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from the "Guavina" *Gobiomorus maculatus* (Osteichthyes:
Eleotrididae) in Chamela Bay, Jalisco, México**

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PROTEOCEPHALUS CHAMELENSIS N. SP.
(CESTODA: PROTEOCEPHALIDAE) FROM THE “GUAVINA”
GOBIMORUS MACULATUS (OSTEICHTHYES: ELEOTRIDIDAE)
IN CHAMELA BAY, JALISCO, MÉXICO

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ABSTRACT: A new species of *Proteocephalus* inhabiting the eleotridid estuarine fish *Gobiomorus maculatus* is described from Chamela Bay, Jalisco State, Mexico. The new species and *P. pugetensis* are nearly identical in strobila length, presence of a vestigial apical organ, having vaginae only anterior to the cirrus sac, an average of 4–7 uterine diverticula per proglottis, and a ratio of cirrus sac length to proglottis width averaging approximately 1:4. *Proteocephalus pugetensis* differs from the new species by having an average of 35 rather than 68 testes per proglottis, vitelline follicles terminating posteriorly at the level of the anterior margin of the ovary rather than at the level of the posterior margin, and equatorial genital pores rather than genital pores located in the anterior ¼ of the proglottis. Finally, *Proteocephalus pugetensis* occurs from estuarine habitats along the Pacific coast of the United States; the new species was collected from an estuarine habitat on the Pacific coast of México.

During an inventory of the helminth parasites of marine and brackish fishes from Chamela Bay in the state of Jalisco on the west coast of México, an undescribed species of *Proteocephalus* Weinland, 1858 was collected. We describe that species herein.

MATERIALS AND METHODS

In August 1993, 2 specimens of *Gobiomorus maculatus* (Günther, 1859) Eigenmann and Eigenmann, 1941 (local name guavina) were collected by fishermen using gill nets in the Estero Chamela, which is located in Chamela Bay on the Pacific coast of México. Cestodes were relaxed in hot tap water (80 °C); some were fixed in 10% formalin for cross sections and some were fixed with Bouin's fluid with slight coverglass pressure for whole mounts. They were stored in 70% ethanol, stained in Mayer's paracarmine and Harris' hematoxylin, cleared in methyl salicylate, and mounted in Canada balsam. Cross sections cut at 7 µm were stained with hematoxylin-eosin. All measurements are in micrometers unless otherwise stated, with the range followed by the sample measure, and the mean and standard deviation in parentheses. Illustrations were made with the aid of a camera lucida.

DESCRIPTION

***Proteocephalus chameleensis* n. sp.**
(Figs. 1–5)

The description is based on measurements from 15 specimens: Strobila 15–57 mm (n = 8; $\bar{x}$ = 34.8 ± 16.4) long. Scolex aspinose, 737–1,375 (n = 15; $\bar{x}$ = 916 ± 182) wide, with vestigial glandular apical organ, ventral longitudinal incision, and 4 shallow suckers. Suckers 312–437 (n = 30; $\bar{x}$ = 371 ± 31) long by 250–300 (n = 30; $\bar{x}$ = 277 ± 19) wide. Immature proglottides wider than long, 137–450 (n = 15; $\bar{x}$ = 295 ± 94) long by 850–1,425 (n = 15; $\bar{x}$ = 1,081 ± 198) wide. Ratio of proglottis length to width 1:2.12–5.68 (n = 15; $\bar{x}$ = 1:3.73). Mature proglottides 200–587 (n = 15; $\bar{x}$ = 363 ± 157) long by 1,062–2,162 (n = 15; $\bar{x}$ = 1,301 ± 401) wide. Ratio of proglottis length to width 1:1.9–6.9 (n = 15; $\bar{x}$ = 1:4.17). Testes medullary, in 2 indistinct fields, 55–81 (n = 15; $\bar{x}$ = 72 ± 12 per proglottis) in number, averaging 10 preporal, 22 postporal, and 33 aporal, 40–50 in diameter (n = 30; $\bar{x}$ = 45 ± 4). Cirrus sac elongate, 250–462 (n = 15; $\bar{x}$ = 345 ± 80) long and 120–207 (n = 15; $\bar{x}$ = 150 ± 40) wide, containing ejaculatory duct and cirrus; ratio of cirrus sac length to mature proglottis width 1:3.2–5.0 (n = 15; $\bar{x}$ = 1:3.79). Vas deferens coiled. Genital pore alternating irregularly in

