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Merodoras nheco, new genus and species from Rio Paraguay basin, Brazil (Siluriformes, Doradidae), and nomination of the new subfamily Astrodoradinae

HORÁCIO HIGUCHI[1], JOSÉ L. O. BIRINDELLI[2], LEANDRO M. SOUSA[2] & HERALDO A. BRITSKI[2]

[1]*Museu Paraense Emílio Goeldi, Av. Magalhães Barata, 376, CEP 66040-170, Belém, Pará, Brazil.*
[2]*Museu de Zoologia da Universidade de São Paulo, Caixa Postal 42494, CEP 04218-970, São Paulo, São Paulo, Brazil.*
E-mails: jbirindelli@yahoo.com.br; leandro.m.sousa@gmail.com; heraldo@usp.br

Abstract

Merodoras nheco, new genus and species of Doradidae (Siluriformes) is described from Rio Paraguay basin, Brazil. The new genus belongs to the new subfamily Astrodoradinae, a monophyletic group formally named herein that includes, besides *Merodoras*, *Amblydoras*, *Anadoras*, *Astrodoras*, *Hypodoras*, *Physopyxis*, and *Scorpiodoras*. This group is diagnosed by the possession of: lacrimal serrated and participating in the orbital margin, four to seven pleural ribs; spines on the postcleithral process; postero-inferior portion of the coracoid exposed. *Merodoras nheco,* new species, is distinguished from other doradids by the unique combination of the following characteristics: 1) tips of retrorse spines on the midlateral scutes ventrally oriented in adults; 2) incomplete lateral line, with only a few midlateral scutes anteriorly; 3) pectoral girdle entirely exposed ventrally, with the opening of the *arrector ventralis inferior* reduced to a small fossae on the anterior edge of the coracoid; 4) caudal fin truncate; 5) dorsal-fin spine smooth, without serrae on both faces; 5) lacrimal serrated; 6) lateral ethmoid serrated. *Merodoras nheco* inhabits the "Pantanal Matogrossense," a flooded portion of the upper Rio Paraguay basin in western Brazil.

Key words: thorny catfish; Pantanal; taxonomy

Resumo

Merodoras nheco, novo gênero e espécie de Doradidae (Siluriformes), é descrita da bacia do Rio Paraguai, Brasil. O novo gênero pertence à nova subfamília Astrodoradinae, um grupo monofilético nomeado aqui que inclui, além de *Merodoras*, *Amblydoras*, *Anadoras*, *Astrodoras*, *Hypodoras*, *Physopyxis*, e *Scorpiodoras*. Este grupo é diagnosticado pelos seguintes caracteres: lacrimal serrilhado e participando da margem orbital; quatro a sete costelas pleurais; espinhos no processo pós-cleitral; porção póstero-inferior do coracóide exposta. *Merodoras nheco* nova espécie distingue-se dos outros doradídeos pela combinação única das seguintes características: 1) ponta dos espinhos retrorsos dos escudos laterais voltada inferiormente; 2) linha lateral incompleta, com poucos escudos laterais; 3) cintura peitoral completamente exposta inferiormente, com a abertura do músculo *arrector ventralis inferior* reduzida a uma pequena fossae na extremidade anterior do coracóide; 4) nadadeira caudal truncada; 5) acúleo da dorsal liso, sem serrras em ambas as faces; 5) lacrimal serrilhado; 6) etimóide lateral serrilhado. *Merodoras nheco* habita o Pantanal Matogrossense, uma área inundável da bacia do Alto Rio Paraguai no centro-oeste brasileiro.

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Introduction

Doradidae is a monophyletic catfish family easily recognized by the well-developed nuchal shield preceding the dorsal fin, and the lateral line with well-developed ossifications as midlateral scutes with median retrorse thorns. In one of his last papers, Carl H. Eigenmann (1925) presented a revision of the family, wherein he classified all known species into 26 valid genera and provided descriptions of various anatomical features of the family. Subsequent work on the family included relatively isolated descriptions of new genera and species, and a revision of doradid species from Venezuela by Fernández-Yépez (1968). Higuchi (1992) completed a comprehensive morphological study of Doradidae that helped resolve many taxonomic problems and placed the genera in a phylogenetic context. The results of Higuchi's cladistic analysis of intergeneric relationships, including the synapomorphies for his proposed clades, are reproduced in de Pinna (1998). Most recently, Sabaj and Ferraris (2003) further refined the taxonomy of Doradidae by compiling a checklist of all nominal species (127) and genera (41) of doradids from which they recognized 72 species and 30 genera as valid. Five species were subsequently added by Sousa and Rapp Py-Daniel (2005), and Sabaj (2005).

During the preparation of "Peixes do Pantanal," a book on fishes from the "Pantanal" region of western Brazil, one of us (HAB) discovered specimens of a new genus and species of Doradidae (see Britski *et al.*, 1999). Higuchi (1992) applied the name "*Merodoras nheco*" to this discovery and a complete description of the genus and species appears in an appendix to his unpublished doctoral dissertation. The name "*Merodoras"* subsequently appeared in de Pinna (1998), but remained unavailable. The new genus and species belong to the new subfamily Astrodoradinae, a monophyletic group that was first recognized by Higuchi (1992; see also de Pinna, 1998, Moyer et al., 2002) that includes *Amblydoras, Anadoras, Astrodoras, Hypodoras, Physopyxis,* and *Scorpiodoras*. This paper formally describes this new genus and species, and nominates the new subfamily Astrodoradinae. It also includes comments on the taxonomy of the subfamily Astrodoradinae and a discussion of its phylogenetic relationships based on morphological characters of the new taxon.

Materials and methods

Measurements were made to the nearest 0.1 mm using dial calipers; methodology and terminology follow Sousa and Rapp Py-Daniel (2005). Standard length (SL) is expressed in mm and all other measurements are expressed as percentage of SL, except subunits of head, which are expressed as percentage of head length.

