

New species of freshwater crab genus *Kingsleya* Ortmann, 1897 (Decapoda: Brachyura: Pseudothelphusidae) from Piauí, northeastern Brazil

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ABSTRACT

A new species of freshwater crab, *Kingsleya parnaíba* n. sp., collected in a tributary stream of the Parnaíba River Basin in Brazil, is described and illustrated. *Kingsleya parnaíba* n. sp. morphologically resembles *Kingsleya attenboroughi* Pinheiro and Santana, 2016 and *Kingsleya gustavo* Magalhães, 2005, from which it can be separated by a set of characters of the first gonopod, chelipeds, and female abdomen.

KEYWORDS

Biodiversity, Kingsleyini, Neotropical region, Parnaíba River, taxonomy

INTRODUCTION

In the last few years, several species of freshwater crabs of the tribe Kingsleyini have been described from Brazil (Magalhães and Türkay, 2008; Pedraza *et al.*, 2015; Pedraza and Tavares, 2015; Pedraza *et al.*, 2016; Pinheiro and Santana, 2016). Despite most species of this tribe being commonly distributed in the Amazon River Basin (Magalhães, 2005), recent studies have shown a great diversity outside this basin, with the Ceará State as the eastern limit (Pinheiro and Santana, 2016) and Rondônia State as

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the southwestern limit in Brazil (Magalhães *et al.*, 2014). The finding of *Kingsleya attenboroughi* Pinheiro and Santana, 2016 in a restricted area of humid forest remnants in the middle of the semiarid area of Brazil, instigated us to survey different areas for freshwater crabs. Consequently, we found a new species, *Kingsleya parnaíba* n. sp., in a small stream tributary of the Parnaíba River, which we describe and illustrate here in detail and compare to its congeners.

MATERIAL AND METHODS

The specimens were collected in the Riacho do Manezinho, close to the Parnaíba River, in the municipality of Ribeiro Gonçalves, 07°33'20"S 45°14'31"W (Fig. 1). The specimens were captured using “covo” traps with babaçu coconut (*Attalea speciosa* Mart. ex. Spreng.) and fish pieces as bait, and placed near the right margin of the stream.

Twelve traps were placed for approximately 12 hours. Following this, the crabs were placed in plastic bags, anesthetized on ice, and fixed in 70% ethanol.

The material studied here is deposited in the Instituto Nacional de Pesquisas da Amazônia (INPA); the Laboratório de Crustáceos do Semiárido da Universidade Regional do Cariri (LACRUSE); the Museu de Zoologia da Universidade de São Paulo (MZUSP); the Museu Paraense Emilio Goeldi (MPEG); and the National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM). Abbreviations used are: cl, carapace length (from the fronto-orbital region to the posterior margin of the carapace); cw, carapace width (measured at the widest point); coll., collector or collected by; det., determiner or determined by; m, meters; mm, millimeters; G1, gonopod 1; G2, gonopod 2; P1, cheliped; P2–P5, pereopods 2 to 5.

