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Gamidactylus piranhus sp. nov. (Copepoda, Vaigamidae) from the nasal fossae of serrasalmid fishes from the Três Marias Reservoir, Upper São Francisco River, Minas Gerais State, Brazil

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Abstract

Gamidactylus piranhus sp. nov. (Copepoda, Vaigamidae) from the nasal fossae of “San Francisco piranha”, *Pygocentrus piraya* (Cuvier, 1819) and “White piranha” *Serrasalmus brandtii* (Lütken, 1875) is described. The new species is similar to the type species of the genus, *Gamidactylus jaraquensis* Thatcher et Boeger, 1984, but differs from it in the following respects: the cephalothorax is shorter, the free thoracic segments are usually longer, leg 5 is reduced to a simple seta and a spine on the second antennal segment is lacking. *Gamidactylus bryconis* Varella, 1995 and *Gamidactylus hoplii* Varella et Malta, 1996, do not closely resemble the new species because they are much larger and both present leg 5 reduced to a double seta.

Keywords

Gamidactylus piranhus, *Pygocentrus*, *Serrasalmus*, Três Marias Reservoir, São Francisco River, Brazil

Introduction

Vaigamidae and *Vaigamus* were proposed by Thatcher and Robertson (1984) to include two new species found in zooplankton, *Vaigamus retrobarbus* (type species), from Marchantaria Island, Amazonas State, Brazil and *V. spinicephalus*, from Tocantins River, Pará State, Brazil. Later, Thatcher and Boeger (1984a, b, c) described three other genera and species of this family, namely: *Gamidactylus jaraquensis*, *Gamispatulus schizodontis* and *Gamispinus diabolicus*, respectively. Subsequently, *Gamidactylus bryconis* was described from *Brycon pellegrini* Holly, 1929 = *B. amazonicus* (Spix et Agassiz, 1829) and *B. melanopterus* (Cope, 1872) by Varella (1995) and *Gamidactylus hoplii* from *Hoplias malabaricus* (Bloch, 1794) by Varella and Malta (1996). All of these species were found in the Amazon River Basin.

Amado *et al.* (1995) based on cladistic analysis considered Vaigamidae to be a synonym of Ergasilidae. They apparently gave more weight to the similarities in mouthparts and leg morphology between these groups. We continue to believe that

Vaigamidae deserve family status because of the moveable lateral retrostylets. The presence of these structures implies profound modifications in thoracic musculature and nerve supply.

The present paper reports the first species of Vaigamidae known from the São Francisco Basin and the fourth species of the genus *Gamidactylus*.

Materials and methods

The fish hosts *Pygocentrus piraya* (Cuvier, 1819) and *Serrasalmus brandtii* (Lütken, 1875) were captured in the Três Marias Reservoir (18°12'59"S, 45°17'34"W), Upper São Francisco River, in the municipality of Três Marias, Minas Gerais State, Brazil, between January 2004 and July 2005. Host voucher specimens were deposited in Museu de Zoologia of the Universidade de São Paulo, USP, São Paulo State, Brazil (MZUSP no. 95149 – *P. piraya*; MZUSP no. 95150 – *S. brandtii*). Copepod parasites from the nasal fossae were removed