anterior 22–26% (n = 15; $\bar{x}$ = 25%) of proglottis. Vagina anterior to and never crossing cirrus sac, with muscular sphincter. Ovary medullary, bilobed, 560–970 (n = 15; $\bar{x}$ = 743 ± 114) wide; lobes 125–275 (n = 20; $\bar{x}$ = 213 ± 35) long. Uterus medullary, preformed in mature proglottis. Vitelline follicles medullary, extending from near posterior end of proglottis to slightly anterior to vaginal level, occupying 80–87% of proglottis length and situated in dorsal position in transverse sections; 16–32 in diameter (n = 30; $\bar{x}$ = 25 ± 6). Gravid proglottides 560–970 (n = 15; $\bar{x}$ = 730 ± 134) long by 1,800–2,110 (n = 15; $\bar{x}$ = 1,500 ± 283) wide; ratio of proglottis width to length 1.30–3.70 (n = 15; $\bar{x}$ = 1:2.11). Testes degenerating, fewer in number than in mature proglottides. Uterus with 3–7 (n = 13; $\bar{x}$ = 5 ± 1) lateral diverticula on each side. Embryophore 19–25 (n = 50; $\bar{x}$ = 20 ± 4) long by 12–16 (n = 50; $\bar{x}$ = 14 ± 2) wide.

Taxonomic summary

Host: *Gobiomorus maculatus* (Günther, 1859) Eigenmann and Eigenmann, 1891, “guavina” (Osteichthyes: Teleostei: Eleotrididae).

Site of infection: Small intestine.

Type locality: Estero Chamela, Bahía de Chamela, 19°30', 19°32' latitude N and 105°06' longitude W. Jalisco State, west coast, México.

Prevalence: One hundred percent (2/2, with 39 and 19 specimens).

Specimens deposited: Holotype: Colección Helmintológica, IBUN-AM No: Mexico II-333. Paratypes: USNPC No. 84880, Colección Helmintológica IBUNAM México Nos: II-334–335 and the Museum de Histoire Naturelle de Geneve, Switzerland No. INVE 18256.

Etymology: The new species is named for the type locality.

DISCUSSION

The genus *Proteocephalus* Weinland, 1858, which includes more than 170 nominal species with a worldwide distribution (Schmidt, 1986), and the family Proteocephalidae La Rue, 1911 have been the subject of a number of taxonomic reviews (La Rue 1911, 1914; Freze, 1965; Brooks, 1978a, 1978b; Chamberier, 1989a, 1989b). Recently, García-Prieto (1993) examined the status of 97 nominal species of *Proteocephalus* reported from the Americas as parasites of fishes, amphibians, and reptiles, considering only 57 of them valid.

In México, 7 species of *Proteocephalus* have been reported previously: *Proteocephalus singularis* La Rue, 1911 from the fish *Lepisosteus tropicus* Gill, 1863 in Tabasco by Osorio et al. (1987); *Proteocephalus pusillus* Ward, 1910 from the fish *Goo-dea atripinnis* Jordan, 1880 in Michoacán by Mejía (1987); *Proteocephalus filaroides* La Rue, 1909 by García-Prieto (1986) in the salamander *Ambystoma tigrinum* Green, 1825 in the state

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FIGURES 1–5. Drawings of *Proteocephalus chamelensis* n. sp. 1. Scolex. 2, 3. Cross sections of gravid proglottides showing the medullary position of vitelline follicles and testes. 4. Mature proglottis. 5. Gravid proglottis; cp, cirrus pouch; exd, excretory duct; eyd, ejaculatory duct; o, ovary; pu, preformed uterus; s, suckers; t, testes; u, uterus; v, vagina; vao, vestigial apical organ; vd, vas deferens; vi, vitellaria; vli, ventral longitudinal incision.

