

***Pseudorhabdosynochus yucatanensis* sp. n. (Monogenea: Diplectanidae) from the gills of the red grouper *Epinephelus morio* (Pisces: Serranidae) of the Yucatan Peninsula, Mexico**

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Abstract. *Pseudorhabdosynochus yucatanensis* sp. n. (Diplectanidae) is described from the gills of the red grouper, *Epinephelus morio* (Valenciennes, 1824) (Serranidae), from the coast of the Yucatan Peninsula, Mexico. This new species is characterized by having both the ventral and the dorsal squamodiscs composed of 10–12 rows of rods, with 0–1 innermost row forming a closed circle. Furthermore, the vagina of *P. yucatanensis* has a non-sclerotized ampulla with a fine, sclerotized duct leading to a sclerotized seminal receptacle. Prevalence (percentage of infected fish) and abundance (mean number of worms per examined fish) were estimated for *P. yucatanensis* from 8 localities along the coast of Yucatan. Prevalence varies from 38% to 100%, while abundance was between 1.2 ± 0.6 and 43.2 ± 17.8 worms per fish. The lack of linear relationship between the host length and the number of monogeneans per fish (regression $F_{1,188} = 0.56, p = 0.45$) was probably due to the fact that the sample was restricted to juvenile hosts.

Although the red grouper, *Epinephelus morio* (Valenciennes, 1824) (Serranidae: Perciformes) is a principal resource for demersal fisheries along the Yucatan Peninsula (Solana-Sansores and Arreguin-Sánchez 1991), information on its helminth parasites is limited (Moravec et al. 1995a,b, 1997, Vidal-Martínez et al. 1995). During studies of the helminth fauna of this fish, a new species of diplectanid monogenean was found parasitizing the gills and it was both frequent and abundant at all surveyed localities. Therefore, the objectives of this paper are to describe this new species and to provide data on its prevalence and abundance for each sampling site.

MATERIALS AND METHODS

Serranid hosts, *Epinephelus morio*, were collected from 8 localities along the Yucatan Peninsula between 1994 and 1996 (Table 1; see Fig. 1 in Moravec et al. 1997). A total of 190 fish, ranging from 13 to 38 per locality, were collected with the help of fishermen from the artisanal fishing fleet which specializes on juveniles; hence the sample was restricted to fish from 14 to 57 cm in total length. Methods of collection, preparation and measurement of helminths were the same as those described by Oliver (1968) and Beverley-Burton and Suriano (1981). All measurements reported herein are in micrometres (μm); the mean is followed by the standard

deviation, while the range and sample size (n) are given in parentheses. Prevalence was calculated as the percentage of hosts in a sample infected with *P. yucatanensis*, while abundance was considered to be the mean number of monogeneans per fish in a sample (Margolis et al. 1982). To test the relationship between host size (independent variable) and the number of monogeneans per fish (dependent variable) a linear model was fitted. This particular model was chosen due to the evidence about the relationship of these variables for monogeneans (e.g., Cusack 1986, Fischer and Kelso 1990, Papoutsoglou et al. 1996). A transformation to Neperian logarithms was applied to the dependent variable because its behaviour was not normal, as shown by rankit plots (Sokal and Rohlf 1981).

RESULTS

Pseudorhabdosynochus yucatanensis sp. n. Fig. 1

Description: (based on 14 specimens): Diplectanidae, Diplectaninae. Tegument smooth, without scales on posterior body region. Body 652 ± 144 (440–863; $n = 12$) long, fusiform; greatest width 190 ± 55 (81–260; $n = 12$) near midlength. Two terminal, bilateral cephalic lobes moderately developed. Cephalic glands lateral to pharynx, both with duct leading to 3 head organs. Two pairs of eyespots. Mouth subterminal, ventral; pharynx subspherical, 36 ± 8 (20–50; $n = 14$) long, 36 ± 8

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Table 1. Prevalence and abundance of *Pseudorhabdosynochus yucatanensis* in *Epinephelus morio* from the coast of the Peninsula of Yucatan, Mexico. Localities arranged in alphabetic order.