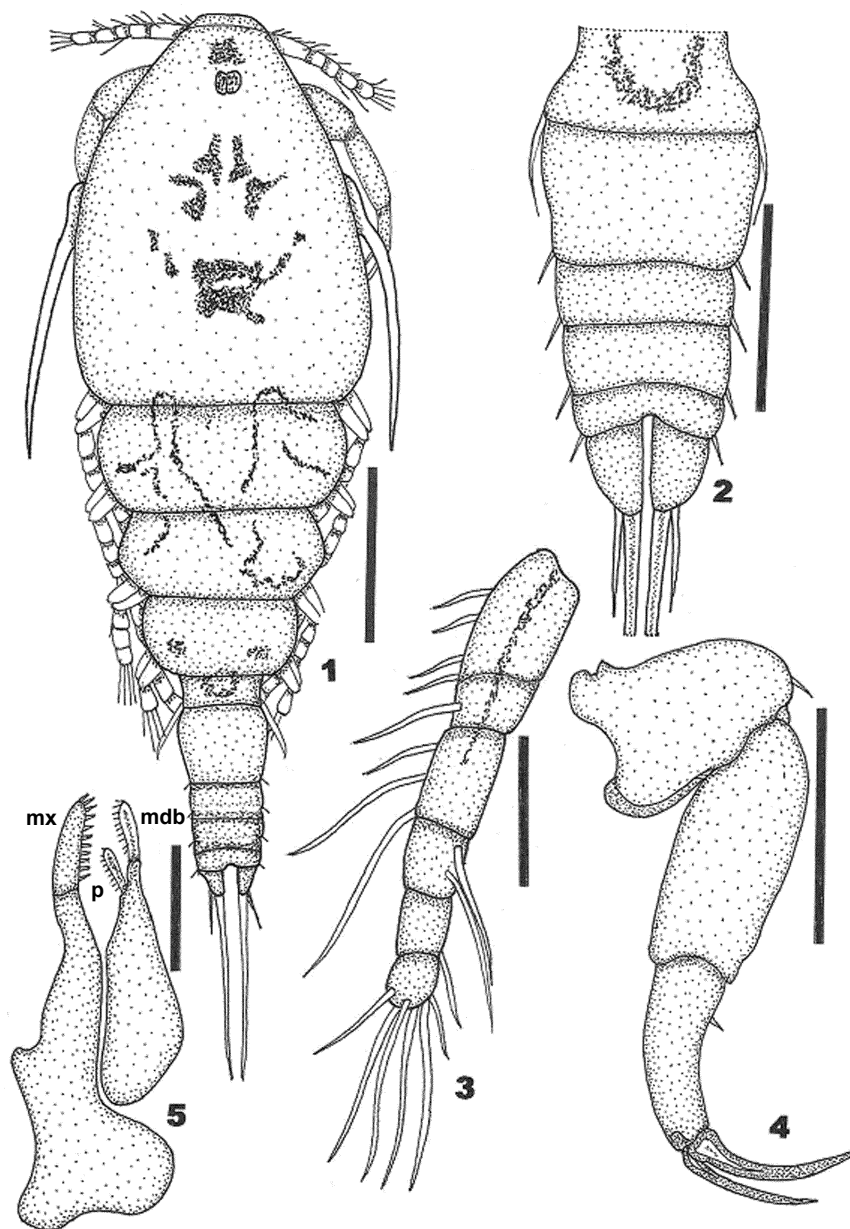
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using jets of distilled water and fixed in 70% alcohol. They were sent to a laboratory of the Zoology Department, Universidade Federal do Paraná, Curitiba, Paraná State, for study. The specimens were stained in 95% alcohol with small amounts of eosin and orange-G, dehydrated in pure phenol, cleared in methyl salicylate (Thatcher 2006) and mounted on microscope slides in Canada balsam. Some specimens were dissected to study the structures isolated. Digital photographs made through a light microscope were utilized in making the drawings. Measurements were taken with a measuring ocular

and are expressed in micrometres (μm). Extremes were followed by the means in parentheses. The parasitological terms used are those suggested by Bush *et al.* (1997).

Type specimens of the new species were deposited in the Crustacea Collection of the Instituto Nacional de Pesquisas da Amazonia (INPA), Manaus, Brazil.

Type specimens of *G. jaraquensis* (holotype: INPA 062) and *G. bryconis* (paratypes: INPA 533a-e), from the Crustacea Collection of INPA were examined for comparison with the new species.



Figs 1–5. *Gamidactylus piranhus* sp. nov. (female) from *Pygocentrus piraya* (Cuvier, 1819): 1. Entire, dorsal view. 2. Genital segment and abdomen. 3. Antennule. 4. Antenna. 5. Mouthparts (mdb – mandible, mx – maxilla, p – palp). Scale bars = 100 μm (1); 50 μm (2, 4); 25 μm (3); 10 μm (5)