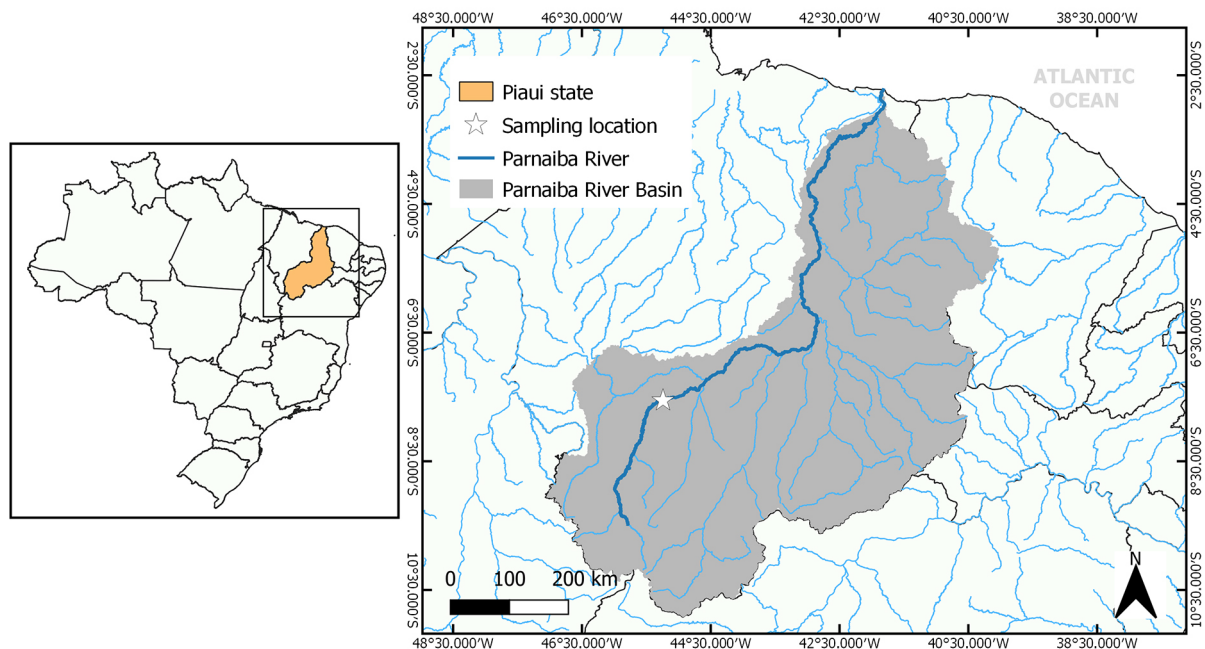


Figure 1. Map of Brazil indicating the state of Piauí, and the Parnaíba River Basin in detail. Sampling location marked with a star at the Riacho do Manezinho.

SYSTEMATICS

Family Pseudotelphusidae Ortmann, 1893

Tribe Kingsleyini Bott, 1970

Kingsleya Ortmann, 1897

Type species. *Kingsleya latifrons* (Randall, 1840) [*Potamia*] by monotypy, gender feminine.

Included species (genera of the original combination indicated in brackets). *Kingsleya attenboroughi* Pinheiro and Santana, 2016; *Kingsleya besti* Magalhães, 1990; *Kingsleya castrensis* Pedraza, Martinelli-Filho and Magalhães, 2015; *Kingsleya celioi* Pedraza and Tavares, 2015; *Kingsleya gustavoi* Magalhães, 2005; *Kingsleya hewashimi* Magalhães and Türkay, 2008; *Kingsleya junki* Magalhães, 2003; *Kingsleya latifrons*

(Randall, 1840) [*Potamia*]; *Kingsleya siolii* (Bott, 1967) [*Potamocarcinus* (*Kingsleya*)]; *Kingsleya ytipora* Magalhães, 1986.

Kingsleya parnaiba n. sp.

(Figs. 2A–E; 3A, B, D; 4A–D)

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Type material. Male holotype, cw 49.7mm, cl 32.4mm, Brazil, Piauí State, Ribeiro Gonçalves, Riacho do Manezinho, 07°33'20"S 45°14'31"W, 19.v.2019, G.P.B. Silva coll., in covo traps (MZUSP 40264). — Paratypes collected at the same locality: 1 male, cw 34.4mm, cl 22.3mm; 1 female, cw 56.9mm, cl 36.4mm (MZUSP 40265); 3 females, cw 42.2mm, cl 29.7mm; cw 45.7mm, cl 30.6mm; 52.5mm, cl 35mm (MZUSP 40266).



Figure 2. *Kingsleya parnaiba* n. sp., male holotype, cw 49.7mm, cl 32.4mm (MZUSP 40264): **A**, habitus, dorsal view; **B**, habitus, ventral view; **C**, cephalothorax, frontal view; **D**, **E**, left and right chelipeds in lateral view, respectively. Scale bars: **A–E**, 10 mm.

