 48°21'10.70"W) in July 2001.

**Other species and localities.** *Darwinoplectanum amphiatlanticus* **n. gen. n. sp.** from *Eucinostomus melanopterus* (Bleeker), Bamboung, Sine Saloum, Senegal (13°49'30.5"N, 16°31'44"W) collected in May 2006, *E. argenteus* from Municipality of Porto Belo, State of Santa Catarina, Brazil (27°09'25.12"S, 48°33'16.75"W) collected in January 2001, *E. argenteus* from Municipality of Pontal do Paraná, State of Paraná, Brazil (25°35'28.27"S, 48°21'10.70"W) collected in July 2001; and *Darwinoplectanum pilittae* **n. gen. n. sp.** from *Gerres cireneus* from Punta Santiago near Humacao, Puerto Rico collected in February 1992.

**Etymology.** The genus is named after Sir Charles Robert Darwin, in celebration of his 200<sup>th</sup> anniversary in 2009.

**Diagnosis.** Body fusiform, comprising cephalic region, trunk, peduncle, haptor. Tegument scaled or smooth. Cephalic lobes poorly developed; head organs present; cephalic glands unicellular, lateral or posterolateral to phar-



ynx. Eyes present (2 pairs). Mouth subterminal, midventral. Pharynx muscular, glandular. Intestinal caeca 2, non-confluent posteriorly, lacking diverticula. Genital pore opening midventral, anterior or posterior to copulatory complex. Genital atrium muscular. One testis, postgermarian. Copulatory complex comprising male copulatory organ, accessory piece; male copulatory organ sclerotised, tubular, simple; accessory piece sclerotised, articulated with the male copulatory organ base. Vas deferens, seminal receptacle not observed. Prostatic reservoir not observed. Germarium saccate, looping right intestinal caecum, dorsoventrally. Vagina sinistral, marginal or submarginal; vaginal atrium muscular. Seminal receptacle saccate. Egg ovate with short filament. Accessory adhesive organ, squamodiscs, present (two), ventral, dorsal; rows with rodlet dumbbell-shaped; anterior rows of rodlets with open rings. Haptor with 3 (1 midventral, 2 laterodorsal) haptoral bars; 14 hooks, similar (8 marginal, 2 central, 4 dorsal); 2 pairs of anchors (1 ventral, 1 dorsal). Ventral bar with longitudinal groove. Superficial, deep roots of ventral anchor well define. Dorsal anchor with inconspicuous superficial root. Parasites of Gerreidae (Perciformes).

**Remarks.** The new genus is defined by possessing: (1) male copulatory organ tubular, simple; (2) accessory piece, articulated with the base of the male copulatory organ; (3) vagina non-sclerotised, sinistral, marginal or submarginal; and (4) egg ovate with short filament.

***Darwinoplectanum figueiredoi* n. sp.**

(Figs. 17–25)

**Type host.** *Eucinostomus argenteus* Baird & Girard.

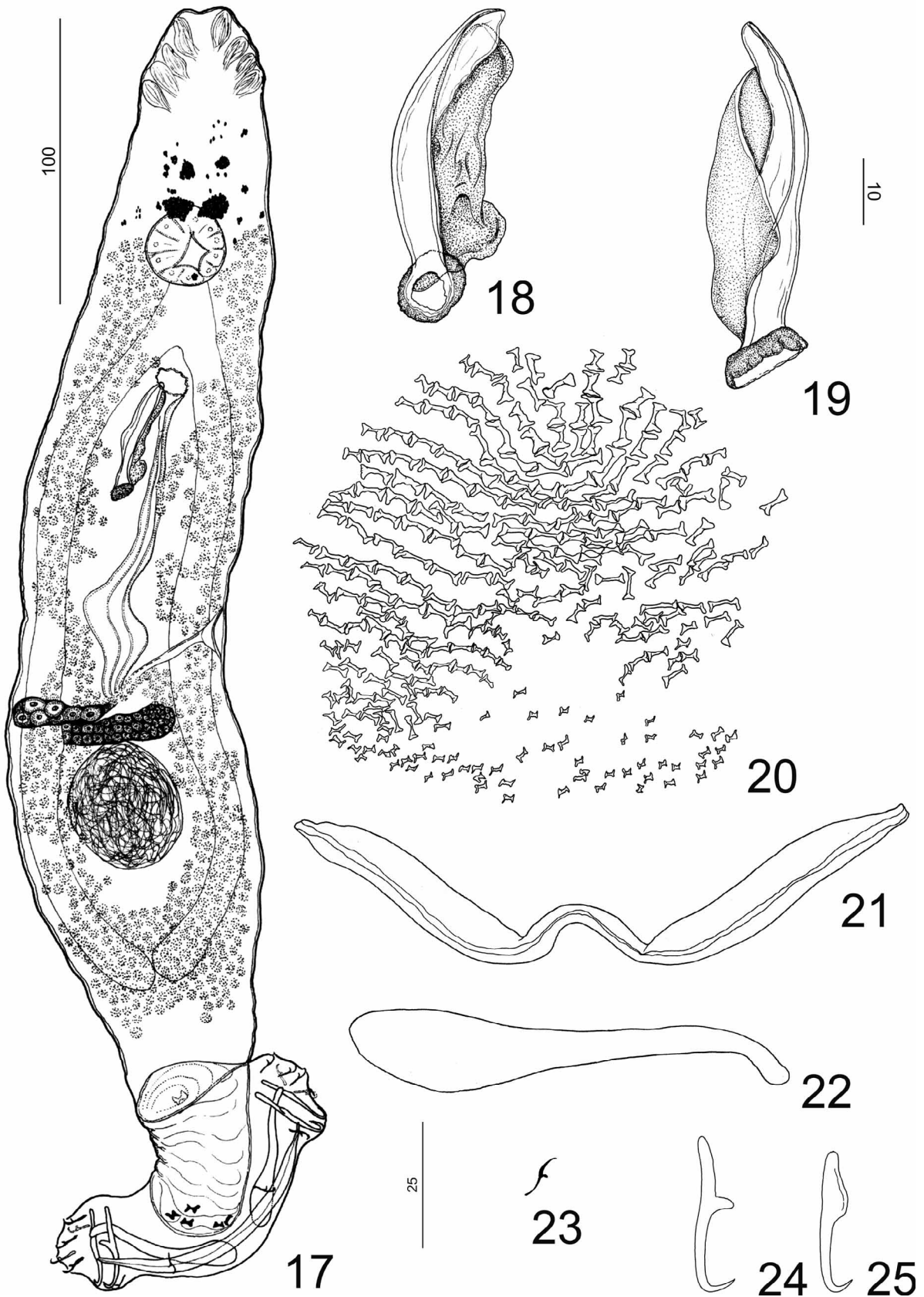
**Site.** Gills.

