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Charles R. Bursey
Pennsylvania State University

Daniel R. Brooks
University of Toronto, dan.brooks@utoronto.ca

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PARAPHARYNGODON DUNIAE N. SP. (NEMATODA: PHARYNGODONIDAE) IN *PHRYNOHYAS VENULOSA* (ANURA: HYLIDAE) FROM THE AREA DE CONSERVACIÓN GUANACASTE, GUANACASTE, COSTA RICA

Charles R. Bursey and Daniel R. Brooks*
Department of Biology, Pennsylvania State University, Shenango Campus, 147 Shenango Avenue, Sharon, Pennsylvania 16146. *e-mail: cxb13@psu.edu*

ABSTRACT: *Parapharyngodon duniae* n. sp. (Nematoda: Pharyngodonidae) in the large intestine of the veined tree frog, *Phrynohyas venulosa*, from the Area de Conservación Guanacaste in northwestern Costa Rica is described and illustrated. *Parapharyngodon duniae* n. sp. represents the 34th species assigned to the genus, the 10th species from the Neotropical Realm, and only the third species to parasitize anurans. It is distinguished from the other Neotropical species by having postbulbar ovaries and a prebulbar excretory pore.

In an ongoing inventory of eukaryotic parasites of vertebrates of the Area de Conservación, Guanacaste, in northwestern Costa Rica (http://brooksweb.zoo.utoronto.ca/index.html), 122 nematodes of an undescribed species of *Parapharyngodon* Chatterji, 1933, were collected from the large intestine of 4 veined tree frogs, *Phrynohyas venulosa* (Laurenti, 1768). *Phrynohyas venulosa* has wide distribution in Central and South America, ranging from central Mexico through western Ecuador, Venezuela, Trinidad, and Tobago to northeastern Brazil, Bolivia, and northern Argentina (Savage, 2002). To our knowledge, there are only 2 previous reports (Combes and Laurent, 1979; Bursey et al., 2001) of helminths from *P. venulosa*.

Thirty-three species of *Parapharyngodon* are currently recognized (Bursey and Goldberg, 1999; Bursey and Telford, 2002; Ramallo et al., 2002). Of these, only *P. garciae* Schmidt and Whittaker, 1975, and *P. osteopili* Adamson, 1981, parasitize anurans. Three species are found in the Australian Realm, 5 species in the Ethiopian Realm, 3 in the Nearctic Realm, 9 in the Neotropical Realm, 4 in the Oriental Realm, and 9 in the Palaearctic Realm. This article describes the 10th species of *Parapharyngodon* from the Neotropical Realm.

MATERIALS AND METHODS

Frogs were collected by hand at night and examined for parasites. Nematodes in the large intestine and rectum were fixed in glacial acetic acid, then preserved and stored in 70% ethanol, and later cleared in glycerol for further examination and identification. Drawings were made with the aid of a microprojector. Measurements (mean ± 1 SD, followed by range in parentheses) are given in micrometers, unless otherwise stated.

DESCRIPTION

Parapharyngodon duniae n. sp.
(Figs. 1–6)

General: Robust nematodes with prominent annulations beginning at cephalic extremity, continuing to anus. Mouth bounded by 3 bilobed lips. Lateral alae present in males, absent in females. Males without caudal alae; caudal filament directed dorsally. Females with conical tail terminating in short, stiff spike. Eggs with subterminal operculum, containing larvae at morula stage of development.

Male: Based on 10 mature specimens. Length 1.86 ± 0.12 mm (1.66–2.04), width at level of excretory pore 127 ± 5 (122–134). Vestibule 15 ± 3 (12–18), esophageal corpus 332 ± 18 (305–360), esophageal bulb 74 ± 4 (67–82) long, 80 ± 6 (67–88) wide. Nerve ring 135 ± 6 (128–146) and excretory pore 605 ± 19 (574–638) from anterior end, respectively. Lateral alae beginning near level of esophageal isthmus, gradually increasing in width to 20, ending about 200 anterior to anus. Annulations about 12 apart. Testis at midbody, flexing posteriorly immediately behind excretory pore. Vas deferens separated from testis by narrow tube. Tail 82 ± 3 (79–88) inserted dorsally, reduced to slender appendage. Spicule 46 ± 4 (40–49) long. Seven caudal papilla, 1 pair ventral, preanal; 1 pair lateral, postanal; 1 median, postanal; 1 pair on caudal appendage. Anterior anal lip echinate.