Comparative material. *Kingsleya attenboroughi*: Brazil, Ceará, Barbalha, Arajara district, 07°20'07.6"S 39°23'58.8"W, 17.iv.2016, male holotype, cw 46mm, cl 29.2mm, (MZUSP 34626). Paratypes: Brazil, Ceará, Barbalha, Arajara district, Córrego do Arajara, 04.v.2016, 1 male, cw 51.2mm, cl 31mm (MZUSP 34627); 1 female, cw 41.5mm, cl 26.7mm (MZUSP 34628); 1 male, cw 40mm, cl 26.1mm, 1 female, cw 35mm, cl 23mm (INPA 2208); 2 males, cw 36.8mm, cl 24mm; cw 36mm, cl 24mm; 1 female, cw 37.7mm, cl 24mm (LACRUSE 0221). — *K. castrensis*: Brazil, Pará, Caverna Pedra da Cachoeira, 03°19'14.8"S 52°19'53.1"W, R. Pinto-da-Rocha coll., 20.vi.2012, male, paratype, cw 50.9mm, cl 30mm (MZUSP 26394); Pará, Altamira, 03°19'14.8"S 52°19'53.1"W, R. Pinto-da-Rocha coll., 24.iii.2012, male, paratype, cw 32.7mm (MZUSP 25943). — *K. gustavo*: Brazil, Pará, Rio Itacaiúnas, Projeto Carajás, 17.vii.1988, 2 male paratypes, cw 37mm, cl 23.3mm; cw 19.5mm, cl 12.2mm (MZUSP 9699); Pará, Canaã dos Carajás, Gruta NV06, Andrade and Amoni coll., 22–28.v.2005, C. Magalhães det., 2 males (MZUSP 16702). — *K. junki*: Brazil, Pará, Rio Xingú, Vitória do Xingú, 02°53'S 52°01'W, R. Santos, C. Maciel and J.O. Dias coll., 03.xii.2000, male holotype, cw 33mm, cl 20.8mm (MPEG 777). — *K. latifrons*: Suriname, Anapaika Village, Rio Lawa, B. Malkin coll., 26.xi.1963, C. Magalhães det., 2 males, 2 females (MZUSP 1887); French Guiana, Cayenne, M. Mélinon coll., sampling date unknown, M. Campos det. in vi.1997, 1 male (USNM 30028); Brazil, Pará, Rio Trombetas, Cachoeira Porteira, V. P. Daniel *et al.* coll., 10.iv.1985, C. Magalhães det., 1 male, 1 female (MZUSP 7008); Amazonas, Imbó, Rio Uatumã, Cachoeira Morena, E. Ferreira *et al.* coll., 07.x.1987, 4 males (MZUSP 11673). — *K. ytupora*: Brazil, Pará, Rio Trombetas, Cachoeira Porteira, C. Magalhães *et al.* coll., 2–10.x.1985, 1 male, paratype, cw 48mm, cl 28.5mm, 2 females, paratypes, cw 64.5mm, cl 38mm; cw 55.6mm, cl 33mm (MZUSP 7009).

Description. Carapace ellipsoidal, 1.5 times wider than long, widest medially, dorsally smooth, slightly

convex anteriorly, regions poorly defined. Two distinct gastric pits on metagastric region. Cervical grooves marked, narrow, slightly divergent anteriorly, fading proximally, distal end almost reaching anterolateral margin. Intestinal, cardiac regions indistinct. Postfrontal lobules inconspicuous; median groove indistinct. Carapace between front, postfrontal lobules smooth, weakly concave. Front upper border smooth, angulate, slightly bilobed in dorsal view, median notch faint; lower border carinated, slightly sinuous in frontal view, not visible in dorsal view. Superior orbital margin smooth, lower orbital margin crenulated; exorbital angle low, somewhat acute; orbital cavity with several thick setae near exorbital angle. Inner orbital tooth well developed, broadly triangular, partially occluding orbital cavity. Anterolateral margin of carapace with very distinct depression just behind exorbital angle, followed by a set of minute teeth increasing in size from the anterior to posterior portion; posterolateral margin smooth, poorly defined.