**Type locality.** Municipality of Pontal do Paraná, State of Paraná, Brazil (25°35'28.27''S, 48°21'10.70''W) on 16 July 2001.

**Specimens studied.** Holotype, CHIOC 37545a; 14 paratypes, CHIOC 37545b–f, INPA 593a–c, MPEG 000016–000019, USNPC 104825.

**Etymology.** This species is named for Dr. José Lima de Figueiredo, Museu de Zoologia da Universidade de São Paulo (MZUSP), São Paulo, São Paulo, Brazil in recognition of his research on taxonomy and systematic of marine fishes from Brazil.

**Description** (based on 12 adult specimens): Body slender, fusiform, total length excluding haptor 386 (350–450; n = 7) long, 73 (60–80; n = 7) wide at the level of germarium. Tegument smooth or scaled; scales plate-like with round anterior margins, lightly sclerotised, directed anteriorly, not easily observed in preserved specimens. Cephalic margin tapered; poorly developed terminal lobes; three bilateral pairs of head organs with rod-shaped secretion; cephalic glands not observed. Eyes 4, equidistant; posterior pair larger than anterior pair; eye granules ovate, elongate, numerous accessory granules at cephalic region (Fig. 17). Pharynx ovate to subspherical, 34 (28–38; n = 6) in diameter; oesophagus short; intestinal caeca, broadly curved. Genital pore opening anterior to copulatory complex. Male copulatory organ slightly straight or arcuate originating from ring-like sclerotised base, marginal flap originating mid-length, 53 (50–55; n = 7) long (figs. 18–19). Accessory piece comprising variable sheath involving male copulatory organ, articulation process attached to base of male copulatory organ; expanded distal portion, 40 (39–42; n = 7) (figs. 18–19). Testis spherical to subspherical. Germarium tubular, elongate, unbranched, distal end transversal or diagonal to body, 40 long; oötype, Mehlis' glands not observed; vaginal aperture marginal; vaginal atrium funnel-shape, slightly muscular, narrowing to short descendent tube; seminal receptacle not observed. Vitellarium extending throughout trunk, absent in regions of major reproductive organs. Egg not observed. Peduncle short to elongate. Haptor bilaterally lobed, 49 (38–68; n = 6) long, 130 (93–163; n = 6) wide (Fig. 17). Squamodiscs similar, subcircular to subtrapezoidal, 18 (n = 4) concentric rows of dumbbell-shaped rodlets becoming progressively more delicate in posterior row, difficult to observe in preserved specimens, 64 (63–68; n = 5) long, 73 (68–75; n = 4) wide. Ventral anchor with elongate roots (deep root longest), straight shaft and recurved point; point reaching level of tip of superficial root, outer 31 (28–32; n = 6) long, inner 18 (16–20; n = 6), base 8 (7–8; n = 6). Dorsal anchor with elongate deep root, inconspicuous superficial root, straight shaft and recurved short point, outer 28 (24–30; n = 6), inner 17 (14–18; n = 6), base 5 (4–6; n = 6). Ventral bar, elongate, with delicate tapered ends, 12 (10–14; n = 5) long, 128 (123–134; n = 5) wide. Paired dorsal bar, spatulate, 14 (13–15; n = 5) long, 76 (70–80; n = 4) long. Hooks similar with protruding thumb with slightly depressed tip, delicate slightly curved point, slender shank, 10 (9–10; n = 22) long; hook pairs 1–5, ventral, hook pairs 6–7, dorsal; hook pair 1



**FIGURES 17–25.** *Darwiniopectanum figueiredoi* n. gen. n. sp. 17. Holotype whole-mount (ventral). 18–19. Copulatory complex. 20. Squamodisc. 21. Ventral bar (bent at mid-length). 22. Sinistral dorsal bar. 23. Hook. 24. Ventral anchor. 25. Dorsal anchor. Fig. 17 scale of 100  $\mu\text{m}$ ; Figs. 18–19 scale of 10  $\mu\text{m}$ ; Figs. 20–25 scale of 25  $\mu\text{m}$ .

nearly to ventral bar end; hook pair 5 at level of distal ventral anchor shaft, others sub-marginal in lateral haptoral lobes; filamentous hook loop not observed.

