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A new species of *Heptapterus* Bleeker 1858 (Siluriformes, Heptapteridae) from the Uruguay River Basin in Misiones, Northeastern Argentina

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Abstract

In this paper we describe *Heptapterus mandimbusu* **sp. n.**, a new species of heptapterid catfish from a small tributary of the Uruguay River Basin in Misiones-Argentina. This new species is distinguished from all other congeners by the unique coloration pattern with aggregated melanophores scattered on dorsal and lateral surface of body, forming conspicuous size-variable blotches, and the combination of a long interdorsal distance (13.8–18.9 % SL), 14–18 anal-fin rays, short maxillary barbels (52.2–74.5 % HL), and the adipose fin confluent with caudal fin.

Key words: *Heptapterus mandimbusu*, new heptapterid, Melo Stream, Argentinian ichthyofauna

Resumen

En este trabajo describimos *Heptapterus mandimbusu* **n. sp.**, una nueva especie de heptaptérido que habita en un pequeño arroyo tributario de la cuenca del río Uruguay en Misiones, Argentina. Esta especie nueva se distingue de sus congéneres por el patrón de coloración único, con melanóforos agrupados y dispersos en las superficies dorsal y lateral del cuerpo, formando pequeñas manchas conspicuas de tamaño variable y la combinación de una distancia interdorsal larga (13,8–18,9 % LE), 14–18 radios en la aleta anal, barbillas maxilares cortas (52,2–74,5 % LC) y la aleta adiposa confluente con la aleta caudal.

Palabras clave: *Heptapterus mandimbusu*, nuevo heptaptérido, Arroyo Melo, ictiofauna argentina

Introduction

Recent collecting expeditions to Misiones, northeastern Argentina, allowed us to discover a new species of catfish from the Uruguay River Basin, which has all the characters proposed by Mees (1974) to define *Heptapterus*, as the body form, length of barbels, eye size, number of anal-fin rays, length of adipose fin, and its confluence with caudal fin, among others.

Heptapterus is distributed in South America from Suriname to Buenos Aires, Argentina, and along the Andean region of Argentina, Bolivia, and Peru (Bockmann & Guazelli 2003). It includes 10 valid species of which three are present in Argentina, the type species of the genus, *H. mustelinus* Valenciennes, and the most recently described species, *H. qenqo* Aguilera, Mirande & Azpelicueta and *H. mbya* Azpelicueta, Aguilera & Mirande (Aguilera *et al.* 2011; Azpelicueta *et al.* 2011). *Heptapterus mustelinus* is widely spread in La Plata and Uruguay River basins, and coastal drainages of southern Brazil (Bockmann & Guazzelli, 2003), while the two remaining species have more restricted distributions. *Heptapterus qenqo* is an endemic species from the Salí River basin in Northwestern Argentina and *H. mbya* is restricted to several streams tributaries of the Paraná River basin.

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The aim of this work is to describe a new heptapterid species from the Melo Stream, Uruguay River basin. The species is assigned to the genus *Heptapterus* given the current definition of the genus.

Materials and methods

The specimens were sampled by electrofishing in the Melo stream, Uruguay River basin. After immersion in an anesthetic solution (0.1% 2-phenoxyethanol), specimens were fixed in a 10% formalin solution and preserved in 70% ethanol. Specimens were cleared and counterstained (C&S) following Taylor & Van Dyke (1985). The vertebral count excludes the elements of the Weberian complex, while the compound preural+ural centrum was counted as one element. Measurements were taken following Aguilera *et al.* (2011) with caliper down to the nearest 0.1 mm. The proportions are expressed as percentages of standard length (SL) and head length (HL). Nomenclature of the laterosensory cephalic system follows Arratia & Huaquín (1995) and Schaefer & Aquino (2000). Comparative data of the *Heptapterus* species were taken, in addition to personal observations, from Ihering (1907), Haseman (1911), Miranda Ribeiro (1911), Boeseman (1953), Mees (1967), and Buckup (1988).

Institutional acronyms: CI-FML (Colección Ictiológica Fundación Miguel Lillo, San Miguel de Tucumán); IBIGEO-I (Instituto de Bio y Geociencias del NOA, Salta); LGEP (Laboratorio de Genética Evolutiva- Peces, Posadas); MACN (Museo Argentino de Ciencias Naturales, Buenos Aires); ZVC-P (Zoología de Vertebrados, Facultad de Ciencias, Montevideo); FMNH (Field Museum of Natural History, Chicago); MZUSP (Museu de Zoologia da Universidade de São Paulo).