Epistome narrow, deeply grooved transversally, upper margin straight, lower margin forming a mesial triangular tooth, deflexed, crenulated. Subhepatic region smooth; pterystogomial region with scarce pubescence bordering buccal frame.

Endopod of maxilliped 3 with ischium outer margin almost straight, subrectangular, slightly wider than merus; mesial margin setose, crista dentata with small, subquadrate, corneous teeth. Merus shorter than ischium, as wide as long, inner margin almost straight, with a small proximal lobe covered with several long setae; outer margin curved distally. Inner surface of palp covered with very few, small setae; outer margin of propodus and dactylus densely covered with long setae, carpus with few long setae. Third maxilliped exopod vestigial, about one fifth of ischium lateral margin length. Aperture of efferent branchial channel wide, subquadrate, lacking setae.

Chelipeds heterochelous in both males, females, more pronounced in males, similarly armed, right P1 usually largest (holotype left cheliped largest). Merus subtriangular in cross section; upper, mesial margins distinctly crenulated; inferior lateral margin with row of distinct small tubercles, not reaching

the proximal, distal margins; distal margin arched, smooth laterally, crenulated mesially. Carpus with inner margin indented proximally, with prominent median spine, smooth distally; outer margin rounded, smooth. Propodus massive, upper, mesial, lateral, ventral surfaces smooth. Movable, fixed fingers with lateral, mesial, dorsal surfaces with punctations arranged in longitudinal subparallel lines; movable finger distinctly curved downwards. Largest cheliped with fingers noticeable gaping, tips crossing distally; cutting edges of fingers with small, acute teeth; fixed finger with two teeth medially slightly larger

than others; movable finger with few stronger teeth intercalated with smaller teeth. Smaller cheliped with gap between fingers less pronounced than larger one, with movable finger slightly arched; teeth shorter, more similar in size than larger cheliped. Smaller males and female chelipeds with smaller gaps between fingers, less curved movable fingers. P2–P5 slender, similar in shape, decreasing in size very slightly from P2 to P5. P2–P5 meri upper margin with sparse row of minute spines; dactyli punctuate in all surfaces, with five longitudinal rows of sharp spines, 3 dorsal, 2 ventral, increasing in size distally.