State Locality	No. of fish examined	Fish standard length (cm)		Parasite		
		x ± SE	Range	Prevalence (%)	Abundance	
					± SE	Range
Campeche						
Campeche	13	30.2 ± 3.3	20.0 – 57.0	85	43.2 ± 17.8	0 – 241
Quintana Roo						
Chiquila	21	30.2 ± 0.7	25.0 – 36.0	38	1.2 ± 0.6	0 – 12
Yucatan						
Celestun	27	27.2 ± 1.1	17.0 – 36.5	59	3.5 ± 1.3	0 – 33
Sisal	23	19.4 ± 0.8	14.0 – 25.5	72	8.2 ± 2.5	0 – 54
Chelem	25	21.5 ± 0.4	18.1 – 29.0	88	5.6 ± 1.0	0 – 24
Progreso	38	30.9 ± 0.9	18.0 – 45.0	55	28.6 ± 9.6	0 – 327
Telchac	15	21.6 ± 0.6	20.0 – 29.5	100	6.3 ± 1.0	1 – 14
Rio Lagartos	28	24.6 ± 0.8	18.5 – 34.0	86	18.8 ± 5.8	0 – 158

SE – standard error

(20–55; n = 14) wide; oesophagous absent. Crura not united posteriorly (Fig. 1A). Peduncle broad, elongate, haptor 139 ± 24 (100–200; n = 14) wide, with two conspicuous bilateral lobes. Squamodiscs ovate, overlying distal peduncle and medial portion of haptor; ventral squamodisc 55 ± 9 (42–68; n = 7) in diameter, with 10–12 semicircular rows of rods, 0–1 innermost rows forming closed circles. Dorsal squamodisc 60 ± 8 (45–75; n = 9) in diameter, with 9–11 semicircular rows of rods, and innermost row forming closed circle. Ventral anchor 36 ± 6 (30–48; n = 17) long, with well developed roots, bent shaft and short point; dorsal anchor 35 ± 5 (29–48; n = 12) long, with large elongated deep root, incipient superficial root, straight shaft and short point. Ventral bar 57 ± 6 (49–69; n = 12) long, with tapered ends, constricted median portion, ventral groove; dorsal bar 53 ± 7 (43–64; n = 17) long, with spatulate medial end. Four pairs of hooks lying on lateral haptoral lobes; hook 10 ± 1 (9–12; n = 15) long, with curved shank, perpendicular thumb, delicate shaft and point. Male copulatory organ 51 ± 14 (32–68; n = 10) long, with a large bulbous basal portion, divided into four compartments. Last distal compartment produces curved spicular filament 13 ± 9 (5–20; n = 9) long. Gonads slightly overlapping. Testis postovarian, ovate, 58 ± 19 (30–91; n = 10) long and 63 ± 19 (30–94; n = 10) wide; vas deferens conspicuous, sinistral to midline; seminal vesicle conspicuous dilation of vas deferens; prostatic reservoir pyriform. Ovary pyriform, 36 ± 6 (28–45; n = 12) in greatest width, looping right intestinal crus. Vagina sinistral, comprising non-sclerotized ampulla with fine sclerotized duct leading to proximal seminal receptacle. Duct from seminal receptacle opening near ootype; ootype surrounded by Mehlis' gland;

uterus opening at genital pore; vitellaria coextensive with intestine. Egg oval, 22 long, 12 wide, lacking polar filament.

Type host: *Epinephelus morio* (Valenciennes, 1824) (Serranidae: Perciformes).

Site of infection: Gills.

Type locality: Progreso, Yucatan, Mexico.

Other localities: Celestun (21°17'N; 89°40'W), Sisal, Chelem, Telchac and Rio Lagartos (all Yucatan State), Campeche (Campeche State) and Chiquila (Quintana Roo State), Mexico.

Deposition of types: Holotype and 2 paratypes in CINVESTAV-IPN Unidad Mérida, Yucatan, México (Coll. No. 96-5), 3 paratypes in the Instituto de Biología, Universidad Nacional Autónoma de México (Coll. No. CNHE No. 2923); 3 paratypes in the Institute of Parasitology, Academy of Sciences of the Czech Republic, České Budějovice (Coll. No. M-346) and 3 paratypes in the U.S. National Parasite Collection, Beltsville, Maryland, USA (Coll. No. 87301).