**Remarks.** *Darwinoplectanum figueiredoi* **n. gen. n. sp.** is the type species of the genus. It can be distinguished from its congeners by the position of the genital pore (i.e., anterior the copulatory complex) and the morphology of the copulatory complex. Also, the male copulatory complex of *D. figueiredoi* is larger than that of its congeners (male copulatory organ: 53 vs. 23 in *D. pillitae* **n. gen. n. sp.**, and 28 in *D. amphiatlanticus* **n. gen. n. sp.**; accessory piece: 40 vs. 20 in *D. pillitae* **n. gen. n. sp.**, and 26 in *D. amphiatlanticus* **n. gen. n. sp.**).

***Darwinoplectanum amphiatlanticus* n. sp.**

(figs. 26–35)

**Type host.** *Eucinostomus melanopterus* (Bleeker).

**Site.** Gills.

**Type locality.** Bamboung, Sine Saloum, Senegal (13°49'30.5"N, 16°31'44"W) on May 2006.

**Other records.** *E. melanopterus* from Bamboung, Sine Saloum, Senegal (13°49'30.5"N, 16°31'44"W) collected in May 2006; *E. argenteus* from Municipality of Porto Belo, State of Santa Catarina, Brazil (27°09'25.12"S, 48°33'16.75"W) collected in January 2001; *E. argenteus* from Municipality of Pontal do Paraná, State of Paraná, Brazil (25°35'28.27"S, 48°21'10.70"W) collected in July 2001.

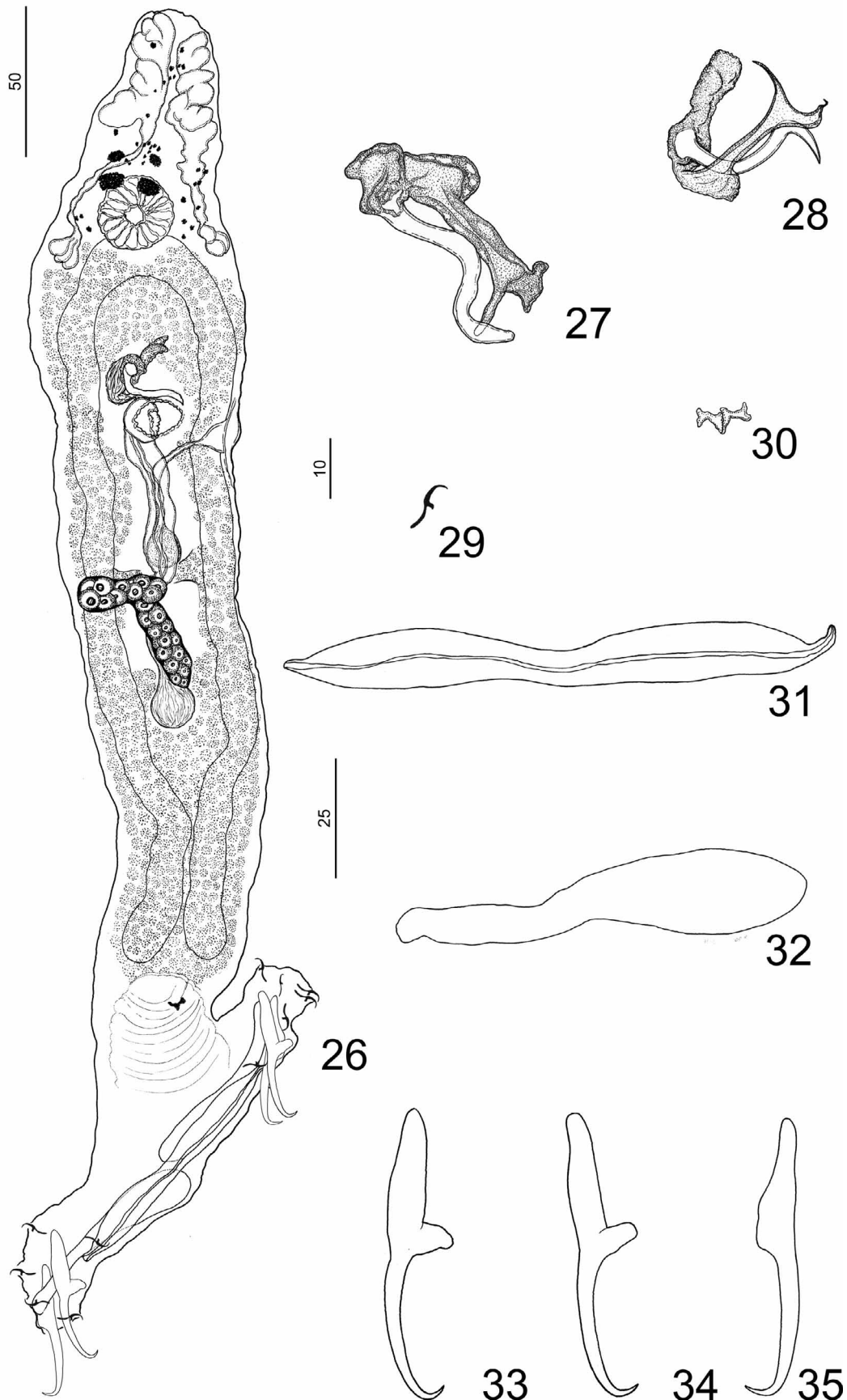
**Specimens deposited.** Holotype, CHIOC 37546a; 7 paratypes, CHIOC 37546b–d, INPA 588, MPEG 000007–000008. USNPC 104826; 17 vouchers, CHIOC 37547–37550, INPA 589–592, MPEG 000009–000015, USNPC 104827–104828.