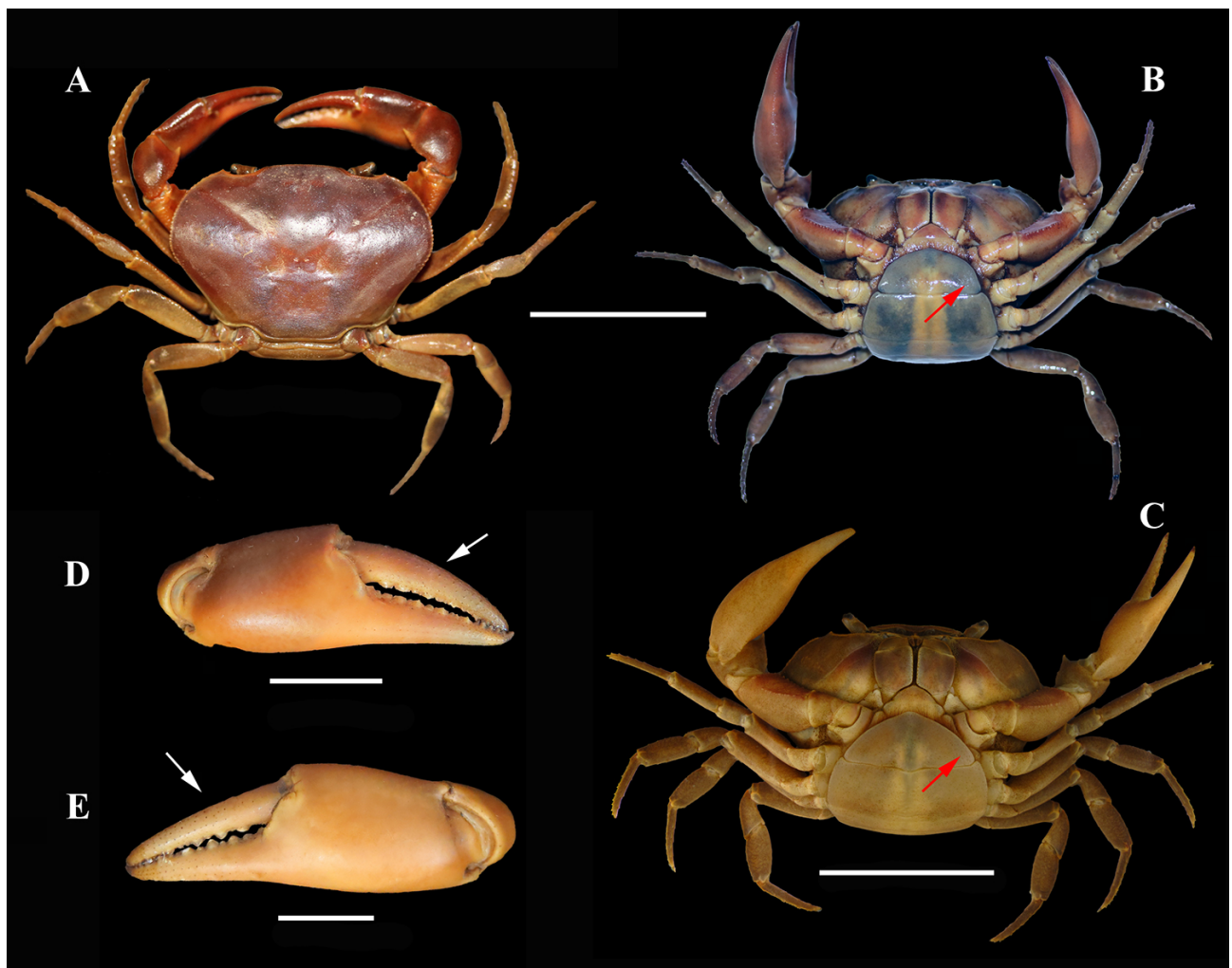


Figure 3. *Kingsleya parnaiba* n. sp., female paratype, cw 52.5mm, cl 35mm (MZUSP 40266): **A, B**, habitus, dorsal and ventral view, respectively. *Kingsleya attenboroughi* Pinheiro and Santana, 2016, female paratype, cw 41.5mm, cl 26.7mm (MZUSP 34628): **C**, habitus in ventral view. *Kingsleya parnaiba* n. sp., male holotype, cw 49.7mm, cl 32.4mm (MZUSP 40264): **D**, right (minor) cheliped. *Kingsleya attenboroughi*, male, cw 51.9mm cl 32.4mm (LACRUSE 0269): **E**, left (minor) cheliped. Notice the differences in the female sixth somite and telson (red arrows), and the movable finger of the smaller cheliped (white arrows). Scale bars: **A–C**, 30mm; **C**, 20mm; **D, E**, 10 mm.