Results

***Heptapterus mandimbusu*, sp. n.**
Fig. 1, Table 1

Holotype. CI-FML 7238, 134.2 mm SL, Argentina, Misiones, Uruguay River basin, Melo stream, 27°25'2.67"S, 54°42'7.93"W, November 13, 2016. G. Aguilera, J. M. Mirande, G. Terán, M. Benitez, D. Baldo, J. M. Ferro and F. Alonso.

Paratypes. All material collected with Holotype. CI-FML 7239, 6 ex. (2 ex. C&S), 54.6 – 175.6 mm SL; LGEP 529, 1 ex., 107.4 mm SL; LGEP 530, 5 ex., 58.3–113.4 mm SL; LGEP 538, 1 ex. C&S, 70.5 mm SL; IBIGEO-I 446, 3 ex., 65.1–89.7 mm SL.

Diagnosis. *Heptapterus mandimbusu* is distinguished by its unique coloration pattern, with aggregated melanophores scattered on dorsal and lateral surfaces of body, forming conspicuous blotches of variable size (Fig. 1 and 2) *vs*. absence of this pattern in the remaining species of the genus. *Heptapterus bleekeri*, *H. fissipinnis, H. multiradiatus, H. mustelinus, H. qenqo, H. stewarti, H. sympterigium* and *H. tapanahoniensis* present a rather uniform earth-brown coloration pattern (with some irregular markings on head and sometimes indistinct on back in *H. bleekeri*); while *H. mbya* and *H. ornaticeps* have a uniform coloration pattern (greyish and blackish respectively).

There are three species of *Heptapterus* inhabiting Argentinean basins, the type species of the genus *Heptapterus mustelinus*, and the recently described, *H. qenqo* and *H. mbya*. *Heptapterus mandimbusu* n. sp., has a longer interdorsal distance (13.8–18.9 % SL), which distinguishes it from *H. mustelinus* (3.1–5.0 % SL), *H. qenqo* (9.5–13.2 % SL), and *H. mbya* (5.8–8.3 % SL). *Heptapterus mandimbusu* can be further distinguished from *H. mustelinus* by a shorter distance between the anal-fin origin and hypural plate (32.9–39.1 % SL vs. 39.6–45.7 % SL), a longer distance between the origins of pelvic and pectoral fins (24.5–28.1 % SL vs. 20.4–24.2 % SL), a shorter adipose-fin base (33.8–41.5 % SL vs. 51.5–59.6 % SL), a shorter anal-fin base (15.7–20.9 % SL vs. 20.9–28.0 % SL), a smaller orbital diameter (10.3–14.1 % HL vs. 15.0–19.9 % HL), and a lower number of anal-fin rays (14–18 vs 18–22). The number of free vertebrae in *Heptapterus mandimbusu* (47) is lower than in *H. qenqo* (51–52) and *H. mbya* (51–53), the caudal peduncle depth is shallowest than in *H. qenqo* (13.8–19.3 % SL vs. 19.8–25.4 % SL), and the adipose-fin base is shorter than in *H. mbya* (33.8–41.5 % SL vs. 47.4–58.55 % SL). From the remaining species of the genus, *Heptapterus mandimbusu* can be distinguished from *H. stewarti* Haseman and *H.*

sympterygium Buckup by the dorsal fin never reaching the adipose fin; from *H. bleekeri* Boeseman, *H. fissipinnis* Miranda Ribeiro, *H. multiradiatus* Ihering, *H. ornaticeps* Ahl, *H. stewarti* and *H. sympterygium* by the lower number of anal-fin rays (14–18 vs. 20–22; 23; 38–46; 19; 30 and 22–29 respectively); from *H. bleekeri*, *H. fissipinnis*, *H. multiradiatus*, *H. stewarti*, *H. sympterigium*, and *H. ornaticeps* by the shorter maxillary barbel length that never reaches the pectoral fin, even in small juveniles; and from *H. tapanahoniensis* Mees by the higher number of vertebrae (47 vs. 43) and branchiostegal rays (8–9 vs. 7) and the adipose fin confluent with the caudal fin (vs. separated). The monospecific genera *Acentronichthys* Eigenmann & Eigenmann, probably allied to *Heptapterus* due to the share of an elongated body and the adipose fin confluent to caudal fin, can be distinguished from *Heptapterus mandimbusu* by the caudal fin deeply forked (vs. distal profile of caudal fin slanted).