Midlateral scute (plate) counts were taken on the left side of the body (when possible) and began with the infranuchal (scute connected dorsally to posterior nuchal plate and internally to rib of sixth vertebra). The ossifications anterior to infranuchal are herein defined as tympanal, situated between nuchal shield, postcleithral process and infranuchal scute. Osteological counts (i.e., branchiostegal rays, pleural ribs, and vertebrae) were restricted to cleared and stained specimens prepared according to the procedures of Taylor and Van Dyke (1985). Vertebral counts included all vertebrae, with the compound caudal centra (PU1+_U1) counted as a single element. Osteological nomenclature follows Weitzman (1962), with the following modifications. The substitution of ethmoid for mesethmoid, follows Fink & Fink (1981). The use of postcleithral for humeral process, lacrimal for antorbital, and pelvic girdle structures names, follows Lundberg & McDade (1986). Supraoccipital is used for parieto-supraoccipital of Fink & Fink (1981). The supraneural, first and second pterygiophores are expanded dorsally as continued plates of the cranium roof in Doradidae and, are herein named anterior, middle and posterior nuchal plates. Myological terminology follows Winterbotton (1974). Museum abbreviations follow Leviton *et al.* (1985).

Results

Astrodoradinae, new subfamily

Type genus.— *Astrodoras* Bleeker, 1862: 5.

Genera included.— *Amblydoras* Bleeker, 1862; *Anadoras* Eigenmann, 1925; *Astrodoras* Bleeker, 1862; *Merodoras* new genus; *Hypodoras* Eigenmann, 1925; *Physopyxis* Cope, 1871; and *Scorpiodoras* Eigenmann, 1925.

Diagnosis.— The genera and species of the subfamily Astrodoradinae can be distinguished by the following combination of characters: spinous postcleithral process (except in *Anadoras*); lacrimal serated (except in *Anadoras*), forming anterior corner of orbit (except in *Physopyxis*; also present in *Pterodoras* and *Lithodoras*); number of pleural ribs reduced, four to seven (also shared with *Acanthodoras, Agamyxis*, *Trachydoras, Doras fimbriatus, D. punctatus* and *Oxydoras eigenmanni*). Other diagnostic, but more widespread, features include: simple barbels, nuchal foramina absent, and gas bladder with abbreviated cordiform shape.

Merodoras new genus

Type species.— *Merodoras nheco* new species.

Diagnosis.— *Merodoras* is diagnosed from all other doradids by having midlateral plates with medial thorns directed ventrally in adults, and from all doradids except *Physopyxis cristata* by having an incomplete lateral line. *Merodoras* also is diagnosed by the unique combination of the following characteristics: pectoral girdle entirely exposed ventrally, with the opening for the *arrector ventralis inferior* reduced to a small fossae on anterior edge of coracoid; caudal fin truncate; dorsal-fin spine smooth, without serrae; lacrimal serrated; lateral ethmoid serrated.

Comparisons.— *Merodoras* can be distinguished from *Anadoras, Scorpiodoras, Astrodoras* and *Hypodoras* by the pectoral girdle entirely exposed ventrally, with the opening for the *arrector ventralis inferior* reduced to a small fossae on anterior edge of coracoid; *Merodoras* is further distinguished from *Scorpiodoras* and *Astrodoras* by having dorsal-fin spine smooth (vs. serrated anteriorly), anterior cranial fontanel oval (vs. elongate), mesethmoid straight in dorsal profile (vs. mesethmoid concave with a median dorsal crest), and gas bladder simple (vs. gas bladder with terminal diverticulum); and from *Astrodoras* and *Hypodoras* by having procurrent rays not modified as plates (vs. procurrent rays modified as plates that frame caudal peduncle). *Merodoras* is further distinguished from *Hypodoras* by the absence of a pre-adipose plate *(vs.* present). *Merodoras* is yet distinguished from *Anadoras* by having lacrimal serrated (vs. lacrimal smooth) and from *Amblydoras* and *Physopyxis* by the smooth dorsal-fin spine (vs. serrated at the proximal portion on the anterior face) and smooth infraorbitals (vs. serrated). It is also distinguished from *Physopyxis* by presence of anterior nuchal plate (vs. anterior nuchal plate absent), tip of coracoid process extending posteriorly beyond tip of postcleithral process (vs. posterior tip of coracoid process falling short of tip of postcleithral process).

Etymology.— From the Greek *meros* (= part, portion), in reference to the incomplete lateral line, plus the suffix *–doras*, as traditionally applied to genera in this family. Gender masculine.

Merodoras nheco, new species

Figure 1

Gênero novo. Britski *et al.*, 1999: 116 [citation and diagnosis].

Holotype.—MZUSP 90591 (40.8 mm), Brazil: Estado do Mato Grosso do Sul: município de Rio Verde de

Mato Grosso, Rio Anhuma, tributary of Rio Negro (Paraguay basin) (19º 10' 07"S; 55º 18' 26"W), 28 August 1998, A. Machado-Allisson, B. Chernoff, P. W. Willink, O. Froehlich & A. Catella.