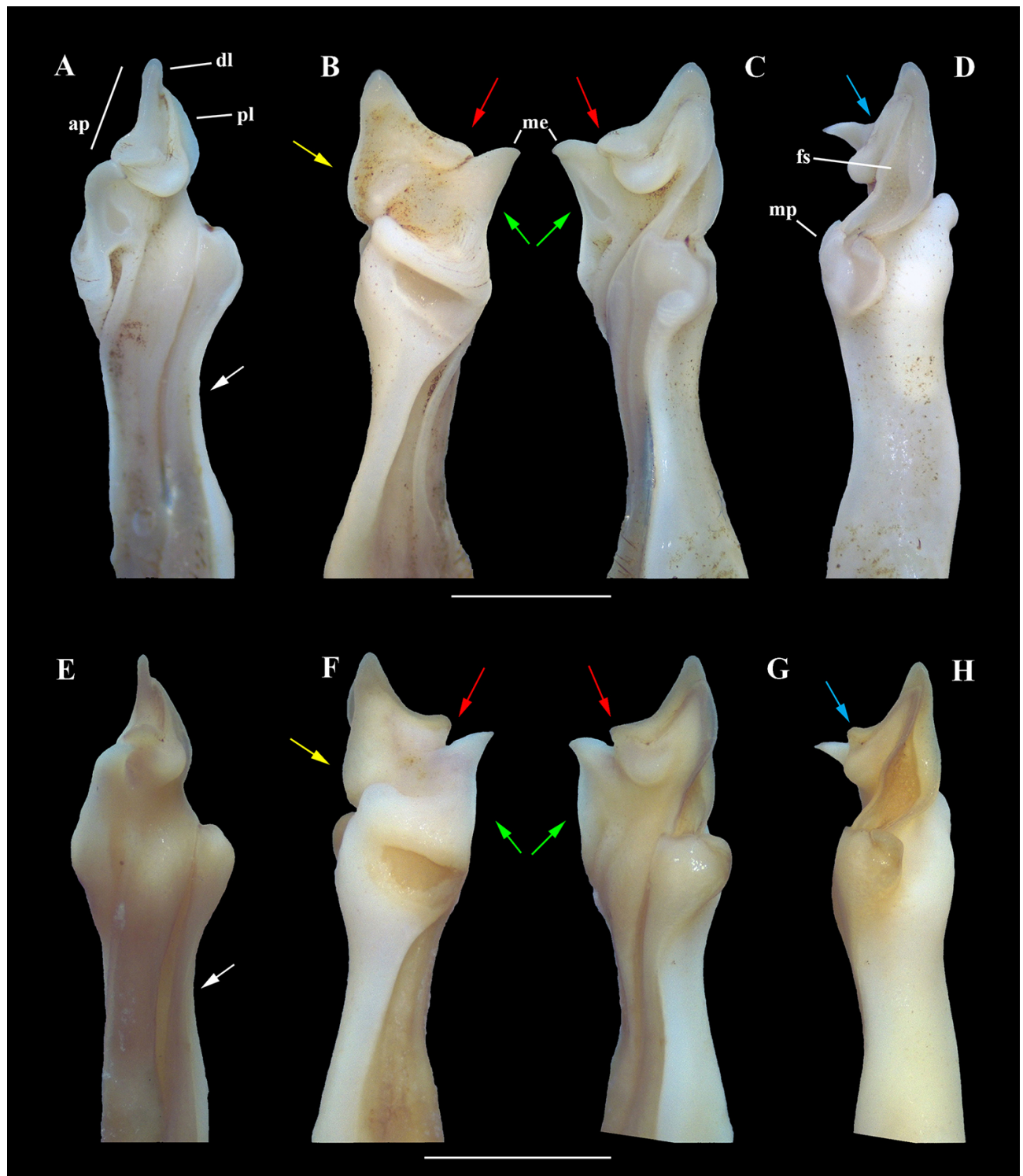


Figure 4. *Kingsleya parnaiba* n. sp., male holotype (MZUSP 40264): **A–D**, distal region of left first gonopod in sternal, lateral, mesial and abdominal views, respectively. *Kingsleya attenboroughi* Pinheiro and Santana, 2016, male paratype (MZUSP 9699): **E–H**, distal region of left first gonopod in sternal, lateral, mesial and abdominal views, respectively. Abbreviations: ap, apical plate; dl, distal lobe; fs, field of apical spines; me, mesial process; mp, marginal process; pl, proximal lobe. Notice the differences in the curvature on the abdominal surface (white arrows); medial portion of the mesial process (green arrows); mesial process and apical plate (red arrows); proximal lobe of the apical plate with a semicircular basal protuberance (blue arrows). Scale bars: **A–H**, 2mm.