Description. Morphometric data of holotype and 16 paratypes presented in Table 1. Body and fins covered by small sharp papillae, more evident on dorsum. Papillae on first rays of dorsal, pectoral, and pelvic fins and upper caudal-fin lobe prolonged into small filament that can carry inside minute dark-brown soft structures, very thin and spiniform (see Figure 3 in Azpelicueta *et al*. 2011).

FIGURE 1. *Heptapterus mandimbusu* **sp. n.**, holotype CI-FML 7238, 134.2 mm SL, from Melo Stream, Nov 13, 2016.

TABLE 1. Measurement data for *Heptapterus mandimbusu* **sp. n.** expressed in percentage of the standard dimensions given above measurements. SL in mm. S.D.= Standard deviation.

	Holotype	Range n= 17	Mean	S.D.
Standard length	134.17	54.6–175.6		
Percent of standard length				
Body depth	16.1	10.7–16.1	13.3	1.4
Body width	16.4	13.6–17.7	15.8	1.2
Predorsal length	39.4	30.5–40.8	37.5	2.5
Prepectoral length	16.8	16.8–23.3	21.2	1.7
Prepelvic length	40.6	35.7–42.9	40.1	1.9
Preanal length	65.2	61.2–69.1	65.7	1.9
Preadipose length	61.5	58.5–65.5	61.0	1.8
Interdorsal distance	16.2	13.8–18.9	16.1	1.5
Caudal peduncle depth	6.7	6.0–7.9	6.8	0.5
Caudal peduncle length	18.2	13.8–19.3	16.7	1.6
Dorsal-fin origin-hypural plate	64.5	61.9–68.8	63.6	1.8
Pelvic-fin origin-hypural plate	60.7	59.0–65.0	61.0	1.4
Anal-fin origin- hypural plate	36.3	32.9–39.1	35.0	1.5
Pectoral-fin origin to pelvic-fin origin	22.3	19.2–23.4	21.2	1.3
Pelvic-fin origin to anal-fin origin	24.9	24.5–28.1	26.4	1.0
Adipose-fin base length	37.4	33.8–41.5	37.4	1.9
Adipose-fin depth	3.4	2.5–4.0	3.3	0.4
Anal-fin base length	17.8	15.7–20.9	18.5	1.5
Dorsal-fin base length	9.6	8.9–11.1	10.0	0.6
First dorsal-fin ray length	7.4	7.4–12.0	10.2	1.2
First branched dorsal-fin ray length	11.4	9.3–15.3	13.2	1.5
First pectoral fin ray length	7.8	6.2–10.2	8.6	1.1
First branched pectoral-fin ray length	9.1	8.2–13.7	11.6	1.5
Head length	22.0	19.0–24.9	22.5	1.3
Percent of head length				
Head width	76.9	68.6–77.2	72.2	2.6
Head depth	42.8	36.7–56.4	43.5	4.4
Interorbital distance	19.1	15.8–22.3	19.1	2.2
Orbital diameter	10.3	10.3–14.1	11.8	1.1
Snout length	41.1	34.7–41.5	37.9	2.1
Posterior nostril to orbit	9.1	7.8–12.6	9.8	1.4
Internarial distance	10.6	8.4–16.9	11.5	2.2
Postorbital distance	53.4	45.8–55.8	51.6	2.8
Snout- anterior nare distance	12.9	9.4–14.1	12.7	1.2
Maxillary barbel length	60.5	52.2–74.5	65.0	6.0
Mouth width	43.2	37.8–49.0	43.4	3.4

Dorsal profile of body slightly convex, from snout tip to dorsal-fin origin, almost straight through dorsal-fin base, concave along dorsal profile of peduncle. Ventral profile slanting ventrally from snout tip to vertical through middle opercle, slightly concave or straight to pelvic-fin origin, almost straight to anal-fin origin, and concave or almost straight to caudal fin. Maximum body depth at dorsal-fin origin. Maximum body width at level of pectoral fins, where body has circular section; posterior half of body increasingly laterally compressed to caudal peduncle.