**Etymology.** The specific name is derived from Greek (*amphis* = on both sides + *atlantikon* = the Atlantic [Ocean]) and refers to the occurrence of the species on the southeastern and southwestern Atlantic Ocean.

**Comparative measurements.** Table 2.

**Description** (based on 26 adult specimens): Body fusiform. Tegument smooth. Cephalic margin tapered; poorly developed terminal lobes; three bilateral pairs of head organs. Eyes 4; posterior pair closer together than those of anterior pair; eye granules ovate, elongate, numerous accessory granules at cephalic region at level of pharynx (Fig. 26). Pharynx ovate to subspherical; oesophagus short or absent; intestinal caeca, inward flexure at distal portion. Genital pore posterior to copulatory complex. Male copulatory organ sigmoid originating from ring-like sclerotised base; base with lateral flap (figs. 27–28). Accessory piece with proximal portion expanded, articulation process attached to base of male copulatory organ; distal portion with two rami, serving as a guide to male copulatory organ (figs. 27–28). Testis spherical to subspherical. Germarium elongate, unbranched, distal end parallel to body; oötype not observed; vaginal aperture marginal; vaginal atrium funnel-shape, slightly muscular, narrowing to short descendent tube; seminal receptacle saccate. Vitellarium extending throughout trunk, absent in regions of major reproductive organs. Egg ovate, short filament. Peduncle short to elongate. Haptor bilaterally lobed (Fig. 26). Squamodiscs similar, sub-circular, concentric rows of dumbbell-shaped rodlets becoming progressively more delicate in posterior row, easily lost in preserved specimens. Ventral anchor with elongate deep root, short depressed superficial root, straight shaft and re-curved point; point reaching level of tip of superficial root. Dorsal anchor with elongate deep root, inconspicuous superficial root, straight shaft and re-curved short point. Ventral bar, elongate, with delicate tapered ends. Paired dorsal bar, spatulate. Hooks similar with protruding thumb with slightly depressed tip, delicate slightly depressed point, slender shank; hook pairs 1–5, ventral, hook pairs 6–7, dorsal; hook pair 1 nearly to ventral bar end; hook pair 5 at level of distal ventral anchor shaft, others submarginal in lateral haptoral lobes; filamentous hook loop not observed.

**Remarks.** *Darwinoplectanum amphiatlanticus* **n. gen. n. sp.** differs from its congeners in possessing an accessory piece with proximal portion expanded and distal portion with two rami.



**FIGURES 26–35.** *Darwiniopectanum amphiatlanticus* n. gen. n. sp. **26.** Holotype whole-mount (ventral). **27–28.** Copulatory complex. **29.** Hook. **30.** Rodlets. **31.** Ventral bar. **32.** Dextral dorsal bar. **33–34.** Ventral anchor. **35.** Dorsal anchor. Fig. 26 scale of 50  $\mu\text{m}$ ; Figs. 27–30 scale of 10  $\mu\text{m}$ ; Figs. 31–35 scale of 25  $\mu\text{m}$ .

**TABLE 2.** Comparative measurements (in  $\mu\text{m}$ ) of specimens of *Darwinoplectanum amphiatlanticus* n. gen. n. sp. from two species of *Eucinostomus* from Africa and Brazil, respectively. MCO= male copulatory organ.