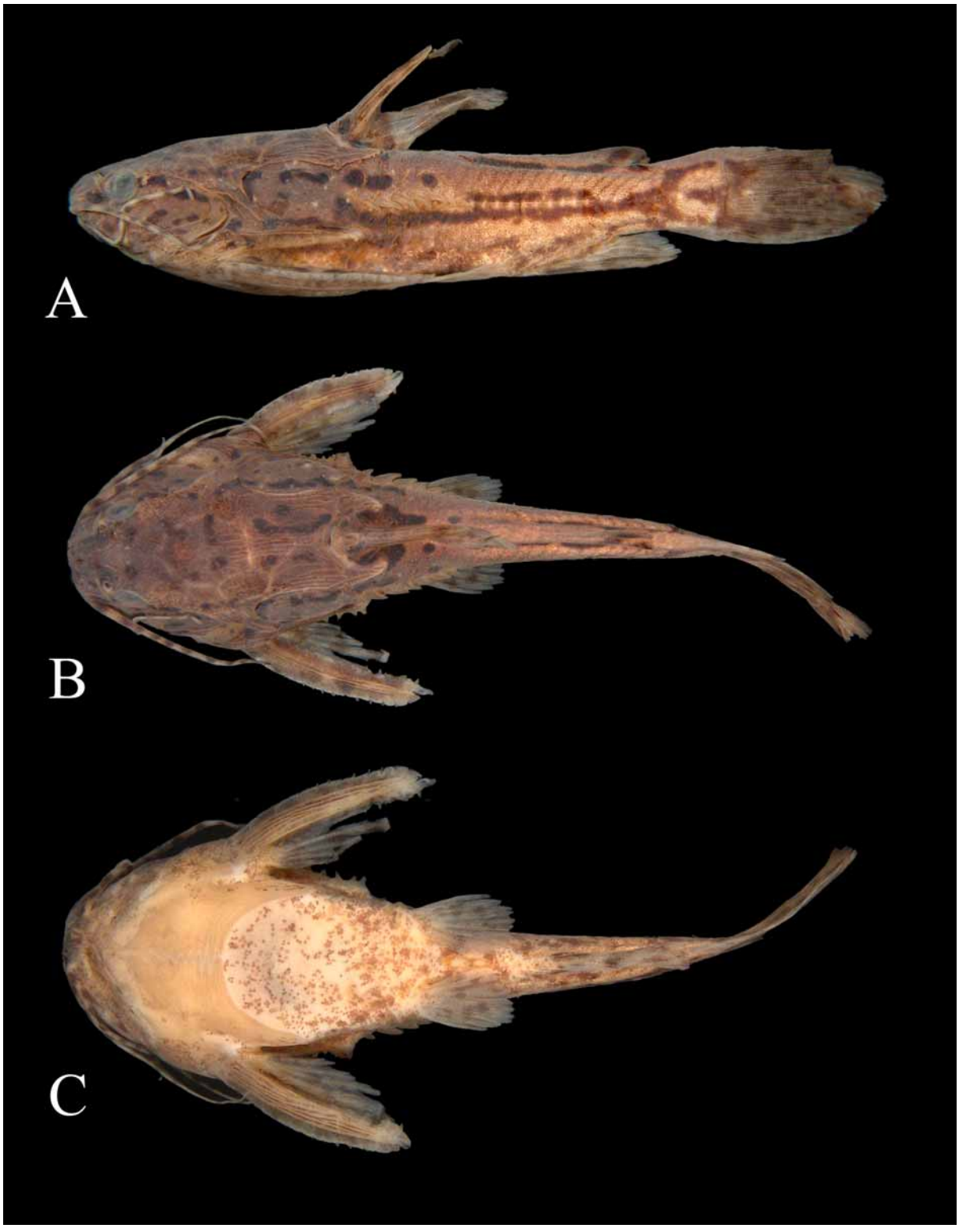

FIGURE 1. Lateral, dorsal and ventral views of *Merodoras nheco*, MZUSP 90591, holotype, 40.8 mm SL

Paratypes.—Brazil: Estado do Mato Grosso do Sul: MZUSP 47180 (4, 25.5 – 35.3 mm); município de Coxim, Rio Piquiri (17º 16'S, 55º 52'W), March 1994, T. Lipparelli. MZUSP 60053 (2, 45.6 – 48.1 mm); same data as holotype. Estado do Mato Grosso: MZUSP 35906 (3, 29.7 – 35.3 mm); município de Itiquira, Santo

Antônio do Paraíso farm, ponds between Rio Piquiri and Rio Itiquira, 01 October 1979, J. H. B. Medeiros & J. C. Oliveira. MZUSP 83556 (23.0 mm); município de Itiquira, seasonal ponds between Rio Piquiri and Rio Itiquira (17°28' 13"S, 55°14' 46"W), 29 September 2003. MZUSP 84414 (28, 45.2 – 54.4 mm); ANSP 185103 (2, 43.6 – 50.8 mm); Tributary at Região do Rombado (16°26'S, 56°25'W), município de Poconé, 17 February 2000, C. Oliveira, F. A. G. Rondon *et al.*. AMNH 236346 (29.9 mm); Rio Pixaime, 20 November 1992, H. R. Axelrod. MZUSP 92610 (20, 21.0 – 61.1 mm); Flooded area, 1 km from Vila Mimoso, Pantanal de Paiaguás (16°17'S, 55°48'W), município de Barão de Melgaço, 30 September 2006, F. A. Machado, F C. T. Lima *et al.*. MZUSP 92611 (4, 26.5 – 61.5 mm); Rio Mutum, between Vila Mimoso and Joselândia, Pantanal de Paiaguás (16°19' 30"S, 55°49'59"W), município de Barão de Melgaço, 30 September 2006, F. A. Machado, F C. T. Lima *et al.*

Diagnosis.— Same as genus.

Description.— Specimens examined ranged from 23.0 to 54.4 mm SL. See Table 1 for counts and measurements and Fig. 1 for dorsal, lateral, and ventral views of holotype (MZUSP 90591, 40.8 mm SL). Body weakly elongate, wide and somewhat depressed anteriorly, deepest at dorsal-fin origin, gently tapering to slender caudal peduncle. Ventral surface weakly flattened.

Anterior nares surrounded by short tubular skin located close to nostril tip; posterior nares larger than anterior, with a skin flap, not tubular, located at antero-superior portion of the orbit. Cephalic shield ornamented with distinct grooves and ridges. Interorbital fontanel divided by epiphyseal bar into a small rounded anterior portion, surrounded by mesethmoid and frontals, and large rounded posterior portion surrounded just by frontals. Nuchal foramina absent. Nuchal shield formed by anterior, middle and posterior nuchal plates (Fig. 2). Nuchal plates with straight to slightly concave lateral margins. Anterior nuchal plate wide, pentagonal, sutured to epioccipital Fig. 2). Epioccipital with no posterior process. Nuchal portion of cephalic shield flat to weakly angled in transversal cut. Six branchiostegal rays (n=3). Five pairs of ribs (n=3), gradually decreasing in size posteriorly. Thirty-one (n=2) or thirty-two (n=1) vertebrae, sixth fused and seventh partially fused into the complex vertebra.

Head somewhat short (24.1 – 27.5 % of standard length), depressed, broadly rounded in dorsal view, dorsal profile gently concave from dorsal spine to nostril tip. Eyes small (diameter 17.3 – 22.8% of head length), located approximately in first quarter between snout tip and dorsal spine origin. Jaws equals, terminal. Premaxillary and dentary with narrow transverse band of small acicular teeth. Maxillary small, located aside base of premaxillary and supporting maxillary barbel.