Etymology: The specific name of this species relates to the Yucatan Peninsula.

Remarks: *Pseudorhabdosynochus yucatanensis* differs from other congeners by having a vagina with a non-sclerotized ampulla with a fine sclerotized duct leading to a sclerotized seminal receptacle (Fig. 1C). Furthermore, *P. yucatanensis* has a ventral squamodisc with 10–12 semicircular rows of rods and at most 1 innermost row forming a closed circle (Fig. 11).

Infection parameters and relationship of host size and number of monogeneans: The values for prevalence and abundance of *P. yucatanensis* for each

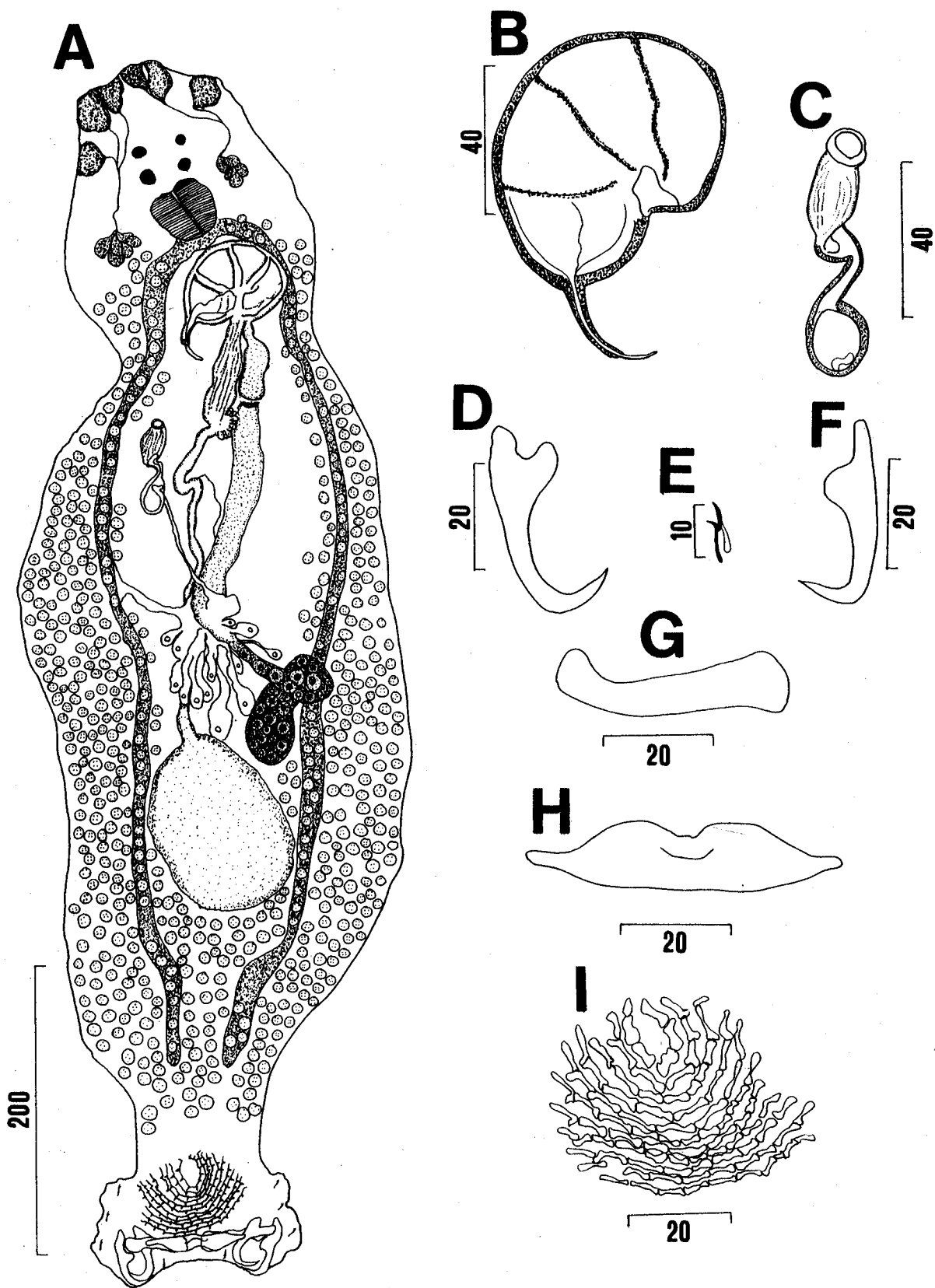


Fig. 1. *Pseudorhabdosynochus yucatanensis* sp. n. **A** – entire worm, dorsal view (holotype); **B** – penis, lateral view; **C** – vagina, dorsal view; **D** – ventral anchor; **E** – hook; **F** – dorsal anchor; **G** – dorsal bar; **H** – ventral bar; **I** – squamodisc, pattern of rows (all measurements in μm).

locality are given in Table 1. This species was highly prevalent in all localities but Chiquila (Table 1). However, abundance values of more than 10 worms per fish and large infection range were recorded only in 3 localities (Campeche, Progreso and Rio Lagartos) (Table 1). There was no linear relationship between fish length and the number of monogeneans per fish (regression $F_{1,188} = 0.56$, $p = 0.45$).

DISCUSSION

Based on the information provided by Kritsky and Beverley-Burton (1986), and Dyer et al. (1994, 1995), there are 18 valid species in the genus *Pseudorhabdosynochus* Yamaguti, 1958. These species are *P. americanum* (Price, 1937), *P. amplidiscatum* (Bravo-Hollis, 1954), *P. beverleyburtonae* (Oliver, 1984), *P. bocquetiae* (Oliver et Paperna, 1984), *P. caballeroi* (Caballero et Bravo-Hollis, 1961), *P. cupatum* (Young, 1969), *P. epinepheli* (Yamaguti, 1938), *P. kritskyi* Dyer, Williams et Bunkley-Williams, 1995, *P. lantauensis* (Beverley-Burton et Suriano, 1981), *P. latesi* (Tripathi, 1955), *P. magnisquamodiscum* (Aljoshkina, 1984), *P. melanesiensis* (Laird, 1958), *P. monaensis* Dyer, Williams et Bunkley-Williams, 1994, *P. querni* (Yamaguti, 1968), *P. riouxi* (Oliver, 1986), *P. serrani* (Yamaguti, 1953), *P. summanae* (Young, 1969) and *P. vagampullum* (Young, 1969). *Pseudorhabdosynochus yucatanensis* differs from all these species by the morphology of the vagina which is a non-sclerotized ampulla with a fine sclerotized duct leading to a sclerotized seminal receptacle.