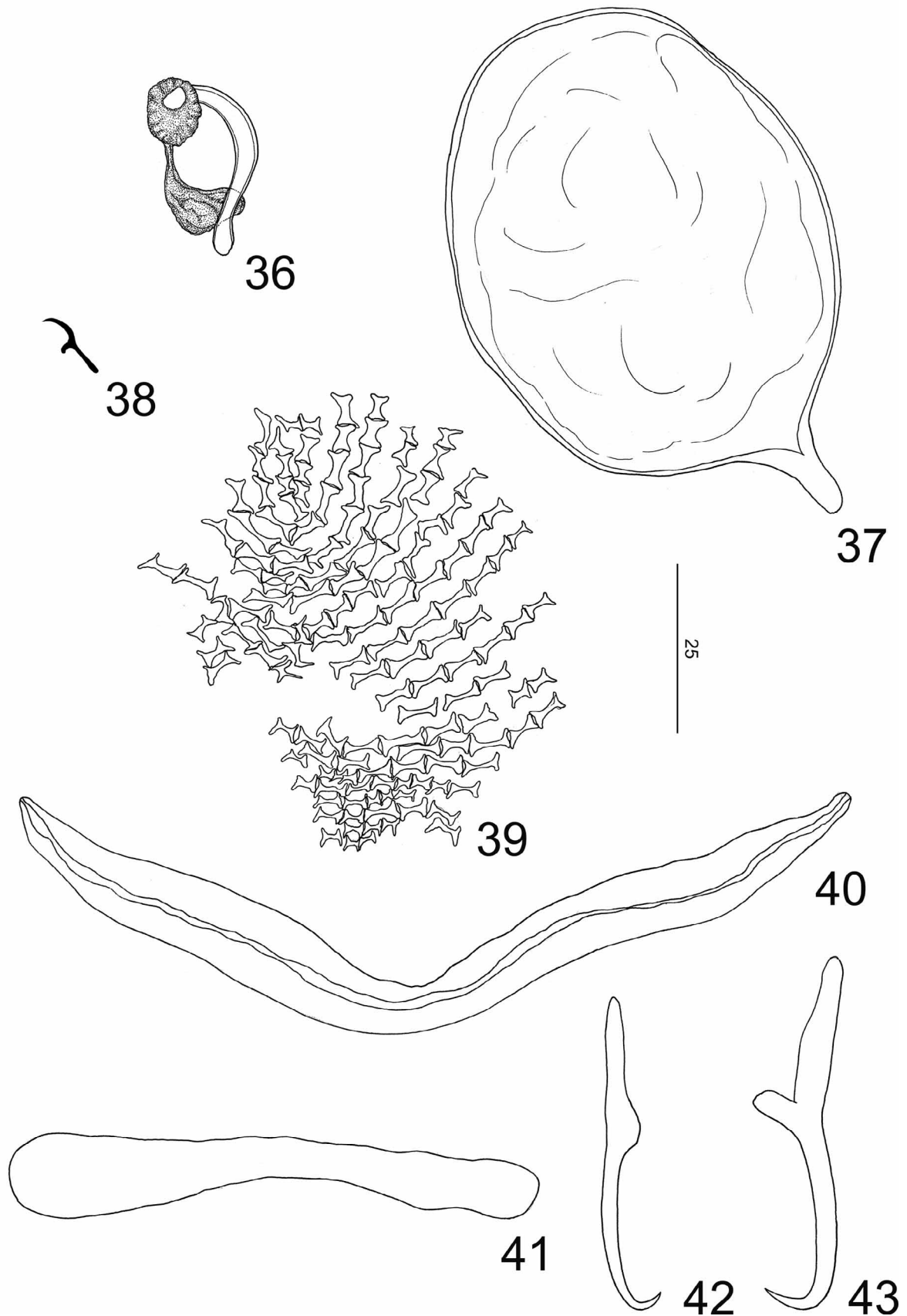
	<i>E. melanopterus</i> Africa	N	<i>E. melanopterus</i> Africa	N	<i>E. argenteus</i> Brazil	N
<b>Body</b>						
Length	362 (350–375)	3	328 (300–355)	2	327 (200–445)	5
Width	58 (55–65)	3	53 (45–60)	2	63 (30–80)	4
<b>Haptor</b>						
Length	48 (45–50)	3	56 (50–63)	3	56 (50–75)	4
Width	156 (148–160)	3	126 (115–138)	3	138 (100–175)	4
Pharynx	29 (25–35)	4	28 (25–30)	2	28 (20–35)	5
MCO	28 (22–35)	4	41	1	22 (20–25)	6
Accessory piece	26 (20–31)	2	29 (26–30)	3	22 (20–30)	5
<b>Squamodisc</b>						
Length	48 (43–50)	3	70	1	75 (63–88)	3
Width	49 (48–50)	3	65	1	73 (58–88)	3
Rows	–	–	18 (17–19)	2	19	2
<b>Ventral Anchor</b>						
Outer	48 (45–51)	6	49 (43–55)	6	41 (38–43)	5
Inner	32 (24–45)	5	29 (26–32)	6	23 (22–23)	5
Base	11 (9–13)	4	10 (9–11)	5	9 (7–10)	4
<b>Dorsal Anchor</b>						
Outer	45 (44–47)	6	46 (44–47)	6	38 (36–40)	5
Inner	25 (23–26)	6	25 (24–26)	6	21 (19–22)	5
Base	6 (6–7)	4	7 (6–7)	4	5	4
<b>Ventral Bar</b>						
Length	10 (8–12)	6	10 (8–12)	6	8 (7–9)	5
Width	109 (101–112)	5	105 (97–119)	5	74 (72–75)	4
<b>Dorsal Bar</b>						
Length	13 (11–16)	4	20 (15–27)	3	10	3
Width	79 (73–86)	4	78 (74–84)	5	56 (51–65)	4
Hook	10 (9–10)	12	9 (9–10)	9	9 (9–10)	15
Germarium	48 (47–48)	2	52 (46–55)	3	48 (41–65)	5
Testis	17 (14–20)	2	28 (25–29)	3	30 (20–40)	2
<b>Egg</b>						
Length	67	1	–	–	27	1
Width	50	1	–	–	18	1

\* Type series

***Darwinoplectanum pilittae* n. sp.**

(figs. 36–43)

**Type host.** *Gerres cireneus* (Walbaum).**Site.** Gills.**Type locality.** Punta Santiago near Humacao, Puerto Rico, February 1992.