Head depressed and broad, covered by thick skin. Anterior nostrils with tubular rim, located closer to snout tip than to eye. Posterior nostrils surrounded by a membrane, largest on anterior margin, and closer to eye than to snout tip. Snout rounded in dorsal view, moderated in size (2.4 to 2.9 times in HL). Small eyes (7.7 to 9.7 times in HL) covered by skin. Interorbital width containing 1.3 to 2.0 times orbital diameter. Mouth subterminal, wide and opening anteriorly. Premaxilla without backward projections, anterior margin convex and posterior one slightly slanted, with a single broad band carrying the teeth. Premaxillary teeth conical and fine placed in 8–10 irregular rows. One tooth band on each dentary; bands anteriorly broad and slender posteriorly; distal end of band following curvature of inner wall of dentary. Dentary teeth conical, placed in 6–8 irregular rows. Cranial fontanel long and slender, with its anterior margin at line through half length of lateral ethmoid and reaching posteriorly end of supraoccipital. Anterior fontanel slightly wider than posterior fontanel. Epiphyseal bar situated at line through posterior eye margin. Maxillary barbel base at same level that anterior nostril, with its basal third resting in deep sulcus. Maxillary barbel short (1.3 to 1.9 times in HL) not reaching pectoral-fin origin, even in small juveniles. Outer mental barbel base at vertical through posterior nostril, its tip reaching near vertical through tip of maxillary barbel. Inner mental barbel base at same level than outer mental barbel, its tip slightly surpassing vertical through posterior orbital margin.

Dorsal-fin origin a little anterior to vertical line trough pelvic-fin insertion, with one short unbranched ray (1.1–1.5 times in first branched dorsal-fin ray) and six branched rays. Dorsal fin not reaching adipose fin, separated from it by distance 1.1–1.8 of HL. Adipose-fin origin slightly anterior to vertical through anal-fin origin. Adipose-fin base length short (2.4 to 3.0 times in SL) and confluent with caudal fin. Caudal-fin distal profile slanted, with i,6 + 6–7,i rays. Upper caudal-fin lobe longer and broader than lower lobe. Dorsal procurrent caudal-fin rays 9(3), ventral procurrent caudal-fin rays 12(1), 15(1), or 16(1). Anal-fin origin located on posterior half of body, with 14(1) 15(5), 16(6), 17(4*), or 18(1) rays. Anal-fin rays in two C&S specimens vi,10–11 (total anal-fin rays 16 and 17 respectively). Pectoral fin with i,7–8 (one specimen with 7 and 16* with 8). Tip of pectoral fin reaching half-length or less between pectoral- and pelvic-fin origins. Pelvic fin with i,5 rays. Pelvic, pectoral, anal, and dorsal fins with their distal margins rounded.

Cephalic sensory canal bearing five pores on supraorbital canal, five pores on infraorbital canal, and 11 on preoperculomandibular canal. Lateral line almost straight, complete, and uninterrupted, reaching compound caudal complex. Pores on anterior portion of lateral line well developed and almost inconspicuous on posterior portion.

FIGURE 2. Coloration pattern from two paratypes A. CI-FML 7239. 105. 2 mm SL. B: LGEP 529. 107.4 mm SL.

Counts on C&S material: vertebrae 47(3), precaudal vertebrae 11(2)–12(1), caudal vertebrae 35(1)–36(2). Twelve to fourteen gill rakers of first gill arch (10–12 on ceratobranchial; one on cartilage between ceratobranchial and epibranchial, and one on epibranchial). Branchiostegal rays 8(2) to 9(1). First dorsal-fin pterygiophore between neural spine of sixth and seventh vertebrae (3), first anal-fin pterygiophore between hemal spine of vertebrae 22–23(1), 23–24(1) or 24–25(1). Pleural ribs 8(2)–9(1).