Beverley-Burton and Suriano (1981) recognized two main groups of *Pseudorhabdosynochus* species on the basis of whether they have more than 12 or less than 12 rings in each (ventral and dorsal) squamodiscs. Since then, at least three species (*P. beverleyburtonae*, *P. kritskyi* and *P. riouxi*) with an intermediate number of

rings (7 to 22) have been described. We therefore suggest that the number of rows of the squamodiscs is not useful anymore for distinguishing groups of species of *Pseudorhabdosynochus* species.

With respect to the infection parameters, it is very difficult to explain why *P. yucatanensis* is highly prevalent in 7 localities, and abundant only in 3 of these localities (Table 1). Seasonal variation in abundance could be a probable reason for such a difference among localities, as suggested by the fact that samples were obtained from different dates (see Moravec et al. 1997). Therefore, it will be necessary to undertake systematic studies of the seasonal variation of *P. yucatanensis* in different localities to determine if this hypothesis is correct. However, the information on the infection parameters of *P. yucatanensis* is still useful for mariculturists, because cultured red groupers would be more prone to acquire high levels of infection with *P. yucatanensis* at localities such as Campeche, Progreso or Rio Lagartos (Table 1).

The most likely explanation for the lack of a relationship between host size and the number of monogeneans per fish is that the sampling was restricted to juvenile red groupers. Since the size range of the fish was very narrow (14 to 57 cm), it is possible that large fish (those longer than 1 m) with presumably larger infestations of monogeneans were not included in the sample. It remains to be seen whether or not the values of infection parameters (prevalence and abundance) increase in larger fish.

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