Female: Based on 10 gravid specimens. Length 4.23 ± 0.20 mm (3.84–4.48), width at vulva 383 ± 40 (318–434). Vestibule 15 ± 3 (12–18), esophageal corpus 574 ± 52 (485–625), bulb 117 ± 7 (110–134) long and 115 ± 7 (106–122) wide. Nerve ring 159 ± 22 (122–183), excretory pore 635 ± 52 (536–689), and slightly salient vulva 2,009 ± 64 (1,920–2,110) from anterior end, respectively. Proximal half of vagina muscular. Vagina directed dorsally, then posteriorly joining parallel uteri. Uteri extending posteriorly to posterior end of body cavity, flexing forward joining oviducts in midbody region. Ovaries originating in region of esophageal bulb. In older gravid individuals, ovaries extend into corporal region, but not wrapped around esophageal corpus. Eggs subovate, slightly flattened on 1 side, circular in optical cross section, 117 ± 4 (110–122) long, 45 ± 4 (36–49) wide, morula stage of development at deposition. Egg shell thick; surface covered with tiny punctations. Posterior end of body conical, terminating in straight, stiff tail spike 243 ± 27 (192–288) long. Anus slitlike with slightly salient posterior lip, 486 ± 54 (384–576) from end of spike.

Taxonomic summary

Type host: Phrynohyas venulosa (Laurenti, 1768) (Anura: Hylidae), veined tree frog; male collected on 22 May 1997.

Type locality: Area de Conservación, Guanacaste, Costa Rica (10°57′N, 85°48′W).

Site of infection: Large intestine.

Type specimens: Holotype—male, U.S. National Parasite Collection, Beltsville, Maryland, USNPC 93494. Allotype—female (USNPC 93495). Paratypes—9 females, 9 males (USNPC 93496).