**FIGURES 36–43.** *Darwiniopectanum pilittae* n. gen. n. sp. 36. Copulatory complex. 37. Egg. 38. Hook. 39. Squamodisc. 40. Ventral bar. 41. Sinistral dorsal bar. 42. Dorsal anchor. 43. Ventral anchor. Figs. 36–43 scale of 25  $\mu$ m.

**Specimens studied.** Holotype, USNPC 83400; 5 paratypes, USNPC 104824; 2 vouchers, USNPC 84667.

**Etymology.** This species is named for Ms. Patricia A. Pilitt in recognition of her valuable work as Collection Manager of the United State National Parasite Collection (USNPC), Beltsville, Maryland, USA.

**Description** (based on 6 adult specimens). Body slender, fusiform, total length excluding the haptor 489 (410–560; n = 5) long, 97 (80–110; n = 5) wide at the level of germarium. Tegument smooth. Cephalic margin tapered; poorly developed terminal lobes; three bilateral pairs of head organs, with rod-shaped secretion; cephalic glands not observed. Eyes 4, equidistant; posterior pair larger than anterior pair; granules ovate, elongate, presence of accessory granules at cephalic region. Pharynx ovate to subspherical, 40 (33–45; n = 5) in diameter; oesophagus short or absent; intestinal caeca blind, straight. Genital pore posterior to copulatory complex. Male copulatory organ arcuate originating from ring-like sclerotised base, spatulate end, 23 (21–25; n = 4) long. Accessory piece with proximal portion narrow, articulation process attached to base of male copulatory organ; expanded distal portion, 20 (n = 2). Testis not observed. Germarium tubular, elongate, unbranched, distal end parallel to body, 80 (n = 1) long; oötype not observed; Mehlis' glands branched, stained deep purple; vaginal aperture marginal; vaginal atrium, vaginal tube, seminal receptacle not observed. Vitellarium extending throughout trunk, absent in regions of major reproductive organs. Egg ovate, short filament, 75 (74–76; n = 2) long, 57 (55–58; n = 2) wide. Peduncle short to elongate; pair of glands associated with haptor. Haptor bilaterally lobed, 92 (80–100; n = 5) long, 189 (175–200; n = 5) wide. Squamodiscs similar, sub-circular to subtrapezoidal, concentric rows of dumbbell-shaped rodlets becoming progressively more delicate in posterior row, easily lost in preserved specimens, 83 (75–88; n = 3) long, 103 (100–110; n = 3) wide. Ventral anchor with elongate deep root, short depressed superficial root, straight shaft and re-curved point; point reaching level of tip of superficial root, outer 49 (46–52; n = 3), inner 30 (28–33; n = 5), base 9 (n = 2). Dorsal anchor with elongate deep root, inconspicuous superficial root, straight shaft and re-curved short point, outer 45 (40–49; n = 5), inner 26 (24–27; n = 5), base 6 (n = 2). Ventral bar, elongate, with delicate tapered ends, 8 (8–9; n = 5) long, 108 (96–125; n = 5) wide. Paired dorsal bar, spatulate, 15 (12–18; n = 6) long, 78 (65–90; n = 6) long. Hooks similar with protruding thumb with slightly depressed tip, delicate slightly curved point, slender shank, 10 (10–11; n = 31) long; hook pairs 1–5, ventral, hook pairs 6–7, dorsal; hook pair 1 nearly to ventral bar end; hook pair 5 at level of distal ventral anchor shaft, others sub-marginal in lateral haptoral lobes; filamentous hook loop not observed.

**Remarks.** Examination of the vouchers of *Diplectanum collinsi* collected from *Gerres cireneus* from Puerto Rico (see Bunkley-Williams & Williams 1994) indicates these specimens are members of *Darwinoplectanum* **n. gen.**, described above as *D. pillitae* **n. gen. n. sp.** The new species differs from all other species in the genus by possessing: (1) a male copulatory organ arcuate with spatulate end; (2) an accessory piece with proximal portion narrow and expanded distal portion; and (3) the size of the haptor and squamodiscs (haptor: 92 long x 189 wide vs. 49 long x 130 wide in *D. figueiredoi*, and 48 long X 156 wide in *D. amphiatlanticus*; squamodiscs: 83 long x 103 wide vs. 64 long x 73 wide in *D. figueiredoi*, and 48 long X 49 wide in *D. amphiatlanticus*).

### Key to diplectanid species from Gerreidae

1. Male copulatory organ and accessory piece non-articulated; male copulatory organ with nested tubes; vagina sclerotised; dorsal anchor with conspicuous superficial and deep roots; squamodisc with anterior and medial rows with rodlet dumbbell-shaped, posterior rows with spinelike rodlets ..... 2 (*Neodiplectanum*)  
Male copulatory organ and accessory piece articulated; male copulatory organ simple (tubular); vagina muscular; dorsal anchor with inconspicuous superficial root; squamodisc with rodlet dumbbell-shaped. .... 3 (*Darwinoplectanum* **n. gen.**)
- 2(1). Accessory piece with laterally expanded distal end ..... *N. wennengeri*  
Accessory piece with tapered distal end ..... *N. magnodiscatum* **n. comb.**  
Accessory piece with pyriform tip possessing delicate indentations on margins ..... *N. gatunense* **n. comb.**  
Accessory piece with distally bifurcate and hook-shaped ..... *N. mexicanum* **n. comb.**
- 3(1). Genital pore posterior to the copulatory complex ..... 4  
Genital pore anterior to the copulatory complex. .... *D. figueiredoi* **n. gen. n. sp.**
- 4(3). Accessory piece with one ramus; male copulatory organ arcuate; distal tip of the male copulatory organ spatulate .....  
..... *D. pillitae* **n. gen. n. sp.**  
Accessory piece with two rami; male copulatory organ sigmoid distal tip of the male copulatory organ acute .....  
..... *D. amphiatlanticus* **n. gen. n. sp.**