Thoracic sternum longer than broad. Sternites 1 to 4 fused. Sternal sutures 4/5 to 7/8 very distinct, sternal sutures 4/5 and 5/6 ending just before reaching median line of thoracic sternum, sternal sutures 6/7 and 7/8 ending in median line of thoracic sternum. Episternites 4–6 subtriangular, episternite 7 shorter, truncated in males, triangular in females. Episternites 4–7 fringed with short setae, longer in females. Sterno-abdominal cavity deeply excavated, shallower in females; sternites 5 to 8 densely covered medially with distinct long, thin setae, sternite 4 with few long setae in males, females with sparse setae mostly on sternites 1–4; tubercle of abdominal holding system reduced in males, almost imperceptible in females, placed near sternal suture 5/6 in males. Male and female pleon with 6 free somites. Male pleon tapering distally from third to sixth somite; telson triangular; margins, including telson, densely setose, setae short. Female pleon somewhat rounded, sixth somite longer, wider; sixth somite and telson forming a subtrapezoid pleotelson. Penis distinctly long, larger proximally, tapering distally, emerging near coxosternal condyle articulation.

G1 sinuous, broadened distally, abdominal surface with distinct curvature mesially, with well-developed mesial process. Marginal suture in mesial surface, almost straight, displaced to mesial side distally, with several long setae proximally. Lateral suture deep, approximately 2/3 of gonopod length from proximal portion. Marginal process short, broad, subtrapezoidal in mesial view, not projecting distally beyond field of apical spines, distal notch in latero-abdominal surface. Mesial process short, subtriangular, medial portion forming obtuse angle, distal portion protruded into sharp conical spine curved in anteromesial direction, mesial process and apical plate attached. Apical plate with two large, subtriangular lobes, completely separated from each other by distinct groove in mesial and sternal views, proximal lobe with semicircular protuberance compressed in mesial and sternal views; distal lobe with a median constriction, noticeable in lateral and mesial views. Sperm channel opening near the base of apical plate in sternal view. Apical spine field well developed, better visible in sternal view, curved proximally, with a patch of minute spines concentrated medially, longitudinally directed along abdominal side of apical plate, delimited by mesial

border of distal lobe and lateral border of proximal lobe of apical plate, distally closed.

G2 slightly sinuous, almost as long as G1, distinctly slender, distal 3/4 tapered; tip flattened, with numerous short spinules on sternal surface.

Type locality and distribution. So far known only from the type locality in the Riacho do Manezinho, in the municipality of Ribeiro Gonçalves, state of Piauí, Brazil, 07°33'20"S 45°14'31"W. However, due to the proximity of the sampling location to the main channel of the Parnaíba River, we did not rule out the possibility of finding *K. parnaiba* n. sp. in this river.

Ecological notes. We collected the specimens at the Riacho do Manezinho, a small stream in the peri-urban region of the Ribeiro Gonçalves, an area of recent agricultural expansion, especially with soybean cultivation (Buainain and Garcia, 2015). The Riacho do Manezinho stream has its margins partially deforested (Fig. 5A) and is surrounded by plantations and livestock on the left bank and by an urban area on the right bank. It is located in a flat area of semi-deciduous tropical Cerrado, locally known as Mata dos Cocais (Castro *et al.*, 1998), an ecotonal area between Cerrado (a savanna-like biome) and the Amazon forest domains. The stream is located approximately 190 m above sea level; it is shallower than 1 m and 5 to 7 m wide (Fig. 5B). The stream is perennial, with low to medium energy, sandy/muddy bottoms, and turbid waters. Burrows were not observed on the margins or in the riverbed.