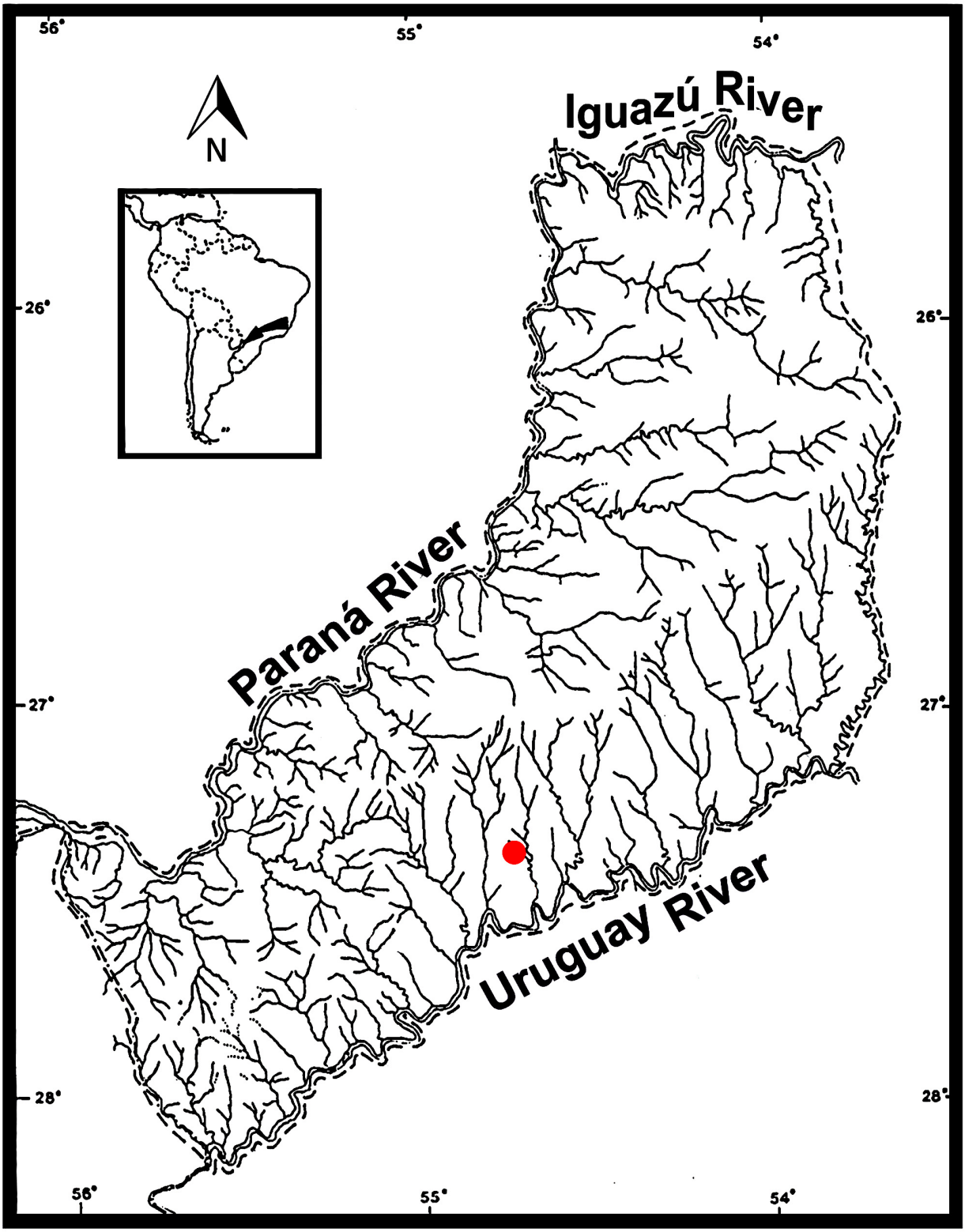

FIGURE 3. Map showing the collecting site on the Melo stream, indicated by a red dot, Uruguay river basin, Misiones province, Argentina.