## Discussion

Originally, *Neodiplectanum* Mizelle & Blatz, 1941 was distinguished from the other diplectanids mainly by having two haptoral bars articulated at their midpoint, similar anchors, and copulatory complex with accessory piece basally articulated with the male copulatory organ. Oliver (1987) detected that Mizelle & Blatz (1941) misinterpreted the morphology of the bars and confirmed that *N. wenningeri* has two dorsal and one ventral bars. The former author (Oliver 1987) also considered *Neodiplectanum* a junior synonymy of *Diplectanum* by sharing the morphology of the squamodiscs.

The “status” of *Diplectanum* within Diplectanidae was questioned by Kritsky *et al.* (2000) who suggested that the genus might represent unnatural taxon by including species with variable features. Domingues & Boeger (2008) listed 64 valid species of *Diplectanum* occurring in freshwater and marine actinopterygian fishes around the world. However, they considered the taxon polyphyletic and proposed limiting the genus to species by possessing a male copulatory organ formed by two nested tubes, accessory copulatory organ; prostatic reservoir separated into three zones, vaginal atrium muscular, and two squamodiscs. Based on this proposal, *D. wenningeri* and other 50 species of *Diplectanum* were considered *incertae sedis* suggesting that these species may represent several genera based on the absence of the synapomorphies proposed by Domingues & Boeger (2008) for *Diplectanum*.

Here, we proposed the resurrection of *Neodiplectanum* for species which have the combined presence of male copulatory organ and accessory piece non-articulated, heavily sclerotised vaginal atrium, dorsal anchors with conspicuous superficial and deep roots, and squamodiscs with spinelike rodlets in the posterior rows. The sharing of these features also supported the transfer of *Diplectanum magnodiscatum* Fuentes Zambrano, 1997, *D. gatunense* Mendoza Franco, Roche & Torchin, 2008, *D. mexicanum* Mendoza Franco, Roche & Torchin, 2008 to *Neodiplectanum*.

As discussed in the remarks for *Neodiplectanum*, this taxon resembles *Paradiplectanum* Domingues & Boeger, 2008. Members of both genera share similarly non-articulated copulatory complex, heavily sclerotised vaginal atrium and squamodiscs with spinelike rodlets. The only character which appeared to distinguish these genera was the morphology of the superficial root of the dorsal anchor which is conspicuous in *Neodiplectanum* and inconspicuous in *Paradiplectanum*. The presence of conspicuous superficial root of the dorsal anchor is also reported from the diplectanid species of *Sinodiplectanotrema* Zhang, 2001. However, they can be distinguished from members of *Neodiplectanum* by having deep root of the dorsal anchor modified as stiff rod attached by flexible hinge and haptor without connecting bars and accessory adhesive organ (Lim *et al.* 2010). These findings allow us to amend the diagnosis for Diplectanidae proposed by Domingues & Boeger (2008) by considering the dorsal anchor with conspicuous (i.e., *Neodiplectanum*, *Sinodiplectanotrema*) or inconspicuous/knob-like superficial root (i.e., the other genera of Diplectanidae).

Mizelle & Blatz (1941) considered *Neodiplectanum wenningeri* closed related to *Diplectanum collinsi* (Mueller, 1936) based on the morphology of the squamodiscs and hook arrangement. The later species was reported by Mueller (1936) from *Morone saxatilis* (Waulbaum) (Moronidae) from Peace River, near Fort Ogdem, Florida, USA. Mueller (1936) described the male copulatory organ as having small fin near the distal end and no accessory piece. However, the original drawing of the male copulatory organ (Plate LVI, fig. 2) suggests that the “small fin near the distal end of the male copulatory organ” could be interpreted as an accessory piece. The drawing of the haptoral structures (Plate LVI, fig. 1) given by Mueller (1936) clearly shows that *D. collinsi* possesses squamodiscs with spinelike rodlets, and anchors (dorsal, ventral) with conspicuous superficial and deep roots. If it is confirmed, the copulatory complex (i.e., accessory piece + male copulatory organ) plus the morphology of the haptoral structures strongly indicate the two species are congeneric. We contacted the curator of the Collection of the Roosevelt Wild Life Station, Syracuse, New York, USA where type specimens were deposited by Mueller (1936), however, no specimen of *D. collinsi* were found in this collection. Since the type material of *D. collinsi* could not be examined for confirmation and comparative study, for instance we cannot make any consideration about the real taxonomic status of this species. Similarly, Skinner (1982) recorded *Gerres cireneus* (Walbaum) from South Biscayne Bay, Florida, USA as a new host and a new locality for *N. wenningeri*, as well as López-Jiménez (2001, *apud* Kohn *et al.* 2006) reported a *Neodiplectanum* sp. from the gills of *Eugerres mexicanus* (Steindachner) from Tabasco, Mexico. In both cases however, attempts to locate these materials for confirmation was unsuccessful.