Three pairs of barbels (maxillary, inner and outer mental), simple, long, surfaced with small papillae. Maxillary barbel longest, almost reaching tip of postcleithral process. Outer mental barbel almost reaching tip of coracoid process. Inner mental barbel shorter, reaching posterior edge of coracoid suture.

Dorsal fin origin located at slightly greater than one-third body length from snout tip. Dorsal-fin spine strong and very gently curved over entire length with distal cartilaginous (break-away) tip. orsal-fin spine smooth, without serrae on both faces. Pectoral-fin spine strong, dorsoventrally flattened, gently curved along anterior margin with distal cartilaginous tip (length greater than that of dorsal-fin spine). Anterior margin of pectoral-fin spine with strong teeth becoming slightly larger and more antrorse distally; posterior margin with strong retrorse teeth shorter than those along anterior margin. Pelvic fin weakly rounded when extended; origin slightly anterior to vertical through tip of adpressed pectoral spine. Anal fin rounded when erect, reaching caudal-fin procurrent rays when adpressed. Caudal fin truncate. Upper and lower procurrent caudal-fin rays small, not modified as plates. Adipose fin small with distal free margin thin and rounded.

Cleithrum laterally expanded and visible in dorsal view, exposed portion sculptured with shallow grooves to base of postcleithral process. Postcleithral process lanceolate, narrow, elongate with one row of spines along its entire length and pointed tip reaching or surpassing vertical through origin of dorsal spine. Coracoid process extends posteriorly to just beyond last branched ray of pectoral fin, shorter than postcleithral process. Pectoral girdle entirely exposed ventrally (covered only by a thin layer of epithelium), with the ventral portion

of coracoid expanded, restricting cavity for *arrector ventralis inferior* to a tubular canal on anterior edge of coracoid (Fig. 3). Axillary pore inconspicuous.

Head and body covered by minute, sparse tubercles, most abundant on dorsal portions of head and body, and on adipose fin. Tubercles almost always punctate, appearing as minute dots.

TABLE 1. Morphometric and meristic data of *Merodoras nheco.*

	holotype	n	range	average (SD)
Standard length (mm)	40.8	44	23.0 – 54.4	
Total length (mm)	51.9	44	30.1 – 67.4	
% Standard length				
Body depth at dorsal-fin origin	25.4	17	22.1 – 29.9	25.34 (1.87)
Pre-dorsal length	40.7	17	37.0 – 42.8	40.22 (1.43)
Pre-pectoral length	29.0	17	26.4 – 31.8	28.68 (1.38)
Pre-pelvic length	52.5	17	47.9 – 55.8	53.11 (1.75)
Dorsal-fin base length	12.9	17	10.4 – 12.9	11.62 (0.70)
Dorsal-fin spine length	19.7	16	18.7 – 30.3	22.80 (3.32)
Pectoral-fin spine length	30.6	17	26.5 – 33.6	30.96 (1.79)
Postcleithral process length	17.0	17	15.7 – 20.00	17.84 (1.20)
Coracoid process length	16.4	17	14.1 – 17.6	16.05 (0.94)
Pectoral girdle width	35.1	17	32.5 – 38.5	36.14 (1.94)
Anal-fin base length	17.6	17	13.5 – 17.6	15.30 (1.16)
Body depth at anal-fin origin	18.2	17	15.2 – 20.2	17.00 (1.40)
Caudal peduncle length	15.0	17	15.0 – 20.6	17.53 (1.56)
Caudal peduncle depth	9.9	17	8.4 – 16.4	9.99 (1.68)
Maxillary barbel length	38.8	17	34.7 – 50.1	41.83 (3.64)
Inner mental barbel length	26.1	16	18.6 – 31.0	25.52 (2.99)
Outer mental barbel length	35.3	16	22.8 – 39.0	32.99 (4.12)
Head length	25.9	17	24.1 – 27.5	25.70 (0.90)
% Head length				
Orbital diameter	17.6	17	17.3 – 22.8	19.10 (1.36)
Interorbital width	44.8	17	41.7 – 46.1	44.01 (1.23)
Snout length	36.6	17	30.2 – 37.0	33.79 (2.01)
Mouth inner width	47.5	17	43.8 – 52.6	48.41 (2.24)
Middle nuchal plate width	61.1	17	49.8 – 66.3	59.42 (4.68)
Meristic				
Dorsal-fin rays	I + 5	17	I + 5	I + 5
Pectoral-fin rays	I + 4	16	I + 4–5	I + 5
Pelvic-fin rays	i + 6	17	i+6	i + 6
Anal-fin rays	i + 11	16	iii–iv + 9–11	iii+9
Caudal-fin rays	8 + 9	17	7–8 + 7–9	8 + 8
Lateral scutes	8	17	4–9	7

Lateral line incomplete, with three tympanal scutes plus 3–8 midlateral scutes, finishing between vertical through posterior insertion of pelvic fin and origin of anal fin. Lateral line pores absent beyond last midlateral scutes. First two tympanal scutes very small and inconspicuous, without medial thorns in adults. Third tympanal scute well developed, connected to posterior nuchal plate and reaching postcleithral process, with medial thorn in adults (thorn sometimes present in juveniles). Infranuchal scute attached to posterior nuchal plate dorsally and rib of sixth vertebra internally, reaching postcleithral process ventrally. Post-infranuchal midlateral scutes taller than wide with distinct medial thorn; thorn ventrally oriented in large specimens; accessory thorns present in upper and lower wings in adults. Scutes becoming slightly shallower posteriorly, covering about one-half of body depth anterior to pelvic-fin origin. Gas bladder with abbreviated cordiform shape (width slightly greater than length) and occupying the anterior half of body cavity (Fig. 4). Longitudinal septum occupying two-thirds of gas bladder length, with transverse septum reduced. Gas bladder divided into only two lateral chambers, with no distinction between anterior and posterior chambers. Pleura covering the internal walls of gas bladder, continuing anteriorly to septum, restricting the communication between lateral chambers to a small foramen (Fig. 4d). Walls of gas bladder distinctly speckled on internal and external faces.