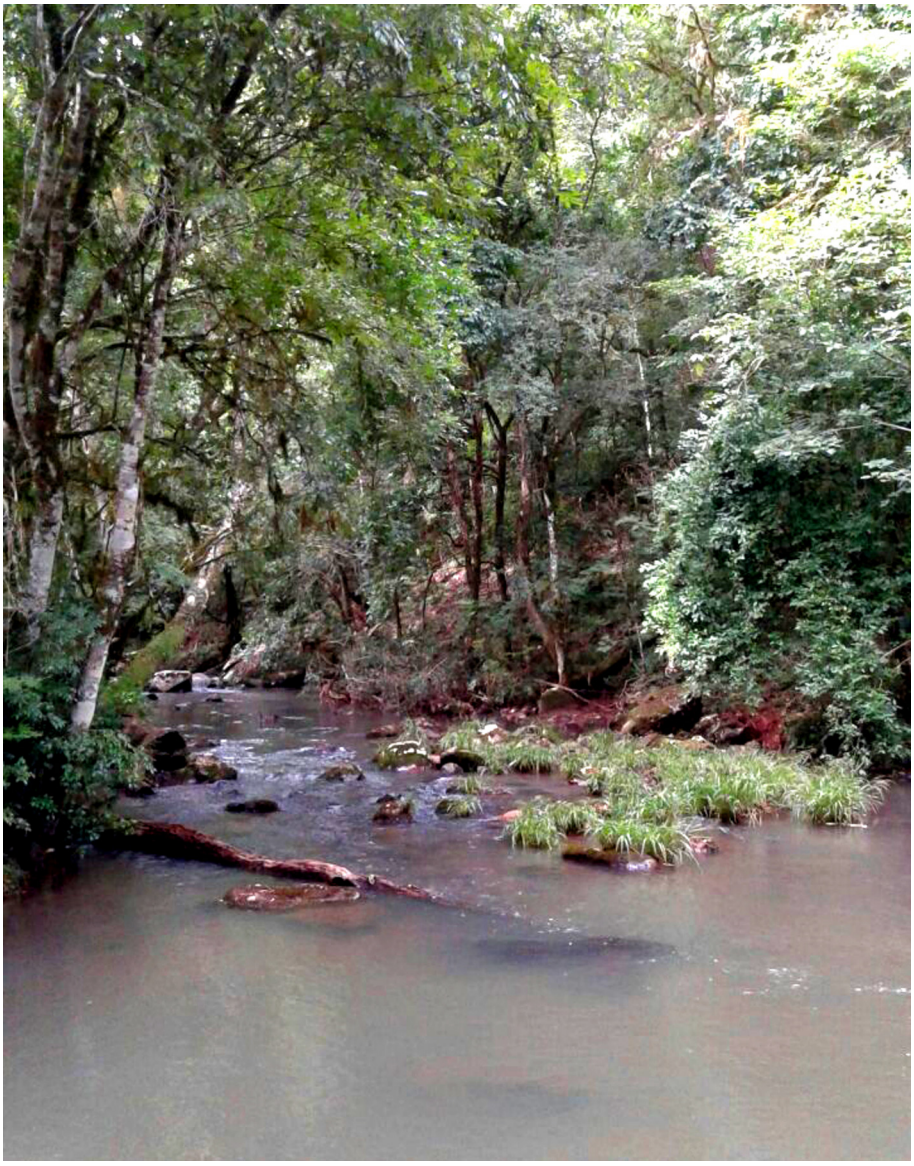

FIGURE 4. Melo stream at type locality, Uruguay River basin. November, 2016.

Color in alcohol. Coloration pattern represented by aggregated melanophores scattered on dorsal and lateral surfaces of body, forming conspicuous size-variable blotches. Body background pale yellow, dorsum dark-brown with melanophores densely aggregated, especially over head, loosely aggregated on lateral surface of body, and ventral surface almost without melanophores, especially on prepelvic area. Five darker transverse bands, first one over supraoccipital region, second one at level of pectoral fins, third one just anterior to dorsal-fin origin and separated from fourth band by lighter area occupying dorsal-fin origin. Fourth dark band at insertion of third or fourth dorsal-fin rays and fifth band at interdorsal area. Second band is prolonged on lateral surface of body to pectoral-fin base. A very slender stripe from that band to end of caudal peduncle. Base of dorsal and anal fins with a dark band, not evident in all specimens, occupying one third of fin length. Caudal-fin base with dark band on distal margin of skin covering caudal-fin rays, more evident in small specimens. Pectoral and pelvic-fin base darker than distal end. Adipose fin with chromatophores scattered over entire fin and aggregated forming a diffuse dark band on distal margin of fin. All fins with minute chromatophores following each ray.

Distribution. Currently known only from its type locality at Melo stream (Fig. 3), Uruguay River basin, Northeastern Argentina.

Habitat and ecological notes. At type locality, the stream is characterized by clear water and low current velocity. The structure of the stream presents sequences of pools of 1 to 1.5 meters and shallow riffles, surrounded by native vegetation (Fig. 4).

Etymology. The specific name "*mandimbusu*" is the combination of two words from the Guaraní language, mandí=catfish and mbusu=eel, in allusion to its body form and the vernacular name used in Argentina to refer to *Heptapterus* (bagre anguila). The specific name is the apposition of two nouns.