*Darwinoplectanum* can be distinguished from the other genera of Diplectanidae by the morphology of the accessory piece of the copulatory complex, vagina (i.e. structure, position) and egg. The accessory piece reported



for species of *Darwinoplectanum* is also detected for other diplectanin genera: *Aetheolabes* Boeger & Kritsky, 2009, *Monoplectanum* Young, 1969, *Neodiplectanum* Mizelle & Blatz, 1941, *Paradiplectanum* Domingues & Boeger, 2008, *Pseudodiplectanum* Tripathi, 1957, *Rhabdosynochus* Mizelle & Blatz, 1941, and some species *incertae sedis* of *Diplectanum*. However, *Darwinoplectanum* can be distinguished from the first six genera and *Diplectanum hilum* Kritsky & Thatcher, 1984 by the accessory piece articulated with the base of the male copulatory organ. Although reported for species of Lamellodiscinae (i.e., *Calydiscoides* spp., *Furnestinia echeensis* (Wagener, 1857) Euzet & Audouin, 1959, *Lamellodiscus mormyri* Euzet & Oliver, 1967), the presence of accessory piece articulated with male copulatory organ is also observed for *Diplectanum jaculator* Mizelle & Kritsky, 1969, *D. toxotes* Mizelle & Kritsky, 1969, *D. sumpit* Lim, 2006. However, species of *Darwinoplectanum* differ from those diplectanin species by the combined presence of marginal or submarginal vaginal opening (medial or submedial in *D. jaculator*; *D. toxotes* and *D. sumpit*), muscular vaginal atrium (sclerotised in *D. jaculator*), and egg ovate with short filament (tetrahedral egg with long filament in *D. jaculator*, *D. toxotes* and *D. sumpit*).

As stated in the remarks of *Darwinoplectanum figueiredoi*, the genital pore opening anterior to the copulatory complex readily distinguish this species from its congeners. The position of the genital pore seems to be conservative within diplectanid genera (see Domingues & Boeger 2008). However, this character is apparently polymorphic within species of *Darwinoplectanum* and the presence of anterior genital pore apparently represents autapomorphic features for *D. figueiredoi*. We have adopted a conservative approach by grouping *D. figueiredoi*, *D. amphiatlanticus* and *D. pilittae* within the genus *Darwinoplectanum*, because all three species share the presence of a male copulatory organ tubular, simple; an accessory piece, articulated with the base of the male copulatory organ; a vagina non-sclerotised, sinistral, marginal or submarginal; and an egg ovate with short filament.

**TABLE 3.** List of host - parasite.

	<i>E. gula</i>	<i>E. argenteus</i>	<i>E. melanopterus</i>	<i>G. cironeus</i>
<i>N. wenningeri</i>	X			X
<i>N. magnodiscatum</i>				
<i>N. gatunense</i>				
<i>N. mexicanum</i>				
<i>Neodiplectanum</i> sp.				
<i>D. figueiredoi</i>		X		
<i>D. amphiatlanticus</i>		X	X	
<i>D. pilittae</i>				X

continued.

	<i>E. plumieri</i>	<i>E. brasilianus</i>	<i>E. mexicanus</i>	<i>D. rhombeus</i>
<i>N. wenningeri</i>				
<i>N. magnodiscatum</i>	X			
<i>N. gatunense</i>		X		
<i>N. mexicanum</i>				X
<i>Neodiplectanum</i> sp.			X	
<i>D. figueiredoi</i>				
<i>D. amphiatlanticus</i>				
<i>D. pilittae</i>				

Species of *Neodiplectanum* and *Darwinoplectanum* seem to be restricted to gerreid fishes. The pattern of distribution of species of *Neodiplectanum* and *Darwinoplectanum* support strict host specificity (table 3). Except for *N. wenningeri* and *D. amphiatlanticus*, the other diplectanid species are known to inhabit a single host species, such as *N. magnodiscatum* from *Eugerres plumieri*; *N. gatunense* from *E. brasilianus*; *N. mexicanum* from *Diapterus rhombeus*; *Neodiplectanum* sp. from *E. mexicanus*; *Darwinoplectanum figueiredoi* from *Eucinostomus argenteus*; and *D. pilittae* from *Gerres cironeus*. *Neodiplectanum wenningeri* was reported from *Eucinostomus gula* (type

host) and *G. cireneus* by Mizelle and Blatz (1941) and Skinner (1982), respectively, from Southeastern Atlantic coast of USA. *Darwinoplectanum amphiatlanticus* occurs in *Eucinostomus melanopterus* and *E. argenteus* from eastern and western Atlantic coast, respectively. Species of diplectanids with wide distribution range are not uncommon. Domingues and Boeger (2007) noticed that specimens of *Acleotrema oliveri* (León-Règagnon, Pérez-Ponce de León & Garcia Prieto, 1997) Domingues & Boeger, 2007 collected from Pacific waters from Mexico and Australia did not significantly differ morphological and morphometrically. As well as, *Diplectanocotyla megalopis* Rakotofiringa & Oliver, 1987, which was reported from Indo-Pacific and Atlantic tarpons (Rakotofiringa & Oliver, 1987; Mendoza Franco *et al.*, 2004).

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