of México, and by Pulido (1994) in the frog *Rana dunni* Zweifel, 1957 from Michoacán; *Proteocephalus racemosus* (Rudolphi, 1819) La Rue, 1911 by Cruz (1974) in the snakes *Thamnophis macrostemma* Kennicott, 1860 and *Thamnophis melanogaster* Peters, 1864 in the states of México, Michoacán, and Federal District; *Proteocephalus perspicua* (La Rue, 1911) Harwood, 1933 in the snake *Thamnophis erythrogaster* Hallowell, 1852 in Nuevo Leon by García Prieto (1986); *Proteocephalus micruricola* Shoop and Corkum, 1982 described from the snake *Micrurus diastema affinis* Jan, 1858 in the state of Oaxaca; and, finally, *Proteocephalus nattereri* Parona, 1901 described by Flores Barroeta (1955) from a “culebra roja” (red snake) in the state of Chiapas. García-Prieto (1993) considered *P. micruricola* a species inquirenda because the original description did not include a description of the position of the gonads in cross section, which is necessary to justify the inclusion of specimens in the family Proteocephalidae. Of those species, *P. chamelensis* is somewhat similar to *P. perspicua* and *P. filaroides* by having a vestigial apical organ but differs by having vaginae that open only anteriorly to the cirrus sac rather than anteriorly or posteriorly and in having a mean number of testes per proglottis of 68 rather than more than 200; in addition, *P. perspicua* is a parasite of freshwater snakes and *P. filaroides* is a parasite of amphibians.

Among American species of *Proteocephalus* recognized by García-Prieto (1993), 29 have an average of fewer than 100 testes per proglottis. Nine of those possess vestigial apical organs similar to that found in *P. chamelensis*: *Proteocephalus ambloplitis* (Leidy, 1887) Benedict, 1900; *Proteocephalus amphiumicola* Brooks, 1978; *Proteocephalus australis* Chandler, 1935; *Proteocephalus buplanensis* Mayes, 1976; *P. filaroides* La Rue, 1909; *Proteocephalus paralacticus* MacLulich, 1943; *Pro-*

teocephalus pugetensis Hoff and Hoff, 1929; *Proteocephalus sireni* (Brooks and Buckner, 1976) Brooks, 1978; and *Proteocephalus tumidicollis* Wagner, 1953. *Proteocephalus chamelensis* appears to be most similar to *P. buplanensis* and *P. pugetensis* because all 3 possess 4–7 uterine diverticula on each side. The other 7 species have more than 11 uterine diverticula on each side and much longer strobilae.

Proteocephalus chamelensis differs from *P. buplanensis* by having vitelline follicles extending posteriorly to the posterior margin of the ovary rather than terminating at the anterior margin and by having vaginae that are anterior rather than dorsal to the cirrus sac. *Proteocephalus buplanensis* also inhabits a cyprinid fish (*Semotilus atromaculatus*) in freshwater systems of Nebraska (Mayes, 1976), whereas *P. chamelensis* inhabits an eleotridid in estuarine habitats of México. *Proteocephalus chamelensis* is very similar to *P. pugetensis* and is perhaps closely related to it. The species are nearly identical in strobila length, presence of a vestigial apical organ, anterior position of the vaginae, number of uterine branches (4–7), and ratio of cirrus sac length to proglottid width (averaging 1:4), but *P. pugetensis* differs from *P. chamelensis* by having an average of 35 rather than 68 testes per proglottis, vitelline follicles terminating posteriorly at the level of the anterior margin of the ovary rather than at the level of the posterior margin, and equatorial genital pores rather than genital pores located in the anterior ¼ of the proglottis. *Proteocephalus pugetensis* was collected in the gasterosteid fish *Gasterosteus cataphractus* (= *aculeatus* s.l.) from estuarine habitats along the Pacific coast of the United States (Seattle) (Hoff and Hoff, 1929); the type locality for *P. chamelensis* is also a brackish water habitat along the Pacific coast of México.

Among species of *Proteocephalus* worldwide, *Proteocephalus*

flicollis (Rudolphi, 1802) Weinland, 1858, *Proteocephalus la-
ruei* Faust, 1919, *Proteocephalus luciopercae* Wardle, 1932, and
Proteocephalus ptychocheilus Faust, 1919 share the following 3
traits with *P. chamelensis*: an average of 4–7 uterine diverticula

in each side, an average of approximately 70 testes per proglottis,
and vaginae opening anteriorly to the cirrus sac only. They differ
from the new species, however, by lacking apical suckers or
organs, having vitelline follicles that terminate posteriorly at

the anterior border of the ovary, and having equatorial or postequatorial (*P. filicollis*) genital pores (see Freze, 1965).

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