Etymology. The specific epithet “parnaíba” refers to the name of the river basin where the new species was found. The name is used as a noun in apposition.

Remarks. *Kingsleya parnaiba* n. sp. shares several characters of the G1 with other *Kingsleya* species: the apical plate of the G1 is bilobed with lobes partially overlapping; the marginal process is distally enlarged, not surpassing the apical field of spines; the mesial process is distinctly separated from the apical plate and stands out from the sternal surface of the principal axis of the G1; and the field of apical spines is distally divided by a terminal notch (Fig. 4A–D) (Magalhães and Türkay, 2008; Pedraza and Tavares, 2015;

Pinheiro and Santana, 2016). Among its congeners, *K. parnaíba* n. sp. is very similar to *K. attenboroughi* and to some extent *K. gustavoii*, but can be distinguished from both by several features. These are: (i) an abdominal surface with distinct curvature mesially (*vs.* shallow curvature on the abdominal surface mesially in *K. attenboroughi* and *K. gustavoii*; Fig. 4A, E); (ii) a medial portion of the mesial process forming an obtuse angle (*vs.* a mesial process with a straight proximal portion in *K. attenboroughi*, rounded in *K. gustavoii*; Fig. 4B–C, F–G); (iii) mesial process and apical plate fused at base (*vs.* a mesial process separated by a deep notch from the apical plate in *K. attenboroughi* and a small incision in *K. gustavoii*; Fig. 4B–C, F–G); (iv) lobes of the apical plate that are completely separated from each other by a distinct groove (*vs.* lobes of the apical plate that are separated by a groove distally and fused near the base in *K. attenboroughi* and in *K. gustavoii*; Fig. 4C, G); (v) proximal lobe of the apical plate with a semicircular basal protuberance compressed (*vs.* a proximal lobe with a conspicuous semicircular basal protuberance in *K. attenboroughi* and a proximal lobe of the apical plate partially folded distally over the mesial crest of the field of apical spines in *K. gustavoii*; Fig. 4A, D, E, H). Other morphological differences between *K. parnaíba* n. sp. and *K. attenboroughi* are: (vi) female sixth somite

and telson forming a subtrapezoid pleotelson (*vs.* lateral margins of the female sixth somite rounded, with a broadly triangular telson in *K. attenboroughi*; Fig. 3B–C); and (vii) movable finger of the smaller cheliped slightly arched and about the same size as the palm (*vs.* movable finger of the smaller cheliped almost straight and slightly shorter than palm in *K. attenboroughi*; Fig. 3D, E). The characters (vi) and (vii) are observable in all specimens of *K. parnaíba* n. sp.

Also, both species, *K. parnaíba* n. sp. and *K. attenboroughi*, inhabit different habitats and hydrographic basins. *Kingsleya parnaíba* n. sp. is found in the lowland areas of the Parnaíba River valley, approximately 190 m above sea level, whereas *K. attenboroughi* is only found in very small, isolated streams of the Chapada do Araripe, about 750 m above sea level. *Kingsleya parnaíba* n. sp. inhabits a stream with sandy/muddy bottoms and turbid waters and *K. attenboroughi* inhabits streams with bottoms of consolidated sandstone blocks and clear water. On the other hand, *K. parnaíba* n. sp. and *K. attenboroughi* share the fact that they occur in areas heavily impacted by anthropogenic changes to the environment, with agricultural expansion, deforestation, pollution and irregular use of water resources being the main problems.



Figure 5. Habitat of *Kingsleya parnaíba* n. sp. at type locality in the Riacho do Manezinho, Ribeiro Gonçalves, Piauí, Brazil, 07°33'20"S 45°14'31"W. **A**, Width of the stream showing the partially deforested margins; **B**, sampling activities; notice the shallow depth of the stream and the turbid waters.

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