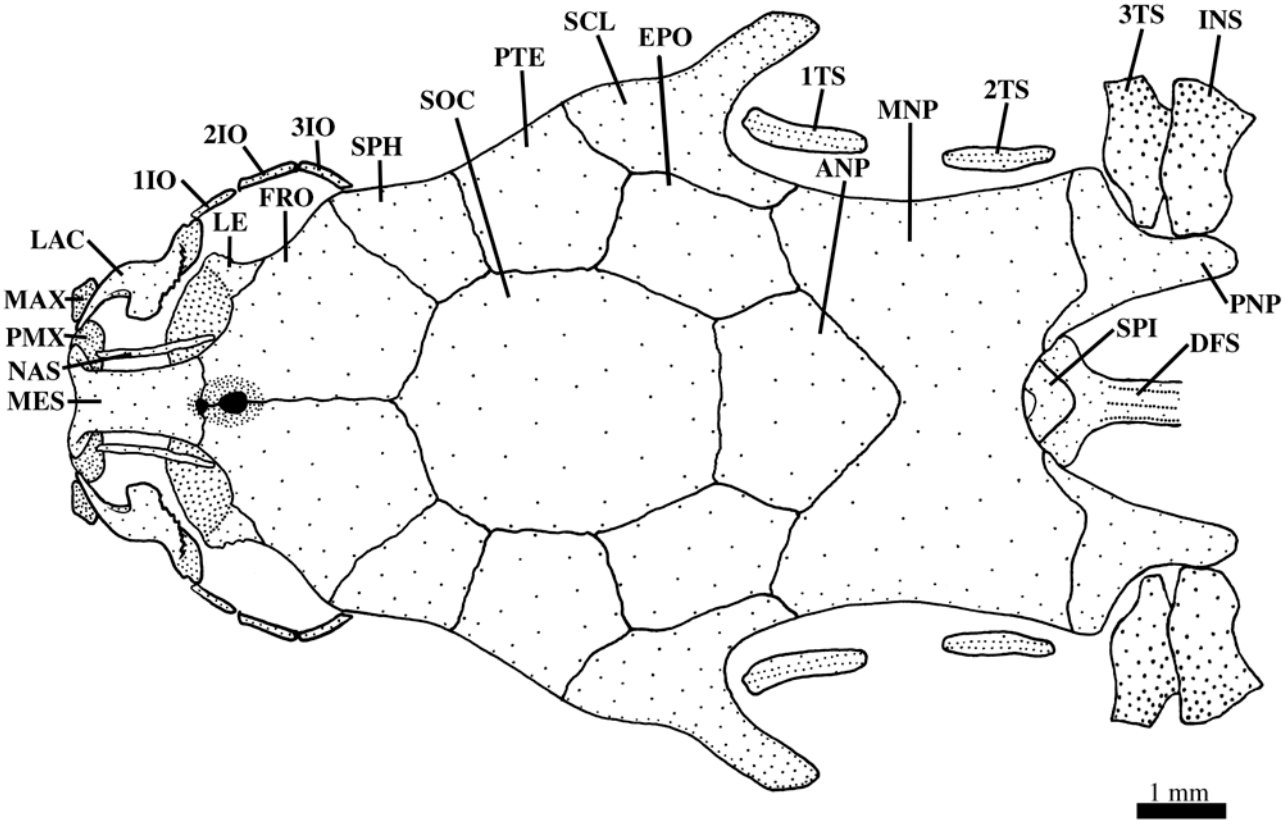

FIGURE 2. Dorsal view of cephalic shield of *Merodoras nheco.* 1IO – first infraorbital, 1TS – first tympanal scute, 2IO – second infraorbital, 2TS – second tympanal scute, 3IO – third infraorbital, 3TS – third tympanal scute, ANP – anterior nuchal plate, DFS – dorsal-fin spine, EPO – epioccipital, FRO – frontal, INS – infranuchal scute, LAC – lacrimal, LE – lateral ethmoid, MES – mesethmoid, MNP – medium nuchal plate, NAS – nasal, PMX – premaxillary, PNP – posterior nuchal plate, PTE – pterootic, SCL – supracleithrum, SOC –supraoccipital, SPH – sphenotic, SPI – spinelet.

Coloration in alcohol.— Overall color pale brown or tawny. Small dark brown spots or blotches covering top and sides of head, all fins, barbels, dorsal and pectoral spines and postcleithral process. A pair of irregular dark brown stripes flank lateral line above and below, and another stripe runs dorsolaterally from base of dor-

sal fin to adipose fin, turning upwards and covering the middle portion of the later. In some specimens, the stripes flanking the lateral line form a marbled pattern at base of caudal fin. Ventral surfaces pale with dark speckles on gular, branchiostegals, abdomen, and pelvic region, largely absent from exposed portion of pectoral girdle. Ventral surface, from head to caudal peduncle, darkly smudged.

Distribution.—Known only from flooded area of Paraguay basin called "Pantanal Matogrossense," in western Brazil (Fig. 3).

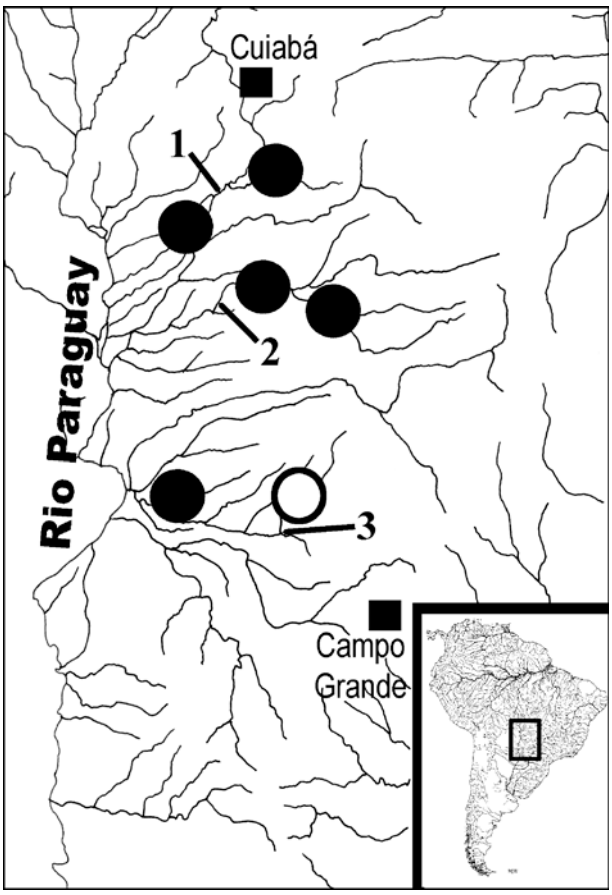

FIGURE 3. Map of Rio Paraguay basin and adjoining area, showing the distribution of *Merodoras nheco* (type-locality represented by open circle). 1 – Rio Cuiabá, 2 – Rio Piquiri, 3 – Rio Negro.