Discussion

Generic allocation of *Heptapterus mandimbusu*. This species of catfish has a very elongate (eel-like) body form, with depressed head, short barbels, small eyes, high number of anal-fin rays, long adipose-fin base that is confluent to caudal fin, earth-brown coloration and the absence of exposed bones on the head, and spines in dorsal and pectoral fins. According to Mees (1974) such combination of characters define *Heptapterus* and, therefore, in the absence of a published phylogenetic hypothesis for the family, it seems to be appropriate to describe the new species in this genus rather than in any other existing or new genus.

Heptapterus mandimbusu was collected at Melo stream, in the Uruguay River basin, which corresponds to the lower Uruguay ecoregion according to Hales & Petry (2015). This region hosts almost 200 fish species. At the sampled site, *Heptapterus mandimbusu* was found living in sympatry with *H. mustelinus*, from which it is easily distinguishable, besides by the unique of the coloration pattern, by several characters enumerated in the diagnosis. *Heptapterus mustelinus* has the wider distribution among members of the genus, and is known from several basins in Argentina, southernmost Brazil and Uruguay (Buckup 1988; Bockmann & Guazelli 2003), and may correspond to a complex of species. As the genus still remains unsatisfactorily diagnosed, as is true for many other genera of the Heptapteridae, a phylogenetic analysis is needed.

Conservation notes. The area where the type locality is located, is under great anthropogenic pressure. The silviculture of pines, and agricultural and livestock practices are common in the region. These practices may endanger aquatic ecosystems by transferring impacts from terrestrial ecosystems. The forests of pines are known, for long, as a potential producer of acidification of floor (Carey *et al.* 1982). This acidification can reach streams by runoff during the rainy season and producing a variation in chemical conditions of water, affecting fishes.

Comparative material. *Heptapterus mustelinus*: MACN 359, 1 ex., 190.0 mm SL, Río de la Plata, in Olivos; MACN 2050, 1 ex., 120.0 mm SL, Río de la Plata, without precise locality; MACN 3370, 3 ex., 115.0-137.2 mm SL, Río de la Plata, in Vicente López; MACN 6187, 9 ex., 88.4-234.0 mm SL, Río de la Plata in Buenos Aires, Obras Sanitarias. All from Uruguay, Río de la Plata basin: ZVC-P 304, 3 ex., 146.0-169.0 mm SL, Departamento (Dep.) Canelones, río Mosquito; ZVCP 3422, 10 ex., 68.1-144.8 mm SL, Dep. Florida, arroyo Milano, affluent of río Santa Lucía; ZVC-P 3874, 2 ex., 46.3-96.0 SL, Dep. Maldonado, arroyo Espinoso; ZVC-P 4147, 3 ex., 48.6-61.2 mm SL, Dep. Colonia, río San Juan; ZVC-P 5633, 4 ex., 116.2-128.6 mm SL, Dep. Montevideo, río Santa Lucía, cascada del Dragón in río de las Piedras. *Heptapterus mbya*: *Heptapterus qenqo*: All from Argentina, in Tucumán: MLP 11231, 1 C&S, 121.8 mm SL, Dep. Juan Bautista Alberdi, río Chavarria; CI-FML 3954, 183.5 mm SL, Dep. Trancas, río Rearte, río Salí basin; CI-FML 3955, 1 ex., 213.1 mm SL, Dep. Monteros, río Los Sosa, río Salí basin; CI-FML 3956, 1 C&S, 168.9 mm SL, Dep. Burruyacu, río Medina, río Salí basin; CI-FML 3957, 1 C&S, 121.8 mm SL, Dep. Juan Bautista Alberdi, río Chavarría; CI-FML 3958, 2 ex., 95.0-107.0 mm SL, Dep. Burruyacu, río Medina, río Salí basin; CI-FML 3959, 2 ex., 123.1-140.2 mm SL, Dep. Trancas, río Choromoro, río Salí basin; CI-FML 3960, 1 ex., 106.6 mm SL, Dep. Trancas, río Choromoro, río Salí basin; CI-FML 3961, 1 ex., 123.5 mm SL, Dep. Chicligasta, río Cochuna, río Salí basin; CI-FML 3962, 1 ex., 67.3 mm SL, Dep. Trancas, río Vípos, río Salí. *Heptapterus stewarti*: FMNH 54234, holotype, photographed by M. Littmann. *Heptapterus sympterygium*: MZUSP 19179, holotype, photographed by E. Baena. Images have been examined from the All Catfish Species Image Base (Morris *et al.*, 2006).

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