Results

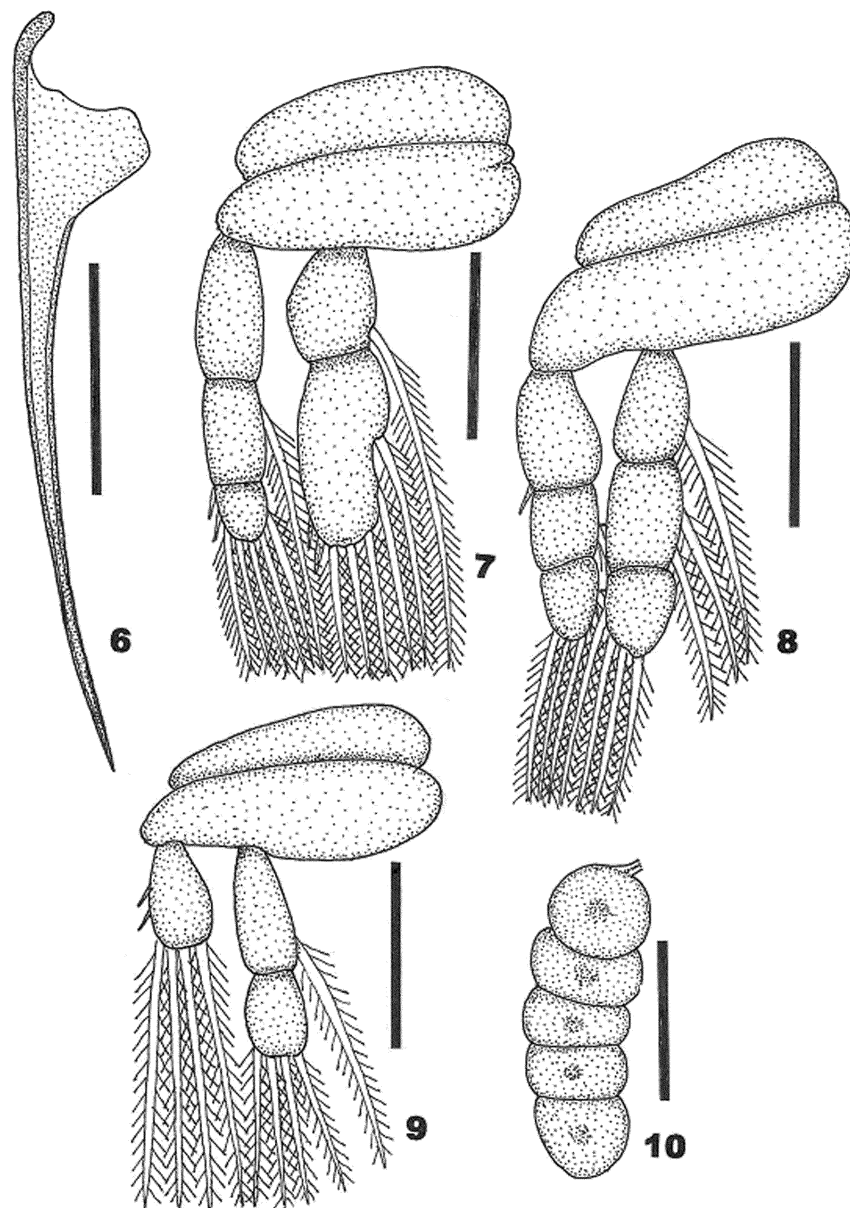
Vaigamidae Thatcher et Robertson, 1984

Gamidactylus Thatcher et Boeger, 1984

Gamidactylus piranhus sp. nov. (Figs 1–10)

Species diagnosis (based on eight adult females studied and measured; measurements in Tables I and II). Body elongate, eye and body pigmentation small blue (color 70 of Smithe 1974), cephalothorax tapered anteriorly, incorporating thoracic segments one and two; thorax of five free segments

(including genital complex) (Fig. 1). Abdomen (Fig. 2) of three segments with lateral spinules; third abdominal segment shorter than other two. Caudal ramus with two, long, terminal setae (Fig. 1). Antennule (Fig. 3) of six segments provided with simple setae; setal formula 4–1–3–2–1–6; first segment longer than others. Antenna (Fig. 4) three-segmented; first with minute lateral spine; second unarmed; third elongate with short seta at base and surmounted with hook and hook-like; moveable elongate spine. Mandible and palp with posterior bristles; maxilla with anterior denticles and maxillule absent (Fig. 5). A pair of strong and long moveable lateral retrostylets on the first thoracic segment (Fig. 6). Legs (Figs 7–9,



Figs 6–10. *Gamidactylus piranhus* sp. nov. (female) from *Pygocentrus piraya* (Cuvier, 1819): **6.** Retrostylet. **7.** Leg 1. **8.** Leg 2 = leg 3. **9.** Leg 4. **10.** Egg sac. Scale bars = 50 μ m (6, 10); 25 μ m (7, 8, 9)

Table I. Measurements (in μm) of eight adult females of *Gamidactylus piranhus* sp. nov. collected from *Pygocentrus piraya* (Cuvier, 1819) and *Serrasalmus brandtii* (Lütken, 1875) from the Três Marias Reservoir, Upper São Francisco River, Minas Gerais State, Brazil

	Length	Width
Body (without caudal setae)	360–520 (444)	110–175 (146)
Cephalothorax	162–235 (196)	110–175 (146)
Retrostylet	90–160 (119)	–
Free thoracic segments		
III	38–79 (49)	100–137 (112)
IV	38–62 (48)	56–112 (83)
V	29–60 (45)	50–110 (84)
VI	13–25 (21)	25–59 (47)
VII (genital)	38–40 (38)	48–59 (52)
Abdominal segments		
I	12–19 (15)	33–47 (41)
II	12–16 (14)	33–44 (39)
III	10–13 (11)	30–38 (34)
Caudal rami	17–25 (22)	14–17 (15)
Caudal setae	119–200 (152)	–
Egg sac	102–225 (164)	–
Egg diameter	25–37 (30)	