Ecological Note.—Merodoras nheco lives in lentic waters, most precisely in lakes in flooded areas of Pantanal. In most specimens, we found many parasites (Pentastomida) in their gas bladder, between the inner walls and its internal pleura. Pentastomida parasites are known to have a reptile as definitive host. According to Francisco Machado (pers. com.), the "jacarés-do-pantanal" ("southern-caiman," *Caiman crocodilus yacare*) feed on *Merodoras nheco* when the lakes dry in the winter, and the fishes became easy to capture.

Etymology.—Specific name toponymic with reference to the town of Nhecolândia, the place where this species was discovered. The Portuguese *nh* is pronounced like the French or Italian *gn* or the Spanish *ñ*. The word *nheco* apparently does not have any particular significance other than having probably been a nickname for the town founder.

Discussion

Taxonomic comments on the subfamily Astrodoradinae.

The taxonomy and relationships among the species and genera in the subfamily Astrodoradinae remain

poorly defined, and the species are often difficult to identify. For example, Higuchi (1992) recognized only one valid species in *Amblydoras* whereas Sabaj and Ferraris (2003) recognized six valid species in this genus. Fernández-Yépez (1950, 1968) proposed *Hildadoras* for two distantly related species: *H. orinocensis* (= *Oxydoras sifontesi*, sensu Sabaj & Ferraris, 2003), and *H. bolivarensis* (= *Amblydoras bolivarensis*, sensu Sabaj & Ferraris, 2003). The best diagnoses of the genera and species are yet found in Eigenmann (1925), who based his diagnoses on few external features and/or gas bladder anatomy (e.g., *Scorpiodoras*, which was described on the basis of having "posterior air-bladder chamber banjo- or scorpion-shaped" – Eigenmann, 1925: 324).

Comments on morphology in Merodoras.

The gas bladder with abbreviated cordiform shape is present in all species of Astrodoradinae, and also in *Acanthodoras* and *Agamyxis*. In all of these taxa the transverse portion of the internal septum is reduced, making the anterior lateral chambers nearly continuous (i.e. not clearly separable into anterior and posterior portions). In *Scorpiodoras*, *Astrodoras* and *Hypodoras* (Sabaj, pers. com.), the gas bladder has a terminal diverticulum, whereas in the others species of Astrodoradinae the gas bladder is simple, with no diverticulum. In *Merodoras nheco*, the transverse portion of the septum is very weakly developed, and the anterior chamber is divided by pleura, making the gas bladder appearing to be composed by two lateral chambers (Fig. 4). This condition has not been reported in any other doradids so far.