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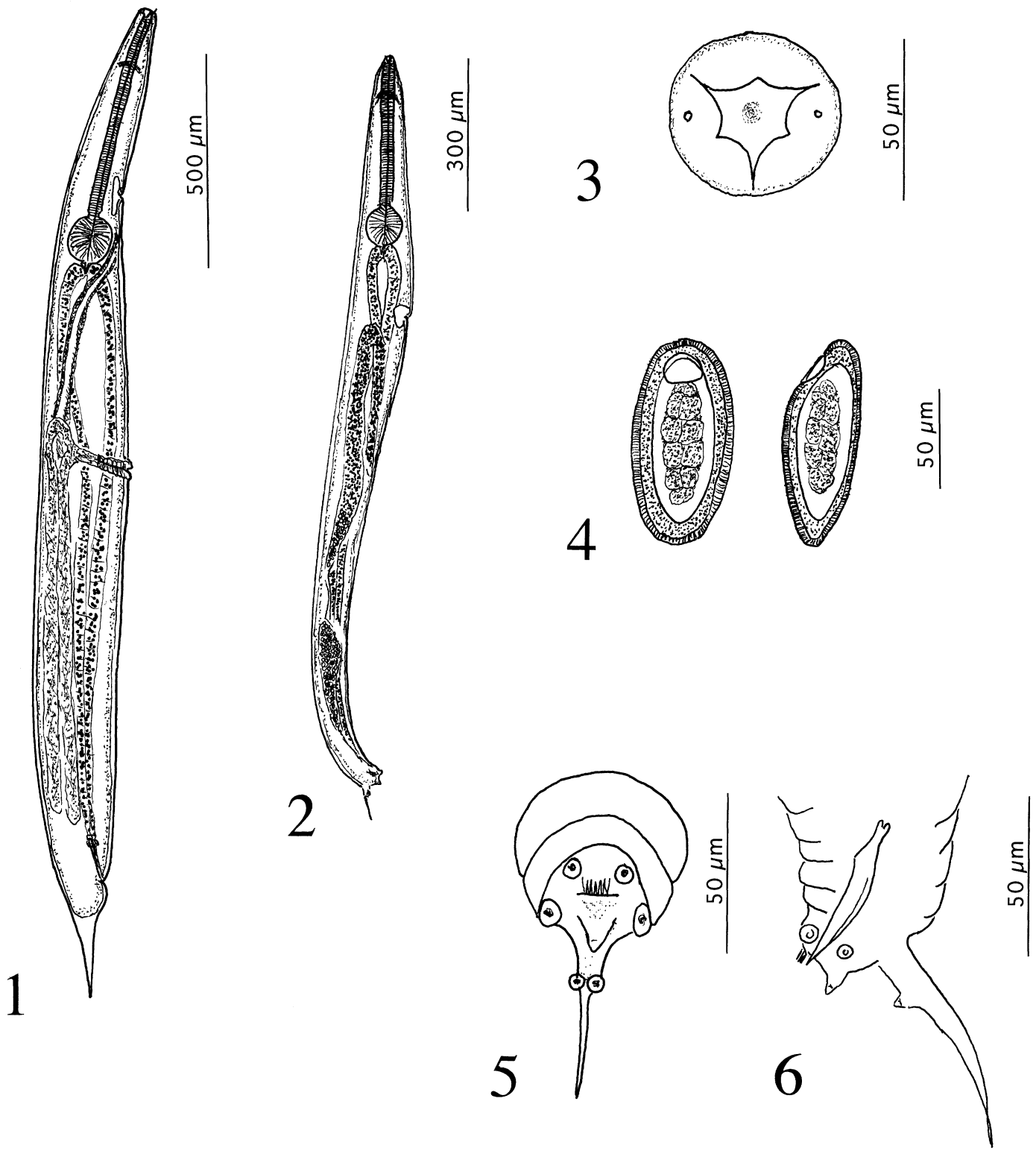
* Department of Zoology, University of Toronto, Toronto, Ontario M5S 3G5, Canada.



FIGURES 1–6. *Parapharyngodon duniae* n. sp. **1.** Female, nongravid, entire, lateral view. **2.** Male, entire, lateral view. **3.** Female, en face view. **4.** Eggs, morula stage of development. **5.** Male, posterior end, ventral view. **6.** Male, posterior end, lateral view.

Etymology: The new species is named after Sra. Dunia Garcia, parataxonomist working in the Area de Conservación Guanacaste, in recognition of her efforts on behalf of the parasite inventory project.

Remarks

We assigned these specimens to *Parapharyngodon* based on the morphology of the egg, i.e., a subterminal operculum, and

a larva in the morula stage of development. The most recent list of Neotropical species of *Parapharyngodon* is that of Ramallo et al. (2002). Of the Neotropical species, *P. duniae* is most similar to *P. riojensis* Ramallo, Bursey and Goldberg, 2002, by having an ovary that does not wrap around the esophagus, eggs that are subovate with a thick, punctated shell, and similar placement of caudal papillae (1 pair ventral, preanal; 1 pair lateral, postanal; 1 median, postanal; 1 pair on caudal appendage). These 2 species differ in the location of the excretory pore of the females, posterior to the esophageal bulb in *P. riojensis* and anterior to the esophageal bulb in *P. duniae*. In addition, the spicule of *P. riojensis* is approximately twice the length of that of *P. duniae* (90–110 vs. 40–49, respectively).

DISCUSSION

The discovery of *P. duniae* requires that a new couplet be placed in the key of Ramallo et al. (2002) as follows:

3b. Eggs oval; thick, punctated shell 3i
3ia. Female excretory pore posterior to esophageal bulb . . . *P. riojensis*
3ib. Female excretory pore anterior to esophageal bulb . . . *P. duniae*

As stated in the introduction, this study represents the third report of helminth parasites in *P. venulosa*, totaling 4 species. Previous studies listed the monogenean *Polystoma lopezromani* from Argentina (Combes and Laurent, 1979) and the nematodes *Batracholandros spectatus* and *Physalotera* sp. (larvae) from Peru (Bursey et al., 2001).

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