Table III): Leg 1 (Fig. 7): endopod two-segmented, exopod three-segmented; first endopodal segment with one pinnate medial seta; terminal segment with two small spines and five pinnate setae; first exopodal unarmed; second segment with one medial pinnate seta; terminal segment with two small spines and five pinnate setae. Leg 2 = Leg 3 (Fig. 8): endopod and exopod three-segmented; first endopodal segment with one medial pinnate seta; second segment with two medial pinnate setae; terminal segment with four pinnate setae; first exopodal segment with one small lateral spine; second with one medial pinnate seta; terminal segment with five pinnate setae. Leg 4 (Fig. 9): endopod two-segmented, exopod consisting of a single segment; first endopodal segment with one medial pinnate seta; terminal segment with four pinnate setae; exopodal segment with two small spines and four pinnate setae. Leg 5 (Fig. 2) reduced to single, simple seta. Egg sac (Fig. 10) with eggs in single chain, number 5–8; eggs large.

Type host: *Pygocentrus piraya* (Cuvier, 1819), “San Francisco piranha” (Characiformes, Characidae).

Table II. Measurements (in μm) of the antennule and antennae of eight adult females of *Gamidactylus piranhus* sp. nov. collected from *Pygocentrus piraya* (Cuvier, 1819) and *Serrasalmus brandtii* (Lütken, 1875) from Três Marias Reservoir, Upper São Francisco River, Minas Gerais State, Brazil

	Length	Width
Antennule	75–107 (91)	15–21 (19)
Antenna		
Segment I	38–69 (53)	25–40 (34)
Segment II	62–90 (67)	14–25 (18)
Segment III	29–44 (37)	10–16 (13)
Claw	25–35	8–10 (9)

Table III. Leg armament formula of *Gamidactylus piranhus* sp. nov. collected from *Pygocentrus piraya* (Cuvier, 1819) and *Serrasalmus brandtii* (Lütken, 1875) of the Três Marias Reservoir, Upper São Francisco River, Minas Gerais State, Brazil. Roman algarism refer to spines and Arabic algarism to setae

	Exopod	Endopod
Leg I	0–0, 0–1, II–5	0–1, II–5
Leg II	I–0, 0–1, 0–5	0–1, 0–2, 0–4
Leg III	I–0, 0–1, 0–5	0–1, 0–2, 0–4
Leg IV	II–4	0–1, 0–4

Other host: *Serrasalmus brandtii* (Lütken, 1875), “White piranha” (Characiformes, Characidae).

Site: Nasal fossae.

Male: Unknown.

Prevalence: 10.2% (*P. piraya*) and 7.7% (*S. brandtii*).

Intensity: 1–9 (*P. piraya*) and 1–3 (*S. brandtii*).

Mean intensity \pm SD: 3.09 ± 2.84 (*P. piraya*) and 1.61 ± 0.77 (*S. brandtii*).

Mean abundance \pm SD: 0.31 ± 1.28 (*P. piraya*) and 0.12 ± 0.48 (*S. brandtii*).

Type locality: Três Marias Reservoir (18°12'59"S, 45°17'34"W), Upper São Francisco River, Três Marias, Minas Gerais State, Brazil.

Holotype: Female, INPA-CR 1562, nasal fossae of *P. piraya* (slide), August 2004.

Paratypes: Three females, INPA-CR 1563–1565, nasal fossae of *P. piraya* and *S. brandtii* (slides), August 2004. All collected by M.D. Santos in the Três Marias Reservoir.

Etymology: The specific name is in reference to popular name of the type host.

Discussion

Gamidactylus piranhus sp. nov. resembles the type species, *Gamidactylus jaraquensis* Thatcher et Boeger, 1984, in general size and in the length of the retrostylets, but it can be distinguished from the latter by the following characters. The cephalothorax is shorter in the new species than in the type (162–235 vs 205–247). The free thoracic segments of the new species usually are longer than those in the type (III = 38–79 vs 37–50; IV = 38–62 vs 35–47; V = 29–60 vs 27–37; VII genital segment = 38–40 vs 27–37). The new species has leg 5 reduced to a simple seta, while in the three other species of the genus (*G. jaraquensis*, *G. bryconis* and *G. hopliis*) leg 5 has two setae. The new species lacks a spine on the second antennal segment, unlike the type and *G. bryconis*. The new species is not very similar to the other two species known for the genus, *G. bryconis* and *G. hopliis* since are much larger (*G. bryconis*: 464–576; *G. hopliis*: 424–536) compared to the new species (360–520). The new species can also be distinguished from *G. bryconis* by having fewer antennule setae, shorter retrostylets and unarmed first exopod, besides absence of spine on the basipods of the four legs. The new species dif-

fers from *G. hoplius* in having fewer setae on antennule segments two to four, in lacking a spine on the first basipod and on the third endopodal segments of legs 2–3. Also, the exopods of legs 2–3 have only five pinnate setae on the terminal segments. Additionally, the new species is from a different host and a separate river basin of its congeners.

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