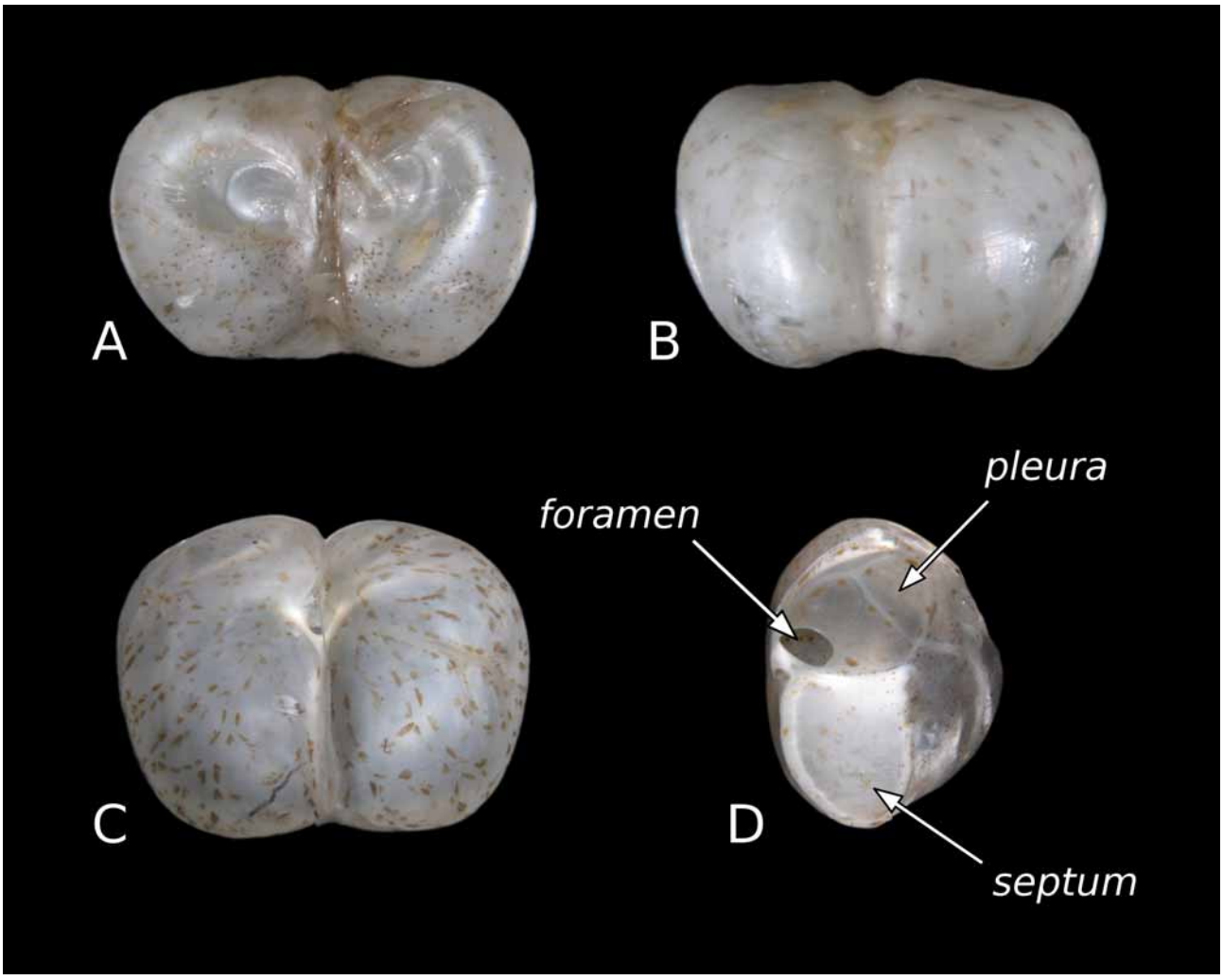

FIGURE 4. Picture of (A) dorsal view of external surface, (B) ventral view of external surface, (C) dorsal view of internal surface of ventral half, and (D) lateral view of a para-saggital cut of the gas bladder of *Merodoras nheco.*

The generalized pelvic girdle in catfishes is composed of a wide basipterygium with an anterior process bifurcated (anterolateral and anteromesial processes) (Higuchi, 1992; Britto, 2002). In *Merodoras nheco*, there is usually an additional third process, which is smaller than and mesial to the anteromesial process of the basipterygium (present in three of the five c&s specimens; Fig. 5).

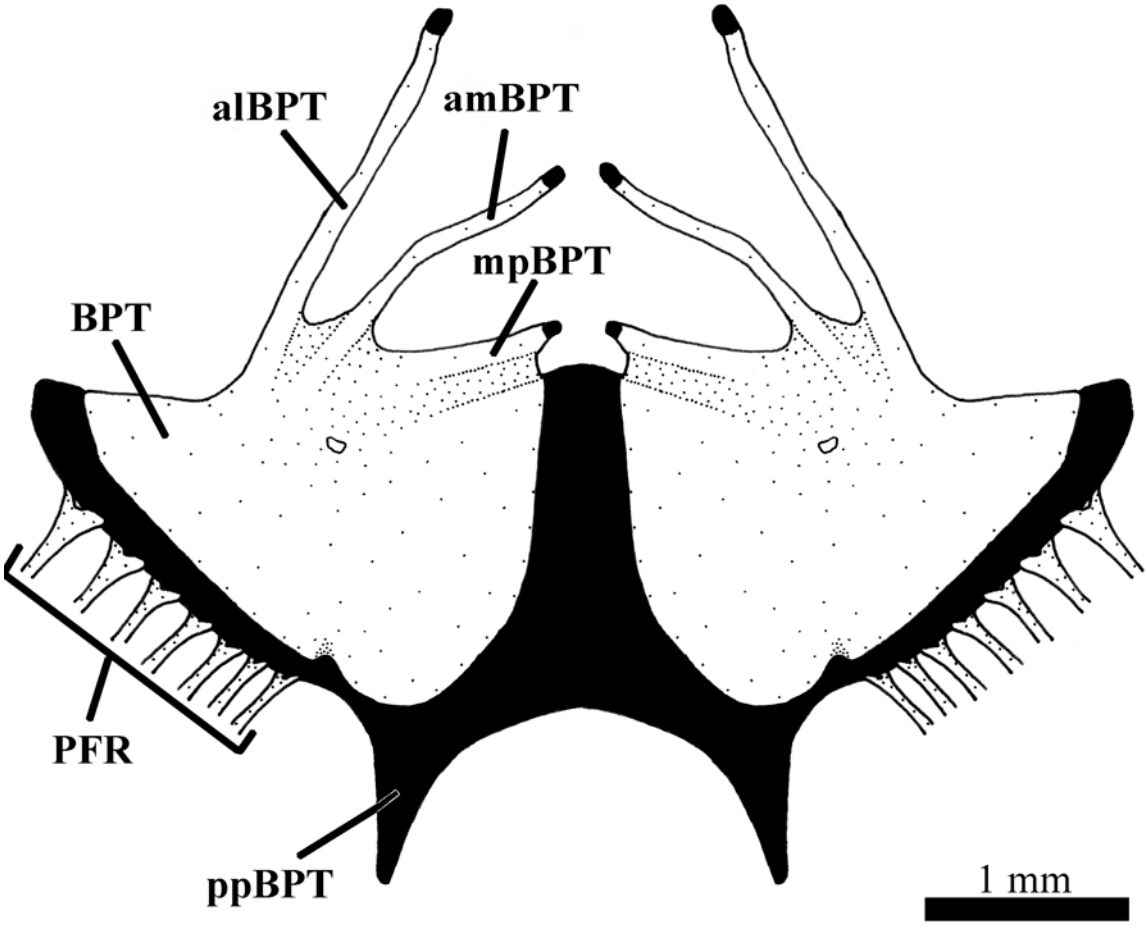

FIGURE 5. Dorsal view of pelvic girdle of *Merodoras nheco.* BPT – basipterygium, alBPT – anterolateral process of basipterygium, amBPT – anteromesial process of basipterygium, mpBPT – mesial process of basipterygium, PFR – pelvic-fin rays, ppBPT – posterior process of basipterygium. Solid black indicates cartilage.

The pectoral girdle of *Merodoras nheco* is characterized by the expansion of the coracoid that restricts the *arrector ventralis inferior* opening to a small mesial fossae (Fig. 6), and covers most of ventral surface of pectoral girdle, making it ventrally exposed. Among doradids, this shape is only shared with *Amblydoras* and *Physopyxis.* In *Physopyxis*, the fossae is absent, and the muscles are completely enclosed by the coracoid, in a putatively more derived state.

In Doradids, the dorsal-fin spine is entirely smooth only in *Merodoras* and *Anadoras*. In *Scorpiodoras, Astrodoras* and *Hypodoras,* the dorsal-fin spine has well-developed serrae along the entire length of the anterior face. In *Amblydoras* and *Physopyxis* the anterior serrae are present only along the proximal portion of the anterior margin of the dorsal spine. In *Amblydoras* the serrae along the anterior margin of the dorsal spine decrease with ontogenetic development.

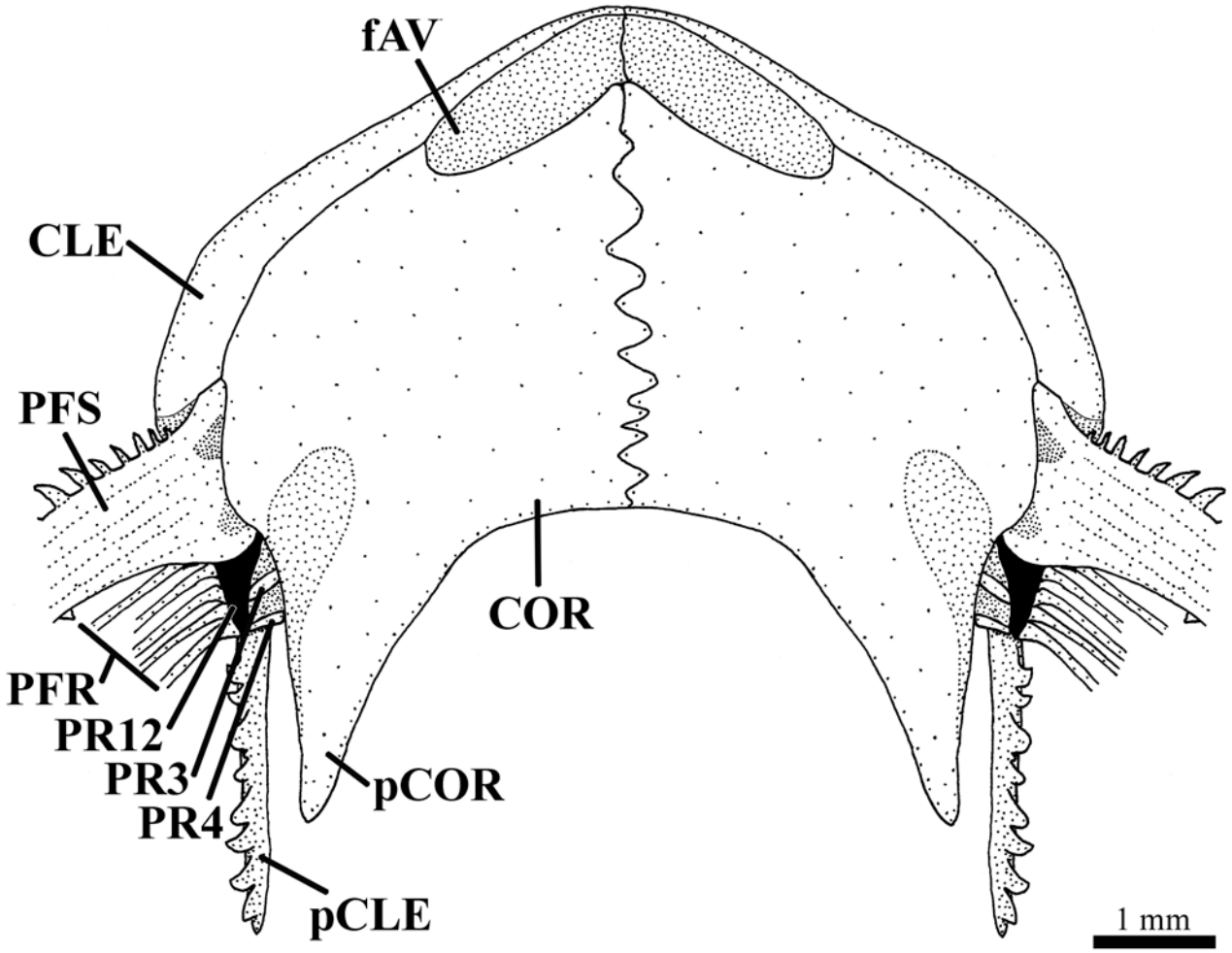

FIGURE 6. Ventral view of pectoral girdle of *Merodoras nheco*. CLE – cleithrum, COR – coracoid, fAV – fossae of *arrector ventralis inferior*, pCLE – postcleithral process, pCOR – process of coracoid, PFR – pectoral-fin rays, PFS – pectoral-fin spine, PR12 – first and second proximal radial, PR3 – third proximal radial, PR4 – forth proximal radial. Solid black indicates cartilage.

Comments on relationships of Merodoras.

According to Higuchi (1992), the genus is most closely related to *Amblydoras*, with which it shares concave anterior edges of hypobranchials 1 and 2, and a very thin parasphenoid. The two genera share with *Physopyxis* a ventrally exposed pectoral girdle, with greatly reduced opening for *arrector ventralis inferior*, and a truncate caudal fin. Other characters, however, like the presence of anterior serrae on the proximal portion of anterior face of the dorsal-fin spine in *Amblydoras* and *Physopyxis (*vs. dorsal spine without serrae in *Merodoras)*, do not support Higuchi's hypothesis. The inclusion of additional species may influence relationships in a cladistic analysis, as documented by several authors (i.e., Schaefer, 1998). Therefore, a more robust analysis, including more characters and taxa within Astrodoradinae, is needed to provide a well-supported hypothesis for relationships within this group of thorny catfishes.

Material examined

Amblydoras sp. — AMNH 97157 (1 c&s). *Anadoras* cf. *grypus* — MZUSP 74864 (7 alc., 1 sk.). MZUSP 77460 (3 alc.). *Anadoras wedellii* — MZUSP 89108 (96 alc.). *Astrodoras asterifrons* — MZUSP 6588 (1

c&s). MZUSP 56803 (1 alc.). *Hypodoras forficulatus* — ANSP 150679 (1 alc.). *Physopyxis ananas* — MZUSP 6430 (2 c&s). *Physopyxis* spp. — cited material by Sousa and Rapp Py-Daniel (2005). *Scorpiodoras heckelii* — MZUSP 36058 (1 alc.). *Scorpiodoras* sp. — MZUSP 7941 (12 alc.). MZUSP 8493 (29 alc., 1 sk.). MZUSP 85494 (1 alc.).

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